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Why Engineers Should Be Members of Public Service Commissions.

Two engineering organizations, the Brooklyn Engineers' Club and the Technical League, have urged Governor Dix to appoint an engineer to fill a vacancy on the Public Service Commission of the First District of New York. Their action should be followed by other engineering organizations, and for reasons that we shall briefly outline.

The most important problems to be solved by public service commissions are problems in rate regulation or rate making. Every step in solving a rate making problem involves the analysis of data of an engineering nature. The first step involves the appraisal of the property of the public utility, which is always placed in the hands of engineers because it is self-evidently engineering. The next step is the analysis of operating expenses, which is equally an engineering matter, although it is not so evident that this is so, because, unfortunately, it has not long been the custom to engage engineers to manage public utility corporations. Within recent years, however, the precedent established in Germany has found extended application in America, and engineers are rapidly stepping into positions of managerial control of the operation of plants of an engineering nature, such as railways, water works, lighting and power plants, etc.

Roughly speaking, interest charges, taxes, depreciation and current repair costs constitute half the cost of railway transportation, whether steam or electric; and they constitute about two-thirds the cost of supplying water for domestic and public use. In other words, the cost of production consists very largely of items that are best rated as a percentage of the cost of the plant used by a public service company. Hence the second step—the analysis of operating costs—is itself a study in costs of engineering structures and their upkeep. Few public service commissions as yet realize this fact. Indeed, many public service companies have themselves not yet grasped the full significance of it. Consequently any engineer who will study the decisions of rate-making bodies—commissions courts—will find blunder heaped upon blun[illegible]r.

At times the blunder is one that favors a blic service company. At other times the under favors the public at the expense of e company. To illustrate: A recent de[illegible]sion of a certain public service commission as such as to allow a public service com[illegible]ny [illegible] secure a rate sufficiently high to pay r [illegible] of the plant depreciation *twice*. This arose through ignorance on the part of the commission as to the distinction between repairs of "plant units" and renewals of "plant units"—the former being current maintenance and the latter being true depreciation. The company claimed that its maintenance accounts had covered only current repairs, whereas, in fact, they had covered a large part of the depreciation, i. e., renewals. The commission therefore ruled that to the actual maintenance account of the preceding year it would be proper to add 6 per cent of the plant cost to cover depreciation, and in this way gave the company considerably more than it was entitled to receive.

The exact converse of this blunder is to be found in many of the decisions of commissions and courts on railway rates. In such cases the custom has been to add little or nothing to the previous annual maintenance expenditures to cover the depreciation in excess of that paid for in the last year's maintenance.

Of course it is argued that engineering experts could have pointed out such facts to a commission of "business men," and that it is not a commission's fault if it erred because of the insufficiency of the evidence submitted. This is true. The facts *could* have been presented, and the *commission* was not at fault. It is also true—and more important—that a commission should not be so ignorant or so blind that it will fail to reach a correct conclusion even if the expert evidence is insufficient or faulty. Also it is not the fault of an ignorant commission that it errs. The fault lies with those who appointed a non-technical commission to be judge of technical subjects.

As yet society is, as a whole, ignorant of technical things, so ignorant that it often fails to recognize that a problem is technical even though it bristles with troubles for even the most scientific mind. Business men talk glibly of being able to handle railway rate-making problems, as if they were akin to estimating the cost of hauling potatoes in a farm wagon to market. A little knowledge, stroking its chin, pronounces more knowledge quite unnecessary—or, if perchance it should be needed, its possessor can be *hired*.

Hired technical brains will always be needed by courts and by commissions, but a better quality of brains is likely to be hired if the employer himself has sufficient technical knowledge to appreciate the intricacies of the problems to be solved.

An attorney who had been attending the recent hearings of the Minnesota rate case before the master in chancery remarked: "I will wager that the judge wished he were an engineer far more often than he was thankful that he was a lawyer. The conflicting theories and testimony as to the facts presented by witnesses and attorneys were such as to require the most technical training to understand and analyze them. It was a case where justice would have been far better served had the attorneys on both sides, the witnesses and court itself been engineers."

The whole tendency of modern jurisprudence is toward the elimination of the antique theory of having a trial by jury even for non-technical cases. It is bad enough to try a non-technical case before business men, farmers and laborers not trained to weigh evidence. It is infinitely worse to try technical cases before "business men."

Honesty and firmness, a logical brain and a trained engineering mind are the most important qualifications needed in a man who is to sit as a judge of rates to be charged by the great public service companies, for the cost of constructing and operating their plants involve little else than the solving of a series of problems in engineering economics. The other elements involved in these problems are readily comprehended by an engineer of broad intellect, whereas the engineering elements of the problem are very difficult of comprehension by a mind not trained to use the data of engineering.

Engineers individually and collectively can do no better public service than to urge the appointment of engineers on public service commissions.

Coal Handling Costs.—Some costs of handling coal by hand and machinery were given in a recent discussion by Architect G. Monks, of Monks & Johnson, Boston, Mass., engineers. It was stated that while hand screening costs between 5 and 10 cts. per ton, loading teams costs about 7 cts. per ton and that the delay in teams and equipment during loading is an elastic quantity ranging between 10 and 15 cts. per ton. Mr. Monks referred to the case of several dealers who were saving 20 to 25 cts. per ton in labor cost over the methods which they formerly employed by the use of pockets. This is not taking into consideration the possible economies in discharging from cars or from vessels. A certain dealer, whose plant was designed by this firm, does only a part of his teaming. On the basis of an equal yearly output of, approximately, 13,000 tons, he saved in one year $3,230 in extra team hire alone. This in itself amounts to about 25 cts. per ton, or to 16 per cent profit from his investment

MOMENT ANALYSES of REINFORCED CONCRETE FLOORS

Analyses for Moments in Three Types of Reinforced Concrete Floors.

Contributed by [illegible]

I. THE SLAB [illegible] BEAMS [illegible] ANGLES

A [illegible] Fig. 1, as is also the distribution of load to the reinforcing elements. The beams are as- [illegible]

[illegible] the moment at the [illegible] at x is [illegible] which according [illegible] equal to a section constant times the second derivative [illegible]

[illegible] $E\ I\ \frac{\delta y}{[illegible]}$ [illegible] $\frac{1}{[illegible]}$ [illegible] $\frac{1}{12}$ [illegible]

Since these moments hold for sections whose length is $2L$, the total positive moment in the slab is $M_1 = +\frac{3}{192} wL^2 \times 2L = +\frac{1}{32} wL^3 = +\frac{1}{32} WL$ (Eq. 1), where W is the total panel load and equals wL^2. Similarly for the total negative moment in the slab,

$$M [illegible] \frac{7}{192} wL^2 \cdot 2L [illegible] \frac{7}{96} WL \quad \text{Eq. 2}$$

Moments in the Beams.—The full load per unit length of beam will at the end be ¼ wL and at the center ¾ wL and at intermediate point distant x from the column center $w' = \frac{1}{4} wL \left(1 + \frac{4x}{L}\right)$. (See lower diagram, Fig. 1.) Letting M'_0 equal the negative moment at the point $x=g$ near the edge of the bracket

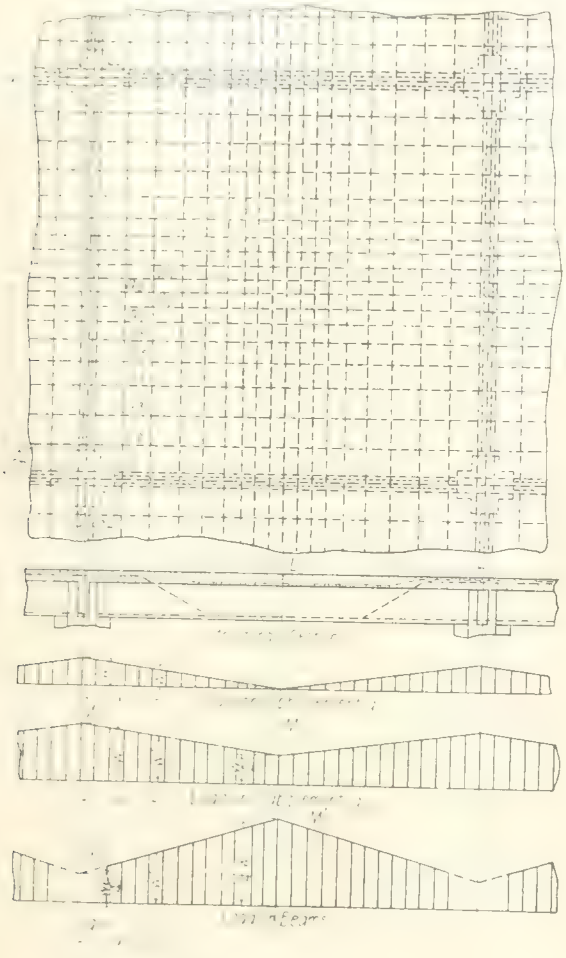


Fig. 1—The Slab and Deep Beams.

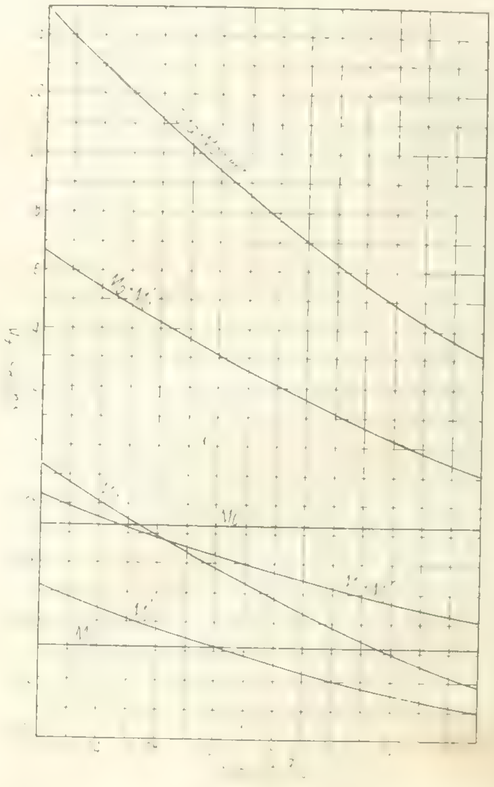


Fig. 2—The Slab and Deep Beams (Curves).

effect on the flexure of the slab, and, in order to study the effect produced by decreasing the free span, they have been given deep brackets at the columns of length g, the total length of beam and panel being L. Due to differences in rigidity the two systems of reinforcement will not take on equal portion of the load at all points in the panel. Since the slab element at the end of its span is as rigid as the beam which supports it, the element perpendicular to the beam at its center may be assumed to take the full unit load, while the mid point of the intersecting element here located will take no load. From symmetry, both systems must each take one-half of the imposed load at the center point and at the corners of the panel. This determines the load distribution at nine points in the panel, and, assuming a straight line variation between them, we have the condition for the two limiting slab elements, a_1 and a_{10}, shown in Fig. 1.

Moments in the Slab.—Considering the element a_1, the total unit load being w, the load, w', at any point distant x from the beam lines [illegible] $\frac{1}{24}\frac{w}{L}$ [illegible] $+ C$. Since $\frac{\delta y}{\delta x} = 0$ when $x = 0$ and when $x = \frac{L}{2}$, $C = 0$, $M_0 = [illegible] \frac{1}{64} wL^2$ and the moment M_1 at the center of the element is $+\frac{1}{192} wL^2$.

For the element a_{10}, $w' = w\left(1 - \frac{x}{L}\right)$ and in a manner similar to the above there is found $M = [illegible] \frac{11}{192} wL^2$ and $M = [illegible] \frac{5}{192} wL^2$. Therefore the average intensity of the center moment in the slab elements will be $+\left(\frac{1+5}{192}\right)\frac{wL^2}{2} = [illegible] \frac{3}{192} wL^2$ and the average negative moment will be $\left(\frac{1}{64} + \frac{11}{192}\right)\frac{wL^2}{2} = [illegible] \frac{7}{192} wL^2$

where the beam can be assumed to be fixed, $M = M'_0 + \frac{1}{4} wL \left(1 + \frac{g}{L}\right)\left(1 - \frac{g}{L}\right)(x - g) - \frac{(x-g)^2}{24}(3wL + 8g + 4x)$. By integrating this for the first derivative of the deflection curve and determining constants by the conditions that the tangent is zero when $x=g$ and when $x = \frac{L}{2}$ and multiplying the resulting equation by 2, since there are two beams involved, the following expression is obtained for the total negative moment:

$$M [illegible] \frac{WL}{[illegible]}\left[\frac{9}{[illegible]} + \frac{15}{4}\left(\frac{g}{L}\right) [illegible] \frac{3}{2}\left(\frac{g}{L}\right) [illegible] \left(\frac{g}{L}\right)\right] \quad \text{Eq. 3.}$$

Letting $x = \frac{L}{2}$ in the general equation for mo ments given above, the total center moment is found to be:

$$M_1' = M_0' + \frac{WL}{48}\left(7 + \frac{4g}{L}\right)\left(1 \text{ [illegible]}\right)$$

Plotted Values.—Letting [illegible] the coefficient of WL, we can [illegible] KWL. For the case in hand K is a constant for the slab and for the beam it varies with functions of $\frac{g}{L}$. In [illegible] 2, 3, and 4 are plotted with values of K as ordinates and values of $\frac{g}{L}$ as absissas. The total positive and total negative moments, obtained by adding the values of slab and beam, are also plotted, and also the total moment, which is the numerical sum of the total positive and negative moments.

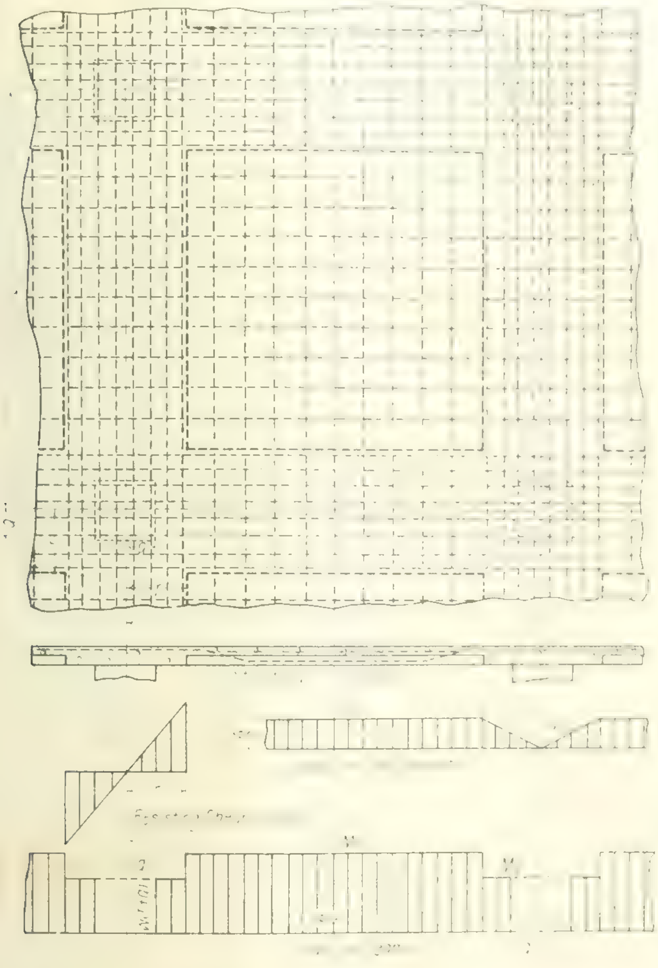


Fig. 3—The Slab and Wide Beams.

It is seen that two way reinforcement decreases the moment in the slab and increases that in the beams, the total positive and negative moments remaining the same [illegible] a uniform distribution of $\frac{w}{2}$ on each system in the case of two way reinforcement or of w for one way reinforcement [illegible] $\frac{1}{12}$ and $\frac{1}{6}$ WL, respectively, when $\frac{g}{L}=0$. This change in the relative values of beam and slab moments is an advantage since the beam moments are resisted by steel having a longer resisting arm than the slab steel. The actual distribution of load between the two systems will be intermediate between a uniform load for each of $\frac{w}{2}$ and the one treated. [illegible] positive moment in the slab will lie be-

[illegible] 12 [illegible] 96 [illegible]

[illegible] ing as before the effect of the column capital.

[illegible] 1 [illegible] 7 [illegible] 3 [illegible] 6 [illegible]

which proves that the total moments remain unchanged for the two extremes assumed and it is fair to suppose that the same will obtain, or nearly obtain, for any intermediate distribution.

[illegible] GLES.

The construction and load distributions for this case are shown in Fig. 3. The beams of width $2r$ are wider and less deep than in I so that they will take part in the flexure of the slab. Considering the distribution of load between the two systems, we have, at the middle of the side of the beams, the reinforcing elements of the slab supported on a beam flange which is subject to flexure both laterally and longitudinally. It is thus less rigid than a deep narrow beam and the assumption seems warranted that each system here takes one-half of the total unit load. This determines the distribution at four points in the panel, which, in conjunction with the known distribution of load at the four corners and center [illegible] $\frac{w}{2}$ for each system over the slab proper. At the [illegible] beam have the same deflection, and, since they are supported by it, the full unit load will be taken by the beam. This establishes the distribution of load on slab elements and [illegible]

Moments in the Slab.—The load on a strip of unit width is supported by a shear in the [illegible] The [illegible] will be greatest at the edge of the flange and zero at the center of the beam, so that the distribution shown at the left in Fig. 3 will obtain. The unit shear at the edge of the beam [illegible] shear at any point distant x from the center of the beam is $\frac{w}{2}\left(\frac{L}{r}-1\right)\frac{x}{r}$. The unit load [illegible]

[illegible]

where M_0 is the negative moment at the center of the beam, I_0 is the moment of inertia of a unit width of beam and E is the modulus of elasticity of the material. Integrating,

$$\text{[illegible]}\left(\frac{L}{r}-2\right)\frac{x^4}{r} + (C_1=0). \quad \text{Eq. 1.}$$

For the portion $x=r$ to $r=\frac{l}{2}$

[illegible] .... Eq. 2.

I_1 being the moment of inertia of a unit width of slab. Therefore

[illegible]

Placing $x=r$ and equating the value of the tangent obtained in the last equation to that obtained in Eq. 1 and solving for M_0, the intensity of the maximum negative moment in the slab is obtained. This multiplied by the length of section $2(L-2r)$, gives as the total value of the negative moment,

$$M = -\frac{WL}{12}\left[\frac{\left(1-\frac{2r}{L}\right)^3}{\text{[illegible]}} + \frac{\left(1-\frac{2r}{L}\right)\left(\frac{r}{L}\right)^2}{\left(1-\frac{2r}{L}\right)\left(\frac{I}{I_1}\right)+\frac{2r}{L}}\right] = -KWL. \quad \text{Eq. 3}$$

The positive moment in the center of the slab is found by substituting $x=\frac{L}{2}$ in Eq. 2, which, multiplied by 2 $(L-2r)$, gives as its total value

$$M_1 = \text{[illegible]}\left(1 - \frac{2r}{L}\right)^2 = \text{[illegible]} \quad \text{Eq. 4}$$

In Fig. 4 equations 3 and 4 have been plotted for three values of $\frac{I}{I_1}$. The value $\frac{I}{I_1}$ will, for the same percentages of reinforcement, vary with the ratio of the two depths cubed and approximately so for other percentages. If greater accuracy is desired, the center of gravity of the composite section is found and the moments of inertia of the steel and concrete components about this center are added to obtain the total moment of inertia of the section.

It is seen from the curves that there is little advantage in making the beam depth more than twice that of the slab as far as concentrating the moment on the greater depth is concerned. The values of K for $\frac{I_0}{I_1}$ = infinity are nearly identical with those for $\frac{I_0}{I_1}=100$.

Moments in the Beams.—For the portion

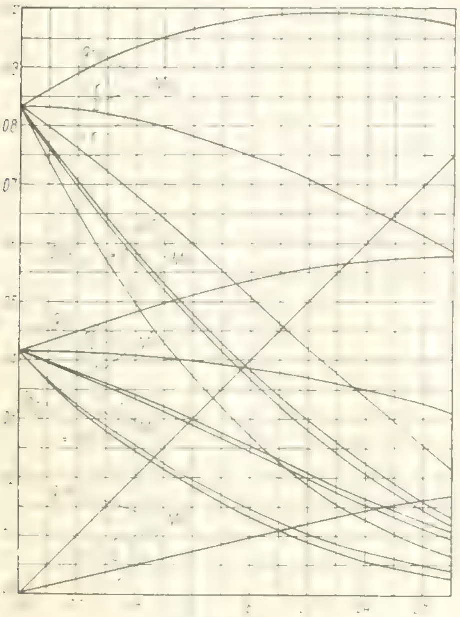


Fig. 4—The Slab and Wide Beams (Curves).

$x=g$ to $x=r$ the load per unit length of beam is [illegible]. Whence

$$M = M_0' + w\left[\left(\frac{L}{2}\right)^2 - g^2\right](x-g) \text{[illegible]} = EI\frac{d^2y}{dx^2},$$

M_0' being the negative moment at the point $x=g$ where the beam can be assumed to be fixed. Therefore,

$$EI\frac{dy}{dx} = M_0'x + w\left[\left(\frac{L}{2}\right)^2 - g^2\right]\left[\frac{x^2}{2} - gx\right] \text{[illegible]} + g\left(\frac{x^3}{3} - x^2g + g^2x\right)$$
$$+ \left\{C - w\left[\left(\frac{L}{2}\right)^2 - g^2\right]\frac{g^2}{2} + \frac{wg^3}{6}(r+g) - M_0'g\right\}$$

For the portion $x=r$ to $x=\frac{L}{2}$

$$M = M_0' + w\left[\left(\frac{L}{2}\right)^2 - g^2\right](r-g) - \frac{w}{2}(r+g)(r-g)^2$$
$$+ w\left[\left(\frac{L}{2}\right)^2 - r^2\right](x-r)$$
$$-\frac{w}{2}\left(\frac{L}{2}+r\right)(x-r)^2 = EI\frac{d^2y}{dx^2}. \quad \text{. . Eq. 5.}$$

$$\therefore EI\frac{dy}{dx} = M_0'x + \left(\text{[illegible]}\frac{gL^2}{4} - \frac{r^2L}{3} + \frac{r^2g}{2} - \frac{rg^2}{2}\right)wx$$
$$+ \left(\frac{L}{8} + \frac{r}{4}\right)wx^2 - \left(\frac{L}{12} + \frac{r}{6}\right)wx^3$$
$$+\left[C_1 - M_0'\frac{L}{2} - w\left(\frac{Lrg^2}{4} - \frac{Lr^2g}{4} - \frac{Lg^3}{4} + \frac{r^2L^2}{8} - \frac{L^2r}{24} - \frac{L^2g}{8} - \frac{L^3}{48}\right)\right]$$

Equating the two expressions for the first derivitive at the point $x=r$ a solution is obtained for M_0' which multiplied by 2 gives the value of the negative beam moment pertaining to one panel.

$$M_0'(\text{total}) = \frac{WL}{12\left(1-\frac{2g}{L}\right)}\left[-1+6\left(\frac{g}{L}\right)-2\left(\frac{r}{L}\right)\right.$$
$$+6\left(\frac{r}{L}\right)^2 - 6\left(\frac{g}{L}\right)^2 + 4\left(\frac{r}{L}\right)^3 - 12\left(\frac{g}{L}\right)^3$$
$$+12\left(\frac{r}{L}\right)\left(\frac{g}{L}\right)^2 - 12\left(\frac{r}{L}\right)^2\left(\frac{g}{L}\right) - 8\left(\frac{r}{L}\right)\left(\frac{g}{L}\right)^3$$
$$\left.+8\left(\frac{r}{L}\right)\left(\frac{g}{L}\right) + 16\left(\frac{g}{L}\right)^4\right] = -KWL. \quad \text{Eq. 6.}$$

Putting $x=\frac{L}{2}$ in Eq. 5 and multiplying by 2 the total moment M_1' in the center of the beams is found to be

$$M_1' = M_0' + WL\left[\frac{1}{8} + \frac{1}{4}\left(\frac{r}{L}\right) - \left(\frac{g}{L}\right) - \frac{1}{2}\left(\frac{r}{L}\right)^2\right.$$
$$\left.+\left(\frac{g}{L}\right)\left(\frac{r}{L}\right)^2 - \left(\frac{g}{L}\right)^2\left(\frac{r}{L}\right) \text{[illegible]} \left(\frac{g}{L}\right)^3\right] = KWL.$$

. . . . Eq. 7.

In Fig. 4 equations 6 and 7 have been plotted for $g=r$, $g=\frac{r}{2}$, and $g=0$.

The Cantilever Moment of the Beam Flanges at the Column.—When g is less than r the proportionate load on the beam outside of the portion included in the column capital will produce a negative moment with reference to the point where the flange can be considered fixed. For the load from the panel on one end of one beam this moment is

$$-w\left[\left(\frac{L}{2}\right)^2 - g^2\right]\left(\frac{r-g}{r}\right)\left(\frac{r-g}{2}\right).$$

Therefore the total moment,

$$M_2 = -WL\left[\frac{1}{4} - \left(\frac{g}{L}\right)^2\right]\left[\frac{r}{L} - \frac{2g}{L} + \left(\frac{g}{L}\right)\left(\frac{g}{r}\right)\right]$$
$$= -KWL. \quad \text{. . . . Eq. 8.}$$

The lower curves of Fig. 4 are plots of Eq. 8 for $g=r$, $g=\frac{r}{2}$, and $g=0$.

Summations of Moments.—In Fig. 5 the total positive and total negative moments have been plotted for the condition $\frac{I_0}{I_1}=10$. It is seen from equation 4 that the numerical sum of positive and negative moments in the slab is not dependent on $\frac{I_0}{I_1}$, so that the curves for total moment, the ordinates of which are the numerical sums of those to the curves M_1 M_1' M_0 M_0' and M_2, hold for all values of $\frac{I_0}{I_1}$. When $r=g=0$ the equations reduce to the values corresponding to those for the slab and deep beams when each system is assumed to take a unit load of $\frac{w}{2}$ over the whole panel.

The positive moment in the slab is $+\frac{1}{24}WL$ and the negative moment $-\frac{1}{12}WL$ which added to the equal moments in the beams give a total positive moment of $+\frac{1}{12}WL$ and a total negative moment of $-\frac{1}{6}WL$.

As $\frac{r}{L}$ increases both positive and negative moments in the slab decrease while those in the beams decrease or increase accordingly as g is greater or less than a value approximating $\frac{r}{2}$. The negative moment of the beam flanges decreases rapidly as $\frac{g}{r}$ increases and becomes zero for $g=r$. For $g=0$ the total positive moment decreases slightly as $\frac{r}{L}$ increases and the total negative moment increases by about the same amount, so that the total moment remains nearly constant at $\frac{1}{4}WL$. The principal modifying influence in this as in the other construction is the shortening of the beam span due to the column.

The extra weight of the beams in both I and II may either be considered a part of the uniformly distributed load or, with greater accuracy, the moment produced by it may be added to the beam moments as found above, considering the same to be a uniform load on a continuous beam of span $L-2g$.

III. THE FLAT SLAB.

In general there will be maximum positive moment at the center lines of the panel and maximum negative moment around the edge of the column capital. Strips taken between edges of corresponding capitals will be somewhat in the condition of continuous beams with points of inflection distant by a fraction of the free span length from the fixed end. Using the same value of this fraction for the direct and diagonal spans, the points of inflection fall approximately on lines bounding a square whose center is the center of column. Along these lines the bending moment will therefore be zero and the bands between opposite columns, direct and diagonal, will be in the condition of simple beams.

If, as before, w be the unit load on a panel whose length and breadth are each L and whose inflection points are distant a from the center of column in a direct direction and $a\sqrt{2}$ in a diagonal direction (Fig. 6), the total shear along the square of inflection is $W(L^2-4a^2)$. For points equally distant from the center of column the shear will evidently be higher in a diagonal direction than in a direct,

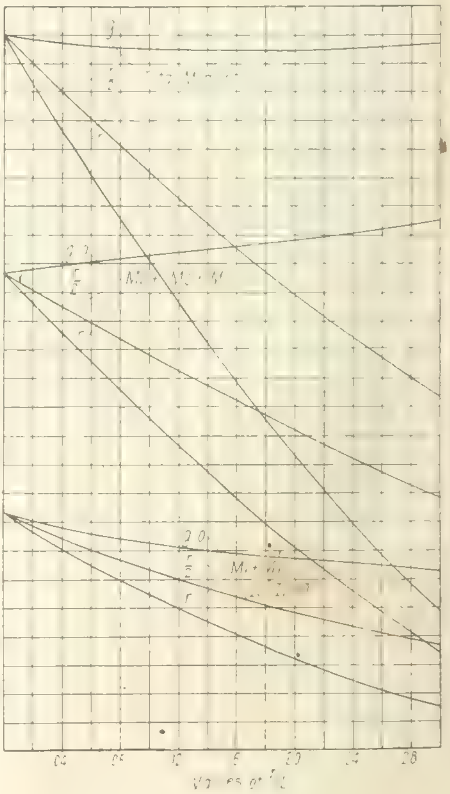


Fig. 5—The slab and Wide Beams (Curves).

column to column direction, and both become zero at the center of the panel and midway between columns. Assuming equal unit shear on lines parallel to a line connecting these two points, as the column is approached, the unit shear will be constant on lines bounding squares having the center of column as center, and, as a consequence, the slab at the lines of inflection may be considered to be subject to a uniform unit shear. The bending moment can therefore be obtained in the direct and diagonal strips extending between opposite lines of inflection by treating them as simple beams.

Moment at the Center.—To simplify the general solution, reinforcing bands of width $2a$ in a direct direction and $a\sqrt{2}$ diagonally will be substituted for the actual bands. The outlines of the assumed bands are represented in Fig. 6 by heavy dotted li[illegible] the actual bands by light full lines. Considering the two bands $x\ x$ [illegible] load coming on these bands will be one-fourth of the load on the panel outside of the square of inflection and the moments at the center of these bands will be one-fourth of the total center moment of the panel. Considering the unit load taken by each unit area of band to be w where there is only one band and $\frac{w}{2}$ with two bands, etc., the reaction along the line $x\ x$ in the direct column to column direction due to the load on the band $x\ x\ y\ y$ is $\frac{1}{24}wL^2+\frac{1}{6}waL-\frac{7}{12}wa^2$ (Eq. 1) and the moment at the center of this band is $\frac{1}{144}wl^3+\frac{1}{12}wL^2a-\frac{1}{2}wLa^2+\frac{23}{36}wa^3$ (Eq. 2).

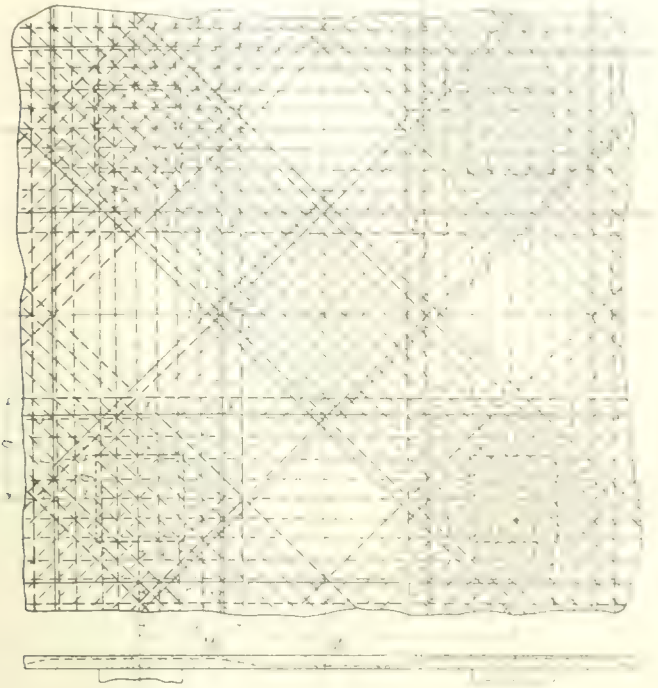


Fig. 6—The Flat Slab.

The shear along the line $x\ x$ due to the load on the diagonal band $x\ x\ z\ z$ is $\frac{1}{12}wL^2-\frac{1}{6}waL+\frac{1}{12}wa^2$ (Eq. 3), and the moment at the center of this band is

$$w\sqrt{2}\left(\frac{1}{36}L^3-\frac{7}{48}L^2a+\frac{1}{3}La^2-\frac{23}{72}a^3\right). \qquad \text{Eq. 4.}$$

Equations 1 and 3 are obtained by adding the load triangles and rectangles on each half band and equations 2 and 4 are obtained by subtracting from the positive moment of this shear about the center of the band, the negative moment of the load components about the same point, both shear and load components being considered effective from their respective centers of gravity. The sum of (1) and (3) is

$$\tfrac{1}{8}wL^2-\tfrac{1}{2}wa^2 \quad \tfrac{1}{2}w\left[\left(\frac{L}{2}\right)\ [illegible]\ \right]$$

which evidently equals the shear in the distance $x\ x$, and the sum of [illegible] one-fourth of the total bending moment across the center of the four full bands belonging to [illegible] this total moment by [illegible]

$$[illegible]\left[\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\ [illegible]\right]=[illegible] \qquad \text{Eq. 5.}$$

As the bands intersect in a manner that makes the fractional values of the unit load assigned to their several divisions apply only between the limits, $\frac{a}{L}=\frac{1}{4}$ and $\frac{a}{L}=\frac{1}{3}$, these will be the limits between which the above equation applies. It will be found, however, that the value of $\frac{a}{L}$ of designs will quite generally fall within these limits.

When $\frac{a}{L}$ becomes less than ¼ the load on the area represented by the triangle *a-b-c* will be carried in shear to the adjacent bands. Fig. 7 shows the distribution of these shears. The unit shear at each apex being zero, there will be maximum unit shears S_1 and S_2 at the centers of the sides. Whence equating vertical shear and load,

$$[illegible]$$

Also taking moments about the center of gravity of the shear on the hypothenuse,

$$[illegible]$$

$$[illegible]$$

and the total shear coming on each of the three bands, one direct and two diagonal, is $\frac{1}{12}w\overline{bc}^2$ or one-third of the load on the triangle *a-b-c*. In a manner similar to that used in the derivation of Eq. 5 the total bending moment at the center of the panel is found to be,

$$[illegible]=[illegible]\left[\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\ \tfrac{2}{3}\left(\frac{a}{L}\right)^2 - [illegible]\left(\ [illegible]\ \right)\ [illegible]\right]=KWL, \qquad \text{Eq. 6,}$$

[illegible] $\frac{a}{L}$ becomes greater than ⅓, the load taken by the triangles *c-x-c'* and *b-y-c'* becomes zero and [illegible]

$$[illegible]\left[\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)-\left(\ [illegible]\ \right)\left(\ [illegible]\ \right)\ [illegible]\right]=[illegible] \qquad \text{Eq. 7}$$

[illegible]

Figure 8 shows values of K, as obtained from equations 5, 6 and 7, plotted against $\frac{a}{L}$.

[illegible] of $\frac{a}{L}$.--No attempt is here made to determine the value of $\frac{a}{L}$ from analytical considerations. It seems reasonable that the value which obtains is not far from that of a continuous beam of uniform section and under uniform load, the effect of a larger section at the center in its tendency to locate inflection nearer to the column being offset by the higher intensity of stress, column to center, than that present in the beam. Thus if the diameter or side of the column and effective part of the capital be $2g$, then on the above basis

$$[illegible]+.211\left(\ [illegible]\ \right)=.11\ [illegible]\ .578\ [illegible] \qquad \text{Eq. 8.}$$

The lower curve of Fig. 9 shows the center moment, as given by equations 5, 6 and 7 and Fig. 8, reduced to the variable $\frac{g}{L}$, assuming the above equation to hold.

The Resulting [illegible] Fig. 6 it is seen that for the diagonal bands no more steel can be considered to resist their center moment than that contained within them, since the steel in the intersecting bands is parallel with the section. The stress in the direct bands may, however, be relieved in part by the diagonal bands as they intersect it in the triangle *d-e-f*. If the width of the half band is *r*, the apex *d* of this triangle will be [illegible] $\left(\ [illegible]\ \right)$ [illegible] diagonal span. The area of this triangle becomes zero for $\frac{2r}{L}=.413$, a common value generally used being 7/16, which with an average value of $\frac{a}{L}$ of 7/24 locates the point *d* at a distance .28 *L* from the center of the diagonal span. At this point the stress in the diagonal

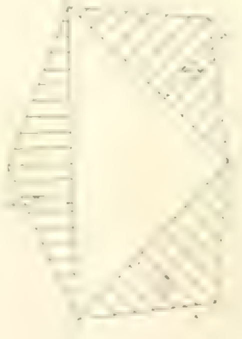


Fig. 7.

steel due to its own imposed load is approximately 5/6 of the full value at the center and if at the limit the interaction from the direct band increases this to a full value across the bands to the center point of the panel, the increment of stress here produced will be about 1/12 of the total stress and thus take 1/12 of the center moment. The principal value of this slab action consists in its tendency to equalize the resisting moment over the different elements of a band and between the different bands.

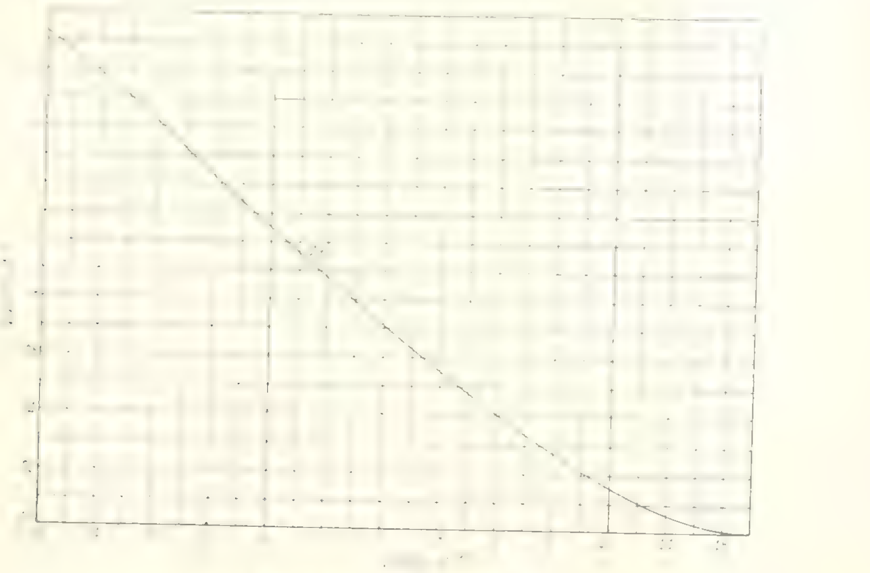


Fig. 8—The Flat Slab (Curves).

[illegible] Concrete.—The flexure of the flat slab with its low percentage of center reinforcement is considerably influenced by the tensional value of the concrete in the lower portion of the slab. Although in design as in the above discussion this value is neglected, it is undoubtedly true that it may carry the greater portion of all but the excessively high loads.

Assuming two resisting sections at right angles, each of length L, $M = K\ W\ L = \frac{1}{3}\ L\ d^2\ S$, where d is the total depth of the slab and S is the unit stress on the outer fiber of the plain concrete slab. The resisting moment as based on the steel may be taken at $M = K\ W\ L = p \times$ [illegible], where d' = depth to the steel = ⅞ d (approx.), p = ratio of steel area to that of concrete and f_s = working stress in the steel = 16,000 lbs. per sq. in. Equating the two expressions for the resisting moment and solving, S = 55,200 p; which, with p varying from .002 to .005, gives a value of S of 110 to 276 lbs. per sq. in. The modulus of rupture of a 1:2:4 concrete being about 300 lbs. per sq. in., it is seen that the concrete without aid from the steel may under favorable conditions carry as much as 150 per cent of the rated load before failing in tension.

The Moment at the Column.—The negative moment at the column may be obtained by considering the cantilever action of the shear along the lines of inflection, plus that of the load within the same, both with reference to a sustaining section near the column. If the capital at the point where the slab may be considered fixed has sides or diameter of length $2g$, the sustaining section for one-eighth of the total load may be taken of length g and parallel to the corresponding line of inflection. The total negative moment pertaining to one panel is,

$$[illegible] \quad \text{Eq. 9.}$$

$$[illegible] \quad \text{Eq. 10.}$$

Eq. 10 may be simplified by substituting from Eq. 8, $\frac{[illegible]}{L} = .211 + .578\frac{g}{L}$. Whence

$$[illegible] \quad \text{Eq. 11.}$$

The middle curve of Fig. 9 is a plot of Eq. 11 and the curve for total moment is obtained as before by adding the ordinates to the curves for M_1 and M_0.

The Steel Over the Column.—The negative moment as expressed in Eq. 9 is composed of four components whose arms are radial and inclined to the center lines of the columns by an angle whose tangent is one-half, and, since the four reinforcing bands pass over the column in as many radial directions, they will on the whole be nearly parallel with the moment arms of the external forces and thus be effective to the full extent of the tension produced in them. The curves show the moment at the column to be from 1.30 to 1.36 times that in the center, while the steel without special provisions is of equal amount. Considering also that the steel at the column has a smaller effective depth and that with all but large column capitals there is a question whether the outer portions of the bands are fully effective, it is seen that if full continuity is to be insured over the columns extra reinforcement must be provided. This can be done by carrying the splice ends of the reinforcing units a sufficient distance past the column to make them effective in tension on both sides of the capital. If three such splices be provided the total amount of steel over the column will be 1¾ times that in the center of the panel, which, with .2 to .5 per cent in the center and a ratio of the two depths of .9, gives a percentage reinforcement in direct and diagonal directions of .92 to 2.30. Since a stress of 16,000 lbs. per sq. in. in a steel reinforcement of 1 per cent corresponds to a stress of 730 to 900 lbs. per sq. in. on the outer fiber of the concrete, the same will be unable without suitable compressive reinforcement to carry the compression produced by all but the smaller percentages of tensional steel.

The Advantages of a Large Column Capital.—As can be seen from the curves in Fig. 9, both positive and negative moments decrease in nearly a straight line relation as the values of $\frac{g}{L}$ increase. This is also true for the vertical unit shear around the edge of the capital. Further, by the use of a large capital the section which resists negative moment is increased so as to fully utilize a greater proportion of the steel passing over the column.

Comparisons on the Three Types.—For the case of the point column the total positive moment has nearly the same value for the three constructions—namely: 1/12 $W\ L$. The identity is exact for the two slab and beam types, I and II, while the value .0831 $W\ L$ for III, the flat slab, is the sum of rational quantities and surds and is within .3 per cent of being 1/12 $W.\ L$. At the same limit the total negative moment is —1/6 $W\ L$ for I and II and —.111 $W\ L$ =—1/9 for III. This smaller total negative moment in the flat slab is due to the relatively larger center section and the consequent greater load on the central portion of the slab. On the other hand, the section resisting negative moment is smaller to such an extent as to make the intensity per unit width greater than in the slab and beam types.

The curve for total positive moment in II coincides for nearly its whole length with that in I if, for the former, $\frac{g}{r} = .4$ and $\frac{I_b}{I_1} = 10$, and it nearly coincides with that in III if $\frac{g}{r} = ¾$ and $\frac{I_b}{I_1} = 10$. In other words, if for ordinary conditions the slab and wide beams are to have the same positive moment as the slab and deep beams, the effective part of the capital need be only 4/10 of the width of the beam, while in order that it may be as low as that in the flat slab, the capital must be ¾ of the width of the beam. The flat slab is thus seen to have a smaller center moment than the slab and deep beams, the ordinates to the respective curves being .06 and .066 at $\frac{g}{L} = .10$ and .039 and .052 at $\frac{g}{L} = .20$.

In connection with this comparison on positive moment it should be noted that the values here given are deduced for the conditions governing full continuity, and any loss in continuity due to poor design or defective workmanship will increase the positive moment. Hence the practice with the slab and beam types of providing for a center moment twice as large as that present in the continuous structure is in part justified. By reference to the curves in Figs. 2, 5 and 9 it is seen that the ratio of negative to positive moment in I and II varies from 2.0 to 2.5, while in III this ratio varies from 1.30 to 1.36. The same proportionate decrease in the negative moment due to lack of continuity will therefore in the flat slab have a smaller effect on the positive moment than in the slab and beam floor. Further, the former construction is more

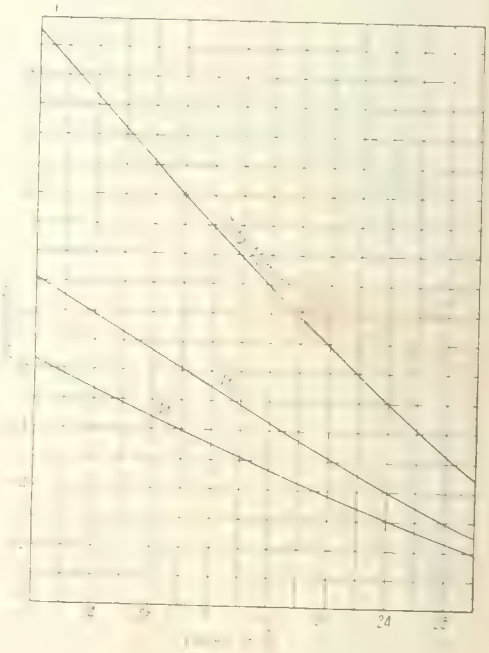


Fig. 9—The Flat Slab (Curves).

homogeneous with a [illegible] body whose outline is devoid of sharp angles. It therefore stands to reason that if the forces resisting moment at the column are properly provided for on both tension and compression sides, there is little object in providing for a greater center moment in the flat slab than that present considering full continuity.

The equations and diagrams here presented give the values of moments at the critical sections and while as such they afford a means for obtaining an estimate on comparative economy, they should not be regarded as directly giving such a comparison. The final comparison must be based on the quantity and the cost of material, the cost of construction, and the utility in the completed structure. For a given moment the volume of steel will vary with its length and inversely with its depth in the concrete. The chief items in the construction cost are the labor and material cost of the form work and the cost of placing the reinforced concrete, while the utility of each type in the structure will depend on the character of the structure.

The Travel of Shear in the Slab.—In the analysis for the flat slab the shear was assumed to travel along the reinforcing bands to the columns and in that for the slab and beams the shear was assumed to follow the lines of slab reinforcement to the beams and through them into the columns. This latter is a condition that exists for rigid beams whose center of deflection is very small compared with that of the slab. With greater deflections the shear will tend to travel diagonally toward the more rigid portions of the beams near the columns. This decreases the moments in the beams, since they receive the load nearer to the reaction, but the slab moments are increased in proportion and at the limit we have the conditions obtaining in the flat slab. All moment being caused by the difference in lever arm of resisting shear and load, the diagonal travel of shear toward the columns, in increasing this effective lever arm, increases the slab moments, and it is easily seen that if the diagonal moment produced thereby in the slab be resolved into two components along the lines of the resisting steel their sum, plus the diminished beam moments, is equal to the sum of slab and beam moments produced on the original assumption of direct travel of shear to the beams.

[illegible]

The central portion of the panel is the only region where moments of the same kind and of equal or nearly equal magnitude act at right angles. At the center in the direct direction between the columns in the flat slab the moments are of opposite kind, and about the capital by far the greater moment is radial. With the concrete broken in tension the only result produced by the interaction of flexural stresses of the same kind is a decrease in the deformation of the compression fiber which thus in effect gives the concrete a higher modulus of elasticity. This will, for a given reinforcement, raise the neutral axis, and for ordinary concretes with Poisson's ratio at 1/5 and reinforcements varying from .3 to 1.5 per cent, it can be shown that the neutral axis will be raised by about .03 of the depth to the steel and thus the lever arm of the latter will be increased 1 per cent. Its effect on the steel stress will therefore be negligible, but under ordinary loads it may be important in increasing the tensional value of the concrete.

The Effect of Arch Action.—Arch action, if present, is in floors a horizontal force and can have no effect in changing the values of moments produced by vertical loads. It will, however, effect a redistribution of the resisting forces, decreasing the tension and increasing the compression, the total resisting moment remaining unchanged and equal to the external moment. In common with slab action and the other modifying influences discussed it concerns itself only with the manner of action of the resisting forces. The moment to be resisted is defined by the dimensions of the panel and its supporting elements and the amount, position and nature of the incumbent load.

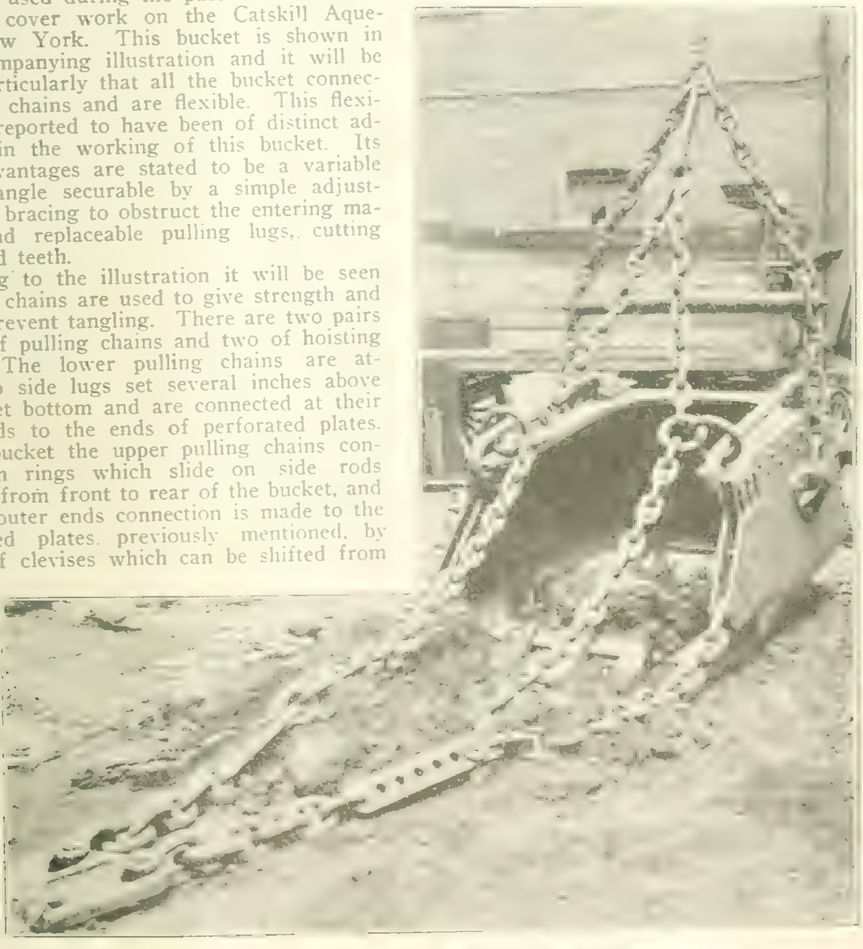
(Other Articles and Items on Concrete Construction Will Be Found on p. 26.)

EARTH AND ROCK SECTION

A Drag Line Excavation Bucket with Chain Connections.

A new form of drag line excavator bucket has been used during the past 18 months for cut and cover work on the Catskill Aqueduct, New York. This bucket is shown in the accompanying illustration and it will be noted particularly that all the bucket connections are chains and are flexible. This flexibility is reported to have been of distinct advantage in the working of this bucket. Its other advantages are stated to be a variable digging angle securable by a simple adjustment, no bracing to obstruct the entering material, and replaceable pulling lugs, cutting edges and teeth.

Turning to the illustration it will be seen that stud chains are used to give strength and also to prevent tangling. There are two pairs or sets of pulling chains and two of hoisting chains. The lower pulling chains are attached to side lugs set several inches above the bucket bottom and are connected at their outer ends to the ends of perforated plates. At the bucket the upper pulling chains connect with rings which slide on side rods reaching from front to rear of the bucket, and at their outer ends connection is made to the perforated plates previously mentioned, by means of clevises which can be shifted from hole to hole at will. In soft digging where the bucket will fill itself riding flat, the pull is chiefly on the lower set of chains and the outer ends of the two sets of pulling chains are connected to the perforated plates close together as shown by the illustration. For harder soil the outer end connections of the upper chains are slid forward a hole or two on the perforated plates and the strain in pulling comes chiefly on the upper chains and fills the bucket so that the cutting edge gets a good "bite" on the ground.



A Drag Line Excavator Bucket with Flexible Chain Connections.

The hoisting chains are also four in number arranged in pairs; the forward pair alone calls for particular notice. As will be seen, the upper ends of the forward chains connect by means of an adjustable clevis to a perforated plate; the lower ends have a common connection with the upper pulling chains to the rings which slide on the side rods. Now if we assume the bucket loaded and ready to hoist the action is as follows: The pulling rope is kept taut to hold the sliding rings at the front ends of the side rods and the bucket is hoisted and swung. When over the dumping place, the taut pulling rope is slacked off; the sliding rings slip back on the side rods, and the bucket tilts downward and discharges its contents. Hanging lip down the bucket is swung back to its work and lowered to take another load.

The dumping arrangement described, it will be seen, pulls all chains clear of the bucket mouth and permits a clean discharge. Also, it will be noticed, the bucket can be hoisted from wherever it lies without pulling in on the drag line.

In the bucket proper the principal features to be noticed are the omission of any interior bracing, the bowl getting its rigidity from its heavy construction and from the curb steel U-brace around its top edge. It will be noted too that the cutting edge is spread so that a path is cleared for the sides of the bucket to prevent binding. This cutting edge is manganese steel and is replaceable, as are also the teeth and the pulling lugs. The bucket can be operated by locomotive cranes, skid excavators and similar types of machines. It is made in sizes from ¾ cu. yd. to 2½ cu. yds. by the Hayward Co., 50 Church St., New York City.

A Cost Comparison of Electric and Compressed Air Hoisting from Deep Mine Shafts.*

Recently it has been suggested to use compressed air for driving large shaft-hoists, the air for the engines being supplied by electrically-driven compressors, and an installation of this character is being erected at Butte, Mont. It is the object of this paper to compare the compressed-air system of hoisting with the various electrical systems from the standpoints of first-cost and cost of operation.

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* [illegible] by K. A. Pauly, [illegible] of Mining Engineers, [illegible]

The Ilgner, converter-equalizer, and Creplet systems are the most common of the purely electric systems using the fly-wheel, and of these the Ilgner is almost universally used. Two systems using compressed air have been suggested; one, the low-pressure system, in which the hoist-engine exhausts into the atmosphere, and the other, the dense-air system, in which the engine cylinders form a part of the closed air-system, the engine exhausting against a pressure considerably above atmospheric pressure, the admission pressure being correspondingly raised.

A comparison between the purely electric system and the compressed-air system will be made first on the basis of a single hoist, following this with a comparison on the basis of a group of hoists situated at comparatively short distances from each other, and, as both systems of compressed air are applicable to isolated installations, they will be compared with the Ilgner system, which has been almost universally adopted in the past.

The operation of hoisting-engines on the low-pressure air-system is very similar to their operation by steam. From the compressor the air is delivered to large receivers, from which it is drawn to supply the engine, the air being exhausted from the engine directly into the atmosphere. As most of the heat generated in the air by compression has been lost before it reaches the engine, it must be reheated in order to increase the efficiency, and to prevent the freezing of the moisture contained in it, which if allowed to freeze will seriously interfere with the operation of the engine.

The closed-air system differs from the low-pressure system in that the engine exhausts into a receiver, from which the air for the compressor is drawn; the working-pressure of the engine being the difference between the admission-pressure and the pressure in the exhaust-receiver.

In the Ilgner system, the hoist is driven by a direct-current motor, power for which is supplied by a fly-wheel motor-generator set. The speed and direction of rotation of the hoist-motor are controlled by varying the voltage of the direct-current generator. The maximum demand upon the power-system is maintained at approximately the average demand during hoisting at the maximum rate by automatically varying the speed of the fly-wheel, a portion of the energy of the fly-wheel being given up during the peak-loads and returned to the fly-wheel during the lighter loads.

At first thought the change from steam to compressed air seems to be comparatively simple, requiring much less expense than changing from steam to electricity; but a careful consideration of the problems involved will reveal the error of this first impression.

As noted above, the successful and economical operation of compressed-air engines requires the temperature of the air at admission to be such that after expansion in the cylinders its temperature is not lowered sufficiently to cause freezing of the moisture contained in it. But the permissible temperature of the air at admission is limited by the flash-point of the cylinder lubricant, approximately from 400° to 450° F. This imposes a practical limit of 90 lb. gage to the pressure of the air for operating the engines on the low-pressure system. Therefore, as steam hoisting-engines operate at much higher pressures, it will usually—if not always—be necessary in changing over to compressed air to replace the engines by entirely new ones having much larger cylinders, thus placing the compressed-air system on a par with the purely electrical system as far as the hoist proper is concerned.

Further, a reheater must be used with a compressed-air system. It is frequently suggested that the old steam-boilers be used as reheaters, adapting them for this purpose by rebuilding the furnaces. To do this, however, is open to two serious objections, except under special conditions: (1) with the best of care a great deal of trouble will be experienced from leaking of the tubes, and (2) unless the nature of the fuel is such that the temperature of the air can be closely regulated its temperature will be raised above the flashing-point of the cylinder-lubricant during the periods when the hoist is drawing no air, and disastrous results may follow the admission of this highly-heated air into the engine-cylinders. A safe way of reheating air is to inject high-pressure superheated steam in it. If the installation is a new one, a reheating plant resembling in essential details a small boiler-plant must be built; this, however, has no counterpart in the purely electrical system.

The fly-wheel motor-generator set supplying power to the hoist-motor may readily be placed in the hoist-house or in a lean-to. The air-compressor may be placed in the hoist-house or it may be included as an addition to the compressor-plant, if one exists. But, wherever placed, the building required for housing the compressor and its intercooler will be larger than that required for the motor-generator set. Further, if the compressor be placed at the main compressor-plant, rather than at the hoist, considerable expense will be involved in many cases in piping the air from the compressor to the hoist. On the other hand, if the compressor be placed at the hoist, it will be necessary to provide cooling-water, which in some cases will involve considerable expense.

The claim is often made that the air for the hoist may be taken from an existing compressor-plant, without the necessity of materially increasing the capacity of the plant. This claim seldom, if ever, has any foundation; for if there is any considerable excess of compressor-capacity, it has been provided for a purpose, either for future growth or to take care of an emergency; and if advantage is taken of this capacity, the protection afforded by it is sacrificed, and the equivalent capacity must be added to meet the future demands.

The capacity of the air-receiver used to equalize the demand from the compressors is often underestimated in making a preliminary study of the problem. The drawing of air from the receiver to supply peak-demands for air results in a reduction of the pressure in the receivers, unless special provisions, too expensive for consideration in connection with an isolated hoist, are made to maintain constant pressure. The percentage-change is much greater within practical operating ranges than the percentage-change in volume of air drawn, a drop in pressure from 90 to 70 lbs. gage, 22 per cent, resulting from a draft of only 14.5 per cent of the air contained in the receiver. On the other hand, a fly-wheel gives up a large part of its energy with a small reduction in speed; approximately one-half of the total energy of the wheel being delivered with a reduction of only 30 per cent of its speed. Therefore, the total energy stored as potential energy in the air contained in the receivers must be approximately 3.5 times that of the equivalent fly-wheel. While it is true that the drawing of power from the fly-wheel of the Ilgner system is accompanied by a loss of power, a similar loss takes place when the air is drawn from the receiver.

When lowering unbalanced or when braking, power is automatically returned to the power-system with the electric hoist. While the air-hoist engine may be made to operate as a compressor when lowering or braking, and thereby return power, it can only be made to do so at the expense of simplicity of control.

For the purpose of making a direct comparison between hoisting by compressed-air engines and by electric motors, I have assumed the following conditions

Depth of shaft, ft.	2,500
Maximum rope speed, per min., ft.	3,200
Weight of ore per trip, lbs.	7,000
Weight of skip, lbs.	4,200
Diameter of rope, ins.	1.5
Time consumed hoisting ore, per cent	40
Time consumed in shifting and other hoisting, per cent	20
Time hoist idle, per cent	40
Power consumed in shifting and other hoisting, per cent of that consumed in hoisting ore.	50
Average temperature at mine, F.	45
Altitude, ft.	6,000

Hoist of the cylindrical-drum type, and hoisting normally done with skips in balance, but provision made in the capacity of the equipment for hoisting full load unbalanced.

2,200-volt, three-phase, 60-cycle power available at the hoist at 1 cent per kw.-hr. consumed.

Coal having a thermal value of 12,000 B.t.u. available at the hoist at $4.50 per ton.

Average depth of hoisting, ft.	2,000

To meet these conditions with an air-hoist will require a two-stage, 6,000-cu. ft. air-compressor driven by a 1,000-hp. synchronous motor, a storage-receiver of approximately 6,500 cu. ft. capacity, and a reheater. The equipment for the electric hoists will consist of a 550-hp. fly-wheel motor-generator set, and a 1,000-hp. hoist-motor.

The first-costs of these two equipments complete and installed are given in Table I.

TABLE I.—FIRST COSTS OF AIR-HOIST AND OF ELECTRIC HOIST.

Air-Hoist.	
Compressor plant, including compressors, building, and air receivers	$41,000
Reheater, modifications of hoisting engine and piping	13,500
Total	$54,500
Electric Hoist	
Flywheel motor generator set, switchboard and alterations to hoist house	$29,300
Direct-connected hoist-motor, control and connections to hoist	24,500
Total	$53,800

The data in Table I indicate that for an isolated installation the first-costs of the compressed-air hoist and the electric hoist are practically the same. In compiling these figures it has been assumed that the compressor would be placed at or near the hoist-house and only a small allowance has been made for piping from the compressor to the hoist. Of course, the variations in conditions of individual installations may cause either one or the other type of hoist to be slightly lower in first-cost, but any advantage which the compressed-air equipment may have in this respect, in individual cases, will always be insignificant when compared with the capitalization of its greater cost of operation.

The power consumed by the electric hoist and the compressed-air hoist per day for various depths and the coal consumed per day for reheating the air are shown by the curves of Fig. I. (As stated under the assumptions made in calculating these curves, it is assumed that the power consumed in shifting and other hoisting is 50 per cent of that consumed in hoisting ore. Therefore, if the efficiency of the two systems is figured from these curves, two-thirds of the power consumed, as shown by the curves, should be used in making the calculation. It should also be borne in mind that the efficiency of the compressed-air system varies directly with the absolute temperature of the air entering the engine-cylinders and a corresponding correction should be made if this temperature differs from 410° F., which temperature was assumed in preparing the above figures.) These curves show that the power consumed by the compressed-air hoist is greater than that required by the electric hoist when hoisting from the greater depths, while for the shallower depths the reverse is true. However, these curves do not truly indicate the relative costs for power for the two systems except where power can be purchased at a flat rate, which will rarely be the case for isolated installations. The power consumed by the compressed-air hoist during hoisting is much greater than that of the electric hoist, as is indicated by the capacities of the motors driving the compressor and the generator of the motor-generator set, so that the penalization of the peak-demand for power increases the cost of power for the compressed-air hoist more than for the electric hoist. However, as the extent to which the cost of power for the compressed-air hoist will be affected by the penalization of the peak-demand depends on the extent to which the peak is penalized, and as a flat rate for power places the compres[illegible] most favorable position, I have assumed a flat rate for power in comparing the operating-costs of the two systems. Further, to the cost of power for the compressed-air system must be added the cost of reheating the air, which, although a comparatively small item, is one which cannot be neglected.

Table II gives the total annual cost of operating the compressed-air hoist and the electric hoist based on hoisting 1,200 tons of ore per day, 275 days per year, from an average depth of 2,000 feet.

TABLE II. ANNUAL COST OF [illegible] COMPRESSED AIR HOIST AND ELECTRIC HOIST.

Compressed Air Hoist.

Fixed Charges:	
Interest on investment at [illegible] per cent	[illegible]
Depreciation	[illegible]
Taxes and insurance, at 1 per cent	[illegible]
Total	[illegible]
Operating Costs:	
Maintenance, repairs, oil, waste and sundries	[illegible]
Fuel for reheating air	2,227
Labor	[illegible]
Cost of power	20,900
Total	[illegible]
Grand total	40,81[illegible]

Electric Hoist.

Fixed Charges:	
Interest on investment, at 5 per cent	$ 2,690
Depreciation	1,883
Taxes and insurance, 1 per cent	538
Total	$ 5,111
Operating Costs:	
Maintenance, repairs, oil, waste and sundries	$ 1,076
Labor	4,100
Cost of power	19,992
Total	$25,168
Grand total	30,279
Cost of operating compressed air hoist	40,815
Excess cost of operating compressed air hoist, above that of an electric hoist	10,536

Table II shows that under the conditions assumed a saving of approximately $10,500 may be realized by the adoption of the electric hoist, which saving will pay for the complete installation in less than five years.

Furthermore, a comparison of the items which comprise the operating-costs of the two systems will reveal the fact that the greater labor required for the compressed-air hoist is largely responsible for its higher operating-cost, from which it follows that for conditions differing widely from those assumed, both as to output and depth of mine, the same general conclusions may be drawn with respect to the costs of operating the two systems, namely, that the compressed-air system will be [illegible] difference in operating-costs may be further increased, as previously pointed out, if the [illegible] mand as well as the kilowatt-hours consumed.

While it has been suggested to operate isolated deep-mine hoists on the closed-air system, the conditions rarely, if ever, are such as to warrant its adoption. For engines taking air throughout the whole or practically the whole length of the stroke, as is the case with small direct-acting pumps, small slope-hoists, etc., a considerable saving in the power required to compress the air consumed by them may be realized by adopting the closed-air system. Where the air can be and is used expansively, there is seldom any saving in power to be gained by adopting this system, and, where the load varies between wide limits, as it does during a hoisting-cycle, the power required to compress the air may be even greater than with the low-pressure system. Further, the loss due to leakage will be much greater than with the low-pressure installation.

The first-cost of the complete installation will be somewhat greater than that of the low-pressure installation because of the exhaust-receiver, the return-air main, and the high pressure for which all the piping, receivers, etc., on the high-pressure side of the system must be designed.

The first-cost of the closed-air system may be further increased over that of its low-pressure competitor in special cases, due to the fact that the compressor cannot be operated in conjunction with existing compressors, and, therefore, no advantage can be taken of the improved load-factor in reducing the total capacity of the compressor-plant.

The labor required to operate the hoist on the closed-air system will be the same as that required for the low-pressure hoist, so that the total annual operating-cost will not be very different from that given in Table II for the low-pressure hoist. Therefore, the comparison which has been made between the electric and the low-pressure air-systems indicates approximately the saving which may be realized by the adoption of the electric hoist in preference to the compressed-air hoist operated on the closed-air system.

Where a group of hoists is to be served, the compressed-air and electric systems differ somewhat from those best adapted to taking care of isolated hoists. If the hoisting is to be done by compressed air, a central compressor-plant is placed as near the center of distribution as conditions will permit.

Where a number of hoists are operated from the same central plant their loads combine and tend to produce a uniform load; but even with a considerable number of hoists operating in conjunction, there may be fluctuations in the combined load due to the simultaneous occurrence of the maximum and minimum loads of several of the hoists. In order to take care of these fluctuations, and thereby permit of compressing the air at a rate corresponding approximately to the average demand, a large receiver for storing air is located at the central compressor-plant. It has already been noted that when air is drawn from receivers the pressure drops rapidly, and, therefore, only a small percentage of the air contained in the tanks is available for assisting in handling the peak-loads unless some means is provided whereby the pressure in the tanks is maintained independently of the quantity of air drawn. To accomplish this result, a large water-storage reservoir is placed at the proper height above the storage-tanks and connected with them, which allows water to flow into or out of the tanks as air is drawn from or delivered to them, thereby maintaining constant air-pressure in the receivers.

Where the hoists are placed at a considerable distance from the central compressor-plant it is necessary to install local receivers to reduce the excessive demands for air from the central plant during hoisting, it being more economical to provide the local receiver-capacity than to install the large air-mains which would otherwise be necessary to prevent undue drop in pressure and loss in energy in the pipes during the maximum demands for air. The capacity of the local receivers, however, may be somewhat less than that of those required for the isolated hoist. The hoisting-engine and reheater are the same as for the isolated hoist.

Owing to the expense of the double pipe-lines necessary with the dense-air system, it is not practical to operate a group of hoists by this system, and it is, therefore, eliminated from the present comparison.

The electric system as applied to a group of hoists differs materially from that for an isolated installation. In cases where it is satisfactory to gear the motors to the hoists, alternating current motors may be used, thus eliminating the cost of the motor-generator set. The losses in the alternating-current motor will be approximately the same as the combined losses with the direct-current motor and motor-generator set.

A central electric storage-plant is placed as near as possible to the center of distribution to provide for the fluctuations in the combined load of all the hoists, as does the central receiver and reservoir for the air-hoists. Storage-batteries connected to the alternating-current supply-system through synchronous motor-generators are used for storing electric

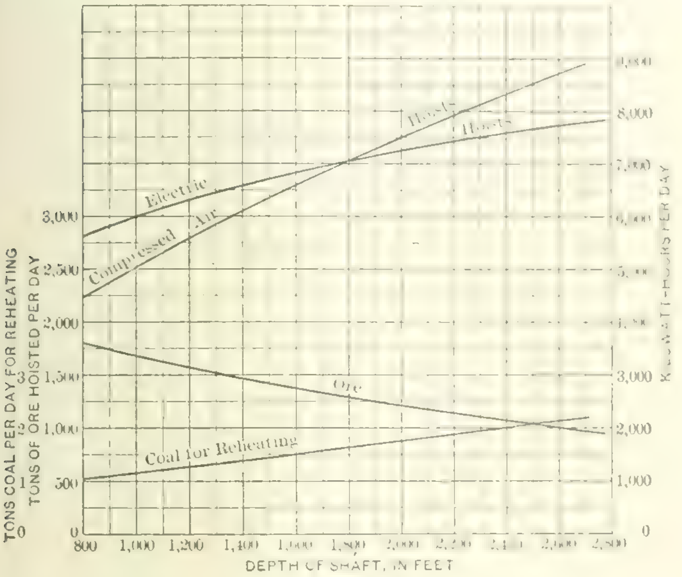

Fig. 1—Consumption of Power and Coal for Reheating; Isolated Electric and Air Hoists.

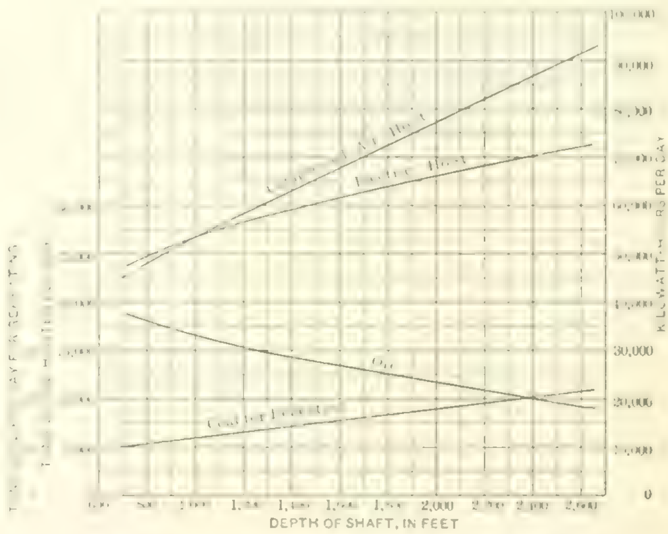

Fig. 2—Consumption of Power and Coal for Reheating; Grouped Electric and Air Hoists.

energy during the light-load periods and delivering it during the periods when the demand for power exceeds the average demand. The storage-battery is automatically controlled in such a way that the maximum demand for power is limited to approximately the average demand, this being accomplished very simply by a relay connected in the main supply circuit.

In some cases it may be found advantageous to use large fly-wheels in conjunction with the storage-batteries, the function of the fly-wheel being to relieve the storage-batteries of the excessive peak-loads. However, as to whether or not fly-wheels can be advantageously used will depend on local conditions, and as the use of fly-wheels will tend to reduce, rather than increase, the cost of the storage-plant, it has been assumed in what follows that storage-batteries only are used.

The hoists are driven by direct-current motors, and, as it is not necessary to make any provision at the hoists for reducing the fluctuations in the load, such as is necessary with the air-hoists, power for the hoist-motors is supplied by direct-current generators driven by synchronous motors.

For the purpose of comparing the air-system and the electric system as applied to a group of hoists, I have assumed an installation involving a group of 10 hoists, each meeting the conditions assumed for the isolated hoist, and each located at an average distance of 1,500 ft. from the central compressor-plant. Not only does the storage-system serve to reduce the peak-loads, but it also provides power for hoisting during short periods when the main power-supply system is shut off. It is assumed for the purposes of this comparison, that the storage-system shall have sufficient capacity to provide power for making two trips with each hoist from the 2,000-ft. level.

To meet these conditions with air-hoists will require six 2-stage, 6,000-cu. ft. air-compressors, each driven by a 1,000-hp. synchronous motor; a central storage-receiver of approximately 30,000 cu. ft. capacity, placed near the compressors; a reservoir of 35,000 cu. ft. capacity connected to the storage-receiver and located approximately 210 ft. above it; and a local receiver of 5,500 cu. ft. capacity and a reheater at each hoist.

The equipment for the electric hoists will consist of an electric storage-plant equivalent in capacity to the central air-receiver and placed centrally with respect to the hoists, and a 1,000-kw. synchronous motor-generator-set and a 1,000-hp. hoist-motor at each hoist.

The first-costs of the two equipments complete and installed are given in Table III.

TABLE III.—FIRST COSTS OF AIR HOISTE AND ELECTRIC HOISTS.

Air Hoists.		
Compressor plant, including compressors, piping [illegible]	$[illegible]	
Air storage plant, including reservoir and receiver	14,900	
Air distribution system	33,200	
Reheaters, local receivers, modifications of hoisting engines and piping	178,300	
Total		$512,000
Electric Hoists.		
Motor generator sets, switchboards and alterations to hoist houses	$184,100	
Electric storage plant, including storage battery, motor generator, switchboard and building	83,700	
Distribution system, including lightning arresters	7,800	
Direct connected hoist motors, controllers and connections to hoists	245,000	
Total		$520,600
First cost of air equipment		512,000
Excess cost of electric hoist above that of compressed air equipment		8,600

It will be seen from the data in Table III that the difference between the first-costs of the electric and the compressed-air hoists is only slight; in fact, less than the variation which would be expected in making two duplicate installations. Also, with the group of hoists, as was stated for the isolated installation, the relative first-costs will vary somewhat with local conditions, but this variation will be comparatively small.

The power consumed per day in hoisting from various depths and the coal required for reheating the air are shown by curves, Fig. 2. The curves show that the power consumed by the compressed-air hoists is greater than that for the electric hoists throughout practically the whole range; and, that the difference in the power consumed by the two systems is greater than was the case with the isolated installations. This is due to the improved efficiency of the electric hoists, resulting largely from the elimination of the friction and windage-losses of the fly-wheel and increased losses in the distributing-mains of the compressed-air system. The coal consumed for reheating the air is, as would be expected, in direct proportion to the number of hoists installed.

TABLE IV.—ANNUAL COST OF OPERATING COMPRESSED AIR HOISTS AND ELECTRIC HOISTS.

Compressed Air Hoists.		
Fixed Charges:		
Interest on investment, at 5 per cent	$ 25,600	
Depreciation, at 4 per cent	20,480	
Taxes and insurance, at 1 per cent	5,120	
Total		$ 51,200
Operating Costs:		
Maintenance, repairs, waste, oil and supplies	$ [illegible]	
Fuel for reheating air	22,270	
Labor	[illegible]	
Cost of power	212,850	
Total		$ 322,670
Grand total		373,870
Electric Hoists.		
Fixed Charges:		
Interest on investment, at 5 per cent	$ [illegible]	
Depreciation—storage battery at 18.5 per cent, remainder at 3.5 per cent	27,821	
Taxes and insurance, at 1 per cent	5,206	
Total		$ [illegible]
Operating Costs:		
Maintenance and repairs—storage battery at 6.5 per cent, remainder at 2 per cent	$ 13,292	
Labor	38,300	
Cost of power	180,950	
Total		$232,542
Grand total		291,599
Cost of operating compressed air hoists		373,870
Excess cost of operating compressed air hoists above that of electric hoists		82,271

Table IV gives the total annual cost of operating the compressed-air hoists and the electric hoists based on hoisting 1,200 tons of ore per day per shaft, 275 days per year, from an average depth of 2,000 ft.

The data in Table IV shows that for a group of hoists, as was found to be the case for the isolated installations, the compressed-air hoists are much more expensive to operate than are the electric hoists, and that the saving (approximately $85,000 per year) which may be realized by the use of electric hoists will pay for the complete installation in approximately six years.

No allowance has been made in the costs of operating the compressed-air hoists for the expense of providing cooling-water for the intercoolers. In many mining-camps water is a somewhat expensive luxury, and the cost of cooling the air between the first and second stages of the compressor cannot be neglected, as it is an item which appears in full in the saving by the use of the electric hoists.

Here also, as was found to be the case for the isolated hoist, the saving in labor is the predominating factor in the total saving, and while the cost of coal and power will vary somewhat with local conditions, the results in general will be about as shown by these figures.

In determining the capacity of the storage-battery, it has been assumed that approximately 15 minutes will elapse before the 20 trips (two for each hoist), which the storage-battery is designed to take care of in the event of the shutting-off of the power-supply, have been completed. This time has been allowed as under normal conditions all the hoists would not be working at their maximum rate simultaneously. If, however, conditions are such that this will not give adequate protection, this time may be shortened to 10 minutes by increasing the cost of the storage-battery installations approximately $20,000.

I have purposely omitted from this paper all reference to the relative efficiencies of the systems compared, owing to the confusion which may follow the use of this term in connection with the compressed-air systems without a clear understanding of the conditions assumed in determining it. Fundamentally, efficiency is the ratio of the work performed (energy delivered to the drum-shaft) to the energy consumed in doing the work, which, for the compressed-air system, is the ratio of the work done by the hoisting-engine to the sum of the energies consumed in the compressing and reheating of the air. But as the costs of energy for compressing and reheating the air differ, no practical use can be made of the efficiency.

There is but one test of the economy of two competitive installations, and that is, cost per ton of rock hoisted; these costs including all the factors, fixed charges on the investment, operating-costs including fuel, labor, maintenance, repairs and cost of power. Compared on this basis the electric installation will show higher economy.

As the power required for compressing the air may be reduced by increasing the temperature to which the air is heated before entering the engine, it is often suggested that the air be heated to a temperature considerably above that assumed in this paper. To do this, however, is open to serious objections; first, because it will require the use of much more expensive engines designed along the lines of gas-engines; and, second, the reduction in the total operating-expense will be comparatively small and not sufficient to warrant experimenting with a new type of hoisting-engine.

In addition to the lower cost of operation, the purely electric systems of hoisting possess important advantages over their competitors, the compressed-air systems, which, although they cannot be capitalized, should be given careful consideration in making a choice. These advantages are:

(1) The number of hoists which can be economically served from a central compressor-plant is limited, owing to the expense of piping the considerable distances.

(2) The extensions may be made with less difficulty and at less expense than with the compressed-air system.

(3) Simple automatic protective devices can be readily applied to the electric hoist, which not only increase its safety and reliability of operation, but which protect the hoist from abuse by a careless operator.

(4) The characteristics of a hoist-motor are such that its speed is automatically limited to a predetermined value without the use of auxiliary devices, thus reducing to a minimum the possibility of a runaway when lowering unbalanced.

(5) The electric system is simpler and therefore more reliable than the compressed-air system with its compressors and hoist-engines with complicated valve mechanisms, its cooling-water system for the compressors, and reheaters for the engines.

(6) The efficiency of the electrical apparatus varies little, if at all, with age, while the losses in the compressed-air system may be materially increased in a short time by leaky valves, pistons, and air-mains, unless extreme care is taken to guard against these losses.

(7) The minor repairs which are the chief sources of the annoyance in either system can be made much more quickly, and therefore with much less loss of production, with the electric hoist than with the compressed-air hoist.

In summing up, I emphasize the following

(1) That from the standpoint of first-cost, the compressed-air system and purely electric systems of hoisting are on a par.

(2) That the annual cost of operating the electric hoist is much less than that of the compressed-air hoist, and that the saving

which may be realized by the use of electric hoists will pay for the complete installation in from five to six years.

(3) That for the isolated hoist, the maximum demand on the power-system is greater for the compressed-air hoist than for the electric hoist; and that where the peak-load [illegible] by the use of the electric hoist will be considerably greater than that shown by the fore-[illegible]

(4) [illegible] for a large part of the deep-mine hoists re-[illegible] and the results obtained are such that many of the existing steam-hoists are being replaced by electric hoists, this extensive application of the electric motors throughout Europe and South Africa being sufficient testimony of their suitability for meeting conditions incident to the deep-mine hoists.

(Other Articles and Items [illegible] Will Be Found on p. [illegible])

ROADS AND STREETS SECTION

Shell Roads.*

For many localities along the sea coast, shells have proved to be both convenient and valuable for use in surfacing roads. Their maximum value is had for moderate traffic roads and over sand, but they have also been used to advantage where cheaply had and where better material was expensive, over clayey soils.

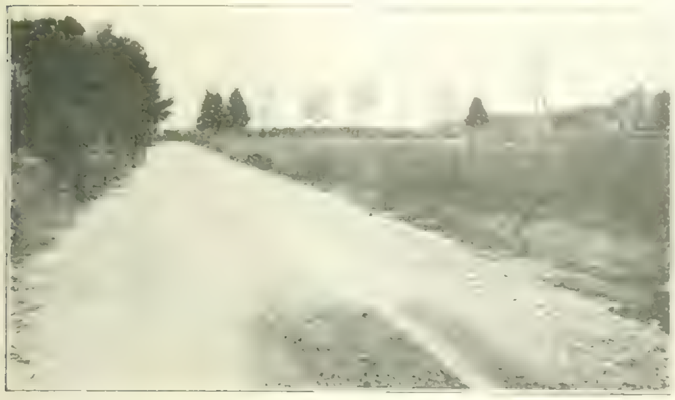

Fig. 1—Shell Road Built Under Old Methods Without Rolling; Partly Compacted by Light and Concentrated Traffic.

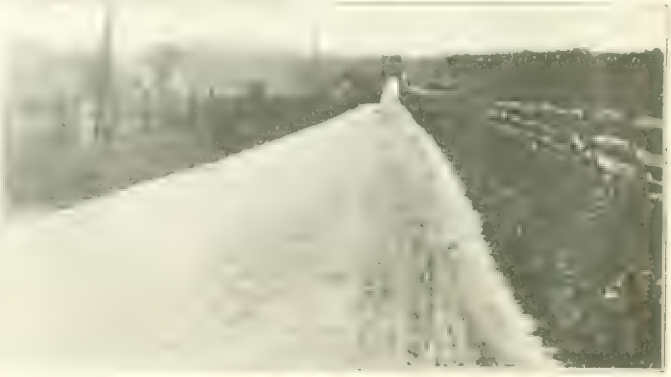

Fig. 2—Shell Road Built Under Old Method Without Rolling; Compacted by Heavy Distributed Traffic.

The usual practice has been to simply spread, without much care and from piles dumped in the roadway, a layer of the shells over the unprepared natural road bed, leaving the traffic to consolidate the shells, which it gradually and reluctantly did. The succeeding season, perhaps some little care was used with additional shells to patch and even up the former work. When intelligently persisted in, this procedure after a considerable period has frequently resulted in a very satisfactory road surface under certain conditions.

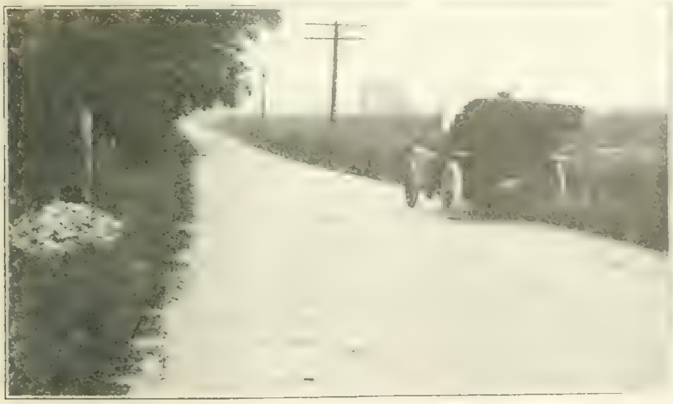

Fig. 3—Old Oyster Shell Road Built Under Old Methods and Fairly Well Maintained.

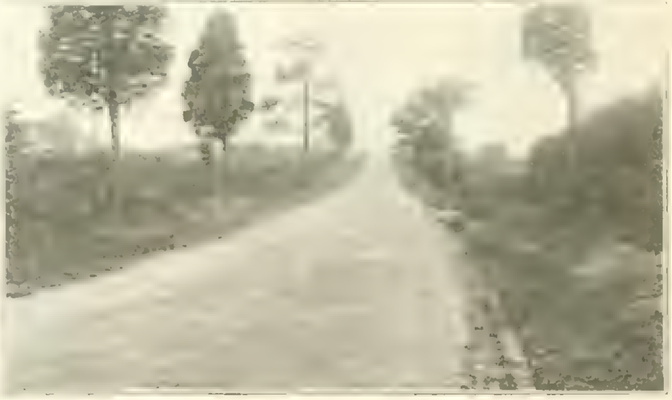

Fig. 4—Modern Oyster Shell Road; Built (waterbound) in 1910 Treated in Summer of 1911 with ½ gal. per sq. yd. "Trinidad A."

It required, however, [illegible] expense for patching to be kept in good condition, especially as the amount of traffic increased, and in many cases the use of shells has been abandoned because of this expense and of the decrease resulting lately in the proportionate prices of stone and shells. Under the old methods, it was customary to first apply anywhere from 20,000 to 60,000 bushels of shells per mile of road and then to patch with between 1,000 and 2,000 bushels annually for several years. In this way, a mile of shell [illegible] bushels of shells when kept in good condition for five years, and its subsequent repair would require, under the same traffic, 2,000 bushels per year indefinitely.

After constructing and maintaining several roads under the above described methods for a period of several years, the writer became impressed with the lack of economy thus had and with the belief that many of the defects, such for instance, as the forming of pot-holes or the "sinking" of the shells when used over clay sub-grades, could be avoided by different methods. He believed the proper way to use the shells would be to treat them precisely as if broken stone was being used. Consequently, he built several miles of shell roads precisely as if the surfacing were broken stone macadam instead of shell macadam, and the results have proved the correctness of his opinion.

No better explanation of his methods can perhaps be given than the following specifications taken from his regular printed form of contract:

Oyster shell surfacing shall be used wherever [illegible] Engineer. The width and class or classes required at different points shall be those shown on the plans or designated by the Engineer.

Class A and B.

[illegible] Class A and B [illegible] of two courses of raw oyster shells and a binder course of sand. The thickness after rolling of the [illegible] shall be as follows:

Class A.

1st Course.	2nd Course.	3rd Course.
5 ins. at center. 3 ins. at sides.	5 ins. at center. 3 ins. at sides.	To be as hereafter described

Class B.

5 ins. uniformly 3 ins. uniformly.

Each course of shells shall be applied as herein specified.

ROAD BED.

Material.

The road-bed for oyster shell surfacing shall consist of the natural earth road-bed prepared and rolled until firm and even. If soil other than clean sand be encountered which will not compact readily under the roller, a small amount of gravel or other means satisfactory to the Engineer shall be used until a firm and even surface is obtained after rolling.

Cuts and Fills.

In cuts, unless otherwise specially directed, the road-bed shall be graded to a width of .... feet, and shall be free from all spongy and vegetable matter, roots and stumps. The portion of the road-bed prepared for the oyster shell surface shall be .... feet wide and brought to the grades and cross-sections as shown on the plans, and unless otherwise directed by the Engineer, shall be rolled with a steam roller until firm and even. All depressions that may appear during the rolling shall be filled with acceptable material and re-rolled until an even surface with a proper grade and cross-section is obtained. Fills shall be .... feet wide on top.

---

*Paper by Maj. W. W. Cr[illegible], Chief Engineer State Roads Commission, Baltimore, Md., presented on Dec. 29 before Section D of the American Association for the Advancement of Science.

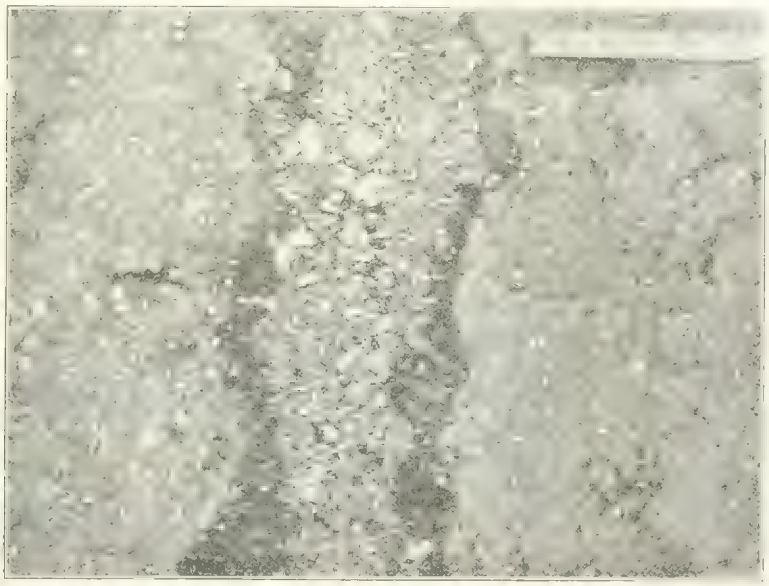

Fig. 5—Surface of Road in Fig. 4 Showing Where Passage of Metal Tired Wagon over Unsanded Pitch Picked Up the Latter. Moisture Darkens Edge of Track.

Old Earth Road.

Where no change from the present grade of those portions of the road not already surfaced with shells is shown on the profile, the road-bed shall be shaped to the proper cross-section and slight elevations and contiguous depressions removed so as to form an even and smooth surface after rolling. The road-bed shall be rolled to a firm, even surface before the application of the shells unless waived in writing by the Engineer.

The portion of the road-bed prepared for the oyster shells shall be below the sides by an amount equal to the thickness of the first course of shells, so as to prevent the shells spreading at the sides.

Shape.

The shape of the road-bed, after rolling, shall be as shown on the accompanying plans and shall have a cross slope of .... inch to 1 foot.

FIRST COURSE.

Material.

The first course of the shell surfacing shall consist of raw oyster shells.

No material shall be used which in the opinion of the Engineer is unfit for the work. If any such material is put upon the road it shall be removed immediately upon notice from the Engineer and replaced by proper material at the Contractor's expense.

Spreading.

No shells shall be spread before the road-bed has been made as specified.

The shells shall be spread upon the road-bed, prepared as herein described, with shovels from piles alongside the road, or from a dumping board, or they may be spread directly from wagons especially constructed for this purpose and approved by the Engineer, but in no case shall the shells be dumped directly upon the road-bed.

Rolling.

After the shells for the first course have been spread evenly to the required thickness, and have a proper cross-section, they shall be rolled with a steam roller, weighing not less than 8 tons, until they are compacted to form a firm, even surface. Should any difficulty be experienced while rolling in having the shells readily compact, sprinkling with water or lightly spreading with sand or other material as the Engineer may approve, shall be employed. The rolling must begin at the sides and work toward the center, thoroughly covering this space with the rear wheels of the roller.

Unevenness or Depressions.

Should any unevenness or depressions appear during or after the rolling of the first course, they shall be remedied immediately with shells and re-rolled until a firm, even surface is obtained. After the first course has been thoroughly rolled and compacted, should the sub-grade material appear to have churned up into or mixed with the shells, if so directed by the Engineer, the Contractor shall, at his own expense and without extra compensation, dig out and remove the mixture of sub-grade material and shells and replace the same with clean shells and thoroughly re-roll the fresh shells.

Thickness.

The thickness of the first course of shells after thorough rolling, shall be that of the class of oyster shell surfacing provided for any particular place as described under Class A and B.

If, for any reason, a greater thickness than specified is made by the Contractor, no extra allowance for such additional thickness will be made.

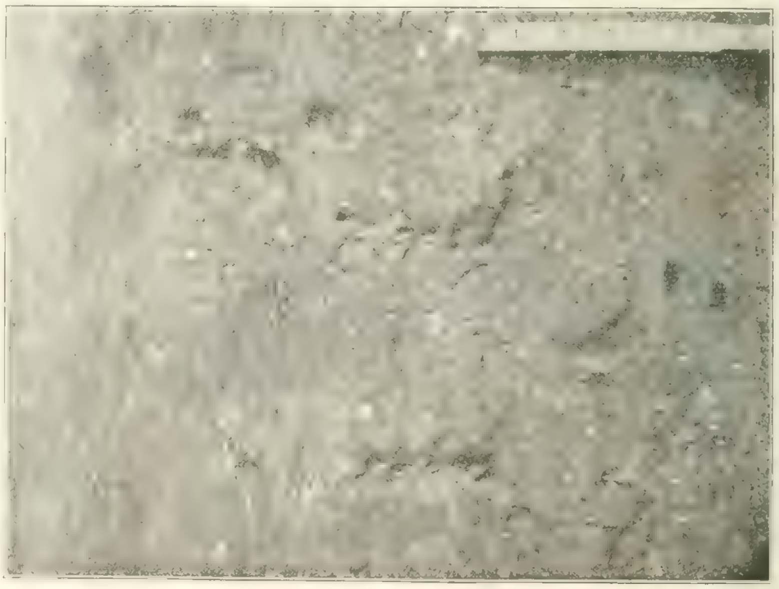

Fig. 6—Surface of Road in Fig. 4, Showing Centre of Road with Imprints of Horses' Shoes and Motor Chains; These Indentions are Subsequently Obliterated by Traffic.

Shoulders.

After the first course has been made as herein described, earth shoulders shall be constructed along each side of the road for a width of at least .... feet, as shown on the accompanying plans.

Against these shoulders shall be spread the shells for the second course as herein described. The shoulders shall contain a sufficient quantity of earth so that a smooth and continuous slope will be obtained after the shoulders and second course are rolled. The shoulders with the .... feet of shells shall make a total width of .... feet in cuts and .... feet on fills to be shaped as shown on the plans.

Material for the shoulders must be free from roots, stumps or other vegetable matter and thoroughly compacted by the roller. Material with a proportion of sand such as prevents it when dry from compacting readily under the roller shall not be used, except under written approval of the Engineer.

No material which is considered unfit for the work by the Engineer shall be used; and where any such is put on the work, it shall be immediately removed upon notice by the Engineer at the Contractor's expense. No first course material shall be spread on the sub-grade when the latter is muddy or soft or in any way, in the opinion of the Engineer, unfit for receiving the first course.

Second Course.

The second course of the oyster shell surfacing shall be the same width as the first course.

Material.

The second course shall consist of clean raw oyster shells.

Spreading.

The shells for the second course shall not be spread before the first course has been completed and shoulders made as herein specified.

The shells shall be spread upon the first course, prepared as herein described, with shovels from piles alongside the road or from dumping boards, or they may be spread directly from wagons especially constructed for this purpose and approved by the Engineer; but in no case shall the shells be dumped directly upon the first course.

Rolling.

After the shells for the second course have been spread evenly to the required thickness and have a proper cross-section, they shall be rolled with a steam roller, weighing not less than 8 tons, until they are compacted to form a firm, even surface. Should any difficulty be experienced while rolling in having the shells readily compact, sprinkling with water or lightly spreading with sand or other material, as the Engineer may approve, shall be employed.

The rolling shall begin at the sides, the shoulders first being rolled firm, so as to prevent the spreading of the shells in the second course. When completed, the surface of the shoulders and of the second course of shells shall be smooth and continuous with the cross-slopes shown on the plans.

Unevenness or Depressions.

If any unevenness or depressions appear during or after the rolling of the second course, either on the surface of the shoulders or of the shells, suitable material shall be added to remove all such unevenness or depression, earth being used on the shoulders and shells for the shell surface. After the second course has been thoroughly rolled and compacted, should the sub-grade material appear to have been churned up into or mixed with the shells, if so directed by the engineer, the contractor shall, at his own expense and without extra compensation, dig out and remove the mixture of sub-grade material and shells and replace the same with clean shells and thoroughly compact the same in layers and re-roll the surfacing.

Thickness.

The thickness of the second course of shells after thorough rolling [illegible] of shell surfacing [illegible] place, as described [illegible] for any reason, a greater [illegible] fied is made by the contractor [illegible] ance for such additional thickness will be made.

THIRD COURSE

Material.

The [illegible] shall consist of clean, sharp sand, with no particles larger than ¼ in.

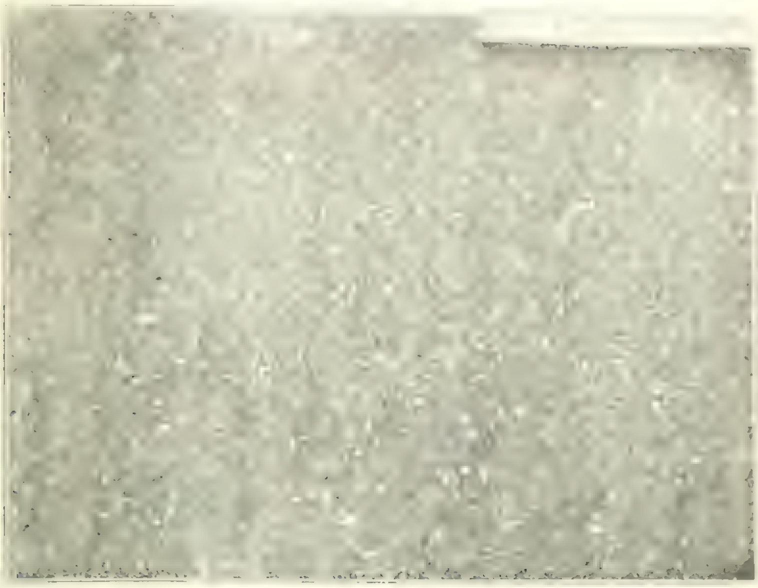

Fig. 7—Surface of Road in Fig. 4 Outside of Line of Horse Traffic.

Spreading.

After the second course of shells has been rolled and completed as above described, the sand shall be spread [illegible] be used until the second course has been thoroughly rolled and compacted. The sand shall be spread dry with shovels from piles alongside the road, or from dumping boards; but in no case shall the sand be dumped directly on the second course. The quantity of sand used shall be such as will just cover the second course.

Watering and Rolling.

After the sand is spread it shall be sprinkled with water from a properly constructed sprinkling cart, and then rolled with a steam roller weighing not less than 8 tons. The amount of water necessary shall be determined by the Engineer. The rolling shall begin at the sides and continue until the surface is hard and smooth and shows no perceptible tracks from vehicles passing over it.

If, after rolling the sand, the shells appear at the surface, additional sand shall be used in such places.

The rolling and watering shall continue until the water flushes to the surface. The rolling shall extend over the whole width of the road, including the shoulders.

Unevenness and Depressions.

If any unevenness or depressions appear in the road surface after rolling the sand, shells and sand shall be used until such unevenness or depressions are removed and the finished surface conforms to the proper cross-section as shown on the accompanying plans, and presents a smooth, even appearance. After the second course has been thoroughly rolled and compacted should the sub-grade material appear to have been churned up into or mixed with the shells, if so directed by the engineer, the contractor shall, at his own expense and without extra compensation, dig out and remove the mixture of sub-grade material and shells and replace the same with clean shells and thoroughly compact the same in layers and re-roll the surfacing.

Price Paid for Shell Surfacing.

The price agreed to be paid for shell surfacing shall include all work and material necessary to do the work as herein specified under Oyster Shell Surfacing.

In using shells over clean sand, rolling of the sub-grade may be impossible and is unnecessary, provided any fills of the sand have been properly settled. All that may be necessary is a trimming and evening up of the sub-grade, so as to secure uniformity in the thickness of the shell layer without waste. Neither is it important to prevent a moderate churning up of the sand sub-grade into the first layer of shells under the roller. This can safely be disregarded when not excessive and the sand is not so loamy or clayey as to possess marked capillarity attraction. In use of shells over clayey or loamy sub-grades, however, the specifications should be strictly adhered to. Further, on some clays, a layer of [illegible] form thickness and really wears better, owing to the greater space offered for travel to distribute itself.

To secure satisfactory results plenty of water must be used with the rolling. It is practicable to so "bind" a shell road by sanding, watering and rolling as to have it ring under horse-traffic identically as does first class macadam. However, the usual practice is to neglect this important feature and to depend on the cementitiousness of the powdered shells to remedy a lack of binding. Shell roads built with insufficient binding will always be "punky" and expensive to maintain in good condition.

Fresh "raw" shells are to be preferred for these surfaces, though "steamed" shells will give fair results. The steaming seems to take some of the toughness and life out of the shells. Dredged shells, procurable in many places, have never been used by the writer, but it seems to him that an excess of mud with them would be detrimental and should be avoided as much as possible, especially where frost action on the surfacing is to be expected. The result of the proper use of good shells are a most satisfactory surface for light traffic. It is pleasantly resilient, smooth though not objectionably slippery, attractive in appearance and especially so on dark nights when its whiteness may be a decided advantage to the driver. Further, the washings from the road surface encourage a [illegible] of shoulders and thereby increase the effective [illegible]

[illegible] extreme dustiness under moderate or heavy [illegible] built under the old methods, but even the best constructed shell road will, in dry periods, [illegible] der heavy traffic. Probably calcium chloride [illegible] to some advantage to mitigate this tendency, but in many cases undoubtedly the better and [illegible] pet the shells with pitch and stone chips or [illegible]

Such treatment of shell roads has been done by the writer and the success has been most satisfactory so far. Owing to the peculiar conditions, sand from the roadside was used on top of the pitch instead of stone chips or pea gravel. Either of the latter would undoubtedly have given even better results and would, in the opinion of the writer, been well worth the additional cost. This treatment was [illegible]

The shell surface (in first class condition) was thoroughly swept free of all fine and loose material. The pitch ("Trinidad Liquid Asphalt A" or "Texaco Road Asphalt 60 per cent") was then applied as evenly as possible by hand and without heating. After being allowed to set for a few hours, sufficient sand was then spread over the pitch to prevent adherence to wheels of vehicles and the treated section opened to traffic.

[illegible] 4 [illegible] 7 [illegible] taken about two months later (October, 1911) —show the results to that time. At the present writing (December, 1911) the condition of the road seems the same and entirely satisfactory. The photographs show the surface perhaps better than any detailed description here possible.

The costs of shell road work under the writer have averaged about as follows:

Assuming shells to cost 4 cts. per bushel f. o. b. cars at the nearest station; to weigh 57 lbs per bushel of 1¼ cu. ft., and the haul from the station to the road not to average over one mile; then, for a shell macadam surface (on sand) 16 ft. wide, 8 ins. thick in the center and 3 ins. at the sides after rolling (allowing a reduction of one-half in the thickness by rolling) 62,000 bushels will be required per mile of 9,387 sq. yds. The cost in detail per square yard will be as follows:

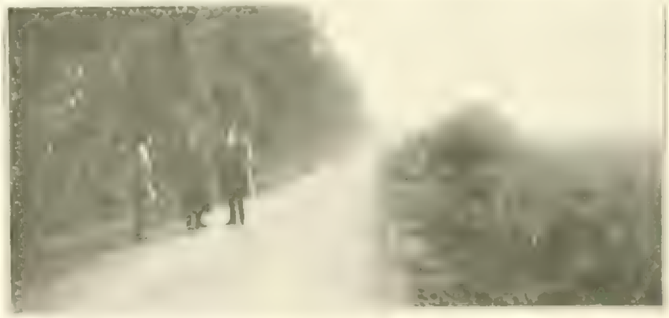

Fig. 8—Section of East Newmarket-Mt. Holly Shell Road Treated with "Texaco 60" Asphaltic Oil.

	Per [illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible] treating with pitch and sand:

	Per sq. yd.
[illegible]	[illegible]
[illegible]	[illegible]
Delivering and spreading pitch............	.004
[illegible]	[illegible]
[illegible]	[illegible]

*No allowance for profit to a contractor is included.

[illegible] in place of sand, the cost of these delivered should be added [illegible]

History of Tar-Concrete Pavements in Ontario.*

Tar-concrete, or more popularly, "tar-macadam" pavements have been in service in several cities of Ontario, Canada, for a number of years, and the history of the earlier of these, while not accompanied by all desirable data, presents features of interest, in view of the growing use of bituminous materials for country highways.

Reference has, from time to time, been made in the technical press to the tar-concrete pavements of Hamilton, Ontario, and it is the purpose of this paper to include also the experience of Toronto, Ottawa, London and other cities. In all cases, the pavements have been laid by the mixing process, and coal gas tar (supposedly) was employed.

HAMILTON.

The beginning of tar-concrete roadways in Ontario was in the year 1880, when the Gas Company of Hamilton laid a short section, about 1,300 sq. yds., on Mulberry St., in that city. No further work of this class was done until 1891, when the same company laid 2,983 sq. yds. at a contract price of $1.50 per yard; and in 1893 another area of 3,768 sq. yds. was laid at a contract price of $1.75 per yard. Experience with these roadways was such that, in 1899, when a considerable extent of old cedar block pavement needed renewal, "tar-macadam" was selected and about ten miles of roadway were built of that material.

The following is the specification under which the later pavements (since 1899) were laid in Hamilton:

(1) All earth or other material above the sub-grade shall be excavated, so as to conform to the level of the sub-grade, which will be 12 ins. below the finished surface of the roadway; and should the sub-grade be above the level of the natural ground, then earth shall be deposited until the level of the sub-grade is reached. The sub-grade shall be shaped to the profile and cross-section which will be furnished by the city engineer.

(2) After the sub-grade has been formed to the proper camber of the road, generally ½ in. per foot, or 6 ins. for a 24-ft. roadway, to be thoroughly rolled with the steam roller, and if by this means soft spots are revealed, they shall be filled with good solid material.

(3) The first 6 ins. shall be made in the ordinary way for a macadam or telford roadway thoroughly rolled. If so required it may be made of hard broken stone, furnace clinkers, or brick rolled smooth and finished to the required camber of the road. Upon this shall be placed the tarred stone. The first layer, 3 ins. of hand-broken stone to pass through a 2½-in. ring, then a 2-in. layer of machine-broken stone, the whole smoothed off with a hand roller, and after top dressing is applied, thoroughly rolled with a steam roller. On this a layer of fine gravel and quarry clippings, mixed in equal proportions, ¾ in. thick, shall be placed, and well rolled in so as to fill all interstices. Before finishing, a dressing of stone screenings, for the purpose of coloring, shall be scattered broadcast to be worked in by the traffic. All layers, including the coloring layer, shall be thoroughly compacted by rolling.

(4) The stone to be tarred shall, if moist, be heated on an iron floor, under which are flues from a fire, until the moisture is driven out. The material in its heated state is then thoroughly mixed with a sufficient quantity of tar. The broken stone in warm weather may be sun-dried, but in all cases the finer course must be artificially dried. At the same time care must be taken not to get this material too hot. The tar should be boiled in iron kettles holding 100 Imperial gals. Eight Imperial gallons should be added to each cubic yard of the coarser material, or more if required to completely cover the stone, and 17 to 18 gals. to the finer kind of stone.

(5) The tar must be pure coal tar free from all foreign substances, and containing not more than 5 per cent of water, and shall contain upon analysis not less than 56 per cent pitch.

(6) The work must be done in the summer months, and all work must be suspended during wet weather.

The tar-concrete was used to replace cedar block pavement, and the preliminary work consisted in the removal of the old cedar blocks. As these were 10 ins. in depth, it was necessary to remove 2 ins. of sand upon which they were placed, to make room for the 12 ins. of macadam, and bring it to the proper elevation with respect to the curb.

The cedar blocks and surplus sand having been removed, the sub-grade was thoroughly rolled with a 15-ton steam roller.

Care was taken in forming the sub-grade, and in laying each layer of stone, to bring the surface in each case parallel to the finished crown of the roadway. The first 6-in. foundation course, referred to in Section 3 of the specification, was made up of flat stones, from 6 to 12 ins. in greatest dimension, laid roughly by hand on their natural beds. On this, smaller stones were placed and broken into the interstices, so as to keep the bottom course in place.

The next two courses of tarred stone were then applied. Large kettles were hung close to the work, and in them the tar was kept at a workable temperature. Convenient to the kettles, the stone to be tarred was placed on mixing boards. With a dipper attached to a wooden handle, the tar was then applied to the stone, being scattered over it by a swinging motion of the dipper.

With shovels kept hot to facilitate the work, the stone was turned over twice after the first application of tar. More tar was then scattered over the stone, and the stone again turned over. These operations of tarring and turning the stone were repeated until each stone was seen to have a coating of tar, there being no bare spots on the stone. One part of tar to 22 parts of stone was specified for this course.

As soon as the stone had been tarred, it was shoveled into wheelbarrows, placed on the road to the desired depth, and raked to the required cross-section. It was found of advantage to roll the tarred stone immediately after being placed on the road, since, if left two or three days, it would not consolidate as perfectly.

The top course of fine tarred gravel was mixed in the proportion of about 20 gals. of tar to 1 cu. yd. of gravel; or 1 part of tar to 8 or 9 parts of gravel. The gravel, before mixing, was screened through a ¾-in. mesh. This material was prepared in an asphalt mixer, being brought hot to the road, and carefully raked to the required grade and cross-section. This having been rolled, stone screenings from the crusher were scattered over the surface to harden it, and improve the appearance.

The cost of the various pavements varied considerably. In 1899 the average was about 79 cts. per sq. yd., but labor then cost 15 cts. an hour, and coal tar f. o. b. Hamilton $2.60 per barrel (50 U. S. gals.). The average in 1900 advanced to about 88 cts. per sq. yd.; with labor at 17 cts. an hour and coal tar at $3.75 per barrel. With the advancing cost of labor and materials the cost in 1901 averaged nearly $1.08 per sq. yd. exclusive of curb—about 30 cts. per yard more than in 1899. Plain macadam laid in 1901 averaged 53 cts. per sq. yd.

None of the pavements were constructed by contract, all work being done by corporation labor. The stone used was a hard limestone quarried within the city limits, the average haul to the work being 1⅓ miles.

TORONTO.

Following the experience of Hamilton, the city of Toronto in 1900 laid an experimental tar concrete roadway on Woolsley St., of three blocks, or approximately, ¼ mile in length. This roadway did not have the heavy foundation, characteristic of the Hamilton pavements, but after the sub-grade had been carefully prepared and rolled, a course of broken limestone 4 ins. in thickness was spread. This consisted of stone not less than 1¾ in. or more than 3 ins. in length or breadth. This was filled with sand, was flushed, and thoroughly rolled. On this course was spread a layer of tarred stone, which was required to be as uniform in size as possible, and not less than 1½ ins. or more than 2 ins. in size. This surface was evenly raked and rolled. Then a layer ¾ in. in thickness of fine granite chips, thoroughly tarred, was evenly spread over the whole surface and rolled. Before finishing, a dressing ½ in. in thickness of approved pea gravel was spread over the entire surface of the roadway, to be worked in by traffic. The specifications for mixing tar were very similar to those employed in Hamilton. Additional pavements were laid in 1901 and 1902. For two or three years these pavements were most favorably regarded as being smooth, noiseless, sanitary and dustless, but in 1903 marked signs of disintegration began to appear, and under specifications prepared for 1904 it was then provided that there should be a foundation course 5 ins. in thickness. The intermediate course of tarred stone was eliminated, and a wearing surface 3 ins. in thickness was provided. Three sizes of broken stone were used in this tarred surface, viz., 1½-in., ½-in. and screenings. A mixture of these three sizes of stone in the proportion of two parts of 1½-in. stone, one part of ½-in. stone, and one part of screenings, was found to give a dense aggregate. During the period, 1900 to 1906, there were laid in all 7.16 miles of tar-macadam roadway on the streets of Toronto.

Work carried on in 1905 required a foundation course 5 ins. in thickness after rolling, this to be of coarsely broken stone, the surface interstices to be filled with 1½-in. stone, and covered with a layer of hot bitumen, using not less than 1 gal. per sq. yd. The specification provided that:

Upon the above foundation course is to be laid a surface course, or wearing surface, thoroughly saturated with the bituminous composition. This course shall be composed of good, hard and tough limestone, samples of which must be approved by the engineer before any is delivered on the ground, and shall be equal as to quality, size and fineness to the samples which may be seen in the office of the City Engineer.

Of this mineral aggregate,

(1) 30 per cent shall be such as will pass a No. 40 sieve.

(2) 12 per cent shall be such as will be held on a No. 40 sieve and pass a No. 8 sieve.

(3) 10 per cent shall be such as shall be held on a No. 8 sieve and pass a No. 4 sieve.

(4) 18 per cent shall be such as shall be held on a No. 4 sieve and pass a ½-in. sieve.

(5) 30 per cent shall be such as shall be held on a ½-in. sieve and pass a [illegible]-in. sieve.

These different sizes of stone shall be heated to a temperature of at least 225° F. and not to exceed 275° F. The No. 1, 2, 3 sizes of stone shall then be measured in accurate proportions by volume, and thoroughly mixed, with a twin-pug or other mechanical mixer, the previously prepared mixture of tar and pitch shall then be added together with sizes No. 4, No. 5 of the broken stone, and the whole mass mixed until the stone dust has become saturated with the mixture of tar and pitch, and is thoroughly mixed through the whole mass, and has a uniformly black appearance.

This aggregate shall then be spread over the entire roadway to the required depth so as to produce a thickness of not less than 3 ins. after being rolled and consolidated. The surface shall be evenly raked, rolled, repaired, brought fully up to grade and true to cross-section wherever required and then re-rolled until firm, compact and true.

A flush coat of California Asphalt, Oxygenized Asphaltum, or other equally good and suitable asphalt, in the Engineer's opinion, having a melting point of about 170° F., shall be flushed over the entire surface at a temperature of at least 250° F., so as to fill all interstices, and present a smooth, perfectly unbroken surface. A sufficient layer of good approved limestone chips, no particle of which shall be more than ½ in. in greatest dimension, shall then be spread over the whole surface and thoroughly rolled. More limestone chips shall be added where and as required from time to time, as the rolling progresses so that the whole surface is completely and evenly covered with a uniform coating of limestone dust when finished, of not less than ⅛ in., nor more than ¼ in. in thickness after rolling has ceased.

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*Paper by W. A. McLean, Provincial Engineer of Highways of Ontario, presented on Dec. 29 before Section D of the American Society for the Advancement of Science.

On commencing work a measured quantity of tar and any quantity of pitch shall be heated in separate kettles of at least 100 Imperial gals. capacity. When the pitch is melted a sufficient quantity shall be added to the heated tar to make a mixture as previously determined by laboratory tests from time to time, and the whole (constantly agitated to insure a perfectly uniform mixture) ready for use. As more is needed measured quantities of melted pitch and tar are added in the proportions which shall be determined by laboratory test, and brought to a temperature of at least 200° F., and not to exceed 250° F. Reliable thermometers shall be used to determine temperatures.

Paving pitch to have the following characteristics: Tenacious, not relatively brittle at ordinary temperatures, insoluble in water, specific gravity of about 1.150, and have a melting point not under 200° F.

Tar is to be coal gas tar, should be quite thick at 70° F., have a specific gravity of 1.200, and be entirely free from water and the lighter hydrocarbons. To insure the above characteristics, the crude tar should be previously heated to 250° F.

Tar that has been refined to the desired consistency may be substituted for the mixture of tar and pitch specified. This refined tar shall have the following characteristics: Tenacious, insoluble in water, all carbonaceous matter solubly in ordinary tar menstrua, free from water and the lighter hydrocarbons. It shall have a flowing point, as determined in a dry oven, of 120° F., and shall be similar in consistency to the standard sample which may be obtained by the manufacturer at the City Engineer's office.

LONDON.

The city of London in the year 1900 laid a tar-macadam pavement on Queen's Ave., one of the important streets of that city, of which the specification in part provided that on the usual construction of sub-grade should be laid a 6-in. foundation of clean, coarse gravel, to conform with the cross-section and finished grade of the street. Upon this foundation of gravel when thoroughly rolled was then placed 3 ins. of tarred stone capable of passing through a 2½-in. ring, 20 per cent of which was fine crushed and capable of passing through a 1½-in. ring. This crushed stone was heated on a steel platform or pans to 120°, and tar composition then poured until the stone was thoroughly covered. Tar was heated to boiling point (212° F.) and pitch to about 240° F. and the whole thoroughly mixed. After mixing it was placed on the street and graded evenly to the required depth, then rolled with a horse roller, after which it was rolled with a steam roller. A second course 2 ins. in depth of crushed tarred stone passing through a 1½-in. and 1-in. ring respectively, mixed in the same manner, was placed and rolled with a horse roller. On this second course was then spread the finishing coat 1-in. in thickness, composed of a thorough mixture of sand, pitch and tar. The sand was thoroughly dry and heated to at least 120° F. This coat was applied while hot, spread evenly to the proper thickness, and rolled with horse roller, after which the whole pavement was rolled with the steam roller and sanded with dry sand ½ in. in depth. Traffic was to be kept off for a period of at least one week. Tar was to be heated to 212° F. and pitch to 240° F. and properly mixed in the ratio of 10 gals. of tar to 1 gal. of pitch per cu. yd. of crushed stone, and 11 gals. of tar to 1 of pitch per cu. yd. for the top coat. Tar was required to be clear coal gas tar containing no water gas tar; the pitch also to be the best of its kind manufactured from pure coal gas tar.

[illegible]

[illegible] laid a 3 in layer of 3 in stone. Then fol- [illegible] then a 1-in. coat of ½ in stone tarred. Both [illegible] poured over the dried stone. Several other [illegible] been similarly paved. The tar is produced at the municipally owned gas works. For both coats of stone, the amount of tar used averaged 2½ gals. per sq. yd.

These roadways are giving satisfaction, and show very little sign of wear. In the years 1910 and 1911 concrete foundations on tar macadam roadways were found to be cheaper than stone. In laying the surface the concrete base was flushed with hot tar. The 2-in. broken stone was then spread to a thickness of 3 ins. and rolled once or twice with a 15-ton roller. The stone was then sprinkled with hot tar sufficient to coat most of the stone, but not enough to fill the voids. For the surface, [illegible] plates and mixed on a mixing board with hot tar, then spread and rolled until well compacted.

In laying the earlier roadways the tar was boiled in ordinary tar kettles, but this method was too slow. The city now uses an old steam boiler set in brick work in the ordinary manner. The tar is emptied into the boiler from an elevated platform, and after being boiled is drawn off by a pipe from the bottom into a tank wagon, and immediately taken to the street. The only refining is by boiling. A slow fire is necessary and constant stirring to prevent boiling over. The tar is frequently tested by cooling a little in water, and the boiling is continued until the tar becomes of the desired consistency.

[illegible]

Tar-concrete pavements were first laid in Ottawa in the year 1902, and the total length laid has been 5.15 miles. In construction, the roadway was excavated to the required subgrade, which was then rolled with the 15-ton roller if soft or loose, until thoroughly compacted. Upon this the spalls were placed to a depth of from 8 to 10 ins., and the top spalls broken up by hammers and made to conform to the shape of the roadway. On the spalls was placed a layer of 2-in. stone, 3 ins. thick and well rolled. The next layer consisted of a layer of 2-in. tarred limestone, 3 ins. thick, and put down while hot and rolled at once until cool. Great care was taken with the layer to see that it conformed to camber and grade in crown and gutter. The last coat or wearing surface consisted of a 1-in. layer of ⅝-in. tarred limestone, laid down while hot and rolled until it presented a hard, smooth surface. This surface was then dusted over with limestone dust to fill up any interstices and render it water-tight. The amount of crown on these pavements varied according to the width from 7½ ins. to 8½ ins., being reduced in amount as the longitudinal grade increased.

[illegible]

One block of tar-macadam was laid in 1898, but this has not been satisfactory, owing, apparently, to the surface of the tar-macadam being destroyed by a coating of clay brought by the wheels of vehicles from unimproved streets. In 1910 it was sufficiently intact, however, to be used as the foundation for a bitulithic pavement.

The specifications for the tar-macadam required: An excavation 12 ins. below the finished grade of the pavement; an 8-in. layer of broken stone; a 4-in. layer of tarred stone; a ¾-in. layer of fine tarred surface coating.

The stone to be tarred was spread on an iron floor, under which were flues from a fire, and heated until the moisture was driven off. The stone in its heated state was then mixed thoroughly with tar. The tar was previously boiled in an iron kettle holding 50 Imp. gals., to which was added a bucketful of pitch. Eight imperial gallons were added to each cubic yard of coarse stone, and from 10 to 12 gals. to the fine stone. The cost of the tar-macadam was $1.23 per sq. yd.

RESULTS.

The tar-concrete roadways described have been made from commercial tars. The work was principally by day labor under corporation foremen and engineers. Reference to proprietary tar products has been purposely avoided. The writer is not personally familiar with the first tar pavements laid, but has observed construction and results in numerous cases since the year 1900. The general history of these pavements has shown much similarity. For the first three years the surface has been all that could be desired, but about the end of that period a disintegration of the top coat has commenced. At the end of five years a mottled condition has become general, where the seal coat has chipped away, exposing the coarser bed of tarred stone. At the end of ten years the surface has become generally disintegrated, but the foundation has rarely if ever broken through, and a portion of the tarred surface course remains in place. Sections of the Mulberry St. pavement in Hamilton laid in 1880 can still be seen. In no case has it been found that adequate attention has been given to the repair of these pavements by tar painting or patching with tarred stone.

In the cities of Hamilton and Toronto, both of which have municipal asphalt plants, the tar pavements have been restored by giving a complete surface of sheet asphalt. The greater part of the tar-concrete roadways in Hamilton laid since 1899 have been treated in this way at the end of ten years, and results have been very gratifying. James St. south in Hamilton, with central lines of car tracks, has been treated in this way, and is indicative of results under heavy traffic. Dupont St. in Toronto, constructed as a tar-macadam in 1903, was surfaced with a coat of sheet asphalt 1 in. in thickness, in 1908, and the pavement is today in good condition. This was put on the tar-macadam merely as a seal coat. A section taken from the pavement shows the tar to be in a plastic condition. The cost in Hamilton for the asphalt surface was 75 cts. per sq. yd., where a binder course was required, and about 45 cts. per sq. yd. where such binder course was omitted.

Under the later Toronto specifications, in which the tarred material was proportioned for greatest density of aggregate, superior results were obtained, as for example, on Hawthorne Ave., a street of light residential traffic. This street, paved in 1905, is now in excellent condition, and shows very little sign of surface disintegration.

The tar used was supposedly, in all earlier cases, the commercial coal gas product, crudely heated to drive off water and volatile oils. In every case difficulty was found in obtaining a uniform quality, and no doubt much of the disintegration was due to the use of inferior tar. In view of the fact that in English practice a desirable tar contains not over 2 per cent of water, and 2 per cent of volatile oil, that it shall have at least 80 per cent of pitch, it is apparent from the specifications quoted in this paper, that earlier Canadian construction was very indefinite in this regard, and permitted the use of a quality of tar not now sanctioned.

The tar pavement in Chatham is interesting from the fact that its more rapid disintegration apparently resulted from clay being tracked on from adjacent streets, and would corroborate the experience suggested by the State Highway Engineer of Maryland, that clay would appear to have an emulsifying effect on bituminous binder.

A side-light is thrown on the use of tar by experience with foot-walks of tarred gravel. Early in the history of tar pavements, sidewalks were used, but have now been almost entirely displaced by the more durable, but less agreeable, cement concrete walks. These walks were laid by first putting down a foundation layer of gravel, which was well consolidated by pounding. On this was spread a 3-in. layer of tarred gravel, well rammed, and this finally given a paint coat, and sprinkled with clean coarse sand. The tar used is the ordinary commercial gas tar, merely heated to permit mixing with sun-dried gravel. Enough tar is used to coat each particle of gravel—about one part of tar to eight or nine parts of gravel. It is considered of primary importance to obtain a firm and unyielding foundation, and to thoroughly consolidate the tarred material. In Richmond Hill, a hamlet near Toronto, these walks, for example, were first laid in 1886; the earlier and more experimental were not a success, but others laid in 1889 are still in use. These, every two or three years, are given a paint coat of tar, gritted with clean sharp sand. Made of gravel, there is a tendency for the crown to flatten, not apparent in pavements of crushed stone.

Owing largely to the reduced price of asphalt, the use of tar (other than proprietary forms of construction) has been discontinued in Hamilton and Toronto, these cities having municipal asphalt plants. Ottawa has stopped the use of tar for this reason, and also because of the uncertain results which have attended its use there. The city of Guelph, having a municipal gas plant, continues the construction of tar-concrete roadways, using some care, however, in refining the tar to remove water and volatile oils.

Were exact data available as to the quality of material used, and variations from the prescribed specifications, numerous positive conclusions might be deduced from the tar-concrete work described. Under the circumstances, while reasonably positive in certain particulars, other factors are merely suggested. It may, the writer believes, be concluded that tar of uniform quality, and of composition within certain range of proportions, while susceptible to extremes of temperature, becoming brittle and slippery in cold weather, and soft under midsummer extremes of heat, is not debarred by climatic or other conditions, as a useful road material; that best results require a dense mixture, preferably proportioning the aggregate for maximum density in order that internal deterioration will not occur from moisture or atmospheric action; that some doubt may be attached to the complete durability of bituminous surfaces made by the penetration process, in which density of aggregate is lacking, and suggesting that the grading of stone in this method, rather than having a uniform size, is desirable; that a moderately coarse aggregate should be brought to the surface, as far as practicable, to overcome slipperiness and take up wear; that tar-concrete is less durable under concentrated wear than is sheet asphalt, wearing rapidly when laid along street car tracks where traffic is confined to narrow lines, but is more resistant to moisture as indicated by the greater durability of tar in gutters; that broken stone will provide a more stable structure than will water rounded gravel when bonded by tar; that a paint and grit coat is necessary as a preservative as frequently as signs of surface wear or oxidation appear; and it is probable that such treatment will add to the durability of auy bituminous pavement, restoring necessary oil, and not merely repairing the worn surface but gradually increasing its thickness.

WATER-WORKS AND SEWERS SECTION

The Hydraulic Ram—Its Possibilities of Development and Use.*

(In ENGINEERING & CONTRACTING of March 22, 1911, we published an article entitled The Hydraulic Ram. The article dealt chiefly with the mathematical theory of the ram. The present article deals with the physical features of the ram, its commercial uses, and its possibilities of development.—Editors.)

The hydraulic ram was first invented by John Whitehurst, in 1772, and was made practical by Joseph M. De Montgolfer in 1796. The latter made the action of the waste valve automatic, thus changing the ram from a laboratory toy operated by hand, to a useful pumping device. Although the hydraulic ram was invented and used over 100 years ago, there was but little improvement in its design up to fifteen years ago.

Today little is known of the hydraulic ram, even by engineers. The average engineer seems to have the most hazy idea of the characteristics of this much neglected pumping device. It is usually looked upon as a type of pump of small capacity and low efficiency, useful for pumping water for isolated dwellings, or where but a small quantity of water is needed and efficiency of no consequence.

Operation.—The essential features of a hydraulic ram are, see Fig. 1, supply or drive pipe A, ram chamber B, waste or impetus valve C, discharge or check valve D, air or equalizing tank E, and discharge or delivery pipe F.

The mere physical operation of the ram is simple, though the attendant phenomena and hydraulic principles involved seem to be but little understood. The general principle of operation is the same in all rams, however the mechanical workings and construction may differ.

Ignoring for the present, the cause of the action, suppose the waste valve (C) to have just opened, the water in the drive pipe and ram being stationary, when the valve opens the water in the drive pipe starts to flow through the open valve, gaining in velocity, until the increasing velocity and pressure behind the valve are sufficient to close the latter. When the waste valve closes, the water flowing in the drive pipe with the momentum and energy of the moving column of water behind seeks another means of escape, which is secured by opening the discharge valve (D), flowing through the latter into the air chamber (E), and thence out through the delivery pipe (F). The air in the chamber acts as a cushion to the sudden inflow of water and maintains a nearly constant pressure in the chamber and steady flow through the delivery pipe.

The velocity gradually decreases until all the energy of the moving column of water is expended in forcing water into the air chamber and the flow ceases. The pressure in the air chamber then starts a back flow similar to the oscillation of water in a U tube. This instantly closes the check valve, thus retaining the water pumped. The tendency to back flow together with the sudden closing of the check valve, causes a momentary reduction of pressure in ram chamber (B), which allows the waste valve to open. The water then starts to escape as before and the cycle of operations is repeated. The action after once being started is automatic and the ram will continue to operate.

The back surge is usually sufficient to create for an instant a partial vacuum in the ram chamber. This condition may be taken advantage of, to introduce automatically into the upper part of the chamber a small amount of air at each stroke. During the waste period this air rises to the top of the chamber and at the delivery period is carried through with the flow into the air chamber. Thus the air supply is maintained, which otherwise would be gradually absorbed by the water under pressure.

Details of Operation.—The operation of the ram may be divided into two distinctive periods, namely, the acceleration or power accumulating period, and the retardation or pumping period. In the former, the waste valve is open and the water escaping through it, while the check valve is closed. In the latter, the waste valve is closed and the water is being delivered through the check valve.

In addition to the two periods mentioned there is the instant between the closure of the waste valve, and the opening of the check valve, and also between the closing of the check valve and the opening of the waste valve. Each of these periods, though extremely short, has its distinctive functions and attendant phenomena.

We will now follow more in detail a cycle of operation or a stroke as it is commonly called.

When the waste valve opens the static column of water in the drive pipe, due to the inertia of its mass, cannot get up velocity at once, but is accelerated gradually. The time required to attain a certain velocity depending upon the ratio of supply head to length of drive pipe or, stated in another way, upon the slope of the drive pipe. Neglecting the effect of friction, the acceleration is constant like that of gravity and may be expressed in the familiar form $V = GT$, modified, of course, by the slope of the drive pipe, into $V = GT\frac{H}{l} = GT \sin A$, where A equals the angle of slope of the drive pipe, H equals the supply head and L the length of drive pipe. This is approximately correct for small velocities, but the friction varies as the square of the velocity, hence it soon becomes an element that must be considered. For any size pipe on a given slope there is a fixed possible maximum velocity. This is found by the Chezy formula $V = C\sqrt{RS}$ where S is the slope of the drive pipe, $\frac{H}{l}$.

Water Hammer.—Up to a certain point there is practically no resistance to the flow offered by the waste valve, as it will pass the water faster than it comes to it. After attaining a certain velocity, the water begins to head up behind the waste valve and when sufficient velocity and pressure are attained the waste valve is closed. When the valve starts to close the area of flow is further restricted, the pressure rises rapidly and the valve goes shut with a bang.

The sudden stopping of the moving column of water produces an instantaneous rise in pressure, causing what is called "Water Hammer." The intensity of the hammer is limited by the pressure against which the ram is pumping, as when this pressure is reached the discharge valve opens and prevents a further rise.

Experiments have shown that the maximum pressure in the ram exceeds that in the air tank by only a few pounds.

When the waste valve closes the lower filament of water is compressed, and is followed by each succeeding filament under like compression to the head of the drive pipe, while at the same time, the pipe walls due to this compression, are expanded. As this compression wave reaches the open end of the drive pipe, the first filament is relieved then each in succession as a wave of rarefaction moves down the pipe. Thus the pressure waves race up and down ordinary pipe at a rate of about 4,000 ft. per sec. until worn out by friction.

The intensity of water hammer depends upon the velocity of flow and the rate of its suppression. If it is stopped instantly, the pressure developed is found by the formula,

$$P = \frac{vVW}{G}$$

where P = water hammer pressure (in excess of static pressure) in pounds per square inch.

v = the velocity of wave motion in the pipe.
V = the extinguished velocity of the water.
W = weight of a cubic foot of water.
G = the acceleration due to gravity.

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*Abstract of paper by Stirling B. Hill, read before the Pacific Northwest Society of Engineers, November, 1911.

For ordinary conditions this would amount to about 60 lbs. for each foot of velocity extinguished.

Losses Involved in Ra[illegible] ing the acceleration period the potential energy in the water supply entering the pipe is being changed into kinetic energy in the form of a moving mass of water, the power being accumulated and concentrated

Without giving the matter consideration one naturally concludes that since water is running to waste, during the acceleration period, there must be a corresponding sacrifice of power and efficiency. This, however, is not the case, the only loss being the velocity head of discharge, which is usually but a fraction of a foot. The potential energy of this water has been stored in the form of kinetic energy in the moving mass of water in the drive pipe. When water power is used to raise water to a higher level it is self-evident that only a portion of the water can be raised to the higher level, hence, the remainder must be wasted at the lower level. For example, if a theoretically perfect machine were operating with a 10-ft. supply head and lift of 20 ft. above the machine, it is evident that it would require two units of water with 10-ft. head to raise one unit 20 ft. The other unit is running to waste, yet no power whatever would be sacrificed, the machine in that case being 100 per cent efficient.

The losses involved during the acceleration period are due to entry head, friction in the drive pipe, and the velocity head of the wasting water with the friction of its passage through the waste valve. These are all losses which can be determined definitely, hence the efficiency of the acceleration period is susceptible of accurate calculation when the co-efficients of friction for the design have been established.

In the case of the larger sized rams operating with medium drive head and moderate velocity the efficiency of the acceleration of power accumulating period may exceed 97 per cent.

The two periods of action are independent of each other. The action during the acceleration period is entirely independent of the conditions of delivery or retardation; that is, of the head against which the water is pumped. Likewise the retardation or pumping conditions are independent of the head used or time required in attaining a given velocity in the drive pipe.

The acceleration period ends when the waste valve is partially closed and the retardation period really commences before this valve is fully closed. The interval between this time and the opening of the check valve is really part of the retardation period though no water is pumped. The pressure is being raised in the ram accompanied by the water hammer effect.

A small amount of velocity is sacrificed in water hammer loss, the amount depending upon the head against which the water is pumped, or more directly the rise in pressure. The water pressure strikes the check valve suddenly and, due to its inertia, an increment of time is required to move it. This causes an instantaneous rise in pressure beyond that required to force the water through the valve and a small loss of efficiency is involved. The losses during the retardation period are: water hammer, opening discharge valve, friction through discharge valve, velocity head of discharge and slip of check valve at end of delivery.

Ram Capable of Mathema[illegible] Thus it will be seen that the action of the ram is capable of analysis and consequently of mathematical treatment.* When the various co-efficients have been determined by experiment for any given type of ram its performance under given conditions can be de-[illegible] later to acquire sufficient experimental data to be able to determine the proper value of the co-efficients.

[illegible] product of the efficiency of the acceleration or power accumulating period, and of the [illegible]

There are two different formulas used for computing the efficiency of the hydraulic [illegible] kine formulas.

[illegible]

E = [illegible] and the latter by E = [illegible] where:

[illegible]

Q equals the water wasted.

q equals the water pumped.

[illegible]

The D'Aubuisson formula represents the efficiency of the machine itself, as it considers all the water flowing through the drive pipe as the working force, and the work done that of raising the water pumped from the ram to this point of delivery. If Q equals the total water supply and h the pumping head above the ram, then the formula takes the [illegible]

qh

[illegible]

The Rankine formula represents the useful work accomplished in raising the water from the level of the supply to the point of delivery.

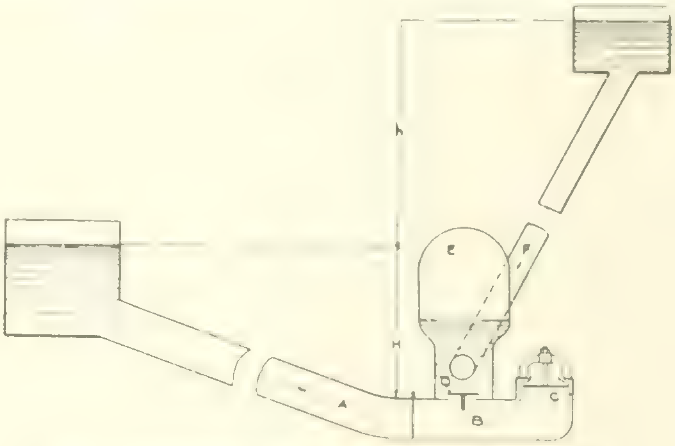

Fig. 1—Essential Features of the Hydraulic Ram.

The losses in the supply pipe are included with those in the machine itself in calculating the efficiency of the ram.

The efficiency of the ram depends upon the size of the machine and the conditions under which it is operating. The efficiency, under ordinary circumstances, of small rams varies from 50 per cent to 70 per cent, and the larger sizes from 70 per cent to 90 per cent.

With a properly designed ram, operating under favorable conditions, it is possible to obtain as high as 95 per cent efficiency (D'Au-[illegible]

[illegible]

TION.

Supply Head.—The effect of the supply head upon the operation of the ram is confined to the acceleration period. Other things being constant, the efficiency is increased by increasing the supply head. However, the same efficiency can be obtained with different heads by proportioning the velocity to the head.

With the higher heads, a greater velocity, with corresponding increase of capacity, can be used without sacrificing efficiency.

Consequently, the effect of increasing the supply head is to increase the capacity of economical operation, or, if the capacity remains constant, to increase the efficiency.

Pumping Head.—The effect of the pumping head is confined to the retardation, or pumping period.

Approximately the same efficiency during the retardation period can be obtained with any pumping head, but the velocity required to obtain this maximum efficiency increases with the pumping head. The efficiency, however, with which this higher velocity can be produced in the drive pipe will decrease; hence, the combined efficiency of the ram will decrease with an increase of pumping head.

If all other conditions remain constant, there is one pumping head for which the efficiency of the ram will be a maximum.

Length of Drive Pipes.—Other things remaining constant, the efficiency with which a given velocity can be produced in the drive pipe decreases as the length of drive pipe increases. This is due to pipe friction. The time required to attain a certain velocity with a given head increases as the length of drive pipe.

The efficiency during the retardation period is theoretically independent of the length of drive pipe. Practically, however, on account of the slip in the check valves and the loss in waste valve closure, it is not. The slip depends upon the frequency of the valve action, which, other things being fixed, depends upon the length of drive pipe. The longer the drive pipe, the fewer the strokes and less the slips.

The proportion of loss due to slip increases with the pumping head, both on account of the greater tendency to slip and the shortening of the delivery stroke. Therefore, a longer drive pipe is required for high heads than for low ones.

If the drive pipe is too long the friction is excessive, and if too short the slip is abnormal, hence there is for each size of ram with each combination of supply and delivery head a certain length of drive pipe that will produce the maximum efficiency.

There is also another working factor involved in the operation of the ram that has an influence on the minimum practical length of drive pipe. If the drive pipe is too short, or steep, the surging and vibration of the water column may interfere with the smooth operation of the valves, and the interfering waves will decrease the efficiency if the stroke is not carefully synchronized with the pressure vibrations. If too long a drive pipe is used with the ordinary upward discharge, the automatic air supply will not work.

Size of Drive Pipe.—The main loss during the acceleration period is the pipe friction. During the retardation period the pipe friction is a minor loss. The efficiency of the ram will be increased by using the larger pipe, or a greater capacity will be secured with the same efficiency. The larger the size of the ram, with corresponding size of drive pipe, the greater the efficiency of the machine.

Strokes Per Minute.—Under any given conditions the capacity of the ram depends upon the velocity obtained in the drive pipe, and that depends upon the number of strokes per minute with which the machine is operating. The fewer the strokes, the greater the capacity, and the greater the number of strokes, the less the capacity.

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*Leroy Francis Harza, in his paper, "An Investigation of the Hydrauli[illegible]" by the University of Wisconsin, as Bulletin No. 205, gives a very complete [illegible] ment of the operation of the ram. He also carried out an elaborate series of experiments to check his theory. See also Eng. & Cont'g for March 22, 1911.

A long, slow stroke allows the water to attain a greater velocity at each stroke and a corresponding greater average velocity, or flow through the pipe and ram.

For any given set of conditions there is a certain number of strokes that will produce the maximum efficiency. The efficiency increases with the number of strokes to a certain point, after which it decreases.

With a given supply head the efficient number of strokes increases with the pumping head to a maximum, and then decreases.

Limiting Factors.—The physical possibilities of the hydraulic ram are limited—first, by natural laws governing its operation, and, second, by human ingenuity in devising ways to make practical its possibilities.

Fundamental Limitations.—There seems to be no law directly limiting the height of supply head that can be used, except that it must always be less than the lift above the ram. Let us, then, consider the pumping head. As stated before, the amount of pressure that can be developed by the sudden stoppage of water in the ordinary pipe is about 60 lbs. per sq. in. per second-foot of velocity stopped. Hence, the problem resolves itself into one of velocity obtainable in the drive pipe. In small pipes the limiting, or critical, velocity is soon reached. For example, a velocity of about 5.5 ft. only per sec. can be attained in a 1-in. pipe with a slope of 10 to 1, while in a 12-in. pipe with the same slope a maximum velocity of nearly 18 ft. per sec. could be attained. The practical operating velocity would probably be about two-thirds the maximum.

Thus it is apparent that, while a one-inch ram is limited to about a 400-ft. lift, under ordinary conditions, a 12-in. ram should be able to lift water at least 1,000 ft. The drive head that can be used must in each case be considerably less than the lift above the machine for practical operation. It is apparent that the fundamental limiting factors are beyond all practical requirements; hence, the problem resolves itself into one of practical design and mechanical construction.

Mechanical Limitations.—The design and operation of the waste valve seems to be the vital point. The ordinary hydraulic ram has an upwardly discharging waste valve of the disc type. The force of gravity—that is, the weight of the valve—is depended upon to open it and hold it open until it is forced shut, as previously described.

Machines of this type naturally have their limitations. Fifty feet seems to be the limit of the height of supply head that can be used. In the first place, the static head against which the valves will open is limited. They will not open with a long drive pipe or small ratio of heads. A moderate velocity will close them. For small rams, however, they answer very well. As the size of the disc valve increases, the area exposed to ram pressure increases as the square of the diameter, while the waterway around the circumference only as the first power. Thus the practical limit as to size is soon reached. This limit seems to be about 8 inches.

Certain manufacturers have lately cut the centers out of their discs and introduced light springs to assist the operation. This was quite an improvement, and they were enabled to increase the size of their machines, so that 12-in. rams may now be secured.

A Progressive Step.—Daniel W. Mead, now professor of Hydraulics at the University of Wisconsin, was the first to depart from the old rule-of-thumb design.

In 1895 he built and installed (under conditions that no ram manufacturer would attempt) a machine for the village of West Dundee, Illinois. In fact, no ram on the market today would operate under the same conditions.

This ram was installed with a 43-ft. drive head and 2,200 ft. of 10-in. cast-iron drive pipe. The makers assured Mr. Mead that such an installation was impossible, as the water hammer, due to stopping such a volume of water, would tear any machine to pieces. The ram was designed to suit the conditions; that is, with a large discharge valve area and with a very heavy spring to operate the waste valve, which was given a small movement. Needless to say, the machine operated successfully, and has continued to do so for the last 16 years.

The pressure in the ram exceeded that in the stand tower by about 2.5 lbs. There was no excessive hammer, as the column of water is not stopped or started suddenly, but gradually. This machine developed from 73 per cent to 75 per cent efficiency. This seems to be about the average efficiency of commercial rams in the larger sizes.

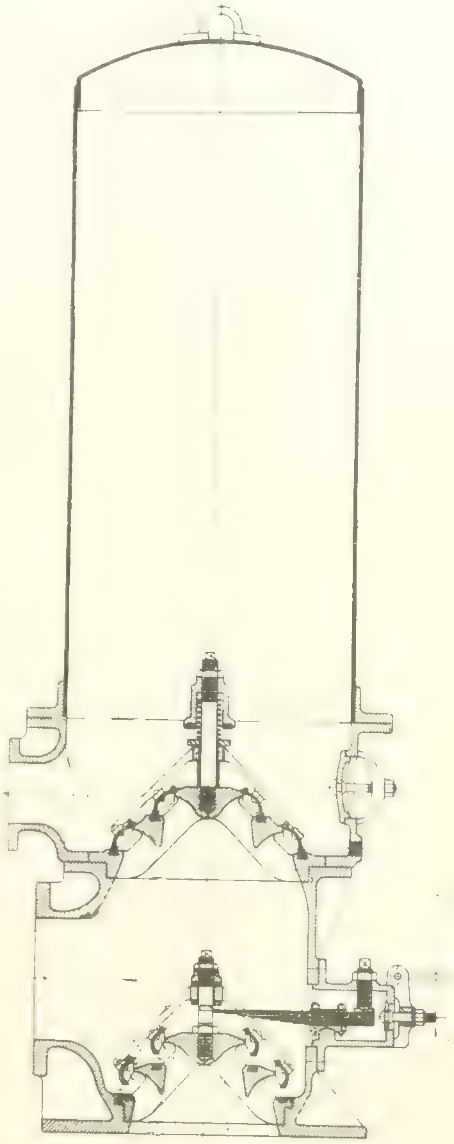

Fig. 2—Section of 10-in. Sterling Ram.

A NEW TYPE OF RAM.

Last year the writer had occasion to investigate the subject of pumping machinery with a special view to the use of water power for its operation. The hydraulic ram, on account of its reasonable cost, automatic operation without the necessity of an attendant, low operating costs, durability and reliability, seemed particularly suited for use on irrigation projects, where conditions permit of its installation.

A particular case was presented to the writer some time ago for his consideration, where the supply head was so high that no ram obtainable would operate.

After a careful study of the principles involved in the operation of rams, there appeared no fundamental reason why their operation should be limited to the narrow bounds of present practice. This being the case, it seemed that it should be possible to design a ram that would operate under a much wider range of conditions. With this idea in mind, a further investigation of existing makes of rams and their construction and operation was made.

It was apparent that a new type of waste valve was necessary in order to increase the capacity or field of operation of the ram. This valve must be so constructed as to eliminate the excessive hammer on its seat, must be light and strong, and have as large free waterway as possible with a small movement of the valve.

The upward discharge was abandoned on account of the amount of head wasted on the larger sizes. The horizontal side discharge was considered, but passed because the machine would have to be submerged to above the valves to prevent their inhaling an excessive amount of air through the upper half of the valve during the fore part of the waste period. The solution seemed to lie in a balanced valve of some description, having a downward discharge and operated with a heavy spring.

After numerous designs had been made and abandoned, a type of valve was finally evolved that seems to fill the various requirements. This valve is composed of one or more concentric rings of increasing diameter, the number of rings depending upon the size of the machine. The plural rings are carried on a frame consisting of four radial arms, guided by a central stem, so they act as a single valve. The rings were changed from short cylindrical sections to ones having an arched cross section. See Fig. 2.

This allowed the water to escape over, as well as under, each ring when raised, thus nearly doubling the capacity of each ring with a given opening. This shape has the further advantage of offering smooth curved guides to the flow of the water and increasing the strength of the valve ring.

This arrangement of valves gives the greatest amount of clear waterway, with a minimum of weight of moving parts and space occupied, thus giving large capacity with high efficiency.

The valves being thin circular rings, with the vertical ram pressure practically balanced, they close very lightly, eliminating the excessive pounding. The hammer on the seats is the same in large rams, with this type of valves, as in the smaller ones, as they have practically the same shape and size of valve section.

A ram with valves of this type has been built and tested by Hill Bros. See Fig. 2. It has a 10-in. supply pipe and a two-ring waste valve. The check valve is of similar construction, except that it has one ring and a central disc.

These valves, with a maximum movement of less than one inch, have an unobstructed opening nearly equal to the section of the supply pipe. The large efficient valve opening, with small movement of light valves, gives the machine large capacity without sacrificing efficiency.

The valve rings close on thick rubber seats consisting of a rubber ring inset in a dovetail groove in the metal seats. The rubber is forced into the groove and is just flush with the metal. This type of rubber seat cannot hammer to pieces as do other types of flat rubber packing seats having exposed edges.

The top of the valve ring closes flush with the outer edge of the valve seat above, the crack between being sealed with a rubber packing carried on the top of the valve. The valves are absolutely watertight, and constructed so they will remain so till the rubber disintegrates with age. The rubbers are easily renewed.

TEST OF 10-IN. STERLING RAM.

The experimental machine was set up on the campus of the University of Washington, and a series of careful tests made under the supervision of the Department of Hydraulics. All measuring apparatus was carefully cale-brated. A 50-ft. supply [illegible] 140 ft. of 10-in. wrought-iron drive pipe.

The conditions were purposely made severe, the drive head being the highest yet used. The machine operated very satisfactorily, and the efficiencies developed were even better than anticipated. Various velocities were used, with lifts ranging from 100 ft. to 325 ft. The efficiencies ranged from 80 per cent., on the high lift, to 95 per cent on the low (DeAubuisson formula). The drive pipe was too short to give the best results, especially on the higher lifts. Eight runs with a 115-ft. lift showed over 90 per cent efficiency, the average being about 93.5 per cent.

It was hoped to secure a sufficient range of experiments to determine the characteristics and coefficients of the ram, but on account of the limited water supply available this proved impossible at the time. However, much valuable knowledge was obtained in regard to the fine points of ram operation.

A series of pressure indicator cards were secured on the ram, half way up the pipe and 20 ft. from the head of the drive pipe. These show the variations of pressure at these points. They seem to bear out the theory of the water hammer waves. The vibration in the drive pipe was very noticeable, especially near the head of the pipe, while in the ram there was hardly any vibration. The indicator cards explain this. The ram cards show an almost constant pressure during the acceleration and retardation periods. The pressure rises very abruptly at the closure of the waste valve, but drops more gradually at the end of the delivery. The rise in pressure is almost instantaneous and scales less than 0.01 of a second in some cases. The closing of the check valve and the opening of the waste valve seems to consume from one-tenth to one-twentieth of a second of time.

Due to the throw of the indicator arm it was impossible to get a reliable record of the actual maximum pressure attained in the ram and drive pipe. In order to secure this data a special device was later made and used. It consisted of a small chamber on which the pressure gauge was mounted, a drain cock was provided in its bottom, and its connection to the ram, or pipe, was through a check valve and stop cock. The chamber contained air so that when the stop cock was opened the pressure vibrations pumped water into the chamber, compressing the air, the check valve preventing the return of the water. When the maximum pressure was reached in the chamber the water no longer was forced in. The gauge then indicated the maximum pressure.

The maximum pressure in the ram was found to exceed that in the air chamber from 3 to 4 lbs. After correcting for difference in the static head, the maximum pressure near the head of the drive pipe was found to be only 10 per cent to 20 per cent less than in the ram. The indicator cards show about the same result.

This shows that the stress in the drive pipe does not decrease uniformly from bottom to top, but is nearly constant the whole length. Consequently, the drive pipe should be designed practically full strength its entire length.

POSSIBILITIES.

Judging from the results of a careful study of the conditions involved, and observations of the operation of the ram described, it is believed the limits of the posisibilities of operation and of capacity are beyond the ordinary requirements of practice.

Mr. Harza, at the conclusion of his paper, says: "If there is any reason whatever tending to limit the size and capacity of the hydraulic ram, it is the practical difficulties which might be encountered in the design of valves. It is believed that these are no more insurmountable than those encountered in the design of valves for other pumping engines of large size." It is believed that the proper valve required to solve the problem has been produced.

Head.—No difficulty should be encountered in operating these rams with supply heads [illegible] 500 ft., the machines being designed to suit the service required.

In addition to the automatic hydraulic ram there is a current ram manufactured by the Lester Duplex Hydraulic Ram Co., of Portland, Ore. The waste valve in this machine is operated mechanically by a separate current wheel. The operating head for the ram is that produced by the velocity of the current of the ditch or stream in which the machine is set.

Capacity.—By the use of the multiple ring valve the size and capacity of the ram may be increased by adding more rings without changing any essential operating conditions. If the capacity is to be doubled, the length of valve ring, the unbalanced pressure on valves, the area of valve seats and the strength and resistance of the actuating spring are all increased in the same ratio. It is believed that rams having at least a 36-in. supply pipe can be built and operated successfully.

USES.

The possible field of useful operation for the ram includes practically all those cases where water is to be pumped and local water power is available to furnish the power.

Water Works.—The ram is sometimes well adapted for pumping water for domestic supplies and city waterworks, as it operates continuously and efficiently without cost of attendance or power. Hydraulic rams in the past have been used mainly for supplying isolated dwellings and small villages. Now, however, the advent of this new type of ram makes these machines available for use in large city waterworks.

Irrigation.—There has been a great need in irrigation work for a cheap pumping machine that would work automatically, economically, and efficiently under all conditions, and having sufficient capacity to make them practical for large installations. Under some conditions the hydraulic ram is an ideal machine for the purpose. The new design makes possible the use of large units.

It operates automatically, no attendant being required. There are no bearings to oil and no moving parts exposed in the new design. It can be set up and operated miles from an attendant without housing or fear of molestation. It furnishes its own power without cost. The cost of maintenance is practically nil and the first cost of installation small. The machines are very flexible as to their operating conditions, the same machine, operating equally well under a high or low head. The delivery head can be changed at any time without touching the machine or interfering with its continuous action.

The hydraulic ram could be included in the design of many gravity projects to advantage. Why construct the main gravity supply canal to the level of the highest land with the great additional length of canal and expense involved when it is possible to locate the supply canal at an intermediate level using the power of the water dropped from the canal to the lower levels to raise the water to the higher levels? In many cases a great saving in cost could be made in this way and much difficult construction avoided.

On existing irrigation projects there are numerous cases where drops in canals and laterals can be used to operate rams to lift water to cover additional lands above the canals. In many instances the cost of the machines for this purpose would not exceed $3 to $10 per acre thus irrigated.

Mining.—The hydraulic ram is very well adapted for pumping water for mining operations. If there is water power available to do the work the ram is the cheapest and most economical pumping installation for the purpose. No fuel or power is needed, no attendant is required and there is practically no cost of operation. The rams will pump direct to the giant for hydraulic mining. Benches above the river bed could be economically sluiced by the use of these pumps to furnish the water required. It is often cheaper to install a ram for pumping than to con[illegible] gravity [illegible] to maintain.

Engineering Procedure in the Brooklyn Bureau of Sewers.*

The Borough of Brooklyn is divided into drainage districts, known as maps. On these maps are shown the layout of sewers for the entire area, showing grades and sizes. This map has been previously legalized by the Board of Estimate, and no deviation from it is allowed, either in size of sewer or grade. In case a change is deemed necessary, a new layout, called a change of plan, must be approved.

The Sewer Bureau is guided in its drainage plan by a complete street map previously prepared by the Topographical Bureau. In this respect the Sewer Bureau is more restricted than in some other cities, where there is no complete street system adopted and there is more latitude in the alignment route of outfall sewers.

Change of Plan.—In case the Topographical Bureau's legal map does not provide sufficient cover for sewers, or is not well adapted for drainage purposes, the Bureau of Sewers may make a change of plan for surface grades, if necessary for proper drainage. This condition seldom arises, however, except in the older parts of the Borough.

From the foregoing, it is evident that one of the most important engineering functions of the Bureau is the preparation of drainage maps. Most of the maps have been designed for the combined system. In the flat and low parts of the Borough, however, it has been deemed advisable to introduce the separate system.

In the determination of sizes for combined sewers, various formulæ have been used to determine the controlling factor—storm flow. The older parts of the city were designed on the Hawksley formula and the Brooklyn formula.

These formulæ, however, were not considered as taking into consideration all of the factors which enter into the relation between rainfall and run-off, and later gave way to the present formula as deduced by McMath:

$$Q = RCA\sqrt[5]{\frac{S}{A}}$$

Where Q = rate of run-off in cu. ft. per second;
A = area in acres;
C = coefficient of imperviousness, a constant;
R = rate of rainfall, in inches per hour.
S = surface fall per thousand.

The constants used at present in Brooklyn are:

For R = 3;
C = .75 for built-up sections;
C = .50 for suburban sections.

In connection with the McMath formula the rainfall curve used is expressed by the equation:

$$R = \frac{150}{T + 20}$$

This equation was derived from a rainfall diagram, made from the records of a Friez self-recording weighing rain gage. The rainfall diagram shows all the storms known as excessive by tho Weather Bureau during the years 1891-1906, inclusive, and is an intensity table, the rates per hour being shown at the end of every five minutes for the preceding five minutes, and such rates connected by straight lines. Other curves are also shown.

The area to be drained is determined by the planimeter and the maximum rate of discharge to be expected at the various junction points is determined from the above formula, taken in conjunction with the rainfall intensity curve. The grade and size of the sewer necessary to carry the flow is obtained by the Kutter formula, in which *n* is taken as .013 for pipe and .015 for brick sewers.

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*Abstract of paper by J. B. Van Vleck before the Brooklyn Engineers' Club.

In this way the sewer map for the whole drainage district is made; so that by consulting this map the size and grade of the sewer for any street on the map is determined.

In the design of a separate system, the quantity of flow is estimated on the probable population when the area is fully developed, and is not less than 100 persons per acre. The per capita flow is assumed at 100 gal. per day, reaching the sewer in 16 hours. The sanitary sewers from 8 to 18 ins. are designed to flow half full, and larger sizes seven-tenths full. Two and one-half feet per second is the minimum allowable velocity, and a uniform velocity is secured with an increase at the outlet sometimes, but never any diminution.

Sewers are built of vitrified pipe as large as 42 ins. (Brooklyn is the first city to use vitrified pipe of this size), and egg-shaped brick sewers from 30 ins. to 66 ins. Sewers still larger are circular, unless it is necessary for some reason of grade, etc., to adopt some special section.

Preliminary Survey.—The preliminary survey shows surface elevations every 100 ft., pluses being taken where there is a marked change in the surface grade. These elevations are taken on the center of the street and on each curb line, the latter in order that the plan shall indicate to the bidders the cut for house connections. The stationing is usually started at the outlet. The preliminary survey shows character of pavement, car-tracks, if any, curbs, sidewalks and any obstructions on corners, such as lamp-posts, telegraph or telephone poles, which might interfere with the construction of a basin, as well as any manholes which would indicate sub-surface structures of any description. One field party has charge of all profiling, as a general rule. This survey is then returned to the Engineer of Construction, and through him to the Engineer of Design, who assigns it to an assistant engineer in charge of one of the three drafting rooms.

The plan is then drawn and the specifications prepared. The plan shows the profile, of both sewer and surface, and sections of the sewer, manholes and sewer basins. Manholes on pipe sewers are placed about 100 ft. apart, and on larger sewers 200 or 300 ft. apart. Sewer basins are placed where two falling curb grades meet, as determined by the street elevations adopted by the Topographical Bureau.

House connections are shown every 20 ft., carried 2 ft. inside the curb, to prevent disturbance of the street pavement when connection is made. In the suburban section, all spurs are not carried out to the curb, but only every 40 ft., or depending on the size of the lots. The wishes of the property owner are followed in the matter as much as possible.

Bidding.—The method of bidding in vogue with the Bureau of Sewers at present is what is known as percentage bidding. The Bureau prepares an estimate of the cost of the work, called the engineer's estimate, with prices arranged thus:

Sewers, per linear foot.
Manhole, unit price.
Catch basin, unit price, including culvert.
House connections, per linear foot.
Sheeting and bracing, per 1,000 ft. B. M.
Foundation planking, per 1,000 ft. B. M.

and such other items as may be necessary in special cases.

This estimate is considered as 100 per cent, and the bid is expressed as a certain per cent of the engineer's estimate and refers to all the items of the contract. The idea is to prevent unbalanced bidding, which is generally considered objectionable.

Engineering Work on Construction.—The field party, generally composed of a transitman, who is known as chief of party, a rodman, a laborer and a driver for the field wagon, under the assistant engineer, then locates the center of the sewer on the ground.

Stakes are put at each station and at pluses where required. The sewer is generally located in the center of the street, but in wide streets, two small side sewers are sometimes built for economy, or when the center of the street is reserved for future subways. The chief of party uses the field book containing the preliminary survey and is thus supplied with necessary benches, transit points, etc., to start the work.

The contractor places grade boards across the trench every 50 ft. or less, depending on size and slope of sewer, set on edge, with a short plank under each end to act as a bearing plate to prevent settlement. These grade boards are centered, and an upright cleat is nailed on the boards with one edge on the [illegible] which is an integral number of feet above the invert of the sewer. This distance is called the "pole" and is laid off on a pole about 2 ins. in diameter, by which the inspector measures to the invert as it is being laid. In case a pipe sewer is being built, a right angle bracket is fastened on the end of the pole, so that the arm may rest on the invert of the pipe.

The measurement is made from a cord which is stretched from one notch to another in the cleats on the grade boards, thus representing the slope of the sewer an even number of feet above the invert, according to the "pole" used. In a sewer about 12 ft. deep, the usual pole is 14 ft., or 2 ft. above the surface of the ground. This distance makes it convenient to see that the grade cord corresponds to the mark on the pole, as mentioned above. In case the sewer is other than a pipe sewer, additional marks on the pole show the sub-grade, top of foundation planking and top of concrete, etc.

In case the sewer is a large one, requiring some sub-grade construction, such as piles, the notes show the elevation of top of pile, elevation of cut-off, etc.

The inspector assigned to the work sees that the work is carried on according to the specifications, as interpreted by the engineer. He keeps a record of the material received, as well as force account, and makes a daily report on a postal card, which is used in compiling cost data. In addition to the cost data, he keeps a record of the location of all spurs and connections built in the work, as well as the linear feet of sewer built, together with general notes on the construction.

The field party give the necessary points for the construction of catch basins. These points consist of a radius stake, for the curve of the curb, and a line stake, which bisects the angle of intersection of the curbs. The grade of the basin heads as finished is given by a cut or fill for the radius stake.

Testing Materials.—Before any sewer is built, the materials must be tested. In the case of pipe, one length for every 200 ft. of sewer is sent, if considered necessary, to the laboratory, and tested. This test is one largely developed by the Bureau. I believe it is one of the few plants in the world built to test sewer pipe. The usual test is a compression test. The pipe is put in a 75,000-lb. Riehlé machine, on a bed of sand, the top bearing being distributed through a plaster of paris block 1 in. wide extending the entire length of the pipe. The pipe must stand a definite load, as stated in the specifications. For 12-in. pipe the load is 1,150 lbs. and for 24-in. pipe, 2,000 lbs. There are other tests—the hydraulic for perviousness, and the drop test for brittleness, which are used in certain cases.

The cement is tested in the cement testing laboratory under the Bureau of Highways, according to American Society of Civil Engineers standards. Concrete is tested by compression tests on cubes and cylinders of samples taken from the mixing-box. The laboratory is equipped to make a great variety of tests on materials of construction.

All cast iron, such as basin and manhole heads and covers, is inspected at the foundry by an inspector detailed for that purpose. All other materials are inspected by the assistant engineer on the work and subjected to such field tests as may be deemed necessary.

Final Estimate.—On the completion of the sewer, the field party makes a final measurement as a basis for payment. All manholes are located by stations and tied in with street lines, and the pavement removed, if any, is measured. Elevations of invert and top of manholes are taken as well as tops of all basins. This data is placed on what is known as a final measurement tracing, and is filed for future reference. The inspector fills out a tracing, known as the "inspector's tracing," showing the distance between manholes, and the location of all house connections, as well as all other connections to the sewer. The location of house connections and spurs as shown on the inspector's tracing is placed on the house connection book, which is the record used to locate the proper place to make connection when applications are made by plumbers for property owners.

The pavement, including sidewalk, removed or damaged by the work, is shown on the "pavement tracing" together with the cost of repairing. A blue print of the tracing goes to the Bureau of Highways, to whom the contractor must pay the cost of the repairing as shown on the blue print. Unit prices for cost of various kinds of pavement are shown in the specifications. If the pavement is under guarantee, the price bid in the paving contract holds, and is paid to the guaranteeing contractor.

The final estimate, or engineer's certificate, as it is called, shows the final quantities to the nearest hundredths. The estimate is signed by the chief of party, the assistant engineer in charge and the engineer of construction. The chief of party certifies to the correctness of amounts, and the assistant engineer to the compliance with the plans and specifications, besides approving the certification of the chief of party. The entire estimate is finally approved by the engineer of construction, through whom it is transferred to the chief engineer. The contractor is paid after the expiration of 30 days.

Private Sewers.—Property owners may build sewers themselves under the jurisdiction of the Bureau, in which case they are called private sewers. The reasons for building private sewers are various. The property owners may think that they can save money by selecting the contractor instead of the usual public bidding; or it may be impossible to have the local board pass a resolution in response to petition for a sewer. Again, the situation may be such that there are no available funds for the construction of a public sewer, or it may be desirable to have the sewer built as quickly as possible, thus saving the time required for advertising, bidding, etc., that would be taken up preliminary to the construction of a public sewer. The principal reason, however, is that by this method the expense of having the street legally opened is avoided, as the street must be legally opened before the city builds a public sewer. It thus frequently happens that the property owners both drain and pave a street by private contracts, and the street may never be legally opened.

Authority for such procedure is given in the charter of the city, which requires the parties requiring to build the sewer to obtain the consent of all the property owners, if the street is not opened, and to sign an agreement to build the sewer according to the plans and specifications prepared by the Sewer Bureau. They must also deposit a sufficient sum to cover the cost of engineering and inspection, about 10 per cent. In case the estimated cost of engineering and inspection is exceeded, more funds are called for before the city issues connection permits. Any excess is returned.

If the street is legally opened it is not necessary to get the consent of the property owners. The Board of Assessors distribute the cost of the sewer over the property benefited, as in public sewers, when the street is legally opened, and before the city will issue permits for connections, the party desiring to connect must first pay to the persons who built the sewer their proportionate share of the cost as determined by the Board of Assessors. If the street is not legally opened, there is no charge for connection. When all connections have been made, the sewer becomes the property of the city.

Private sewers, as far as construction goes, differ in no way [illegible] are supervised by the engineer of construction and the assistant engineer in charge of the work, as well as an inspector who is assigned to it. The specifications are the same as on public sewers. Not being built by public funds, there is no labor lien clause in the contract, so that frequently the working days are [illegible] would become a party to the proceeding, thus [illegible] etc., large sewers are seldom built privately; they are usually 12-in. pipe and run one block. Where there is no sewer directly in front of the house, but one a short distance away, property owners are permitted to build what is known as a plumber's drain for temporary convenience. This is generally an 8-in. pipe and is built without city inspection, and a bond is filed that the property so served will be connected with the sewer when it is built

DRAINAGE AND IRRIGATION SECTION

Reclamation and Conservation of the Alluvial Lands in the Upper Mississippi Valley, Now and Formerly Subject to Overflow.

Contributed by Charles A. [illegible], Assistant U. S. Engineer, [illegible] River Improvement.

The writer [illegible] construction of the only levee the United States has built on the upper Mississippi, that running from the Iowa River to Burlington, and also of several surveys made with a view to the construction of levees. The low lands lying along the Mississippi between St. Paul and the mouth of the Missouri are not as extensive in acreage as along the lower Mississippi, the Missouri, and many other streams, but the land itself wherever reclaimed, has proved immensely fertile, in fact, is not surpassed in fertility by any land in the country. Although more than one-half of the available lands formerly subject to overflow has already been reclaimed and tentative projects for further reclamation have been formed, there still remain many tracts which, although not very extensive in acreage, still afford a profitable field for exploitation.

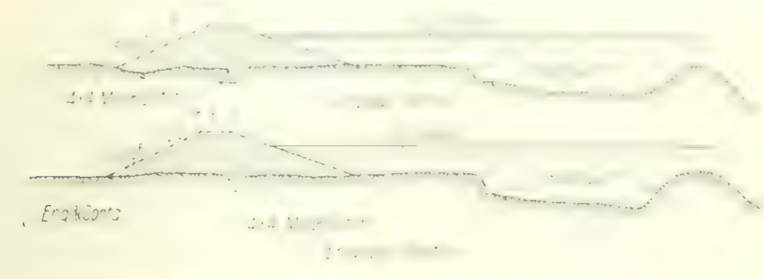

Fig. 1—Sketches of Low and High Bank Levee

Aside from pecuniary considerations, it is manifest that the conversion of a low, swampy and almost worthless tract into an aggregation of fertile farms with appropriate dwellings and farm buildings occupied by an industrious and prosperous population well provided with schools and good roads and reasonably insured against the inroad of malarious diseases, will be of great and lasting benefit to the public welfare and public health, which are important requirements of the drainage laws of the upper Mississippi valley states. On acount of the lessening opportunities for obtaining cheap farm land and to [illegible] ject to more or less frequent overflows and consequent loss, it has become imperative to protect low lands from overflow by means of levees and to get rid of surface water, seepage, swamps, etc., by means of ditches and pumps, and it can easily be shown that in most cases proper levees, ditches, and other means of protecting lands from overflow and of reclaiming low lands, are very profitable.

Thus the matter of conservation and improvement of the soil has become one of the most potent questions of the day and applies with force to the valleys of the Mississippi and its tributaries.

These low lands are the richest in the world, the alluvial deposits ranging from a few feet along some of the small streams to sometimes as much as 200 ft. in depth along the Missouri and Mississippi rivers. Many of these deposits compare favorably with those of the Nile and have an even greater proportion of alluvion.

The map (Fig. 4) of the Mississippi river from Minneapolis to St. Louis, on a very small scale, shows roughly the areas of land now subject to overflow and those already protected by levees.

Of the areas enumerated in Table I, Nos. 2, 3, 4, 9, 10, 11, 12, 13, 14 and 16 are especially adapted to reclamation.

Near Albany the Meredosia drainage district made partial improvements in 1897, by building short levees on the Mississippi and on the Rock River divide, to prevent overflow by those streams at high stages. About 8,000 acres were partially reclaimed, but an additional 17,000 acres await reclamation now in progress.

The Muscatine levee, commenced as early as 1858, is about 13 miles long and incloses 23,000 acres of land. When first built it was drained by three sets of outflow valves and pipes in connection with Muscatine Slough which runs through it lengthwise, but recently two pumping stations have been added. The reclaimed land has more than trebled in value and affords an excellent example of the transformation of a tract of low lying swampy ground into one of the garden spots of the world.

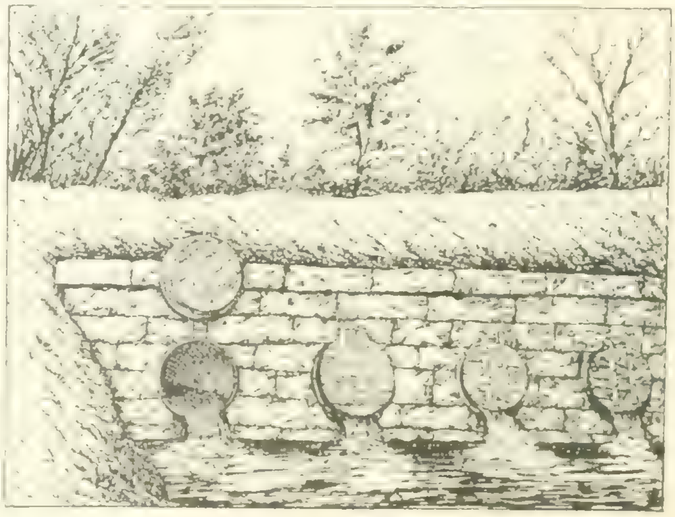

Fig. 3—Sketch Showing Outlets at Laswell Slough.

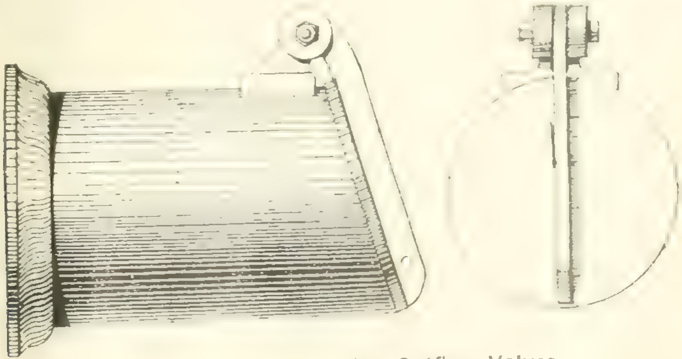

Fig. 2—Sketch Showing Outflow Valves.

TABLE I—LAND NOW SUBJECT TO OVERFLOW.

No.	Location	Miles	Approximate acreage
1	St. Paul to St. Croix River..	30	7,680
2	St.Croix River to LakePepin	26	15,400
3	Lake Pepin to Wabasha	[illegible]	27,[illegible]
4	Wabasha to La Crosse	[illegible]	32,000
5	La Crosse to Lansing.......	35	30,700
6	Lansing to Wisconsin River	33	3,000
7	Wisconsin River to Cassville	24	6,400
8	Cassville to Dubuque........	28	11,500
9	Dubuque to Savanna	12	20,600
10	Savanna to Rock Island....	55	56,700
11	Rock Island to New Boston.	48	5,000
12	New Boston to Dallas	[illegible]	23,800
13	Dallas to Keokuk...........	29	21,300
14	Keokuk to Quincy	[illegible]	37,[illegible]
15	Quincy to Clarksville........	56	23,000
16	Clarksville to Missouri River	81	151.000
	Total		[illegible]

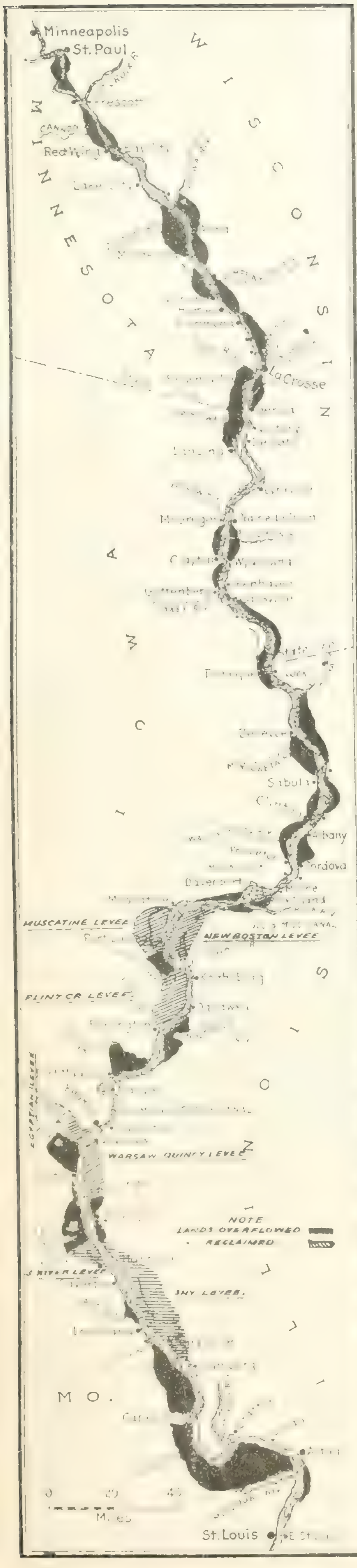

Fig. 4—Map of Mississippi River from St. Louis to Minneapolis, Showing Areas Subject to Overflow and Areas Reclaimed.

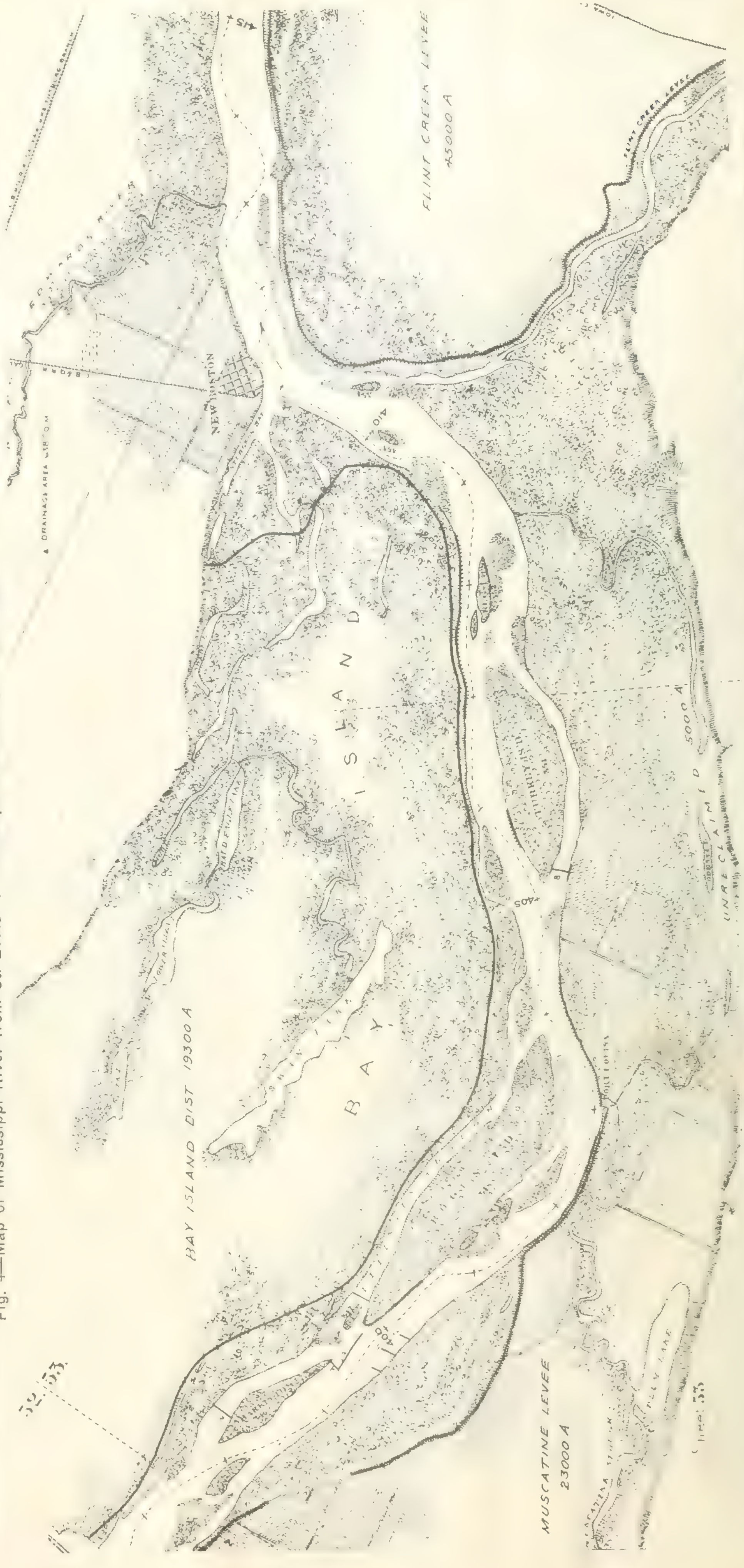

Fig. 5—Sketch Plan Showing Location of Bay Island Levee, Portions of the Muscatine and Flint Creek Levees, and 5,000 Acres Still Available for Reclamation.

TABLE II—LAND [illegible]

Name of Levee
Muscatine
Drurys Landing and Bay
Flint Creek-Iowa River
Egyptian Des Moines R[illegible]
Warsaw to Quincy
South River
Sny Island
Totals

There are 5,000 acres of fine low lying land between the [illegible] River [illegible] claimed to advantage.

The Drurys Landing Levee runs from that landing to Copperas Creek, both sides of which are levied and thence down river to the lower end of Rock Island country, where it connects with the Bay Island levee. This levee was built in 1909, is 15 miles in length, including 4 miles along Copperas Creek. It benefits 8,500 acres of land, the lower 4,000 of which are drained through the Bay Island district, and cost about $4,500 per mile, or about $9.50 per acre reclaimed. Although but two years in operation, the increase in market value of the land is said to be 600 per cent.

The Bay Island Levee commences at the Rock Island-Mercer County line and runs down the river to New Boston, about 14 miles, making a continuous levee of about 25 miles from Drurys Landing to New Boston. This levee, built in 1909-1910, cost, with its large pumping plant and ditches, about $13.93 per acre for the 19,300 acres benefited, and it will cost about 40 cts. per acre per annum for operation and maintenance. The appreciation of property, although a great portion of the land is still unimproved, is from 200 to 300 per cent, and further increase in market value is expected. This levee was chiefly built with a grader, running on the river side, so that there are no borrow pits on the inside. A sketch (Fig. 5) shows the location of the Bay Island levee and of portions of the Muscatine and Flint Creek levees.

The Flint Creek-Iowa River levee was built by the United States ostensibly for river improvement, 1895 to 1900, at a cost of $300,000, including 1,856,351 cu. yds. of embankment, pipes, valves and masonry for gravity drainage, seeding, 14,770 lin. ft. of levee bank revetment and 6,870 ft. of river shore protection. The levee is 35¼ miles in length and reclaims about 45,000 acres at a first cost of $6.67 per acre. Since the levee was turned over by the government to the various drainage districts recently formed, the inside grade has been lowered sufficiently to drain ponds and sloughs and is properly ditched to three large pumping plants. This lowering of the inside grade has put most of the government's gravity drainage pipes out of commission, and the cost of the reclamation will be doubled or increased to about $13 per acre. The right of way was donated to the government. Land formerly valued at from $5 to $25 per acre, has increased in market value to from $80 to $180 per acre, and some land has been sold as high as $225 per acre. The acreage of usable land has been increased about 25 per cent by lowering the grade. The levee was built by teams and scrapers at prices per yard of embankment ranging from 8 to 22½ cts. In 1903 occurred the highest flood ever known at New Boston, which is near the upper end of this levee. At no point was the levee broken, although 23 weak places were found and strengthened. These were chiefly caused by sloughing on the inside slope in the slough crossings and other high sections.

The sketches (Fig. 1) of the levee cross-sections for low and high banks follow, the crest elevation being 3 ft. above extreme high water.

The best form of outflow valve is also shown (Fig. 2). A sketch of the drainage arrangements at Laswell Slough is shown in Fig. 3. There is a short levee, built in 1911, between New Boston and Keithsburg, reclaiming about 5,000 acres. There are also some short disconnected levees between Skunk River and Fort Madison, which territory was surveyed by the United States in 1896, and 15,600 acres of land were found to be capable of reclamation, with 18 miles of levee, at a cost of $136,000.

The United States in 1896 also made levee surveys from Oquawka to Dallas, levee 40 miles, land to be reclaimed 21,000 acres and probable cost $340,000; from La Grange to Hannibal, levee 39 miles, land to be reclaimed 32,260 acres and cost $312,000; also between Alexandria and Canton, levee 12 miles, land to be reclaimed 21,500 acres and cost $130,000.

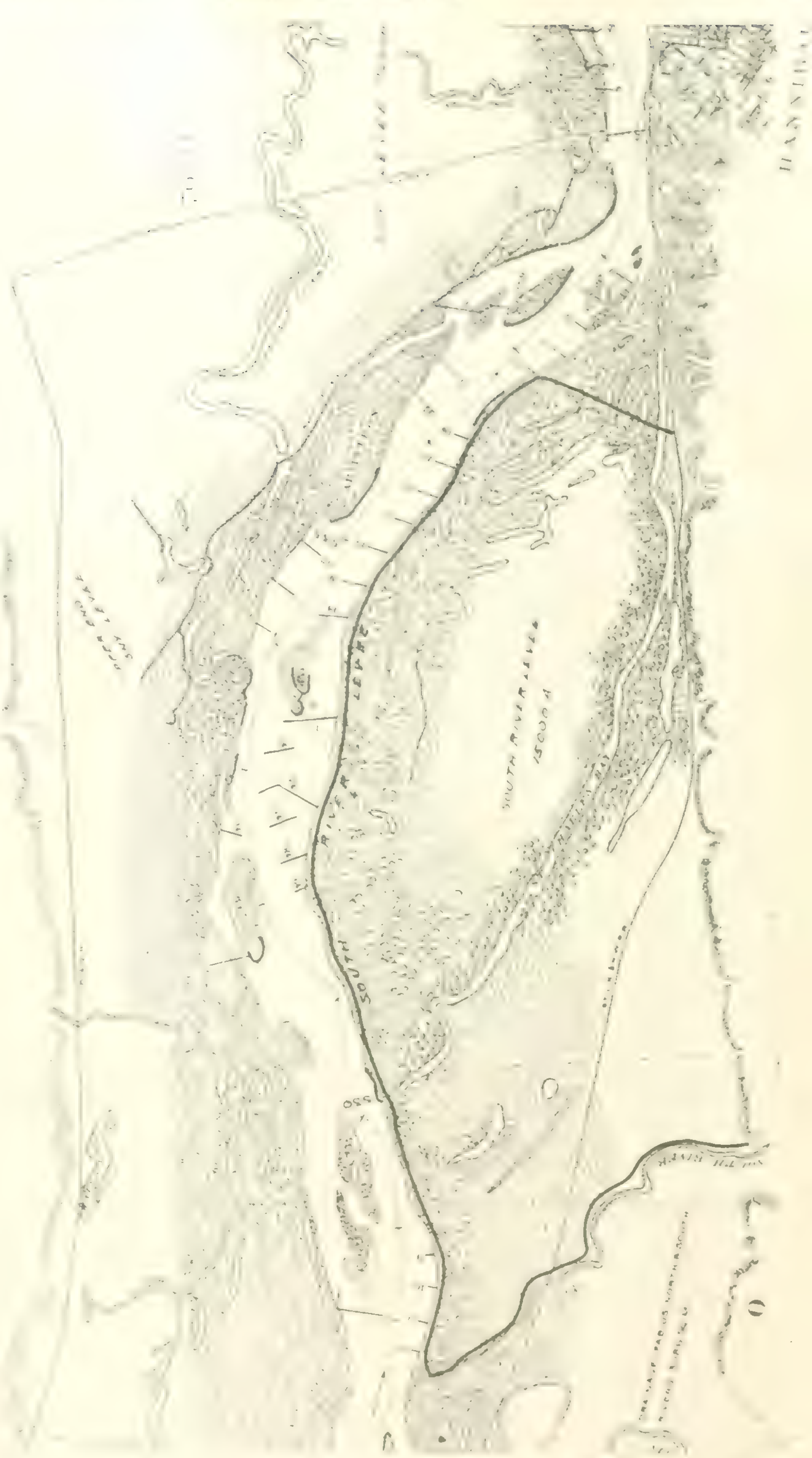

Fig. 6—Sketch Showing Sny Island and South River Levees Which Together Protect [illegible] Acres from Overflow by the Mississippi.

The Egyptian Levee, which protects the district between the Des Moines and Fox rivers, has been in existence many years and protects about 11,000 acres of fine bottom lands which have been long settled and extensively cultivated. Most of the reclaimed land is worth $125 per acre or more.

The Warsaw-Quincy levee on the Illinois side, connecting the cities named, is 30 miles in length and includes 52,000 acres. It was very badly constructed, and with poor material, by three drainage districts in the 70s, and, alt[illegible] $105,000 in reinforcing and strengthening it and in digging a muck ditch, it is broken in several places at every high flood, and land is seriously affected even at moderate stages by seepage. Were the levee properly rebuilt and provided with pumping stations in addition to the gravity drainage now employed, the value of the inclosed land would be vastly increased. Notwithstanding the many vicissitudes this levee has labored under, land worth originally $3 to $5 per acre has increased in value from $25 to $50. The three levee districts are called the Hunt, Lima Lake, and Indian Grave.

During the flood of 1903, the Hunt levee broke in two places, caused by lateral pressure. Several other breaks occurred in this and in the Lima Lake district, but they were due to water on the inside after the districts had flooded from the preceding breaks. The Indian Grave levee broke when the water was 4 ft. below its top. Several other breaks occurred in this levee, caused by the inside water from the previous break.

The Sny Island levee, built under the drainage laws of the State of Illinois, 1872 to 1875, is the longest and most effective levee on the upper Mississippi, reclaiming 110,000 acres. It runs from a point about 12 miles below Quincy along the east bank of the river to Hamburg Bay, about 53 miles. The land is drained into a central channel called the Sny which runs the entire length of the district, but being open at the lower end, a small portion of the land is flooded by backwater from the Mississippi. In the early years of its existence the levee was broken many times with consequent disaster, but owing to improvements to which the United States contributed $100,000, it has successfully withstood all floods since 1903. It is said in connection with the marvelous fertility of this land, that one crop in three would give the farmers a profit. A great deal of the unimproved land before the levee was built was valueless, and the average market value of all the land was about $10 per acre, whereas today it is worth $125 per acre. Up to 1888, 18 crevasses had occurred, but from that year to 1903, there were no breaks, the levee having been raised and greatly strengthened. In 1903, however, a destructive crevasse occurred opposite Louisiana, due to the breaking of the Chicago & Alton Railway bank. Up to 1891, more material had been used in repairing and strengthening the Sny levee than in the original construction.

The South River levee, built by private parties in 1904, embraces the land just above Hannibal, bounded by South River, the Mississippi River, and the bluffs. The levee is about 12½ miles in length, reclaims 15,000 acres of land, and cost, including the pumping plant, nearly $200,000, or about $13.33 per acre. The average value of the land before construction of the levee was $15.00 per acre, and its market value today is from $70 to $100. A large portion of this levee was built by a suction dredge, and this dredge will undoubt[illegible] scraper work would be extremely difficult and expensive.

To form levee and drainage districts, recourse must be had to the drainage laws of the various laws of the various states. These laws are very voluminous, and great care must be taken not to make errors which would be apt to invalidate the bonds. It is to be understood, however, that all work of this kind must be of benefit to the public health and welfare, and that every acre of land improved must contribute its quota toward the cost and maintenance of the improvement, based on the benefits received. A report of the Bureau of Labor Statistics of the State of Missouri for 1910, gives in brief the method adopted in the State of Missouri, which does not differ materially from the methods employed in other states, for forming levee and drainage districts.

First of all, in order to form a district it is necessary to have the sentiment of a majority in interest of the land owners favorable to the enterprise. Without such sentiment it is almost impossible to induce the proper persons to attend a meeting for the purpose of considering the matter. After it has been ascertained that the feeling is favorable for the formation of a levee or drainage district, a mass meeting should be called. Arrangements should be made for a number of persons, who have studied the question thoroughly, to address the land owners. No definite steps toward a permanent organization ought to be taken at the first meeting, but a committee should be appointed to outline further plans. This committee should be authorized by the members of the meeting to collect a small fund which shall be used to pay a competent engineer for making a preliminary survey of the district; the engineer should also furnish estimates of the probable cost. As soon as the survey has been made and the estimates of cost furnished, the land owners should be called together again to hear the report of the committee.

If it is decided the enterprise is feasible, a permanent organization should be perfected. A president and secretary are the necessary officers for such a meeting, and the secretary should keep a strict record of all the proceedings, and preserve the remarks made by the members. It is now time for the land owners to petition the County or Circuit Court for the privilege of organizing their drainage or levee district.

Before further procedure, it will be necessary for the organization to secure the counsel of some competent attorney, who should familiarize himself with the levee and drainage laws of Missouri. Upon the advice and labor of this attorney will depend almost entirely the success of the enterprise. The slightest mistake may invalidate the bonds that are to be issued or make it impossible for the county officers to collect the taxes to defray the expenses.

The organization may be formed through either the County Court or the Circuit Court, depending somewhat on local conditions. No efforts should be made to work out the details of the enterprise until after the district has been incorporated. When this has been done the proper officers to represent the land owners must be appointed, who will have full charge of further work according to the laws of the state, which should be carefully studied by the attorney.

The information contained in this report may be used at meetings held for the purpose of organizing levee and drainage districts and convincing land owners such propositions are paying investments. This information can be depended upon for its reliability, for it has been compiled with the greatest care and from the most authentic sources.

Land owners, when organizing a levee district, should incorporate under the laws of the state and issue bonds to provide the necessary funds. These bonds should run for a specified term of years, depending upon the amount of the bonded indebtedness and the sum land owners are willing to pay each year; care, of course, being taken that all requirements of the law are complied with in the issuance of said bonds. Plans should be arranged for the land in the district to be assessed for about $1 or $1.50 per acre annually. This will enable the land owners to pay off the bonded indebtedness gradually, so it will not prove a burden to them. By this method a farmer obtains protection for his land and crops annually, at a very small expense during a term of a few years, after which he receives his protection free.

Under the laws of Missouri, every acre of land improved by levees must bear its part of the cost of constructing the levee, in proportion to the benefits received. A tax voted for levee purposes takes precedent over all other encumbrances against such land, except state, county and school taxes, or any other special tax that might have been voted previously or concurrently.

STEAM AND ELECTRIC RAILWAY SECTION

Design of a Shallow Floor for a Double Track Through Truss Bridge of 170 Ft. Span.*

The accompanying drawings illustrate a bridge floor having a depth of only 23 ins. It was designed for a through truss span of 170 ft., on the Chicago & Northwestern Ry., and for a Cooper's Class E-50 locomotive; or a concentration of 60,000 lbs. on each of two axles spaced 6 ft. 0 c. to c.

The floor is of trough construction, the troughs being placed perpendicular to the axis of the bridge. Each trough carries a tie under each track, as shown in Section Y-Y, the tie is supported at four points on horizontal angles rivited to the tops of diaphragms extending between the webs of the troughs. In every alternate trough, except those adjacent to the floor beam, special diaphragms are provided near the ends of the ties. To these diaphragms the ties are anchored by bolts through the horizontal angles at the tops of the diaphragms, which are so located in the troughs that the bolts will be about 4 ins.—a convenient working distance inside the guard rail. The horizontal legs of the angles at the tops are turned toward the ends of the ties to make the bolts accessible after the ties are put in place. The tie bolt diaphragms are omitted in the troughs adjacent to the floor beams, as they would interfere with the driving of the field rivets at the ends of these troughs.

The troughs (half-section, B-B), are carried by longitudinal girders which are parallel to the trusses, and placed at a sufficient distance from the lower chord to permit ready inspection of chord and girder. The longitudinal girders are carried by the floor beams (half-section A-A), which are designed to receive the entire panel load and transmit it to the truss.

The troughs are designed to carry a concentration of 60,000 lbs. on each track, each concentration distributed over two ties. This gives a load of 30,000 lbs. on each of the two ties carried by the trough, or 60,000 lbs. carried by the trough.

The floor beam is designed to carry the load from the intermediate troughs, concentrated at the bearings of the longitudinal girders, 2 ft. 1 in. from the center lines of the trusses; and, in addition, to carry its part of the load on the ties in the adjacent troughs.

The heavy load carried by the floor beam, together with its greater length, requires in this member a section considerably heavier than that of the troughs. The depth back to back of angles is made the same in floor beam and troughs, but the addition of flange material required to give the necessary section modulus in the floor beam, makes the extreme depth of this member somewhat greater than that of the trough sections. This extreme depth of floor beam determines the depth of floor for this type of bridge. By flattening the rivets under the rail and allowing a clearance of 1 in. from the base of rail to the tops of the flattened rivet heads, a satisfactory section is worked out with a depth of floor 1 ft. 11 ins.

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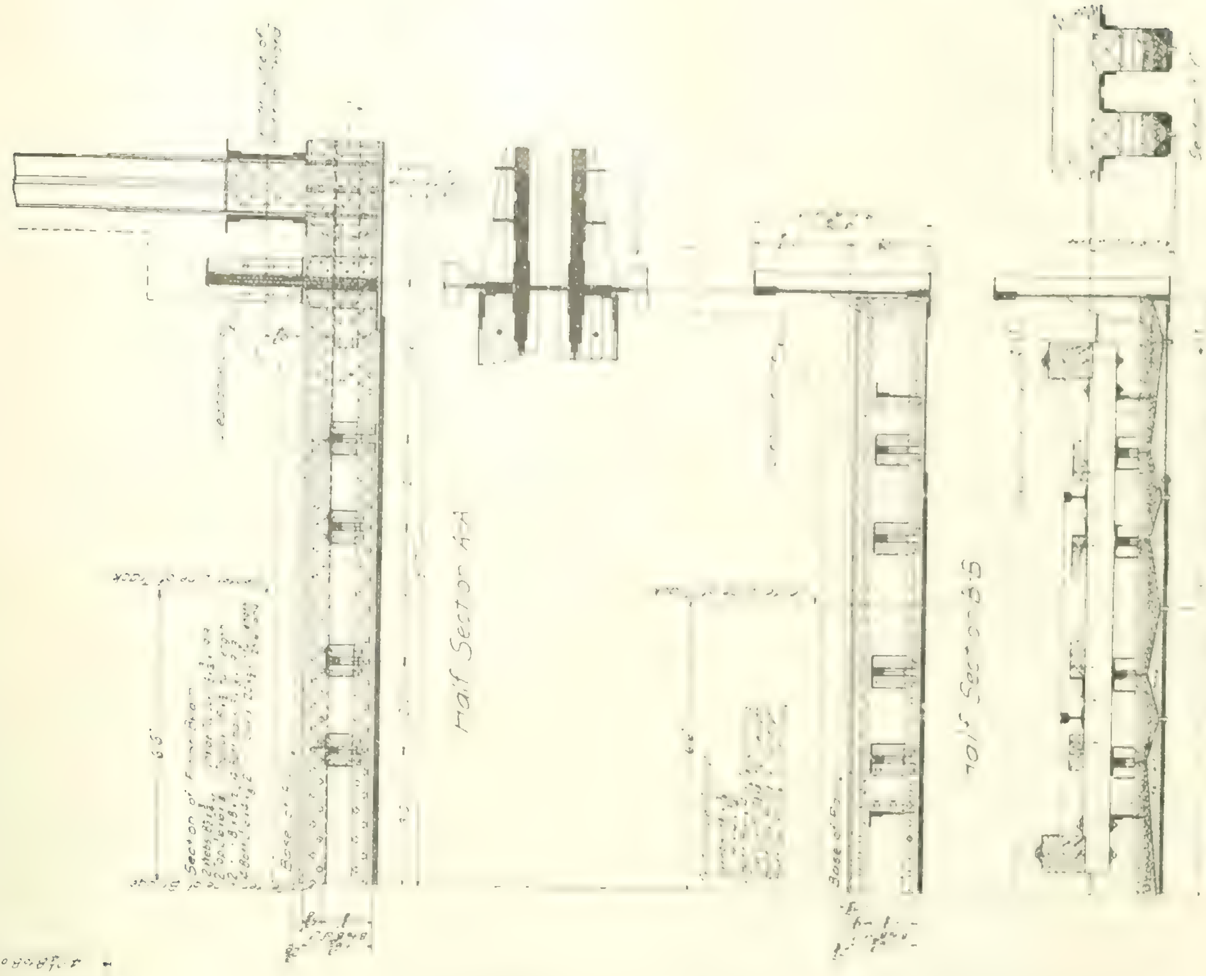
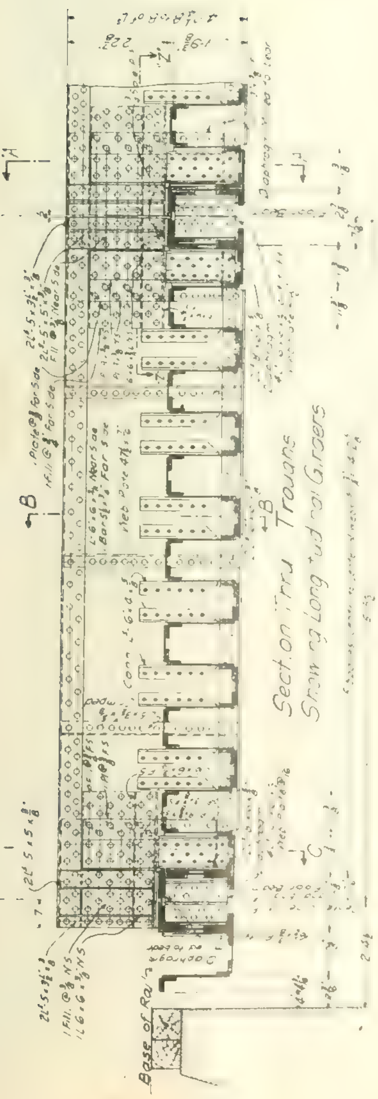
*Abstracted and rearranged from a paper by O. F. Dalstrom, read before the Western Society of Engineers, Dec. 13, 1911.



General Details of Shallow Floor for a 170-ft. Railway Through Span.



It will be noted that the material in the floor beam and trough sections is not disposed symmetrically with reference to a horizontal line at the middle of the section. In order to obtain the most effective distribution of material, the neutral axis is maintained at the middle of the section. The metal is increased on the tension (lower) side to make up for the reduction of section by rivet holes, no allowance for reduction of section by rivet holes being necessary on the compression (upper) side of the section.

The depth of the longitudinal girders is made considerably greater than economic considerations require for the section. This is done to obtain a good detail at the end bearing and at the connection to the floor beam.

The top flange of this girder is unsymmetrical, being composed of a plate and angle, the angle placed with its face against the web, the horizontal leg projecting over the top of the web and outward from the track. This detail of the top flange is to gain an additional horizontal clearance, as at this point the structure approaches, nearer to the clearance diagram than at any other place except at the end post, where the edge of the cover plate is coincident with the extreme vertical line of the clearance diagram. An advantage in erection is also obtained by this detail of top flange section, as it permits setting the trough sections in place on the bottom flanges of the girders, with only a very slight displacement of the girders from their permanent position.

To further facilitate erection of the troughs, the stiffeners are omitted from the inner side of the longitudinal girder. The end connection angles of the troughs, which are field riveted to the web of the girders, are placed high enough so that the tie bolt diaphragms near the ends of the troughs will not interfere with the driving of the field rivets at the ends of the troughs in which the tie bolt diaphragms occur.

The troughs are drained through 1-in. gas pipes fitted into holes in their bottoms and projecting slightly below the trough to form a drip. These are shown in the typical section showing floor and drainage. This projection of the drain pipes must not extend below the line of low steel determined by the rivet heads on the under side of the extreme cover plate of the bottom of the floor beam. The upper ends of the drain pipes are threaded into washers to hold them in place.

The lower part of the troughs is filled with asphalt mastic, the surface sloping toward the drain pipes and flashed over the washers at the upper ends of the pipes. A layer of broken stone covered with gravel is spread over the mastic for a protection.

The deflection of this floor under a maximum load is considerably greater than that of floors designed for depths determined by economical sections. Under maximum load the theoretical deflection at the center of the floor beam is 0.65 in.

The erection of truss bridges of the open trough floor type requires a special order of work in riveting owing to the longitudinal girders being located so close to the trusses.

After the girders have been placed in position, no riveting can be done on the inside of the lower chord opposite the girder. On this account all riveting in the trusses below the level of the tops of the girders must be done before the girders go into place, which means that all lower chord splices, floor beam connections to trusses, and web member connections to gusset plates, up to the level of the tops of the girders, must be riveted before placing girders and trough sections. There is no interference from the girder in driving the rivets on the outside of the truss, but these rivets, up to the level of the tops of the girders, should be driven at the same time that the riveting on the opposite side of the truss is done.

Below are given a few figures for the comparison of a 170-ft. double-track span of the above type, and a double-track span of the same length, with the usual open floor construction, in which the floor beam and stringer sections are determined by the economical depth.

	Shallow trough floor type	Deep floor type
Depth of floor............	1 ft. 11 in.	4 ft. 9 in.
Weight of floor system per lineal foot of bridge	5,000-lb.	1,700-lb.
Weight of trusses and bracing, per lineal foot of bridge	[illegible]	[illegible]
Weight of 170-ft. span, complete	[illegible]	[illegible]
Total cost of span, f. o. b. cars at bridge company's plant at [illegible] per lb.	[illegible]	[illegible]

Difference, $14,900.00 = 66.2 per cent of deep floor type.

As the depth of floor is increased, the weight diminishes rapidly. At 2 ft. 4¼ ins. depth, the weight is 4,100 lbs. per lin. ft. of bridge. This is the weight of the floor in the bridge at Denison, Ia. Further increase of depth would show a corresponding decrease in weight until the minimum thickness [illegible] is reached.

Unit prices in bids submitted by bridge companies for the fabrication of material for the shallow trough floor type, have been found to run about the same as those submitted at the same time for open floor truss bridges. On this basis, a comparison of the two types of the span selected show that the shallow floor type would cost, f. o. b. cars at bridge company's plant, about 66 per cent more than the deep floor type.

The cost per ton for erecting would be about the same for both types. The number of field rivets per ton is somewhat less in the shallow floor type than in the other type; but an allowance, for which no figures are at present available, must be made for the order of procedure in riveting, which requires that part of the riveting be done before all the material in the bridge is assembled, and for the additional falsework and blocking that is necessary under the floor system to provide for the uninterrupted movement of trains. The comparison of costs of the two types erected would, show about the same relation as that of the costs of fabrication.

The range of application of floors of this type in double-track truss bridges would cover depths of floor of about 3 ft. and under, if the panel lengths do not exceed 15 ft. With a depth of floor over 3 ft. an open floor bridge is practicable and would be more economical. For double-track through girder bridges, where panel lengths can be varied as desired, the application would be limited to about 2 ft. 6 ins. depth of floor.

A Reinforced Concrete Railroad Water Tank 187 Feet High.

Although reinforced concrete water tanks for railway service are comparatively new and but few railroads have adopted reinforced concrete for this type of structure, the few tanks built have demonstrated the value and the wide range of design which is possible. The accompanying drawings show a rather notable design of tank recently built by the Central of Georgia Ry. at Savannah, Ga. It rises 187 ft. 3 ins. from the ground line to the top of the parapet wall and 6 ins. higher to the peak of the conical roof. The tank has a capacity of 150,000 gals. and consists of a chimney-like shaft 33 ft. 7 ins. inside diameter at the ground line, tapering to an inside diameter of 24 ft. 7½ ins. at a height of 66 ft. from the ground line, at which point the shaft assumes a cylindrical form, which is continued to the top.

One of the features of the tank is that it is double. There are two water storage compartments separated by dome shaped diaphragms in the shaft. These diaphragms serve as bottoms for the tanks. The upper tank has a capacity of 100,000 gals. and the lower one 50,000 gals. The upper tank is used for storage of water in case of fire on the terminals and the lower tank is for general use.

In a report on concrete water tanks for railway service presented to the American Railway Bridge and Building Association, a detailed description of the work is given by Mr. H. E. Sharpley, Assistant to the Chief Engineer, as follows. The tank was built under Mr. Sharpley's supervision.

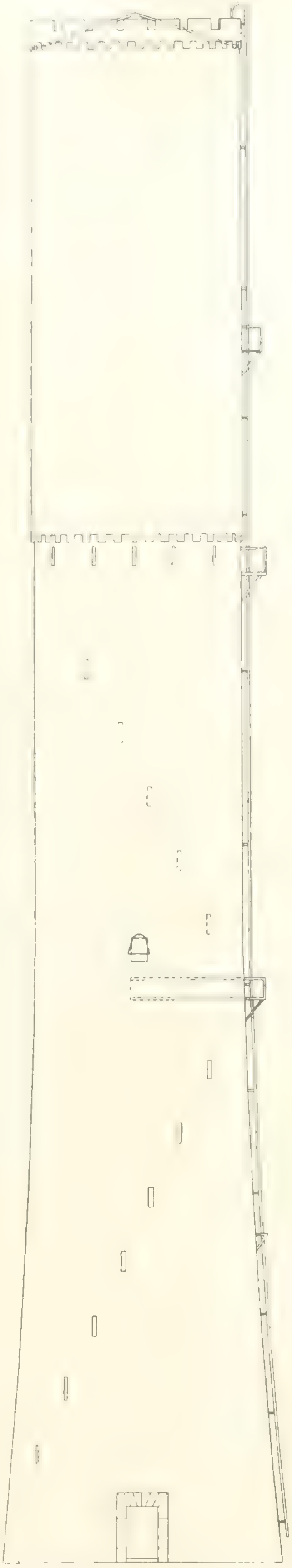


Fig. 1—Elevation of Reinforced Concrete Double Water Tank for Central of Georgia Ry. at Savannah, Ga.

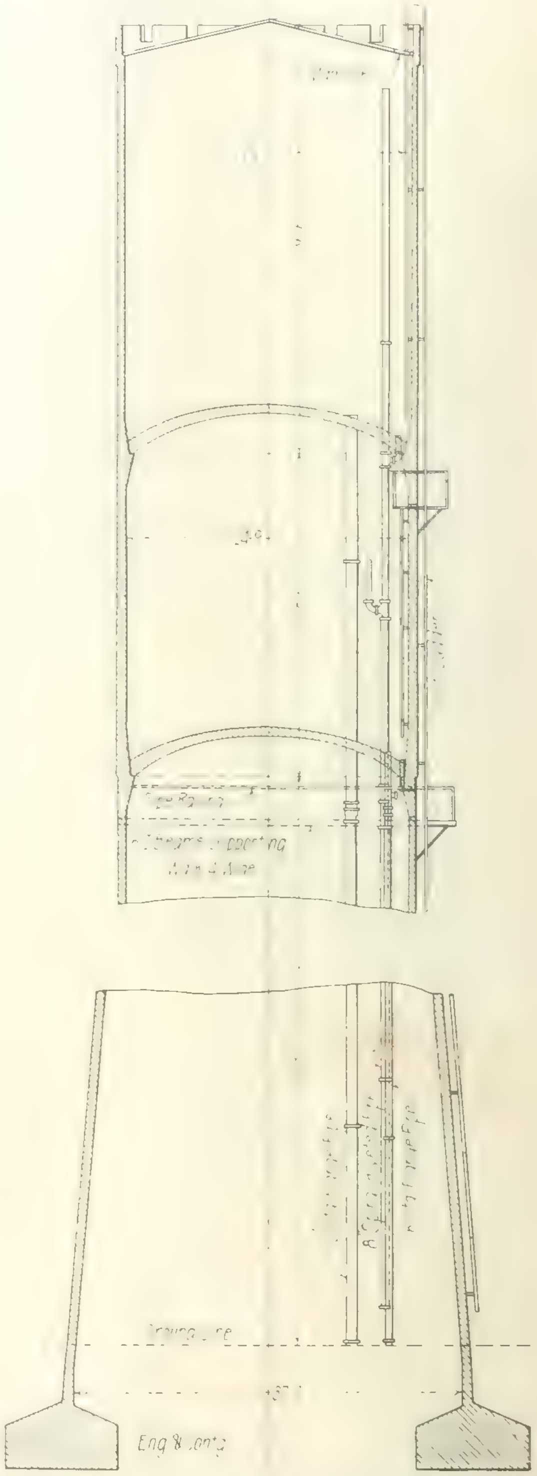


Fig. 2—Sectional Elevation Showing Details of Double Tank Tower, Central of Georgia Ry.

The structure is carried on a foundation consisting of 112 pine piles, with three additional piles supporting the riser and overflowing pipes, all having a penetration of 30 ft. below permanent moisture and driven 3 ft. centers in three concentric circles. The concrete in the foundation consists of a 1:2½:5 mixture, and was poured around the piles on a mud foundation, without the use of grillage.

The reinforcement for the foundation consists of ¾-in. corrugated bars laid both radially and as concentric circles, six of these circular reinforcing rods, together with two ½-in. metal rods 2 ft. long, spaced 10 ft. apart, tie in the foundation around the piling, preventing any tendency of the foundation to spread outward. Three circles of ¾-in. reinforcing rods on top of the piling act to distribute the pressure from the radial reinforcing rods, which consist of 294 ¾-in. bars 10 ft. long laid in a horizontal position on the top of the circular reinforcement and spaced 6 ins. apart at the periphery. Six additional concentric circles of ¾-in. rod are laid on top of these radial reinforcing rods still further to tie in the foundation. The foundation is 10 ft. 6 ins. wide for a height of 3 ft. 9 ins., from which height it tapers in a height of 22 ins. to 9 ins in width at the base of the hollow shaft.

The walls of the shaft below the tank were made of a 1:2:4 mixture, and reinforced horizontally with ½-in. bars embedded near the middle of the wall properly curved and laid in a spiral. The pitch of the spiral being 1 ft. vertical for each complete circumference, resulting in what is practically a ring or hoop of ½-in. bars every 12 ins. in height of tower. The reinforcing rods were lapped over 24 ins. and wired. The vertical reinforcement was also ½-in. bars spaced 24 ins. in centers, lapped 24 ins. and wired to the horizontal reinforcement.

At the periphery of the tank bottoms the walls of the shaft were widened to form a supporting ledge for the dome shaped bottoms as well as to permit of the necessary reinforcement to resist the tendency of the dome-shaped bottom to flatten out due to the hydrostatic pressure. This hydrostatic pressure was taken care of by using horizontal rings of ½-in. bars, each ring being made up of a sufficient number of ½-in. bars lapped 42 ins. at joints or splices in successive rings staggered, and the successive rings so spaced to take up the full tensile stress when the tank is full of water; not permitting any of the tensile stress to be taken up by the concrete.

In addition to these horizontal rings in that part of the shaft forming the wall of the tank, vertical reinforcing rods of ½-in. bars were also placed 16 ins. apart. The dome-shape bottoms and walls of that part of the shaft forming the tanks were made of 1:1½:2½ mixture. The thickness of the concrete walls of the shaft is as follows: 9 ins. at the top of foundation and gradually decreasing to 8 ins. at a height of 66 ft. above the ground line, which thickness continues to the widening required for the tank bottom.

The wall of the 50,000-gal. tank is 9 ins. thick and that of the upper or 100,000-gal. tank is 7 ins.

The size of gravel used in foundation was 2 ins. and under; in the shaft supporting the tanks, 1 in. and under, and in the dome shape bottoms and shaft forming the tanks, ½ in. and under.

The roof is conical, also having a tendency to flatten, which is taken care of by additional horizontal rings in the walls of the shaft in same manner as the tank bottoms. The reinforcement in the roof consists of sheets of 3-in. mesh No. 10 expanded metal embedded near the center of the slabs.

The portion of the shaft beneath the tanks is lighted by windows 8x30 ins. arranged in the form of a spiral, each window being 8 ft. higher than the one preceding and 20° in advance. In each of these window openings a pane of double thick glass has been placed and securely fastened with neat cement mortar. Three large windows and a panel door have been provided at the bottom of the tower to make that portion serviceable as storage room. The whole structure is neat and pleasing in appearance and resembles somewhat an ancient tower.

The riser pipes are carried up inside the tower and directly through the bottoms of the tanks. Access is had to the tanks by an iron ladder which runs on the outside of the tower from the bottom to the top and extends down on the inside to the bottom of each tank. Openings are provided at three places along this ladder with platform and guard rail to permit safe passage in and out. The lower opening, about 75 ft. above the ground, is at the level of the fire alarm bell and its electro-mechanical striking apparatus. The second opening is just below, and third just above the 50,000-gal. tank. In addition there is an opening through the roof to the 100,000-gal. tank.

Lightning protection is provided by 10 rods of ¾-in. solid copper, set 2 ft. in the concrete, and extending 5 ft. above the parapet; each of these rods terminate at the upper end in a three point aigrette. The lower ends are wired to the reinforcing and in addition are connect- [illegible] base of the lower tank. This bottom cable is connected to the expansion joint of the 12- [illegible]

The tanks are supplied by electrically driven pumps and these are controlled automatically In addition metal indicators are provided on the outside to show correctly the amount of water in the tanks

It might be interesting to know that when water was first turned into the tanks a considerable number of small leaks developed in the sides, evidently due to not using sufficient care in cutting the wires which held the forms together. These, however, rapidly took up and in a couple of months the tanks became entirely water-tight.

The concrete work was done by the Piedmont Construction Co., Atlanta, Ga. The average force employed was 16 men, including the foreman and carpenter. The metal forms which were used are of patented design. Only one form or course was poured each day and the balance of the time being spent in removing the forms set the day before and putting them in place for the next pouring.

The entire work was carried out under the railway company's Chief Engineer, Mr. C. K Lawrence.

Cost of Track Laying on the Erie Railroad.

There is no question that where there is sufficient track building in sight, an efficient track-laying machine, together with an efficient organization, will effect a considerable economy and aid in completing the work in a shorter time than by old methods, but to use a tracklaying machine economically the grade and smaller structures should be ready so that the track laying can be continuous. Otherwise a well-organized gang will be as effective using the old methods. An article by H. C. Landon, Division Engr. of the Erie R. R., in the *Erie Railroad Employees' Magazine*, gives some interesting figures of cost on track laying under the old methods, which may be of use in determining whether or not the use of a track-laying machine will be economical. Mr. Landon writes as follows: "In 1905 and 1906, while Engineer M. of Way of the Buffalo & Susquehanna R. R., I was in direct charge of all track laying, ballasting, etc., between Wellsville and Buffalo, and had, in fact, previous to this time, charge of all the track laying of the Buffalo & Susquehanna system from 1898, about 110 miles in all. I have not the data of cost of this work, except that with the low price of labor, the cost per mile, including rental of engines, cars, etc., and the cost of labor, it did not exceed $275 per mile. As much as 5,700 ft. of track had been laid in a single day with about 65 men, through the winding valleys of the branches of the Susquehanna River, south of Wharton, Pa., and the average kept up to very close to a mile per day, where any considerable grade was ready ahead of the track layers.

On the line between Wellsville and Buffalo there were a large number of bridges to be constructed, as the track laying advanced, the steel for the bridges being brought over the new line, so that the track layers hardly became organized for rapid work before they were stopped for a period of two or three days to two months, while the new structures were being erected. During this period the track layers were ballasting the new track, or engaged in completing unfinished track on troublesome fills. The laborers, especially the spikers and members of the iron gang, had had previous experience, and had in general become quite expert in the work.

About one-third of the men were Hungarians and the balance Italians. No natives were employed. While at first the Slavs were decidedly the better laborers, some of the Italians became expert in spiking and in handling the rail, so that spike gangs and iron [illegible] rians, creating a rivalry which expedited the work considerably.

[illegible] passing each other by using a portable turntable, or by lifting the heavy truck body from the wheels. Good camp cars were provided, and also a well-equipped blacksmith's shop. A combined gasoline engine and pump, and a tank of 10,000 gals. capacity—which could [illegible] part of the equipment, so that the track-laying engine could be kept close to the work.

The longest stretch of grade which was ready for the track and where no large bridges intervened to delay the work, was between Belvidere and Belfast and White Creek bridge. On this stretch it was demonstrated what a track-laying gang could do when the organization was well in hand. This work does not compare with feats in the west over a level country, but among the winding roads of the east, it does compare very favorably. The biggest day's work on this stretch was 5,000 ft. and the average for the 6 miles was 4,600 ft. per day.

North of White Creek bridge, 5,900 ft. was laid on July 2, 1905, including delay of several hours placing a small bridge at Transit Bridge. The average for this one gang during the time employed was about 4,400 feet per day.

Other smaller gangs were employed out of Arcade and Hamburg, working north and south to reach important large structures nearby, and while these did not accomplish as much in a single day, the average of about 50 ft. per man was accomplished.

The track-laying gang was made up about as follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible] at $1 [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
1 spike puller, at $1.50	1.50
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total	$ [illegible]
Behind the supply train, full tie-ing:	
[illegible]	$ [illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total	$ [illegible]
At storage yard, loading rail and ties:	
[illegible]	$ [illegible]
[illegible]	[illegible]
Engine and crew, at $40 per day	40.00
Total	$ 79.00
Total in all	$225.75

The average amount of track laid per day was over 4,000 ft. At 4,000 ft. per day the cost per mile would be $297.97. As much material, rail, ties, etc., was received while track laying was in progress, the expense of rehandling in the supply yard was avoided.

The auditor's books, when rail laying was completed between Wellsville and Buffalo, indicated the entire cost of labor for laying 98.1 miles of track to be $29,515.45, or $300.85 per mile. Of this 98.1 miles of track, 85 miles was main track and the balance sidings, "wye" tracks, and passing tracks.

The labor cost included the building of the turnouts, etc. This is the total cost of labor, including engine and train crew, fuel, supplies and rental of engine and of office force.

All rail laid was 80-lb. A. S. C. E. section

The U. S. Civil Service Commission announces examinations to secure eligibles in the positions of (1) senior highway engineer, Office of Public Roads, Department of Agriculture, at a salary ranging from $2,000 to $2,400, and (2) specialist in rural engineering, Office of Experimental Stations, Department of Agriculture, at Washington, D. C., at a salary ranging from $1,500 to $1,800 per annum. Information and blanks may be had from the Civil Service Commission at Washington. Applications must be filed at Washington by Jan. 3, 1912

PERSONALS.

Mr. Thos. E. Mitten, President of the Chicago City Railway Co., has resigned.

Mr. Bert L. Baldwin has been appointed Superintendent of Water Works of Cincinnati, Ohio.

Mr. J. A. Zehner has been appointed Division Engineer of the Mahanoy Division of the Lehigh Valley R. R.

Mr. W. Pagan, Mem. Inst., C E., has been appointed Deputy Commissioner of Railways of Queensland, Australia.

Mr. Henry F. Waige, formerly Chief Engineer of the Clinchfield Coal Company, has been appointed City Engineer of Cincinnati, O.

Mr. F. Merritt, Chief Engineer of the Gulf, Colorado & Santa Fe R. R., has been given jurisdiction over the Pecos & Southern Texas Ry.

Mr. Paul Schultze, Mem. Am. Soc. C. E., formerly Superintendent of Highways of Oneida County, N. Y., has been appointed City Engineer of Troy, N. Y.

Mr. A. S. Lewis, Chief Engineer and Superintendent of Lincoln Park System has been reappointed by the Board of Commissioners of Lincoln Park, Chicago.

Mr. I. F. Stern has resigned his position as Bridge Engineer for the Chicago & Northwestern Ry. Co. and has entered private practice with offices at 315 Old Colony Bldg., Chicago.

Mr. Wm. T. Donnelly was elected President of the Brooklyn Engineers' Club at the annual meeting on Dec. 14, Mr. John F. Steinmetz Vice-President, Mr. Jos. Strachan Secretary and Mr. James W. Nelson Treasurer.

Mr. I. A. Cottingham, Engineer Maintenance of Way of the Houston & Texas Central, of the Houston East & West Texas and the Houston & Shreveport Ry., has been appointed to Assistant General Manager of these roads.

Mr. Edward Shelah, formerly Engineer of Maintenance of Way of the Wabash Railroad, Springfield and Decatur Divisions, has retired on account of ill health. Mr. Shelah will be retained as Consulting Engineer of the Railway.

Mr. W. C. Armstrong, formerly Terminal Engineer for the Chicago & Northwestern Ry., under whose direction the Chicago terminal has been constructed, has been appointed Bridge Engineer of the road to succeed Mr. I. F. Stern.

Mr. Creighton H. Hollingsworth, Member American Society of Engineering Contractors, formerly Superintendent of Construction for the Buffalo Dredging Co., Buffalo, N. Y., has become Superintendent for O'Toole & Gilleray, General Contractors, of Ottawa, Canada.

Mr. Mason D. Pratt was elected President of the Engineers' Society of Pennsylvania at the annual meeting on Dec. 11, Mr. Chas. H. Mercer First Vice-President, Mr. Farley Gannett Second Vice-President, Mr. John K. Meyers Treasurer and Mr. Edward R. Dasher Secretary.

Mr. D. K. Coleburn, Engineer Maintenance of Way of the Galveston, Harrisburg & San Antonio and the Texas & New Orleans Railways, has been appointed Assistant General Manager with jurisdiction over the same department and such new duties as shall be assigned to him.

Mr. Geo. H. Preston, Assoc. Mem. Soc. C. E., has resigned his position as Structural Engineer with the Turner Construction Co. to enter the services of F. J. Ellithorpe & Co., Consulting Engineers, in connection with the air cushion installation for 28 Otis elevators in the new Wollworth Bldg., New York City.

Mr. John A. O'Connor has been appointed Chief Engineer in charge of the construction of the canal terminals of the New York barge canal. Mr. Carleton Greene, New York City, has been appointed Division Engineer to have charge of the terminal work for the barge canal at New York City. Mr. O'Connor and Mr. Greene were formerly Resident Engineers on the barge canal work

Mr. Calvin W. Hendrick, Chief Engineer of the Sewerage Commission of the city of Baltimore, was re-elected President of the National Association for Preventing Pollution of Rivers and Water Ways on December 13. The other officers elected were Mr. Rudolph Haring, First Vice-President; Brigadier General George H. Torney, Second Vice-President, and Mr. H DeB. Parsons, Secretary and Treasurer.

Mr. C. C. Cooke has been appointed Chief Engineer of the Wichita Falls & Northwestern Ry. Co. of Texas, The Wichita Falls & Northwestern Ry. Co. and the Wichita Falls & Southern Ry. Co. His appointment was affected on the 1st of December. Mr. Francis V. Marshall, formerly Assistant Engineer of the railroad at Decatur, has been appointed Engineer of Maintenance of Way of the Springfield & Decatur Division.

Mr. W. S. Blake has been appointed Assistant Engineer of the Pere Marquette Ry. Co. at Detroit. Mr. V. E. Duncan, formerly Assistant Engineer of the Pere Marquette Ry. Co. at Detroit, has been appointed Division Engineer at Ionia, Mich. Mr. J. P. Reynolds, formerly Division Engineer at Grand Rapids, has been made Division Engineer at Traverse City, and Mr. W. J. Long succeeds Mr. Reynolds at Grand Rapids.

Mr. Wm. Madden, formerly Division Engineer at Detroit, has been transferred to Division Engineer at Port Huron.

Mr. Louis C. Kelsey, Civil and Hydraulic Engineer, Selling Bldg., Portland, Ore., has been employed by the Oregon State Board of Health to make reconnoissances, preliminary surveys and inveestigations and to prepare a report and estimates on cost and results of constructing a gravity water system from Clear Lake in the Cascade Mountains to the state institutions at Eugene and Salem and for providing adequate water for cities and towns from Eugene to Salem. This is preliminary to action by the legislature and municipalities toward carrying out a gravity water supply propject. If the project is carried out there will be required a main supply line of approximately 60 miles in length besides subsidiary lines of about 5 miles in length, together with distributing reservoirs [illegible]

Civil Engineering Society Meetings.

Pacific Northwest Society of Engineers.—Joseph Jacobs, 803 Central Bldg., Seattle, Wash., Sec'y. Annual meeting at Seattle, Wash., January 6.

American Society of Engineering Contractors. J. R. Wemlinger, 15 Park Row, New York, Sec'y. Annual meeting at New York, Jan. 9.

Michigan Engineering Society. — Alba L. Holmes, Grand Rapids, Sec'y. Annual meeting at Lansing, Jan. 9-11.

Western Society of Engineers.—J. H. Warder, Sec'y. Annual meeting at Chicago, Jan. 10.

Iowa Association of Cement Users.—Ira A. Williams, Ames, Ia., Sec'y. Annual show and convention at Sioux City, Jan. 10-12.

Eastern Cement Show.—Annual show at Madison Square Garden, New York, Jan. 9-Feb. 3.

Engineers' Society of Western Pennsylvania.—Elmer K. Hiles, 3511 Oliver Bldg., Pittsburgh, Sec'y. Annual meeting at Pittsburgh, Jan. 16.

American Society of Civil Engineers.—Charles W. Hunt, 220 W. 57th St., New York, Sec'y. Annual meeting Jan. 17-18.

Illinois Society of Engineers and Surveyors.—E. E. R. Tratman, 1138 Monadnock Block, Chicago, Sec'y. Annual meeting at Urbana, Jan. 17-19.

Ohio Engineering Society.—C. J. Knisely, New Philadelphia, Sec'y. Annual meeting at Cleveland, Jan. 24-26.

Canadian Society of Civil Engineers.—C. H. McLeod, 413 Dorchester St., Montreal, Sec'y. Annual meeting at Montreal, Jan. 24-26.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING & CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Electric Signal Apparatus. Paper, 6x9 ins., [illegible] pp. The Hall Signal Co., 122 So. Michigan Ave., Chicago, Ill.

These loose leaves have just come off the press containing illustrations, specifications and lists of prices of relay apparatus and parts.

Electric Rock Drills.—Paper, 8x10½ ins., 8 pp. Pneumelectric Machine Co., Syracuse, N. Y.

This catalog illustrates and describes the electrically operated rock drills which are now being manufactured by this company. Complete descriptions of the parts of the machine are given with special attention to the details.

Portable Dumping Boxes.—Paper, 7¾x5 ins., 4 pp. Everett Manufacturing Co., Newark, New York.

This catalog gives complete information regarding the construction of the Everett Bottom Dump Wagon with dimensions and illustrations.

Rope Transmission.—Paper, 5½x7½ ins., 28 pp. Columbian Rope Co., Auburn, N. Y.

This book gives information of material assistance to anyone interested in the operation of rope drives. Illustrations of installations are shown with complete discussions and descriptions. Tables of sizes, weights, breaking strengths, largest working tension, horsepower, etc., are given.

Wood Working Machinery.—Paper, 9x6 ins., 24 pp. Seneca Falls Mfg. Co., 196 Water St., New York City.

This catalog illustrates and describes foot, hand and light power wood working machinery. Bulletin is No. 21A and contains complete descriptions and illustrations of machines and details.

Waterproof Cement.—Paper, 7x5 ins., 32 pp Hercules Waterproof Cement Co., 208 Pearl St., Buffalo, N. Y.

This catalog gives several summaries of reports of tests of Hercules waterproof cement and gives illustrations of various construction where this material is used.

Another pamphlet 3x6 ins., 24 pp., gives the results of tests by the Research Laboratory of the company and a discussion of waterproofing and methods of strengthening standard Portland cement.

Water Meters.—Paper, 4x9 ins., 32 pp. Buffalo Meter Co., 270 Terrace, Buffalo, N. Y.

This catalog illustrates and describes American and New Niagara water meters and accessories. Illustrations are given showing the details of construction. Catalog also contains price list and tables of capacities, dimensions and weights.

Stationery and Office Supplies.—Paper, 8¾x12 ins., 56 pp. Stromberg, Allen & Co., 430 S. Clark St., Chicago, Ill.

Bulletin No. 25, under date of January, 1912, gives a complete list, with tables and prices, of up-to-date stationery and office supplies.

Sergeant Rock Drills.—Paper, 6x9 ins., 4 pp. Ingersoll-Rand Co., 11 Broadway, N. Y. City.

Bulletin No. 4108 describes the "B-104" Sergeant drill, which is brought out for the special purpose of driving small headings, stoping, or similar work requiring a light and small but powerful machine. Illustrations, specifications and lists of duplicate parts are given.

Factories and Warehouses of Concrete.—Paper, 6x9 ins., 224 pp. Association of American Portland Cement Manufacturers, Philadelphia, Pa.

The purpose of this book is to present to those intending to build industrial buildings a few examples of factories and warehouses of reinforced concrete construction. There are 235 buildings shown, which house 198 industries. Thirty states are represented, as is also the work of 132 architects, 193 engineers and 97 contractors.

Electric Fans.—Paper, 8x10½ ins., 40 pp. General Electric Company, Schenectady, N. Y.

Bulletin No. 4895 contains illustrations, descriptions and prices of electric fans.

Goulds Pumps.—Paper, 8x10 ins., 16 pp. Goulds Manufacturing Co., Seneca Falls, N. Y.

Bulletin No. 106 is entitled "Vacuum and Stuff Pumps," containing illustrations, descriptions, dimensions and capacities.

Paving and Roads.—Paper, 5⅝x7⅝ ins., 16 pp. The Texas Co., 17 Battery Place, New York City.

This pamphlet is published monthly in the interests of good roads. It contains several articles of interest to road builders.

Deane Pumps.—Paper, 6x9 ins., 32 pp. Deane Steam Pump Co., 115 Broadway, New York City.

Catalog D 205 deals with triplex power pumps. This bulletin is intended to give a clear insight into the details of the construction of these pumps. The treatise will prove of practical value to the operating engineer. Complete illustrations and descriptions are given, with tables, specifications and useful information.

Portland Concrete Pile.—Paper, 6x9 ins., 62 pp. Portland Concrete Pile & Equipment Co., Portland, Ore.

This catalog deals with products of the above named company and also the Puget Concrete Construction Co., Seattle, Wash., and the Gulf Concrete Construction Co., Houston, Texas. The pages give a detailed description of the Portland Pile, together with its advantages, and a comparison of wooden and concrete piles. The examples given cover a wide range of work.

Watertight Floor Outlets.—Paper, 6x9 ins., 16 pp. Steel City Electric Co., 1207-19 Washington Ave., North Side, Pittsburgh, Pa.

Bulletin E gives complete illustrations and descriptions of the Fullman Adjustable Watertight Floor Outlets. Special attention is given to details and a list of prices is given.

Another catalog issued by this company, 6x9 ins., 12 pp., is condensed from catalog H and supersedes Bulletin D. This gives illustrations of Steel City Stamped Outlet Boxes and a list of prices, etc.

Radiator.—Paper, 8½x7 ins., 24 pp. American Blower Company, Detroit, Mich.

Bulletin No. 306 deals with the Vento Cast-Iron Hot-Blast Heater. Gives complete illustrations and descriptions, with special attention to details of construction.

Hoisting Machinery.—Paper, 9x12¼ ins., 88 pp. The Contractors' Plant Manufacturing Co., Buffalo, N. Y.

These pages contain illustrations, descriptions, tables of sizes, etc., of various contractors' hoists, boilers, derricks, fittings, etc.

Webster Method.—Paper, 6x9 ins., 20 pp. Webster Mfg. Co., Tiffin, Ohio.

This interesting monthly bulletin deals with conveying machinery for coal handling, gravel washing, etc.

Building Progress.—Paper, 6½x9¾ ins. National Fire Proofing Co., Pittsburgh, Pa.

This is the December number of this company's bulletin, which contains some interesting articles regarding fireproof construction with special reference to well-known buildings

CONTRACT NEWS SECTIO

ENGINEERING & CONTRACTING

The Doings of the Week.

Ra[illegible] work [illegible] cials [illegible] year, [illegible] from the contracts that have been let during the closing weeks of D[illegible] these contracts was the one for the extension of the Oregon Short Line from Vale, Ore., west up Malheur Can[illegible] This work calls for approximately 139 miles of line, and will cost about $6,000,000. The Utah Construction Co., Ogden, Utah, secured the general contract, and has already placed subcontracts with the Brown Construction Co. and the Wasatch Construction Co. Another good-sized contract that was let the latter part of December calls for the construction of 60 miles of line from Dodge City, Kan., southwest, for the Atchison, Topeka & Santa Fe Ry. Among the other railroad construction contracts let recently are the following: L. J. Smith Construction Co., Kansas City, Mo., for 31 miles of double track work in New Mexico from the Santa Fe system; John T. Adams, Columbus, O., for the projected road of the Battle Creek, Coldwater & Southern Interurban Ry. Co. of Michigan; Lindquist Bros., 2201 First Ave., Seattle, Wash., for grubbing, grading and installing culverts for three miles of electric railway for the Lake Burien Ry. of Seattle; the McCarthy Improvement Co., Davenport, Ia., for grading for the Longview Park street car line of the Tri-City Ry. Co. of Davenport, Ia.

The principal contract for bridge work let recently appears to be the one for the Ludlow Ave. viaduct at Cincinnati, O. Contracts for various parts of this work were let to C. H. Glandorf, Thos. P. Stack and The Kirchner Construction Co., all of Cincinnati, O., the total amount of the contracts being $259,585. Several big bridge jobs are to come up for letting shortly. The City of Chicago, Ill., has begun advertising for bids for several new bridges to be erected under the $4,655,000 bond issue voted at the Nov. 7 election. The Kansas City Terminal Co. of Kansas City, Mo., is also preparing to let about $1,000,000 worth of contracts for viaducts, subways and retaining walls in connection with its terminal project at Kansas City.

In the line of drainage and levee work the principal contracts let in the past few days appear to be the ones secured by R. H. & G. A. McWilliams, Chicago, Ill., and the Kinser Construction Co., Chicago, Ill. The McWilliams' contract provides for about 1,600,000 cu yds. of ditch work for Bayou Deview Drainage District No. 5 of Poinsett County, Ark. The Kinser Construction Co.'s work is a subcontract from the Illinois Dredging & Construction Co., of East St. Louis, Ill. It amounts to about $880,000 and calls for the filling, dredging and mattress work for the construction of the levee in front of East St. Louis, Ill. The most important item regarding irrigation work is that the citizens of the Kittitas Reclamation District in Washington have voted to issue $5,000,000 of bonds to pay for the construction of the high line canal. It is expected that work on the canal will be started within the next six months. The canal will furnish water to about 90,000 acres of land.

In the way of road and street work, the principal paving contracts let recently appear to be the ones at Edmonton, Alberta, and at Portland, Ore. The latter contract calls for the hard surfacing of Sandy Blvd., the contract [illegible] the latter being let to the National Paving & [illegible] the early spring on the entire line of the Cole[illegible] Wilmington, Del., is the Chief Engineer.

Late advices from Ottawa indicate that the Canadian Government will carry out the plans for the development of Courtney Bay, the site of the National Transcontinental terminal at St. John's, N. B. Bids on this work were taken under the former administration, the Norton-Griffiths Co., London, England, at $7,700,000, being the low bidder. It is now probable that the work will be awarded to that company and work started in the spring. The contract will provide for the construction of a breakwater across the entrance of the bay to protect it from the heavy seas which prevail whenever there is a wind from the south; for the dredging of an entrance to the basin and the basin itself; for the construction of wharves and warehouses, and a drydock large enough to accommodate the biggest ocean-going vessels.

The Outlook for 1912.

There are many indications that business in general will be better in 1912 [illegible] tions is the air of conservative cheerfulness that prevails in most lines of trade and industry. The decisions last year of the U. S. Supreme Court in the Standard Oil and Tobacco cases and the results that followed have in a measure reassured capitalists regarding the working of the Sherman anti-trust law. This, and the fact that money is, and promises to be, reasonably easy, indicates that the coming season will see increased expenditures in many lines of industrial development. The amount of railroad construction as regards new main lines in 1911, as is shown elsewhere on this page, was the smallest since 1897. The present outlook indicates that railroad construction work in 1912 will exceed the record of the previous year. Indications of this are seen in the awarding of contracts during the last week of the past year by the Oregon Short Line for some 140 miles of new line in Oregon, and by the Atchison, Topeka & Santa Fe for 60 miles of new line in Kansas. Many of the other large railroads have mapped out extensive construction programs, and it is practically a certainty that much of their work will be placed under contract this year. In New England much railroad work is already assured by The Grand Trunk Ry. and probably the Boston & Maine. The former road expects this year to build its new lines from Palmer, Mass., to Providence, R. I., and from Windsor, Vt., to Brattleboro, Vt. The starting of work on these lines will also mean that the Boston & Maine will likewise begin work on several expensive cutoffs. In the middle west the Minneapolis & St. Louis, it is expected, will begin work shortly on two exten- [illegible] most construction work will probably [illegible] the Illinois Central, of the older road [illegible] been busy with the preliminaries have [illegible] system of highways; in Pennsylvania [illegible] have been made for road work whi [illegible] that make construction prospects for [illegible] pear good. It is, instead, the general [illegible] prevalent in business circles that thi [illegible] barring the disturbance incidental to a [illegible] dential election, will mark the beginni [illegible] period of what is commonly called pro [illegible] that makes the outlook for constructio [illegible] loom big.

Railroad Building in 1911.

Statistics publish [illegible] the Railway Age [illegible] the United States [illegible] compared with 4,12 [illegible] in the previous year. Of the mileage [illegible] in 1911, the Chicago & Northwestern [illegible] a total of 173 miles, including the new [illegible] from Lindwurm, Wis., to Necedah, a d [illegible] of 130.55 miles, which was the largest [illegible] stretch of track reported for the year [illegible] Kansas City, Mexico & Orient Ry. la [illegible] second longest stretch of single trac [illegible] miles, from Tanhersly, Tex., to G [illegible] The Harriman lines built a total of ab [illegible] miles and the Santa Fe lines a total [illegible] miles. Texas, which was first in 19 [illegible] 1910, in mileage of new lines built, wa [illegible] first in 1911, with 414 miles. Orego [illegible] next with 224 miles, and North Dako [illegible] Wisconsin each built over 200 miles. [illegible] rado, Idaho, Kentucky, Georgia, Cal [illegible] and Florida follow in that order, each b [illegible] over 100 miles of main line in the pas [illegible] No new mileage was reported in the f [illegible] ing: Connecticut, Delaware, District [illegible] shire, New Mexico, Rhode Island or [illegible] mont. In Canada 1,898 miles was repor [illegible] compared with 1,841 miles in 1910. In [illegible] ico 351 miles was reported as compare [illegible] 138 miles the previous year. The abo [illegible] fourth track, siding or electric lines, [illegible] Age Gazette is somewhat disappointin [illegible] asmuch as it is the smallest figure since [illegible] when 2,109 miles were added. The [illegible] mileage, however, includes only the m [illegible] completed in that year. It does not [illegible] into account the new lines for which [illegible] tracts were let last year, and which [illegible] not been completed. These contract [illegible] gether with the contracts for second trac [illegible] other betterment work, which were let in [illegible] will probably bring the aggregate ex [illegible] tures of the railroads for construction [illegible] well up within the average expenditu

RAILWAYS, STEAM AND ELECTRIC

Alabama.

[illegible] R. R. which was incorporated last October with a [illegible] about ready to begin preliminary work early this year on the construction of its line from Pittsview, in Russell County, to Eufaula. C. B. McDowell, Jr., and Perry Thomas, Eufaula, Ala., are interested.

Alaska.

A bill has been introduced in Congress by Congressman Sulzer which provides a $1,000,000 appropriation for the construction and operation of a railway to be known as the Alaska Central Ry., and other Alaskan conservation. The measure would include Alaska, in the interstate commerce jurisdiction, and would provide a railway commission, "The [illegible]

Arizona.

The Douglas Street Ry. Co., Douglas, Ariz., and the local light and power company, have been combined with other properties under one management, to be known as the Douglas Investment Co. The new company in understood to have extensive improvements in view. The Douglas Street Ry. Co. has been operating 10 miles of line and has been contemplating building an extension.

Arkansas.

Negotiations are reported under way for the sale of the Citizens' Light & Transit Co. of Pine Bluff to outside capitalists. At present the stock of the company is controlled by Pine Bluff parties.

Grading work in now under way for the proposed interurban line between Jonesboro and Nettleton, of which Preston Hatcher, Jonesboro, is the promoter. The work is light and will probably be completed this month.

Surveys have been completed by the Central Missouri R. R, and work, it is believed, will be started on the construction in the near future. As proposed, the line will start at Reyno, Ark., and will extend via Maynard, Ark., through Southern Missouri to Jefferson City. Eastern capitalists are behind the enterprise and will rush the work along as rapidly as possible. A large force of office employes is at work at Reyno now.

Preliminary arrangements are being completed at Russellville, Ark., by W. M. Yore, St. Louis, Mo., promoter of the proposed Russellville, Dover & Northern R. R. It is probable that construction work on the road extending from Russellville to Dover, a distance of 10 miles, will be started early this month.

The potash sulphur springs, near Hot Springs, have been purchased for $100,000 by Isaac Lowenhauft of St. Louis, Mo. It is said that a plan is under consideration for building a street car line from Hot Springs to the sulphur springs.

The Harrison Mineral Belt Ry. Co. has been granted an amendment to its charter whereby its name is changed to the St. Louis, Arkansas & Pacific Ry., and its capital stock increased from $80,000 to $3,000,000. The original charter provided for an 8-mile line. The plan, however, has been greatly extended, and under the amendment it is now proposed to construct 100 miles of line. Of the [illegible] first 100 miles has been subscribed. It is proposed eventually to extend the line from St. Louis on the north to Fort Smith, thence to the gulf. It is chartered in Missouri as the St Louis, Houston & Mineral Belt Ry. Co. Actual construction has been commenced in Missouri, where the grading contractors have been at work since August. J. H. Muder, Harrison, Ark., is President.

California.

⊙The Atchison, Topeka & Santa Fe Coast Line Ry. has awarded the contract for the construction of two reinforced concrete roundhouses, one at Calwa and the other at Riverbank, to Sharpe & Fellows Construction Co., Los Angeles, Cal. Although no figures were given out by officials, it is understood the railroad company has appropriated $150,000 for the construction of the two roundhouses in the valley, and according to plans and specifications the Calwa and Riverbank structures are to be of the same dimensions.

The California, Arizona & Santa Fe Ry. Co. has filed its articles of incorporation in the County Clerk's office at Los Angeles. The capital stock is $50,000,000, of which $243,000 has been subscribed. This is a subsidiary company to the Santa Fe system, the direct object of the incorporation being to organize leased lines of Arizona and the main line of the Santa Fe from Needles to Mojave into one company, and to sell bonds for the construction of other lines in Southern California and Arizona. Among the leased lines of the Santa Fe included in the new corporation are the Lordsburg Ry., the Barnwell & Searchlight Ry., the Arizona & California Ry., Perris & Lake View R. R., the Bradshaw Mountain Ry., Western Arizona and the S. F., P. & P. R. R.

The Camino-Placerville & Lake Tahoe Ry. Co. has been incorporated with a capital stock of $100,000 and proposes to construct a railroad from Camino to Placerville. The incorporators are C. B. Dabaher, B. Sair and C. F. Wood, all of San Francisco, and the principal place of business will be in San Francisco.

The U. S. Department of Agriculture, Washington, D. C., is advertising for bids on a large body of timber on the Tahoe National Forest, in California. About 73 000,000 board ft. of saw timber is offered for sale, with a 10-year period for the removal of the timber. The Tahoe sale will call for the construction of 20 miles of railroad, which will be a common carrier.

The Oakland & Antioch R. R. is stated to have secured all right of way for an extension from Antioch to Sacramento, and it is expected that contractors will submit figures on the work in the near future. W. Arnstein, 347 Grant Ave., San Francisco, is interested.

A plan is under consideration for the construction of a railroad from Modesto to Newman, 22 miles. Residents of Modesto are back of the project and it is stated that $75,000 has already been subscribed by these parties. It is further stated that T. K. Beard, of Modesto, has offered to build the road if $150,000 is subscribed.

It is probable that surveys will be started shortly for a route for the Fresno & Eastern R. R. Co., which projects a standard gage steam line from Fresno to Pine Ridge and Shaver Lake, a distance of 80 miles. This company was incorporated on Nov. 7. The project, however, was first considered in 1905 and 1906. Three surveys were made at that time. F. M. Meigs, San Francisco is President and A. B. Dodd is Chief Engineer

The San Joaquin Light & Power Co., A. G. Wishon, General Manager, Fresno, Cal., has completed the surveys for the steam road which it is to build from the Pollasky branch of the Southern Pacific to the site of its new power plant on Big Creek. The company has set aside $750,000 for the construction of this road. It will be used primarily for handling supplies for the work on the power plant.

The construction of the Cement, Tolinas & Tidewater R. R., according to advices from Suisun, Cal., will be commenced April 1, 1912 The road will extend from Tolenas on the Southern Pacific, the terminal of the cement company's present road to Rush Landing.

Georgia.

C. K. Lawrence, Savannah, Ga., Chief Engineer, Central of Georgia Ry., has plans under way for an under pass to be built at the Bay St. crossing on 4th St. in Macon, Ga.

Grading on the line of the Hawkinsville & Western R. R. has, according to information received from Perry, Ga., been completed as far as Grovania on the Georgia Southern & Florida Ry. The officers expect to have the road completed to Grovania within the next 30 days. Five miles of track have been laid from Hawkinsville. The road from Grovania to Perry has been contracted for and is now being graded.

Idaho.

The Boise & Interurban Ry. has been taken over by the Southern Idaho Light & Power Co., of Boise. The new owners are understood to have negotiations under way for the rebuilding of the road from Boise to Nampa.

Village Trustees of Burley, Idaho, have granted a franchise to Albert Ploeger for a street railway system upon the principal streets of the town. The franchise requires that work upon the system must be begun within one year from date, and that a passsenger service must be in operation upon the principal streets within a period of two years.

Illinois.

Reports from Beardstown, Ill., state the Chicago, Burlington & Quincy R. R. is planning the construction of a new roundhouse and turntable at that place.

Indiana.

Surveys have been completed from McCoysburg to a point five miles south for the projected interurban line of the Chicago & Wabash Valley, and the promoters expect to have cars in operation on this stretch within six months. The line will cross the Monon at McCoysburg, and it is believed that the grading will reach this point in February. R. J. Gifford, Makeever House, Rensselaer, Ind., is the promoter.

Iowa.

⊙The Tri City Ry. Co., J. F. Porter, President, Davenport, Ia., has awarded the contract for grading for its Longview Park street car line to the McCarthy Improvement Co., Davenport, Ia. The grading work will probably be completed by May 1.

Kansas.

⊙Ransom & Cook, Ottawa, Kan., have been awarded the contract for the first 60 miles of the Atchison, Topeka & Santa Fe's new line from Dodge City southwest.

The surveying corps of the Winnipeg, Salina & Gulf R. R. has moved its camp from Sterling to Huntsville, Kan., a distance of about 16 miles north of Turon.

Louisiana.

The Millikin & Southwestern R. R. Co. of Lake Providence, La., has been incorporated, the officers and directors being as follows: W. E. Hyde, President, and C. E. Hyde, C. W. Hyde, L. H. Brothers, E. O. Johnson and H. Schadt, all of Arkansas City, Ark., and South Bend, Ind.

Maine.

The Rochester, South Thomaston & St. George Ry. has secured a franchise on certain streets in the south end of Rockland which gives it an entrance to that city, and will probably begin construction work in the early spring on an extension to South Thomaston; eventually the line will be extended to St. George. Alfred S. Black, Rockland, Me., is President.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Maryland.

[illegible] land R. R. will probably go before the state legislature to secure a renewal of the charter for the extension of the line from Mechanicsville to Esperanza in St. Mary's county. [illegible] Prince George's county, to Mechanicsville and is operated by the Pennsylvania R. R.

Directors of the Western Maryland R. R. are discussing the matter of financing equipment needs for the new Connellsville extension and for additional terminal facilities at Bal- [illegible] has to do with an issue of $8,000,000 to $10,000,000 short term notes.

The Baltimore & Ohio R. R. has placed orders for 40,000 tons of steel rails. The Carnegie Steel Co. received 17,000 tons and the Illinois Steel Co. 7,000. The balance was divided among various independent companies, the Pennsylvania Steel Company, it is understood, taking the largest share.

Massachusetts.

⊙The Holbrook, Cabot & Rollins Corp., Boston, Mass., has opened construction headquarters at North Wilbraham, and has placed a large force of laborers at work on its contract for constructing the line of the Hampden R. R. west of Minnechogue Mountain. Blakeslee & Son, New Haven, Conn., who have the contract for work on the east side of the mountain, have a large force employed on the work.

Michigan.

The foreclosure sale of the Detroit, Toledo & Ironton R. R. has been postponed for the third time.

Steps are being taken to organize a company to be known as the Central Traction Co. It is understood that this company is being formed to build new lines for the Michigan United Ry. Co. Sanford W. Ladd, Detroit, Mich., is interested.

⊙The Battle Creek, Coldwater & Southern Interurban Ry. Co. is reported to have sold $400,000 of bonds and it is stated that construction work on the projected line will be started by April 1. The contract for this work is understood to have been let to John T. Adams, Columbus, O.

Minnesota.

The Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Co. (Dan Patch Line), Minneapolis, Minn., has had engineers working between Fairbault and Owatonna. Definite location for the entrance of the line into Owatonna has been secured and it is believed that the line will reach that place by next summer. At the present time the line is being constructed from Northfield into Faribault.

Duluth and the Ranges.

BY PETER E. [illegible]

⊙Peppard & Fulton, dock contractors, were awarded a contract by the Minneapolis, St. Paul & Sault Ste. Marie Ry. Co. for the construction of its ore dock at Duluth, Minn. They will start on this contract immediately, and will rush same to completion.

⊙P. G. Pastoret and W. L. Lawrence of the Pastoret-Lawrence Co. were callers last week and stated they had been awarded a small sewer contract at Duluth, Minn., and would start on the same immediately. They were on their way to the southern part of the state to bid on some new work.

Paul Bains, Superintendent for the Drake & Stratton Co., stripping contractors on the Iron Ranges near Duluth, was in the city a few days ago. We understand that they are going to close down their operations for the winter.

J. C. Murphy, representing Macomber & Whyte Rope Co., manufacturers of wire rope, spent two or three days with us here recently. He stated that business in his line was pretty good.

N. P. Flodin, representing the Lake Shore [illegible] but he stated that all the contractors on the [illegible]

[illegible] stripping contract on the Iron Range near Duluth, stated that they are going to close [illegible]

There is nothing doing in the construction work in this vicinity at the present time. Men are very plentiful; but lumber companies and logging contractors in this vicinity are getting quite busy, and putting large numbers of these men to work. Wages are quite low at the present time, but if the demand for men keeps up, believe they will be higher in about two weeks.

Contractors and others interested in the Equipment of Labor line are cordially invited to make the offices of Peter E. Meagher, No. 409 West Michigan St., their headquarters while in Duluth.

Mississippi.

It has been announced, according to reports from Batesville, Miss., by C. C. Tye of that place, General Manager of the Batesville & Southwestern R. R., that the road is completed to the Yocona River, with the exception of one or two short gaps delayed by recent rains. It is hoped to throw the new line open for operation by Feb. 1 and also during the present year to extend either into Charleston direct or to a connection with the Philipp & Charleston branch of the Y. & M. V. at Gladys. The road is backed by R. J. Darnell, Inc., which owns a valuable tract of timber land along Yocona River.

Missouri.

It is believed that the Kansas City Terminal Ry., J. V. Hanna, Chief Engineer, Kansas City, Mo., will be ready by Feb. 1 to let contracts amounting to about $1,000,000 for work in connection with its terminal at Kansas City. These contracts will include a number of viaducts, subways and retaining walls.

The Kansas City, Ozark & Southern R. R. Co., now operating a standard gauge line between Mansfield and Ava, Mo., has completed plans for the construction of an extension from Ava, the present terminus, to Rockbridge, Hammond or Bradleyville. The route decided upon will depend upon the assistance of the farmers along the right of way. It is asked that each property owner donate a strip of land 100 ft. wide and subscribe a bonus of $2 per acre of land they own. J. B. Quigley, Ava, Mo., is President of the company.

St. Louis Items.

[illegible]

✣The commissioners of the Silver Creek Levee and Drainage District at Edwardsville, Ill., rejected three bids received Dec. 14, and will advertise for new bids to be opened Jan. 20. The names of the bidders and their figures have been withheld. The commissioners are R. F. Tunnell and Jacob Waber, of Edwardsville, and J. L. Schaefer, of Fruit. The object of the improvement is to protect several thousand acres of farm lands in the Silver Creek bottoms, east of Edwardsville. The specifications provide for the excavation of about 13,000 cu. yds of dirt and clearing ten acres of timber land for a new creek channel. Nine miles of winding channel will be cut to less than three miles by the improvement.

⊙Ransom & Cook, of Ottawa, Kan., were awarded the contract by the Santa Fe R. R. for building a 60-mile extension from Dodge City, Kan., southwest.

⊙The Federal Contracting Co. of Beardstown, Ill., were awarded quite a nice levee and ditch contract near Winchester, Ill.

⊙L. J. Smith of the L. J. Smith Construction Co. of Kansas City spent a day in town. Informs us that they just secured 31 miles of double tracking from the Santa Fe R. R. Co. in New Mexico. They are making rapid progress with their electric line work between Kansas City and St. Joe and expect to have this completed shortly.

At the East St. Louis City Council meeting last week a formal acceptance of the franchise granted the Denverside Connecting Railway six weeks ago was read. The franchise grants the company the right to lay tracks from the Aluminum Ore Co. in Denverside to th: Reber approach of the Free Bridge.

We wish all of our readers a Happy and Prosperous New Year.

Harrington Bros. have 15,000 yds. of machine work to let at West Frankfort, Ill.

Alton, Ill., is interested in a report that Calhoun County is to have a railroad, but that the railroad is to go by the way of St. Charles, Mo., instead of towards Alton. Representatives of the Keokuk Power Co. have been in the county several weeks securing options on land for a right of way for the power transmission line. The options secured cover so much land that it is believed it is the purpose to construct a trolley road along the same route. The options expire May 1. The road as planned at present will enter Calhoun County, and after running the length of the country will cross the Mississippi into Missouri at Auers Landing. The corresponding landing on the Missouri shore is War Eaglelanding. From there the route will run through St. Charles into St. Louis. Alton would rather have the line cross the Illinois river out of Calhoun County onto the mainland of the state and run by the way of Alton.

Wm. O'Connor came in from his work near Kansas City to spend the holidays with his family.

The outlet sewer, constructed in East St. Louis, at a cost of about $800,000, is expected to be completed next week. It is in such shape that the tapping of the lateral sewers will be commenced Thursday. This tapping process will start at the southern end of the city, and progress northward to State street. The sewers north of that thoroughfare empty into a district sewer, which will be tapped into the outlet sewer as soon as completed. It is the intention of the city officials to make the formal acceptance of the sewer an event of consequence, and Mayor Lambert will set apart a day for the affair. City officials from other cities will be invited to be the city's guests, when a tour of inspection, followed by an appropriate celebration, will be in order. This event will probably not be held until the early spring, as there is much work to be done by the contractors after the sewer is completed, before they complete the requirements of their contract.

Major Clark S. Smith, U. S. Engineer at Memphis, Tenn., will let contracts on Jan. 10 for furnishing 40,000 tons of rip-rap to be used on Mississippi river shore protection [illegible]

Z. C. Mitchell of the L. J. Smith Construction Co. went out to Ft. Scott, Kan., the other day and married the belle of that city. Congratulations.

Bids have been solicited by the United States Government at Little Rock, Ark., for the construction of big river dredges to be used on the Arkansas. The appropriation for these dredges is $375,000, and added to this is $51,000 for their maintenance.

The concrete wall of the C. & A. R. R. near Mitchell has been completed and is one of the features of the big East Side drainage scheme. The railroad management found that to purchase land for the building of a

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

dirt levee would cost a large sum of money, and it was decided to use a concrete wall 5 ft. 7 ins. high and 2 ft. thick and running along a strip of track 600 ft. long. The wall will protect the railroad from floods, based on the highest water mark of late years.

Big Jack McCaughey is taking a trip around the world. We look for Jack to relate some interesting stories about this trip when he returns in March.

The Kinser Construction Co. of Montezuma, N. Y., secured the contract for grading, paving, rip-rapping and pile-driving for the new levee in East St. Louis. They want to sublet 300,000 lin. ft. of pile-driving on this work. Expect to open an office in East St. Louis next week, but in the meantime they can be reached care of Koenig's Labor Agency, 612 Walnut St., St. Louis, Mo.

Members of the East St. Louis Commercial Club at their annual meeting on Jan. 4 will listen to an illustrated lecture explaining the building and possibilities of the Keokuk electric dam at Keokuk, Ia., which is supplying electrictiy in St. Louis. A representative of this company will tell the Commercial Club guests how his company expects to develop a volume of electricity equal to 300,000 H. P. from the dam. Stereopticon views illustrating the lecture will be shown.

Mike Conroy has shut down his levee work in Granite City, Ill. He expects to resume as soon as the weather will permit.

A large number of sprinkling contracts were to be let by the Board of Public Improvements here on Jan. 2, 1912.

Papers will be presented by M. C. Andrews and H. M. Cryder, vice presidents of the William P. Carmichael Co., before the Associated Engineering Societies of St. Louis Wednesday night at the Academy of Science Hall, 3817 Olive street. The meeting is to be held under the auspices of the American Society of Engineering Contractors. The subject of the papers will be "The King's Highway Viaduct Construction Features" and they will be illustrated with the stereopticon views.

It is rumored in Alton that the Illinois Traction Company is preparing to extend its lines to Alton. Surveys have been made from Edwardsville to Alton, and at present the company is completing lighting contracts in East Alton, Wood River and Benbow City. The Alton City lighting contract will expire in 1913, and it is expected that the McKinley interests will compete for the business.

Walter Denison expects to finish his work on the Wichita Falls & Northwestern R. R. in about fifteen days. He reports having 275 teams at work on this line. His headquarters at the present time is Woodward, Okla.

Nebraska.

It is reported that construction work will be started shortly on the Nebraska Northwestern R. R. This company projects a 38-mile line between Bassett, Neb., and Springview, Neb., traversing Keya Pasha County. Construction material has been shipped to Springview. Carl Tennis, Sioux City, Ia., is interested.

Information received from Lincoln, Nebr., states that engineers of the Chicago, Rock Island & Pacific Ry. recently inspected the proposed route of the State Farm track to be built from the Rock Island University Place spur to the State Farm, and it is understood that arrangements have been practically agreed upon whereby the company will build the spur. It will run south from the University Place line along the west edge of the State Farm, turning east into the farm near the present power station on the farm.

Nevada.

It is reported in Reno, Nev., that the Southern Pacific Ry. Co. plans to begin the work of double tracking from Lawton to Truckee next spring and to start boring the tunnel through the Sierra as soon as the double track is completed. It is stated that the work will be in charge of A. J. Barclay and that his headquarters will be in Reno. It is thought that the work of tunneling the Sierra will take about ten years.

It is reported that the Western Pacific Co. has purchased the Nevada-California-Oregon R. R. and is planning to broad gauge the line and enter Reno. Later it is said the line will be extended to Los Angeles.

It is understood that the San Pedro, Los Angeles & Salt Lake Ry. will construct a branch line from Las Vegas to Searchlight, a Nevada mining camp, 22 miles from the main line. E. G. Tilton, Los Angeles, Cal., is Chief Engineer of the company.

At a meeting of the directors of the Suncook Valley Railroad at Manchester, N. H., recently it was reported that because of the terms of the lease of the Concord & Montreal and its branches to the Boston & Maine the managers of the latter prefer that the proposed lease of the Suncook Valley for the coming two years be with the Concord & Montreal [illegible] rather than to the Boston & Maine.

New Mexico.

⊙The L. J. Smith Construction Co., Kansas City, Mo., has been awarded a contract for 31 miles of double track work in New Mexico for the Santa Fe system.

North Carolina.

The Asheville Electric Co., Asheville, is to build a short extension to its street car line to the site of proposed Grove Hotel.

The Concord Street Ry. Co., of Concord, N. C., will have work started at once on the construction of 1½ miles of track at Concord.

Following the recent purchase by the Norfolk Southern R. R. of the Raleigh & Southport, the Aberdeen & Asheboro lines and the Durham & Charlotte Railroad, it is reported that the first named system will immediately complete a direct line from Raleigh to Charlotte. The old Durham & Charlotte road, which extends from Colon to Troy, will be a link of the completed road, as will also that part of the Raleigh & Southport between Raleigh and Fuquay Springs. A short new link will connect Fuquay Springs and Colon, and another link of 60 miles or more will complete the connection from Troy, via Albemarle and Concord, to Charlotte. F. L. Nicholson, Norfolk, Va., is Chief Engineer of the Norfolk Southern R. R.

North Dakota.

The Fargo & Moorhead Street Ry. Co., M. L. Hibbard, Manager, Fargo, N. Dak., has completed preliminary surveys for a 3-mile line from Moorhead, Minn., to Dillworth. Grading work will probably be started early in the spring.

The Davenport, Iowa & Western Traction Co. has filed its articles of incorporation in North Dakota. This is the company which is constructing a traction line from Davenport, Ia., to Iowa City, Ia., with a branch line from the main line to Tipton, Ia. The whole system will cover approximately 70 miles, at an estimated cost of $30,000 a mile. C. E. Coon, a contractor of Omaha, Neb., is head of the company. The other incorporators are Stephen Bradley and G. W. Koentz of Iowa City, Ia., and Tillman Todd, Springdale, Ia.

Ohio.

The South Dayton R. R. Co. has been incorporated and proposes the construction over private lands of a short spur line in South Dayton. This line is to be built to facilitate the shipping of freight. The incorporators are George W. Ozias, Abner Rhodes, Rush E. Evans, Charles Rhodes and Joseph M. Weigand of Dayton.

The Cleveland Underground Rapid Transit Ry. Co., W. R. Hopkins, President, Cleveland, has practically completed the engineering work for its proposed system of subways at Cleveland, and it is possible that construction work on a portion of the system may be started early in the spring.

The Springfield & Washington Ry. Co., G. W. Baker, President, Springfield C. H., O., is clearing up franchise and right of way matters so that it can have work started in the spring on a proposed extension of its traction line.

The Grand Trunk Ry. Co. has purchased the coal lands and mines of the Rail & River Coal Co. of Pittsburgh. The railroad company takes title to 31,000 acres of coal in Belmont County, Ohio, near Wheeling, W. Va., including six operating mines with a capacity of 750,000 tons of coal annually. It is said the Grand Trunk purchased the 31,000 acres of land with the six mines in Belmont county, Ohio, because of the impending deal that is going through to consolidate forty-one mining companies in Belmont and Jefferson counties, Ohio.

The Erie R. R., J. Burke, Engineer Maintenance of Way, Cleveland, O., is planning to have work started early this spring on the double tracking of its line from Marion, O.

The City Council of Cincinnati on Dec. 28 passed an ordinance granting a franchise to the Cincinnati Union Depot & Terminal Co. to erect a new central railway depot at Cincinnati to cost $40,000,000. The new depot will give the nine railroad and interurban lines entering the city a common terminus. It is expected work will be commenced early in the spring and the entire project will be completed in five years.

Oregon.

⊙The Utah Construction Co., Ogden, Utah, has started work on its contract for building an extension of the Oregon Short Line R. R. from Vale west, up Malheur Canyon to Dog Mountain, which is a point near Harney Lake. The work includes much heavy grading, several tunnels and some big bridges, and will cost the Harriman company for this stretch of 139 miles approximately $6,000,000. The Brown Construction Co. and the Wasatch Construction Co. have taken sub-contracts on this work. Carl Stradley, Chief Engineer Oregon Short Line R. R., Salt Lake City, will supervise the work.

The Portland & West Coast Railroad & Navigation Co. has applied to the City Council of Bay City for a franchise through the city streets. This company is projecting a line and has secured franchises from Sheridan via Bentley, Dolph, Netarts, Hebo and Tillamook. It is believed that the company is a subsidiary of the Pacific Great Western Ry., of which R. B. Hunt, Eugene, Ore., is chief engineer.

The citizens of Prineville have ratified an ordinance granting to the Prineville & Eastern R. R. terminal facilities and right of way on D St. in the city. The directors and stockholders are Prineville and Eastern men and have promised that they will turn over their holdings under this franchise for a nominal sum to any legitimate railroad enterprise that will show an earnest effort to build a line connecting the county seat with the Deschutes & Oregon Trunk Railroad. The franchise expires within three years if no construction work is accomplished.

The Oregon Washington Ry. & Navigation Co. is understood to be temporarily holding up building its proposed Coyotte cut off pending a final determination by the government authorities as to whether or not the Umatilla reclamation project will be extended westward. Some time ago it was stated that if the west extension of the Umatilla irrigation project was abandoned, the O.-W. R. & N. would build the Coyote cut-off, beginning near Stanfield, and running through the area appropriated as a reservoir site.

Property owners and residents of South Mount Tabor, a suburb of Portland, are raising $40,000 to be used in the construction of a street car line eastward from the line of Hawthorne Ave., Portland. The Mount Hood Ry. & Power Co., Lewis Bldg., Portland, is understood to have agreed to build the line if $40,000 was raised.

Information received from Falls City, Ore., is to the effect that the railroad connecting Bridgeport, a station on the Salem, Falls City & Western, with the quarry of the Newberg

Cement Works, located

be opened to traffic next summer.

Pennsylvania.

The stockholders of the Reading & Columbia R. R., R. T. Dill, General Manager, Reading, Pa., will hold a special meeting on Feb. 28 to vote on a proposal to increase the indebtedness to $850,000

It is reported that the Bucks County Electric Ry. Co., Newtown, Pa., has purchased the New Jersey & Pennsylvania Traction Co. The Bucks County Company operates between Bristol and Doylestown. The other company operates in New Jersey and Pennsylvania.

The Gaynor Contracting Co. has been incorporated under the laws of Delaware to engage in the construction of railroads, bridges and other structural work. The capital stock is placed at $50,000. The incorporators are William L. Gaynor, Thomas P. Gaynor and K. M. Gaynor, Scranton, Pa.

It is believed that work on the new Western Maryland line between Connellsville, Pa., and Cumberland, Md., will be completed early in the year. Reports the latter part of December show of the grading 98.5 per cent was completed; concrete work, 90 per cent completed; bridge masonry completed; bridge superstructure, 95 per cent in place; track laid, 40 miles, including 20 miles of main line, eight miles secondary main and the balance in sidings. In the big Savage tunnel there remained only 90 ft. more to bore in the heading before reaching daylight. This will be done in five or six days. Of the bench there remains 1,200 ft. to be removed. There are still employed on the work 3,500 men, including the contractors and railroad company employes. Thirty "dinkey" engines and fifteen steam shovels are still at work cleaning up odds and ends of cuts and fills.

Rhode Island.

The Board of Aldermen of Providence have removed the last obstacle to the Grand Trunk Ry.'s new line reaching the water front in that city. The Board has voted to allow the road to lay tracks parallel to those of the New York, New Haven & Hartford Railroad on Allens Ave. The Common Council voted three weeks ago to allow the Grand Trunk to utilize Allens Ave., the only available route to the harbor, but the Aldermen refused permission on the ground that the city was giving the Grand Trunk a perpetual franchise.

South Dakota.

The Dakotas Transit Co. has filed its articles of incorporation with the Secretary of State at Pierre. It is stated that the company is to be financed by Englishmen who propose to construct 1,625 miles of road at an average cost of $20,000 per mile. It will touch South Dakota in Roberts and Marshall counties, running northwesterly through North Dakota into Canada, and from a point at about the middle of the north state will have a line into the Twin Cities. The incorporators include J. N. Pouby, E. S. Gognan, L. F. Askwith and H. Despardend, all of Ottawa, Ont.

A meeting was recently held by the farmers in the vicinity of Mitchell, S. D., in regard to assisting the promotion of a railroad from Mitchell to Blunt, and it is said that many of them expressed willingness to subscribe $100 for every quarter section of land they own. About $2,500 per mile guarantee is needed to start work on the project.

Tennessee.

The Arkansas & Memphis Railroad Bridge & Terminal Co., which filed its charter last week, is understood to be planning the construction of a new bridge over the Mississippi River and the building of new terminals at Memphis. The work is to be done for the Chicago, Rock Island & Pacific R. R., and it is believed the project will involve the expenditure of $10,000,000 to $15,000,000. J. T. Harahan, Chicago, Ill., former President of the company. The other incorporators are J. T. Reichman, C. Hunter Raine, E. E.

Texas.

Traction Co., a franchise for his interurban line through the city. This line is to be built from Greenville to Paris and thence to Clarksville.

engineers at Waco working on estimates preliminary to asking bids for the construction of the East Waco terminal.

San Antonio, Rockport & Mexico R. R. has been financed and will have construction work started early this year on its proposed line from San Antonio to the Crowther oil fields, and branches to Rockport on the Gulf and Mission on the Texas border. The officers of the company are President, R. R. Russell; vice president, A. L. Matlock; treasurer, J. S. Haile; secretary, Butler L. Knight.

Ordinances have been presented at a recent meeting of the City Council, Houston, Texas, granting the International & Great Northern R. R. permission to lay a switch track upon and across Commerce Ave. and Buffalo St.; also granting the Galveston, Houston & Henderson permission to lay a spur across Shepherd St. and along Texas Ave.

Further information is available concerning the contract signed by the Executive Committee of the Commercial Club of Pecos, Texas, and M. J. Healy, President of the Panhandle, Pecos & Gulf R. R., by the terms of which a line will be built from Pecos to Dawson Fields, Colo., via Knowles, N. Mex. The line is to be completed to Knowles within 18 months after posting $75,000 cash penal bond by the railroad. The citizens guarantee to raise, under certain stipulations, a bonus of $75,000, which is to be given to the railroad company, together with terminal sites and other inducements. The railroad guarantees to locate shops, roundhouses and general offices in Pecos and to maintain same for a period of not less than 25 years. The road is projected between Pecos and Dawson Fields, Colo., a distance of about 350 miles, but the first link, and that provided for in the contract, is to be for 90 miles, or the building of the road between Pecos and Knowles, Eddy County, N. M. F. W. Johnson, Pecos, Texas, is a member of the Executive Committee.

Utah.

The City Council of Salt Lake City, Utah, has referred to the committee of the whole for consideration the application filed by the Emigration Canyon R. R. Co. for a franchise to extend its line to the city limits, preparatory to building through to Halliday. The company has the necessary franchise from the county and has secured an extension of time in which to do the work.

The Salt Lake & Ogden Railroad Company's application for a franchise covering additional trackage on North Salt Lake has been referred to the City Engineer by the Council. The company desires to build three tracks on Beck St. E. A. Vail, Salt Lake City, Utah, is Chief Engineer of the railroad.

The Union Pacific R. R. is reported to be planning to start work as soon as the weather will permit on laying double track east of Ogden through the Weber canyon. The company contemplates building the double track as far as Evanston, Wyo., the right of way for the extra track having been secured.

Vermont.

The construction of the Mettowee Valley R. R., according to reports, has been commenced at Pawlet, Vt. The directors appointed C. L. Leach, Pawlet, Vt., and John Sheldon, Dorset, Vt., a committee to further the work.

Virginia.

The Henrico County Board of Supervisors has taken final action on the application of the Richmond & Henrico Ry. Co. (electric) Richmond, for franchise to extend its line from Fulton to the National cemetery.

Washington.

⦿Lindquist Bros., 2201 First Ave., Seattle, Wash., have been awarded the contract for grubbing, grading and installing culverts for the 3 miles of electric railway now being built for the Lake Burien Ry. between Seattle and Lake Burien. Rietze, Storey & Duffy, Northern Bank Bldg., Seattle, are the Engineers.

City Council of Tacoma is reported to have extended the franchise of the Seattle-Tacoma Short Line Ry. to enter Tacoma until Jan. 10, 1914. This extension of time was made with the provision that the new line should expend $20,000 in the Pierce County in the next six months. It is stated that this money will be expended for pile driving work.

The Oregon, Washington Railway & Navigation Co. will start extensive improvement work in and about Seattle in the spring. This work will cost about $500,000.

The City Council of Vancouver, Wash., has granted a franchise to Lawrence Harmon for the Washington Trunk Railway, which is designed to open up the territory northeast of Vancouver as far as North Yakima. Preliminary surveys will be made within a short time along two routes. Both will pass close to Mount Adams and Mount St. Helens, in the Cascades, and close to the Lewis River.

A party of Northern Pacific Engineers recently arrived at Ellensburg, Wash., according to information received from that place, and it is rumored that surveyors are to lay out lines for a double track from that place to North Yakima and that the O. W. R. & N. will have use of the lines. Traffic in the canyon is heavy, and the present line, built in 1882, follows the line of least resistance and has many curves. The distance through the canyon can be shortened and most of the curves eliminated by placing the tracks on a higher level and making several cuts and fills.

Wisconsin.

A special meeting of the Milwaukee Electric Railway & Light Co. was held in Milwaukee Dec. 30 to vote on the proposal to authorize $90,000,000 bonds.

The Chicago & Wisconsin Valley R. R. Co. (electric), capitalized at $40,000, has filed with the State Railroad Commission, Madison, Wis., an application for a certificate of public convenience and public necessity, authorizing the construction of the proposed line between Madison and Portage. The application states that it is the purpose of the company to build a line from a point in Janesville to the city of Merrill, extending in a northerly and southerly direction through the counties of Rock, Green, Dane, Columbia, Marquette, Adams, Portage, Marathon and Lincoln.

The Minneapolis, St. Paul & Sault Ste. Marie will build 19 additional sidetracks, each a mile long, at the yards at Superior, Wis., to handle the increased traffic upon the completion of its Twin Ports-Twin City line.

Canada.

The St. John & Quebec Ry. Co. has entered into a contract with the government for building a 208-mile line from Grand Falls, N. B., to St. John, N. B., and has location surveys under way. The New Brunswick Provincial Government is to guarantee bonds to the extent of $25,000 per mile and the Dominion Government is to grant $6,400 per mile additional. The construction of the line will require three bridges which will cost about $1,250,000. F. J. Lisman, 30 Broad St., New York City, is handling the financial end of this project.

At last reports the head of steel on the Canadian Northern Edmonton-Athabasca Landing line was only 16 miles from the Landing. Completion of the line was temporarily delayed by the construction of a

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

short stretch of grade and some trestle bridges, on which work was being rapidly carried forward. Steel was then 14 miles beyond Stoney Creek, or 72 miles north of Edmonton.

The Canadian Government has decided to authorize J. B. McArthur to proceed at once with work on the first section of the Hudson Bay Ry. The contract was awarded by the Laurier Government. This section, from the Pass to Split Lake, is 185 miles in length.

The Canadian Pacific Ry.'s program for this year is said to include the construction of 450 miles of line in the Province of Ontario. It is believed that this work will include the following: A section of the alternate Toronto-Montreal route, from Belleville to Toronto, passing the lake shore towns of Trenton, Brighton, Colborne, Grafton, Cobourg, Port Hope, Bowmanville, Oshawa and Whitby; a line from Hamilton to St. Catharines, Welland and Port Colborne; a line from Ingersoll north, connecting with the Port Burwell branch and the St. Thomas branch, passing through Embro, Tavistock and Shakespeare (about 8 miles east of Stratford), connecting with the company's Goderich, Guelph and Listowel lines at Linwood, then on to Arthur, where connection is made with the Teeswater & Mount Forest and Wingham lines, crossing its Owen Sound lines in the vicinity of Dundalk and terminating at Collingwood. It is also said that the company intends extending the lines now stopping at St. Mary's to the shore of Lake Huron, and passing through Exeter, possibly to Sarnia. Another proposed line is from St. Mary's to connect with the Goderich line near Goderich, which will pass through Mitchell, Dublin and Seaforth.

Premier Sifton of Alberta has announced a comprehensive railway policy for Alberta. His present plans contemplate a line from Athabasca Landing, which, it is expected, the steel of the Canadian Northern will reach early next year to Fort McMurray. The latter was to have been the terminus of the Alberta & Great Waterways line, which was, however, to have been built direct from Edmonton. From McMurray there is a waterway of 1,700 miles to the Arctic Ocean interrupted only by a portage of 16 miles at Fort Smith on the Great Slate River, 300 miles beyond McMurray. In addition to this a line is to be built from Athabasca Landing in a northwesterly direction along the north shore of Lesser Slave Lake to Peace River Crossing, and another from Edmonton to the Grande Prairie country south of the Peace River, into which there has been a large movement of population during the past year. The northeastern part of the Province is to be served by a railway in that direction from Edmonton to a point near Cold Lake on the eastern boundary. The Sifton Government plans to strengthen the connection between the north and the south of the Province by having two lines constructed, one close to the eastern boundary from a point north of the present C. N. Ry. main line to the American border, and another starting from Edmonton in a southwesterly direction and traversing the foothill country down to Pincher Creek, on the Crow's Nest line.

Mexico.

The new federal government has granted to a syndicate of Seattle men, headed by Moritz Thomsen, a concession to build 300 miles of railroad, which, when completed, will connect the Pacific port of Acapulco with the City of Mexico. The syndicate has already under construction 120 miles of track between Acapulco and an agricultural district in the interior and the line to the capital will be an extension of the road now being built. The grant calls for completion of the railroad in six years.

A concession has been granted to the Mexican Pacific Co. to build a new railroad from Balsas station, Guerrero to Zihuatenejo, a small port on the Pacific Coast. Surveys are now under way on a branch line between Organal, connecting with the line to Uruapan and Acambaro. The company has been granted four mouths in which to have the contracts signed with the government, and 20 months to build the first three sections of the road. The government has subsidized the company with $20,000 for each kilometer.

ROADS, STREETS AND PAVEMENTS

Arkansas.

⊙Commissioners of the Gaines Street Improvement District, Little Rock, Ark., have awarded the paving contract for that district to Radcliffe, Gibson & Dillingham of St. Joseph, Mo.

California.

✣Bids will be received until 10 a. m., Jan. 9, by Mayor, Riverside, Calif., for the construction of a fill on Magnolia Ave., including approximately 142,000 cu. yds. of material. Plans and specifications are on file with the City Clerk.

✣Bids will be received until 7:30 p. m., Jan. 8, by Board of Trustees, Azusa, Calif., for the construction of sidewalks, curbs and gutters on San Gabriel Ave.

⊙The Board of Public Works of Los Angeles, Cal., has awarded the contract for the paving of Wilshire Blvd. with bitulithic to the Barber Asphalt Co., for $227,199.

Upon the recommendation of Commissioner of Streets W. J. Baccus the following resolutions providing for street work were adopted by the City Council of Oakland, Cal.: Plans and specifications for improving 4th St., from Clay to Washington Sts.; plans and specifications for improving 4th St., from Franklin to Harrison Sts.; plans and specifications for improving 4th St., from Broadway to Franklin Sts.; plans and specifications for improving 6th St., from Clay to Broadway; directing Superintendent of Streets to notify property owners to lay cement sidewalks on 59th St., between Claremont and College Aves., and on Hanover St., between Wayne and Newton Aves.; instructing City Engineer to prepare plans, etc., for improving Webster St., from 1st to Water Sts.; directing City Engineer to prepare proceedings for the improvement of Bay View Ave.; directing City Engineer to prepare proceedings for improvement of Market St., from 56th to Adeline Sts.; directing City Engineer and City Attorney to draw resolution of intention for opening Keith Ave., from Shafter Ave. southerly; petitions for opening of Keith Ave. filed; petitions to change grade on Bay View Ave. filed; communication from Oakland Chamber of Commerce in repairing lower Webster St. filed; directing City Engineer to prepare plans, etc., for improving West and Market Sts.; specifications of City Engineer for sewer in East 30th St.

Connecticut.

✣Bids will be received until 2 p. m., Jan. 5, by State Highway Commissioner J. H. MacDonald, 27 State Capitol, Hartford, Conn., for the following roadwork: Town of Stafford, about 1,969 lin. ft. of macadam road; plans and specifications at Selectmen's office, Stafford Springs, Conn. Town of Glastonbury, about 6,200 lin. ft. of macadam road; plans and specifications at Selectmen's office. Town of Roxbury, about 11,809 lin. ft. graded road; plans and specifications at Selectmen's office. Town of Westport, about 8,545 lin. ft. macadam road; plans and specifications with Selectmen, Westport. Town of East Windsor, about 9,884 lin. ft. graded or gravel road; plans and specifications at Selectmen's office, Broad Brook. No plans or specifications can be sent to any contractor, but they may be examined at the places named above.

Georgia.

The Board of Brooks County Commissioners, Quitman, Ga., is considering the purchase of improved road machinery, including a gasoline traction engine.

Illinois.

⊙The General Cement Construction Co., of Chicago, Ill.; has been awarded the contract by the Board of Local Improvements of Berwyn, Ill., for the construction of cement sidewalks on 26th St., between Ridgeland and Lombard Aves., for $1,350. Bids were opened Dec. 10.

⊙The Board of Local Improvements, Chicago, Ill., has awarded the contract for constructing cement sidewalks to the General Cement Construction Co., 167 W. Washington St. E. J. Glackin is Secretary of the Board.

⊙A. E. Rutledge has been awarded the contract by the City Council of Rockford, Ill., for the brick paving of North Water St., for $1.70 per yd. for brick and $0.30 for excavating. The total amounts to about $9,000.

Plans were made at a recent mass meeting of the property owners located on East 1st Ave., and the cross streets between East Broadway and East 2nd Ave., city of Monmouth, Ill., for the forming of a paving district, and a petition is to be circulated asking that the streets within this district be improved by paving. The district as planned includes 1st Ave., from 1st to 8th Sts.; South 7th St., South 6th St., South 5th St., South 4th St., all from Broadway to 2nd Ave., and South 3rd, from 1st to 2nd Ave., approximately 16 blocks in all.

A petition is being signed by property owners of Galesburg, Ill., for the proposed pavement on West Losey St., from Seminary St. west to Hawkinson Ave.

The City Council of Chicago Heights, Ill., has passed ordinances providing for the paving of Forest Ave., Circle Court, 19th Place, West End Ave., from the Michigan Central railroad to Main St., and Main St., from Chicago road to the Chicago & Eastern Illinois railroad.

The City Council of Centralia, Ill., contemplates constructing about eight miles of paving during this year, including the paving of Cemetery Ave., from Broadway to the cemetery. Plans and specifications will be prepared by City Engineer L. S. Trainor.

Definite plans have been made by the Board of Local Improvements of Shelbyville, Ill., for the several miles of paving which has been decided upon by the City Council. Washington St., will be paved from the courthouse to South 2nd St., and the paving will probably be extended north as far as the end of the street, which is about three blocks. It is also planned to pave Broadway from end to end, more than a mile, and Morgan St., from the south end to within a short distance of the Chautauqua grounds. North 3d and North 6th Sts. will be paved and extended.

The Board of Local Improvements of Alton, Ill., has decided to recommend to the City Council the paving with brick of 15th and 17th Sts., between Langdon and Henry Sts.

The Board of Local Improvements of Rochelle, Ill., has ordered the construction of 25 miles of new pavement. The estimate calls for brick paving on 2 ins. of sand and 4 ins. of concrete, joints between brick to be filled with concrete. The streets to be improved are Washington, 6th, 7th and 11th,

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

with the intersecting street between 3rd and 8th Ave.

The City Council of Kankakee, Ill., has passed an ordinance [illegible]ing of West Court St., between West and 5th Aves., with vitrified paving block and Portland cement filler, with 2 ins. of sand cushion and 6 ins. of Portland cement concrete base, along with concrete sidewalks and curbing. The improvement will cost approximately $21,000.

The Board of Local Improvements of Peoria, Ill., has ordered the [illegible] Ave. with brick 30 ft. wide, from Pacific Ave. to North St., and also to pave North St., from Michigan Ave. to McClure. The projects to pave Line and L[illegible] abandoned. The Board also instructed the City Engineer to prepare an estimate for the paving of Hurlburt St., from Reed Ave. to Steubenville St.

The Board of Local Improvements of Waukegan, Ill., has passed a resolution for the paving of South Ave., between the west line of Marion St. and the east line of McAlister Ave., with brick.

Indiana.

✣Bids will be received until 10 a. m., Jan. 18, by Commissioners of Laporte County, Laporte, Ind., for the construction of macadamized roads in Noble and Dewey townships. F. A. Hausher is County Auditor.

✣Bids will be received until 11 a. m., Jan. 20, by Board of Parke and Vigo County Commissioners, Terre Haute, Ind., for the construction of two county line roads. Nathan G. Wallace is Vigo County Auditor.

✣Bids will be received until 10 a. m., Jan. 31, by Huntington and Wells County Commissioners, Bluffton, Ind., for the construction of a county line gravel road. O. D. Garrett is Wells County Auditor.

Bids have been received by the Board of Public Works of Indianapolis, Ind., for the paving of La Salle St., from Washington St. to Moore Ave., and for paving Oakland Ave., from 10th to 13th Sts., as follows: La Salle-Hoosier Construction Co., asphalt, $3.30 per lin. ft.; Republic Construction Co., asphalt, $3,66; Oakland Ave.-Hoosier Construction Co., $2.47; Union Asphalt Construction Co., $2.40; Republic Construction Co., $2.63.

County Surveyor C. C. Ernst, Decatur, Ind., with two other viewers, have decided that the proposed macadam road on the Wells-Allen County line is a necessity and have recommended to the County Commissioners the construction of the same. The new road will be 6 miles long, macadamized 40 ft. wide, with 10 ins. of stone in the center, 8 ins. at the sides and with 3 ins. of screenings.

The reviewers and engineers appointed to review the petition for the improvement of the Hirsch road in Knight Township, Vanderburg County, Ind., have made their report to the County Commissioners, Evansville. The improvement, according to estimates, will cost $8,126.

Plans are being prepared for the paving of the square in the city of Angola, Ind., next summer. It is also contemplated to improve other streets during the year. Thos. Owens is Mayor.

Pike St. property owners have petitioned the Common Council of Goshen, Ind., for the paving of that street from 5th St. to the Elkhart River with vitrified brick, and for sidewalks on both sides of the thoroughfare.

Iowa.

At a recent meeting of the City Council of Davenport, Ia., the Aldermen presented a list of the streets recommended for paving this year, as follows: First Ward—Cedar St., from 4th St. to Telegraph Road; Telegraph Road, from Davie to Sharon St.; Pine St., from 4th St. to Telegraph Road; Oak St., from 4th to 6th St.; 5th St. from Davie to Pine St.; 6th St. from Cedar St. to Telegraph Road; Pine St., from Telegraph Road to Newberry St. Second Ward—Lombard St., from Marquette to Washington Sts.; 6th [illegible] vision St.; 8th St., from Marquette to Davie Sts.; South St., from Marquette to Washington Sts.; Washington St., from Locust to [illegible] Road and 3rd St. and Fillmore and Ainsworth Sts. Third Ward Fifteenth St., between Warren and Marquette Sts.; Vine St., between 13th and 15th Sts.; Myrtle St., between 13th and 15th Sts.; Myrtle St., between Hamilton and 7th Sts.; 12th St., between Gaines and Brown; Brown St., between Front and 2nd; Warren St., between Front and 2nd Sts.; alley between 3rd and 4th Sts. and between Myrtle and Marquette Sts.; Myrtle St., between 9th and 10th Sts.; 10th St., between Hilltop Ave. and Myrtle St.; alley between Gaines and Brown Sts. and between 11th and 12th Sts.; alleys between Gaines St. and Western Ave. and between 7th and 8th Sts. Fourth Ward—Alley between Harrison and Ripley Sts. and between 7th and 8th Sts.; alley between Harrison and Ripley Sts. and between Lombard St. and Norwood Ave.; alley between 6th and 7th Sts. and between Scott St. and Western Ave.; Grant St., between Brady and Harrison Sts.; Koester Ave., between Harrison and Scott Sts.; Ripley St., between 9th and 12th Sts.; Pleasant St., between Harrison and Brady Sts.; Main St., between Park Lane and the south line of Garfield St.; alley between Ripley St. and Western Ave. and between 7th and 8th Sts.; Western Ave., between 5th and 6th Sts. Fifth Ward—Rusholme St., between Rock Island and Iowa Sts.; Rusholme St., from the west line of Iowa St. to a point 180 ft. west of Farnam St.; Winthrop Ave., from the south line of Rusholme St. to the north line of High St.; LeClaire St., from the north line of 11th St. to the south line of 13th St. Paving for the west half of the street only is asked; Farnam St., between Colorado and South Sts.; 6th St., between Brady and Iowa Sts. Sixth Ward—East River St., from Iowa St. to Bridge Ave.; Oneida Ave., from East River St. to Fulton Ave.; Esplanade Ave., from the north end of the present paving to Locust St.; College Ave., from Fulton to Valley Sts.; Locust, from the east end of the paving to Esplanade Ave.; alley between 13th and 14th St. and between Arlington Court and Carey Ave.; bridge Ave., between 13th and 14th St.

The City Council of Corning, Ia., has adopted resolutions for the paving of several more blocks. These will extend into the residence district, and include seven blocks on 6th St., two on 8th, and will extend from the business part of town to the court house.

Kansas.

✣Bids will be received, it is reported, until Feb. 19, by Board of County Commissioners, Topeka, Kan., for the furnishing of a road roller and grader.

Petitions have been presented to the City Commissioners of Topeka, Kans., asking for the paving of approximately 20 blocks of streets, in addition to those already sent before the commissioners asking for 40 blocks. The petitions call for paving on the following streets: On Buchanan, from 20th St. to Hampton St.; on Huntoon St., from Fillmore St. to Clay St.; on West St., from Huntoon St. to 15th St.; on Branner St., from 2nd St. to 4th St., on Huntoon St., from Lincoln St. to Mulvane St.; on 14th St., from Van Buren St. to Harrison St.; on 15th St., from Western Ave. to Buchanan St.; on 16th, from Mulvane St. to College Ave.; on Euclid Ave., from Kansas Ave. to Bolles Ave.; on the alley between Topeka Ave. and Tyler St. from 12th St. to Huntoon St., and on the alley, between Harrison St. and Topeka Ave., from 9th St. to 10th Ave.

Louisiana.

The Caddo Parish Police Jury, Shreveport, La., has passed an ordinance calling for an election for Jan. 23 for the purpose of voting on the proposition to levy a 5-mill special tax for five years, for the purpose of building permanent highways throughout the parish.

Maryland.

[illegible] others of upper Harford County, Md., recently appeared before the Board of County Commissioners, Bel Air, relative to making extensive improvements to the public road leading from Highland, via Pylesville, to Cardiff. The road is about four miles long.

State Senator Charles A. Wells of Prince Georges County, Upper Marlboro, Md., will introduce a bill early in the approaching session of the legislature directing a bond issue of $100,000 for the construction of permanent highways in that county. The money will be divided among the four road districts.

Michigan.

✣Bids will be received until 8 p. m., Jan. 15, by City Recorder, Muskegon, Mich., for grading and paving with tarvia, taroid, asphalt, pioneer road asphalt, Bermudez asphalt, bituminous macadam or brick on 6-in. concrete base, 4,956 sq. yds. on Clay Ave., from Pine to Ottawa St.

Park Commissioner Hurlburt of Detroit, Mich., is at work on the annual budget of the department. The Commissioner plans to ask an appropriation of $50,000 for Belle Isle roads, and more than that amount for new work on the boulevard system.

The Village Council of Lowell, Mich., has engaged Edward H. Christ of Grand Rapids, Mich., to establish grades and do all preliminary work up to the letting of a contract for the paving of Main and Bridge Sts., from Hudson St. to the Baptist church.

Provisions have been made by the City Council of Mt. Clemens, Mich., for a considerable amount of paving to be done in the spring on the following streets: North Gratiot, from present terminus to city limits; East St., from Jones to Clemens; North Walnut St., from North Gratiot to Market; Cherry St., from Olympia to Market; Pine St., from Macomb to the south line of Market; Lincoln, from New to North Ave.; Welts St., to city limits; Market St., North Gratiot to North Ave.; Hubbard Ave., from North Ave. to Market.

Mississippi.

An election will be held in Vicksburg, Miss., on Jan. 23 for the purpose of voting on the issuance of bonds in the sum of $100,000 for improving and paving the streets.

Missouri.

⊙E. F. Clarkson, 3921 St. John St., Kansas City, Mo., has been awarded the contract by the Board of Public Works of that city for the grading of Pendleton road at $.34½. Bids were opened Dec. 29.

⊙The G. A. Heman Construction Co., of St. Louis, Mo., has been awarded the contract by the City Council of Maplewood, Mo., to pave Manchester road, from the St. Louis city limits to Sutton Ave., at $21,240. The paving will be brick, with granitoid curbing, and include a 12-in. storm sewer. The Council at the same time awarded the contract for the laying of several thousand ft. of sidewalk in Maplewood to the Graham Granitoid Co., of St. Louis, for $18,183.

A petition has been filed with the Board of Public Works of St. Joseph, Mo., for the paving of 33rd St., from Olive St. to Mitchell Ave., with asphalt-macadam.

A petition has been filed with City Clerk J. H. Langston of Springfield, Mo., from owners of property abutting on Center St., asking the City Council to cause that thoroughfare to be paved with concrete from Clinton Ave. to the National Blvd.

New Mexico.

Arrangements have been made by County Commissioners William Atkinson and Thomas D. White, Roswell, N. Mex., with Engineer J. W. Lewis, to advertise for bids for the construction of the territorial road east from Roswell across the Mescalero sands.

New York.

New York State Engineer J. A. Bensel is reported to have stated that bids will shortly be advertised for the state road contracts from Bath to Campbell, and also for the road from Bath to Hornell. It is expected that work upon both of these roads will be commenced early the coming spring.

Advices from New York City state that the Metropolitan Motor Speedway Association has acquired control of 330 acres of land on the Kearney meadows in New Jersey for use as a motor speedway and aviation and athlete ground. The association has received authority to issue $1,500,000 capital stock, and it proposes to construct a motordrome, two miles long, with seats for 100,000 persons. It is stated that work will begin Feb. 1.

Following bids have been received by the Board of Contract of Syracuse, N. Y., for paving work: Paving Elk St., uniform pavement, with stone curb, Central City Paving Co., macadam, $9,416; sandstone block, $16,306; Mack block, $11,849; Trinidad asphalt, $11,694. F. J. Baker, sandstone block, $15,973; Olean block, $11,827; Trinidad asphalt, $11,517. Warner-Quinlan Asphalt Co., sandstone block, $16,616; Olean block, $11,850; Trinidad asphalt, $11,587. Paving Elk St. with asphalt in the center and block at the sides, with stone curb: Central City Paving Co., asphalt and sandstone block, $12,840; asphalt and Mack block, $11,721. F. J. Baker, asphalt [illegible] Olean block, $11,570. Warner-Quinlan Asphalt Co., asphalt and sandstone block, $12,436; asphalt and Cowan block, $11,622. Paving Elk St. with uniform macadam and concrete curb, Central City Paving Co., $8,830.

Following bids have been received by the Board of Contract of Syracuse, N. Y., for the grading of Avery Ave., from Essex St. to Milton Ave.: C. T. Hookway, $4,220; Lowery Bros., $3,460; James Swift, $3,920; Blanche Gaffey, $3,336; S. Bonn, $3,259; S. Sposato, $4,114; F. S. Sposato, $3,620.

Ohio.

✤Bids will be received until noon, Jan. 5, by W. M. Dean, Village Clerk, Rocky River, O., for the construction of concrete walks on Wooster road. W. H. Evers Engineering Co., The Arcade, Cleveland, O., are Engineers.

✤Bids will be received until noon, Jan. 30, by H. H. Canfield, Clerk of the Village of Cleveland Heights, at the town hall or at 309 Beckman Bldg., Cleveland, O., for the necessary labor and material for the improvement of Ridgefield road from the north line of Mayfield road to the north end of the street, by establishing a grade, grading, draining and paving the same with brick. F. A. Pease Engineering Co., 931 Williamson Bldg., Cleveland, O., are Engineers.

✤Bids will be received until noon, Jan. 4, by Director of Public Service W. H. McMillin, Clerk, Youngstown, O., for furnishing the necessary labor and materials for paving Ridge Ave., between Market St. and Oak Hill Ave.

✤Bids will be received until noon, Jan. 4, by W. H. McMillin, Clerk, Director of Public Service, Youngstown, O., for furnishing the necessary labor and material for paving Glenaven St., between Hillman and City Lot No. 16601.

⊙Clo. Edgington of McComb, O., has been awarded the contract by the Board of Hancock County Commissioners, Findlay, O., for the construction of 3½ miles of stone pike on the Mt. Blanchard road in Delaware Township. The contract price is $18,195. Bids were opened Dec. 30.

⊙Henkel & Sullivan, Michigan Ave., Cincinnati, O., have been awarded the contract by the Department of Public Service of that city for the improvement of Michigan Ave., from Observatory Ave. to Erie Ave., by grading, laying cement combined curb and gutter, macadamizing the roadway with tar binder and finishing course and constructing the necessary drains and inlets. Bids were opened Dec. 8.

Resolutions have been adopted by the City Council of Youngstown, O., providing for the improvement of the following streets: Erie St., between Woodland Ave. and Fairmount Ave.; Cedar St., between Poland Ave. and East Federal St. bridge; Hawn St., between Jackson St. and Truesdale Ave.; Homer Ave., between Hillman St. and city limits; Ayers St., between Rigby St. and Shehy Ave.; Byron St., between Rigby St. and Shehy Ave., and Charlotte Ave., between Fruit St. and Truesdale Ave.

The County Surveyor has reported to the County Commissioners, Cincinnati, O., that the improvement of River road, from West Baltimore pike to New Haven and Venice road, will cost about $14,883. Plans and specifications for the improvement are to be prepared at once.

The Tuscarawas County Commisisoners, New Philadelphia, O., have decided to pave another mile of the Wooster road in addition to the two miles already contracted for, at an estimated cost of $13,000. The paving will extend from the city limits of Canal Dover to a point between Parral and Loudon. The contract will be let in time to have construction begin in the spring.

The City Council of Columbus, O., has decided to improve Grant Ave., from Town St. to Rich St., by grading, draining, curbing, paving the roadway with asphalt or brick and laying water service pipe. John T. Barr is Clerk of the Council.

The City Council of Toledo, O., has passed ordinances declaring it necessary to improve the following streets: Goodale Ave., from Auburn Ave. to Ayers Ave., by grading and paving; Starr Ave., from Main St. to East Broadway, by re-paving, and Utah St., from First St. to Greenwood Ave., by grading and paving.

The City Council of Akron, O., has passed an ordinance determining to proceed with the improvement of Voris St., from High St. to Kling St., by grading, curbing and paving, constructing sidewalks and laterals to the sewer.

A petition is being circulated by business men of Urbana, O., for the paving of East Court St. It is thought other petitions will be presented shortly for additional paving.

The City Council of Cleveland, O., has passed ordinaces providing for the improvement of the following streets: Kouba Ave., S. W., from West 48th St. to West 56th St., by grading, draining and paving; Lakeview road, N. E., between Superior Ave., N. E., and East 123d St., and E. 123d St., between Lakeview road, N. E., and Castlewood Ave., N. E. by grading, draining, curbing and paving; Nevada Ave., S. E., from East 93d St. to East 98th St., by grading, draining, curbing and paving.

The City Council of Cleveland, O., has passed ordinances providing for the improvement of the following streets: Field Ave., S. W., from West 48th St. to West 56th St., by grading, draining and paving; East 81st St., from Holton Ave., S. E., to Kinsman road, S. E., by grading, draining, curbing and paving, and Grand Ave., S. E., from East

A resolution has been passed by the City Council of Cincinnati, O., declaring it necessary to improve Sweeney St., from Stone St. to Mill St., by grading, paving the street full width with brick, and constructing the necessary drains and inlets.

Oregon.

⊙The City Council of Portland, Ore., has let the contract for the hard-surfacing of Sandy Blvd., from East 28th St. to East 72nd St., to the Oregon Independent Paving Co., for $192,000. The general contract covering the entire street was let in two contracts, one from East 28th to Laurelhurst, for $28,000, and the other from Laurelhurst to East 72nd St., for $164,000.

The Board of County Commissioners of Wasco County, The Dalles, Ore., is contemplating calling a special election for the purpose of voting on the issuance of bonds, probably in the sum of $1,500,000, for the building of good roads.

From Portland, Ore., comes a report that the Secretary of War has sent to Congress with his indorsement the report of Major J. J. Morrow on the survey and estimate for a system of roads and trails in the Crater Lake National Park. Major Morrow's plan contemplates the construction of 62 miles of road and 100 miles of trails at a total cost of $642,000, of which amount $100,000 will be available next year if Congress approves the recommendation. In addition it is proposed to expend $65,000 for a system of tanks and water supply lines for sprinkling. It will cost $20,000 annually to maintain the roads when complete. Briefly, he recommends building a 33-mile road around the rim of the crater overlooking the lake, a 5-mile road to the pinnacles, a 5-mile road down Bear Creek, a 10-mile road to the Fort Klamath entrance and a 7-mile road to the Medford entrance.

Pennsylvania.

⊙The Board of Westmoreland County Commissioners, Greensburg, Pa., has awarded the following contracts for the construction of roads: Parnassus, Puckety Creek road, let to Rinehart Bros., of East Liverpool, O., for $42,018; Salina, Perrysville road, let to Duster Contracting Co., of Tarentum, Pa., for $48,897. The roads are 1.75 and 2 miles long respectively. Bids were opened Dec. 20.

Tennessee.

For several notes regarding paving work in Memphis, Tenn., see under Memphis and vicinity notes in the Irrigation and Drainage section of this issue.

Texas.

The citizens of Midland, Tex., have arranged to build sample stretches of highway in Andrews and Gaines counties for the purpose of encouraging the construction of good roads in that portion of the state.

The Dallas County Commissioners, Dallas, Tex., have instructed the County Engineer to furnish an estimate of the amount of money that will be required to complete the four cardinal and intermediate roads of the county. The figures will be used as an estimate for the expenditure of the $500,000 bond money.

The City Council of Hillsboro, Tex., has adopted an ordinance providing for paving the streets around the square according to the original plan, thus paving 64 ft. on each side of the square and leaving unpaved a space of 18 ft. between the paved street and the county line.

The citizens of Beaumont, Tex., on Dec. 20, voted the issuance of bonds to the amount of $60,000 for paving work, and in the sum of $60,000 for park improvements.

The citizens of Victoria, Tex., on Dec. 21 voted the issuance of bonds to the amount of $200,000 for road improvements in that commissioner's precinct.

The citizens of Orange County, Orange, Tex., on Dec. 19 voted the issuance of bonds to the amount of $200,000 for the construction of good roads.

Surveys are being made of Texas St., in the city of Fort Worth, Tex., preliminary to the paving of that thoroughfare.

The Commercial Club of Terrell, Tex., is considering the question of paving Moore Ave. The proposition will probably be submitted to the taxpayers of the city with a view to securing a bond issue.

The City Council of Denison, Tex., has instructed City Attorney James S. Kone to prepare two ordinances, creating two improvement districts, which will be paved in the immediate future. One district will include that portion of Main St., from the present end of the paving east to Travis Ave., and the other will include the 100 block of North Houston Ave., and 100 block of East Woodard St. This includes the approach to the new Union passenger station and several wholesale houses.

Virginia.

The Finance Committee of the City Council of Portsmouth, Va., has recommended to that body a bond issue of about $150,000 for paving more of the streets of the city during the coming spring and summer.

✤ indicates work now open for bids. ⊙ indicates a contract let recently.

The Spottsylvania [illegible] Commissioners, Spottsylvania, Va., has obtained an order [illegible] building and perma[illegible] of the Rappaha[illegible] from Frederi[illegible]

Washington.

City Engineer [illegible] Wash., has made [illegible] of a trunk road over a portion of North Aberdeen.

Wisconsin.

✣Bids will b[illegible] gust Baltzer, City Engineer, Kenosha, Wis. for paving various [illegible] of vitirified brick, concrete foundation, sandstone curb and asphalt filler, estimated to cost $17,000.

The Common Council of Delavan, Wis., has voted to pave Walworth Ave., from Terrace St. to 8th St.; Racine St., from its intersection with Walworth Ave., to Fremont St., and 7th St., to the new C. M. & St. P. passenger station. City Engineer P. J. Hurtgen of Burlington, Wis., has been employed by the city to prepare plans and specifications for the work.

According to the Wisconsin State Highway [illegible] 250 miles of dirt road, a total of 645 miles [illegible] special committee of members of the County Board recently appointed to take up the ques[illegible] schools and churches in the county. It is ex[illegible]pended in road work this year.

The City Council of Manitowoc, Wis., has added another set of specifications for paving to the three already adopted. The new kind of pavement is sheet asphalt, being a 5-in. concrete base and 2 ins. of sheet asphalt. Pavement will be laid in the First, Third and Fourth Wards of the city next season.

The Board of Public Works of Oshkosh, Wis., has been directed by the City Council [illegible] Waugoo St., from Broad to State St.; 13th St., from Oregon St. to the crossing of the Wisconsin Central railroad; Light St., from Church to High St.; Jackson St., from Irving St., to New York Ave., and Oregon St., from 17th to 19th St., Waugoo St. will be paved with either asphalt, creosote blocks or tar macadam. Creosote blocks, cedar blocks or asphalt will be used on 13th St. It is planned to use either asphalt, creosote blocks or sarcolithic on that portion of Light St. which [illegible] Jackson St. to be improved will be paved with asphalt creosote blocks or sarcolithic. Bloom's cement, cement or sarcolithic will be used on [illegible]

Canada.

[illegible] Ltd., of Winnipeg, Man., and Edmonton, Alta., has been awarded a contract in Edmonton for the construction of 75,000 sq. yds. of bitulithic paving during the year 1912, and the National Paving & Contracting Co., Ltd., of Winnipeg, Man., secured a contract for the laying of 25,000 sq. yds. of sheet asphalt pavements during the year. A. J. Latornell is City Engineer. 79th St., to 92 ft. east of East 82nd place, by

BRIDGES—STEEL AND CONCRETE

California.

✣Bids will be received until 2 p. m., Jan. 28, by Los Angeles County Commissioners, Los Angeles, Cal., for the construction of a concrete bridge over the Sawpit Wash on the Wild Rose Ave., in Duarye Road District.

⦿The Pacific Construction Co., which was awarded the contract for the construction of the bridge over the Stanislaus River for the San Joaquin Valley Electric Railroad, has commenced preliminary work. The bridge will be located just east of the wagon bridge near Ripon, Cal.

Among the improvements planned in the vicinity of Lodi, Cal., is the construction of a new steel bridge over the Mokelumne River three miles east of Lodi, which will cost about $35,000.

City Council of Los Angeles, Cal., has adopted an ordinance providing that the city shall pay $42,200, or one-fourth the total cost of constructing the Arroyo Seco 6-arch concrete bridge now being built at the end of Pasadena Ave. jointly by the city, South Pasadena, the Salt Lake R. R. and the county.

Colorado.

✣Bids will be received until 10:30 a. m., Jan. 5, by Board of Las Animas County Commissioners, Trinidad, Colo., for the construction of a 50-ft. span bridge over Canyon Delagua on main Aguilar Road 12 to 14 miles north of Trinidad. Bidders will furnish plans and specifications on concrete and steel spans. G. F. Harlan is Chairman of the Board.

Delaware.

The Gaynor Contracting Co. has been chartered under the laws of Delaware to engage in the erection of bridges and railroads and structural work. The incorporators are Katherine M. Gaynor, Thomas P. Gaynor and William L. Gaynor, Scranton, Pa. The company is capitalized at $50,000.

It has been announced by the Levy Court Commissioner, S. J. Dennison, Chairman of the Committee on Wilmington, Del., bridges, that the Court has adopted the bascule type bridge over the Christiana river. The western approach of the new bridge will be across part of the Pennsylvania Railroad Company's land now used for park purposes fronting on the Christiana river. James Wilson is County Engineer.

Georgia.

Several schemes are under consideration by the City Council of Atlanta, Ga., for narrowing or closing the underpass in the Forsyth St. bridge. One scheme considered the best by the committee is to close the underpasses entirely, provided the city can secure from the Central R. R. permission to make public the present private roadway over the tracks at the foot of Alabama St. and extend same to give access to the Western & Atlantic yards.

Idaho.

Plans for the construction of a bridge across Snake River at Bliss, Idaho, have been completed by C. S. Smith, Gooding, Engineer. The cost of the work is estimated at $11,000.

Illinois.

Advices from Lewistown, Ill., state that a bridge will probably be constructed at Waterford in Isabel township, Fulton County.

Residents in the vicinity of Ohio St. are circulating a petition requesting the City Council, Joliet, Ill., to take steps toward the construction ,of a new bridge over Spring Creek at Ohio St. to replace the old structure removed at the time of the creek improvement.

Indiana.

It is reported that the Baltimore & Ohio Southwestern R. R. is planning the construction of a new bridge over the Wabash River to replace the present structure at Vincennes, Ind. New bridges will also be built at Lawrenceville and Breeze, Ill., it is said. Nothing definite will be done before the spring, it is believed.

Plans for the construction of the new bridge over the Whitewater River at South L St., Richmond, Ind., have been filed with the County Commissioners. The proposed structure will be of concrete, and its length, exclusive of earth approaches, will be 604 feet. Its width will be sixty feet, and its highest point above the water line will be more than ninety feet. The estimated cost is $125,000. The county council will be asked to appropriate this sum at its first meeting in January, but it is possible that the matter will be deferred until spring.

Iowa.

✣Bids will be received until noon, Jan. 23, by Board of Emmet County Supervisors, Estherville, Ia., for the erection of several reinforced concrete bridges according to list and specifications on file in the Auditor's office at Estherville, Iowa. Bridges include one 8-ft., three 10-ft., three 12-ft., one 16-ft., one 18-ft., and two 20-ft. spans. Charles A. Root is County Auditor and W. H. Gibbs is Chairman of the Board.

⦿The Lana Construction Co., Harlan, Ia., has been awarded the contracts for constructing both steel and wooden bridges in Pottawattamie County, Ia., for the year of 1912. It is thought that the cost of the work will amount to about $40,000 or $50,000. Other companies bidding on the work were: Omaha Structural Steel Works, Omaha, Neb.; Beach Manufacturing Co., Charlotte, Mich.; Monarch Engineering Co., Falls City; Minneapolis Steel and Machinery Co. and the S. E. Wood company.

Kansas.

⦿The Wichita Construction Co., Wichita, Kan., has been awarded the contract for the construction of a bridge over the Ninnescah River south of Cheney. This bridge will be 231½ ft. long, with a 16-ft. roadway. It will be of steel, supported by concrete filled steel tubes, 48 in. in diameter, and will have a concrete floor. The contract price was $6,200.

Preliminary plans are under way for the reconstruction of the brick yards bridge west of the water works plant, Topeka, Kan. Actual construction work will be started on the bridge next spring as soon as the weather permits.

Engineering Department of the Metropolitan Street Railway Co. has taken charge of the reconstruction work on the Seventh St. viaduct in Kansas City, Kan., and it is announced that work will be started immediately. The cost of the work is estimated at about $10,000. E. Butts, Kansas City, Mo., is Chief Engineer and Roadmaster of the railway company.

The City of Topeka, Kan., is considering calling a special election shortly to submit to the taxpayers a proposition to issue $160,000 for the construction of about 20 reinforced concrete bridges within the city limits to replace the present steel and iron structures. W. G. Tandy is Commissioner of Streets and Public Improvements.

Commissioners of Sedgwick County, Wichita, Kan., have been petitioned for the construction of a new bridge over the Arkansas on the line between sections 15 and 22 in

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Riverside township. The work will be considered provided it does not cost too much to open a road to it on either side of the river. A viewer has been appointed to investigate conditions.

Louisiana.

✣Bids will be received until noon, Jan. 11, by Police, Jury, New Iberia, La., for the construction of a steel bridge over Bayou Teche, Oliver.

Maryland.

The Baltimore Bridge Co., Baltimore, Md., submitted the lowest bid for the tearing down and rebuilding of the Monroe St. bridge over the Baltimore & Ohio R. R. at $2,750 and $15,000 respectively. Other bidders were Fitzpatrick & Koontz, at $17,989 in 28 days; Lauer & Harper Company, at $20,810 in 45 days; Pennsylvania Bridge Company, $18,840, in 40 days; Pennsylvania Steel Company, $19,484, in 40 days, and the McIntosh-Marshall Construction Company, at $17,575.

Minnesota.

A bill has been introduced by Congressman Halvor Steenerson, authorizing the Board of Beltrami County Commissioners, Bemidji, Minn., to build a bridge across the Mississippi River immediately east of the outlet of Cass Lake.

Missouri.

An election was held at Jefferson, Mo., Dec. 28, to submit to the voters the proposition of issuing bonds amounting to $70,000 for the construction of a viaduct, the establishment of a paid fire department, and for the construction of sewers.

It is reported that a viaduct will be constructed on Broadway, Joplin, Mo., within a short time, and that improvements on that street will be postponed until the structure is completed.

W. L. Hannaca, Mayor of Glasgow, Mo., is agitating the construction of a new bridge over the Missouri River at that place on the state highway, which now crosses the river by means of a ferry.

According to information recently received from Kansas City, Mo., considerable progress is being made in parts of the big terminal project. By February 1 contracts involving $1,000,000 will be let. These will provide for a number of viaducts, subways and retaining walls. The plans for viaducts at Grand, Woodland and Park Aves. are nearly complete. Plans also are being worked out for temporary viaducts on Troost, Prospect and Brooklyn Aves., over which street car traffic will be diverted while the permanent structures are being built. The terminal company bears the expense of this work. Cars will be routed over the McGee St. viaduct while the new structure on Grand Ave. is being built. The temporary viaducts will be erected early in the spring. J. J. O'Brien & Co., Chicago, the firm which has the Campbell St. viaduct contract, will start work next week.

Montana.

The Board of County Commissioners, according to advices from Corvallis, Mont., have ordered the construction of a temporary crossing to be built over the Bitter Root River at Woodside.

In answer to the petition the Custer County Commissioners have called a special election on Feb. 20 to vote on the issuance of bonds amounting to $60,000 for the construction of a bridge over the Yellowstone River at Miles City, Mont. A re-election will be held at the same time on the question of the Power River bridge near the mouth.

Nebraska.

✣Bids will be received until 2 p. m., Jan. 8, by S. B. Hohman, chairman of the Sanitary District No. 1, Lancaster County, 303 Brownell Block, Lincoln, Nebr., for the construction of four bridges in the district located on the new channel of Oak Creek, one where the same crosses West Lincoln Boulevard, and one on North First St., one on North Ninth St. and one on North Fourteenth St., the same to be constructed according to plans and specifications now on file in the office of the board and also in the office of the County Clerk of said county.

City Council of Omaha, Nebr., has passed a resolution granting the Chicago, Burlington & Quincy and the Missouri Pacific railroads permission to repair the 11th St. viaduct.

The following low bids were received by the State Engineer and Bonnen County Commissioners, Albion, Nebr., for the construction of the State aid bridge over the Cedar River three-quarters of a mile northwest of Cedar Rapids; for a steel structure consisting of two 112-ft. spans, Canton Bridge Co., Omaha, Nebr., $7,905; for concrete structure, Lincoln Construction Co., Lincoln, Nebr. (State plan), $9,700 (own plan), $7,980. All bids for the work were rejected. D. D. Price, Lincoln, Neb., is State Engineer.

New Jersey.

✣Bids will be received until noon, Jan. 15, for the construction of a .5-trestle bridge aggregating 6,415 lin. ft. and for 3,490 lin. ft of sand fill between sod walls, between Mannahawkin, N. J., and Long Beach. Plans and specifications for this work may be obtained of W. H. Ford, Arcade Bldg., Philadelphia, Pa., Engineer.

Directors of the recently-formed Long Beach Turnpike Co., Mannahawkin, N. J., have announced that the plans for the new toll bridge across the bay from Mannahawkin to Long Beach are about ready, and that bids will be advertised for early in the year. The bridge when completed will open the resorts of Beach Haven, Harvey Cedars and Surf City, with a string of smaller summer villages, to automobile traffic.

Ohio.

✣Bids will be received until 1:30 p. m., Jan. 15, by Board of Erie County Commissioners, Sandusky, O., for the construction of a system of pile bents for the reinforcing of the east and west approaches of the Huron River bridge at Huron, O. John Derst is County Auditor.

⊙The Department of Public Service of Cincinnati, O., has awarded the contract for the construction of the Ludlow Ave. viaduct, under Sections A, B, C and D, to C. H. Glandorf, Thos. P. Strack and the Kirchner Construction Co., all of Cincinnati. The work includes concrete piling, substructure, superstructure and approach work, and reinforced concrete structure. The contract price is $259,585. Bids were opened Nov. 24.

Advices from Elyria, O., state that the County Commissioners and counsel of the Lake Shore Electric Co. recently met to discuss the terms of the proposed Erie St. viaduct franchise.

Col. J. Mills, U. S. Engineer, Cleveland, O., has approved the plans for the construction of the river span of the new high level bridge at that city and will recommend the official approval of the War Department. The approval, it is said, removes the last obstacle in the way of starting work on the structure. W. E. Eirick, Cleveland, is County Commissioner.

A resolution has been adopted by the City Council of Cincinnati, O., declaring necessary the construction of a reinforced concrete bridge over West Fork Creek on Beekman St. E. O. Bathgate is chairman of the Council.

After an investigation of the city bridges, Director of Public Service, Canton, O., has urged that the Council take up the question of locating a new bridge in East North St. over the East Creek and make provisions for the fill necessary for such a structure.

At a recent meeting of the East Federal Street Improvement Association, Youngstown, O., two resolutions were passed, one for the elimination of the Himrod Ave. crossing and the other for the construction of the bridge. The proposed plan is for a new bridge over the Erie and Lake Shore tracks to intersect at Wilson and Himrod Aves. at a point where the hotel stands, and to take the old structure and add to the approach across the river, giving a better, broader and more improved outlet.

Board of Stark County Commissioners, Canton, O., has unanimously adopted a resolution requesting the County Engineer to prepare plans for the construction of a concrete arch, a brick and stone arch and a steel bridge to be constructed at Navarre St. crossing of the west branch of Nimishillen Creek. It is proposed by the commissioners to have work on the new structure commenced early this year.

Oklahoma.

All bids received by the Board of Garfield County Commissioners, Enid, Okla., for the construction of bridges along the Chisholm trail have been rejected and the clerk will readvertise the work. The contracts to be let are for about fifty bridges and culverts, all being on the Chisholm trail through this county. The county is to furnish the cement for the work, delivered at Kremlin for the bridges from the north line of the county to the vicinity of Kremlin; at Enid for the bridges in this locality, and at Waukomis and Bison for the bridges in the south part of the county.

Oregon.

⊙The Coast Bridge Co., Portland, Ore., has been awarded the contract for the construction of three solid riveted steel bridges over the Kootenai River, one at Libby, one at Troy and the other at Rexford, in Lincoln County, Mont. Steps have been taken to gain the required permission from the Government and it is quite probable that work on the structures will be commenced in the near future. Paul D. Pratt, Libby, Mont., is chairman of the Board of County Commissioners. J. M. Duthie is County Surveyor.

According to recent information from Portland, Ore., plans for the new and reinforced concrete bridge across Sullivan's Gulch at East Twenty-first St. have been completed by the City Engineer. The structure, including the approaches, will cost approximately $77,000. The viaduct will be 318 ft. long between the abutments and 740 ft. long, including the approaches. It will be 60 ft. wide and will have a roadway 44 ft. in width. Street railway tracks will be laid on the bridge, as it is proposed that a railway line will cross it.

Pennsylvania.

✣Bids will be received until noon, Jan. 9, by Clerk of the Council, Borough of Bristol, Bucks County, Pa., for furnishing all materials and erecting complete, as per plans and specifications, a reinforced concrete bridge across the Delaware Division of the Pennsylvania Canal on Beaver Dam Road between Canal St. and Buckleys St., Bristol, Bucks County, Pa., including necessary wing walls, curbing and paving. Plans and specifications may be seen and forms of proposal procured by applying to the office of the Borough Surveyor, 205 Radcliffe St., Borough of Bristol, Bucks County, Pa. A certified check for $250, payable to the order of the Borough Clerk of Bristol, Pa., must accompany each bid. W. H. Boardman, 426 Walnut St., Philadelphia, Pa., is Engineer.

⊙The Rogers Co. has been awarded the contract for the repairs necessary to the Mead Ave. bridge in Meadville, Pa., at $3,000. The expense will be borne by the county and the Northwestern Pennsylvania Railways Co., each paying half the cost.

The railway officials have, according to advices from Pottsville, Pa., consented to the construction of another large bridge over Mill Creek opposite the new St. Clair yards, near the air inspectors' department. The structure will reach across the creek to the trolley road.

The County Court, Reading, Pa., has recommended the construction of the new concrete bridge to replace the present wooden one over the Monocacy creek in Amity Town-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ship. The improvemen[illegible] steel [illegible] the County Commissioner[illegible]

Tennessee.

At a conference of engineers recently held at Chattanooga, Tenn., to discuss plans prepared by Wilbur J. Wat[illegible] construction of the proposed McCallie Ave. viaduct, two sets were adopted, one calling for a steel structure with concrete floors and railings and the other for a reinforced concrete arch bridge estimated to cost $50,000 and $130,000 respectively. The plans will be submitted to the executive committee of the Cincinnati, New Orleans & Texas Pacific and the Nashville, Chattanooga & St. Louis railroads. Present at the conference of the viaduct engineers were: City Engineer Robert Hooke, chairman; Hunter McDonald, chief engineer of the Nashville, Chattanooga & St. Louis; J. L. Albers, engineer of bridges of the Nashville, Chattanooga & St. Louis; G. H. Gilbert, engineer of bridges of the Cincinnati, New Orleans & Texas Pacific; E. D. Reed, chief engineer of the Chattanooga Railway & Light Company, and W. Watson, the designing engineer for the viaduct. The meeting was held in the office of R. Hooke at the city hall.

Texas.

⊙The Gulf Concrete Construction Co., Carter Bldg., Houston, Texas, has been awarded the contract for the construction of the two bridges on Houston Ave., one over the White Oak Bayou and the other over a branch of the same stream, at $17,200 and $6,785 respectively. By terms of the contract the first structure will be completed within 105 days and the second within 15 days. List of bids received for the work was published in our last issue.

Commissioner of Streets J. E. Lee, Dallas, Texas, and W. E. Maxson, General Superintendent of the Atchison, Topeka & Santa Fe R. R., recently held a conference on the matter of building a viaduct across the railroad tracks on Merlin St. and with regard to a proposed viaduct on Chestnut St. An ordinance providing for these passageways has passed its second reading.

Washington.

✣Bids will be received until 2 p. m., Jan. 16, by Board of King County Commissioners, Seattle, Wash., for furnishing all labor and material (Jap or Chinese labor not allowed) necessary for the construction of the Patten bridge. The structure will consist of a steel span 204 ft. long. Plans and specifications are now on file with the County Engineer; O. A. Case is Clerk of the Board.

✣Bids will be received until 2 p. m., Jan. 16, by Otto A. Case, Clerk of the Board of King County Commissioners, Seattle, Wash., [illegible] bridge.

✣[illegible] and specifications are on file with Bowerman & McCoy, Consulting Engineers, Central Bldg., Seattle, Wash. The work to be contracted for now includes about 100,000 ft. of lumber, 2,300 cu. yds. concrete and 18,000 ft. of piling [illegible] the superstructure. The bridge will be made [illegible]

✣Bids will be received shortly for the construction of a $60,000 bridge over the north fork of the Lewis River, near Woodland, Wash. Plans and specifications are on file with Bowerman & McCoy, Consulting Engineers, Central Bldg., Seattle, Wash. The structure will be 1,000 ft. long, high fixed span on concrete piers.

✣Bids are being received, it is reported, by County Commissioners, Seattle, Wash., for the construction of a 300-ft. steel bridge at Franklin, King County, Wash. The cost of the work is estimated at about $15,000.

Stone & Webster Engineering Corporation, White Bldg., Seattle, Wash., will, according to an announcement, start construction work at once on a $150,000 steel bridge over the Skagit River, near Bellingham, to be used by the interurban.

The United States Senate has passed a bill authorizing the Oregon-Washington Railway & Navigation Co. to build a bridge across the Snake River from Walla Walla to Franklin County, Wash.

Under the present plans of the Seattle-Tacoma Electric Short Line Ry., the tracks will cross the tidelands and enter Tacoma at 21st St., crossing the Puyallup River at Lincoln Ave. A viaduct of half a mile from St. Paul Ave. to connect with the new 11th St. bridge will be necessary because of the height of the bridge.

Engineers are preparing a report on the construction of the proposed bridge over the Skagit River on the proposed route of the State Road No. 6, which, it is said, will form a part of the proposed Pacific Highway. Mt. Vernon is the county seat of Skagit County, Wash.

City Engineer A. H. Dimock, Seattle, Wash., has completed plans for the reinforced concrete viaduct on Fremont Ave., between the Lake Washington Canal and Ewing St. The structure will be 36 ft. high, 400 ft. long and 80 ft. wide, and will cost $50,000. Bids for the construction of same will probably be called for in the near future. Specifications call for structural and reinforcing steel, galvanized iron, lumber, etc. Temporary wooden railings and approaches are provided for. Specifications also include brick paving and railroad ties

Wisconsin.

Citizens of Caledonia, Wis., will soon decide on one of two steps as a final settlement of the McGilvray bridge question. First, whether to take a vote of the people on keeping up the repair of the Trempeleau County approach to the bridge and one-half of the bridge, and a second proposition is to have the people of Caledonia build the Trempeleau County approach and donate a sum toward the repair of the McGilvray road on the La Crosse side.

A committee of citizens of Beloit, Wis., have decided to confer with the officials of the Chicago & Northwestern and the Rockford & Interurban railroads in regard to the construction of a foot bridge over the Rock River to the C. & N. tracks on the west side.

City Council of Milwaukee, Wis., has referred the request of Alderman Anthony Szczerbinski for a new bridge over the Kinnickinnic River at Ninth St. to the Board of Estimates.

Wyoming.

A bill has been introduced in the Senate appropriating $10,000 for the construction by the Reclamation Service of a bridge over Snake River in the Jackson Hole region of Wyoming.

Canada.

Engineers of the Grand Trunk Ry., according to reports, have prepared tentative plans for rebuilding the international bridge connecting Buffalo with Victoria, Ont., and providing an additional track in addition possibly to a highway for pedestrians and teams that the present structure does not have and for which there has been an insistent demand for many years. The structure is owned by a separate corporation, but it is a Grand Trunk subsidiary. If these plans are carried out it is estimated the cost of the improvement will be about $1,000,000.

It is stated in Montreal, Que., that the Canadian Pacific Ry. will soon start the erection of a new big steel bridge over the north fork of the Kettle River on the boundary line of the C. P. R. The structure will be 350 ft. long and will be supported on three concrete piers.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

⊙R. H. & G. A. McWilliams, 28 E. Jackson Blvd., Chicago, Ill., have been awarded a contract for ditch work for Bayou Deview Drainage District No. 5 of Poinsett County, Ark., the contract including about 1,600,000 cu. yds. of excavation.

California.

✣Bids will be received until 2 p. m., Jan. 8, by Directors of the Turlock Irrigation District, Turlock, Cal., for the construction of the canal and works of the district. A. Sorensen, Turlock, Cal., is Secretary.

Colorado.

✣Bids will be received until 4 p. m., Jan. 23 (postponement of date from Jan. 10), by U. S. Reclamation Service, Montrose, Colo., for the construction of 12 miles of the West Canal, Uncompahgre Valley project, in the vicinity of Montrose, Colo. The work will include the excavation of about 210,000 cu. yds. of material in open cut and 1,750 lin. ft. of tunnel. Further information may be had of the U. S. Reclamation Service, Montrose, Colo., 519 Commonwealth Bldg., Denver, Colo., or Washington, D. C. F. H. Newell is Director. Official advertisement will be found elsewhere in this issue.

Illinois.

✣Bids will be received until Jan. 20 (readvertisement) by Commissioners of the Silver Creek Levee and Drainage District, Edwardsville, Ill., for the excavation of approximately 13,000 cu. yds. of dirt and clearing 10 acres of timber land for a new creek channel.

✣Bids will be received until 2 p. m., Jan 6, by Commissioners of the Hanover Drainage and Levee District, Clinton County, Ill., at the office of H. V. Murray, Attorney, Carlyle, Ill., for cleaning out and deepening and widening Main Ditch and Lateral No. 1 in the district. Main Ditch, Station 0 to Station 212, base width 12 ft., side slopes 1 to 1; Main Ditch, Station 212 to Station 232, base width 10 ft., side slopes 1 to 1; Lateral No. 1, Station 0 to Station 25, base width 10 ft., side slopes 1 to 1; Station 25 to Station 45, base width 8 ft., side slopes 1 to 1; all stations being 100 ft. in length. The work contemplated will require the excavation of about 78,000 cu. yds. of earth, as follows: Main Ditch, Stations 0-232, 70,000 cu. yds.; Lateral No. 1, Stations 0-45, 8,000 cu. yds.

⊙The Illinois Dredging & Constructing Co. of East St. Louis, Ill., has sublet to the Kinser Construction Co., 80 East Jackson Blvd., Chicago, the filling, dredging and mattress work for the construction of the levee in front of East St. Louis for the East Side Levee and Sanitary District. The subcontract is said to amount to $880,000.

Hearing will be held on Jan. 8 at the County Court, Jerseyville, Ill., on the commissioners' report, estimates, etc., for the organization of Sub-District No. 1 or the Nutwood Drainage and Levee District. Under the sub-district it is planned to improve Macoupin Creek by a 6-ft. ditch.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Indiana.

✣Bids will be received until Jan. [illegible] by Construction Commissioner Marvin E. Schrock, at the office of the County Surveyor, Knox, Ind., for the construction of the S. M. Quick ditch. Plans and [illegible] with the County Auditor.

Iowa.

⦿Charles R. Lewis, Champaign, Ill., has been awarded the contract for work for Drainage District No. [illegible] C. A. Hall, County Auditor, Bedford, Ia.

Minnesota.

✣[illegible] 18, by J. L. George, Beltrami County Auditor, Bemidji, Minn., for the construction of Judicial Ditch No. 6. The work will include an 11-mile ditch involving about 74,000 cu. yds [illegible] is estimated at about $16,400.

✣Bids will be received until 10 a. m., Jan. 18, by J. L. George, Beltrami, County Auditor, Bemidji, Minn., for the construction of Judicial Ditch No. 8, including the excavation of a 14-½mile canal involving the excavation of approximately 102,797 cu. yds. The average cut is 4.5 ft. The cost of the improvement is estimated at about $19,000.

Bids will be taken shortly for the construction of Big Stone County Ditch No. 9. This work will require about 178,342 cu. yds. of excavation, part of which can be done with a floating dredge. M. J. McDonnell, Graceville, Minn., is engineer.

Nebraska.

⦿Bids were opened Dec. 27 by Frank E. Blake, County Clerk, Auburn, Neb., for constructing a drainage ditch involving 5,000 and 6,000 cu. yds. of excavation, the contracts being awarded to H. Y. Moore, Brownville, Neb., and F. W. Wheeldon, Brownville, Neb.

Ohio.

A report has been presented to the Tuscarawas Improvement Co. of Massillon, O., on a plan for diverting the course of the Tuscarawas River, which would reclaim about one square mile of land in Massillon. The plans call for the diversion of the channel of the river under the Pennsylvania railroad tracks north of Cherry street, elimination of the big curve to the east from that point and excavation of a straight channel south along the west side of the Pennsylvania tracks to the present Main St. river bridge. The Osborne Engineering Co., Cleveland, O., made the [illegible] reports.

Oklahoma.

Farmers in the Panhandle counties are considering a plan to store water from the deep wells put down by the state. Water has been stored in all the wells at a depth of 150 to 400 ft., and while no artesian flows were obtained, plenty of water can be obtained by use of pumps. It is the idea to store the water in reservoirs and supply to the adjacent pieces of land for irrigation. T. M. Latham, Carthage, Okla., is interested.

Memphis and Vicinity.

[illegible]

⦿Beverley Turner has taken contract for hauling gravel from the Frisco Railroad on Kansas avenue to Colorado street and by this arrangement will be able to keep his teams busy all winter. Bev has a bunch of pretty mules and takes good care of them, too. He is one of those street contractors who by hard work and careful planning have made a great deal of money in Memphis during the past two years.

⦿J. W. Williams has taken contract for grading approximately 10,000 cu. yds. around the new Union Station in Memphis. By the terms of the contract the work must be started at once and finished before March 1st, and in order that Williams may do this, he has placed his entire outfit on the work, which, by the way, presents many difficult features and requires a fine knowledge of grading to successfully handle.

⦿Roach & Manigan were awarded a contract on December 28th, by the Louisville & Nashville R. R. for paving with vitrified brick various intersections around the Seventh street crossing. The work involves about 11,000 sq. yards of brick and concrete pavement, the foundation being 6 ins. in depth. As soon as the bad weather let up, Roach & Manigan will place a large force on the new contract and push same through as rapidly as possible.

•Mike Manigan [illegible] the curbing and gutters on Union avenue between the Parkway and Cooper street and started on the job with a large crew last week. Mike states that weather permitting, he should be able to finish the job before spring.

⦿The Roach-Manigan Paving Co. were awarded [illegible] Memphis Union Station Co. for approximately 10,000 sq. yards of wood-block pavement. The pavement is for carriage drives and small streets surrounding the handsome new depot in this city, and the work will be built according to City of Memphis specifications and subject to the approval of City Engineer Weatherford. The pavement will be laid on a 6-in. concrete foundation. W. F. Schultz, Engineer of the Union Station Company, will be in charge of the work, which will be started at once.

When J. T. Harahan, former President of the Illinois Central R. R. and now at the head of the Arkansas & Memphis Railway Bridge & Terminal Co., announced that his concern, backed by the Rock Island Railroad, was to spend $14,000,000 for a new bridge and freight terminals for the C., R. I. & P. at Memphis, it was like the explosion of a bomb from an unlooked for source. This announcement was made on Dec 28 and so firmly do the people of Memphis believe that all the things which Mr. Harahan promises will come true, that not a foot of property can be bought in the vicinity of the improvements proposed for double what it could have been secured for the day before the announcement. The fact that H. U. Mudge, President of the Rock Island, backs up Mr. Harahan in his statement, together with the certainty that Mr. Harahan is by no means a dreamer, but is one used to doing things all his life and a man that would not couple his name with anything that was not bona fide, has placed the rumor as one of those certainties that come upon a community so suddenly that the realization of the big project outlined is hard to grasp. In selecting Mr. Harahan to head their movement, the Rock Island officials have done a wise thing and to complete their clever coup, they have formed a stock company to carry on their immense undertaking, and in this company they have secured some the leading citizens of Memphis, to the end that the project may have all things made easy for it in a local way. For instance, the board of directors of the Arkansas & Memphis Railway Bridge & Terminal Co. include such men as J. A. Riechman, formerly Vice-Mayor and the real head of the City of Memphis government—a man picked by all who are wise to the powers that be as the next Mayor of Memphis. Eldridge Wright, son of the former Secretary of War, and a man whose influence in Congress is known far and wide, is another director. Lee Mallory, owner of the majority of the land where the new terminals will be laid out, is another man of influence on the board, and so on down the line have the Rock Island officials shown their sagacity in the selection of those men who will be big influences in helping the work. As to the work itself, no time is to be lost in the start. Hon. K. D. McKeller, the Congressman from Memphis, has his bill already prepared for presentation to the House, whereby permission will be secured to commence work on the big bridge which will be the second bound between Tennessee and Arkansas at Memphis. According to H. U. Mudge of the Rock Island, the new bridge will be for a double track road, will contain room for wagons and trolley cars, and will be in every way bigger and better than the structure now existing. It will be built north of the old bridge, some place near the present freight depot of the Rock Island. About $12,000,000 will be expended on the bridge alone, according to those on the inside of the new company. Then the remaining $2,000,000 will go towards the new freight terminals which will perhaps be located in the southern part of the city, near the South Memphis Land Co. tract. Some members of the new company, speaking confidentially, go even further in their remarks than did the shrewd Harahan, who says as little as possible about anything. One director in particular said that he would not be surprised if the Illinois Central had joined in the big undertaking with the Rock Island and that a new belt line encircling the city would not be a distant possibility. It has been known that the Iron Mountain road, with its excellent belt line facilities, was getting a great number of new industries to settle on its line around the municipality, which fact has not been to the liking of the mighty Illinois Central which really thinks Memphis is solely its property and resents any other road getting too much business in this town. Operating a huge new bridge in connection with the Rock Island, which would furnish a Western outlet for its freight and possessing a belt around the city in connection with same, would be a very desirable proposition indeed. Then larger terminal facilites would come in handy for both roads and would be a very good thing for all concerned. It is needless to state that the above announcement of the large amount of work contemplated has brought good cheer into the hearts of the contractors contingent to Memphis. To build the freight terminals outlined, an immense amount of grading will be necessary, mostly steam shovel work, to be sure, and those firms which have had idle shovels and equipment all winter, are pricking their ears for word of the perfecting of plans and the sending out of the first bunch of invitations to bid. And President Harahan says this latter fact will not be a far distant possibility for work must start soon and must be pushed to a rapid completion in order that all may be in readiness for the Panama trade which is surely to swamp the roads of the Mississippi Valley. No Chief Engineer has as yet been selected by the new company, but it is known that several men of high standing have applied for positions, but on this point Mr. Harahan has given out no information.

Jessie Nichols has sublet all but a few yards of his subdivision work in this city and these few yards he is holding for himself in case the river comes up next spring and prevents him from carrying on his large Mound City contract. Jessie is also wearing a broad happy smile, for he states that he has sublet his Memphis work at exceptionally good prices.

Jack Rison, who for many years was Assistant to the General Superintendent of the Y. & M. V. R. R., was in Memphis last week for a few days with friends. Jack is now in charge of the Southern line of the Valley road and has the reputation of having the best kept road bed on the system. Jack was always a hustler and a great favorite with all classes.

The camps of the various levee contractors on the Mississippi River have been thrown into consternation by the news that the river would reach flood stage before Jan. 1st. The excessive rains throughout the central and valley states have caused the streams flowing into the Mississippi to hurl an unprecedented volume of water, for this season, into the main river and as a result, for the first time in the history of the Weather Bureau, the Mississippi will overflow its banks before the regular flood date, which is in March. To one not acquainted with the conditions which attend the building of levees along the river banks, it is rather hard to grasp just what a [illegible] coming [illegible] Levee building, like [illegible] works, has its season [illegible] which the best work can be accomplished. As a rule and with [illegible] bid scientifically, these periods [illegible] sons are taken into consideration in bidding on work. The autumn seasons [illegible] winter and January [illegible] riods for levee men. But this year all tra- [illegible] nal river which [illegible] contractors along its banks, and before these notes are read the river at Memphis will have reached thirty feet or over and continue rising until the flood stage of thirty-three feet is registered on the gauge. On Dec. 11, the Weather Bureau at M[illegible] letin which was in itself very innocent looking and one to which very few contractors paid much attention. But those who looked deeper than the surface of the report, saw that rain was falling all over the country and that Uncle Sam's man said that the river would begin to rise and [illegible] indefinite period. The stage at Memphis was then but thirteen feet. B[illegible] twenty-seven and four-tenths feet was registered on the Memphis gauge and over a third of the outfits doing [illegible] banks were idle as a result of the high water. Thus a season that bid fair to be one of the most brilliant working periods ever recorded in the South has been [illegible] hardest and the money that will be lost by many construction firms as a result of the unlooked for rise in the Mississippi will be enormous. One might start at Cairo and come south telling of all those firms that must suspend operations because of the condition of the river, but it will suffice to tell of only a few of the biggest sufferers. Roach & Stansell with their steam shovel outfit at Huntington, which operation has attracted wide attention on account of novel ideas used for the first time in levee building, were forced to close down their forces until early summer [illegible] the river has [illegible] track built and many of the pits and from present indications the work which, according to all reckonings of engineers in charge, would be finished before summer, will run far into the fall months before the final estimate is secured. And Roach & Stansell having more different forces on the river at various places than perhaps any construction firm in the South, will be the hardest hit on account of the river. Lowrance Brothers, another large levee builder, [illegible] greatly on account of the Mississippi River coming out of its banks so unlooked for and before time was given to complete many gaps and breaks in the levee which was taxed so severely last high water. Charlie Lowrance has forces at Mound City, Arkansas, which must lay up during the flood period now on, while Jessie Nichols will be crippled at the same place. Henry McCarten at Hollybush, Ark., one of the most treacherous places on the Mississippi, must move his forces to Louisiana, while Charlie Siler, just above, must move to Pecan Point to help Pat McCadden out in the later's fight to save the lit- [illegible] government improvement districts, where re- [illegible] done, will have to suspend operations, but Monte Gardiner has the situation well in hand and will be ready to start work with a new vim as soon as the water recedes.

[illegible] visitor to Memphis during the Christmas holi- [illegible] its, for he is making much money and has good health. He states that never again will he come back to the Mississippi River which, by the way, was where he got his first start in the construction game. Ed Moseley is perhaps one of the best known of the old time contractors in this section. Years ago, when work was plentiful, prices for same high and feed and supplies cheap, Ed was the proud possessor of an ideal outfit which made him a world of money each year. But when competition in the South for levee work became too keen, Ed was wise and went West with his outfit and now feels he has done the right thing, as he looks upon the other boys in this section battling with high water and rainy weather. Ed will leave next week for his Del Rio contract.

S. S. Morris, the General Superintendent of the Y. & M. V. R. R., whose headquarters are in Memphis, states that now that the strike on his system is at an end, he will have more time on the road and will give much attention during the coming spring to making improvements and building up the track where needed. He states that Jake Baxter has now forces at work making urgent track repairs in the Clarkesdale District and that all such problems will be met and dealt with as presented. Mr. Morris certainly has his hands full with the striking employees and Memphis being the central point on the entire I. C. system for the strikers to carry on their work, the general offices at this place had more than their share to attend to. Incidentally, Mr. Morris states that business on his road was excellent during the Christmas holidays and at its normal stage for this season of the year.

R. J. Darnell, president of the Batesville & Southwestern R. R., states that this road is now completed to the Yocoma River except for two small gaps, which would have been closed some time ago had it not been for the excessive rains in the Mississippi Valley. By February 1st, the road will be open for regular traffic if all goes well and during the summer of 1912 the road will be built into Charleston, Miss., provided satisfactory terminal facilities can be secured. If the latter arrangement cannot be perfected, a connection with the Y. & M. V. R. R. at Gladys will be made. The road is an Illinois Central proposition and it is understood that the latter road will have full control of the operations of the new line.

Big Bill Stephenson has been forced by the high water to move his outfit from Hard Bar- [illegible] in Louisiana and was on the Morrisy boat out of Greenville, Miss., last Friday. Bill hated [illegible] had figured on remaining at Hard Bargin all winter.

[illegible] various equipment arrived in Memphis last week from Ft. Worth, Tex. Bob is the General Superintendent of the Roach-Manigan Paving Co., one of the largest asphalt concerns in the South, and his object in Memphis is to build a number of asphalt streets in this city for his concern. As soon as the Memphis work is finished, Bob will hie himself and crew back to Ft. Worth, where his firm has yet many yards of asphalt pavement to lay.

Texas.

•E. H. Perry, vice president of the Cham- [illegible] contract with the Green, Herr, McNaughton Development Co. of Plainview to put down ten irrigation wells nine miles south of Plainview, with a complete individual pumping [illegible]

Utah.

The Provo Reservoir Co., according to advices from Lehi, Utah, is to extend its canal from a point above Pleasant Grove to the American Fork canyon creek as soon as the weather will permit. If satisfactory arrangements can be made the farmers of Highland beach will take enough water from the com- [illegible]

Washington.

The citizens of the Kittitas Reclamation District have voted to issue $5,000,000 of bonds to pay for the construction of the high line canal. It is expected that work on the canal will be started within the next six months. The canal will furnish water to about 90,000 acres of land. A. C. Spalding, Ellensburg, and J. C. Boedscher, Cle Elum, Wash., are in charge of the financing work. Frank C. Kelsey, Portland, Ore., is the engineer.

Wisconsin.

⊙W. F. Hill, Superior, Wis., has been awarded the contract for the reconstruction of the outer half of the No. 2 ore dock at Allouez for the Great Northern R. R. The contract is said to amount to about $100,000 and will require several million feet of timber and piling.

Mexico.

Governor Copeda of the state of San Luis Potosi proposes to have large reservoirs constructed at Mexquitic, Cañada del Lobo and other points. The plan of the governor includes also the sinking of numerous artesian wells throughout the sections where the long droughts are frequent.

WATER-WORKS

California.

✣Bids will be received, it is reported, until Jan. 10, by City Trustees, Oceanside, Cal., for laying about 3,000 ft. of 4-in. water main in Pacific St. C. Brodie is Clerk.

✣Bids will be received until 2 p. m., Jan. 15, by Board of Los Angeles County Supervisors, Los Angeles, Calif., for the franchise granting the right to lay and maintain for a period of 40 years a system of water pipes.

⊙According to advices from Redlands, Cal., the Bear Valley Pipe Line Extension Co., has let a contract for about 6,000 ft. of pipe line from the end of the present system to Mound City, to the Western Pipe Co., of Los Angeles, for $14,000. The line will furnish water to a tract in the Bryn Mawr section.

Colorado.

The Empire Water & Power Co. has offered to sell all its land, water rights and reservoir sites in Ute Pass to Colorado Springs, at a price to be fixed by appraisers. The company owns approximately 1,000 acres, with water rights and several reservoir sites, above Cascade, on the north slope of Pike's Peak. The City Council is considering the proposition.

Delaware.

Following bids have been received by the Board of Water Commissioners of Wilmington, Del., for the new horizontal water turbine wheels and the triplex pumps to be installed at the pumping station: Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., $11,000, for the 4,000,000-gal. triplex pump, and $6,550 for the 2,000,000-gal. pump; Risdon Alcott Turbine Co., Mt. Holly, N. J., $3,300 for the 80,000,000-gal. daily discharge wheel to be erected on foundations supplied by the city, and $3,000 for the 40,000,000-gal.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

well. Other bidders on this work were Camden Water Well Works, Camden, N. J., $3,864 and $2,983 respectively; S. Morgan Smith Co., Holyoke, Mass., $4,500 and $3,700.

Florida.

⊙The Board of Public Works of Tallahassee, Fla., has awarded the contract for furnishing cast iron pipe for water service in streets that are to be paved with brick, to the Central Foundry Co., 90 West St., New York City. The work will include about 95 tons of 4, 6 and 8-in. pipe, either Universal or bell and spigot and six tons of fittings. Bids were opened Dec. 28.

D. D. & C. M. Rogers, of Daytona, Fla., have been retained as engineers by the city of Fort Pierce, Fla., to prepare plans for the installation of a waterworks system.

Georgia.

⊙B. F. Roberts of Macon, Ga., has been awarded the contract by the City Council of Jesup, Ga., for the construction of a waterworks. The work includes reservoir, 100 ft., tower, 80,000-gal. tank, pumps, boilers, pipe, etc. The work will cost approximately $30,000.

At a recent election the citizens of Sylvester, Ga., voted the issuance of bonds to the amount of $20,000 for the purpose of extending the waterworks and sewers.

Illinois.

✣Bids will be received until 10 a. m., Jan. 18, by W. L. Kelly, Treasurer, Danville Branch of the N. H. D. V. S., Danville, Ill., for furnishing and delivering wrought-iron pipe and fittings.

✣Bids will be received until 8 p. m., Jan. 8, by Board of Trustees, Melrose Park, Ill., for sinking an artesian well 1,600 ft. John Engbrecht is Village Clerk.

✣Bids will be received until 10 a. m., Jan. 8, by Board of Local Improvements, W. S. Welch, Clerk, Joliet, Ill., for the construction of a water main in Center St. and Plainfield Ave.

✣Bids will be received until noon, Jan. 8, by Board of Local Improvements, Joliet, Ill., for the improvement of Nicholson St. by the construction of a water main therein. W. S. Welch is Clerk of the Board.

✣Bids will be received until noon, Jan. 8, by Board of Local Improvements, Joliet, Ill., for the improvement of Broadway by the construction of a water main therein. William S. Welch is Clerk of the Board.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 9, for furnishing, delivering and erecting steel lockers at the Roseland pumping station, 104th street and Stewart Ave. Cash or certified check for $100 must accompany proposal.

Following is the lowest bid submitted to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering, in quantities as desired, compounded rubber pump valves, to each of the city's pumping stations. Sizes ranging from 1¾ ins. in diameter to 6¼ ins. in diameter, and in quantities of from 150 to 3,000. Western Packing & Supply Co., 231 N. Fifth Ave., Chicago, $4,428. Bids opened Dec. 14.

Bids were opened Dec. 12 by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing, delivering and erecting at the Roseland pumping station, 104th St. and Stewart Ave., a railroad track scale with suspended bearings, frame work, etc., as required by specifications. Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, were low bidders. Price, $1,125.

The Western Electric Co., 500 S. Clinton St., Chicago, has submitted a bid of $7,894 to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing tools, labor appliances, etc., necessary to design, deliver and erect complete in the Roseland pumping station, 104th St. and Stewart Ave., according to specifications, two turbo generator units complete, including steam and exhaust piping, foundations and pipe trenches. Bids opened Dec. 18.

The Carl Anderson Co., 510 W. Huron St., Chicago, Ill., has submitted a bid of $8,150 to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for removing the present engine, shafts and steam piping to the boiler room wall, and providing tools, appliances, material to design and erect at the Fullerton Ave. pumping station, motors, drives, transformers, switchboard, wiring and all appurtenances and accessories necessary to complete the work according to specifications. Bids opened Dec. 16.

The W. S. Shields Co., Hartford Bldg., Chicago, Ill., Consulting Engineer for the city of Pittsfield, Ill., has submitted a report to the City Council to ascertain the best way, in all respects, for a city water plant and sewer system. The work will cost approximately $20,000.

Complete plans, specifications and blue prints for a proposed system of waterworks have been presented to the water committee of the Tampico, Ill., City Council by Consulting Engineer Arthur M. Morgan, 160 W. Jackson Blvd., Chicago. The plans call for a system to cover the entire city at an estimated cost of $13,000, including site, pumping plant, tower, mains, etc. The elevated steel tank is to be erected on a 90-ft. tower and to hold 40,000 gals. Two wells will be sunk.

Iowa.

The Keokuk Water Works Co., incorporated under the laws of the state of Pennsylvania, has filed a copy of its articles with W. C. Hayward, Secretary of the state of Iowa. The incorporators are: Harry W. Davis, M. L. Rogers and S. E. Roberson of Wilmington, Del. Capital stock invested in Iowa at present amounts to $95,000.

A company with $20,000 capital stock is being formed in Albia, Ia., to sink a deep well for pure water, and build an artificial ice plant.

Kansas.

At an election held in Independence, Kans., on Dec. 20, for the purpose of voting on the issuance of bonds in the sum of $131,000 for the extension of the waterworks, establishing of a new fire station, purchase of a fire auto and the purchase of 147 acres of park land, everything but the $99,000 for water extension carried.

Louisiana.

⊙The executive committee of the Sewerage & Water Board of New Orleans, La., has awarded the contracts to the National Lead Co., of St. Louis, Mo., for supplying lead pipe at $24,850, and for solder at $3,075. Bids were also received from the Illinois Smelting Co., the Ahrens & Ott Co., and the Well-Gutmann Supply Co.

Michigan.

✣Bids will be received until 8 p. m., Jan. 25, by Board of Water Commissioners, S. A. Freshney, Secy., Grand Rapids, Mich., for furnishing and erecting one 350 to 375-h.p. water tube boiler for the combination pumping and lighting plant.

Minnesota.

Peter Nelson & Son of Hastings, Minn., at about $8,000 submitted the lowest bid to the City Council of that city for the construction of sewer and waterworks on 5th St., from Ramsey to Forrest St. Bids were opened Dec. 26. The contract will be let about Jan. 8.

The Town Council of Wayzata, Minn., has retained Civil Engineer W. T. Lovell of Minneapolis, to prepare plans and specifications for the installation of a waterworks and an electric light plant. The system will cost approximately $35,000.

Mississippi.

⊙The City Council of McComb, Miss., has awarded the contract for the extension of the city water mains to B. A. Heidenreich & Co., of that city, for $0.64 per ft.

An election will be held in Vicksburg, Miss., on Jan. 23, for the purpose of submitting the question of whether or not bonds in the sum of $400,000 will be voted for the construction of a water supply system.

Missouri.

✣Bids will be received until 7:30 p. m., Jan. 22, by City of St. Charles, Mo., for furnishing and laying about 5,000 lin. ft. of 12-in. and 631 lin. ft. of 6-in. cast-iron water pipe with valves, special castings, etc. Carr Edwards is City Engineer. The work will also include two concrete storage reservoirs.

✣Bids will be received until 2 p. m., Jan. 10, by Purchasing Agent, Kansas City, Mo., for cleaning 18,000 ft. of 36-in. cast-iron pipe. Plans and specifications are on file with E. B. Harrington, Secy. Board Fire and Water Commissioners.

⊙The County Court at Kansas City, Mo., has made a contract with the Interurban Water Co. for laying a pipe line from Independence to the county home. The county is to pay an annual rental of $3,600, pay for the water in addition, and have the privilege of buying the pipe.

Nebraska.

The Nebraska State Normal Board, Lincoln, Nebr., has decided to rebuild the recently destroyed waterworks plant at the Peru normal school.

New York.

The Town Board of Seneca Falls, N. Y., has received a request from the Seneca Falls Water Co. for the right to lay a 4-in. water main along the lake road for a distance of about three miles. The new main will connect with the force main at Bridgeport.

The New York State Conservation Commission, Albany, has approved the plans of the water commissioners of the Manhasset-Lakeville Water district of North Hempstead, Nassau County, for a new water supply.

Bonds to the amount of $175,000 were voted by the citizens of Hudson Falls, N. Y., at a recent election for the purpose of installing a gravity water supply system.

North Carolina.

According to advices from Asheville, N. C., a movement is on foot for the organization of the West Asheville Water Supply Co., with a capital stock of $25,000. The company proposes to establish a water supply system in West Asheville at an estimated cost of $20,000.

Oklahoma.

✣Bids will be received until 8 p. m., Jan. 9, by E. Sanders, Town Clerk, Porum, Okla., for the construction of a complete waterworks system and electric light plant. M. A. Earl & Co., Flynn Ames Bldg., Muskogee, Okla., are Engineers.

⊙The contract for the construction of the waterworks system for Olustee, Okla., bonds for which were recently voted, has been let to E. D. Lundsen of Oklahoma City, Okla. The water will be supplied from a deep well on Turkey Creek.

⊙The American Cast Iron Pipe Co., of Birmingham, Ala., has been awarded the contract by the city of Muskogee, Okla., for furnishing 1,800 tons of 24-in. cast iron pipe, 50 tons of specials and 70 tons of 6-in. pipe. The pipe will cost $26.55 per ton and the specials $0.02½ per lb. Bids were opened Dec. 29. Alexander Potter, 114 Liberty St., New York City, is Engineer.

Oregon.

✣Bids will be received until 4 p. m., Jan. 9, by Water Board, City of Portland, Ore., Frank T. Dodge, Supt., for furnishing f.o.b cars Portland, Ore., 200,000 lbs. of Selby pig lead and 20,000 lbs. of "leadite" for use in laying water mains. The pig lead must be Selby pig lead, or its equal, of the quality suitable for pouring joints in cast-iron pipes. The "leadite" must be that made by the Leadite Company of Philadelphia, Pa., or equal thereto. Delivery of these materials must be begun within 30 days after date of contract, and be completed within 60 days after date of contract.

⊙The Water Board of Portland, Ore., has awarded contracts for furnishing 12,000 tons of cast iron pipe of various sizes as follows:

Oregon Iron & Steel Works, [illegible] tons of 20-in., 600 tons of 16-in. [illegible] pipe at $30.50, total [illegible] 8-in. pipe at $31.50 per ton, $63,000; grand total $117,900. United States Cast Iron Pipe & Foundry Co., 320 tons 20-in., 1,04[illegible] tons 16-in., 1,760 tons 12-in., 4,190 tons 8-in. and [illegible] tons of 6-in. pipe at $32.50 a ton, $265,220. The contract for furnishing [illegible] ings was awarded to the Smith & Watson Iron Works for $24,5[illegible] delivered by rail to Portland.

The new City Council of Monmouth, Ore., is considering the advisability of constructing a waterworks system. Bonds to the amount of $25,000 have been voted for the improvement.

The City Council of Klamath Falls, Ore., has declared its intention to claim all springs on or near section 30, township 37, S. R. 7, E. W. M., for a city water supply, the present domestic supply. A reservoir will be located on the adjoining section, 100 ft. above the level of Aspen Lake, and the pipe line will run southeasterly to the city. Estimates on cost and plans for the perfection of the system have not been worked out.

The citizens of Sutherlin, Ore., have voted the issuance of bonds to the amount of $30,000 for the installation of a gravity water supply system.

South Dakota.

✣Bids will be received until Jan. 8, by Mayor, Bellefourche, S. Dak., for drilling and casing an artesian well. Plans and specifications are on file at the office of C. Seward, City Auditor.

Tennessee.

The Water Commission of Memphis, Tenn., is considering plans for some improvements and extensions in the artesian water system. Bonds to the amount of $250,000 for waterworks improvements have been sold, and part of this amount will be used for this improvement.

Texas.

The City Council of Terrell, Tex., has decided to lay an additional 8-in. water main on Moore Ave., to be used for fire protection purposes.

Consulting Engineer N. Warenskiold, Flateau Bldg., Dallas, Tex., has submitted three plans to the Board of Water Commissioners [illegible]

Vermont.

[illegible] city will acquire Silver Lake as an annex to [illegible] system. Silver Lake will be connected to the [illegible]

Virginia.

✣ [illegible] Pipe & Construction Co., A. H. Kneen, Asst. [illegible] pipe and about 1,600 tons of 16-in. cast-iron pipe. Second, laying about 24,400 ft. of 24-in. wood pipe and about 28,500 ft. of 16-in. cast-iron pipe. Third, constructing earth dam on North Landing River. Location is from 7 to 12 miles east of Norfolk, Va. Copies of draw[illegible] positing certified check, for $5.00 for each set of plans and specifications.

Perry W. Ruth, at $8,188, submitted the lowest bid to the Board of Control of Norfolk, Va., for the laying of a water main on Church St.

Washington.

✣Bids will be received until Feb. 15, by Town of Twisp, Wash., for the construction of a waterworks system, estimated to cost approximately $12,000.

The International Contract Co., Central Bldg., Seattle, Wash., at about $150,000, submitted the lowest bid to the City Council of Ellensburg, Wash., for the construction of the water system in that city.

The Mayor and the utilities commission of the City Council, Seattle, Wash., it is reported, have selected three engineers to pass upon the engineering problems confronting the city in its water supply system and power plant in the Cedar River watershed. The engineers will be asked to pass upon the following propositions: "What is the best and most economical method of protecting the Cedar River pipe line against floods?" "The feasibility and practicability of the present plans for constructing a dam at camp No. 2; to determine the character of the soil, and whether the foundation is suitable for the dam proposed." "The amount of time required to construct said dam." "The best and safest route of the penstocks for the development of power." "Proper location of power house for additional power to be developed when dam is completed." It is estimated that the expense of having these plans experted will be about $4,500. City Engineer A. H. Dimock reports that the borings and soundings being taken at the site of the proposed dam will [illegible]

Residents of the district north of Union Bay and east of 20th Ave., Seattle, Wash., have formed the Northeast Improvement Club and have circulated petitions asking for the laying of city water mains and hydrants in the district. R. W. Douglas is President of the club.

West Virginia.

The City Council of Kimball, W. Va., has granted a franchise to the Russell Co., Conover Bldg., Dayton, O., to install a waterworks and electric light plant. The work will cost about $50,000. The franchise will run for 50 years.

Canada.

⊙The Board of Control of Winnipeg, Man., on Dec. 26 awarded contracts for much of the material required for the proposed extensions of the high pressure system on Portage Ave., next year, the material to be delivered in the near future, so that it will be available for work to be started in the early spring. The contract for 5,000 ft. of 12-in. and 2,000 ft. of 10-in. iron water pipe was let to the Canada Iron Corporation of Montreal. The Florence Iron Works of Philadelphia, Pa., the contract for 15 8-in. hydrants; T. McAvity & Sons of St. John, N. B., will supply high pressure valves; the A. P. Smith Mfg. Co., of East Orange, N. J. will supply all brass fittings. The Crane & Ordway Co. will supply 60 tons of pig lead for use on this and other waterworks jobs.

⊙Contracts have been awarded by the city of Neepawa, Man., for waterworks and sewers, for which Chipman & Powers, Winnipeg and Toronto, Ont., are Engineers, and bids opened Dec. 15, as follows: Standpipe and housing, 20x80, Des Moines Bridge & Iron Work, Des Moines, Ia; standpipe foundation, W. R. Black of Neepawa, and pump house and filter room, W. T. Shearer, Neepawa.

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

✣Bids will be received until 11 a. m., Jan. 4, by City Council, Union Springs, Ala., for the construction of a sanitary sewer system and disposal plant. W. Hill, Attalla, Ala., is Engineer.

Arkansas.

Mayor Charles E. Taylor of Little Rock, Ark., will at once inaugurate a movement for an amendment to the State constitution under the initiative and referendum, permitting cities of the first class to issue bonds for municipal improvements. If the proposition is indorsed by the voters at the general election, to be held next September, an effort to secure authority to issue bonds for the following purposes will be made: Sewers, $500,000; fire department equipment, building, grounds, etc., $250,000; electrical department, $125,000; hospital, $150,000; parks, boulevards, etc., $300,000.

The Sewer Committee and the Commissioners of Sewer Districts Nos. 43 and 46, Little Rock, Ark., have approved the plans drawn by Supt. Levinson to remodel the septic tank at 18th and McGowan Sts., and bids will be advertised for so that work can begin immediately. The committee also granted permission to the Commissioners of Sewer Districts Nos. 69 and 70 to connect their sewers with the old State sewer.

California.

City Engineer C. B. Greeley of Bakersfield, Cal., A. K. Warren, Civil Engineer of Bakersfield, and City Engineer Chris P. Jensen of Fresno, Cal., are going over the plans prepared by the former for the extension of the sewer system of Bakersfield. After the engineers have reported on the plans the Trustees will call an election to vote on the issuance of bonds for the building of the system.

The Board of Public works of Los Angeles, Cal., has recommended to the City Council that a storm drain system be constructed on Gless St., north of First St., at an estimated cost of $18,000.

Colorado.

The Board of Public Works of Denver, Colo., has adopted specifications for the construction of subdistrict lateral sewers and appurtenances for sanitary drainage in Part B of Subdistrict No. 6 of East Side Sanitary Sewer District No. 1. The estimated cost is $4,864.

Idaho.

⊙The contract for the construction of the first lateral sewer in Pocatello, Ida., running from the main trunk line on East Clark St., through the alley between First and Second Aves., to Lewis St., has been awarded to R. M. Bardsen & Co. for $1,700.

Resolutions have been introduced in the City Council of Pocatello, Ida., providing for the creation of five lateral sewer districts, as follows: District No. 1—North of the trunk line on East Clark St. and east of the tracks as far as Seventh St. District No. 2—North of the Clark St. trunk line and east of the tracks, in a zig-zag direction as far out as Ninth Ave. District No. 3—South of the Lander St. trunk line, taking in the territory between Harrison and Hayes Aves., as far south as Lewis St. District No. 4—North of the Lander St. trunk line and west of the tracks, taking in the territory as far north as Wyeth. District No. 5—South from the Clark St. trunk line, and taking in the territory between Sixth and Eighth Aves., as far out as the Academy.

Illinois.

✣Bids will be received until noon, Jan. 8 by Board of Local Improvements, W. S. Welch, Clerk, Joliet, Ill., for the construction of a sewer in Broadway.

✣Bids will be received by the Board of Trustees of the Municipal Tuberculosis Sanitarium, Chicago, Ill., for constructing sewer system, water distribution system, heating and ventilating system, engines, motors, etc., until Jan. 5. Bids will be opened in conjunction with bids for the construction of the sanitarium at the office of the Board of Trustees.

15th floor, Fort Dearborn Bldg., Chicago. H. M. Higginbotham is President.

⊙The Board of Local Improvements, Chicago, Ill., has awarded the following contracts for constructing sewers: S. Springfield Ave., Geo. Pontorelli; E. 74th Pl., Thos. Burk[illegible]; De Vito Passarelli & Tutilli, 600 W. DeKoven St.; Tremont St., N. Leavitt St., W. 47th St., W. 48th Pl., W. 48th St. and W. 49th St., to Chris. Fosco, 814 S. Des Plaines St. E. J. Glackin is Secretary of the Board. Bids opened Dec. 11.

⊙P. F. McDonald has been awarded the contract by the City Council of Normal, Ill., for the construction of 8 and 10-in. sewers in Cherry St., for $810. Melluish & Broyhill of Bloomington, Ill., are Engineers. Bids were opened Dec. 20.

Chief Engineer G. W. Wisner of the Sanitary District of Chicago recommended in a report that an experimental station be built at the outlet of either the Center Ave. or the Ashland Ave. sewer. The station is for the purpose of ascertaining what plans should be made for the building of one or two large disposal stations to handle the sewage of the stock yards.

Petitions have been circulated among the property owners of the Sixth and Seventh Wards, city of Joliet, Ill., asking for the organization of a drainage district to carry into effect either of two plans proposed for the improvement of Hickory Creek. One of these plans provides for an expenditure of $200,000, the other for $150,000. The petitions are to be presented to the County Court, Joliet.

Indiana.

✣Bids will be received until 8 P. M., Jan. 9, by City Council, Columbus, Ind., for the construction of the Maple Grove Sewer system, estimated to require an expenditure of $40,200. E. A. Cobb is City Clerk. W. H Rights is City Engineer.

✣Bids will be received until 10 A. M., Jan. 8, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in and along Wheeler St. from Glen Drive to Roosevelt Ave.

✣Bids will be received until 10 A. M., Jan. 8, by Board of Public Works, Indianapolis, Ind., for the construction of local sewers in and along Dearborn St., from a point 1,645 ft. north of Michigan St. north for a distance of 270 ft.

✣Bids will be received until 10 A. M., Jan. 8, by Board of Public Works, Indianapolis, Ind., for the construction of local sewers in and along Adams St. from Glen Drive to 25th St.

Kansas.

A petition has been filed with the City Commission of Iola, Kans., asking that a new sewer district be established in the northeast part of the city.

Massachusetts.

⊙Bids were received Dec. 12 by the City of New Bedford, William F. Williams, City Engineer, for the construction of Sections 1 and 2 of the intercepting sewer system, the contracts being awarded on Dec. 27 as follows: Section 1, location A, the J. W. Bishop Co., Providence, R. I.; Section 2, to Frank A. Gammino, Providence, R. I. The unit bids of the bidders who bid on both sections of the work were as follows: (1) Standing for bid of Leo M. Kelly, Brooklyn, N. Y.; (2) Cendella & Co., Milford, Mass.; (3) Frederick E. Shaw, Providence, R. I.; (4) Luke D. Mullen, Boston, Mass.; (5) A. G. Tomassello, Dorchester, Mass.; (6) Bruno & Petitti, Boston, Mass.; (7) Frank A. Gammino, Providence, R. I.; (8) Coleman Bros., Boston, Mass.; (9) Merrill, Ruckgaber Co., New York; (10) Bush, Moller & Smith, Hartford, Conn.; (11) Geo. Phillips, Boston, Mass.; (12) James E. Bunting, Flushing, N. Y.; (13) Whiting, Turner Construction Co., Baltimore, Md.; (14) J. W. Bishop Co., Providence, R. I.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Section 1, Loc. A															
Earth excavation, I. S.	[illegible] cu. yds.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Earth excavation, Pipe S.	[illegible] cu. yds.	1.00	[illegible]	1.00	0.75	1.25	2.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rock	[illegible] cu. yds.	[illegible]	[illegible]	1.00	3.50	4.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cofferdam, etc., Junc. Ch.		1,000	1,000	175	1,200	600	2,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Granite masonry	[illegible] cu. yds.	[illegible]	[illegible]	[illegible]	8.00	[illegible]	20.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concrete masonry, Junc. Cham.	140 cu. yds.	[illegible]	[illegible]	13.00	9.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concrete masonry, T. G. Cham.	[illegible] cu. yds.	10.00	[illegible]	13.00	9.00	17.00	10.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concrete masonry, in sewer	1,200 cu. yds.	[illegible]	7.50	[illegible]	7.00	8.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concrete masonry, pipe sewer	[illegible] cu. yds.	10.00	10.00	10.00	7.00	10.00	10.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pipe Sewer	[illegible] lin. ft.	[illegible]	0.40	0.50	0.65	0.25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Reinforcing bars	[illegible] lbs.	[illegible]	0.01	[illegible]	0.025	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lumber in place	100,000 ft. B. M.	[illegible]	20.00	[illegible]	20.00	20.00	[illegible]	20.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20.00
Fibre ducts	[illegible] lin. ft.	[illegible]	0.20	0.06	[illegible]	0.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pipe underdrain	1,000 lin. ft.	[illegible]	[illegible]	0.40	0.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$111,440	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Section 1, Loc. B															
Earth excavation, I. S.	[illegible] cu. yds.	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	..	[illegible]	[illegible]
Earth excavation, Pipe S.	160 cu. yds.	3.00		[illegible]	[illegible]	1.00	2.00			[illegible]	[illegible]	[illegible]	..	[illegible]	[illegible]
Rock excavation	800 cu. yds.	[illegible]		[illegible]	[illegible]	10.00	[illegible]			[illegible]	[illegible]	[illegible]	..	[illegible]	3.00
Cofferdam, etc., Junct. Ch.		[illegible]		975	1,200	600	[illegible]			[illegible]	[illegible]	[illegible]	..	[illegible]	[illegible]
Granite masonry, Junct. Ch.	30 cu. yds.	[illegible]		50.00	8.00	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	..	[illegible]	[illegible]
Concrete masonry, Junct. Ch.	110 cu. yds.	16.00		13.00	9.00	20.00	10.00			[illegible]	[illegible]	[illegible]	..	[illegible]	[illegible]
Concrete masonry, T. G. Ch.	125 cu. yds.	[illegible]		13.00	9.00	15.00	10.00			[illegible]	[illegible]	[illegible]	..	[illegible]	9.70
Concrete masonry in sewer	[illegible] cu. yds.	[illegible]		8.00	[illegible]	12.00	8.00			[illegible]	[illegible]	[illegible]	..	[illegible]	[illegible]
Concrete masonry, pipe sewer	[illegible] cu. yds.	10.00		10.00	[illegible]	10.00	10.00			[illegible]	[illegible]	[illegible]	..	[illegible]	[illegible]
Pipe sewer	100 lin. ft.	[illegible]		0.50	[illegible]	0.25	2.00			[illegible]	[illegible]	10.00	..	[illegible]	[illegible]
Reinforcing bars	103,000 lbs.	[illegible]		[illegible]	0.03	0.03	[illegible]			[illegible]	[illegible]	[illegible]	..	[illegible]	[illegible]
Lumber in place	[illegible] ft. B. M.	[illegible]		20.00	20.00	20.00	20.00			[illegible]	[illegible]	[illegible]	..	[illegible]	20.00
Fibre ducts	1,060 lin. ft.	[illegible]		0.06	[illegible]	0.10	[illegible]			0.04	[illegible]	[illegible]	..	[illegible]	[illegible]
Pipe underdrain	1,100 lin. ft.	[illegible]		[illegible]	[illegible]	0.30	[illegible]			2.00	[illegible]	[illegible]	..	[illegible]	[illegible]
Total		[illegible]		$130,864	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	..	$119,108	[illegible]
Section 2															
Earth excavation, I. S.	26,000 cu. yds.	[illegible]	$1.10	[illegible]	$1.10	$1.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$1.66
Earth excavation, Pipe S.	1,200 cu. yds.	[illegible]	[illegible]	1.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rock excavation	1,000 cu. yds.	[illegible]	[illegible]	3.50	3.00	4.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concrete masonry in sewer	6,100 cu. yds.	[illegible]	[illegible]	[illegible]	7.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concrete masonry, pipe sewer	[illegible] cu. yds.	10.00	10.00	[illegible]	[illegible]	10.00	10.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pipe sewer	[illegible] lin. ft.	[illegible]	[illegible]	[illegible]	0.65	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Reinforcing bars	[illegible] lbs.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lumber in place	150,000 ft. B. M.	[illegible]	20.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fibre ducts	10,885 lin. ft.	[illegible]	0.20	0.06	0.05	0.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pipe underdrain	[illegible] lin. ft.	0.40	[illegible]	[illegible]	0.10	[illegible]	[illegible]	0.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total		[illegible]	[illegible]	$117,818	$115,006	$122,031	[illegible]	$104,214	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Maryland.

⦿ [illegible] east of Jones' Falls that will [illegible] complete the new system in [illegible]imore, [illegible] are as follows: Second section of [illegible] high-level interceptor, covering a large [illegible] of the middle part of the city, to R[illegible] & Reilly; [illegible] the new paving to be done this year, and also to prevent floods in districts where heavy damages occurred after the recent storms, to McCarty & Co.; the building of a drift catcher near the Timanus mills to intercept logs com[illegible]

Minnesota.

Village Engineer F. C. Lang of Chisholm, Minn., is investigating sewage disposal statistics in Minneapolis and St. Paul for the purpose of using the data in the construction of a $25,000 sewage disposal tank in Chisholm the coming summer.

The city of Albert Lea, Minn., is planning on constructing approximately 10 miles of new sewers this year to drain the section west of the M. & St. L. tracks south of Fountain St.; the residential part near the lake known as the park; the section east of Newton St., south of the lake, and some of the more thickly settled districts south of Charles St. William Barneck is City Engineer.

Missouri.

✣Bids will be received until 8:30 p. m., Jan. 5, by city of Cameron, Mo., for the construction of 2,280 ft. of 8-in. sewers, 36 manholes and three flush tanks. Clarence Staples is City Clerk.

✣Bids will be received, it is reported, until Jan. 15 by City Council, Springfield, Mo., for the construction of sewage disposal plants at the outlets of the two main sewers of the city.

⦿The Board of Public Improvements of St. Louis, Mo., has awarded a contract for the construction of Lindenwood district sewer to John F. McMahon for $19,820. The Lindenwood district is in the southwest part of the city.

⦿The Board of Public Works of St. Joseph, Mo., has awarded contracts for the construction of three district sewers as follows: Olsen-Schmidt Construction Co., District 110; D. B. Kelley, Districts 109 and 125.

⦿The Board of Public Works of Kansas City, Mo., has awarded the contract for the construction of a vitrified clay pipe sewer from 29th St. to 25th St., in Raytown Road, and along Shuttle Creek to the Blue River, to T. W. Roberts for $26,461. After the construction of the Blue River sewer this sewer will empty into it. The new sewer will drain all of the Shuttle Creek district, an area of about 1,200 acres. Lateral sewers will soon be constructed for the whole territory.

An election was held in Jefferson City, Mo., on Dec. 28 for the purpose of voting on the issuance of $70,000 in bonds for the construction of a viaduct, the establishment of a paid fire department, the extension of a sewer system and for marking the streets.

The Municipal Assembly of St. Louis, Mo., has passed ordinances providing for the establishment of the Gratiot Joint Sewer District, to include Subdistricts Nos. 1, 2, 3 and 4.

Plans for the installation of flood gates and a pumping engine on the banks of the Missouri River at the foot of Santa Fe St., to prevent backwater from getting into the sewers of the West Bottoms, have been prepared by Paul McGeehan, Chief Engineer of the Sewer Division of Kansas City, Mo. The plans have been submitted to the Board of Public Works of that city with the statement that the cost of the improvement will be $35,000.

The City Council of Chillicothe, Mo., has passed an ordinance di[illegible] neer Jo Broaddus.

Nebraska.

[illegible]

Nevada.

✣[illegible] 6, by W. H. Reavis, City Clerk, Fallon, Nev., [illegible] tem consists of about 6,000 lin. ft. of 12-in. and 10-in. pipe sewers averaging 6 ft. deep, and Imhoff or septic tank. The water works [illegible] verse steel or cast iron pipe, valves and hy[illegible] sheet piling work. Plans are on file with E. P. Osgood, Bank Bldg., Fallon, Nev., Engineer. Official advertisement will be found else[illegible]

New Mexico.

⦿The contract for the construction of a sewerage system and water works system in the city of Las Cruces, N. Mex., for which bids were opened Dec. 15 by the City Council, has been awarded to Bash & Gray of Joplin, Mo., for $55,754. The contract calls for the complete construction of both systems.

New Jersey.

The special committee representing the towns of Orange, East Orange and Montclair, N. J., has authorized Rudolph Hering and John H. Gregory, Consulting Engineers, to complete plans to cost $8,000 for the proposed Imhoff sewage disposal plant, and submit them to the State Board of Health.

New York.

Bids have been received by the Board of Contract of Syracuse, N. Y., for the con[illegible] sewer in Emerson Ave. from Harbor St. to a point 400 ft. north of Lewis St., and a 12-in. sewer from the last point to Chemung St.—C. T. Hookway, $4,926; Blanche Gaffey, $3,113; Samuel Bonn, $5,982; James Swift, $4,819; F. S. Sposato, $4,351. 15-in. pipe sewer in Kenmore Ave. from Newell St. to Ostrander Ave.—Anthony Sposato, $1,938; F. S. Sposato, $2,153; Charles Bonn, $1,921. 15-in. pipe sewer in Loehr Ave. from Hoefler St. to the center of lot No. 1, Loehr tract—Charles Bonn, $612; Philip Thomas, $599; C. T. Hookway, $820; James Swift, $950; Blanche Gaffey, $718; A. Sposato, $796; F. S. Sposato, $771. 12-in. pipe sewer in Willis Ave. from Schuyler St. to Hamilton St., and a 12-in. pipe sewer in Hamilton St. between Milton and Willis Ave.—Philip Thomas, $1,105; James Swift, $1,227; Alexander Barr, $979; Blanche Gaffey, $915; Samuel Bonn, $1,227; A. Sposato, $1,012; F. S. Sposato, $1,243; Charles Bonn, $1,166.

North Dakota.

City Engineer T. R. Atkinson of Bismarck, N. Dak., is making plans for a sewer [illegible] south side of the city.

Ohio.

✣Bids will be received until noon, Jan. 10, by Director of Public Service R. F. Harbert, Canton, O., for the necessary labor and material for the construction of a sanitary sewer in Cherry St., Hiram St. and E. Lake St., for the construction of a sanitary sewer in Shorb St. from Aultman Ave. to Marvin St., for the construction of a sanitary sewer in Harrison Ave. from Navarre St. to South St., for the construction of a storm water sewer in Harrison Ave. from Navarre St. [illegible] cations on file in said office. Engineer's Di[illegible] lows: N. Cherry St., Hiram St. and E. Lake St. Sewer—730 lin. ft. 9-in. vit. pipe, 1,020 lin. ft. 8-in. vit. pipe, 4 manholes, 2 lampholes, 1 [illegible] lin. ft. 8-in. vit. pipe, 4 manholes. Harrison Ave. Sanitary Sewer—3,830 lin. ft. of 8-in. vit. pipe, 16 lin. ft. of 6-in. vit. pipe, 12 manholes, 1 flush tank, 1 flush tank reconstructed [illegible]

✣Bids will be received until noon, Jan. 5, by Director of Public Service, Toledo, O., for the necessary labor and material for the construction of local sewer 1126 in Academy Ave., Bancroft and Oxford St. F. G. Stockton is Secretary.

✣Bids will be received until noon, Jan. 22, by C. C. Taylor, Village Clerk, Arcanum, O., for the construction of 2,012 ft. sewer and [illegible] sary grading, draining and curbing.

✣[illegible] 22, by C. C. Taylor, Village Clerk, Arcanum, O., for the construction of 7,029 sq. yds. of brick paving, 2,012 ft. sewer and all necessary grading, draining and curbing.

⦿J. L. Croft & Co. and Baldwin Bros., Rose Bldg., Cleveland, O., have been awarded the contract by K. Leet, City Clerk, East Cleveland, 1113 Williamson Bldg., Cleveland, O., for the construction of sewer and water connections in Mississippi, Missouri, Savannah, Scioto, Bender, North Lockwood, Phillips Kennebec, and other streets, at $2,475 and $10,295, respectively. The F. A. Pease Engineering Co., Williamson Bldg., Cleveland, are Engineers. Bids were opened Dec. 22.

The City Council of Youngstown, O., has adopted ordinances providing for the construction of a sewer in Oak St., from Truesdale Ave. to Bond St., and Himrod Ave., from Truesdale Ave. to Out Lot 719, and a sewer in South Ave., between Marion Ave. and the city limits.

Following bids were received by the Service Director of Lorain, O., H. P. Nielson, for the construction of two new sewers, one on West 21st St. and the other on Clinton Ave.: West 21st St.—Cockell Construction Co., Amherst, O., $1,083; C. D. Nicola, Lorain, $1,107; C. E. Chilson, Lorain, $1,156; M. J. Burke, Lorain, $1,212, and Faragher & Randall, Lorain, $1,761. Clinton Ave.—M. J. Burke, $2,489; Ohio Engineering Co., $2,677; Cockell Construction Co., $2,824; C. E. Chilson, $2,841, and Faragher & Randall, $2,963.

City Engineer F. J. Cellarius of Dayton, O., has been instructed to make a study of the present sanitary sewer system and report plans that will relieve the present overtaxed sewers and thus provide for the future needs of the city.

The City Council of Canal Dover, O., has accepted plans, specifications and estimate for the construction of a 36-in. brick sewer in Washington St. The plans call for 1,650 ft. of sewer, and the estimated cost is $5,819.

The City Council of Akron, O., has passed ordinances providing for the construction of the following sewers: On East York St., from Howard St. to the east corporation line; on Francis Ave., from Rider St. to Elma St.; on Market St., from High St. to Case Ave.; on Fifth Ave., from Fuller St., and other streets from Tolbot St. to Second Ave., and Diagonal Road, from a point 775 ft. east of East Ave. to a point 100 ft. from the west corporation line.

The City Council of Cincinnati, O., has passed resolutions providing for the construction of sewers on the following streets: Gladstone Ave., from Collins Ave. to a point 2,000 ft. eastwardly; Mohawk St., from existing sewer in Hamburg St. 400 ft. eastwardly; Cummins St., from Beekman St. to the summit, 300 ft., more or less, south of Carl St.; Moosewood Ave., from summit, 350 ft., more or less, south of Yonkers Ave., to a point 400 ft., more or less, north of Yonkers

Resolutions have been passed by the City Council of Toledo, O., providing for the construction of the following sewers: Sewer No. 1134 in main sewer district No. 43; sewer No. 1133 in main sewer district No. 12.

The City Council of Dayton, O., has ordered the construction of a new sewer in part of Sewer District No. 8, according to plans and specifications already prepared.

Oregon.

Plans for an intercepting sewer to extend from Marquam Gulch, in South Portland, along the water front to Nicolai St., a distance of three miles, to take up all sewerage now emptied into the river between those points, have been completed by City Engineer Tom Hurlburt, Portland. The sewer as planned will be 11 ft. in diameter at the outlet at Nicolai St., and taper down to 4 ft. at its beginning in South Portland. The pipe will cost approximately $500,000.

City Engineer Tom Hurlburt of Portland, Ore., has prepared two plans for a complete sewer system for Eastmoreland, to be known as the Eastmoreland Sewer System. The plans are for vitrified pipe and cement pipe. The system will cost approximately $58,818.

Pennsylvania.

Among the sewers which will be contracted for by the city of Scranton, Pa., and the work undertaken as soon as weather conditions permit, are: Tenth sewer district, relief, $22,000; 17th sewer district, relief, $18,326; Sixth sewer district relief, $4,486; Section A, Fifth sewer district, relief, $186; system, Section K, 17th sewer district, property owners' approximated cost, $16,686, city's share, $4,477; sewer, North Main Ave. to Oram St., property owners' approximate cost, $10,030, city share $2,848.

Texas.

On Dec. 20 the citizens of Beaumont, Tex., voted the issuance of bonds in the sum of $30,000 for the construction of sewers.

Washington.

⊙D. T. Daniels, 213 So. 11th Ave., North Yakima, Wash., has been awarded the contract by the City Council of that city for the building of the main storm sewer for $43,286. The sewer will be 42 ins. in diameter and will be of reinforced concrete construction. Bids were opened Dec. 18.

⊙It is reported the contract for the construction of the main storm sewer in the city of North Yakima, Wash., for which Robinson & Foster of Spokane were low bidders, has been awarded to the International Contracting Co., of Seattle, at a bid of $42,556. The lowest bid received by the City Commissioner was $37,432.

A mass meeting of the citizens of Union Park, Spokane, Wash., was recently held for the purpose of discussing the plans, specifications, assessment roll, etc., for the proposed Union Park sewer improvement. The plans were explained by Commissioner of Public Works D. C. Coates and City Engineer Morton Macartney.

The Town Council of Cathlamet, Wash., has passed an ordinance providing for the construction of a sewer on Main and River Sts.

Civil Engineer C. H. Green of Spokane, Wash., has submitted specifications to the City Councils of Kellogg and Wardner, Ida., for the proposed construction of a joint sewer system for the two cities. The estimated cost of the improvement calls for $25,000 for Kellogg and $19,000 for Wardner. The plans call for a main trunk sewer through the heart of the two towns.

Plans and specifications are being prepared for the construction of a sewer system in Cashmere, Wash. The town also proposes to do a considerable amount of street work and sidewalk building during the year.

Wisconsin.

⊙The City Council of Menasha, Wis. has awarded the contract for the construction of the Nicolet Ave., sewer to Joseph Quella and A. Walbrum.

Canada.

⊙The city of Neepawa, Man., has awarded the following contracts for sewer and water improvements, for which bids were opened Dec. 15, and Chipman & Powers of Winnipeg, Man., and Toronto, Ont., are Engineers: Laying sewer and water mains, L. W. Schruth, Fargo, N. Dak.; sewerage disposal works, L. W. Schruth; furnishing cast iron pipe, Canada Foundry Co., Winnipeg; furnishing wood stave pipe, Dominion Wood Pipe Co., Winnipeg, and laying wood stave pipe, L. W. Schruth.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

✣Bids will be opened on Jan. 5 by Frank R. Thompson, City Clerk of Oakland, Cal., for a completion of the estuary quay wall for the city. Under a previous contract about 308 ft. of wall has been completed and there now remains about 2,000 ft. The estimated cost of completing the wall is $278,000.

District of Columbia.

✣Bids will be received until 10:30 a. m., Jan. 8, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing, under Canal Circular 670, gasoline launch, steel cable, sheet brass, cocks, valves, pipe fittings, nuts, claw bars, blacksmiths' punches, cold chisels, files, carpenters' braces, hacksaw frames, hinges, locks, tacks, rakes, sledge handles, machetes, tallow pots, solder, steel tapes, life preservers, chalk line, mop heads, marline, cotton waste, metallic hose, packing, belt lacing, soap, creosote oil, linseed oil, sienna, metallic brown, etc.

Georgia.

✣Bids will be received until 11:45 a. m., Jan. 5, by Lieut. W. O. Selkirk, Quartermaster, Fort Screven, Ga., for the construction of a concrete target butt at Fort Screven, Ga.

Illinois.

✣Bids will be received until 2 p. m., Jan. 9, by Commanding Officer, Rock Island Arsenal, Rock Island, Ill., for furnishing and delivering at the arsenal 190,000 ft. each of white oak and hickory, green stock; also 46 poles of white oak and 46 hickory poles.

Louisiana.

✣Bids will be received until noon, Jan. 12, by J. L. Strickland, chairman of the Building Committee, Independence, La., for the construction of a basement and two-story brick school building, plans and specifications of Mr. Wm. T. Nolan, for the town of Independence, La., on file at the Builders' Exchange, New Orleans; the office of Wm. T. Nolan, 310 Hennen Bldg., New Orleans; the office of J. H. Strickland, Independence, La., and the office of the Parish Superintendent of Education, Amite, La.

Massachusetts.

✣Bids will be received until noon, Jan. 22, by Col. F. V. Abbott, U. S. Engineer, Boston, Mass., for dredging in Weymouth Back River, Mass.

Ohio.

✣Bids will be received until 2 p. m., Jan. 30, by Maj. H. Jervey, U. S. Engineer, Cincinnati, O., for constructing and delivering the steel or steel and iron hull light draft snagging plant, consisting of the derrick boat Mingo and the towboat Iroquois.

Pennsylvania.

✣Bids will be received until Jan. 10 by Building Committee of the Board of Trustees, State Hospital for the Insane, Southeastern District, Norristown, Pa., for the erection of an annex to the nurses' home at the State Hospital for the Insane. Richard Markley is Steward.

✣Bids will be received until noon Jan. 20 by Maj. Herbert Deakyne, U. E. Engineer, Witherspoon Bldg., Philadelphia, Pa., as noted in our last issue, for the construction of four dikes in the Delaware River, in connection with the 35-ft. channel project. Bids for this work were called for and received several months ago, but as they exceeded the amount available, $600,000, were rejected. The new specifications include only two types of dike, an all rock and a rock filled. The dikes to be constructed include one each at Chester Island, Old Man Point, lower end of Artificial Island and the extension of Reedy Island dike, besides topping off the old Reedy Island dike.

Texas.

✣Bids will be received until 10 a. m., Jan. 18, by Lieut. C. S. Hoffman, Quartermaster, Fort McIntosh, Texas, for furnishing miscellaneous plumbers' supplies, including ball cocks, block tin, rubber bath stoppers, bushings, tank bumpers, caps, stop cocks, copper wire, closet tank, supply pipes, copper floats, street ells, pipe clamps, bath cocks, basin cocks, flange unions, valves, hose bibbs, valves and washers, malleable saddles, nipples, pipe, rubber tubing, shampoo sprinklers, tees, unions, etc.

✣Bids will be received until 10 a. m., Jan. 6, by Capt. P. Whitworth, Constructing Quartermaster, Fort Crockett, Galveston, Texas, for the reconstruction of coal shed at that post.

✣Bids will be received until Jan. 17 by Maj. R. H. Rolfe, Depot Quartermaster, Fort Sam Houston, Texas, for delivering at Fort Sam Houston rubber bulbs, bibbs, bushings, force cups, clamps, eccentrics, galvanized iron fittings, gaskets, handles, cutter keys, wires, leather, metal, siphon rubber, water pipe, brass stems, stops, tubing, valves, waste washers, rubber washers, etc.

Virginia.

✣Bids will be received until Jan. 10 by Capt. R. B. McBride, Quartermaster, Fort Monroe, Va., for miscellaneous repairs to the deck and boiler departments of the tug Reno.

TRADE NOTES.

The Chicago office of the Ohio Ceramic Engineering Co. has been moved from 1015 First National Bank Bldg. to 555 West Quincy St., at which location it has been combined with the warehouse in which is carried a stock of standard equipment for quick delivery.

The Dayton Pneumatic Tool Co. of Dayton, O., gave a banquet and smoker to its employees on the evening of Dec. 27. After the banquet a general discussion was indulged in. The discussion was preceded by remarks from the officers of the company as regards the future business outlook, and methods best adapted to turning out their product in the best possible manner. It is the intention of the company to make this an annual event.

The Concrete Steel Co. of 29 Broadway, New York, has opened a western office in the Monadnock Block, Chicago, Ill., to which office orders, inquiries, etc., may be addressed. The western office is in charge of Mr. Fred C. Harper, Engineer. Orders for Havemeyer bars will be placed directly by the western office with the rolling mills. The Concrete Steel Co. is now rolling Havemeyer bars, both round and square sections, in Milwaukee and Pittsburg.

Mr. W. E. Davis, vice-president in charge of sales of The Goulds Manufacturing Co., Seneca Falls, N. Y., has just started on an extensive

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

trip in the interest [illegible]. He is planning to visit their representatives in Boston, New York, Philadelphia, Richmond, Pittsburgh, Wheeling, Cleveland, Warren, Cincinnati, Louisville, Chicago, St. Louis, Kansas City, Joplin, Memphis, Birmingham, Montgomery, Mobile, New Orleans, Beaumont, Houston, Galveston, San Antonio, El Paso, Phoenix, Tuscon, Albuquerque, Los Angeles, San Francisco, Portland, Seattle, Tacoma, Boise, Salt Lake City, Denver, Omaha. If [illegible]. Mr. Davis expects to complete his trip and return to Seneca Falls in March

PROPOSALS

SEWERS.

Notice is hereby given to contractors that the Board of Trustees of the Town of Williamsport, Warren County, Indiana, will on the 15th day of January, 1912, at the hour of 8 o'clock p. m., at the office of the Town Clerk in said town, let contracts for the building of sewers in said town. The work to be let is as follows:

3,845	cubic yards of excavation.
1,579	lineal feet of 4-in. sewer pipe, house connections.
4,914	lineal feet of 8-in. sewer pipe.
60	lineal feet of 10-in. sewer pipe.
500	lineal feet of 12-in. sewer pipe.
200	lineal feet of 18-in. sewer pipe.
40	lineal feet of 24-in. sewer pipe.
7	manholes.
8	lamp holes.
8	catch basins.

Plans and specifications for said work may be seen at the office of the Town Clerk of said town.

RUFUS HAUPT,
President of Board of Trustees.

PROPOSALS

WATERWORKS.

[illegible] o'clock p. m., Jan. 29th, and then opened [illegible] receiving well, pumping plant, including two 40 H.P. oil engines, two 350-gal. triplex pumps, with all necessary piping and fittings, approximately 3,000 lin. ft. 10-in. water main, fire hydrants and appurtenances.

After Jan. 10th plans and specifications may be seen at the office of the City Auditor, at the office of the Missouri Valley Engineering Company, 406 Western National Bank Bldg., Mitchell, S. D., or may be secured by making deposit of $10.00, which will be returned upon return of plans and specifications in good condition. Check for $500.00 to accompany bid.

December 29, 1911.

F. K. BERRY, Mayor.
[illegible] BINGHAM, [illegible]

DEPARTMENT OF THE INTERIOR. UNITED STATES RECLAMATION SERVICE.—Washington, D. C., December 13, 1911. Sealed proposals will be received at the office of the United States Reclamation Service, Montrose, Colo., until 4 [illegible] the construction of 12 miles of the West Canal, Uncompahgre Valley Project, in the vicinity of Montrose, Colo. This work involves the excavation of about 210,000 cu. yds. of material in open cut, and 1,750 lin. ft. of tunnel. For particulars address the United States Reclamation Service, Montrose, Colo., 519 Commonwealth Bldg., Denver, Colo., or Washington, D. C. F. H. NEWELL, Director.

PROPOSALS

SEWERS AND WATER WORKS.

Fallon, Nev.

Sealed proposals for the material and [illegible] $35,000, respectively, will be received by the City Clerk up to 7:30 p. m. of Jan. 6th and Jan. 7th, respectively.

[illegible] lin. ft. of 12-in. and 10-in. pipe sewers [illegible] tank.

Water works consists of about 30,000 lin. ft. of wood, converse steel or cast iron pipe, valves and hydrants, but no pumps, 200,000 gal. wood stand pipe and about 19,000 ft. B. M of T. & G. sheet piling work. Plans on file in office of Engineer, E. F. Osgood, Bank Bldg., Fallon, Nev., or will be forwarded by City Clerk, prepaid, on receipt of $5 per set each, said sum being subject to refund on return of papers in good condition.

Award will not be made on sewer bids until after opening of water works proposals.

Dated Fallon, Nev., Dec. 21, 1911.

W. H. REAVIS,
City Clerk.

MacLean Daily Reports

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You Simply Turn a Hand Wheel

And form an adjustment in a few seconds time, to produce any size of uniform stone from 2½ inches in diameter to sand with the

Mitchell Improved Crusher

There is no screen required, no additional power to operate a screening attachment, no cumbersome devices to make the crusher unportable, every pound of metal is converted directly into energy for crushing rock and you crush 80 per cent to any uniform size.

That means that you obtain a crusher that is so compact, light, and portable that you can always keep it at the exact location on the job where most crushing can be done with least power and labor with a corresponding saving in crusher costs when you figure the profits.

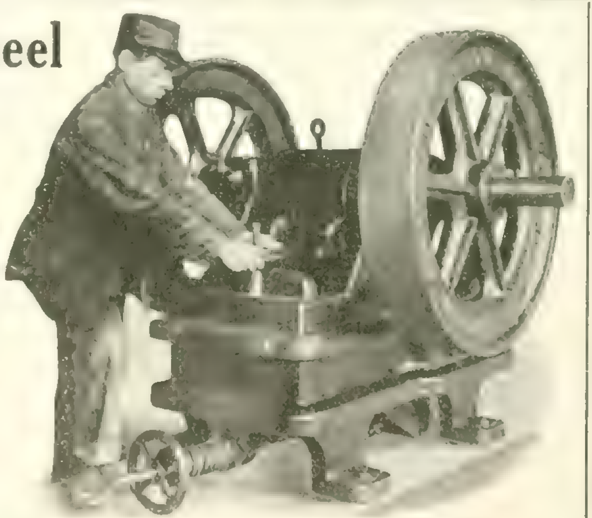
It means in road construction that you crush the coarse rock for the road bed first, then the intermediate course and finally the top dressing, and complete the work in any manner in which the rock crushing can be done at least cost with the other work of road construction.

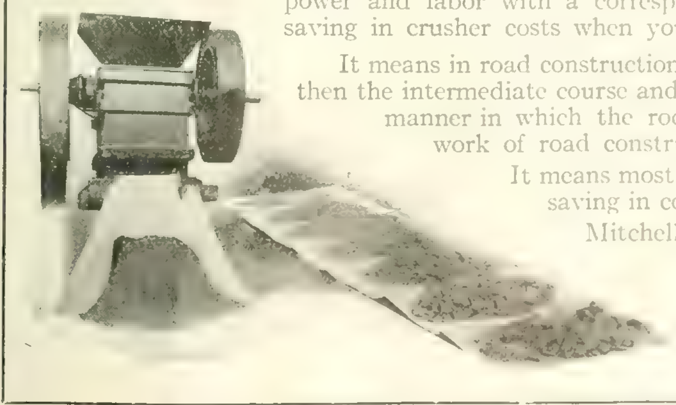
It means most money for the contractor because there is an important saving in cost of installation and a big saving in cost of operation.

Mitchell Crushers are made in capacities of 10 to 300 tons a day.

Our 60 page catalog No. 6 E. C. describes 1912 model. A copy will be sent you by first mail on request.

Eureka Stone & Ore Crusher Co.
CEDAR RAPIDS, IOWA





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The unequaled **practical** experience back of Western Dump Car [illegible] **sturdy** [illegible] they have always led in improvement is the reason for their matchless reputation for **quality** and **efficiency**—they are as [illegible]

The Western Four Yard Car

is ideal size for 3-ft. gauge. It is unbeatable in design and construction—ample capacity for heavy loads. yet of low, compact form, with bed and truck separable, steep dumping angle and automatic pivoted side boards. It is dependable in **any** service.

Sizes and styles of Dump Cars for every purpose are described in our general catalog of earth and stone-handling machinery.

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Aurora, Ill., U. S. A.

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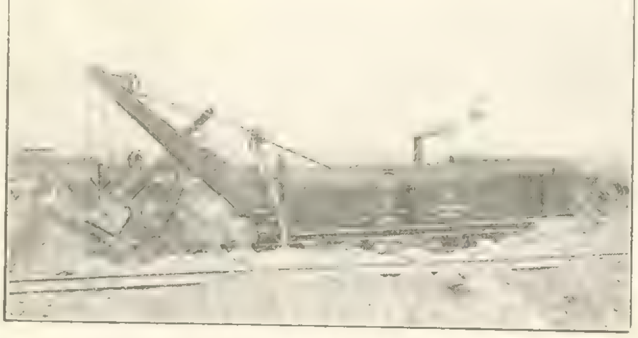

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Write today telling us your requirements, and let us quote you our prices.

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Devoted to the Economics of Civil Engineering Design
and to Methods and Cost of Construction

P[illegible]
EDITOR: H [illegible] Ill.
SUBSCRIPTION RATE [illegible] MANAGER: F. P. Burt.

Volume XXXVII. No. 2. January 10, 1912.

[illegible]
Unit Costs of Concrete Buildings of Various Types
Detailed Methods Employed in Sinking and Converting Caisson Foundations in Chicago
[illegible] .. 46

Entered as second class [illegible]
Clark Publishing Co.

Efficiency in Water Works Management.

All students of scientific management and of efficiency engineering will be pleased to note that a paper on the Coming Efficiency in Water Works Management was presented recently before the New England Water Works Association. The paper was presented by W. H. Richards, Engineer and Superintendent of Water Works and Sewers in New London, Conn. The discussion of the paper was led by practical water works men of high standing. We print the paper in full in another part of this issue.

Mr. Richardson, in concluding the discussion of his paper, wrote as follows:

> Any increase in efficiency must finally in the long run result in a saving, either a saving in maintenance, reduction in first cost, or a reduction in liability to excessive cost. Take, for instance, a dam; if built of excessive strength at excessive cost, the interest on that excessive cost must be paid forever. On the other hand, if weakly constructed, to save money, it finally goes down, causing great damage and great cost. It is apparent that it lacks efficiency in both cases. Again, if a pipe system is so constructed as to reduce the cost of repairs per mile below the average, the efficiency of the works is increased and that efficiency is measured by the reduction in the cost of repairs.
>
> An elaborate system of locating mains and other underground fixtures may require a considerable expenditure of time and thought, and will surely result after a time in the saving of money.
>
> And so it will be found on careful analysis that efficiency or lack of efficiency can always be reduced to dollars and cents.

The Engineering Meaning of a Safe Bridge.

(Contributed.)

Particular attention has lately been called to the collapse of a 122-8 highway span across Assiscunk Creek at E. Pearl St., Burlington, N. J., on Dec. 19, 1911, under a 19-ton electric car of the Riverside Traction Co.'s line, carrying ten passengers. The bridge was built in 1891 by Clark Reeves & Co. About eleven years ago arrangements were made for an electric railway to run over it and to pay one-half of the maintenance. This electric line was taken over two years ago by the Riverside Traction Co., at which time the bridge was inspected and found satisfactory.

The bridge was apparently of light construction, but not enough figures of sections are at hand to determine stresses. Both ends of the span pulled off the abutments and fell down.

The significant statement is made that "two years ago the bridge was inspected by an engineer and pronounced in a satisfactory condition," apparently for the loads it had to carry. Notwithstanding this examination the bridge [illegible] injured, but it would appear that a serious death list was narrowly averted. The question naturally arises, how many other bridges are there which are being stressed beyond the safe limit and where an accident is likely to occur at any time.

It is an old principle in bridge inspection maintenance that a bridge is not necessarily safe because it is carrying a certain loading without collapsing. It may be so close to the limit that the element of danger is always present. This applies particularly to electric railway bridges. Managers of these properties have not fully realized the need of constant inspection by a bridge engineer. They are continually purchasing second hand spans that have been in use by railroad companies and that have been taken out on account of an increase in the weight of locomotives. It is true these spans may have been carrying loads fully as great as those that they are to carry on the electric road, but the new owners fail to take into account that the railroads have as a general thing been inspecting these spans very frequently, have often placed speed restriction in going over them, and have taken them out finally when they began to indicate impending danger. These spans go into their new location, are often erected by inexperienced men, so that the metal is subjected to rough usage and unduly strained, and as they do not collapse are passed as O. K. and usually forgotten.

Now as to highway bridges that are used for carrying electric lines. The small towns and rural electric lines are not the only ones at fault in this matter. Often in large populous cities the demands of traffic have overcome the objections raised by engineers and cars which are continually being increased in weight are run over bridges in a way that might be called tempting Providence. Pressure is sometimes brought to bear on inexperienced engineers by showing them other structures no stronger than the one in question which are carrying loads as great as those proposed, and are standing up under these loads and very often the bridge is "passed as safe by the engineer." In some cases the heavier loading is put on the bridge before the "engineer" has been called in and the fact that the bridge is still standing up is used with great effect.

Electric lines are not the only offenders in this regard, however, as the following well authenticated episode will demonstrate. The names of the roads involved are not given. A certain trunk line (call it the X. Y. Z. R. R.) has a small subsidiary company, the A. B. C. R. R., which has its own motive power and its own engineering department. To get to the terminal the A. B. C. R. R. turns its trains over to the X. Y. Z. road at a junction point where X. Y. Z. locomotives are put on the [illegible] weights of locomotives are increased or new power is to be put on its lines, the effect on [illegible] them from the junction point with the A. B. C. R. R. to the terminal. The bridge engineer of the X. Y. Z. road, after careful consideration and study decided the proposed engines could not be run in this territory with- [illegible] bridges. The report was accepted and it was [illegible] Some of the A. B. C. officials decided, how- [illegible] engineer of the X. Y. Z., as an engine of this type had at various times during the preceding three months been hauling the A. B. C. trains over the X. Y. Z. R. R. from the junction point and "none of the bridges had broken down." We are pleased to say that the A. B. C. officials were fully convinced of the error of their ways after the president of the X. Y. Z. road had called them "on the carpet."

There is also another side to this question, which is certain but is equally indefinable. Many bridges are taken out long before there is any necessity of such action on account of not having proper experienced engineering investigation made of their strength. In many cases bridges that are taken out could be carried with perfect safety for ten to fifteen years, when they are taken out. This is simply because an expert bridge engineer was not called in to pass upon them. This always happens after an accident to a bridge such as the one described at the beginning of this article, at which time there is likely to be a great deal of spasmodic effort at rehabilitation. Some bridges will be taken out. These will undoubtedly in some cases not be the worst on the system. Other bridges will be left in that should have come out. The lesson does not strike home properly. The bridges across rivers or other openings are usually the vital parts of the system and none but a specialist should have the ultimate decision as to whether they are well enough to carry the loads to [illegible] taken out and replaced. With a few lamentable exceptions, the American bridge engineer can be depended on. The trouble is that the proper men are not called upon and the generally prevalent feeling that "our bridges are all right, we do not need to have them inspected." After a bridge is passed as O. K. the matter should not be allowed to rest there indefinitely. Security is only obtained by constant vigil. Inspections by trained men must be made regularly and repairs made as promptly as necessity for them develop. There should be no false feeling of security. Nearly all engine cabs have the motto "Safety before speed." The executor in charge of bridges on both electric and steam roads, and also highways, should have the motto, "Eternal vigilance is the price of safety," constantly before him.

William Coulson Armstrong, President Western Society of Engineers.

William Coulson Armstrong was elected president of the Western Society of Engineers on Jan. 5, 1912. The new president has been actively identified, for a number of years, with the affairs of the society. He has been a mem- [redacted] men chiefly instrumental in forming the Bridge and Structural Section. Mr. Armstrong first served officially for the society in 1907 on the Committee on Membership. As a member of this committee he assisted materially in the phenomenal growth which the society has had during the past few years. In 1908-9 he was a member of the Library Committee and in 1910 was elected Vice-Chairman of the Bridge and Structural Section. During the three years from 1907-10 he was Trustee and member of the Board of Directors. In 1911 he was elected First Vice President, and in this capacity was Chairman [redacted] Committee.

W. C. Armstrong

Mr. Armstrong is a native of Marshall Co., Iowa, where he was born June 21, 1859. He received his engineering education at Iowa State College, [redacted] 1881. He was a student with more than ordinary seriousness and a far-sighted purpose, and with these characteristics he deliberately set out upon graduation to get a great variety of engineering experience to fit himself for the later important work which he has done. He began his engineering experience as transitman on location and afterwards as draftsman on the Wisconsin, Iowa & Nebraska Ry., which is now a part of the Chicago, Great Western System. In 1883 he was made Chief Draftsman on that railway, which position he held until accepting a position as resident engineer on the Burlington, Cedar [redacted] charge of construction in [redacted] was employed compiling maps and drafting for a map publishing company in Minnesota. In 1886 he was employed as transitman on location work in South Dakota and resident engineer on the Chicago, Milwaukee & St. Paul Ry. in charge of construction in South Dakota. In 1887 he became resident engineer in charge of construction in Minnesota on the St. Paul, Minneapolis & Sault Ste. Marie Ry., and in 1884-9 was employed again as resident engineer on the Eastern Minnesota Ry., which road is now a part of the Great Northern System. In the service of this road he was promoted in 1890 to the position of engineer of track and bridges on the Pacific Extension of the railway. His work in this position consisted of [redacted] tion of bridges, water stations, depot buildings and all construction work which followed on about 500 miles of the coast extension of the line. In 1893 he became associated with a bridge contracting firm as engineer and held the position until 1895, when he became draftsman and engineer with the Toledo Bridge Co., Toledo, Ohio. He occupied this position for four years and resigned to become resident engineer for the Chicago & Northwestern Ry. in charge of double track cut-off construction between Boone and Ogden, Iowa. This work included the construction of the Boone Viaduct, a double track bridge over the Des Moines River, which is one of the notable via- [redacted] completed in 1902 Mr. Armstrong was appointed Bridge Engineer of the Chicago & Northwestern Ry., which position he filled until 1905, when he accepted a position as Superintendent of Construction on the Missouri Pacific Ry. in charge of construction of the Sedalia shops, the Despo gravity switching yard near East St. Louis and other construction work. In 1906 he was made Bridge Engineer of the Chicago, Rock Island & Pacific Ry., and in 1907 was called back to the Chicago & Northwestern Ry. and appointed Terminal Engineer in charge of construction work for the great new passenger terminal at Chicago. This terminal was opened for service in June, 1911. After the completion of his work as terminal engineer he was appointed Resident Engineer on the St. Louis, Peoria & Northern Ry., a new line which the Chicago & Northwestern Ry. proposes to build southward into the coal fields from its present Peoria terminus. Upon the resignation of Mr. I. F. Stern as Bridge Engineer Mr. Armstrong has again been made Bridge Engineer and in this position he will have charge of the bridge construction which he has already laid out for the Peoria line.

In Mr. Armstrong's career as an engineer, at least two notable works stand out prominently. These are the construction of the Boone Viaduct and the Chicago passenger terminal. Mr. Armstrong's position as terminal engineer placed him in charge of the preparation of all plans and the execution of all work pertaining to the track and track structures, train shed, viaducts, retaining walls and foundations, with general supervision over all construction work, reporting to the Chief Engineer. The station occupies three blocks in the downtown district of the city. Several miles of four-track elevated approaches connecting the new station with the original elevated tracks were built near the project. The construction of the terminal required careful solution of details and problems of many kinds. Incidental to the construction of the terminal was the re-elevation of the Oak Park Elevated Ry., which crosses the terminal yard at Lake St.; the simultaneous construction of the Washington St. Tunnel, the west approach of which passes under the train shed; a large number of complicated street subways; and countless other problems.

Mr. Armstrong is a member of the commission appointed by Governor Deneen of Illinois to revise and codify the building laws of the state. The legislative committee of the Western Society of Engineers, of which Mr. Armstrong is a member, was instrumental in having the commission appointed. The chairman of the commission is Prof. N. C. Ricker of the University of Illinois, and the other members are Prof. Ira O. Baker, Geo. J. Jobst, Richard E. Schmidt, Wm. H. Merrill and Wm. Sherman Stahl.

The Canadian Northern Ry. will probably have work started in the spring on improvements at Montreal, Que., which will involve the expenditure of something like $25,000,000. The plans include a 3-mile tunnel under the mountain, the electrification of all lines from Black River to the city, and an overhead line from the Lagauchetiere St. to the river front and connecting with the Harbor Commissioner's lines.

CONCRETE AND REINFORCED CONCRETE SECTION

Methods of Waterproofing Available for Various Structures and Costs of Various Waterproofing Processes.

Available Waterpr[illegible] I and II suggest the waterproofing processes to be adopted for structures and conditions of various kinds. In Table I, columns 3 and 5 give the methods of waterproofing for the different structures listed in columns 1 and 2. These methods are listed by key letters as A, B, C, etc., the essential features of which are described in Table II. Column 3 gives the method of waterproofing that may be provided for in plans and specifications for new structures or which may be employed before the construction work has advanced too far. Column 5 gives the methods available for the structures already erected and for remedying leaky conditions in such structures. The fact that a method is not listed in column 5 means [illegible] tures.

[illegible] posed walls; methods given are D, B, and C, in order of desirability Now look in column No. 7, Table II, and those following for description of the methods D, B, and C. For the foundation to resist water pressure under walls, G, K, L, M, are given in order of desirability, but G is omitted if walls are not reinforced. The remarks point out some special features such as for L and M, "Asphalt not to be used in ground polluted by gas drip, oils, etc.," that injuriously affects it. This is an important precaution

It is not claimed that the arrangement of methods will in all cases be decisive or that some methods not listed may not be employed, but the use of the table will prevent such glaring but frequent mistakes as using a surface coating for sub-surface work or using a wash on the inside of cellar walls, to waterproof against pressure and in other ways prevent the use of wholly unfit methods.

[illegible] *Place, of Processes Listed in Table I.*—Tables III to V give approximate cost of different classes of waterproofing which may be used as a basis for comparing relative economy of the methods selected from the table:

A.—Sylvester process, ½ ct. to 4 cts. per [illegible]

B, D.—Dampproofing masonry walls, two coats applied in place, 2 cts. to 4 cts. per square foot. Material costs about $1 to $1.50 per gallon.

[illegible], 5 cts. to 8 cts. per square foot.

F.—Adds about 10 per cent to the cost of untreated mass concrete. See Table III for details of cost of materials.

G.—Cement coatings with waterproofing compounds; 1 in. on floors, ½ in. to ¾ in. on walls, 8 cts. to 30 cts. per square foot, depending upon conditions. For cost of compounds only, see Table III.

I.—Hot coal tar, pitch, and felt. Horizontal

TABLE I.—METHODS OF WATERPROOFING AVAILABLE FOR VARIOUS STRUCTURES.

Nature of Structure.	During Construction. (New Work.)	Remarks.	After Construction. (Old Work.)	Remarks.
Buildings.				
Exposed Walls	D B, C	For Damp Proofing Only. For Damp Proofing and Preservation of Stone.	B, C	D. Principally for Brick and Stone Walls. Not Advisable on Smooth Concrete Walls.
Superstructural Floors	I, K, J, G, M	For Bath Rooms and Floors Liable to be Wet.	G, M	
Foundation Pits	[illegible]	For Resisting Dampness Only.	G	For Dampness Only or Pressure Work.
Foundation Trenches	[illegible]	For Resisting Dampness Only.	G	
Foundation Footings, Walls and Floors	[illegible]	For Resisting Dampness Only.	G	
Walls, Reinforced	[illegible] K, L, M	[illegible]	G, M	For Resisting Water Pressure.
Walls, Not Reinforced	K, L, M	For Resisting Water Pressure.	G	For Resisting Water Pressure.
Floors, Reinforced	G, K, L, M	For Resisting Water Pressure.	G	For Resisting Water Pressure.
Floors, Not Reinforced	K, L, M	For Resisting Water Pressure.	G, M	For Resisting Water Pressure.
Column Footings, Heavily Loaded	O			
Concrete Block, etc	G, B, C			
Preservation of Stone	B, C	Also for Preventing Efflorescence.	B, C	
Railroads.			B, C	
Subways and Tunnels	K, L, M, G		G, H	
Bridges	N, [illegible] M		G, M	
Culverts	F		G, A, B	
Retaining Walls, Arches	E, F, K, L		G, A, B, H	
Water Supply and Sewerage.	E, F, K, L, M		G, A, B, H	
Reservoir Banks	K, [illegible]		K, L, M	
Dams	E, F, H			
Conduits	E, F, G		[illegible] B	
Tanks	G, F, B		[illegible] A	
Chambers	G, F, B, A		G, B, A	
Sewers	[illegible] E			
Manholes	F, G		[illegible] H	
1 2	[illegible]	[illegible]	[illegible]	6

TABLE II.—INDEX AND DESCRIPTION OF WATERPROOFING METHODS LISTED IN TABLE I.

Method.	Classification.	Material Employed.	Manner of Application.	Position in Structure.	Thickness, Etc.	Remarks.
A	Surface Coating	Solutions of Alum and Soap (Sylvester Process)	[illegible]	[illegible] Surface	4 to 7 Coats	Applicable to New or Old Work. Not to Underground Work.
B	Surface Coating	Paraffine in [illegible] Solution	[illegible] Paint	[illegible] Surface	2 to 3 Coats	" " " " Also a Preservative for Building Stone
C	Surface Coating	Melted Paraffine Wax Applied Hot	[illegible]	On Exterior Surfaces (Surfaces Previously Heated)	Penetrates ¼ to ½ inch	Also a Preservative for Building Stone
D	Surface Coating	Proprietary Bituminous Compounds, Applied Cold	As a Paint	On Interior Surface	2 Coats	Used also as a Substitute for Furring and Lathing
E	Integral or Rigid	Masonry or Concrete Correctly Proportioned				Available Only During Construction.
F	Integral or Rigid	Masonry or Concrete Correctly Proportioned with Cement Water-Proofing Compound	In the Body of the Work			Available Only During Construction.
G	Integral or Rigid	Cement Mortar with Compound	As a Plaster or Stucco	On Interior Surface	[illegible] on Floors [illegible] on Walls	For New Work or Remedying Defective Work.
H	Integral or Rigid	Cement Mortar or Bituminous Grout	Pumped Under Pressure	In Interor of Mass		Employed Principally to Fill Voids Otherwise Inaccessible.
I	Membrane or Elastic	Asphalt or Coal Tar Pitch with Felt or Burlap	In Alternate Layers	On Surfaces Exposed to Water	1 to [illegible]	Applicable Only During Construction for Subsurface Work. To Resist Dampness Increase Thickness According to Pressure.
J	Membrane or Elastic	Proprietary Bituminous Compounds, Applied Cold with Felt or Burlap	In Alternate Layers	On Surfaces Exposed to Water	1 to 3 Ply	
K	Membrane or Elastic	Coal Tar Pitch Applied Hot with Felt	In Alternate Layers	On Surfaces Exposed to Water	[illegible]	For Water Pressure Work.
L	Membrane or Elastic	Asphalt Applied Hot with Felt or Special Fabrics	In Alternate Layers	On Surfaces Exposed to Water	2 to [illegible] Ply	Asphalt Not to be Used in Ground Polluted by Gas Drip, etc.
M	Membrane or Elastic	Asphalt Mastic or	As Plaster or Coating	On Surfaces Exposed to Water	¼ In. to 1 In	
N	Membrane or Elastic	Asphalt Mastic Alternating with Saturated Felt Layers		On Surfaces Ex-[illegible]	¼" to 1" Mastic [illegible] Ply Felt	Useful Particularly for Bridge Waterproofing Subject to Vibration.
O		Sheet Lead or Copper		Under Column Footings		Used as Substitute for Felt When Column Loads Are Very Heavy.
7	8	[illegible]	[illegible]	11	12	13

•Extracts from a paper by Myron H. Lewis before the American Society of Engineering Contractors.

TABLE III.—APPROXIMATE M[illegible] [illegible], IN PLACE, OF VARIOUS INTEGRAL WATERPROOFING COMPOUNDS

Material (Trade Name.)	Sold By—	Sold for About—	Proportion Recommended.	Approximate Cost of Compound Only, for Mortar [illegible] Thick, for 100 sq. ft. Cement [illegible] Sand	[illegible]	[illegible]	Approximate Cost of Compound Only, in Mass Concrete. 1:2:4.	1:2:5.	1:3:6.
Powders									
Medusa	Sandusky Portland Cement Co.	10c to 12c per lb.	2 lbs. powder to 1 bag cement.	[illegible]	70c to [illegible]	[illegible]	$1.[illegible] to $1.[illegible]	[illegible]	[illegible] to 80c
Hydratite	A. C. Horn Co.	"	2 lbs. powder to 1 bag cement.	[illegible]	[illegible]	[illegible]	$1.1[illegible] to $1.25	[illegible] to $1.1[illegible]	70c to 80c
McCormick	McCormick Waterproof Portland Cement Co.	7c per lb.	2 lbs. powder to 1 bag cement.	65c	[illegible]	[illegible]	[illegible]	65c	55c
Toxement	Toch Bros.	12c per lb.	2 lbs. powder to 1 bag cement.	[illegible]	80c	[illegible]	$1.25	$1.00	80c
Keystone	Harrison Waterproof Materials Co.	8c to 10c per lb.	2 lbs. powder to 1 bag cement.	70c	60c	50c	80c to $1.00	75c to 90c	60c to 75c
			For Mortar Coats Paste. Water.						
Pastes:									
Integral, No. 1	Leaw Bros., Asbury Park, N. J.	$1.00 per gal	[illegible] 20 gals.	70c	65c	60c	—	60c	55c
Integral, No. 2	Leaw Bros., Asbury Park, N. J.	1.75 per gal	1 gal. [illegible] gals	[illegible]	45c	[illegible]	—	45c	40c
Ceresit	Ceresit Waterproofing Co.	1.25 per gal	1 [illegible] 12 gals.	$1.[illegible]	[illegible]	$1.35	$1.20	$1.10	$1.00
Truscon	Trussed Steel Concrete Co.	1.25 per gal	1 gal. 12 gals.	1.40	1.35	1.20	1.20	1.10	1.00
Aquabar	Girvan Nachod Co.	1.[illegible] per gal	1 gal. 24 gals.	1.00	92c	85c	90c	85c	80c
Lapadas	Hydrobar Waterproofing Co.	1.25 per gal	1 gal. 15 gals.	$1.[illegible]	$1.30	$1.25	$1.10	$1.00	[illegible]
			For concrete, use ½ the quantity of paste given above.						

TABLE IV.—MEMBRANE WATERPROOFING COMPOUNDS.

(For cost in place, see Table 2.)

	Sold by	
R. I. W.	Toch Bros.	Prices range from [illegible] to $1.[illegible] per gallon, according to quantity, locality, etc.
Dehydratine	A. C. Horn Co.	
Insulite	Girvan Nachod Co.	
Elaterite	Elaterite Co.	
Truscon	Trussed Steel Concrete Co.	
[illegible]	Rubberolene Mfg. Co.	
Hydrex	Hydrex Felt & Eng. Co.	
Standard Asphalt and Coal Tars	Barrett Mfg. Co. Sicilian Asphalt Paving Co. Barber Asphalt Paving Co. Standard Asphalt Rubber Co., Etc.	

PRINCIPAL MEMBRANE FABRICS.

Barrett Spec. Felt.	Barrett Mfg. Co.	Prices range from 25 cents to $2.00 per square of 100 square feet.
Hydrex	Hydrex Felt & Eng. Co.	
[illegible]	Sicilian Asphalt Paving Co.	
[illegible]	Girvan Nachod Co.	
[illegible]	A. C. Horn Co.	

EXPOSED SURFACE WATERPROOF COMPOUNDS.

Solutions of waxes in volatile carriers, made by many leading waterproofing concerns, sold under various names at prices ranging from 75c to $1.50 per gallon. For details of cost, etc., see Tables I and II.

TABLE V.—ESTIMATING TABLE FOR INTEGROL PASTE.*

At $1.00 per gallon (net bulk price at this date.)

Character of Structure.	Proportions. 1 Gal. Paste to No. Gals. Water.	No. Gals. Paste to 1 Cu. Yd.	Required Thickness in Structure.	Area, Etc., 1 Gal. Paste Will Waterproof.	Unit Cost of Paste in Place.
Concrete Blocks:					
Face of Blocks	20 gal.	2	1 inch.	162 sq. ft.	$.0062 sq. ft.
Body of Blocks	40	¾		36 cu. ft.	.0277 cu. ft.
Stucco	20	2	⅜	216 sq. ft.	.0031 sq. ft.
Mass Concrete	40	½		54 cu. ft.	.0185 cu. ft.
Mortar for Joints	20	1½	¾	432 sq. ft.	.0016 sq. ft
Grout	60	1		27 cu. ft.	.0370 cu. ft.
Integrol Cement Coatings:					
Walls (Damp Proofing Only)	30	1½	½	324 sq. ft.	.0031 sq. ft.
Walls (Pressure Work)	15	2½	⅝	260 sq. ft.	.0040 sq. ft.
Floors (Damp Proofing Only)	30	1½	¾	216 sq. ft.	.0031 sq. ft.
Floors (Pressure Work)	15	2½	1	162 sq. ft.	.0062 sq. ft.
Tanks, Reservoirs, etc.	15	2	⅝	260 sq. ft.	.0040 sq. ft.

*Note.—For No. 2 Integrol, 40% of above quantities of paste is required; and unit cost, at $1.75 per gallon, is 75% of above costs.

surfaces: first ply, $2 to $4 per square (100 sq. ft.); additional plys, $1.50 to $2.50 per square; vertical surfaces add 10 per cent to 25 per cent.

J.—Cold process, felt or burlap, same as commercial asphalt.

K.—Pressure work, 1 ply, $4 to $5 per square.

L.—Commercial asphalt and asphalt felt, add 15 per cent to 60 per cent per ply, depending upon conditions.

L.—Special asphalts and felts, add 30 per cent to 50 per cent per ply. Black compounds sell for 75 cts. to $1.25 per gallon.

M.—Asphalt mastic, 1 in., 15 cts. per square foot.

Naphthalene in Road Tars.—The U. S. Office of Public Roads has issued recently the [illegible] of naphthalene in road tars. Tars used as road binders are for the most part soft pitches obtained by distilling from 15 to 30 per cent of the lighter products from the crude material. The soft pitch contains a large proportion of the naphthalene which may have been present in the original tar, and it is the study of the effect of naphthalene upon this grade of material that is the subject of this paper. Various tests were made by the Chemists of the Office of Public Roads, the results of which, according to the paper, indicated the following: (1) That the fluxing calue of naphthalene for tar pitches is somewhat greater, although quite similar, to the heavier naphthalene-free tar distillates, until the mixture becomes saturated with naphthalene; (2) that for the harder tar pitches the addition of very small percentages of naphthalene will produce a marked increase in fluidity of the resulting product; (3) that for the softer pitches the addition of naphthalene in small quantities causes less increase in fluidity than for the harder pitches; (4) that where naphthalene is added beyond the point of saturation a rapid decrease in the fluidity of tars at temperatures below the melting point of naphthalene is observed, but at temperatures above its melting point the fluidity continues to increase.

Unit Costs of Concrete Buildings of Various Types.

The costs given in the accompanying table have been compiled by Lockwood, Greene & Co., Boston, Mass., as estimates of the approximate costs of reinforced concrete buildings of various types. These engineers have had an extended experience in the line of work covered by the table and their estimates based on actual costs are of exceptional interest.

Coal pockets above 3,000 tons capacity cost from $6 to $7.50 per ton. Reinforced concrete stand pipes above the foundations cost from 2½ to 3 cts. per gallon.

UNIT COSTS OF VARIOUS TYPES OF REINFORCED CONCRETE BUILDINGS.

Type of Building and Dimensions.	[illegible]	Cost above foundation, [illegible] ft.	Cost above foundation, cu. ft.	Cost including foundation, sq. ft.	Cost including foundation, cu. ft.
Machine shop, 120x50 feet, 4 stories	150	$1.05	$0.08	$1.17	$0.09
Machine shop, 220x100 feet, 1 story*	...	1.65	0.09	1.75	0.10
Cartridge factory, 223x56 feet, 2 stories	300	1.40	0.09	1.55	0.10
Cotton mill, 550x129 feet, 2 stories	75	0.99	0.07	1.06	0.075
Weave shed, 341x231 feet, 1 story*	125	1.66	0.064	1.79	0.07
[illegible] x62 feet		2.53	0.115	2.67	0.12
[illegible] feet, 4 stories		1.08	0.065	1.15	0.07
Store house, 256x100 feet, 12 stories	[illegible]	[illegible]	0.09	0.98	0.105
Store house, 223x56 feet, 2 stories	300 & 1,000	1.20	0.08	1.35	0.09

*Sawtooth skylights.

EARTH AND ROCK SECTION

Detailed Methods Employed in Sinking and Converting Caisson Foundations in Chicago[*].

Contributed by [illegible]

The f[illegible] wing is an [illegible] developed for supporting the [illegible] column and wall loads [illegible] ings in Chicago. It is applicable in all cases where similar conditions occur.

The down town district of Chicago is bounded on three sides by water: Lake Michigan, the Chicago River and the South Branch. Bedrock (limestone) is found at an average of about 110 or 115 ft. below the street level, overlaid with glacial and sedimentary formations. Figure 1 shows a typical caisson and the material encountered. The top of this caisson is at the basement level about 15 ft. below street grade, which is 15 to 20 ft. above water level. The water level is practically constant. Although all of the materials are moist, only the sand and gravel are sufficiently pervious to produce water. The hardpan, in fact, is almost bone dry.

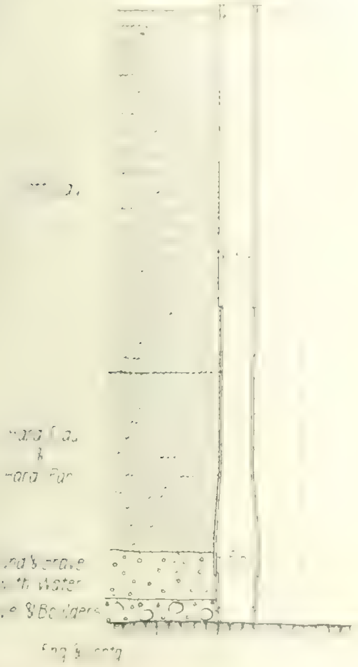

Fig. 1—Section of Typical Caisson Showing Progress and Number of Men Working Per Shift.

The top of the rock is usually not satisfactory for a footing. Glaciation has shattered it, producing 2 feet or more of "shell," which can be removed in fragments. As a rule it is not difficult to determine when the solid formation has been reached. An inspector striking a sharp blow with a pick a few inches from his feet can feel a distinct tremor in the "shell." Where there is not sufficient water and mud flowing in to obscure the surface the appearance also is different. Limestone, being a sedimentary formation, occurs in layers and even good rock will break off in ledges with the fragments showing flat surfaces. However, if the lower side of a removed fragment shows a black film of mud adhering, it is evident that it had no solid attachment to the underlying bed. By following along such a "sand seam" with pick or ball point this layer of "shell" can be removed over the entire bottom of the caisson, several layers, usually 4 to 8 ins. thick, often have to be removed.

[illegible] liability to collapse [illegible]

the [illegible] depth of about 18 ins. less than the length of the first set of lagging which is some times 6 [illegible] ins. trimmed carefully to exact diameter. Skilled diggers can trim a hole true within a variation of ½ in. In the soft clay a variation of over 1 in. is seldom permitted unless settlement of the surrounding ground is of no moment.

It may be well here to describe the lagging and rings. The lagging is pieces of 2 or 3 in. planking tongued and grooved. The standard lengths are 4 ft. and 5 ft. 4 ins. Six and 8 ft. lengths are used for the special purposes herein mentioned. The 4 ft. lagging is usually 3 ins. thick and the 5 ft. 4 in., 2 ins. thick. The planks are about 6 ins. wide, but for reasons given later, some slight variation is desirable. One edge is cut beveled in order to make a closer joint when the lagging is placed in the caisson. The lagging is placed as the staves of a barrel, and the bevel should correspond to the average diameter of the caissons.

The rings (Fig. 2) are pieces of ¾x3 in. or 1x4 ins. steel bars, bent to the required diameter with projecting lugs. The lugs are punched for bolts as shown.

A set of lagging with a ring near the top and bottom is placed in the trimmed hole mentioned above. The tongue of one plank is matched with the groove of the next and driven close home with a sledge. When the circle is almost completed the workmen select the last one or two planks of a width suitable to complete the closure tightly. It is for this purpose that some variation in width is desirable. In order to hold the lagging together at the top where the hole is wide a rope is passed around.

When the lagging is completed the space between the lagging and the sides of the hole is filled with clay well tamped. The tops of the planks should extend a few inches above the general level and the clay be carried to the same height in order to prevent surface water running into the hole. The entire operation of starting the hole, placing the first set of lagging, and tamping is known as "topping." A "topped" caisson may be immediately continued or be covered and left for several days or weeks.

After a caisson is "topped" a substantial platform of 3-in. planking is built over it, either laid directly on the top of the lagging or higher as may be more convenient. A hole about 30 ins. square is left in the platform as near the center of the caisson as surrounding structures will permit. This hole is to allow the passage of the bucket. (Fig. 3). On one side of the hole a dumping block of 10x10 in. or 12x12 in. timber is placed. This greatly facilitates emptying the bucket.

The bucket is of heavy galvanized iron with steel straps. It should be made water tight. The bail is made of ¾-in. round steel and should be so made that the bucket can turn clear through it. A latch is shown at the top of the bucket on the right. This is merely an L-shaped piece of bar steel punched with a hole at one end to slide along the bail. The long end, shown dotted, slides into an eye formed by riveting to the inside rim of the bucket another flat piece behind which it slides. For easy dumping the bucket is pivoted at half height, and the latch prevents [illegible]

small diameter a somewhat smaller bucket is found convenient.

Over the platform is placed a tripod (Fig. 4) made of wood and bolted together. A block, [illegible] of 1 in. diameter is given several turns round the capstan, or "niggerhead" then led through the block and down into the caisson through the hole in the caisson. A hook on the end [illegible] bail.

As the rope must be long enough to reach to the bottom of a completed caisson there is a great deal of spare length in the early stages of excavation. This spare rope is coiled and tied at several points to prevent uncoiling. The coil is suspended by a swivel from the upper part of the tripod. The swivel permits taking out kink producing twists. Canvas covers are spread over the tripods in wet weather in order that the rope may not become wet and slip on the capstan. The resulting appearance of a caisson job is strikingly like that of an Indian encampment.

The capstan is driven by a ⅝-in. wire cable passing round the sheave wheel. The shaft [illegible] in diameter and passes through holes in the two 3-in. planks. The holes are well greased, but not bushed. Excavated material is hoisted in the buckets by a man overhanding the manila line over the capstan. For proper handling the capstan should make 30-50 R. P. M. In lowering the bucket the winchman takes several turns round the capstan to give him control and slacks off the line. The fact that the capstan is turning in the opposite direction presents no difficulty beyond a slightly increased wear on the rope. Winchmen usually drive several large nails in the tops of the 3-in. planks at such a distance apart that the rope may be bent back and forth between them, thus holding the bucket stationary without their attention. Winchmen also should wear gloves or "hand leathers" on their hands to protect them from burning if the rope is allowed to slide. Foremen should pay some attention to this point. A rope paid out too rapidly may jump off the capstan and let the bucket drop on the diggers' heads.

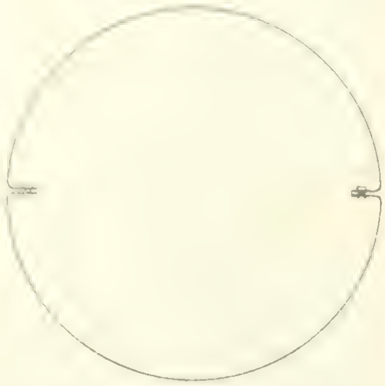

Fig. 2—Ring for Bracing Lagging.

The ⅝-in. wire cable mentioned above is made endless, passed round the sheaves of several caissons and finally round the driving sheave of the source of power. Any power may be used, but the customary equipment is a steam hoisting engine with a sheave rigged on one of the drums. The number of caissons which may be driven by one engine varies with the rapidity with which material is being excavated. The sheaves turn constantly, the ascent and descent of the buckets being controlled by the winchmen as described above. In general an 8x10-in. double cylinder engine will handle 8, 10 or even 12 caissons. If it happens that too many loaded buckets are hoisted simultaneously the engine will stall.

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[*] These notes are based [illegible] as engineer for contractors [illegible] foundation work.

Enough buckets must then be loaded to permit the engine to start.

If the caissons are not all in line they may none the less be operated on a single cable by means of idler sheaves. An idler rigged with block and tackle for taking of slack must be provided, or, if the cable is high enough in the air, an idler with a heavy weight suspended will perform this function automatically. If isolated caissons prove too inconvenient to rig a hand winch may be substituted for the tripod and capstan.

Considering a caisson "topped" and rigged with platform and tripod the procedure is as follows:

Workmen descend in the bucket and excavate to a depth sufficient for another set of lagging. The lagging with its rings is then placed and the digging resumed. The excavation is at first rough and later trimmed to the proper diameter. Experience diggers acquire an almost incredible skill in trimming but, as a record is kept of the progress of each crew, they object to being compelled to exercise it.

The clay in the upper part of the caissons is soft enough to be removed with shovels alone. It sticks badly and for this reason a bucket of "digging water" is occasionally sent down. A sump is always kept at one side of the hole, so that the shovels can be dipped in the water. The clay then slides off easily. When the bucket is full it is hoisted to the top and dumped. Before hoisting, however, an empty bucket previously held just over the men's heads is lowered so that no time is lost in waiting for buckets.

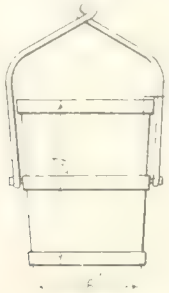


Fig. 3—Sketch of Bucket for Hoisting Excavated Material.

The soft clay adheres to the bottom of the buckets, rendering dumping difficult. A few loose shingles or short pieces of plank placed in the bucket greatly lessen the trouble.

The top formation of clay is quite soft and all through this material the 3 in. x 4 ft. lagging is used. Further, if unusually heavy pressures are expected, as next the footing of an adjoining building, three rings to each set of lagging are required. Occasionally, especially in caissons of large diameter, segments of timber, cut to the curve of the lagging, are used and braced apart by jackscrews at either end.

As the excavation progresses the clay becomes harder and dryer. When it is so firm that it can no longer be shoveled, but requires grubs, a change is made to 2 in. x 5 ft., 4 in. lagging with two rings. No fixed rule can be given for the thickness of lagging or for the number of weight of rings for the reason that specifications leave the determination of these points to the architect's representative. In general 1x4 in. rings are used for all caissons in soft clay and all caissons 8 ft. or more in diameter and ¾x3 in. rings for caissons less than 8 ft. in hardpan. Figure 1 shows the change from 3 in. to 2 in. lagging.

The hardpan is a tough, black, sandy clay containing fragments of rock. It is occasionally so hard that even grubs will not dig it and picks must be used. Obviously such material is not likely to cave or settle, therefore the accuracy of trim requisite in soft clay is not insisted on.

If the footing is to be on hardpan the caisson is "belled" as described later to provide a greater bearing area and concreted. It is a nice point of judgment to decide at what depth to place a hardpan footing. The material must have become hard enough to support the load; on the other hand, every foot dug into the hardpan is just so much less firm material over the softer formation below, and detracts just so much from the security of the footing.

Though not shown in Fig. 1, which represents an actual caisson, a fine, compact, gray sand, which, when wet, becomes quick sand, is sometimes found under the hardpan in beds up to 8 or 10 ft. thick. It also occurs in pockets or lenses through the hardpan. This sand when just damp enough, will stand with a vertical face while a 5 ft. 4 in. length of lagging is excavated and placed. On the other hand it is highly unreliable, caves of several cubic yards occurring with almost no warning. Furthermore when the excavation is almost completed quicksand may be found. For these reasons it is advisable to use the 4 ft. lagging through the sand formation. The writer can recall several instances where a 4 ft. length could have been easily placed and the attempt to continue to 5 ft. 4 ins. resulted in 24 hours work of four or five men, to say nothing of special anxiety on the part of the superintendent in charge, plugging a cave.

The formation marked "sand and gravel with water" will not stand in a face, but runs. Hence the lagging must be driven as sheeting. Before this can be done the caisson must be "belled," that is, its diameter increased the amount necessary in the case of the caisson shown, 18 ins. This is accomplished by introducing wedge shaped lagging planks, one for every three or four straight pieces. In Fig. 1 the 18 ins. is made in two lengths of 5 ft., 4 in. lagging. A 5 ft., 4 in. set of straight lagging is placed under the "belling sets" in order to give the "driving sets" a straight face to work against. Belling must be started early enough to insure the possibility of placing the straight set. If the first caisson sunk shows the "belling" to be unnecessarily high, it may be placed lower in succeeding caissons, but no chances should be taken on the first one, for if a mistake is made it is necessary to refill several feet with clay or sand and redig.

Excavation progresses below the straight set until the material begins to run. A "driving set" of 2 in. x 6 ft. lagging is then placed. The bottoms of the planks are sharpened to a cutting edge. The sharpening is done all on one side and the planks are so placed that the tendency on driving is to crowd against the circumference of the hole. The two planks opposite the lugs on the rings of the straight lagging are omitted. The "driving sets" are driven and excavation carried on as in any sheeted excavation. A lap of 4 to 6 ins. is left over the straight set, clearly shown in Fig. 1. When the lagging has been driven almost its full depth the tops of the planks below the rings of the preceding set and the omitted planks can be inserted. If the material is so fluid as to run through the space temporarily left open short pieces of board or shingle can be slipped behind the lagging, spanning the slot. These in no way interfere with subsequently placing the lagging.

As several "driving sets" each overlapping the other are generally necessary, it is obvous that the successive reductions of 4 ins. 2 ins. on each side, the thickness of the lagging in the diameter of the caisson would result in a bottom diameter less than the top were it not for the "belling."

Near the bottom much water is often encountered. Occasionally several successive eight-hour shifts will send up nothing but water. If it is eventually found that water cannot be bailed fast enough to permit progress an electric motor individual hoist is some times rigged over the caisson. This hoist will handle buckets much more rapidly than the capstan. If even this proves inadequate a pump of the Nye, Emerson or Pulsometer type can be slung on a rope and suspended in the caisson near enough the bottom for satisfactory suction.

When rock is reached, the "shell" removed, and the inspector's approval obtained, concreting begins. If there is a considerable leakage of mud between the bottom of the lagging and the rock the inspector may require several bags of dry cement to be spread round the bottom of the lagging to make a seal. The writer doubts the efficacy of this procedure, but it is a standard practice.

If several caissons are being sunk simultaneously and close together, it may be desirable to defer concreting of the first one for the reason that keeping a pump working in it will often hold the water level low enough to eliminate almost all water troubles in the neighboring caissons.

The concrete is mixed at the surface and dumped from wheelbarrows or cars. The only precautions necessary are the rigging of hoppers or baffle boards at the surface to ensure the concrete falling straight and down the center. As fast as the concrete reaches a ring the ring is removed and kept for future use. Ordinarily two rings at a time are removed, the upper one on one set of lagging and the lower one of the next set above. The lagging is not removed.

It is, of course, desirable that a whole caisson should be concreted in one operation except for stops necessary for removal of rings However, if concreting is stopped for any length of time some responsible person should satisfy himself that the top surface is level in order that the concrete subsequently placed may have a fair bearing.

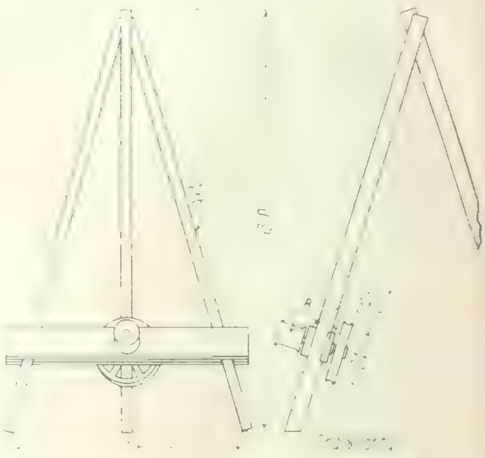


Fig. 4—Sketch of Hoisting Tripod.

It is essential that concreting shall proceed with no interruption except for removing rings until the highest point at which water was encountered is reached, otherwise water flowing in at the bottom of the caisson may work through and wash out the cement.

As a rule the rings of the driving sets are not removed because the nature of the material renders the danger of collapse too great. The exact number of rings to be left in is determined by the inspector.

SPECIAL DETAILS OF PROCEDURE.

While the general procedure has been covered some description of details is desirable.

The sinking of a caisson is kept true by means of plumb line and "sweeps." The "sweep" is merely a stick cut to the exact radius of the caisson at the outside of the lagging. A nail is driven through the stick 2 or 3 ins. from one end for 2 or 3 in. lagging respectively. Consider that a set of lagging has just been placed. The diggers excavate, keeping true by eye, until they are deep enough for another set. A single piece of lagging kept in the hole easily determines this point. When the excavation is complete, the plumb line is lowered and the center of the hole marked by a spike or small stake driven in the bottom. The sweep is swept around in a circle from this center and the sides of the hole at the bottom trimmed to a true circle. By using the single piece of lagging previously mentioned as a straight edge and taking the trimmed circle at the bottom and the preceding set of lagging at the top as guides the trimming is completed. An expe[illegible] the straight edge, their eyes being quite sufficient.

[illegible] points round the bottom. The two halves of a ring are then lowered, placed on the blocks and bolted loosely together. By holding the nail in the sweep on the center spike the ring can be centered. Lagging is then started at two or more points round the circle and when suffi[illegible] the ring large wire nails (40) are driven into a few [illegible] the ring and clinched over the ring. The blocks are then removed and the lagging completed. As the lagging progresses any spots found to be trimmed [illegible] rammed behind the lagging. [illegible] slightly excessive [illegible] have been made of slightly too small diameter, separators with a hole for the bolt placed between the lugs of the two halves of a ring will eliminate the difficulty. In anticipation of this trouble a few extra long bolts should be kept on the job. If the overtrimming has been serious, an inspector may order enough additional trimming to permit the placing of a [illegible] further, have authority to order the discharge of diggers who habitually overtrim or otherwise show carelessness or incompetence. After the lagging is all placed a few spikes are driven at the proper height to support the next ring, middle or top according to whether three or two rings are used. After all rings are placed and bolted, spikes are driven over and under the rings and clinched over them every third or fourth plank. If, on account of any irregularity in the rings, there is a space between the rings and the lagging, shingles are driven in to form a good bearing. A spike is then driven through the shingles into the lagging and clinched over the ring. The shingles should be inserted from the top that they may not drop out. If the hole has been insufficiently trimmed a great deal of sledging is required to place the upper ring. The same difficulty occurs with rings made slightly too large or untrue, or with rings used the second or third time which have become untrue through previous sledging, etc.

The lower ring of a "driving set" is placed early in the driving and carried down with the lagging. The upper ring is not placed until the driving is complete. "Driving Sets" are kept plumb by inserting wedges behind the tops of the planks, on the side which shows a tendency to crowd into the hole. The bottom of the planks are thus forced out. There is never any difficulty on account of lagging working too far into the bank, as the pressure of the material will always force it in until it is stopped by bearing against adjacent planks. The excavation can often be kept a few inches ahead of the bottom of a "driving set," which greatly facilitates the operation. The lagging then has only to be driven against the frictional resistance of the material along its sides. It is easier also to keep it plumb. "Driving sets" have a tendency not only to get out of plumb, but also to deviate from a true circle. For this reason it is advisable to bell somewhat more than the amount required by the overlapping thicknesses of lagging. An inspector will usually require that the nominal radius of the caisson swung from a suspended plumb line shall not touch the sides at any point. Small deficiencies of 1 or 2 ins. are often overlooked, especially if there is a corresponding excess on the opposite side.

"Belling sets" should always be securely anchored to at least two sets above in order that there may be no danger of their dropping out of place.

The running into the caisson of quicksand or other flowing material through small openings is greatly lessened by ramming in hay.

Boulders are frequently encountered. If they lie entirely within the caisson they are broken up and hoisted in the buckets. If they project in from one side they are either broken off or worked into the caisson and the cavity plugged according to size. Rarely a very large [illegible]

is then [illegible] Saturday to [illegible] Sunday. Caissons [illegible] would be in water over Sunday and resume operations the following week.

The crew for a caisson consists of a laborer dumping, a winchman and one to five diggers [illegible] four in a 6 ft. However, in soft clay two men will dig all that can be handled by the bucket.

W[illegible] union control. Wages are 52½ cts. per hour for diggers, 47½ cts. for winchmen, and 37½ cts [illegible] Sundays and holidays, and time and a half for overtime. The day is eight hours, and the week 5½ days. On three shift work the sixth shift for any crew is counted as Saturday afternoon [illegible] midnight Friday to 8 a. m. Saturday receives time and a half for the last four hours. Fifteen minutes for lunch is allowed in the middle of each shift with no deduction of pay. The employer provides water-proof clothing and hats, but not boots, for rainy weather or wet holes. Pressing on the top of a shovel would quickly ruin a rubber boot. Diggers therefore provide themselves with "foot irons" which are merely pieces of iron, often made of an old shovel blade, in the shape of a trough without ends. The foot is slipped into the trough and two straps attached as to a skate to hold it on.

The caissons are lighted by incandescent lights on long cables lowered as work progresses. All directions are shouted to the winchmen by the diggers. In a hole 4 ft. in diameter and 100 ft. deep considerable confusion sometimes occurs, and while he knows of no instance in which it has been done, the writer is of the opinion that the installation of a bell signal system would be well worth while. A few rope ladders should be kept on hand in case of an accident to the engine.

The horizontal lines at the right of Fig. 1 represent the depth at the ends of eight-hour shifts. The figures indicate the number of men working exclusive of the dumper and winchman. In "topping" no winchman or dumper is required. The line is omitted at the end of the first shift for the reason that all of the first shift and part of the second was necessary for "topping." During "topping" two of the men were diggers and the third a laborer. The unequal progress by different shifts is accounted for by the fact that one shift will leave just at the end of digging, leaving the trimming and lagging to their successors.

If a line of caissons is under a party wall, or adjacent to footings of other structures, specifications often require that only alternate caissons may be dug, and these concreted before the remainder can be started. For this reason, also to economize plant, caissons are sunk in three or more successive sets. A great deal of skill is required in laying out the job for convenience of rigging and to prevent one operation interfering with another or with storage of material.

Some South African Experiments in the Use of Water Jets in Drilling.

A method of dust prevention in drilling which consists simply of forcing a jet of water into the drill hole is described by Mr. C. J. N. Jourdan in the Journal of the South African Institute of Engineers for September, 1911. Incidentally the author gives some records showing the increased efficiency in drilling which results from the use of water jets and which is a matter of interest to all persons doing drilling whether for mining or other purposes. As described by Mr. Jourdan the requirements of the water jet system are a [illegible] plying water to within a safe distance of the face, where they cannot be damaged by blasting operations. To this is attached an arm[illegible] The hose is removed during blasting operations, but it is absolutely essential that it should reach easily up to the very face of the drive to insure proper working conditions for the system and also that there should be a head of water of 40 to 80 lbs. per square inch. From the very first stroke of the drill a back or dry hole gives dust; it is thus essential that so soon as the drilling operation starts a jet should be played on to the face where the drill starts to collar. As the hole deepens, the hose, which has been previously slightly flattened, is inserted into the hole by the helper. The object of flattening the hose is dual—it assists in the formation of a more or less forcible jet and it does not interfere with the action of the drill, as it takes up less space in the hole.

It stands to reason then that this jet of water playing constantly to the very back of the hole kills the dust where it is made. It is found possible at any moment during the process of drilling to stop the machine and water at the same instant, and to detect that no dust and hardly any grit is present in the hole. The dust then is never formed. As the hole is deepened the hose may be inserted further, until it is about 18 ins. or 2 ft. in at the time the hole is finished. An examination of a finished 5 or 6 ft. back hole will show a clean barrel, free from obstruction of any sort. Once a hole is commenced with this method the water supply must not be interrupted, for the dust and grit would cake with the small amount of water left in the hole on stopping and jamb the drill.

It may be thought that great inconvenience would be caused to the machine workers, or at any rate to the helper holding the hose in position, for one naturally thinks that a drill pounding away into a hole almost filled with water would cause spray and sludge to spurt all over the place. In practice this is not the case. The helper standing at the face all the time a hole is being put in will be found to be almost free from damp on his clothes, and as a matter of fact the water flows quietly out of the hole down the face carrying in suspension all the disintegrated rock, whether in the shape of dust or grit. The tendency of the drill to fitcher is minimized by this system, for the hole is kept so free from grit and the drilling is more rapid than under the ordinary system.

This method has to its credit advantages of economy, small in themselves, but nevertheless saving in time and money. We know that in practice it takes a miner anywhere from 2 hours and upwards to put in a back hole under present conditions. With the jet playing into the hole it is possible to put in a 5 to 6 ft. hole in about 1 hour and 20 to 30 minutes in hard quartzite.

The only practical objection to this method is the quantity of water used and the consequent flooding of the drive. The failure of similar ideas elsewhere has been due, in my mind, to the small volume of water used. If, however, a drain is cut and kept open the water can be led away. The extra cost of pumping is inappreciable.

Below are given tables showing the records of two experiments in which it may be seen that considerable saving in time and in drill steel was made over the ordinary way of drilling a dry hole.

Holes 1 and 2 were 8 ins. apart and were drilled dry and wet respectively in hard quartzite, and in the same bed of quartzite. The same angle of elevation was kept by dropping the arm about 8 ins. after the No. 1 hole was drilled. The same machine and men drilled both holes. The air pressure remained constant, 60 to 65 lbs. The collaring in each hole was good. The time given does not include time for changing drills, but only actual drilling time.

HOLE NO. [illegible] DRY.

	Minutes.	Depth, ins.	Drill marked
[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	

HOLE NO. [illegible] WET.

	Minutes.	Depth, ins.	Drill marked
[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	

†A cross-bit was unfortunately not available.

[illegible] or .33 in. per minute, as compared with 42½ [illegible] minutes to drill 59 ins., or 1.34 ins. per minute, by the method described. Furthermore the [illegible] and 4 were drilled with two different machines in very hard quartzite cross cutting the [illegible] rock. The dry hole was steeper than the wet one.

HOLE NO. [illegible] DRY.

	Minutes.	Depth, ins.	Drill marked
Collared and started hole	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	

HOLE NO. 4—WET.

[illegible] and started	[illegible]	[illegible]	Q
[illegible] diamond	[illegible]	[illegible]	R
[illegible] chisel	[illegible]	[illegible]	S
Total	[illegible]	[illegible]	

Thus by the wet method 68 ins. were drilled in 87 minutes, or .78 in. per minute, as compared with 48 ins. in 150 minutes, or .33 in. per minute, by the dry method. The two drills Q and R drilled 50 ins. in 73 minutes, as compared with 48 ins. in 150 minutes with five drills. It will be seen therefore that there is a saving of from 30 to 50 per cent in drills and that no more time is required for the drilling of a back hole than a wet or down hole.

ROADS AND STREETS SECTION

A New Scarifying Device.

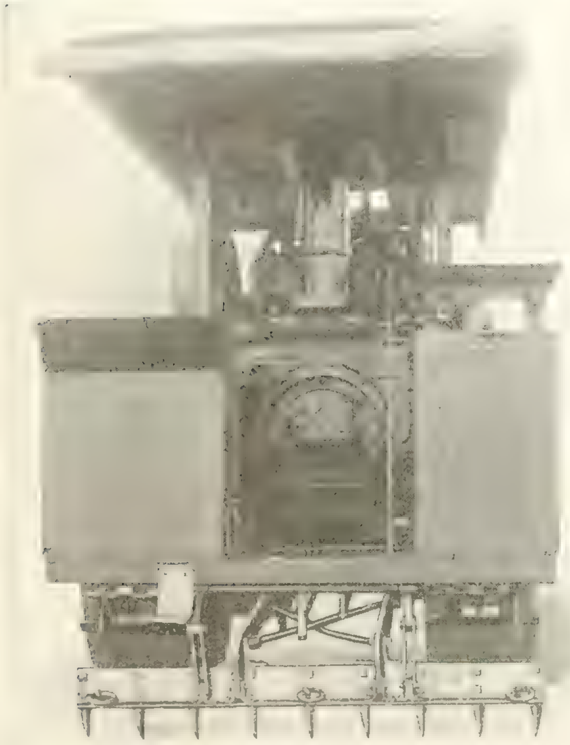
The use of scarifiers for loosening the surface of a road or street preparatory to resurfacing is much less common in this country than it should be. In England scarifiers are in common use and are considered an indispensable adjunct in connection with steam rolling. Thomas Aitken, the English road authority, in his book, "Road Making and Maintenance," states that the saving effected in breaking up a road surface by using a macadam scarifier, inclusive of all charges, over that performed by manual labor, may under ordinary circumstances be estimated at 94 per cent.

Several types of mechanical scarifiers have been placed on the market, perhaps the latest of these being the scarifying attachment shown in the accompanying cuts. This attachment is manufactured by the Huber Manufacturing Co., of Marion, O., and is designed for use with the rollers made by that firm. Owing to the boiler construction of these rollers being different from other rollers the device is not adapted to other makes.

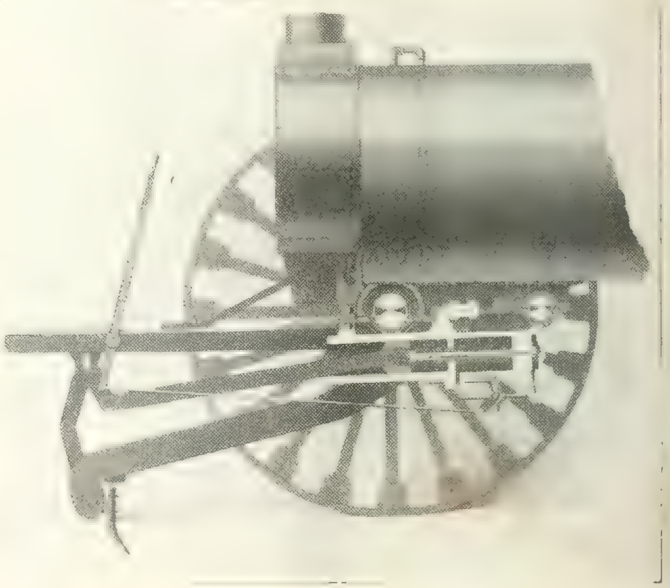
The attachment is built to, and made a part of, the roller outfit. Nine heavy spikes, properly shaped and spaced, are attached to the front of a heavy Z-shape bar, as long as width of roller at rear. This bar is connected by strong rods to the rear axle, on which all the pulling strain comes. The shape of the spikes is such that as the roller travels forward they are drawn into the ground, tearing and breaking it up to a sufficient depth to leave the whole mass loose and in condition to be easily shaped up by the grader. When not in use, the spikes are carried clear of ground, and high enough that they do not interfere with any other use of the roller. A strip of road surface as wide as the extreme width of roller is worked.

The spikes are raised and lowered by steam power. A simple cylinder is placed beneath the rear of the boiler and steam is conveyed to it by pipe from the top of the boiler. The valve admitting steam alternately to either end of cylinder is operated by the straight lever at the platform. As the piston travels forward or back, motion is transmitted to the spike bar, raising or lowering it. When the scarifier is thrown down, the spikes are held in ground by steam pressure. This gives cushioned compression. If solid rock should be encountered, the piston working against the steam will permit the spikes to raise enough to pass over, but they are forced down again immediately after passing.

It is claimed that the steam pressure feature assures uniform working depth of the spikes at all times, and that no matter what the position of the roller wheels on an uneven road, the scarifier will follow the surface and tear it up to same depth in low places as the high spots. Another advantage claimed is that the surface of a street may be broken up right to a crossing, then the spikes raised and carried across and dropped down exactly at the other side, without disturbing the walk or delaying the machine. It takes but a fraction of a minute to raise or lower the scarifier, and the whole operation is controlled by the one lever. The boiler shown is high mounted, and this allows plenty of room for attaching the cylinder beneath. This device has been patented by The Huber Manufacturing Co. It has been tested out, and will be for sale to purchasers of Huber Rollers this year.



End View of New Scarifying Attachment.



Side View of Attachment.

London's New Storage Reservoir.—London's newest reservoir was placed in service on Nov. 4. This reservoir has a capacity of about 1,000 million gallons, and is about 120 acres in water area. The water is drawn from the Thames. The cost of the reservoir was over $750,000.

Panama Canal excavation for October amounted to 2,331,678 cu. yds. This is less than was done in the corresponding months for 1909 and 1910 by about 500,000 cu. yds. There remains to be excavated 42,267,739 cu. yds.

Survey Work and Organization of the Engineering Department of the Coleman Du Pont Road, Inc., of Delaware.

The coming spring will [illegible] struction work under way on the entire line of the highway to be built at D[illegible] pense of General Du Pont. This road on its completion is to be given the state free and clear of any incumbrance. It will be about 106 miles long, and therefore will be one of the longest continuous stretches of highway ever put under construction at one time. The construction of such a road involves many features of interest, not the least of which is the engineering organization which will have charge of the work. An excellent description of this organization was given by Mr. Frank M. Williams, chief engineer of the road, in the following paper presented on Dec. 29 before Section D of the American Society for the Advancement of Science:

The Coleman Du Pont Road, Incorporated, came into being in accordance with the act by the Delaware state legislature authorizing any boulevard company, which would comply with certain conditions, to construct a highway from some point on the southern boundary of Delaware to a point in the vicinity of Wilmington in the northern part of the state.

The principal condition contained in the act of the legislature was that such a company, incorporated under the act, should give to the state free and clear of any incumbrance a road for vehicular travel from one end of the state to the other. As a matter of fact this legislation was passed with a view of facilitating the gift which General Coleman du Pont had offered to Delaware of something which, so far as practical results are concerned, will be of much more benefit to the whole people of the state than would be gifts of universities, art galleries or libraries, as it will go far toward making possible a development of the latent agricultural wealth of this portion of the Delmarvia peninsula.

As soon as the legislation had been approved by the governor and the necessary preliminary steps had been taken, General du Pont began the making of surveys, acting for some weeks as his own chief engineer. Thereafter he employed a chief engineer and began building up a complete organization. This organization now consists, beside the chief engineer, of an assistant chief engineer, one division engineer for each of the three counties of New Castle, Kent and Sussex, a chief draftsman in charge of the department of plans and estimates, and a testing engineer in charge of the testing laboratory. There are 14 assistant engineers with a full complement of instrument men, rodmen, chainmen and axemen, besides a corps of draftsmen. A large field force was made necessary in the southern part of the state by reason of General du Pont's uncertainty as to whether he would build on the eastern or western side and in all sections by his purpose to place the road where most desired by the greatest number of residents, in keeping with the general scheme of as direct a location as possible. He has frequently said that he plans to construct the road where the greatest number of his fellow citizens want it if he can find out where that is. It has been necessary therefore to run numerous preliminary lines.

Inasmuch as it is the purpose of the company to build a considerable portion of the road with its own forces, there is, in addition to the above, a construction department, directly connected with the engineering department. The organization of this department at present consists of a general superintendent of construction, two assistant superintendents and a number of foremen, time keepers, etc. This part of the organization will be much amplified in the spring, when construction work will be pushed as rapidly as possible.

The financial department and the right of way department of the road are under independent heads, but are co-ordinated with the engineering department, though independent of it.

In perfecting the engineering organization it [illegible] construction w[illegible] the division engineers, and for tha[illegible] each division engineer has full authority to discharge any employe working under him, and in most cases has authority to [illegible] his own assistants.

When it is desired by the chief engineer to run a certain line, [illegible] is sent to the division engineer in whose division the line is located, and it is his duty to put a party in the field at the earliest possible moment to make a survey of the line in question, locating as much topography as may be necessary to permit of paper location being made from the field notes. Particular attention must be paid to locating property lines between various owners and obtaining the correct names of such owners, inasmuch as 95 per cent of the road will be on entirely new location, and also as property lines are not well defined by fences in country where cattle raising is rare, this requires considerable care. The division engineer then sends in, drawn to a 500 ft. to an inch scale, a plot of the line as run. This plot is then adjusted, paper location made, traced, blue printed and one copy turned over to the right of way department and one each to the chief and division engineers.

Preliminary survey parties consist of an assistant engineer in charge, transitmen, two chainmen and two rod and axe men. As there are no adequate maps of southern Delaware and as the country is exceedingly level, it was necessary in that portion of the state to evolve some scheme in order to connect desirable points without the necessity of running numerous random lines. This was accomplished by sending up rockets at night and obtaining a line of sight on them. In one case a rocket was plainly visible at a distance of 14 miles, and the line which was run from the sight thus taken struck the desired point within a very few feet. These rockets were made especially for this work, and are of 2, 4 and 8 lbs. in weight. Each is equipped with a parachute, carrying a light of changing color and capable of sustaining itself in the air for nearly a minute.

The utility of such a plan must be apparent to any one familiar with the topography of southern Delaware, where the general surface of the ground varies in elevation from 30 to 50 ft. above sea level, and being heavily wooded at frequent intervals furnishes slight opportunity for usual methods of location. Very often it is necessary to supplement the original preliminary surveys with a number of cut-off lines or side locations to avoid impracticable crossings of rivers or swamps or to avoid right of way difficulties which the long tangents of the first line very often involve. Preliminary surveys also include the running of such random lines off the original line as prove necessary to develop the general area of water sheds and the location of mill ponds and dams, of which the southern part of Delaware has a great number. Up to the present time it has been necessary to run about 470 miles of preliminary location besides the incidental work mentioned above. This preliminary work has now been finished in the county of Sussex, but there are four preliminary parties working in each of the other two counties.

After the right of way department has favorably reported on the line as run and the location has received the approval of General du Pont, it is referred to the state commission, composed of the governor, lieutenant governor and secretary of state. Maps are furnished to this commission showing the proposed location and a personal inspection of the route is made by them. If they approve such proposed location it is signified by their signing the plans and then the engineering organization takes up the matter of final location surveys and preparations of plans and estimates.

Final location survey parties have in general the same organization as the preliminary parties, except that they require one less axeman and the addition of a stake man and a property line man. It is the duty of the latter to interview property owners and have them on the ground, when the survey party crosses, to point out and agree on the division lines between their respective properties.

It has been decided to run all final surveys by the azimuth method, locating a primary base from polar observations and referring the bearings of all lines to the true north. Night observations are taken every five or six miles of line run as a check upon the original work [illegible] end of the state to the other, which may serve ultimately for referencing adjacent property surveys.

The right of way taken for the boulevard is [illegible] of its location through three or four of the larger towns and cities, where it will be reduced to 120 ft. It is the duty of the final location party to locate all topography within the right of way lines and for 100 ft. on either side, also to locate with a fair degree of accuracy the highways leading from the right of way to the nearest railroad or dock, giving directions and distances. The center line is marked by tack-centered stakes set 300 ft. apart except at transit points and on curves. All curves have stakes set at each 100 ft. station. Tack-centered stakes are set at the intersection of the right of way lines with every property line crossed and also uniformly at each 1,000 ft. station.

Two general limits have been established for final location. One is that the limiting degree of curvature for the entire line shall be 5° and the other that the limiting rate of grade for Sussex county shall be 2 per cent. The limiting rate of grade in Kent county and in New Castle county has not as yet been established, but it seems probable that it will be 3 per cent in the former case and 5 per cent in the latter. Granite or concrete monuments will be set on both right of way lines 1,000 ft. apart and these monuments will be carefully centered and every location checked and rechecked so that the lines which they mark may have an accurate azimuth determination. There will also be placed along the line of the road permanent monuments marked with the accurate distances between the southern boundary of Delaware and the principal points in the state north of it.

A cross section party closely follows the final location party taking sections in the usual manner. It is the duty of this party also to develop existing and possible drainage courses and determine the available fall. This is highly important in a country as flat as that of Sussex county and the southern part of Kent county. The cross section party establishes bench marks at intervals of not greater than 1,000 ft. for use in construction, the datum assumed being that of the United States Geological Survey. The organization of the cross section party consists of an assistant engineer in charge, instrument man and two rodmen. Up to the present time about 70 miles of cross sections have been taken.

As fast as the field work for the final surveys and cross sections have been completed the notes are forwarded to the Wilmington office for platting.

The location notes sent in are platted on two scales. One plat is made on the scale of 500 ft. to the inch, showing the adjacent railroad switches and barge docks, with the highways leading from them to the proposed route, as well as the line of the proposed route itself and the various topography upon it. The construction plans are made in standard size of 24x36 ins., giving the plan on a scale of 100 ft. to the inch and the profile and grade line on a scale of 10 ft. vertically and 100 ft. horizontally. The road sections are generally in the form of standards and are on a scale of 10 ft. to the inch.

After the platting of the notes has been completed, an experienced road engineer is sent over the line with a blue print showing the profile with a trial grade line to make such changes as may be necessary to better provide for the distribution of materials and the perfection of the drainage system. This work is in the hands of the department of plans and estimates, but employs the division engineer of each division in a consulting capacity as to the work planned for his particular division.

The organization of the department of plans and estimates comprises the chief draftsman, two assistant chief draftsmen and a requisite number of draftsmen, tracers, calculators, etc. Attached to this office is also a blue printing department. After the determination of the grades, section and type of road to be constructed, the plans and estimates are completed. Wherever possible, standards are employed for small structures, but anything requiring special treatment is made the subject of a special plan. This department is under the direct supervision of the assistant chief engineer.

The testing laboratory, directly under the supervision of the chief engineer, is in charge of a testing engineer and is thoroughly equipped for the testing of oils, asphalts, tars, cement and sand. The equipment of this laboratory is further supplemented by the testing laboratory of the E. I. Du Pont De Nemours Powder Co.'s works.

Thomas Aitken of Cupar, Fife, Scotland, and Ernest Storms of Brussels, Belgium, have been employed as consulting engineers. They visited the line of the work during the latter part of the summer and made many suggestions as to methods of construction, materials, etc. They also made exhaustive studies of sub-soil conditions, for the determination of which they sunk a considerable number of test pits. During their stay several short sections of experimental road were laid down. They are now kept in touch with the work by correspondence. General du Pont, himself an engineer, has also supplied a considerable amount of data and information.

The offices of the chief engineer and assistant chief engineer are at Wilmington, as is also the office of the division engineer of New Castle county. The offices of the division engineers of Sussex and Kent counties are at Georgetown and Dover respectively.

The work of the engineering organization has been greatly facilitated by the use of automobiles furnished by General du Pont. There have been four of these and they have enabled the engineers in charge to keep closely in touch with every operation in the field. The engineering equipment is nearly all new and very ample.

Construction, which began late in the fall, has been carried on as vigorously as weather conditions would permit. Twelve miles of road have been graded and nearly all the culverts for this section have been built and about two miles of surfacing is nearing completion. The construction department, which has handled a considerable part of this work, is also engaged in the development of gravel pits and stone quarries.

Early next spring it is planned to begin construction on the whole line. As nearly as can now be determined this line will be about 106 miles in length.

Notes on Road and Street Work.

Spreading Traffic Over the Road Surface.—A simple method for spreading traffic over the road surface is employed at Versailles, France. When a road begins to rut three cobblestones are put in the rut and a fourth cobblestone is placed on top of the other stones. This top cobblestone is painted white. After a time these stones are moved to another part of the road, which has begun to show signs of wear, thus compelling the traffic to use all of the road surface.

Dust Laying and Road Preservation in the District of Columbia.—During the fiscal year ending June 30, 1911, the use of oil for dust laying and road preservation in the District of Columbia was considerably extended. Five steel tanks, each containing 15,000 gals. of oil for road use were erected at various railroad points. The total costs of these tanks was $2,863. Oils of several kinds were used, including a considerable amount of emulsified oil. According to the last report of the Engineer Department of the District the latter is found better adapted to residence streets where there is much foot traffic, on account of being less adhesive to the feet when first applied. It is also less expensive. The heavier oils are found to be best adapted to roads with a preponderance of automobile travel; and the lighter oils more frequently applied to roads having more heavy hauling and to roads with very loose surface. The selection of an oil for a particular road is thus dependent upon the character of the surface and of the traffic. The use of tarvia B and tarvia A and calcium chloride were continued, each giving good results commensurate with the cost of application. The latter is found to be especially advantageous on residence streets with only local travel, the streets always presenting a clean, damp appearance where it is used. The cost of applying the various dust preventives per sq. yd. per season is found to be about as shown in Table I, the figures representing an average cost in an average situation:

[illegible] COST [illegible] APPLYING DUST PREVENTIVES

Lo[illegible]	Oil [illegible] per sq. yd.	Labor for hauling, applying, cleaning and protecting road	Total cost	Screenings or sand
[illegible]	$0.0[illegible]	$0.010	$0.003	$0.048
[illegible]	[1].0[illegible]	.010	.008	.068
[illegible]	[illegible]	.018	.004	.034
Light oils.				
Rock Creek Church Road (Texas Road oil No. 2), one application only[2]	.011	.002	.000	.01
Wisconsin Avenue (emulsified oil), 15 applications per season	.022	.012	.000	.034
Military Road (tarvia B)	.038	.021	.003	.061
Various streets (calcium chloride), eight applications	.030	[3].011	....	.041

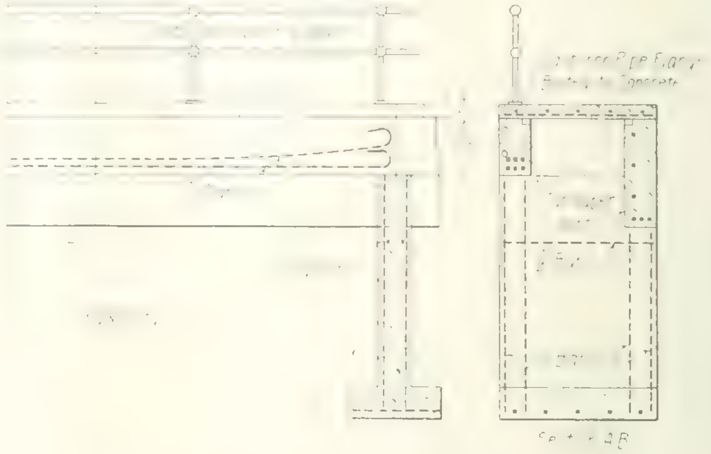
[1]Applied by contract, hauling included in price of oil.

[2]This work done in fiscal year 1912 and used for comparison. Two or three applications per season would be needed.

[3][illegible] application.

Resurfacing Asphalt by Lutz Heater Method.—During the fiscal year ending June 30, 1911, a total area of 78,794 sq. yds. of asphalt pavement at Washington, D. C., was resurfaced by the Lutz heater method, at an average cost of 68.17 cts. per sq. yd. The specifications for resurfacing by the heater method were as follows: The engineer commissioner may order certain streets resurfaced by what is known as the Lutz asphalt heater method or a similar device satisfactory to the engineer commissioner, as follows:

> The old surface of the street shall be heated and softened by means of this heater to the satisfaction of the engineer commissioner or his authorized agent, and so much of the old asphalt topping so softened shall be removed as may be directed. Immediately upon the surface exposed by the removal of the aforesaid old top there shall be deposited new asphaltic-top material, and immediately the same shall be spread by means of hot shovels and rakes to such an amount and of such thickness as will not be less than 1½ ins. before compression, as may be directed by the district inspector assigned to the work, the intention being to cover the new surface while still hot with hot new material. This new material shall without delay be rolled with hand or steam rollers and finally finished by means of a steam roller of not less than 5 tons weight to a firm condition as to compression and to a regular section in a manner entirely similar to that of new construction. It is the intent of this specification that new work shall be joined to old in all cases with a hot joint, and the contractor is expected to make every reasonable effort to secure this result. Successive heatings shall be made when necessary, as above described, until the entire street or such portions thereof as indicated has been covered. This class of resurfacing will not be considered new work, and therefore no retent will be held on the amount paid for this class of work. The same will be paid for by the cubic foot of material furnished, and the price bid on material for this class of work will include all incidental work in connection therewith, such as cutting out old material where necessary and removing same, also removing old heated material, cleaning up, etc., as in the case of ordinary repairs. In the event that asphaltic binder is required in connection with this work it will be paid for by the cubic foot at the price named in item 4 of the contract prices herein for binder furnished in connection with resurfacing work.



Half Elevation and Section of Concrete Sidewalk at Hillsboro, Ill.

Concrete Sidewalk and Retaining Wall.—An interesting type of combination reinforced concrete sidewalk and retaining wall has been constructed recently on Seward St. in the City of Hillsboro, Ill. In order to bring the sidewalk to grade it was either necessary to carry it on a fill or support it by means of piers. The idea of making a fill was abandoned because additional land could not be secured, which would have necessitated the building of a retaining wall to hold the earth in place. At 35 cts. per cu. yd. for filling and allowing the slopes to encroach upon adjoining property; that is, building no retaining wall, the cost was estimated at about $1,700. To build the retaining wall would have brought the total cost considerably above the estimated cost of a sidewalk supported on piers. As built the 600 ft. long. reinforced concrete sidewalk rests on reinforced concrete piers every 25 ft. The sidewalk is supported by means of two reinforced concrete beams running parallel with the walk. The concrete beam next to an adjoining road is carried down sufficiently to act as a retaining wall and to protect the adjacent slope on the side road from sliding off. The accompanying illustration shows a half-elevation and section of the construction, according to the plans prepared by the Illinois Highway Commission. The contract was awarded to the P. J. Goggin Construction Co., Arcola, Ill., for $2,485.

Road Construction and Maintenance.—The American Society of Civil Engineers is to hold three meetings on Jan. 19 and 20th at its headquarters, 220 West 57th St., New York, at which the subject for discussion will be, "Road Construction and Maintenance." At the first meeting at 10 A. M., Jan. 19, two subdivisions of the subject will be discussed: (1) "Drainage and Foundations." The discussion on this topic will be introduced by James Owen, M. Am. Soc. C. E. (2) "Fillers for Brick and Block Pavements." The opening discussion on this topic will be by George W. Tillson, M. Am. Soc. C. E. At the second meeting at 2 P. M., Jan. 10, the following subdivision of the subject will be discussed: (3) "Bituminous Surfaces." This topic will be introduced by A. W. Dean, M. Am. Soc. C. E. The following subdivision of the subject will be discussed at the third meeting on Jan. 20: (4) "Use of Bituminous Material in Penetration and Mixing Methods." The discussion on this topic will be introduced by Linn White. A number of Engineers specially interested in Road Construction have agreed to be present and to take part in the discussion of each of these topics, and it is the intention to afford an opportunity to all who attend the meetings to present their opinions. All Engineers, whether members of the Society or not, are cordially invited to attend these meetings, and it is hoped that the resulting discussion when collated and published will bring the whole subject up to date.

The Chemistry of Modern Highway Enginering.*

With the modern evolution of the ordinary macadam road to the bituminized or bituminous form, the old situation has entirely changed, and while it is still possible for an engineer with little or no knowledge of the chemistry of road materials to construct a good road, his chances of so doing are far less than they were in the old days. So much has already been written concerning the causes for bringing these new materials, commonly known as bitumens, into the field of highway construction, that it seems unnecessary in this paper to discuss them in detail. It may be stated, however, that the development of a new class of traffic, motor vehicles, has made it necessary to utilize some form of binder other than rock dust, to hold the larger stone fragments in place and preserve the integrity of the road. The bitumens as a class have given more promise of suitability than any other materials, and their utilization for this purpose during the past few years has developed to an enormous extent.

Unlike road stone the use of bitumens is not controlled by their local occurrence, as the amount required for the treatment or construction of a road is not so great as to make the cost of transportation prohibitive except for very long distances. The utilization of these materials is not, therefore, confined to localities in which they occur, except in rare instances. This fact makes it possible for the highway engineer to choose from a far larger number of materials than formerly, but owing to the complex nature and great variety of these materials, the selection of the best available for a given purpose is a much more difficult matter. These substances are as a rule new to him, and in the matter of selection he has been obliged either to depend upon the experience that a comparatively few have so far gained, or else to select a material at random and himself experiment with its use. Whichever he does, it is safe to say that unless he thoroughly understands the properties of the material which he uses he [illegible]

At the present time, many highway engineers know bitumens only as black, more or less sticky substances which range from fluid to semi-fluid consistency. To some they are all tars or all oils, or all asphalts, the meaning of these terms being at best very vague. Trade products are known by name only, and when it is desired to describe these products in somewhat more detail, the use of such terms as "asphalt contents," "percentage asphalt," etc., are often used with rare indiscrimination.

The fact that bituminous road materials are subject to many changes both during and after application, makes it impossible to determine by purely physical tests just what properties a given material will develop after being placed on or in the road, and a knowledge of the chemistry of such materials is therefore essential to their best use. The subject is a comparatively new one, both to the engineer and the chemist, and while a certain amount of progress along this line has been made by a few progressive men, there is much yet to be learned. And here we arrive at a very important fact. Neither the chemist nor the engineer, can by himself, secure a practical application of chemistry to road building, the former because he is ignorant of the principles of highway construction and the conditions which have to be met in practice, and the latter because he is deficient in chemical training. It is only by close co-operation on the part of chemist and engineer that ultimate success can be obtained. The subject is of considerable interest from the standpoint of industrial chemistry but few chemists have given it serious consideration because of the lack of demand for their services on the part of engineers. To the author's mind, the cause for this lies in the lack of chemical education of the highway engineer.

It is evident that the great majority of highway engineers cannot also become chemists, and the question at once presents itself as to just what extent his chemical education should be carried. The answer is not as simple as it might at first thought appear to be, but there are undoubtedly certain facts concerning the chemistry of bituminous road materials with which the highway engineer should be thoroughly familiar. In the first place, he should have some knowledge of the origin, occurrence and production of various types of native and artificial bitumens. He should have a comprehensive idea of the processes of refining these products and of the methods of manufacture by which they are converted into road materials. He should acquire the fundamental principles of hydrocarbon chemistry to the extent of at least knowing the more important series of compounds which are at present in bituminous materials. He will then be able to appreciate their great complexity in composition, which is accountable for their widely varying behavior in practical use. With this knowledge he will be in a position to intelligently study the methods of examination which have been devised for bituminous materials, and to correctly interpret the result of such examination as regards their identification. His engineering experience will then enable him to correlate the results of examination to those obtained in practical construction, and if he has an opportunity to conduct original experimental work, the knowledge thus acquired will lead him to develop new fields in chemical investigations pertaining to highway work, and to co-operate with the chemist in such work.

Some few highway engineers have acquired, or are acquiring this information, but to the rank and file, the chemistry of the bitumens is a sealed book enshrouded in more or less mystery; something they feel that they should like to become acquainted with, but do not know just how to proceed. They read specifications for bituminous road and paving materials, and glimpse the purposes of those who have framed them; they perhaps study one of the few books that have been published on the subject, but fail to grasp it comprehensively enough to derive real benefit thereby. In fact, this smattering of knowledge is apt to prove more troublesome than otherwise when they attempt to utilize it in practical work. Such procedure may be compared to that of the layman who reads a materia medica and then attempts to practice medicine upon himself or his neighbors. The results are apt to be the same, injurious to the patient. The comparison may be carried further. An expert in the chemistry of road materials and its practical application is, in fact, a road doctor. He is called upon to inspect an old road in bad condition or the location of a new one, and prescribe a remedy in the one case or precautionary measures of construction in the other. He first of all diagnoses local conditions, available materials of construction, climate, character of the sub-grade and foundation, drainage, both natural and artificial, the kind and volume of traffic to which the road is or will be subjected, etc., etc. He then writes a prescription in the form of a specification. Also, like the doctor of medicine, he promptly submits a bill for services rendered—but this is not pertinent to the present discussion. If his diagnosis is correct, and his experience sound, his prescription will act as a cure or preventive if properly applied, and perhaps his specifications will be published in some engineering magazine. The same thing will occur in other instances and through the medium of the technical press the highway engineer finds himself in possession of a number of valuable specifications for bituminous road and paving materials.

Now, as in the case of a prescription, few people would care to apply it to a different type of sickness than that for which it was written, and fewer still would dare to combine two or more prescriptions into one. This, however, is just what has frequently been done by highway engineers in the matter of specifications for bituminous materials, and in many cases the results have proved the fallacy of the procedure. Either a totally unsuitable material has been specified or else certain clauses in the specifications are incompatible, and the specifications therefore impossible. Frequent instances of this sort have come within the author's notice, and a number of cases might be cited where specifications have been framed, by combining clauses from specifications of two such dissimilar materials as crude petroleum and residual coal tar. Such things would not occur if the highway engineer was more familiar with the chemistry of the materials specified. That these matters are receiving serious consideration is evidenced by the fact that the education of our highway engineers in this subject has recently been cared for in a post-graduate course in highway engineering by one of our leading educational institutions, Columbia University.

The chemistry which a modern highway engineer should know, according to the author's idea, has already been outlined in a general way, but in the matter of the examination of road materials, especially those coming under the classification of bitumens, it may not be amiss to enter into somewhat more detail. These products consist of a great variety of complex mixtures, solutions and emulsions of hydrocarbons and their derivatives, together with varying quantities of organic matter not bitumen, mineral matter, etc. They consist of petroleum and petroleum products, including residual petroleums, fluxes, oil-asphalts and fluxed or cut-back oil-asphalts; malthas, native asphalts, and other solid native bitumens and asphaltic cements produced by fluxing them; coal tars and water gas tars, their distillates and residues; mixtures of tar with petroleum or asphalt products, bituminous emulsions and factitious asphalts; bituminous aggregates, including rock asphalts or bitumin-

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*Abstract of an address by Prevost Hubbard, Chief Division of Roads and Pavements, Bureau of Industrial Research, Washington, D. C., presented Dec. 29, before Section D of the American Association for the Advancement of Science.

[illegible] other bituminous topping.

It is often an exceedingly difficult matter for even the analytical chemist to differentiate between certain of these products, but the principal classes or groups can usually be identified with little difficulty. The engineer should be able to do this. He need not necessarily carry out the examinations himself, but he should know how to do so if occasion requires and a laboratory course of instruction should therefore be included in his training. Such instruction should be given along broad general lines owing to the varying methods of examinations at present practiced. Because of this lack of standardization he should be given ample opportunity to compare the relative advantages and disadvantages of various methods, and to study their relation to each other.

He should learn the ranges in specific gravity of the various types of bitumens and to what extent they are affected by non-bituminous matter of different sorts which are found in certain types of native asphalt, oil-asphalts injured by overheating, tars, etc. He should understand the reason for using a number of solvents in determining the characteristics of these materials with relation to their identification, process of manufacture and behavior after application. He should appreciate the difficulties of quantitatively determining all of the constituents of a road or pavement from the examination of a finished section; why, for instance, it may be impossible to extract all of the bituminous material if a large amount of finely divided mineral matter is present and why the recovery of the bitumen in its original condition is often impracticable.

He should learn to distinguish crude materials from cut-back products, and cut-back products from straight residuals; what qualitative tests may be made to determine the presence of tar in petroleum or asphalt products, and vice versa; what tests indicate chemical stability; in what products chemical stability is a desirable feature and in what products chemical changes are to be looked for and relied upon to improve the quality of the material for road purposes. He should understand the principles of fluxing; why the combination of certain bitumens will not produce a good road binder and why the inferior quality of such combinations does not necessarily indicate inferiority in either of the constituents. These and many other questions of a similar nature are matters which are of the greatest practical interest in modern highway work.

It seems unnecessary to enter into a lengthy dissertation on all the chemical tests applied to bitumens with which the highway engineer should have a general acquaintance, but a few others of special interest may be mentioned, such as distillation, bromination and sulphonation tests, determination of phenols, naphthalene, paraffin scale, carbenes, sulphur, etc.

The statement has been made by some that the more useful tests applied to bituminous road materials are not chemical, but physical tests, and that the former being of little value should be eliminated and reliance placed upon the latter for obtaining the necessary information regarding the properties of these materials. At a very recent gathering of highway engineers and others interested in road building, a statement of this nature was made from the platform, the speaker supporting his argument by reference to the customary methods of examining Portland cement. Reasons have already been advanced in the first part of this paper which disprove such statements, but for those engineers who hold similar views, of which there appear to be quite a few, attention should be called to the misapplication of such arguments.

In the first place, it is safe to say that few industries are so completely dependent upon the application of chemical principles as the manufacture of Portland cement. This is so fully appreciated by the manufacturers that every cement mill of importance employs its own chemist. At almost every stage of the process of manufacture, chemical analyses are made, analyses of the raw materials which are used, of the mix before it is burned and of the clinker after it has emerged from the kiln. The chemical composition of the finished product is very clearly fixed within certain narrow limits and all of the physical properties of the cement are known to be controlled primarily by the relative proportions of the various elements present, and secondly, by the peculiar combinations which these elements have assumed during the process of manufacture. The second factor is of such importance that from the ultimate analysis of the cement no surety of its physical properties can be determined by the consumer, and so recourse is had mainly to physical tests. Could the mineral composition or peculiar chemical combinations which are present be quantitatively determined by chemical analysis the entire method of examining cement would be revised and considerably shortened by the elimination of some of the physical tests. As it is, most specifications for Portland cement call for the determination of at least two chemical elements or radicals.

In the case of bituminous cements, as well as Portland cements, an ultimate analysis, i. e., a quantitative determination of the elemental constituents, is seldom of value in determining the suitability of the product for practical use. With the former, however, it is possible to determine by chemical means many of the compounds which are present in the material and to at least separate them into certain series of compounds which are known to possess, or to impart to the original substance definite properties. The possibilities of the practical application of chemical analysis in the testing of bituminous cements is, therefore, much greater than in the case of Portland cements. This is due to the greater flexibility of bitumens and their susceptibility to processes of distillation, sublimation, various kinds of fractionation and to their solubility in menstrums.

The fact that different bitumens vary so widely in general characteristics, makes a chemical examination more necessary. The chemistry of bituminous road materials has as yet received but little attention, but as the demand for knowledge on this subject increases, as it surely will, more chemists will enter the field and much valuable information will be obtained to the benefit of highway construction.

The foregoing remarks should in no sense be construed as belittling the physical tests commonly applied to bituminous road materials. The value of many such tests is indisputable and some of them with perhaps slight modification will continue to be used indefinitely. Their significance, however, will be much more clear when they are considered in connection with certain chemical tests. For instance, in a given piece of road construction or treatment, a certain fluid bitumen may be as suitable for use as a semi-solid bitumen of another type. In such cases, what standard of purely physical properties can cover both and be of any value? It is evident that no one physical standard can be applied to both, but each can be covered by a physical standard if such standards are modified by chemical tests.

In conclusion, one other question relating to the chemistry of road materials, which has been accorded some recent discussion in engineering magazines, may be touched upon. "Should the highway engineer do his own testing, or should it be placed in the hands of the chemist?" Arguments have been advanced in support of both sides of this question, but to the author's mind there is only one logical answer, in so far as the chemistry of the subject is concerned. Modern conditions are calling for the work of specialists in highway construction, as in many other branches of engineering, and it is not reasonable to expect that the man whose training has been primarily developed along engineering lines can satisfactorily apply the principles of other highly specialized subjects to his work without the assistance of those who have specialized in such subjects.

It would, therefore, be as unwise for the average highway engineer to attempt the analysis and chemical testing of road materials, as for the average chemist to attempt to construct a modern highway. As before stated, it is only by the close co-operation of engineer and chemist that ultimate success can be obtained and the construction of modern highways be placed beyond the experimental stage.

WATER-WORKS AND SEWERS SECTION

Coming Efficiency in Water Works Management.*

Much has been written of late of scientific efficiency, the aim being to get a greater return with less effort, but behind this movement is the increasing desire to promote that efficiency which saves material as well as labor and thus reduces cost of output. So strongly has this idea taken hold of the people that the day is not far distant when the management of at least all the larger corporations both public and private will be judged by the resulting cost.

So far as water departments, either public or private, are concerned, this will first manifest itself in the cities of medium size. And it is important that this society consider some of the ways in which this demand must be met, and it is with this in view that this paper is presented.

Whatever of criticism will be found in this paper applies with equal force to private companies or public corporations, as lack of efficient management is found as often in one as in the other, and in the final analysis the public pays in each case.

To promote the greatest efficiency the board of managers or commission, by whatever name it may be called, should be non-political and its duties should be strictly separated from the executive part of the work, being confined to matters of general policy, approval of expenditures, appropriations, general plans, formulation of rules, etc., appointment and removal of subordinates being made only on recommendation of the general manager, superintendent, engineer, commissioner or whatever title may be given to the executive head, for upon the latter rests or should rest mainly the responsibility for the efficiency of the work. For the remainder of this paper he will be referred to as the superintendent.

What kind of a man should the superintendent be? Not necessarily an engineer in the sense of being a graduate with a "sheepskin," but he certainly should be an engineer in the larger sense that he should be ingenious, capable of interpreting a drawing or making one if necessary, with a thorough knowledge of construction and tools, and he must have or immediately acquire a knowledge of the fundamental principles of hydraulics, and over and above all else he should understand the principles of business management. Such a man, it is perhaps unnecessary to state, cannot be secured for $1,200 or $1,500 per year. If the organization be a new one, several years must elapse in experiments, and usually the "fads and fancies" of the superintendent have to be tried out and their utility tested. Even with the above qualifications he has much to learn, for the management of waterworks requires much special knowledge.

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*Paper by W. H. Richards, Engineer and Supt. of Water and Sewer Department, New London, Conn., read before the New England Water Works Association and printed in the Journal of the Assn. for Dec., 1911.

The powers of the superintendent should be large, and to secure the greatest efficiency he should have a voice in the appointment of his subordinates, as well as the power to recommend discharge after proper hearing, for efficiency cannot be secured without discipline by a single responsible head. With such an organization the economy in conducting the work will be improved from year to year; efficiency without economy is impossible. Many policies have been settled by experience, and most of them have been put in print, but there remains much that is experimental, and the solution of many problems must be left to the ingenuity of the superintendent as they arise. For instance, while the efficiency of the cast-iron mains has been pretty thoroughly tested with most waters, the life and coatings of steel mains are still problematical. The size of mains necessary in certain places offers a wide field for ingenuity and thought on the part of the superintendent; so with the service pipe; except in special qualities of water, lead is almost universally used, yet the regulation of the size is subject to wide variation dependent on the pressure and quantity of water necessary or desirable to be supplied in a given time, and the regulation of the size calls for even more consideration than the size of the mains, for the theory that a certain quantity of water will go through a certain-sized hole regardless of the length of the pipe is one of the most common errors of the ignorant and unthinking.

I believe no one has yet discovered the best water meter, yet there is a chance to exercise considerable judgment of the kind or type for different circumstances or uses, and if the board of management insist on selecting the cheapest without regard to material or construction, the result will be disastrous to the efficiency of the meter department.

The conclusions of sanitary experts are changing every minute and the superintendent must have a very logical mind to separate the theoretical from the practical.

What about the composition of the board of directors? The corner grocery or professional politics do not usually fit men for undertaking large affairs, and a man who never handled a hundred dollars in his life is somewhat bewildered when given $100,000 to spend. Some men are so constituted that they magnify a dollar to cartwheel size; others have so little knowledge of its value, especially when it belongs to some one else, as to ignore its size altogether. The first, while saving cents, will lose dollars, and the second will lose both. The best proof of a man's ability to manage large undertakings for other people is that he has managed his own large business successfully. A board of managers, for instance, when buying land or rights, may in their effort to drive a sharp bargain, overreach and get into a lawsuit which will cost many times the amount saved. Another board may saddle the city or company with a filter or an expensive reservoir unnecessary for the time being at least.

In construction or extension of the work where it is necessary to engage a designing engineer, the superintendent may give advice which should always be given consideration. For the design of work is one thing and the care of it another. Many a superintendent has been worried into the grave trying to adapt an impractical scheme designed by an engineer without experience in management.

The board when selecting its designing or consulting engineer might remember that a six weeks' trip to Europe does not make an engineer, and might well consider if an expensive filter or massive dam is necessary. The interest account of many a city or company is burdened with the cost of an extravagant structure built but to gratify the fad of the designing engineer.

A celebrated foreign engineer on viewing a large waterworks dam once said that "any fool could build a dam if he could use a large enough factor of safety."

It should be [illegible] and that every gallon of water has a fixed [illegible] and that that value [illegible] work and the expense of maintaining it. No work can be run [illegible] until this fact is recognized and understood. If the rates are [illegible] for the price of [illegible] the man who uses one gallon and pays [illegible] pays part of the other man's water rate.

The cost of the water system and its main- [illegible] water and, except as to that part of the ex- [illegible] fires, in proportion to the amount of water used.

The practice of furnishing water free to the city departments, hospital and other institutions which may make a plausible plea to the board, as well as the practice of furnishing extra fire protection free to certain parties who are patrons of certain insurance companies, is not only unjust to the rate payers, but makes a statement of the measure of efficiency impossible.

If it is thought necessary to lay out a park or pleasure ground on lands controlled by a public water department, why not charge it to the park department? What has tree culture to do with the conduct of a water system?

Many cities have tons of lead service pipe where they will never be used, laid with the expectation of preventing the disturbance of the pavement which other public service corporations dig up without hindrance. It has become necessary in one large city to expose the mains and shut off these unused extra service pipes to prevent leakage.

Few water departments make any account of water furnished to other city departments, and, on the other hand, few water departments make remuneration for damage to streets. A precise system of accounting would stop many leaks in a waterworks system. In fact, it is usually impossible to tell whether the works are efficiently managed or not from the published accounts. A balance sheet is of rare occurrence in a water report, and an inventory or any charge for depreciation still more rare.

The president of one water company furnishes all water pipe used, and a relative furnishes all coal, without competition; the water taker pays for both, in high rates. The superintendent has been dismissed, being of a too prying disposition. Another water company has all outside work done by a relative of the president on a percentage. What is more common than for one member of the board to interfere with details of the management of a department?—and the more ignorant he is the more likely he is to interfere.

Of what use is a meter system when 30 per cent of the water is wasted by poorly jointed pipe and 20 per cent by the waste in public buildings?

Efficiency can only be effected by order and system coming through one responsible head, and that head must be more or less of an autocrat, each subordinate being in turn responsible to the one above.

In this age when improvements in methods and means of transacting business are constantly being introduced, it required constant study and clear discernment to find and apply the device or method necessary for the particular work.

In a city of considerable size it is impossible for the superintendent to observe every detail of the work, and he will accomplish more in his office than in his automobile, but he must first acquire a knowledge of the work and his subordinates by observation. At his desk he decides a multitude of problems, from the color of paint to quality of yarning, from the probable registry of an obstructed meter to the efficiency of his pumps; and all the time he must know what each subordinate is doing and what he is going to do the next day.

This in general is an outline of some of the things necessary to have and a few of the things to avoid in an efficient water-works system, and the efficiency is measured by the cost of the water supplied, taking into consideration its quantity and the necessary expense to secure and distribute it.

As mentioned above, the time is fast approaching when the constantly increasing indebtedness of water supply systems will attract the public attention and managers will be held strictly accountable to the public. Until that time comes, the following description of the waterworks superintendent by President Alvord, of the American Water Works Association, will hold good: "He has held out to him no alluring pension as a reward for the honest, faithful and nerve-racking care and service he gives, but is haunted day and night by fear of a broken main, failure of water supply, or of disease traceable to the water. He has trouble securing funds for procuring the necessary equipment, and, above all, has to deal, always courteously but firmly, with the ever-present infuriated citizen who insists he is not getting his just dues from a government he helps support."

How can efficiency be best promoted? I should say by system carefully thought out, by having order everywhere, and by well-defined rules thoroughly and impartially enforced.

Methods and Cost of Operating the Dibdin Slate Beds at Devizes, England.

In Engineering and Contracting of Nov. 3, 1909, an article on the theory and practice in the use of the Dibdin Slate Beds for sewage disposal was published. The article described the structural features of the beds, and presented tables showing operating results in both municipal and residential plants. The following information taken from *The Surveyor* of London for Dec. 22, 1911, shows the present attitude toward these beds by the local surveyor in charge of their operation:

With a view to obtaining absolutely authoritative data as to the working of the Devizes slate beds, we recently asked Mr. F. G. Billingham, the borough surveyor of that town, to favor us, for publication, with some particulars of the results obtained and the cost of operation both before and after the installation of the beds in question. Mr. Billingham has courteously responded, and his statement is reproduced herewith:

"The mode of sewage disposal in Devizes is the process known as 'Dibdin's slate beds,' which has now been in work between six and seven years, and has given every satisfaction.

"Previous to the entire plant being laid down, we had an experimental slate bed, followed by a coke-breeze secondary bed. This was worked for twelve months, and carefully watched, with the result that the council had no hesitation in adopting the system.

"Previous to this, the system in use was that of precipitation by aluminoferric, the sludge obtained being mixed with lime and pressed. This was not only very costly to work, but resulted in such an enormous accumulation of pressed sludge that we were unable to get rid of it. I estimate that we made about 700 tons per annum, and the annual expenditure was from $3,250 to $3,500 for labor, chemicals, coal, etc. The nuisance was considerable, and we were constantly getting complaints from the town as to the smell when the wind was in the west or southwest.

"The present plant consists of six slate beds, 68 ft. by 45 ft., and two storm-water beds, 80 ft. by 68 ft., and ten coke-breeze beds, 68 ft. by 45 ft., as well as two grit chambers, being two of the old precipitation beds, which, however, do not come into use except during wet weather. Upon all other occasions the sewage from the town runs directly on to the slate beds, without any screening.

"The sewage is a very dense domestic sewage, with washings from large slaughterhouses, dairies and breweries; the dry-weather flow is 200,000 gals. per 24 hours. We have no separate system, all the storm water being taken into the sewers.

"After dealing with a six-volume flow, the storm water, etc., is distributed over land

"The slate beds are filled consecutively, and take about 2½ hrs. to fill; they are allowed to rest about 3 hrs., and then emptied slowly, the effluent being treated on the secondary fine coke-breeze beds in a similar manner.

"At the commencement of emptying a slate bed, and during the last draining, most of the humus (residue) comes away, and is diverted on to a small, dry ash bed to drain and dry.

"The total cost of working, irrespective of new works, repairs, etc., is under $1,000 per annum, beside which we have no large accumulation of sludge. The humus when dry is easily dealt with, and forms no nuisance. The quantity made has never been measured, but I estimate it, after air drying, at about 20 to 30 tons per annum. The grit from the storm-water chambers is allowed to run on to a large withy bed; this, of course, contains a very small proportion of sewage matter.

"The final effluent from the secondary beds is so good that it can be, and is at times, run into the brook direct, as well as over land. In fact, when it is not wanted on the land it is run directly into the brook, and we have not received any complaints.

"I am of the opinion that this system solves the sludge problem, gives an excellent effluent and a total absence from smell from beds; and that the slate beds do not silt up, as they did not lose capacity after the first 12 months."

Sewer Standards in American Cities.

(STAFF ARTICLE.)

No class of engineering information is so difficult to find in print as that explaining current practice in the design and construction of ordinary structures. It is assumed by writers that standards in this class of work have been long ago established and have become common knowledge. The series of articles of which this is the second has been planned in opposition to this assumption. The articles will describe current practice in the design and construction of ordinary engineering structures.

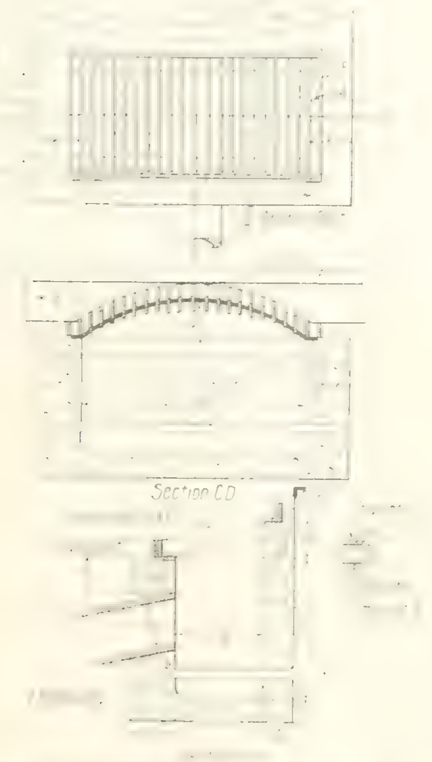

Fig. 1—Standard Concrete Catch Basin, Portland, Ore.

The first article related to standard sewer manholes. The present article will be followed by others relating to standards in various branches of civil engineering work.

[illegible] PLAN[illegible] TIONS.

Portland, Oregon.—The city of Portland is using a concrete catch basin with a curved bar inlet grating. This form of basin was adopte[illegible] tions in Fig. 1. The specifications governing the construction are as follows:

Concrete to consist of 1 part of cement, 3 parts of sand and 5 parts of broken stone or gravel, as per city ordinance. Basin to be made water tight by ramming the concrete and by applying inside a coating of ¼ in cement mortar. The angle irons to be secured to the concrete by four anchors in such a way that the grating fits therein without play. One flat bar to be embedded in the concrete over the outlet as reinforcement.

All wrought iron bars and gratings shall be bent and constructed as designated on plans and made of wrought iron which shall conform to the following specifications: Wrought iron shall be tough, ductile and fibrous, of uniform quality, free from crystalline structure, cinders, flaws or cracks. In bars it shall have a tensile strength of not less than 50,000 lbs. per sq. in., with an elastic limit of not less than one-half the tensile strength and the elongation shall be not less than 25 per cent in [illegible]

The concrete is mixed and placed as specified for concrete manholes in Engineering and Contracting of Dec. 27, 1911.

The following material is required for one basin: 1 cu. yd. of 1:3:5 concrete; 141 lbs. of ½ in. by 2 in. wrought iron grating bars; 10½ lbs. of ⅜ in. by 1½ in. reinforcement rods; 33 lbs. of 2½x2½x⅜ angle iron; 2 lbs. of bolts.

Two bars, each ½x2x28 ins., are bent and placed at each end of the grate as shown in Fig. 1. The ends of the grating and angle irons project 1 in., allowing such bars to be placed on 1½ in. centers from grate bars.

Indianapolis, Indiana.—Catch basins are built of brick in the Indianapolis sewer system. The present standard basin is shown in plan and section in Fig. 2. The specifications follow:

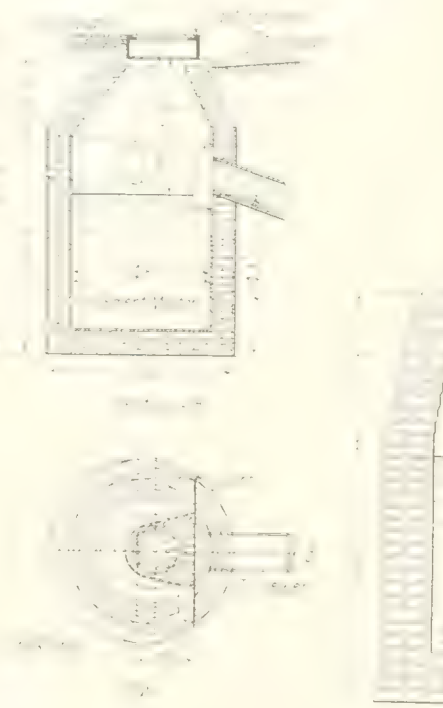

Fig. 2—Standard Brick, Catch Basin, Indianapolis, Ind.

Catch basins must be built when shown on the plan of the work, or at such places as the engineer may designate. They must be built according to drawings on file in the city engineer's department and connected with sewers by vitrified pipe of such size as may be determined by the engineer. They shall be constructed of brick masonry equal in all respects to that provided for manholes. (See Engineering and Contracting for Dec. 27, 1911.)

All catch basins shall be filled with water by the contractor and shall show no leakage.

Cast iron covers, traps and frames, of the form and dimensions shown on drawings on file, are to be furnished and set in place by the contractor, and the cost of the same must be included in the price bid for catch basins complete. All castings shall be of the best grade of gray iron, smooth and true in shape.

The cost of resetting curb or gutter flagging or repaving of street or sidewalks deemed necessary by the engineer, adjacent to the catch basin constructed, must be included in price bid.

Milwaukee, Wisconsin.—The standard brick catch basin which has been used in the Milwaukee sewer system since 1909, is shown in Fig. 3. These basins are built by force account by the sewer department and there are no printed specifications governing their construction. These basins cost from $25 to $30 by day labor.

Present Condition of the Chicago Water Supply—Proposed Measures for Improving Its Quality.

In our issue of Nov. 29, 1911, we published an abstract of Mr. G. M. Wisner's report on the Sewerage Problem in the Sanitary District of Chicago. The report contains further interesting matter relating to the present condition of the water supply and suggested methods for improving its quality. A map of the district was published in the former article.

A report on the sewage disposal situation in Chicago and the Sanitary District would not be complete without some reference to the water supply question. The purpose of the Sanitary District was to remove the sewage from Lake Michigan to protect the water supply. At the time the charter was adopted, such a procedure seemed adequate. Today standards of sanitary science are much higher, and in consequence the demand is rising for the filtration of all surface supplies. It is thought that in the future, filtration of the water supply of Chicago will be urged. Should untreated, or even treated, sewage be discharged into the lake, in the vicinity of the intakes, the water should be sterilized and finally filtered. Such discharge of sewage is not contemplated in the plan of the Sanitary District. There is, however, need in emergency for treating the water supply coming from the Sixty-eighth street crib by the use of hypochlorite of lime, so long as the Calumet situation is unimproved.

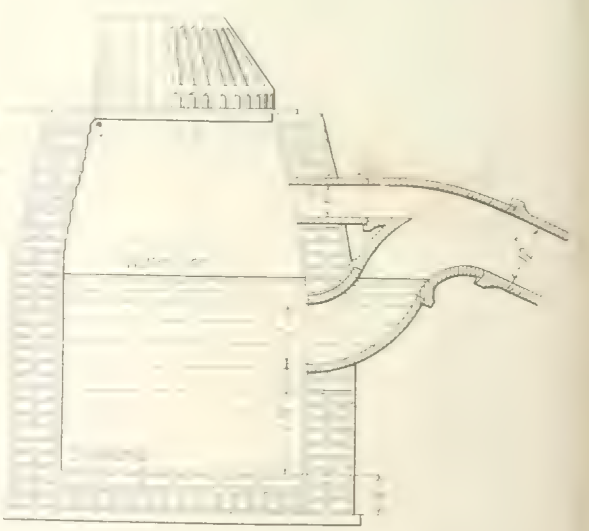

Fig. 3—Standard Brick Catch Basin, Milwaukee, Wis.

From the records of the Board of Health, of Chicago, Health Commissioner Young has furnished Table I.

The records, while very incomplete, show a water supply open to suspicion and decidedly unsatisfactory at times, as in July, 1911.

TABLE I.—RECORD [illegible]

Month	1909 Number Total	Positive	[illegible]	[illegible]	[illegible]	[illegible]
Jan.	[illegible]	4				
Feb.	21	1	[illegible]			
Mar.	[illegible]	[illegible]	[illegible]			
April	[illegible]	4	[illegible]	..	..	..
May	6	..	4	3	..	..
June	5					
July	4	[illegible]				
Aug.	4	[illegible]				
Sept.	[illegible]	[illegible]				
Oct.	[illegible]					
Nov.	[illegible]					
Dec.	[illegible]					

[illegible] able II summarizes the yearly records.

TABLE II.—SIXTY-EIGHTH STREET CRIB SUMMARY.

Year	[illegible]	[illegible]	[illegible]
Total tests	[illegible]	[illegible]	[illegible]
Number positive	28	12	10
Count over 1,000 per c.c.	11	5	..
Over 500 per c.c.	18	7	..

These records would indicate that the pollution is not continuous, but comes intermittently. This may probably be explained by the prevailing winds. Where the tests show positive, it indicates the presence of colon bacilli. The condition of the water from the Sixty-eighth street intake would probably have been more unsatisfactory if there had been any excessive flood in the Calumet River during the last season. This flood would have scoured much of the filth that is now accumulated on the bottom of the river into the lake. Beyond all probability, a flood will occur within the next year, at which time the accumulated filth on the river bed will be scoured into the lake, and the water supply at the Sixty-eighth street intake be polluted to a point to make it dangerous. The conditions seem to have become somewhat serious during the past three years. The possibility of trouble is aggravated now by the fact that the Calumet River was not flooded during the [illegible] year, and large deposits [illegible] rest on the bottom of the river. These will be flushed out into the lake when the next flood comes. The danger to the Sixty-eighth street crib of pollution is increased whenever a southerly wind occurs. This crib is situated only 3½ miles from the mouth of the Calumet River. A strong southerly wind drives the surface water directly to the crib. Examination of the tests made by the City Board of Health show that the times of pollution are intermittent, and usually bunched with certain winds, indicating that this conclusion is in accordance with the facts. That the surface water of the lake may travel long distances is shown by the floating blast furnace slag which has reached the Thirty-ninth street pumping station during the last summer. This has apparently been driven by the wind from South Chicago and Gary. The present condition in the Calumet region is, therefore, a menace to the health of the people who drink the water supplied by the Sixty-eighth street crib.

TREATMENT OF WATER SUPPLY.

It is perfectly practicable, in accordance with modern sanitation, to provide an emergency treatment which will protect the health of the citizens in this district. Sterilization by the use of hypochlorite of lime, in small amounts, is the proper remedy. A dosing apparatus can be built at or near the Sixty-eighth street crib so that it could be under adequate control. It would, however, be better if the chemical could be added at the crib, provided space were available there for the apparatus and storage of chemicals. Bacterial tests and examination of [illegible] will probably indicate that the application of chemicals need not be continuous. It should, however, be put in whenever the conditions induced by winds are ripe for the movement of surface or bottom water from the Calumet River into the lake towards the crib. The amount of the chemical required is small, being approximately five pounds per million gallons, and the estimated cost, including interest charges and depreciation, as well as operating expenses, would be about 35 cts. per million gallons pumped. Efficient management and control, on a large scale, may reduce [illegible] age through the C[illegible] River into the lake [illegible] mouth of the Chicago River. At times also the water supply becomes turbid. All the intakes are located in water less than 40 ft. in [illegible] or less. The intakes are, therefore, inside the zone of turbid water. Eventually, for sanitary and esthetic reasons, it is believed that the city of Chicago will consider and undertake the filtration of the water supply. In the near future sterilization will be resorted to, and should be resorted to at once as an emergency treatment in such cases as that of the Sixty-eighth street crib. Suitable locations for filter plants can be found on the water front, where connection can be made to existing water tunnels. Either filtration at a high rate in mechanical filters with the use of a coagulant, such as alumina sulphate, or treatment at a low rate on a slow sand filter, will provide adequate purification. The exact design will depend upon circumstances. Estimate of cost, on the basis of mechanical filtration, as well as disinfection, have been tabulated and are shown in Table III. The pumpage has been assumed at 200 gals. per capita daily.

TABLE III.—COST OR DISINFECTION OF ENTIRE WATER SUPPLY.

Year	Popu-[illegible]	Daily average pumping in [illegible]	[illegible]
1911	[illegible]	[illegible]	$ [illegible]
1922	3,000,000	600	76,700.00
1935	3,800,000	760	97,100.00
1942	4,200,000	840	107,300.00

COST OF FILTRATION.

Year.	Population.	Daily average pumping in millions gals.	Annual cost.
1922	3,000,000	600	$1,860,000.00
1935	3,800,000	760	2,280,000.00
1942	4,200,000	840	2,530,000.00

PRECAUTIONARY MEASURES.

It is recommended that buoys be established for a half mile, at least, all around the intakes, within which vessels shall not be allowed to pass. By this means the possibility of excreta washing into the intakes will be reduced. The principal source of danger is from the excursion boats with a large number of passengers. Undoubtedly this condition could be remedied by some federal regulation of shipping, such as using tanks to store the excreta and urine for discharge after the vessels have arrived within the Chicago River, or, on going out of the river, when a safe distance from the cribs have been reached. Such handling of this problem is not without precedent, as a similar system has been recommended in the west on the watershed of the city of Seattle. The danger from shipping in our case is a live one, since Dr. Young, the Health Commissioner of the city of Chicago, has shown that typhoid fever is far more prevalent on board vessels on the Great Lakes than in the towns bordering on the lakes, and that steamers are not only carriers of passengers and freight, but of typhoid as well. It is deemed very important that no excreta or human waste be dumped into the lake within four or five miles [illegible]

DUMPING.

The question of dumping dredging from the Chicago River in the vicinity of the intakes was a live one until last year, when Congress passed an act prohibiting the dumping of material within eight miles from the shore of Lake Michigan, unless such material be placed within a breakwater built to prevent the escape of any matter into the lake and the contamination thereof. This provision, if observed, will undoubtedly protect the intakes. There is, however, a question whether it is being strictly observed. The penalty for the offense should be visited upon the man in responsible command of the vessel or tug that is doing the work. This provision of the law is more often violated on account of the employes being anxious to finish their work than it is by any directed violation of this act by the owners or contractors doing the work.

A Tool Box, Built on Skids.

On a great many classes of construction work, especially sewer and water works jobs, it is convenient to move the tool box frequently and keep it close to the gang. Ordinarily the moves are short, only a block or so at a time. As it is very inconvenient to empty a tool box to load into a wagon at each move, and a box on wheels is expensive in first cost, also heavy to move when the ground is soft, a box on runners, to be dragged from place to place, has frequently been found most convenient.

The box shown in the accompanying illustration has proven very satisfactory, easily moved by one man and team, and of ample capacity. The box proper is made 6½ ft. long inside by 3 ft. wide, 2½ ft. high in front and 4 ft. high behind. All measurements except the first are outside dimensions. The small box increases the length about 2 ft. and is 2 ft. high on the low side. The runners should be of 3x8 in. by 10 ft. with eye bolts, so the box may be pulled from either end. The upright posts are of 2x4 in. pieces and extend 6 ins. down alongside the runner. The ones at the rear of the box are brought 6 ins. above the top to support the lid when open. The 2x4 in. pieces on which the floor is laid are let into the runners at least an inch and are spaced when possible so the uprights are directly against them. This construction makes a very strong box that may be handled very roughly without damage. The smaller compartment is especially convenient for nails, oil cans, and small tools.

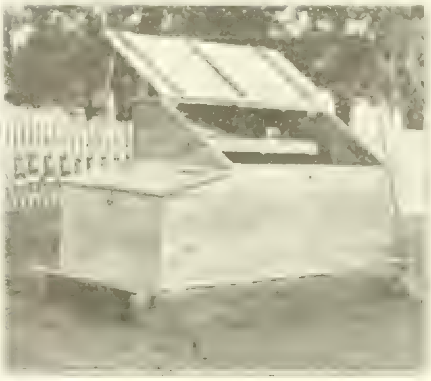

Fig. 1—View of Tool Box Built on Skids.

Results of the Application of the Hypochlorite Process to Kansas City's Water Supply.

The last annual report of W. M. Cross, City Chemist of Kansas City, contains some interesting figures on the results of the application of calcium hypochlorite to public water supplies, referring especially to its adoption by the Kansas City Water Department. The following information is taken from Mr. Cross' report:

Owing to the fact that there have always been present in the sedimented but otherwise untreated Missouri River water, germs whose positively known origin and normal habitat is the intestinal tract of man and animals, the question has been an open one in the minds of many sanitary engineers as to whether or not the city's water supply should not be unreservedly condemned for drinking purposes unless it had first been boiled or sterilized. Indeed, there have been occasions when the City Chemist has urged upon all of the citizens the advisability of boiling all river water before drinking it. Then to make matters [illegible] clear and sparkling waters that issue in many [illegible] from wells. These wells and springs throughout the settled districts of the city, although

Fig. 1—Arrangement of Head Plant at East 61st St. Shaft.

of very attractive appearance have been almost invariably the cause of disease at some time, and in most instances are at least ten times as badly contaminated as was the river water. Thus it happened that the city's water, on account of its questionable character, became a possible direct and certainly an indirect cause of disease.

During the years of 1908-9 some experiments were made with ozone to determine, if possible, some practical method of sterilizing our entire water supply at least as far as the destruction of germs likely to become the cause of disease, is concerned. These experiments indicated that although it was possible to sterilize to a satisfactory degree all of the city water, the expense of installing the apparatus and the maintenance of it would be prohibitive. At about the conclusion of the ozone experiments reports had begun to be circulated that there had been discovered the new application of the process of hypochlorite sterilization to the improvement of the entire water supplies of great cities. During the early part of the present municipal administration it was reported that in the case of Jersey City, the installation of the hypochlorite sterilization process on such a large scale as to make possible the treatment of the entire water supply of that city, had for its effect an astonishing diminution in the typhoid death rate. Then in rapid succession there came reports from numerous sources of the remarkably satisfactory effect of this wonderful agent, which is able to destroy, so efficiently, by oxidization, those germs most likely to produce disease and death if taken into the human system by drinking water. At Jersey City, using hypochlorite sufficient to produce 0.03 grains of available chlorine per gallon of water, the following germ counts were obtained:

Raw water, maximum, 1,600 per cubic centimeter; minimum, 240 per cubic centimeter.

Treated water, maximum, 30 per cubic centimeter; minimum, 0 per cubic centimeter.

This process, as indicated by this result, and many others similar to it, insures protection against disease germs and can be depended upon to render a moderately polluted water safe at a low cost.

During the early part of last fall, the Board ordered the writer to make a tour of inspection of several cities known to have the hypochlorite sterilization system in satisfactory operation. It was found that the results obtained at Jersey City, Harrisburg, Chicago and other places, were fully as good as reported, and that the method of installation of the system was both easy and cheap. It was found [illegible] a little over 15½ cts. was sufficient to treat a million gallons of a moderately polluted [illegible] took steps to install this system of treatment to improve the entire municipal water supply of Kansas City. The result has been all that could have been anticipated. Already it is reported that the number of cases of typhoid in Kansas City is unusually small for this time of the year.

Now, with this last danger removed from the general water supply, it is made possible for the Health Commissioner to so enforce the abandonment of questionable sources of water supply and regulate sanitary conditions as to make the occurrence of typhoid fever and most intestinal diseases an uncommon thing in Kansas City.

The following are some germ counts on the city water supply, showing the improvement of the water by the hypochlorite process:

Germs in 1 cubic centimeter of water (about 20 drops).

[illegible]	Quindaro River before treatment.	Clear Basin before treatment.	Hydrant at City Hall after treatment.	R. Club after treatment.
[illegible] 20	10,000	1,200	[illegible]	0
[illegible]	8,000	1,800	[illegible]	[illegible]
[illegible]	3,000	800	100	0
March 24	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	8,000	600	[illegible]	[illegible]
[illegible] 27	8,000	400	[illegible]	[illegible]
March [illegible]	5,000	26	20	0

Methods of Construction on the Cleveland Main Intercepting Sewer Between East 61st and East 79th Streets.

Contributed by [illegible] A. Greenwood, Assistant Engineer Sewers and Drains, Cleveland, O.

The Main Intercepting Sewer of Cleveland extends 13 miles along the lake shore with an outlet about 9 miles east of the center of the city. This outlet runs out half a mile into the lake. Into this main interceptor flow the various lateral sewers of the city. Overflow manholes are placed at the junctions of the laterals with the interceptor and so arranged that the ordinary sanitary flow goes into the interceptor and the storm flow goes into the lake.

The design of this system was based on a future population of 1,000,000 people spread over an area of 38,500 acres; the density of population being figured at 20 people per acre for the outlying districts, 30 people per acre for the ordinary residence districts, and 320 people per acre for the congested districts. Careful estimates were made to determine these boundaries and the size of the interceptor arranged accordingly.

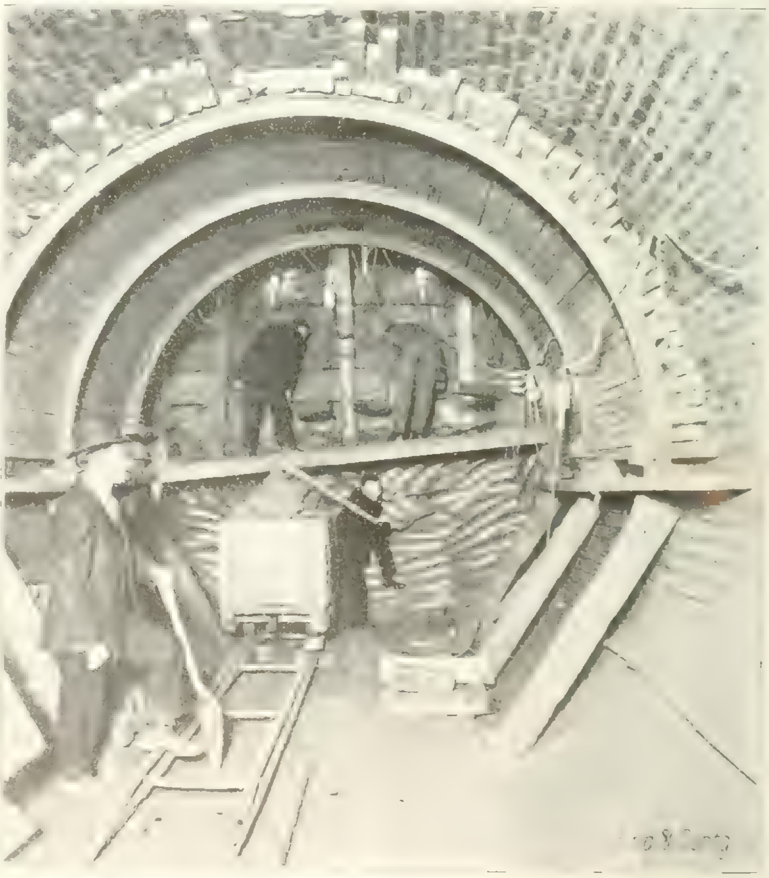

Fig. 2—View Showing Steel Centers and Lagging for Brick Lining.

The s[illegible] varies [illegible]. The grade is 2 ft. to the mile, giving a velocity of about [illegible] ft. [illegible] 405,000,000 gals. capacity for 24 hours at the outlet.

The flow is based on an estimate of 27 cu. ft., sanitary flow, per capita for 24 hours. The overflow manholes are so designed that an equal amount of storm water will mix with the sanitary flow before the storm outlet comes into use and the water flows directly into the lake.

The last two contracts, extending from East 61st St. to East 67th St., and from East 67th St. to East 79th St., completed April 1, 1911, finish that part of interceptor which lies east of the Cuyahoga River, leaving about 1.5 miles to build on the west side. This will be the most difficult portion of all as it will involve the construction of an inverted syphon under the Cuyahoga River. The contracts for the sections most recently completed between East 61st St. and East 79th St. were let to John Wagner, Bratenahl, Ohio. This section, 12 ft. 3 ins. in diameter, 6,850 ft. long, built by tunneling about 40 ft. under ground, was constructed with three rings of No. 1 shale brick laid with Portland cement mortar mixed in the proportions of 1 to 2. A 6-in. ring of wooden cants extended around the outside of the brickwork. The cants served the double purpose of providing a temporary roof during the mining, and also saved the brickwork from damage when the shield was shoved forward by the hydraulic jacks, which braced directly against the cants.

The material encountered for the most part consisted of hard blue clay which was readily knifed. Two pockets of quicksand were encountered one of which necesitated open cutting.

But two shafts were used, one situated at the west end of the work, at East 61st St., was operated with one heading; the other, situated at about two-thirds of the way between beginning and end of the work at East 70th St., had two headi[illegible]

[illegible] for conveying [illegible] two hydraulic pumps with a capacity for a pressure of 6,000 lbs. per [illegible] 200 electric lights at 110 volts, and a 30 h. p. engine for operating the dynamo. The cants [illegible] sawing sticks of 6x8 in. timbers, 3 ft. long, [illegible] tunnel. The East 61st St. shaft had practically the same machinery, with the exception that only one boiler, one compressor and one hydraulic pump were required. The general layout may be seen from accompanying sketches. The Lake Shore & Michigan Southern Ry. furnished convenient facilities for receiving material.

T[illegible] The mining was done during the day and the bricklaying at night. The work was started Oct. 1, 1909, and finished April 1, 1911. Considerable difficulty was encountered due to water and poor roof at each of the shafts when the headings were first started, and before compressed air was used. As soon as about 50 ft. of sewer had been built, brick masonry locks were constructed and the compressors started. About 14 lbs. pressure was all that could be obtained, as beyond that the air could not be held because of the comparatively shallow depth. The average pressure used was scarcely 6 lbs. and served to keep the face and roof dry. No trouble of any kind was encountered on account of the use of compressed air, except that great care had to be used by the workmen to avoid catching cold in leaving the shafts, and a slight cold in the head caused discomfort, due to the passage between the throat and ear being blocked. The 3-in. pipe conveying the air was not stopped at the face end of the locks, but was carried along with the construction. Another similar pipe extended from the shaft side of the lock up to the face. This was provided with a valve and was used to take out any water accumulating at the face. It also served as a means of rapidly changing the air at the face.

The shields were of the ordinary variety, consisting of a circular steel shell with a 4-ft. follower for the roof. Two different sizes were used, one only slightly in excess of the required diameter of the tunnel and the other about 4 ins. larger. The larger proved to be much more satisfactory, for the reason that if the shield were tipped slightly in order to go up for grade, the rear end of the follower of course would come down, the result being that the cants were forced downward. This often made it difficult to get in the three full rings of brickwork in the arch. Since the removal and replacement of the cants in the arch was an arduous and sometimes dangerous piece of work, it was found much more satisfactory to have a larger shield and to carry this a little high as the time saved much more than compensated for any slight excess of brickwork required. Each shield was provided with eight hydraulic jacks 4 ins. in diameter. While it was possible to obtain a pressure of 6,000 lbs. to the square inch, as a matter of fact a pressure much ocer 2,000 lbs. per square inch was seldom used, simply because the lesser pressure proved sufficient to move the shield. The jacks were the ordinary single action jacks, long enough to shove the shield 2 ft. The jacks were pushed back into their cylinders after a shove by releasing the water and prying them with crowbars. The double acting jacks would have been much more satisfactory for this purpose. The water from the hydraulic pump was carried in a high pressure ¾-in. pipe, especial care being used to secure perfect joints at the coupling. An extension arrangement at the shield fitted with movable joints allowed the shield to progress without uncoupling during a shift.

The actual process of mining was carried on by a force of six miners, two muckers, one timber man for the cants, and a boss miner. These men by means of knife and mattacks

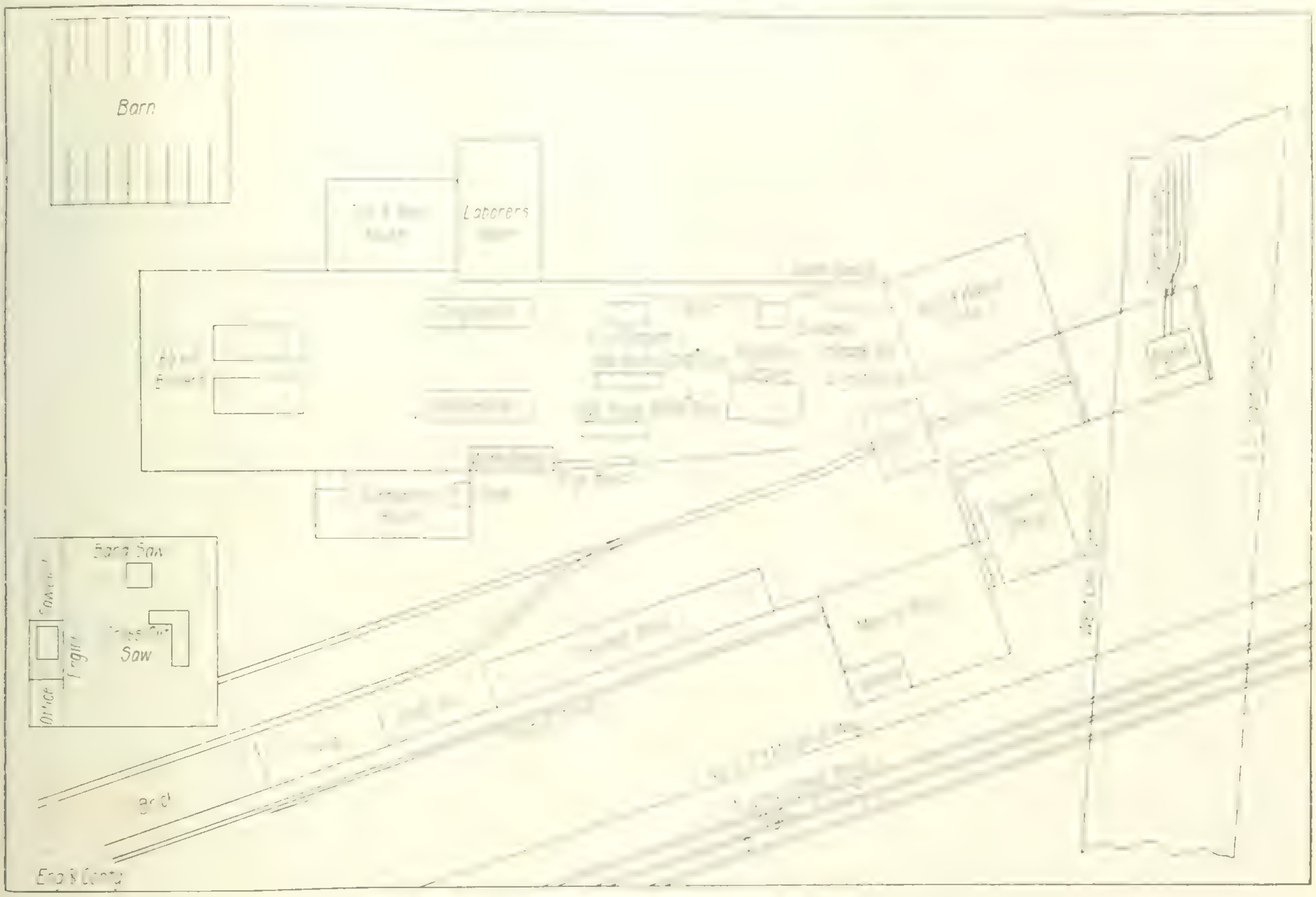

Fig. 3—Arrangement of Head Plant at East 70th St. Shaft.

would dig out the clay about 2 ft. ahead of the shield. The shield would then be forced ahead, and cants set and the process repeated. Each shove would take about five or ten minutes, but the mining for each shove generally took about two hours. As a rule about five shoves a day were made. The greatest distance made for one heading in one day was a little over 17 ft., but the average per heading was about 9 ft. As fast as the material was cut out, it was placed on cars, each holding ½ cu. yd., and hauled by mules to the shaft. The cars ran directly from the tunnel onto the hoist and were raised to a platform, above the street, run out on the platform and dumped into wagons, which carried the clay to the lake shore where it was dumped into the lake. At the East 70th St. shaft the clay was dumped into cars which were hauled on a narrow gage track to the lake about a quarter of a mile away. The brick shift came on at about 7 o'clock in the evening, and stayed until the brickwork was brought up to the face. Two bricklayers with seven helpers could take care of a day's work in eight hours. Steel ribs with wooden lagging 2 ins. square and 12 ft. long were used for the arch, with 2-ft. strips of block lagging for the key.

The contractor employed one superintendent for each shaft. Each superintendent was assisted by a boss miner and mason foreman. The sawing of the cants was sublet by the contractor. One sawing equipment did the work for both shafts.

Several nationalities were represented on the work: One mining gang was made up entirely of Irish miners, and another entirely of Poles. As a rule the bricklayers were Americans. The following tables show the makeup of each shift together with the average wage paid for each class of labor:

[illegible] 61st St [illegible] ing).

[illegible] per day....	[illegible]
[illegible] $4.50 per day	[illegible]
[illegible] per day	[illegible]
[illegible] per day	[illegible]
[illegible] per day	[illegible]
[illegible] per day	[illegible]
[illegible] per day	[illegible]
[illegible] per day	[illegible]
[illegible] per day	[illegible]
[illegible] per day	[illegible]
[illegible] per day	[illegible]
1 Engineer at $4.00 per day.............	4.00
1 Repair man at $4.00 per day..........	4.00
[illegible] per day	[illegible]
1 Superintendent at $6.00 per day........	6.00
[illegible]	[illegible]

Bricklaying Shift at East 61st Street Shaft.

2 Bricklayers at $8.00 per day...........	$16.00
[illegible] per day	[illegible]
1 Lock tender at $2.50 per day...........	2.50
2 Mule drivers at $2.00 per day.........	4.00
3 Laborers at $2.00 per day..............	6.00
1 Engineer at $4.00 per day..............	4.00
[illegible]	[illegible]
[illegible]	[illegible]

Mining Shift at East 70th Street Shaft (2 headings).

12 Miners at $4.50 per day................	$ 54.00
4 Muckers at $2.50 per day.............	10.00
2 Timbermen at $4.50 per day..........	9.00
2 Boss miners at $5.00 per day..........	10.00
4 Mule drivers at $2.00 per day.........	8.00
2 Lock tenders at $2.50 per day..........	5.00
2 Cage men at $2.00 per day...........	4.00
1 Tipple man at $2.00 per day..........	2.00
2 Dump men at $2.00 per day...........	4.00
4 Yard laborers at $2.00 per day........	8.00
1 Engineer at $4.00 per day.............	4.00
1 Repairman at $4.00 per day...........	4.00
1 Fireman at $2.00 per day.............	2.00
1 Superintendent at $6.00 per day........	6.00
[illegible] Total	$1[illegible].00

Bricklaying Shift at East 70th Street Shaft.

4 Bricklayers at $8.00 per day...........	$32.00
12 Helpers at $2.00 per day................	24.00
2 Lock tenders at $2.50 per day..........	5.00
2 Mule drivers at $2.00 per day...........	4.00
1 Foreman at $3.50 per day..............	3.50
[illegible]man at $2.00 per day............	2.00
[illegible] laborers at $2.00 per day.........	6.00
[illegible]man at $2.00 per day............	2.00
1 Repairman at $3.00 per day............	3.00
[illegible] at $4.00 per day	4.00
Total	$8[illegible].50

The tables show clearly the advantage in economy of operating two headings from one shaft. As a matter of fact this did not work out all the time, due to a bad quicksand pocket struck in the heading going east from East 70th St., which delayed that heading until the other two headings came together.

About 750 bricks per running foot were used in construction laid with ½-in. joints. The cement used was Lehigh Portland; between 7 and 8 bags being used with about 0.6 cu. yds. sand per running foot. The cants required about 282 ft. B. M. per running foot. The contract price for the section running between E. 61st St. and E. 67th St. was $35.97 per lin. ft. and for the section running for E. 67th St. to E. 79th St. it was $32.73 per lin. ft.

The line and grade of the sewer were given by inspectors from points set by the levelman every 25 ft. In spite of the fact that the course of the tunnel ran around two sharp curves coming west, and around one slight curve going east, nevertheless the two center lines came but 2⅝ ins. apart when the connection was made, while the stationing and grade were each found to be in error but .03 of a foot. Those in charge of work were as follows: John Wagner, Contractor; James Donnelley and Patrick Graham, Superintendents; James Gallagher, Levelman; Albert Reed, Chief Inspector, and Ivan A. Greenwood, Assistant Engineer Sewers.

GENERAL ARTICLES AND CLASSIFIED ITEMS

General Specifications for Underground Electric Conduit.

Contributed by R. E. Froisetti, Engineer, Utah Independent Telephone Co.

Plans.—All conduit construction shall be done in accordance with the plans furnished by the Engineering Department, and these specifications. The plans are to show the proposed location in the streets, the proposed cross-section to be built, the proposed locations of the man-holes, the grade and elevations.

Materials.—All materials used in conduit construction shall be satisfactory to the engineer and shall conform to the specifications for the particular piece of work.

Inspection.—All work shall be inspected by the engineer or his representative, to insure the use of proper material, and the faithful performance of work in accordance with the plans furnished and the specifications. All deviations from the plans or specifications shall be called to the attention of the foreman in charge, who shall immediately make the necessary corrections. Should questions arise that can not be readily adjusted by the inspector and foreman, the same shall be referred to the engineer, who will issue the necessary instructions.

Test Holes.—This subject, while of great importance on some work, will not be included in these specifications, as the necessary data can be obtained from the city engineers regarding locations of water mains, sewers, etc., the depth of water from the surface and the nature of the ground. Therefore test holes are not considered necessary.

Excavation of Trench.—In excavating material from the trench, the paving and surface materials of the street or alley shall be placed to one side so as to be available to re-surface the trench when work is completed. When the trench is excavated in private right of way, parks, or lawns, care shall be taken to cut, remove and preserve the sod, and replace same upon completion of the work. The earth excavated from the trench shall be placed upon cloth, burlap, or some other suitable protection placed upon the grass. The trench for the conduit shall be excavated to such a depth as will leave between the top of the conduit and the grade of the street a distance not less than 30 ins., except by special orders from the engineer. The width of the trench shall be such as to permit the convenient laying of conduit, and to allow between the walls of the conduit and the sides of the trench a distance not less than 3 ins.

Before the laying of concrete or conduit, the trench shall be opened the entire distance between adjacent man-holes to show the nature and extent of obstructions to be met with. This rule may be deviated from only when local conditions warrant it, such as a street crossing between adjacent man-holes. The sides of the trench shall be cut vertical and when necessary shall be shored to prevent caving. The trench shall be kept free from water. Any springs encountered must be drained, the soft place removed and filled with concrete. When gas, water or other pipes are encountered the work shall be carried on so as not to interfere with them, and when necessary shall be supported by some suitable means, until the trench is refilled. This condition will often result in the changing of the grade, but must only be done with permission from the engineer.

When gas, water and other pipes are to be included in the concrete protection of the conduit, the same shall be surrounded with sand without cement to avoid damage to the conduit or concrete in case the pipes are replaced or removed. When it is necessary to lay a conduit through a position or property of another corporation or individual owner, the obstruction shall be removed by the owner thereof upon agreement with the engineer, or by the contractor, upon written consent of the other party. The botom of the trench shall be firm and smooth and the conduit shall follow the grade of the street, if the specified grade is not shown upon the plans. Grades may be established with a spirit level with a side attachment, or with a plumb line and "strait edge" if grade hubs have been set by the city engineer, or any method approved by the engineer. In all cases the amount of slope, the method of making and necessary changes of grade shall be determined by the engineer.

CONCRETE.

Cement.—The cement shall be Portland, which will meet the requirements of standard specifications.

Sand.—Sand shall be clean, sharp and coarse, free from clay, loam and other impurities or organic matter, and shall be thoroughly screened.

Gravel.—Gravel shall be composed of clean, coarse pebbles of hard stone, the size not to exceed 2 ins. in diameter.

Proportions.—The proportions of material for concrete for all conduits and man-holes shall be as follows:

One part Portland cement.
Three parts sand.
Five parts clean pit gravel.

MIXING.

Hand.—Tight platforms shall be provided of sufficient size to accommodate men and material to mix batches not to exceed 1 cu. yd. and smaller batches are preferred, based upon the multiple of the number of sacks to a barrel. Place the gravel evenly upon platform about 4 ins. thick, the sand shall be added and evenly spread, then the cement shall be spread out and evenly distributed. This dry mixture shall be turned with shovels at least four times to insure thorough mixing. Sufficient water shall then be added and the mass turned with shovels until thoroughly incorporated and all gravel covered with mortar. This will probably require the mass to be turned four times.

Machine.—A machine mixer shall be used wherever the volume of work will justify the expense of installing the plant. The requirements for the machine will be that a precise and regular proportioning of materials can be controlled, and the product delivered be of the required consistency and thoroughly mixed.

Consistency.—The concrete [illegible] above way will have a consistency that when rammed the mass will not shake like jelly, but will when struck compact within the area of the face of the rammer without displacing the material laterally. Concrete used with fiber conduit shall be of such consistency that when dumped in place will not require much tamping. It shall be spaded down and tamped sufficiently to level off.

Immediate Use.—The concrete thus prepared shall be immediately placed in the trench. It shall be spread and thoroughly compacted by a ramming until free mortar appears upon the surface. Concrete in which the mortar has begun to set will be rejected. No regauging of concrete will be permitted.

MORTAR

Proportions.—Cement mortar for tile joints, brick work, etc., shall consist of one part Portland cement, two parts clean, coarse sand.

Mixing.—Cement mortar shall be mixed upon a close wooden platform or tight wooden box. Sand shall first be spread on the mixing board for a depth from 2 to 3 ins., the cement added and evenly distributed, and the material well mixed with shovels or hoes until of an even color. Sufficient water shall be added to make a stiff paste and mixed until every particle of sand is thoroughly dampened.

Immediate Use.—The mortar shall be used immediately after adding the water. Mortar that has been mixed in too great a quantity of water or that has been regauged, will be rejected.

CONDUIT MATERIAL.

Vitrified Clay (Multiple Duct).—Clay conduit must be free from blisters and shall have a smooth inside surface and be of a quality to meet the requirements of standard specifications.

Vitrified Clay (Single Duct).—Single duct shall meet the requirements of the above.

Fiber Duct (American or Orangeburg).—Fiber conduit shall meet the requirements of standard specifications.

Laying of Conduit (General).—Conduit shall always be laid in a straight line. When necessary to avoid obstructions or changes in streets, the conduit may vary slightly, but must not deviate to exceed 1 ft. in 20 ft. of trench. No change in line shall be made without the approval or directions from the engineer. When more than one length of conduit are laid the joints shall be staggered, also successive lengths shall be staggered with the first sections laid. Care shall be taken in dumping concrete, laying duct and refilling the trench not to disturb the conduit or concrete partially set or knock off earth from the side of the trench. Any dirt falling into the trench must be removed before the work can proceed.

Laying Multiple Duct.—There are any number of methods for laying multiple duct, and the one described herein has proven very satisfactory. The trench shall first be prepared with a 3-in. layer of concrete well leveled and tamped. The clay duct is then put in place, a strip of canvass or burlap soaked in grout shall be placed under the joints, the necessary dowel pins inserted and the canvass or burlap wrapped on both sides of the joint and the end sealed with mortar. The successive joints shall be treated in the same manner and the entire surface of the tile plastered with cement mortar. This applies to only one section of tile, but if the cross-section of the conduit mass is large it shall be built up in the same manner, the joints being staggered. In joining six duct tile, two dowel pins shall be used. Each duct shall be thoroughly scraped and all rough edges removed before being laid, and before the work is accepted each duct must be mandrelled with a steel mandrel and threaded with a No. 12B.B. iron fish wire.

Laying Fiber Duct.—The trench shall be prepared as for [illegible] conduit with a 3-in foundation of [illegible]. Upon this the conduit shall be laid [illegible] well settled into place. All lengths shall [illegible] together and joints shall be [illegible]. This shall be done by [illegible]

will be in the middle of length of the duct adjacent. Successive joints shall be laid in a similar manner and when the cross-section is completed the conduit mass is to be topped with three inches of concrete. This allows for three inches of concrete completely around the conduit, using the wall of the trench for one side forms, filling the 3-in. space allowed on each side of the trench with concrete. The cross-section of the conduit mass will show the thickness of the concrete between successive tiers of the fiber conduit.

Laterals.—Laterals shall be of single clay duct or standard 3-in. sewer file. Two separate laterals shall be laid from each side of the man-hole, one being stopped up at the propertly line for future use. When laterals are laid in the main trench, they shall be located at the top of the conduit and shall be included in the concrete or cement enclosing the conduit. When laterals are laid in separate trench, trench shall be wide enough to permit convenient laying of the pipe and deep enough to make the top of the completed tile at least 18 ins. below the surface of the ground. When joints are made between tile and iron pipe, the joints shall be wrapped with canvass or burlap and sealed with cement mortar. All joints must be made with cement mortar and must be staggered with the adjacent tile in the trench. Laterals shall have a slope toward the man-hole of not less than 8 ins. per 100 ft. If conditions arise to prevent giving the lateral the desired drainage, the slope may be reversed, using a "Y" section of pipe at the terminal pole. This change shall not be made without the approval of the engineer. When conditions warrant it, iron pipe shall be used for laterals. This will only be necessary when there is danger of tile being damaged by other excavations, or on the improved streets. No protection plant is considered necessary when tile is used under paved streets or alleys. One lateral shall be threaded with No. 12 iron fish-wire.

Man-holes.—Man-holes shall be located as shown on the plans unless conditions arise that would make the location impracticable, under which conditions the man-holes may be changed upon agreement with the engineer. The excavation shall be made to such a depth as to allow the level of the top of the vault to be about 12 ins. below the grade of the street. If the street is not paved the necessary grades shall be obtained from the city engineer and the top or cover set to conform to the given grade. If this grade cannot be obtained the top shall be built up to a height satisfactory to the engineer, and a chimney built to set the cover upon. This will allow for lowering the rim and cover without reconstructing the roof of the man-hole when the street is improved. The excavation shall be of sufficient width and length to make a space of 6 ins. around the outside of the man-hole when completed. The man-hole shall be standard (brick or concrete), as specified, with concrete bottom, cast-iron frame and cover, and the roof reinforced with 3-in. I beams. In size it shall be approximately the inside dimensions as shown upon the plans. No material variation shall be made in the size of the man-hole unless permitted by the engineer. For the different cross-sections of the conduit and desirable forms and dimensions of man-holes will be those shown on the plans and drawings. The man-holes shall be connected with a sewer drain, or sump, consisting of a 3-in. sewer tile, unless otherwise specified or the method of draining determined by the engineer after the excavation is completed. In constructing a brick man-hole the bottom of the excavation shall be first tamped, a layer of concrete 8 ins. thick and of sufficient length and width to project 2 ins. beyond the foundation course of the brick shall be placed and well tamped. The walls shall be of good quality "clinker" brick, laid in cement mortar; the brick shall be well moistened before using. The walls shall be 9 ins. thick and the foundation course shall be 4 ins. wider than the wall, which shall be built up to the length required, every sixth course laid as leaders. As the wall progresses in heighth, it shall be plastered with a coat of cement mortar on the outside. The brick work shall be racked away around the entrance of the ducts to afford room for turning cables when installed. All pipes and lateral tile entering the man-hole shall be cemented to the brick work and the inside shall be well pointed. The man-hole top shall be set so as to make the center line of ducts as nearly as possible underneath the man-hole opening, going both ways and midway between the ends of the vault, or the opening rim may be set on the end of the vault in case of a heavy rain one way. This, however, is left to the judgment of the engineer.

Cable hangers in each side wall shall be set in the brick, the number and location of each to conform to the plans of the vault in question. The vault shall be kept well barricaded until the concrete and mortar is well set.

Refilling Excavations and Temporary Paving.—In refilling excavations the better part of the material excavated shall be used. This material shall be deposited around the manholes, ducts, laterals, etc., in such a manner as not to injure cement or concrete wholly or partially set, or the tile or conduit. After a layer of about 12 ins. is placed over the ducts, the balance can be filled with teams and scrapers, allowing water to run in the trench to settle the earth. Excavations around man-hole shall be filled and tamped by hand. The surface of the trench shall be crowned with about 3 or 4 ins. of earth where streets are not paved. Where excavations have been made in pavement or paved streets, a layer of concrete 4 ins. thick shall be placed upon the surface. All surplus dirt and filth shall be gathered up and carted away.

Guarding of Street Obstructions.—All material to be used in the prosecution of the work shall be delivered along the line and piled so as to cause the least possible obstructions to traffic and to loss or damage to material.

All openings and obstructions shall be properly guarded and lighted. Bridges and temporary crossings shall be provided when necessary, so as to cause as little obstruction to traffic as possible.

Sealing of Ducts.—After conduit runs from vault to vault are completed, all ducts shall be closed with wooden plugs, previously boiled in oil. Ends of laterals shall be sealed with wooden plugs at the time they are laid. The ends of all ducts and laterals shall be closed with wooden plugs when work is suspended.

Cost of Electrical Power for Dredges.

The Oroville, Folsom and Yuba River dredging fields in California are admirably situated for the adoption of electric power, lying close to the foothills of the Sierra Nevada mountains. An abundance of water power is thus easily obtained, and numerous power plants have been erected at points convenient to the fields. The close proximity of these power stations naturally reduces the cost of motive energy, enabling the gold boats to be operated at costs that less favored districts are unable to approach. The following shows the varying costs of electrical power in the principal districts of the state:

Type of dredge.	Cost per cu. yd.	Per cent total costs.
[illegible] ft	$0.[illegible]	9.9
[illegible] ft	[illegible]	[illegible]
[illegible] ft	[illegible]	13.8
[illegible] ft	[illegible]	12.6
8 cu. ft.	.65	20.9
13 cu. ft.	.44	15.9
13.5 cu. ft.	.54	21.9

These figures are compiled from *Bulletin No. 57* of the *California State Mining Bureau*. The data given have been selected with a view of indicating the average cost of electric power per cubic yard, this expense item naturally varying in different localities, where more energy is required to perform a specified amount of work, or when the natural conditions demand the expenditure of electricity above normal requirements. Figures relative to the power costs on the new 15-ft. boats recently installed by the Natomas Con. Co. of California and the Yuba Con. Gold Fields, the two largest dredging enterprises in California, are not available, but it is probable that this expense is only a few cents higher than that of the 13.5-cu. ft. boat. A dredge handling 8,000 cu. yds. of material per day will consume approximately $43.20 per day in electric power, when the cost per cubic yard runs about a half cent.

Cost of Blue-Printing.

Contributed by F. H. Cushman, City Engineer's Office, Tacoma, Wash.

The cost of operation and maintenance from Oct. 1, 1910, to Oct. 1, 1911, of the electric blue-printing machine in the City Engineer's office at Tacoma, Wash., is shown in the following table:

[illegible]	sq. ft. blue print paper	$ [illegible]
6,645	sq. ft. blue print cloth	274.30
[illegible]	sq. ft. [illegible]	[illegible]
[illegible]	sq. ft. [illegible] printing brown [illegible] paper	14.25
118,710	sq. ft. of printing	$1,084.25
3.756	K.W. hours, at 3 cts	$ 112.65
	Labor	[illegible]
	Potash (intensifier)	5.20
	Total operation	$2,105.65
	New [illegible]	$ [illegible]
	New globes	5.00
	Repairs	7.50
	Carbons, oil, etc	4.85
	Total maintenance	$ 78.35
	Grand total	$2,184.00

Local commercial blue printers allow 2 per cent for waste, but the writer believes that 4 per cent has been waste during the past year due to the large amount of odd size prints that have been made. This leaves a net amount of 113,962 sq. ft. of printing at an average cost of 1.92 cts. per sq. ft.

The labor charge appears to be high, being rated about 43 per cent of the operation cost, but the blue-printer is rated as a draftsman at $75 per month.

The machine used is a continuous printing 54-in. Paragon; although 56-in. prints have been made. Alternating current at 110 volts is used with induction motor drive and four enclosed arcs for printing light. Any one or all four lamps are used according to the width of work being done. Printing speed is regulated by a friction drive, the motor running at constant speed. At high speed the machine feeds at 6.5 ft. per minute and at low speed about 1 ft. per minute. Tests show the machine in operation, with four lamps burning, to take 6.8 h.p.

A Rod for Cross-Sectioning.

The accompanying sketches illustrate a new rod for cross-section work in the field which has recently been patented by Chas. R. Hauke, of Rossfork, Idaho. The rod is constructed with different scales for determining slopes, and which may be used in either direction from the center stake of a cut or fill without reversing the rod. It is also arranged with a set of graduations which can be used in measuring the bottoms of the cuts, the rod being used in the same manner in either direction from the center without reversing. There is also included in the outfit a rod for measuring the differences in elevation. In the drawing, *A* represents one side, *B* the top and *C* the other side of the slope rod; *D* is a section through the clamp at the ends of the rod.

The depth of all cuts and fills are found mechanically and without mathematical calculation, and consequently the work can be done faster and with less liability of error.

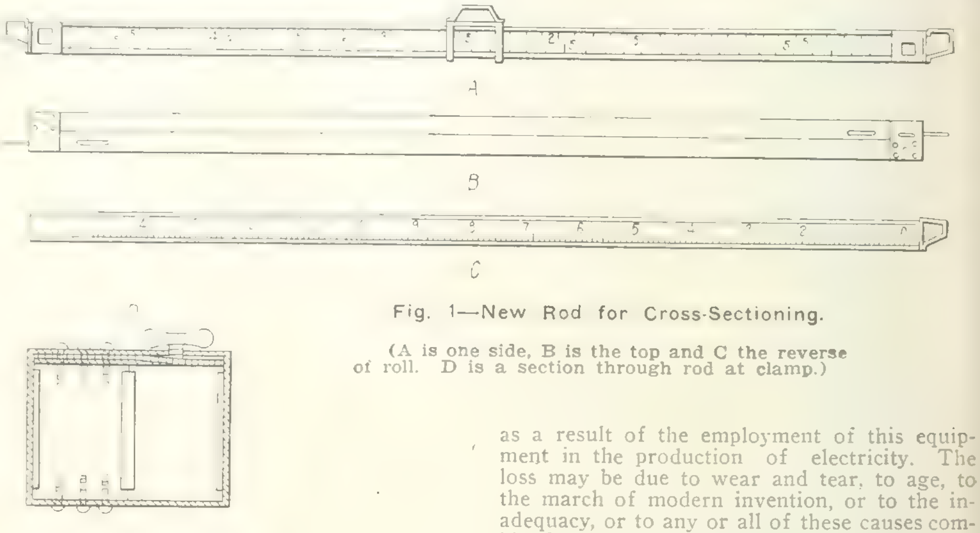

Fig. 1—New Rod for Cross-Sectioning.

(A is one side, B is the top and C the reverse of roll. D is a section through rod at clamp.)

Methods of Obtaining Cost of Electric Lighting Service to Consumers Based on Decisions of the Wisconsin Railroad Commission.*

At the last meeting of the San Francisco Section of the American Institute of Electrical Engineers, at which Honorable Max Thelen, attorney for the California Railroad Commission, made an address in connection with the recently adopted amendments to the Constitution of the State enlarging the powers of the railway commission and extending their control over other public service corporations than steam and electric railways, it was brought out that in the State of Wisconsin its railroad commission has practically the same control over the construction, operation and rates for service of the municipally owned public utilities as over the privately owned corporations providing service to the public.

Since [illegible] been done by it, and especially since the decisions of the Wisconsin Railroad Commission have been almost universally adopted, at least in principle, it is certainly desirable most carefully to consider the important opinions and findings of this commission in the principal cases it has considered and especially the decisions it has rendered.

Such conclusions are of necessity in the form of generalities rather than specific instances, and, while it should be fully understood that the conditions in Wisconsin may and probably are very different from those existing in California, the application of these conclusions to two typical electric lighting systems in two different Pacific Coast cities give results which are certainly illuminating.

In arriving at a basis for a just fixing of rates, this commission has consistently maintained that the rates for current should be based upon the cost of the service.† Each consumer occasions expenses to the plant. In order that every consumer shall pay his just share of the expenses, it is necessary to apportion the expenses of the plant between the capacity and output costs, and determine what part of each class of expense should be charged against each particular consumer. Thus, a particular consumer installs in his residence thirty incandescent lamps, thereby necessitating the power plant to be ever ready to supply the necessary current should the consumer turn on all its lights. The particular consumer, however, except in rare instances, burns only four lamps for a few hours each day. The consumer has thus forced the power plant to install sufficient capacity to care for maximum load conditions and should be charged a proper amount for this constant or capacity expense and also should pay a proper charge for the actual service rendered. Some eastern meters are installed so as to register these separate factors. It is then seen that operating expenses are of two classes—constant and variable.

Constant expenses are not affected by the business done but depend more on the capacity of the plant rather than any other factor. The variable expenses depend upon the amount of service rendered. The fixed or constant expenses should as nearly as is possible be charged proportionally for maximum capacity of each consumer while variable charges should be proportionally to the amount of service rendered.

The Wisconsin Railroad Commission in numberless decisions maintains that in the accounts of a public service corporation provision must always be made for depreciation. Depreciation is defined as that loss or shrinkage of value which inevitably occurs from time to time in the equipment of the plant, as a result of the employment of this equipment in the production of electricity. The loss may be due to wear and tear, to age, to the march of modern invention, or to the inadequacy, or to any or all of these causes combined. The aim of a depreciation fund is in a word to keep the investment intact. Repairs and maintenance do not offset depreciation. Depreciation must always be taken care of in the operating costs which are charged directly to the consumer and not charged against construction, thus warping this account out of proportion and apparently showing large earnings.

The commission goes further and states that as depreciation is continually going on a just and proper method of providing for it is to include depreciation under the head of operating expenses, charging off to the constant expense account such proportion of the depreciation as rightfully belongs under this heading, and to the variable expense account such proportion as properly belongs under its heading.

In the course of its investigations the commission found it necessary in cases of improperly arranged accounts or in case of no accounts being kept at all to order properly classified and detailed reports of expenses for the future.

Furthermore in the matter of municipal plants the commission found certain cases in which the accounts showed that taxes were not assessed against these plants and consequently the commission put itself on record as opposed to such practice. The commission stated that as capital invested in a public plant is the capital of the municipality or the taxpayers, the taxes and interest are a necessary factor in the determination of the cost of furnishing the service.

In order to apply the methods of approximately obtaining the cost of service to each customer, as is so clearly and completely set forth in the above quotations, I have worked out on two typical electric lighting systems on the Pacific Coast the segregated costs, setting forth separately the fixed and variable expense as affected by the load factor as well as the quantity of electrical energy used by each customer. System No. I has its power generated with steam, while System No. II receives its power at a sub-station outside of the city limits, stepping down from 60,000 volts to the voltage of distribution allowed within the city power.

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*A paper read by C. L. Cory before the fourteenth annual convention of the League of California Municipalities.

†Wisconsin Railroad Commission Reports, Vol. 3, pages 299-321; Vol. 4, pages 219-229; Vol. 5, [illegible] pages [illegible]

Probably no point is of such serious consequence in connection with the operation of a municipally owned lighting system as the low load factor resulting from the fact that most of the electrical energy used is for residence lighting, the period of use being of probably not more than an average of two hours each night of the 24-hour day. Again, the wide difference between the maximum demand or peak load and the average load for the year is caused by the difference in the seasons between December and June, and it is not extraordinary to find that the peak load for residence and retail business lighting during the last few days of December is 50 per cent greater than the corresponding peak load during the summer season. As an illustration of this Fig. 1 is the load curve of System No. II on June 30, 1910, showing a maximum load of 1,619 kw. at 9 p. m., lasting for a very short time. In fact, the load above 1,200 kw. was only of two hours' duration, or between 8 and 10 p. m. The average load for the 24 hours was 471.8 kw., making a load factor of 29.1 per cent for the day.

Figure 2, on the other hand, is the load curve of System No. II six months later, or on Dec. 31, 1910. The actual peak on this day was 2,363 kw., or almost exactly 50 per cent greater than on June 30. This peak of practically 2,400 kilowatts occurred at 6 p. m. and lasted for the better part of an hour. The load above 1,200 kw. continued for a period of 5½ hours, or between 5:15 and 10:45 p. m. The average load during the 24 hours was 920.7 kilowatt, or nearly 100 per cent greater than on June 30, six months previous. The load factor for the day was 38.9 per cent. While these curves are for particular days, yet they are typical of the summer and winter load, neither of them being abnormal for the two seasons. An annual load factor for such electric lighting service of from 20 to 30 per cent is not uncommon, while, in comparison, due to the large use of electrical energy for power in the operation of manufacturing plants, transportation systems, mines, etc., the load factor of extensive transmission systems, which often include a number of hydroelectric as well as steam driven central stations, have a load factor of between 70 and 75 per cent.

Another point of importance in connection with the construction and operation of municipally owned lighting systems is the rapid growth required of such systems in many progressive western cities. The increased investment demanded each year must be met ordinarily by a new bond issue and to show what this would mean in the city where System No. II is installed, I have given in Table I the year, the additions to plant, and the total investment for a period of seven years. During this time the additions to the plant varied from a minimum of $35,000 to a maximum of $120,000 per year, the total investment increasing in the seven years from $155,000 to $565,000, or practically three and a half times its original figure.

To meet this growth very many times requires additional money which ordinarily cannot be raised except by new bond issues.

Under favorable conditions, if there be a surplus, it may be used for short periods to do needed construction work and later, the cost of such construction work may be met by a bond issue, reimbursing the surplus fund by the electric lighting system from such bond issue. In such cases it may sometimes be proper to expend, for new construction, money which properly must be set aside each year to cover depreciation, provided such accounts are always properly carried on the books of the system so that the depreciation reserve, temporarily used for new construction, is replaced and used as required at such [illegible] able the funds actu[illegible]d in reality required [illegible] struction.

TABLE [illegible]

SYSTEM NO. II.

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Sixth	120,000	520,000
[illegible]	[illegible]	[illegible]

In determining the fuel cost on the steam plant switchboard per kilowatt-hour at different load factors I have used the figures given by C. R. Weymouth, M. E., in a paper entitled "A Method for Calculating Steam Power Plant Economy," for condensing direct connected steam driven units based on plants installed at Pacific Coast railway terminal points.

Fig. 1—Peak Load Conditions for Summer Months.

The kilowatt-hours per barrel of oil as there given for a 1,500 kilowatt condensing plant operating 24 hours per day are as follows:

Load factor.	Kw.-hr. per bbl. of oil.
12 hr. Test.	217
100%	197
50%	155
[illegible]	125

Figure 3 shows the cost of fuel with oil at 70 cts. and also at $1 per barrel per switchboard kilowatt-hour as affected by the load factor and indicates clearly the increased cost of fuel resulting from a low average daily load.

I have used $1 per barrel as the cost of fuel, primarily for the reason that, if the fuel costs a greater or less amount it is quite convenient to find the exact fuel cost by taking a direct proportion between the actual cost and the figure given of $1 per barrel.

The curves of Fig. 3 show what is considered to be the maximum and minimum range of price for the cost of fuel oil, namely $1 per barrel for the former and 70 cts. per barrel for the latter.

It must be noted in Mr. Weymouth's paper on Power Plant Economy, from which these figures are taken, that he is careful to state that "The above figures are approximate only, and are subject to considerable variation, depending on operating conditions, etc.," and the oil is assumed as having a thermal value [illegible] per barrel.

In this connection it is also well to have it fully understood that the figures given in Tables II and III for the two particular electric lighting systems, both as regards the investment in the different portions of the systems, and the resulting average costs per kilowatt-hour are to be considered as only relative and not as indicating absolutely the average costs per kilowatt-hour, especially as delivered to customers' meters, in other plants operating under decidedly different conditions as regards the cost of electric energy on the switchboard and character and extent of the complete installation, primarily in the distribution systems.

TABLE II.—SYSTEM NO. 1.

[illegible]	[illegible]
Installed capacity, kw.	1,750
Peak load for year, kw.	1,200
[illegible]	[illegible]
Load factor for year, per cent.	34.6
[illegible]	[illegible]
Aggregate length, distribution system, [illegible]	[illegible]
Average cost of distribution system per [illegible]	[illegible]
Number of customers	3,057
[illegible]	[illegible]
Number of pole transformers	552
Aggregate capacity transformers, kw.	2,179
[illegible]	[illegible]
Total valuation system	$560,000
Kw.-hr. steam plant switchboard per [illegible]	[illegible]
Kw.-hr. delivered to customers' meters per year	2,362,000
Average generating cost per kw.-hr. steam plant switchboard, cents	1.91
Average generator cost per kw.-hr. delivered to customers' meters, cents	2.94
Average total cost per kw.-hr. delivered to customers' meters, cents	6.32

TABLE III.—SYSTEM NO. II.

	From water and steam power transmission system.
Charter of Electric Service.	
Peak load for year, kw.	2,500
Average load for year, kw.	750
Load factor for year, per cent.	33 1/3
Efficiency of distribution system from switchboard to customers' meters, per cent	70
Aggregate distribution system:	
Overhead, miles	100
[illegible]	[illegible]
Average cost distribution system per [illegible]	[illegible]
Number of customers	7,250
Number of customers per mile of distribution system	69
Number of pole transformers	424
Aggregate capacity transformers, kw.	4,167
Average capacity per transformer, kw.	10
Total valuation of system	$577,000
Kw.-hr. substation switchboard per [illegible]	[illegible]
Kw.-hr. delivered to customers' meters per year	4,600,000
Cost per kw.-hr. substation switchboard:	
100 per cent load factor, cents	75
20 per cent load factor, cents	2.25
Cost at the substation switchboard per kw.-hr. delivered to customers' meters:	
30 per cent load factor, cents	3.21
Average total cost per kw.-hr. delivered to customers' meters	6.34

The relation, Table IV, between the investment per kilowatt in the generating stations, distributing system, and electrical meters, based on the peak load and the average load, indicates clearly the disadvantage of a low load factor. When the total investment is as much as $1,349 per kw. average load, and the investment in meters alone is $120.50 per kw. average load, it is easy to understand the causes of the higher fixed charges under such operating conditions.

In Table V the average rate of depreciation upon the generating station is taken at 5 per cent, which has been determined by considering separately the estimated life of the different parts of the station, including buildings, foundations, and the steam and electrical machinery. The total generating cost per kw.-hr. at the plant, it will be noted, is less than one-half as much at 100 per cent load factor as at 35 per cent load factor, the actual figures being 0.9 cts. per kw.-hr., with the best character of load and 1.90 cts. per kw-hr., with the [illegible] imum of peak load.

In Table VI the annual depreciation for the distribution system has been taken at 8½ per cent and has been determined by estimating the life of the different elements of the distribution system, including poles, crossarms, transformers, conductors and other outside construction materials.

It is to be noted in this table that the total distribution cost per kw.-hr. delivered to customers' meters is nearly three times as great at 35 per cent load factor as at 100 per cent load factor, or 0.257 cts. per kw.-hr. in the former case and 0.091 cts. per kw.-hr. under the most favorable operating conditions.

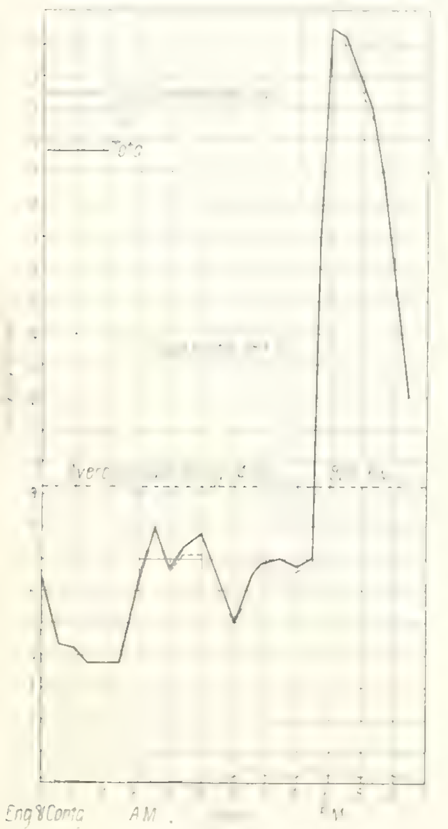


Fig. 2—Peak Load Conditions for Winter Months.

The total average cost per kw-hr. delivered to customers' meters at 100 per cent, 70 per cent, and 35 per cent load factor in Table VII are, respectively, 2.57 cts., 3.4 cts. and 6.32 cts., which comparative figures indicate clearly why the customer, using electrical energy, even though it is comparatively small in magnitude, is justly entitled to a decidedly low rate if the electric energy used by him is utilized at a high daily average load, or in other words, if his demand for service is such that the load factor is high. In this instance, if the load factor is uniform throughout the 24 hours, his rate may properly be 2.57 cts. per kw.-hr., increasing from this to 3.4 cts., if the average load is 70 per cent of the maximum, and finally to 6.32 cts. if the average load is but 35 percent of the maximum or peak load.

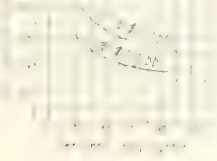


Fig. 3—Dependence of Fuel Consumption on Load Factor.

TABLE VIII.—TOTAL COST OF ELECTRIC SERVICE PER KW.-HR. TO CUSTOMERS METERS AT DIFFERENT LOAD FACTORS. SYSTEM NO. 1.

	Per kilowatt hour [illegible]		
	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.57c
[illegible]	[illegible]	[illegible]	0.81c
Total cost (average).	2.57c	3.40c	[illegible]

The figures in the last column, Table VII, are shown graphically in Fig. 4, which includes the average segregated cost of electrical service to customers in System No. I per kw.-hr. as well as the corresponding average monthly cost per customer. The average monthly bill in System No. I is $4.12, divided as follows:

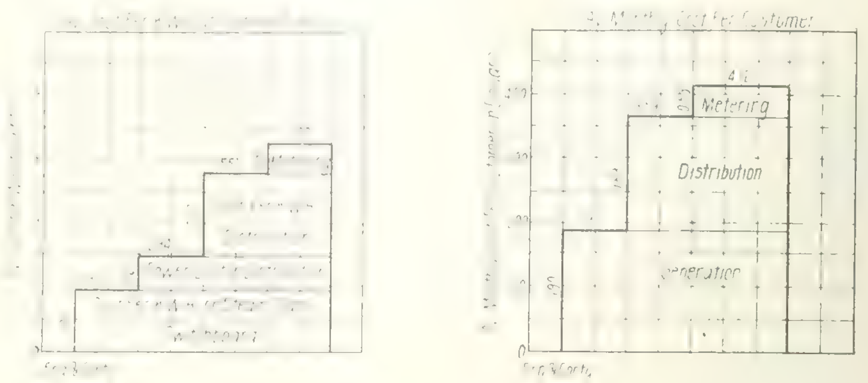


Fig. 4—Average Cost per Kilowatt Hour per Customer. System I.

Generation costs	$1.90
Distribution costs	1.69
Metering, billing, collecting, etc.	.53
Total	$4.12

It will be noted in the above that the cost of distributing the energy due to the fixed charges on the required investment, and losses in the distribution system and the comparatively low load factor, are not materially less than the corresponding cost of generating the electrical energy, while the cost of metering, billing, and collecting, per month, per customer, averages 53 cts., which is an indication at least of the necessity of a minimum bill whether current is used by the customer or not.

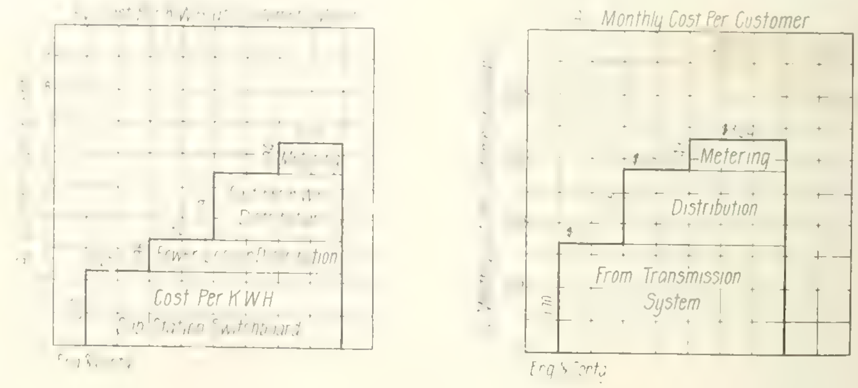


Fig. 5—Average Cost per Kilowatt Hour per Customer. System II.

TABLE IX.—TOTAL INVESTMENT IN SYSTEM NO. II.

Substation—		
[illegible]	$ 22,000	
Buildings	33,500	
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	$271,500	
Underground	44,000	318,500
Meters		115,500
Total		$5?7,000

TABLE X.—INVESTMENT IN SUBSTATION, DISTRIBUTION SYSTEM AND ELECTRICAL METERS PER KW.-HR., PEAK AND AVERAGE YEARLY LOAD, SYSTEM NO. II.

	Total investment.	Investment per kilowatt. Peak load.	Av. load.
Substation	[illegible]	$ 57.20	$190.60
Distribution	318,500	127.50	424.70
Meters	115,500	46.50	153.90
Total	[illegible]	$230,90	$769.20

From the above figures, Tables IX and X, it is to be noted that the total investment per kilowatt for the average load in System No. II is only a little more than one-half the corresponding investment in System No. I, this being due to the fact that there is no investment required for the generating station in System No. II. This is also shown in a rather striking manner by the fact that the total investment in System No. I for a peak load of 1,200 kw. is $560,000, while the total investment in System No. II, not requiring a generating station, is but little more, or $577,000 for a peak load of 2,500 kilowatts, or more than twice that of System No. I. This is true notwithstanding the fact that in System No. II there is a considerable portion of the distribution system underground, thereby requiring a relatively higher investment than for an overhead system of the same capacity.

From Table XI the distribution cost per kw.-hr. delivered to customers' meters at 100 per cent load factor—0.66 cts. is less than ⅓ of the corresponding distribution cost at a load factor of 30 per cent, which clearly indicates the reason why rates for electric service for a low average load as contrasted with the maximum load, are materially higher than for a load approximating 100 per cent load factor.

The figures of Table XII have been used to show graphically, as per Fig. 5, the average segregated cost of electric service to customers in System No. II per kw.-hr., and also per month. In this system the cost of electric energy from the transmission lines represents an average monthly cost to customer of $1.70. The corresponding distribution cost,

TABLE IV. - INVEST[illegible] ELECTRIC METERS [illegible] YEARLY LOAD, SYSTEM NO. 1.

Portion of system.	Investment.	Investment Installed. [illegible]	Kilowatt [illegible] load	[illegible]
Generating station	[illegible]	[illegible]	$210.65	$ [illegible]
Distribution system	257,000	[illegible]	214.17	[illegible]
Electric meters	[illegible]	[illegible]	[illegible]	[illegible]
Total	$560,000	$319.89	[illegible]	$1,349.00

TABLE V.—ANNUAL STA[illegible] CUSTOMERS' METERS FOR DIFFERENT LOAD FACTORS, SYSTEM NO. 1.

Item	Yearly total	Per kilowatt hour. 100%	[illegible]	[illegible]
Interest	$12,650	0.12	0.17	0.34
Taxes	4,050	0.04	0.06	[illegible]
Depreciation	12,650	0.12	0.17	0.34
Fuel	[illegible]	0.51	0.56	0.79
Operation and maintenance	[illegible]	0.11	0.16	0.33
Total generating cost per kw. at plant		0.90c	1.12c	1.91c
Total generating cost per kw. delivered to customers' meters		1.38c	1.73c	2.94c

TABLE VI.—ANNUAL DISTRIBUTION CHARGES AND COST PER KW.-HR. ON SWITCHBOARD AND AT CUSTOMERS' METERS FOR DIFFERENT LOAD FACTORS, SYSTEM NO. 1.

Item.	%	Amount.	Per kilowatt hour. 100%	[illegible]	[illegible]
Interest	[illegible]	$12,850	[illegible]	0.17	0.35
Taxes		4,120	0.04	[illegible]	0.11
Depreciation		21,850	0.21	0.30	0.59
Maintenance and operation		23,000	0.22	0.31	0.62
Total distribution cost per kw.-hr. at plant			[illegible]	0.84c	[illegible]
Total distribution cost per kw.-hr. delivered to customers' meters.			0.91c	1.29c	2.57c

TABLE VII.—ANNUAL METERING, BILLING AND COLLECTING, ETC., CHARGES AND COST PER KW.-HR. ON SWITCHBOARD AND TO CUSTOMERS' METERS FOR DIFFERENT LOAD FACTORS.

Item.	%	Amount.	Per kilowatt hour. 100%	70%	35%
Interest	5%	$ 2,500	0.02	0.03	0.07
Taxes		800	0.01	0.01	0.02
Depreciation	8%	4,000	0.04	0.05	0.11
Maintenance and operation		12,000	0.11c	0.16c	0.33c
Total metering cost per kw.-hr. at plant			0.18c	0.25c	0.53c
Total metering cost per kw.-hr. delivered to customers' meters			0.28c	0.38c	0.81c

TABLE XI.—ANNUAL DISTRIBUTION CHARGES AND COST PER KW.-HR. ON SWITCHBOARD AND AT CUSTOMERS' METERS FOR DIFFERENT LOAD FACTOR, SYSTEM NO. II.

Cost of distribution. Item.	Amount.	Per cent.	Yearly charge.	100 miles of distribution system. Cost per kw.-hr. 100%	70%	30%
Interest	$461,000	5%	[illegible]	0.11c	0.15c	0.35c
Taxes	461,000	1.6%	7,376	0.03c	0.05c	0.11c
Depreciation—						
Buildings	33,500	[illegible]	1,005			
Electrical apparatus	87,500	[illegible]	4,375			
Distribution:						
Overhead	274,500	[illegible]	23,333			
Underground	44,000	4%	1,760			
	[illegible]	[illegible]	[illegible]	0.14c	0.20c	0.46c
Maintenance and operation			$40,000	0.18c	0.26c	0.61c
Total distribution cost per kw.-hr. at substation				0.46c	0.66c	1.53c
Total distribution cost per kw.-hr. delivered to customers' meters				0.66c	0.94c	2.19c

TABLE XII.—ANNUAL METERING, BILLING AND COLLECTING, ETC., CHARGES, AND COST PER KW.-HR. ON SUBSTATION SWITCHBOARD AND AT CUSTOMERS' METERS FOR DIFFERENT LOAD FACTORS, SYSTEM NO. II.

Item.	Amount.	Per cent.	Yearly charge.	Cost per kilowatt hour 100%	70%	30%
Interest	$115,500	5%	$ 5,775	0.03c	0.04c	0.09c
Taxes	[illegible]	[illegible]	1,850	0.01c	0.01c	0.03c
Depreciation	115,500	7%	9,240	0.04c	0.06c	0.14c
Maintenance and operation			[illegible]	0.12c	0.17c	0.40c
Total metering cost per kw.-hr. at substation				0.20c	0.28c	0.66c
Total metering cost per kw.-hr. delivered to customers' meters				0.28c	0.40c	0.94c

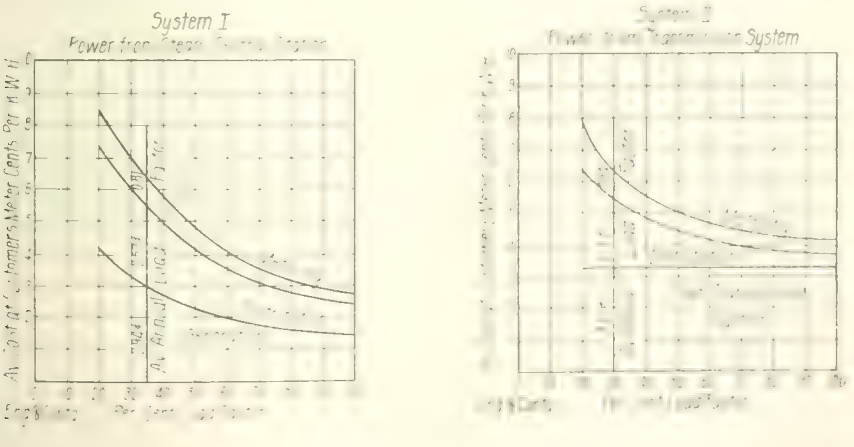


Fig. 6—Comparison of Power from Steam Central Station as Opposed to Power from Transmission System.

$1.15, and the metering, billing and collecting 49 cts., or a total monthly cost per customer of $3.34. The average cost per kw.-hr. at customers' meters is practically the same in System No. I and in System No. II, namely, 6.32 cts. and 6.31 cts. respectively. The corresponding average monthly cost per customer is considerably less in System No. II than in System No. I, as a result of the greater number of meters, or customers in the latter case

Figure 6 shows for both systems the variation of the generation cost, in the one case, and the cost of electrically transmitted power in the other, and for both cases the distribution and metering costs per kw.-hr. average to customers' meters at different load factors The effect upon the rate per kw.-hr. at low load factors and the necessity of increasing this rate in such cases is clearly shown by the curves for both systems.

TABLE XIII.—TOTAL COST OF ELECTRIC SERVICE PER KILOWATT HOUR TO CUS[illegible] FACTORS, SYSTEM II.

[illegible]	Cost per kilowatt hour at customers. [illegible]	[illegible]	[illegible]
Cost of power at sub-station	1.07c	1.50c	3.21c
Distribution	0.66c	0.94c	2.19c
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

TABLE XIV.—ANNUAL AND MONTHLY COSTS PER CUSTOMERS.

[illegible]

	Per year.	Per month
Average cost of electric energy at steam plant switchboard per cus-[illegible]	$ [illegible]	[illegible]
Average cost of electric distribution [illegible]	[illegible]	[illegible]
Average cost of metering, billing and collecting per customer	6.31	0.53
Combined cost of electric distribution, metering, billing and collecting per customer	26.53	2.23

SYSTEM NO. II.

	Per year.	Per month
Average cost of electric energy at substation switchboard per cus-[illegible]	[illegible]	$ [illegible]
Average cost of electric distribution per customer	13.91	1.15
Average cost of metering, billing and [illegible]	[illegible]	[illegible]
Combined cost of electric distribution, metering, billing and collecting per customer	19.81	1.64

In the determination of costs as given in Tables XIII and XIV, interest has been assumed as 5 per cent on the investment corresponding approximately to the interest charge on investments made by municipalities as a result of bond issues. Taxes have been considered at 11.6 per cent per annum, corresponding to an assessment of 50 per cent on the valuation and a tax rate of $3.20 per $100 assessed value.

If the return upon the investment is assumed as that to which a privately owned public service corporation, furnishing electric light and power to the inhabitants of a city, is entitled, as per the decisions of the Wisconsin Railroad Commission in the case of the State Journal Printing Company vs. The Madison Gas & Electric Company, page 648 W. R. C. R., Vol. 4, namely 8 per cent and the taxes are assumed as equivalent to those actually paid by the company owning System No. I, kw.-hr. on the basis of 4 per cent of its gross receipts the corresponding costs per kw.-hr. at 35 per cent load factor, would be as follows:

SYSTEM NO. I.

Generating costs per kw. at plant	2.16c
Generating costs per kw. delivered at customers' meters	3.33c
Distribution costs per kw.-hr. at plant	1.91c
Distribution costs per kw.-hr. delivered to customers' meters	2.94c
Metering costs per kw.-hr. at plant	0.58c
Metering costs per kw.-hr. delivered to customers' meters	0.89c
Total costs per kw.-hr. delivered to customers' meters	7.16c

If the return upon the investment is assumed at 8 per cent and the taxes equivalent to those paid under the California law, of 4 per cent of the gross receipts, the corresponding costs per kw.-hr. at 30 per cent load factor would be as follows:

SYSTEM NO. II.

Cost per kw.-hr. at substation switchboard	2.25c
Substation cost per kw.-hr. when delivered to customers' meters	3.21c
Distribution costs per kw.-hr. at substa[illegible]	[illegible]
Distribution costs per kw.-hr. delivered to customers' meters	2.54c
Metering costs per kw.-hr. at substations.	.72c
Metering costs per kw.-hr. delivered to customers' meters	1.03c
Total costs per kw.-hr. delivered to customers' meters	6.78c

It must be most clearly borne in mind that the above figures refer to the average cost per kilowatt-hour, as delivered to customers' meters, and have no direct relation to the [illegible] charged some customers, or in a similar manner the minimum rate, or any rates between the maximum and minimum rates. This is manifest because every customer who requires for his service an investment and maintenance and operating charge in the cost of electric power at the substation and steam plant, or excessive expenses connected with distribution due to the small amount of current used or the comparatively high investment required to reach him in the distribution system; or as a result, also of the low load factor, must pay a rate in excess of the average cost per kilowatt-hour delivered to customers' meters, while other customers using greater quantities of electrical energy at a decidedly higher load factor than the average, with a comparatively smaller investment in the distributing system and meters, should in equity be given a rate per kilowatt-hour decidedly less than the average cost as delivered to customers' meters.

[illegible] KILOWATT-HOUR, FIRST, WITH RETURN ON [illegible]

SYSTEM NO. I.

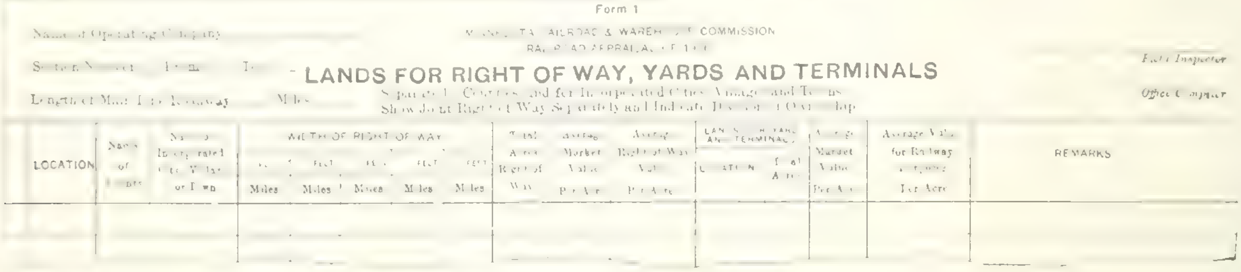
[illegible]	[illegible]	[illegible]
[illegible] meters	[illegible]	[illegible]
Distribution cost per kw.-hr. delivered to customers' meters	[illegible]	[illegible]
[illegible] cost per kw.-hr. delivered to customers' meters	[illegible]	[illegible]
Total average cost per kw.-hr. delivered to customers' meters	[illegible]	[illegible]

SYSTEM NO. II.

	Return.	
Cost per kw.-hr. at substation [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Distribution cost per kw.-hr. delivered to customers' meters	[illegible]	[illegible]
Metering cost per kw.-hr. delivered to customers' meters	0.94c	1.03c
Total average cost per kw.-hr. delivered to customers' meters	[illegible]	[illegible]

Forms Used In Compiling Information In the 1906 Appraisal of the Railways of Minnesota.

In the valuation of the railways of Minnesota in 1906 for rate making purposes much of this information was compiled on special forms or blanks. These forms were based on forms used in the Michigan and Wisconsin appraisals but were made considerably more complete. They were printed on sheets 14 by 18½ inches in size. While conditions in any set of forms to suit them to the requirements of different appraisal acts, yet all appraisals have so much in common that a good set of forms is of somewhat general application; they may at least be helpful as a skeleton on which to construct other forms especially adapted to the work. The accompanying figures show, therefore, the complete set of forms used in the Minnesota appraisal. This appraisal was made by Mr. Dwight E. Morgan, engineer, Minnesota railway and warehouse commission.



Form 1

Name of Operating Company

Section Number From To

Length of Main Line Roadway Miles

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

LANDS FOR RIGHT OF WAY, YARDS AND TERMINALS

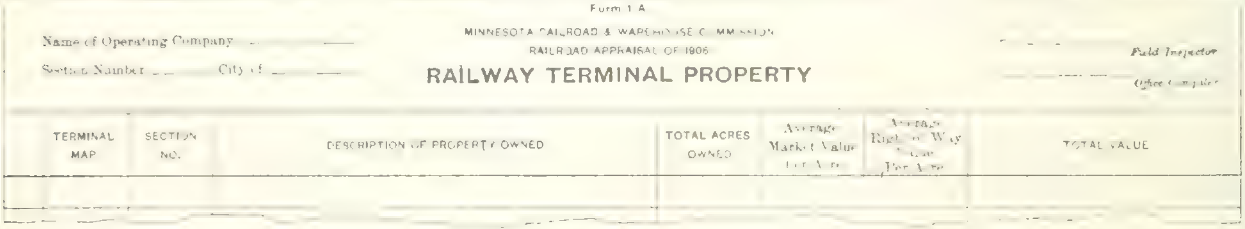
Separately Counties and for Incorporated Cities, Villages and Towns

Show Joint Right of Way Separately and Indicate Division of Ownership

Field Inspector

Office Compiler

LOCATION	Name of Counties	Name of Incorporated City, Village or Town	WIDTH OF RIGHT OF WAY					Total Acres Right of Way	Average Market Value Per Acre	Average Right of Way Value Per Acre	LANDS FOR YARDS AND TERMINALS		Average Market Value Per Acre	Average Value for Railway Purposes Per Acre	REMARKS
			Feet Miles	Feet Miles	Feet Miles	Feet Miles	Feet Miles				LOCATION	Total Acres			



Form 1 A

Name of Operating Company

Section Number City of

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

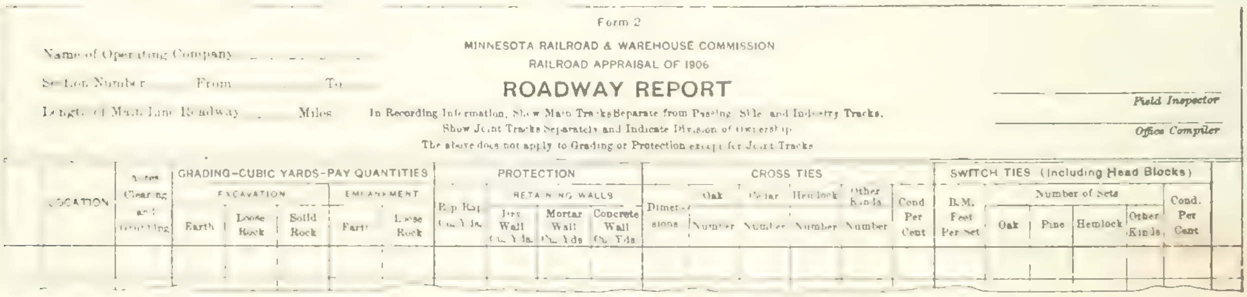
RAILROAD APPRAISAL OF 1906

RAILWAY TERMINAL PROPERTY

Field Inspector

Office Compiler

TERMINAL MAP	SECTION NO.	DESCRIPTION OF PROPERTY OWNED	TOTAL ACRES OWNED	Average Market Value Per Acre	Average Right of Way Value Per Acre	TOTAL VALUE



Form 2

Name of Operating Company

Section Number From To

Length of Main Line Roadway Miles

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

ROADWAY REPORT

In Recording Information, Show Main Tracks Separate from Passing, Side and Industry Tracks.

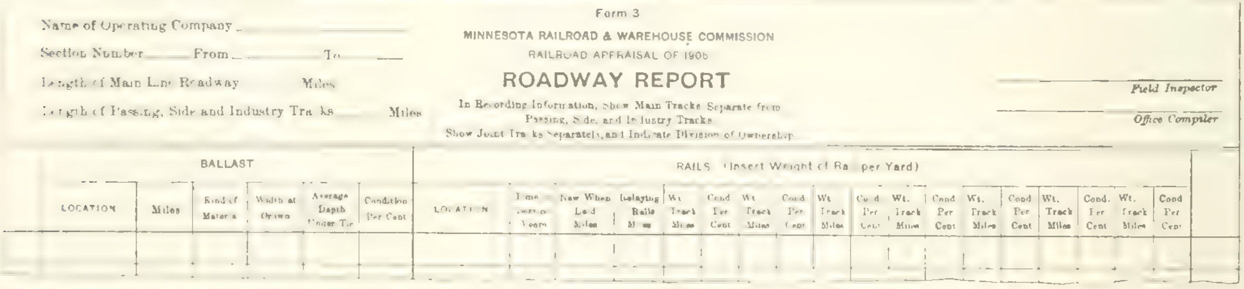
Show Joint Tracks Separately and Indicate Division of Ownership

The above does not apply to Grading or Protection except for Joint Tracks

Field Inspector

Office Compiler

LOCATION	Acres Clearing and Grubbing	GRADING—CUBIC YARDS—PAY QUANTITIES					PROTECTION				CROSS TIES						SWITCH TIES (Including Head Blocks)					
		EXCAVATION			EMBANKMENT		Rip Rap Cu. Yds.	RETAINING WALLS			Dimensions	Oak	Cedar	Hemlock	Other Kinds	Cond Per Cent	B.M. Feet Per Set	Number of Sets				Cond. Per Cent
		Earth	Loose Rock	Solid Rock	Earth	Loose Rock		Dry Wall Cu. Yds.	Mortar Wall Cu. Yds.	Concrete Wall Cu. Yds.		Number	Number	Number	Number			Oak	Pine	Hemlock	Other Kinds	



Form 3

Name of Operating Company

Section Number From To

Length of Main Line Roadway Miles

Length of Passing, Side and Industry Tracks Miles

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

ROADWAY REPORT

In Recording Information, Show Main Tracks Separate from Passing, Side, and Industry Tracks

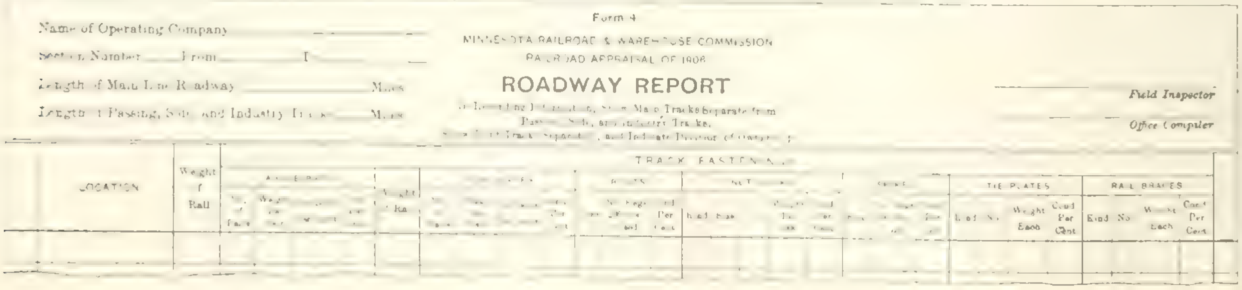
Show Joint Tracks Separately and Indicate Division of Ownership

Field Inspector

Office Compiler

BALLAST					
LOCATION	Miles	Kind of Material	Width at Crown	Average Depth Under Tie	Condition Per Cent

RAILS (Insert Weight of Rail per Yard)																	
LOCATION	Time in Service Years	New When Laid Miles	Relaying Rails Miles	Wt. Track Miles	Cond Per Cent	Wt. Track Miles	Cond Per Cent	Wt. Track Miles	Cond Per Cent	Wt. Track Miles	Cond Per Cent	Wt. Track Miles	Cond Per Cent	Wt. Track Miles	Cond Per Cent	Wt. Track Miles	Cond Per Cent



Form 4

Name of Operating Company

Section Number From To

Length of Main Line Roadway Miles

Length of Passing, Side and Industry Tracks Miles

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

ROADWAY REPORT

In Recording Information, Show Main Tracks Separate from Passing, Side, and Industry Tracks.

Show Joint Tracks Separately and Indicate Division of Ownership

Field Inspector

Office Compiler

LOCATION	Weight of Rail	TRACK FASTENINGS									
		[illegible]	[illegible]	[illegible]	[illegible]	TIE PLATES			RAIL BRACES		
		[illegible]	[illegible]	[illegible]	[illegible]	Kind No.	Weight Each	Cond Per Cent	Kind No.	Weight Each	Cond Per Cent

Name of Operating Company

Section Number From To

Length of Main Line Roadway Miles

Length of Passing, Side and Industry Tracks Miles

LOCATION

Name of Operating Company

Section Number From To

BRIDGES

Field Inspector

Office Computer

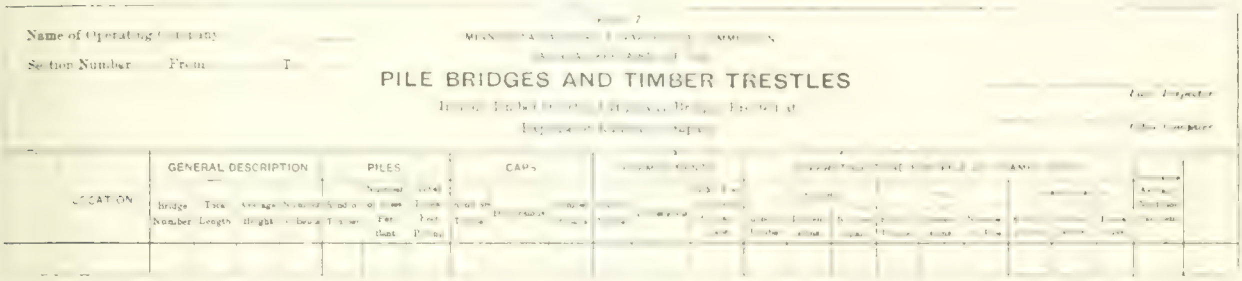
LOCATION

Bridge Number

SUBSTRUCTURE

SUPERSTRUCTURE

FRAMED TIMBER



Name of Operating Company

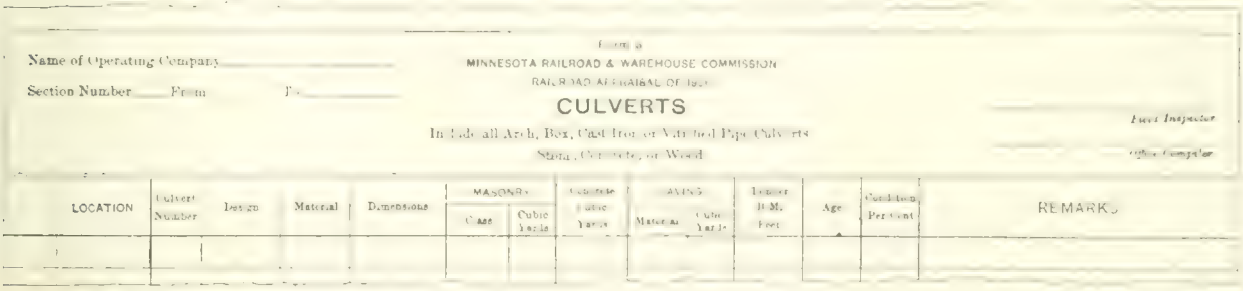
Section Number From To

PILE BRIDGES AND TIMBER TRESTLES

Field Inspector

Office Computer

LOCATION	GENERAL DESCRIPTION					PILES		CAPS
	Bridge Number	Track Length	Average Height		Timber	Per Bent	Feet Per Bent	



Form 8

Name of Operating Company

Section Number From To

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1908

CULVERTS

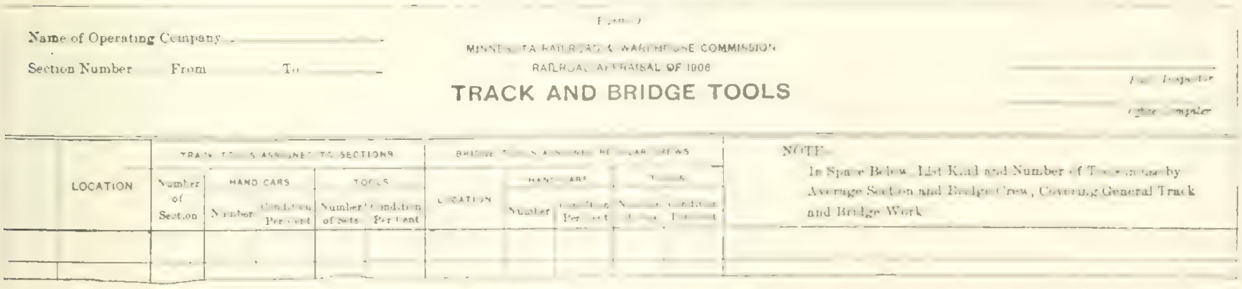
Include all Arch, Box, Cast Iron or Vitrified Pipe Culverts

Stone, Concrete, or Wood

Field Inspector

Office Computer

LOCATION	Culvert Number	Design	Material	Dimensions	MASONRY		Concrete Cubic Yards	PAVING		Timber B. M. Feet	Age	Condition Per Cent	REMARKS
					Class	Cubic Yards		Material	Cubic Yards				



Name of Operating Company

Section Number From To

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1908

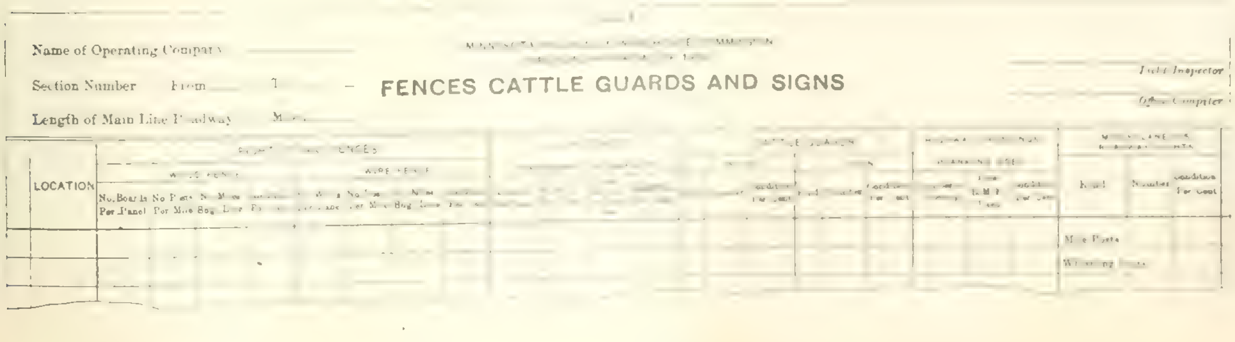
TRACK AND BRIDGE TOOLS

Field Inspector

Office Computer

LOCATION	TRACK TOOLS ASSIGNED TO SECTIONS					BRIDGE TOOLS ASSIGNED REGULAR CREWS				
	Number of Section	HAND CARS		TOOLS		LOCATION	HAND CARS		TOOLS	
		Number	Condition Per Cent	Number of Sets	Condition Per Cent		Number	Condition Per Cent		

NOTE—In Space Below List Kind and Number of Tools in use by Average Section and Bridge Crew, Covering General Track and Bridge Work



Name of Operating Company

Section Number From To

Length of Main Line Roadway Miles

FENCES CATTLE GUARDS AND SIGNS

Field Inspector

Office Computer

LOCATION

RIGHT OF WAY FENCES

WIRE FENCE

No. Boards Per Panel

No. Posts Per Mile

CATTLE GUARDS

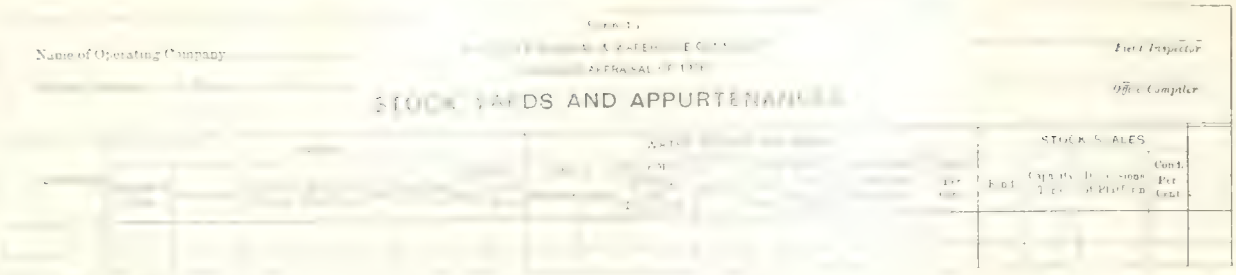
Kind

Number

Condition Per Cent

Mile Posts

Whistling Posts



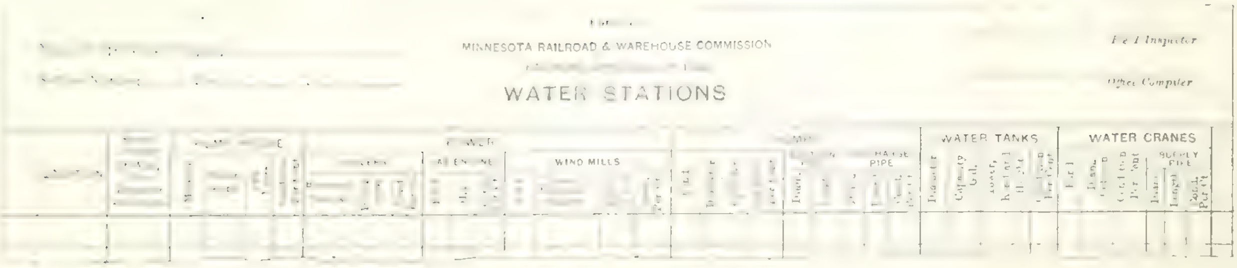
Name of Operating Company

Field Inspector

Office Compiler

STOCK YARDS AND APPURTENANCES

	STOCK SCALES				
	Kind	Capacity Tons	Dimensions of Platform	Cond. Per Cent	



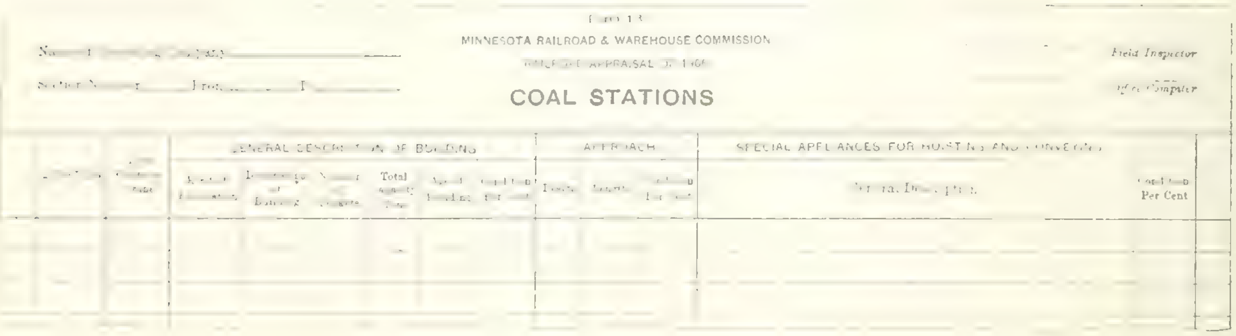
MINNESOTA RAILROAD & WAREHOUSE COMMISSION

Field Inspector

Office Compiler

WATER STATIONS

	POWER		WIND MILLS		DISCHARGE PIPE	WATER TANKS		WATER CRANES
						Diameter	Capacity Gal.	Supply Pipe



Form 13

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

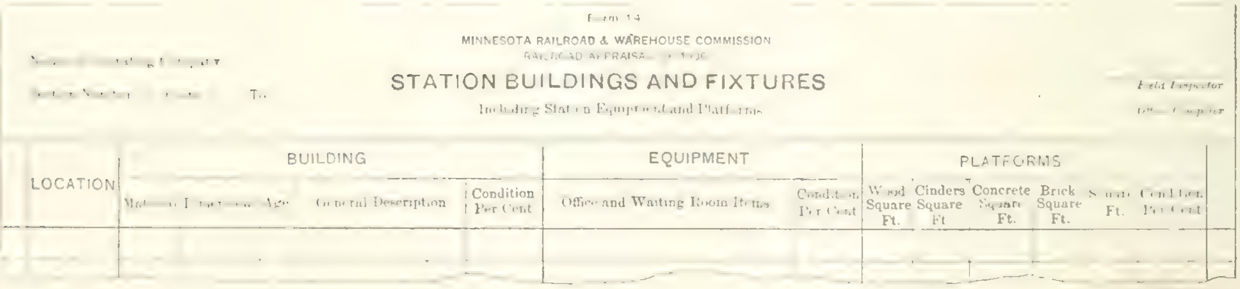
RAILROAD APPRAISAL OF 1906

Field Inspector

Office Compiler

COAL STATIONS

	GENERAL DESCRIPTION OF BUILDING					APPROACH	SPECIAL APPLIANCES FOR HOISTING AND CONVEYING	
		Dimensions of Building		Total Capacity Tons		Condition Per Cent	General Description	Condition Per Cent



Form 14

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

Name of Operating Company

Section Number From To

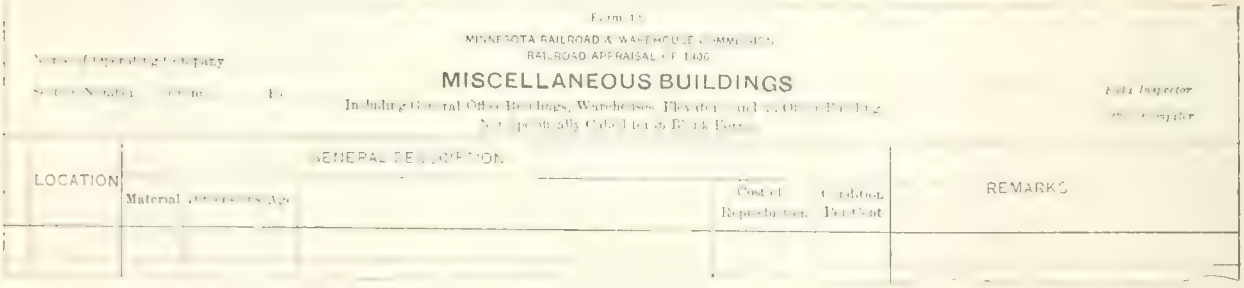
STATION BUILDINGS AND FIXTURES

Including Station Equipment and Platforms

Field Inspector

Office Compiler

LOCATION	BUILDING					EQUIPMENT		PLATFORMS					
	Material	Dimensions	Age	General Description	Condition Per Cent	Office and Waiting Room Items	Condition Per Cent	Wood Square Ft.	Cinders Square Ft.	Concrete Square Ft.	Brick Square Ft.	Square Ft.	Condition Per Cent



Form 15

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

Name of Operating Company

Section Number From To

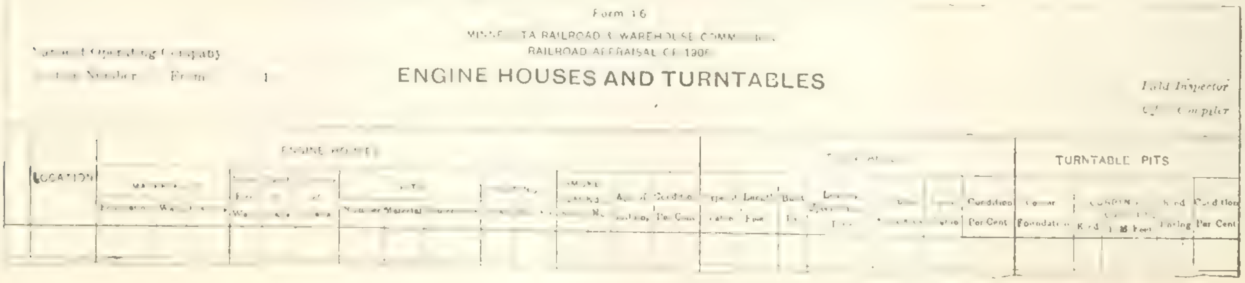
MISCELLANEOUS BUILDINGS

Including General Office Buildings, Warehouses, Elevators and All Other Buildings Not Specifically Called for on Blank Forms

Field Inspector

Office Compiler

LOCATION	GENERAL DESCRIPTION						REMARKS
	Material	Dimensions	Age		Cost of Reproduction	Condition Per Cent	



Form 16

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

Name of Operating Company

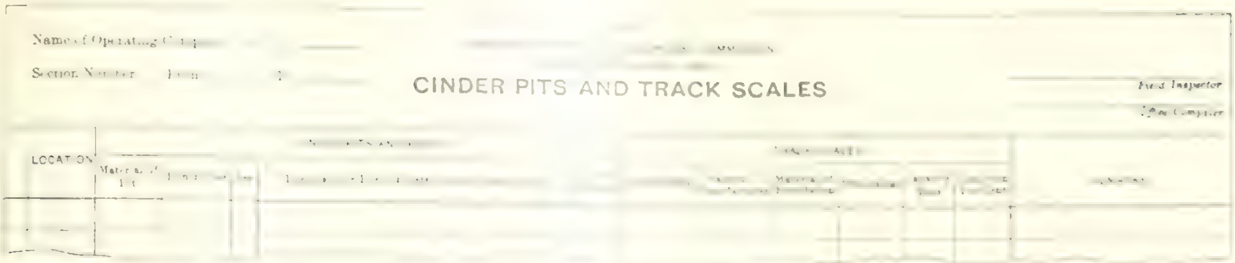
Section Number From To

ENGINE HOUSES AND TURNTABLES

Field Inspector

Office Compiler

LOCATION	ENGINE HOUSES						TURNTABLE PITS		
		Age of Building	Condition Per Cent	Length Feet	Condition Per Cent	Foundation	Kind	Kind Facing	Condition Per Cent



Name of Operating Company

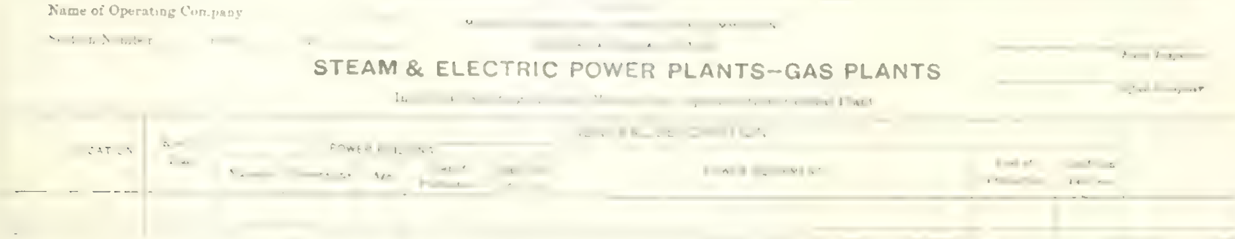
Section Number From To

CINDER PITS AND TRACK SCALES

Field Inspector

Office Compiler

LOCATION



Name of Operating Company

Section Number

STEAM & ELECTRIC POWER PLANTS—GAS PLANTS

Field Inspector

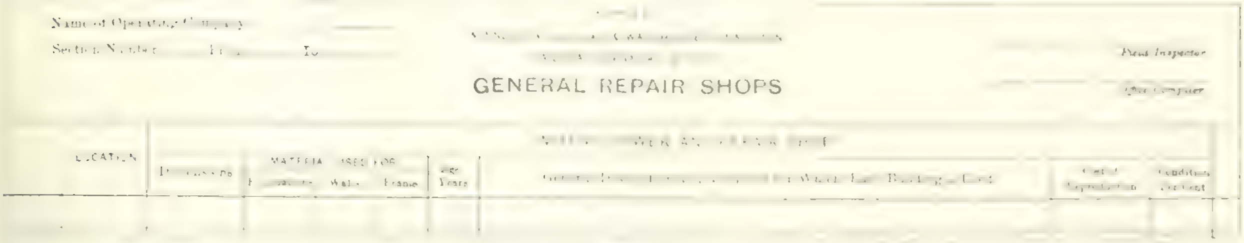
Office Compiler

LOCATION

POWER BUILDING

Age

POWER EQUIPMENT



Name of Operating Company

Section Number From To

GENERAL REPAIR SHOPS

Field Inspector

Office Compiler

LOCATION

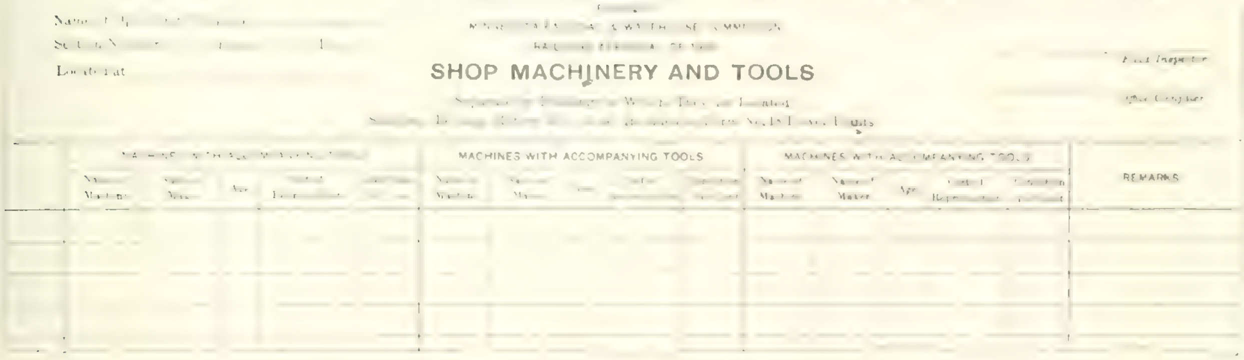
MATERIAL USED FOR

Walls Frame

Age Years

Cost of Reproduction

Condition Per Cent



Name of Operating Company

Section Number From To

Located at

SHOP MACHINERY AND TOOLS

Field Inspector

Office Compiler

MACHINES WITH ACCOMPANYING TOOLS

MACHINES WITH ACCOMPANYING TOOLS

MACHINES WITH ACCOMPANYING TOOLS

Name of Machine

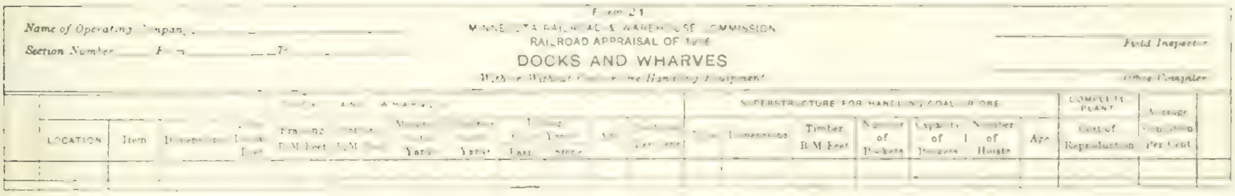
Name of Maker

Age

Cost of Reproduction

Condition Per Cent

REMARKS



Form 21

Name of Operating Company

Section Number From To

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

DOCKS AND WHARVES

Field Inspector

Office Compiler

LOCATION

Item

SUPERSTRUCTURE FOR HANDLING COAL OR ORE

Timber B.M. Feet

Number of Pockets

Capacity of Pockets

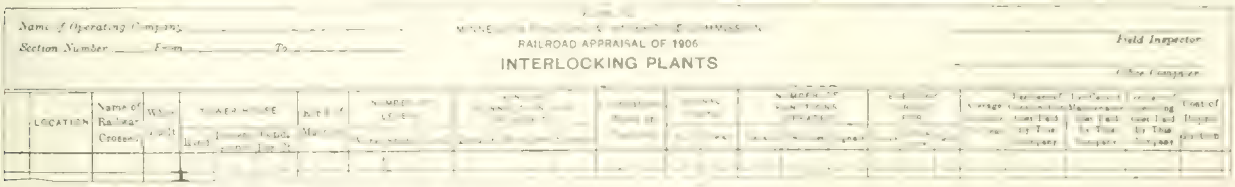
Number of Hoists

Age

COMPLETE PLANT

Cost of Reproduction

Per Cent



Name of Operating Company

Section Number From To

RAILROAD APPRAISAL OF 1906

INTERLOCKING PLANTS

Field Inspector

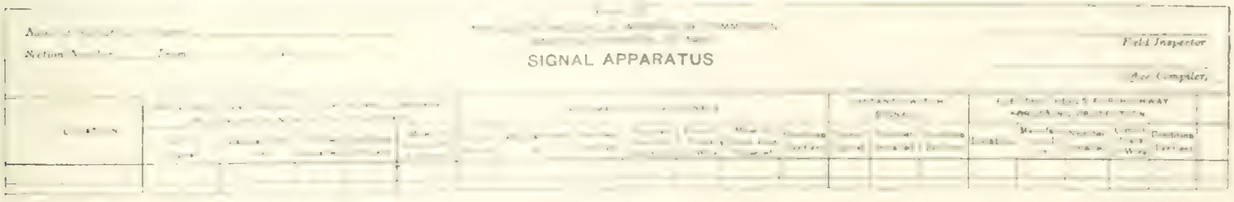
Office Compiler

LOCATION

Name of Railway Crossed

TOWER HOUSE

Cost of



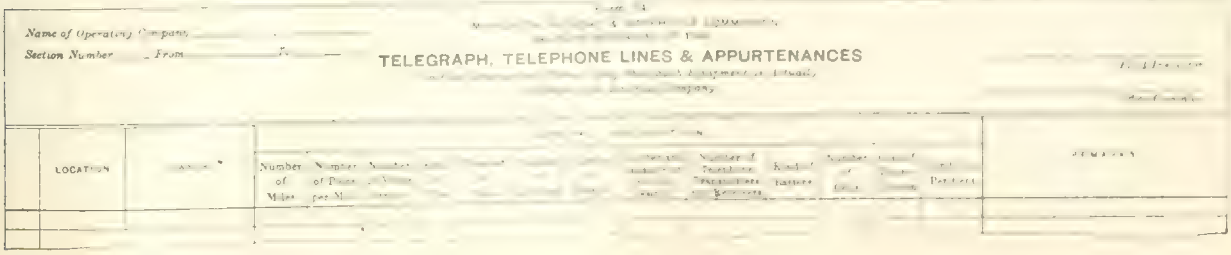
Section Number From

SIGNAL APPARATUS

Field Inspector

Office Compiler

LOCATION



Name of Operating Company

Section Number From

TELEGRAPH, TELEPHONE LINES & APPURTENANCES

LOCATION

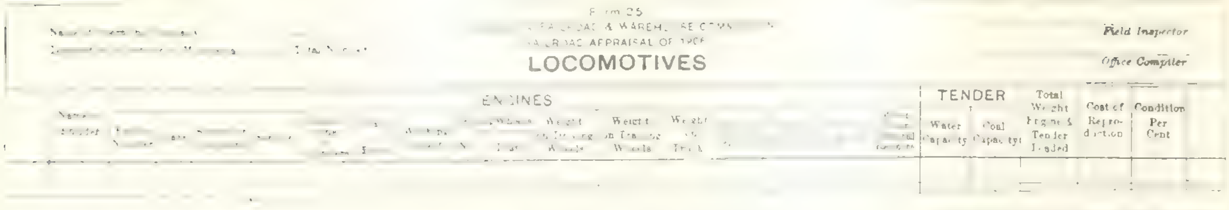
Number of Miles

Number of Poles per Mile

Kind of Battery

Per Cent

REMARKS



Form 25

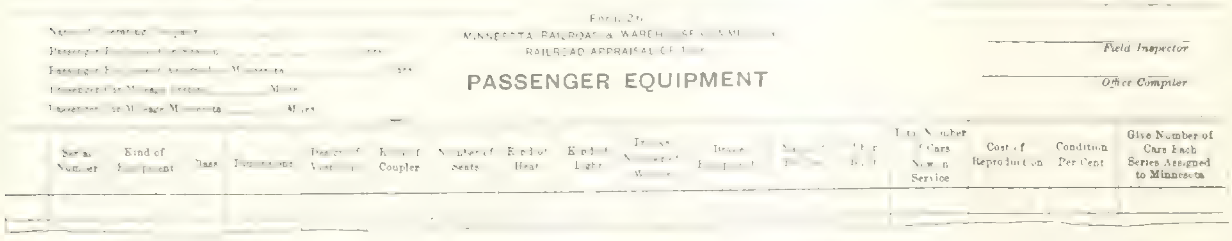
RAILROAD APPRAISAL OF 1906

LOCOMOTIVES

Field Inspector

Office Compiler

ENGINES	TENDER Water Capacity	Coal Capacity	Total Weight Engine & Tender Loaded	Cost of Reproduction	Condition Per Cent



Form 26

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

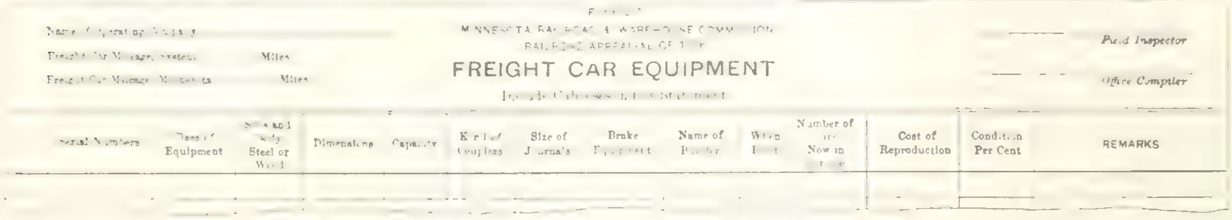
RAILROAD APPRAISAL OF 1906

PASSENGER EQUIPMENT

Field Inspector

Office Compiler

Serial Number	Kind of Equipment	Class			Kind of Coupler	Number of Seats	Kind of Heat	Kind of Light					Total Number of Cars Now in Service	Cost of Reproduction	Condition Per Cent	Give Number of Cars Each Series Assigned to Minnesota



MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

Miles

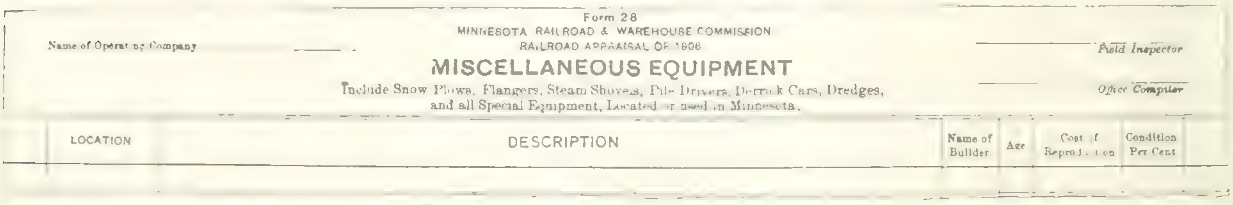
Miles

FREIGHT CAR EQUIPMENT

Field Inspector

Office Compiler

Serial Numbers	Class of Equipment	Steel or Wood	Dimensions	Capacity	Kind of Couplers	Size of Journals	Brake Equipment	Name of Builder	When Built	Number of Cars Now in Service	Cost of Reproduction	Condition Per Cent	REMARKS



Form 28

MINNESOTA RAILROAD & WAREHOUSE COMMISSION

RAILROAD APPRAISAL OF 1906

Name of Operating Company

MISCELLANEOUS EQUIPMENT

Include Snow Plows, Flangers, Steam Shovels, Pile Drivers, Derrick Cars, Dredges, and all Special Equipment, Located or used in Minnesota.

Field Inspector

Office Compiler

LOCATION	DESCRIPTION	Name of Builder	Age	Cost of Reproduction	Condition Per Cent

PERSONALS.

Mr. Geo. W. West has been appointed City Engineer of Glendora, Calif.

Mr. Frederick S. Parkhurst, Jr., has been reappointed City Engineer of Niagara Falls, N. Y.

Mr. R. F. Stoddard, Assoc. M. Amer. Soc. C. E., and Mr. M. F. McKenna, formerly City Engineer, have announced the formation of a partnership for the practice of civil engineering with offices at 83 Fairfield Ave., Bridgeport, Conn.

Mr. Valier Mayhew was appointed on December 28 assistant to City Engineer Chas. H. Snyder of Oswego, N. Y. Mr. Mayhew has been connected with the engineering department of the Ontario division of the New York Central R. R.

Mr. S. D. Clinton, Assoc. M. Amer. Soc. C. E. has resigned his position as Chief Engineer of the Fort Pourtneuf Marsh Valley Irrigation Co. at Downey, Idaho, and will resume a general engineering practice with his partner, Mr. Chas. H. Mull, City Engineer of Twin Falls, Idaho.

Mr. Bernard W. Murphy, U. S. Civil Engineer, died in Seattle, Jan. 3, at the age of 49. Mr. Murphy built Fort Wyngate, New Mexico, Forts Worden, Flagler and Casey in Washington. He was Superintendent of Construction for the Santa Fe R. R. in Colorado for several years prior to 1886.

Mr. Fred L. Johnson has been appointed Supervising Engineer for the Southern Sierras Power Co. in charge of the construction of a high tension transmission line between San Bernardino, Calif., and Bishop, Inyo County, Calif. Mr. Johnson was, until recently, City Engineer of Santa Barbara.

Mr. Daniel J. Hennessey has been appointed by Mayor-elect John E. Boland as Superintendent of Public Works for Fulton, N. Y. Mr. Hennessey has been Foreman of Construction work for nearly ten years and is planning to carry on a large amount of construction work during his administration.

Mr. Wm. C. Sucro was elected Chief Engineer to the Commissioners for Opening Streets at Baltimore, Ind., on January 1, succeeding Mr. August E. Christhilt. Mr. Sucro has been connected with the department as Assistant Engineer since the beginning of the new street work, about five years ago. An assistant to Mr. Sucro will be selected after the commissioners are ready to start on spring work.

Mr. Edw. Sawyer, a well known civil engineer in Massachusetts, died Dec. 27, at his home in Newton at the age of 84. He had suffered from a stroke of paralysis, with which he was afflicted four years ago. He had been connected with many public and private works of importance and was a member of the leading technical societies. He was born in 1828 in Warner, New Hampshire, and was educated in the public schools of that town. When still a [illegible] he began business as a railroad engineer. In 1869 he entered into partnership with J. Herbert Shedd. The firm had charge of the construction of the water and sewer system in Providence. In 1872 Mr. Sawyer was in charge of Mill No. 1 of the Chicopee Mills. He acted as Hydraulic Engineer on a number of large undertakings. After retirement from more active work, he served for a number of years as Consulting Engineer. He was a Member of the Amer. Soc. of C. E. and the Boston Soc. of Engineers.

Civil Engineering Society Meetings.

American Society of Engineering Contractors.—J. R. Wemlinger, 13 Park Row, New York, Sec'y. Annual meeting at New York, Jan. 9.

Michigan Engineering Society. — Alba L. Holmes, Grand Rapids, Sec'y. Annual meeting at Lansing, Jan. 9-11.

Western Society of Engineers.—J. H. Warder, Sec'y. Annual meeting at Chicago Jan. 10.

Iowa Association of Cement Users.—Ira A. Williams, Ames, Ia., Sec'y. Annual show and convention at Sioux City, Jan. 10-12.

Eastern Cement Show.—Annual show at Madison Square Garden, New York, Jan. 9-Feb. 3.

Engineers' Society of Western Pennsylvania.—Elmer K. Hiles, 3511 Oliver Bldg., Pittsburgh, Sec'y. Annual meeting at Pittsburgh, Jan. 16.

American Society of Civil Engineers.—Charles W. Hunt, 220 W. 57th St., New York, Sec'y. Annual meeting Jan. 17-18.

Illinois Society of Engineers and Surveyors.—E. E. R. Tratman, 1138 Monadnock Block, Chicago, Sec'y. Annual meeting at Urbana, Jan. 17-19.

Ohio Engineering Society.—C. J. Knisely, New Philadelphia, Sec'y. Annual meeting at Cleveland, Jan. 24-26.

Canadian Society of Civil Engineers.—C. H McLeod, 413 Dorchester St., Montreal, Sec'y Annual meeting at Montreal, Jan. 24-26.

The Hart-Parr Co., Lawler St., Charles City, Ia., has established a correspondence school to teach prospective or actual users of Gas-Traction engines. A course of 12 lessons will be given dealing with the theory and practice of gas traction engine construction, methods of economical operation, repair problems, etc. After the lessons are completed the student may complete the work in one of the 14 practice schools located in as many cities west of the Mississippi.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING & CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Lehigh Cement.—Paper, 8¾x11⅝ ins., 16 pp. Lehigh Portland Cement Co., Chicago, Ill.

This catalog contains several articles showing the various uses to which concrete is put. A map also shows the location of the cement plants of the Lehigh Company.

Vanadium.—Paper, 8x10½ ins., 12 pp. American Vanadium Company, 302 Frick Bldg., Pittsburgh, Pa.

This is the January, 1912, issue of the pamphlet called "American Vanadium Facts," the journal of the industrial applications of vanadium through the use of "Andervan," "Masvan" "Ferro Vanadium," the "Master Alloys." The pamphlet contains several interesting articles showing the applications and utility of vanadium to various classes of mechanical construction.

Eaves Trough Hangers.—Paper, 5½x8¼ ins., 8 pp. Crescent Specialty Co., Rochester, N. Y.

This catalog describes a galvanized channel steel eaves trough hanger and gives illustrations of details, with tables of dimensions, etc. The hanger is adjustable.

Lubrication.—Paper, 5½x8½ ins., 16 pp. The Texas Co., 17 Battery Place, New York City.

This catalog contains articles on the losses caused by inadequate filtering systems, rules of lubrication, difficult places to lubricate and conditions in hydraulic pump work.

Doud's Grab Buckets.—Paper, 6x9 ins., 16 pp. Arthur N. Doud Engineering Co., Cleveland, Ohio.

Catalog No. 2 illustrates and describes the clam shell grab bucket, which is claimed to be successfully operated in clays and shales, as well as in other materials. The booklet gives complete information regarding the details of the bucket, capacities, dimensions and weights.

Well Drilling Machinery.—Paper, 7¾x10¾ ins., 12 pp. Williams Bros., Ithaca, N. Y.

This catalog contains complete illustrations and descriptions of well drilling rigs and tools. Illustrations cover the machines and their parts and special tools for well drilling operations

CONTRACT NEWS SECTION

of

ENGINEERING & CONTRACTING

The Doings of the Week. The pr[illegible] the past [illegible] railroad [illegible] is the news that the Louisville & Nashville R. R. has awarded the first contracts for work between Nashville and Birmingham. The contracts just let involve some 800,000 cu. yds. of excavation. It is stated additional contracts are to be let at once. This work is being done for the Lewisburg & Northern, a subsidiary company, of which J. H. Peyton, 805 L. & N. Bldg., Louisville, Ky., is Chief Engineer. Among the other railroad construction contracts let recently are the following: Robert Sherer & Co., 650 Pacific Electric Bldg., Los Angeles, Cal., for the grading of another section of the San Diego & Arizona R. R., westward from Dixie; T. W. Ellis, Jr., Macon, Ga., for grading 10 miles of line for the Cary North & South R. R., running from Cochran to Cary, Ga.

Late news from Texas indicate that a considerable amount of railroad building is projected in the near future in that state. The Palacios, San Antonio & Pecos Valley Ry., a new line proposing the construction of 180 miles of road, is planning to let construction contracts in three months. The Quanah, Acme & Pacific is also understood to be about ready to begin construction work on an extension. It is also announced that the San Antonio, Rockport & Mexican Ry. has been financed by English capital, and that surveys have been started at the Rockport end of the projected line. This company is said to plan the immediate building of 370 miles of line.

Bids on a large government dredging job were opened Jan. 2 at the office of the U. S. Engineer at Dallas, Tex. This work called for dredging the Sabine-Neches Canal and involved some 7,291,000 cu. yds. of excavation. The Bowers Southern Dredging Co., Galveston, Tex., at 7.29 cts. per cu. yd. was the low bidder. Bids on another large government contract are to be opened Feb. 15 at the office of the U. S. Engineer, Burke Bldg., Seattle, Wash. This work calls for the excavation of the Lake Washington Canal from the lock site at the Narrows to Lake Washington. The estimated cost of the work is $800,000, and it involves 1,875,900 cu. yds. of excavation. The canal prism will be 25x75 ft., 75 ft. wide at the bottom and 25 ft. deep at mean lower low water.

In the way of levee work the principal contract now open for bids appears to be the one for work in the Fourche Drainage District in Arkansas. The work calls for the construction of approximately 300,000 cu. yds. of river protection levee along the Arkansas river, and Fourche Bayou, in Pulaski county, Ark. Bids will also be received for clearing approximately 500 acres. In the way of drainage work the largest piece of work of the past week is that which is to be done for the Sny Island Levee Drainage District of Pike, Adams and Calhoun Counties, Ill. The work will consist principally of enlarging and deepening the principal drainage canal of the district [illegible] bottom width [illegible] ¼ to 1. The approximate number of cu. yds. is 1,000,000. Surveys for the extensive irrigation project of the Valverde County Reservoir & Irrigation Co., in Valverde and Kinney Counties, Tex., will be completed about April 1, and the work will probably be ready for bids about July or August. The project will include a main dam about 1,000 ft. long and 200 ft. high, of concrete construction; 2½ miles of tunnels and 25 miles of main canal. The system will irrigate about 200,000 acres. The probable cost is $5,500,000.

Road Building Day. Lincoln County, Oklahoma, has had a road building day, in which 33 miles of dirt road were put in good condition between sunrise and sunset. According to published reports of the event nearly 2,000 teams and several thousand men were spread along the road. The road was divided into sections of from ½ mile to one mile in length, and each section was in charge of a captain, who directed the men in his charge regarding the grades and ditches. Each Mayor of the towns in the district affected by the building of the highway had issued a proclamation that all business houses, as far as possible, be closed and the men devote a day to working on the road. The suggestion was promptly complied with and the business men vied with the laboring men as to which could do the greatest amount of work. Toll lines were established all along the thoroughfare and when a traveler chanced to pass that way, unless he could give a reasonable excuse as to why he was not at work, toll to the amount of $1 was exacted. Penalties were also fixed for soldiering on the job. If a man was caught resting on his spade or delaying his team, his tobacco was taken from him. If this occurred in the morning he was deprived of his noon-day meal. This meal, by the way, consisted of a picnic dinner 33 miles long, served by the women of the county. Co-operative road building like the above serves one good purpose. It arouses the interest of a community in good roads, and this, sometimes, will result in the providing of funds for improved highways.

Panning Public Officials. Public officials in the larger cities expect more or less of a panning from the newspapers of the party which is out of office. But when it comes to good, plain speaking right out in meeting, these city papers have nothing on the country journals. For example, read this little item which appeared recently in a newspaper published in a small town in Illinois.

> The foot bridge in front of the Eli Wiley residence, to the north, was not in repair and the Spizwinks administration instead of putting up five dollars for temporary repairs took it down and gave it to their retainers who took it away and no doubt it came in nicely for kindling. The whole neighborhood had voted for Shoemaker and Dodds, and while they see their children walking around on other streets they are saying that they never believed that this here dod-blasted Spizwinks could do such a fool thing. Old Uncle Olmstead is turning seven hand springs in fury at this act which is said to give a chance to put in a concrete graft bridge, and no wonder the five dollars' worth of repairs were not wanted. Several people say they would have donated the repairs of the foot bridge but the Spizwinks wanted to get their fingers in the concrete "contract," so they made their menials haul the bridge to the Spizwinks woodpile. A lot of fellow in this town ought to be put where the dogs won't bite, while [illegible] booty. They are against a commission form of government.

Driving the Golden Spike. The driving of the golden spike marking the completion of a railroad is usually accompanied by more or less of a celebration. Down in Texas, a couple of weeks ago, a decided novation was introduced in the ceremonies that marked the completion of the Brownwood North & South R. R., to the little town of May. Two men were hung. A year ago two prominent citizens were pessimistic enough to say that they didn't believe the road would be completed to May by Jan. 1. They went a step further and said they were willing to be hung if the road did reach that town by the first of the year. It so happened that the line was completed late last year, and accordingly, when the golden spike was driven on Jan. 1, the two men were held to their agreement. A trial was held, and the men found guilty. A scaffold was erected, the men placed in position, the noose adjusted, and the trap sprung, dropping the pessimists to the ground 3 ft. below. Following the "execution" there was a banquet at which it is needless to say, both men were present in person rather than in spirit. Decidedly, the "execution" was a novelty and the man who devised it is well worthy of place in the front rank of publicity men.

Why She Collapsed. Early last month a concrete building in course of construction at Indianapolis, Ind., collapsed, killing several persons. In rounding out his "story" of the disaster, a newspaper reporter interviewed Governor Marshall of Indiana, who according to the Indianapolis Star, gave the following erudite opinion:

> "Horrible, isn't it horrible!" the Governor said. "I never have had much faith in concrete buildings. An old friend of mine, who is a stone mason and therefore perhaps a little prejudiced, has declared to me that concrete will not hold up in this climate. He has told me upon several occasions that some day the bridges in this climate which have been made of concrete would begin to go down.
>
> "My friend explains it by asserting that there is no concrete into which water will not penetrate. It undermines the structure eventually, no matter how close-grained it is. And it begins to look as if there were something in his arraignment of the material."

Some opinion that. But it could have been worse. Think what it might have been had the "old friend" of the governor been a barber.

W. T. Bell. In the death of W. T. Bell the Republic of Mexico loses one of its pioneer railroad contractors. He had resided in Mexico for about 30 years and his work as a contractor is seen on almost every important railroad in the Republic. His first construction work was on the Monterey & Gulf R. R.; he also worked on the old Mexican Central R. R. and built the so-called Lecheria branch from the City of Mexico to Pachuca. His last work was the construction of the cut-off from Acambaca to Morelia, which was finished several months ago. At the time of his death he was senior member of the contracting firm of Bell & Semmes. He died Dec. 31 at the Hotel Ribera, Lake Chapala, Mexico.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The Southern Ry., W. H. Wells, Chief Engineer of Construction, Washington, D. C., has placed an order with the Ensley mills of the Tennessee Coal & Iron Co. for 21,500 tons of 90 lb. steel rails. These rails are to be used in the beginning of the double tracking of the main line between Birmingham and Washington.

Practically all grading and bridge work except on the last six or eight miles of the line, which will give the Pensacola, Mobile & New Orleans R. R. an entrance to Mobile, have been completed. On Jan. 1 there remained about 34 miles of track laying required to reach the east side of Mobile Bay, and it was expected to have this completed by May. This road has terminals at Pensacola and the present end of the track is 18 miles northwest of that place. Henry McLaughlin, Pensacola, Fla., is President.

Arizona.

The Southern Pacific R. R. has bought from the Santa Fe the Sonora Ry. and the New Mexico & Arizona, and the Santa Fe has bought from the Southern Pacific the line between Mojave and Needles in California. The Santa Fe as previously noted in these columns, has organized the California, Arizona & Santa Fe, capitalized at $50,000,000, to consolidate the Mojave-Needles line with the line from Bengal, Cal., to Wickenburg, Ariz., on the Santa Fe, Prescott & Phoenix, a distance of 196 miles. The deal involves properties which already practically had been exchanged under 100-year leases, but it leaves both systems free to develop the properties as they see fit.

California.

⊙Robert Sherer & Co., 650 Pacific Electric Bldg., Los Angeles, Cal., have been awarded an additional contract calling for the grading of another section of the San Diego & Arizona R. R. westward from Dixie.

The contract for grading the Colusa and Hamilton City branch of the Southern Pacific between Hamilton City and Grimes, Cal., will, it is said, be completed by June 1, and grading to Harrington on the main line by July 1.

A project is under consideration for the construction of an electric railway from Sacramento to Amador. George W. Peltier and M. K. Crowell, Sacramento, are interested.

The Camino, Placerville & Lake Tahoe R. R. Co., recently incorporated with a capital stock of $1,000,000, as mentioned in our last issue, is to take over the Placerville & Lake Tahoe R. R., a 10-mile line extending from Cammo to Placerville. The incorporators are C. D. Danaher, Tacoma, Wash., and Bruce Fair and Charles F. Wood, of Placerville.

About 20,000 ties have been received at Fresno for use in the construction of the track of the interurban line of the Fresno, Hanford & Summit Lake R. R. F. S. Granger, Fresno, is the promoter.

The City Ry. Co. of Los Angeles, a subsidiary company of the Los Angeles Ry. Corporation, has been granted franchises for the cross-town lines at Los Angeles.

Colorado.

According to estimates made in the office of the City Engineer of Colorado Springs, Colo., the cost of connecting railway lines with the new union depot at that place, will be about $115,000. Santa Fe engineers, who estimated the cost of connecting their line north of the city with the Denver & Rio Grande tracks, place the total at $78,560. South of Colorado Springs it is estimated that the cost of joining the respective roads would reach $35,000.

The Montezuma & Western R. R. is reported to have financed its projected 17-mile narrow-gage line, and it is said that the construction work will now be pushed through to completion. This line is to extend from Waldorf to Keystone, and already 1½ miles of track have been laid west of the former place. A 1-mile tunnel through Mt. Clellan, near Argentine Pass, is now in 3,500 ft. The construction work is being done by the Argentine Construction Co., of which A. J. Woodruff, Denver, Colo., is Secretary.

Officials of the Union Pacific, the Colorado & Southern, the Denver & Rio Grande, the Santa Fe, the Rock Island and the Burlington are reported to have reached an agreement for the construction of a new union station at Denver. It is said that the new depot and trackage arrangements will involve the expenditure of $6,000,000.

Incorporation papers are to be taken out for the Montrose-Paradox Railroad Construction Co., which is composed of local and eastern capitalists. Preliminary surveys will be made shortly for a 100-mile railroad between Montrose and the Paradox Valley. The principal promoters of the project are S. S. Sherman, J. V. Lathrop, George O. Gilbert, C. J. Moynihan and James F. Kyle of Montrose and E. L. McKee, S. E. Blakeslee and K. B. Hequenbourg of Paradox.

The Pueblo Traction Co., Pueblo, has been granted a franchise to extend its lines to the gates of Mineral Palace park. As soon as favorable weather comes construction of the line will be commenced.

The election of Benjamin F. Bush, President of the Missouri Pacific R. R., to the presidency of the Denver & Rio Grande probably means that the improvement work long projected will be taken up soon. Bush succeeds E. T. Jeffery, for 20 years the head of the Denver & Rio Grande, and in turn Jeffery succeeds George J. Gould as chairman of the Denver & Rio Grande board of directors. Bush will be in absolute charge of the operations of Denver & Rio Grande, but according to a statement made by Gould, management of the finances of that road will devolve upon Jeffery. It is understood that the Gould estate, which retains a large interest in Missouri Pacific and Denver & Rio Grande, will continue to give Bush a free hand and that plans now in contemplation involving the expenditure of many millions of dollars have been formally approved.

Connecticut.

The directors of the New York, New Haven & Hartford R. R. have ordered the extension of the electrification of the New York division from Stamford to New Haven. No date is given for beginning the work of electrification. The electric zone from Woodlawn to Glenbrook is approximately 26 miles, while the section from Glenbrook to New Haven is about 39 miles.

Georgia.

⊙T. W. Ellis, Jr., Macon, Ga., has been awarded a contract for grading 10 miles of line for the Cary North & South R. R., running from Cochran to Cary, Ga., and has already placed a grading outfit on the work. D. B. Dunn, Macon, Ga., is Chief Engineer of the Cary North & South R. R.

Illinois.

The Illinois Traction System is reported to be contemplating building an extension from Edwardsville to Alton by way of Wood River and East Alton.

The Village Board of Oak Park has granted a one month's extension to the Chicago & Oak Park Elevated R. R. Co., Chicago, for the work on the elevation of the tracks in Oak Park.

It is now stated that the officials of the Chicago, Burlington & Quincy R. R. have reached a decision not to extend the lines of the company south of the Ohio River into Southeastern territory. When the Burlington built a line to Metropolis, Ill., on the Ohio River, a short time ago, it was reported that it would go further and make a strong bid for southeastern business.

The directors of the Quincy & Western Illinois Interurban R. R. Co. at a meeting at Quincy, Ill., on Jan. 11, voted to increase the capital stock from $25,000 to $250,000. This company proposes the building of an interurban line between Quincy and Niota. Work is to be started soon.

A plan is under consideration for the organization of a railroad to operate in St. Clair County. As proposed the line will touch Millstadt, St. Libiory, Mascoutah and Nashville. The projected length is 69 miles. The promoters, in company with C. G. Young, an engineer, of 60 Broadway, New York City, recently made a trip over the proposed route. David O. Thomas, Belleville, Ill., is the promoter.

It is reported that the Chicago, Burlington and Quincy Railroad Company is considering the construction of new freight yards in Canton, Ill., and also the construction of a new station at North Fourth Ave.

A project is reported under way for the consolidation of the Springfield, Rochester & Clear Lake Interurban Ry., the Springfield & Jacksonville Electric Ry., now being built, the Taylorville Street Ry. Co. and the Hillsboro Street Ry. Co. under the name of the Mississippi Valley Railway Co., with the central offices located in Springfield. The plan is also understood to include the construction of an interurban terminal station and tracks under the control of a company to be known as the Springfield Interurban Terminal Co., to be used by all electric lines entering the city as well as by the local street railway company. J. E. Melich, Springfield, Ill., is President of the Mississippi Valley Co.

The Quincy & Western Illinois Ry. Co. will probably have surveys started this winter on the Quincy end of its projected electric railway. Rudolph Anton, Nauvoo, Ill., is a director.

A meeting of the stockholders of the Belleville & Mascoutah Electric R. R. Co. is to be held shortly to take steps for raising additional funds for the completion of the road. About $30,000 has already been expended for roadbed work. George Postel, Mascoutah, Ill., is interested.

It is stated that the Illinois Traction System, H. E. Chubbuck, Peoria, Ill., General Manager, will start surveys shortly for a 45-mile extension from Bloomington to Champaign, thus completing an important link in the chain through Central Illinois. The traction company now has a line from Danville to Decatur via Champaign and from Decatur to Bloomington.

The Beardstown Street Ry. Co., of Beardstown, has been incorporated with a capital stock of $50,000, and proposes to operate a street railway system in that city. The incorporators are Stephen H. Cummins, J. F. Adkins and C. B. Meredith.

Indiana.

The Indianapolis & Cincinnati Traction Co., Chas. L. Henry, President, Indianapolis, Ind., has started surveys for an extension east from Greensburg, Ind., to Harrison, O. It is believed the company will utilize the old road of the Big Four as far as Batesville for this extension.

Iowa.

The Chicago, Rock Island & Pacific Ry. and the Chicago Great Western Ry. have secured property at Mason City, Ia., for right-of-way for tracks, two new freight depots and a modern passenger station. Nearly two miles of right-of-way has been secured from the Great Western's main line to the main street site for the Rock Island freight depot. The securing of a passenger station site for the Great

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Western depot means the Rock Island will use the Great Western to Manley.

A considerable amount of improvement work at Cedar Rapids is under construction by several of the railroads entering that city. The Rock Island is considering the erection of a central power plant to cost possibly $150,000, and the Chicago & Northwestern Ry. contemplates a number of track changes. These may include a double track line from Otis to Cedar Rapids and then on to Beverly.

Kansas.

The State Public Utilities Commission has granted permission to the Wichita, Kinsley, Scott City & Denver Air Line to issue bonds for its proposed railroad from Wichita to Denver, 500 miles in length. This project has been under way for two years. W. H. Brown, of Pratt, and H. P. Ketelson, of Kinsley, are the promoters.

Surveys for the line of the Salina, Winnipeg & Gulf R. R. have been completed to a point near Turin. From Turin the surveys will be continued to Kiowa, after which right of way will be secured for the line from Salina to that place. This will be the first section of the line to be built and it is planned to begin construction work on this in March. H. Leone Miller, Saline, Kan., is the President. The Brindley Co., 17 Battery Pl., New York City, is understood to have the contract.

Kentucky.

Practically all stock for the Evansville-Henderson traction line has been subscribed and it is expected that the line will be completed. Construction work will probably be started this month on the small portion of work on the Indiana side. In the spring work will be started on the Kentucky side. W. A. Carson, Evansville, Ind., is General Manager.

Maryland.

The Baltimore & Ohio R. R. is understood to be planning to construct a branch line, primarily for the purpose of transporting material and machinery for the hydro-electric development on the Cheat River. It is said that the road will be constructed at first as far as Beaver Hole, where one of the dams is to be located, and then will be extended through Preston County, West Virginia.

The Western Maryland Ry. Co., H. R. Pratt, Chief Engineer, Baltimore, Md., has arranged for a loan of $10,000,000, and is understood to have already made plans for the expenditure of a considerable part of this sum. It is said that new equipment will absorb $3,000,000; improvements in Hagerstown, Cumberland, Rockwood and points along the line of the Connellsville extension will take perhaps $1,000,000 or $1,500,000 more for terminal facilities. Additional improvements in Baltimore may also require a substantial slice.

Massachusetts.

The Massachusetts State Railroad Commission has approved the purchase of the Plymouth & Middleborough Railroad, a short line running between the two towns by the Old Colony R. R. to which it was leased for 99 years from Dec. 1, 1892.

A hearing on the elimination of the Boston & Maine R. R. grade crossings in Lawrence was held on Dec. 28, and a plan broader in scope than any previously proposed was presented. This plan involved the construction of a bridge over the Merimac River about 4,000 ft. from the present station in North Andover and the extension of railroad tracks through the Clover Hill Section of Lawrence to a point near the junction of Broadway and Brown sts. in Methuen, where it would join with the present tracks and continue to the Methuen Station and thence north. The bridge across the river would also provide for freight facilities to corporations on the north side of the river and thereby would do away with one of the objections raised to the conversion of the Boston & Lowell bridge into a central bridge for public use. The present tracks over Broadway and Essex st. would be used for industrial business only. Hugo [illegible] appointed [illegible] Stone, of Sprinfield, to [illegible] the riverfr[illegible] at that city. He will [illegible] pressed way for the New Haven tracks on the [illegible] tion with the city engineering department has begun work to determine how feasible a depressed way would be and how great an expense it would involve. There has been some doubt as to whether a depressed way or a viaduct to retain the New Haven tracks on Springfield side of the river would be a practical solution of the principal phase of the riverfront problem, and it is expected that when Mr. Stone has made his report the city will at least know whether there need be any further consideration of any riverfront plan which provides for retention of the tracks along the river bank.

At the annual meeting of the stockholders of the Boston & Lowell R. R. Corporation the directors were authorized to issue 2,800 shares of additional capital stock, thereby increasing the capital from 73,994 to 76,794 shares. The proceeds of the new stock will be applied in payment for permanent additions and improvements to the property by the Boston & Maine R. R.

Minnesota.

According to information received from Two Harbors, Minn., citizens of Grand Marais and other north shore points are endeavoring to secure the construction of an extension of the Duluth & Northern Minnesota Ry. Co. to that section. Some time ago the officials of the railroad were quoted as stating that it was their intention to push through to the Canadian border, and in this event they would pass within a few miles of Grand Marais. John Millen, Duluth, Minn., is President and General Manager of the company.

Information has been received from Brainerd, Minn., that all work has been completed on the line of the Cuyuna Northern R. R. connecting Brainerd with the Cuyuna Iron Range, and it is expected that the operation of the new road will commence shortly.

The citizens of Grand Rapids, Minn., are strongly in favor of the construction of an extension of the Duluth, Missabe & Northern R. R. to that place. The Missabe has a grade and track built a mile or two this side of Coleraine, leaving only a few miles more to build. Aside from this, the Steel trust, whose road the Missabe is, has vast holdings of ore at Prairie river and on Pokegama lake, which will probably be opened up before long, and it will be only a short time until they have to build the road anyway. W. H. Hoyt, Duluth, Minn., is Chief Engineer.

Advices from Cayuna state that the Minneapolis, St. Paul & Sault Ste. Marie Ry. has completed surveys for an extension from the Kenedy mine across Rabbit Lake Narrows to the Blackwood property and thence to the Mississippi River. It is said that grading work on this extension will be started as early as possible in the spring.

Surveys have been made for a railroad from Nakota on the M. & I. R. R. to Bigfort, and it is said that the line will be built this spring so that the Backus-Brooks interests can log in that county next fall. E. W. Backus, Andrus Bldg., Minneapolis, Minn., is interested.

Mississippi.

The Mobile & Ohio R. R. has secured property south of the city of Meridian, Miss., in which to lay switch tracks.

The Gulfport & Western R. R. Co. is understood to have secured the necessary capital for the construction of its 60-mile line, surveys for which are now under way. This line will extend from Gulfport to Covington. It will cross Wolf River at the head of tide water, and East and West Pearl River near the northern end of Honey Island. The line will pass, as now proposed, north of Picayune and will cross the New Orleans and Northeastern, Great Northern, Illinois Central and connect with the Yazoo and Mississippi Valley at Baton Rouge, and the Texas and Pacific. Judge W. H. Hardy, Pass Christian, Miss., is the promoter.

Montana.

It is rumored in Lewistown, Mont., that the Chicago, Milwaukee, & St. Paul Ry. and the Great Northern Ry. Co. have reached an agreement with regard to the construction of the cutoffs from Great Falls through Lewistown from the connections with their main lines, the Great Northern at Rockford, N. D., and the Milwaukee at some point near Melstone in Musselshell county. Going west from Lewistown the Milwaukee will use the Great Northern's road to the Judith river, some 17 miles, and then branch off following its own survey toward Denton and on to Great Falls. From Lewistown eastward the Milwaukee will start building in the early spring to Grass Range and at the same time the Great Northern will build the line on from Grass Range to Weede on the Musselshell. From that point the Milwaukee will run southward to connect with the main line, and the Great Northern will build on to meet the road coming in from New Rockford. Thus one road will be made to serve both lines from the Judith river to Weede, a distance of about 90 miles. The arrangement would enable the companies to complete cutoffs next year, and while ultimately it is expected there will be two lines, for a good while to come one will answer all needs. This plan, it is stated, will take precedence over everything else and the proposed extension of the Hilger branch on from that place to Roy will be for the present abandoned.

Nebraska.

Press dispatches quote W. L. Park, Vice-President of the Illinois Central R. R., as stating that the road is to double track its Omaha-Chicago line and construct new and enlarged freight terminals in Omaha. "While the Illinois Central has no great amount of work laid out for next year," said Mr. Park, "we find it imperative to build new terminals on the Missouri River to take care of our increasing Pacific Coast and Western business. The work of double tracking the Western line will go steadily onward for the next two years anyway, and will probably be completed in time for the San Francisco Exposition."

New York.

The New York, New Haven & Hartford R. R. Co. has filed an application with the Public Service Commission, Albany, N. Y., for authority to purchase the shares of the capital stock of the Rutland R. R. Co., now controlled by the New York Central & Hudson River. The New Haven desires to purchase the stock as the lines of Rutland Ry. connect with other lines owned or controlled by the New Haven in such a way that by controlling all of them the New Haven will be able to establish through routes between New York, Boston, Portland, Me., and Montreal, and between Boston, Portland, Me., and the West by way of Ogdensburg, N. Y., and the Great Lakes.

The Delaware, Lackawanna & Western R. R. Co. has practically completed plans for a new passenger station on the site of the present building in Syracuse and intends to start construction as soon as weather in the spring will permit.

North Carolina.

It is reported that the Southern Ry. Co. will ask for bids shortly for the construction of a belt line at High Point, N. C., connecting the main line with the Asheboro branch. This project, it is said, has been under consideration for some time and right of way has just been obtained. The route will be two miles in length leaving the main line opposite the Pickett Cotton mills and running easterly to the Asheboro branch. J. S. Lemond, Charlotte, N. C., is Engineer, Maintenance of Way.

North Dakota.

Contractors have practically completed work on the Frederick, Wis., extension of the Min-[illegible] taken up will be the construction of the Drake-Devils Lake-Fordville cutoff. Orders have been received at Devils Lake to have the right of way through that city, which was bought last summer, cleared of buildings, so as to be ready for the graders, when the ground is thawed next spring. Five carloads of culverts and bridge timber, for use on the new line in Benson county, have been shipped to Brinsmade, near which the Soo will cross the Northern Pacific's Jamestown-Leeds branch. Most of the right of way across Pierce, Benson and Ramsey counties has been bought, but some farmers have been unable to agree on the value of the land taken, and have been served with summons to have the value fixed by a jury in condemnation proceedings. Thomas Green, Minneapolis, Minn., is Chief Engineer.

The City Council of Devils Lake, N. Dak. will at its January meeting take up the matter of granting a franchise for a street car system in that city to the Stotlar Investment Co. of Devils Lake.

The Great Northern R. R. is reported to be contemplating building a cutoff from New Rockford, N. Dak., to Lewistown, Mont. It is said that the line will leave New Rockford and going westerly, cross the Soo at Manfred; thence to Douglas or Ryder; thence will cross the Fort Berthold reservation, crossing the Missouri in the southern part of Montrail county; thence west into Montana and following the route of the original Mondak cutoff to Lewistown. The line will enter Montana at a place named Sidney on the Yellowstone, and will cross that river at or near there. Thence it will continue west between the Misosuri and the Yellowstone rivers, cross the Musselshell between the postoffices of Weede and Ross, follow along McDonald creek for some distance into the Judith Basin and to Lewistown. Beyond that the route, as is generally known, will be from Lewistown to Moccasin, thence to Great Falls over the present Billings & Northern.

Ohio.

The Public Improvement Committee of the City Council of Toledo, O., has granted the Kinsey Manufacturing Co. permission to construct a railroad switching track across Derby St. to its property on the north side of the street.

The Ohio Electric Ry. Co., Traction Bldg., Cincinnati, O., is considering extending its line at Hamilton to the Prospect Hill section of that city.

The Portsmouth Street Railroad & Light Co., L. D. York, President, Portsmouth, O., is planning to extend its Sciotoville street car line to Wheelersburg the coming summer. The original plan for building an extension to Hanging Rock is understood to have been abandoned for the present.

The recent establishment by the Pennsylvania System of a Central division with headquarters at Toledo, is taken in railroad circles as an indication that the long contemplated plan of closing the gap between the terminals at Toledo and the terminus of the Logansport Division at Butler, Ind., may be taken up in the near future. The distance from Toledo to Butler is 60 miles, and the topography of the country is comparatively level the entire distance. From Butler the route from Toledo to Chicago would be over the Logansport branch to Columbia City, Ind., and from there to Chicago over the main line between that city and Pittsburgh, known as the Fort Wayne route. This would not only give the Pennsylvania the short line between Toledo and Chicago, but from Pittsburgh to Chicago. It would also give the company a short line from Toledo to St. Louis, as it would have a direct route via Butler, Columbia City, Logansport and Terre Haute, Ind. The new road would place Toledo on a direct [illegible] Ohio. The latter road is also Pennsylvania property. The story is given added weight, owing to the fact that the Pennsylvania has been buying considerable dock property on the west bank of the Maumee river at Toledo, where it could have larger facilities. The [illegible] a bridge across the Maumee river, and will take over the dock property on the west side of the river now owned by the H[illegible] ley, as soon as the latter road builds its con-[illegible] east side.

Oklahoma.

The Vinita, Blue Flint, Chat & Gravel Co., Miami, Okla., has filed articles of incorporation with the Secretary of State, Oklahoma City, Okla., proposing the construction and operation of railroads and acquiring other railroad lines.

According to an announcement recently made by J. W. S. Hatwell, Vice-President and General Manager of the Oklahoma Northwestern Ry., which was chartered with a capital stock of $100,000 Aug. 28, 1911, work will be started on the line in the immediate future. The proposed road will open up the isolated northwestern part of the state, and will bring the cattle of the Texas Panhandle, Western Kansas and Western Oklahoma in direct line for the Oklahoma market.

A plan is in contemplation for the organization of a company for the purpose of building an electric railroad from Guymon, Oklahoma, to Clayton, N. Mex., a distance of 120 miles. J. A. Margo, Boise City, Okla., is interested.

The Rapid Transit Interurban Co. of Oklahoma, J. W. Saxon, Tecumseh, has entered into agreements with the citizens of Sulphur and Roff to build a traction line through those places. The former city gives $40,000 and the latter $20,000 bonuses. The citizens of Stratford have offered a bonus of $10,000 and right of way to secure the line.

Oregon.

P. C. Lavey, who recently incorporated a company to build a belt line from Eugene, Ore., to several surrounding towns has been at Eugene in company with Frederick C. W. Brindley and A. W. Waddy, a civil engineer, investigating the proposition.

The Utah Construction Co., Ogden, Utah, has completed the grading of the Oregon Short Line extension from Nyssa, Ore., to Homedale and the laying of steel will be commenced at once.

The Portland Railway, Light & Power Co., Portland, will probably expend about $1,500,000 this year for improvements in Portland. These will include a new $100,000 substation and power plant on the West Side.

Business men of Burns, Ore., are considering raising a bonus of $50,000 for the extension of the Sumpter Valley Ry., D. Eccles, President, Ogden, Utah, to that place.

The Utah Construction Co., Ogden, Utah, of which W. H. Wattis is General Manager, which has the contract for grading from Vale, Ore., to Dog Mountain, a distance of 139 miles, for the Oregon Eastern R. R., an Oregon Short Line project, noted in our last issue, has established headquarters at Vale, Ore. Camps have also been established at mile post 15 and at mile post 40. Work on the tunnel at the latter point was started on Jan. 2. The Wasatch Construction Co., which has a sub-contract on the work, has located a camp about 30 miles from Vale and has started on a big cut at that point.

Pennsylvania.

Right-of-way is being secured for an extension of the Hummelstown & Campbellstown Street Ry. from Campbellstown to Palmyra. H. N. Herr, Lancaster, Pa., is Chief Engineer.

It is expected that work in Fayette County on the line of the Monongahela R. R. extension will be completed about Feb. 1. After this section is completed work will be started on the Greene County side. Zevely, Donovan & Moore, Morgantown, W. Va., have a subcontract for the latter work.

Engineers R. H. Culbertson of Buffalo, N. Y., and N. Stahl, of Pittsburg, have been over the route of the proposed Tioga Traction Co.'s trolley line between Wellsboro and Mansfield gathering data from which to make a report on the feasibility of constructing the road. It is stated that if the report is favorable capitalists in Philadelphia stand ready to finance the scheme.

The Philadelphia & West Chester Traction Co., C. A. Entrekin, Chief Engineer, Upper Darby, Pa., has engineers in the field checking up a survey made two years ago for the building of a trolley line from the 69th St. terminal to Media. It is said that the line will be built if the necessary right-of-way can be secured at reasonable prices.

South Dakota.

A company, to be known as the Olivet Interurban R. R. Co., is being organized by business men of Olivet, S. Dak., for the purpose of building a line from that place to Tuscan, where connection will be made with the Sioux City-Aberdeen line of the Milwaukee. The right of way has been secured and it is planned to begin construction work so that the line can be in operation by Aug. 1.

Tennessee.

The Louisville & Nashville R. R., has awarded the first contracts for the work of double tracking its line from Nashville, Tenn., to Calera, Ala. The contracts just let number some 800,000 cu. yds. of excavation and will cost about $750,000. Additional contracts are to be let at once, and it is believed the whole work will be completed in two years.

Texas.

The Commercial Club and citizens of Rotan, Tex., recently held a meeting to take action on the proposed line of the Santa Fe, Rotan and Southern R. R. Thirty-five miles are in operation and 150 miles of the road are under construction.

Information from Caldwell, Tex., is to the effect that grading is being pushed on the short cut of the Houston & Texas Central R. R. from Giddings to Stone City on the 13-mile section from Giddings to the Chriesman Chapel. Right of way agents are working between the latter point and Stone City, and contracts for the grading will be awarded for the last section shortly. T. Fay, Houston, Tex., is President and General Manager of the company.

Contract is to be let shortly by the San Antonio & Aransas Pass R. R. for laying heavy steel rails on a 40-mile stretch between Yoakum and Houston, Tex. When completed the main line from San Antonio to Houston will be equipped with heavy steel. L. Andrews, Yoakum, Tex., Assistant Engineer.

It is reported that W. H. Stark, Orange, Tex., of the Orange & Northwestern Ry. has been informed by B. F. Yoakum, President of the Executive Board of the Frisco Railroad, that work of extending and connecting lines of his system that will finally link up with the Orange & Northwestern road, connecting Orange with Sherman and Paris, is now in progress. The Orange and Northwestern railroad, which was built by local capitalists, was only a few years ago sold to the Frisco Railroad Company.

Proposition has been submitted to the citizens of Hallettsville looking to the construction of a railroad from La Grange to Aransas Pass via Hallettsville.

The State Railroad Commission has approved an order granting to Rock Island the right to register $1,193,000 of bonds on the newly constructed line of the Amarillo division, west of Amarillo. The valuation was made last June and totaled $1,265,739. The company has issued stock to the amount of $72,000 on the valuation.

Surveys have been started at the Rockport end by Percival & Son, Rockport, Locating Engineers, for the projected line of the San

Antonio, Rockport & Mexican Ry. mentioned in our last issue. This company plans the immediate building of 370 miles of line, and the ultimate building of about 2,000 miles. The first line to be built will be from San Antonio to a point on the Rio Grande near Mission, passing through Crowther, and a branch will be built from Crowther to Rockport and Harbor Island, where a half-mile of docks to handle the incoming and outgoing traffic will also be constructed. It is proposed to build later lines to Tampico and Mexico City and from San Antonio to San Angelo. The project is stated to have been financed by English capital. R. R. Russell, San Antonio, is President and A. L. Matlock, San Antonio, is Vice President.

It is stated that a railroad is to be built at once from Riviera to Riviera Beach, a distance of 10 miles. Theodore F. Koch, Houston, Tex., is reported to be interested

Surveys have been completed and the capital secured for the construction of the projected line of the Palacios, San Antonio & Pecos Valley Ry. This company projects an 180-mile line, the route taking in Palacios, Yoakum and San Antonio. Construction contracts are to be let in the next 90 days. J. P. Pierce, Palacios, Tex., is President and H. L. Montandon, Palacios, is Chief Engineer.

It is now stated that construction work will be started this spring on the first 90 miles of the Pecos, Panhandle & Gulf R. R. mentioned in our last issue. M. J. Healy, Texico, N. Mex., is President.

Announcement has been made at Fort Worth that work would be started shortly on an extension of the Quanah, Acme & Pacific Ry., C. E. Ensminger, General Manager, Quanah, Tex., with El Paso as the ultimate point. Construction on 50 miles southwest of Paducah, the present terminus of the road, will be undertaken at once, according to the announcement.

The Kansas City, Mexico & Orient Ry. is understood to be offering for sale in France a $20,000,000 bond issue, proceeds of which will be used to complete its line. Sufficient funds are now on hand to assure the completion of the present construction work to Alpine, Tex. Work on this end of the line is progressing at the rate of five miles a week. The Pecos River will be reached in a few days, and Fort Stockton, 35 miles distant, will be reached by Feb. 14. It is expected the work to Alpine, 95 miles from the Pecos River, will be completed by July 1912.

Utah.

Advices from Ogden, Utah, state that work is about complete on the double track of the Oregon Short Line R. R., between Ogden and Farmington, including the line to Cope, and it is expected that the trackage will be turned over to the operating department within a few days.

The Logan Rapid Transit Co., David Eccles, President, Ogden, Utah, has applied to the County Commissioners at Logan for a franchise. According to the terms of the franchise desired, the company will be given twelve months in which to commence [illegible] and two years in which to build five miles of railroad out of Logan. It is understood that the contemplated road, when finished, will connect with the Brigham City railroad, which will form an interurban line to Salt Lake.

Vermont.

Two plans are under consideration for the proposed new union station at Burlington. Central Vermont [illegible] R. Morrison, Engineer, St. Al[illegible] [illegible] Vermont plan, is [illegible] which $75,000 is the cost of depot, [illegible]

Virginia.

The Henrico County Supervisors, Richmond, have granted permission to the Richmond & Henrico Ry. Co., Ebel Bldg., Richmond, Va., to extend its present street car line from Fulton to the National Cemetery. The line will start from Louisiana and Gilliam Sts., Fulton, over Fulton Hill to the Williamsburg turnpike, down the Williamsburg road to Central Ave., down Central Ave. to Montrose St. to the government road, across the government road to Belmont.

Commercial organizations of Richmond are urging that the City Council of that city make haste in passing the ordinances to permit the sale of the Seven Pines electric line to the Richmond, Urbanna & Peninsula R. R. Co order that a railroad may be built to the Pamunkey River.

Washington.

The fact that surveyors are setting new grade stakes over the old right of way secured by the Oregon-Washington Railway & Navigation Co. in the vicinity of Ringold, Wash., seems to indicate that construction work on the line from Connell to Benton City, via Ringold, will be started shortly. F. L. Pittman, Spokane, Wash., is Engineer.

The Thurston County Railroad Co. has filed articles of incorporation with the Secretary of State, Olympia, Wash., with a capital stock of $200,000. The company proposes the construction and operation of a logging railroad from the Black Hills to Mud Bay. The incorporators are Mark Draham, George Draham and Daniel O'Leary.

The Willapa Harbor Ry. Co. has been incorporated with a capital stock of $200,000 and proposes to build an electric railway between Raymond and South Bend. Its principal place of business will be at the former place. The trustees are Jay D. Crary, J. B. Bridges, Aberdeen, Vice President of the Grays Harbor Ry. & Light Co., and Theo. B. Bruner.

West Virginia.

The Baltimore & Ohio R. R. is stated to have taken over the Hampshire Southern R. R., a 38-mile line, built two years ago, and extending from Romney, W. Va., to Moorfield at Petersburg. It is probable that the line will be extended to Franklin, and also in Hyland County, Virginia.

Canada.

The citizens of Toronto at the election on Jan 1 voted to construct civic car lines along Danforth Ave. at a cost of $139,488. C. H. Rust is City Engineer.

At the recent election at Toronto the citizens voted against the construction of a subway system. Bids on the construction of the subway were taken some time ago but the award of the contract was laid over pending the action of the taxpayers at the Jan. 1 election.

According to plans made public recently, the Canadian Northern Ry. will expend $25,000,000 for securing its entrance to Montreal. The plans include a tunnel under the mountain three miles long, from a point a few yards behind the Hunt Club to the heart of the city, and a station at the city end of the tunnel on the site of the Joseph property, corner St. Monique and Dorchester Sts., and adjoining properties down to Lagauchetiere street. The plans also call for a hotel on the site of the Bath Hotel and adjoining properties, a model city of residences on part of the 4,800 acres acquired behind the mountain on both sides of the electric railway, the electrification of all lines from Back River to the city, an overhead line from the Lagauchetiere St. station to the riverfront, connecting with the Harbor Commissioners' lines, a spur from the Moreau St. Station to the Harbor lines in the east so that from the tunnel mouth to Moreau street will be a continuous line, commodious and up-to-date freight sheds near the corner of William and Nazareth Sts. with the latest devices in freight handling. Work on these improvements will commence in the early spring.

The Intercolonial Ry., W. B. MacKenzie, Chief Engineer, Moncton, N. B., is to submit plans to the City Council of Moncton for a subway under the railway property south of Main St.

English capitalists, said to be acting for the Hill interests, have closed a deal for 900 acres of land at Port Arthur, Ont. It is stated on reliable authority that the land is to be used partly for the terminals of the Hill lines, when they are carried into Port Arthur, and that the Canadian shops of the Hill lines will be built there, costing several million dollars. The land purchased extends along the boundaries of the two cities, the great bulk of it being within the limits of Port Arthur, and the balance of it in the township of McIntyre. In the past few days several Great Northern officials have been in Port Arthur looking over the site, and the announcement was made that the route for a line from Port Arthur to Winnipeg has already been selected. Work on this will start as soon as the plans fully mature.

Reports received at the executive offices of the Canadian Northern Ry., at Vancouver, B. C., the latter part of December, showed that the total number of men employed on construction work between Port Mann and Kamloops was 5,400, a slight gain over the figures for November. It is expected that with the opening up of big cuts along the grade the pay rolls will contain nearly 7,000 names before the end of January.

Mexico.

Among the promoters of the Mexican-Pacific Ry., mentioned in our last issue as planning the construction of a railroad from the City of Mexico to Acapulco on the Pacific Coast, are the following: Sam Glasgow, A. L. Killner, Albert Held, all of Spokane, Wash. The company is incorporated at $3,000,000, and has headquarters at Seattle, Wash. Moritz Thomsen of Spokane and Seattle, Wash., is at the head of the movement.

According to an announcement reported to have been made by the President of Guatemala, work on the Guatemala Railroad will be connected with the Pan-American connecting Mexico from coast to coast by July, 1912. While this Guatemala road does not run very far south, it passes near the Honduran border and through a rich section of country, and likely will prove to be a link in the New York-Panama railroad.

ROADS, STREETS AND PAVEMENTS

Alabama.

⦿A. F. Bearden has been awarded the contract by the Board of Marion County Commissioners, Hamilton, Ala., for grading, draining and surfacing with gravel approximately 2½ miles of state aid road and for building the same road 11 miles further into the country. The contract price is $17,250. Bids were opened Nov. 15.

An election will shortly be held in Cullman County, Ala., for the purpose of voting on the issuance of bonds to the amount of about $400,000 for the construction of good roads. Cullman is the county seat.

The Marshall County Good Roads Association, Col. W. W. Shortridge, Secretary, Guntersville, Ala., is agitating the calling of an election for the purpose of voting on the is-

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] roads in Marshall County. It is probable the election will be called by the County Commissioners in March or April.

Arkansas.

A movement has been started by the property owners on West 10th St., between Schiller Ave. and Appian Way, city of Little Rock, Ark., to organize an improvement district to provide for the pavement of that section. The proposed district will include West 10th St., from the east property line of Schiller Ave., to the west property line of Appian Way; Appian Way, from the south property line of West 12th St. The plan is to make specifications for brick, block or asphalt pavement.

California.

The Board of Public Works of Fresno, Cal., has decided upon the substitution of bitulithic pavement for a model pavement in the resurfacing of down-town business blocks. The pavement will cost from $0.16½ to $0.17 per

Following bids were received by the City Council of San Jose, Cal., for the furnishing of a rock crusher: Austin-Western Co., $4,885; A. L. Young Machinery Co., three styles of machine, $4,997, $1,650 and $2,886.

The Ventura County Board of Supervisors, Ventura, Cal., has accepted a right of way on the south side of the Santa Clara River, beginning at the east end of Bardsdale, ending at present near the old Guiberson home, for the extension of the Guiberson road in Road District No. 3.

Colorado.

✣Bids will be received until 11 a. m., Jan. 16, by Board of Public Works, Denver, Colo., for the necessary labor and material for grading, constructing concrete curb and gutter, alley returns and alley crossings and otherwise improving North Side Improvement District No. 18. A certified check for $2,500 must be filed with each bid. Henry Read is President.

Connecticut.

The Board of Appropriation and Apportionment of Stamford, Conn., has authorized a bond issue of $26,000 for the paving of West Main St., and in the sum of $24,000 for the paving of Elm St.

Florida.

⊙The contracts for furnishing tools, labor, material, etc., necessary to pave the following streets and alleys have been awarded by the Board of Local Improvements, Chicago, Ill., E. J. Glackin Secretary. Prices include concrete curb and gutter sewer construction, manhole and catch basin construction and adjustment, 6 in. Portland cement concrete foundation, etc., where specified: Indiana St., 7,500 sq. yds. granite, $30,786, Jas. A. Sackley & Co., Chamber of Commerce, Chicago; Western Ave., 21,500 sq. yds. brick, Calumet Coal & Teaming Co., 2926 E. 95th St., Chicago; Lawndale Ave., 10,000 sq. yds. brick, $27,417, Citizens' Construction Co., 133 W. Washington St.; Montrose Ave., 5,820 sq. yds. brick, $17,158, Citizens' Construction Co.; W. 59th St., 12,570 sq. yds. brick, $34,858, Calumet Coal & Teaming Co.; 56th St., 12,180 sq. yds. brick, $14,007, Rennaker Construction Co., 9 S. La Salle St.; 43d Ave., 4,000 sq. yds. brick, $10,333, Citizens' Construction Co.; Exchange Ave., 17,210 sq. yds. macadam, $28,572; Charles St., 17,200 sq. yds. macadam, $29,194, Farr Bros., 356 W. 111th St., Chicago; Ave. N, 7,000 sq. yds. macadam, $17,029, Illinois Improvement & Ballast Co., 72 W. Adams St.; alleys, Arlington Pl., etc., 1,860 sq. yds. brick, $4,832, Central Paving Co., 179 W. Washington St.; alleys, Flournoy St., etc., 1,200 sq. yds., brick, $3,045; alleys, Washington blvd., etc., 700 sq. yds. brick, $1,860, Jas. A. Sackley Co.; alleys, Barber St., etc., 600 sq. yds. brick, $1,728, Jno. A. McGarry, Teutonic Bldg., Chicago; alley, Jackson blvd., etc., 1,500 sq. yds. brick, $3,735, Central Paving Co.; alley, South Park Ave., etc., 300 sq. yds. brick, Jas. A. Sackley Co.; alley, Kenmore Ave., etc., 500 sq. yds. brick, [illegible] Ann Kissack, 133 W. Washington St., Chicago; alleys, Wilson Ave., etc., 1,060 sq. yds. brick, $2,985, Central Paving Co.; alleys, Schiller St., etc., 390 sq. yds. brick, $1,041, Jas. A. Sackley & Co.; alley, Sheridan Rd., etc., 1,100 sq. yds. brick, $2,811, Central Paving Co.; alley, Dearborn St., etc., 400 sq. yds. brick, $1,112, Jas. A. Sackley Co.; alleys, Clark, St., etc., 380 sq. yds. brick, $1,043, Jas. A. Sackley Co.; alley, Cleveland Ave., etc., 140 sq. yds. brick, $193, Jas. A. Sackley & Co. Bids opened Dec. 13, 1911.

[illegible] 90,000 gals. of bituminous asphalt with which to build asphalt macadam pavement.

Idaho.

⊙It is reported the citizens of Lewiston, Ida., on Dec. 30 voted in favor of the paving on 8th St., from the city to the gates of the Lewiston orchards. The contract for this work has been let contingent upon the outcome of the election, to the Inland Empire Hassam Paving Co., of Spokane, Wash.

The City Council of Boise, Ida., has passed an ordinance providing for the creation of Paving District No. 17. Approximately 15 miles of paving will be done in the city during the year. The City Engineer has figured there will be 238,600 sq. yds. of paving and 69,400 sq. yds. of gutter, making a total of 308,000 sq. yds. Approximately $1,000,000 will be spent for improvements. Ern G. Eagleson is City Engineer.

Illinois.

✣Bids will be received until Jan. 18, it is reported, by City Council, Edwardsville, Ill., for approximately $75,000 worth of street paving in six Edwardsville districts. There are six districts which will be paved, as follows: Fillmore-Buchanan, Schwartz, Park-Benton, Fillmore-Buchanan, Commercial-College, Union extension and Grand-Elm.

✣Bids will be received until 1 p. m., on Tuesday, Jan. 23, at which time the bids will be opened in A. H. Mueller's Hall, Highland, Ill. Trenton Road—The proposed improvement begins at the south end of the existing macadam on the Trenton Road and extends in a southerly direction for a distance of 9,300 ft. The beginning of the proposed improvement is by road approximately 1½ miles from the Vandalia R. R. station in Highland, and there is a good macadam road the entire distance. Quantities: 12,400 sq. yds. finished macadam, 8 ins. thick, or 12,400 sq. yds. of concrete roadway, 7 ins. thick; 2,271 cu. yds. earth excavation. Separate bids are requested for water bound macadam, oil bound macadam and a concrete road. Work to be completed on or before Nov. 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing from the Illinois Highway Commission, Springfield, Ill.

The Board of Local Improvements of Moline, Ill., has confirmed the project for asphalt paving, 25 ft. wide, on 14th St., between 16th and 23d Aves., at an estimated cost of $20,675. The Board also ordered the paving on 15½ St., between 8th and 10th Aves., at an estimated cost of $2,905.

The property owners on Benton, Float, Shawnee and Delaware Sts., and the Board of Local Improvements, Freeport, Ill., recently held a meeting to consider the question of paving Float and Benton Sts., one block on Delaware and one block on Park Ave. Estimates are being prepared by the City Engineer.

A move for paving 10th Ave., between 17th and 21st Sts., with asphalt, in the city of Rock Island, Ill., is under way, and the matter will be brought before the Board of Local Improvements at an early date.

The Board of Local Improvements of Lincoln, Ill., has passed ordinances calling for the paving of three streets. The streets to be paved are: Lincoln Ave., Ottawa St. and Sixth St.

The Board of Local Improvements of Bloomington, Ill., has adopted a resolution to pave Woodland Ave., between Grove and Taylor Sts. City Engineer Elmer Folsom has estimated the cost of the work at $10,281.

The Board of Local Improvements of Ottawa, Ill., will shortly take up the question of paving certain streets in South Ottawa and East Ottawa.

Arrangements are being made by the City Council of Freeport, Ill., to have all the macadamized streets in the city oiled during the coming summer.

Indiana.

✣Bids will be received by Boards of Commissioners of Hendricks and Putnam Counties, Danville, Ind., until 10 a. m., Feb. 1, for the construction of the highway improvement petitioned for by John Masten and others. The highway to be improved is on the boundary line between the counties of Hendricks and Putnam, separating the township of Mill Creek, in said Putnam County, from the Township of Franklin, in Hendricks County, and is 6,765 ft. in length.

✣Bids will be received until 11 a. m., Jan. 25, by Boards of Commissioners, Marion and Hendricks Counties, at Indianapolis, Ind., for the construction of a free gravel road on the line between Marion and Hendricks counties, petitioned for by Albert McCalment et al., according to the plans, profile and specifications now on file in the office of the Auditor of each of Marion and Hendricks counties. This free gravel road is to commence at and extend from the Crawfordsville Free Gravel Road, at the town of Clermont, Ind., on the north, on and along said county line to the Wall St. Free Gravel Road on the south, a distance of 8,900 ft., crossing the tracks of the Big Four and C. H. & D. steam lines and the "Ben Hur" Traction Ry.

✣Bids will be received until noon, Feb. 6, by Board of Dearborn County Commissioners, Lawrenceburg, Ind., for the construction of a highway in Jackson Township. W S. Fagaly is County Auditor.

✣Bids will be received until 1:30 p. m., Feb. 5 (readvertisement), by Board of Jackson County Commissioners, Brownstown, Ind., for the construction of a road in Hamilton Township. H. W. Wacker is County Auditor.

✣Bids will be received until 2 p. m., Feb. 6, by Board of Knox County Commissioners, Vincennes, Ind., for the construction of gravel roads in Vigo, Vincennes and Busseron Township. J. T. Scott is County Auditor.

✣Bids will be received until 10 a. m., Feb. 5, by Commissioners of Adams County, Decatur, Ind., for the construction of five macadam roads. H. S. Michaud is County Auditor.

⊙Geo. B. Tillotson has been awarded the contract by the Board of Huntington County Commissioners, Newport, Ind., for the construction of a gravel road in Helt Township for $2,810. Bids were opened Jan. 1.

⊙William Avery of Waldron, Ind., has been awarded the contract by the Board of Decatur County Commissioners, Greensburg, Ind., for the construction of a macadamized road in Clay Township for $9,200. Bids were opened Jan. 3.

⊙The Benton County Commissioners, Fowler, Ind., have awarded contract for road work as follows, bids opened Jan. 2: Three miles in Parish Grove Township, Nicoson & Pierce of Alexandra, Ind., $10,832; nine streets in city of Fowler, G. A. Matthews of Fowler, $7,157.

⊙H. L. Short of North Judson, Ind., has been awarded the contract by the Starke County Commissioners, Knox, Ind., for the construction of 2½ miles of gravel road in Davis Township, for $5,062. Bids were opened Jan. 2.

⊙The Western Construction Co., of Indianapolis, Ind., has been awarded the contract by the Board of Public Works of Michigan City, Ind., for the paving of Willard Ave. and Warren St., at $1.86 and $1.95 per sq. yd., respectively. The work will include grading, foundation of concrete and necessary catch basins and connections. Bids were opened Dec. 19.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

⦿William H. Burton of Orleans, Ind., has been awarded the contract by the Orange County Commissioners, Paoli, Ind., for the macadamizing of the roads in Orleans Township, at $2,800. Bids were opened Jan. 2.

Bids were recently received by the Board of Public Works of Michigan City, Ind., for the paving of Willard Ave., from Fourth St. to the north line of the prison grounds, and Warren St., from Washington to Pine, and the hotel alley, extending one block east and one block west of Franklin St. Bids were offered on 8 or 10 makes of brick. The bids of John McGillicuddy of Valparaiso, Ind., range from $25,935 to $28,063; Peter Michaely, Michigan City, from $25,942 to $27,134; Hatch & Sons Co., Goshen, Ind., from $25,007 to $27,135, and William Kissack of Chicago, Ill., from $21,109 to $28,726. Warren St., McGillicuddy, from $4,743 to $4,792; Michaely, from $4,665 to $4,938; Hatch & Sons, from $4,516 to $4,880; Kissack, from $4,909 to $5,114; Vincent Milcareck, from $4,758 to $4,895, and the Western Construction Co., of Lafayette, Ind., asphalt, $4,796.

Bids will shortly be solicited by the Board of Public Works of Elkhart, Ind., for the paving of nearly two miles of thoroughfares, at a total cost of approximately $65,650. Oakland Ave., will be paved from the south line of West Franklin St., southwardly to the north line of Lusher Ave., and will require about 14,912 sq. yds. of paving material, costing about $41,348. East Beardsley Ave. will be paved from west line of Cassopolis St., eastwardly to the main tracks of the E. & W. railroad, 2,243 sq. yds. of paving material, costing about $6,227. St. Joe St. will be paved from the west line of South Main St., to the west line of South Sixth St., about 6,635 sq. yds. of material, and costing about [illegible]

Iowa.

The City Council of Corning, Ia., has passed resolutions providing for the paving of about 16 blocks of streets this year.

City Attorney F. B. Blair of Manchester, Ia., is preparing a resolution of necessity for the paving of Main St., from Bremer to Iowa, and Delaware, from Franklin to Madison. It is also intended to pave Madison, north from Delaware to Fayette, and the latter street west to Franklin.

Kentucky.

The Calloway County Fiscal Court, Murray, Ky., has appropriated $10,000 for the Jefferson Davis highway on condition that a like sum is raised by the citizens for the extension of good roads.

Louisiana.

✣Bids will be received until noon, Jan. 15, by Board of Aldermen, Bastrop, La., for the construction of approximately 1,358 lin. ft. 8-ft. walk, 600 lin. ft. 7-ft. walk, 3,735 lin. ft. 6-ft. walk, 19,738 lin. ft. 4-ft. walk and 376 lin. ft. 4-ft. crossings.

Michigan.

✣Bids will be received until 4 p. m., Jan. 12, by Saginaw County Road Commissioner, J. W. Ederer, Saginaw, Mich., for supplying Saginaw County road system with crushed stone, gravel and cement for the season of 1912. (1) Crushed field stone of hard quality materials, free from shale, coral and other limestone materials. (2) Crushed limestone equal in crushing resistance to the best limestone in the state. (3) Gravel to be clean, coarse bank gravel of approved size and quantity. (4) Cement to be best Portland. Specifications on file in the County Road Commissioner's office. All stone to be crushed to a size as may be ordered by the Commissioner, from one-half to two and one-half inches, largest diameter. Proposals submitted must be for furnishing stone and gravel by the ton and also by the cubic yard f. o. b. cars any point in Saginaw County, Michigan. Proposals for cement to be for cement in the original package, seal unbroken, at bidder's storage or warehouse in Saginaw, Mich., and car lots, Saginaw County delivery, as may be [illegible] ner. Samples to [illegible] tive bidders.

[illegible] wnship in Genesee [illegible] Flint, asking for the submission [illegible] to bond the [illegible] presented [illegible] Commissioners at Flint at the [illegible]

Minnesota.

[illegible] luth, Minn., have requested the City Engineer to make estimates on the cost of paving that thoroughfare, from Superior to Third Sts.

Petitions are being circulated in Duluth, Minn., for the paving of Minnesota Ave., Park Point, from Eighth St. to 40th St. An estimate based on the laying of 2½ ins. of tarcon, or crushed rock and tar, on a base of 4½ ins. of concrete, has been prepared by the City Engineer.

City Engineer Oscar Claussen of St. Paul, Minn., will adopt asphaltic concrete on some of the improvements to be made during this year.

Mississippi.

The contract for working 7 links of county road in Beat Two, 31 links in Beat Three, and 55 links in Beat Four, for which bids were asked by the Board of Yazoo County Supervisors, Yazoo, Miss., until Jan. 1, has not been awarded. S. S. Griffin is Clerk of the Board.

Missouri.

✣[illegible] received until [illegible] Jan. 18, by Hal. Myers, Secretary of Commissioners of King's Highway Road District, New Madrid county, Sikeston, Mo., for the construction and improvement of a road in the district, a distance of 10 miles and 1,000 ft. Plans and specifications are on file with the Secretary.

⦿The Board of Public Improvements of St. Louis, Mo., has let street sprinkling contracts for 1912. The contracts aggregated $319,945. The contractors and districts are as follows: No. 1, Ruprecht Construction Co.; Nos. 2 and 40, William R. Bush Construction Co.; No. 3, Joseph Knaus; No. 4, Peter Fabick; No. 5, Casper Fabick; No. 6, Evermann Construction Co.; Nos. 7 and 9, August F. Pollman; No. 8, John Fabick; No. 10, Michael F. Pfeffle; No. 11, Wurst Coal & Hauling Co.; No. 12, Mueller Coal, Heavy Hauling & Transfer Co.; Nos. 13, 26 and 27, J. E. Sippy; Nos. 14 and 33, Peter J. Ratican; Nos. 15 and 16, Ernst Weber; Nos. 17, 18, 34 and 36, Wm. H. Redemeyer; Nos. 19, 21, 22, 23, 28, 29 and 30, Luke Coal Co.; No. 20, William Cogan; Nos. 24 and 25, Chas. A. Kalbfell; No. 31, Timothy E. Cavanaugh; Nos. 32 and 25, Frank A. Stiers; Nos. 37 and 38, Fred C. Pollman; No. 39, Wade Bros. Construction Co.

Voters of the Fulton special eight-mile road district, Fulton, Mo., on Dec. 29 voted the issuance of bonds in the sum of $100,000 for permanent road improvements in the district.

Nebraska.

⦿Able & Roberts have been awarded the contract by the City Council of Lincoln, Nebr., for the construction of pavement in four districts of the city, for $46,600. Other bidders on the work were: M. Ford, $48,040, and Burke-Cochrane Co., $49,747. The districts to be paved are: 16th, from F to Washington Sts.; F St., from 12th to 16th; H St., from 12th to 14th, and 26th St., from Garfield to South. The successful firm classified their bid as follows: $1.73 per sq. yd. for asphalt, $2.14 per sq. yd. for the brick work, $0.55 per ft. for the curbing, and $0.45 per cu. yd. for the grading.

The City Council of Norfolk, Nebr., has passed an ordinance providing for the paving of Norfolk Ave., from 7th St. west to 14th, and 9th St., from Norfolk Ave., north to Prospect, to be known as Paving District No. 2.

New Hampshire.

Mayor William H. Barry of Nashua, N. H., has recommended to the City Council the continuance of the plan of oiling the streets begun as an experiment last year, and that it be extended in scope and area.

New Mexico.

✣Bids will be received, it is reported, until Jan. 25 by Territorial Engineer C. D. Miller, Santa Fe, N. Mex., for the construction of clay road across the Mescalero sands, about 40 miles east of Roswell.

New York.

✣Bids will be received until 2 p. m., Jan. 16, by George McAneny, President of the Borough of Manhattan, New York City, for five street improvement contracts, the largest being No. 5. For repairing asphalt block pavements in the Borough of Manhattan. Engineer's estimate of amount of work to be done: 35,000 sq. yds. of new asphalt block pavement; 1,000 sq. yds. of old asphalt block pavement relaid; 800 cu. yds. of Portland cement concrete mixed and laid; 800 cu. yds. of mortar bed. The period during which the repairs are to be made and the termination of this contract shall be until Dec. 31, 1912, or until all the work called for in this contract shall have been completed. The amount of security required will be $17,000.

✣Bids will be received until 8:30 p. m., Jan. 15, by Commissioner of Public Works, Olean, N. Y., for the construction of approximately 9,500 sq. yds. brick paving, 5,600 lin. ft. of 5-in. curb and 3,500 cu. yds. of excavation in North 1st St. Plans and specifications are on file with the City Engineer.

⦿The Barber Asphalt Paving Co., 30 Church St., New York City, has been awarded the contract by the Park Board, Department of Parks, New York City, for the repairing of roadway pavements in the borough of Manhattan during the year 1912, for $5,864. The work includes 3,000 sq. yds. of sheet asphalt, 1,000 sq. yds. of asphalt block, and 30 cu. yds. of Portland cement concrete. Bids were opened Dec. 28.

Commissioner of Public Works Frank M. Westcott of Syracuse, N. Y., in his annual report to the Mayor and City Council recommends that the Aldermen in the different wards present ordinances for the resurfacing of asphalt pavements on which the city has repaired 37½ per cent of the surface, and that this be done at an early date, so contracts may be let and work started by spring.

The Common Council of Syracuse, N. Y., has adopted ordinances declaring intention to order six new pavements and to resurface asphalt pavements in eight streets, as follows: New pavement—Fulton St., from West Division St. to the present pavement; Division St., from North Clinton to North State; East Adams St., from University to Irving; Harrison St., from University to Irving; South Beech St., from East Water to Westcott. Resurfacing—North State St., from the Erie Canal to James St.; East Willow St., from North State to Townsend; Townsend St., from East Willow to James; East Fayette St., from Almond to South Crouse; South Warren St., from East Genesee to South Salina; East Onondaga St., from South Salina to South State; East Genesee St., from South Warren to South State; Montgomery St., from East Genesee to East Jefferson. H. C. Allen is City Engineer.

North Dakota.

State Engineer T. R. Atkinson's proposition to create a general fund for the improvement of the Meridian road through North Dakota, approved by Grand Forks County, will be submitted immediately to the other five counties in the valley.

Ohio.

✣Bids will be received until noon, Jan. 24, by Harry Jenkins, Village Clerk, Sebring, O., for paving, grading, curbing and otherwise improving sections of a number of streets in accordance with plans on file at the office of the Clerk.

✣Bids will be received until noon, Jan. 30, by H. H. Canfield, Clerk of the village of Cleveland Heights, O., for furnishing the material and labor necessary for the improvement [illegible] field Road to the north end of street, by establishing a grade, grading, draining and paving the same with brick, according to the [illegible] said Clerk at the Town Hall and at the office of the F. A. Pease Engineering Co., at 931 Williamson Bldg., Cleveland, Ohio.

The City Council of Cincinnati, O., has passed a resolution declaring it necessary to improve Sweeney St., from Stone St. to Mill St., by grading, paving the street full width [illegible] drains and inlets.

The City Council of Toledo, O., has passed resolutions providing for the improving of Genesee St., from Paine Ave. to York St., by grading and paving, and the alley between Southard Ave. and Smith St., from Canton St. to Spielbusch Ave., by paving.

According to advices from Salem, O., Township Trustees J. R. Ramsey and J. F. Tescher recently conferred with the County Commissioners at Lisbon, relative to the desired improvement of a portion of the old Painter road. The improvement asked includes 3,500 ft. of the Post hill, leading to Salem from the Reese coal mine.

The Huron County Commissioners, Norwalk, O., recently took up the question of improving roads in various parts of the county so as to permit the proper adjustment of funds for this work, which will be decided upon Feb. 1.

Oregon.

⦿The Warren Construction Co., it is reported, has been awarded the contract by the City Council of Portland, Ore., for the paving of Raleigh St., from 15th to 28th Sts., at $52,000.

Following bids were received recently by the City Council of Portland, Ore., for street improvements: 14th St. district—Oregon Independent Paving Co., stone blocks, $83,158; Montague-O'Reilley, stone blocks, $80,544, wood blocks $69,672, vitrified brick $71,487; Allen & Williams, stone blocks $84,639, wood blocks $68,129, vitrified brick $74,472; Carbolineum Wood Paving Co., wood blocks, $68,635; Harry Howard, stone blocks, $82,536; Elliot & Scoggin, stone blocks, $87,691; O'Neill & Co., vitrified brick, $71,515; Consolidated Contract Co., vitrified brick, $74,747; Jeffery & Bufton, stone blocks $82,429, vitrified brick $74,711, wood blocks $69,256. Dekum Ave., from Morse to East 26th, grading and concrete curbs and walks, Giebisch & Joplin, $8,850; Bechill Bros., $8,106; F. Kubik, $8,945; Joplin & Meeks, $8,744. Going St., from East 15th to East 24th, grading and concrete curbs and walks, Giebisch & Joplin $5,608; Bechill Bros., $5,705; Joplin & Meeks, $5,611. Brazee St., from East 59th to East 62d, grading and concrete curbs and walks, G. K. Howitt, $1,109; Bechill Bros., $820; Joplin & Meeks, $1,054. East 20th St., from East Oak to East Pine, grading and concrete curbs and walks, O'Neill & Co., $498; Simpson St., from Patton to Michigan, grading and concrete curbs and walks, Joplin & Meeks, $1,713; O. M. Patton, $2,001. Lincoln St., from Third to Fifth, Warren Construction Co., bitulithic pavement, $3,617; Oregon Independent Paving Co., asphalt pavement, $3,401; Barber Asphalt Paving Co., asphalt pavement, $3,315. East 69th St., from East Glisan to East Davis, grading and concrete curbs and walks, G. K. Howitt, $1,735; Bechill Bros., $1,729; Joplin & Meeks, $1,730. Borthwick St., from Skidmore to Humboldt, Barber Asphalt Paving Co., asphalt pavement, $12,931; Oregon Hassam Paving Co., Hassam pavement, $12,538; Oregon Independent Paving Co., asphalt pavement, $12,351; Warren Construction Co., bitulithic pavement, $13,373. Borthwick St., from Emerson to Ainsworth, grading and concrete curbs and walks, Giebisch & Joplin, $3,247; Oregon Independent Paving Co., $3,122; Carter Bros., $2,977; O. M. Patton, $2,905; Bechill Bros., $2,946. Sumner St., from Patton to Kerby, Oregon Independent Paving Co., asphalt pavement, $21,[illegible] Paving [illegible] pavement, $21,688; Barber Asphalt Paving Co., asphalt pavement, $22,129; Warren Construction Co., bitulithic pavement, $24,216. East Sherman St., from East 26th to Merrymeade, Oregon Independent Paving Co., asphalt pavement, $666; Barber Asphalt Paving Co., asphalt pavement, $656; Warren Construction Co., bitulithic pavement, $785.

At a recent good roads meeting in Canby, Ore., a special tax of 5 mills for road improvements was voted. The roads in the immediate vicinity of Canby are to be improved.

Pennsylvania.

Surveyors working under the direction of Samuel D. Foster, Chief Engineer of the State Highway Department, Harrisburg, Pa., have completed their lines for the 65 routes for 2,755 miles of main highways carried by the Sproul act of 1911. Commissioner E. M. Bigelow has the detailed report. The routes surveyed include the following: Sunbury to Danville, Bloomsburg to Laporte, Sunbury to Williamsport; Wellsboro to New York state line; Lewisburg to Sunbury, Clarion to Franklin, Pittsburg to Butler, Butler to Mercer, Mercer to Ohio line, Mercer to Meadville, Meadville to Erie, Erie to Warren, Meadville to Warren, Meadville to Franklin, Warren to Smethport, Smethport to New York state line, Ridgeway to Emporium, Coudersport to Wellsboro, Washington to Waynesburg, Waynesburg to West Virginia state line, Uniontown to Washington, Washington to West Virginia line, Washington to Beaver, Wellsboro to Towanda, Bedford to Ebensburg, Washington to Greensburg, Pittsburgh to New Castle, Franklin to Mercer, Warren to Mercer, New Castle to Meadville, Reading to Allentown, Allentown to Easton, and Allentown to Mauch Chunk.

South Carolina.

✣Bids will be received until 7:30 p. m., Jan. 15, by W. G. Smith, Chairman, Special Paving Committee of the City Council, Orangeburg, S. C., for the grading and paving with vitrified brick, E. Russell St. and S. Broughton St., including approximately 5,800 sq. ft.

Tennessee.

The citizens of Sullivan County, Tenn., on Jan. 1 voted the issuance of bonds to the amount of $200,000 for the extension of pikes now under construction, including the Sullivan County section of the Memphis-to-Bristol highway. Of the amount the city of Bristol will receive $25,000 for street improvements. Blountville is the county seat.

The Board of City Commissioners of Memphis, Tenn., has passed a budget covering the distribution of $69,715 of the special turnpike fund. Of this amount $50,000 will be used to repave Lamar Bvld., between Central Ave. and the Parkway. The remainder of the fund will be divided as follows: Chelsea Ave., $6,200; Mississippi Blvd., between Kerr and Trigg, $4,000; Florida St., between Kerr and Trigg, $7,649, and Poplar Ave., $1,865.

Texas.

✣Bids will be received until 8 p. m., Jan. 27, by the city of Houston Heights, Tex., for the paving of the boulevard from White Oak Bayou to the north line of 19th Ave., with brick, creosoted blocks, asphalt, bitulithic or concrete. The class to be determined after the bids are received and considered. Bids by mail should be sent to D. Barker, 505 Kiam Bldg., Houston, Tex. The work consists of approximately 47,200 sq. yds. of paving with all work incidental thereto. Plans and specifications can be seen in the office of the engineers, Howe & Wise, 722-723 First National Bank Bldg., Houston, Tex., and in the office of D. Barker, Mayor of Houston Heights, 503 Kiam Bldg., Houston, Tex.

The County Commissioners at Palestine, Tex., on Jan. 1 sold bonds to the amount of $150,000 for the construction of good roads. The bonds were purchased by Kean & Co., of Chicago, Ill. Work will now be resumed on good roads in Precinct No. 1.

An election will take place Jan. 10 in Precinct No. 1 of Wharton County, Tex., for the purpose of voting on the issuance of bonds in the sum of $200,000 for the construction and repair of good roads. Wharton is the county seat.

Utah.

Zerbe & Walker of Salt Lake City, Utah, at $2,515 submitted the lowest bid to the City Council of that city, G. F. McGonagle, City Engineer, for the construction of sidewalk extension No. 158. Other bidders were: McKay & Reed, $2,524; Eldred & Co., $2,564; L. A. Weber, $2,653; Consolidated Construction Co., $2,819; Gilkerson Construction Co., $2,881; and A. A. Clark, $3,268.

Virginia.

At the recent convention of good roads in Richmond, Vt., the Quebec-Miami International Highway Association was formed for the purpose of constructing a continuous highway from Quebec, in Canada, to Miami, Fla. The following officers were elected: Howard D. Hadley, President, Plattsburgh, N. Y.; George A. Samard, Vice President, Montreal, Canada; Norman M. Parrott, Secretary, Baltimore, Md.

Washington.

The City Council of Seattle, Wash., has oredered the resurfacing of Fourth Ave., S., with asphalt, and passed ordinances providing for the following: Planking the alley in block 16, Plat of Columbia; planking a portion of Nickerson St., and paving Boyer Ave. et al.

Plans have been approved by the Board of Public Works of Seattle, Wash., for approximately $200,000 worth of street work, including the following: Grading of Leary Ave. et al., 371,400 cu. yds. of earthwork, 1,585 M. ft. of lumber, etc., estimated to cost $150,000; replanking Railroad Ave., 880 M. ft. of lumber, estimated to cost $20,000.

Property owners along Marietta road just outside of the city limits of Bellingham, Wash., have circulated a petition which will be presented to the State Highway Board, Olympia, asking for the improvement of the road from the limits of Bellingham to the village of Marietta at the mouth of the Nooksack river, a distance of three miles. The improvement will cost between $40,000 and $50,000.

The Washington State Highway Board, Olympia, has decided to sign up the contract with the Great Northern Railroad by which the railroad company is to build a new highway between Wenatchee and Pateros, along the Columbia River, in exchange for state road No. 10. Over the latter highway the Great Northern proposes to build its new line into the Okanogan country.

Following bids were received recently by the Board of Public Works of Seattle, Wash., for the grading of Ninth Ave. West et al.: Sloane Bros., $31,084; J. H. Cullen & Co., $31,411; Andrew Peterson & Co., $28,067; Andrew Peterson, $32,853; Agassiz & Hadley, $29,298; Lane & Dilley, 407 Hinckley blk., Seattle, $27,525; P. J. McHugh, $33,159; W. F. Manneg & Co., $31,416.

⦿The Board of Public Works of Seattle, Wash., has awarded the contract for the paving of Dearborn Ave., from Rainier Ave. to Seventh Ave. South, to Ryan, Sullivan Bldg., Seattle, at $46,682.

Wisconsin.

✣Bids will be received until 2 p. m., Jan. 20, by Board of Public Works, West Allis, Wis., for furnishing all material and doing all work of grading, curbing and paving of National Ave., from 75th Ave. to 53d Ave., and from 51st Ave. to the east limits of the City of West Allis, with a permanent pavement, having a concrete foundation and a bituminous wearing surface, a Kettle River sandstone wearing surface, a creosoted wood block wearing surface, and a sheet asphalt wearing surface, in accordance with specifications on file in the office of the city clerk. Bids will be received for all the kinds of wearing surface above named and for all

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

kinds of curbing named in specifications above mentioned.

The Board of Commissioners of Milwaukee and Racine Counties recently held a meeting in Milwaukee, Wis., to discuss reconstruction of the Janesville plank road. Plans contemplated provide for its parking to the Racine County line, the first project to be undertaken under the Board's program for much highway improvement, there being available about $212.000 for good roads.

The Marathon Highway Commission, according to advices from Wausau, Wis., re- [illegible] cussing plans for carrying out the state highway proposition. The Commission has several plans under consideration for highway [illegible]

to the [illegible] for approval.

Canada.

[illegible] contracts of street pavement work, the Bitulithic & Contracting Co., Winnipeg, Man., being awarded 17,000 sq. yds. at $2.93 per sq. yd., and the Eloso Co., Vancouver, B. C., being awarded 11,000 sq. yds. at $2.43 per sq. yd. The following is an analysis of the bids received:

				Remarks.
[illegible]	$4.97	$3.99	$3.94	4-in. wood block.
[illegible]		3.76	3.71	[illegible]
[illegible]		3.51	3.46	3-in. wood block.
[illegible]	3.20	3.26	3.25	Sheet asphalt.
[illegible]	2.69			Sheet asphalt.
[illegible]	2.65	2.69	2.59	Sheet asphalt.
[illegible]	2.50	2.54	2.43	[illegible]
[illegible]	4.45		4.43	[illegible]
[illegible]	3.05			Sheet asphalt.
[illegible]	2.90	2.93	2.97	Bitulithic.

BRIDGES—STEEL AND CONCRETE

Arizona.

✣Bids will be received until 2 p. m., Jan. 30, by Board of Control, Territory of Arizona, Phoenix, Ariz., for the construction of a 102 ft. steel highway bridge over Chevalon Creek. Robert A. Craig is Secretary of the Board.

Arkansas.

Charles E. Taylor, Little Rock, Ark., has suggested the construction of a new reinforced concrete viaduct over the railroad tracks at West Third St., connecting with Pulaski Heights.

California.

✣Bids will be received until 2 p. m., Jan. 15, by Board of Los Angeles County Supervisors, Los Angeles, Calif., for the construction of a 75-ft. pile trestle on Sherman way, in Lankershim road district. H. Lelande is Clerk.

The Glen County Board of Supervisors, Willows, Cal., have sold $200,000 of the $450,000 bonds voted some time ago and funds are now available for road and bridge improvements.

Florida.

Commissioners of Duval County, Jacksonville, Fla., have announced that a new concrete bridge will be constructed over Trout Creek, on the Lem Turner road, to replace the present structure.

Illinois.

⊙Highway Commissioners of Grant Township have let the contract for the construction of three new bridges over the Hoopeston Drainage District Ditch to the Paris Bridge Co., Paris, Ill., at $2,490.

⊙Board of Jersey County Commissioners, Jerseyville, Ill., has awarded the contract for the construction of a bridge over the north branch of Otter Creek to the Missouri Bridge & Iron Co.

City and township of Joliet, Ill., will jointly share the expense of a new concrete bridge over Spring Creek at Ohio St., if present plans materialize. At a recent meeting of the Township Highway Commission, Alderman Arthur Leach and a delegation of property owners appeared before the meeting, and asked that the commission share its portion of the expense of erecting a $4,500 concrete span over the creek. The Township Commissioners favored this plan, and were willing to contribute their share and allow the city to build the structure.

Providing the estimated cost of the new bridge over the Fox River at New York St., Aurora, Ill., does not exceed $100,000, an election will be held next April to submit the proposition to the voters.

The City Budget of Chicago, Ill., for 1912, provides $90,000 for the construction of four bridges at Irving Park Blvd., Montrose Blvd., Lawrence and North California Aves.

The Board of Cumberland County Supervisors, Toledo, Ill., has voted to erect a new concrete bridge at Ryan's Ford, on the Ambraw River, to replace the old structure destroyed recently. Cottonwood and Union Townships will pay one-half the expense. It is estimated that the work will cost about $12,000.

James R. Mann, Representative of Illinois, has, according to advices from Washington, introduced into the House, two bills providing for the construction of bridges across the Calumet River. One authorizes the city of Chicago to build a bascule bridge at 92nd St. and the other grants permission to the Lake Shore & Michigan Southern Ry. for a bascule to replace the company's present Calumet River span.

L. E. McGann, Commissioner of Public Works, Chicago, Ill., with a representative of the Sanitary District of Chicago, recently visited Washington, D. C., for the purpose of having the time extended for removing middle-pier bridges over the Chicago River and the waterway. The time expired Dec. 31, 1911.

Indiana.

✣Bids will be received until 10 a. m., Feb. 5, by Board of Adams County Commissioners, Decatur, Ind., for the necessary labor and material for the construction of a bridge over St. Mary's River in Washington Township. H. S. Michaud is County Auditor.

⊙The Vincennes Bridge Co., Vincennes, Ind., has been awarded the contract at $3,500 for the construction of a steel bridge across Eleven Points River at Birdell, 6 miles northeast of Imboden. By terms of the contract the work must be completed within 6 months.

The City Council of Elkhart, Ind., has asked the county for an appropriation of $11,000 for the construction of piers for the proposed Elkhart Ave. bridge. It is believed that cost of the bridge complete will not exceed $25,000.

At a meeting of the County Council, Richmond, Ind., Jan. 8, several bridge appropriations were made. The expense attached to the construction of the bridge over the Whitewater River was also discussed.

Iowa.

City Council, Des Moines, Ia., has passed a resolution to transfer some of the bridge repair funds to the Locust St. bridge fund. The City Auditor was instructed to draw warfants for $67,500 as payment on bonds and interest on the Locust St. bridge and $12,660 for payment on other bonds.

Kansas.

⊙Lundberg & Gustafson, village of Randolph, Kans., have been awarded the contract by George H. Hungerford, County Clerk, Manhattan, Kans., for the construction of a 20-ft. stone arch bridge with wing walls across a branch 1 mile north of the Randolph depot in Jackson Township. The contract price is $2.75 per cu. yd. Bids were opened Jan. 4.

The Missouri, Kansas & Texas R. R. Co. has been directed by the State Corporation Commission of Oklahoma to construct an overhead passageway for pedestrians and vehicles across its tracks in the city of Caddo extending from Bell to Court St. A. S. Clopton, Parsons, Kan., is Superintendent of Bridges and Buildings.

It has been announced that the viaduct to be constructed in connection with the proposed 23d St. trafficway will be 48 ft. wide from the Wyoming St. approach to the easterly terminus of the structure at 23d and Bank Sts., where it will eventually connect with a roadway along Shawnee Ave., in Kansas City, Kan. L. R. Ash is City Engineer.

In connection with the good roads movement in Franklin County, an effort is being made to have the old swinging suspension bridge across Tauy Creek, on East Logan St. road, replaced by a modern bridge. A petition is now being circulated asking the Commissioners of the County at Ottawa, Kan., for the improvement.

Maryland.

Among the plans under consideration by Maj. Joseph W. Shirley, Chief Engineer of the Topographical Survey, Baltimore, for the development of North Baltimore, Md., is the one for the construction of a general traffic bridge over the Stony Run Ravine, east of Druid Hill Park, in place of the Huntingdon Ave. bridge of the United Railways and Electric Ry. Co. A concrete structure similar to the Connecticut Ave. bridge in Washington, is under consideration.

According to the estimate made by Harbor Engineer Oscar Lackey, Baltimore, for the construction of the proposed V-shaped bridge across Spring Gardens, the improvement including approaches, will necessitate the expenditure of approximately $1,000,000. The bridge proper will cost $586,000.

Michigan.

✣Bids will be received until 2 p. m., Jan. 10, by Committee on County Roads and the County Road Commissioner of Saginaw, Mich., at the Court House, for the construction of the superstructure and the substructure of a highway bridge on the Gratiot road, across Swan Creek, in Thomastown. J. W. Ederer is County Road Commissioner.

Minnesota.

According to an estimate completed by City Engineer McGilvray, Duluth, Minn., the cost of rebuilding the burned portion of the 81st Ave. bridge will be about $3,000.

The erection of three new bridges across the Mississippi River are among the important projects undertaken by the City Council of Minneapolis, Minn. Plans are well advanced for a structure on 42d Ave. N., and engineers are at work on preliminaries for bridges on 3d and 19th Aves. S. Both the latter projects involve street improvements of importance. Plans are well perfected for a proper approach to the 19th Ave. bridge and proceedings are under way for the widening of 3d Ave. S., one of the biggest street improvements ever considered in the Council.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Missouri.

The City Council of St. Joseph, Mo., has adopted a resolution at its meeting recently, instructing the Board of Public Works to submit complete set of new viaduct plans for the proposed South 6th St. structure. Carl P. Hoff is Assistant City Engineer.

It has been announced by Mayor Kreismann, St. Louis, Mo., that an effort would be made to have a resolution introduced at the present session of Congress, to extend the time for the completion of the new municipal free [illegible]

City Council of St. Joseph, Mo., has voted [illegible] at Park St. The cost of the improvement is estimated at about $4,000. The proposed viaduct will be of steel and concrete construction.

Nebraska.

The City Council of Omaha, Nebr., has announced that the proposed 11th Ave. viaduct will probably be a stone arch structure. The matter is also under consideration by the engineers of the Union Pacific Ry.

Applications for state aid for the construction of county bridges have been filed at Lincoln, Nebr., by a number of counties, as follows: One application is a joint one from Boyd and Holt Counties for a bridge over the Niobrara River, between the two counties. It is estimated to cost $25,000. Morrel County wants two bridges over the North Platte, one near Bayard and the other near Bridgeport, each estimated to cost $20,000. Washington wants one bridge over the Elkhorn, near Arlington, to cost $10,000. Keya Paha has applications in for two bridges over the Niobrara. One is to be near Carnes and the other near McCullough. One is to cost $12,000 and the other $14,000. Red Willow wants a bridge over the Republican River, the cost of which is not yet estimated. Platte County wants a bridge over the Loup River at Monroe to cost $34,000. Lodge and Saunders counties combined want the state to aid in bridging the troublesome Platte at North Bend. It is estimated this structure will cost $68,800, the most expensive of any of the bridges so far contemplated under the act. D. D. Price is State Engineer.

New Jersey.

A modern electric drawbridge will probably be erected over Assiscunk Creek, on the site of the iron structure that collapsed under the weight of a trolley car at Burlington, N. J., recently.

New York.

⦿It is reported to have been announced by Samuel Rea, President of the New York Connecting R. R. Co., that the contract for the steel work for the approaches to the East River bridge on Long Island, Randall's Island and in the Bronx, has been awarded to the McClintic-Marshall Construction Co., New York. The award covers all steel required for Bronx Kill and Little Hell Gate bridges.

City Engineer H. C. Allen, Syracuse, N. Y., has recommended in his annual report that additional appropriation be made to rebuild Jefferson St. bridge and that new bridges be constructed at Newell and Oxford Sts., over Onondaga Creek.

M. E. Connolly, President of the Borough of Queens, New York City, received the following lowest bid for the temporary repair of the Norton's Creek bridge, in the Fifth Ward: Phoenix Construction Co., $27,308.

Board of Wayne County Supervisors, Lyons, N. Y., has adopted a resolution petitioning the State Canal Commissioners to build a bridge across the barge canal at the county poor farm to replace the one which has been torn down.

North Carolina.

⦿The contract for furnishing and erecting steel work for an 80-ft. span steel bridge over Little River, near the State Hospital at Goldsboro, N. C., has been awarded by Dr. W. W. Faison, Supt. State Hospital, Goldsboro, N. C., [illegible] Co., Owego, [illegible] [illegible] $1,328. Bids were opened Jan. 3.

North Dakota.

•The contract for furnishing corrugated galvanized steel culverts has been awarded by C. Ahlster, Auditor of La Moure County, La Moure, N. Dak., to the Berger Manufacturing Co., Minneapolis, Minn., as follows: 12-in. diameter 16 gage at 54 cts.; 18 in. 16 gage, 77 cts.; 24 in. 15 gage, $1.03; 36 in. 14 gage, $1.87; [illegible] in. 12 gage, $4.80. Bids were opened Jan. 4.

Ohio.

✣Bids will be received until noon, Jan. 26 (readvertisement of work), by Board of Hamilton County Commissioners, Cincinnati, O., for the construction of a bridge over Mill Creek, at 2d Ave., Carthage, in Mill Creek Township. Albert Reinhardt is Clerk of the Board.

✣Bids will be received until noon, Jan. 26, by Board of Franklin County Commissioners, Columbus, O., for the construction of two bridges. The work will include only the superstructures and floors. F. Sayre is Auditor of the county.

✣Bids will be received until noon, Jan. 30, by Board of Marion County Commissioners, Marion, O., for the construction of the following bridge work in Marion County: A steel superstructure for a bridge over the Little Scioto River on the Radner pike, in Green Township; also for steel superstructure for a bridge over the Little Scioto River on the Morris pike, in Green Camp Township, and for the erection and completion of concrete foundations, abutments, wing walls, etc., for bridge across the Little Scioto River on the Radner pike, in Green Camp Township. Estimated cost $3,250, $4,450 and $1,089, respectively.

⦿E. J. Landor, Canton, O., has been awarded the contract for raising the old bridge at the Gorge by the Northern Ohio Traction & Light Co. in order that the structure will conform with the plans for completing the dam at that place.

Advices from Ashley, O., state that a new steel bridge will be built over the river just east of Winsor Corners, in the spring. The structure as proposed will be of steel.

The City Council of Dayton, O., has adopted an ordinance authorizing the issuance of bonds aggregating $65,000 for the erection of the proposed concrete steel bridge over the Mad River at Keowee St., connecting with North Dayton.

Oklahoma.

Among the improvements for which the bonds were recently issued by the Commissioners of Tulsa, Okla., is the construction of a number of bridges estimated to cost approximately $30,000.

Oregon.

✣Bids will be received until 4 p. m., Feb. 16, by Executive Board of the city of Portland, Ore., for furnishing the necessary labor and material for the construction of a reinforced concrete viaduct over Sullivan's Gulch at East 21st St. The work will include about 5,000 cu. yds. of concrete. A. L. Barbur is City Auditor.

The location of the proposed bridge across the Williamette River in South Portland has not been definitely decided upon, and will not until City Engineer Thomas Hurlburt has completed investigations of the river and approaches. Woodward Ave., or old Ellsworth St., on the East Side, and Meade or Wood St., on the West Side, have been named as the possible ends, but these may be changed as the result of the soundings and investigations. Mayor Rushlight has been quoted as favoring Beacon St., on the East Side, as that approach would bring the bridge closer to Ross Island. A suggestion has been made that the bridge might be made double-decked, that the lower portion could be used for a belt line railway, but nothing has been done in that direction, and it will probably not be entertained in connection with the proposed bridge.

Pennsylvania.

✣The State Water Supply Commission, Harrisburg, Pa., has refused the Lewisburg Bridge Co. permission to reconstruct the bridge at Lewisburg, on the west branch of the Susquehanna River.

⦿Commissioners of Bedford County, Bedford, Pa., have awarded the contract for the construction of a bridge over Dunning's Creek at Smith's Crossing, to Nelson-Merydith Co., Chambersburg, Pa., at $2,249. The contract includes the construction of the steel superstructure.

Residents in the vicinity of Glassport and Wilson, Pa., have petitioned the Commissioners of Allegheny County, Pittsburgh, Pa., for the construction of a bridge between the boroughs. Plans will be prepared shortly, it is believed, by the County Engineers.

In connection with the proposed new cutoff from Clarks Summit to Halstead, Pa., the Delaware, Lackawanna R. R. Co. is reported to be planning the construction of a concrete bridge at Nicholson spanning the creek and valley, eliminating the tunnel.

Tennessee.

An agreement has been reached by the Joint Bridge Commission of White and Warren Counties whereby a highway bridge 565 ft. long will be erected over Caney Fork River, near Rock Island, Tenn. The cost of the proposed structure is estimated at $15,000. McMinnville is the county seat of Warren County.

The recently incorporated Arkansas & Memphis Railroad Bridge & Terminal Co., mentioned in our last issue, plans the construction of a bridge over the Mississippi River and new terminals at the city of Memphis, in connection with the Chicago, Rock Island & Pacific Ry. System. It is said that $10,000,000 will be spent for the improvement.

Texas.

According to recent information received from El Paso, Texas, Mayor C. E. Kelly is negotiating with the street car company with a view to widening the two bridges between El Paso and Juarez and doing away with the toll charges.

It has been announced that work will be started at once on the proposed Wichita Falls & Northwestern railroad bridge across the Canadian River, at a point half way between Elk City and Woodward. As planned, the structure will be 1 mile long, supported by piling. The cost of the structure is estimated at $150,000. D. S. Hooker, Wichita Falls, Texas, is Chief Engineer of the railroad.

Washington.

⦿The contract for the construction of a pile trestle and planking on Canal St. has been awarded to O. U. Mills, Tacoma, Wash., at $10,000. Bids for the work were opened Dec. 4, 1911.

The Oregon & Washington Railway & Navigation Co. has notified the city of Pullman, Wash., that immediate steps will be taken to remove the piles and other obstructions under the bridges owned by the railroad and used for crossing the South Palouse River, within the city limits.

Wisconsin.

⦿The Board of Jackson County Commissioners, Black River Falls, Wis., has given that city the iron bridge which the county owned, and which was washed out by the flood, to be used to span Town Creek. The board also voted $13,000 to rebuild the Black River bridge and donated $12,000 to the relief committee of the city to be used in constructing the cofferdam.

Canada.

Following an early report that the proposition to construct the proposed Bloor St. viaduct at Toronto, Ont., was carried at the

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

recent election, it has been officially announced that the measure was defeated by a small plurality. A recount of the votes is now being advocated. As proposed the structure would connect the [illegible]

estimate[illegible] at $1.5[illegible] Engineer[illegible]

[illegible] will start w[illegible] construction of a new steel bridge over the north fork of the Kettle River, on the boundary line of the C. P. Ry. The new structure will be 550 ft. long and will be supported on three mammoth concrete piers

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

✣Bids will be received, it is reported, until Jan. 30, by the Fourche Drainage District, at the office of Lund & Hill, Engineers, Little Rock, Ark., for the construction of approximately 300,000 cu. yds. of river protection levee along the Arkansas river, and Fourche Bayou, in Pulaski county, Ark. Sealed bids will be received at the same place and till the same time for clearing approximately 500 acres along Fourche Bayou, in Pulaski county, Ark. Specifications for the above work will be ready January 10. 1912. Wm. M. Kavanaugh, president. Warren E. Lenon, secretary.

California.

Supervisors of San Joaquin County, Stockton, Cal., have volunteered to appropriate $2,500 toward reclamation work in Linden Protection District No. 1. This district, which is located near Stockton will expend about $15,000 in building levee and straightening Mormon Channel.

A movement has been started at Fresno to raise $25,000 among the business men of that city for a private survey of the San Joaquin River, in consequence of the report of Major S. A. Cheney against the Government's undertaking the work. The survey will ascertain methods for impounding overflow water to maintain a uniform flow, both for irrigation and navigation, from tide water to the city. F. M. Hill, Fresno, Traffic Manager of the Fresno Traffic Association, is interested.

Illinois.

✣Bids will be received until 2 p. m., Jan. 22, by Richland Drainage District of Alexander Countv. Ill., at the office of Gilbert & Gilbert, Cairo, Ill., for the excavation of about 110,000 cu. yds. of material; all timber; 10 to 18 ft. bottoms; 00 to 4 to 8.8 cuts. D. I. Kirkham, Olive Branch, Ill., is Secretary of the District.

✣Bids will be received until 2 p. m., Jan. 16, by Commissioners of Middle Fork Special Drainage District for the construction of a 15-mile main outlet ditch and 2-mile lateral ditch for said district. Plans and specifications are on file with J. W. Davis. Clerk of Saline County, Harrisburg, Ill. W. E. Keelin, West End, Ill,, is one of the commissioners.

✣Bids will be received until 1:30 p. m., Jan. 17, by Commissioners of the Sny Island Levee Drainage District of Pike, Adams and Calhoun Counties, at the office, Pittsfield, Ill., for dredging the Sny canal. The work will consist principally of enlarging and deepening the principal drainage canal of the district to a bottom width of 50 ft. with slopes of ¼ to 1. Approximate number of cu. yds., 1,000,000 or more. The work will require at least two dredge boats and may be let to one or more bidders. The right is reserved to reject any and all bids. For specifications and further information address, E. J. Chamberlain, Engineer, Pittsfield, Ill.

✣Bids will be received until 1:30 p. m., Jan. 24, by Cloud & Thompson, Attorneys, Paxton, Ill., for cleaning out, deepening and enlarging by dredge boat of approximately 8 miles of ditch in the Vermillion special Drainage District in Ford and Livingston counties, Ill. Bottom width of ditch 20 to 60 ft., and estimated yardage 184,860 cu. yds. Upper end of ditch about five miles southeast of Kempton, Ford County, Ill. Full particulars can be obtained upon application to C. F. Helman, Engineer, Paxton, Ill.

Bids will be received until 11 a. m., Jan. 26, Taylorville, Ill., by Drainage Commissioners, Union Drainage District No. 1, of the towns [illegible] County, Ill., for the construction of ditch work in accordance with plans and specifications therefor, on file in the office of Lem. L. Potts, Town Clerk of the Town of Raymond, Raymond, Ill., or which may be seen at the office of J. W. Dappert, Engineer, at Taylorville, Ill. Said work of construction is as follows: Open Ditch—Base with 3 ft., side slopes 1½ to 1, from .0 to 3.5 ft. deep, estimated at 5,500 cu. yds. The drains—33 in., 6,220 ft., average cut 4.9 ft.; 30 in., 1,140 ft., average cut 4.6 ft.; 22 in., 2,625 ft., average cut 3.7 ft.; 20 in., 2,640 ft., average cut 4.6 ft.; 18 in., 4,120 ft., average cut 4.2 ft.; 16 in., 5,525 ft., average cut 4.6 ft.; 15 in., 3,535 ft., average cut 4.4 ft.; 14 in., 5,085 ft., average cut 5.0 ft.; 12 in., 6,540 ft., average cut 5.0 ft.; 10 in., 19,145 ft., average cut 5.1 ft.; 8 in., 13,675 ft., average cut 5.0 ft.; 6 in., 8,930 ft., average cut 4.6 ft. All tiles have been delivered along the lines of the improvement, or are on hands near thereto, and work is ready to proceed with at once.

Hearing was held in the County Court at Alton, Ill., on the petition for the Wood River drainage project. An agreement has been reached on the project and it is expected that the improvement will now be carried out. The new plan will save about $100,000, it is said. The proposed levee will join on the north with the East Side project, and will give protection to a large area lying near the Alton bluffs.

Iowa.

⊙Bids were opened Jan. 3 by C. A. Batman, County Auditor, Nevada, Ia., for constructing Drain No. 32 of Story County, contracts being awarded as follows: Open work, Lewis & Holdaway, Champaign, Ill., at 8.97 cts. per cu. yd.; labor for tile work, Hawkeye Construction Co., Webster City, Ia., at $14,451; tile, Lehigh Clay Products Co., Lehigh, Ia., at $29,500. The drain includes the following: 93,000 cu. yds. of open work; 4,800 ft. of 36-in. tile; 3,900 ft. of 30-in. tile; 1,350 ft. of 26-in. tile; 1,700 ft. of 24-in. tile; 5,970 ft. of 22-in. tile; 1,200 ft. of 20-in. tile; 5,675 ft. of 18-in. tile; 16,825 ft. of 16-in. tile; 7,600 ft. of 14-in. tile; 5,841 ft. of 12-in. tile; 6,058 ft. of 10-in. tile; 2,562 ft. of 8-in. tile; 42.7 cu. yds. of concrete masonry.

⊙Bids were opened Jan. 4 by F. L. Marriage, Hardin County Auditor, Eldora, Ia., for drainage work in District No. 25, the contract for the labor being awarded to the Gade Excavating Co., at $3,974, and the contract for tile to the Eldora Pipe & Tile Co., at $7,943. The work in this district includes the following: Sec. 1—4,000 ft. of 28-in. tile, average cut 5.82, maximum 7.90. Bulkhead of 4 cu. yds. concrete. Sec. 2—1,600 ft. of 22-in. tile; 1,400 ft. of 20-in. tile, average cut 6.33, maximum 7.40. Sec. 3—2,895 ft. of 18-in. tile, average cut 6.49, maximum 7.00. Sec. 4—Railroad crossing. Sec. 5—2,000 ft. of 16-in. tile; 2,000 ft. of 15-in. tile; 1,800 ft. of 14-in. tile; 1,500 ft. of 12-in. tile; average cut 6.57, maximum 9.20. Sec. 6—1,200 ft. of 10-in. tile, average cut 5.28, maximum 7.10. Sec. 7—200 ft. of 10-in. tile, average cut 5.10, maximum 6.00. Sec. 8—2,020 ft. of 12-in. tile, average cut 5.73, maximum 7.30. Sec. 9—Railroad crossing. Sec. 10—2,680 ft. of 12-in. tile, average cut 5.75, maximum 8.20. Sec. 11—1,600 ft. of 10-in tile; 900 ft. of 8-in. tile, average cut 5.25, maximum 6.70. Average haul approximately two miles from Garden City, Ia. S. B. Gardner, Eldora, Ia., is Engineer of Construction.

Bids will probably be taken in March for the construction of a drainage system for the Lost Nation Drainage District in Sharon and Liberty Townships, Clinton County. The work will include a main open ditch requiring about 300,000 cu. yds. of excavation, 20 open laterals requiring 220,000 cu. yds. of excavation, and tile work estimated to cost $25,750. R. C. Hart, 317 Howes Block, Clinton, Ia., is the engineer.

Memphis and Vicinity.

Last week Lowrance Brothers moved their large outfit from Hollybush, Ark., to the Red River levee work in Miller county. This latter is the contract taken from the Miller County Levee board last fall and which embraced about 2,000,000 cu. yds. of material. While it was not the intention of the Lowrance boys to move on the new work so soon, the flood in the Mississippi River prevented them from further continuing their operations for the St. Francis Levee Board at Hollybush, and made the journey to Red River necessary. from present indications, no work can be done at Hollybush until early summer. Pres and Tate Lowrance went with the outfit.

Ed. Parker, an old time levee builder from the Vicksburg territory and who has been doing some United States enlargement work in the St. Francis basin, moved his outfit to the Red River levee with the Lowrance equipment, Ed. having taken a sub-contract from the latter firm. In company with Helgason and Gibson, Ed. was successful last summer in securing a good slice of Government work in the Memphis territory and from all indications he made plenty of money on this latter contract which he has just concluded.

After many ups and downs and a hard struggle against the raging Mississippi, Bill Stephenson landed at Atherton, La., on Dec. 30, in a down pour of rain and at midnight. Bill says never in his whole history as a levee builder (and he has been at the game for many winters), did he experience such a move. He broke camp in a downpour and on the long trip to Greenville, from which point he took steamer for Atherton, a cold drizzle set in which went to the marrow of the men's bones and made everything wet. But Bill is cheerful as usual, and has now buckled down to roll up the new levee and forget past hardships. All such things, he says, belong to the life of a levee builder!

Ed. White of the firm of Dameron & White of New Orleans, was a visitor in Memphis last week on a return trip of inspection of some new lines of railroad work which are soon to be let. Ed. is a wise old owl and does not tell half of what he knows. But what he does tell is always reliable information and a great deal more than some people ever dream of. Ed. is heavily interested in a Memphis street paving concern of note. Together with C. D. Smith and E. J. Scott he has large railroad interests in Arizona and the Western states.

Henry McCarten has announced his decision to move from Hollybush, Ark., to Atherton, La., where he will build a section of the big loop being constructed at that place under the direction of Capt. J. A. Woodruff, U. S. A. Henry was on the same piece of enlargement work for the St. Francis Levee Board that Lowrance Brothers have just moved from, and like the latter firm, the high and unexpected stage in the Mississippi has forced

✣ indicates work now open for bids. ⊙ **indicates a contract let recently.**

him [illegible]

While the Atherton work is very wet from the excessive rains in this territory, it is thought that in a week the ground will be in condition to do something worth while.

J. K. [illegible] one of the well known contractors of the Mississippi River, was in Memphis last week from his large plantation near Walls, Miss. While not enjoying the best of health at this time, Mr. Jefferies seems to be possessed of his old-time jovial spirit and spoke fondly of the time when he was rolling up dirt into many of the levees that now line the bank of the river. J. K. is the father of Maud Jeffries, one of the best known of the American actresses.

C. D. Smith and Ed. White have just finished an inspection trip of some heavy rock work which the Louisville & Nashville R. R. will build in the vicinity of Birmingham, Ala. The new project involves several million yards of rock and earth and will be one of the largest contracts which the L. & N. will let this season. The invitations to this particular piece of work, it seems, were not sent broadcast, only those firms which were specially equipped for heavy work being asked to bid. A decision as to whom the work is to be awarded will be announced by the time this is printed.

That the new railroad from Memphis to Pensacola, Fla., is a certainty is evidenced by the fact that C. D. Smith & Co., one of the largest construction concerns of the South has taken charge of the project and already have sent out three corps of engineers in the field locating that part of the line which had not already been staked out under the first organization. Not only have C. D. Smith & Co., the contract for the construction of the line, but this firm is heavily interested financially in the new road and together with some other prominent Memphis and Mississippi men, are determined that the road will be built at once. This too, will be necessary if several valuable right of way grants are to be taken over, and which latter are too valuable to let go by the board. The fact that Charlie Smith has interested himself in the new road, lends a wonderful amount of strength to the enterprise and raises it to the plane of an absolute certainty.

J. W. Coburn, one of the best known local street builders, states that he is finishing up all the work which he has on hand and will be in good shape to acquire new contracts for the coming year.

W. W. Hayden, Assistant Chief Engineer of the Missouri, Kansas & Texas R. R., was a visitor to Memphis last week, where his family is located. Bill is doing big things in the West since being associated with Mr. Kenifick the president and promoter of the road and is enthusiastic over the prospects held out to him by the new road being built through Oklahoma. When Chief Engineer of the Lake View Traction Co., the first interurban line touching Memphis, Bill acquired quite a reputation. In the face of great opposition on the part of the President of the road and board of directors, Bill took the bit into his own mouth and built the road. The same is now one of the best paying propositions in Memphis and many citizens and stockholders are grateful to Bill Hayden, the man who made the proposition possible.

Maj. Clarke S. Smith announces that in the near future he will have approximately 100,000 cu. yds. of new levee to let in the St. Francis basin. The work which Maj. Smith has to let always attracts wide attention, for the levee builders have come to realize that they may expect the fairest of treatment at his hands and no work which is not embraced in the specifications will be asked for, as has been done by some of the state levee boards in this section of late years. Luther Y. Kerr is one of the able assistants of Major Smith, and is a recognized authority on levee building.

The year 1912 will be a banner one in drainage in this section, according to all those who are in position to speak with authority. The large contract to be let on the 25th of this month at Osceola, Ark., embracing about 14,000,000 cu. yds. is only a starter according to Willis Ayers, one of the best drainage experts in the South. Mr. Ayers, who by the way, is extensively quoted in drainage matters and who has perhaps built more of this sort of work than any other engineer in this section, says that from now on, the South may look for many districts to be established and many acres of land to be reclaimed. Maj. Dabney acting for the state of Mississippi is ative with the legislature of his state in passing laws authorizing drainage where needed and will be instrumental in getting much work done in his section during the coming spring. With Willis Ayers pushing this sort of work in Arkansas and Maj. Dabney doing the same stunt in Mississippi, the drainage boys may look for an unprecedented amount of work this season. In fact, many claim that there are now enough drainage contractors in the South to take care of the work to be done during 1912.

Harry Pharr, the City Engineer of Binghamton, Tenn., is advertising a juicy bit of work to be let on the 9th of this month. It embraces about $50,000 of gravel streets, road grading, curb and gutter and sidewalk work. Harry expects a number of bidders on his work.

Texas.

✣Bids will be opened Feb. 15 at the office of the U. S. Engineer, Burke Bldg., Seattle, Wash., for the excavation of the Lake Washington Canal from the lock site at the Narrows to Lake Washington. The estimated cost of the work is $800,000, and it involves 1,875,900 cu. yds. of excavation. The canal prism will be 25x75 ft., 75 ft. wide at the bottom and 25 ft. deep at mean lower low water. Other work in connection with the canal for which bids will be asked following the letting of the excavation contract, include locks to cost $2,000,000, controlling works to cost $130,000 and structures in Shilshole Bay to cost $50,000.

The La Lomita Canal & Construction Co. of Brownsville, Tex., is planning to place 26,000 acres of land in Hidalgo County under irrigation. Arvid Franke, Brownsville, Tex., is the Consulting Engineer. The work may require wood stave pipe, 18 in. to 24 in.; steel flumes, 3 ft. radius to 5 ft. radius; headgates for laterals; water motors; materials for oil supply pipe line; vc. pipes, 12 in. to 24 in., and creosoted lumber.

Surveys will be completed about April 1 for the irrigation project of the Valverde County Reservoir & Irrigation Co. This irrigation system is to be located in Valverde and Kinney County, Texas. D. B. Chapin and associates are the owners. The project will include a main dam about 1,000 ft. long and 200 ft. high, of concrete construction; 2½ miles of tunnels and 25 miles of main canal. The system will irrigate about 200,000 acres The probable cost is $5,500,000. The work will be ready for bids about July or August. C. S. Young Co., 501 Frost Bldg., San Antonio, Tex., are the engineers.

Topographical surveys are to be made at once by Arthur A. Stiles, State Levee and Drainage Commissioner, Austin, of lands on the Trinity River near Dallas. This survey work is preliminary to the taking of steps by the county authorities for the establishment of a levee and drainage district.

Washington.

Bids as follows were received Jan. 2 by Capt. T. H. Jackson, U. S. Engineer, Dallas, Tex., for dredging Sabine-Neches Canal, the work including 7,291,000 cu. yds. of excavation and the clearing of 30 acres of timbered land: Atlantic, Gulf & Pacific Co., New York, dredging at 8¼ cts. a yd. total, $601,507.50; clearing woodland at $20 per acre, $600; total bid, $602,107.50. North American Dredging Co., Galveston, dredging at 8.14 cts., $593,487.40; clearing at $180 per acre, $5,400; total, $598,887.40. Duluth-Superior Dredging Co., Duluth, Minn., dredging at 7¾ cts., $565,052.50; clearing at $150 per acre, $4,500; total, $569,552.50. Southern Dredging Co., Mobile, Ala., dredging at 10.4 cts., $758,264; clearing at $500 per acre, $15,000; total, $773,254. Bowers Southern Dredging Co., Galveston, dredging at 7.29 cts., $531,513.90; clearing at $50 per acre, $1,500; total, $533,013.90.

Wisconsin.

⊙Contracts for furnishing 50,000 yds. of brush for river work have been let as follows by Capt. W. A. Thompson, La Crosse, Wis., Government Engineer, in charge of improving the river from Winona to Prairie du Chien: F. J. Fugina, Fountain City, 17,000 yds. at 23.9 cts. per yd.; George Holzhammer of La Crosse, 16,500 yds. at 24 cts. per yd., and Charles Ott, Genoa, 16,500 yds. at 24 cts. per yd. As 100,000 yds. of brush in addition to the above amount will be needed in the spring for building dams, Captain Thompson will advertise for bids for the cutting and delivery of this quantity at that time.

WATER-WORKS

California.

✣Bids will be received between 2 and 3 p. m., Jan. 24, by Board of Public Works, San Francisco, Cal., for the general construction of a Class A building to be located in the Fort Mason military reservation for the Auxiliary Water Supply system for fire protection.

✣Bids will be received between 2and 3 p. m., Jan. 24, by Board of Public Works, San Francisco, Cal., for furnishing and installing mechanical equipment in a Class A building to be located in Fort Mason military reservation for the Auxiliary Water Supply system for fire protection.

✣Bids will be received between 2 and 3 p. m., Jan. 24, by Board of Public Works, San Francisco, Cal., for the structural steel and iron work of Class A building to be located in Fort Mason military reservation for the Auxiliary Water System for fire protection.

⊙According to advices from Fullerton, Cal., C. C. Durker has ben awarded the contract for the construction of a reservoir for J. R. Carhart on the Carhart ranch, one mile north of Fullerton. The reservoir will be 60x120x6 ft., and will contain 10,000 gallons of water.

Mayor Charles M. Morse of San Mateo, Cal., has appointed the following committee of citizens to investigate the water situation in the city and decide upon the advisability of purchasing the present system of the San Mateo Water Co., or the construction of an entirely new system: M. M. Brown, chairman; J. J. O'Brien, George Fitzgerald, J. P. Duffy and Hy Meyer.

Colorado.

⊙B. R. Gibbons has secured the contract for building a cement reservoir to be used in connection with the pumping plant for the city of Pueblo, Colo. The reservoir will be located south of town.

Connecticut.

The special committee appointed Dec. 9, 1910, by Mayor John F. Wade of Bristol, Conn., to investigate the advisability of purchasing the rights and franchise of the Bristol Water Co., has made its report to the Mayor and recommends the purchase of the property. An election has been called for Jan. 17 for the people to vote on the proposition.

The Water Commissioners of Hartford, Conn., have retained Engineer Caleb M. Saville of Brookline, Mass., to construct the Nepaug water system in that city.

Georgia.

✣Bids will be received [illegible] Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 18, for furnishing all tools, patterns, labor, material, etc., necessary to construct, deliver and erect complete Hawley down draft furnace for boiler No. 7 at the 22d St. pumping station according to plans and specifications on file at office. Cash or certified check for $100 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 18, for furnishing all labor, tools, materials, etc., necessary to construct and deliver 300 tons of special castings for cast iron water pipe as may be required until Dec. 31. Pipe offered for delivery under this contract must be smooth, free from scale, blisters, sand holes and other defects recognized by inspectors as detrimental. Specifications governing sizes, weight, delivery, coating, etc., may be had upon application to the Commissioner of Public Works. Cash or certified check for $700 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 18, for furnishing 5,000 tons (approximately) of cast iron water pipe and delivering same in quantities as specified to each of five city pipe yards located as follows: Yard A, Avers Av. and Wabansia Av.; B, 2352 S. Ashland Av.; C., 49th St. and Union Av.; D., 68th St. and Yates Av.; E. 104th Pl. and Harvard Av. Bidders are to submit prices on 1,000 pieces 6 in. pipe, 12,500 pieces 8 in. pipe and 2,225 pieces of 12 in. pipe. All pipe are to be made with hub and spigot joints and not to vary in weight more than 5 per cent from standard weight for size. All pipe to be made according to specifications on file at office of the Commisioner of Public Works, of a good quality of iron, free from lump, blisters, sand holes, etc. Cash or certified check for $6,000 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 18, for furnishing and delivering approximately 300 tons of cast iron valve basin and five cistern covers to the city pipe yards, located as follows: Avers Av. and Wabansia Av., 2352 S. Ashland Av., 48th Pl. and Union Av. and 68th St. and Yates Av. All castings are to be made of tough gray iron without admixture of inferior materials and must be free from blow holes, cold shuts, etc. Castings should be free from sulphur and true to pattern. Plans and specifications on file at office of Commissioner of Public Works. Cash or certified check for $200 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until Jan. 18, for furnishing and delivering 250 tons of hydrant and stop valve castings according to plans and specifications on file at office of the Commissioner of Public Works. Cash or certified check for $500 must accompany proposal.

The new council of Atlanta, Ga., will be urged to purchase a 15-acre tract of land, costing $16,500, on which to construct a coagulating basin. The land is situated near the corner of 14th St. and Hemphill Ave.

Idaho.

The citizens of Salmon, Ida., at a recent election voted the issuance of bonds in the sum of $60,000 for the purchase and improvement of the water works.

Kansas.

The Wichita Water Co. has been incorporated in the state of Delaware with a capital [illegible] W. Davis of Wilmington, Del., [illegible]

Massachusetts.

Mayor Charles L. Frank of North Adams, Mass., has recommended to the City Council the construction of a new storage reservoir, or other suitable means of increasing the water supply of the city.

According to advices from Ashburnham, Mass., Ivers Adams of Boston, Mass., has offered to install a new water system for the [illegible] consider the matter.

Minnesota.

The Board of Water Commissioners of Red Wing, Minn., is considering the advisability of installing apparatus at the pumping station so as to pump all city water by electric power. The cost of the electric equipment is [illegible]

Montana.

⊙E. Lindstrom of Billings, Mont., was recently awarded the contract by the recently incorporated town of Manhattan, Mont., for the installation of a system of waterworks, at a cost of $25,000. Bonds for this improvement have been sold to the Union Bank & Trust Co., of Helena.

Nebraska.

A petition is being circulated in York, Neb., to call an election to vote bonds in the sum of $125,000 for the purpose of building and equipping a water and electric light plant in the city of York.

New York.

Plans for the establishment of municipal waterworks for Watervliet, N. Y., are being considered by the city officials. The city proposes to purchase the Watervliet Hydraulic Co., the pumping of water from the wells of the Shaker settlement seven miles south of Colonie, filtration of Hudson River water or the construction of waterworks at Stony Creek, near Crescent.

Commissioner John D. Moore of the State Conservation Commission gave a hearing in the Town Hall at Mexico, N. Y., on Jan. 3, on the proposed plan of establishing a water supply for the village of Mexico. At a special taxpayers' election last April bonds to the amount of $40,000 were voted for this improvement, and shortly afterwards plans and specifications were prepared by an engineer. The plans provide for obtaining a supply of water from springs located on 35 acres of land about three miles south of the village. The springs from which the water is to be taken are located 71 ft. above the level of the village and are capable, according to engineers, of furnishing 218 gallons of water per minute. The plans call for the erection of a pumping station operated by electricity and to store water in tanks for fire protection.

The Rochester & Lake Ontario Water Co. has been granted a franchise by the Town Board of Irondequoit, N. Y., to extend the water mains of its system in the town. The comtemplated improvements will amount to approximately $100,000.

North Dakota.

The Board of Aldermen of Hankinson, N. Dak., is considering the installation of a new water plant similar to the one now in use in Mott, N. Dak.

Canadian Pacific Railway engineers were recently in Portal, N. Dak., looking over the ground and making preparations to commence work in the spring on the new pipe line to the river, which the company contemplates putting in this year.

Ohio.

Mayor Edward P. Speidet of Alliance, O., in his annual message to the City Council, recommends the construction of a water system by utilizing the Mahoning river storage plan. The estimated cost of such a system [illegible]

Oklahoma.

✣Bids will be received until 8 p. m., Jan. 10, by City Clerk, El Reno, Okla., for the sinking of a 3,000-ft. well. Plans and specifications are on file with the City Engineer.

Oregon.

Louis C. Kelsey, Civil and Hydraulic Engineer, Selling building, Portland, Ore., has been employed by the Oregon State Board of Health to make reconnoissances, preliminary surveys and investigations and to prepare a report and estimates on cost and results of constructing a gravity water system from Clear Lake in the Cascade Mountains to the state institutions at Eugene and Salem, and for providing adequate water for cities and towns from Eugene to Salem. This is preliminary to action by the legislature and municipalities toward carrying out a gravity water supply project. If the project is carried out there will be required a main supply line of approximately 60 miles in length besides subsidiary lines of about 5 miles in length, together with distributing reservoirs and pipe distributing systems.

The citizens of Canyon City, Ore., at a recent election voted the issuance of bonds in the sum of $6,000 for the installation of a water system.

Pennsylvania.

✣Bids will be received until Jan. 12, by Commissioners of Water Works, Erie, Pa., for constructing a steel standpipe, 25 ft. in diameter and 80 ft. high, in accordance with plans and specifications of Chester & Fleming, Consulting Engineers, Union Bank building, Pittsburgh, Pa.

The Pennsylvania State Water Supply Commission, Harrisburg, Pa., has approved the application of the Towanda Water Co. for the construction of the proposed power dam in the Susquehanna river in Bradford county.

The Pennsylvania State Water Supply Commission, Harrisburg, has held over the application of the Shohola Hydro-Electric Co. for a water power project in Shohola township, Pike county.

The Hooversville Water Co., Hooversville, Pa., has been granted a franchise by the Pennsylvania State Water Supply Commission, Harrisburg, to install a waterworks system in Somerset county.

According to advices from Wilkes-Barre, Pa., the Spring Brook Water Co. has announced that plans are now being prepared for the erection of the fourth dam of the company. The new dam will be built at Spring Brook corners, near Moosic, and will have a capacity of 3,000,000,000 gallons. The dam is to be 80 ft. high.

The citizens of Greencastle, Ind., at a recent election voted the issuance of bonds in the sum of $10,000 to complete the new reservoir and water works.

South Dakota.

✣Bids will be received until 8 p. m., Jan. 29, by Commissioners of Chamberlain, S. Dak., for the construction of an intake crib, receiving well, pumping plant, including two 40 h. p. oil engines, two 350 gal. triplex pumps with all necessary piping and fittings, approximately 3,000 lin. ft. 10 in. water main fire hydrants and appurtenances. F. K. Berry, Mayor. J. H. Bingham is City Auditor.

Engineer Trimmer of the Missouri Valley Engineering Co., Mitchell, S. Dak., and Commissioner J. H. Stevens of Chamberlain, S. Dak., recently made a trip to several cities of the state to view the water systems which have been installed, including the one at Pierre, with a view to installing a pumping station in Chamberlain. The work includes intake crib, pumping plant, two triplex pumps and about 3,000 lin. ft. of 10-in. supply main. Noted in our Dec. 27 issue.

Tennessee.

✣Bids will be received until 7 p. m., Feb. 1, by Board of Mayor and Aldermen, Johnson, Tenn., for the necessary labor and material for the construction of a gravity water supply embracing approximately 12½ miles of 16-in.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

pipe; one-half mile of 18-in. pipe; 1¼ miles of 10-in. pipe and one 4,000,000 gallon reservoir. Plans may be seen at the office of City Commissioner P. F. McDonald or at the office of the Consulting Engineers, J. B. McCrary Co., Third National Bank building, Atlanta, Ga.

✣Bids will be received until 2 p. m., Jan. 18, by Mayor and Board of Aldermen, Lexington, Tenn., for the construction of deep well for the proposed water works system. A certified check for $250 must be filed with each bid. R. C. Huston, 1634 Exchange Bldg., Memphis, Tenn., is consulting engineer.

The city of Columbia, Tenn., has employed Granbery Jackson of Nashville, Tenn., to examine the plant of the Columbia Water and Light Co., and report on the condition of the system.

An ordinance has been passed by the Board of Aldermen and Mayor of Lexington, Tenn., for the establishment of a waterworks, sewer system and an electric light plant. Bonds to the amount of $50,000 have been sold for the improvements.

Texas.

The city of Cleburne, Tex., contemplates purchasing the water works of that city from the bondholders and improving the same with money from the recent $178,000 bond issue.

The Board of Water Commissioners of Temple, Tex., is considering the policy of gradually causing the installation of water meters. It is proposed to bring the entire business section under metered service.

The Water Commissioners of Waco, Tex., have requested a loan of $80,000 from one of the city's sinking funds, to make contemplated improvements, consisting of water galleries, a standpipe, with a capacity of 400,000 gallons, and extensions of mains. N. Werenskiold of Dallas, Tex., is engineer. Judge William Sleeper is chairman of the Board of Water Commissioners.

Plans and specifications for the proposed Carrollton dam on the Elm Fork have been completed for the city of Dallas, Tex., and bids for its construction will shortly be asked. The estimated cost is placed between $20,000 and $25,000.

Following bids were received Dec. 29 by the Municipal Commissioners of Dallas, Tex., for sinking a well in Fair Park to the Trinity sands: American Well and Prospecting Co., Corsicana, $9; R. J. Harper, Dallas, $9.50; Fauscett & Hall, Corsicana, $8; R. H. Dearing & Sons, Dallas, $9.35; D. C. Richardson, Shreveport, $9.50, and Fred M. Allison, Terrell, $9.

The Board of City Commissioners of Dallas, Tex., W. M. Holland, Mayor, has retained Consulting Engineer James H. Fuertes, 140 Nassau St., New York City, to prepare plans for a water purification or filtration plant and later to prepare plans for a sewage disposal plant. Bonds amounting to about $500,000 will be voted upon for this improvement soon.

Washington.

⊙The Chicago Bridge & Iron Works, Chicago, Ill., has been awarded the contract by Herbert T. Condon, bursar, University of Washington, Seattle, Wash., for the construction of a 100,000 gal. steel tank on the campus. The work includes all material and complete construction. The contract price is $8,950. Bids were opened Dec. 19.

⊙The Board of Public Works of Seattle, Wash., has awarded the contract for castings, fitting and steel work on Refuse Destructor No. 2, to the N. & S. Foundry, Smith's Cove, at $3,994.

⊙The Board of Public Works of Seattle, Wash., has awarded the contract for constructing water mains and sewers on Dearborn St., from Rainier Ave. to Seventh Ave., South, to P. J. McHugh, Third Ave. North and Mercer, Seattle, at $36,088.

The City Council of Seattle, Wash., has ordered the construction of water mains on 15th Ave. S., et al.

Following bids were received recently by the Board of Public Works of Seattle, Wash., for furnishing 20,000 ft. of fire hose: A. G. Long, $13,800; Gutta Percha & R. Mfg. Co., $15,600; H. Channon Co., $19,400; Boston Woven Hose Co., Pacific Coast Fire Supply Co., Mehlhorn building, agents, $13,200; Manhattan Rubber Mfg. Co., $20,000; Republic Rubber Co., $15,600; Bowers Rubber Works, $15,200; American Rubber Co., $13,950; J. L Phillips Co., $13,800; Gorham Revere Rubber Co., not according to specifications; Eureka Fire Hose Co., not according to specifications.

Plans have been approved by the Board of Public Works of Seattle, Wash., for the laying of about 2,928 ft. of 20-in. cast iron water mains, Class A, on Dexter Ave. and Nickerson St., estimated to cost $17,000.

Following bids were received at Ellensburg, Wash., for the installation of a waterworks system in that city: International Contract Co., Seattle, $122,280; Sausett & O'Toole Bros., $135,180; Hillard & McGinnes, $134,767; Atlas Const. Co., $129,985; Jones Contracting Co., $137,280; Stillwell Bros., $139,167; J. D. Huli, $140,978.

Wisconsin.

✣Bids will be received until noon, Feb. 27, by Committee on Fire and Water, Common Council, Cumberland, Wis., for furnishing the necessary labor and material for the laying of a 4-in. water main in the said city. A. F. Wright is city clerk.

⊙The W. L. Thorne Co., of Platteville, Wis., has been awarded the contract to drill a new well at South Wayne, Wis., for the city water supply.

Consulting Engineer A. T. Maltby, 20 W. Jackson Blvd., Chicago, Ill., has submitted plans and specifications for the new well system for the city of La Crosse, Wis., to the Special Water Committee.

In making up the budget for the city of Milwaukee, Wis., for 1912, provision was made for a bond issue of $265,000 for the proposed Menomonee river flushing tunnel, as recommended by the Menomonee Sewage Commission, to flush out the impurities in the river. An issue of $300,000 was included for the proposed new intake for the water department, which, it is estimated, will take care of Milwaukee's water supply for fifty years to come.

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

✣Bids will be received until 11 a. m., Jan. 18 (extension of date from Jan. 4), by City Council, Union Springs, Ala., for the construction of a sanitary sewerage system and disposal plant including approximately 11 miles of 6 to 15-in. pipe sewers with appurtenances. W. Hill, Attallia, Ala., is Engineer.

Connecticut.

The City Council of Meriden, Conn., contemplates constructing sewers in Kensington Ave., and Kensington Heights at an approximate cost of $7,500. F. B. Flynn is Supt. of Sewers.

Florida.

On Dec. 30 the citizens of Lakeland, Fla., voted to bond the city in the sum of $150,000 for the purpose of building sewers, $75,000; pavements, $60,000, and buildings, $15,000. City Civil Engineer C. F. Brush, Lakeland, has finished preliminary estimates of the sewers and pavements. Vitrified pipe will be used for the sewer construction and as the city is hilly it will be necessary to install one pumping plant. The street will not be paved until after the sewers are down, when it is proposed to pave with asphalt macadam, brick gutters and concrete curb.

Illinois.

Plans and specifications are being prepared by the Aetna Engineering Bureau, 17 N. La Salle, St., Chicago, Ill., for the installation of a sewerage system in Odell, Ill. The contract for the work will be let some time in April.

Plans are being prepared by the Aetna Engineering Bureau, 17 N. La Salle St., Chicago, Ill., for the construction of a sewer system in the city of Rochelle, Ill., a distance of two miles, at an estimated cost of $90,000. Bids will be asked about March 1.

The City Council and citizens of Rushville, Ill., on Jan. 4 held a mass meeting for the purpose of discussing the proposed sewerage system for which plans and specifications were prepared some time ago by Engineer A. E. Phillips of Chicago.

The City Council of Madison, Ill., has authorized the purchase of a tract of land near the river front in Venice, on which they propose to locate a pump station for an extensive sewer system. The system, according to plans prepared some time ago, will cost approximately $65,000.

Indiana.

The Board of Public Works of South Bend, Ind., has adopted a preliminary resolution for the construction of the large Bowman Creek sewer, to be built through the southeast section of the city.

Iowa.

✣Bids will be received until 9 a. m., Jan. 29, by City Council, Fort Dodge, Ia., for furnishing the necessary labor and material for the construction of a sanitary sewer beginning at the Des Moines River at the end of M st., extended thence west to center of Ave. A, West Fort Dodge to be 8 in. sewer pipe, thence west along M St. to the east line of Ave. B, to be 6-in. pipe with one manhole, one lamphole, and one flush tank. W. L. Tang is City Clerk.

⊙The City Council of Creston, Ia., has awarded the contract for three blocks of 12-in. sewer to the Rogers-Wood Co., of Council Bluffs, Ia., at $0.60 per lin. ft. The average depth of the three sewers will be about 10 ft.

The City Council of Sioux City, Ia., has passed a resolution providing for the placing of a five-mile sanitary sewer in the suburb of Leeds. It is proposed to have everything in readiness to start work in the spring.

Kansas.

The City Commissioners of Girard, Kans., have passed an ordinance providing for the installation of a new sewer system in the city. Bids will soon be asked for the construction of the system. E. M. Mason is City Attorney.

The City Council of Mulvane, Kans., has decided to install a sewerage system at an estimated cost of $10,000. Bids for its construction will be received at once.

Kentucky.

P. L. Atherton of the Commmission of Sewers, Louisville, Ky., is agitating a $2,000,000 bond issue to complete the sewerage system, for which $4,000,000 has already been expended. It is probable the General Assembly will pass an enabling act providing for the issue.

The Board of Public Works of Louisville, Ky., is engaged in planning work for the year. A large amount of sewer work is mapped out for the East and West Ends. Laterals will be extended from the new M. St. main.

Maryland.

A movement is on foot in Salisbury, Md., to introduce a bill at the coming session of the Legislature authorizing a bond issue for the

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

continuation of street imp[illegible] installation of a sewerage system.

Following bids were received by the Board of Awards of Baltimore, Md., on Sanitary Contracts Nos. 78, 81 and 82, [illegible]ter Contracts Nos. 17 and 18, which cover work as follows: Sanitary Contract No. 78, lateral sewers in District 20-A. Sanitary Contract No. 81, section No. 5 of high level interceptor. Sanitary Contract No. 82, house connections across footways in districts 25, 27, 28, 34-A and 35. Storm Water Contract No. 17, Jones Falls drift-catcher. Storm Water Contract No. 18, Storm-water drains. Sanitary Contract No. 78—Wm. McCarthy & Co., 3 Oliver St., Baltimore, $121,452; B. F. Sweeten & Son, Baltimore, Md., $135,226; David M. Andrew Co., Baltimore, Md., $143,463. Sanitary Contract No. 81—McDermott Construction Co., 101 N. St. N. E., Washington, $183,156, 175 days; Ryan & Reilly, Baltimore, Md., $188,599, 250 days; Frank B. Sweeten, Baltimore, Md., $193,926, 175 days; C. B. Clark & Co., 1808 Greenmount Ave., City, $204,786, 300 days; Jas. Ferry & Sons, Inc., Pittsburgh, Pa., $237,978, 190 days. Sanitary Contract No. 82—Wm. McCarthy & Co., Baltimore, Md., $45,381; Martin J. Beach, Baltimore, Md., $49,871; B. F. Sweeten & Son, Baltimore, Md., $54,505. Storm-water Contract No. 17—N. A. Middleton & Co., Baltimore, Md., $5,189, 25 days; Joseph A. Lavezza, Baltimore, Md., $4,651, 150 days; B. F. Sweeten & Co., Baltimore, Md., $7,085, 90 days. Storm-water Contract No. 18—Wm. McCarthy & Co., Baltimore, Md., $111,894; Ryan & Reilly, Baltimore, Md., $120,093; James Ferry & Sons, Pittsburgh, Pa., $124,207; The Whiting, Turner Construction Co., Baltimore, Md., $139,239; B. F. Sweeten & Son, Baltimore, Md., $153,143.

Massachusetts.

Surveys are being made and a committee is considering a sewerage system for the city of Ipswich, Mass., other than to turn the sewage into the river.

Extensions will be made to the sewerage system of Northampton, Mass., during this year in King, Barrett and Hinckley Sts., with a probable extension of the sewer parallel with Bridge St.

Mayor Edward H. Lathrop of Springfield, Mass., has recommended to the City Council the installation of a plant for the disposal of garbage and other combustible rubbish.

Following bids were recently received at Fall River, Mass., for the collection and disposal of garbage for terms of one, three and five years: Charles F. Menard, three years, $11,780 per annum; five years, $11,780 per annum; one year, $12,000 per annum. Benjamin W. Brown, one year, $9,000; three years, $26,400, or $8,800 per annum; five year, $42,400, or $8,480 per annum. Horbidas Boudreau, three years, $30,473, or $10,158 per annum; five years, $50,968, or $10,194 per annum. James McNamara, one year, $8,995. James Brazeil, three years, $31,422, or $10,474 per annum; five years, $54,990, or $10,998 per annum. W. C. Gardner, one year, $9,000; three years, $25,800, or $8,600 per annum; five years, $39,000, or $7,800 per annum. A. M. Reed, one year, $9,500; three years, $26,400; five years, $43,800. A. H. Barney, Seekonk, one year, $8,400; three years, $24,900, or $8,300 per annum; five years, $45,000, or $9,000 per annum.

Michigan.

The City Council of Grand Rapids, Mich., has accepted the report of City Engineer L. D. Cutcheon relative to the proposed construction of an intercepting sewer in Lock St., and the alley west of Canal St. The estimated cost is placed at $9,560.

Mississippi.

A majority of the taxpayers of Macon, Miss., have petitioned the Board of Aldermen to float a bond issue of $25,000 for the purpose of installing a sewerage system.

Missouri.

✣Bids will be received until noon, Jan. 12, by the Board of Public Improvements, St. Louis, Mo., for the construction of sewers in [illegible] inside diameter [illegible] 210 ft. of 24-in. [illegible]

[illegible] sewer division, Kansas City, Mo., has prepared plans for the third section of Brush Creek sewer, west from Main St., to 51st and Holly, and has submitted the same to the Board of Public Works for approval. The estimated cost of this section is $30,000. Bids for its construction will shortly be asked.

Nebraska.

City Engineer Geo. W. Craig, of Omaha, Neb., has submitted to the City Council recommendations for new sewers costing about $200,000, as follows: Storm sewer to and across the east bottoms, $125,000; Miller Park sewer, $67,500; Saddle Creek sewer extension, Harney to California Sts., $62,500; Burt St., sewer extension, $9,000; branch of South Omaha sewer, $7,000; relief sewer for 32d Ave. and Ed. Creighton Ave., $2,500. These sewers are proposed for this spring's campaign.

New Hampshire.

Mayor William H. Barry of Nashua, N. H., has recommended to the City Council the construction of an extensive sewer system. It is planned to bond the city for this improvement.

New York.

⊙The Board of Estimates and Apportionment of Syracuse, N. Y., has awarded the contract for the construction of a sewer in Emerson Ave., to Blanche Gaffey of that city for $3,113. Other contracts were awarded as follows: Sewer in Willis Ave. and Hamilton St., Blanche Gaffey, $916; sewer in Kenmore Ave., Alexander Barr, $1,615, and a sewer in Loehr Ave., Philip Thomas, $599.

⊙Chas. J. McAleer, 1307 Lafayette St., Schenectady, N. Y., has been awarded the contract by the City Council of Johnstown, N. Y., for the construction of a 30-in. trunk sewer with all lateral connections in or along the Cayadutta Creek from the end of the 1911 construction north of the Main St. Stone arch southerly to a point 700 ft. south of Montgomery St., a distance of about 2,904 ft. Estimated quantities: 1,443 lin. ft. 30-in. iron pipe sewer; 70 lin. ft. 20-in. iron pipe sewer; 75 lin. ft. 12-in. iron pipe sewer; 1,461 lin. ft. 30-in. vitrified tile sewer; 340 lin. ft. 20-in. vitrified tile sewer; 70 lin. ft. 15-in. vitrified tile sewer; 150 lin. ft. 10-in. vitrified tile sewer; 216 lin. ft. in 18 brick manholes; 2,350 cu. yds. slate rock excavation. Bids were opened Dec. 11.

⊙Whitmore, Rauber & Vicinus of Rochester, N. Y., it is reported, have been awarded the contract by the City Council of Gates, N. Y., for the construction of a sewer in Otis St., for $42,928.

The citizens of Oswego, N. Y., at a special election on Dec. 29 voted against the issuance of bonds to an amount not exceeding $190,000 for the construction of trunk sewers, one on the east side of the river. Mayor David D. Long has recommended to the City Council that the proposition again be taken up at an early date.

The Newtown Local Board has passed resolutions asking that Queens Borough, New York City, construct the following sewers: Ridgewood—Putnam Ave., from Seneca to Forest, cost $7,270; McKinley Ave., from Central to Myrtle, cost $1,445; Amory Ave., from Metropolitan to Bleeker St. Long Island City—Hamilton St., from Harris Ave. to South Jane St., cost $6,433.

Following low bids have been received by the President of the Borough of Queens, New York City, on the construction of six sewers, as follows: Sewer in Van Alst Ave., Long Island City, from Ditmars to Hoyt, Clancy & Van Alst, $8,206.06. In Woodward Ave., Ridgewood, from Troutman St. to Stanhope, and in Starr St., from Woodward Ave. to Onderdonk, Charles Meyers, $6,667. In Troutman St., from the Brooklyn Borough line to Metropolitan Ave., and in Metropolitan Ave., from Troutman St. to Starr St., Ridgewood, Charles Meyers, $22,147. In Flushing Ave., from Metropolitan Ave. to Caspian St., Maspeth, Evergreen Construction Co., $12,754. In Howland St., from Hoyt Ave. to Woolsey Ave., Long Island City, Peace Brothers, $2,718. Gabriel Hill was awarded three contracts to construct sewer basins in Long Island City, on Webster Ave., Hancock, Marion and Sunswick St., and Boulevard, Van Alst, Ely, Graham, Fourth, Fifth, Seventh and Fifteenth Ave., Long Island City. The total of his bids [illegible]

Ohio.

✣Bids will be received until noon, Jan. 24, by Village Council, at the office of Harry Jenkins, Village Clerk, Sebring, O., for the construction of sanitary sewers in that place.

⊙Hecker & Kirschner have been awarded the contract by the Department of Public Service of Dayton, O., for the construction of storm water sewers on Forest Ave., from Grand Ave. to Kenwood Ave., at $4,713. Other bidders were Joseph Bailey, Boyd & Cook, Larkin Bros., T. J. Backus Construction Co., and Shafer & Dill.

⊙Hounker & Williams have been awarded the contract by the Board of Control of Springfield, O., for the construction of the Belmont Ave. storm sewer for $10,451. The sewer will be constructed from Main St. and Belmont to Edwards Ave., and then in Edwards Ave. to Henry St., thence to Lagonda Ave., along Henry St. Work will begin early this year.

City Auditor H. A. Grimmer of Hamilton, O., will sell bonds Jan. 23 in the sum of $2,500 for the construction of storm sewers.

The Ohio State Board of Health has denied the request of the city of Sandusky, O., for a sewer in Mills Creek district, for the alteration of the filtration plant. The Board has called attention to the necessity of a comprehensive study of the water supply by an expert sanitary engineer, with a view to securing the supply beyond the influence of the sewage of the city.

The City Council of Pleasant Ridge, O., has sold bonds to the amount of $85,000 for sewer improvements to Seasongood & Mayer.

Oregon.

City Engineer Tom Hurlburt of Portland, Ore., has completed plans for the proposed intercepting sewer to drain the west side from South Portland to the foot of Nicolai St. It is planned to lay this sewer almost paralleling the river. It will taper from 4 to 11 ft. in diameter, the largest diameter being at the mouth

Tennessee.

The Board of Mayor and Aldermen of Lexington, Tenn., has passed an ordinance providing for the establishment of an electric light plant and the installation of a waterworks system and sewerage system. Bonds in the sum of $50,000 have been sold for the improvements.

Texas.

⊙The City Commissioners of Waco, Tex., have awarded the contract for making extensions to the sanitary sewer system to H. C. Gass of Independence, Kans. The improvement will cost approximately $25,000. Bids will shortly be asked for the extension of the storm water sewer system to the extent of [illegible]

Washington.

⊙The Board of Public Works of Seattle, Wash., has awarded the contract for constructing sewers and water mains on Dearborn St., from Rainier Ave. to Seventh Ave., South, to P. J. McHugh, Third Ave., North, Seattle, for $36,088.

The City Council of Seattle, Wash., has ordered work to proceed on the construction of the West 61st et al. sewers, and has passed an ordinance providing for the construction of sewers in the east side [illegible] Ave. South.

A petition has been signed by property owners of Pomeroy, Wash., asking for sewer improvements in the portion of town west of the county road. The petition asks for the construction of the sewer according to plans prepared by the City Engineer.

Following bids were received recently by the Board of Public Works of Seattle, Wash., for the construction of sewers on North 78th St.: J. Ruthe, $15,405; Johnson & Co., 4272 Whitman Ave., $13,030; Becker & Walk [illegible] $17,[illegible]; Krogh & Jessen, $14,137; Dastrom & Rodal, $14,718; Young & Uhrich, $14,457; Erickson Bros., $15,646; Hayden & Sons, $13,552; Ward & Scherer, $15,180; Will Koptee, $16,206; R. J. Barter, $15,746.

Canada.

⊙Hotson, Leader & Goode of Lethbridge, Alta., have been awarded the contract by that city for the installation of a sewage disposal works for which plans and specifications were prepared by Consulting Engineer T. Aird Murray, Toronto, Ont. Bids were opened Dec. 27.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

✣Bids will be received until 11 a. m., Jan. 22, by Maj. C. A. F. Flagler, U. S. Engineer, Mobile, Ala., for the construction of the 80-ft. twin-screw motor survey boat Dauphin.

California.

The City Council of Santa Cruz, Cal., has granted a franchise to the Santa Cruz Portland Cement Co. of Santa Cruz, for a wharf to be built from the foot of Pacific Ave. and to extend 3,000 ft. into the bay.

It is proposed to erect a 12-story commercial building at Broadway and 13th St., Oakland, at a cost of about $400,000. A. Jonas, 11th St. and Broadway, Oakland, is the owner; C. W. Dickey is the Architect.

The City Council of Los Angeles has passed the ordinance of intention to construct the proposed Hill St. tunnel between First and Temple Sts. The proposed tunnel will parallel the tunnel of the Los Angeles Pacific Co. and be built on the assessment district plan, the property owners in the assessment district paying their proportion and the city its proportion of the cost. The tunnel will cost $133,000 and will be 31 ft. 10 ins. wide with portal walls, artificial stone railings, copings, foot walks, curb, wheel fender, paving and a drainage system. It will be built for use of vehicles and pedestrians.

Connecticut.

✣Bids will be received until 11 a. m., Jan. 24, by Board of Contract & Supply, Joseph Buths, Secy., at the office of the Mayor, Hartford, Conn., for the construction of a proposed municipal building at Hartford, Conn. Plans and specifications are on file with Davis & Brooks, Architects, 49 Pearl St., Hartford, Conn.

Delaware.

✣Bids will be received until 11 a. m., Jan. 26, by Maj. A. A. Raymond, U. S. Engineer, Wilmington, Del., for dredging in Salem River, N. J.

District of Columbia.

✣Bids will be received until 10:30 a. m., Jan. 25, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing, under Canal Circular 669, automatic signal material for relocation of the Panama Railroad.

✣Bids will be received until noon, Feb. 20, by Beekman Winthrop, Assistant Secretary of the Navy Department, Washington, D. C., for constructing by contract one submarine tender.

✣Bids will be received until 11 a. m., Jan. 27, by R. C. Hollyday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for two electrically driven capstans for the navy yard at Norfolk, Va.

✣Bids will be received until 10:30 a. m., Jan. 24, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for cast iron car wheels, copper wire, hose and long leaf yellow pine car lumber.

✣Bids will be received until Jan. 15 by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing in accordance with Circular 671-A, plow steel cable, pipe fittings, gate valves, washers, galvanized buckets, screen door catches, flat paint brushes, railway signal flags, neatsfoot oil and orange gum shellac.

Illinois.

✣Bids will be received until 2 p. m., Feb. 2, by Lt. Col. G. E. Burr, Commanding Officer, Rock Island Arsenal, Rock Island, Ill., for the erection of a structural steel lumber shed at Rock Island Arsenal. Specifications, plans, etc., may be had upon application.

The following estimates of the manner in which the $5,000,000 harbor bonds of the city of Chicago is to be expended has been submitted to the City Council: Two piers, 2,500 ft. long, including concrete capped docks, with filling foundations, roadways, etc., $1,600,000; buildings, fireproof, $1,500,000, filling and dredging, $400,000; transportation facilities, machinery, etc., $700,000; condemnations, $300,000; engineering, inspection, etc., $500,000.

Indiana.

✣Bids will be received until 3 p. m., Feb. 7, by James Knox Taylor, Supervising Architect, Treasury Department, Wasington, D. C., for the construction of a one-story and basement brick and stone faced building, covering approximately 5,000 sq. ft ground area, first floor of fireproof construction, tin roof, including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures for the U. S. Postoffice at Goshen, Ind.

✣Bids will be received until 11 a. m., Feb. 5, by Quartermaster, Fort Benjamin Harrison, Ind., for furnishing the necessary labor and material for the construction of a storage shed at that post.

Iowa.

✣Bids will be received until 3 p. m., Jan. 24, by James Knox Taylor, Supervising Architect, Treasury Department, Wasington, D. C., for an electric passenger elevator in the United States Postoffice and courthouse, Ottumwa, Ia.

Louisiana.

✣Bids will be received until 11 a. m., Jan. 24, by Lt. Col. Lansing H. Beach, U. S. Engineer, 325 Custom House, New Orleans, La., for the construction of lock gates in Inland Waterway between Vermilion Bay and White Lake.

✣Bids will be received until noon, Jan. 22, by E. S. Lewis, M. D., Vice-President of the Board of Administrators of Charity Hospital, at the office of L. P. Dalahoussaye, Treasurer, New Orleans, La., for the construction of alterations and extension of brick building at the Charity Hospital of Louisiana.

✣Bids will be received until 11 a. m., Jan. 24, by Lieut. Col. Lonsing H. Beach, U. S. Engineer, 325 Custom House, New Orleans, La., for the construction of lock gates in inland water way between Vermilion Bay and White Lake.

James Gamble Rogers, New York City, has been selected as the architect for the new college buildings of Newcomb College, New Orleans. The present plan of the building committee is to erect four buildings for Newcomb, on the Newcomb campus, adjacent to Tulane University. It is proposed to spend about $500,000 in the immediate future. Of the four buildings to be erected one will be the college building proper, and one will be a students' residence.

Maryland.

⊙Bartlett, Hayward & Co., Baltimore, Md., have been awarded the contract by the Consolidated Gas, Electric Light & Power Co., of Baltimore, for the erection of a 6,000,000 cu. ft. capacity gasholder. The structure will be 222 ft. high and 219 ft. in diameter and will cost about $300,000.

The Sanford & Brooks Co., Baltimore, Md., at 10.9 cts. per cu. yd. was low bidder for dredging about 75,000 cu. yds. from the upper harbor and Jones Falls for the city of Baltimore.

Massachusetts.

The city council of Springfield, Mass., has passed an order providing for a petition to the Legislature for the passage of an act which will permit the city to bond itself outside the statutory debt limit to the extent of $800,000 for completing and furnishing the municipal group and for purchasing land or other property as may later seem necessary.

The Boston Dock Board has under consideration the following petitions: Lockwood Manufacturing Co., Boston, for authority to erect a bulkhead and fill in East Boston near the North Ferry; the Rhines Lumber Co., for authority to extend its pile wharf in Weymouth Fore River; of the city of Quincy, for authority to build a pile pier, float and runway at Hough's Neck, for beautification of the harbor; of George T. Bendle, for a wharf in Chelsea Creek; of the Standard Oil Co., for authority to fill in Chelsea Creek, and of Richard T. Green for a marine railway in Chelsea Creek.

Bids as follows were received Dec. 28 by the Supervising Architect, Treasury Department, Washington, D. C., for the construction of the superstructure of the extension of the custom house at Boston: Norcross Bros., Washington, D. C., $1,393,000, two years to complete; George H. Fuller Co., New York, $1,464,200, 20 months to complete; Woodbury & Leighton, Boston, $1,535,000, two years to complete; Connors Bros., Lowell, $1,665,000, 30 months to complete. The foundation work has already been completed.

New Jersey.

✣Bids will be received until 8 p. m., Jan. 16, by Board of Education, Union, N. J., for the erection of a new school building on a plot of ground on the easterly side of Hudson Ave., between Lewis St. and Gardner St., in the Town of Union, in the County of Hudson, N. J., according to drawings, plans and specifications for said building prepared by Joseph D. Lugosch and P. W. Roos, associate architects.

✣Bids will be received until 8 p. m., Jan. 11, by Committee on High School, Board of Education of Jersey City, N. J., for supplying various items of furniture and equipment to the New Technical and Industrial High School, Newark and Palisade Aves., in accordance with Section 2 of the plans and specifications on file in the office of the Secretary of the Board. Copies of plans and specifications and blank forms of bid must be obtained at the office of the Supervising Architect, Mr. John T. Rowland, Jr., 15 Exchange Place, Jersey City. G. Fred Ege is Secretary of the Board.

✣Bids will be received until 1 p. m., Jan. 12, by Commanding Officer, Picatinny Arsenal,

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Dover, N. J., for furnishing and delivering at Picatinny Arsenal the following sheet zinc. Sheet must be cut to exact size and corners must be true right angles: 2,000 sheets 24.5x 50.75 ins., .024 in. thick, about 15,528 pounds; 2,000 pounds, 9.75x16.5 ins., .024 in. thick, about 2,012 pounds, and 137 sheets 3 ft. by 7 ins., .014 in. thick, about 1,496 pounds

New York.

✣Bids will be received until 10 a. m., Feb. 7, by Georgiana Griffith, President, Board of Trustees Woman's Relief Corps Home, Oxford, N. Y., for hydraulic elevator in hospital building, including construction, plumbing and elevator work. Allan C. Bakewell is Secretary.

✣Bids will be received until 11 a. m., Feb 15, by Lt. Col. J. G. Warren, U. S. Engineer, 540 Federal Bldg., Buffalo, N. Y., for removing steel sheet pile cofferdam, Black Rock Shiplock, Buffalo, N. Y.

Plans have been completed for the new plant to be erected in the Flatbush section of Brooklyn for the Brooklyn Baseball Club of the National League. The plant will cost $750,000 and will have a capacity of 30,000 people. Charles H. Ebbetts, Brooklyn, N. Y., is the owner.

Ohio.

✣Bids will be received until noon, Jan. 11, by Director of Public Safety, Cincinnati, O., for performing labor and furnishing material for the erection of sleeping porch addition to Ward building No. 1, of the Branch Hospital according to plans and specifications adopted and on file at the office of Harry Hake and Charles Kuck, Architects, Provident Bank building, Cincinnati, O. E. P. Durr is Secretary of the department.

✣Bids will be received until noon, Jan. 25, by Board of Directors of Longview Hospital, at the office of Elzner & Anderson, 136 Ingalls building, Carthage, O., for furnishing the necessary labor and material for the completion of the new Amusement Hall on the grounds of the hospital at Carthage. Bidders shall submit bids in lump, including the following items of construction, viz.: Excavation, masonry and cut stone, concreting (embracing re-enforced concrete work and cementing), brick work and terra cotta, carpenter work, roofing and sheet metal work, plastering, iron work, painting, glazing, plumbing and gasfitting, tiling and marble work, electric work.

Resolution is to be introduced in the city council of Cleveland by Councilman E. B. Haserodt, calling upon Fred Alber, superintendent of parks, to prepare a report showing the estimated cost of a recreation pier at some point between Gordon and Edgewater parks and recommending a site.

Oklahoma.

Citizens of Guthrie have voted to sell $100,000 of park improvement bonds.

Oregon.

The following bids were received Dec. 27 by the County Court at Portland for building a ferry system to operate between St. Johns and Claremont: Hull and cabin—St. Johns Shipbuilding Co., $17,375; Portland Shipbuilding Co., $13,350. Boiler—Portland Boiler Works, $4,150; Standard Boiler Works, $4,455. Machinery and equipment—St. Johns Iron Works, $8,650; Albina Engine & Machine Works, $8,153; Phoenix Iron Co., $9,500; Portland Iron Works, $7,900; Western Foundry & Machine Works, $5,955; Nelson & Unden Co., $8,165.

Claussen & Claussen, Architects, Portland, Ore., have plans under way for a 17-story reinforced concrete building to be erected at 1st Ave. and Pine St., Portland, for W. P. Keady.

Pennsylvania.

✣Bids will be received until 11 a. m., Jan. 16, by Assistant Quartermaster, U. S. Marine Corps, Depot of Supplies, Philadelphia, Pa., for furnishing 2 prismatic compasses, clinometer, No. 5,400, with cases 5,405S; 2 Abney levels, No. 5,710, with cases; 2 pace tallies, No. 7,854; 2 pedometers, No. 6,900; 2 field sketching cases, No. 5,212; 12 rolls sketching paper, suitable for use with the sketching cases; 1 celluloid protractor, No. 1,868A; 1 ivory scale, No. 1,320; 1 aneroid barometer, No. 5,855; 1 pocket case drawing instruments, No. 624P; 1 standard thermometer, No. 5,932; 24 thumb [illegible] No. 2,502; 1 T square, 24 ins., No. 2,360; 1 triangle scale, No. 1,620P; 10 crow quill pens, No. 3,206; 12 black pencils, No. 3,380B; 12 [illegible] each, red, green and blue; 2 bottles black drawing ink, Higgin's or equal, ¾ ounce bottles; 3 bottle drawing ink, red, blue and green, Higgin's or equal, ¾ ounce bottles; 1 sandpaper block, No. 3,500; 2 No. 3,455R, 12 to pound; 1 roll Imperial tracing cloth, 30 ins., No. 156 (24 yds.); 2 rolls drawing paper, 10-yd. rolls, 30 ins. wide, duplex; 1 xylonite triangle, 45 degrees, and 1 do. 30 and 60 degrees.

⊙The contract for placing approximately 1,500 Raymond concrete piles for the foundations of the Webb Terminal Warehouse Building to be erected at Walnut St. and Delaware Ave., Philadelphia, has been awarded to the Raymond Concrete Pile Co. of New York and Chicago. Irwin & Leighton, general contractors.

Texas.

✣Bids will be received until 3 p. m., Feb. 15, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures of a one-story and basement nonfireproof building of approximately 4,235 sq. ft. ground area, brick faced with stone trim for the U. S. Postoffice at Bonham, Tex.

✣Bids will be received until noon, Jan. 15, by School Board, Beaumont, Tex., for the erection and completion of a two-story and basement brick and concrete school building at Beaumont. H. C. Mauer, 1 and 2 Gordon building, Beaumont, Tex., is Architect.

✣Bids will be received until noon, Feb. 5, by Dan C. Smith, City Secretary, Houston, Texas, for the construction of the new Rusk public school building. Cooke & Co., 507 Theater Bldg., Houston, Texas, are architects.

The city of Beaumont, Texas, has voted to issue $50,000 of park bonds.

Washington.

✣Bids will be received until noon, Jan. 19, by Saunders & Lawton, Alaska Bldg., Seattle, Wash., architects, for furnishing and installing pressed brick, terra cotta, steel and iron work, reinforcing steel, sheet metal work and mill work in the Washington State Reformatory, Monroe, Wash. Plans and specifications may be had of the above or C. B. Roe, superintendent, at Monroe.

The King County Commissioners, Seattle, have appointed Lee Monohan, J. C. Marlow and Thomas Dobson as commissioners of the Renton Waterway district, to have charge of expending $50,000 at once in the dredging and straightening the Cedar River at Renton. The money will be expended under the supervision of the county officers, who state that work will proceed at once.

Wisconsin.

E. J. Basherville and J. W. Groves, of Madison, Wis., have secured an option on about 270 acres of land near Pleasant Branch. They propose to dredge the stream to Lake Mendota to make a channel for launches and to plat the land on both sides of it.

Porto Rico.

✣Bids will be received until 11 a. m., Feb. 27, by Simon Moret, Alcalde, Ponce, P. R., for the construction of 160 lin. ft. of concrete bulkhead and a pier 427 ft. long and 110 ft. wide, with a concrete and timber pile substructure, steel frame, reinforced concrete deck and steel framed shed, at Ponce, P. R. Bids must be made out upon the printed forms, accompanied by the plans and specifications, which may be obtained from the Bureau of Insular Affairs, Washington, D. C., the Commissioner of the Interior, San Juan, P. R., or the Alcalde of Ponce, Ponce, P. R., upon the deposit of $20.

Canada.

•R. J. Lecky, Regina, Sask., has been awarded a contract at about $122,000 for constructing a church at Saskatoon, Sask., for the Knox Presbyterian Society. The building will be of pressed brick, with Bedford stone trimmings, and will have a seating capacity of 1,110.

It is believed that the present government will carry out the plans for the development of Courtney Bay, the site of the National Transcontinental terminal at St. John's, N. B. Bids on this work were taken under the former administration, the Norton-Griffiths Co., London, England, at $7,700,000 being the low bidder. It is now probable that the work will be awarded to that company and work started in the spring. The contract will provide for the construction of a breakwater across the entrance of the bay to protect it from the heavy seas which prevail whenever there is a wind from the south; for the dredging of an entrance to the basin and the basin itself; for the construction of wharves and warehouses, and a drydock large enough to accommodate the biggest ocean-going vessels.

R. P. Reichet & Co., Victoria, B. C., have plans under way for the enlargement of their present dock at Victoria and the erection of a new one of larger size.

Mexico.

Diego Fernandez, City of Mexico, has applied to the Department of Communications for a concession to construct an oil pipe line in the states of Tamaulipas and Veracruz. A former application was defeated during the last session of Congress. According to the previous application, the line was to cost $8,000,000. It was supposed that Fernandez was backed by an American company, possibly the Standard Oil.

PROPOSALS

PAVING.

[illegible] Board of Public Works of Boise City, [illegible] concrete, bitulithic, Westermite asphalt, dolarway, hassamite, plain concrete, concrete with cement top, granocrete, hassam or brick pavement (with brick along street car tracks) in all streets and parts [illegible] purtenances as provided for by ordinance [illegible] will be received up to 2 p. m., February 2nd, 1912, and immediately opened publicly by the Board of Public Works in the City Hall of said city.

Said pavement to be laid and constructed according to plans and specifications which may be seen at the office of the city engineer.

Each bid must be in accordance with the form of proposal furnished by the Board of Public Works, and accompanied by a certified check on some local bank, payable to Boise City, for the sum of two thousand ($2,000) dollars, to be forfeited if the successful bidder fails to enter into a contract and furnish a good [illegible] equal to twenty-five (25%) per cent of the total amount of his bid for the faithful performance of each and every covenant in the contract.

The right is reserved to reject any and all bids, or to let the work as a whole or in parts, or for one or more kinds of the above pavements, as may appear to the best interests of the city.

By order of the Board of Public Works of Boise City, Idaho, this third day of January, 1912. KARL PAINE,
President.

✣ indicates work now open for bids. • indicates a contract let recently.

PROPOSALS

SEWERS.

Sealed proposals will be received at the office of the City Auditor of the City of Mitchell, South Dakota, up till 8 o'clock p. m., on the 5th day of February, 1912, for the construction of lateral sewers including labor and material, in said City of Mitchell as follows:

Branch "R," Mitchell Sewer District No. 3, approximately [illegible] feet 8-inch pipe, 4 manholes.

Branch "S," Mitchell Sewer District No. 3, approximately 1,065 feet 8-inch pipe, 3 manholes.

Branch "T," Mitchell Sewer District No. 3, approximately 1,690 feet 8-inch pipe, 4 manholes.

All complete and connected with existing sewers.

All work to be done in accordance with plans and specifications on file in the office of the City Engineer.

All bids must be accompanied by a certified check upon some solvent bank in the city of Mitchell, or a draft made payable to the treasurer of said city, in the sum of five per cent of the amount of bid to insure the signing of the contract and furnishing of proper and acceptable bond in the amount of forty per cent of contract price, within eight days from time of notification of the award of said contract.

The city reserves the right to reject any or all bids.

By order of the city council. Dated at Mitchell this 6th day of January, 1912.

N. H. JENSEN,
City Auditor.

SEWERS.

Notice is hereby given to contractors that the Board of Trustees of the Town of Williamsport, Warren County, Indiana, will on the 15th day of January, 1912, at the hour of 8 o'clock p. m., at the office of the Town Clerk in said town, let contracts for the building of sewers in said town. The work to be let is as follows:

3,845 cubic yards of excavation.
1,579 lineal feet of 4-in. sewer pipe, house connections.
4,914 lineal feet of 8-in. sewer pipe.
60 lineal feet of 10-in. sewer pipe.
500 lineal feet of 12-in. sewer pipe.
200 lineal feet of 18-in. sewer pipe.
40 lineal feet of 24-in. sewer pipe.
7 manholes.
8 lamp holes.
8 catch basins.

Plans and specifications for said work may be seen at the office of the Town Clerk of said town.

RUFUS HAUPT,
President of Board of Trustees.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE.—Washington, D. C., December 13, 1911. Sealed proposals will be received at the office of the United States Reclamation Service, Montrose, Colo., until 4 o'clock p. m., January 23, 1912, for the construction of 12 miles of the West Canal, Uncompahgre Valley Project, in the vicinity of Montrose, Colo. This work involves the excavation of about 210,000 cu. yds. of material in open cut, and 1,750 lin. ft. of tunnel. For particulars address the United States Reclamation Service, Montrose, Colo., 519 Commonwealth Bldg., Denver, Colo., or Washington, D. C. F. H. NEWELL, Director.

U. S. ENGINEER OFFICE, Seattle, Wash., Jan. [illegible], 1912. Sealed proposals for dredging and excavating in Lake Washington Canal right of way will be received at this office until 12 M., February 15, 1912, and then publicly opened. Information on application. J. B. Cavanaugh, Maj. Engrs., Agent for the State of Washington and King County, Wash.

New and Standard Books

Send for Complete Catalog of the Following Books:

Handbook of Cost Data. SECOND EDITION.
By Halbert P. Gillette, M. Am. Soc. C. E., Managing Editor of "Engineering-Contracting." The 1910 edition of this book contains nearly 1,900 pages. Postpaid, $5.00.

Diagrams for Designing Reinforced Concrete Structures.
Including Diagrams for Reactions and Strengths of Steel Beams, by G. F. Dodge, M. West. Soc. Engrs. 13 × 15½ inches; 104 pages. Postpaid, $4.00.

Cost of Electric Transmission Lines.
(Both Conduits and Pole Lines.)
The title of this book, by Clarence Mayer, is "Telephone Construction-Methods and Cost," which is somewhat a misnomer in that it does not connote its wide scope. It is 6 × 9 ins.; 300 pages. Postpaid, $4.00.

Engineers' Pocketbook of Reinforced Concrete.
By E. Lee Heidenreich. "Mr. Heidenreich's pocketbook is nearer the ideal than any on the same subject heretofore published." —Engineerings News, Jan. 14, 1909. Leather; 4½ ×6¾ ins.; 374 pages. Postpaid, $3.00.

The Reinforced Concrete Pocketbook.
By L. J. Mensch, M. Am. Soc. C. E. A book by an experienced engineer and successful contractor. Leather; 4¼ × 6¼ ins.; 216 pages. Postpaid, $4.00.

Concrete Bridges and Culverts.
(Both Railway and Highway.)
By H. Grattan Tyrrell. Leather; 4½ × 6¾ ins.; 272 pages Postpaid, $3.00.

Tables for Structural Engineers.
By Edward Godfrey. Leather; 4 × 6½ ins.; 218 pages. Postpaid, $2.50.

Solid Bitumens.
Their Physical and Chemical Properties and Chemical Analysis, by S. F. Peckham. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $5.00.

Graphic Statics.
By Charles W. Malcolm. This book has been adopted as a textbook by a large number of engineering colleges. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $3.00.

Cost Keeping and Management Engineering.
By Halbert P. Gillette and Richard T. Dana. Cloth; 6 × 9 ins.; 360 pages. Postpaid, $3.50.

Theory and Design of Reinforced Concrete Arches.
By Arvid Reuterdahl, Chief of Bridge Dept., City of Spokane. Cloth; 6 × 9 ins.; 132 pages. Postpaid, $2.00.

Railroad Location Surveys and Estimates.
By F. Lavis, M. Am. Soc. C. E. Cloth; 6×9 ins.; 270 pages. Postpaid, $3.00.

The Trackmen's Helper.
By J. Kindelan. Cloth; 5¼ × 7½ ins.; 350 pages. Postpaid, $1.50

Practical Switchwork.
By D. H. Lovell. Cloth; 4¼ × 6¼ ins.; 174 pages. Postpaid, $1.00.

Maintenance of Way Standards.
By F. A. Smith. Cloth; 5½ × 7¾ ins.; 600 pages. Postpaid, $1.50.

Railway Curves.
By F. A. Smith. Cloth; 4 × 6¼ ins.; 50 pages. Postpaid, $1.00.

Standard Turnouts.
By F. A. Smith. Leather; 4½ × 7¾ ins.; 41 pages. Postpaid, $1.00.

Engineering Work in Towns and Cities.
By Ernest McCullough. Cloth; 6 × 9 ins.; 510 pages. Postpaid, $3.00.

A Treatise on the Design and Construction of Mill Buildings and Other Industrial Plants.
By Henry Grattan Tyrrell, C. E. (Toronto University). Author of Mill Building Construction (1900), Concrete Bridges and Culverts, History of Bridge Engineering, etc. Cloth; 6 × 9 ins.; 500 pages. 650 illustrations. Price, $4.00 net, postpaid.
"Affords by far the largest and best collection of practical information on Mill Buildings yet published." — Engineering News, August 17, 1911.

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By W. Purves Taylor. The most complete book on the subject. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $3.00.

Concrete Construction—Methods and Cost.
By Halbert P. Gillette and Charles S. Hill, Editors of "Engineering-Contracting." Cloth; 6 × 9 ins.; 700 pages. Postpaid, $5.00.

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By Myron S. Falk. A summary of tests and conclusions derived therefrom. Cloth; 6 × 9 ins.; 184 pages. Postpaid, $2.50.

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By T. U. Taylor, Professor of Civil Engineering, University of Texas. Leather; 4½ × 7 ins.; 328 pages. Postpaid, $2.00.

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By Homer A. Reid, Assoc. M. Am. Soc. C. E. The largest book on concrete. Cloth; 6 × 9 ins.; 906 pages; 715 illustrations. Postpaid, $5.00.

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Rock Excavation—Methods and Cost.
By Halbert P. Gillette. Cloth; 5½ × 7 ins.; 384 pages. Postpaid, $3.00.

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By T. U. Taylor, Professor of Civil Engineering, University of Texas. Cloth; 4½ × 7 ins.; 56 pages. Postpaid, $1.00.

Engineering Law—The Law of Contract.
By Alexander Haring, LL.B., M. Am. Soc. C. E., Professor of Bridge and Railway Engineering, New York University. Cloth; 6 × 9 ins.; 510 pages. Postpaid, $4.00.

Concrete Inspection.
By Chas. S. Hill, C.E. Cloth; 3½ × 6 ins. 186 pages; illustrated. Postpaid $1.00.

Reinforced Concrete—A Manual of Practice.
By Ernest McCullough, M. West. Soc. Engrs. Cloth; 5 × 7¾ ins.; 136 pages; illustrated. Postpaid $1.50.

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CHICAGO

PROPOSALS

WATERWORKS.

Sealed bids will [illegible] Commissioners of the [illegible] at the City Hall in [illegible] o'clock p. m., Jan. 29th, and then opened for the construction of an intake crib, receiving well, pumping plant, including two 40 H.P. oil engines, two 350-gal. triplex pumps, with all necessary piping and fittings, approximately 3,000 lin. ft. 10-in. water main, fire hydrants and appurtenances.

After Jan. 10th plans and specifications may be seen at the office of the City Auditor, at the office of the Missouri Valley Engineering Company, 406 Western National Bank Bldg., Mitchell, S. D., or may be secured by making deposit of $10.00, which will be returned upon return of plans and specifications in good condition. Check for $500.00 to accompany [illegible]

December 29, 1911.

F. K. BERRY, Mayor
J. H. BINGHAM, City Auditor.

MISSISSIPPI RIVER COMMISSION 1st and 2nd Districts, U. S. [illegible] fice, Memphis, Tenn., [illegible] proposals for furnishing one locomotive crane will be received at this office until 12 o'clock, noon, Feb. 8, 1912, and then publicly opened. Information on application. Clarke S. Smith, Major, Engrs.

SEWERS AND WATER WORKS.

Fallon, Nev.

Sealed proposals for the material and construction of sewerage system and water works system for City of Fallon, Nev., under bond issues of $10,000 and $35,000, respectively, will be received by the City Clerk up to 7:30 p. m. of Jan. 6th and Jan. 7th, respectively.

Sewerage system consists of about 6,000 lin. ft. of 12-in. and 10-in. pipe sewers averaging 6 ft. deep and Imhoff or septic tank.

Water works consists of about 30,000 lin. ft. of wood, converse steel or cast iron pipe, valves and hydrants, but no pumps, 200,000 gal. wood stand pipe and about 19,000 ft. B. M. of T. & G. sheet piling work. Plans on file in office of Engineer, E. P. Osgood, Bank Bldg., Fallon, Nev., or will be forwarded by City Clerk, prepaid, on receipt of $5 per set each, said sum being subject to refund on return of papers in good condition.

Award will not be made on sewer bids until after opening of water works proposals.

Dated Fallon, Nev., Dec. 21, 1911.

W. H. REAVIS,
City Clerk.

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Systematic Research as a Principle of Managerial Economics.

Next in importance to the principle that producers should be paid in proportion to their performance is the principle that performance be improved by systematic and inventive research. Although it is evident that the object of all management should be to increase profits, both by increasing sales and by reducing unit costs, it has not been the general practice to investigate existing methods and machines systematically with a view to reducing unit costs. The Taylor scheme of timing the elements of operation of machines has merited all the praise that it has received. But it seems not to have been perceived by many of the exponents of "scientific management" that unit timing of processes is itself only one method, and not the most important method, of conducting systematic research for the purpose of devising more economic methods of production. Nor has it been generally recognized that unit cost keeping—which is a much older device—is also but a method of conducting a continuous research whose ultimate aim is the reduction of unit costs.

Systematic research, then, is a broad principle to be applied in all management, and, as we shall indicate, it may receive application in numerous ways.

The greater part of Wellington's "Economic Theory of Railway Location" is devoted to investigation and analysis of the costs of railway operation—a systematic research. Using the data thus collected, Wellington proceeds to solve for a minimum unit cost of transportation under any given condition. His whole treatise is, in fact, an application of two principles of the science of management.

Another sort of systematic research has been applied with remarkable results by certain manufacturers and by a few railway companies. We refer to laboratory experiments with materials and devices. Research laboratories are characteristic of many large electrical and chemical manufacturing establishments. Recently several technical articles have been published giving exact data as to some of the economies effected by investigators in these laboratories. That such laboratories have long been maintained at great expense is itself sufficient evidence that this sort of systematic research pays.

If we turn to the various departments of the federal government we shall find more or less evidence of systematic research undertaken to effect economy of production, but in no department does it approach in its results what has been accomplished by the Department of Agriculture. Within the last few years the art of farming has rapidly been elevated to the rank of a science, and this change has been due in large measure to the systematic research conducted by the Department of Agriculture. Profiting by this example, several railway companies have undertaken similar scientific investigation for the purpose of teaching the farmers in their territory how to produce larger and more profitable crops.

The manufacturers of machines have usually been content to effect improvements slowly, either by adopting the suggestions of owners of the machines or by using the invention of some employe or of some free lance in the inventing field. Latterly, however, many of the most progressive manufacturers are hiring engineers to make a systematic study of the work performed by the machines under all kinds of conditions. Two results are accomplished by this sort of research: First, the machine itself is improved; and, second, methods of using the machine are bettered, and owners are taught how to use the machines to greatest advantage.

Like many another principle whose merit is conceded, the principle of systematic research does not as yet receive a fraction of the attention that it deserves. The majority of business firms are small, and the manager of a small firm is apt to say: "Systematic research is all very well for the big business concern, but we, being small, have neither the money nor the time to devote to such things. It keeps us busy enough doing what we have to do now."

In this argument we have one of the main reasons why most small concerns remain small. Unless the manager of a small business takes the time himself or assigns someone else to study the problems of economic production and selling, he will always be extremely busy—busy trying to keep from going to the wall under the stress of competition. Systematic and continuous research is the secret of the rise of many a small firm into prominence. Such research usually begins with unit cost keeping and a careful study of the elements of cost with a view to cost reduction. Then it may be followed by the Taylor method of unit timing of operations. Then laboratory and field research may follow, leading to a number of small improvements, which, in the aggregate, however, add very substantially to the economy effected. Finally some radical improvement, so radical as to merit being called an important invention, gives the business a great forward impetus. The invention need not necessarily consist in a mechanical combination or in a chemical combination, for it may be a [illegible] improved process or product that is not even patentable.

Failure to succeed greatly in management usually occurs not so much from lack of knowledge of the important principles of the science of management as from failure to apply them. Most of the principles of successful management are old, and many of them have received sufficient publicity to be well known, but managers are curiously prone to look upon managerial success as a personal attribute that is slightly dependent on principles or laws. In fact, however, managerial success is but an evidence of skill in applying the laws of management. The laws, it is true, may not have been learned from books. More often they have been derived from experience and intuition, which is but a way of saying that they have been arrived at by a process of induction. None the less, every successful manager owes his success to an understanding of at least a few of the important laws of the science of management, which laws he has diligently and skillfully applied. This statement carries with it another: "Scientific management" is new only in name. Every successful manager, from immemorial time to the present, has applied laws of management that are scientific. It is true that there has been no codification of the laws of scientific management into a science until recently. It is also true that no scheme of management that involves the application of only three or four of the laws of management is a *science* of management, although such a scheme may be *scientific* management. An act may be scientific but an act can never be a science.

The recent attempt to accredit a certain system of "scientific management" with the attributes of a complete science of management has aroused much just criticism; but the critics have themselves usually gone to an equal extreme in maintaining that there is no such thing as a science of management. Some, indeed, have claimed that such a science can never exist. Prior to Aristotle it might have been argued with equal seriousness that a science of reasoning—logic—could not be developed, for it could have been said: "A man is born either with or without a faculty for reasoning well, and cannot be taught to reason." There is now a science of reasoning, and the science of management is itself one of the developments of inductive logic.

Among the principles of the science of management, one of the most important may be stated thus:

To secure greatest economy of production, regular systematic research should be employed, with a view to improving materials, machines and methods.

Systematic research involves: (1) Unit cost keeping and cost analysis; (2) unit timing of operations; (3) laboratory testing and experimenting; (4) systematic investigation and experimenting in shop and field under working conditions.

In conducting such research there is a great field for trained engineers, and particularly for those who have an imagination that leads to the invention of improved means and methods. Few, we believe, are wholly lacking in such imagination, and in all it can be developed to a greater degree by study and application of the principles of the science of management

Use of the Water Jet in Drilling Rock.

[illegible] description of a method of preventing dust in underground drilling operations in South Africa. This method was the result of an investigation made at the instigation of the public mining officials with the object of protecting miners from the ill effects of continuous work in dust laden atmosphere. The investigations led to experiments with the water jet and showed that its use not only prevented dust in drilling but that the rate of drilling was very much increased and that an economy of from 30 to 50 per cent was effected in drill bits.

The experience in South Africa, although a new discovery in that locality, is but a confirmation of the results produced with the water jet in this country. In the columns of [illegible] Gillette's "Rock Excavation" and elsewhere much has been published to show the economy in the use of the water jet in rock drilling, and it is really surprising to find it so little in use.

In the system used in underground work in South Africa, water under a pressure of 40 to 80 lbs. was directed into the drill hole during the drilling operations, thus killing the dust before it was made. The water was carried in a pipe to a point near the drilling face and from the end of the pipe a ½ in. or ¾ in. hose was used. It is claimed that the water flows quietly out of the drill hole and down the face causing no inconvenience to the operator or his helper. The hose is flattened at the end, more easily to be inserted alongside the drill bit. The saving in steel is said to be from 30 to 50 per cent and the rate of drilling according to the results of the tests in hard quartzite was shown to be increased from 0.33 in. per minute without water to 0.78 in. per minute in [illegible] case

The use of water under pressure involves the use of a pumping plant, which may be used to furnish the water or to remove it from the work. The amount of water necessary to remove the particles of broken rock from a vertical drill hole may be calculated from the formula which was first published in Engineering & Contracting, Feb. 5, 1908, and which is based on the rate at which particles of rock will fall in water. In order to lift grains of rock vertically by means of water the velocity of the up current must exceed the velocity that the grains would attain in sinking. The rule follows:

Square the diameter (inches) of the drill hole at its mouth and multiply by the square root of the diameter (in inches) of the largest grains of sludge, and then multiply again by seven. The result is gallons of water per minute.

A small pumping outfit to furnish 6 gals. of water per minute to 6 holes at 100 lbs. pressure will cost approximately $1.25 per day, including operation, repairs, interest and depreciation. As stated in "Rock Drilling," by Dana and Saunders, these jets will increase the output from 30 to 100 per cent. Even if the cost per lineal foot amounted to 50 cts. and the output per day was only 50 ft., then a 30 per cent increase in the output at a cost of $1.25 would reduce the cost per lineal foot to 41 cts. This is an extremely safe estimate and there should be no reason why a 30 to 100 per cent increase in the output should not result in nearly as great a reduction in the cost.

Contractors' foremen are quite generally opposed to new ways of doing work and it is only by rigid insistance that new methods can be put into use. The average foreman moreover can not be trusted to carry out experiments to secure greater economy and such experiments must be made under the direction of some person who knows how to carry them out. Otherwise the experiment is apt to fail and the opportunity for saving money is lost. This is perhaps one reason why the use of the water jet in drilling has not become as common as its economic merit warrants.

CONCRETE AND REINFORCED CONCRETE SECTION

A Controllable Discharge Concrete Dump Bucket Especially Adapted for Pouring Thin Walls.

The accompanying drawing shows a new design of concrete dump bucket that is especially adapted for placing concrete in thin walls, even as thin as 3 ins., without waste or extra handling. The section of the bucket is a right-angle triangle with the vertical or front side free from all mechanism. The dumping devices are located on the hypotenuse and thus the operation of the bucket is easily effected without interference from projecting steel reinforcement rods or forms. In operation the vertical side is brought up against the steel work.

The dumping device is controlled by a handle operating a cam that bears on an equal arm lever that connects by another lever to the drop bottom. The operator has ready control over the amount of concrete to be placed and by moving the bucket forwards and backwards can place concrete in as thin layers as is desired. This bucket can be placed directly against vertical steel rods throwing the contents of the bucket between them. The shape of the drop bottom is such that with a little experience the operator can cast the concrete through a steel system from 4 to 6 ft wide.

The straight side gives the concrete a clear fall by gravity, which produces a scouring on the sloping side and completely clears the bucket thus reducing to a minimum the time for the ordinary cleaning operation. When desired the bucket is furnished with legs so that it can be set down in an upright position. The bucket is patented and manufactured by the Ransome Concrete Machinery Co., of Dunellin, N. J.

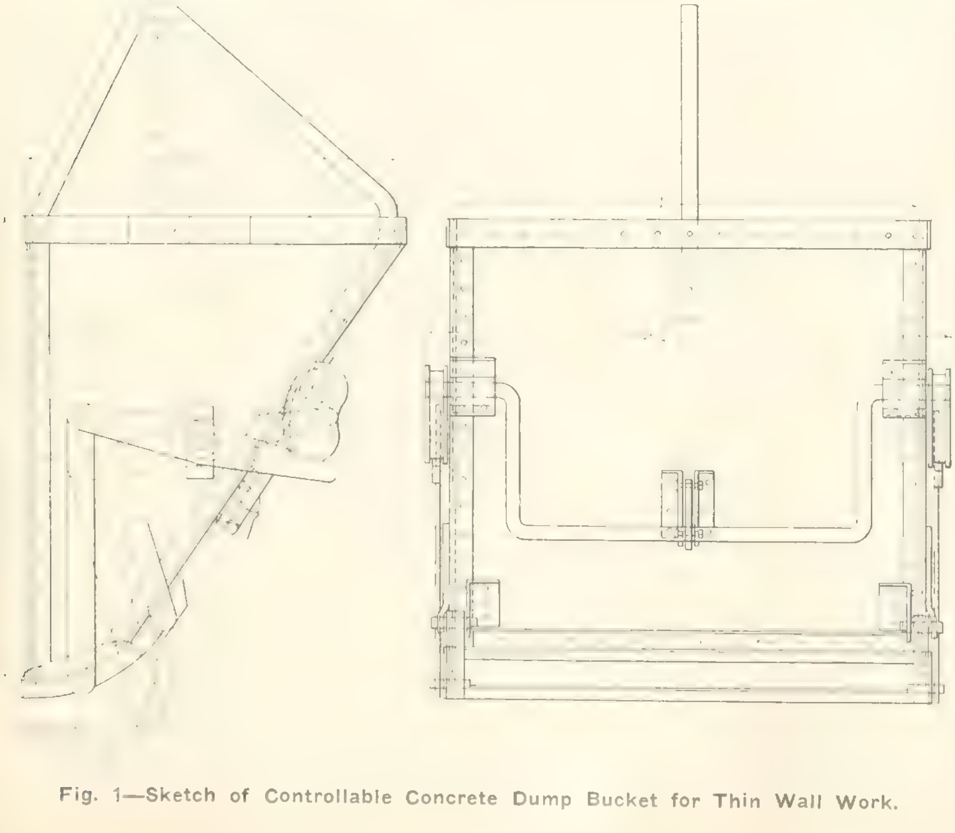

Fig. 1—Sketch of Controllable Concrete Dump Bucket for Thin Wall Work.

An Inexpensive Method for Testing the Strength of a Reinforced Concrete Floor-Slab.*

The building ordinances in nearly every large city require that the reinforced concrete floor systems of all buildings erected within the city limits be tested for strength. This is done by applying a test load to two or more adjacent panels in one or more floors of the building. The test load is usually some multiple of the theoretical safe load. The Chicago Ordinances require the superimposed test load to be equal to twice the live load, plus the dead load. Previous to applying the load the distance from the under side of the slab to be tested to the top of the floor beneath is measured very accurately. When the load is in place this distance is again measured. The difference between the two measurements is the deflection. The maximum deflection allowed by the Chicago Ordinances is 1/700 of the span.

A number of materials have been tried out for loading the floors; such as pig iron, rubble stone, and bags of cement, gravel or sand. Where cartage charges and wages are high, the cost of a single test, using any of the above materials, will run from $200 to as high as $700. The latter figure may look very high, but a little figuring will show that the amount is not excessive or unusual. In the first place two slabs which measure [illegible] load 250 lbs. per sq. ft. [illegible] 200 tons of material for the test load. Cartage on this material [illegible]

---

*An article by C. H. [illegible] in the "Bridge Engineering Review."

Per ton: [illegible]
Unloading and hoisting [illegible]
Taking down and removing [illegible]

Total cost per ton [illegible]

This makes a total [illegible] 200 tons [illegible] mate of the cost where laborer's wages are $3 [illegible] teams cost $7 per day.

[illegible] method [illegible] hit upon the use of torpedo sand in the bulk. Damp torpedo sand weighs about 110 lbs. per cubic foot as it is shoveled into a bin or pile. A 2-in. plank enclosure was built on the center [illegible] The height of this enclosure in feet was just [illegible] foot of the test load. For instance, a test load [illegible] per square [illegible] 3 ft. 7 ins. high.

The sand can be loaded into wheelbarrows and hoisted on a brick hoist, or, more cheaply, in a concrete skip; or, still more cheaply, if conditions permit, by means of a bucket elevator. The sand should be hoisted first to the highest floor to be tested, thrown into the bin and leveled off even with the sides of the bin with a straight edge. The cost of hoisting the sand by the first method will run about 75 cts. per ton; by the second method 30 cts. per ton; and, by the third method 15 cts. per ton. These prices include placing the sand in the bin provided it is located within 30 ft. of the place where the sand is delivered by the hoisting apparatus. There is usually one or [illegible] mechanisms available on the job, so that it is unnecessary to erect a hoist especially for testing purposes.

As soon as one floor is tested and the load is wanted on a lower floor, it is not necessary to lower the sand by means of a hoist or to carry it down a stairway as is the case when pig iron, rubble, or ballast in bags is used. Instead, all that is needed is to cut a small hole in the slab from beneath and let the sand run through. The hole can then be patched at slight expense.

When as many tests are made as is required the sand may be dropped down a stair or elevator shaft, through a window, or down a rubbish chute directly into wagons. However, there are usually a number of things remaining to be done, such as basement floors, sidewalks, etc., for which a quantity of torpedo sand is needed so that it is seldom necessary to remove any of the sand from the premises.

On a recent job about 150 tons of sand were hoisted by means of a bucket elevator to the third floor and spouted through a window on to the floor. This sand was then shoveled into a bin covering two panels to the required depth. The load was allowed to remain 24 hours for the city inspector to make his observations. A hole was then cut in the slab and the sand allowed to run down to the second floor where a bin had been prepared. After the test of the second floor the sand was dropped to the ground and was all used for cinder concrete and for the first floor which was laid directly on the ground.

The entire cost of these two tests, which involved the handling of 150 tons of material three times, was slightly less than $50.

A Simple Diagram for Designing Reinforced Concrete Culvert Slabs.

Contributed by Walter R. Root, [illegible]
Chicago Great Western Ry.

In designing reinforced concrete flat top culverts, floor slabs, beam, etc., I have found by using the accompanying diagram that considerable time may be saved in tedious trial calculations to get a consistent relationship between the depth of a beam and the amount at reinforcement required under given specifications.

[illegible] are similar to those recommended by the [illegible] the allowable [illegible] stress in steel (high carbon) is 17,000 lbs. per square inch, [illegible] fiber in cross bending is 750 lbs. per square inch [illegible]

When width = 12 ins. [illegible]

[illegible]

The moments in inch pounds for a section 12 ins. wide are:

[illegible] $5)\frac{12}{10}$ = 214,500
[illegible] = 107,250
[illegible] = 77,150

[illegible]

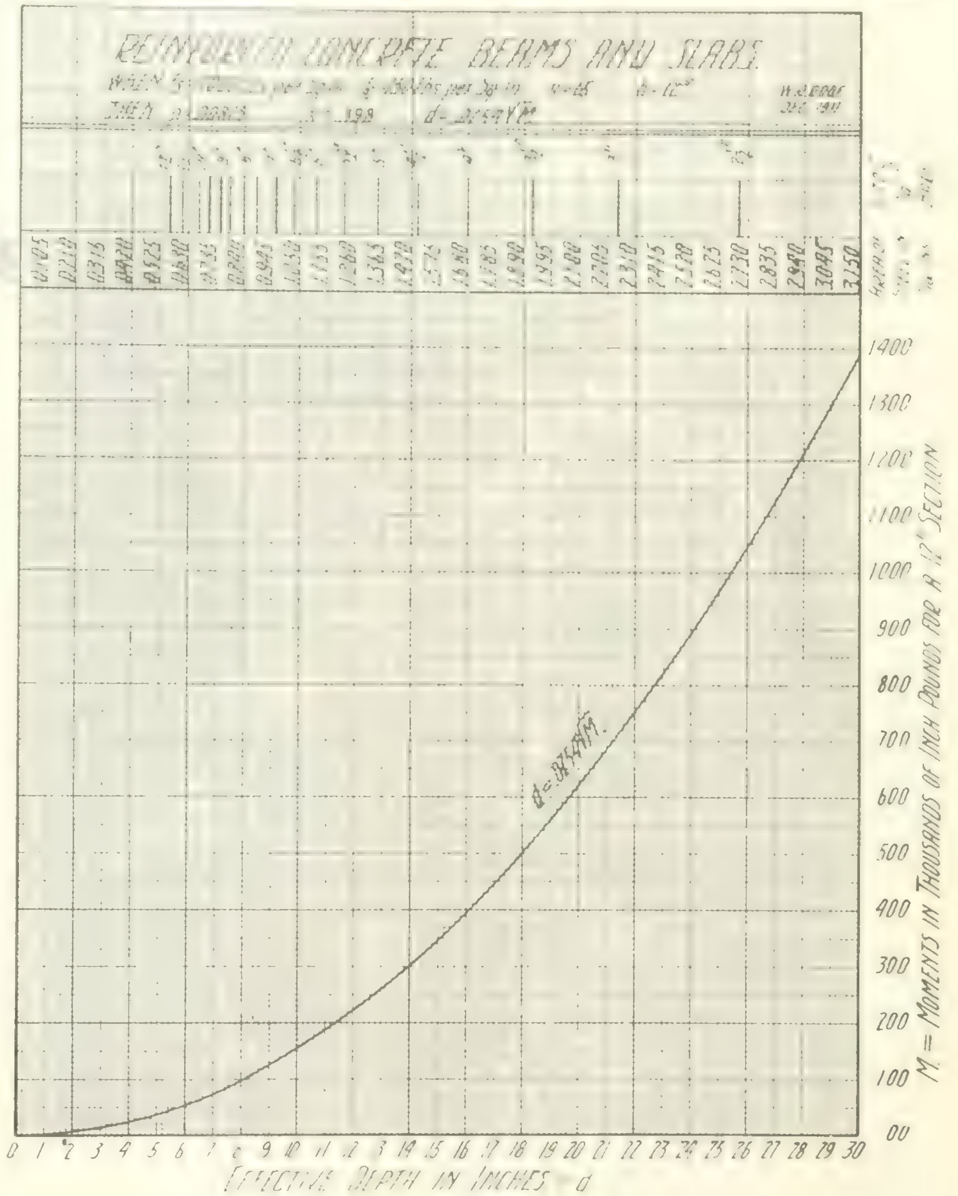

Diagram for Designing Reinforced Concrete Culvert Stubs.

which is the equation of the curve used in the diagram.

Example.—Design a slab for a 10-ft. reinforced concrete box culvert to take care of Cooper's E 55 loading plus 50% for impact, and 18 ins. of fill. The dead loads in pounds per square foot are:

Concrete	[illegible]	(assumed total thickness at slab to be 18 ins.)
Fill	[illegible]	
Track	50	(500 pounds per foot distributed over 10-ft. width.)
Total	125	

The live loads are distributed over 10-ft width, as follows:

[illegible]

[illegible] Read across from moment for 398,900 in. lbs. to intersection of curve. Read down for effective depth, which is in this case 16 ins. Read up for area of steel required per foot. This is 1.68 sq. ins., which corresponds to ¾-in. sq. rds. 4 ins. center to center, as shown in the auxiliary scale.

Other auxiliary scales for various sizes and shapes at reinforcement may be added to the diagram to suit the kind of reinforcement used. Various combinations of the unit stresses in steel and concrete and the ratio of moduli of elasticity of steel and concrete may be used in making up diagrams in accordance with the specifications used by any one office.

The state commissioners of Washington have resolved in favor of the general use of block signals on electric as well as steam roads. The Boston & Maine road has increased its plants and towers by 423, the Burlington, 1,305, and the Northern Pacific 200.

Reinforced Concrete Lumber Wharf for the Panama Railroad. Methods of Sinking Concrete Caissions and Progress of Construction.

[illegible]

Across a tidal inlet, at the Pacific terminals of the Panama Railroad, is being constructed a reinforced concrete lumber wharf 656 ft. long and 55 ft. wide. This is the first of the permanent improvements to be constructed at the Pacific end of the canal and is a part of the scheme for the completed Pacific Terminal of the railroad. It was necessary to shut off the water from the Pacific by means of a cofferdam near the entrance of the tidal inlet. Two centrifugal pumps were installed to keep the bed of the inlet dry.

The character of the material for foundations was determined by a line of borings and a test pit, sunk along the outer edge of the proposed dock. For about 20 ft. sand is encountered; this changes to a heavy bluish-gray clay which continues some distance, when a layer of sand and gravel a few feet thick is found overlying the bedrock. The latter [illegible] of argillaceous sandstone, and was found in the borings at depths varying from 60 to 70 ft. below mean sea level.

In building the piers a heavily reinforced concrete cylindrical shell 1 ft. thick, built in 6-ft. sections, is forced down to rock and the interior then filled with concrete. The bottom section is a hollow frustum of a cone, interior diameter 6 ft. throughout, exterior diameter 10 ft. at the base, tapering to 8 ft. at the top. The purpose of the enlarged footing thus formed is to minimize skin friction while the pier is going down and also to bring the unit pressure on the foundation well within the allowable limit. From the top of the footing section the 8-ft. exterior diameter is maintained to the top of the pier, giving a cylindrical shell 1 ft. in thickness. A steel shoe attached to the bottom of the footing serves at once as the bottom concrete form and also as a cutting edge.

Two methods of construction have been employed—in the first, the footing form was made, partially filled with concrete and lowered by crane into position. The successive sections, after subsequently completing the footing, were then built up in place whenever the progress of sinking required. This interfered with the sinking operations, the steel and forms were difficult to handle on account of the limited standing room—the concrete had to be placed laboriously by hand and required a reasonable length of time to set before the work of sinking could be resumed. These difficulties led to casting 6-ft. sections on the ground near one of the mixers. In these the vertical reinforcement does not pass through the joint between sections, but bond is given by means of six vertical iron rods, made continuous by stout, square junctions threaded at each end to receive the rods. By this method any number of sections may be built in advance and become well seasoned before required for use. They are handled by crane and lowered into position, the rods which project from the preceding section passing through holes left in the section being lowered. The top surface of each section is so molded as to leave the inner half of the ring about 1 in. higher than the outer half; the lower surface corresponds. The sections then fit into each other, the joint being strengthened by a rich cement mortar. The footing and 3 ft. of cylindrical shell are made as before, the upper

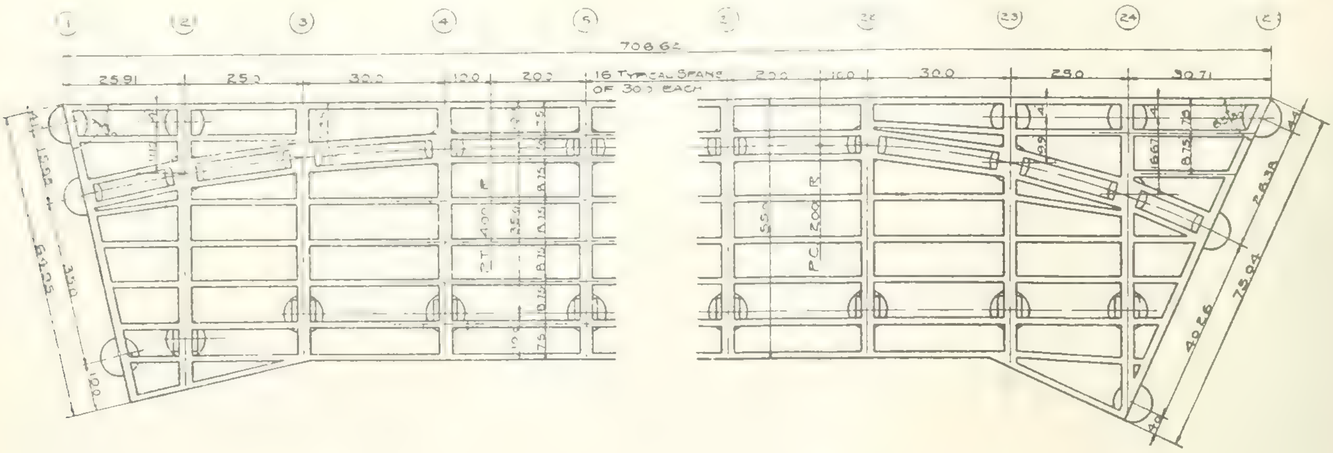

Fig. 1—Plan of Floor System Showing Location of Piers for Reinforced Concrete Dock for Panama Railroad.

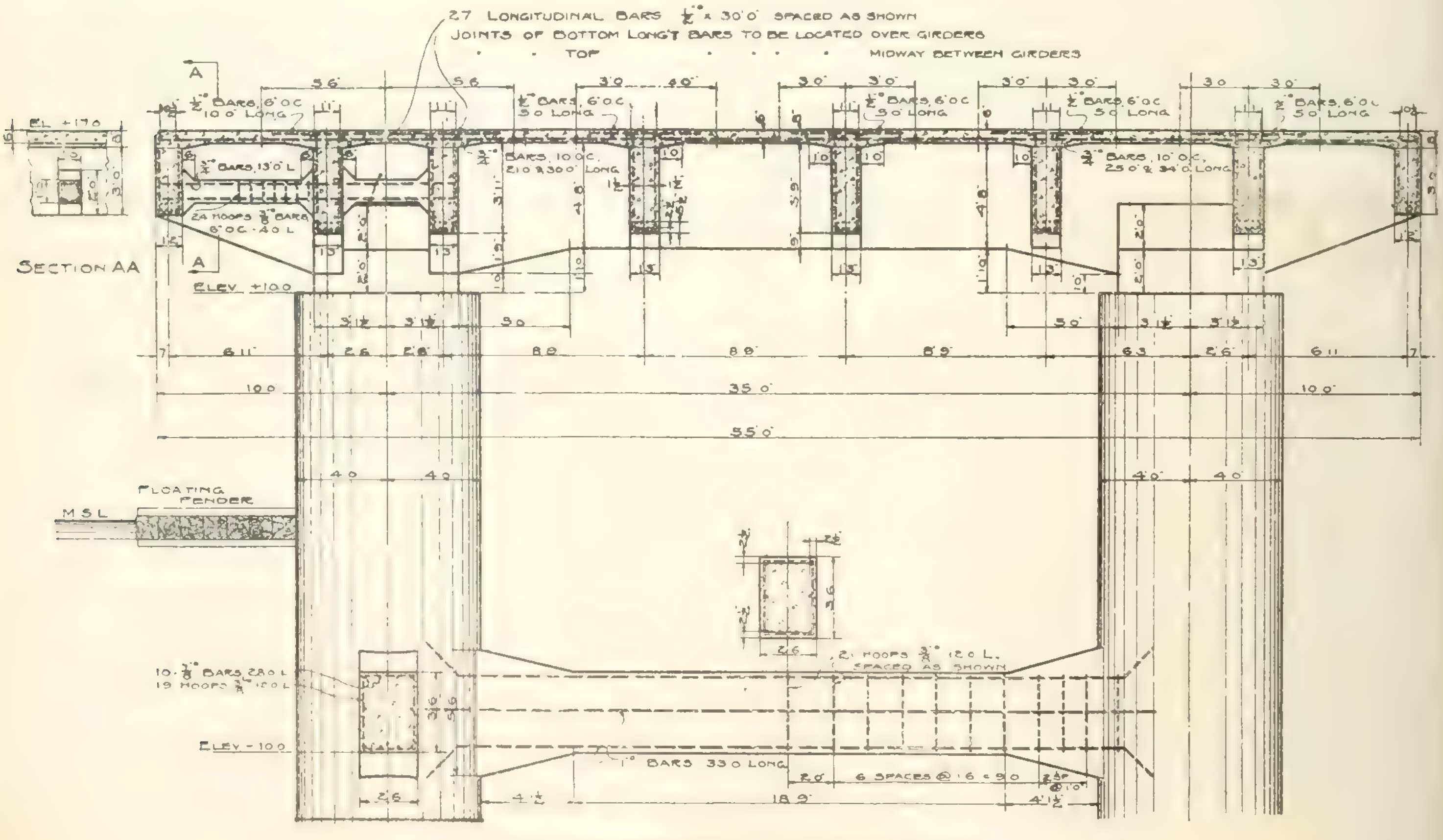

Fig. 2—Cross Section of Dock between Piers.

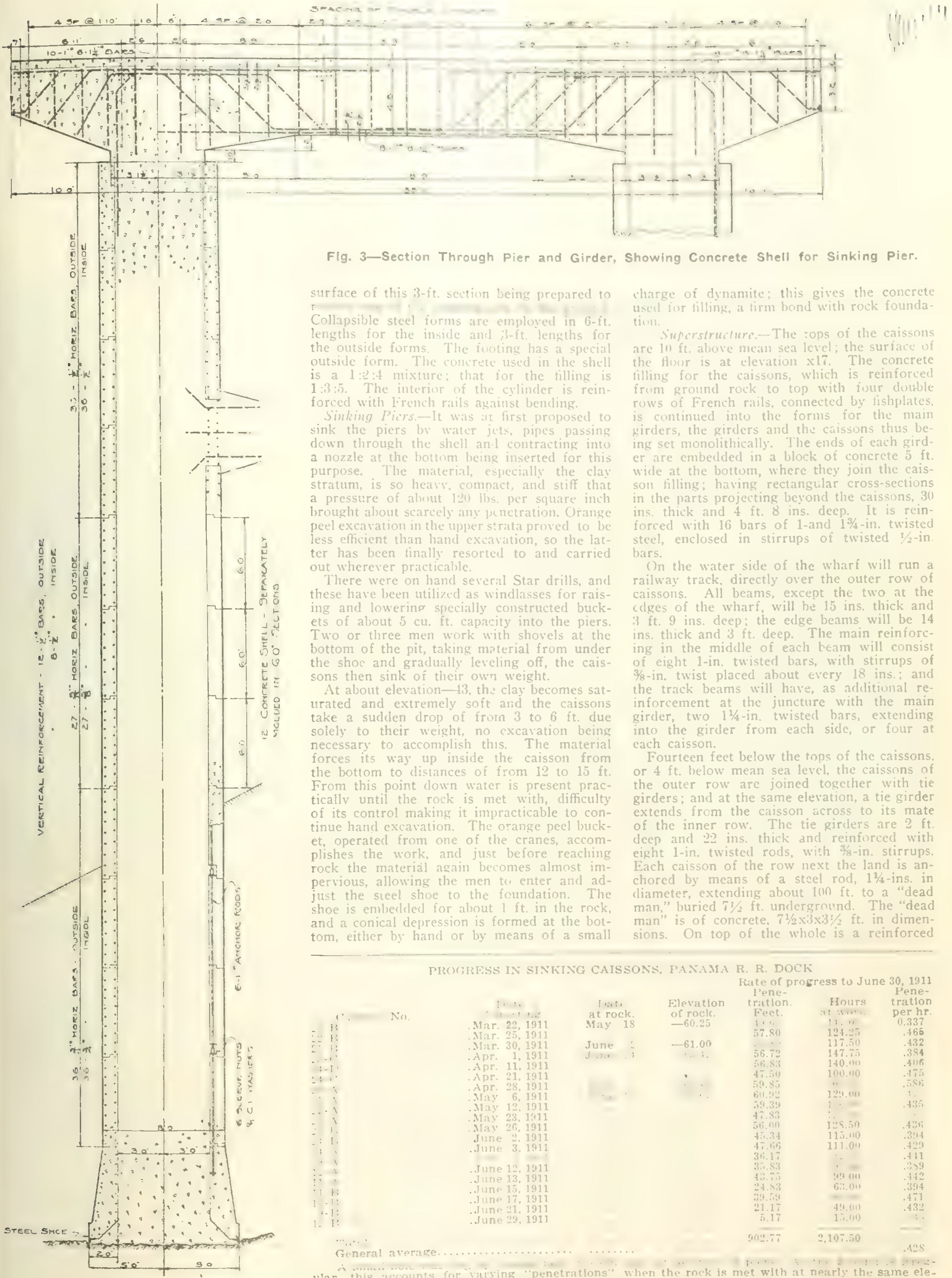
SPACING OF
4 SP @ 11'0"
4 SP @ 2'0"
10-1" & 8-1¼" BARS
VERTICAL REINFORCEMENT - 12 - ½" BARS, OUTSIDE
8 - ½" INSIDE
HORIZ BARS OUTSIDE
INSIDE
12 CONCRETE SHELL - SEPARATELY MOLDED IN 6.0' SECTIONS
6-1" ANCHOR RODS
6 SLEEVE NUTS & 6 WASHERS
6.0'
STEEL SHOE

Fig. 3—Section Through Pier and Girder, Showing Concrete Shell for Sinking Pier.

surface of this 3-ft. section being prepared to [illegible] Collapsible steel forms are employed in 6-ft. lengths for the inside and 3-ft. lengths for the outside forms. The footing has a special outside form. The concrete used in the shell is a 1:2:4 mixture; that for the filling is 1:3:5. The interior of the cylinder is reinforced with French rails against bending.

Sinking Piers.—It was at first proposed to sink the piers by water jets, pipes passing down through the shell and contracting into a nozzle at the bottom being inserted for this purpose. The material, especially the clay stratum, is so heavy, compact, and stiff that a pressure of about 120 lbs. per square inch brought about scarcely any penetration. Orange peel excavation in the upper strata proved to be less efficient than hand excavation, so the latter has been finally resorted to and carried out wherever practicable.

There were on hand several Star drills, and these have been utilized as windlasses for raising and lowering specially constructed buckets of about 5 cu. ft. capacity into the piers. Two or three men work with shovels at the bottom of the pit, taking material from under the shoe and gradually leveling off, the caissons then sink of their own weight.

At about elevation—43, the clay becomes saturated and extremely soft and the caissons take a sudden drop of from 3 to 6 ft. due solely to their weight, no excavation being necessary to accomplish this. The material forces its way up inside the caisson from the bottom to distances of from 12 to 15 ft. From this point down water is present practically until the rock is met with, difficulty of its control making it impracticable to continue hand excavation. The orange peel bucket, operated from one of the cranes, accomplishes the work, and just before reaching rock the material again becomes almost impervious, allowing the men to enter and adjust the steel shoe to the foundation. The shoe is embedded for about 1 ft. in the rock, and a conical depression is formed at the bottom, either by hand or by means of a small charge of dynamite; this gives the concrete used for filling, a firm bond with rock foundation.

Superstructure.—The tops of the caissons are 10 ft. above mean sea level; the surface of the floor is at elevation x17. The concrete filling for the caissons, which is reinforced from ground rock to top with four double rows of French rails, connected by fishplates, is continued into the forms for the main girders, the girders and the caissons thus being set monolithically. The ends of each girder are embedded in a block of concrete 5 ft. wide at the bottom, where they join the caisson filling; having rectangular cross-sections in the parts projecting beyond the caissons, 30 ins. thick and 4 ft. 8 ins. deep. It is reinforced with 16 bars of 1-and 1¾-in. twisted steel, enclosed in stirrups of twisted ½-in. bars.

On the water side of the wharf will run a railway track, directly over the outer row of caissons. All beams, except the two at the edges of the wharf, will be 15 ins. thick and 3 ft. 9 ins. deep; the edge beams will be 14 ins. thick and 3 ft. deep. The main reinforcing in the middle of each beam will consist of eight 1-in. twisted bars, with stirrups of ⅜-in. twist placed about every 18 ins.; and the track beams will have, as additional reinforcement at the juncture with the main girder, two 1¼-in. twisted bars, extending into the girder from each side, or four at each caisson.

Fourteen feet below the tops of the caissons, or 4 ft. below mean sea level, the caissons of the outer row are joined together with tie girders; and at the same elevation, a tie girder extends from the caisson across to its mate of the inner row. The tie girders are 2 ft. deep and 22 ins. thick and reinforced with eight 1-in. twisted rods, with ⅜-in. stirrups. Each caisson of the row next the land is anchored by means of a steel rod, 1¼-ins. in diameter, extending about 100 ft. to a "dead man," buried 7½ ft. underground. The "dead man" is of concrete, 7½x3x3½ ft. in dimensions. On top of the whole is a reinforced

PROGRESS IN SINKING CAISSONS, PANAMA R. R. DOCK

Caisson No.	Date starting	Date at rock.	Elevation of rock.	Rate of progress to June 30, 1911 Penetration. Feet.	Hours at work	Penetration per hr.
[illegible] B	Mar. 22, 1911	May 18	—60.25	[illegible]	[illegible]	0.337
[illegible] B	Mar. 25, 1911			57.80	124.25	.465
[illegible] B	Mar. 30, 1911	June [illegible]	—61.00	[illegible]	117.50	.432
[illegible]	Apr. 1, 1911	June [illegible]	[illegible]	56.72	147.75	.384
[illegible]	Apr. 11, 1911			56.83	140.00	.406
[illegible]	Apr. 21, 1911			47.50	100.00	.475
[illegible] A	Apr. 28, 1911	[illegible]	[illegible]	59.85	[illegible]	.586
[illegible] A	May 6, 1911	[illegible]	[illegible]	60.92	129.00	[illegible]
[illegible] A	May 12, 1911			59.39	[illegible]	.435
[illegible] A	May 23, 1911			47.83	[illegible]	[illegible]
[illegible] B	May 26, 1911			56.00	128.50	.436
[illegible] B	June 2, 1911			45.34	115.00	.394
[illegible] A	June 3, 1911			47.66	111.00	.429
[illegible] A	[illegible]			36.17	[illegible]	.441
[illegible] A	June 12, 1911			35.83	[illegible]	.389
[illegible] A	June 13, 1911			43.75	99.00	.442
[illegible] B	June 15, 1911			24.83	63.00	.394
[illegible] B	June 17, 1911			39.59	[illegible]	.471
[illegible] B	June 21, 1911			21.17	49.00	.432
[illegible] B	June 29, 1911			5.17	15.00	[illegible]
[illegible]				902.77	2,107.50	
General average						.428

A small [illegible] irregular, this accounts for varying "penetrations" when the rock is met with at nearly the same elevations; also for discrepancy between "Elevation of rock" and "Penetration" columns for any one pier. Labor based on 9-hour day in effect on Panama Railroad.

concrete slab 6 ins. thick. The system is designed to support a uniformly distributed live load of 400 lbs. per square foot, and a concentrated live load over the track beams equivalent to the weight of a 301 class locomotive. The track comes immediately over the outer line of piers, with extra piers following the track where it curves at each end of the dock.

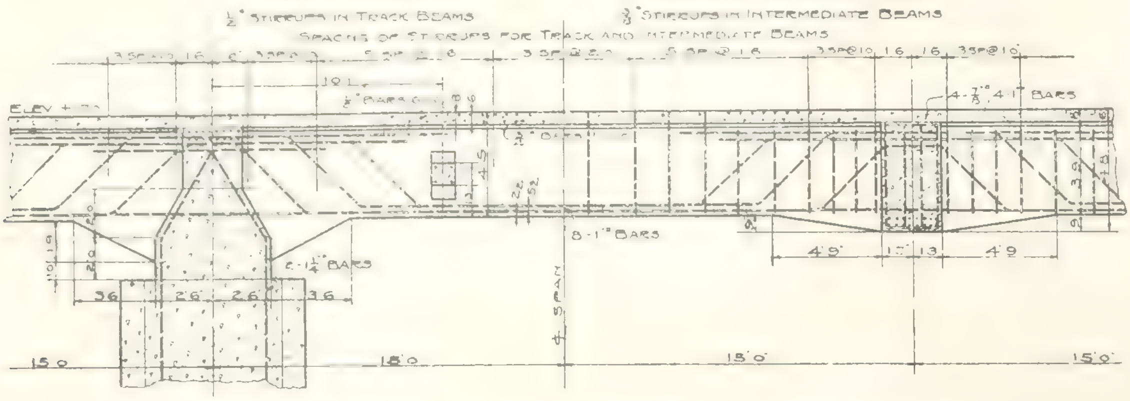
½" Stirrups in Track Beams
⅜" Stirrups in Intermediate Beams
Spacing of Stirrups for Track and Intermediate Beams
Elev +
4-⅞" 4'1" Bars
8-1" Bars
6-1¼" Bars
4'9"
1'3"
3'6"
2'6"
Span
15'0"
18'0"

Fig. 4—Longitudinal Section of Track Beam and Intermediate Beam.

Plant.—The main part of the construction plant consists of two locomotive cranes, one having a capacity of 15 tons at 10 ft. radius, the other a capacity of 20 tons at 12 ft. There are three concrete mixers; two of ½ cu. yd., and the third of ⅓ cu. yd. capacity; six No. 1 and No. 3 Emerson pumps, for keeping the cylinders dry during sinking; a marine boiler, which, however, furnishes power to other units besides the dock proper; and about a dozen Star drills. The pumps are operated by steam from the boiler, and the cranes and one mixer by self-generated steam; the remainder of the plant by compressed air.

Progress of Work.—Caisson construction was begun the last week in February, 1911, and work on sinking the first caisson began March 22. Work was commenced on the inner line of piers starting at bent 20, and carried toward the nearer end of the dock, the other corresponding piers being placed as work progressed.

The accompanying table showing rate of progress of sinking operations from the start of the first caisson to June 30, 1911, as given in the report of S. B. Williamson, division engineer Pacific division.

The caissons are designated as in Fig 1. The numerals refer to the number of the bent and the letters to the position of the caissons in the bent, the letter *A* referring to the outside caisson of any bent, *B* to the one next inshore, and so on.

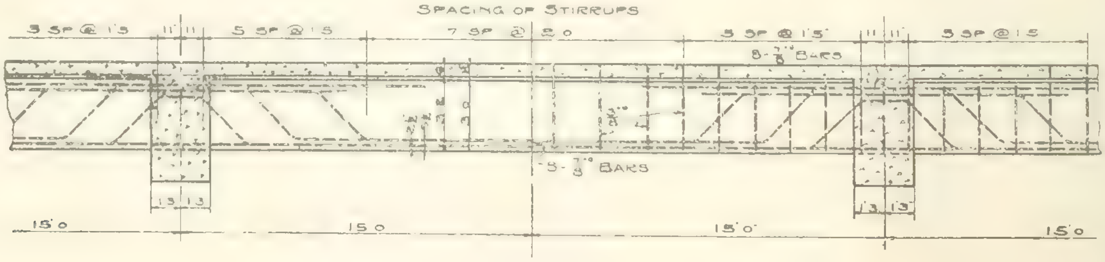

Fig. 5—Longitudinal Section of End Beam.

Five panels of the superstructure had been completed up to Jan. 1, 1912. For each uniform panel, 102.4 cu. yds. of concrete are used. All the concrete for a panel is laid in one day from the ½-cu. yd. portable mixer employed. A panel is laid every fourth day, the additional time being required for placing the forms and the reinforcing steel.

The Denver, Northwestern & Pacific R. R. is reported to have finished its long projected extension to Salt Lake City.

Analysis for Moments in Continuous Beams of Non-Uniform Section.

Contributed by **S. Ingberg, Structural Engineer,** with James Stewart & Co., Chicago, Ill.

Continuous beams with enlarged sections at the supports are common in building constructions since it is economical to take care of the greater moment at the supports on a greater depth of beam. On the other hand continuous or partially continuous beams designed for center moment alone are sometimes made of greater section over the central portion, the ends being designed to take shear rather than moment. The ordinary analysis for the continuous beam assumes its section to be uniform with a constant moment of inertia, *I*, and the elastic properties of its materials to be also constant with a modulus of elasticity, *E*. Any variation in either of these properties will affect the distribution of stress in the beam, the more rigid portions receiving in general the greater stresses. In the following analysis the modulus of elasticity is assumed to be constant and the cross section to be a rectangle of constant width but of varying depth. The ratio of the moment of inertia of two sections is taken to vary with the ratio of their depths cubed. This is true for homogenous material and nearly true for a non-homogenous material like reinforced concrete when the respective ratios of steel to concrete area are not too far different for the two sections.

1. THE VARYING PORTION RECTANGULAR.

A beam is shown in Fig. 1 (a) as fixed at the supports and with an enlargement of length r and total depth d_0, the depth of the central portion being d_1. In Fig. 1 (b) a beam of span L is shown continuous over an indefinite number of supports with an enlarged central portion of length $L-2r$ and total depth d_1, the depth at the support being d_0. The analysis for the loadings given below will apply to either of these cases or to any combination of the two, the length L being taken to be that of the effective clear span.

(a) *Uniform Loading.*—With a uniform load of w per unit length of beam, the moment, M, at any point distant x from the left support is

$$M=-M_0+\tfrac{1}{2}wLx-\tfrac{1}{2}wx^2 \qquad (1)$$

where M_0 is the moment at the support. According to the principles of flexure this expression for the moment is equal to the second derivative of the deflection y with respect to x, multiplied by a section constant, or, for the portion $x=o$ to $x=r$,

$$EI_0\frac{\delta^2 y}{\delta x^2}=-M_0+\tfrac{1}{2}wLx-\tfrac{1}{2}wx^2$$

Whence

$$EI_0\frac{\delta y}{\delta x}=-M_0x+\tfrac{1}{4}wLx^2-\tfrac{1}{6}wx^3 \qquad (2)$$

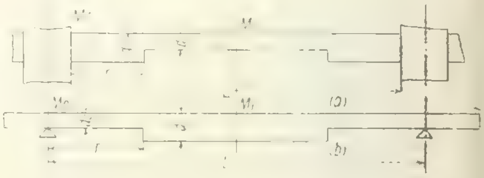

Fig. 1.

Similarly there is obtained for the portion $x=r$ to $x=\frac{L}{2}$,

$$EI_1\frac{\delta y}{\delta x}=-M_0x+\tfrac{1}{4}wLx^2-\tfrac{1}{6}wx^3+M_0\frac{L}{2}-1/24wL^3 \qquad (3)$$

Since the two curves whose differential equations are given by (2) and (3) have a common tangent at the point $x=r$

$$\frac{-M_0r+\frac{1}{4}wLr^2-\frac{1}{6}wr^3}{I_0}=\frac{-M_0r+\frac{1}{4}wLr^2-\frac{1}{6}wr^3-M_0\frac{L}{2}-\frac{wL^3}{24}}{I_1}.$$

Solving for M_0 and substituting $wL=W$, the total load on the beam,

$$M_0 = -\frac{WL}{12}\left[\text{[illegible]}\right] \qquad (4)$$

In Fig 2 the upper [illegible] Eq. 4 for five values of $\frac{I_0}{I_1}$, taking the same [illegible] to vary with $\left(\frac{d_0}{d_1}\right)$ The lower curves are the corresponding plots for the center moment M_1, which is obtained from Eq. 1 by placing $x=\frac{L}{2}$, whence [illegible]

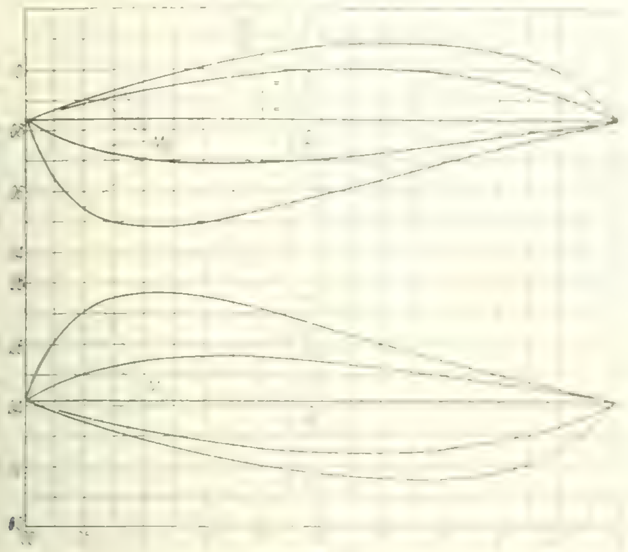

Fig. 2.

(b) *Load P at the Center.*—The expression for moment for this condition of loading is

$$M = M_0 + \tfrac{1}{2}Px$$

and by the same method as was outlined above for (a) the following solution results for the negative moment:

$$M_0 = -\frac{PL}{8}\left[\frac{4\left(\frac{r}{L}\right)^2 + \frac{I_0}{I_1}\left[1-4\left(\frac{r}{L}\right)^2\right]}{2\frac{r}{L} + \frac{I_0}{I_1}\left(1-2\frac{r}{L}\right)}\right] \qquad (5)$$

and

$$M_1 = M_0 + \tfrac{1}{4}PL \qquad (6)$$

The curves in Fig. 3 are plots of equations 5 and 6, the values for M_1 being obtained by reading the coefficients at the left and those for M_0 by reading at the right.

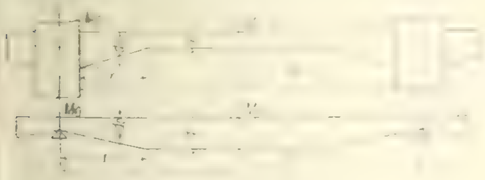

Fig. 4.

II. THE VARYING PORTION TRIANGULAR.

The outline of the beam may be of the form shown in either (a) or (b) of Fig. 4, depending on the relative values of d_0 and d_1, and since only symmetrical loading is considered, it may, as in *I*, be either continuous over an indefinite number of supports or fixed ended, or a combination of the two.

(a) *Uniform Loading.*—For the portion $x=o$ to $x=r$ the depth at the point distant x from the left support is $\left[d_0 - \frac{x}{r}(d_0 - d_1)\right]$, and hence the moment of inertia at the same point is $I_1\left[\frac{d_0}{d_1} - \frac{x}{r}\left(\frac{d_0}{d_1}-1\right)\right]^3$, where [illegible] is the moment of inertia of the central portion of uniform depth d_1.

$$\therefore EI_1\frac{\partial^2 y}{\partial x^2} = \frac{M_0 + \frac{1}{2}wxL - \frac{1}{2}wx^2}{\left[\frac{d_0}{d_1} - \frac{x}{r}\left(\frac{d_0}{d_1}-1\right)\right]} \text{[illegible]}$$

$$\text{[illegible]}$$

where [illegible]

[illegible] $\frac{\delta y}{\ }$ [illegible]

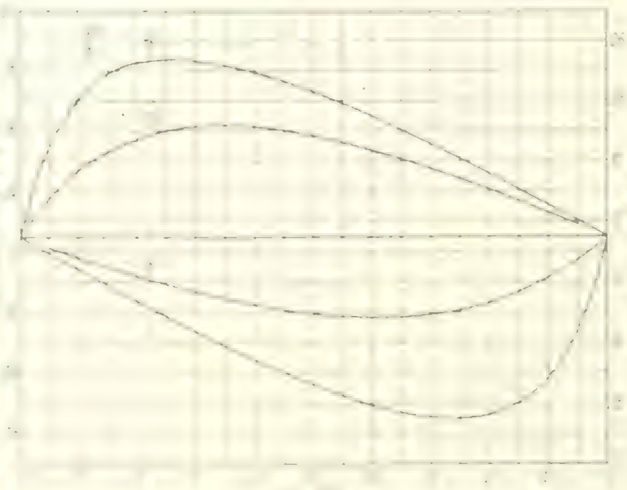

Fig. 3.

which equated to that obtained from the equation for the central portion of the beam with $x=r$ in both expressions, gives the following solution for the negative moment:

$$M_0 = -\frac{WL}{12}\Big[\text{[illegible]}\Big] \qquad (7)$$

The upper curves of Fig. 5 are plots of this equation for a range of values of $\frac{d_0}{d_1}$ and the

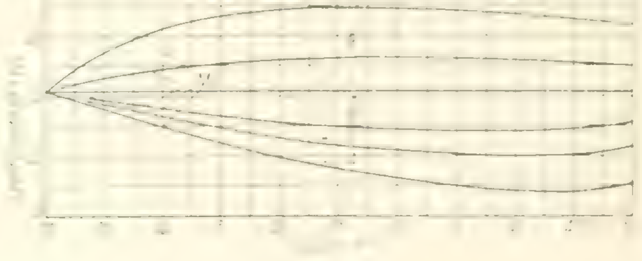

Fig. 5.

lower curves give the corresponding positive moments. For $\frac{d_0}{d_1}=1$ eq. 7 becomes indeterminate, but by successively differentiating numerator and denominator in terms of [illegible] determinate expression is obtained which gives $M_0 = -\frac{WL}{12}$ for $\frac{d_0}{d_1}=1$, the terms in $\frac{r}{L}$ cancelling out of the expression.

[illegible] moment equation now becomes [illegible]

and in a manner similar to that in (a) the [illegible] the support:

$$M_0 = -\frac{PL}{8}\left[\text{[illegible]}\right] \qquad (8)$$

The curves in Fig 6 are plots of this equation, as also of that for the corresponding positive moment, M_1.

Application to Structures.—The above analysis may within its limits be used to find the moments in continuous beam members subject to pure flexure. It can also be used in the analysis of arches supported on columns where the absence of end support precludes the presence of any thrust, an equivalent triangular bracket being substituted for the curved outline. In reinforced concrete the beam with the enlarged section at the support has been much used as a means for decreasing the depth of beam at the center of the span. In the so-called cantilever slab and beam constructions the slab is given a greater depth for a distance on each side of the beams for a similar reason.

By comparing the curves it is seen that the triangular bracket is, for the same amount of material, more effective than the rectangular form in producing any desired change in moments. Cost of construction may, however, materially modify this relative economy. The curves further furnish evidence as to the economic length and depth of bracket that will effect a given increase or decrease in either of the moments. For any one condition of loading the numerical sum of the latter remains constant for all symmetrical changes in the shape of the beam, but the distribution of the moment is greatly influenced by the resulting changes in the rigidity of its different portions and the quantity subject to the greatest relative change is the positive moment for uniform loading.

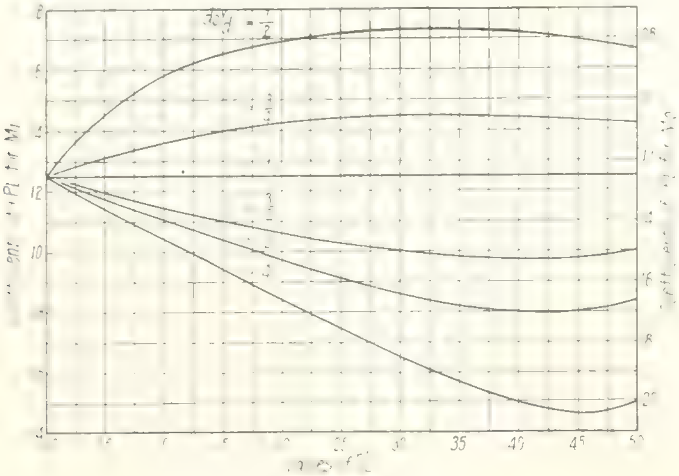

Fig. 6.

III. THE NOTCHED BEAM.

A beam will seldom be notched in practice, but the discussion is here introduced in order to investigate the effects of defects in the beam on the distribution of the moment. A fully continuous or fixed-ended beam is assumed as before (Fig. 7), the distance from the left end to the near side of the notch being *r* and that to the far side *q*. The notch may be cut so as to diminish either the width or the depth of the beam, or both, the moment of inertia of the reduced section being I_1 and that of the uncut section I_0.

(a) *Uniform Loading.*—The general moment equation is,

$$M=M_0+Rx-\tfrac{1}{2}wx^2-EI\frac{\delta^2y}{\delta x^2}$$

where R is the shear at the left support. Three portions of the elastic curve must be considered—namely: that between the left support and the notch, that over the notch, and that to the right of the notch. Integrating the second derivative twice for each of these portions and determining the constants by the conditions that both tangent and deflection equal zero when $x=o$ and when $x=L$ and by the further conditions that the tangents and deflections for the adjacent portions are equal when $x=r$ and when $x=q$, eight conditions result for the determination of six constants of integration and the quantities R and M_0. Solving for the latter,

$$\begin{aligned}R=&\Big\{2wL\left[\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)^2+\frac{2q}{L}-1\right]\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^3-\left(\frac{r}{L}\right)^3\right)+1\right]\\&-wL\left[\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)+1\right]\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^4-4\frac{q}{L}\left(\frac{r}{L}\right)^3+3\left(\frac{r}{L}\right)^4\right)+4\frac{q}{L}-3\right]\Big\}\\&\div\Big\{6\left[\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)^2+\frac{2q}{L}-1\right]\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^2-\left(\frac{r}{L}\right)^2\right)+1\right]\\&-4\left[\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)+1\right]\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^3-3\frac{q}{L}\left(\frac{r}{L}\right)^2+2\left(\frac{r}{L}\right)^3\right)+3\frac{q}{L}-2\right]\Big\}\\M_0=&-\Big\{\frac{RL}{2}\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^2-\left(\frac{r}{L}\right)^2\right)+1\right]-\frac{wL^2}{6}\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^3-\left(\frac{r}{L}\right)^3\right)+1\right]\Big\}\div\Big\{\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)+1\Big\}\end{aligned}\quad\ldots(10)$$

On account of the number of variables no graphic solutions will be made for these equations, but two cases will be considered for each limit in the position of the notch. When the same is at the support and cut half way into the depth of the beam for length of one-twentieth of the span,

$$\frac{r}{L}=0,\quad \frac{q}{L}=.05,\quad \frac{I_0}{I_1}=8.$$

Whence $R=.435\,wl$, a reduction in the total shear of 13 per cent and an increase in the unit shear of 74 per cent, compared with what obtains for a beam of uniform section throughout. The negative moment $M_0=-.04\,wL^2$, a decrease of 52 per cent and an increase in the outer fiber of 92 per cent if the same is assumed to vary as the square of the depth. In comparison, if at any point in a simple beam the depth be decreased by one-half, the outer fiber stress will be increased by 300 per cent. The maximum positive moment occurs at $.444L$ and equals $+.0545wL^2$, and the negative moment at the right support equals $-.105wL$, which represent increments in moments and fiber stresses of 31 and 26 per cent respectively over what obtains for a beam of uniform section. If a similar notch be cut one-half into the width of the beam at the support, $\frac{I_0}{I_1}=2$, and the shear will be reduced to $.478wL$ and the negative moment at the support will be $.07wL^2$, which latter represents a reduction in moment of 16 per cent and an increase in fiber stress of 68 per cent.

If a notch one-twentieth of the span in length be cut one-half into the depth of the beam and be located to the left of its center,

$$\frac{r}{L}=.45,\quad \frac{q}{L}=50,\quad \text{and}\quad \frac{I_0}{I_1}=8$$

The shear at the left support will undergo little change, but the negative moment will be increased 13 per cent and the center moment will be $+.0308wL^2$, against .0417 for a beam of uniform section, a decrease of 26 per cent in moment and an increase of 196 per cent in fiber stress. If the notch were cut into the width of the beam by the same amount the center moment would be decreased 3 per cent and the fiber stress increased 94 per cent. A similar cut in a simple beam would increase the outer fiber stress 100 per cent.

(b) *Load P at the Center.*—The expression for the moment over the left half of the beam is, M_0+Rx, and for the right half,

$$M_0+Rx-P\left(x-\frac{L}{2}\right).$$

Assuming the notch to be wholly in the left half of the beam, the first of the above expressions is integrated twice over the three portions, $x=o$ to $x=r$, $x=r$ to $x=q$, and $x=q$ to $x=\frac{L}{2}$.

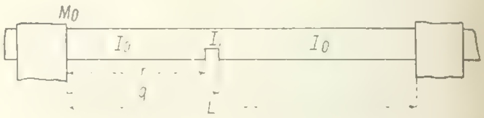

Fig. 7.

The second expression for moment is similarly integrated over the right half of the beam. Determining constants in the manner indicated for (a), the following solution results:

$$\begin{aligned}R=&\frac{P}{4}\Big\{3\left[\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)^2-1+\frac{2q}{L}\right]+\left[\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)+1\right]\left[5-6\frac{q}{L}\right]\Big\}\\&\div\Big\{3\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^2-\left(\frac{r}{L}\right)^2\right)+1\right]\left[\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)^2-1+\frac{2q}{L}\right]\\&-2\left[\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)+1\right]\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^3-3\left(\frac{r}{L}\right)^2\frac{q}{L}+2\left(\frac{r}{L}\right)^3\right)+3\frac{q}{L}-2\right]\Big\}\end{aligned}\quad\ldots(11)$$

$$M_0=-\left[\frac{\frac{RL}{2}\left[\left(\frac{I_0}{I_1}-1\right)\left(\left(\frac{q}{L}\right)^2-\left(\frac{r}{L}\right)^2\right)+1\right]-\frac{PL}{8}}{\left(\frac{I_0}{I_1}-1\right)\left(\frac{q}{L}-\frac{r}{L}\right)+1}\right]\quad\ldots\ldots(12)$$

These equations hold for values of $\frac{q}{L}$ from o to $\frac{L}{2}$. For a notch in the right half of the beam the origin of coordinates should be taken at the right support.

For $\frac{r}{L}=0$, $\frac{q}{L}=.05$, and $\frac{d_0}{d_1}=2$,

$R=.4P$ and $M_0=-.0567PL$, against $.5P$ and $-.125PL$ for a uniform beam. The unit shear will be increased 60 per cent and the outer fiber stress 82 per cent. The center moment will be increased 15 per cent and the moment at the right support 33 per cent. The same notch cut into the width of the beam would decrease the shear at the left support by 6.5 per cent and the moment by 17 per cent, the latter giving an increase in the flexural outer fiber stress of 66 per cent.

For $\frac{r}{L}=.45$, $\frac{q}{L}=.50$, and $\frac{d_0}{d_1}=2$,

$R=.5P$, $M_0=-.154PL$, and the moment at the center is $+.096PL$, a decrease of 23.5 per cent. If the notch were cut into the width of the beam the center moment would be decreased 4 per cent.

It is thus seen that the action of continuity has a favorable influence in preventing failure in continuous beams in its tendency to reduce the moment on the portions which due to defects or overstress have in part lost their rigidity. It should also be noted that there is a second effect in the same direction produced by the lowering of the modulus of elasticity at the points where the material is defective or overstrained. Since, however, these effects do [illegible] ceeded there is little justification for designing [illegible] moment than that present, considering elastic conditions to obtain. The large percentage variation in the positive moment under uniform load as produced by the changes in the rigidity at the support justifies the practice of designing the center portion of a greater moment than the theoretical quantity. It is only with regard to ultimate failure that continuity offers an addition to the factor of safety.

EARTH AND ROCK SECTION

Notes on Surveying Methods for the Construction of a Double Tube Tunnel Under the East River, New York.[*]

The tunnel lies under the East River, between South Ferry, Manhattan and Joralemon St., Brooklyn. It consists of two parallel single-track tubes, of the usual cast-iron ring construction, having an interior diameter of 15 ft. 6 ins.

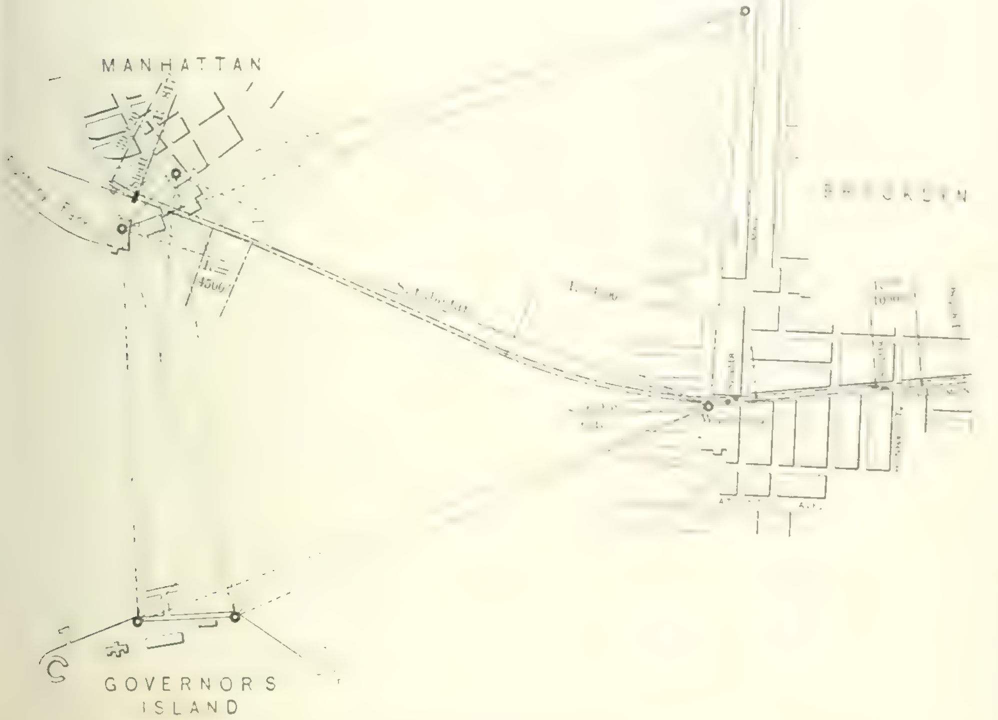

Fig. 1—Triangulation System for Construction Surveys of Double Tube Tunnel under East River, New York.

Between the Manhattan and Brooklyn shafts, a distance of about 6,000 ft., there are three tangents in the tunnel line, the middle or river tangent being joined to the Manhattan and Brooklyn tangents by curves of 4,500 ft. radius. (Fig. 1). The grade on each side is 3.1 per cent, joined at the middle by a short grade of 0.5 sloping up toward Brooklyn. The grade tangents are connected by vertical curves of 20,000-ft. radius. (Fig. 2.)

The intersection of the south tube lines of the Joralemon St. tangent and the Manhattan tangent produced was located on the roof of a dock warehouse at the foot of Joralemon St. It was necessary to determine the exact distance between this intersection and a point of known stationing on the south tube line in Manhattan, and this required a triangulation survey. It was apparent that no base line of suitable length could be laid out in the vicinity that could be measured directly from end to end as one of the sides of the triangulation system. Although the ends could be located on roofs so as to be seen from each other, the measurement had to be made along a broken line. A reconnaissance showed that [illegible] be obtained on the Brooklyn water front north of Joralemon St. The southern teminus was chosen to be the above-mentioned intersection of the south tube lines, and the northern terminus was also located on the roof of a warehouse. Each of these points commanded a view of each other and of the adjoining water fronts of Manhattan and Governor's Island, and, accordingly, were suitable for triangulation stations. In Manhattan, because of intervening buildings, it was found impracticable to locate a triangulation station on the south tube line in the vicinity of the shaft, so that it would be visible from all other stations. On this account two elevated points on the roof of near-by buildings, one on each side of the Manhattan tangent, were chosen as triangulation stations, and carefully referenced to the point of known stationing on the south tube line, which was visible from them. On Governor's Island on the northerly seawall, two triangulation stations were chosen, which marked the extremities of a shorter base used two seasons before in making a preliminary triangulation of the tunnel line.

The foregoing arrangement gave four fairly-well proportioned quadrilaterals, the Brooklyn base forming one common side. In the system were no angles of less than 26° or more than 78°, and the ratio of length of base to the distance sought was about 1:1½. By having four quadrilaterals from which to calculate the coördinates of the Manhattan points, referred to in the Brooklyn base as the axis, it was thought that any material error in the angular work could be detected and this would give a measure of the error to be regarded as unavoidable.

The base line traverse was measured with a 50-ft flat, steel-wire tape, provided with a spring-balance handle containing a level bubble, thermometer, and adjustment for temperature correction. It was marked with niches at each end for use with plumb-bobs The tape was tested for absolute length by comparison with a standard tape of known error, as determined by the Bureau of Standards at Washington. Measurements were made on cloudy days, or during early mornings in the shade, to secure uniform temperature conditions. The line was marked in advance every 50 ft., and paper pads, ruled with a longitudinal line, were weighted down at these points, so as to relieve the head chainman of the distraction of getting line from a transit. Each measurement was made by simultaneous plumbings at the ends of the tape, which was held level. The forward point was marked at the average of a number of trials. For each series of measurements a fresh sheet of the pad was used. With a tape of this kind the difficulty of steady and precise plumbing was such that no individual measurement could be depended on to less than 0.003 ft. or 1 in 17,000. No doubt a better method consists in using a longer tape, supported at short intervals, with a tape-stretcher, and measuring directly, without plumbing, on portable stations, as was done later in connection with other tunnel surveys in New York. However, with care, it was found that the errors were not cumulative, and, in a distance of 2,880 ft. measured in this way, the variation between the mean and the greatest extreme of several measurements was only about 1 in 100,000. The ends of the line measured two different ways, in order to avoid repeating an error. The points on the copings were transferred to the dock level by casting down intersecting lines of sight from three transit set-ups. As a further check, an independent traverse, closing on the same points, was run by a different party in the marginal street back of the warehouses, and this gave a result agreeing with the dock traverse to 1 in 150,000.

The triangulation sights were octagonal pine poles, 2¼ ins. in diameter and 8 ft. high, painted in alternate bands of red and white. While these could be bisected readily, and gave no sensible difficulty from phase, because of the comparatively short range and the cloudy weather selected for instrumental work, it would have been better practice to use higher targets with wide, flat vanes, set alternately at right angles.

The angles were read separately by two observers, with different instruments. These were ordinary engineers' transits, reading to 20" on a 6¼-in. limb. The eight angles of a quadrilateral were measured separately by successive additions upon the limb. The entire angle at a station was also read, as a check on the sum of its components. To avoid bias, the angles were started at random near zero. Turnings were made, accumulating from left to right, until the sum became as nearly as practicable 360°, or its multiple. Reversing the telescope, and setting on the right-hand target, the same number of turnings was made from right to left until the sum was diminished to near the original reading. Both verniers were read at the beginning, at the middle, at intermediate points, and at closing. In case an angle failed to close nearer than an average of 4" to each turning, the result was discarded and the angle was read again. When the third angle of any triangle of the system had been read, the angles were added, and if their sum varied from 180° by more than an average of 5" for each angle, the three angles were read again. The quadrilaterals were tested in like manner. It was found necessary to read over only one triangle, and in this case the trouble was located at a station where the conditions for observing had been less favorable than elsewhere.

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[*] Abstracted from a paper by Frederick C. Noble, Proceedings American Society of Civil Engineers, Vol. XXXVII, p. 1301.

In comparing the observed angles, it was noted that the direct reading of an angle was generally greater by 2″ or 3″ than its value as found by taking the difference between two angles, and that, at the end of an observation, the closing reading was nearly always greater than the first. As this pointed to a small persistent error, it was seen that it would have been a better programme to measure each angle both directly and by its 360° complement, and to take the mean.

The set of observed angles of each quadrilateral was adjusted by the method of logarithmic residuals, based on the principle of least squares, according to Johnson, and using the rigid method of making the side equation correction. The angles read by each observer were adjusted separately. The corrections for spherical excess and reduction to sea level were omitted as insignificant.

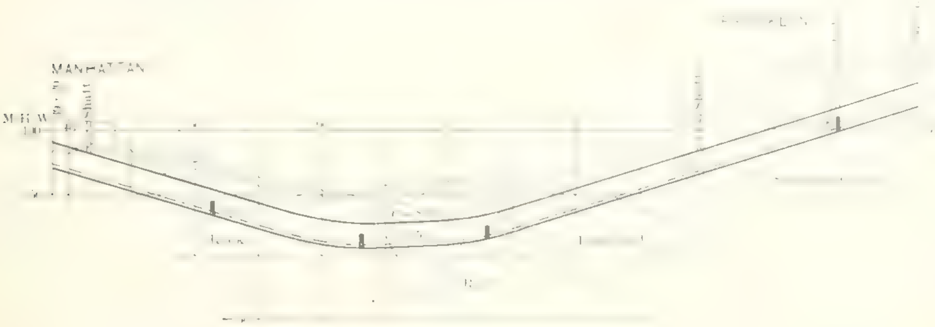

Fig. 2—Profile Showing East River Tunnels and Materials Through Which they Were Driven.

The four quadrilaterals formed four pairs, each with a common triangle. These relations would give rise to additional equations of condition, and the simultaneous adjustment of all four quadrilaterals would be possible, theoretically. However, this was not attempted because the refinement would not pay for the effort, and because it was desired to compute each quadrilateral separately adjusted, so as to gain a practical idea of the effects of error in the angular work.

For the purpose of comparing results, the co-ordinates of the Manhattan and Governor's Island stations, referred to the Brooklyn base, were then computed for each of the four adjusted quadrilaterals of each observer. On plotting to full size it was found that for any point the various positions thus computed fell within the section of the target pole. It was seen that considerable time and labor would have been saved (and with sufficiently accurate results) by using any one quadrilateral, but the advantage of learning in this way the probable extent of errors from all causes was thought to warrant the extra trouble.

The sides of the triangle formed by the two Manhattan triangulation stations and the point of known stationing in Battery Park were then measured, and the co-ordinates of the latter point were computed from those of the other two. The distance triangulated for was then determined. The computed length of the Governor's Island base, about 700 ft., was found to agree with its original measured length within 0.016 ft., or much less than the probable angular error would account for.

The stationing of the Brooklyn intersection of the south tube tangents then being known, base-tape measurements were made from this point to the Brooklyn shafts. All measurements, above and below ground to determine stationing in the tubes, were made with the same kind of tape as that used for measuring the base, and in a similar manner. When the first headings were connected, the measured distance was found to be about 0.02 ft. short of that calculated. The discrepancy was somewhat more than had been expected, but may be adequately accounted for as combining the error in angular work with the error due to the difference in conditions, with the appara[illegible]ween taping in th[illegible] and taping the base line on the surface. Its effect on the results of the surveys for alignment and grade, however, was very slight.

For establishing the Manhattan tangent alignment, there was no point on line in Battery Park, near the shaft, that was high enough to afford a sight to Brooklyn over the intervening ferry-houses. For this purpose, two towers, about 35 ft. high, one on each tube line, were erected about 150 ft. west of the shaft. From these it was possible to look across the river over all obstructions and see targets on the warehouse roof in Brooklyn set on the Manhattan tube lines prolonged. The towers were built as triangulation towers usually are: with an interior tripod of three 8 to 8-in. timbers rigidly bolted together at the top and braced; this being enclosed within, but nowhere touching, a four-post tower braced on all sides and supporting a platform for the observer a little below the top of the tripod.

Line was transferred to the tunnel in the following manner: A transit, mounted on a trivet, was set on the tower tripod on the tube center line, as plumbed up from a hub under the tripod by several reversals of another transit set on the center line a short distance away. The tower transit, fore-sighting on the Brooklyn target, set, by repeated plungings, a point on center line on the surface, about 10 ft. beyond the shaft. On this point a transit was set up, with its plumb-string in the mean position of the several settings, and, fore-sighting on the plumb-string of the tower transit, aligned two plumb-wires suspended in the shaft.

Steel piano wire, 1/50 in. in diameter, was used for this purpose. It was wound on brass reels 9 ins. in diameter. The reels were set, with their axes across the line, on stringers attached to the head-frame posts, high enough to permit sighting on the wires and to fore-sight by merely changing the focus. As the wire left the reel it ran over a small grooved wheel on a threaded axis, turned with a thumb-screw, by which slow lateral adjustment could be given. The wire was kept taut by a 20-lb. weight suspended in a pail of water at the bottom of the shaft.

The wires were shifted laterally until the vertical hair exactly bisected the plumb-string fore-sight and both plumb-wires. When this condition was reached, a transit, set up in the tunnel below, as close to the wires as practicable, was shifted laterally until its vertical hair exactly bisected both wires, and reversing, threw the line forward, setting two or more plummet-lamps hung from verniers reading on graduated brass scales attached to the roof of the tunnel. Resetting on the wires, another set of readings was taken. Two more sets were taken in like manner with telescope reversed. The wires were then shifted and reset by the upper transit, and the previous operations were repeated for four more sets. The whole of the foregoing operations was then repeated, after interchanging transits at top and bottom, turning the water pails containing the weights partly around, shifting the wires, examining them to see that they hung free, and interchanging the members of the party. This work of plumbing the lines down the shaft was usually done on Sundays, when the cages were not running.

At the Brooklyn shafts, the same method was followed, but the first part of the operation was simpler because the warehouse targets could be sighted directly from the surface at the shafts. The base between the wires was about 10 ft. at the Manhattan shaft and 15 ft. at the Brooklyn shafts, and in each case was as long as permitted by the width of the shaft. On account of the shorter base in Manhattan, and the extra operation there in transferring line, opportunity was taken, when the headings were afterward extended west from the shaft, to check the line by plumbing through a vertical 6-in. pipe sunk from the surface to the tunnel at a point on the center line of one of the tubes, about 130 ft. from the shaft. The alignment scales were brass bars, 1 in. wide, ¼ in. thick, and 10 ins. long, graduated to 0.01 ft. They were connected by three flat iron bars to the bolts of the tunnel lining at the roof. (Fig. 3.) The scales were read to 0.002 ft. by a sliding vernier from which a plummet-lamp was suspended

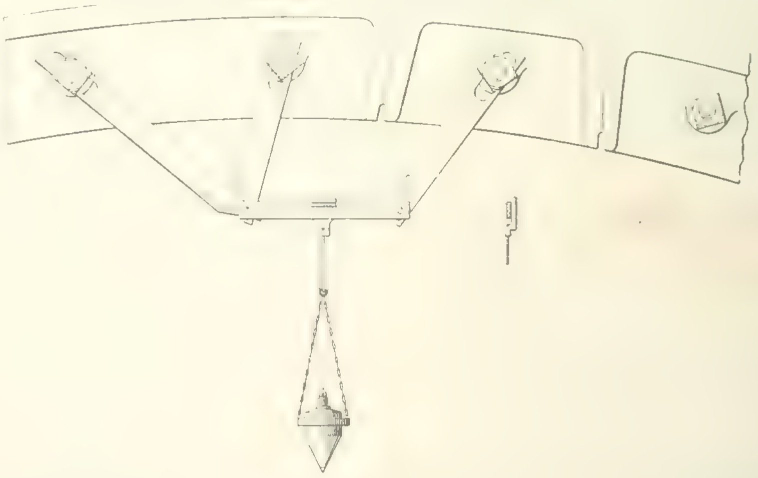

Fig. 3—Sketch Showing Scale and Plummet Lamp Attached to Cast Iron Rings of Tunnel Lining.

The line established on the scales near the shaft, as the mean result of many days' droppings, was produced by repeated runs read on scales set at intervals of about 200 ft. These runs were made by different observers, and using different transits, until mean readings were well established on the advance scales. Where the tube was on a curve, the scales were placed on tangents as long as could be obtained, and usually near points of intersection. The angles at these points were carried forward by repeated turnings on the forward scales.

When it became necessary to carry the line through a lock, the transit was placed in a trivet on a timber wedged across the lock at the forward end, where [illegible] of the bulkhead wall. It was then lined in with the last two scales, the forward one having been located as close as practicable to the lock and a reading was taken [illegible] scale set inside the lock over the outboard door. The lock was then taken in, and, before throwing the line ahead, the paper scale was again read to detect any possible movement due to change in pressure. No trouble was ever experienced on this account, however, and when the bulkheads were advanced the lines thus locked through checked quite satisfactorily with the lines carried through in free air.

To assist in aligning a transit with two given points a very useful device was given by the instrument maker. This consisted of two sliding plates, which were attached between the transit base and the tripod head or trivet, and permitted considerable range of lateral movement by means of a slow-motion screw.

Grade was established between the two sides of the river as follows: Level runs were made from the shafts on each side to benches under the Brooklyn Bridge on the river side of each tower, at which point the river is much narrower than at the tunnel line. Levels were set up on each side, and simultaneous reciprocal readings were taken a number of times. The instruments were then interchanged and the readings repeated. In this way errors due to refraction, curvature, and imperfect adjustment were compensated.

Levels were transferred down shafts by reading on a tape hung in the shaft, and applying the required corrections. To guard against errors of method in using a tape in this way, a test was made by hanging the tape in the stair-well of a high building and comparing elevations obtained thus with those obtained by pegging up and down the stone steps with level and rod. Tunnel benches were generally located on lugs or cross flanges near the lower quarter point of the tube.

Conditions for instrumental work in the tunnel were at times as good as could be desired, but at other times fog, powder smoke, and heat interfered seriously with the work. Much trouble was caused by scales being removed or disturbed, and, where this was likely to occur, they were boxed around. The zero points of scales were referenced to chisel cuts in the flanges of the lining. Where the tubes were in soft material, with one considerably in advance, the passage of the second shield would disturb the scales in the other ube.

When the Brooklyn headings had progressed about 1,000 ft. along the tangent, and part way around the curve to the foot of Joralemon street, caissons were sunk at this point and connected to the tops of the tubes to form new shafts. To locate the corners of each caisson and to guide it during sinking, an underground traverse, tying in the corners of the roof opening, provided for by special segments, was reproduced on the surface. On making the connection the instrumental work checked closely.

These shafts afforded an opportunity to check the survey work thus far run, directly from the surface, and this was done with very satisfactory results. As the headings advanced on either side of the river, cross-connections were made between the tubes at certain points, giving an opportunity to compare the alignment, levels, and measurements carried forward in one tube with those carried forward independently in the other. There were three of these connections: two in rock on the Manhattan side, and one in the rock reef on the Brooklyn side.

The north headings were the first to meet under the river, and this was in December, 906. When the shields were still 90 ft. apart, 6-in. pipe was driven from the Brooklyn to the Manhattan side, by jetting and jacking, and the lines and grade were checked through. The pipe was driven straight enough to afford clear sight from end to end, and, although somewhat off center line, was almost perfectly level, so that readings for grade could be made through it. A transit set up at each end produced the line through the pipe to the [illegible] means the two center lines were found to be exactly parallel and 0.13 ft. apart. Of this discrepancy, about one-fourth could be attributed to the discrepancy of 0.2 ft., before [illegible] ured distance across the river. The grades checked through the pipe within 0.01 ft.

The south headings, which had been keeping some distance behind the corresponding north headings, met in March, 1907. As the south shields were approaching to a junction, it was possible to reference the center line of each heading to the joined and corrected center line of the north tube. This was effected by pushing rods of a measured length through grout holes in the south side of the north tube until they brought up against the shell of the south tube at points which were then located and measured to. In this way the center lines of the south headings were brought together with an error of only 0.01 ft.

The greater part of the instrumental work in the tunnel consisted of giving the contractor lines and grades for the guidance of the shields and rock headings, and for the erection of the cast-iron lining of the tubes. A profile of the center line, taken at the top on the flanges of the rings, was kept posted up on a cross-section sheet in the contractor's office near the shaft, and a similar record was plotted for line. Where the lining was erected behind a shield, the transit and level were used directly for giving working lines and grades, and no simpler method could be devised that would answer the purpose, because it was found that the reaction of the shield jacks would disturb the lining for a considerable distance back. Where the headings were in rock, working points were given by lining in with the eye the flames of two plummet-lamps, hung from the roof by chains of adjustable length, and set so as to indicate grade as well as line. These lamps were made of a short piece of iron pipe, capped at the bottom, reduced at the top for a wick, and provided with a bail. They were suspended from hooks screwed in roof plugs, timber caps, or wedges in caulking recesses, with a piece of sash chain and an adjustable section made of two strips of brass, by which the length of suspension was varied. This arrangement was set by the line and grade party during the day shifts, and was ready for use by the inspectors at all times for erecting the rings, for giving points in rock headings, and for setting roof timbering.

Methods of Raising a Shaft on Timber in Hard Rock.*

The shaft described was raised from the 7th level of the America Mine to the 6th level, where it joined the main shaft. A winze was sunk from the 6th level to the 7th. It was sunk near the main shaft where the least water and best ore was expected, and carried down 125 ft. Drifts were opened from the bottom of the winze both ways at the same time; one to open up the new level, and one going to a point from which the shaft was raised. Here a room was opened up to the full size of the shaft and a sink cut made about 6 ft. deep. The hitches were then cut and the shaft bearers put in, and also the level set of shaft timber. This was lined up and squared with the transit, and the set blocked up solid and covered with 8-ft. lagging or flat timber. Progress thus far is shown by the sketch, Fig. 1.

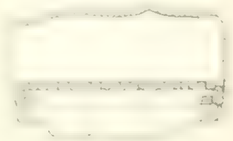

Fig. 1.

The back, or roof, was then blasted out to make room for the station sets of the shaft. After these were in place, room was made and four sets of round timber put in the level station.

The shaft having three compartments, a rock chute was built in the center compartment by spiking plank on the inside of the divids, the plank being extended up to the second set from the top. By having one set open it insures perfect ventilation. The north compartment was used as an air-way and the south compartment for the air pipe, ladder road, and bucket way to hoist drills, tools, timber, etc. The top set was covered with a piece of 6x8-in. maple timber, laid on top of the wall plates (Fig. 2) to protect them in blasting. The shaft was lagged over on top of the flat timber with 10-in. round maple timber, hewn off a little on each end to prevent rolling. A 2-ft. space in the center was left open for the broken rock to pass through into the chute, and for the miners to pass up to their working places. Two pieces of flat timber were put in between the round timber, one at each end, and spiked to prevent the lagging getting out of place when blasting. With the ladder road covered in this manner the danger to the men in going up the shaft after a blast is reduced to the minimum. By tramming enough rock from the chute so that it will hold all the rock from one blast, there is no danger of breaking the air pipes or ladders, and with the chute nearly full all the time it makes the ventilation almost perfect. The farther the shaft was advanced the better was the ventilation.

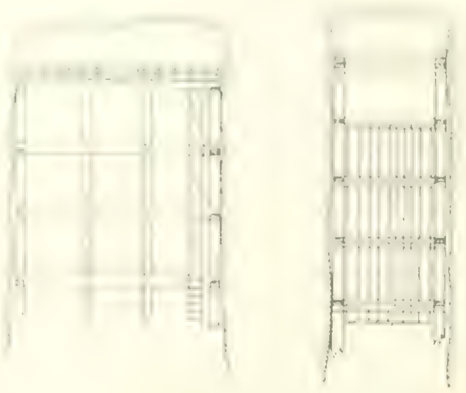

Fig. 2.

At first there were four miners on each shift of 10 hours each, with four hammer drills. The rock being a hard jasper and very blocky, the progress was very unsatisfactory. The hammer drills were taken out and four No. 3 Rand piston drills put in mounted on ordinary 8-ft. shaft bars and clamps. Two more miners were put on each shift, making three men to two drills at each end of the shaft. The rounds consisted of 32 holes drilled 6 ft.

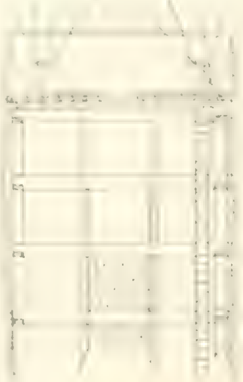

Fig. 3.

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*[illegible] lished in the Proceedings of the Lake Superior [illegible]

fired with fuse; the electric blast was considered too heavy on the timber, the 16 cut holes being fired first. After trimming the back, a set of shaft timber was put in (Fig. 4) and lined up with the station set (all sets being lined from station set), and blocked securely. Flat timber was put on this new set with round maple lagging and secured the same as the last set. The tools were all passed up, and the chute and ladder extended. The remaining 16 holes, eight on each end, were then fired. The cut being already blasted out, these holes are not as heavy and do not affect the timber to any great extent. As much rock as possible from this blast was kept on the lagging, making the best possible protection to the new set of shaft timber from the cut holes of the next round. With this system progress was much more satisfactory, considering the hard blocking nature of the rock. Three sets of timber per week were put in, 10x10-in. shaft timber and 4-ft. studdle, making 4 ft. 10 in. per set.

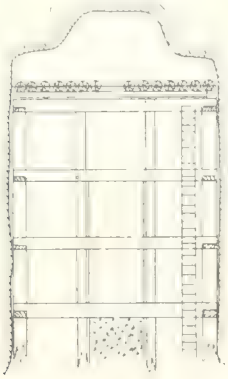

Fig. 4.

On being certain that there was only 6 ft. of rock between the back of the raise and the bottom of the shaft above the last round of holes was drilled accordingly, and let stand until all was ready to fire them. The timber in the raise was extended up as far as possible, so that when the pillar was shot out it would take only one set of timber to fill the space between the new and old shaft timber. The top set in the shaft was then lagged over and blocked up solid, Fig. 5. Then the tools were sent down, the broken rock trammed out of the chute, the chute plank taken out, also the shaft raise cleaned down and the skip sump stripped, and the broken rock was trammed with a bucket on a truck and hoisted up to the level through the winze. After completing the sump the skip runners or guides were put in, the chutes built, the car dumps put in, and everything completed. The pillar was shot out at 11 o'clock Saturday night and on the following Monday at noon all was ready to hoist ore, delaying the hoisting only five hours.

Railway Commissioners to Have an Official Organ.—The National Association of Railway Commissioners—the country-wide organization of state railroad, public service, utility and interstate commerce commissioners—is to have an official organ which will carry monthly a resume of rulings, regulations and decisions of the state and federal transportation regulatory bodies. These data, which will be furnished direct by the various commissions, will cover not only the activities of the governmental supervisory bodies with respect to traffic rates and service, but will also include an official account of orders along other lines, such as safety appliance rules and general operating regulations. Such a publication has been advocated for several years. At the 1911 meeting, however, the matter was finally brought to a head, the issue definitely decided upon and the work of preparation and publication intrusted to The Traffic Service Bureau of Washington and Chicago. The commissioners' journal will be known as "Public Service Regulation." The first number will appear about Jan. 15, 1912.

Method and Cost of Dredging Silt Bars, Muscle Shoals Canal.*

The Muscle Shoals Canal is divided into two parts, locally designated as the upper and lower divisions, which are separated by 8 miles of open river. The upper division consists of two locks connected by a mile of canal, an upper pool 2½ miles long, and a dredged channel below the lower lock. The lower division is composed of 14½ miles of canal and nine locks. Fifteen streams, varying in size, empty directly into the canal, though none of them are very large, yet at every freshet they bring down a certain amount of sediment, and bars are constantly forming in the channel opposite their mouths. At the entrance to both divisions of the canal a large amount of silt also accumulates at every high water, and constant dredging is therefore required to keep it cleaned.

A Bucyrus dredge of the elevator type is employed on the canal for this purpose, having the following general dimensions: Length, 80 ft., width in center, 38 ft.; width at each end, 13 ft.; depth of hull, 6 ft. The sides are circular, being struck with a 68-ft. radius so as to give the above dimensions. Draft when working, 42 ins.

A chain of 24 buckets and 24 links is mounted on a ladder frame 48 ft. long, equipped with truss rods and fittings, rollers with shafts and bearings, top and bottom tumblers, device for holding bucket chain, and hoisting tackle for regulating the depth of cut. This chain of buckets works over the forward end of the boat, and slopes back at an angle of 45° until it reaches an elevation of about 22 ft. above the deck, where the material is discharged into a hopper. This chain of 24 buckets, each having a capacity of 5 cu. ft., makes one complete revolution in 1¼ minutes, discharging 4.44 cu. yds. per revolution, which gives the dredge a capacity of 213 cu. yds. per hour, or 2,130 cu. yds. per day of ten hours.

From the hopper, which is located 15 ft. above the center of the boat, a discharge pipe 26 ins. in diameter and 80 ft. long, suspended by a set of tackle attached to an A-frame, conducts the material that is dumped into the hopper to the place of deposit, which is usually beyond the tow-path. When the material is thick and heavy, a stream from a 6-in. pump is turned into the pipe to keep it flushed out.

The dredge is equipped with a 10x14 in. double cylinder engine making 140 revolutions per minute, developing 40 h. p. The swinging engines are double cylinder, 8-in. diameter and 8-in. stroke. The boiler is of marine type, 40 h. p., 60 ins. in diameter, 17 ft. long, and carries a pressure of 90 lbs. For flushing the discharge pipe a Gordon Duplex steam pump is used, having 12-in. steam cylinders, 10-in. plungers, and 16-in. stroke; capacity, 326 gals. per minute.

This dredge, when in operation, revolves about a center spud, which is 40 ft. from the point of the buckets, thus enabling a cut 80 ft. wide to be made. The depth of the cut varies from 3½ to 10 ft. below the surface of the water.

This dredge has an advantage over other types, as it cleans the entire width of the canal as it moves forward, and deposits the material outside of the canal bank, where it does not have to be handled again. The canal is cleaned with a single cut, with the exception of a few places where two cuts, and sometimes three, have to be made before the material is finally deposited outside the canal bank. This method is a little slow, but it is the best way to handle the work, as it would not be practicable to load the material in scows and tow them outside of the canal. Above Lock A (upper division) three cuts have to be made, and between Locks 1 and 2 (lower division) three cuts are necessary. Another point where some difficulty is experienced in operating the dredge is above Lock 1, where the banks are too high for the discharge pipe to reach over them. To dredge this part of the canal the river has to be caught at a stage that will allow the discharge pipe to clear the bank.

The crew necessary to operate the dredge consists of one dredge runner, one engineman, one fireman, one spudman, and two linemen.

The hull of this dredge was built at Chattanooga, Tenn., by contract, in 1891. The machinery was placed on hull and floated to the canal, where the cabin was built and machinery installed. The total cost of the dredge was approximately $20,000. The hull was rebuilt at the canal by hired labor in 1902 and 1903, at a cost of $10,000, being put back in commission in October, 1903. The dredge has been operated almost continuously since it was rebuilt. A new hull will have to be built within the next year or two, also a complete set of new buckets and links will be required. The machinery is in good condition and will outlast another hull.

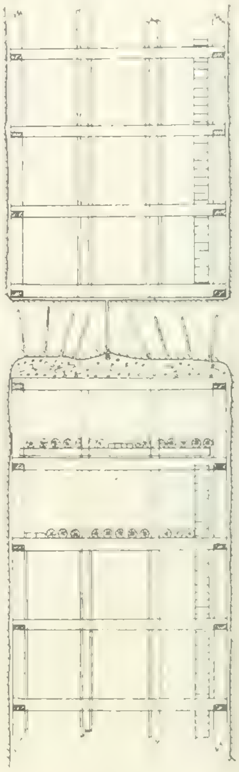

Fig. 5.

The following statement gives the number of cubic yards dredged with cost of labor, material, and field repairs since the dredge was put in commission.

Year.	Cu. yds. dredged.	Unit cost.	Total cost.
1892..........	27,210		
1893..........	38,964		
1894..........	42,800		
1895..........	13,235		
1896..........	5,513		
	127,722	$0.036 +	$ 4,725.54
1897..........	61,550	.039 +	2,440.37
1898..........	62,097	.041 +	2,586.39
1899..........	39,375	.036 +	1,455.44
1900..........	59,200	.038 +	2,288.25
1901..........	18,093	.144 +	2,615.84
1902..........	55,764	.031 +	1,753.96
1903..........	38,123	.028 +	1,102.08
1904..........	100,012	.030	3,000.00
1905..........	105,490	.031 +	3,291.10
1906..........	146,968	.030	4,409.04
1907..........	111,337	.023	2,560.75
1908..........	59,372	.056	3,324.83
1909..........	117,777	.046 +	5,507.43
1910..........	195,982	.036 +	7,065.98
*1911..........	87,731	.036 +	3,174.75
	1,386,593	$0.036 +	$51,302.04

*To Jan. 1, 1911, of fiscal year ending June 30, 1911.

Total cost of labor, material and field repairs	$51,302.04
Cost of rebuilding hull in 1902 and 1903.	10,000.00
Deterioration of plant	10,000.00
Total cost of dredging since 1892	$71,302.04

This gives for the unit cost of dredging 1,386,593 cu. yds. of material, $0.051142 per cubic yard.

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*A paper by A. D. Edwards in "Professional Memoirs" for January-February, 1912.

ROADS AND STREETS SECTION

Cost Data on the Construction of 27 Sand-Clay Roads.

(STAFF ARTICLE.)

During the fiscal year ending June 30, 1911, 27 sand-clay object lesson roads were constructed under the direction of engineers of the U. S. Office of Public Roads. For these roads the Office of Public Roads furnished the engineers to make the necessary surveys, estimates and specifications and to supervise construction, while the local authorities furnished all machinery, material and labor. The following outline of the sand-clay construction work in 1911 has been taken from the recently issued annual report of Logan Waller Page, Director of the Office of Public Roads:

Mobile, Ala.—The work here consisted in grading and building a sand-clay surface on the Lott Road, running northwest from Mobile toward Georgetown. The surrounding country is hilly. The construction commenced on March 15, 1911, and was completed on April 1, 1911. The grade was reduced from a maximum of 6 per cent to 4; 2,450 ft. were graded to a width of 28 ft. in the cuts and 20 ft. in the fills. The work required 360 cu. yds. of excavation, which cost, with an average haul of 200 ft., 38.8 cts. per cu. yd., or a total of $139.84. Four pipe culverts were built at a total cost of $70.56. The surface material was a heavy, sandy clay, and was applied 16 ft. wide, with 1-ft. shoulders, and 6 ins. deep, with a crown of ½ in. to the foot. A split-log drag was the only machine used in finishing the road. The clay was hauled approximately ¼ mile. It had low binding value, but good wearing qualities. The cost of hauling, including loading, was 43.3 cts. per cu. yd., and the cost of spreading, 5.9 cts. per cu. yd., making a total of $349.11 for placing 708.5 cu. yds. The cost of shaping the subgrade was $32, which was 0.7 ct. per sq. yd. for the portion which required shaping. For a distance of 550 ft. no treatment was required, except patching the depressions. The surface was hard, sandy soil. The total length surfaced was 3,000 ft. The total cost to the community was $593.01, which is 11.1 cts. per sq. yd., or $1,042 per mile. Labor for a 9-hr. day cost $1.50, and teams with a driver, $4. The work comprised 5,342 sq. yds.

Vernon, Fla.—Work was begun on Aug. 4, 1910, on the sand-clay road running northeast from Vernon toward Chipley and was finished on Sept. 2, 1910. The road runs through rolling country with a sandy top soil underlaid with clay. One mile of road was graded to a [illegible] 30 ft. wide, while the remainder of the road was surfaced to a width of 16 ft. The earth [illegible] handled with drag and wheel-scrapers, and 2,400 cu. yds were excavated, with an average haul of 200 ft., at a total cost of $362.15, or 15 cts. per cu. yd. The grade was reduced from [illegible] were made in layers about 1 ft. in thickness, which tended to avoid the settling incidental to the use of scrapers. One 4-horse grader borrowed from the town of Chipley was also available for the work. Shaping the subgrade was partly included in the cost of excavation, but in addition $43.12 was expended. Three cypress culverts were built, two of which were log culverts 35 ft. long and cost $34.50. The third culvert was a box culvert 10 ins. by 24 ins. by 35 ft., in which 200 feet b. m. of sawed cypress were used with a total cost of $7. A total of 856 cu. yds. of clay were applied to a depth of 6 ins. and were mixed with the sandy subgrade and compacted by the traffic to a depth of 4 ins. The road was shaped with a crown varying from 1½ ins. to 1 in. to the foot. The total cost of this road to the community was $860.26, which is at the rate of 7.1 cts. per sq. yd. or $860 per mile. These figures were based on labor at the rate of $1.50 per 10-hour day, teams without drivers at $2 per day, and foreman's wages, $3 per day. The work comprised 12,031 sq. yds.

Chalybeate Springs, Ga.—This work consisted in grading and surfacing with sand and clay 2,100 ft. of the Manchester Road, which runs through the hilly land west from Chalybeate Springs. Two hundred feet additional were also graded. Construction commenced on July 22, 1910, and was completed on Aug. 19, 1910. About 1,752 cu. yds. of excavation were required, which reduced the grade from 10 to 7.14 per cent. The cost of excavation was 8.8 cts. per cu. yd., with an average haul of 350 ft. The subsoil is mostly red and mica clay. The work was done with a plow, six wheel scrapers, and a road machine. Excellent sand for the surface was obtained at an average haul of ⅞ mile and was put on 16 ft. wide. The disk harrow was used to mix the sand with the clay subsoil, and, since from stations 0 to 9 the subsoil clay contained an excess of mica, a more suitable clay from other portions of the work, amounting to 88.8 cu. yds., was used. The sand was placed 7 ins. deep and compacted to about 5½ ins. Sand to the amount of 444.4 cu. yds. was used, at a cost of 40.5 cts. per cu. yd., in place. The total cost for harrowing and dragging was $8.15. An oak bridge with a 16-ft. span cost $29.58. The road was finished with 3-ft. shoulders, and its total cost to the community was $650.52, or 17.4 cts. per sq. yd., which is at the rate of $1,561.25 per mile. The work comprised 3,733 sq. yds. The labor on this work was done by prisoners and cost 50 cts. per day of 10 hours. Mule teams cost $1 per day.

Eastman, Ga.—The work of grading and surfacing 6,200 ft. of a 30-ft. roadway was begun here on Dec. 5, 1910, and completed on Jan. 5, 1911. The road was the Rhine Road, running southwest from Eastman. The surrounding country is rolling and the subsoil is alternately sand and clay and was suitable for surfacing. The exacation was done with a loosening plow and small tools, and the hauling was done in slat-bottomed wagons for an average distance of 500 ft. The cost of excavation was 9.3 cts. per cu. yd. for 5,395 cu. yds. The maximum grade was reduced from 10 to 4 per cent. Seven 30-ft. corrugated pipe culverts (either 16, 18, or 24 ins. in diameter) were required at a total cost of $272.94. Spreading the entire surface material cost $74.79, or 1.4 cts. per cu. yd. Two road drags and one road machine were used on the work. The crown was finished ¾ in. to the foot. The labor was done by prisoners and cost 36 cts. per day. Mule teams cost 45 cts. per day. These figures include guards, medical attendance, food, and clothes. The total cost to the community was $818.94, which is at the rate of 4.1 cts. per sq. yd., or $722.92 per mile. The work comprised 20,706 sq. yds.

Lumber City, Ga.—This is a mile section of the McArthur Road, running northeast from the city, and was started on Oct. 6, 1910, and finished on Nov. 16, 1910. The road was graded 24 ft. wide and surfaced with sand-clay construction to a width of 16 ft. It runs through rolling country and has a sandy subsoil throughout. It is an entirely new location and replaces an old winding trail formerly almost impassable in dry weather, especially for motor traffic, on account of the unusually loose character of the sandy topsoil. The road is very nearly straight. A total of 1,538 cu. yds. of excavation was done, for which a road grader was used. The grading cost 11.1 cts. per cu. yd., making a total cost of $171.40. The old grade of 9 per cent was reduced to 4 per cent. A 16-in. corrugated metal culvert, 24 ft. long, was built at station 13. The end walls for this culvert were constructed of brick laid in lime mortar and were 8 ft. by 3 ft. by 1 ft. The culvert, with labor, cost $25.50, and the end walls, $6.20. The subgrade was shaped at a cost of 0.8 ct. per sq. yd., making a total of

TABLE I.—SOME DETAILS OF THE CONSTRUCTION OF 23 SAND-CLAY OBJECT LESSON ROADS.

Place.	Length [illegible] ft.	Width surfaced, ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] day.
Mobile, Ala.	3,000	16	360	38.8		708	43.3	5.9	6.5	11.1	$[illegible]	$1.00[1]
Vernon, Fla.	[illegible]	16[2]	2,400		6	[illegible]			3.4	7.1	1.50	[illegible]
Chalybeate Springs, Ga.	2,100	16	[illegible]	[illegible]		[illegible]				17.4	.50[4]	1.00[5]
Eastman, Ga.	[illegible]	30	5,395	9.3		...		1.4		4.1	.36[4]	[illegible]
Lumber City, Ga.	5,280	16	1,538	11.1		2,115	26.5	[illegible]	[illegible]	10.6	1.25[6]	.75[7]
Reidsville, Ga.	[illegible]	[illegible]				[illegible]			3.8	4.75	.30[4]	1.30[8]
Washington, Ga.		15				1,640		.26	1.2	2.3	.30[4]	1.20[8]
Mullinville, Kan.	[illegible]	[illegible]	3,635	11.2	12	1,758	31.4	1 6		[illegible]	1.80[1]	3.60[1]
Wichita, Kan.	[illegible]	16	[illegible]	15.5		950			7.6	14.2	2.00[9]	[illegible]
Coffeeville, Miss.	[illegible]		3,410	[illegible]		148	[illegible]	[illegible]		[illegible]	1.00	2.50
Gulfport, Miss.	[illegible]	[illegible]	4,500	35		1,759		[illegible]		24.3	1.00	3.00
Elizabeth City, N. C.	[illegible]		1,208	21.6						3.31	.60[4]	1.00
Morehead City, N. C.	1,200	14			6	311	30.3	2.1	6.6	11.9		
Williamston, N. C.	[illegible]	[illegible]	3,471	23.1		622	39.4	1.6	4.8	27.5	1.00	2.50[3]
Wilson, N. C.	[illegible]	16	1,387	15.7			62.4[10]		10.7	16	.60[4]	4.00
Carnegie, Okla.	[illegible]	14	3,352	8.8		3,156	25.5	3.22	10.8	20.34	1.60[9]	2.80[9]
Cordell, Okla.	4,500	16				2,666			2	5.8	.18[4][1]	.85[1]
Aiken, S. C.	[illegible]	30	315	14		1,000		.04		2.3	.40[4]	1.00
Allendale, S. C.	[illegible]		350	12	10					33.6	.50[4]	[illegible]
Kingstree, S. C.	[illegible]	20				345	23.5	1.8	5.7	6.3	5.00[11]	...
Waterloo, S. C.	[illegible]		3,654	6.06		1,630	20.2	1.4		10.28	.50[4]	1.00
Center, Tex.	[illegible]	[illegible]	[illegible]				23.2	1.4		[illegible]	[illegible]	3.50
Livingston, Tex.	1,100	12	184			500	[illegible]	2.0		15.00	1.50	3.50

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[1] 9-hour day. [2] 3,820 ft., 16 ft.; 1,[illegible] ft., [illegible] ft. [3] With[illegible] [illegible] teams. [illegible] labor, [illegible] cts. for convicts. [illegible] Prison camp teams. [8] County teams. [9] For 8-hour day. [10] Include stripp[illegible] [illegible] per hour for teams. [illegible] in. to 12 in.

$73.03. The material used for surfacing was a natural mixture of sand and clay of good grade, and 2,115 cu. yds. of this material were used, the average haul to the road being 3,000 ft. The surfacing was placed 8 ins. thick and compacted to 6 ins. The unit cost of the surfacing material was as follows: Loading at the pit, 14 cts. per cu. yd.; hauling, 12½ cts. per cu. yd.; and spreading, 4.8 cts. per cu. yd. Incidentals amounted to $62.29. The total cost of the mile of road to the community was, therefore, $1,000.90, which is at the rate of 10.6 cts. per sq. yd. An interesting feature of this work was the teams furnished free of cost by the citizens. The labor costs were $1.25 per 10-hour day for free labor and 60 cts. per day for convicts. Prison camp teams cost 75 cts. per day. The work comprised 9,387 sq. yds.

Reidsville, Ga.—Work began here on June 1, 1911, and was finished on July 1, 1911. The road is the Claxton Road, running through slightly rolling country northeast from Reidsville. One mile of road underlaid with sand and sandy loam was graded 30 ft. wide and surfaced 16 ft. wide with sand-clay construction, and, with 4-ft. shoulders, cost $449.15. The work was done with a road machine, plow, wagons, and small tools. Two corrugated metal pipe culverts were built, one 18 ins. by 22 ft. and one 15 ins. by 30 ft., at a cost of $26.70 and $32.10, respectively. About 2,060 cu. yds. of clay and 810 cu. yds. of sand were used, the unit costs of which were as follows: Stripping the clay pits, 6.7 cts. per cu. yd.; loosening, 1.33 cts.; loading, 1.3 cts.; hauling to the road, 5.5 cts.; spreading, 0.3 ct.; loading the sand, 0.9 ct.; hauling to the road, 4.3 cts.; and spreading, 0.3 ct. Further costs were: Shaping the roadbed, 30 ft. wide, $25.31; harrowing, $3.64; foreman, $49.50; guards for prisoners, $69; and clearing the right of way, $9. The total cost of this road to the community was at the rate of 4.75 cts. per sq. yd., or $449 per mile. These figures are based on a labor cost of 30 cts. per 10-hour day for prisoners, $1.30 for county teams, $3 for foreman, and $1.50 for guards. The work comprised 9,387 sq. yds.

Washington, Ga.—This was the Lexington Road, running northwest toward Lexington. The work began here on May 15, 1911, and was completed on May 23, 1911. The road runs through hilly land and the subsoil is red clay. The road had been graded and cross-drains had been built by the county. About 1,640 cu. yds. of topsoil were obtained from adjacent fields located along the road. The material contained some stone which was raked out after dumping and kept in the bottom of the surface course. The surfacing was spread 8 ins. thick and compacted by triffic to 6 ins. It was made 15 ft. wide with 4½-ft. shoulders. The costs on this work were as follows: Surface material, $37.50; hauling for 1,800 ft., 4.32 cts. per cu. yd.; loading, 0.83 loading, 0.83 cts. per cu. yd.; spreading, 0.26 cts. per cu. yd.; shaping the subgrade with a road machine, $5.85; shaping with a drag, $1.80; foreman's wages, $21.25; and guards' wages, $22.50. The total cost of the road was $177.55, which is at the rate of 2.3 cts. per sq. yd., or $204 per mile. Prison labor cost 30 cts. per day of 10 hours; teams owned by the county, $1.20 per day; foreman, $2.50; and guards, $1.50 per day. The work comprised 7,607 sq. yds.

Mullinville, Kans.—Work on the road running north from Mullinville toward Kingsley was started on Oct. 17, 1910, and completed on Nov. 25, 1910. The adjacent land is hilly and the soil sandy. A total of 3,635 cu. yds. of excavation were required, with a maximum cut of 2½ ft. and an average haul of 223 ft. The maximum grade was reduced from 11 to 6 per cent, and a total length of 4,460 ft. was graded. This excavation cost 11.2 cts. per cu. yd. The road was graded 24 ft. wide. It was prepared for a distance of 3,640 ft. for surfacing 14 ft. wide, and on this were placed 1,758 cu. yds. of clay hauled from a pit an average distance of 2,340 ft. The cost of hauling this clay was 31.4 cts. per cu. yd., and the cost of spreading it, 1.6 cts. per cu. yd. The clay was placed on the roadbed 12 ins. deep at the center and 10 ins. at the sides, and was thoroughly mixed and compacted by traffic to a depth of 10 ins. at the center and 8 ins. at the sides, with a crown of ½ in. to the foot. The roadway was given 5-ft. shoulders, making a total finished width of 24 ft. Other items of expense on this road were: Shaping the subgrade, $23.20, and stripping the clay pits, $41.70. The total cost of the road to the community was $1,045, which is at the rate of 18.4 cts. per sq. yd. for the finished surface, or $1,425.75 per mile. Labor cost $1.80 for a 9-hour day, and teams, with driver, $3.60 per day. The work comprised 5,662 sq. yds.

Wichita, Kans.—The work here consisted in the improvement of 13th St., running west from the city for a distance of 2,640 ft. The adjacent land varies from level to a gently rolling surface with a sandy-loam subsoil. The work was begun on Sept. 16, 1910, and was completed on Oct. 10, 1910. Excavations were made to the extent of 950 cu. yds. and the maximum grade was reduced from 4 to 2 per cent. The excavation cost 15.5 cts. per cu. yd., with an average haul of 400 ft. The road was graded to a width of 36 ft. and a 16-ft. subgrade was shaped for surfacing, at a cost of 6 cts. per sq. yd. One 18-in. corrugated metal culvert, 32 ft. long, cost $15.20 complete. A total of 950 cu. yds. of sand and gumbo was hauled for an average of 5,000 and 1,160 ft., respectively. The sand was from the bed of the Big Arkansas River, while the gumbo was obtained from draws adjacent to the work. This material cost as follows: Hauling and spreading, per. cu. yd., 36.2 cts.; mixing, $9.25; and rolling with a 1½-ton roller, $4.50. The cementing power of the gumbo varied. For 250 ft. the gumbo was spread 6 ins. deep and 4 ins. of sand were mixed with it; the remainder of the surfacing was done with 9 ins. of gumbo and from 1 to 2 ins. of sand. About 400 ft. of the road required no surface treatment. The teaming and rolling compacted the surface material to a thickness of 7 ins. The machinery used on this work included 2 road graders, 1 drag, 6 drag scrapers, and 8 wheel scrapers. Labor cost $2 per 8-hour day and teams $4 and $4.50. The total cost to the community was $667.45, which was at the rate of 14.2 cts. per sq. yd., or $1,334.90 per mile. The work comprised 4,693 sq. yds.

Coffeyville, Miss.—This is a section 1 mile long of the Grenarda Road, running west toward Grenarda. The work was begun on Feb. 3, 1911, and finished on April 13, 1911. The road runs through slightly hilly country and is underlaid with sand and clay. Seven lines of cross drains of 15 and 24-in. vitrified pipe were required. Each pipe culvert was finished with end walls of brick laid in cement mortar. A road machine and 8 drag scrapers were used in the excavation, which amounted to 3,410 cu. yds. and cost 20.8 cts. per cu. yd. The grade was reduced from 14.2 per cent to 7.8 per cent, and the road was graded 24 ft. wide for the first ½ mile and 22 ft. wide for the remainder of the distance. The average length of the haul for the excavation was 200 ft. One hundred and forty-eight cu. yds. of sand were hauled at a cost of 42 cts. per cu. yd. and spread on the road at a cost of 4.7 cts. per cu. yd. The sand and clay were mixed with a harrow. The cost of the items entering into the construction of the culverts was as follows: 107½ ft. of 15-in. vitrified pipe, $29.02; 125 lin. ft. of 24-in. vitrified pipe, $93.75; labor and hauling, $22.15; 8,400 brick, $54.60; 60 sacks of cement, $30; hauling, $8.45; and masons and helpers, $51.70. The total cost of this road to the community was $1,289.41, which is at the rate of 13.7 cts. per sq. yd. The labor cost $1 per day of 10 hours and teams $2.50 per day. The work comprised 9,387 sq. yds.

Gulfport, Miss.—The work was commenced here on Oct. 6, 1910, and was completed on Nov. 12, 1910. The road is the Harrison County race track, ½ mile in length, and was graded and surfaced with sand clay 50 ft. wide. The surrounding country is level and swampy. The subsoil presented swamp conditions with heavy vegetable mat, hummocks and sand. One 12-in. box culvert was built to drain the oval within the track. Earth was excavated to the amount of 4,500 cu. yds. at a contract price of 35 cts. per cu. yd., making a total of $1,575. Shaping the subgrade cost $60.85. The surface was finished with a 0.5 per cent grade. The grading was done with 1 grader, 4 drag scrapers, 3 wheel scrapers, and wagons. It required 1,759 cu. yds. of clay, which was obtained at Soucier, 19 miles north of Gulfport. The clay was taken out with a steam shovel and loaded on the cars, and a total of 99 cars were used at cost, on the siding, of $891. The charge for the clay was $4 per car, plus $5 for freight. Hauling from the car to the road cost 49.5 cts. per cu. yd., and spreading 24.4 cts. per cu. yd., making a total cost of the material, per cu. yd. in place, of $1.25. The track was finished with a drag and rolled with a 7-ton horse roller. Rolling and dressing cost $117. The total cost to the community was $3,560, which is at the rate of 24.3 cts. per sq. yd., or $7,120 per mile for a 50-ft. road, which is equivalent to $2,278 per mile for a 16-ft. road. These costs are based on labor at $1 per day of 10 hours, and on teams without drivers, at $3 per day. The work comprised 14,667 sq. yds.

Elizabeth City, N. C.—The work commenced here on July 5, 1910, and was finished on July 28, 1910. The road improved was the Norfolk Stage Road, running northeast from Elizabeth City toward Norfolk. The adjacent land is generally level, with some bottom land. The subsoil was loamy sand and fine sand with silt. The road improved was 1 mile in length, graded to a width of 30 ft. in the cuts and 24 ft. in the fills. One steel girder, 1 dump wagon, and four 2-wheel dump carts were furnished by the local authorities. No clay suitable for sand-clay construction could be found in this vicinity, although an extensive search was made, and consequently the material found on the road was used to construct the surface, with the exception of a section 200 ft. long, which was spread with heavy silt-bearing sand hauled about ¾ mile. This treatment was somewhat in the nature of an experiment. Two wooden culverts were built at a cost of $50.20. The total amount of excavation was 1,208 cu. yds. and cost 21.6 cts. per cu. yd. The grade was reduced from 3 per cent to a maximum of 1 per cent. The total cost of the road to the community was $311.20, which is at the rate of 3.31 cts. per sq. yd. for the finished surface, or $311.20 per mile. Prison labor cost 60 cts. per 10-hour day per man, and teams cost $1 per day. The work comprised 9,400 sq. yds.

Morehead City, N. C.—Work began at Morehead City on June 12, 1911, and was completed on June 25, 1911. The road is the Mansfield Road, running west toward Newbern, and extends through level country with a very sandy subsoil. A total of 1,200 ft. was graded 30 ft. wide and surfaced with sand clay 14 ft. wide, with 8-ft. shoulders. The maximum grade was reduced from 1 per cent to 0.5 per cent, and the work was done with a 2-horse road machine, carts, and small tools. The charge for this grading is included in the surfacing of the subgrade, which cost $36.20. A total of 311 cu. yds. of clay were hauled from a pit for an average of ⅔s mile, and were spread to a depth of 6 ins. The road was finished with a crown of ¾ in. to the ft. The unit costs of the clay were: Loading, 11 cts. per cu. yd.; hauling, 19.3 cts.; spreading, 2.1 cts.; and stripping the clay pit and constructing the approach, $23.20. The total cost of the work was $223.45, which is at the rate of 11.9 cts. per sq. yd., or $982.08 per mile. The work comprised 1,866 sq. yds.

Williamston, N. C.—This work was begun on April 17, 1911, and was finished on May 24, 1911. The improvement is a section of the Hamilton Road running northwest and lies in a rolling country with a soft, sandy subsoil. A distance of 4,000 ft. was graded, 3,000 ft. of which were surfaced with sand clay to a width of 16 ft., and finished with 4-ft. shoulders. It was necessary to excavate 3,471.2 cu. yds. at a cost of 23.1 cts. per cu. yd. This work was done with a grader and five drag slips. One reinforced-concrete culvert, 2 ft. 2 ins. by 2 ft. [illegible] was built at a cost of $100 [illegible] for a wooden deck culvert cost $227.56. Two vitrified-clay pipe culverts of 18-in. pipe, 25 ft. long, and a 12-in. pipe, 26 ft. long, cost $50.77. The pipe culverts were finished with brick end walls. There were 622 cu. yds. of surface material hauled at a cost of 39.4 cts. per cu. yd. and spread for 1.6 cts. per cu. yd.; shaping the subgrade cost, $32.75; and the total cost of the road was $1,468.81, which is 27.5 cts. per sq. yd., or at the rate of $2,584 per mile. These figures apply both to the 5,333 sq. yds. surfaced and to 1,000 ft. of unsurfaced grading. They are based on labor at $1 per day of 10 hours, and teams, without drivers at $2.50 per day.

Wilson, N. C.—Work began at Wilson, N. C., on May 17, 1911, and was completed on June 23, 1911. The road is the Raleigh Road, running west through comparatively level country and underlaid with clay. About 4,300 ft. were graded to a width of 34 ft. in the cuts and 26 ft. in the fills, and surfaced with 16 ft. of sand-clay mixture and 5-ft. shoulders. A 2-horse grader was used for this work. Three tile culverts were required, two 12 ins. and one 15 ins. in size. These culverts were finished with brick end walls and, in addition, 1 culvert was repaired, lengthened with 6 ft. of 15-in. tile, and brick end walls were built; 1,387 cu. yds. of earth were excavated, of which 420 cu. yds. were hauled an average distance of 310 ft. The excavation cost 15.7 cts. per cu. yd., or a total of $218.68. The grade was reduced 0.5 per cent from a maximum of 5 per cent. The surfacing material was obtained from a pit 1½ miles from the road, and cost as follows: Stripping and loading, 13.3 cts. per cu. yd.; hauling, 49.1 cts. per cu. yd.; and spreading, 0.8 ct. per cu. yd. This material was mixed with a disk harrow to a depth of 8 ins. at a cost of $29.65. Additional items of cost on this road were as follows: Preparing the subgrade, $8.35, final shaping and incidentals, $27.56; drainage ditches, $18.97; end walls for the culverts, $33.02; culvert pipe, $97.40; and labor for this, $3.29. The total cost of the road to the community was $1,228.29, which is at the rate of 16 cts. per sq. yd., or $1,508 per mile. Prison labor cost 60 cts. per 10-hour day; 1-horse teams, owned by the county, 60 cts.; 2-horse teams, $4; and 4-horse teams, $8 per day. The work comprised 7,644 sq. yds.

Carnegie, Okla.—The road runs north toward Alfalfa, through rolling country, for a distance of 9,800 ft., and the subsoil is alternatively sand, loam, clay, and mixtures of these in varying proportions. The work was commenced on March 6, 1911, and was completed on April 28, 1911. The entire job was let to a contractor on a unit price basis. The road was graded to a width of 24 ft. and all but 1,000 ft. was surfaced 14 ft. wide with a sand-clay mixture. Grading amounting to 3,352 cu. yds. was done with a road grader, 9 wheel scrapers, and 8 slips. The grade was reduced from 8 per cent to 5 per cent. The average excavation haul was 200 ft., and the cost was 8.8 cts. per cu. yd. Five concrete culverts and 1 concrete bridge were constructed. The contract price for the bridge, which was 12 ft. by 16 ft., was $474. Additional unit costs on this work were: Shaping the subgrade, 0.27 cts. per sq. yd.; concrete for the culverts, $682.82; loading 3,156 cu. yds. of surfacing material at 3.4 cts. per cu. yd., $112.40; hauling, at 22.1 cts. per cu. yd., $698; spreading, at 3.22 cts. per yd., $104.80; rolling, $38.25; ditches, $4.40; miscellaneous items, $135.55; superintendence, $273; and repairs and incidentals, $23.80, making an actual total cost of $2,407.27, except for the transportation of the contractor's outfit. The contractor was paid $2,786.61. The 8,800 sq. yds. of surfaced road cost 20.34 cts. per sq. yd., which includes the 1,000 ft. graded, but not surfaced. This is at the rate of $1,912 per mile. The labor cost $1.60 for an 8-hour day, and teams, $2.80 per day.

Cordell, Okla.—This improvement was on the State Road, running west toward the county line, and was 5,000 ft. long, of which 4,500 ft. were surfaced 16 ft. wide with sand-clay construction. The work began on May 5, 1911, and was completed on May 13, 1911. The road runs through level country and is underlaid with black loam and sand. It was necessary to excavate 500 cu. yds. of material at a cost of $12.10, and shaping the road cost $9.45. A sand-clay mixture was spread over an extent of 2,666 cu. yds. to a depth of 6 ins. Excavating, hauling, and spreading the material cost $160; and charges for superintendence, guards, warden, sergeant, and the camp amounted to $246.36. The total cost of the road was $466.32, which is 5.8 cts. per sq. yd., or at the rate of $546 per mile; 8,000 sq. yds. of finished surface were improved, together with a portion graded, but not surfaced. Prison labor cost 18 cts. and teams 85 cts. per day of 9 hours.

Aiken, S. C.—Construction began here on Oct. 18, 1910, and was completed on Nov. 10, 1910. The work consisted in surfacing with a sand-clay mixture a section 5,255 ft. long and 30 ft. wide, on the Montmorency Road, running northeast from Aiken city limits. About 315 cu. yds. of earth were excavated at a cost of 14 cts. per cu. yd., and 1,000 cu. yds. of clay were removed from ditches at the sides of the road at a cost of 11.1 cts. per cu. yd. This clay material was used for surfacing and cost 0.04 ct. per cu. yd. to spread. The clay and sand were mixed with a disk harrow and the road was rolled with a 2-ton horse roller. The surface was given a crown of ½ in. to the ft. and was compacted to 8 ins. in depth. One 10-in. vitrified pipe culvert, 30 ft. long, with 5-ft. ends, was built at a cost of $28.86. The maximum grade was reduced from 10 per cent on the old road to 1 per cent on the new road. The surrounding country is level and the subsoil is mostly sand, intermixed with clay, and worked up with the material from the side ditch into a good surface. The following machinery was available for this work: One road machine, one cutaway disk harrow, one spike-tooth harrow, one hardpan plow, one side-hill plow, one split-log drag, and one 2-ton roller. Among the items of cost on this work were: Back-filling the side ditch, $40.07; plowing, harrowing, and grading, $81.42; grading and clearing, $28.92; and rolling, $15.98. The total cost to the community was $391.10, based upon prison labor at 40 cts. per day and double teams, with driver, at $1 per day. This is at the rate of 2.33 cts. per sq. yd., or $391.10 per mile. The work comprised 16,750 sq. yds.

Allendale, S. C.—The work commenced here on Oct. 29, 1910, and was completed on Nov. 16, 1910. About 3,070 ft. of the Matthews Bluff Road, running southwest from Allendale, were graded and surfaced with a sand-clay mixture to an average width of 22 ft. It was necessary to excavate 350 cu. yds., and this reduced the maximum grade from 4 to 1 per cent. The average excavation haul was 1,000 ft., and the cost per cu. yd. was 12 cts. The total cost of shaping the subgrade was $6.50. The road runs through level country and the soil is very sandy. Below the sand is found a layer of clay, which was excavated from the ditches and placed on the road at a cost of $132.75. Mixing the clay with the sand cost $35.50, and backfilling the ditches with surface sand cost $19. The depth of the surfacing was 10 ins., but it was compacted by traffic to 8 ins. The road was given a crown of ½ in. to the ft. The machinery used on this job was 1 road grader, 4 wheel scrapers, 1 cutaway disk harrow, 1 clay plow, 1 turning plow, and 1 spike-tooth harrow. The total cost of this road to the community was $252.75, which is at the rate of 33.6 cts. per sq. yd., or $435 per mile. These figures are based on prison labor at 50 cts. per day and county teams at 75 cts. per day. The work comprised 7,845 sq. yds.

Darlington, S. C.—The work at Darlington, S. C., was begun on June 27, 1910, and finished on July 9, 1910. It thus falls partly within the preceding fiscal year. The road was the Darlington-Florence Road, and was graded to a length of 3,780 ft. an average of 25 ft. wide. All but the last 100 ft. was surfaced 20 ft. wide with sand-clay construction, of which 2,045 cu. yds. were used. This material was obtained near the road and cost $127.25. Four pipe culverts were built at a cost of $52.70. Clearing, grubbing, and grading the road cost $90. The total cost of the road to the community was $269.95, which is at the rate of 3.3 cts. per sq. yd., or $387 per mile. Prison labor cost 50 cts. per 10-hour day and mule teams 75 cts. per day. The work comprised 8,178 sq. yds.

Hampton, S. C.—For a distance of 500 ft. on the Estelle Road, running south from Hampton, a sand-clay wearing surface was built. The construction commenced on Aug. 13, 1910, and was completed on Aug. 17, 1910. In addition to the sand-clay surfacing, 1,000 ft. were graded 30 ft. wide. The local authorities furnished a grading machine, two wheel scrapers, and four 2-wheel dump carts. No grading was done, but the road was [illegible] yds. of sand-clay material, costing 19 cts. per cu. yd. in place, were used. A force of 23 prisoners, costing 35 cts. per day per man for a working day of 12 hours, was used on this road. Teams cost 50 cts. per day. The total cost of the road to the community was $54, which is at the rate of 6.1 cts. per sq. yd., or $429.10 per mile. This expenditure includes the unsurfaced grading. The work comprised 889 sq. yds.

Kingstree, S. C.—This road is the Johnsonville Road, running east toward Johnsonville. The road is 800 ft. long, runs through level country, and is underlaid with sand. The work commenced on April 6, 1911, and was finished on April 13, 1911. No excavating was done, but a sand-clay mixture was applied for a width of 20 ft., with 2½-ft. shoulders. Clay to the amount of 345 cu. yds. was dug from a pit at a cost of 3½ cts. per cu. yd., hauled an average distance of ½ mile for 23.5 cts. per cu. yd., and spread for 1.8 cts. per cu. yd. Shaping and mixing cost $6.20, while spreading the sand and dragging the road cost $5.90. The total cost of the road was, therefore, $112.10, which is at the rate of 6.3 cts. per sq. yd., or $739 per mile. This road was constructed for the purpose of demonstrating the best methods for securing a proper sand-clay mixture by the use of the disk harrow and in order to introduce the use of the split-log drag. The above figures were based on prison labor at 5 cts. per hour, teams at 10 cts. per hour, and foreman at 20 cts. per hour. The work comprised 1,777 sq. yds.

Kingstree, S. C.—Work on surfacing with a sand-clay mixture 400 ft. of the Charleston Road, running north toward Lake City, began here on April 10, 1911, and ended on April 13, 1911. The road was finished to a width of 20 ft., with 2½-ft. shoulders, at a cost of $41.80. The cost was 47 cts. per sq. yd., or at the rate of $552 per mile. The work comprised 885 sq. yds. Prison labor on this work cost 45 cts. per day of nine hours; foreman, $1.80; and teams, 90 cts. per day. This section of road was built for the purpose of demonstrating the method of mixing sand and clay by using the disk harrow and also in order to introduce the use of a drag. No excavation was required.

Waterloo, S. C.—This road is the St. George Road, running northwest toward St. George for 1 mile. The work commenced on Sept. 20, 1910, and was completed on Nov. 25, 1910. The surrounding country is mostly level or slightly rolling. The subsoil was partly sand and partly clay. A total of 3,654 cu. yds. of earth excavated, and this reduced the grade from 5 per cent to 2.86 per cent. The cost was 6.06 cts. per cu. yd., making the total cost $221.55. The work was done with a road machine, slip scrapers, 5 dump wagons, a steel road drag, and a disk harrow. Two galvanized-iron pipe culverts were installed, one 18 ins. in diameter and 33 ft. in length, costing $43.65, and one 20 ins. in diameter, 33 ft. long, costing $48.60. The end walls were made of brick, laid in cement mortar, and cost $6.70. Shaping the subgrade cost $69.93. In surfacing this road 1,630 cu. yds. of clay, which were obtained from a pit ½ mile distant, were used. The costs of this clay were as follows: Stripping the pit, 13.5 cts. per cu. yd.; loading, 7.8 cts. per cu. yd.; hauling, 12.4 cts. per cu. yd.; and spreading, 1.4 cts. per cu. yd. To obtain the sand-clay mixture, sand costing $17.11 was applied. Harrowing and dragging the road and trimming the shoulders cost $53.25. The road was graded 30 ft. in width and the surfacing material was applied to a width of 20 ft., with a depth of 9 ins., which compacted to 6 ins. Digging an outlet ditch also cost $6.93. The cost of this road is based on prison labor at 50 cts. per day of 9 hours; guards, $1; superintendent, $2.20; and teams, $1 per day, making a total cost of $1,206.07 to the community, which is at the rate of 10.28 cts. per sq. yd., or $1,206 per mile. The work comprised 11,733 sq. yds.

Center, Tex.—An extension 2,300 ft. long, from the gravel road running east toward Shelbyville, was built with sand-clay construction 30 ft. wide. Work on this road lasted from July 8, 1910, to September 10, 1910. The road runs through a rolling country with an alternate sand and clay soil. The work required 1,225 cu. yds. of earth excavation, which cost, with an average haul of 100 ft., 15 cts. per cu. yd., and reduced the maximum grade from 4 to 3 per cent. A road machine was used one day at a cost of $4.20. Two corrugated-iron pipe culverts were constructed. For one culvert, two of these pipes, 24 ins. by 48 ft., were used, costing $1 per lin. ft.; while for the other culvert, pipe 15 ins. by 48 ft. was used, and cost 60 cts. per lin. ft. The clay far the sand-clay surface was hauled 1,000 ft. It was loaded with shovels on wagons carrying 1 cu. yd., at a cost of 8.8 cts. per cu. yd., while the hauling cost 14.4 cts. per cu. yd. At the road, spreading cost 1.4 cts. per cu. yd. Over portions of the clay a layer of sand 2 ins. thick was applied, at a cost of 7 cts. per cu. yd., in place. The compacted surfacing varied from 8 ins. to 5 ins. in depth and was given a crown of ¾ in. to the foot. The cost of the service of a foreman was $65.55, while shaping the subgrade amounted to $4.20. The total cost of this road to the community was $798.58, making a cost per sq. yd. of surface, exclusive of culverts, of 8.7 cts., which is at the rate $1,530 per mile. This is based on labor at the rate of $1.50 per 10-hour day, teams at $3.50, and foreman at $3 per day. The work comprised 7,667 sq. yds.

Livingston, Tex.—The work at Livingston, Tex., was begun on Oct. 24, 1910, and completed on Nov. 3, 1910. It consisted in grading a total length of 2,200 ft., 24 ft. wide, and in preparing 1,100 ft., 12 ft. wide, and surfacing the same with sand-clay construction. As the soil here consisted of sand for the first 11 ins. and then clay for the next 11 ins., the required surfacing material was secured near by. A total of 184 cu. yds. of excavation were required, at 20 cts. per cu. yd. The maximum cut was 3 ft., and the old maximum grade of 3 per cent was not changed. The average haul for the excavation was 1,000 ft. The work was done with six road plows and four No. 2 slip scrapers, besides the wagons for hauling. The cost of loading the surfacing material was 8.4 cts. per cu. yd.; hauling, 22.4 cts. per cu. yd.; and spreading, 2 cts. per cu. yd. This material was deposited to a depth varying from 9 to 12 ins. and compacted to a depth of from 6 to 9 ins. by the traffic. The road was given a crown of ¾ in. to the foot. A total of 500 cu. yds. of surface material was used. One road machine was available for this work, and the total cost of the road to the community was $227.15. The rate per sq. yd. for the clay surface was 15 cts., and the rate per mile $1,199. These figures were based on a labor cost of $1.50 per 10-hour day and $3.50 for teams. The work comprised 1,467 sq. yds.

Rockdale, Tex.—Work began here on July 25, 1910, and was stopped on Aug. 2, 1910. The road was a sand-clay road, on which $207 had been expended at the time that work was stopped on account of the scarcity of teams. A total of 2,100 ft. of road were rough-graded and surfaced with clay, with the exception of the final 300 ft. The clay was obtained from a pit with an average haul of ¼ mile. Figuring the clay surface as 18 ft. in width, the cost of the road was 5.75 cts. per sq. yd., or at the rate of $607.20 per mile. The total cost of the road to the community was $207. The cost of labor on this work was $1.50 per 10-hour day; foreman, $3.50 per day; while the teams were furnished free, with drivers, by the neighboring farmers. The work comprised 3,600 sq. yds.

Table I. has been compiled from the data in the above notes.

Creosoted Wood Block Pavements in Chicago.

Last June John Ericson, City Engineer of Chicago, at the request of the Board of Local Improvements, began an examination of the method of treating wood paving blocks and the form of specifications under which creosoted wood block pavements are constructed in this city. The examination was made with a view to determining: whether the treatment of the blocks was proper and sufficient; whether the exuding of tar from the pavement under the heat of the sun could be avoided; and whether the material used was controlled by an individual or combination and was non-competitive. Mr. Ericson's report was submitted to the President of the Board of Local Improvements on Nov. 21 last. In it he states that the specifications for the treatment of creosoted blocks for pavements in Chicago previous to the year 1907 carried the following stipulations concerning the oil:

> After the blocks have been inspected and found satisfactory, they shall be placed in air-tight chamber, where by means of superheated steam and the use of the vacuum pump the blocks shall be vaporized and the moisture in them removed. When the blocks are thoroughly dry the wood preserving oil shall be admitted into the chamber and subjected to a pressure which shall be maintained until 16 lbs. of the oil shall have been forced into each cubic foot of timber and until the oil shall have impregnated the timber through the entire depth of the block and to the satisfaction of the Board of Local Improvements. The wood-preserving oil shall be Kreodone-Creosote paving oil, or any creosote paving oil which shall in the opinion of the Board of Local Improvements be equal thereto in quality for this purpose."

A change in the specifications was made in 1907, the quality of the preservative, as well as the manner of treating the blocks, being different from what it had previously been. The clauses pertaining to the oil in the revised specifications read as follows:

> The oil shall be a pure coal tar product, free from any adulteration. It must not contain any petroleum oil or any product obtained from petroleum, and shall contain not more than 5 per cent of matter insoluble in hot benzol and chloroform. No oil obtained wholly or in part from water gas tar or oil tar will be accepted.
>
> The specific gravity of the oil shall not be less than 1.10 or more than 1.13 at 25° C.

This specification, with a requirement that from 16 to 20 lbs. of oil be injected in each cubic foot of wood, has since been in use for creosoted wood block pavements in Chicago.

Mr. Ericson states in his report that the creosoted wood block pavements laid in Chicago under the earlier specifications, with from 12 to 16 lbs. of oil to the cubic foot of wood, have been generally successful and have given little or no trouble from other causes. As to the wood block pavements laid in the city under the later specifications he states that they have given a good deal more trouble from "bleeding," and also from buckling on account of the expansion of the blocks. He further states that a comparison of actual results obtained by the use of the lighter as well as by the use of the heavier oils as preservatives for paving blocks, both in Chicago and elsewhere, seems to indicate in a general way that pavements treated with the lighter oils bleed less, give no more trouble from expansion, and so far as known, will not fail through the decay of the blocks, which are fully preserved during the entire mechanical life of the pavement.

From the engineers in charge of the Forest Products Laboratory of the U. S. Forest Service at Madison, Wis., Mr. Ericson obtained a specification for a genuine coal tar creosote of high quality, and this specification he recommended for use in paving of Wabash Ave.

SPECIFICATIONS FOR COAL-TAR CREOSOTE.

> 1. It must be obtained entirely from coal-gas or coke-oven tar, and must not contain any admixture of any tar oil or residue obtained from petroleum or any other source except coal-gas or coke-oven tar.
>
> 2. It must be completely liquid at 38° C., and not more than 3 per cent of the water-free oil shall be insoluble in chloroform or benzol.
>
> 3. The specific gravity of the oil at 38° C. must be at least 1.03 and should not exceed 1.08.
>
> 4. It shall be subject to a distillation test as follows:
>
> The apparatus for distilling the oil must consist of an ordinary 200 cm. distilling flask having side neck not over 2 ins. above the body of the flask.
>
> The bulb of the standardized thermometer shall be one-half inch above the surface of the liquid in the flask and during the progress of the distillation it shall remain in the position as originally placed. The distance between the thermometer bulb and the end of the condensing tube shall be 22 ins. The bulb of the flask shall rest on an asbestos board at least 6 ins. square, through which a round hole has been cut 2 ins. in diameter. This hole is to be further enlarged by cutting 6 notches around its circumference, these notches to be ½ in. deep. The bulb of the flask shall also be protected so as to prevent excessive heat radiation by placing around it an asbestos cylinder 4 ins. in diameter and 3 ins. high; and resting on this shall be a piece of flexible asbestos board of sufficient size to fully cover the cylinder; said cover having a slit cut from the outside edge to a round hole 1½ ins. in diameter cut in the center to admit the neck of the flask.
>
> The distillation shall be continuous and at the rate of 1 to 2 drops per second.
>
> One hundred grams of the oil shall be taken and all percentages determined by weight on the basis of dry oil.
>
> Tested in the above manner it shall give no distillate up to 200° C.; less than 5 per cent up to 210° C.; less than 25 per cent up to 235° C.; less than 35 per cent residue at 355° C.
>
> 5. The distillate between 210° and 235° shall, on cooling to room temperature (77° F.), yield solids.
>
> 6. The oil shall not contain more than 3 per cent of water.

From his investigations and inquiries Mr. Ericson concludes: That pavements laid with blocks treated under the old forms of specifications or with creosote of a specific gravity of 1.08 a 1.09 are preferable to those treated with the heavy oil later specified, at least for traffic streets in the City of Chicago, where the traffic soon makes the blocks impervious to water.

That the "bleeding" is caused principally by the use and excessive quantity of this heavy tar oil in the preservation of the blocks which is in some cases aggravated by improper provision for expansion;

That this "bleeding" can be largely avoided by the use of the lighter creosote oil as a preservative, and by the proper selection and manner of placing the filler between the blocks;

That absorption of water and the consequent heaving of the paving can be largely avoided by laying the blocks in the pavement as soon as they are delivered on the work and by the provision of proper expansion joints;

That no definite rule as regards the character of oil, manner of treatment, etc., can be adopted for all conditions of streets and traffic, but that different conditions require different treatment.

That if the lighter oils for preserving wood blocks for pavements are eventually found to be preferable to the heavier oils for all conditions, there can and will undoubtedly be an inducement to cause sufficient oil to be man-

TABLE [illegible]

Districts. Average Number of Horses Kept. Items.	[illegible]	Cost per [illegible]	[illegible]	Cost per [illegible]	[illegible]	Cost per [illegible]	[illegible]	Cost per [illegible]	[illegible]	Cost per [illegible]	[illegible]	Cost per [illegible]	[illegible]	Cost per [illegible]
Labor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hay and grain	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fuel, light and rent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Shoeing	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stable repairs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Veterinary services and medicine	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Furnishings and repairs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*New addition to stable, $485.85.

ufactured for this purpose at a reasonable price;

That 15 lbs. of oil per cubic foot of wood is generally sufficient to effectively preserve the wood for the length of time of its mechanical life and prevent absorption of water and that it may be found that much less than fifteen pounds will do. This will vary with traffic conditions;

That the manufacture of both creosote and the heavy or "special paving oil" seems to be limited to comparatively few concerns, which may or may not have formed combinations;

That the lighter creosote oil is also manufactured in and imported from Europe and can be obtained at reasonable price.

In view of the troubles encountered from "bleeding" and other causes with many pavements constructed in accordance with the later specifications, and in view of such information and conclusions as above stated, Mr. Ericson recommended that the specifications for the treatment of blocks for creosoted block pavements as now in vogue, stipulating the use of a heavy oil with a specific gravity of from 1.10 to 1.13, be, at least temporarily, discarded, and that the specifications recommended for the treatment of blocks for the paving of Wabash Avenue be tentatively used for any creosoted block pavements that must be constructed in the immediate future.

Costs of Street Cleaning, Street Watering, Oiling and Maintenance of Horses at Boston, Mass.

(STAFF ARTICLE.)

The work of cleaning the streets of the city of Boston, Mass., for the year ending Jan. 31, 1911, was done under the direction of the Street Cleaning and Watering Section of the Sanitary Division of the Street Department. This section for the year above noted cared for 135.47 miles of paved streets and 114.43 miles of macadamized streets. The total area cared for included 2,831,000 sq. yds. of paved streets and 604,195 sq. yds. of 9-ft.-wide gutters. The distribution of the force for street cleaning service on Feb. 1, 1911, was as follows:

9	Foremen at, per year	$1,400.00
1	Clerk at, per year	1,000.00
1	Messenger at, per year	800.00
25	Sub-foremen at, per day	3.00
8	Inspectors at, per day	2.50
8	Stable laborers at, per day	2.50
19	Yard laborers at, per day	2.25
26	Machine drivers at, per week	15.00
319	Drivers, broom men and helpers at, per day	2.25
1	Boy at, per day	1.25

Including office the total of the street cleaning force was 421. The street watering force on Aug. 1, 1910, consisted of 41 men, making the total number of the force 462. The horses and rolling stock in charge of the section were as follows:

Cart horses	132
Driving horses	15
Carts, single	139
Carts, watering	20
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Wagons, express	4
[illegible]	[illegible]
Snow plows	8
[illegible]	[illegible]

The cost of maintaining the horses of the section on a basis of 365 days per year is shown in Table I. The hay, grain, etc., used in the maintenance of these horses was as follows:

		Price paid per ton. Highest.	Lowest.
Hay, lbs.	737,264	$24.25	$19.50
Straw, lbs.	80,667	21.50	13.50
Shorts, lbs.	15,500	29.00	24.00
		Per bushel.	
Oats, bus.	19,940	$0.56	$0.40½

The total number of square yards of pavement cleaned by flushing was 398,228, and the number of square yards flushed once was 15,029,567. For this flushing work 3,026,400 gals. of water was used, or .132 gals. per sq. yd. of pavement cared for. The cost of the flushing, not including the cost of water, per 1,000 sq. yds. flushed once was as follows:

	Total.	Per 1,000 sq. yds.
Supervision	$[illegible]	$[illegible]
Labor and teams	4,112.13	.274
Repairs and tools	817.57	.054
Total	[illegible]	[illegible]

[illegible] cart patrol by districts is shown in Table II.

Machine sweeping was employed for cleaning a considerable area of the paved streets, the total mileage of streets cleaned once being 16,767.42. In addition 4,954.9 miles of gutters were cleaned once. The average cost per 1,000 sq. yds. cleaned once was 48.9 cts. Further details regarding this work are given in Table III.

A large amount of street oiling work was done in 1910, the total area oiled being 5,845,178 sq. yds. The area covered once was 43,497,329 sq. yds., the average cost per sq. yd. being $0.00223. Table IV shows the details of this work. In addition to the oiling with emulsion some 1,630,737 sq. yds. in West Roxbury, Dorchester and Roxbury were covered once with terra colia. No terra colia was used after Aug. 17, 1910. At the beginning of the season about 475,000 sq. yds. were treated once; 233,151 sq. yds. of this area were treated regularly to Aug. 17 with an average number of 4.188 treatments. The streets not treated regularly with terra colia were subsequently treated with other dust preventives. The total number of gallons of terra colia used was 35,592. The total cost of the treatments was $5,766, or $0.00353 per sq. yd. for one treatment. The estimated cost for six treatments was $0.02118.

During the month of January, 1911, when the temperature was below 32° F. and the streets somewhat dry and dusty, calcium chloride was used as a dust preventive. It proved to be satisfactory. About 51,266 sq. yds. in District 8-10 was treated at a cost of $0.0036 per sq. yd. for one treatment. In applying it to the streets two parts of calcium chloride and one part sand were used, the mixture being distributed by a spreading machine.

[illegible]

District.	[illegible] labor and teams.	Barrel loads removed.	Cu. yds. removed.	Cost per cu. yd.	Cost per barrel
1	$ 2,120.81	5,849	758	$2.80	$0.362
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Average.

Capacity of barrels	3½ cu. ft.
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

TABLE III. [illegible]

District.	Paved Streets— Miles cleaned once.	Paved Streets— 1,000 sq. yds. cleaned	Gutters— Miles cleaned once.	Gutters— 1,000 sq. yds. cleaned once.	Total— 1,000 sq. yds. cleaned once.	Paved Streets and Gutters. Total cost.	Paved Streets and Gutters. Cost per mile cleaned once.	Paved Streets and Gutters. Cost per 1,000 sq. yds. cleaned once.	Loads of Dirt Removed. Total.	Loads of Dirt Removed. [illegible]	Cu. Yds. of Dirt Removed. Total.	Cu. Yds. of Dirt Removed. [illegible]	Cu. Yds. of Dirt Removed. Cost per cu. yd. of dirt removed
[illegible]	1,944.76	[illegible]	1,279.73	6,757	47,641	$[illegible]	$5.57	$0.377	[illegible]	[illegible]	[illegible]	[illegible]	$[illegible]
[illegible]	610.04	[illegible]	888.45	4,691	17,685	[illegible]	7.53	.637	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1,104.67	[illegible]	379.73	2,005	27,081	13,106.37	8.83	.484	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	212.57	4,279	470.83	2,486	6,765	5,529.50	8.09	.817	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1,145.75	25,321	425.38	[illegible]	27,567	15,030.27	9.57	[illegible]	7,902	[illegible]	[illegible]	[illegible]	[illegible]
8 Uptown	1,631.18	[illegible]	646.40	3,413	36,363	14,621.02	6.42	.402	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8 Downtown	[illegible]	110,240	[illegible]	425	[illegible]	36,757.49	[illegible]	.332	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	1,050.19	21,214	643.74	3,399	[illegible]	[illegible]	5.12	.353	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0 West End	1,890.00	[illegible]	116.67	616	38,794	18,346.84	9.14	.472	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0 North End	1,720.84	34,761	23.48	124	34,885	16,710.65	9.58	.479	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals	16,767.42	345,897	4,954.90	26,162	372,059	$158,023.68	*$7.64	*$0.489	71,314	*[illegible]	[illegible]	*[illegible]	*$1.095

*Averages.

TABLE IV.—STREET OILING, SHOWING COST OF LABOR, TEAMING, OIL, ETC., INCLUDING SUPERINTENDENCE, 1910.

District.	Total area oiled (sq. yds.)	Equivalent mileage, 30-ft. roadway	Area covered once sq. yds.	Dates of Oiling— First.	Last.	Number of times district treated.	Total cost.	Cost —per sq. yd.— Covered once.	Entire season.	Emulsion used (gals.)	Emulsion per sq. yd. of total oiled area.	Total water used (gal.).
1 South Boston	[illegible]	[illegible]	[illegible]	Mar. 14	Nov. 17	[illegible]	[illegible]	$0.00209	$0.01628	137,447	.2554	411,750
2 East Boston	[illegible]	23.399	[illegible]	Mar. 24	Nov. 19	8.767	6,216.90	.00171	.01509	93,069	.2259	283,275
3 Charlestown	163,481	9.288	[illegible]	Mar. 25	Oct. 6	8.267	3,279.06	.00242	.02005	38,549	.2358	124,200
4 Brighton	[illegible]	[illegible]	[illegible]	Mar. 31	Nov. 18	5.442	10,348.59	.00275	.01499	183,867	.2663	574,200
5 West Roxbury	[illegible]	[illegible]	[illegible]	Mar. 29	Nov. 1	4.674	14,185.00	.00302	.01413	215,014	.2141	608,175
6-9 Dorchester	[illegible]	[illegible]	[illegible]	Mar. 22	Nov. 18	7.041	21,513.79	.00208	.01465	380,806	.2593	1,174,950
7 Roxbury	[illegible]	[illegible]	[illegible]	Mar. 16	Nov. 17	7.987	15,337.71	.00219	.01754	267,050	.3054	909,000
8-10 South End, Back Bay and part of Roxbury	[illegible]	[illegible]	[illegible]	Mar. 10	Nov. 21	12.323	13,777.43	.00160	.01982	249,500	.3589	805,950
Totals	5,845,178	332.108	43,497,329	....	....	62.301	$93,423.33	$0.01786	$0.13255	1,565,302	2.1211	4,891,500
Averages	....	.	...	....	.	[illegible]		[illegible]	$0.01656	....	.2651	....

TABLE V.—TOTAL COST PER SQUARE YARD AND AMOUNT OF WATER USED.

District.	Total sq. yds. watered.	Equivalent mileage. 30-ft. roadway.	Dates of Watering. First.	Last	No. of days one cart or more out.	Total cost.	Cost per sq. yd	Cart-days worked.	Loads spread during season.	Sq. yds. covered once during season.	Total gals. of water used.
1 South Boston	[illegible]	[illegible]	Mar. 17	Nov. 27	192	$ 8,788.19	$0.01894	1,351	20,265	85,113,000	12,159,000
2 East Boston	130,793	7.431	Mar. 19	Nov. 19	170	3,393.69	.02594	392	5,880	24,696,000	3,528,000
3 Charlestown	[illegible]	13.957	Mar. 22	Nov. [illegible]	179	4,775.85	.01944	671	10,065	42,273,000	6,039,000
4 Brighton	*164,877	9.368	Mar. 20	Dec. 4	[illegible]	3,770.69	.02286	458	6,870	28,854,000	4,122,000
5 West Roxbury	[illegible]	[illegible]	Mar. 19	Nov. 27	185	3,983.92	.02548	459	6,885	28,917,000	4,131,000
6-9 Dorchester	*302,221	17.171	Mar. 19	Nov. 27	188	6,527.11	.02159	912	13,680	57,456,000	8,208,000
7 Roxbury	[illegible]	[illegible]	Mar. 15	Nov. 27	200	7,571.23	[illegible]	1,168	17,520	73,584,000	10,512,000
8 South End and part of Roxbury	414,025	23.524	Mar. 20	Nov. 27	[illegible]	10,261.76	.02478	1,521	22,815	95,823,000	13,689,000
10 City proper	[illegible]	31.443	Mar. 20	Nov. 27	208	12,235.10	.02210	1,937	29,055	122,031,000	17,433,000
Totals	2,651,908	150.673				$61,307.54	$0.21543	8,869	133,035	558,747,000	79,821,000
Average							$0.02393	...	.	.....	....

*Approximate, not treated regularly.

Note.—A watering cart distributes on an average of 15 loads per day on an area of 4,200 sq. yds. to the load.

The total area of streets sprinkled during the season of 1910 was 2,651,908 sq. yds., the total area covered once being 558,747,000 sq. yds. The average cost of the street sprinkling work was $0.02393 per sq. yd. Fuller details of this work are given in Table V. We are indebted for the matter in this article to the last annual report of L. K. Rourke, Superintendent of Streets.

Utilization of Motor Truck Trains in the Maintenance of Trunk Highway.*

During the road building season just drawing to a close, about $142,000,000 was expended in this country on road construction. A considerable portion of this money was raised by bond issues. In most of the communities where bonds were issued practically no serious thought has been given to maintenance of the roads after they are constructed. In other words, 30 or 40 year bonds were issued for 5 year roads. It is impossible for this condition to obtain for any considerable length of time, for we can not continue to borrow money for the construction of roads and let them go to ruin. It is necessary for us to turn our attention more to the maintenance problems than to those of construction, for the former are far more complicated under the present condition of traffic. As far as I have been able to ascertain, practically no data on maintenance exist in this country. A few of the state highway commissions are inaugurating plans for maintenance, and also a very few counties, but aside from this almost nothing has been done.

The cost of maintenance for the national roads of France has been more or less our guide for many years, but my observations lead me to believe that the French roads today are not being maintained as they should be. This I believe is due to two causes, one that a sufficient amount of money per mile per year is not being expended, and the other is that I do not consider under present traffic conditions that the canton system of road maintenance is effective.

The British system of maintenance can hardly be called a system, but judging from the results obtained I think it is more thorough and gives better results than the French. It must be remembered, however, that the British maintenance costs almost twice as much as the French.

I have been considering the maintenance problem under American conditions for some years and it is my belief that the canton or patrol system will not meet the conditions that obtain on a bituminous macadam road. When such a road is properly constructed, for at least a year and a half there is almost nothing for the patrolman to do but walk over it. When trouble comes, it is generally due to the disintegration of the binder, bringing about loose spots on the surface. For a patrolman to repair such trouble is expensive, for a tar kettle, stone, and small tools are necessary. Such work can be done better and more quickly with a small gang of men, and if a quickly moving vehicle to carry the equipment and men is obtainable, a considerable length of road can be repaired in a very short time. On roads that have a bituminous blanket coat treatment, this method of maintenance is even more applicable than on roads built by the penetration or mixing method.

With this idea of maintenance in mind, some months ago the Office of Public Roads engaged the services of one of the ablest motor truck designers in the United States for the purpose of designing a motor maintenance car or train, the thought being that we might "cure the bite with the hair of the dog." The instructions given to this designer were that the train or motor truck should have the capacity for maintaining at least 100 miles of bituminous macadam road, and should have the necessary equipment to aply blanket coat treatments. The result of this investigation was as follows:

The object to be accomplished is the development of an automobile equipment which will include all the apparatus and facilities necessary to efficiently employ a repair gang of eight men in the maintenance of road surface over 100 miles of roadway or more as the working conditions will permit.

This equipment is to be capable of making quick transport of men and their necessary working outfit between a central base or headquarters and the various places along the roadway where repairs may be necessary; the equipment to carry, as well as men and apparatus, enough road repair material for a number of quick repairs in isolated places, when these are not very extensive. Where extensive repairs are necessary and require considerable material, the equipment is to be flexible enough to provide for rapid conveyance of stone or other material from a distant supply station to the place of operation.

The purpose of developing such an equipment is to provide an actual working outfit as a practical exemplary inducement to state highway commissions and others charged with road maintenance to procure and use similar outfits, thereby effecting a much greater efficiency and economy than can be accomplished with existing methods and insuring the collateral advantage of a better condition of road surface, in view of the facility with which timely repairs can be made.

This purpose as set forth has three significant implications. First, that the cost of the equipment should be kept consistently low or within the range of customary expenditures in this direction; second, novel or especially manufactured apparatus should be avoided so that equivalent apparatus can be secured in any locality, and further that existing investment in similar details of equipment can be made use of; third, that the outfit should be so flexible in its makeup as to readily serve a variety of utility or lend itself to peculiar requirements under varying conditions.

These considerations necessarily prohibit the employment of any cumbersome or expensive tractor trains and rather demand a single machine with ability to handle a single trailer where such may be required. This machine should be capable of performing all the useful transporting functions required in road repairs, as well as being serviceable for maintenance work, such as the distribution or sprinkling of road oils or bituminous material, and furthermore should be available during the winter season for general trucking purposes, such as snow and refuse removal or other hauling service.

In performing service in road repairing, the machine should incorporate as many of the requirements of a portable power plant as possible, such as hoisting, pumping, and where necessary, air compression and power shaft driving. It should have considerable traction ability and be operable at a reasonable speed when loaded, as well as at a higher speed for empty return trip or emergencies.

To secure the required combination in such an outfit the entire supply of available equipment on the market has been investigated and carefully considered.

The automobile chassis selected for recommendation is the 5 ton gas-electric type manufactured by the Couple-Gear Freight Wheel Co., Grand Rapids, Mich. This is well developed and has been in a variety of rigorous service for a number of years. Its availability and service capacity is vouched for by a number of merchant users and its flexibility is well shown in the United States War Department, Engineer Department at Large, Professional Memoirs, Volume III, No. 9.

The advantage in this line of work of a traction drive at each of the four wheels will be appreciated and the range of application of the power of the machine in auxiliary work performing apparatus by its conversion into electric current is self evident.

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*Paper by Logan Waller Page, Director U. S. Office of Public Roads, presented before Section D of the American Association for the Advancement of Science, Dec. 29, 1911.

This chassis, in addition to its regular equipment, is fitted with a Sprague electric hoist, the purpose of which is to aid in loading and unloading the body and other apparatus which the machine carries (to be described later), as well as for general hoisting external to the machine whenever required. The electric motor of this hoist is directly connected to a rotary pump which is used to force the road oil or bituminous material from a tank, carried on the machine, through a distributing device permanently attached to the rear of the chassis. This electric hoist and rotary pump are located forward of and about one-fourth the distance from the rear to the forward wheels, below the floor of the body, which rests on the chassis. The pump and distributor recommended for permanent attachment to the chassis by the automobile engineer are a part of the H-P spreader built by the A. Burlingame Co. of Worcester, Mass.

This chassis can be fitted with a removable platform body of any convenient or desirable dimensions with or without stakes or side racks when the machine is used for hauling purposes in those seasons of the year when road work is not feasible.

The chassis may also be fitted with a steel dumping body, length 130 ins., height 36 ins., bottom width 56 ins., and top width 78 ins. The forward half of this body should have two removable partitions, so placed that 1 cu. yd. of material can be carried in the forward space and 2 cu. yds. of material in the rear space. Each of these two spaces should have vertical sliding side doors, operated by hand levers, to allow material to be unloaded from the floor of the body rather than over the sides. The purpose of these removable partitions is to provide for carrying a variety of road material or to carry a limited amount, and to permit the balance of the body being used for other purposes. This body should be so located on the chassis as to leave sufficient space behind the driver's seat and in front of the dumping body for carrying tools and men. The body should be entirely removable when the machine is required for a platform wagon. In operation for road work, this steel body can be dumped either by hand winches or by a proper arrangement of pulleys the electric hoist may be used for this purpose. The mounting on or removing of this dumping body from the chassis would be accomplished by the use of the electric hoist.

The next essential part of the equipment is a tar heating kettle of sufficient capacity to be serviceable on the roadside for repair work or to serve the purpose of a distributing tank wagon when carried on the machine.

For this purpose a 500 gal. kettle, mounted on wheels and of such dimensions that it will occupy all of the dumping body but the forward 1 yd. compartment referred to, is recommended. About the only change necessary to adapt any of the standard tar heating kettles to this purpose would be the shortening of the rear axle. The tar kettle may be loaded and unloaded by means of the power winch.

On either side of the tool carrying compartment, immediately in front of the dumping body, there should be seats provided on each side for two men. The driver's seat will also be wide enough to carry four men, so that eight men in all may be transported. It is also presumed that the foreman of the gang will operate the machine.

With the equipment described, it will be quite possible to do isolated patch work over a long stretch in caravan fashion without dismounting any of the apparatus. In such service the small stone compartment may be replenished at stone supply stations along the route, and if these do not exist and it becomes desirable to carry on the machine a larger working supply from the original base, the tar kettle could be projected outward some distance at the rear of the body so as to use the forward half of the body for stone, but it would be preferable under such working conditions to use a tar kettle of smaller capacity.

It may be suggested here that a feasible means toward operating in transit as described would be to provide at various points in the system of roads to be cared for a number of supply stations where stone and bituminous materials could be kept on hand. These stations could be periodically replenished by the machine under consideration.

When working under normal roadside conditions, where a large amount of work is to be done, the machine would proceed from headquarters, loaded, to the place of operation, where the tools and preliminary stone supply would be removed and the tar kettle unloaded. This would leave the machine free to be used immediately for the transfer of stone in quantity from the nearest base of supply.

Should it be desired to transport material where the dumping body would be a handicap, such as long timbers for bridge work, the steel body can be temporarily removed and the machine used as a flat platform wagon.

In the event of work being so far from the stone supply base as to keep the gang inactive during the return trips of the machine, a trailer could be used to furnish a larger initial supply and transport a greater quantity for each of the subsequent trips. It might also be used to make the outfit and initial supply complete for extremely isolated or outpost work

To use the machine as a sprinkler of road oils or a spreader of bituminous material, the tar kettle is loaded in the steel body and by means of a pipe connection at the back of the machine the rotary pump is supplied with the liquid material from the kettle, which it forces through the spreader, and for such a use a removable rear seat is provided. In long trips away from the supply of oil or bituminous material an additional supply in barrels may be carried in the forward part of the machine.

To get the required heat for bitumens, the firebox of the tar kettle can be fitted with a removable gasoline or kerosene burner. If gasoline is used as a fuel, the regular tank on the car can be made to furnish the supply. If kerosene is used, an auxiliary tank can be located on the chassis frame, and the necessary pressure in either case furnished by the exhaust from the engine. The feature of having this burner removable admits of the use of wood in the firebox for roadside work.

Should the employment of the tar kettle as above described be considered inadequate in the matter of capacity, a complete tar equipment could be provided and placed on the chassis when required for this service.

In the event of compressed air being desirable for any part of the work, the machine can be fitted with an electric air compressing outfit.

In selecting a pressure type of distributor, consideration is given to the speed at which the machine may be made to work. If this is not required, there are several cheaper forms of gravity devices on the market which may be applied.

An approximate estimate of the total equipment suggested above is as follows:

[illegible] steel dumping body	$6,000
Sprague Electric Hoist........................	250
H-P Spreader, with rotary pump and [illegible]	700
Tar kettle, 500 gallon capacity............	300
Double kerosene burner outfit.............	200
[illegible]	50
[illegible]	$7,500

WATER-WORKS AND SEWERS SECTION

Has the Time Come for Adopting the Double System of Municipal Water Supply?*

It has often been proposed that two water supplies be provided for cities, one to furnish water of the highest quality for drinking and cooking, and another for all other purposes. Our large cities with but few exceptions obtain their water supply from rivers, lakes, or large artificial storage reservoirs. These sources are in some cases grossly polluted, and many that are not polluted at present are in constant danger of becoming so, notwithstanding the fact that elaborate precautions are taken to guard against contamination. In case the present supply is polluted, the city will generally be compelled, sooner or later, to go to the expense of constructing a filtration system or of obtaining a new supply from a more distant, non-polluted source. Cities having as a source of supply lakes or artificial reservoirs must maintain a constant and efficient oversight of the watershed in order to guard against pollution. Moreover, no matter how complete and efficient the system of filtration or the supervision of the watershed, these provisions are not always infallible as safeguards. This is shown by the typhoid fever epidemics at Lawrence, Mass., and elsewhere, due to trouble with the filters, and those at New Haven, Conn.; Scranton, Pa.; Plymouth, Pa.; and many other places, due to pollution of the watersheds feeding the storage reservoirs.

We are at present in a peculiar position—namely, when most of the water supplied to our modern communities is not used either for drinking or for cooking, and yet, since any of it may at any time be used for these purposes, all of the huge streams that pour through our cities are expected to be, from the sanitary standpoint, above suspicion. Thus far we have got on fairly well under this arrangement, but the time will probably come when the amounts so required will become so vast, and so costly to keep up to the required purity, that we shall be driven to double supplies, one for drinking and cooking, the other for all other purposes.

Even if it be granted, however, that with proper precautions the danger to the public health from ordinary water supplies is small, the question still deserves to be considered whether from a sentimental or esthetic standpoint the time has not come for double municipal supplies.

For it is an open secret that many persons dwelling in cities provided with filtered water supplies derived from polluted sources cheerfully purchase spring or other waters which they believe to be naturally pure rather than drink the purified waters which are known to come from sewage-laden sources. It must be admitted, moreover, that it is by no means agreeable to dwell in detail upon the proximate sources of some of our most reputable water supplies, derived as these often are more or less directly from streams laden with human excrements or with street washings, the drainage of slaughter houses, of hospitals, and the like. Some years ago we were grateful for even a moderate degree of cleanness, but our standards in these matters are constantly rising, and decency is everywhere more and more being added to health as a consideration of importance in public affairs. Again, many filtered waters are at times colored or turbid, or have a disagreeable taste or odor, due to the presence of organic matter not removed by the filters, although the bacterial efficiency of the latter may be high. Water obtained from impounding reservoirs is also often colored, and of a marked taste or odor, due to the growth of microscopic organisms. The New

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*Paper by W. T. Sedgwick and H. P. Letton before New England Water Works Association, published in Journal of the Association for December, 1911.

York and the Boston supplies are examples of this type. In order to prevent such growths the reservoir is sometimes during construction, at great expense, completely stripped of the top layer of soil; and even then the result may be only partially successful. Again, a water from a surface supply is frequently quite warm during the summer months and correspondingly less potable than a ground water with a fairly constant temperature all the year round.

The average daily per capita consumption of water in cities of the United States, with a population of 100,000 or more, is about 115 gals., and of this amount Brackett has shown that not over 35 gallons are used for domestic purposes, while the amount actually used for drinking and culinary purposes is less than 3 gallons. If, however, we allow 10 gallons per capita per day and consider the fact that this would only be 1,000,000 gals. per day for a city of 100,000 population, we see at once that it would be possible in practically every case to obtain a sufficient supply of ground water that would be purer and more potable than most surface waters, even if these last are filtered.

We are in the midst of a mighty sanitary awakening, and are spending millions of dollars every year in protecting and purifying our water supplies, yet of all the water distributed probably less than three per cent actually concerns the public health. With this fact in mind it is evident that we seem to be following an uneconomical course, and that any plan for betterment should be thoroughly investigated.

Heretofore, whenever the question of a double supply has been proposed, the one insurmountable objection has been that it would be impossible to prevent people from drinking from the second and impure supply. This was clearly shown at Lawrence, Mass., in 1893. The city used a filtered supply from the Merrimac River, while in some of the mills the raw river water which was badly polluted with sewage was used for washing. During the year there were nine deaths from typhoid fever of mill operatives who had drunk the river water notwithstanding the fact that they had been fully warned of the danger, while the total number of deaths from typhoid in the entire city was only seventeen.

In order to make the double system practicable it is necessary (1) *to so regulate the use of the smaller supply that it shall not be wasted*, and (2) *to so treat the larger supply that it shall not under any circumstances be used for drinking.*

The first condition could be attained by making the cost of the water such that its value would be appreciated, and by metering all services. It is the second condition, or that of *denaturizing* or *sterilizing* the supply, so to speak, that is the main object of consideration in the present paper.

In recent years there has come into general use an agent which it is believed will be a satisfactory *denaturizer*, both from a sanitary and an economic standpoint. This substance is calcium hypochlorite, which is being extensively employed as a sterilizer for water and sewage. Its especial fitness for the case under discussion lies in the fact that if put into a water in such quantity that it is not all decomposed, it imparts to the water an odor and a taste that are very disagreeable. With a water thus treated its use for drinking would be very rare, and even if it were so used no harmful results would follow, as the water would be practically sterile and as a little undecomposed hypochlorite is probably not detrimental to health. Brackett has shown that about ninety per cent of the water used for domestic purposes is employed in flushing water-closets, in wash tubs, in bath tubs, and in sinks and bowls. The addition of the hypochlorite would not affect the use of the water for any of the above purposes if we except the small amount used for drinking and cooking. From the same authority it appears that of the water used for commercial purposes the larger portion is employed in steam railroads, factories, elevators, power plants, and office buildings. The hypochlorite would affect the use of the water in very few, if any, of the above cases. It is also quite evident that it would not affect the public use of the water for such purposes as street sprinkling, ornamental fountains, sewer flushing, and fires, but would instead be a benefit on account of its disinfecting action.

From a consideration of all the above facts, it appears that as a sanitary measure the plan is highly commendable. To determine whether is is economically practicable is a much harder problem, as this will be established largely by local conditions. It would, of course, be necessary to install a separate distribution system, and, although this would be of much smaller piping than the present one, it would still be the large item of expense. Separate services and meters would also be required, which would be another large item. These, however, are points which would have to be considered as special problems in each individual case.

The object of this paper is merely to present the plan as it stands to-day to waterworks officials, engineers, and sanitarians, in the belief that it is a new aspect of an old problem, and one that can be, and will be, profitably applied in some cases in the near future.

Operating Results of the Columbus, Ohio, Sewage Purification Works.

The operating results of the Columbus sewage disposal works for the year 1910 have been made public in the recent report of C. B. Hoover, chemist in charge at the plant. The structural features of this plant were described and illustrated in our issue of Feb. 9, 1910. The following information is abstracted from Mr. Hoover's report:

The Columbus Sewage Works has just finished the second full year (1910) of service and the result has been that the purposes for which the plant was designed, and its ability to meet the situation, have been more sharply defined. The sewage problem which confronts this city may be stated in a general way as follows:

During "low-water-warm-weather" conditions, which prevail from late spring to early fall, the flow in the Scioto River varies from 20,000,000 to 30,000,000 gals. per day. A stream of this size is able to consume about 1,000,000 gals. of normal Columbus dry flow sewage per day without showing the evidences of gross pollution which are offensive to both sight and smell. The dry flow sewage of this city varies from 15,000,000 to 18,000,000 gals. per day so that if all of this sewage were discharged into the river without treatment, the river would be called upon to dispose of 15 times as much sewage as it is able to consume, and the result would be the conversion of the river into a large open sewer which condition would be undesirable from both a sanitary and aesthetic point of view.

The problem of sewage treatment for this city may then be defined as follows: The treatment of the raw sewage should be carried to such an extent that the river, which is able to consume but 1,000,000 gals. of raw sewage per day, will be able to consume 15,000,000 gals. per day of partly purified sewage without showing the evidences of gross pollution.

The treatment of the sewage consists in preliminary sedimentation and clarification in large open concrete tanks, aeration and oxidation in sprinkling filters, and final sedimentation and clarification in open shallow concrete basins preceeding the discharge of the treated liquor into the river.

PRELIMINARY TREATMENT

All of the sewage of the city east of the Scioto River is collected by an intercepting sewer which discharges into the suction wells of the main sewage pumping station. This sewer is 6.9 miles in length, has an average grade of 0.1063 per cent, and receives domestic and storm water sewage and trade wastes.

All of the sewage of the city, after reaching the Main Pumping Station, passes through coarse screens, which remove only the coarsest material such as rags, sticks, cans, paper, etc. After being thus roughly screened, the sewage is pumped through a 48-in. cast iron force main, 1.2 miles in length, to the Purification Works where it is discharged into open concrete tanks. These tanks are 12 ft. deep with a combined capacity of 8,000,000 gals. and cover an area 423 ft. in length by 236 ft. in width which is divided into six separate compartments, any two or more of which may be used together. From what has just been said regarding the collection of the sewage, it is evident that the grades of the sewers and the distances through which the sewage travels, result in the delivery of a stale sewage which makes rapid handling at the Purification Works desirable.

The sewage received at the Purification Works is a mixture of domestic and storm sewage and trade waste and consequently carries in suspension or solution, materials which are common to kitchen, lavatory, storm water and street drainage, and wastes from various manufactories.

The first treatment which this sewage gets is a sedimentation and clarification in the large open concrete tanks into which it is discharged from the force main. The purpose of this treatment is the removal of the heavier and coarser suspended matter and this is accomplished by passing the sewage through these tanks at velocities which vary from 30 to 120 ft. per hour and which favor the settling of the solids. During the flow of the sewage through these tanks about 60 per cent of the total suspended matter settles out and about 50 per cent of the bacteria disappear so that the liquor which leaves the tanks carries only the very finely divided suspended matter and about one-half as many bacteria as the raw sewage. During the year 1910, 4,597,840,000 gals. of sewage were passed through these tanks. This sewage carried in suspension, 4,000 tons of material, 2,480 tons of which were deposited in the tanks.

The solid and dissolved constituents of the raw sewage may be divided into two general classes with respect to stream pollution, viz., active and inert, or, unstable and stable. The inert and stable material will not cause trouble when discharged into a stream while the active or unstable material will and should be converted into some stable form before it is discharged into the river. The unstable material, which causes the active pollution of the river, possesses all degrees of stability from slowly decomposing cellular matter to the rapidly decomposing forms of nitrogenous organic matter. It is the unstable material which concerns us in sewage work, the inert material being of interest only when it interferes with the handling or treatment of the other form. Our experience at Columbus has been that the presence of so much silt and sand in the sewage is a disadvantage in the prelim inary tank and sand in the sewage is a disadvantage in the preliminary and final tank treatments and one of the pressing needs at the Purification Works is relief along this line.

A part of the unstable material which settles out in the tanks is partially or completely decomposed by the countless millions of bacteria which are found in the sludge deposits. This decomposition is continually taking place and fresh material is being continually provided. The result of this decomposition is the conversion of this material into various soluble and insoluble products. Some of these products are gases which are either absorbed by the flowing liquor or pass up through the liquor and escape into the air causing the odors which can usually be detected in the immediate vicinity of such tanks. The gases which are constantly passing up through the flowing liquor gives it the appearance of boiling water. This boiling has been found to be detrimental because the gases in passing up through the liquor interfere with the settling of the solids and also keep the sludge stirred up. An attempt has been made, in an experimental way, to obviate this trouble by constructing an Imhoff tank which is so designed that the gases from sludge decomposition escape through a restricted vent and do not pass through the flowing liquor at all.

Although the tanks remove 60 per cent of

[illegible]

	[illegible]	[illegible]	Minimum		Mean.	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	97	6	—14	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	41	45	60	[illegible]
[illegible] M. G. D.	1.4	17.9	3.1	2.5	11.1	12.9
[illegible]	6.0	17.0	4.3	3.5	10.1	7.2
[illegible]	[illegible]	17.7	3.1	2.4	10.7	11.4
[illegible]	[illegible]	10.0	[illegible]	5.00	8.05	[illegible]
[illegible]	[illegible]	[illegible]	.10	.90	8.87	9.91
[illegible]					1.33	1.46
Rate of filtration ... ..M. G. D. A.					3.60	3.52
[illegible]						
[illegible]						
[illegible]	[illegible]	[illegible]	13	16	[illegible]	211
[illegible]	230	[illegible]	12	9	[illegible]	80
Filter effluent ...	40	286	14	13	84	79
[illegible]	[illegible]	172	[illegible]	[illegible]	41	[illegible]
[illegible]						
[illegible]	[illegible]	117	[illegible]	[illegible]	[illegible]	51
[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	40	[illegible]	31	19	1
*Oxygen consumed as dissolved oxygen:						
[illegible]		301		4		102
[illegible]	....	[illegible]		3.5		73
Filter effluent	....	[illegible]		3		[illegible]
Settling basin effluent		87		9		27
[illegible]						
Parts per [illegible]						
[illegible]	218	143	10	23	[illegible]	68
[illegible]	12.7	12.7	.6	2.3	[illegible]	7.7
Nitrogen as nitrites and nitrates	11.9	13.4	.10	.0	3.35	4.00
After [illegible]						
[illegible]	7.0	13.4	.0	.0	2.34	2.00
[illegible]	[illegible]	[illegible]	.0	.0	.64	1.00
[illegible]	7.0	7.0	.3	.4	[illegible]	3.9
Whole numbers of bacteria millions per c. c.—						
[illegible]	9.00	16.80	.03	.13	2.37	3.49
Septic effluent	6.45	10.00	.04	.02	1.05	1.71
Filter effluent	5.30	4.60	.02	.04	[illegible]	[illegible]
Settling basin effluent	2.35	2.14	.11	.81	.74	1.50
	[illegible] Matter.		*Ox[illegible] Con[illegible]		Bacteria.	
	1909	1910	[illegible]	[illegible]	1909	1910
Per cent removed by—						
[illegible]	58	[illegible]		[illegible]	54	51
Sprinkling filters				68	45	62
Settling basins ...	[illegible]	[illegible]		19		
Whole system ...	[illegible]	59		76	74	79

the total suspended matter [illegible] the bacteria from the sewage [illegible] fication, with respect to stream pollution, amounts to only 28 per [illegible] which purification of the [illegible] by tank treatment alone, [illegible] by the freshness, composition and strength of the sewage and the design [illegible] advances in the design of preliminary treatment tanks have so increased the efficiency of this part of the process that in some places tank treatment alone suffices. It is our expectation to improve our tank treatment in the future, but the staleness of our sewage forbids any very marked improvement and all that we expect to do is to maintain the production of a somewhat [illegible]

The sludge which settles out in the tanks and which is not destroyed by bacterial agencies, is flushed into the river during flood stages. The justification for this practice is based on the principle that a flowing stream of water is able to oxidize or burn up putrescible matter and that a non-water supply stream, like the Scioto, may receive limited amounts of such material without causing a nuisance. The tank sludge, which is the same as concentrated sewage, is discharged into the river whenever the dilution is sufficient, and this practice is even more justifiable than the daily discharge of the purified effluent of the works during low water. During extreme high stages of the river, the flow is amply sufficient to consume the daily day flow of sewage of the City of New York.

Sludge was flushed into the river on five different occasions during the year 1910. The river is unfit for boating, bathing, fishing and stock watering during high stages so that the discharge of sludge at such times could not in any way interfere with the rights of riparian owners unless it created a sight or smell nuisance. The discharge of sludge into the river during flood stages causes a blackening of the water until a thorough mixing has taken place, after which there are no evidences of pollution discernible to sight or smell. This mixing is accomplished within one mile below the point of discharge and the blackening, which is very pronounced at the point of discharge gradually disappears so that at a distance of one mile below the works there is no perceptible coloring of the water.

AERATION AND OXIDATION BY SPRINKLING FILTERS

After the crude sewage has been clarified in the tanks, it is ready for the second step in the process of purification, which consists of a spraying of the liquor over beds of crushed limestone through which it trickles to underdrains which carry it away. The crushed stone is from 1 to 4 ins. in diameter and the beds have an average depth of about 5½ ft. The liquor, which is applied to the beds in the form of a spray, carries the finely divided sewage solids in suspension, soluble and unstable products of decomposition, and high numbers of bacteria. The spraying of this liquor causes it to be broken up into small drops and this in turn promotes the absorption of oxygen from the air and causes the release of much of the gas which was absorbed in the tanks. This tank liquor is often more offensive than the raw untreated sewage, because of this absorption of offensive gases. After the sprayed liquor reaches the surface of the beds, it trickles down over the stones and a part of the suspended matter settles out and is deposited. In a short time these stones become coated with a slimy mass (particularly those within the surface foot) which, when examined, is found to be composed of organic matter, particular species of bacteria which find the environment favorable, and many other species of microscopic and larger plant and animal organisms to which this slime is a food supply. The particular species of bacteria referred to are those forms which take the partly decomposed and unstable substances and convert them by oxidation into stable products which are not of a polluting nature.

The question naturally arises as to whether or not these stone beds ever become clogged. As a result of more than two years experience it can be said with reasonable certainty that these beds, if properly handled, will never become clogged to such an extent as to necessitate the removal and cleaning of the stone. This failure to become clogged may be accounted for in two ways: First, there is a continual destruction of a part of these deposits by the living organisms which are so abundant in the beds, and second, this material is periodically unloaded or washed out leaving the stones sometimes remarkably clean. The causes of this unloading are not well understood, but the unloading is practically always noted in sprinkling filter treatment of sewage. The cyclic life of some of the larger organisms (particularly the moth fly) is thought to be a contributing factor.

The rate of application of the clarified sewage to these beds will be governed by the kind of effluent which is desired. A good result may be secured if the filters are dosed on a 15 minute on and off schedule with an actual application of 1,500,000 to 1,750,000 gals. of normal clarified sewage per acre per day. When this rate is exceeded with normal sewage the result is very apt to be unsatisfactory during the "warm-weather-low-water" season.

The actual purification effected by the sprinkling filters varies from 60 to 80 per cent with an average for the year 1910 of 68 per cent. The highest purification is obtained during the warm weather months and this is also the time of the year when the best results are demanded. The reduction in the whole numbers of bacteria by the sprinkling filters amounted to 62 per cent for the year 1910 and is also greatest during the warm weather.

During intensely cold weather, the purification by the sprinkling filters is not so good because of the inhibiting action of the cold on the microscopic life. At such times there is more or less ice formation on the surface of the beds and the liquor becomes chilled through contact with it. The freezing on the beds in the coldest weather has never seriously interfered with the operation of the filters.

FINAL TREATMENT.

The effluent from the sprinkling filters carries at all times some suspended matter, and, during unloading periods large effluents which should be removed before the effluent is discharged into the river. This final sedimentation and clarification is accomplished in two shallow concrete basins which have a combined capacity of 4,000,000 gals. and which may be operated singly or together.

The removal of suspended matter by these basins will average a little better than 50 per cent, the removal being greatest during the unloading periods of the filters. During the passage of the filter effluent through these basins, an increase in the whole numbers of bacteria is noted most of the time, and a loss of dissolved oxygen usually occurs during the warm weather. The decrease in dissolved oxygen is greatest when the filter effluent has not been very completely oxidized in the filters. This loss of dissolved oxygen in the basins is partly retrieved by the aeration which the effluent from the basins gets at the outfall weir.

The final settling of the filter effluent is very desirable at Columbus especially during the warm weather months of the year, and this part of the process ought to be brought to the highest efficiency. The discharge of an unsettled filter effluent into a sluggish stream like the Scioto, is very sure to cause trouble during the warm weather. The light, flaky suspended matter, found in the effluent from the sprinkling filters, settles out in the river and decomposes during warm weather. Masses of this sludge are floated to the surface of the water by imprisoned gas bubbles and this floating material gives the stream an unsightly appearance.

Table I gives a summary and comparison of the conditions of operation and analytical result for the years 1909 and 1910.

The regular force at the Sewage Purification Works includes the chemist in charge, one assistant chemist, three attendants, one on each trick of eight hours, and two laborers. Additional laborers are employed in the summer and fall on the grounds for the cleaning of nozzles, settling basins, etc. With a more compact arrangement of the plant a much smaller area in grass would have been required and the cost of maintenance would have been lessened. The proposed tank changes will reduce the cost of operation also by eliminating nozzle troubles, etc. A part of the area inside the levee has been seeded to alfalfa and promises to make a good return on the investment while at the same time lessening the cost of maintenance.

Measured Run-off From Sewered Areas.*

The data on run-off here given are from certain sewered areas in the southern part of the city of Chicago. These areas are three in number, designated by the location of the outfall sewers as the 39th St. district, the Wentworth Ave. district, and the 92d St. district.

39th Street District.—The area of this district is 14,340 acres. The population in 1910 was 273,698—an average of 19 per acre. The distribution of population, however, is not at all uniform. The north half is densely populated. Streets are generally paved. The tabulation of run-off presented here is compiled from the pump records of the 39th Street pumping station for the year 1909. This was a year of excessive precipitation. The rainfall was 43.22 ins., whereas the normal annual precipitation is 33.70 ins. The territory is very flat, being practically level from north to south and sloping only 2 or 3 ft. per mile from west to east.

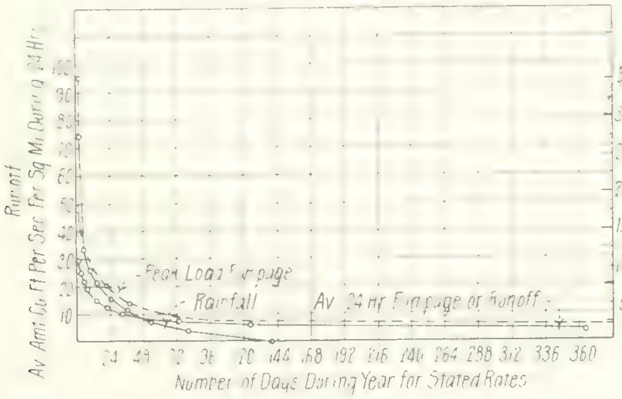

Fig. 1—Diagram Showing Relative Rainfall and Run-off in 39th St. Sewer District, Chicago.

(Example: Run-off is from 10 to 12 cu. ft. per second per square mile for 36—24=12 days per year.

A table was prepared showing the run-off of the 39th Street district, arranged according to the amounts in cubic feet per second, and the corresponding 24-hour period for such amounts of run-off or pumpage for each month of the year 1909. From this tabulation Fig. 1 was made. The curve marked "Rainfall" is platted to the same scale as the run-off curve and the difference between the two curves, less the supply from the water mains, shows the absorption and evaporation. The average daily per capita consumption of water may be taken as 200 gals.

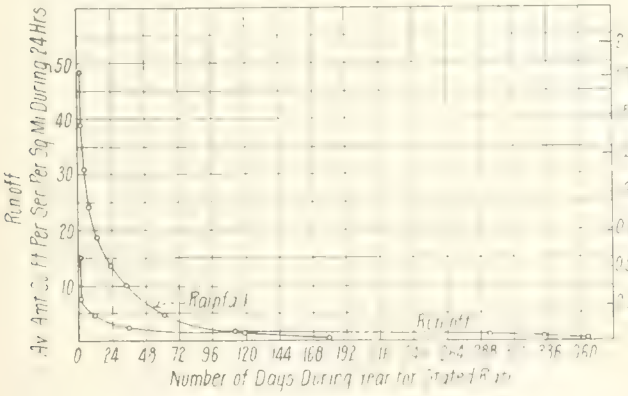

Fig. 2—Diagram Showing Relative Rainfall and Run-off in Wentworth Ave. Sewer District.

(Example: Run-off is from 5 to 7 cu. ft. per second per square mile for 9—3=6days per year.)

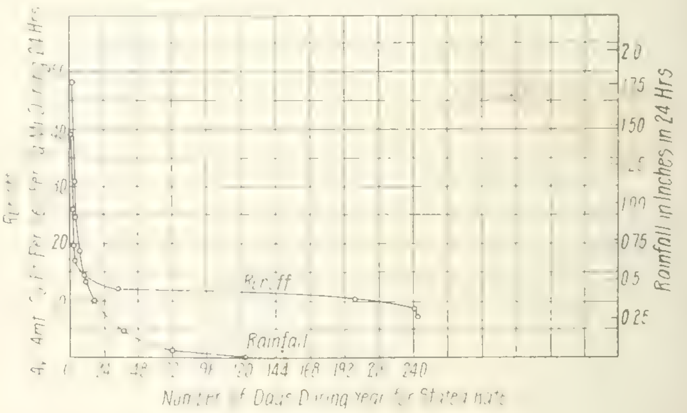

Fig. 3—Diagram Showing Relative Rainfall and Run-off in 92d St. Sewer District.

(Example: Run-off is from 12 to 20 cu. ft. per second per square mile for 36—2=34days in a period of 243 days.)

Wentworth Avenue District.—The Wentworth Ave. sewer district is an irregular shaped area extending from 87th St. on the north to the outlet into the Calumet River on the south—a distance of 5¼ miles. The north 2½ miles is about 2½ miles wide. The south part varies from one mile down to one-half mile in width at the outfall. The west part of the north half of the drainage area includes a steep ridge, the summit of which is 70 ft. above the east half. The surface along the east portion through which the main outfall sewer runs is nearly level.

The area of the Wentworth Ave. district is about 5,300 acres. The population in 1910 was 28,039—an average of 5.3 per acre. It is a suburban district with but a small portion of paved streets. The outfall sewer is 10.5 ft. in diameter. The record of run-off was obtained by means of a sharp-crested weir placed near the outlet of the sewer. The crest of this weir is 2.2 ft. above the sewer invert and is 8.72 ft. wide without end contractions. The observer read the weir gage three times daily and also noted any high water marks on the gage during intermediate periods. The discharge is thought to be correct to within 5 per cent.

A table was prepared showing the run-off of the Wentworth Ave. district arranged according to amounts in cubic feet per second, and the corresponding 24-hour periods for such amounts of run-off for each month of the year from Aug. 1, 1910, to July 31, 1911. The rainfall for this year was 28.23 ins., as compared with the mean annual rainfall of 33.28 ins. Figure 2 was platted from this table.

92nd Street District.—The 92nd Street district includes an area of 99 acres in the center of the business district of South Chicago. The population in 1910 was 3,496, an average of 35 per acre. The surface is level, compactly built up and streets paved. Much of the land has been filled in for street grades. Figure 3 shows the run-off from this district for the period from Aug. 1, 1910, to March 31, 1911.

The outfall of the 92nd St. sewer is 3.5 ft. in diameter. The record of run-off was obtained by weir gage reading similar to the Wentworth Ave. sewer. The weir was sharp crested with top 1.1 ft. above the invert of the outfall and 3.16 ft. wide without end contractions except for a short period of time when a weir 30⅛ ins. wide with end contractions was used.

The rainfall record given is from the downtown (Chicago) station of the U. S. Weather Bureau. While the amount of individual downpour on any one day between the downtown district and the South Side districts may be different, it is not likely that there is any material difference in the amount of maximum downpour, the annual precipitation or the number of days per year for any stated rate.

General.—Several detailed and elaborate analyses have been presented in recent years for estimating the amount of run-off for sewered areas based upon records of rainfall. In the absence of the more direct data of actual run-offs such methods may have to suffice the engineer in designing storm sewers or sewage pumping plants. For large areas in this climate the maximum run-off will occur during a period of warm rains falling upon an accumulation of snow or upon an impervious surface of frost and ice. In this case there is obviously no relation between the downpour and run-off. The amount of run-off depends not only upon the rainfall but upon evaporation, slope, and some ten or twelve other factors which have to be guessed at.

The writer believes that if the same efforts now expended in endeavoring to find a relation between rainfall and run-off were directly applied to the collection and comparison of actual run-off figures, a more definite basis for the design of sewers would he obtained

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New Stream Pollution Law in California.—Among the new public health laws enacted during 1911 is one on stream pollution. This act makes it unlawful to discharge any sewage or other feculent matter into any body of water used or where intended for human or animal consumption. It differs from the stream pollution law passed in 1907 in the following particular: When a city, institution, etc., desires to discharge sewage or other feculent matter into a body of water it must first get permission from the State Board of Health, whereupon a thorough investigation as to the kind of substance proposed to be discharged shall be made before permission may be granted. This act delegates all authority for protecting the streams to the State Board of Health.

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*Abstract of paper by L. K. Sherman before the Western Society of Engineers, Jan. 15, 1911.

Lawrence Experiment Station Studies in the Purification of Water.

During 1910 studies [illegible] polluted water [illegible] double filtration, and by mechanical filters with the aid of coagulents, and systematic studies on the relative efficiency of filters of equal depths and containing sand of the same effective size, but operated at different rates, were made at the Lawrence Experiment Station by H. W. Clark and Stephen De M. Gage. The results of these studies are summarized in the annual report of the Massachusetts State Board of Health for 1910.

Studies [illegible] Sand Filters Operated at Different Rates.—Filters Nos. 220, 244, 281 [illegible] taining about 40 ins. in depth of sand of an effective size of [illegible] continued in operation during the first ten months of the year. Filter No. 330 was operated at an average rate of 4,859,000 gals., No. 220 at an average rate of 6,775,000 gals., No. 281 at an average rate of 6,890,000 gals., and No. 244 at an average rate of 15,352,000 gals. per acre daily. The surface of No. 330 was washed to a depth of 1 in. to relieve clogging 25 times; that of No. 281, 40 times; that of No. 220, 57 times; and that of No. 244, 57 times during the period of ten months they were operated during the year. In addition to washing the surface, it was necessary to scrape No. 330 twice, No. 281 once, No. 220 three times, and No. 244 four times, and to wash the whole body of sand in Nos. 220 and 244 twice each. The filters were of different ages when the experiment upon comparative rates was begun, and for this reason the comparison has hardly been a fair one. It was intended to operate No. 220 at a higher rate (approximately 10,000,000 gals. per acre daily) than No. 281. Owing to serious clogging within the lower layers of sand in this filter, which could not be removed except by rebuilding the filter, the high rate of operation could not be maintained, and the experiment was discontinued on Sept. 30, 1910.

The filters handled Merrimac River water, which contained 5,600 bacteria per c. c. at 20° C. The effluent from filters Nos. 220, 244, 281, and 330 contained 53, 295, 28, and 95 bacteria per c. c. respectively at 20° C.

Mechanical Filtration Combined with Disinfection.—Filter No. 336, 1/40,000 of an acre in area, and containing 24 ins. in depth of sand of an effective size of 0.35 millimeter, was first put into operation on Dec. 11, 1907. This filter has been operated as a mechanical filter at a rate of 100,000,000 gals. per acre daily with canal water which has been treated with sulphate of alumina and a mixture of soda ash and hypochlorite of lime, and passed through a settling tank with a storage capacity of 3¼ hours. In the report for 1909 it was proved that in order to obtain an effluent containing low numbers of bacteria, the use of about 2.0 grains sulphate of alumina and 1.5 grains soda ash per gallon are necessary, but that by the addition of small amounts of a disinfectant such as hypochlorite of lime an effluent of low bacterial content and of satisfactory physical appearance can be produced by the use of about 1.0 grain sulphate of alumina and 0.75 grain soda ash per gallon.

For purposes of comparison, the filter was operated during one day in each week without the addition of the disinfectant. The average number of bacteria in the effluent of the coagulation and settling basin on the days when no disinfectant was added was 530 per c. c. and the average number in the effluent from the filter was 95 per c. c., the bacterial efficiency of the settling tank being about 93 per cent, the efficiency of the filter being about 82 per cent and the efficiency of the system being about 98.3 per cent. The average number of bacteria in the effluent from the settling basin during the remainder of the time when disinfectant was being added was 22 per c. c. and the number in the filter effluent was 13 per c. c., the average bacterial efficiency of the process of coagulation and sedimentation combined with disinfection being 99.6 per cent., the removal of the bacteria by the filter being about 41 per cent, and the efficiency of the system being about [illegible] per cent. It will be observed that the bacterial efficiency of the settling tank under the combined process was greater than the efficiency of the entire system on the days when no disinfectatnt was added. In other words, as was pointed out in the last report, the filter in this case acted as a very large factor of safety, insuring an effluent of low bacterial content.

Chemically, the effluent from this filter was of satisfactory quality throughout the year, the water being free from turbidity and hav- [illegible] color was about 66 per cent, and the removal of organic matter was 48 per cent and 51 per [illegible] oxygen consumed determinations respectively [illegible] during 1910 have been 0.97 grain sulphate alumina and 0.62 grain soda ash per gallon, and the amount of disinfectant used has averaged about 0.15 grain per gallon, equivalent to 0.096 part per 100,000 available chlorine. With sulphate of alumina and soda ash each at 1 ct. per lb. and bleaching powder, averaging 37 per cent available chlorine, at 1¼ cts. per lb., the cost for chemicals averaged about $2.55 per million gallons.

The average quantity of water filtered between washings was about 30,000,000 gals. per acre, the average length of time the filter could be operated without washing being about seven hours ten minutes.

Double Filtration Combined with Disinfection—Filters Nos. 331 and 286.—Filter No. 331, 1/80,000 of an acre in area, containing 18 ins. in depth of sand of an effective size of 0.45 millimeter, and first put into operation on July 7, 1907, has been operated as a pre-filter at a rate of 50,000,000 gals. per acre daily throughout the year. The canal water applied to this filter is first passed through a settling basin having a storage capacity of about ten hours. The entire body of sand in the filter was washed in the same way that mechanical filters are washed, 34 times during the year, the average quantity of water filtered between washings being about 520,000,000 gals. per acre. The effluent from No. 331 flows into a tank where it is treated with hypochlorite of lime, and after about 30 minutes' storage is pumped into a storage tank from which it is applied to No. 286. The average amount of hypochlorite of lime added was about 0.076 grain per gallon, equivalent to about 0.048 part available chlorine per 100,000. The average cost of chemicals, with bleaching powder containing 37 per cent available chlorine at 1¼ cts. per pound, was about 45 cts. per million gallons.

Filter No. 228, 1/20,000 of an acre in area, containing 4 ft. in depth of sand of an effective size of 0.21 millimeter, was first put into operation on Jan. 20, 1906. This filter has been operated as a secondary filter with the treated effluent from No. 331, at a rate of 5,000,000 gals. per acre daily. The surface of this filter was scraped twice during the year, the average quantity of water filtered per scraping being about 780,000,000 gals. per acre. The net rate of the double filtration system was about 4,550,000 gals. per acre daily.

From a chemical and physical viewpoint the effluent from this double filtration system was of about the same quality as effluents from single filters operated at about the same net rates. The color of the canal water was reduced about 10 per cent and the albuminoid ammonia about 50 per cent during passage through both filters. The amount of nitrates in the water was about doubled during filtration and the free ammonia was decreased about 70 per cent. About 50 per cent of the bacteria were removed from the canal water by passage through the settling tank before being applied to No. 331. The average removal of bacteria by No. 331 was about 47 per cent. The result of the disinfection process was a removal of about 86 per cent of the bacteria as shown by room temperature counts [illegible] perature counts. In the tank in which the treated effluent was stored before being applied to the secondary filter the numbers of bacteria increased about 120 per cent, as shown by room temperature counts, but there [illegible] the body temperature counts. The average bacterial efficiency of the secondary filter was about 86 per cent as shown by the room temperature counts and about 50 per cent as shown by body temperature counts, a very satisfactory result considering the low numbers of bacteria in the water applied to this filter. The average efficiency of the entire system computed from the averages of the effluent from the secondary filter and from the canal water before entering the settling tank was about 98.8 per cent, or slightly less than that of filters Nos 220, 281 and 330, previously discussed, each of which was operated at a somewhat higher rate, and in each of which the water received only a single filtration, without any disinfection treatment.

Classification by Upward Filtration Through a Roughing Filter of Course Material.—Filter No. 389.—In the last report, studies of upward filtration at a high rate through a filter of sand overlying a layer of charcoal were reported, and it was shown that extreme difficulty was experienced in keeping such a filter in operation owing to the accumulation of clogging matters in the lower layers, which clogging could not be removed either by reversing the flow or by washing the filter material in place. In order to determine whether a filter of coarser material and operated at a lower rate could be successfully operated in this manner, Filter No. 389, 1/20,000 of an acre in area, was put into operation on April 14, 1910. This filter contained 6 ins. depth of wood charcoal supported upon a ¼-in. mesh galvanized wire screen placed 12 ins. above the bottom of the tank. Overlying the charcoal and separated from it by a ⅛-in. mesh copper screen, was placed 24 ins. in depth of broken stone pebbles, of an effective size of 4.4 millimeters. Canal water entered at the bottom, passed upward through the filter material and overflowed through an orifice placed 3 ins. above the surface of the stone. This filter has been operated at a rate of about 10,000,000 gals. per acre daily, the rate of flow being controlled at the outlet. As constructed, the available loss of head is about 10 ins. On October 6, or after about six months' operation, the filter had become so clogged that the prescribed rate could not be maintained, and the filter was then washel by reversing the flow for a few minutes. This washing was successful in removing the clogging, and the filter was operated without further treatment during the remainder of the year.

This filter constructed of such coarse material and operated at this high rate, cannot be considered as other than a roughing filter to prepare the water for ultimate treatment by some other process. From this viewpoint the work of the filter was very satisfactory. Practically all of the suspended matters were removed, the color was reduced about 12 per cent and the organic matter was reduced about [illegible] consumed and albuminoid ammonia determinations respectively, while the nitrates were increased about 67 per cent. The monthly averages of bacteria varied between 130 and 1,760 per c. c., averaging 860 per c. c. during the year. The average removal of bacteria was about 85 per cent, as shown by counts at room temperature and about 82 per cent, as shown by body temperature counts. Comparing the work of this filter with that of pre-filter No. 331, constructed of sand, but operated at a rate about ten times as great, it will be observed that the effluent from Filter No. 389 was of slightly better quality, both chemically and bacterially, than the effluent from Filter No. 331.

Purification of Water by a Sprinkling Filter of Sand.—Filter No. 390, 1/20,000 of an acre in area, and constructed of 54 ins. in depth of sand of an effective size of 0.42 millimeter, was first put into operation on April 21, 1910. Canal water was sprinkled upon the surface of this filter by means of a tipping basin discharging into a perforated pan placed 12 ins. above the surface. The outlet of the filter was kept wide open at all times, the rate of operation being controlled at the influent pipe, the average rate being 4,143,000 gals. per acre daily. The practice has been to rake the surface of the filter to a depth of 1 in. whenever pooling of the water on the surface occurred. After six months' operation pooling on the surface could no longer be prevented by surface raking, and on October 21 3 ins. of dirty sand was scraped from the surface and the filter was allowed to rest for one week. Even after this radical treatment almost daily raking was required. Up to the end of the year the filter was actually operated 177 days, during which period the surface was raked 158 times. Chemically the effluent from this filter was of better quality than the effluents from Filters Nos. 220, 330 and 343, which were constructed of somewhat finer material and were operated at similar rates. The average removal of color by the filter was about 43 per cent, as compared with a removal of about 23 per cent by Filters Nos. 220 and 343. The average reduction in albuminoid ammonia was 54 per cent and the reduction in oxygen consumed was about 30 per cent, while the greatest reductions by the best of the three slow sand filters were 46 per cent in albuminoid ammonia and 20 per cent in oxygen consumed respectively. Nitrification was also more active in the sprinkling filter than in any of the comparable slow sand filters, the average amount of nitrates in the effluent being 0.32 part per 100,000, while the highest average nitrates in the effluents of the other filters were found in the effluent from Filter No. 343, which contained .023 part per 100,000.

The effluent from this filter contained more bacteria than the effluents from the slow sand filters. The average numbers of bacteria varied from 17 per c. c. to 310 per c. c. in different months, the average being 110 per c. c. The average bacterial efficiency was 98 per cent. In comparison, the numbers of bacteria in the effluents from Filters Nos. 220, 330 and 343 averaged 53, 95 and 80 per c. c. respectively, the least bacterial removal by any of these filters being 98.3 per cent and the maximum removal being 99 per cent. As regards numbers of bacterial growing at body temperature the effluents from both types of filters were quite similar. An interesting feature in the operation of this filter was the comparatively low numbers of bacteria obtained in the effluent from the beginning. With slow sand filters the number of bacteria in the effluents, when such filters are first put into operation, are usually as high or higher than the number in the applied water, and a period of time ranging from a week to some months is required before such filters come to maturity and the numbers of bacteria decrease to normal. With this filter, however, no maturing period was observed, the numbers of bacteria in the effluent being 360 per c. c. on the first day, 290 on the second day, 144 on the third day and 85 on the fourth day, after which the numbers fluctuated, as previously stated.

From the results quoted it is evident that while something may be gained in the removal of color and organic matter by the use of a filter of this type, the diminished bacteria efficiency and especially the very frequent surface treatment required to keep the filter in operation greatly diminished the practicability of filters of this type for use with waters resembling the Merrimack River waters.

DRAINAGE AND IRRIGATION SECTION

A 200,000-Acre Drainage Project Calling for 14,000,000 Cu. Yds. of Ditch Excavation.

The accompanying map Fig. 2, shows the drainage project officially known as Drainage District No. 9, of Mississippi County, Arkansas, which is about to be constructed. In round figures the area reclaimed will be 200,000 acres. The work to be done comprises 14,083,000 cu. yds. of excavation, 22 steel bridges, 17 wooden bridges, and spillways and minor structures and is estimated to cost $1,200,508. Plans and specifications and all engineering are the work of the Morgan Engineering Co., of Memphis, Tenn. The specifications for the work were published in our issue of Oct. 4, 1911. The following is a general description of the conditions and of the structures required.

The drainage district being described is located in Mississippi County, the northeasternmost county of Arkansas. It is a portion of the so-called St. Francis River drainage basin described previously in this journal. The western boundary of Mississippi county is the Mississippi River running south by west. To the west, 15 to 20 miles, on the Pemiscot Bayou and Little River running nearly parallel with the Mississippi. The land drained lies east of Little River and is an area roughly 40 miles long and from 5 to 16 miles wide; its boundaries are shown by the map Fig. 1.

The maps, Fig. 2, shows the layout of the ditch system, of which Ditch (1) and Ditch (6) may be called the main ditches. These main ditches start with bottom widths of 14 ft. and increase in size to bottom widths of 40 ft. Their side slopes are 1 on 1 except for certain positions, having 14-ft. bottom and the average cuts ranges from 4 ft. to 15 ft. The next largest is Ditch (40), which ranges from 14 to 50 ft. in bottom width. The other ditches are generally 14 ft. wide on the bottom except for about 12 miles of 4 ft. laterals, etc. The total mileage of ditches is 292.62 miles divided according to bottom widths about as follows:

Bottom width.	Miles.
4 ft	12.60
14 ft	192.39
18 ft	5.60
20 ft	7.00
22 ft	14.20
24 ft	4.00
25 ft	11.00
28 ft	7.00
30 ft	15.00
35 ft	12.75
40 ft	16.78
50 ft	6.90
Total	292.62

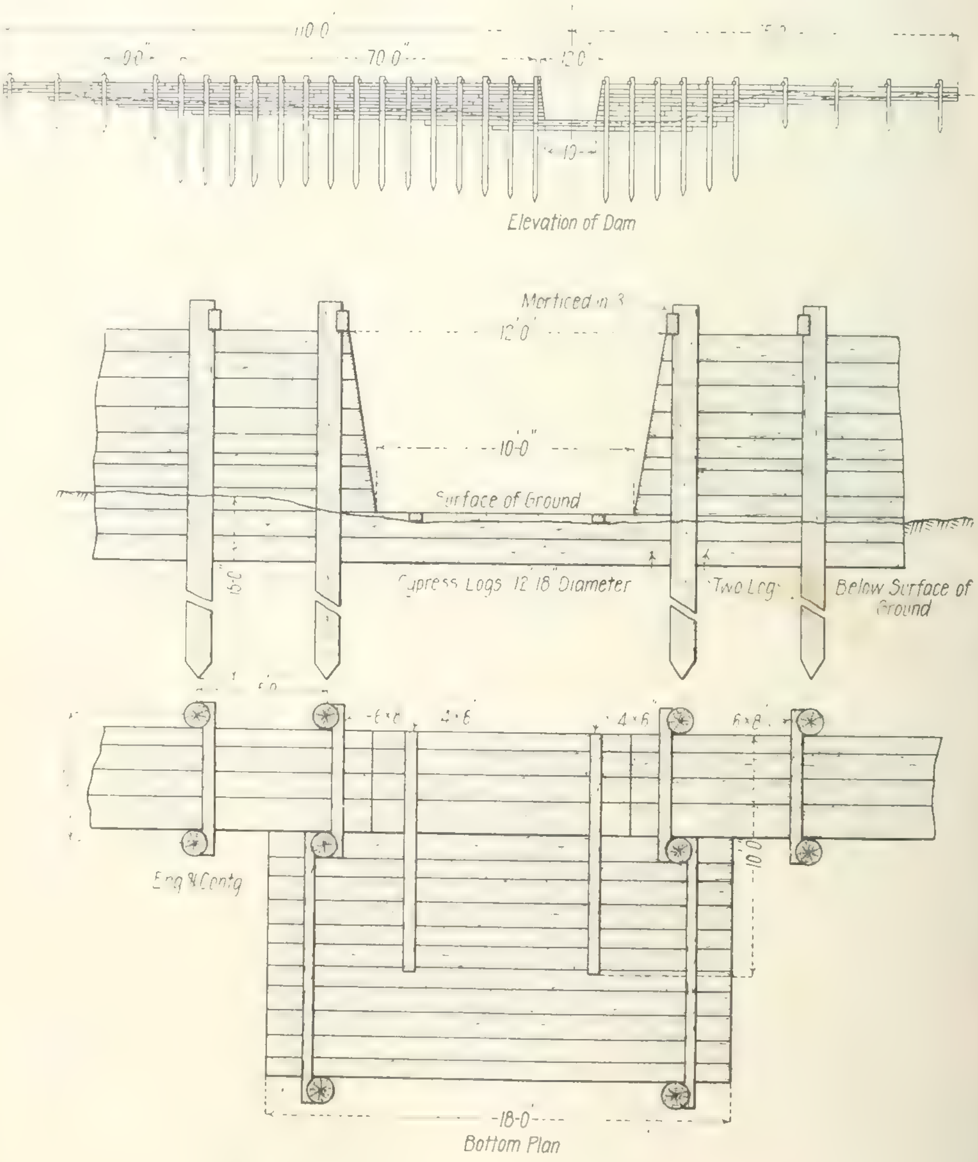


Fig. 1—Log Dam and Spillway for Drainage Ditch.

It will be seen that all but about 12 miles of these ditches are designed for construction by dredges. Of the 14 ft. ditch some 170 miles are planned with side slopes of ½ or 1; these are mostly laterals and upper ends. If this will show a substantial saving by doing so most of these ½ or 1 ditches will be changed to 6 ft. bottom and 1 on 1 side slopes. This change will reduce the excavation per mile from 30,000 cu. yds. to 24,000 cu. yds.

Most of the area to be drained is covered with hardwood timber. The road throughout is pine except perhaps in about two miles of lake bottom.

Ditches (1) and (6) as indicated on the map will be leveled; this work is estimated to cost some $20,000. The estimated cost per cubic yard of ditch excavation is 8 cts., 10 cts. and 15 cts. The 15 ct. estimate is for 252,200 cu. yds. of 4-ft. laterals which will be scraper work and the 15 ct. estimate is for 552,200 cu. yds of larger ditch; the 8 ct. estimate covers therefore about 95 per cent of the excavation. The total estimated cost of ditch and lower work is $1,175,338.

The work calls for very few structures except bridge crossings of which there will be 39, estimated to cost $20,675. There will be two spillways, one a concrete structure on Ditch (1), and the other a pile and timber structure at Tyronza Cut-off. These spillways are shown by Figs. 1 and 3. The concrete structure shown by Fig. 3 calls for 127 cu. yds. of excavation and 55 cu. yds. of reinforced concrete; estimating concrete at $20 per cubic yard, and excavation at 20 cts. per cubic yard, the work will cost $11,125.40. The structure is simple and is noteworthy for that reason. This log dam and spillway shown by Fig. 1, is not a familiar type. It is estimated to cost $950 in place.

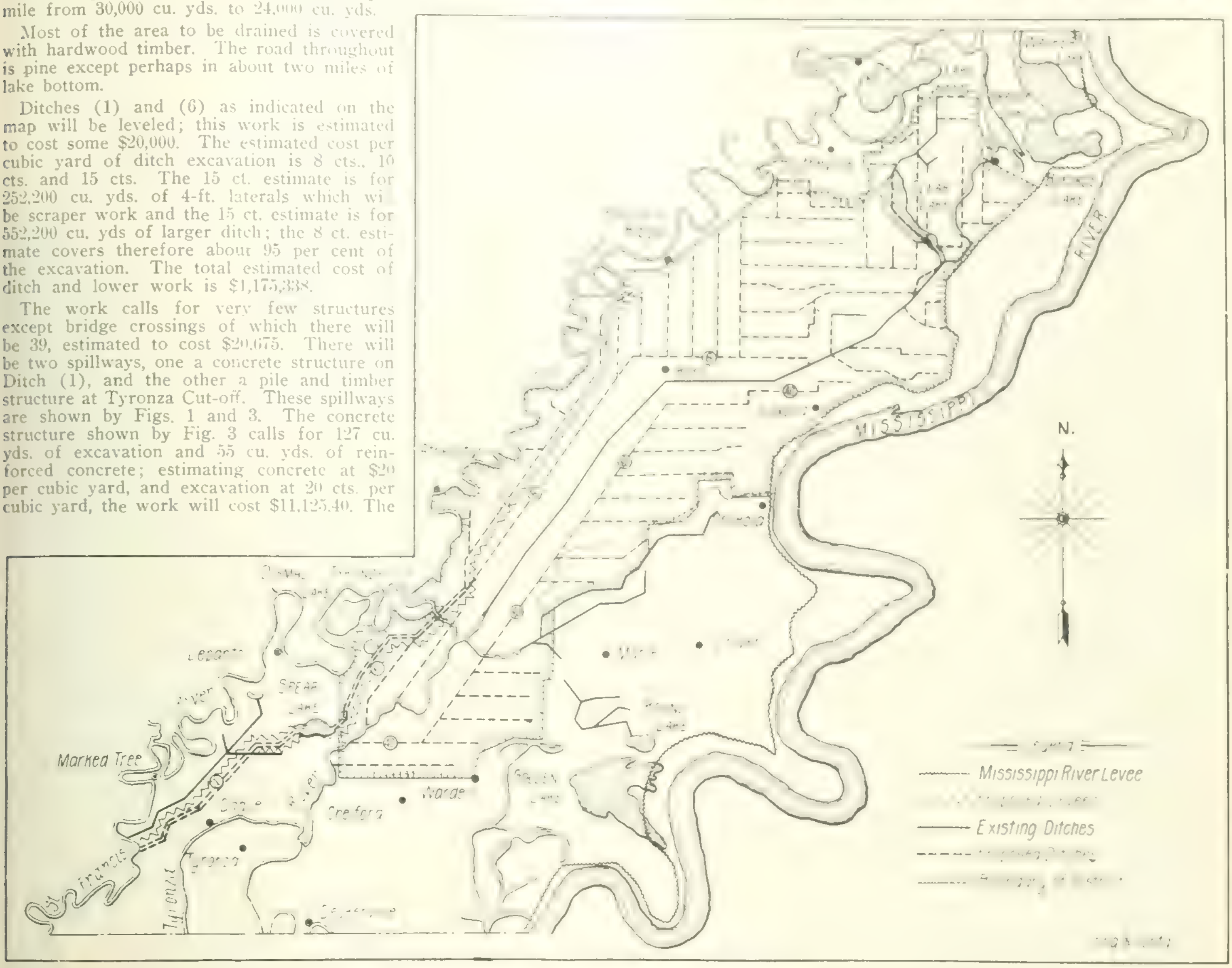


Fig. 2—Map of 200,000-Acre Drainage Project, Mississippi County, Arkansas.

International Conference on People's Baths and School Baths.—An international conference on people's baths and school baths will be held this year at The Hague during the last week of August. The preliminary circular, issued by the committee on organization, states that the chief purpose of the meeting is the promotion of public interest in bathing and that it is intended to afford an opportunity to all those interested in the subject to compare notes regarding the best manner of arranging and operating public and school baths and regarding the results obtained by existing establishments from a hygienic point of view. Municipal authorities and civic improvement societies in all civilized countres will be invited to send delegates to attend the conference. It is proposed to hold four sessions, embracing the following subjects: (1) Reading of essays, reports and papers regarding people's baths, school baths, factory baths, military baths, river and sea baths. (2) Discussion of technical questions [illegible] general arrangement, [illegible] operation and the [illegible] the attitude of the state, province or county and the municipal community toward this social problem. (4) Relation between public baths and public health. Dr. William Paul [illegible] gineer, 39 Strong Place, borough of Brooklyn, N. Y., has been chosen as member of the general international committee to represent the United States and to organize here a national committee.

The Estimation of Costs in Relation to Drainage Systems.

Contributed by J. L. Parsons, Drainage Engineer.

The estimated total approximate costs of drainage systems is a comparatively simple problem, as the various cost items are few in number and may be closely estimated from local retail price lists and prevailing contract prices for similar work. But of more import to the contractors or bidders are the peculiar conditons or obstacles to be encountered during construction which will tend to increase or decrease the cost as compared to average costs. Therefore to intelligently estimate costs drainage engineers must be familiar with and recognize the items of cost which must necessarily be considered by prospective bidders and should deduce estimates from the contractors' standpoint, both for the purpose of arriving at accurate estimates and fairly presenting the facts to bidders. The cost fac- [illegible] material, cost of labor, cost of delivery of materials, cost of administering drainage contracts, cost and depreciation of necessary plant, cost of financing the contract, and probable damage claims and legal expenses. In addition to the probable contract price as [illegible] other contingent expenses and right of way or damage claims must be considered by the engineer in arriving at the total estimated cost to the owner.

The principal materials entering into the construction of tile drains are tile, gravel and cement for concrete work, grates, sewer pipe, corrugated pipe, tile Y's and sewer pipe T's. No material is permanently placed in the average open drain excepting that necessary for the construction of a limited number of ditch inlets. As a rule the cost of tile delivered at nearest railroad station for points within the state of manufacture is fixed by the published price list of tile companies. The costs will be materially increased in cases where long distance shipments are necessary. Discounts are seldom made by tile plants for any consideration except cash payments excepting when trade wars occur between competing plants, a possibility which is not to be safely considered in estimating costs. The general prices for standard glazed clay tile, cement tile, tile Y's and T's, sewer pipe, sewer pipe Y's and T's, grates and corrugated pipe, are listed in Table I, together with other information of convenience to drainage engineers. These prices are applicable to the central western states and are subject to slight fluctuations because of variations in the cost of labor and demand for tile. At the present time the quotations upon cement tile are approximately the same as for clay for the smaller and considerably cheaper for the larger sizes. However, the standard of manufacture is tending toward a better product and it is problematical as to what the difference in cost will finally be between properly manufactured tile of the two materials. As the engineer's estimate often precedes the installation of the work for periods of several years, it is a difficult matter to accurately forecast tile costs. However, allowances may be made for a general downward or upward trend of prices. It is an evident fact that tile production increases during wet periods when drainage is most extensively practiced, with a consequent tendency to overproduction during the succeeding drier years. These periods or cycles of wet or dry years occur at fairly regular intervals and by an investigation of this tendency an engineer may forecast the general condition of the market with some degree of accuracy. The contractor's bid is compiled at a time closely preceding the actual purchase of the tile bill and there is consequently less danger of changes in prevailing prices. The engineer's estimate should itemize the probable cost of tile, other materials, labor, etc., in order that contractors may compare the various units in relation to their cost at the time of estimating and the time of bidding and make the proper allowances. The amount of concrete work necessary usually constitutes a small percentage of the contract cost and may be estimated with sufficient accuracy at $8 to $10 per cubic yard. In cases where larger quantities of concrete are necessary the cost of gravel, cement, forms and other necessary items should be definitely computed from local prices and estimates made accordingly.

While the foregoing material cost items may be estimated with reasonable exactness, especialy by bidders, the cost of labor does not admit of such accurate approximation. The rates of wages often fluctuate as much as 30 to 40 per cent upward or downward during the time intervening between the preparation of the estimate and the process of construction. To the contractor operating on a small capital margin such changes are serious. In many cases the original contractor attempts to insure his profit by tentatively subletting all labor before submitting his bid. This arrangement results satisfactory as long as the subcontractor is prospering, but the sub-contractor usually operates with little surplus capital and in case of unforeseen losses must either abandon the work or receive additional support from the original contractor. In all instances of this nature, and they are far from exceptional, the contracting party or his bondsman must ultimately sustain the losses.

The cost of trenching, laying of tile and backfilling may be estimated by the lineal foot or per cubic yard of excavation, the price varying according to depth, but whatever system is used the rate of wages and condition of soil and weather are governing factors. Drainage contractors have generally been forced to gamble upon the nature of the soil and file bids in accordance with the restrictions of competition, as a result often bearing destructive losses or receiving unreasonable profits. The author holds that common business justice should require that soil surveys be made and recorded for the investigation of bidders. Such a procedure would tend to

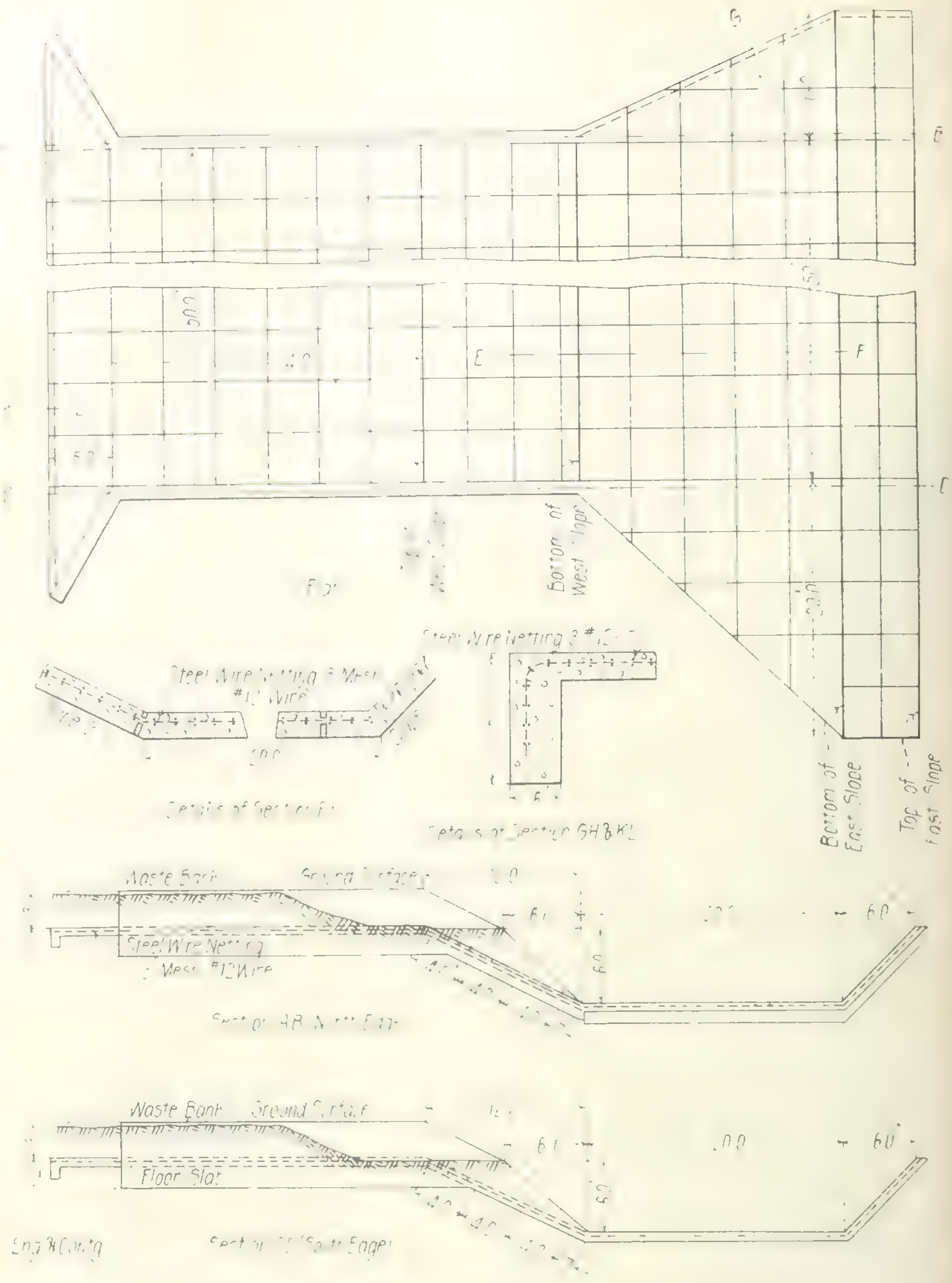


Fig. 3—Reinforced Concrete Spillway for Drainage Ditch.

TABLE II.

Contract prices per 100-foot section for trenching back-filling and laying of tile for varying depths and sizes of tile.

Size, ins.	3 to 4 ft depths	4 to 5 ft. depths	5 to 6 ft depths	6 to 7 ft. depths	7 to 8 ft. depths	8 to 9 ft. depths	9 to 10 ft depths
5 & 6	$6.00	$6.10	$10.60	$11.80	.....	.....	.....
[illegible]	7.70	8.40	9.40	15.30	$20.70	.....	$22.46
10	10.00	10.20	13.50	15.80	24.80	.....	.....
12	...	10.20	14.10	18.70	22.10	$22.00	.....
14	..	21.60	29.30	.....	28.60	30.20	36.06
15		26.00	22.10	24.30	.....	33.30	.....
16	.	.....	24.00	24.50	28.50	31.55	.....
18	...	16.00	27.00	31.10	33.35	.....	50.45
20	....	. .	27.00	26.90	.....	.....	39.60
22	..	. .	30.00	36.60	.....	.....	38.90
24	.....	.....	25.80	25.30	38.80	.....	.....

TABLE III.

Yardages.	Average coal haul.	Contract cost per cu. yd.
74,828	6 miles	$0.12
64,154	4 miles	0.15
90,813	4 miles	0.10
94,102	1 mile	0.12
112,182	5 miles	0.09
141,741	2 miles	0.09
183,454	1½ miles	0.11
202,277	4 miles	0.07

TABLE I.

Diam. of pipe in inches	Clay Tile: Cost per 1,000 ft	Clay Tile: Cost of Y's and T's.	Clay Tile: Weight per ft., lbs	Cement Tile: Cost per 1,000 ft	Cement Tile: Weight per ft	Sewer Pipe: Cost per ft	Sewer Pipe: Cost of T's and Y's	Cost of grates	Cost of corrugated pipe per ft. with trap door	Cross sectional area of pipe in sq inches
5	$ 25.00	.....	10	$ 25.00				.	..	19.63
6	30.00	$0.20	12	35.00		[illegible]	$0.36	$0.30	...	28.27
7	40.00	.25	15	[illegible]				.40	....	38.48
8	55.00	.25	18	[illegible]		.15	.65	.40	$0.55	50.27
10	85.00	.35	27	75.00	...	.20	.86	.60	...	78.54
12	120.00	.45	36	[illegible]	.	.24	1.08	.90	.70	113.09
14	190.00	.75	48	165.00		.	...	..	.	153.93
15	230.00	.90	50		...	.37	1.67	1.50	[illegible]	176.71
16	260.00	1.00	60	240.00	..			....	.85	201.06
18	360.00	1.87	70	300.00	100	.56	2.50	2.25	.....	254.46
20	500.00	2.50	90	360.00	116	.75	3.30	2.60	.....	314.16
22	575.00	2.88	110	420.00	142	.90	3.97		..	380.13
24	675.00	3.38	124	540.00	[illegible]	1.05	4.75	...	1.30	452.39
26	900.00	4.50	141	660.00	224			..	...	530.93
28	1,050.00	5.25	190	750.00	251	.	.	...	....	615.75
30	1,300.00	6.50	210	840.00	286			...	1.70	706.85
32	1,450.00	8.75	222	960.00	320	.	....	....	.....	804.25
36	1,800.00	10.80	300	1,200.00	400				2.25	1,017.88

attract the better class of contractors and discourage the inexperienced and incompetent plungers from attempting work which they would be unable properly to execute. The slight increase in first cost would be more than compensated for by the advantages accruing from the intelligent prosecution and completion of the work. Table II is a tabulation of averages of a large number of actual (Iowa) contract prices compiled from accepted bids, which includes all items of labor cost and contractor's profit for trenching, backfilling and laying of tile. The average labor cost for these contracts is $2.50 per day for day labor without board and $3.50 per day for skilled tile layers. The wide variation in costs for apparently similar work illustrates more the keenness of competition, as very little was known of soil conditions in any of these instances. Statistics compiled by contracting firms of actual costs for known soil conditions would be valuable particularly to the contracting profession and more such data should in the common interest of the profession be prepared and published. Sand and joint clay in the presence of water are the moist serious obstacles in tile trenching, as it is not necessary to curb the sides of the trench for ordinary tiling operations unless the soil is too unstable to maintain its position without it. Hence the cost is materially increased when it becomes necessary to solidly curb the trench and lay each tile separately in a specially prepared sand box.

Under the division of cost of delivery of materials will be considered only the cost of transporting all requisite materials from the nearest railroad station to the line of work. Because of the small amount of gravel, cement and forms necessary the average cost per cubic yard for concrete work may be considered as including all items connected with concrete work. The cost of delivery of the necessary tile forms a large percentage of any tile drain cost because of the tonnage involved. This work is usually best accomplished by the contractor subletting the hauling to local parties at so much per ton, an arrangement which may also prove unsatisfactory in case the sub-contractor is losing money. A more business like method would be to withhold a percentage to insure the completion of the hauling, but as a rule available teamsters in country towns generally refuse to contract the work otherwise than upon a full payment basis. They are also often able to dictate terms and fix their own standards of compliance because of their scarcity. Conditions favorable to low ton mile rates are hard roads, level gradients, stable right of way along which the tile are to be distributed, such a length of haul that a certain number of complete round trips may be made in one full day and dry weather during the time of hauling. It is seldom, however, that many of these ideal requirements exist in a given case. The average country roads are not surfaced with hard material and become heavy and impassable during wet weather, and it often occurs at such times that the delivery of tile cannot be readily delayed because of the economy of hauling direct from the car and the demand for tile at the line of ditch. At times when tile companies are sufficiently stocked to be able to make shipments as desired the delivery of tile may be more closely conformed to road conditions. The necessity of traversing one or more steep hills on the route or of distributing the tile upon wet, swampy locations, conditions which require lighter loads or the occasional doubling of teams, tend to materially increase the cost of hauling. To estimate the cost of hauling per ton most accurately the number of tons per load that may be successfully hauled and the number of trips possible per team per day should be determined for the probable road conditions and the resulting daily tonnage divided into the rate of wages customary for a man and team per day gives the approximate cost per ton. At a rate of $5 per day for a man and team the cost of hauling averages from 50 cts. to 80 cts. per ton mile for the first mile and 20 cts. to 35 cts. per ton mile for each additional mile. Over favorable earth roads one team will move a 2 to 2½ ton load as readily as two teams could move a 1 ton load under the most unfavorable conditions, which indicates the difficulty of tabulating average ton mile costs and illustrates the risk of a contractor basing his bid upon the possibility of favorable roads. The cost of transporting dredging machinery and hauling coal in general would be subject to the same road restrictions applicable to the hauling of tile. The cost of dredging outfits, their transportation, assembling and tearing down, the cost of hauling coal and all other cost items connected with open drains not being accurately available, a table of contract prices per yard for drains of varying yardages is included—Table III. This table illustrates approximately the cost per yard considered necessary to cover all costs for jobs of the given yardages and for Iowa soil conditions. As the yardage involved is the basis for all computations in relation to open drains, a table showing the yardages for 100 ft. sections for varying depths for given bottom widths and slopes is very convenient to drainage engineers and contractors. Table IV is compiled for ditches of side slopes of 1 to 1 only. Similar tables may readily be computed for ditches of any given dimensions.

The cost of administering contracts or overhead expenses often amounts to a very nominal percentage, as many of the smaller tile contracts are taken by local contractors, who fulfill the duties of manager, foreman and office man while at the same time personally the work—the laying of the tile. In the case of the contracting companies operating on a larger scale a central office must be maintained and the work closely supervised and the expense thus incurred must be pro rated over all the work under construction. These conditions tend to demoralize the contracting business from the standpoint of the general contractor and operate against the formation and healthy development of tile drainage contracting companies. For the larger contracts aggregating a total cost of $15,000 and upward the individual local contractor ceases to be a competitor because of his inability to finance them and to compete in the item of management with the more scientifically organized companies. Although these conditions may not be the best in all cases for the final interests of owners, they exist so generally that they must be recognized by engineers and contractors in the preparation of estimates and bids. Before bidding upon dredge work a contractor must be of sufficient financial stability to at least own a dredging outfit and in addition furnish the necessary certified check and bonds, which limits the construction of open drains to a lesser number. Notwithstanding the tendency has been for a large number of individuals to enter the field and scale bids in order to secure work, often slighting the work as much as possible to enable them to pay out, the consequence being unsatisfactory work, legal suits and sometimes the failure of the contractor concerned, the greatest losers being the land owners, who

[illegible]

2-Ft. Bottom—Side Slopes 1 on 1

Depth.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
[illegible]	[illegible]	[illegible]	[illegible]	45.2	48.0	50.9	53.9	57.0	60.3	63.4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	80.6	84.3	[illegible]	91.8	95.7	99.7
[illegible]	[illegible]	[illegible]	112.0	116.3	120.6	125.0	129.5	134.0	138.7	143.4
[illegible]	[illegible]	[illegible]	[illegible]	162.9	168.0	173.1	[illegible]	[illegible]	189.0	[illegible]
[illegible]	[illegible]	[illegible]	212.3	[illegible]	[illegible]	228.7	234.7	[illegible]	246.8	253.0
[illegible]	[illegible]	[illegible]	[illegible]	278.5	285.0	[illegible]	[illegible]	305.2	312.0	318.9
[illegible]	[illegible]	[illegible]	[illegible]	347.4	354.7	362.0	[illegible]	377.0	384.6	392.3
[illegible]	[illegible]	[illegible]	[illegible]	423.7	[illegible]	439.8	448.0	456.3	464.6	473.0
[illegible]	[illegible]	[illegible]	[illegible]	507.4	516.2	525.0	533.9	[illegible]	552.0	[illegible]

4-Ft. Bottom

Depth.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	97.2	101.3	105.5	109.8	114.1
[illegible]	[illegible]	[illegible]	127.6	[illegible]	136.9	141.7	146.5	[illegible]	156.4	161.5
[illegible]	[illegible]	171.9	177.2	182.6	[illegible]	193.5	198.9	204.8	210.5	216.3
[illegible]	[illegible]	228.2	234.2	240.3	246.5	[illegible]	259.1	[illegible]	272.0	278.6
[illegible]	[illegible]	[illegible]	298.7	305.5	[illegible]	319.1	326.5	333.7	340.9	348.2
[illegible]	[illegible]	[illegible]	370.5	[illegible]	[illegible]	393.5	401.3	409.2	417.2	425.2
[illegible]	[illegible]	441.5	[illegible]	458.1	466.5	475.0	[illegible]	492.2	500.9	509.7
10 ft.....	518.5	[illegible]	536.4	545.5	[illegible]	563.9	573.2	582.6	592.0	601.5
[illegible]	[illegible]	[illegible]	630.5	[illegible]	650.2	660.2	[illegible]	[illegible]	690.5	[illegible]
[illegible]	[illegible]	721.5	[illegible]	[illegible]	[illegible]	763.9	774.7	[illegible]	[illegible]	807.4

6-Ft. Bottom

Depth.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
[illegible]	[illegible]	104.5	[illegible]	113.7	118.4	123.1	128.0	132.9	[illegible]	143.0
4 ft.....	148.1	[illegible]	158.7	164.0	169.5	175.0	180.6	186.3	192.0	197.8
5 ft.....	203.7	[illegible]	[illegible]	221.8	228.0	234.3	240.6	247.0	253.5	260.0
6 ft.....	266.6	273.4	[illegible]	[illegible]	[illegible]	300.9	308.0	315.1	322.4	329.7
[illegible] ft	[illegible]	[illegible]	[illegible]	359.6	367.3	375.0	[illegible]	390.7	398.7	406.7
[illegible] ft	[illegible]	423.0	431.3	439.6	448.0	456.5	465.0	473.7	482.4	491.1
[illegible] ft	[illegible]	[illegible]	517.9	[illegible]	526.1	[illegible]	554.7	561.0	573.5	583.0
10 ft.....	592.6	602.3	612.0	621.8	631.7	641.7	651.7	661.8	672.0	682.3
[illegible]	[illegible]	703.0	713.5	[illegible]	731.7	745.4	756.1	767.0	777.9	[illegible]
[illegible]	[illegible]	811.1	[illegible]	833.7	845.0	856.5	868.0	879.6	891.3	903.0

8-Ft. Bottom

Depth.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
[illegible]	[illegible]	127.4	132.7	138.1	143.6	149.1	154.7	160.3	166.1	171.9
4 ft.....	177.8	183.7	189.8	195.9	202.1	208.3	214.7	221.1	227.6	234.1
[illegible]	[illegible]	247.4	254.2	261.1	268.0	[illegible]	[illegible]	289.2	296.4	303.7
6 ft.....	311.1	318.6	326.1	333.7	[illegible]	349.1	356.9	364.8	372.7	380.8
7 ft.....	388.9	397.1	[illegible]	413.7	422.1	430.6	[illegible]	447.7	455.7	465.2
[illegible]	[illegible]	483.0	492.0	501.1	510.2	519.4	528.7	538.1	547.6	657.1
9 ft.....	566.7	576.3	586.1	595.9	605.8	615.7	[illegible]	635.9	646.1	656.3
10 ft.....	666.7	677.1	[illegible]	698.1	[illegible]	719.4	730.2	741.1	752.0	763.0
11 ft.....	774.1	785.2	796.3	807.7	819.1	830.6	[illegible]	853.7	865.3	877.1
12 ft.....	888.9	900.8	912.7	924.7	936.9	949.1	961.3	973.7	986.1	998.6

10 Ft. Bottom

Depth.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
[illegible]	[illegible]	150.4	156.4	162.6	168.7	175.0	181.3	187.7	194.2	200.8
4 ft.....	207.4	214.1	220.9	227.7	234.7	241.7	248.7	255.9	263.1	270.4
[illegible] ft	[illegible]	285.2	292.7	300.3	308.0	315.7	323.6	331.4	339.4	347.4
6 ft.....	355.6	363.7	372.0	380.3	388.7	397.2	405.8	414.4	423.1	431.9
[illegible] ft	[illegible]	449.7	458.7	467.7	476.9	486.1	495.4	504.8	514.2	523.7
[illegible] ft	[illegible]	[illegible]	552.7	562.6	572.4	582.4	592.4	602.6	612.7	623.0
[illegible] ft	[illegible]	643.7	654.2	664.8	675.4	686.1	696.9	701.7	718.7	[illegible]
10 ft.....	740.7	751.9	763.1	774.4	785.8	797.2	[illegible]	820.3	832.0	843.7
11 ft.....	855.5	867.4	879.4	891.4	903.5	915.7	[illegible]	940.3	952.7	965.2
12 ft.....	977.7	990.4	1003.1	1015.9	1028.7	1041.7	1054.7	1067.7	1080.9	1094.1

12-Ft. Bottom

Depth.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
3 ft.....	166.7	173.4	[illegible]	187.0	193.9	200.9	209.0	215.2	222.4	229.7
4 ft.....	237.0	244.5	252.0	259.6	267.3	275.0	282.8	290.7	298.7	306.7
5 ft.....	314.8	[illegible]	331.3	339.6	348.0	356.0	365.0	373.7	382.4	391.2
[illegible] ft	[illegible]	[illegible]	[illegible]	427.0	436.2	445.4	454.7	464.0	473.5	483.0
7 ft.....	492.6	[illegible]	512.0	521.8	531.7	541.7	551.7	561.8	572.0	582.3
[illegible] ft	[illegible]	[illegible]	[illegible]	624.0	634.7	645.4	656.2	667.0	677.9	688.9
9 ft.....	700.0	711.1	722.4	733.7	745.0	756.5	[illegible]	779.6	791.3	803.0
10 ft.....	814.8	826.7	838.7	850.7	862.8	875.0	887.3	899.6	912.0	924.5
[illegible]	[illegible]	949.7	962.4	975.1	988.0	1000.9	1013.9	1027.0	1040.1	1053.4
[illegible] ft	[illegible]	[illegible]	1033.5	1107.0	1120.6	1134.3	1148.0	1161.8	1175.7	1189.7

must eventually pay excessively for a satisfactory ditch. In view of these facts, boards of supervisors, engineers, attorneys and others upon whom devolves the letting of contracts should inquire more into the ability of bidders to prosecute and complete the work satisfactorily and less stress be placed upon low bids. Drainage notices usually reserve the right to let the work to the lowest responsible bidder, but the instances where the lowest bids have been rejected have been very rare, although in many cases their rejection would have been amply justifiable.

Plant expenses for tile drains are reduced to a minimum, as practically all items of cost consist principally of labor and of materials entering permanently into the construction of the drain. It is sometimes economical or necessary to erect shacks or tents in which to house and board the men, in which instances the cost of such structures should be estimated. Also when tile work is prosecuted during the winter months it is necessary to provide a shelter and heat near the location of the work, which is readily transported as the work progresses. In ordinary warm weather the principal tools and materials necessary are tiling spades, shovels, pick, ax, devices for grading the bottom of the ditch, maul for driving curbing, sheet iron sand box, crow bar, sand pump, derrick, trench braces, curbing and sometimes tools and materials for blasting rocks. In colder weather or in cases where extreme hard pan is encountered more picks are necessary and all tools wear more rapidly. The amount, cost and life of the tools and materials varies widely between different contracts, but no estimate is complete without a liberal allowance being made to provide for these items. A very false economy of attempting tile work without providing curbing, trench braces, sand box and sand pump is commonly practiced and far greater losses are sustained than would result from the provision and use of them. Therefore their cost enters into the total cost of tile trenching work either directly if provided or indirectly through higher labor costs if not provided. The plant necessary for the construction of open drains consists of the necessary machinery and housing cabins and forms a larger percentage of the total cost. As the total cost of dredge work has been referred to as being pro rated over the yardage it will not be discussed further.

The cost of financing drainage contracts constitutes the defeat of many would-be contractors. These novices in this phase of public works contracting, who are usually of limited financial resources, often estimate all other items of cost with reasonable accuracy, but neglect the consideration of the cost of providing the necessary working capital. There are various points in this connection to be relatively considered by a prospective bidder, which will be noted in the order of their occurrence during the progress of a contract. First a certified check must be furnished of a stipulated percentage of the bid, which is usually a small item of expense, as banks require an interest bearing note to secure them against loss, the interest being legitimate returns for borrowed credit. The bidder may deposit the cash in lieu of a certified check if he possesses sufficient funds, but in this case he loses the possible interest on his money until it is returned. If for any reason the successful bidder is unable to secure the necessary bonds, he is generally required to forfeit the security deposit, a fact which should impress upon all bidders the importance of ascertaining definitely their ability to furnish bonds before filing bids. Second, the successful bidder must furnish bonds to insure the completion of the contract. Personal bonds, if securable, may or may not cost the contractor anything; but a percentage of approximately 1 per cent is charged by bond companies, the premium to be paid annually; and a very pertinent point to be remembered in this connection is that bond companies do not furnish bonds unless the contractor is able to prove himself safe financially. Funds are also necessary to the prosecution of any contract and the relative cost of providing them depends upon the bank account of the contractor, the methods of payment and the duration of the contract. In the exceptional case where the contractor commands sufficient funds to finance the entire project, warrants or other form of paper he might receive in payment would usually bear as high a rate of interest as his funds would draw in the form of bank deposits, and the only loss or expense would be the loss of the interest upon the percentage of payments withheld until the completion of the contract. To the contractor who does not command working capital the method of payments is a vital matter. If payments are to be in cash only approximately the difference between monthly payments and actual cost need be provided for. The necessity of providing these funds may often be delayed by the buying of tile and other materials on 60 or 90 days' time, although this financial advantage would be counterbalanced in case these materials could be purchased at a cheaper rate for cash payments. Also if payments to tile or other companies are delayed beyond the specified time of payment overdue accounts are charged a specified rate of interest which operates similarly to the borrowing of the same funds at a similar rate of interest as regards the resultant cost. But if the method of payment is by drainage warrants or similar paper bearing a low rate of interest which is not payable at any specified time, the contractor is burdened with the additional expense of their disposal. In many communities where such paper is abundant it is a difficult matter to dispose of them upon reasonable terms and in all cases the buyer discounts them a sufficient percentage to insure him 7 to 8 per cent upon his investment. Many contractors secure drainage work without properly estimating the cost of disposal of such warrants, with consequent disastrous losses or reduction of profits.

During the prosecution of drainage contracts there is considerable danger of stock falling into the ditches, with resulting claims for damages by the owners, and some allowance should be made in a contractor's estimate for such accidents. Also a contractor should avail himself of sufficient legal advice to insure business methods. Although neither of these items is of much importance in the average contract it occasionally occurs that one or the other or both constitute a large percentage of the cost, and it is good business for the contractor so to protect his drains and business relations that future complications will not be possible, which protection requires the expenditure of funds and thus merits consideration.

Legal expenses should be incurred by the engineer and owners also upon all drainage organizations to a sufficient extent to insure that all methods of procedure are according to law, which item of cost is ordinarily not prominent as a factor of the total cost to the owners. In cases of appeals to the courts and extended litigation, legal expenses may constitute a surprising percentage, which fact emphasizes the necessity of proceeding with such projects in accordance with law and good engineering practice.

Damage claims or right of way expenses are only of importance in the case of open drains. The specific method of awarding damages to the owners through whose land the open drains extend may vary for different states, but the elements of damages are the same for all cases, which consist of the actual value of the land appropriated for ditch purposes, the cost of fencing the ditch on both sides if fencing is necessary or required, the cost of necessary bridges across the open ditch for convenience in farming operations, and the reduction in the value of the farm because of the resulting appearance and inconvenience resulting from the construction of the ditch. In estimating the value of land appropriated for open drains the actual value of the particular strip of land in question may be very little, but it must be remembered that the value of any part of a farm is fixed in the minds of buyers partly by the possibilities of draining it and the prospective buyer would naturally not be informed as to the particular location of a future ditch. Hence the value of any particular acre taken should be measured by its value in its natural state plus any additional value resulting from the possibility of securing drainage, providing the ditch or drain were located on some closely adjacent land. Three-wire fencing is ordinarily sufficient for open drains and costs about 50 cts. per rod in place. Four foot woven wire fencing with 5 in. posts spaced 1 rod apart will average approximately 75 cts. per rod. Bridges of sufficient strength for farm purposes may be constructed at an approximate cost of $5 per lineal foot. The cost of repairing and replacing bridges and fences over a reasonable length of time is not generally considered. The deterioration of farm values because of the construction of open drains is often given considerable prominence by juries because of the natural aversion of many people to the existence of open drains upon lands belonging to them. The author believes that little weight should be given this item except in unusual cases, as open drains are ordinarily constructed upon lands which in their natural state are crossed by watercourses which are more unsightly at times and which render the different portions of the farm more inaccessible than is possible by the construction of open drains.

The contingent expenses incidental to legal drainage organizations, as engineering, legal expenses, publication of notices, etc., if wisely administered, need not exceed 8 to 12 per cent of the total cost for drains costing $5,000 and upward. These expenses equal a larger percentage for the smaller districts, as many of the legal procedures required are as expensive for small drains as for the larger ones. The item of engineering alone, including the preliminary survey, construction superintendance, and assistance in the assessment of benefits and fixing of damages, should not be less than 5 to 8 per cent of the total cost, based upon the prevailing salary rate received by drainage engineers of approximately $5 per day and necessary expenses.

Drainage engineers generally escape apparent responsibility for wild or unbalanced estimates because of the facts that bidders themselves vary so radically in their bids and that prevailing prices and wage rates do change materially after estimates are prepared. These things, however, should not excuse them from investigating all conditions affecting cost and presenting the data and unit estimates so completely that bidders may acquaint themselves with actual facts and conditions.

PERSONALS.

Mr. A. J. Latornell, City Engineer of Edmonton, Alberta, has resigned.

Mr. Oliver Hardgrove, Superintendent of Sewers of the Borough of Queens, has resigned. His successor will be appointed at an early date. Mr. Hardgrove has held the position since March 1, 1910.

Mr. John H. Diven, Secy. and Supt. of the Charleston Light & Water Co., Charleston, S. C., has tendered his resignation and will accept the position of Superintendent of the Water Plant of the city of Troy, N. Y.

Grant Smith & Company, Vancouver, B. C., is a new corporation capitalized at $100,000 to build wharves, piers, docks, etc. Directors of the company are Messrs. Grant, Smith, Angus, McDonnell and Sims, all of Vancouver.

Mr. C. E. Knickerbocker, M. Am. Soc. C. E., has resigned as Chief Engineer of the New York, Ontario & Western Ry. Co., and has become associated with the MacDonald Construction Co., 149 Broadway, New York City. Mr. Knickerbocker will assume charge of the company's railroad construction.

Mr. W. H. Beers, Jr., Chemist and Bacteriologist, who has been in charge of the filtration plant of the Columbia, S. C., water works for the past five years, has resigned to accept a position in charge of the Birmingham, Ala., laboratory of the American Waterworks & Guarantee Company of Pittsburgh, Pa. This laboratory controls those of Shreveport, La., Chattanooga, Tenn., and Little Rock, Ark.

Mr. L. W. Rundlett, formerly City Engineer of St. Paul, Minn., has been appointed Commissioner of Public Works for the city of Moosejaw, Can. He will have charge of all the construction work of the city and will have direct supervision over the engineering department. Mr. Rundlett takes a position in a city of 20,000 at an increase in salary over that received as City Engineer of St. Paul. Moosejaw has a modified commission form of government and contemplates improvements in the water system to the extent of $400,000.

CONTRACT NEWS SECTION

of

ENGINEERING & CONTRACTING

The Doings of the Week.

Th[illegible] ver[illegible] undert[illegible] railroad [illegible] ects. About the only news of importance is the report from Denver that the Denver, Northwestern & Pacific Ry. has completed financial arrangements for the long projected extension of its line from Steamboat Springs, Colo., to Salt Lake City, Utah. Arrangements for this financing have been under way for some time, and it is to be hoped that they finally have been carried to a successful completion. The construction of this extension will involve the building of some 390 miles of line, and will require the expenditure of at least $16,000,000. Another bit of news of particlar interest at this time is the decision of the stockholders of the Virginian Ry. to vote a $29,000,000 increase of capital stock. It is probable that the proceeds of the sale of a part of this stock will be used for building extensions.

The principal railroad construction contract of the past week appears to be the one for the construction of Sec. 3 of Route No. 5 of the Lexington Avenue Rapid Transit R. R. in New York City. Bids on this work were opened on Jan. 11, the contract being awarded the next day to the Underpinning & Foundation Co., 290 Broadway, New York City, at $2,295,086. Among the other railroad contracts let recently are the following: Ahern Bros., for constructing a spur track 4,950 ft. long, from the Central Vermont Ry. to the Connecticut Colony for Epileptics at Mansfield, Conn.; Grant Smith & Co., Henry Bldg., Seattle, Wash., a $50,000 contract for the erection of machine shop, tower house, etc., at Argo, Wash., for the Oregon-Washington Railway & Navigation Co.; Utah Construction Co., Ogden, Utah, for the extension of the Klamath Falls-Natron line of the Southern Pacific for Hazeldell for a distance of eight miles; Walton, McDowell & Co., for the Louisville & Nashville work mentioned in our last issue. this contract involving about 800,000 cu. yds. of excavation and amounting to about $750,000; J. B. Smith & Co., Knoxville, Tenn., for concrete and structural work on the Louisville & Nashville's new line between Ooltewah and Chattanooga, Tenn.; J. F. Mallon, Princeton, Cal., for grading work on the Colusa and Hamilton City branch of the Southern Pacific Ry.

The biggest street paving job so far this year is now being advertised by the City of Boise City, Idaho. This work calls for the construction of some 328,000 sq. yds. of pavement. Bids for the work are to be opened on Feb. 2. Of great interest to road·contractors is the decision last week of the New York State Court of Appeals holding that Albany County could not bring an action to restrain the letting of contracts under special acts of the Legislature for special highways. This decision will expedite the work of letting about $4,000,000 worth of road work which will be made in about two weeks, to be followed later on with a letting for a similar amount.

In the way of drainage work the principal contract let during the past few days appears to be the one for the construction of 216,000 cu. yds. of dredge ditches and 210,000 cu. yds. of lateral ditches for a drainage system in the vicinity of Robinsonville, Miss., for the Mary Mac Plantation Co., of Memphis. The contract for the dredge work was let to the Lewis Engineering & Construction Co., of Knoxville, Tenn., at 9½ cts. per cu. yd.; the [illegible] to Lowrence Bros. & Co., Memphis, Tenn., at 12.9 cts. per cu. yd. Another good-sized drainage contract let recently calls for work in Drainage District No. 3 of Little Rock, Ark. This contract amounts to about $47,000; was awarded to R. H. & G. A. McWilliams, 28 E. Jackson Blvd., Chicago, Ill.

Stevens Made Him Move.

Now that John F. Stevens, at one time Chief En[illegible] Lines, has gone into the contracting business, it seems a fitting time to rake up some of the events of his past career. At one time when Mr. Stevens was a resident engineer on the construction of a railway in the west, his work was seriously hindered by the presence of an itinerant saloon, if we may so call it. The keeper of the saloon was warned several times not to locate his booze joint near the construction camp, but every time the camp was moved the saloon moved also. Finally Stevens decided to use something more likely to be persuasive than threats. Right after pay day, when the saloon was crowded with workmen busily getting rid of their wages, Stevens walked into the place and said:

"Casey, you have been told four times to move away from this camp and you haven't moved yet." "No, and I aint goin' to. I aint on the railroad right-of-way. This is government land I'm on and nobody but the government kin put me off. Jest roll that into a cigarette and smoke it." "I give you exactly twenty-four hours to pack up your liquors and get out," replied Stevens. "If you aren't gone then, you will find out that there are forces besides the government that will make things move hereabouts." Turning on his heel, Stevens walked out. Twenty-four hours later, several hundred men had congregated at the saloon to see the fun. In fact, mighty little work was going on "down the line," for Casey had sworn that all hell wouldn't make him move, and the men knew that Casey was a fighter. They also knew that Stevens was not a bluffer, and that Casey's hand was going to be called at the appointed hour.

The saloon looked like an armory. Behind the bar stood Casey, flanked right and left by several husky "barkeepers." Pistols stuck out of their belts and sawed off shot guns loaded with "buck" hung conveniently from the wall. Men walked in and took a drink—it might be the last one for weeks, and then again it might not. Casey himself was in savage good humor. Certainly thinks looked bad for the "chief." Punctual to the minute, Stevens swung into sight of the crowd, not at the head of a cavalcade of special police or of picked men of his own, but alone. He rode a large black horse, and appeared to be unarmed. The crowd parted and he brought his horse to a stop at the door, dismounted and asked one of the men to hold the animal. Walking to the door of the saloon Stevens looked in upon Casey and his arsenal. "I see you are still here, Casey." "Yes, and by hell, you'll see me here still for some time yet, Mister Stevens." "I hope not for very long," said Stevens, pulling a package wrapped in brown paper from his pocket. From one corner of the package protuded a small rope or cord about the thickness of a lead pencil, and against the end of this cord Stevens now placed his lighted cigar. "Hell," yelled one of the barkeepers, "it's dynamite," and, forgetting all the power of his own powder encased in pistol cartridges, the barkeeper made a rush for the rear door. "You are a good guesser, my friend, and unless I'm mistaken there's enough of it here to move this whole building and its contents without any of the government assistance that Casey would have me invoke. There she goes." Stevens tossed the package into the middle of the bar room, turned and mounted his horse, and shouted the well known warning that precedes a railroad blast—"Fire!" Those that had come to scoff did not remain to pray. The running was furiously fast; and about the fastest—certainly the most furious—of the runners was Casey. Bold as he was, he had not dared risk the time to ascertain the length of the fuse inside that brown package. The roar of exploding dynamite sped them all on faster for a moment and then they turned to watch out for and dodge the falling fragments. "It was a grand sight," as one of the men afterward said, "a grand sight, but it seemed a pity to send so much hell-water to heaven where everybody's on the rain wagon and can't appreciate good liquor."

The Dog and the Dynamite.

The ancient tale of the dog and the stick of dynamite, which Adam first sprung on the laughing hyena, has been resurrected. According to the revised version six workmen in a road building camp in Ohio had a dog which they decided to get rid of by the dynamite route. One of the party tied a stick of the explosive to the dog's tail, lighted the fuse, and then took to his heels. As the party neglected to tie the dog, it, of course, followed them, and being a good runner, kept close to their heels. Then ran into a shanty and slammed the door shut, but before they could bolt it, the dog had got into the room. This naturally made them somewhat nervous and they proceeded to get out and quite rapidly. In fact, they fairly boiled out of the shanty, three by way of a small window, sash and all going with them, and the remainder by way of the door. The last man had hardly emerged from the shanty before the dynamite let go, and there was one less dog. The shanty went with the dog, and all of the party was knocked down and stunned, but otherwise uninjured except for a few cuts and bruises.

A Drill Write Up.

[illegible] perfect drill instrument of its kind is still in use. In fact, more of these drills are [illegible] drill has few parts and the simplicity of its mechanism is one of its advantages. Its main feature consists of three long pieces which are dovetailed one with another, and glide easily through their entire length, the boring being accomplished by the alternate gouging of the chiseled tips. Two of these parts act as guides which close about the drill proper. This drill is not adapted for work in hard material but for all that those who have used it prefer it to any other type on the market. This drill is controlled by a bug, whose nickname is *Thalessa Lunator*, or in plain United States, the great ichneumon fly. Its boring mechanism is said to have furnished the idea for the modern rock drill.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

At late reports both engineering parties of the Valdvosta, Moultrie & Western R. R. were working in Barbour County. The party under Gordon Tillman, Chief Engineer, Valdosta, Ga., which is working north from Ft. Gaines, was within two miles of Clayton, while the party working south from Montgomery was at Inverness and will meet Engineer Tillman at Clayton. When this survey is run, there will be a tentative route for the road from Valdosta to Montgomery. It had been rnn to Ft. Gaines, but when the extension to Montgomery was proposed, work had to be resumed by the engineers, who are expected to file their report with President Roberts, of the railroad company, within the next few weeks.

The Alabama & Northwestern R. R., which recently began the operation of trains on its new line from Pine Hill, Ala., to Sweetwater through Marengo County, has filed articles of incorporation. The capital stock is $160,000. This is a subsidiary company of the Alabama, Tennessee & Northern R. R., of which Wm. Toxey, York, Ala., is Chief Engineer.

Prospects are reported good for the sale of $50,000 capital stock to Chicago parties for the construction of a railroad from Gadsden to Hotel Bellview on Lookout Mountain. Louis Hard, Gadsden, Ala., is interested.

As a result of the announcement that the Eufaula & Chattahoochee Valley Railroad will commence work shortly on the construction of the proposed Pittsview line, the business men of Columbus, Ala., have under consideration the construction of a line to Pittsview. Although nothing definite can be learned in regard to the proposed plans, it is known that engineers of the Alabama, Tennessee & Northern R. R. have completed a survey for a line through Marion County, touching Hamilton, Ala.

Engineers in charge of the construction of the Gulf, Florida & Alabama R. R. between Pensacola, Fla., and Jasper, Ala., have announced that the grading has been interrupted to some extent during the past month, but that this portion of the work will be completed to Cantonment within 20 days. There the road will connect with the road bought from the Southern States Lumber Co. The company is now receiving on an average of 1,000 crossties each day, and this number is to be increased at once to 2,000 daily. It is also announced that within 20 days work will be commenced on the bulkheads and piers to be constructed on the waterfront. Five piers are contemplated, but, for the present, one or two will be rushed to completion. It is estimated that rail laying will be commenced within 30 days and that one mile per day will be laid. On reaching the line at Cantonment the company will have a road then to Local, Ala., a distance of about 85 miles, and from Local the construction force will commence building towards Jasper, Ala.

It has been announced by J. M. Spradlin, Boaz, Ala., that plans for the proposed new railroad from Birmingham, Ala., to Chattanooga, Tenn., via Boaz and Albertville, were progressing rapidly.

Arizona.

⊙L. W. Lewis, Emporia, Kan., has been awarded a contract for the supply of rock ballast on the coast line of the Santa Fe R. R. from Albuquerque, N. M., to Winslow, Ariz., a stretch of 285 miles. The job will keep 200 men employed for three or four years. No figures have been given out, but it is understood that the contract involves $1,000,000. Two rock crushing plants will be installed at Blue Water, N. M

Arkansas.

C. H. Sharp Contracting Co., Malvern, Ark., according to late advices, had 150,000 cu. yds. of good machine wheeler and fresno, work to sublet on the Rock Island in Arkansas.

The Crossett Lumber Co., now operating a railroad from Crossett, Ark., to Lacey, according to reports, plans the extension of the road to Monticello, a distance of 16 miles, providing the city will furnish the necessary right of way. Further information will be available in about two months. E. W. Gates, Crossett, Ark., is interested.

J. H. Oliver, railroad contractor, Lono, Ark., at late reports, had five miles of grade work on the Rock Island, 17 miles south of Malvern, Ark., which he wished to sublet.

The Citizens' Light and Transit Co. of Pine Bluff, operating a lighting plant and street railway service, has been sold to the Equitable Securities Co. of New York City. It is understood the price paid was approximately $300,000.

It is reported that the Kansas City & Memphis Ry. will by April 1 complete its Fayetteville extension, immediately after which construction will be continued toward Memphis. M. Hays, Rogers, Ark., is Chief Engineer.

California.

⊙The contract for grading on the Colusa and Hamilton City branch of the Southern Pacific has been awarded to J. F. Mallon, Princeton, Calif. Work on the construction of the roadbed will be commenced at once, as it is planned to have the road in operation by August 1 of this year. The length of the projected road is 61 miles from Hamilton City to Harrington on the main west side road of the Southern Pacific south of Arbuckle. The road will pass through Grimes, Sycamore, Colusa and Princeton.

City Council of Los Angeles, Calif., has passed an ordinance granting W. W. Wilcox permission to construct, maintain and operate a double-track railroad spur from Aliso St. to Jackson St., paralleling Alemeda St., between Alameda and San Pedro St.

The Southern Pacific Co. is planning to fill in several blocks of land north of its shops at Sacramento. Sand from the Sacramento River is to be used for filling. At present a large part of the land is swamp or brush-covered.

The Tidewater & Southern Electric R. R., which proposes to buiid a line from Modesto to Stockton, has opened offices in the First National Bank Bldg., Modesto, and has begun preliminary construction work in that city. J. C. Lindsay is the engineer.

The Central California Traction Co., San Francisco, will, it is stated, begin construction work on a branch line to Lockeford. The branch will leave the main line at a point just north of the bridge across the Mokelumne River and extend east one-half mile south of and parallel to the Acampo and Lockeford road.

The Peninsular Ry., F. E. Chapin, general manager, 143 South Market St., San Jose, will probably commence construction work this spring on its new electric line from Meridian to Santa Clara. About $70,000 will be expended for this line.

Colorado.

The Arkansas Valley Railway, Light & Power Co., of Pueblo, Colo., has made a loan for $10,000,000, and will, it is understood, issue $6,647,000 worth of bonds. This is the company which plans to build an electric railway line through the Arkansas valley into Kansas. A big irrigation project is also planned.

The Santa Fe System is reported to be considering expending about $500,000 for improvements at Colorado Springs, to consist principally of concrete undercrossings at various streets.

Officials of the Laramie, Hahn's Peak & Pacific R. R., which is building from Laramie, Wyo., to Steamboat Springs, Colo., hope to have the work completed by next fall. The project has been finished as far as Coalmont, a distance of 20 miles from the Colorado terminus. R. D. Stewart, Laramie, Wyo., is Chief Engineer.

It is reported at Fort Collins, Colo., that the Union Pacific Ry. has already let the contract for the bridge across the Poudre River at that city, and that work will soon be commenced on the extension of the road up the Poudre Canon. According to the report, the road will be built up Poudre Canon, across North Park to Steamboat Springs, and thence west, either to connect with the main line, or to go clear through to Salt Lake City, Utah.

The Denver, Northwestern & Pacific Ry. (Moffat Road), L. D. Blauvelt, chief engineer, Denver, Colo., is understood to have completed financial arrangement for the construction of its extension from Steamboat Springs, Colo., to Salt Lake City. The extension is said to have been financed by French and American capital, and the Denver men, now at the head of the road, are to remain in control. The extension would be about 390 miles long, and would cost, including the expensive tunnel, about $16,000,000. It is believed that construction work will be started this year, and that the first section will be put under way by May 1.

Connecticut.

⊙Ahern Bros., at $7,950 have been awarded the contract for constructing a spur track 4,950 ft. long from the Central Vermont Ry. to the Connecticut Colony for Epileptics at Mansfield, Conn. Bids for the work were opened Dec. 30 at the office of R. E. Mitchell, engineer, Willimantic, Conn.

Georgia.

Work will be started at once on the depot track for the Macon & Birmingham at Macon, Ga.

Idaho.

It is reported that the Hill interests have secured the Pacific & Idaho Northern (Pin) road, which runs out of Weiser, and will use it as a connecting link in the proposed line from Butte to Central Oregon, and probably to the coast.

Among the improvements reported to be under consideration by the Chicago, Rock Island & Pacific Ry. for the coming season is the construction of double track between Topeka, Kan., and McFarland. There is said to be a great deal of traffic over the single track line between Topeka and Herington, which is practically a single track link connecting two double track lines. With its own line to St. Joseph and its lease of the Union Pacific tracks to Kansas City, the Rock Island practically has a double track east of Topeka. At McFarland the road again branches, one line going south to Oklahoma and the other west to Colorado. The need of the proposed double track between Topeka and McFarland has been realized for some time. J. M. Brown, Topeka, Kan., is Engineer maintenance of way.

Illinois.

The Central Illinois Ry. Co. has been incorporated with a capital stock of $25,000, and proposes to construct a railroad which will connect Chicago with Muscatine, Ia. The principal office is in Aurora. The incorporators and first board of directors are: George E. Ackerman, Kaneville; J. H. Raymond, Aurora; W. E. Williamsan, Marseilles; Henry N. Morganson, Seneca; N. A. Eruland. Ottawa.

The Keokuk, Nauvoo & Fort Madison Electric Ry. Co. has been incorporated and proposes to construct an electric railway from Keokuk, Ia., through Hancock county, Illi-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

nois, with branches at [illegible]. The capital stock is $6[illegible] principal office is at Nauvoo. The incorporators are: Wm. H. Fisher, Charles H. Petsch, Frederick McCatlin, Edward J. Neier and Wm. McCanby, all of St. Paul, Minn. The first board of directors includes Charles S. Carscallen of Jersey City, N. J.; Charles D. Warren of Toronto, Ont.; Edward D. Parnell of Chicago; Charles H. Petsch of St. Paul, Minn., and Jacob M. Fisher, Frederick Salm, Jr., and August J. Roger, all of Nauvoo, Ill.

The Beardstown Street Ry. Co. incorporated recently, as mentioned in our last issue, proposes the construction of about three miles of street railway at Beardstown. The route as proposed starts at the B. & O. S. W. station, thence runs on 4th st. to State, on State to Second, on Second to Washington, out Washington to Third, on Third to State, on State to 15th or beyond. S. H. Cummings, an attorney of Springfield, Ill., is one of the incorporators.

The Kankakee & Urbana Traction Co. is reported to have decided to receive bids on Jan. 30 for the grading work for the first section of its projected interurban line. Bids for the ties are to be received on Feb. 1. Carl Hayes, Champaign, Ill., is chief engineer.

Indiana.

An agreement is reported to have been entered into between E. Atkins of Bristol and H. E. Bucklin, of Chicago, for a preliminary survey of a long contemplated extension of the electric railway east of Bristol to Klinger lake, passing through Vistula, and White Pigeon.

The Lake Shore & Michigan Southern Ry. is to expend $70,000 for building an underpass at Ligonier, Ind.

The Indiana & Ohio Southern Interurban R. R. Co. has been incorporated with a capital stock of $150,000 and proposes to build a line between Rising Sun and Aurora in Dearborn county. The road at present will be 9½ miles long, but extensions may be built later. The officers are Lucian Harris of Rising Sun, president; J. W. Whitlock, Rising Sun, vice president; James N. Perkins, Rising Sun, secretary, and Raymond D. Lynch, Chicago, treasurer.

It is understood that the Chicago & Eastern Illinois Railway, the Evansville & Terre Haute and the Baltimore & Ohio Railroads, will shortly take steps toward having plans and specifications prepared for the improvement of the Union Station at Vincennes, Ind.

The Board of Works of Marion, Ind., has accepted the proposition of the Indiana Union Traction Co., of Anderson, Ind., for the extension of the company's West Marion line. By the terms of the contract the Indiana Union Traction Co. will extend the West Marion line north from Spencer Ave., south on Butler Ave. to Factory Ave., and thence west to Henderson Ave., where a freight station will be erected.

The Evansville, Henderson & Owensboro Ry. Co. of Evansville, Ind., has filed notice of an increase of capital stock from $10,000 to $50,000.

Joint committee composed of citizens of Richmond, Cambridge City, Milton and Connersville is to hold a conference with officials of the Terre Haute, Indianapolis & Eastern Traction Co., Indianapolis, to urge the extension of the traction line to Connersville.

Kansas.

It is rumored that the Chicago, Rock Island & Pacific Ry. is contemplating the construction of a line in Iowa crossing the Missouri River at Aspinwall and running south by way of Falls City to Sabetha, Kan.

A project is under consideration for building an interurban line west from Hutchinson to Huntsville, with spurs connecting the main line with Nickerson, Patridge, Sterling and Sylvia. The commercial organizations of Hutchinson have taken up the matter and have appointed the following committee to decide on ways and means of building such a line: Commercial Club—C. O. Hitchcock, [illegible]

Kentucky.

[illegible]

Massachusetts.

Extensive street railway construction work will probably be undertaken in Massachusetts if the state Legislature approves the proposal to restore the street railway companies in central and western Massachusetts now controlled by the New England Investment and Security Company to the direct control of the New York, New Haven and Hartford R. R. Co. The plan involves the extension of lines [illegible] reached, as well as in western Massachusetts. [illegible] and the Springfield Street Ry. Co. are the two [illegible] plans at the Worcester end provide for the development of the new Millbury power station to its maximum capacity, so that it will generate enough power to supply not only all the trolley lines in Worcester county, but the through lines to the city, Fitchburg, Holden, Grafton, Spencer, Marlboro and Woonsocket, doing away with the smaller direct power stations on the different lines and putting into service sub-stations. The plans for Worcester county include the construction of a line to Petersham and other extensions. The plans for Worcester county, if carried out, will mean the expenditure of several million dollars. The improvements would include a 25-mile line through Paxton, Rutland, Colebrook [illegible] The enlargement of the Millbury power plant will be done at an expenditure of about $500,000.

Michigan.

The Michigan Railways Co., Portland, Mich., has been incorporated with a capital stock of $10,000 for the construction and operation of railways. [illegible] is President and W. S. Linnell, Portland, Mich., is Treasurer.

Promotion plans are understood to be well along for the projected line which the new Port Huron & Northern R. R. proposes to build through the Thumb District of Michigan. As now planned this route will be as follows: Port Huron to Lakeport, Stevens Landing, Birch Creek, Lexington, a distance of 22 miles, thence west to Croswell and Peck 15 miles, north to Sandusky, 13 miles. William E. Bolles, Detroit, Mich., is treasurer of the Port Huron & Northern Ry. Co.

Surveys are being completed for a railroad in which P. U. Jacobson, 12 Campau Bldg., Detroit, Mich., is interested, and construction work may be started in the near future. The promoters would be glad to hear from any construction company making a business of financing and construction.

Minnesota.

The Minnesota & International [illegible] reported, will build an extension from Kelliher, Minn., to Winnipeg, Man., and will purchase of the Crookston Lumber Co. the line extending from Funkley to Kelliher, now leased. This route over the Northern Pacific and the new extension of the Minnesota & International will give these roads a line 80 miles shorter than any other route from the Twin City to Winnipeg. Brainerd is on the air line. The line, it is said, will skirt the east end of upper Red Lake. Through the lowlands is a narrow pine ridge stretching towards Baudette, which will be utilized by the extension.

Missouri.

[illegible] & Gulf Ry. Co. [illegible] St. Louis Union Trust Co., as trustee, to secure an issue [illegible] is the plan of [illegible] being constructed is along the Ozark ridge on an elevated plateau, which contains extensive farms, now thirty-five miles from any railroad. The company is capitalized at $3,000,000 and is financed by Rolla, Le Coma and St. Louis capital. The officers of the company are: Gilbert Lay, St. Clair, president; E. C. Comstock, Le Coma, treasurer; William E. Fink, Rolla, secretary; E. E. Young, St. Louis, general manager. Directors, Carl Kimmel, Le [illegible] ox; E. C. Halbert, Licking, Mo.

St. Louis Items.

[illegible]

[illegible] as soon as he can [illegible] ground.

City Comptroller B. J. Taussig, a few days ago, recommended more aggressive work on the part of St. Louis in the extension of the city sewer system. He said that the city was in greater need of an enlarged sewer system than of anything else. John J. Dowling, secretary of the Real Estate Exchange, in gathering material for the annual report, found that St. Louis has a sewer system of nearly 675 miles that has been built and maintained at a cost of $17,721,885.64. During the last ten years the construction work on sewers has been as follows:

Year.	Miles.	Cost.
[illegible]	[illegible]	$ 96,075.66
[illegible]	[illegible]	[illegible]
1904	26.835	984,108.98
1905	30.482	603,411.53
1906	29.897	445,079.40
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
1910	12.610	496,470.72
[illegible]	[illegible]	[illegible]
Totals	180.461	$5,015,162.79

In the same time the number of miles of streets improved and the cost was as follows:

Year.	Miles.	Cost.
1902	11.02	$ 597,825.00
1903	35.37	2,033,283.00
[illegible]	[illegible]	[illegible]
1905	32.22	1,658,237.00
1906	22.77	1,100,595.00
[illegible]	[illegible]	[illegible]
1908	37.68	1,966,381.00
1909	30.00	1,569,600.00
1910	33.77	1,569,568.96
1911	31.57	1,423,533.63
Totals	288.95	$14,970,640.59

Total number of miles of improved streets in St. Louis are 600.37. The alley improvement in the last ten years has been as follows:

Year.	Miles.	Cost.
1902	5.98	$ 65,418.73
1903	2.50	61,981.35
1904	5.33	107,412.85
1905	7.65	149,495.02
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
1910	12.91	238,710.86
1911	12.61	228,578.98
Totals	99.46	$1,857,730.98

There are 198.21 miles of improved alleys in St. Louis.

Mike Conroy is not doing anything at present, except burn up a car load of coal in camp that he bought a short time ago for his engines at Granite City, Ill. Cold weather has forced him to shut down.

Surveyors have started work for the Burlington Railroad in the vicinity of Alton, Ill. It is believed that the surveying is preliminary to the proposed return of the Burlington passenger service to Alton.

John Higgins has taken a piece of Mike Conroy's levee work near Granite City, Ill. John is going to move his outfit on to it as soon as the weather permits.

The Board of Public Improvements introduced bills in the Municipal Assembly providing for the opening of seventeen streets and alleys. They will be opened by condemnation proceedings through the Circuit Court. The bills, themselves carry no appropriations. The bills follow: Alleys in city block 4500A, between Maffitt Ave., Terry Ave., King's Highway and Norwood Ave. Alleys in city block 3837, between Wells Ave., Easton Ave., Hamilton Ave. and Hodiamont Ave. Liberty St., from Virginia Ave. to Alabama Ave. A street to be known as Park Lane, from Florissant Ave. to Melrose Ave. An east and west alley in city blocks 4803 and 4811. An east and west alley in city blocks 4804 and 4810. An alley running north and south in city blocks 2693 and 2731, from Neosho St. to Osceola St. and between Grand Ave. and Grace Ave. Alleys in city block 4500B, between Terry Ave., St. Louis Ave., King's Highway and Norwood Ave. An east and west alley in city block 4621 east, from Prather Ave. to Forest Ave. and between Mitchell Ave., a private street, and Plateau Ave. An east and west alley in city block 4386, from the north and south alley in said city block to Calvary Ave., and between Natural Bridge Ave. and San Francisco Ave. An alley running north and south in city block 3816 East A, from Page Blvd. to Minerva Ave. and between Temple place and Blackstone Ave. An alley running north and south in city block 3818 East B, from Ridge Ave. to Wells Ave., and between Clara Ave. and Temple place. Alleys in city block 3656, between Cote Brilliante Ave., Garfield Ave., Warne Ave. and Sarah St. To open and widen an alley running north and south in city block 4467, west from Ashland Ave., southwardly to the west alley in said city block, and between Rolla place and New Ashland place. An alley running east and west in city block 4186, from Spring Ave. to Gustine Ave., and between Fairview Ave. and McDonald Ave. To open and widen Eichelberger St. from Broadway to Virginia Ave. To open and widen Louisville Ave., from Dale Ave. to Clayton Ave.

R. L. Leonard has finished his work at Hazlehurst, Miss., and moved his outfit, consisting of 40 fine big mules and 75 colored men, over to the new levee job at Texarkana, Ark. Ben Stark is in charge of this outfit.

The new plans for the Wood River Drainage District were filed in the County Court at Alton, Ill., and the cause was continued one week to allow time for drawing petitions and securing the necessary signatures to properly bring the matter before the court. The new plans provide for the work at a cost of $185,000, where the first plans meant an outlay of $287,000. On account of the high cost of the work, the Standard Oil Co. and other large manufacturing concerns in the District objected, but the new plan has the approval of the engineers, commissioners and several of the objectors, and it is believed that it will be confirmed. The work will vastly improve what is known as Alton's factory district.

The Board of Local Improvements of East St. Louis last week authorized the payment of $25,016.80 to the Lorimer-Gallagher Construction Co. on account of work done on the great outlet sewer during the last thirty days. This payment makes a total of $744,873.74 that has been paid the contractors minus 15 per cent, which has been held back until the work is accepted. A part of the sewer is already in service. It will be turned over to the city by March 1, the contractors say.

Charley Lowrance, of Lowrance Bros., left Memphis last week with a 50 team outfit which they are going to place on the big levee job near Texarkana.

Bob Cheshire expects to ship his team outfit the latter part of this week from Memphis to the levee work at Texarkana. When Cheshire's outfit and several others that are on the way, arrive on this work there will be in the neighborhood of 300 teams on the job.

Activity in the suburban sections has caused a revival of interest in the Houseman franchise for an electric belt railroad around the city, extending from Spanish Lake to Jefferson Barracks. For several weeks parties have been securing options on improved and vacant property in the section south of Home Station on Easton Ave., through the subdivisions of Wheaton, Lyndhurst, Vinita Park and sections lying farther south. Interested parties have refused to state the cause of the activity, but many suspect that the proposed Houseman line is being revived. Others have offered the suggestion that the McKinley Traction System is to be extended through that section into the interior of Missouri. It is also known that the Missouri, Kansas and Texas Railroad Co. has for some time contemplated a cut-off from a point above St. Charles by a bridge over the Missouri River and a route to a connection with the belt line of St. Louis, instead of maintaining its trackage arrangement with the Burlington Co. by which it now reaches St. Louis. It is also said that a transmission company is seeking a right of way across the country from Florissant to St. Louis for a line to convey power from the Keokuk Water Power plant to this city, which gives rise to the extensive deals for land in that section. Several sections of this proposed right of way near Florissant were transferred a few days ago by the Loretto Academy and others at the office of the Recorder of Deeds at Clayton.

The fact that the free bridge with a total width of 52 ft. will have a roadway of only 13 ft. 9 ins. for vehicle traffic was deplored in a resolution introduced in the House of Delegates. The resolution was presented by Delegate John J. Lahiv, who said he did so that steps might be taken to widen the approach wagon roadways before it is too late. The resolution was laid over for one week. The resolution was accompanied by a drawing, purporting to be a copy of the official plans. According to the drawing the sidewalks will occupy 12 ft., while there will be a space of 3 ft. 7½ ins. on each side of the two street railway tracks. Lahiv said part of this space and also part of the sidewalk space should have been set aside for vehicles.

A building permit was applied for last week by the Monadnock Realty Co. to erect the Railway Exchange Building, the 21-story skyscraper to be built on the site of the Barr block, the razing of the buildings on which already has commenced. According to the application the building is to cover a ground space 222x271 ft., will be 250 ft. high and will cost $2,600,000. There will be eighteen office elevators and twenty elevators used for the May Co.'s store on the first seven floors. The construction will be under the supervision of the Westlake Construction Co., of St. Louis, and Mauran, Russell & Crowell are named as the architects who drew the plans.

At a meeting held in the Belleville Commercial Club steps were taken to push work on the Belleville-Mascoutah Railway Co. line, which is now in course of construction, but on which work has been suspended for eight months. The line will connect Belleville with Rentchler Station and Mascoutah, Illinois, covering a distance of 12 miles. The greater part of the money was obtained by subscription.

We wish to remind contractors that the contract for Drainage District No. 9 of Mississippi County, Arkansas, will be let at the County Court House at Osceola, Ark., on Thursday, Jan. 25th, at 12 o'clock. The Morgan Engineering Co., of Memphis, Tenn., are engineers.

Jim Joyce, of Joyce Bros. & Bagwell, stopped off a day here on his way to Keokuk, Ia., where he expects to spend a month before returning to their work on the Memphis and Marianna cut-off of the Iron Mountain R. R. in Arkansas. Wet weather has bothered them some on this work lately.

The severe cold weather and heavy snows during the past week put a crimp in all outside and public works in this neighborhood. Everything shut down temporarily.

Sprinkling contracts have been awarded by the Board of Public Improvements. The Luke Coal Co. obtained more districts than any other bidder. Seven districts were awarded them. The awards were: District No. 1, Ruprecht Construction Co.; Districts Nos. 2 and 40, William R. Bush Construction Co.; District No. 3, Joseph Knaus; District No. 4, Pater Fabick; District, No. 5, Casper Fabick; District No. 6, Eyermann Construction Company; Districts Nos. 7 and 9, August F. Pollman; District No. 8, John Fabick; District No. 10, Michael F. Pfeffle; District No. 11, Wurst Coal and Hauling Co.; District No. 12, Mueller Coal, Heavy Hauling and Transfer Co.; Districts Nos. 13, 26, 27, J. E. Sippy; Districts Nos. 14 and 33, Peter J. Ratican; Districts Nos. 15 and 16, Ernst Weber; Districts Nos. 17, 18, 34 and 36, William H. Redemeyer; Districts Nos. 19, 21, 22, 23, 28, 29 and 30, Luke Coal Co.; Districts Nos. 24 and 25, Charles A. Kalbfell; District No. 31, Timothy E. Cavanaugh; Districts Nos. 32 and 35, Frank A. Stiers; Districts Nos. 37 and 38, Fred C. Pollman; District No. 39, Wade Bros. Construction Co.; District No. 20, William Coogan. There are 40 districts into which the street sprinkling is divided. The total cost for sprinkling under the contracts is $319,945.

The Labor Market in St. Louis is easier now than it has been in the past ten years. Lots of idle labor here. The Police Department are housing from 1,000 to 1,200 of them every night in the Old Four Courts. With the exception of a little snow shoveling there is nothing doing. The high water south of Cairo, Ill., has forced the Government to shut down on its river improvement work and has also caused the levee contractors to move to higher ground.

The McKinley Electric Railroad has obtained the contract for lighting East Alton, Illinois, and one of the agreements in the contract is that the company shall light the City Hall of East Alton free for the next forty-nine years from cellar to garret, no matter how large the town or the hall may become. The winning of this contract by the McKinley line means much to Alton. First it means that the franchise of the Alton, Granite City and St. Louis Traction Co., which runs out in 1913, will be bid for by more than one company and it also points to the fact that the Alton, Granite City and St. Louis Traction Co. will not have a monopoly on the lighting in Alton. The victory in the East Alton Council for the McKinley line also means that they will get their power in Woodriver and Benbow City, as the three towns are in favor of being supplied by the same company.

Arthur J. Koenig, the youngest son of A. B. Koenig, was married to Miss Vera Fuller at the home of her uncle, Mr. C. T. Sharp, in Evansville, Ind., last week. The young folks thought they were putting one over on the old man, but he had received advance information from the newspapers of that city and the joke was on the young folks.

Missouri needs 1,500 miles of new railroad to open up for settlement 5,000,000 acres of unoccupied land in the state and bring 150 towns in closer touch with central markets, according to a pamphlet just issued by John H. Curran, former chief commissioner of immigration of Missouri and a candidate for the Democratic nomination for railroad and warehouse commissioner. These proposed lines open up not only the Ozark region, but cut off hundreds of miles by more direct routes in other parts of the state. Mr. Curran in his pamphlet cites his work for good roads in Missouri, but says the state needs more efficient railroad service as well. He says one may travel 150 miles in a straight line in certain parts of the state without crossing a railroad. He sees in more railroads a greater development of the state in agriculture, dairy-ing, manufacturing and [illegible] increased benefits to all citizens.

Montana.

The Chicago, Burlington & [illegible] concluded negotiations with the Chicago & Northwestern Ry. for a ten years' lease of that portion of the Northwestern's tracks between Orin Junction and Powder River, where the Burlington's southern extension from Thermopolis will strike the line of the Northwestern. The lease will become effective Aug. 1 next, and it is believed that by that date the new line of the Burlington will be finished. With the completion of the Southern extension and the lease of the Northwestern tracks the Burlington will then have a transcontinental system from the Gulf of Mexico to the North Pacific coast.

Residents of Roundup and the Musselshell Valley have started a movement for the construction of an electric railroad between Roundup and Billings, and have made overtures to the capitalists building the street railway system at Billings to extend the urban road north to connect with an electric line to be built from Roundup to Klein, Davvis and West Roundup, a distance of eight miles.

Nevada.

Contractors have been going over the route of the proposed 8-mile branch line of the Prince Consolidated Mining Co. from Pioche, Nev., to its mine. It is probable that the grading contracts will have been let by the time this appears. Among the contractors who have been over the route are the Brown Construction Co., Salt Lake City, and Utah Construction Co. of Ogden. This line is to be built by the mining company.

New York.

⊙Bids were opened Jan. 11 by the Public Service Commission, First District, Travis H. Whitney, Secretary, 154 Nassau St., New York city, for the construction under revised plans of Sec. 3, Route No. 5 of the Lexington Ave. Rapid Transit Railroad, the contract being awarded on Jan. 12 to the Underpinning & Foundation Co., 290 Broadway, New York, at $2,295,086. The other bidders were: Frederick L. Cranford, 177 Montague St., Brooklyn, $2,387,932; Bradley Contracting Co., 1 Madison Ave., New York, $2,578,832; Degnon Contracting Co., 60 Wall St., New York, $2,676,989; J. H. Louchheim, 2 Rector St., New York, $2,759,943; Holbrook, Cabot & Rollins Corp., 331 Madison Ave., New York, $2,899,244; Metropolitan Contracting Co., 95 Milk St., Boston, Mass., $2,909,573; J. F. Cogan Company, 290 Broadway, New York, $2,933,422; the O'Rourke Engineering Construction Co., 345 Fifth Ave., New York, $2,950,341; the Cranford Company, 190 Montague St., Brooklyn, $2,981,357; Oscar Daniels Company, 38 Park Row, New York, $3,256,301; the United Engineering & Contracting Co., 17 W. 42d St., New York, $3,316,993; Empire Engineering Corporation, 60 Wall St., New York, $3,448,750.

The Brooklyn & North River R. R. Co. incorporated Dec. 30 with a capital stock of $500,000, as a subsidiary concern of the Brooklyn Rapid Transit, the Coney Island & Brooklyn, and the Third Avenue interests, has applied to the Public Service Commission for a certificate of convenience and necessity for a street railway line from the intersection of the Flatbush Ave. extension and Fulton St., Brooklyn, across the Manhattan Bridge and through Canal and other streets to West St., near the Desbrosses Ferry, New York City.

The State Public Service Commission has authorized the Hudson River & Eastern Traction Co., Ossining, N. Y., to issue bonds for the construction of an extension from Ossining to White Plains, a distance of 16 miles.

It is probable that if the plans for the merging of the New York Central & Hudson River R. R. and the Lake Shore & Michigan Southern R. R. go through one of the greatest improvement campaigns ever undertaken by a railroad will be put under way. It is said [illegible] of that system with the parent company, the [illegible] to provide for a four track system all the way [illegible] portion of the New York Central proper is already four-tracked, and there are stretches [illegible] Toledo on the Lake Shore, while the entire line of the Lake Shore between Buffalo and Chicago is double-tracked.

Petitions are to be submitted to the Syracuse, Lake Shore & Northern Electric R. R. 500 O. C. S. Bank Bldg., Syracuse, asking for the construction of a belt line through the north end of Oswego. The plan, as outlined in the petition, recommends that the tracks in Erie St. be extended south along Hawley St. to Ellen, to Fifth, to Munn, to Murray, to the intersection of the present interurban line of the Lakeshore & Eastern in West First St.

North Carolina.

The Southern Ry. Co., W. H. Wells, chief engineer of construction, Washington, D. C., has asked bids for constructing a belt line at High Point, N. C. The contract had not been awarded on Jan. 10, and it was expected that it would not be for several days later. The line will be about 8,500 ft. long.

The Pembroke, Red Springs & Northern R. R. Co. has been chartered in North Carolina to construct a railroad from Pembroke, on the Carolina Central division of the Seaboard Air Line, to Red Springs in Robeson county, a distance of 12 miles. The capital is $12,000 subscribed and $75,000 authorized, the incorporators being J. L. McMillan, C. G. Vardell, J. G. Williams, J. D. McLean and others of Red Springs, the principal office to be in Red Springs.

Ohio.

The Akron, Canton & Youngstown R. R., building a line between Akron, O., and Mogadore, is endeavoring to secure permission to construct a spur in Springfield Township.

It is expected that a definite announcement will be made shortly by the Cleveland Underground Rapid Transit Co. as to its plans for the proposed subway at Cleveland. It is reported that the company has been financed and that American and European bankers are ready to put up at the start $3,000,000 to $3,500,000. With this amount at least one of the high level routes could be constructed and equipped ready for operation. As previously noted in these columns much of the advance engineering work has been completed. W. R. Hopkins, Cleveland, is president.

A company is to be organized at Wellston for the purpose of developing Southern Ohio timber and coal lands and completing a railroad to Sandusky. It is reported that the men interested in the plan have raised $8,000,000 for a railroad from Portsmouth through Wellston to Lake Erie at a point near Sandusky. B. F. Howland and C. F. Butterfield, New York, and E. B. Bingham, Toledo, O., are interested in this project.

The Cleveland, Randall & Eastern Railway & Power Co., Cleveland, O., has been incorporated with a capital stock of $10,000 and proposes to operate street railways and manufacture and sell electricity. The incorporators are: R. H. Jamison, Harley S. Adams, Claude W. Skimmon, D. S. Sheet and H. W. Dickson.

Construction work is to be started shortly it is said, on the line of the Oklahoma Northwestern Ry. Co. chartered Aug. 28 last. This line is to extend to the northwestern part of the state. John W. Shartel, Oklahoma City, is interested.

Representatives of the Paterson interests controlling the Oklahoma City Traction Co., 110 N. Broadway, Oklahoma City, are reported to be negotiating for the purchase of franchises for the construction of a line from Lawton to Fort Sill.

A conference of officials representing the railroads entering Cincinnati and officials of the Cincinnati Union Depot & Terminal Co. was held at Cincinnati on Jan. 9. No definite action regarding the construction of the depot was taken. The revised plans were submitted to the committee of railroad engineers to make a new estimate of cost. It is possible that these engineers may have their estimates completed and their report ready for the railroad executives within a month. John E. Bleeckman, Cincinnati, Ohio, is vice president of the Cincinnati Union Depot & Terminal Co.

Oklahoma.

The Missouri, Oklahoma & Gulf Ry., J. J. Harrison, Chief Engineer, Muskogee, Okla., is understood to be planning to let contracts this month for the proposed extension from Henryetta to Oklahoma City, 102 miles.

Oregon.

⊙The Utah Construction Co., Ogden, Utah, has been awarded contract for the extension of Klamath Falls-Natren line of the Southern Pacific from Hazeldell, the present terminus, for a distance of eight miles. The gap from Klamath Falls to Natren is 192 miles. Of this, 119 miles have been practically completed, leaving 93 miles of road yet to be constructed. There are 40 miles of comparatively heavy grading between Hazeldell and the summit of the mountains.

Promoters of the Marshfield Terminal R. R. have announced that they expect to begin actual construction in Marshfield, Ore., the latter part of March. According to the franchise granted the company by the City Council of Marshfield, the company must expend $10,000 on construction before June 1. The company expects to build about a mile of electric line first. The franchise also provides for a steam road down the waterfront streets, but this will not be started until the conditions warrant. The plans of the company will be completed at a meeting to be held early this month, when C. A. Smith, the lumberman, who is interested in the movement, will be present.

It is reported at Baker, Ore., that owing to the inability of the Harriman right of way men to secure the needed strip of land for the Malheur extension which is to be built this winter, surveyors have been put to work running a line west from Parma, and which may result in Vale being left on a branch line, if a suitable grade can be secured from that point.

Pennsylvania.

⊙Bids were received Dec. 28 by the Philadelphia & Reading Ry., W. Hunter, Chief Engineer, Philadelphia, Pa., for the following work in connection with the work appurtenant to the abolishment of grade crossings on the Richmond Branch Elevated. Contract No. 57, Engine Water Supply, Frankford & Lehigh Aves., Richmond Branch Elevated, contract awarded to Enos L. Seeds, 6314 Wissahickon Ave., Philadelphia, contract price, $13,910. Contract No. 58, reconstruction of coal yard between Aramingo Ave. and Richmond St., Richmond Branch Elevated, contract awarded to J. S. Caldwell, 811 Edgewood Ave., Trenton, N. J., contract price, $19,505.

The Ardmore & Llanerch Street Ry. Co., a subsidiary company of the Philadelphia & West Chester Traction Co., A. M. Taylor, President, 610 Arcade Bldg., Philadelphia, Pa., has authorized an increase of capital stock of $100,000. Proceeds of this stock issue will be applied to double-tracking Ardmore division between the Manoa road and Oakmont, the elimination of a curve, construction of a stone station at Brookline, and the purchase of additional cars.

The Philadelphia & West Chester Traction Co. is considering enlarging its power station at Llanerch by the installation of new machinery of sufficient capacity to give more than double the present electrical output. This improvement is required by the large increase in traffic, necessitating the operation of additional cars. Other extensions will be made to the Llanerch power station, providing the proposed Media extension of the Collingdale division is built during the year. The con-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

struction of this extension will depend entirely upon the measure of co-operation extended by the municipalities and property owners along the line.

The Cumberland Ry. Co., now operating 21 miles of electric line, is reported to be considering extending its line from Newville to Chambersburg, a distance of 22 miles. John Graham, Newville, Pa., is president.

The New York Central Lines, G. W. Kittredge, Chief Engineer, New York City, is understood to have been placing contracts for 100,000 of ties to be used in double tracking its river line between Clearfield and Keating, and it is believed that grading work for this will be started early in the spring. A considerable addition to the trackage facilities in the yards below Clearfield is also to be made.

The Baltimore & Ohio Ry. has under consideration the construction of a short connecting line between Rockwood and Garrett on the Pittsburgh division.

It is believed in Scranton, Pa., railroad circles that the Directors of the Delaware, Lackawanna R. R. will shortly give serious consideration to the building of the cutoff from Clark's Summit to Hallstead. Plans outlined some time ago call for the elimination of curvatures and grades and shortening of the road three miles. The whole, it is estimated, will cost approximately $14,000,000. A large concrete bridge is embodied in the plans. It will be near Nicholson, and will span two mountains, across a valley. The Nicholson tunnel will be eliminated. The plans were made by R. M. White, Easton, Pa., formerly Division Engineer, who is now superintendent of the Bangor & Portland Division in the operating department. The new line will leave the main line at the Summit and then not strike the old main line again until it reaches Alford, in Susquehanna County.

South Carolina.

The Charleston & Western Carolina Ry. Co., according to reports, plans the reconstruction of its entire line between Spartansburg, S. C., and Augusta. It is said that the grade will be lowered, curves eliminated and heavier steel installed, which will necessitate the expenditure of a large sum. A. W. Anderson, Augusta, Ga., is General Manager of the road. A. H. Porter is Engineer of the roadway.

South Dakota.

There is a rumor that a stock company will soon organize to build an electric line from Rapid City by the way of Sturgis to Newell, South Dakota.

The stockholders of the Belle Fourche & Spearfish electric railroad have held a meeting in Belle Fourche to decide on what time they will begin actual construction on the proposed line. They expect later to extend this line from Spearfish up the Spearfish Valley to Deadwood and Lead.

The Burlington R. R. expects to extend its line farther at Galena, So. Dak., to the new mines and smelter as soon as the weather permits.

The Yankton Railway Construction Co., Yankton, S. Dak., has filed articles of incorporation with the Secretary of State, Pierre, S. Dak. The company proposes to purchase grading machinery and do railway grading and general grading contract work. The company is capitalized at $100,000. The incorporators are J. R. Hanson, C. J. B. Harris, W. M. Powers, M. P. Ohlman and E. A. Bruce.

Tennessee.

⊙J. B. Smith & Co., Knoxville, Tenn., has been awarded the contract for the construction of all structural and concrete work on the new double-track work of the Louisville & Nashville, between Ooltewah and Chattanooga, Tenn. The contract price was $100,000.

⊙The W. J. Sparks Co., Mt. Vernon, Tenn. (temporary office at Lewisburg, Tenn., has been awarded the contract for about seven miles of grading for the Lewisburg & Northern R. R., in the vicinity of Lewisburg.

⊙The first contract for the construction of the new Lewisburg & Northern R. R., a subsidiary line of the Louisville & Nashville, has been let to Walton, McDowell & Co., Nashville (temporary office at Brentwood, Tenn.). The job will include excavating and grading for 19 miles of the new road in the vicinity of Nashville, Clovercroft and Brentwood, where the present main line is intersected by the new line. This section includes the Big Brentwood cut, which is nearly a mile long and 70 ft. deep. The contract with Walton, McDowell & Co. calls for the excavation of about 800,000 yds., of which nearly 300,000 is in the Brentwood cut. Most of this excavation will be through rock and will involve an estimated outlay of $750,000. While steam shovels and drills and other appliances will be used, it is expected there will be 1,000 men on the job when it gets in full swing. Arrangements have been made for beginning the work. Five steam shovels are on the way, camp sites have been secured, and arrangements for provisions and supplies have been made. The contracting firm is composed of S. Walton and E. B. Bawn of Falls Mills, Va., J. R. McDowell of Knoxville and J. E. Rodes of Franklin.

Texas.

Surveys for the 40-mile Stone City-Giddings line which will connect the main line of the Houston & Texas Central with the San Antonio & Aransas Pass Ry. line, have been made. Contracts for the first 13 miles of this line were let to Owen, Levy & Owen, Houston, Tex., as stated sometime ago in this column. Contracts for an additional 10-mile section will be let in a short time. E. B. Cushing, Houston, Tex., is engineer of construction.

It is reported that grading work will be started shortly on the extension of the St. Louis, Brownsville & Mexico Ry., F. G. Jonah, chief engineer, St. Louis, Mo., from Bloomington to Victoria, a distance of 13 miles.

Smith Brothers, Crockett, Tex., have started grading work for the government railroad to be built from Crockett to the site of the government lock and dam at Hurricane Shoals on Trinity River. The railroad will be used for hauling material for use in the construction of the lock and dam.

Utah.

It is reported that the Salt Lake & Ogden Electric Ry. Co., E. A. Vail, chief engineer, 161 S. Main St., Salt Lake City, will have completed by the end of this year the double tracking of its line from Salt Lake City to Ogden. Considerable work toward this has been done between Farmington and Kaysville, and it is expected that work will be resumed this season from Farmington to Salt Lake City.

Vermont.

It now looks as though the Boston & Maine R. R. was planning to begin construction work in the spring on its short cut-off from Hinsdale, N. H., to Brattleboro, Vt. Last week A. B. Corthell, Boston, Mass., chief engineer of the Boston & Maine, and L. Curtis, Boston, engineer of construction, were over the right of way. It is also believed that the Boston & Maine and Grand Trunk R. R. have about reached an agreement regarding the connection of the new lines at Brattleboro, Vt.

It is probable that construction work will be started this spring on the Barre Granite Ry. This is to be a 5 or 6-mile steam line which will serve to give a number of quarries at Barre an outlet to the Central Vermont Ry. The railway will be a subsidiary of the Central Vermont and Grand Trunk Ry. The capital stock is $100,000. Charter for this line was granted last week to E. H. Fitzhugh, St. Albans, Vt. president of Central Vermont Ry. J. M. Morrison, St. Albans, is engineer Central Vermont Ry.

Virginia.

The Lynchburg, Danville & Carolina Ry. Co. has been chartered under the laws of Virginia for the purpose of constructing 125 miles of track, beginning at a point on the James River division of the Chesapeake & Ohio R. R., near Lynchburg, and extending to a point on the North Carolina line near Milton. The officers are: T. O. Troy, president, Amherst; W. P. Read, secretary, Amherst. Directors, Mr. Troy, Mr. Read, J. E. Bowman, Edward Meeks and L. B. Davies, all of Amherst; A. B. Carrington, W. R. Fitzgerald and R. A. James, all of Danville.

Stock holders of the Virginia Ry., H. Fernstrom, Chief Enginer, Norfolk, Va., at the annual meeting to be held on Jan. 27, will vote to increase the capital stock from $36,000,000 to $65,000,000, to be divided into $29,000,000 5 per cent cumulative preferred stock and $36,000,000 common stock. The minimum stock will be placed at $50,000,000 and maximum $65,000,000. It is believed that the proceeds of this increase of capital stock will be used for extensive improvements and extensions.

Washington.

⊙The Oregon-Washington Railway & Navigation Co. has awarded a contract to Grant Smith & Co., Henry Bldg., Seattle, Wash., for the erection of a 90x180 ft. machine shop, a 40x90 ft. power house, a 36x36 ft. store house, etc., at Argo, to cost $50,000. All buildings will be of reinforced concrete construction.

Engineers of the Chicago, St. Paul, Minneapolis & Omaha R. R. have completed surveys for a line cutting off Hudson, Wis., from the main route between St. Paul and Chicago. Officials of the company are reported to have stated that no definite action will be taken toward actual construction for some time. The work, it is estimated, will cost about $1,500,000, and will include a 4½-mile trestle.

West Virginia.

Commissioners of Lawrence County, Ohio, have granted an extension of franchise until Sept. 20 for beginning work on a traction line along the county pike from Ironton, O., to the Galion County line. This franchise was granted to A. E. Cox, Huntington, W. Va. It is stated that the line has now been financed, and that construction work will be started shortly.

The Northern Pacific Ry., A. R. Cook, Principal Assistant Engineer, Tacoma, Wash., is understood to be about ready to let contracts for work on its Point Defiance line. This will be a somewhat expensive piece of work, as it will include a tunnel about one mile long from a point near the smelter at Rustin, and the construction of a roadbed along the shore of Puget Sound from the Narrows to Nisqually River and thence to Tenino.

The Seattle Clearing House Association has announced that at a meeting the members, including all the Seattle banks, voted unanimously to purchase or acquire any of the city bonds proposed to be issued for constructing a municipal street railway. Bonds amounting to $800,000 were voted last spring by the city of Seattle for the purpose of constructing a north and south line through the city. None of the bonds have been issued, and the clearing house resolution was in answer to a letter from the City Treasurer asking for bids for the bonds. A. R. Dimock is City Engineer of Seattle.

Canada.

The Canadian Pacific Ry. has filed a route map of a line to run along the north side of Burrard Inlet from Port Moody into North Vancouver. This is taken as an indication that North Vancouver will be the southern terminus of the Canadian Pacific line to the Peace River country. The Canadian Pacific and other companies are understood to be ready with proposals to build from Vancouver into northern British Columbia. The question is one of the main subjects for the coming session of the legislature.

The main estimates of the Dominion Government for the coming fiscal year were sub-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

mitted in the House of Commons on Jan. 10. Of the estimates $11,870,[illegible] ital expenditures, of which $25,000,000 is for the National Transcontinental Ry.; $3,000,000 for the Quebec bridge; $2,000,000 for the Hudson Bay Ry.; $4,158,350 for capital improvements on the Intercolonial Ry., including $1,000,000 for the branch line from Dartmouth to Dean's Settlement; $900,000 for docks and wharves at Halifax, and $400,000 for new rolling stock.

The citizens of St. Thomas, Ont., voted at a recent election on extending the municipally owned St. Thomas Electric Street Ry. to Port Stanley, a distance of seven miles.

The Montreal Street Ry. Co., Duncan McDonald, General Manager, 78 W., Craig, St Montreal, Que., is planning a new car line for the Outremont section. The route is Park Ave., St. Bernard, Outremont Ave., Van Horne and Park Aves.

Sir Thomas Tait has been appointed President of the Fredericton & Great Lake Coal & Ry. Co., of Fredericton, N. B. This is a new company which has extensive plans for the development of the Grand Lake coal fields.

[illegible] arrangements have al[illegible] been made for [illegible] continental Ry., between Winnipeg and Moncton was complete and that the road between Winnipeg and Prince Rupert would be completed next year. The total mileage between Winnipeg and Moncton is approximately 1,805 miles. Between the two cities there has been laid to date by the railway company, including sidings, 1,475 miles of steel, including the mileage for terminals, there has been laid 1,550 miles. In addition, much grading has been done, on which the steel will be laid at an early date. The mileage between Winnipeg and Prince Rupert is also approximately 1,800 miles. Between Winnipeg and Edmonton, approximately 900 miles, there has been built a roadbed of the highest character and the trains have been in operation for a long period. West of Edmonton there is steel for a distance of 250 miles, [illegible] 140 miles, and then steel for 100 miles into the city of Prince Rupert.

Mexico.

Dr. F. S. Pearson, 20 Exchange Pl., New York City, is planning the construction of trolley lines from the City of Mexico to Puebla, and from the City of Mexico to Toluca. The Puebla line will run between Popocatepetl and Ixtaccihuatl, reaching an altitude of more than 14,000 ft. Final surveys on the Mexico-Puebla and Mexico-Toluca lines were stopped owing to the disturbed conditions in the country, but as soon as peace has been restored finally the work will be continued. The construction of the Puebla route will be started as soon as the surveys have been finished and it is possible that work on both lines will be commenced at the same time

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received until noon, Jan. 19, by J. Smith, City Engineer, Selma, Ala., for the construction of about 1,000 sq. yds. vitrified brick, 2,000 sq. yds. cement pavement, 12,000 sq. yds. wood block, vitrified brick, bitulithic, asphalt, asphalt block, concrete or Hassam, on a concrete base, or bituminous binder macadam on a chert or screened stone foundation, about 4,500 lin. ft. granite curb or combined curb and gutter and all necessary storm sewers, inlets, etc.

California.

⊙John Doyle of San Jose, Cal., has been awarded the contract by the board of Santa Clara County Supervisors, San Jòse, for the construction of a bulkhead and road fill on the Coyote Creek at the Schallenberger place, at $2,132. Bids were opened Jan. 2.

The Board of Trustees of Coronado, Cal., has decided to call a special election to vote on the question of issuing bonds for the paving of Orange Ave., over its entire length, at an estimated cost of $80,000, and the reconstruction of the sea-wall along Oceanfront Blvd., at an estimated cost of $75,000. The wall will require 40,000 tons of rock distributed over 3,700 lin. ft. Provision is also made for laying gutters and culverts to afford drainage from side streets.

Georgia.

✣Bids will be received until 3 p. m., Feb. 5, by Mayor and General Council, Atlanta, Ga., for the following work and material for the Street and Sewer Departments of the city during the year 1912: 1. Furnishing and setting granite curbing. 2. Furnishing and setting concrete curbing. 3. Furnishing and laying tile sidewalks. 4. Furnishing and laying sheet cement sidewalks. 5. Furnishing and laying brick sidewalks. 6. Constructing sewers (eastern section). 7. Constructing sewers (western section). 8. Furnishing vitrified sewer pipe. 9. Furnishing castings for sewer. 10. Furnishing cement for sewer work. 11. Furnishing chert or gravel. 12. Furnishing brick for repair work. 13. Furnishing cement tile for repairs. Furnishing and laying tile sidewalks and cement drives for repair work. 14. Furnishing stone and crushed stone for macadam. 15. Furnishing sand. 16. Furnishing cement for the street department.

Specifications will be furnished upon application to the undersigned. The right is reserved to reject any or all bids, or waive technicalities. R. M. Clayton is Chief of Construction.

Idaho.

✣Bids will be received until 2 p. m., Feb. 2, by Board of Public Works, Boise City, Idaho, for the construction of approximately 328,200 sq. yds. of asphalt, asphaltic concrete, bitulithic, Westermite asphalt, dolarway, hassamite, plain concrete, concrete with cement top, granocrete, hassam or brick pavement (with brick along street car tracks) in all streets and parts of streets in Paving District No. 17, with necessary excavations, gutters, and appurtenances. K. Paine is President of the Board. Official advertisement will be found elsewhere in this issue.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 25, for furnishing and delivering to the Bureau of Streets on any public team track, 800,000 paving brick, according to specifications. All brick are to be of the best quality of vitrified paving brick, not less than 8 ins. in length, 4 ins. in depth, and 2½ ins. in thickness, with edges rounded to a radius of ¼ in. Brick shall be free from lime and other impurities and shall be uniform in size and structure. Salt glazed bricks shall not be accepted. Cash or certified check for $500 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m. January 25, for furnishing and delivering to the Bureau of Streets, at various points throughout the city, approximately 5,000 gals. of gasoline for use of steam rollers. Cash or certified check for $100 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m. Jan. 25, for furnishing and delivering to the Bureau of Streets, on any public team track in the city, approximately 1,000,000 gals of road oil. The oil must be subject to the following and other tests: Specific gravity, .92 at 77 degrees F., not more than 8 per cent fixed carbin; flash point not less than 275 degrees F., 99 per cent soluble in cold carbon bi-sulphide. Cash or certified check for $2,500 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 25, for furnishing and delivering to the Bureau of Streets in tar wagons, approximately 50,000 gals. of paving pitch. The paving pitch is to be the direct result of the distillation of straight run coal tar, and of such a character as to adhere to the paving block. It shall contain not less than 15 per cent and not more than 35 per cent free carbon, and a melting point between 130 degrees and 140 degrees F. Cash or certified check for $500 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 24, for furnishing paving gravel to the Bureau of Streets and delivering same to the 1st, 17th, 18th, 19th, 21st and 22nd ward yards. All gravel must be clean, free from sand loam, etc., and not more than ½ in. in size. Cash or certified check for $200 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m. Jan. 24, for furnishing to the Bureau of Streets bank sand as specified. The same to be delivered to various ward yards. Cash or certified check for $400 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m. Jan. 22, for furnishing to the Bureau of Streets various sizes, grades and qualities of lumber as specified, and delivering same to the ward yards located throughout the city. Cash or certified check for $800 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 22, for furnishing and delivering to the various ward yards of the Bureau of Streets approximately 325 dozen scoops and shovels, and 1,200 dozen street brooms. Cash or certified check for $100 must accompany proposal for shovels and $600 for brooms.

City Engineer W. B. Thistlewood of Cairo, Ill., is preparing estimates for the paving and graveling of the downtown cross streets between Second and 20th, from Ohio St. to Washington Ave. It is proposed to pave with brick all of the even-numbered streets and gravel the odd-numbered streets.

The Board of Local Improvements of Peoria, Ill., has decided to lay brick pavement on Hurlburt St., from Reed Ave. to Steubenville St., to a width of 40 ft. The Board also directed City Engineer R. J. Canterbury to prepare an estimate for the paving with asphalt of Madison Ave., from Cornhill to Abingdon St., and for surfacing with asphalt the brick pavement on North Monroe St., from Main to Hamilton.

The Board of Local Improvements of Waukegan, Ill., has passed resolutions providing for paving, as follows: Steele Court and Corey Ave., with brick, to cost about $15,913; retaining wall for the side of the Belvidere St. hill, to cost about $990; Lawn Court, with macadam, at a cost of approximately $1,006.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

and Gillette Ave., with brick, at an approximate cost of $9,720.

The Board of Local Improvements of Sterling, Ill., has under contemplation the laying of 56 blocks of pavement during this year. The work will cost approximately $100,000.

The Board of Local Improvements of Moline, Ill., has confirmed the proposed improvement of 14th St., from 16th to 23rd Ave., with asphalt at an estimated cost of $20,675, and the paving of 15½ St., from 8th to 10th Ave., with brick, at an estimated cost of $2,905.

A petition has been circulated in Mendota, Ill., and presented to the Board of Local Improvements, asking for a reconsideration of the plan to pave the two blocks on Illinois Ave., extending from Burlington to Springfield St., and thence to Main.

The Township of Stockland, in Iroquois County, Ill., is making preparations to lay a considerable amount of brick pavement during the coming spring and summer. Watseka is the county seat of Iroquois County.

The City Council of Lincoln, Ill., has passed ordinances providing for the paving of Lincoln Ave. and Ottawa St., from Union to College Ave., and Union to Tremont Ave., respectively.

Commissioner of Public Works L. E. McGann of Chicago, Ill., has asked the engineering department to draft plans for the construction of a creosoted block manufacturing plant, which is to be located at the Bridewell. The plant will cost approximately $60,000.

New brick paving to cost $44,790 has been ordered for portions of three streets by the Board of Local Improvements of Rockford, Ill. The proposed improvements are as follows: Railroad Ave., brick pavement, with a 36-ft. driveway, estimated at $23,840; East State St., brick pavement, from Third St. to East St., and Charles St., brick pavement, from State St. to Seventh Sts., estimated at $20,950.

A petition has been filed with the Board of Local Improvements of Mattoon, Ill., for the paving of Marshall Ave., in the west part of the city. The specifications under consideration call for pavement 30 ft. wide on South 21st St., from the Indiana division of the Illinois Central to Marshall Ave., thence westward to 33rd St.

Indiana.

✣Bids will be received until 1 p. m. Feb. 6, by Board of Jefferson County Commissioners, Madison, Ind., for the construction of a macadamized road in Madison township. A. M. Taff is County Auditor.

✣Bids will be received until Feb. 5, by Board of Warren County Commissioners, Williamsport, Ind., for the construction of gravel roads in Steuben and Jordan townships. D. H. Moffitt is County Auditor.

✣Bids will be received until 1 p. m., Jan. 31, by Board of Wells County Commissioners, Bluffton, Ind., for the construction of four highways in Harrison township and two in Chester township. L. A. Williamson is County Auditor.

✣Bids will be received until 10 a. m., Jan. 19, by Board of Public Works, Indianapolis, Ind., for the improvement of Morris St., from the northwest property line of Kentucky Ave. to southeast property line of River Ave., running north by grading and paving the roadway.

✣Bids will be received until 10 a. m., Jan. 19, by Board of Works, Indianapolis, Ind., for the improvement of Morris St., from the east line of River Ave., running northeast to west property line of Reisner St., running south by grading and paving the roadway.

✣Bids will be received until noon, Feb. 6, by Board of County Commissioners, Monticello, Ind., for the construction of a stone road in Big Creek Township. A. G. Fisher is County Auditor.

✣Bids will be received until noon, Feb. 6, by Board of Pulaski County Commissioners, Winamac, Ind., for the construction of certain public highways. W. E. Munchenburg is County Auditor.

✣Bids will be receiced until 3 p. m., Feb. 6, by Board of Jasper County Commissioners, Rensselaer, Ind., for the construction of a macadam road in Wheatfield Township. J. P. Hammond is County Auditor.

✣Bids will be received until 10 a. m., Feb. 6, by Board of Cass County Commissioners, Logansport, Ind., for the construction of macadam roads in Tipton and Eel Townships. J. E. Wallace is County Auditor.

✣Bids will be received until 2 p. m., Feb. 6, by Board of Monroe County Commissioners, Bloomington, Ind., for the construction of stone roads in Perry and Beam Blossom Townships.

✣Bids will be received until noon, Feb. 6, by Board of Dearborn County Commissioners, Lawrenceburg, Ind., for the construction of a road in Jackson Township. W. S. Fagaly is County Auditor.

✣Bids will be received until 10 a. m., Feb. 5, by Board of Clark County Commissioners, Jeffersonville, Ind., for the construction of a gravel road in Monroe Township. G. W. Stoner is County Auditor.

✣Bids will be received until 2 p. m., Feb. 5, by Board of Newton County Commissioners, Kentland, Ind., for the construction of a macadam road in Colfax Township. E. R. Bringham is County Auditor.

✣Bids will be received until 1:30 p. m., Feb. 5, by Jackson County Commissioners, Brownstown, Ind., for the construction of a gravel road in Hamilton township. H. W. Wacker is County Auditor.

✣Bids will be received until 2 p. m., Jan. 31, by Board of Rush County Commissioners, Rushville, Ind., for the construction of three gravel roads and four macadam roads. J. M. Stone is County Auditor.

✣Bids will be received until 2 p. m., Jan. 31, by Board of Rush County Commissioners, Rushville, Ind., for the construction of a highway in Walker Township. J. M. Stone is County Auditor.

⊙The Roach-Mannigan Paving Co., Memphis, Tenn., it is reported, has been awarded the contract by the City Council of Fort Wayne, Ind., for the paving of Terrell Ave., from Missouri to Evans Aves., at $1.95 per sq. yd.

Advices from Fort Wayne, Ind., state that petitions are being circulated in Cedar Creek Township, Allen County, for the building of a system of 17 miles of stone road in that township, centering at Leo. The petition will be presented to the Board of County Commissioners, Fort Wayne, and will ask that an election be called to decide whether or not the township wants the road improvement.

The Board of Public Works of South Bend, Ind., has provided for the paving of nine streets and the same number of alleys during the first part of 1912. Bids are now being asked for the paving of West Division St., from Michigan St. to Chapin; South Fellows St., from Bronson St. to Broadway, and Walnut St., from Colfax Ave. to Laporte; work to be started as soon as the weather permits. Resolutions have been ordered for pavements on the following streets: East Madison St. and Hydraulic Ave., North Scott St., Cedar St. and Niles Ave.

The Board of Public Works of Vincennes, Ind., contemplates making an appropriation for the paving of the intersections of streets this year. It is proposed to make these improvements as soon as the sewer work is completed.

A petition has been circulated in Fort Wayne, Ind., for the paving of South St., with brick, from the interurban corner to the street opposite.

The City Council of Kendallville, Ind., has passed Improvement Resolution No. 31, providing for the paving of Diamond St., from Main St. to the east line of Grant St., near the waterworks station, at a width of 36 ft.

Iowa.

⊙McLaughlin Bros., of Carson, Ia., have been awarded the contract by F. Weeks, Clerk of the township of Carson, Ia., for road work during 1912. The work includes grading, repair work and bridge building; payment on basis of $4 per day per man and team used. Bids were opened Jan. 9.

The City Council of Fort Dodge, Ia., has decided to advertise for bids for the repair work needed on asphalt paving between 12th and 9th sts., and between Sixth Aves., north and south. C. H. Reynolds is City Engineer.

The City Council of Webster City, Ia., has decided to advertise for bids on either concrete, asphaltic, concrete or brick block for the construction of 20 blocks of paving early this year.

City Engineer T. S. Delay of Creston, Ia., has submitted estimates to the City Council for the construction of about 60 blocks of paving. The pavement will be laid on Union from Elm St. to the Standard Oil house, South Elm St., to the corner south of the South Brick school; North Sycamore St., north to the Fair Grounds; New York Ave., south to the bridge; West Jefferson St., from New York Ave. to Stone St.; Stone, from Jefferson to Adams; Lincoln, from Adams to Montgomery; Sumner Ave., from Adams to Jefferson, and from Mills to Montgomery; Spruce, one block north from Mills; North Oak, from Montgomery to the corner north of Cottage hospital; North Elm, from Howard to Jefferson; Howard, from Elm to Maple; North Pine, from Mills to Jefferson; Jefferson, from Pine to Elm; Spruce and Northwest Chestnut, from Mills to Adams, and North Cherry, from Montgomery to Jefferson. The width of the paving will be 24 and 30 ft., on some streets 24 ft. and on others 30 ft. The work will include 50,000 sq. yds of paving, 45,000 ft. of curbing and 800 sq. yds, of alley paving.

Kentucky.

✣Bids will be received until March 8 by Monroe County Judge, Tompkinsville, Ky., for the construction of four miles of pike from Tompkinsville, toward Cumberland River. Each bid must be accompanied by a certified check for $200, payable to B. L. Bradshaw, Chairman of the Board of Road Commissioners, Tompkinsville, Ky.

Louisiana.

The Police Jury of Caddo County, Shreveport, La., has changed the date of the special election on the proposition of voting a tax of 5 mills for five years for permanent good roads from Jan. 23 to Feb. 27, so as to have more attention given the issue, which might receive small consideration on the first state primary date.

Maryland.

Eight kinds of paving will be used by the city of Baltimore, Md., during the year in the repaving of its streets, as follows: Belgian blocks, wood blocks, vitrified blocks, asphalt blocks, sheet asphalt on a concrete base, sheet asphalt over cobblestones, bituminous macadam, bituminous concrete.

Michigan.

✣Bids will be received until 7 p. m., Jan. 30, by J. A. Hagman, Village Clerk, Howell, Mich., for paving with concrete Grand River, between Walnut and Court Sts.

A public meeting was held in Saginawtown, Mich., on Jan. 9, for the purpose of considering the proposed submission to the citizens of a bonding proposition in the sum of $12,000 for the improvement of the Dill, Mackinaw and Shattuckville roads. This amount is to be supplemented with from $4,000 to $8,000 by the West Side Business Men's Association of Saginaw. The state will give an additional $1,000 per mile for road work when properly made.

The City Council of Ontonagon, Mich., is contemplating the paving of Front St., during the summer. Brick or asphalt will be used.

Petitions have been presented to the City Council of Ann Arbor, Mich., for the paving of South Ashley St., Huron to William, and Hill St., State to Washtenaw. The improvement of the former has been ordered. Over

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

100,000 sq. yds. of paving [illegible] for this year.

Minnesota.

✣Bids will be received [illegible] seph Winczewski, County Auditor, Winona, Minn., for the construction [illegible] macadam road.

✣Bids will be received [illegible] 26, by City Council, Minneapolis [illegible] furnishing the city with Portland cement to be used in paving and curb and gutter work during the season of 1912, in accordance with specifications on file with H. N. Knott, City Clerk. A certified check for $500, payable to C. A. Bloomquist, City Treasurer, must be filed with each bid.

◉A. W. Van Hafften, [illegible] been awarded the contract by the paving Committee of the City Council of Minneapolis, Minn., for the furnishing of creosoted paving blocks during the year at $1.53 per sq. yd. The blocks are to be of yellow pine.

The Clay County Commissioners, Moorehead, Minn., have established a new six-mile state road in Holy Cross Township, running through Comstock, east and west. The state will assume a portion of its cost.

No bids were opened Jan. 5 by J. Winczenski, County Auditor, Winona, Minn., for the construction of 25 miles of macadam road in Winona County, as advertised, on account of the heavy snows. A contract was to have been let at the same time for one 80 ft. bridge. O. B. Leland is Engineer.

Mississippi.

◉J. B. Silver & Son of Alliance, O., has been awarded the contract by the Town Council of Magnolia, Miss., for the construction and laying of sidewalks and crossings at $0.79 97.100 per sq. yd., and $1.23 respectively. The work includes 8,050 sq. yds. of concrete walks and 1,075 sq. yds. of concrete crossings. Bids were opened Jan. 8.

The Southern Paving Co., Birmingham, Ala., submitted the only bid to City Clerk of Vicksburg, Miss., on Jan. 12 for the paving of Bowmar Ave., from Washington St. to the fill and for graveling and tarring of the fill. The work includes 4,800 brick, 3,486 curbing, 170 headers, 3,486 cu. yds. excavating, and 2,172 metaling, at the following figures: Brick, $2.13; graveling, $1.35; curb, $0.65; headers, $0.45, and excavating, $0.45.

Missouri.

✣Bids will be received until Jan. 22, by City Clerk, De Soto, Mo., for the improvement of six blocks of Third St. S. C. Campbell is City Engineer.

The City Council of Springfield, Mo., has passed a bill providing for the paving of Center St., from Benton Ave. to the National Blvd., and adopted a resolution providing for the construction of concrete paving on Billings St., from Mt. Vernon to State Sts.

New Jersey.

✣Bids will be received until 2 p. m., Jan. 22, by Board of Street and Water Commissioners, Assembly Chamber, City Hall, Jersey City, N. J., for widening and improvement of Bergen Ave., between Montgomery St. and a point 100.40 ft. north of Montgomery St., in accordance with plans and specifications on file with E. B. See, Clerk of the Board. Bids must be addressed to John Prout, Chairman of the Committee on Streets, Sewers and M. L., Jersey City, N. J.

◉The Passaic Board of Freeholders, Paterson, N. J., has awarded the contract for improving River road to George F. Brackett, for $40,000. The road will be improved from Vreeland Ave. to the Wesen Brook, and will be constructed with the "G. F. B." compound.

New Mexico.

Plans are being made to build an interstate highway from Tahoka to Roswell, N. Mex. The road has been completed part of the way, and the intervening counties are preparing for bond issues.

New York.

[illegible] sion, Albany [illegible] two week [illegible] and repair [illegible] Engineer.

Ohio.

[illegible] a resolution declaring it necessary to im- [illegible] roe St., by grading and paving.

Oregon.

[illegible] election voted in favor of a special additional tax of 6 mills for Road District No. 7, to aid in building the Pacific Highway. A commit- [illegible] Sam H. Brown and Thomas Harrison, was named to oversee the work for the district.

At a recent meeting of the taxpayers of Scio, Ore., a 3-mill tax was voted for the further improvement on the road between Scio and West Scio, and on the road extending eastward to Jordan, both in Road Dis- [illegible] for road work in District No. 16 was defeated.

The taxpayers of Jordan Valley, Ore., at a recent meeting voted a 10-mill tax for the purpose of improving roads in Road District No. 25.

Plans are now under way for paving the entire district surrounding Beaumont, city of Portland, Ore., with the exception of three blocks in the Rossmere district. Tom Hurlbert is City Engineer of Portland.

Property owners on East Glisan St., between East 60th and East 82nd Sts., city of Portland, Ore., have asked for the paving of that thoroughfare with an inexpensive material.

Umatilla County, Ore., is about to construct a macadamized road from Freewater, Ore., to the Washington state line. Pendleton is the county seat.

Pennsylvania.

◉The Commissioners of Fairmount Park, 127 City Hall, Philadelphia, Pa., have awarded the following contracts for paving work for which bids were opened Dec. 21: Class I Paving—Granite blocks, $2.86 per sq. yd., Mack Paving & Construction Co., 2212 Land Title Bldg., vitrified blocks delivered, per 1,000, $25; vitrified blocks furnished and laid, $1.65; granite curb 6-in. thick and curves, also 8-in. curves, $1.50; 6-in. curves, $1.95; 8-in. curves, $2.30 and $2.85; Class U—Asphalt walks, Vulcanite Paving Co., $0.81 per sq. yd.; H. H. Staley, 569 Hermitage St., Class V—Fencing, $0.57 per lin. ft.; Class W—Cleaning wells, Fairhill Odorless Excavating Co., city, $0.11 per lin. ft.

Rhode Island.

The General Assembly of Rhode Island will shortly be called upon to provide for the issue and sale of bonds for highway pur- [illegible]

South Dakota.

According to reports Lawrence County, Deadwood, S. Dak., contemplates building a public highway from Deadwood and Lead down Elk Canyon to the Crystal Cave. They will use the old Burlington road bed that was abandoned three years ago.

The Meade County Commissioners, Sturgis, S. Dak., on Jan. 2 held a meeting with a view of taking up the proposition of maintaining and building good public highways. It is expected that several good contracts will be advertised in a short time.

The Homestake Mining Co. expects to build a highway more direct from Camp 11, in Spear Fish Canyon to Lead, S. Dak. This will require a great deal of heavy rock work and deep excavation. The work will begin immediately.

Tennessee.

◉The contract for the construction of concrete sidewalk, curb, gutters and installation of soil pipes for the city of Binghamton, Tenn., has been awarded by the Board of Street Commissioners to Hughey & McTighe of Memphis, Tenn., under the supervision of Harry N. Pharr, Consulting Engineer. The contract calls for 24,734 sq. ft. of sidewalk, at $0.8.7, 4,377 lin. ft. of curb at $0.29, 5,010 lin. ft. of gutters at $0.36½, 1,200 cu. yds. of [illegible] soil pipe at $1.20, and 350 ft. of 36-in. pipe at $3.45. The total for the work is $13,648.

Bids will be asked within the next 40 or 60 days for a considerable amount of road work to be done in Sullivan County, Tenn., during the year, amounting to $200,000. Jas. E. Miller, Indian Springs, Tenn., is Secy.

Landscape Architect George E. Kessler of St. Louis, Mo., has completed an inspection of the proposed route of the new parkway, Riverside Park, with Forest Hill cemetery, city of Memphis, Tenn., and is now engaged in preparing blue prints. Tentative plans contemplate the construction of a boulevard to be 250 ft. wide practically all the way.

Texas.

◉The City Commission of Port Arthur, Tex., has awarded the following contracts for the construction of shell sidewalks, etc.: Supplying 20,000 cu. yds. of clam and 20,000 cu. yds. of oyster shells, John T. Ireland & Co., at $1.25 for oyster delivered at place of use, and $1.75 for clam, also put where used; 125,000 sq. yds. of sidewalk, Lindsely & Smith of Dallas, $0.13½ per sq. ft., and for 25,000 lin. ft. of curbing at $0.42 per lin. ft.; excavation 11,500 cu. yds. of Shreveport ditch, John T. Ireland & Co., at $0.28.

An election held in the northwest part of Orange County, Orange, Tex., on Jan. 9, for the purpose of voting on the issuance of bonds in the sum of $75,000 for the construction of good roads, is reported lost. The proposition was to build a road from Mauriceville to Beaumont.

The City Council of Denison, Tex., has instructed City Attorney James S. Kone to prepare two ordinances, creating two improvement districts which will be paved in the immediate future. One district will include that portion of Main St. from the present end of the paving, east to Travis Ave., and the other will include the 100 block of North Houston Ave. and 100 block of East Woodard St.

Washington.

From Bellingham, Wash., comes a report that a petition is being circulated in behalf of the construction of a state aid road between Bellingham and Marietta, at a cost of $50,000.

Wisconsin.

✣Bids will be received until 10 a. m., Feb. 3, by Board of Public Works, Racine, Wis., for the construction of 10,900 sq. yds. of pavement, 2,221 lin. ft. concrete gutter and 2,723 lin. ft. combined concrete curb and gutter in W. 6th St. and Kinzie Ave. P. Connolly is City Engineer.

◉The White Construction Co., Majestic Bldg., Milwaukee, Wis., has been awarded the contract by the city of Kenosha, Wis., for the construction of 9,500 sq. yds. of vitrified brick pavement for $18,000. The work includes 5-in. foundation, 2,200 lin. ft., of 4-in.x26-in. sandstone curb, 1,800 cu. yds. of excavation and asphalt filler. Bids were opened Jan. 5.

According to advices from Madison, Wis., all the 71 counties in the state have petitioned for state aid under the new state highway law except the counties of Burnett, Calumet, Iron, Ozaukee, Pepin and Vilas. A total of $350,000 is available for road construction in 1912. A. R. Hirst, Madison, is State Highway Commissioner.

The city of Woodstock, Wis., is contemplating paving and other municipal improvements. The citizens have voted the issuance of bonds to the amount of $25,000 for the work.

The City Council of Beloit, Wis., has voted against the proposed paving of St. Paul Ave. and Back Sts., and for the paving of the alley back of the Hilton hotel, Broad St., from State to Mill, and East Grand Ave., from Third to Fourth St.

Public Works Commissioner Harry F. Briggs of Milwaukee, Wis., on Jan. 15 sent to the City Council estimates for 350,000 sq. paving. The first estimates will include hills in need of permanent pavement.

The City Council of De Pere, Wis., has decided to lay concrete pavement on Main Ave., Fourth and Fifth Sts., west side. Plans and specifications are now being prepared.

According to advices from Wausau, Wis., the special county board committee, with the County Highway Commissioner, has completed a map of state roads for Marathon County. It provides for a system of about 200 miles of roads, with Wausau as the hub.

BRIDGES—STEEL AND CONCRETE

Arkansas.

✣It is reported that the contract for the construction of the proposed new steel bridge across the lake at Lake City, Ark., will be let by W. A. Maywood, County Judge, Jonesboro, Ark., on Jan. 27. The cost of the improvement is estimated at $50,000.

The City Council of Pine Bluff, Ark., has voted to confer with the officials of the St. Louis-Southwestern R. R. with a view of inducing the company to build a viaduct over its tracks on Ohio St. from Fifth Ave., north to Second Ave. W. B. Sorrells is the City Attorney.

California.

⦿The Commercial Bridge Co., Los Angeles, Cal., has been awarded the contract for the construction of the new county bridge over the Escondido river in the east end of Escondido valley. The contract price was $1,700.

Colorado.

⦿The contract for the construction of a 250 ft. concrete span in Las Animas County has been awarded by the County Board, Trinidad, Colo., to Charles Emerick at $8.50 per cu. yd. The county will furnish all the steel necessary. G. H. Harlan is chairman of the Board. Bids were opened Jan. 5.

Commissioners of Kiowa County, Eads, Colo., recently inspected a bridge 4 miles south of Chivington where the road crosses Rush Creek and it was decided that a new structure is necessary. Specifications and plans will be prepared at once and the actual work will probably be taken up in the spring. A bridge will also be constructed at a point about 7½ miles west of Haswell, where the county road crosses the creek.

Florida.

⦿The Board of Duval County Commissioners, Jacksonville, Fla., has awarded the contract for the construction of a bridge over McGirts Creek at 104th St. to S. A. Turknett at $3,900. The Converse Co. was awarded the contract for the steel draw at $5,266

Idaho.

⦿The State Engineer, Boise, Idaho, has awarded the contracts for the construction of bridges at Clear Lakes and Bliss, Idaho, as follows: Two 140-ft. pin connected through Pratt trusses at Clear Lakes, Idaho, to the Minneapolis Steel & Machinery Co., Minneapolis, Minn., at $11,289, bids opened Jan. 4; one 120-ft. through Pratt and one 80-ft. Warren, both riveted, at Bliss, Idaho, to Charles G. Sheely, Denver, Colo., at $7,995, bids opened Jan. 8. The structures will include the trusses, concrete abutments and tube piers.

Illinois.

✣Bids will be received up to 2 p. m., Feb 10, at the Town Clerk's office, St. Jacob, Ill., for the construction of three reinforced concrete bridges to be built in St. Jacob Township, Madison County, Ill. W. P. Sweeny, Town Clerk, St. Jacob, Ill. Joe Pyle Bridge: Span, 14 ft.; roadway, 16 ft.; height of abutments, 14 ft. Superstructure concrete, 11.3 cu. yds.; steel, 2,187 lbs. Substructure concrete, 59.2 cu. yds.; steel, 3,155 lbs. Nearest railroad station, St. Jacob, on the Vandalia, 6 miles. Excavation average, about 10 ft. in clay and to be carried about 3 ft. below bed of stream. Present bridge, wood. Schupbach Bridge: Span, 10 ft.; roadway, 16 ft.; height of abutments, 7¼ ft, Superstructure, reinforced concrete, 7.3 cu. yds.; steel, 1,074 lbs. Substructure, plain concrete, 27.6 cu. yds. Nearest railroad station, St. Jacob, 2¾ miles. Excavation in clay, and to be carried 2½ ft. below bed of stream. Present bridge, wood floor on old stone abutments. Lindley Bridge: Span, 12 ft.; roadway, 16 ft.; height of abutments, 9½ ft. Superstructure concrete, 9.2 cu. yds.; steel, 1,469 lbs. Substructure, reinforced concrete, 33.8 cu. yds.; steel, 1,530 lbs. Nearest railroad station, St. Jacob, about 3 miles. Excavation in clay, and to be carried 3 ft. below bed of stream. Present bridge, wood. Work to be completed on or before June 15, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m. Jan. 25, for furnishing the necessary tools, labor, materials, etc., necessary to remove and dispose of the center pier and center pier protection of the present Chicago Ave. bridge over the north branch of the Chicago River; to pull all piles of the center pier, pier protection, pile clumps and dredging the river as specified of approximately 15,000 cu. yds. of material. Cash or certified check for $300 must accompany proposals.

✣Bids will be received at the Town Clerk's office, Princeton, Ill., up to 3 p. m., Jan. 25, for the construction of one steel bridge in Princeton Township, Bureau County. Clarence A. Johnson, Town Clerk, Princeton, Ill. Edgewood Bridge: Span, 150 ft.; roadway, 18 ft.; height of abutments, 25 ft.; length of wings, 24 and 28 ft. Estimated amount of concrete in substructure, 304.6 cu. yds.; reinforcing steel, 32,945 lbs. Gravel may be secured in Bureau Creek for, about 10 cts. per cu. yd.; ¾ of a mile from the bridge site. This gravel will probably run high in the per cent of sand, and it may need washing. This bridge is located about 3½ miles northwest of Princeton; roads, good; average load, 5,000 lbs. Old bridge, 200 ft. from proposed site. Excavation, east side, 9 ft. deep; west side, 23 ft. deep. Piles will be necessary. Work to be completed on or before, Substructure, July 1, 1912; superstructure, August 15, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission which may be seen at the Town Clerk's office, or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

⦿The Springfield Bridge & Iron Co., Springfield, Ill., has been awarded the contract for the erection of a bridge over Sugar Creek on the new road southeast of Springfield connecting the Fox and Rochester roads. The contract price was $3,785.

At a recent meeting of the City council, Waukegan, Ill., an ordinance was placed on file providing for the construction of a new reinforced concrete viaduct over the ravine on Genesee St.

Further information concerning the proposed bridge over the Spring Creek at Ohio St., Joliet, Ill., mentioned in our last issue, is to the effect that the City Council at its last meeting instructed that an appropriation of $3,300 be included as the city's share of the expense.

The Board of Local Improvements, Sterling, Ill., contemplates the construction of a reinforced concrete arch bridge over the Broadway ravine in connection with the extension of pavement through the Dillon property.

Soundings of the Fox River were recently made at Aurora, Ill., by A. N. Johnson, State Engineer preparatory to drawing plans for the proposed bridge at New York St. The proposition was mentioned in our last issue.

Indiana.

✣Bids will be received until 10 a. m., Feb. 5, by Board of Vermillion County Commissioners, Newport, Ind., for the construction of two bridges. H. T. Payne is County Auditor.

✣Bids will be received until 1 p. m., Feb. 5, by Board of Jackson County Commissioners, Brownstown, Ind., for the construction of bridge in Salt Creek Township. H. W. Wacker is County Auditor.

✣Bids will be received until 2 p. m., Feb. 5, by Board of Jasper County Commissioners, Rensselaer, Ind., for the construction of four steel bridges in Kankakee township. J. P. Hammond is County Commissioner.

A petition signed by 800 citizens has been filed with the Gibson County Commissioners, Princeton, Ind., by the Princeton Commercial Club, asking for the construction of a new bridge over the White River at Hazleton and it is expected that the board will consult the Knox County officials in regard to the matter.

The County Council has rejected the requisition of the Elkhart County Commissioners for the construction of piers for the proposed bridge over the St. Joseph River on Elkhart Ave., Elkhart, Ind.

A petition is being circulated in the Panhandle shops at Logansport, Ind., asking the County Commissioners for the construction of a foot path on the 18th St. bridge for the accommodation of pedestrains.

Iowa.

⦿As mentioned in a recent issue of ENGINEERING & CONTRACTING The Lana Construction Co., Harlan, Ia., was awarded the contract for the construction of all steel and wooden bridges in Pottawattamie County, Ia., for 1912. The bids received by the Board of Supervisors at Council Bluffs, Ia., were as follows: Steel Bridges: Lana Construction Co., Harlan—16-ft. span, complete except for floors, abuttments and caps, $155; 20-ft. $185; 24-ft., $250; 30-ft., $325; 36-ft., $385; 40-ft., $465; 50-ft., $575; 60-ft., $825; 70-ft., $925; 80-ft., $1,100; 5-in. steel piles, $1.70 per lin. ft.; ¼-in. steel web for pile, 60 cts.; steel cap for steel pile, $30. Minneapolis Steel & Machinery Co., Minneapolis—16-ft., $182; 20-ft., $209; 24-ft., $271; 30-ft., $341; 36-ft., $409; 40-ft., $490; 50-ft., $580; 60-ft., $850; 70-ft., $940; 80-ft., $1,150; 5-in. pile, $2; web, 80 cts.; cap, $20. Monarch Engineering Co., Falls City, Neb.—16-ft., $163; 20-ft., $196; 24-ft., $263; 30-ft., $343; 36-ft., $400; 40-ft., $475; 50-ft., $575; 60-ft., $829; 70-ft., $938; 80ft., $1,125; 5-in. piles, $1.80; web, 85 cts.; cap, $38. Omaha Structural Iron Works, Omaha.—16-ft., $165; 20-ft., $195; 24-ft., $267; 30-ft., $332; 36-ft., $391; 40-ft., $473; 50-ft., $584; 60-ft., $836; 70-ft., $938; 80-ft., $1,121; 5-in. piles, $1.89; web, 69 cts.; cap, $19. Wooden Bridges: Lana Construction Co., Harlan—Superstructure, including joist, floor, railing, bridging and bolts, attaching joist and floor to cap, $4[illegible] per lin. [illegible] wide bridge. Red cedar [illegible] white oak piling, 40 [illegible] work, extra piling, 50 [illegible] cts. for white oak; fir lumber furnished and laid in place, $28 per M. [illegible] Council Bluffs—Superstructure [illegible] red cedar piling, 58½ cts.; white oak, 65 cts.; caps, $50; repair work, red cedar piling, 60 cts.; white oak, 60 cts., fir lumber, $42.50. Beach Manufacturing Co., Charlotte, Mich., by P. S. Storm, Sioux City—Superstructure, $4.89; red cedar piling, 41 cts.; white oak, 47 cts.; caps, $49.50; repair work, red cedar piling, 43 cts.; white oak, 47 cts.; lumber, $49.50. Monarch Engineering Co., Falls City, Neb.—Superstructure, $4.80; red cedar, piling, 43 cts.; white oak, 43½ cts.; caps, $49; repair work, red cedar piling, 45 cts.; white oak, 46 cts.; lumber, $44. The Marsh Engineering Co., Des Moines, submitted a bid for concrete bridges, but as no such bids had been asked for, it was not considered. The company offered to construct the superstructure at $15 per lin. ft. and the substructure at $12.50 per ft., under their own specifications. Wing walls and webbing were quoted at 54 cts. and foundation piles in place at 55 cts. a foot.

⊙According to information received from Theodore S. Delay, County Surveyor, Creston, Ia., the Board of Union County Commissioners received the following [illegible] construction of all bridges during the year of 1912: (1) standing for the Monarch Engineering Co., Falls City, Nebr.; (2) Midland Bridge Co., Kansas City, Mo.; (3) Standard Bridge Co., Omaha, Nebr., (awarded contract); (4) Des Moines Bridge & Iron Works, Des Moines, Ia.; (5) Wheeler Lumber, Bridge & Supply Co., Des Moines, Ia.; (6) Elkhart Bridge & Iron Co., Elkhart, Ind.; (7) Beach Manufacturing Co., Sioux City, Ia.; (8) Federal Bridge Co., Des Moines, Ia.

Items	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pile bridge and approach superstructures, per lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Steel girders, 20 to 28 ft., superstructures, per lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Steel girders, 30 to 40 ft., superstructures, per lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Spans, [illegible] ft., superstructures, per lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Spans, [illegible] to 50 ft., superstructures, per lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Spans, [illegible] to 65 ft., superstructures, per lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Spans, [illegible] to [illegible] ft., superstructures, per lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Spans, 80 to 100 ft., superstructures, per lin. ft.	11.75	11.15	11.00	11.50	13.80	11.80	12.80	13.00
Spans, 105 to 120 ft., superstructures, per lin. ft.	*	13.85	13.50	12.10	17.00	14.40	15.60	16.00
[illegible] plank, each, per foot of [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Steel joist for spans and approaches, extra, per foot of bridge	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Extra girder arrangement, extra, per foot of bridge	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Steel L rail on spans and girders, extra, per foot of rail	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Steel lattice rail on spans and girders, extra, per foot of rail	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tubes, one tube only, per lin. ft., [illegible]-in.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tubes, one tube only, per lin. ft., 30-in.	6.90	7.15	6.00	6.90	8.40	7.30	8.00	8.00
Tubes, one tube only, per lin. ft., 36-in.	8.35	8.35	7.30	8.30	10.20	8.60	9.00	9.00
Tubes, one tube only, per lin. ft., 42-in.	8.50	8.60	7.50	8.75	11.00	9.00	10.00	10.00
Tubes, one tube only, per lin. ft., 48-in.	9.40	8.90	7.65	10.00	11.90	9.10	11.00	11.00
Tubes, one tube only, per lin. ft., 54-in.	*	*	*	*	*	*	*	*
Tubes, one tube only, per lin. ft., 60-in.	*	*	*	*	*	*	*	*
Steel piling and caps, plan "A," per lin. ft.	1.14	1.30	1.10	1.10	1.80	1.35	1.40	1.79
Steel piling and caps, plan "B," per lin. ft.	2.08	2.40	2.00	2.00	2.60	2.25	2.40	2.55
Steel piling and caps, plan "C," per lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Red cedar piling, per foot, driven	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Red cedar piling, per foot, f. o. b. any station in Union Co.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Steel caps for wood bridges, each cap	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fir lumber in place, per M., commercial cut	37.00	40.00	35.00	34.00	37.00	41.00	42.50	39.00
Fir lumber, f. o. b. any point in Union Co., per M., commercial cut	26.00	26.25	24.75	24.00	26.50	26.75	28.90	28.00

Board of Guthrie County Supervisors, Grundy Center, Ia., are making arrangements for the construction of a new concrete bridge across the Blackhawk on the Holland road. The cost of the improvement is estimated at $4,500. The plan calls for a bridge 124½ ft. long, with an 18 ft. roadway in the clear, and two spans each measuring 45 ft. The plans call for concrete with steel reinforcements.

It is rumored that the Chicago, Rock Island & Pacific Ry. and the Chicago & Northwestern Ry. are engaged in an effort to secure the construction of a bridge over the Missouri River at Council Bluffs, Ia. The plans of the Rock Island have, it is said, gone so far that an estimate of $1,000,000 has been made for the project, and the point at which [illegible] tity of the purchaser [illegible] been maintained [illegible]

Kansas.

City Engineering Department of Topeka, Kan., have plans underway for the construction of about 10 new bridges spanning the Shunganunga Creek. When these are completed the matter probably will be put before the voters of the town and they will be asked to issue bonds for money enough to replace the bridges over the Shunganunga with structures of concrete construction. It is estimated that each new bridge will cost $10,000.

Louisiana.

✣Bids will be received until noon, Jan. 22, by the Harvey Canal Land Improvement Co., Harvey, La., for the removal and repair of the steel traffic bridge over the canal. Henry P. Dart is President and H. H. Harvey is Secretary and Terasurer.

Maine.

Plans have been prepared for the construction of a new steel draw for the Grand Trunk [illegible] same submitted to the U. S. Engineers. According to the plans for the new draw the construction throughout will be of steel and the structure will be modern in every detail. The foundation of the present draw is of spiling but the foundation for the new steel draw will be of solid masonry. The width of the channels between the approaches and the foundation pier of the draw at the present time is 73 ft., but it is planned to have greater width when the new draw is completed. The present draw which was built about 17 years ago has only one track but the new one will be wide enough to accommodate two tracks.

Michigan.

✣Bids will be received until 2 p. m., Jan. 17, by City Council, St. Joseph, Mich., for the construction of a viaduct over the Pere Marquette Railroad tracks on Park St. W. J. Cleary is City Engineer.

⊙The Committee on County Roads and the County Road Commissioner have awarded the contract for the construction of the sub and superstructure of the highway bridge on the Gratiot road across Swan Creek in Saginaw County, Mich., to the Joliet Bridge & Iron Co., Joliet, Ill., at $10,650. The structure will be steel plate girder type. Other bids received Jan. 10 were as follows: Wynkoop & McGornley, $12,365; Central States Bridge Co., $13,250; Detroit Bridge & Steel Co., $7,- [illegible] (substructure); William Kiemert, $4,182 (substructure).

Advices from Saginaw, Mich. state that a legal difficulty has arisen in connection with the construction of the Johnson St. bridge which apparently may considerably delay the work of replacing the old bridge now in ser- [illegible]

Minnesota.

✣Bids will be received until April 9, by Winona County Auditor, Winona, Minn., for the construction of one 80-ft. steel truss bridge. O. Leland is Engineer.

⊙The Board of St. Louis County Commissioners, Duluth, Minn., has awarded the con- [illegible] over the St. Louis River to the Continental Bridge Co., at $6,490.

The Commercial Club of Duluth, Minn., has passed a resolution favoring the construction of a fill to replace the bridge on the road to New Duluth at 82d Ave. The cost of the work, according to an estimate prepared by City Engineer, is $3,500.

K. Oustad, City Bridge Engineer, Minneapolis, Minn., is making soundings in the river bed just above St. Anthony Falls to locate foundations for the proposed new bridge on Third Ave. S. The Council has made an appropriation of $2,500 for this part of the preliminary work.

Mississippi.

At a recent conference with the city officials of Meridian, Miss., R. A. Taylor, Vice-President and E. C. Rendel, General Superintendent of the Mobile & Ohio Railroad, asked that the matter of building a subway or viaduct over the tracks at 22d Ave. crossing be held up until the yards of the company be moved to a site southwest of the city.

Montana.

⊙Commissioners of Madison County, Virginia City, Mont., have awarded the contract for the construction of a bridge across the Ruby River about 3 miles from Twin Bridges, replacing the Closton bridge, to William Wilcox, Sheridan, Mont., at $1,550. F. W. Sommers at $1,628 was the only other bidder on the work.

Nebraska.

⊙The Sanitary District No. 1, Lancaster County, Brownell Block, Lincoln, Nebr., has awarded the contract for the construction of four bridges over the new drainage ditch to the Nebraska Construction Co., 12th and Ohio St., Lincoln Nebr. Bids were opened by S. B. Hohmann, Chairman of the Board, Jan. 8. The contract price was $1,800.

⊙The Western Bridge & Construction Co., Omaha, Nebr., has been awarded the contract for the construction of all steel and wooden bridges that may be built in York County, Nebr., during the year of 1912. Bids were opened Jan. 9. H. F. Chapin is County Clerk, York, Nebr.

City Council of Omaha, Nebr., has approved the contract drawn by the railroads interested in reconstruction of the 11th St. viaduct.

New Jersey.

Senator Johnson of Bergen County, according to information received from Hackensack, N. J., in an effort to arrive at something tangible in the proposition to construct an interstate bridge between New York City and New Jersey, is preparing to introduce at the coming session of the Legislature a bill to provide an appropriation of $25,000 to be used with a like appropriation from New York State in making borings and preparing estimates of the cost of a bridge across the Hudson at Fifty-ninth St., Trenton, N. J.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

North Carolina.

A delegation of citizens from Lincoln [illegible] recently conferred with W. M. [illegible] chairman of the Mecklenburg County Board, Charlotte, N. C., in regard to the construction of a bridge over the Catawba River connecting Lincoln and Mecklenburg counties. The idea is to construct a bridge at either Graham's or Sherrill's, the choice of the one or the other to be made by the commissioners of the two counties jointly and the cost to be shared equally.

Ohio.

⊙The contract for the construction of the bascule span of the Cherry St. bridge, Toledo, O., has been awarded the Scherzer Rolling Lift Bridge Co., Chicago, Ill., at $132,980. The work will include the complete construction and installation. Bids were opened by Department of Public Service, F. G. Stockton, Secy., Dec. 5.

Oregon.

⊙According to information received from Roseburg, Ore., the County Court of Douglas County has awarded the contract for the erection of the Browns Ferry, Umpqua and Winston bridges to the Portland Bridge Co., at a cost of $12,000, plus the approaches, which probably will total about $1,000. The contract of retimbering and otherwise improving the Winchester bridge was awarded to the Columbia Bridge Co., of Portland, at a cost of $8,400. There were seven bidders for the former contract. Work on the bridges will be commenced early in the spring.

Thomas Hurlburt, City Engineer, Portland, Ore., has prepared plans showing the elevations of the river bottom from Grover St. on the west side to Beacon St. on the east side preparatory to making an estimate of the probable cost of building a bridge over the river at that place. The length of the structure would be about 3,000 ft. and the Beacon St. approach would be at an elevation of 117.5 ft. The cost of the improvement, it is believed, will not exceed $800,000.

A delegation of citizens of Nehalem Valley has presented to the County Court, Astoria, Ore., a petition for the construction of a bridge over the Nehalem River about 5 miles below Jewell, Clatsop County, Ore. The proposed bridge will be about 150 ft. in length, and its estimated cost will be about $3,000.

Pennsylvania.

⊙The Heyl-Patterson Construction Co., Pittsburg, Pa., has been awarded the contract for the erection of the new steel coal handling bridge at the Northwestern Fuel Company's dock No. 2, St. Louis Bay, Superior, Wis. The contract price was $50,000.

⊙Drake & Stratton Co., Philadelphia, Pa., has been awarded the contract for the construction of the Monongahela river bridge at Brownsville, Pa., to be built for the Pennsylvania railroad. The structure will be a two-track span, the main river span being a truss 401 ft. center to center of the piers, with deck girder approaches of 100 ft. span. The bridge will give a clearance of 52 ft. from the under side of the truss to the pool level.

As a result of the decision of the Middletown & Elizabethtown St. Railway Co. to change the route of its line through Royalton, Pa., it will be necessary to construct a new bridge over Swatara Creek at Middletown. The old structure and the one crossing the tracks of the Pennsylvania R. R. at Royalton are both considered too weak to permit any heavy traffic.

The matter of building a free county bridge over the river between Monessen, Pa., and Donora is strongly agitated in that vicinity. It is suggested that the structure could be erected jointly by Washington and Westmoreland counties and an expense of not more than $300,000 incurred.

Burgess Alexander, Chambersburg, Pa., has approved amendments to the ordinances for the highline through the city, in which two bridges are to be built of concrete instead of steel.

South Dakota.

✣Bids will be received by the Board of Butte County Commissioners at the office of D. C. Barr, County Auditor, Bellefourche, S. Dak., until noon, Feb. 6, for the construction of all wooden bridges and for all pile work which may be needed in the county during the year commencing March 1, 1912, and ending Feb. 28, 1913. All bridge work is to be performed at so much per lin. ft. and all pile work, so much per pile. The county will furnish all materials. Plans and specifications are on file with the County Auditor. A certified check for $100 must be filed with each bid.

✣Bids will be received until noon, Feb. 6, by Board of Butte County Commissioners, at the office of D. C. Barr, County Auditor, Bellefourche, S. Dak., for the construction of all steel bridges required during the year of 1912. All bids must be per lin. ft. of both sub and superstructure. A certified check for $1,000 must be filed with each bid.

Tennessee.

Lexington County Court, Henderson, Tenn., has made an appropriation for the construction of an iron bridge over Beech River at McHaney's mill.

Utah.

⊙The Board of Public Works, Salt Lake City, Utah, has awarded the contract for the construction of the new Ninth South St. bridge over the Jordan River to A. A. Clark at $6,981. The next low bid for the work was that of Joseph Burke & Co., at $7,665. Bids were opened Dec. 29 at the office of H. G. McMillan, chairman of the Board.

Virginia.

⊙Information received from Charleston, W. Va., is to the effect that the contract for the construction of the county bridge over the Poca River near the mouth of Kelly Creek, has been awarded to the Owego Bridge Co., Owego, N. Y. By terms of the contract the work is to be completed by May 5.

Wisconsin.

At a recent meeting of the City Council of New London, Wis., the City Council received an ordinance providing for the issuance of bonds to the amount of $15,000 for the construction of a new bridge across the Wolf River.

The State Railroad Commission of Wisconsin has instructed the city of La Crosse, Wis., and the Chicago, Milwaukee & St. Paul R. R. to erect a new viaduct over the railroad tracks at Rose St. to replace the old structure now in use. It is also recommended that the LaCrosse City Ry. Co. remove its tracks from Mill St., and cross the new viaduct. It is estimated that the city's share of the expense will be about $13,000 and the railroad's about $18,000.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Florida.

✣Bids will be received until 10 a. m., Feb. 1, by Trustees of the Internal Improvement Fund, J. C. Luning, Secy., State Capitol, Tallahassee, Fla., for the construction of a concrete lock in the Miami Drainage Canal about 4 miles from Miami. Plans and specifications are on file with J. O. Wright, Chief Drainage Engineer, Tallahassee, Fla. Bids should be addressed to A. W. Gilchrist, Chairman of the Trustees.

Illinois.

⊙Bids were opened Jan. 3 by Hanover Drainage and Levee District, Clinton County, for cleaning out, deepening and widening main ditch and lateral No. 1. The contract for the 78,000 cu. yds. of excavation was let to Lewis & Davis, Urbana, Ill., at 9.96 cts. per cu. yd. The contract for removal of bridges was let to J. B. Brueggemann at $399.

The Richland Creek Drainage District No. 2 has been organized by land owners of Smithson township for the purpose of extending the system now under construction by District No. 1 from Belleville to a point in Prairie du Long township, making a system nine miles long. Surveys for the extension have been made by Walter C. Wolf, assistant county surveyor, Belleville, Ill., and the cost estimated at about $25,000.

Iowa.

⊙Bids were opened Dec. 28 by C. O. Dixon, auditor Calhoun county, Rockwell City, Ia., for the construction of Drainage District No. 149, the contracts being let as follows: Lanesboro Cement Tile Co., Lanesboro, Iowa, for all tile on line of drain, $10,788; Harry McCaulley, Lake City, Ia., for all labor for Sec. 1, 4, 5, 6 and 7, $2,642; S. M. Grant, Lake City, Ia., for all labor for Sec. 9, $771; Scott & Scroggins, Lake City, Ia., for all labor for Sec. 2, $500; J. H. Larison, Lanesboro, Ia., for all labor for Sec. 3, 8 and 10, $1,355. The approximate number of feet of the different sizes of tile are as follows: 2,000 ft. 32-in., 2,500 ft. 28-in., 1,700 ft. 24-in., 1,200 ft. 22-in., 5,900 ft. 20-in., 1,500 ft. 18-in., 5,000 ft. 16-in., 9,400 ft. 15-in., 2,400 ft. 12-in., 5,000 ft. 10 in., 4,600 ft. 8-in., 2,700 ft. 6-in., 1,300 ft. 5-in.

A considerable amount of drainage work is projected in Davis county, Ia. Among this is the work of straightening a creek for about 15 miles. Preliminary surveys for the latter work are now being made by Chas. H. Murphy, county engineer, Bloomfield, Ia.

Montana.

The county commissioners at Billings, Mont., have awarded the contract for the construction of rip rap work on the Yellowstone River north of Huntley and for excavating a new channel to change the course of the river to Frady & Denton, at $6,700.

North Carolina.

✣Bids will be received until noon, Feb. 16, by G. V. Richardson, Chairman of the Board of Mosely Creek Drainage Commissioners, Dover, N. C., for the constructions of drainage canals. The work will include about 415,000 cu. yds. and the canals will be 14 miles in length. Plans and specifications are on file with R. R. Eagle, Engineer, New Bern, N. C. A certified check for $1,000, payable to the Chairman, must be filed with each bid.

The Board of Engineers of the United States Army has presented its report on the proposed system of inland waterways from Beaufort to Boston, Mass. The report proper deals with the first section of the project which is the part north of Beaufort. Between Beaufort, N. C., and Chesapeake Bay an inland waterway, 12 ft. deep, is recommended. This waterway will be provided by deepening the present canal between Beaufort inlet and Pamlico Sound from 10 ft. to 12 ft.; by the purchase of the present Albemarle and Chesapeake Canal, between Currituck Sound and Elizabeth River, provided it can be purchased for $500,000. The estimated cost of this section is $5,400,000. The chief of engineers recommends the purchase of the Chesapeake Bay and Delaware River Canal at a price not

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

to exceed $2,500,000, and [illegible] tide level canal of 25 ft. depth. The final cost of this canal is estimated at $9,900,000. For the stretch from Delaware River to New Yory Bay the board prepared plans for a canal to run from the Delaware River at Bordentown, N. J. northeastw [illegible] Raritan Bay, at a total cost of $15,000,000. The board recommends that the construction of this section be deferred until after the construction of the two more southerly sections and the plant now at work on the Panama Canal be available for the work. Between New York Bay and the eastern end of Long Island Sound no work is necessary. The plans for the section from Long Island Sound to Narragansett Bay are for a canal 18 ft. deep, with 125 ft. width from Fisher's Island Sound to the west side of Narragansett Bay, following the southern coast of Rhode Island. The total length would be 36 miles and cost $12,200,000. The board recommends [illegible] struction of this part of the proposed wat- [illegible] department is that there is no commercial [illegible] enter into nego- [illegible] Canal.

Mississippi.

[illegible] Mac Plantation Co., Memphis, Tenn., for the construction of 216,000 cu. yds. of dredge ditches and 210,000 cu. yds. of lateral ditches for a drainage system in the vicinity of Robinsonville, Miss. The contract for the dredge work was let to the Lewis Engineering & Construction Co., of Knoxville, Tenn., at 9½ cts. per cu. yd.; the contract for all the lateral ditches was let to Lawrence Bros. & Co, Memphis, Tenn, at 12.9 cts. per cu. yd.

Texas.

The Texas Bldg. Co., Fort Worth, Tex., [illegible]

Plans are under consideration for the formation of a district for the protection of land along the Rio Grande in the vicinity of El Paso. It is estimated that the cost of the work will be about $10,000. Felix Martinez, El Paso, is interested.

Washington.

The expenditure of about $130,000 has been authorized by the secretary of the interior for the construction of a number of laterals and for enlarging and extending part of the existing canals in order to complete the Sunnyside unit of the Yakima Project. C. H. Swigart, North Yakima, Wash., is supervising engineer Yakima Project; Ernest McCullough, Sunnyside, Wash., is project engineer of the Sunnyside Unit.

WATER-WORKS

Alabama.

Jefferson County Engineer Jerry Gwin, Birmingham, Ala., is completing plans for the construction of a waterworks system at the Red Mountain camp for tuberculosis patients.

Arizona.

The Inspiration Copper Co., according to advices from Globe, Ariz., will begin immediately the construction of the storage dam across Pinal creek, near Wheatfield. The dam will be used to store flood waters of Pinal Creek and will be the chief source of water supply for the proposed new concentrator.

California.

Preliminary to acquiring a municipal water plant the City Trustees of Tulare, Cal., have asked the present water company to place a valuation on its plant. Consulting Engineer Robson of Sloan & Robson, San Francisco, Cal., has placed the cost of a new system at $150,000 and appraised the private operating plant at $42,000.

Colorado.

The town of Olathe, Colo., is offering bonds in the sum of $65,000 for sale, the proceeds of which will be used for the purpose of constructing an up-to-date waterworks system. The new supply will be brought by a gravity system from a point 25 miles to the southwest of the city. The pipes will run through an irrigated farming country and in addition will supply the country population tributary to its line for a distance of about 18 miles.

Florida.

Bonds to the amount of $30,000 have been voted by the citizens of Madison, Fla., for the purpose of purchasing the present water works and electric light plants.

Georgia.

✤Bids will be received until noon, Jan. 20, by Boyce Ficklen, Jr., city clerk, Washington, Ga., for the construction of an addition to the water works plant.

✤Bids will be received until 8 p. m., Jan. 25, by Board of Water Commissioners, W. H. Fetner, chairman, Macon, Ga., for the furnishing and delivering f. o. b., Macon cast iron pipe and special castings.

The Water Board of Columbus, Ga., Harry L. Williams, secy., has asked the City Council for $350,000 in addition to the sum now available for the purpose of putting in a waterworks system.

Idaho.

City Engineer Congdon of Pocatello, Ida., has reported to the City Council the completion of preliminary surveys for a pumping system on the west bench and for a gravity system from Mink and Gibson Jack Creeks.

Illinois.

✤Bids will be received until 3 p. m., Jan. 23, by Board of Local Improvements, New Athens, Ill., for the construction of a water distributing system consisting of about 4 miles of water mains with necessary valves and hydrants. G. C. Probst is Mayor.

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 20, for furnishing and delivering approximately 60,000 lbs. of lead pipe to the city water works shop, 2354 S. Ashland Ave. The pipe shall be made of what is commercially known as "new lead" and shall be 99% pure. 65% of contract shall be 1 in. in diameter, weight 1⅘ lbs. per lin. ft., and the balance as follows: ⅝-in., 2½ lbs. per lin. ft.,; ¾-in., 3 lbs. per lin. ft.; 1-in., 4 lbs. per lin. ft.; 1½-in., 7½ lbs. per lin. ft.; 2-in., 10½ lbs. per lin. ft. Cash or certified check for $150 must accompany proposal.

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 20, for furnishing and delivering to the various pumping stations of the city 6,900 gals. of engine oil, 10,150 gals of cylinder oil, and 200 gals. dynamo oil (approximate quantities) during the year 1912; general requirements are as follows: No. 1 cylinder oil, specific gravity, not more than 26° nor less than 23°, flash point 595° F., free from mineral acids and fatty acids; engine oil, specific gravity, not more than 32° and less than 30°, Baume, flash point 400° F., cold test, will not congeal above 45° F. Cash or certified check for $200 must accompany pro[illegible]

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 20, for furnishing and delivering to the city water works shops, 2354 S. Ashland Ave., approximately 40,000 lbs. of plumber's refined metal solder. All solder shall consist of 37 parts new tin, 63 parts lead, with a tract of antimony, and shall be delivered in 1½-lb. bars. Cash or certified check for $100 must accompanying proposal

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 20, for furnishing and [illegible] packing as follows: Ring, spiral coil, sectional ring, or strip metal for steam pressure over 100 lbs., 1,500 lbs., steam pressure less than 100 lbs., 1,500 lbs.; ring, sectional, coil and combination hot water packing for water 220° F., 175 lbs. pressure, 900 lbs.; hydraulic packing of various kinds, 3,000 lbs.; sheet rubber packing, Ebonite, Rainbow or equal; high pressure cloth-inserted packing, asbestos fibre sheet packing, etc., 1,200 lbs.; rope packings [illegible] check for $200 must accompany proposal.

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 20, for furnishing and delivering to the city water works shops, 2354 S. Ashland Ave., 4,000 rubber gaskets 8-15/16 ins. outside diameter, 6-11/16 ins. inside diameter, weight 3 oz.; 1,000 rubber gaskets, 10-15/16 ins. O. D., 8-7/16 ins. I. D., weight 5¾ oz., thickness ⅛ in., and rubber hydrant valves as follows: 2,000 5½ ins. O. D., 2 ins. I. D., 1 in. thick, weight 19 oz.; 500 6-9/16 ins. O. D., 2-15/16 ins. I. D., thickness 15/16 in., weight 22 oz.; 1,000 4⅞ ins. O. D., ⅞ in. I. D., thickness 9/16 in., weight 10½ oz.; 100 3-15/16 O. D., 1 in. I. D., ⅞ in. thick, weight 9½ oz. Cash or certified check for $150 must accompany proposal.

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 20, for furnishing and delivering approximately 200,000 lbs. of 99.5% pure pig lead as follows: Pipe yard "A," Avers Ave. and Wabansia Ave., 20,000 lbs.; "B," 2354 S. Ashland Ave., 70,000 lbs.; "Water Works Shops," 2304 S. Ashland Ave., 10,000 lbs.; "E," 104th St. and Stewart Ave., 100,000 lbs. Cash or certified check for $500 must accompany proposal.

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 23, for furnishing approximately 2,000 bbls. of natural cement and 200 bbls. of Portland cement, to the following yards: "A," Avers Ave. and Wabansia Ave.; "B," 2354 S. Ashland Ave.; "C," 49th Pl. and Union Ave.; "E," 104th St. and Stewart Ave. Cash or certified check for $150 must accompany proposal.

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 23, for furnishing to the meter mechanical shops, 1330 Indiana Ave., gate valves as follows: 100 3-in., 30 4-in., 20 6-in., 10 8-in., 2 10-in. The valves are to be parallel seat valves, with loose discs, and the mechanism such that in closing, the travel of the discs shall cease before they begin to seat. The seats, disc ring and spindle of each gate valve shall be of solid bronze. Cash or certified check for $100 must accompany proposal.

✤Bids will be received until 11 a. m., Jan. 24, by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the water works shops, 2352 S. Ashland Ave., corporation ferrules as follows: 15,000 ¾-in., 100 1-in., 100 1½-in., 200 2-in., 400 1-in. ferrules without couplings, and 400 1-in. octagonal head galvanized iron caps. The composition of ferrules to consist of 80 to 84 per cent copper, 5 to 9 per cent tin, 8 to 12 per cent zinc, and not over 2 per cent lead. Cash

✤ indicates work now open for bids. ⊙ indicates a contract let recently.

or certified check for $500 must [illegible] proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 23, for furnishing and delivering approximately 33,200 lbs. of pure white cotton waste to the various pumping stations. Cash or certified check for $200 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 24, for furnishing to the bureau of engineering approximately 1,000 cu. yds. sand for mason work. Cash or certified check for $100 must accompany proposal.

Mayor Joseph Paden of Evanston, Ill., has suggested to the Town Council the installation of a sand filtration plant to purify the water supply of Evanston. Northwestern University has offered the town 2½ acres near the water tower for the improvement.

The Village Council of Tampico, Ill., has accepted plans and specifications prepared by Consulting Engineer Arthur M. Morgan, 160 W. Jackson Blvd., Chicago, Ill., for the construction of a new waterworks in Tampico, at an estimated cost of $16,000.

Indiana.

The new Town Council of Owensville, Ind., is in favor of the installation of a waterworks system. It is probable that plans and specifications for the improvement will be prepared by the last of the month.

Iowa.

The voters of Central City, Ia., have signed a petition asking the Council to call a special election on the proposition of issuing $10,000 bonds for the purpose of installing a water system, chiefly for protection from fire.

Kansas.

⊙The Des Moines Bridge & Iron Co., Des Moines, Ia., has been awarded the contract by the City Council of Waterville, Kans., R. Smith, City Clerk, for the entire construction of a waterworks and electric lighting system for $27,976. Bids were opened Dec. 29. Contract let Jan. 10.

Kentucky.

The Paducah Water Co., Paducah, Ky., has increased its capital stock from $250,000 to $300,000. Improvements costing several thousand dollars are being considered.

The Waterworks Commissioners of Covington, Ky., in their annual report to the City Council recommends the installation of a 30-in. supplementary main from the Covington reservoir to cross the Licking river at Latonia and to connect with the 10-in. main in Madison Ave. The Commissioners also recommend a 10-in. main crossing the Licking river over the Newport and Covington bridge be done away with and a 20-in. main be installed in its place; also the purchase of the Kenton Water Co.'s plant in Latonia.

Maryland.

⊙The Board of Awards of Baltimore, Md., has awarded the following contracts for the furnishing of supplies to the water department: S. R. Carr & Co., Baltimore, iron castings, $9,456; William Gisriel & Son, Baltimore, brass castings, $5,745; William H. Whiting & Co., Baltimore, jute, packing and cotton waste, $1,167.

Samuel Williams, 223 N. Calvert St., Baltimore, Md., has been retained by the city of Williamsport, Md., for the construction of a waterworks to cost about $25,000.

Massachusetts.

The Board of Water Commissioners of Springfield, Mass., on Jan. 12 held a special meeting with the Water Board of Agawam, Mass., to talk over the matter of supplying that town with Little river water. The Board has petitioned the Legislature for the passage of an act amending the bill which cared for the construction of the Little river supply whereby the board may enter into agreements with outside towns to supply them with Little river water.

Minnesota.

✣Bids will be received until 7:30 p. m., Jan. 26, by City Council, Minneapolis, Minn., for furnishing the city of Minneapolis, Minn., with Portland cement to be used during the year of 1912 in the construction of the Filtration Plant. A certified check for $200 payable to C. A. Bloomquist, City Treasurer, must be filed with each bid. H. N. Knott is City Clerk.

Montana.

⊙The citizens of Manhattan, Mont., at a recent election voted the issuance of bonds in the sum of $25,000 for the construction of a waterworks system. The contract has been let to E. Lundstrom of Billings, Mont.

Nebraska.

The City Council of North Platte, Nebr., is making arrangements to accept the decree of the circuit court of appeals which requires the city to purchase the waterworks plant at the appraised price of $85,000, and arrangements are being made to vote the necessary bonds.

New York.

✣Bids will be received until 8 p. m., Feb. 15, by Board of Water Commissioners, Manhasset-Lakeville Water District, Manhasset, L. I., for two 8-in. driven wells, brick pumping station, 3 sets of fuel oil engines, triplex pumps and accessories, oil tank and accessories, water tower and foundations, 21 miles of cast iron pipe 4 to 10-in. laid, 170 hydrants, necessary valves and boxes set in place. Johnson & Fuller, 150 Nassau St., New York City, are engineers. D. S. Woolley is chairman of the Board. Official advertisement will be found elsewhere in this issue.

North Carolina.

✣Bids will be received until Feb. 1, by the Board of Water Commissioners, Charlotte, N. C., for furnishing about 200 water meters constituting the supply for 1912.

✣Bids will be received until 8 p. m., Feb. 1, by Board of Water Commissioners, Charlotte, N. C., for the construction of a reservoir including about 55,000 cu. yds. of embankment; 6,600 sq. yds. of 6-in. concrete slope; 600 cu. yds. of concrete core wall; clearing, grubbing, stripping, etc. Plans and specifications are on file with A. H. Wearn, Clerk of the Board, or Gilbert C. White, Charlotte, N. C., Engineer.

The residents of West Asheville, Asheville, N. C., at a recent meeting decided to at once increase their water supply untl it was entirely adequate for all purposes. Stock to the amount of $20,000 will be sold for the purpose. J. G. Merrimon is interested.

Ohio.

⊙Nye & Clarence Bingham of Toledo, O., have secured a contract from the Auglaize Power Co., at Defiance, O., to install machinery for the new water power plant being constructed there under the direction of James D. Ashley and others of Toledo. The contract calls for the handling of 915,000 lbs. of machinery. Four of the pieces weigh 18 tons each and must be hauled from four to nine miles.

⊙The Lanese Co., Cleveland, O., has been awarded the contract by the Village Council of Euclid, O., F. H. Shoaff, Village Clerk, for the installation of water mains in Vineland, Canterbury, Clarewood and Rollin Sts., for which bids were opened aJn. 8. F. A. Pease Engineering Co., Williamson Bldg., Cleveland, O., are Engineers.

⊙Wilhelmi & Smith, 1329 Cove Ave., Lakewood, O., have been awarded the contract by the Village Council of Euclid, O., F. H Shoeff, Village Clerk, for the installation of a 6-in. water main in Lake road for $30,319. Bids were opened Jan. 8. F. A. Pease Engineering Co., Williamson Bldg., Cleveland, O., Consulting Engineers.

Supt. C. E. Shulz of the Water Department, Cleveland O., has submitted to the City Council a plan that would eliminate the construction of a brick or concrete water tunnel and would substitute two 6-ft. steel pipe lines with flexible marine hinges in a trench on the lake bottom.

Oregon.

Mayor K. C. Eldridge of Independence, Ore., is in favor of the proposition to purchase the present waterworks system of the city.

Washington.

⊙The firm of Welton, Kibbe & Cochran of Portland, Ore., has been awarded the contract by the city of Elma, Wash., for the construction of a pumping plant and a three-mile supply main at an approximate cost of $14,806. Water is to be procured by developing a group of springs located about three miles weset of Elma. Plans and specifications were prepared by Consulting Engineer Louis C. Kelsey, Selling Bldg., Portland, Ore., under whom the work will be done.

Pennsylvania.

The Borough of Brookville, Pa., has purchased the franchises and property of the Brookville Water Co., for a consideration of $56,000 and expenditures on contracts let for the erection of the new work at the filtration plant now approaching completion.

The River Pipe Line Co., of Pittsburgh, Pa., has been incorporated with a capital stock of $10,000.

Texas.

✣Bids will be received until 8 p. m., Jan. 18, by City Council, Paducah, Texas, for furnishing material and equipment for the watereworks at that place. Fountain-Shaw Engineering Co., Dallas, Texas, are engineers.

The Crescent Pump Works, Fort Worth, Tex., has been incorporated with a capital stock of $10,000. The incorporators are: R. Vickery, W. W. Manning, G. E. Cranz and others.

At a recent election the citizens of Leonard, Tex., voted the issuance of bonds in the sum of $10,000 for the installation of a waterworks system. Work on the system will be started as soon as the bonds are sold.

The Board of Water Commissioners of Temple, Tex., is considering the adoption of a policy of requiring water meters to be used by consumers.

West Virginia.

The Marlinton Service Co., Marlinton, W. Va., has been incorporated with a capital stock of $30,000 for the purpose of establishing waterworks, ice factory and power plant. The incorporators are: John Alexander and Dwight Alexander of Marlinton: John T. McGraw, John L. Hechmer and George A. Hechmer of Grafton, W. Va.

Wisconsin.

The Wisconsin Condensed Milk Co., of Burlington, Wis., will shortly begin the construction of a 75,000-gal. reservoir, to be used for cooling purposes.

The Board of Public Works of La Crosse, Wis., will shortly advertise for bids for the installation of a new well system for which plans and specifications have been prepared by Consulting Engineer A. T. Maltby, 20 W. Jackson Blvd., Chicago.

Canada.

⊙The City Council of Vancouver, B. C., has made the following awards in connection with the new main for Seymour Creek, for which bids were opened Dec. 27: Balfour, Guthrie & Co., at $75,000, for pipe on the extension; The Canadian Fairbanks Co., at $7,893, for valves, and C. E. Poltage, of Port-$7,893, Ore., at $37,650, for trench work.

The report of the city engineer of Calgary, Alta., embodying a recommendation as to the installation of a filtration system and including the various additions to the waterworks system, has been prepared. The total cost of these improvements, as shown in the report, is $405,000.

✣ **indicates work now open for bids.** ⊙ **indicates a contract let recently.**

SEWERAGE AND GARBAGE DISPOSAL

Colorado.

✣Bids will be received until [illegible] 26, by Board of Public Works [illegible] for furnishing the necessary labor and material for constructing in place the subdistrict sewers, their manholes, inlets and appurtenances in Subdistrict No. 11, West and South Side Sanitary Sewer District. Henry Read is President of the Board. J. B. Hunter is City Engineer.

Illinois.

✣Bids will be received until 8 p. m., Jan. 22, by Board of Local Improvements, George Comerford, President, Cicero, Ill., for sewer, catchbasins and manholes, as follows: Special 860, brick sewer in South 52d Ave., from the west fork of the south branch of the Chicago River to West 22d St.; 7,330 lin. ft. of 7½-ft. 3-ring brick sewer, complete; 2,670 lin. ft. of 7-ft. 3-ring brick sewer, complete; 1 concrete bulkhead; 47 catchbasins and connections, complete; 34 manholes, complete; including all house and catchbasin slants and street connections, removing existing sewers and reconnecting existing sewers, catch-basins and drains.

✣Bids will be received until 1:30 p. m., Jan. 17, by Board of Local Improvements, Lincoln, Ill., for the construction of a vitrified pipe sewer 15-in. diameter in and along the center line of Ninth St., beginning at the Rubicon Sewer and extending westward therefrom in and along the center line of Ninth St. 1,050 ft.; said sewer to be provided with Y's and manholes, accessories to the same. Specifications are on file in the office of the City Clerk, in the City Hall.

✣Bids will be received until 2 p. m., Jan. 27, by the Board of Local Improvements, Savannah, Ill., at the office of City Comptroller, for the construction of a sanitary sewer. A. J. Gray is City Attorney.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 23, for furnishing to the various pipe yards sewer pipe as follows: 15,000 pieces 4 in., 800 pieces 6 in., and 600 pieces 9 in. All pipe to be sound, salt glazed, vitrified sewer pipe of the hub and spigot pattern, straight and free from cracks, blisters, etc. Cash or certified check for $100 must accompany proposal and be labeled sewer pipe for Bureau of Engineering.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill. until 11 a. m., Jan. 23, for furnishing to the Bureau of Sewers, sewer pipes of the following sizes: 175 pieces 6 in., 1,000 pieces 9 in., 225 pieces 12 in., 150 pieces 15 in., 50 pieces 18 in. (double strength), 25 pieces 24 in., 90 half traps and 200 curved pieces. All pipe to be vitrified salt glazed sewer pipe in 2 ft. length of the hub and spigot type, and free from blisters, fire cracks, etc. Cash or certified check for $100 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 22, for furnishing to the Bureau of Sewers, hemlock, Norway pine and No. 1 oak lumber in quantities of from 1,000 to 12,000 ft., B. M., and sizes from 1 in. x 2 in. x 16 ft. to 6 in. x 6 in. x 16 [illegible] lumber to be delivered as specified by the contractor. Cash or certified check for $200 must accompany proposal.

✣[illegible] delivering approximately 1,000 bbls. of natural [illegible] the various ward yards located throughout the [illegible]

✣[illegible] Commissioner of Public Works, Chicago, Ill., [illegible] hole and catch basin covers and other castings to the various sewer yards of the Bureau of Sewers. The quantities as specified are as [illegible] lids, 110 tons; catch basin curbs, 18 tons; inlet grate boxes 18 tons; inlet grates, 16 tons; lawn cover curbs, 5 tons; (standard) lawn cover lids, 26 tons, lawn cover lids, 3 tons. Cash or certified check for $200 must accompany proposal.

Maryland.

✣[illegible] 24, by Board of Awards, Baltimore, Md., for the construction of lateral sewers in Bayview, Sanitary Contract No. 80.

Minnesota.

✣Bids will be received until 7:30 p. m., Jan. 26, by City Council, Minneapolis, Minn., for the necessary pine lumber needed by the city for the construction of sewers in accordance with plans and specifications on file with the City Engineer. A certified check for $200 must be filed with each bid. H. M. Knott is City Clerk.

✣Bids will be received until 7:30 p. m., Jan. 26, by City Council, Minneapolis, Minn., for furnishing the city with paving brick for use in sewer construction in accordance with plans and specifications on file at the office of the City Engineer. A certified check for $200 must be filed with each bid. H. N. Knott is City Clerk.

✣Bids will be received until 7:30 p. m., Jan 26, by City Council, Minneapolis, Minn., for furnishing the city with sewer brick for use in sewer construction in accordance with plans and specifications on file with the City Engineer. A certified check for $500 must be filed with each bid. H. N. Knott is City Clerk.

✣Bids will be received until 7:30 p. m., Jan. 26, by City Council, Minneapolis, Minn., for furnishing the city with vitrified clay pipe for sewer construction in accordance with plans and specifications on file with the city engineer. A certified check for $500 payable to the City Treasurer. C. A. Bloomquist. must be filed with each bid. H. N. Knott is City Clerk.

✣Bids will be received until 7:30 p. m., Jan. 26, by City Council, Minneapolis, Minn., for furnishing the city with special castings for sewer construction in accordance with plans and specifications on file at the office of the City Engineer. A certified check for $200 must be filed with each bid. H. N. Knott is City Clerk.

✣Bids will be received until 7:30 p. m., Jan. 26, by City Council, Minneapolis, Minn., for furnishing the city with the necessary Portland cement for sewers during the season of 1912, in accordance with specifications on file at the office of the City Engineer. A certified check for $200 payable to C. A. Bloomquist, City Treasurer, must be filed with each [illegible]

Missouri.

✣Bids will be received until Jan. 19, it is [illegible] City, Mo., for the construction of the third [illegible]

New Jersey.

✣Bids will be received until 8 p. m., Jan. 17, by Common Council, Ventnor City, N. J., for furnishing the necessary labor and material for the construction of sewers, including the [illegible] wide vitrified salt glazed sewer pipe and branches as follows: 6,000 ft., more or less, of 8-in. sewer pipe, 3 ft. lengths; 1,000 ft., more or less, of 6-in. sewer pipe, 3-ft. lengths; 50 pieces, more or less, of double 8x6 Y branches; 50 pieces, more or less, of single 8x6 Y branches. Also for the following quantities of cast-iron water pipe of standard quality and designated as Class A: 600 ft., more or less, of 12-in. bell and spigot pipe; 6,500 ft., more or less, of 8-in. bell and spigot pipe; 300 ft., more or less, of 6-in. bell and spigot pipe; 2,000 ft., more or less, of 4-in. Bell and spigot pipe. Also price per ton for special castings. Also for 5 tons, more or less, of first-class calking lead. Prices submitted to be net, f. o. b. Ventnor City, in car-load lots. E. Steelman Royal is City Clerk.

New York.

✣Bids will be received until 2 p. m., Feb. 15, by Watervliet Storm Sewer Commission, 1555 Broadway, Watervliet, N. Y., for the construction of two earth-filled dams across Dry River, together with levees, overflow and outlet works, concrete and brick conduits and storm drains and other appurtenances. Solomon, Norcross & Keis, Atlanta, Ga., are Engineers. Official advertisement will be found elsewhere in this issue.

Pennsylvania.

✣Bids will be received until 10 a. m., Jan. 22, by Department of Supplies, Herman Loeb, Director, 312 City Hall, Philadelphia, Pa., for furnishing the following supplies during the year of 1912: Class U, trees, plants, bulbs, fertilizer, top soil, etc.; Class V, inlet and manhole covers and grates, etc.

South Dakota.

✣[illegible] 5, by N. H. Jensen, City Auditor, Mitchell, S. Dak., for the construction of lateral sewers including labor and material, in said city of Mitchell as follows: Branch "R," Mitchell Sewer District No. 3, approximately 1,292 ft. 8-in. pipe, 4 manholes; Branch "S," Mitchell Sewer District No. 3, approximately 1065 ft. 8-in. pipe, 3 manholes; Branch "T," Mitchell Sewer District No. 3, approximately 1,690 ft. 8-in. pipe, 4 manholes. All complete and connected with existing sewers. All work to be done in accordance with plans and specifications on file in the office of the City Engineer. Official advertisement will be found elsewhere in this issue.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

✣Bids will be received until 11 a. m., Feb. 17, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Wash [illegible] States Naval Magazine, Mare Island, Calif.

District of Columbia.

✣[illegible] Lieut. R. G. Alexander, Quartermaster, U. S. Army, Washington Barracks, D. C., for furnishing the following building supplies: 20 barrels cement, 10 cu. yds. sand, 10 cu. yds.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ber, 1,000 ft. Virginia pine sheathing and 14,000 cypress shingles.

✣Bids will be received until 10:30 a. m., Jan. 22, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 672, steel reinforcement bars and centrifugal sump pump, direct connected to induction motor and mounted on truck, together with necessary fittings.

✣Bids will be received until 10:30 a. m., Feb. 7, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 673, lumber, monkey wrenches, nails, nuts, pig lead, manila rope, gasoline and sal soda.

✣Bids will be received until 2:30 p. m., Jan. 20, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing lumber and untreated piles under Canal Circular 673-A.

✣Bids will be received until 2 p. m., Jan. 22, by District Commissioners, Washington, D. C., for furnishing f. o. b. Washington, D. C., one horizontal electrically driven centrifugal pump for use on the Plaza, Union Station, Washington, D. C.

✣Bids will be received until 11 a. m., Feb. 17, by R. C. Hollyday, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for new foundry building at the navy yard, Washington, D. C.

New Jersey.

✣Bids will be received until 2 p. m., Jan. 30, by Commander H. O. Stickney, U. S. N. Lighthouse Inspector, Philadelphia, Pa., for furnishing the necessary labor and material for complete concrete filling of foundation and erect the superstructure, etc., of Miah Maul Shoal Light Station, Delaware Bay, N. J.

✣Bids will be received until 11 a. m., Feb. 2, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging Mantua Creek, N. J.

Pennsylvania.

✣Bids will be received until 11 a. m., Jan. 22, by Lieut. Col. C. S. Radford, Depot of Supplies, 1100 South Broad St., Philadelphia, Pa., for furnishing steel cases for the Marine Corps.

✣Bids will be received until 11 a. m., Jan. 17, by Lieut. Col. C. S. Radford, Depot of Supplies, 1100 South Broad St., Philadelphia, Pa., for furnishing lumber for the Marine Corps.

Tennessee.

✣Bids will be received until noon, Feb. 8, by Maj. Clarke S. Smith, U. S. Engineer, Memphis, Tenn., for furnishing one locomotive crane for the Mississippi River Commission, First and Second Districts.

Texas.

✣Bids will be received until Jan. 27, by Walter Perkins, County Judge, for the construction of a court house and jail at Alice, Jim Wells County, Texas. Plans and specifications are on file at the office of Atlee B. Ayres, Architect, San Antonio, Tex.

Washington.

✣Bids will be received until 2:30 p. m., Feb. 24, by Capitol Commission, Olympia, Wash., for the construction of the Temple of Justice building in that city. Estimated cost $350,000, covered by appropriation. Plans can be secured of the Commission of Archts. Wilder & White, New York and Olympia. C. H. Bebb of Bebb & Mendel, Denny Bldg., advisor.

Canada.

✣Bids will be received until noon, Jan. 20, by D. C. McNab, Acting Deputy Minister, Department of Railways and Telephones, Regina, Sask., for telephone supplies, including insulators, toppins, guy wire, copper sleeves, cross arms, galvanized iron wire, pole line hardware, porcelain insulators, bare copper wire. Specifications are on file with the department of Railways and Telephones.

PROPOSALS

STORM SEWER.

PROPOSAL FOR BUILDING DAMS AND CONDUITS FOR A STORM SEWER SYSTEM FOR WATERVLIET, N. Y.

Sealed proposals for the construction of two (2) earth-filled dams across Dry River, together with levees, overflow and outlet works, concrete and brick conduits, and storm drains and other appurtenances, will be received by the Watervliet Storm Sewer Commission at No. 155 Broadway, Watervliet, N. Y., until 2 o'clock p. m., on the 15th day of February, 1912.

The work will consist of approximately 80,000 cu. yds. of earth fill, concrete overflow and outlet works, together with 9,100 lin. ft. of concrete conduit, from 3 ft. 0 ins. to 8 ft. 6 ins. in diameter, and 1,000 ft. of terra cotta sewer pipe.

Alternate bids are asked on buttress type, reinforced concrete dams, and on concrete pipe.

Each proposal must be accompanied by a certified check payable to the Watervliet Storm Sewer Commission, to an amount equal to 5 per cent of the bid as a guarantee that the contract will be entered into if awarded. A bond of fifty (50) per cent of the contract price will be required. Payments will be made in cash on monthly estimates.

Plans and specifications are on file at the office of the Watervliet Storm Sewer Commission, and also at the office of Solomon, Norcross & Keis, Engineers, 1622 Candler building, Atlanta, Ga., and with the Engineering News, 220 Broadway, New York City. Bidders may obtain copies from the engineers by enclosing check for twenty-five dollars ($25), payable to the engineers, and to be held by them until return of plans and specifications. The Watervliet Storm Sewer Commission reserves the right to reject any and all bids.

WATERVLIET STORM SEWER COMMISSION.
John D. Browne, President.
Thomas Conway, Secretary.
Watervliet, N. Y.
Solomon, Norcross & Keis, Engineers,
Atlanta, Ga.

WATER WORKS.

Sealed proposals will be received by the Board of Water Commissioners of the Manhasset-Lakeville Water District, Manhasset, L. I., until 8 o'clock p. m., February 15, 1912.

The work will consist of two (2) eight-inch driven wells, brick pumping station, three (3) sets of fuel oil engines, triplex pumps and accessories; oil tank and accessories; water tower and foundations; twenty-one (21) miles of cast iron pipe, four (4) to ten (10) inch, laid; one hundred and seventy (170) hydrants, necessary valves and boxes set in place.

Plans and specifications will be on file at the Town Hall, Manhasset, and copies may be obtained at the office of Johnson & Fuller, Consulting Engineers, 150 Nassau St., New York City, by depositing five ($5.00) dollars.

All inquiries must be addressed to the Consulting Engineers.

All bids must be accompanied by a certified check made payable to the Manhasset-Lakeville Water Commissioners, for eight thousand ($8,000) dollars.

The right is reserved to reject any or all bids.

BOARD OF WATER COMMISSIONERS, MANHASSET-LAKEVILLE WATER DISTRICT.
Daniel S. Woolley, Chairman.
Owen P. Kennedy.
John M. Belknap.

PAVING.

Sealed bids will be received by the Board of Public Works of Boise City, Idaho, for paving with asphalt, asphaltic concrete, bitulithic, Westermite asphalt, dolarway, hassamite, plain concrete, concrete with cement top, granocrete, hassam or brick pavement (with brick along street car tracks) in all streets and parts of streets in Paving District No. 17, approximating 328,200 square yards, with necessary excavation, gutters, and appurtenances as provided for by ordinance No. 991. Said bids will be received up to 2 p. m., February 2nd, 1912, and immediately opened publicly by the Board of Public Works in the City Hall of said city.

Said pavement to be laid and constructed according to plans and specifications which may be seen at the office of the city engineer.

Each bid must be in accordance with the form of proposal furnished by the Board of Public Works, and accompanied by a certified check on some local bank, payable to Boise City, for the sum of two thousand ($2,000) dollars, to be forfeited if the successful bidder fails to enter into a contract and furnish a good and sufficient bond, in a sum equal to twenty-five (25%) per cent of the total amount of his bid for the faithful performance of each and every covenant in the contract.

The right is reserved to reject any and all bids, or to let the work as a whole or in parts, or for one or more kinds of the above pavements, as may appear to the best interests of the city.

By order of the Board of Public Works of Boise City, Idaho, this third day of January, 1912.
KARL PAINE,
President.

WATERWORKS.

Sealed bids will be received by the Commissioners of the City of Chamberlain, S. D., at the City Hall in that city up to 8 o'clock p. m., Jan. 29th, and then opened for the construction of an intake crib, receiving well, pumping plant, including two 40 H.P. oil engines, two 350-gal. triplex pumps, with all necessary piping and fittings, approximately 3,000 lin. ft. 10-in. water main, fire hydrants and appurtenances.

After Jan. 10th plans and specifications may be seen at the office of the City Auditor, at the office of the Missouri Valley Engineering Company, 406 Western National Bank Bldg., Mitchell, S. D., or may be secured by making deposit of $10.00, which will be returned upon return of plans and specifications in good condition. Check for $500.00 to accompany bid.

December 29, 1911.
F. K. BERRY, Mayor.
J. H. BINGHAM, City Auditor.

MISSISSIPPI RIVER COMMISSION, 1st and 2nd Districts, U. S. Engineer Office, Memphis, Tenn., Jan. 8, 1912. Sealed proposals for furnishing one locomotive crane will be received at this office until 12 o'clock, noon, Feb. 8, 1912, and then publicly opened. Information on application. Clarke S. Smith, Major, Engrs.

U. S. ENGINEER OFFICE, Seattle, Wash., Jan. 5, 1912. Sealed proposals for dredging and excavating in Lake Washington Canal right of way will be received at this office until 12 M., February 15, 1912, and then publicly opened. Information on application. J. B. Cavanaugh, Maj. Engrs., Agent for the State of Washington and King County, Wash.

MacLean Daily Reports
The only systematic method for reporting CANADIAN BUILDING and ENGINEERING projects from their inception to completion. Ask us for Rates and Specimen Reports.
220 King St. West - TORONTO, CANADA

✣ indicates work now open for bids. ◉ indicates a contract let recently.

ure is very essential to the [illegible] concrete, and the loss due to evaporation from concrete and forms by drying [illegible] replaced by sprinkling or [illegible]

For a spaded or mortar finish, extreme care should be taken to protect the work, preferably by covering the [illegible] forms with a layer of tar [illegible] leave an air space between it and the face lagging. Tests have shown a difference in temperature of 15° F. between the air in the air space and the outside atmosphere. Care should be taken to tack this paper on securely. Structures in which the surface finish is important must not be permitted to freeze until the concrete is well set. Blocks of the lagging, (say) 4x12 ins., at different points of the most exposed sides of the work, may be cut out, in order to note whether or not the mortar facing is being affected by frost.

Special pains should be taken to protect the north and west side of the structure. Canvass curtains may be hung on the north and west sides of the building to keep out the wind.

Removal of Forms.—The most important precaution, and one whose importance can not be over-estimated, is *caution in the removal of the formwork.*

All forms under concrete placed in freezing weather should remain until the season has advanced beyond the probability of a frost. If earlier removal of forms is permitted, they should remain until all evidences of frost are absent from the concrete and the natural hardening of the concrete has proceeded to the point of safety. Forms for such work should be kept in place at least two weeks longer than customary. Special care must [illegible] before removing falsework. In other words, [illegible] tain that the concrete is thoroughly hardened [illegible]

The only sure way of knowing when the cement is fully set and the concrete properly hardened, is to actually test it with a hammer for hardness. To do this, it is necessary to remove small portions of the formwork in each section of the structure to be certain that there are no soft spots.

The forms must be removed very carefully and without shock to the structure. Always leave in place a few intermediate posts so as not to place the entire dead weight too suddenly on the beams and columns. A regular procedure should be followed in removing forms, and the work should be done by regular gangs so that the men become trained in the requirements and methods of the work. Care must be exercised and precautions taken to prevent large masses of forms from falling on floors. Prying with bare bars or striking with a sledge must not be allowed, as all jar and vibration must be avoided.

A competent and experienced foreman should be in charge of the removal of forms at all times. At no time are more men to be engaged in the striking of forms than the foreman can fully direct and supervise. No foreman lacking the required experience in this line on high-grade work should be allowed upon the work.

Forms are removed from the concrete at [illegible] especially during the winter months, and should any of the concrete give way by such removal or become permanently injured, the contractor should be required to remedy same at his own expense. The contractors should be expected by suitable observa- [illegible] section of the work is sufficiently hardened to bear its own dead load plus additional load as may be imposed by the work of installation and should not by any means be relieved of responsibility for premature removal of centers. The engineer's asquiesence in permitting removal of forms should not relieve the contractor of responsibility for [illegible]

[illegible] ing character of the work, the variations in the setting of different cements and the influence of atmospheric conditions. Forms should, however, remain longer under beams and arches than around columns or walls, and longer under beams and arches of long spans than of short spans.

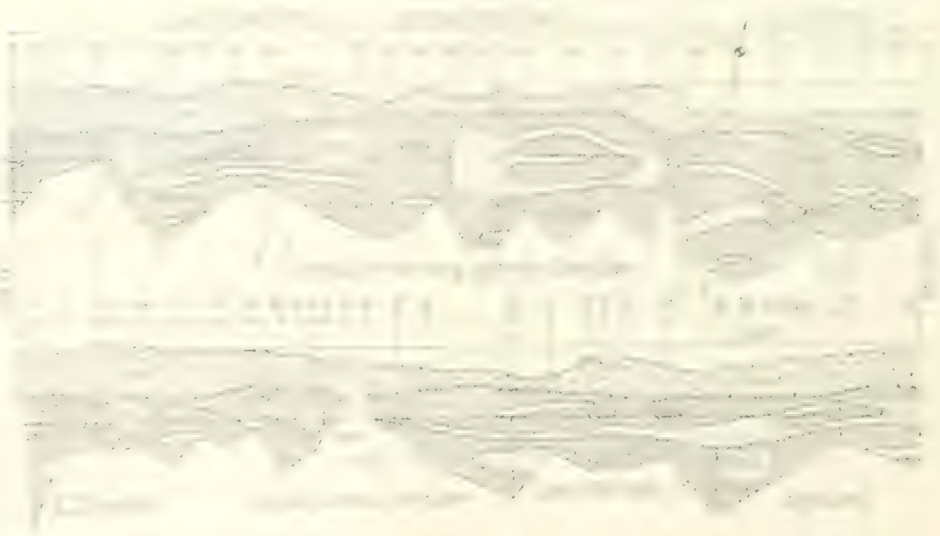
[illegible] proper appreciation of guarding against its dangers, are fundamentally responsible for practically all failures in concrete work. Engineers should, therefore, take most special care in the inspection of the work, and thoroughly familiarize the contractor with the additional cautions that must be taken to successfully place concrete in freezing weather. Very few accidents, indeed, are due to improper design, and nine-tenths are due to lack of proper inspection. Every concrete building of importance should have an inspector on the work continually.

EARTH AND ROCK SECTION

Method of Solidifying Chambered and Fissured Rock for Excavation for Power House and Dam Foundation.[*]

The construction of a dam across the Tennessee River at Hales Bar to provide power for generating electricity has been carried on by a private company for several years under a contract with the United States. At one end of the dam it is proposed to build the power house in which to install the machines, and at the other end a lock is provided to pass vessels from one level to the other. The dam will be 41 ft. high above the low water surface, and from 50 to 65 ft. high above the rock foundation. All structures are to be founded on solid rock and are to be of concrete.

All foundations at this work are in a formation locally known as "Chickamauga limestone." Probably its most familiar characteristic is the number of seams, both horizontal and vertical, that occur all through it and that cut it into distinct blocks, more or less. On this work these seams vary in thickness from that of a knife blade or less, in which case the seam is called "tight," to 12 ins. or more. They are usually filled with clay, shale, or rotten rock, more susceptible, of course, to mechanical disintegration than the rock proper. As existing in the foundation under discussion, these seams are most usually filled with a smooth, grainless, yellow clay or mud saturated with water. It is evidently a deposit from the river water. The side walls have been hollowed out and wrought into grotesque chambers. Some have been encountered 20 or 30 ft. below the surface, conaining quantities of sand and gravel of varyng sizes. This proves an existing connection with the river above, a condition of the founation that must certainly be reckoned with to guarantee the integrity of the upper pool, especially at low water stages. As a commentary upon the extent of the leakage into the coffered sections of the dam through the foundation (the dam is coffered into four sections of about 300-ft. length each), it may be stated that two of three sections now coffered could not be drained, even to the gravel, before the leaks were treated. The general elevation of the rock on the dam site is about 9 ft. beneath low water level, with from 5 to 8 ft. of gravel overlying it. The depth of footing required is from 3 to 6 ft., dependent upon the character of the rock, and beneath this it is the endeavor to obtain about 10 ft. of foundation through which practically all leakage is stopped. It is known that beneath this level there are yet other openings and passages in the rock that perhaps will require sealing, but their treatment will constitute an operation separate from, and probably additional to, that necessary to secure stability alone.



Sections Showing Cavities Requiring Solidifying in Foundation Bed for Haleo Bar Dam.

The meaning of the word "treating" in this discussion is synonymous with grouting. If the contents of the seams and caves in the foundation could be solidified or removed to make way for grout, a substantial result would be achieved. In view of the depths at which these conditions obtain, excavation in the open was unfeasible. Results could have been obtained with the use of caissons and compressed air, but this would have been an extremely costly and very slow method.

The logical thing to do, then, was to treat subsurface conditions from the surface through well holes and percussion drill holes sunk from 15 to 40 ft. into the rock. This was done. The procedure was to mount well drills on floats, from which the holes were sunk. The operation was not unlike driving a well on land. The water was usually pumped down in the cofferdam low enough to locate the main leaks. These locations then became especial points of attack. A hole once down and piped, about an 80-lb. air pressure was applied. This usually caused the water to seeth and boil over an area 50 ft. square, more or less. The points showing the greatest disturbance were then attacked and other holes sunk.

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[*] Abstract of a paper by C. H. Tisdale in "Proessional Memoirs" for January-February, 1912.

In drilling, an outer 8-in. casing was placed, through which the hole was started. As drilling proceeded, this casing was driven down till it rested upon rock. After drilling 3 ft. into rock, another casing (6 ins.) was placed inside the 8-in. casing and tightly driven into the rock. After the hole was finished, this inner casing was extended to an elevation 2 ft. above the water level outside the pit and covered with an ordinary blind cap, or plugged, or else reduced to receive the 2-in. connection with the grouting machine.

After a sufficient number of holes were down, and all were piped and capped, the air was applied to one and the others were uncapped one or two at a time. In some instances a pump was connected with the holes and water forced through. In this way different combinations of air and water jets were used to loosen the contents of seams and cavities and clear them out. The next step was to flood the pit and begin grouting. Usually, during this operation a head of water of a foot or more was maintained in the section over the outside river level. The idea was to make the grout flow with the water through the subterranean channels into the river. An ordinary grouting machine was used, and the usual charge was 280 lbs. of cement (three bags) and about 10 gals. of water.

This machine consists of a cylindrical tank of 40 gals.' capacity, through which passes a shaft fitted with paddles for mixing the charge. The mixing is done by a motor at the rear of the machine, which is operated by compressed air. After measuring in the charge of water and cement, the trap at the top is closed and the batch mixed. From 5 to 15 lbs of air is then admitted to the cylinder, which forces the grout through the flexible connection into the pipe being grouted. The holes were always filled before stopping. After all holes were filled and allowed to set two or three days, the pit could generally be drained. The gravel overlying the rock was then removed and percussion drilling was begun. Holes 16 ft. deep, spaced about 4 ft., were drilled around the area over which concrete was to be laid. Dependent upon the degree of leakage through these holes and the condition of the seams and openings beneath, grouting was again in order. The effect of grouting operations conducted in the dry through the small drill holes was nearly always successful. Such a procedure, however, required a fairly tight top surface in order to hold the grout underneath. Progress under these conditions was faster and the effects could be more accurately gaged than where the pit was flooded. On the other hand, flooding the pit was necessary where the rock surface was too much cut up to hold the grout beneath it. In two instances it was found impossible to grout a very shallow, though water bearing, horizontal seam some 4 ft. below the footing in the dam. These seams were known to be there because of the leakage through the test holes. They were so shallow that the percussion drills would not show their presence. In these areas anchor rods were grouted over the affected surface, extending 4 ft. below the seam and 4 ft. into the concrete. The surfaces requiring this treatment were not large. The precaution of using these anchor bars or rods along the face of all dam footings has been adopted. The rods are of 1-in. section, cold-twisted structural steel of an ultimate strength of 60,000 lbs. They are spaced about 3 ft. apart and extend 10 ft. into the footing, along a line not over 8 ft. from the upstream surface. The holes are filled with a thick grout and the rods dropped in. If the holes leak so that the grout will not be retained, they are extended below the leaky seam 3 or 4 ft., provided it be within 10 ft. of the footing, then filled with grout and the rod dropped in. The grout below the seam stays. This cannot be done in case of a heavy discharge from the hole without using a pipe, through which the grout is introduced at a point below the seam. Occasionally, in leaky holes or seams in the dam footing, it has been expedient to concrete the pipe in place, the water being conducted through a pipe extension outside of the concrete and grouted later.

In the power house a more serious condition was developed in the foundation than any previously encountered in the dam. Here the excavation was carried about 35 ft. into the rock. The deeper the excavation was carried the heavier the leakage through the bottom became, until some 20 ft. of rock excavation had been made. At this level a blast uncovered a large water-worn vertical crevice—that we found later extended down some 20 ft. farther into rock—through which gushed about 15,000 gals. of water per minute. This leak flowed for about one year before being grouted. At the expiration of that time three Keystone well drilling machines (size No. 3) were put on floats and some 30 holes were put in the first dam section next the power house pit and two were sunk in the power house pit itself. These holes averaged about 35 ft. in rock. About one-third of these holes were dry, no openings or crevices of consequence being struck. The remainder, however, including the two in the power house pit, encountered seams and openings, at elevations from 15 to 25 ft. below the rock surface, some of which were 18 ins. thick. A number of these holes were "gushers," or would have been had the tops of the casing not been above the river level. The main leak in the power house pit before mentioned was simply "piped"—that is, a 4-in. pipe was thrust some 5 ft. down into the crevice and carried some 10 ft. above the river level. It was grouted by gravity alone, no machine being used. Machines were used on all the holes drilled. The water level in the pits was kept from 6 ins. to 3 ft. above river level during the grouting. This head was, of course, too great, and resulted in the loss of a large percentage of the cement used. Fifteen thousand bags of cement were used in this grouting, 2,000 of which were used in the large leak mentioned. Both pits were dried thereafter without trouble. The cavity, which was the source of the heavy leak in the power house pit, was later excavated for about 15 ft.—that is, to where it passed into the foundation below grade, which at this point is about 40 ft. below low water in the river. It had been scoured clean of all mud by the water and filled full of hard grout that hugged the sides of the passage so closely that the joint could hardly be detected. The grout seemed as hard as the rock itself.

After this, while the excavation was proceeding in the dry, seven more holes were sunk 20 ft. below grade in the power house pit. In each hole a mud seam was encountered about 18 ins. thick at an elevation a few feet below grade, that gushed a 6-in. stream about 10 ft. in the air. The pit was flooded as before, and 1,700 bags of cement were used in grouting. A few days later in blasting near grade, this seam was again reached and the pit was filled with very muddy water in twelve hours. A hole was put down at this point, grouted, and the pit finally drained again. Then the percussion drills were brought in to test the bottom preparatory to concreting. They revealed the presence of a horizontal layer of mud or saturated clay lying from 2 to 5 ft. below grade, extending indefinitely up and down the river and about 70 ft. wide across. It varied from 6 ins. to 5 ft. thick, and was under water pressure everywhere. The programme adopted by the contractors was to drill holes over the affected area with percussion drills, all of which were piped and capped. Through these holes alternate jets of air and water were forced. Then grouting through these pipes followed. It was then discovered that the grout was finding its way into the pit through a large opening at one end of the affected area. In order to continue grouting in the dry, the whole area was covered with concrete in which steel rods were placed. This concrete was the floor of the power house. Then began a steady campaign of drilling and cleansing by air and water jets as before described, and grouting. The idea was to clean out the mud and fill with grout. This was continued for nearly four months, and over 400 holes were drilled and grouted over an area about 50 by 70 ft. About 3,000 barrels of cement were used in this grouting. Probably about two-thirds of the mud in the cavity was replaced with grout. It lay along the bottom and the grout was on top. The solidity of the grout was such that a half-inch rod could not be thrust into it by hand. The drill, though, would drive a bit through it almost as easily as through the mud below. All water flow was practically cut off. The foundation was accepted in this shape.

The following conclusions have been formed as to how grouting operations should be conducted under conditoins such as obtain here: (1) The more thoroughly the seams and cavities are cleansed, the more certain will be the effect of the grout; (2) the head of water in the pit over the outside water should be not over 1 or 2 ins. during the grouting; (3) the air at the machine should be used sparingly. Ordinarily, a 5-lb. pressure is plenty, and it should not be allowed to enter the pipe; (4) less water should be used in the grout; (5) grouting in the dry is, wherever possible, a more certain operation than grouting with a flooded pit; (6) grouting in the dry, especially when the drilling is done by percussion drills, is much cheaper, more convenient and rapid than any other way.

Record Excavation for Culebra Cut.

Excavation in the Culebra Cut during December, 1911, was the greatest for any December during the eight years since the work was begun by Americans. The accompanying tables show a record of the December work for eight years. The cut is now 82 per cent completed. There remains to be excavated 15,941,181 cu. yds.

The work for December of 1,351,082 cu. yds. was done by 40 steam shovels. The high record is due to the fact that there has been little rainfall during December, which is ordinarily considered as one of the rainy season months.

EXCAVATION IN CULEBRA CUT, DECEMBER, 1904 TO 1911

December.	Cu. yds.
1904	42,937
1905	70,630
1906	307,689
1907	1,025,487
1908	1,210,043
1909	1,172,922
1910	1,211,406
1911	1,351,082

EXCAVATION IN CULEBRA CUT YEARS 1904 TO 1911.

Year.	Cu. yds.
1904	243,472
1905	914,254
1906	2,70[illegible],991
1907	9,177,130
1908	1[illegible],912,45[illegible]
1909	14,5[illegible]7,09[illegible]
1910	15,398,599
1911	16,596,891
Total	73,502,82[illegible]

Since December, 1907, the excavation has fallen below the million-yard-a-month mark only once, and the rate at which it has advanced during the year just closed is shown in the following statement:

Months.	Cu. yds
January	1,356,394
February	1,409,338
March	1,728,748
April	1,414,336
May	1,299,10[illegible]
June	1,401,026
July	1,337,833
August	1,442,402
September	1,340,173
October	1,306,971
November	1,209,498
December	1,351,082
Total	16,596,891

Comparison of Plant and Operating Cost of Day Labor and Contract Work in the U. S. Improvement of The Upper Mississippi River.

Contributed by Charles W. [illegible],
Assistant Engineer, Upper Mississippi
River Improvement.

In an article published in the Oct. 18, 1911, issue of ENGINEERING AND CONTRACTING the writer undertook to [illegible]

Fig. 1—View of Towboat "Coal Bluff," Upper Mississippi River Improvement.

the work of river improvement performed by contract and made a prophecy of the probable amounts to be available for such work annually in the future, describing the plant required and giving general information as to contract prices, cost of materials, wages, and other incidental items. It may now be of interest to compare the U. S. day labor plants and operating costs with those of our best contractors.

The improvement of the river is based on the principle of contraction accomplished by means of closing dams to cut off the side chutes and of wing dams to narrow the selected low water channel way. This contraction brings all the water at low stages into one groove and the increased current, due to this contraction, scours out the sand until a sufficient depth is obtained and an equilibrium established, when the river flows on with its original slope and velocity but with a different shaped although equivalent cross section of water way. The only harm done is that the sand thus dislodged moves down and generally causes further trouble below, so that a more or less complete regulation is needed to secure and maintain a desirable depth for navigation. Hydraulic pipe line dredges recently built will minimize the bad effects of these sand movements by pumping the sand to one side between dams and outside of the projected channel, so that it can never again become obstructive. All the banks in the bends and wherever liable to abrasion, are protected by a revetment of rock and brush to prevent undesirable deposits in the channel.

The specifications and methods for both day labor and contract work are practically the same, but occasionally, especially in the two upper divisions, the government forces have been given more latitude than the contractors as regards the relative proportions of rock and brush used in wing dams. The office regulations prescribe that the proportion of brush shall not exceed 1 to 1 rock in shore protections, 1½ to 1 rock in closing dams, and 1 to 2 rock in wing dams, but in some day labor practice, the proportion of brush to rock in many wing dams and occasionally in closing dams is often made 2½, 3, and sometimes 4 to 1. This affects the unit cost per yard of day labor work as compared with contract, and apparently cheapens the completed cost of the dams, as brush is much the cheaper material, both in original cost and in towing and handling. The advisability of this practice, which is, however, chiefly confined to the up[illegible]lished.

The original project for the improvement of the upper Mississippi between the Missouri [illegible] 1878, provided for a channel 4½ ft. deep at low water and, up to 1907, improvement work was carried on with that object in view. But in that year Congress adopted a 6-ft. project [illegible] secured by further contraction and by an in[illegible] posed channel widths of the two projects are shown in Table I.

Between the St. Croix River and Lake Pepin no further contraction is necessary, as the 4½-ft. project work realized the 6 ft. desired.

The 6-ft. project differs with the 4½ only in the degree of contraction, so that none of the old work has been wasted, the wing-dams in existence being simply lengthened, repaired and restored to the projected crest elevations of 4 ft. above low water above the Des Moines River and 6 ft. from the rapids to the mouth of the Missouri. The closing dams and shore protections proposed remain as before.

Up to the close of 1906, under the 4½-ft. project, there had been put in place 5,332,116 cu. yds. of rock and 7,163,037 cu. yds. of brush, making a total of 12,485,153 cu. yds. of material for both construction and maintenance and at a cost of about $11,000,000. The 6-ft. project calls for the use of 6,846,698 cu. yds. of rock and 10,540,170 cu. yds. of brush additional; total material, 17,386,769 cu. yds., about 40 per cent more than already put in place, and, in addition to the rock and brush, the project covers 12,500,000 cu. yds. of dredg[illegible].

The total quantities to 1910, inclusive, with other statistics, are shown in Table II.

The government has four complete day labor plants, one operating between St. Paul and Winona (Division No. 1), another between Winona and the Wisconsin River (Division No. 2), a third between the Wisconsin

TABLE I.

Localities.	[illegible]	[illegible]
[illegible]	[illegible]	300
St. Croix River to Lake Pepin.	[illegible]	600
Lake Pepin to Wisconsin River.	[illegible]	[illegible]
[illegible]	1,000	900
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1,200
[illegible]	[illegible]	1,200
[illegible]	[illegible]	[illegible]

[illegible] noa to Wisconsin River.

TABLE II. UNITED STATES IMPROVEMENT, UPPER MISSISSIPPI RIVER, ST. PAUL TO [illegible] (ROCK ISLAND RAPIDS NOT INCLUDED), 1878-1910, INCLUDING SOME DESULTORY WORK DONE PRIOR [illegible].

(Day Labor and Contract.)

	Miles.
[illegible] ft.	[illegible]
Total length of shore protection (1,- [illegible]	[illegible]
Dams:	Cu. yds.
Total rock	3,901,390.9
Total brush	6,238,142.8
Total material	10,139,533.7
Average per linear foot:	
[illegible]	[illegible]
[illegible]	[illegible]
*Av. per lin. ft. (material)	[illegible]
Shore Protections:	
Total rock	1,942,591.6
Total brush	1,716,294.7
Total material	3,658,886.3
Average per lin. ft.:	
Rock	1.71
Brush	[illegible]
*Av. per lin. ft. (material)	3.22

Grand total of material used, 13,798,420.0 cu. yds.

*Includes repairs.

Fig. 2—View of Towboat "Grace," Upper Mississippi River Improvement.

TABLE III.

Plants [illegible]

Pieces	Div. 1 U. S.	Div. 2 U. S.	Div. [illegible] U. S.	Div. 7 U. S.	Div. 3 and 5 Cont.	Div. 6 Cont.	Div. [illegible] Cont.	Div. [illegible] Cont.*
Towboat, large	[illegible]			1	1	1	2	1
Towboat, small				[illegible]				
Office boat	[illegible]	[illegible]		1	1	1		
Quarter boat	2			2	2	2		1
Store boat	1	[illegible]		1	1	1		
Building boat	1	2	1	1	1	2	1	1
Barges, 100x20 ft.	12	20	8		16	13	9	7
Barges, 110x24 ft.			2	18				
Grasshopper	[illegible]	[illegible]	1	1	2	[illegible]	1	1
Grader pile driver				1			1	
Original cost new	$ [illegible]	$ [illegible]	$ 71,600	$ 65,000	$55,000	$46,400	$50,300	$25,000
Cost of work in 1911	$101,470	$106,770	$118,646	$124,938	$94,169	$77,272	$58,897	$17,618

*Only 3 months work.

TABLE IV.—COST OF TOWBOAT REPAIRS.

	Year.	"Fury." Built in 1881.	"H. Bosse." Built in 1881.	"Alert." Built 1874. Bought 1881.
Original cost		$11,976.00	$11,976.00	$ 6,000.00
Repairs to and including	1890	6,292.71	10,4[illegible].01	*14,20[illegible]
Repairs	1891	3,187.09	2,032.26	[illegible]
Repairs	1892	426.75	588.95	406.31
Repairs	1893	1,977.82	875.72	1,086.61
Repairs	1894	[illegible]	749.84	1,170.12
Repairs	1895	3,364.72	*5,070.51	559.08
Repairs	1896	2.80	272.45	590.88
Repairs	1897	463.70	232.30	1,938.49
Repairs	1898	497.46	209.42	1,031.91
Repairs	1899	*5,247.28	224.16	1,064.78
Repairs	1900	147.19	1,744.01	191.28
Repairs	1901	38.91	231.22	0.00
Repairs	1902	998.54	629.91	304.47
Repairs	1903	19.76	460.44	1,619.06
Repairs	1904	401.53	523.90	476.68
Repairs	1905	583.63	3,375.25	692.31
Repairs	1906	1,209.11	61.12	1,208.05
Repairs	1907	3,026.34	87.41	1,804.35
Repairs	1908	337.25	497.52	1,574.92
Repairs	1909	719.70	695.27	1,680.45
Repairs	1910	1,178.67	1,210.28	2,720.89
Totals to date		$42,883.89	$41,650.76	$41,562.00

*New hull.

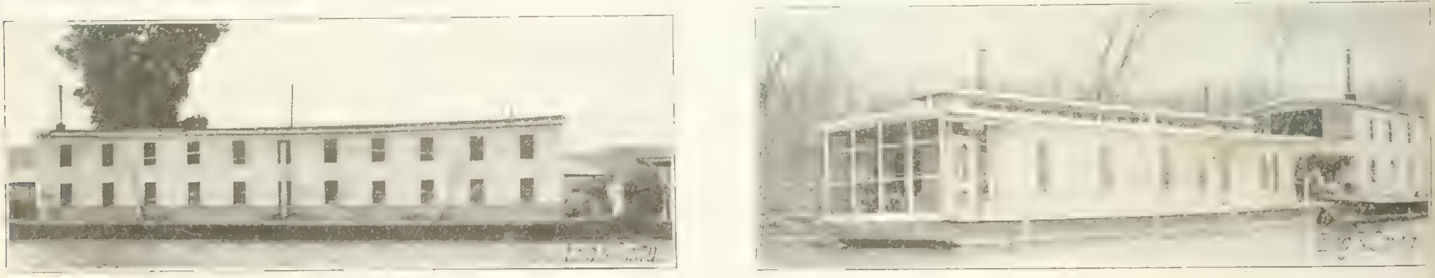
TABLE V.—SMALL AUXILIARY TOWBOATS USED IN U. S. IMPROVEMENT, UPPER MISSISSIPPI RIVER.

	"Lucia," built 1885. Oak hull.	"Louise," built 1884. Oak hull.	"Elsie," built 1889. Steel hull.	"Emily," built 1889. Oak hull.	"Ada," built 1889. Oak hull.
Original cost	$ 4,000	$ 3,538	$ 5,110	$ 4,034	$ 4,000
Repairs to Dec. 31, 1910	12,575	11,495	7,450	10,442	8,251
Total	$16,575	$15,033	$12,560	$14,476	$12,251

The "Lucia" had new hulls in 1895 and 1910.
The "Louise" had new hulls in 1894 and 1905, the latter steel.
The "Elsie" has required no additional hull.
The "Emily" had new hulls in 1902 and 1910.
The "Ada" had a new hull in 1904.

River and the Rock Island Rapids (Division No. 3), and the fourth between Hannibal and the Missouri River (Division No. 7).

A comparison of day labor and contract plants engaged during 1911, follows in Table III. This table gives the approximate original cost of each plant and also the amount of money expended by day labor plants and that paid to the contract plants, in 1911.



Figs. 3 and 4—Views of U. S. Office Boats, Mississippi River Improvement.

One of the towboats of the U. S. plants and one which, although not of great power, is well adapted to the work, is shown by Fig. 1. The "Coal Bluff" is 148 ft. long over all and 129 ft. on deck; width of hull 25 ft. 4 ins.; over guards 28 ft. 2 ins.; 5 ft. deep in the dead flat, and draws light 2 ft. 6 ins. Her wheel is 14 ft. wide, 18 ft. 3 ins. in diameter, and has 24-in. buckets. She has two propelling engines, 15½ ins. diameter by 5 ft. stroke, and 3 boilers, 24 ft. long by 36 ins. diameter, with six 13-in. return flues in each.

A complete detailed showing of what it costs to keep wooden hull towboats in repair is given in Table IV, for three boats of nearly the same size and power, built or purchased in 1881. While the repairs in 30 years amount to about three times the original cost of each boat, yet the cost per annum for a serviceable towboat is only about $1,400, and the salvage on each today would be about $5,000. These boats have all had new boilers and have been practically rebuilt as to their hulls two or three times. Repairs to cabins and machinery have been nominal. It will probably be decided to condemn them in a year or two and build steel hull boats.

A sample of the small auxiliary towboats attached to the U. S. plants is shown by Fig. 2. These boats are very useful with light tows and in handling the barges in dam construction. The "Grace" is 92 ft. 6 ins. long over all and 78 ft. on deck; width of hull 17 ft. and depth 3 ft. 11 ins. She has a wheel 10 ft. long and 12 ft. in diameter with 18-in. buckets; 2 cylinders 7½x49 ins., and 2 boilers 10 ft. long and 30 ins. in diameter with 44 3-in. flues. The cost of this boat, which was built by the United States in 1894, at Keokuk, was $8,616.

The cost of other small auxiliary towboats is shown in Table V.

All of these boats are in good condition (Dec., 1911). They have cost the government about $500 a year each, and the salvage on each would be about $3,000.

Figures 3 and 4 give a good idea of a typical office-boat and quarter-boat used with the government plants. The office boat shown in 50 ft. x 18 ft. hull dimensions, has a single-story cabin, nicely fitted with staterooms, bunks and office furniture. It was built in 1893, at a cost of about $1,800, including outfit. The repairs to 1907, during which year the hull was rebuilt, were small. Repairs to Dec. 31, 1910, were about $2,500, including maintenance of outfit. On Dec. 31, 1911, this boat was in fine condition.

The quarter boat, accommodating 70 men, is 70x20x3 ft. in hull dimensions, and has a two-story cabin fitted with bunks for laborers in the second story and with dining room, kitchen

TABLE VI.—LONGEVITY OF SCOW BARGES.

Group.	No. of barges.	Dimensions, feet.	Material.	Cost, each.	Years in service. Max.	Min.	Av.	—Repairs.— Max.	Min.	Av.	Remarks.
I	8	100x20x4	White pine.	$ 770	8	6	7¼	$ 681	$ 91	$ 367	Light loads for the last year or two.
II	8	100x20x4	White pine.	770	8	6	7½	561	134	264	Light loads for the last year or two.
III	8	100x20x4	Fir.	806	16	13	14¼	1,323	628	1,052	Wrecked barge omitted. Barges show great vitality. Principal repairs new decks and calking.
IV	6	100x20x4	Fir.	800	17	15	16[illegible]	881	564	716	Great longevity. Small repairs—all but two in fair condition, 1911.
V	3	100x20x4	Fir.	806	14	12	13	958	661	822	Not so satisfactory as III and IV.
VI	5	100x20x4	Fir and pine.	790	15	11	14	1,780	517	1,314	Very large and apparently unjustifiable repairs in the last 4 years. Three still in use and in fair condition.
VII	9	100x20x4½	Fir.	768	15	9	12½	1,783	349	1,067	Built by U. S. Three in fair condition, 1911, large repairs.
VIII	8	110x24x4½	Fir.	1,600	15	14	15	1,454	1,086	1,283	Wrecked barge omitted. Long life with moderate repairs.
IX	6	110x24x4½	Fir.	1,400	14	13	13½	1,097	802	911	Two of this group rebuilt in 1908. Built by U. S., good life, small repairs.
X	6	120x20x5	Pine with oak bottom.	1,300	22	15	21	2,871	447	2,066	All but one rebuilt.

TABLE VII.—FORCES EMPLOYED BY THE [illegible], 1911.

Designations.	Div. 1. U. S.	[illegible] U. S	Div. 3. U. S.	Div. 7. U. S	[illegible] Cont.	Div. 6. Cont.	Div. 7. Cont.	Div. 5. Cont.
Assistant engineer	1	1	1					
Clerk	1	1	1	1		1	1	1
Pilot and master								
Overseer and Foremen								
Steam engineers								1
Receiver of materials								
Cooks								
Cooks' helpers		1	[illegible]					
Carpenters								
Firemen					1			
Deck hands								
Watchmen		1						
Laborers								20
Boatmen				1				
Timekeeper				1	1	1		
Monthly payroll	[illegible]	[illegible]	[illegible]	[illegible]	$2,021	[illegible]	$1,807	[illegible]

TABLE VIII [illegible] RIVER, 1911

[illegible]

Add for deterioration of plant............ 5,000

[illegible] vested

Total cost to contractor..............$ 91,[illegible]

Estimated profit of contractor.......$ 24,[illegible]

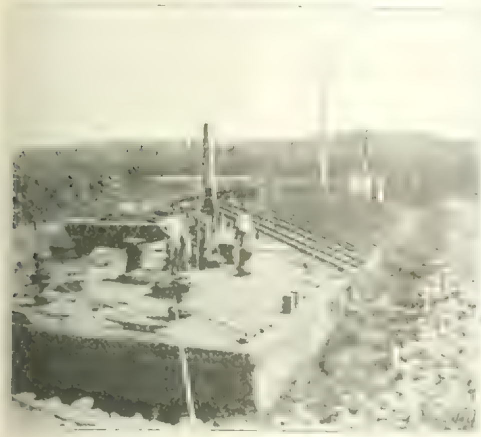


Fig. 5—Building Boat with Ways Raised.

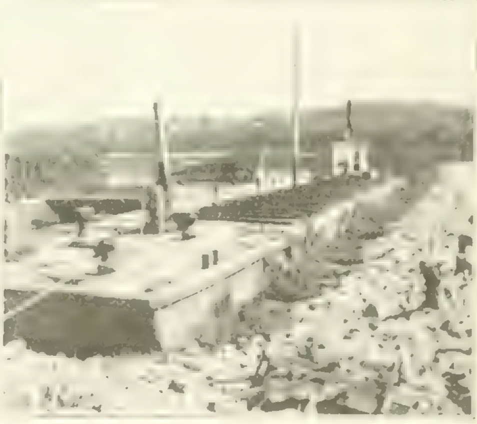


Fig. 6—Building Boat with Ways Flat on Deck.

TABLE IX.—SUMMARY SHOWING LOCALITIES, [illegible] IN [illegible] BETWEEN ST. PAUL AND MOUTH OF MISSOURI RIVER

Method and Locality.	Rock. Cu. yds.	Brush. Cu. yds.	Total. Cu. yds.	Cost	On [illegible]	Towing.	Putting in place.	General superintendence	Local superintendence	Plant.	In place.
Hired Labor—											
St. Paul to Winona	23,938.5	72,287.9	96,226.4	[illegible]	$0.361		$0.166	$0.023	$0.037	$0.099	[illegible]
Winona to Wisconsin River....	25,625.2	74,497.8	101,123.0	77,461.65	.324			.022	.040	.122	.766
Wisconsin River to Le Claire...	22,097.3	31,469.7	53,567.0	58,159.72	.415	.192	.240	.031	.039	.169	1.086
Hannibal to Missouri River	29,059.9	31,159.5[1]	60,219.4	71,831.77	.492	.165	.259		.098[2]		1.193
Contract—											
Rock Island to Burlington, 1909.	18,556.5	14,610.4	33,166.9	37,705.03				.023	.052		1.136
Rock Island to Burlington, 1910.	9,195.6	13,083.1	22,278.7	23,468.23				[illegible]	.027		1.053
[illegible] to Hannibal, 1910	4,392.1	5,457.1	9,849.2	12,119.91				[illegible]	.048[3]		1.220
Clarksville to Illinois River.....	1,668.8	3,910.9	5,609.7	5,789.47					.110		1.032
											946

[1]Includes 1,487.5 cu. yds. gravel. [2]Includes surveys. [3]Inspection.

Average cost per cu. yd., hired labor [illegible]

Average cost per cu. yd., contract work.............................. 1.115

TABLE X.—SHOWING WHAT THE DAY LABOR [illegible] WOULD HAVE COST IF DONE BY CONTRACT UNDER UNIT PRICES OF THE 1910 CONTRACTS

Division.	Rock. Cu. yds.	Brush Cu. yds.	Actual [illegible] of work.	[illegible] it would have cost by contract.	Saving	Day labor[illegible]
St. Paul to Winona.........	[illegible]	72,288	[illegible]	[illegible]	$ 7,32[illegible]	
Winona to Wisconsin River...	25,625	[illegible]	72,842	88,293	15,451	
Wisconsin River to Le Claire.	22,097	31,470	57,201	54,612		[illegible]
Hannibal to Missouri River.....	29,060	31,160	64,677	65,546	869	
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note 1.—In this statement general superintendence and office is omitted, and the contracts are charged 3 cts. a yard for inspection.

Note 2.—A profit to the contractor of $21,051, or about 10 per cent, is indicated, which is, however, much less than the actual or usual profit.

[illegible] quarters for overseers and cooks [illegible]. [illegible] built in 1891, at a cost of [illegible] nd with a new hull built 1910, it is now in ood condition, although the repairs and renewals of outfit in 19 years have cost $3,205. t may here be said that all boats recently uilt cost about twice as much as similar ones uilt 15 to 20 years ago.

The plans of a building boat [illegible] sed by the government, are shown in the [illegible] 18, 1911, issue of ENGINEERING AND CONTRACTING, p. 422, as also two views of the boat [illegible]. Two additional views, [illegible] nd 6, are given below. The building boat hown is 160x26x4 ft. in hull dimensions, built f Douglas fir in 1903, is fitted with steam apstans and movable ways, and cost about 3,600. Repairs on it to Dec. 31, 1910, including a new boiler, were $2,092, and it is ow after 8 years' service in good condition.

Plans of the 100-ft. barges, which are simir to the 110-ft., were shown in the issue of this periodical above mentioned. The cost of the former have increased in the last 15 years [illegible] $1,500 [illegible] years the lumber has been creosoted, either [illegible] adds to the cost. Table VI gives the record of a number of groups of barges, all of which were built prior to 1907 of untreated lumber.

A typical plan of the grasshoppers, which are boats with ways for building continuous mattresses, is shown in the issue of this periodical above mentioned. They vary in size from 30x16 ft. to 48x40 ft., and in cost from $300 to $900. They all have oak ways or fingers upon which the mattress is built.

In Table VII is shown the force employed with each plant and the monthly expenditure for labor, which latter, in the cases of con[illegible]

It will be noted that the cost per yard in place, shown in Table IX, depends materially on the relative proportions of rock and brush. Where the brush preponderates, the cost per yard is less, as brush is the cheaper material both in actual cost and in handling. The contract work is handicapped in cost by a relatively large proportion of rock.

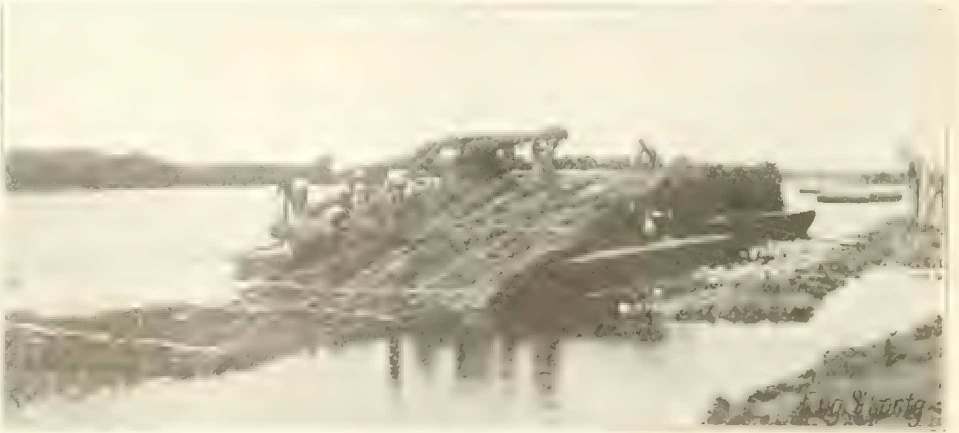


Fig. 7—Grasshopper Barge at Work.

Table for Proportioning the Sizes of Air Mains and Branches.

The accompanying table shows the number of branch pipes of a given size that can be efficiently supplied with air from a given sized main. The figures in the vertical column at the left are the diameters of the mains and those at the top are the diameters of branches.

Diameter of Mains.	Diameter of Branches															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	[illegible]															
3	[illegible]	[illegible]														
4	[illegible]	5.7	2.3	...												
5	[illegible]	[illegible]	3.6	1.8												
6	88	16	5.7	2.8	1.6											
7	129	23	8.3	4.1	2.3	[illegible]										
8	[illegible]	32	12	5.7	3.2	[illegible]	[illegible]									
9	[illegible]	42	16	7.6	4.3	2.8	1.9	1.3	...							
10	317	56	20	9.9	5.7	3.6	2.4	1.7	1.3							
11	[illegible]	71	26	12	7.0	4.5	3.1	[illegible]	[illegible]	1.3						
12	[illegible]	88	32	16	9.0	5.7	3.8	2.8	2.0	1.6	[illegible]					
13	[illegible]	107	39	19	11	6.9	4.7	3.4	[illegible]	1.9	[illegible]	1.2				
14	[illegible]	129	47	23	13	8.3	5.7	4.1	[illegible]	2.3	[illegible]	1.5	1.2			
15	[illegible]	152	56	27	16	9.9	6.7	4.8	[illegible]	2.8	[illegible]	1.8	1.4	[illegible]		
16	1026	[illegible]	65	32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.2	[illegible]	2.1	[illegible]	1.4	1.2	
17	1197	208	76	37	21	13	9.2	[illegible]	[illegible]	3.8	[illegible]	2.4	2.0	1.6	1.4	1.2
18	[illegible]	[illegible]	88	43	27	[illegible]	[illegible]	[illegible]	[illegible]	4.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	275	100	49	28	[illegible]	[illegible]	[illegible]	[illegible]	5.0	[illegible]	3.2	[illegible]	[illegible]	[illegible]	1.5
20	[illegible]	312	114	[illegible]	32	20	14	9.9	[illegible]	[illegible]	[illegible]	3.6	2.9	[illegible]	[illegible]	1.7
21	[illegible]	345	130	61	35	22	[illegible]	10	8.4	6.3	[illegible]	4.1	[illegible]	[illegible]	[illegible]	2.0
22	[illegible]	398	145	71	41	26	18	13	9.3	7.2	[illegible]	4.5	3.7	[illegible]	[illegible]	2.2
23	[illegible]	460	160	77	47	29	[illegible]	14	10	7.8	[illegible]	[illegible]	4.1	[illegible]	[illegible]	[illegible]
24	[illegible]	493	180	88	50	[illegible]	[illegible]	16	[illegible]	[illegible]	[illegible]	[illegible]	4.6	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	202	[illegible]	55	[illegible]	24	17	13	10	[illegible]	6.4	5.2	[illegible]	[illegible]	[illegible]
26	[illegible]	590	219	108	[illegible]	[illegible]	27	19	14	11	8.6	6.9	[illegible]	[illegible]	[illegible]	3.4
27	[illegible]	677	243	121	68	43	[illegible]	21	15	12	9.6	7.5	6.1	[illegible]	[illegible]	3.6
28	4100	725	265	129	74	[illegible]	32	23	17	13	10	8.3	6.8	[illegible]	[illegible]	4.1
29	[illegible]	[illegible]	289	141	79	52	35	25	19	14	11	9.1	7.5	6.2	5.2	4.4
30	[illegible]	[illegible]	315	151	88	56	38	[illegible]	20	16	12	9.9	8.0	6.7	[illegible]	4.7
31	5312	[illegible]	[illegible]	[illegible]	[illegible]	59	40	[illegible]	[illegible]	17	[illegible]	10	8.9	7.4	[illegible]	5.1
32	[illegible]	1070	[illegible]	[illegible]	[illegible]	63	[illegible]	32	23	18	14	11	9.3	8.0	[illegible]	[illegible]
33	[illegible]	1140	401	196	109	70	[illegible]	35	25	[illegible]	15	12	10	[illegible]	[illegible]	[illegible]
34	6675	1208	433	212	119	76	51	[illegible]	27	21	16	13	11	9.1	[illegible]	[illegible]
35	7075	1280	470	229	127	82	56	40	30	[illegible]	[illegible]	14	12	10	[illegible]	[illegible]
36	[illegible]	1355	497	242	138	[illegible]	[illegible]	43	32	25	19	16	[illegible]	11	[illegible]	[illegible]
37	[illegible]	1435	537	260	146	94	64	45	33	26	20	16	[illegible]	11	[illegible]	[illegible]
38	8715	1625	[illegible]	[illegible]	[illegible]	[illegible]	68	[illegible]	37	29	[illegible]	18	14	12	10	8.6

The figures in the table show the number of branches of the diameter indicated at the head of the column which will be equal to one pipe of the diameter designated in the column to the left on the same horizontal line.

The table is taken from a recent catalog of the Green Fuel Economizer Co. It is based upon calculations according to the laws of the flow of air through pipes.

Diagrams for Safe Loads on Piles.

The accompanying diagrams are for determining safe loads for piles. The first is for piles driven with a drop hammer and the second for piles driven with a steam hammer. The diagrams are constructed with the use of the *Engineering News* formula as given by the late A. M. Wellington as follows:

$$P=\frac{2wh}{1+S}$$

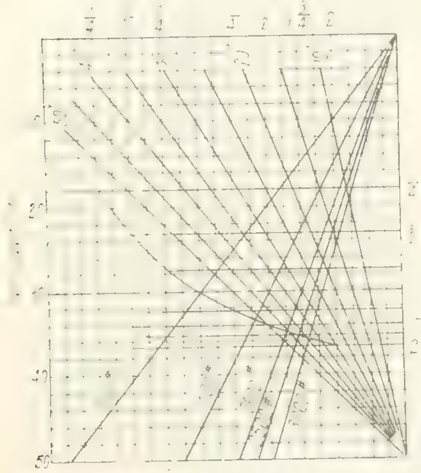


Fig. 1—Diagram for Safe Load on Piles Driven with Drop Hammer.

Where P = safe load in tons, w = weight of hammer in tons, h = fall of hammer in feet, and S = penetration of pile at last blow. This formula is intended for piles not driven to rock, as such piles should be figured as columns. The quantity S is the average penetration for the last few blows, which under ordinary circumstances becomes fairly constant. This condition in the driving shows that the pile is in such material that the formula may safely be used for figuring its loading.

The diagrams given here are by Prof. Edward R. Cary, as published in the *Polytechnic* of the Stevens Institute of Technology.

For the construction of the diagrams the formula may be expressed as follows:

$$P=\frac{2}{1+S}\cdot w\cdot h \quad \text{Let } y=\frac{2}{1+S},\ z=h\ y \text{ and}$$

$$P=w\ z$$

Values of S are taken on the X axis of the diagram and the corresponding values of Y are plotted as ordinates. A curve is drawn through the plotted points, and lines parallel to the X axis are also drawn through these points. The equation $z = h\ y$ is that of a straight line making with the Y axis an angle whose tangent is h. A point is taken on the X axis, at such a distance from the origin, used for plotting points of above curve, as will make a convenient size for the diagram. This point is used as the origin for plotting the line $z = h\ y$. On the line of y for a value of $S = 1$ in., two divisions on the cross section paper are taken for the value of z when $h = 10$ ft., four divisions when $h = 20$ ft., six divisions when $h = 30$ ft., etc. From these points lines are drawn to the origin for z. On a line parallel to the Y axis and drawn through the origin for z, a point is taken for the origin for $P = w\ z$. On a line parallel to the Y axis and drawn through the intersection of the 40 ft. line for the fall of the hammer and the line marked 1 in. parallel to the Y axis, are laid off, to an adopted scale, values of P for w = 1,000 lbs., 1,500 lbs., etc., and for S = 1 in. and h = 40 ft. The lines above described and the Y axis are properly numbered to make the completed diagram.

Knowing the penetration in inches for the last blow, find the intersection of the line parallel to the X axis that is marked with this amount and the line which gives the fall of the hammer, then go parallel to the Y axis until the line which gives the weight of the hammer is reached, then go parallel to the X axis to the left edge of the diagram and read the safe load in tons; *e. g.*, for a penetration of ¾ in., fall of hammer of 20 ft. and weight of hammer of 2,000 lbs., find intersection of ¾ in. and 20 ft. lines, then go parallel to Y axis until 2,000 lb. line is reached, then go parallel to X axis and read 22+ tons.

For steam hammer driven piles the formula $P=\frac{2wh}{0.1+S}$ is used, where terms represent the same quantities as above. The methods of construction and use are the same as for the above. The diagram is seen to be very similar in form to the one for drop hammer driven piles.

Some Notes on Rubble Mound Breakwater Construction at Lake Erie Ports, with Costs of Unloading Stone from Scows.

During the past decade practically all of the breakwaters built at the various American ports along Lake Erie have been constructed wholly of stone, and are known as rubble mound breakwaters. The core of these breakwaters is composed of stone of a classification known as "quarry run" which consists of stones varying in weight from a few pounds to several tons. On the outside of this core, on both lake and harbor side, heavy blocks of a minimum weight of 3 tons, some weighing as much as 12 or 15 tons, are placed. For the top, large stones of a minimum weight of 3 tons are used. These stones for the superstructure are placed in regular order; they must be approximately rectangular in shape, and of a quality that will withstand the action of the elements, especially of frost.

The slope of these breakwaters is about 1 ft. vertical to 1½ ft. horizontal, with a top width of 10 ft., the crest being 8 ft. above mean lake level. Hence it will be seen that the width of the base is dependent on the depth of the water at the location where the breakwater is to be built.

In quarrying rock to be used for the superstruture of these breakwaters caution should be exercised in the amount and kind of explosive employed. The writer spent several seasons at the quarries both on Johnson's Island and Kelley's Island and while there studied the methods used and the results obtained. After handling a million tons of rock, the larger part of this amount being at the quarries and the remainder on breakwater construction, he has reached certain conclusions, some of which are as follows:

(1) In quarrying rock to be used in the superstructure of breakwater a very limited amount of dynamite should be used, and, if possible, it is better not to use any, using only powder. There is no doubt that where a rock that is firm and of uniform strength

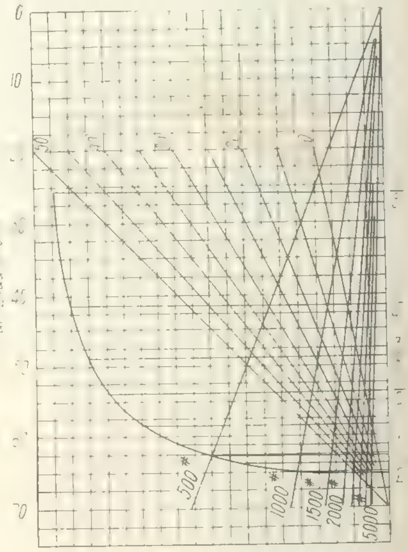


Fig. 2—Diagram for Safe Load on Piles Driven with Steam Hammer.

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*Abstract of a paper by H. F. Alexander, in the Journal of the American Society of Engineering Contractors for November, 1911.

is desired, dynamite is too quick-acting and not only weakens the strength of the rock, but is also likely to cause minute seams that cannot be detected by the eye of the inspector.

(2) No stone to be used in superstructure work should be quarried later than at least one month before freezing weather is likely to begin. This gives the stone time to season and lose most of its *greenness* or native moisture.

The rock is conveyed on scows to the place where the breakwaters are being constructed. Three classes of scows are used, viz.: derrick scows, deck scows, and dump scows. The smaller stone used for the core is, as far as practicable, carried in the dump scows. The latter are placed over the spot where the core is to be placed and are then dumped the same as mud scows are. This is by far the cheapest method of handling stone but only a limited amount can thus be handled.

The larger stone, and occasionally loads of small or hand stone, are loaded on the deck scows. The derrick scows also carry large stone and unload by means of their own derricks.

The writer has no records of the cost of handling stone from dump or derrick scows. [illegible]

The stone was [illegible] by hand.

[illegible]

1st ..				$84.17	[illegible]
[illegible]		334	2.642	86.17	.1014
3rd .		344	2.04	88.67	.1263
4th	485	160	3.03	41.67	.0859+
5th .	[illegible]			72.00	.0787+
6th ..	[illegible]	[illegible]	2.55	45.17	.1017
7th	840			84.08	.1000
8th	641		[illegible]	64.83	[illegible]
9th	592		2.436+	63.08	.1065
		2,432	2,623	629.84	$.1000

The high cost per ton on the third scow was due to unfavorable weather conditions. Owing to a severe storm the work of discharging this load had to be done on two different days, and considerable time was lost during a heavy rain. It will be seen that the average tons per man per hour on both the fourth and fifth scows, was much higher than on any of the other scows. When the fourth scow was unloaded, a number of ore shovelers and experienced men were employed; on the fifth scow, nearly all the men were of this class. [illegible] hour than the men employed on the other scows, the results show them to have been the cheaper in the end. The men who unloaded the other scows were unskilled, being simply picked up on the streets, and while paid less per hour, they finally cost the contractor considerably more than the experienced and higher-priced men. This experi- [illegible] of work as shoveling, is certainly a strong argument against the employment of cheap labor for almost any class of work.

The total cost of towing the scows from the docks to the breakwater and back to the docks was $110, or an average of $0.0175 per ton, making the total average cost per ton for handling the stone after being received at the dock $.1175. The stone is bought from the quarry by the short ton (2,000 pounds).

ROADS AND STREETS SECTION

Cost of Street Sprinkling in a Small City.

By E. W. Robinson.*

The following data give the actual cost of sprinkling streets in Webb City, Mo., for the season from May 9 to Oct. 31, inclusive, 1911. The streets sprinkled were all paved with brick, with the exception of three blocks which were paved with macadam. The same route was followed each day, covering the entire distance of 6,239 lin. ft., or 30,231 sq. yds., four times in ten hours. Of the total of 176 days in the season, sprinkling was done on 140 days, or 82.4 per cent of time. The 36 days lost represents actual time when sprinkling was unnecessary.

The driver was paid $2 per day straight time and took care of team. The collector was paid 4 per cent of collections for first five months and 5 per cent of the collections for the last month. Sprinkling was paid for by the property owners at front foot rate. The cost given below does not include time of city engineer spent on organizing and supervising the work:

	Total for 176 days.	Per day.
Driver, 176 days at $2.	[illegible]	[illegible]
Collector, 4 per cent of $927.83, 5 per cent of $190.33	46.65	0.2651
Medicine for team.	[illegible]	[illegible]
Shoes for team	23.20	0.1318
Hay at $9.25 per ton, straw at $0.10 per bale	[illegible]	[illegible]
Feed, bran at $1.50, chops at $1.30 per 100 lbs	[illegible]	[illegible]
Repairs	[illegible]	[illegible]
Receipt books	5.50	0.0312
Horse hire, replaced sick horse, 16 days at $1	[illegible]	[illegible]
Water, 5.76 months at $35 flat rate	201.70	1.1460
Interest on investment, 6 per cent of $350 for 1 year, 6 per cent of $560 for six months of year.	[illegible]	[illegible]
Depreciation on sprinkler, value $350, life 10 years at 3 per cent compound = 8.73 per cent of $350	[illegible]	[illegible]
Depreciation on team and harness, value $560, life 8 years, at 3 per cent compound = 11.2[illegible] per cent of $560, for six months of year	[illegible]	[illegible]
Total	[illegible]	[illegible]

The depreciation given above on sprinkler is reduced to amount per day of the total season, while theoretically there was no depreciation when not in use.

The water was paid for at flat rate of $35 per month. There was used during the whole season 5,003 tanks of 82.58 cu. ft. capacity, or a total of 413,147 cu. ft., at an average cost of $0.049 per cu. ft. An average of 2,951 cu. ft. of water per day, or .098 cu. ft. per sq. yd. per day was applied to the streets in the four sprinklings each day. The cost per front foot of property per month of 30 days for four sprinklings per day was $0.01532.

Some Principles of Street Planning.*

In dealing with this subject, it is necessary to classify the streets to be formed into broad groups, according to their purpose, as the requirements of each kind differ in almost every way. This is usually done by dividing them into traffic and non-traffic streets, but, in most instances, such a division is too sweeping, and many different kinds of roads are thus lumped together quite unjustifiably, and no place is given to open spaces in either category. I would divide them into monumental open spaces, recreational open spaces, traffic places, markets, shopping and business places and streets, main through routes, main residential thoroughfares, secondary residential streets, main arteries of the manufacturing district, secondary manufacturing streets. This gives us as many as nine main divisions, but even then cases are constantly arising of streets which cannot be included under any of these heads, without straining a point, and, of course, in special cases, there will be other special classes, such as the cathedral town with its close, the shipping town with its wharves, and so on.

With the open spaces, considered as such and not as traffic centres, I propose now to examine some of the various attempts which have been made at orderly planning, and I think we shall find that the more the existence of these fundamental differences in the functions of different classes of streets and highways is recognized, the more successful is the plan.

We begin, then, with the "gridiron" plan, which is found in the remains of the Roman colonies; and even earlier than that, we have the earliest known effort at comprehensive planning in the ancient town of Kahun, as drawn and described by Professor Flinders Petrie, which is in this same gridiron system of planning, and again at New York, San Francisco, and many towns commenced during the last century, we have the same thing. In Bloomsbury, London, the same style of thing was done, and many other towns have been partly laid out in this manner.

That a style of planning so primitive and ancient is not well adapted to modern conditions we should be prepared to find, though it may sometimes be adopted for small areas with great success, especially if the architectural features bear strong evidences of a classical influence. Such a case is found in Edinburgh, where the district to the north of Princes St. is most successfully laid out on this principle, and it is much to be deplored that, when the coming of the railway upset the scheme, nothing was done to insure its replacement. Development ever since has gone on on the meanest lines.

The chief fault of the gridiron plan, from a practical point of view, is that it only allows of through traffic routes in two directions, and that traffic proceeding diagonally across the plan is compelled to take a zigzag course, which means much loss of time at every corner, not to mention the extra distance traversed. So greatly has this been felt in towns originally laid out on this principle that great efforts are now being made to superimpose diagonal lines into the original layout. Philadelphia is a very typical case.

Some cities have attained this combination of gridiron and diagonal lines by chance, or rather, by the compelling force of circumstances, which is a strong point in its favor. Generally the diagonal lines have been evolved first and the square lines added afterwards, as at Calais, in France.

From the aesthetic point of view, the gridiron plan is also very undesirable, not only from its monotony, but also because it does not provide sites at the ends of long vistas whereon to place important buildings, and so the necessary perspective cannot be gained to view them properly. In many towns, too, where the streets are near together, this form of planning has resulted in there being no parcel of land big enough for the site of an exceptionally large building, and so excessively and undesirably tall buildings result.

Even the superimposition of diagonal lines will not entirely do away with these defects, though, that very much may be accomplished is evident from the detail plan of the proposals for a parkway from City Hall to Fairmount Park, which forms part of the Philadelphia scheme. Nevertheless, these efforts all partake of the nature of patchwork improvement, showing that the principle is at fault, and should not be adopted for new cities.

The better way is found when we come to

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*Assistant City Engineer, Webb City, Mo.

*Abstracted from a lecture by Thomas H. Mawson, [illegible] England, delivered at the University of Toronto, and reprinted [illegible] study the traffic and other requirements to be faced. We then see that three-quarters of the traffic in every town proceeds to or from a point near the center and the suburbs or surrounding country. This means that three-quarters of our traffic streets should radiate from the center of the city to its boundaries, and further study will show that, in all ordinary cases, the remaining quarter of the traffic gyrated round that center so that, if we do the best for the traffic, we have a plan which follows the lines of the spider's web.

A further development of the radial plan is what is known as the "ringstrasse," as it has been more extensively adopted so far in Germany than elsewhere. It consists of a ring of parks round the central part of the city, and, in old cities, has usually been obtained by clearing away obsolete fortifications. Vienna gives the best example, where a very fine use has been made of the opportunity there afforded.

In a theoretical case, then, our plan will consist of a series of radial streets and another system encircling the point where all the others join. At the latter point will probably be placed a large open square or plazza, in the center of which may stand the chief building of the town, say, the cathedral, university, capitol or commercial exchange, according to whether it is an ecclesiastical, educational, administrative or commercial center. We are, however, at once confronted with two difficulties, which are, that our radial streets will be too far separated in the outer parts of the town, and that so many streets, and consequently so much traffic crossing at one point, will create great congestion in the central square, which is highly undesirable round an important building or group of buildings of the nature suggested. Here the ringstrasse comes to our aid and provides not only trees, greenery, water and the songs of birds, within a moment's walk of the busy offices in the center of the city, but also the opportunity of providing interlacing roads, which are really short cuts, diverting all traffic from the central square, which is not destined for a point exactly on the opposite side of it from that which it starts. It also provides for the arrangement of a series of secondary radial roads which do not proceed right into the center of the town and so are not traffic routes, but merely means of access, and do not proceed out into the country, and so leave large sites available for industrial purposes or for development as individual units for residential suburbs.

Such a plan could never, of course, be carried out without adaptation to the needs and possibilities of an individual site, nor is it desirable that it should be, but the principle may always be used, and has been in many instances. It seems equally suited to a large town or a small suburb.

This indicates another way in which the radial system of planning surpasses the gridiron plan, that is in its adaptation to and recognition of the contours. Its adaptability to various conditions met with on the individual site, which are never the same on any two pieces of work, must necessarily be much greater than a collection of stiff straight lines crossing one another at right angles, and necessarily so near together that no deviation to meet the contours is possible.

In a number of instances the curved roads are not struck from a center, but deviate somewhat. This is for the purpose of meeting the contours, and, in fact, these lines were laid down on a carefully prepared contour plan, as all such work should be. The adaptation of the lines of roads to the contours in this way has both practical and aesthetic advantages. Not only does it allow of easier gradients, making traffic easier, but it also expressed, in a logical and straightforward way, the prevailing characteristics of the surrounding country, and, as no two sites are alike, provides infinite variety.

The fan-shaped construction of this plan also brings up another point. Where the town is a port on the shore of a large river, or lake, or the sea, we have a variation in the traffic problems to be met, for not only will there be traffic radiating from and gyratory about the center, but also traffic proceeding from the wharves and warehouses along the shore inland in all directions. The fan-shaped plan allows of this in a very simple manner, for the circular roads, at the water side, become a means of reaching the center of the town from every point where they touch it. This has evidently been realized by the city officials at Liverpool, who are at the present time constructing just such an avenue enclosing their city, and most town plans of recent date for cities on a waterway, such as Mr. Burnham's plan of Chicago, recognize it.

The plan of Copenhagen is very interesting in this respect and shows that what was intended primarily as a gridiron plan has evolved these very characteristics from the force of circumstances in a manner particularly adapted to the site which is on a peninsula.

We have not yet exhausted all the advantages which the radial plan has over the gridiron, however, for it has the additional advantage of allowing of town gardens, squares, and open spaces, in the placing of which there is an obvious raison d'etre which is absent in the rectangularly planned town. In the latter, when you want an open space of any kind, you simply miss out one, two or three blocks of buildings, as the case may require, and the fact that this may be done anywhere at random gives the result the appearance of being the outcome of an arbitrary apportionment. In the radially planned town, however, there are numerous sites where roads divide, and so on, which call aloud for treatment as open spaces, and so, when this obvious need is fittingly met, we have a sense of fitness which adds greatly to the aesthetic effect. I need hardly add, too, that where two roads converge at either side of an open space, where drivers of traffic along one road can see that approaching the point of junction by the opposite road, there is much less danger of collision than where they meet suddenly round a corner in the square plan. In the radial plan, too, where they approach each other obliquely, the two streams of traffic unite or cross much more easily than where they cross one another at right angles.

This brings us to the important and, in some of its connections, very abstruse question, of traffic circulation and control. The most important traffic question of all relates to those points in the busiest parts of the town, where the traffic has a tendency to converge on one point and so create congestion and delay. The axiom one finds in books on town planning with regard to these places is that, "The multiplication of traffic places should be avoided." Now, while I entirely agree with what the writers mean when they say this, I think it may be far better put by saying that, "The points where traffic crosses should be multiplied, so that a large number of streams do not converge at any one point." This, I take, is what is meant by the previous assertion, for streams of traffic proceeding in every direction must cross somewhere.

One way of overcoming the inconvenience of a number of streams of traffic converging on, and recoiling from one point, which has been very much discussed of late, and which has attracted a very considerable attention, is what is known as the gyratory circulation of traffic. The principle is that, wherever the traffic enters the open space at the junction of the roads, it should all proceed round the space in one direction until it reaches the road leading away from the center which it wishes to traverse, when it would naturally and easily fall out of the stream. This idea would work most excellently for street cars on rails, but there would be considerable difficulty in persuading the average driver to go round three parts of the circle, to reach the point he wants, when the fourth segment is so much shorter, and the more democratic the local sentiment, the greater the difficulty. Many devices are proposed for overcoming this defect, the most usual being to make the roadways approach the open space tangentially, so as to bring the traffic into it pointing in the direction in which it is proposed it should gyrate. Unfortunately this involves the slowing up of the traffic at the point where it leaves the traffic center in order to turn a sharp corner, thus neutralizing the chief advantages claimed for this system, and I have not yet seen a really successful attempt to overcome this difficulty. The aesthetic possibilities of the two systems are quite different. While there are numerous examples where the vistas down the four streets converge on one focal point in the center of the square, which would, almost necessarily, be graced by a fine architectural feature, such as a clock tower or fountain, in other cases we have separate vistas not calling for such heroic treatment, but providing a fine opportunity for an extra bold treatment of the facade at the point where it comes across the view down the street.

There is yet another means of overcoming the dislocation of traffic, which occurs where two streams cross, and this is the superimposed thoroughfare, that is to say, by carrying one road over the other by bridge. We have done this in London by means of the Holborn Viaduct, and the plan has proved to be all that could be wished on the practical side, though one wishes that the bridge were more successful architecturally. Crescent roadways are provided to accommodate this traffic, and there is no valid reason, except expense, why these quadrants should not be adopted everywhere where two important traffic roads cross, whether they are superimposed or not.

Notes on Road and Street Work.

Iron-Ore Roads.—In St. Louis County, and in parts of Itasca and Aitkin Counties, Minnesota, about 150 miles of road have been built of lean ore containing about 25 per cent of iron. These roads are generally constructed by depositing from 6 to 10 ins. of ore on the graded bed for a width of from 12 to 18 ft. and allowing it to be compacted by travel. The results are stated to have been very satisfactory, but the roads are necessarily dusty in dry weather and carry a slight coating of red mud when wet. It is believed that a top dressing of coarse gravel would add materially to the value of the road.

Tennis Courts in Public Parks.—One of the most difficult problems confronting park officials is the laying out and maintenance of tennis courts. In the Washington Park common at Chicago, about 40 courts are maintained on an area approximately three times the requisite size. Once each week the position of all courts is shifted, with the result that there is not sufficient play at any one point to ruin the grass. The courts are marked with whitewash each week, and 4x4 posts are used for the nets, being moved as the courts are moved. No attempt is made to take in the nets at night or when it rains. Grass courts are out of the question in the smaller parks. The ordinary clay court is unsightly and dusty, often causing injury to adjacent vegetation. In the south parks at Chicago experiments have been made with concrete, asphalt, asphaltic concrete and asphalt with an admixture of ground cork. The latter combination is said to be satisfactory, being dustless, resilient and easy to the feet of the players, while it is very fast and true. In the first court so built the error was made of draining to the ends. It is preferable to drain to the net. An actual gutter beneath the net is no impediment to the play, and the slight downward slope to the center is favored by the players, while the slope in the opposite direction meets with their strong disapprobation.

Concrete Road Construction in Michigan.—In its report to the Michigan Engineering Society, the Committee on Roads and Pavements, of which Mr. Frank F. Rogers is chairman, gave the following information regarding the progress of concrete reinforced road construction in Michigan: Recognizing the demand for concrete roadways in certain sections, notably in the vicinity of Detroit, the Legislature of 1911 provided for the payment of a state reward at the rate of $1,000 a mile on concrete roads and designated them as class "F." This is the same amount of state reward as is still on the ordinary macadam, which is designated as class "E." As in the other classes of roads, the law, providing for the concrete roadway, is a general specification in itself and contains the following requirements: That the steepest incline on the road shall not exceed 6 per cent; that the width of roadway or turnpike shall be not less than 20 ft.; that the concrete track shall not be less than 9 ft. in the clear between beveled edges; that the concrete shall be not less than 6 ins. in depth and composed of Portland cement and gravel, or sand and crushed stone, laid with or without a paving brick surface. The cement used is required to meet the standard tests of the American Society for Testing Materials and the other ingredients, the manner of laying and the kind of inspection employed shall be made to comply with specification made by or approved by the State Highway Commissioner. Up to this time, with the exception of the state reward on 1.088 miles paid to Saginaw county, all the rewards paid on concrete highways have gone to Wayne county. Since the passage of the 1911 law, that county has been paid rewards on 14.465 miles and has applied for, all told, 31.201 miles. The methods of building the concrete roads of Wayne county have been changed very much since the work was first started. Some of these changes are as follows: The mix has been changed from a 1:2:4 to 1:1½:3 mix. More care is taken to exclude clay loam and other foreign substances from the aggregate. The depth has been increased from 6 and 6½ ins. to 7 ins. A protecting plate of soft steel is now used at the transverse expansion joints, which are still placed every 25 ft. Several concrete streets have been built in Michigan, notably at Bad Axe, Alpena, Grand Ledge, Ann Arbor and Lansing. In the latter two cities, a sand and tar dressing was applied for a wearing surface. So far as the committee has been able to learn these streets have been laid in two courses, using a much leaner mix in the bottom layer. The cost per square yard has varied from $1.08 in Saginaw to as high as $1.60 in Wayne. Both figures include grading, drainage and everything required to make a complete road. Some of the city streets above referred to have been built at smaller cost.

Cost of Constructing a Macadam Road at Berea, Ky.—The following data relate to a macadam road constructed at Berea, Ky., under the direction of engineers of the U. S. Office of Public Roads. The work was begun on Sept. 24, and completed on Dec. 20, 1911. Chestnut St. was graded for a distance of 1,180 ft., 30 ft. wide, and reinforced with stone. The grading required 2,772 cu. yds. of excavation at a cost of 34.4 cts. per cu. yd., [illegible] per cent. Two center lines of 4-in. vitrified tile, 180 and 360 ft. in length, respectively, were constructed in order to drain the heavy yellow clay subsoil on which the road was built. The pipes were laid in crushed stone and the ends were turned into the ditches. In [illegible] engine with a rooter plow was used in some places. On a portion of the road, covering an extent of 1,686 sq. yds., the yellow clay [illegible] field stone, varying in depth from 15 to 6 ins., was laid in place. This treatment effectually prevented any further trouble with the subgrade. The macadam was placed in two courses. The first course was 4 ins. thick, varying in size from 3 ins. to 1 in., and was compacted under a 15-ton steam roller to a depth of 3 ins. The second course, 4 ins. in depth, varied in size from 2 ins. to 1 in., and was rolled until it was 3 ins. deep, thus making a total depth of 6 ins. of compacted macadam surface with a crown of ¾ inch to the foot. The widening of the macadam from 14 to 30 ft. commenced on Nov. 22, 1910, but no steam roller was available to complete this part of the surfacing properly. The various cost data in this work were as follows: 2,014 sq. yds. of finished macadam surface costing, for stone on the siding, 97.6 cts. per cu. yd.; for hauling, 37.2 cts per cu. yd.; for spreading, 13.2 cts. per cu. yd.; and for sprinkling and rolling 3.1 cts. per sq. yd. The unrolled surface of the road amounted to 2,097 sq. yds. additional. The binder for this portion was not placed on the road, but 120 cu. yds. were left in piles by the side of the road, together with 40 cu. yds. of crushed stone for maintenance, which brought the total amount of stone purchased up to 1,195 cu. yds. The average haul for stone, from the car to the road, was ½ mile. The first-course stone was limestone field stone for which the railroad haul was 19 miles. The surfacing stone was dolomite and limestone, hauled 27 miles by rail from the Sparks County quarry. The stone used in the subbase was field stone and stone from the excavated roadbed. A total of 271.2 cu. yds. of field stone was purchased for this purpose, at a cost of 97.7 cts. per cu. yd. In all, 4,111 sq. yds. of surfacing were laid at a cost of 91.5 cts. per sq. yd., making the total cost of the road to the community $3,763.51, which is at the rate of $16,840 per mile. These costs are based on labor at $1.25 per day, [illegible]

Underground Pipe Construction Before Making Streets and Roads.—In communities that are improving and developing the first need is a good road. Then later follows the demand for water, sewerage and light. Whenever a section is sufficiently built up to demand these necessities pipe lines are constructed and connections made to the improved or occupied lots scattered along the line of the highway. In most cases the connecting pipes from the main lines are not extended to the vacant lots. In a paper presented before Section D of the American Society for the Advancement of Science, Mr Charles E. Bolling, City Engineer of Richmond, Va., calls attention to the importance of having the connections extended from the main pipes to these vacant lots at the time the main pipes are laid in the street. This, however, is often attended with difficulty, on account of uncertainty as to what may be the future sub-division of the lots. Mr. Bolling states in his paper that generally this subdivision can be quite closely ascertained by an examination of the recorded plats and the frontage of the improved lots and the connections adjusted accordingly. Assuming that the essential underground pipe connections are sewer, water and gas, and that the block or square contains a frontage of 300 ft. and that the subdivision into lots averages 30 ft., that only ten of these lots had been built upon, there would be ten vacant or unimproved lots and ten unused connections. Basing the estimate of cost of such connecting pipes, in a street 60 ft. wide, the average cost of such connecting pipes, in a street 60 ft. wide, Mr. Bolling finds that the average cost of connections in Richmond is as follows: Sewer connection, 10 ft. deep, $12.00; gas connection pipe, 2½ ft. deep, $6.00; water connection pipe, 2½ ft. deep, $6.00; each of the latter having the necessary stop cocks at the curb line; making a total of $24.00 for each lot. Assuming the rate of interest upon the outlay to be 4 per cent, 96 cts. would be the annual expense on this cost. It is also the experience of Mr. Bolling that in the communities where these conveniences, such as sewer, water and gas, exist, the growth and improvement are rapid and in a short time all the abutting lots are improved and occupied. Under the laws governing the city of Richmond, the cost of water and gas mains, as well as connections to same, are not charged to the abutting property, nor is the main sewer, but there is an annual sewer tax of 10 cts. for every foot of frontage in the street, and the cost of the sewer connection is paid by the lot owner only where the fixtures on the lot are connected, and the owner of the vacant lot does not pay for this connection to the sewer until it is used. The increased value of the abutting property, however, is so great, due to having the necessities and conveniences of sewer, gas and water, that the tax receipts are greatly in excess of the small annual interest on the cost of pipe connections. Mr. Bolling states that in all cases where the street had already been paved, or otherwise improved, the cost of making the pipe connection is at least 60 per cent greater than in the unimproved street, and the restoration and maintenance of the paving of the street, in the end, amounts to double the original cost.

WATER-WORKS AND SEWERS SECTION

Suggested Methods for Increasing the Efficiency of Water Works Management—Office System and Field Inspection.

At about the same time a prominent association of waterworks men in this country were discussing methods of increasing the efficiency of waterworks management, the same subject was being considered in England. At the recent winter meeting of the Institution of Water Engineers, held in London, a paper on waterworks management was presented by Messrs. Easton Devonshire and William Matthews. The paper is published in full in recent issues of our London contemporary, *The Surveyor*, and the following abstract is based on the paper as published in that journal:

The authors have been induced to submit this paper because the subject, while less alluring than engineering, is not less important; because it has not, so far as they are aware, been previously discussed by this or any kindred institution; and lastly, because it is within their knowledge that the management of many undertakings lacks such system as is essential to the maintenance of satisfactory and economical results

It will be generally admitted that the official responsible for the management must, at least, possess such knowledge of waterworks engineering as will ensure his dealing in an intelligent manner with such matters as the economical utilization of the sources of supply, the reduction of waste, the maintenance of structural works, mains and machinery, the filtration or treatment of water, the laying of pipes, services and fittings, and the handling of labor. The need for such knowledge presents itself in every department of management other than that of pure accountancy, and makes it essential that the chief officer of a waterworks undertaking should have been trained as a water engineer. Such training alone, however, will not make a good manager, but must be supplemented by the possession of sound commercial experience. Public water authorities and companies alike are becoming alive to the value of the man in whom are combined a sound knowledge of both engineering and business; and the authors venture, in view of this fact, to impress upon the younger members of the institution the necessity of qualifying in both these departments.

[illegible]

The administration should be under one roof and one chief officer, subject only to the control of the governing body.

This system is predominant among companies, and even where some of the secretarial and accountancy work is done apart, such division of responsibility is there unattended with ill effect because the control is centered in a single board, before whom all chief officials appear, and by whom all differences are adjusted.

When, however, the undertaking is large and in the control of a public authority there are, almost invariably, one or more officials besides the engineer or manager reporting to other committees than the water committee, each having a tendency to support its own particular officer and obtain a predominating influence in the direction of the undertaking.

This condition of affairs is becoming acute, and detrimental to the best interests of the undertakings, and should be checked by councils insisting that such committees shall work jointly, and give equal ear to the representations of all officials concerned. It is safe to say that an impartial investigation would, in many cases, reveal the fact that the cost of administration has increased enormously, and is still increasing, in cases where such divided control exists. The system is demoralizing, as the nominal manager of the water department is sorely tempted to relax his efforts towards economy owing to their being counterbalanced by the extravagance in other departments, and because he is looked to as responsible for the gross result of operations of which he has but part control.

Many cases could be cited to prove that, although the officers and staff are better paid by companies than by public bodies, the result of transfer to a public authority has been to increase the cost of administration.

If sole control by one officer is impracticaple, the authority should insist upon the officials acting under a single or joint committee, having their respective duties properly defined, and, to prevent duplication of work, it should be incumbent upon the officials to agree upon the forms of accounts and books to be used, so that, in whichever department they be kept, they shall equally serve the purposes of all concerned. Where agreement seems impossible, the question in dispute should be settled by the one committee, after hearing both officers concerned, and on sound practical and economical lines.

Minutes.—All minutes of proceedings should be indexed in a manner convenient for reference, and it is an excellent plan to make a simple marginal note against each entry indicating, for instance, whether the matter was "disposed of," "adjourned," "reconsidered," or "new matter"; while a copy of every minute should be at once sent to the officer responsible for carrying out the resolution.

Statistical Reports.—At each regular board meeting statistical information relating to the previous month should be presented, and give particulars as to: (1) Sources of supply, (2) consumption and distribution, and (3) receipts and expenditure.

Under the first heading should fall statistics as to rainfall, percolation, water levels in wells, storage in reservoirs, steam gaugings, the quantity drawn or pumped in each week from each source, together with its destination in each case, filtration and treatment, and the results of analyses and bacteriological examinations.

Under the second heading there should appear information relating to the number of services in operation, the population supplied, the separate quantities of water used for domestic and other purposes, the consumption per head per day for domestic supply, and, where the water is pumped, the weekly consumption of fuel, oil, etc.

Under the third heading, dealing with finance, there should be given particulars of all monies paid, received, and in hand or arrears, both on capital and revenue accounts, which can best be done by the adoption of a "cash sheet," the headings being varied to suit the character of the works in operation.

Much of the statistical information previously indicated can well be presented in the form of continuous diagrams, whereon the weekly or monthly fluctuations extending over a period of twelve months or more, may be seen at a glance from the plotted curves. The authors have found that this graphic method of presenting statistics is much appreciated by members of committees and boards, as being more lucid, and obviating the necessity for laborious searches through tabulated figures.

Order Books.—All goods and work should be ordered through the medium of order books, with counterfoils upon which can be noted the dates when the order was completed, the account certified, and the price charged, these particulars being of value for the purposes of reference, estimating outstanding liabilities, and hastening the presentation of accounts by dilatory tradesmen, who should be required to render these either monthly or quarterly, but in any case regularly, and with the order number placed against each item.

Accounts.—The accounts for such goods and work, and for wages, should be certified by the manager, who alone has the technical knowledge and information necessary to determine the correctness of the charges, and he should note upon the face of each account the amounts to be severally allocated under the proper heading of detailed expenditure.

Cash Sheet.—In order to avoid confusion, these headings must be agreed upon between the manager, accountant and auditors.

These main headings cannot be conveniently extended to all the sub-divisions of expenditure or receipts, which it is most desirable should be adopted by the manager, who should keep a book, or books, which will show at a glance the expenditure and receipts in such detail as to constitute this a cost-price book, particularly separating labor and material as distinct items. However many sub-divisions are adopted, they must be assembled in groups under the main headings already referred to, and the totals found by such grouping must be the amounts transferred to the cash sheet.

The expenditure on capital account should be entered in a separate book without printed headings, the particulars or name of each work or job furnishing a separate heading until its completion, and great care should be taken that all order forms should distinctly state that the amount is chargeable to capital, and that a separate account thereof is to be rendered by the tradesman or contractor.

Detailed Data.—The manager should also keep a book, or books, into which, as soon as received, must be entered the daily, weekly, or other regularly-collected data necessary to furnish the statistics and plot the diagrams already referred to, and such other details as may seem desirable or are essential to a thorough insight to the working of the undertaking, or the production of reliable data as evidence, when such is needed, and when its absence would jeopardize the interests of the proprietors.

Requisition Book.—The manager should keep a requisition book, to be presented and signed by the chairman at each meeting, which should set out in detail all the goods and work required or to be done prior to the next meeting, as well as such as may have been wanted at short notice, and were not included in the list for the preceding period. A column should be provided and filled in with the number of the order when given out, this enabling the manager to note at a glance any irregularity upon the part of clerks in issuing the orders.

For the purposes of auditing, this system is useful in tracing any item of expenditure from the authority to purchase right up to its payment and allocation in the accounts.

Time Sheets.—Time sheets should have separate columns for the entry of each day's work, and one for the description of work performed, the latter entries being repeated where any man is employed upon more than one class of work.

Pay Sheets.—All weekly pay sheets should be prepared in the office from time sheets kept at and issued from each labor center, these latter only recording the time actually employed, for in no case should estimating be permitted.

The pay sheets, when assembled together in the office, should have attached to them a summary indicating the allocation of the expenditure under its proper headings, that under capital account being kept distinct and, by preference, on separate sheets.

Stores Account.—The keeping of suitable stores and stock accounts, while imperative, presents many difficulties, the ideal and theoretically perfect system, which some accountants would insist upon, being in the majority of cases practically impossible, owing to the detached character of the operations of a waterworks undertaking and the limited capacity of the average foreman to keep anything like satisfactory books or accounts.

The more experienced accountants and auditors recognize these limitations, and seek, by consultation with the manager's department, for a compromise which, while affording reasonable safeguards against dishonesty, is not impracticable, cumbersome, irritating, nor abnormally costly in operation, it being an undoubted fact that where such a compromise has not been effected there are cases where pounds are being expended to detect the just possible leakage of pence and the impossible loss of shillings, except through such acts of gross dishonesty as could hardly fail to be traced and detected by less cumbersome means.

With this little exception the goods used in a waterworks undertaking are neither easily carried away nor readily disposed of if stolen. The chief exceptions are brass taps or fittings and lead pipe; of the former a stock account is easily kept, and the legitimate use of the latter can reasonably be checked and accounted for if issued from a central depot; but any system having as its objective the hunting down of fag ends of pipes and stray tools is predoomed to failure; the fag ends mostly go, and can always be alleged to have gone, into the lead pot; and small tools do accidentally get lost and buried in trenches, and thus cannot be accounted for.

Stocktaking.—Stock of every sort should be taken regularly, and at least once a year, in such detail that its value can be computed.

In any stocktaking system which can be recommended the prime cost of each item will, at some prior date, have appeared in the books, but this will not by any means be its proper valuation after the lapse of time. Such value must be assigned to it as is arrived at by applying a regular rate of depreciation, due regard being had to the more or less perishable character of the goods.

One of the foremost duties of the waterworks manager is to keep an up-to-date and correct record of the underground system of pipes, valves, and fittings, showing, upon suitable maps, their location, size, and, in exceptional cases, their depth.

Where possible the date at which they were laid should be marked upon the maps, or, alternatively, be registered in a book. This work permits no delay, and should be done as soon as the work is completed, while, in the case of old and unrecorded work, no occasion should be missed, when pipes are laid bare for any purposes, of obtaining and recording all the particulars mentioned and of noting the structural condition of the materials.

In the author's experience it is the exception rather than the rule to find this done properly, or even at all, and it frequently happens that all the information available as to the location and size of pipes, valves, and complicated connections is centered in some elderly turncock who, for selfish reasons, is too often indisposed to impart his knowledge to another.

The preparation of engineering drawings is outside the scope of this paper, but it is the duty of the manager to obtain and keep for reference copies of the corrected drawings of all works as finished, and not, as is often the case, the originals, upon which alterations made during progress are either absent or very imperfectly portrayed.

Keeping [illegible] *Drawings* [illegible] mize space and avoid [illegible] original drawing should, after a safe interval, be destroyed and give place to the corrected copy, and it is strongly recommended that the bulk of the drawings should be on tracing linen.

Filing of Specifica- [illegible] tions, reports, and sheets of statistics (other than those entered in books) should be filed and, more conveniently still, be from time to time bound up in suitable volumes, it being hardly realized what concentration of matter, order and economy of space can thus be effected at a trifling cost for binding.

All statistical matter to which frequent reference has to be made should be in books, even where the system of keeping records in the diagram form is also in vogue.

Diagrams.—These diagrams, to which reference has already been made and their special use pointed out, should be kept well up to date, and plotted to scales large enough to bring into clear relief all characteristic variations of any importance, but not so large as to extend the diagrams to unwieldy size, it being desirable that each should record the data for at least twelve months back.

APPLICATIONS AND [illegible]

Application Forms.—Applications to supply any premises with water for domestic purposes should be on proper forms.

Upon every occasion when there is such change of ownership or occupancy that liability to pay the water charges is removed from one person to another, the signing of a fresh application form should be insisted upon.

Each application form should state the character and position of the fittings from which water is to be used, and upon the receipt of each an inspector should be sent to verify this information and make a thorough inspection to see whether the pipes and fittings are all in accordance with the regulations, and only after the receipt of his satisfactory report should the water be turned on.

The application forms constitute contracts, and should bear numbers, assigned to them consecutively as soon as all formalities have been complied with and the water turned on.

The applications accepted during the past month should be laid upon the table at each committee or board meeting, and after that filed in numerical order. Any contracts annulled or replaced by fresh contracts relating to the same premises should either be destroyed or withdrawn from the general file and assembled apart.

Similarly, application forms or contracts for the supply of water for building purposes, gardens, or trade uses should be numbered and filed in numerical order and assembled separately for reference.

INDEX CARDS AND RENT ROLLS

The preparation of rent rolls involves the expenditure of much time and labor, so that any device by which these can be reduced and the collections advanced should be welcomed.

Index Cards.—There has been devised and put into successful operation a system which by the use of "index cards" at once furnishes the means of reducing labor and the establishment of a record in the most convenient form for reference; and it is therefore proposed to describe in considerable detail the principles, use and application of the cards as being well worthy of close consideration by waterworks managers.

As far as the authors are aware the system they are about to describe was first elaborated by Mr. Kemna, manager of the Antwerp Waterworks Company. It has since been adopted by other companies with which the authors are either separately or jointly connected.

The cards recommended for use are about 4¾ ins. by 3 ins., with a single perforation for wiring them in file boxes; those referring to ordinary domestic supplies are of white color, while those for trade meter, garden, building, or other special purposes are of distinctive colors.

The boxes may be of any convenient depth, [illegible] streets or districts arranged in permanent topographical order, and irrespective of color.

At the outset each card stands for a house or premises having a distinctive address, supplied with water under an application form with a consecutive number, liable to the charges named in that contract, and furnished with the fittings enumerated therein.

As soon as brought into use, and year by year thereafter, each card assumes a number and stands for the same in the rent roll to which it relates, and on the demand notes and receipts for the whole year.

Directly after water has been turned on to any premises a card should be prepared by writing at its head the address with a line ruled under it; and close below this, on the left-hand side, the number assigned to the application form or other contract, followed by the name of the contracting party liable for the charges, and the total charges collectable per quarter, or the conditions of the meter, or other contract, all these particulars being copied direct from the application form or contract. On the back of the card should be noted the date when the water was turned on, and following this the particulars of the fittings, which also appear on the application form or on the report of the initial inspection of the premises.

Each card thereupon becomes a register of all the particulars of a distinct supply, and only in case of dispute is reference to the application form or contract necessary.

Assuming an undertaking to be started at the commencement of any year, and that, say, 1,000 supplies for domestic purposes were then turned on, that number of cards would have been prepared and must then be placed in file boxes in their proper topographical order. The next operation would be to assign them their rent roll numbers, which would be from 1 to 1,000, following the topographical order throughout and whether in one or a dozen boxes. These numbers must be put on the front of the cards on the right-hand side, on the same line as the name already there written.

Cards relating to meter supplies, etc., of distinctive color, are dealt with in a similar manner and placed topographically among the white cards.

Everything will be then ready for simultaneously writing up the rent rolls, the demand notes, and the corresponding receipts.

Rent Rolls.—The rent roll will have at its left-hand margin a column into which already have been written or stamped consecutive numbers beginning at 1 and ending at 1,000, and neither address nor name need be written in the roll.

Following the marginal numbers from left to right the double pages of the rent roll are ruled in four groups of columns headed First, Second, Third and Fourth Quarters, and containing, as sub-headings, arrears (brought forward), water rate, payments, allowances, and voids for each quarter, with a space at the right-hand edge of the book in which to write a reference number to next year's rent roll for arrears carried forward.

In this manner each rent roll deals with one year, and may conveniently contain 5,000 marginal numbers and be of such size as may be kept in a small safe. Each double page of a rent roll is ruled horizontally, with a space at the foot of each column for totals.

Rent Roll Summary.—A similarly ruled book may be used as a rent roll summary, with marginal numbers indicating the successive pages of a rent roll, the columns of which are added up quarterly and their totals on each page entered in the summary, where they are again totalled so as to show quarterly the credit and debit accounts between the water authority and its consumers.

Meter [illegible] supply rent rolls the entries under the heading "gallons consumed" are obtained from the meter reading books and the charges for the previous quarter entered in the appropriate column. Reference to meter reading books is made below.

Method of [illegible] with the white card now bearing the number 1, a clerk calls the necessary particulars, another enters opposite No. 1 on the rent roll the charges, while yet another enters on the demand note and receipts already correspondingly numbered the same charges, and, in addition, the name and address; card No. 2 is then read off, and so on throughout the series.

It will thus be seen that, owing to the cards being arranged in both topographical and numerical sequence, a reference to the rent roll [illegible] the property, all particulars connected therewith, and the application form, and that by the simple process of adopting a quickly stamped or written number it becomes unnecessary to reproduce, and year after year repeat, on the rent roll matter permanently inscribed on the cards; while, incidentally, attention may be called to the saving in space and consequent reduction in the size of the rent rolls themselves.

The colored cards with their corresponding rent rolls, demand notes, and receipts are then dealt with in the same manner.

Temporary Rent Rolls.—Between the commencement and end of each year (or rent roll period) new supplies will come into operation and furnish the basis for charges which cannot be put into the current rent rolls without causing confusion, and to provide for these a supplementary or temporary rent roll for each class of supply should be kept, and this should have space reserved for the address.

Assuming that there are 500 such new supplies for domestic purposes during the year, the first of these should, following the last number in the general current roll, receive the number 1,001 and the last 1,500.

Returning now to the index card procedure, in each such case the card must be prepared as before, but the rent roll number be prefixed by the letters "T.R.," indicating the temporary rent roll, into which the particulars must then be entered, as well as onto the demand note and receipt, after which the card should be filed in its proper box according to its topographical position.

If no properties have in the interval ceased to be supplied, there will at the end of the year be 1,500 cards in the boxes, and the new rent roll numbers range from 1 to 1,500; and as each is in its proper place the cards have only to be taken out in rotation and be numbered in regular sequence from first to last, each number being placed under that for the last year, after which the rent roll and demand notes and receipts can be made up as before.

Where a property ceases to be supplied altogether, the card should be permanently withdrawn or replaced by a card of distinctive color bearing only the address of the void premises, but in cases where one contract ceases and a new application form applies, the original card remains as the index to that particular property or supply, and must be revised by inserting on the first clear line below the last rent roll number the application form number, the name, and the charges payable under the new contract, followed by the temporary rent roll number, while on the back must be noted the date when the supply was turned on, and any necessary correction in the description of the fittings; after which the card is returned to its place.

Cards which become filled with details should be replaced by new ones, into which the paramount particulars and the data for the current year must be transferred, the old card being either destroyed or filed apart, but there is really little use in keeping them for, at any rate, longer than a year.

In order to avoid the use of numbers exceeding four figures, on either cards, rent rolls, or demand notes, it is well to distinguish the collecting districts by letters A, B, C, and so on, and using these in combination with the rent roll numbers.

These letters need not be repeated in

Lawrence Experiment Station Studies in the Purification of Sewage.

During the year 1910 studies of the purification of sewage were made at the Lawrence Experiment Station by H. W. Clark and Stephen De M. Gage. The results of these studies are summarized in the annual report of the Massachusetts State Board of Health for 1910.

During the year 38 filters were in operation in investigations upon the purification of domestic sewage. The sand filters to which sewage has been applied for 23 years, and the trickling and contact filters operated for eleven and nine years, respectively, have been continued. The prolonged operation of these various filters continues to yield valuable information concerning many problems relating to sewage purification and to the methods of operation necessary to maintain sewage filters in good working condition. Particular attention has been paid to methods of preliminary clarification of sewage designed to prevent the clogging of various types of filters, and thus to increase the length of life of such filters and their capacity to purify sewage. The disposal of sludge, which is one of the most serious problems in the purification of sewage on a large scale, has received attention, as in past years. Studies of tanks for the concentration of sludge, and of certain filters constructed of horizontal layers of slate, installed in 1909 and first operated at Lawrence in 1901, have been continued. The present abstract will cover only the experiments with the contact and percolating filters.

PRELIMINARY TREATMENTS FOR CLARIFICATION OF SEWAGE.

Studies upon the clarification of sewage before filtration have been continued during 1910. The large settling tank, installed in 1906 for the clarification of the sewage applied to trickling and contact filters at the station, has been continued in operation. This is a cylindrical tank with a sloping bottom, near which the sewage enters and then rises slowly to an outlet near the top, the period of sedimentation being about two hours and the maximum velocity of the rising sewage being about 1 in. per minute. The accumulated sludge has been removed from this tank each week. During the year the average removal of matters in suspension by this tank has been about 53 per cent as shown by albuminoid ammonia determinations, and about 71 per cent as shown by determinations of total and organic solids. The total removal of organic matter has been 34 per cent as shown respectively by the total albuminoid ammonia and by the oxygen consumed determinations, and about 29 per cent as shown by total organic solids.

The work of the settling tank, which is a part of the sewage-disposal system of the town of Andover, has also been noted, as in previous years. This tank has a capacity of about 13,500 gals., and the average time required for the sewage to pass through it is approximately two hours. The average removal of suspended matters by this tank during the period from April to November, 1910, inclusive, was about 49 per cent, as shown by albuminoid ammonia determinations. About 66 per cent and 54 per cent of the total organic matters were removed as shown by albuminoid ammonia and oxygen consumed determinations, respectively.

Strainer E, containing 12 ins. in depth of buckwheat coal, was put into operation in 1901, and has been operated at a rate of 800,000 gals. per acre daily throughout 1910. Sixty-six per cent of suspended matter was removed, as shown by albuminoid ammonia determinations; and the total removal of organic matter was about 39 per cent, as shown by albuminoid ammonia and oxygen consumed determinations. The work of this strainer is remarkable and in some respects unexplainable. Year after year it removes large percentages of suspended matter from the sewage, and by some biological process not fully understood appears to destroy this matter with great rapidity. During the entire nine and one-half years which this strainer has been receiving sewage at rates of from 800,000 to 1,500,000 gals. per acre daily, averaging 1,000,000 gals. per acre daily, sludge has been removed from the surface only twice, and the filtering material has been raked or otherwise disturbed only four times. The two scrapings were made during the first year of operation. Of the four other disturbances of material, three were necessitated by the collapse of the tank, requiring the transfer of the material to a new tank. From Sept. 23, 1905, when the material was last transferred, to Jan. 28, 1910, when the strainer was raked to a depth of 3 ins., or during a period of four and one-third years, no treatment of the surface or removal of sludge was required.

In addition to these methods of preliminary treatment of sewage, studies have been made with tanks constructed of layers of slate and operated on the contact principle. The results of the operation of these tanks will be given below.

CONTACT FILTRATION.

Filters Nos. 175, 376 and 377.—Studies upon purification by contact filtration have been continued, and three contact filters were operated for this purpose during 1910. One, Filter No. 175, is constructed of coke, and has been in operation about ten years; the other two, Nos. 376 and 377, are constructed of horizontal layers of slate, and have been in operation for about one and one-half years to study the deposition and destruction of sludge by this method. Such filters were first operated at the station in 1901, and they have been exploited abroad during recent years.

Filter No. 175, 1/20,000 of an acre in area and 5 ft. in depth, was first put into operation on June 3, 1901, and is constructed of pieces of coke of such size that all will pass through a sieve having a 1-in. mesh, 75 per cent through a ½-in. mesh and practically none through a sieve with a ¼-in. mesh. This filter has always received strained sewage, is filled once daily with one application of sewage, allowed to stand full two hours before draining, and rested every sixth week. Its average rate of operation during 1910 was about 359,000 gals. per acre daily. On Dec. 1, 1909, 52 per cent of the original open space of this filter was occupied by deposited matters. Until the end of May the open space of the filter remained fairly constant, but during July and August the amount of deposited matters increased until about 63 per cent of the voids in the material were filled. During the latter portion of the year the filter gradually relieved itself of this clogging material, and the open space at the end of the year was only slightly less than at the beginning of the year.

Filters Nos. 376 and 377, put into operation on July 9, 1909, are constructed of layers of roofing slate placed horizontally, the layers of slate being separated from one another by small concrete blocks ¾ in. thick. Filter No. 376 has a superficial area of about 1/4,200 of an acre, and contains 27 layers of slate, the exposed surface available for the deposition of sludge being about 314 sq. ins. for each gallon of sewage contained within the filter. Filter No. 377 has a superficial area of about 1/6,500 of an acre, and contains eight layers of slate, the area available for the deposition of sludge amounting to about 187 sq. ins. per gallon of sewage. Both filters are so arranged that the layers of slate can be cleaned by flushing. Filter No. 376 has received regular station sewage and Filter No. 377 the fresh supernatant sewage from the Imhoff tank, both filters being operated as contact filters and filled in one dose applied daily. Until June 1, 1910, the sewage was allowed to remain within the filter for two hours, but after that date the contact period was reduced to one hour. Both filters have been operated six days a week without systematic resting.

The average removal of suspended matters by Filter No. 376 during the year was about 41 per cent, as shown by determinations of albuminoid ammonia in suspension, and about 39 per cent, as shown by determinations of total solids in suspension. The total removal of organic matters was about 22 per cent, as shown by albuminoid ammonia determinations, and 25 per cent, as shown by determinations of oxygen consumed and total organic solids. The average removal of suspended matters by Filter No. 377 was about 11 per cent, as shown by determinations of albuminoid ammonia in suspension, and about 53 per cent, as shown by determinations of total solids in suspension. The total removal of organic matters during the year by this filter was 11 per cent as shown by the albuminoid ammonia determinations, 7 per cent as shown by the determinations of oxygen consumed and 16 per cent as shown by determinations of total organic solids. In comparing the removal of suspended matters by these two filters, it should be borne in mind that a considerable proportion of the suspended matters had been removed from the sewage before it was applied to Filter No. 377, while none of the suspended matters had been removed from the regular sewage applied to Filter No. 376.

On March 19 sludge equivalent to about 1 per cent of the capacity of the filter was removed from Filter No. 376. At the end of the year about 10 per cent of the capacity of each filter was occupied by accumulated sludge. Up to the end of April there was a gradual increase in the amount of sludge held in Filter No. 376. During the summer, however, a considerable amount of this sludge was eliminated, and much of the lost open space was recovered.

Further than the removal of suspended matters, the amount of actual purification accomplished by these two filters has been very small, and nitrification has been feeble. The average amount of nitrates in the effluent from Filter No. 376 during the year was only .09 part per 100,000, and in the effluent from Filter No. 377 only .27 part. Judging from the results during the year, and from the experience obtained with similar filters operated in 1901 and 1902, filters or tanks of this type cannot be expected to accomplish more than a preliminary clarification of sewage, and for this reason they should perhaps be classed and compared in efficiency with other clarification treatments. It will be noted that slate Filter No. 376 was far less successful in removing suspended matters than either the coal strainer or the setling tank operated with the same sewage. The value of the slate-filled tanks for the digestion of sludge, and for giving it such a composition and consistency that it may readily be disposed of, cannot be stated from the results at present available.

OPERATION OF TRICKLING FILTERS.

Filters Nos. 135, 136, 222, 248, 360, 361, 362, 363 and 364. During 1910, ten trickling filters have been operated, eight at the experiment station and two at the Andover filtration area. Of the eight filters at the station, six were constructed of broken stone, one of clinker and one of metallurgical coke. Two of the broken stone filters, Nos. 135 and 136, have been in operation for over eleven years. With three filters, Nos. 360, 361 and 362, the effect of different size and character of material, of different depths of filtering material, and of uniform and uneven distribution of the sewage upon the surface have been studied comparatively. With two filters, a direct comparison has been made of the relative ease of purification of settled sewage at Lawrence and Andover. Filter No. 363 has been used in studies of the refiltration of trickling filter effluents, and will be found described below. All of these filters, except Filter No. 222, have had the sewage applied to them by means of automatic tipping basins discharging into perforated pans. Filter No. 222, which is of the same size as the large sand filters at the station, is located at Andover, and has had sewage applied to it by means of a large mechanical distributor of the Fiddian type.

Filters Nos. 135 and 136, 1/20,000 of an [illegible] acre in area, [illegible] constructed [illegible] of broken stone, all of [illegible] through a screen with a [illegible] cent through a screen with a ½-in. mesh and 4 per cent through a screen with a ¼-in. mesh. These filters were first put into operation in November, 1899. Settled sewage has been applied to each throughout the year at a rate of approximately 2,000,000 gals. per acre daily, the filters being operated seven days a week, and receiving one hour's rest night and morning. Operated in this manner, the filters have continued to yield well-nitrified effluents at all times, and no trouble from clogging has been experienced.

Filter No. 218, 1/20,000 of an acre in area and constructed of 8 ft. in depth of material [illegible] and 136, was first put into operation on May 16, 1904. Settled sewage has been applied to this filter six days each week throughout the [illegible] 2,000,000 gals. [illegible] Nitrification has been active within the filter, and the effluent of the filter has been nonputrescible.

Filter No. 222, 1/200 of an acre in area, is located at Andover, and was first put into operation in July, 1903. In April, 1906, the filter was rebuilt, and at present consists of 6 ins. of cobble stones above Akron pipe underdrains, overlaid with 7 ft. of broken stone all of which will pass through a screen with a 1½-in. mesh and none of which will pass through a screen with a ¾-in. mesh. Andover settled sewage was applied to this filter seven days each week from April 1 to the end of the year at a rate of 1,500,000 gals. per acre daily, by means of a self-propelled traveling distributor of the Fiddian type.

As noted in a previous report, the effect of more uniform distribution of the sewage upon the surface of this filter resulted in an increase in nitrification and an improvement in the quality of the effluent over that of previous years. The improved nitrification has been even more marked during the past year.

A comparison of the uniformity of distribution and of the quality of the effluent from this filter when operated with the two different types of distributors may be of interest. As the revolving distributor could not be operated during the winter months, only the summer months, June to October, inclusive, may be used in such a comparison. During these months the amount of nitrates in the effluent from the filter averaged 0.01 in 1907 and 0.57 in 1908. During these two years sewage was applied by the dashplate distributor, about 24 per cent of the surface receiving little or no sewage, about 23 per cent of the surface receiving sewage at rates of between 500,000 and 1,000,000 gals. per acre daily, about 17 per cent of the surface receiving sewage at rates of from 1,000,000 to 2,000,0000 gals. per acre daily, about 20 per cent of the surface receiving sewage at rates of from 2,000,000 to 4,000,000 gals. per acre daily, the remaining 16 per cent of the surface receiving sewage at rates of from 4,000,000 to 7,500,000 gals. per acre daily.

The rotary distributor was installed in April, 1909, and distribution measurements showed that about half the surface received sewage at approximately the intended rate, that is, between 1,000,000 and 2,000,000 gals. per acre daily, while about one-fourth of the surface received less than 1,000,000 gals. per acre daily, and the remaining fourth of the surface received sewage at a greater rate than 2,000,000 gals. per acre daily. The highest rate on any portion of the surface with this type of distributor, however, was only 3,250,000 gals. per acre daily, or about half of the maximum rate at which sewage had been applied by the dashplate system. Immediately following the installation of the rotary distributor, nitrification increased, the average nitrates in the effluent during the following six weeks being 0.69 part, a result higher than had ever been obtained with this filter previously. The nitrates in the effluent from the filter averaged 1.09 parts per 100,000 during the summer of 1909, and 1.69 parts during the same period of 1910. This improvement in [illegible] filter has been operated at approximately the same rate during the [illegible] quoted in all [illegible] increase in strength, the [illegible] of the ap- [illegible] containing 8 ft. 9 ins. in depth of material held in place by open cobwork sides, were started Nov. 11, 1908. Filters Nos. 360 and [illegible] stone having a mean diameter between 1 and 2 ins., and Filter No. 362 was filled with pieces of hard clinker having a mean diameter of from 4 to 6 ins. All of these filters had underdrain channels open at each end in order that any sediment might be readily [illegible] placed in the material in Filter No. 361 at different levels, from which samples were collected regularly to show the amount of purification of the sewage after it had passed through 2, 4, 6 and 8 ft. of filter material, respectively. Settled sewage was applied to each of these filters at a rate of about 1,500,000 gals. per acre daily until October 31. On November 1 Filters Nos. 361 and 362 were discontinued, and the rate of Filter No. 360 was increased to 2,000,000 gals. per acre daily. In the present discussion only the period from Dec. 1, 1909, to Oct. 30, 1910, will be considered. The distribution of sewage upon Filters Nos. 361 and 362 has been practically uniform over the whole surface, while the distribution upon the surface of Filter No. 360 has been so arranged that although the net rate upon the entire area was the same as that on Filters Nos. 361 and 362, the sewage was applied at a gradually increasing rate from one side of the filter surface to the other, as is the case with portions of the surface of trickling filters, which are equipped with distributors of the nozzle or dashplate types. The underdrain system of this filter is divided into three distinct collecting areas of equal size, and the whole filter may thus be considered to be composed of three separate filters united in one container, these being designated as Nos. 360A, 360B and 360C. Frequent measurements have been made of the rate at which sewage is applied to each of these sections, and separate samples of the effluent have been regularly collected from each underdrain system. The operation of these three filters during the past two years furnishes a number of interesting comparisons.

During both years the amounts of free and albuminoid ammonia were less in the effluent from the filter of large pieces of clinker than in the effluent from that constructed of a smaller grade of broken stone. Nitrification was slightly more active within the clinker filter during the first year, but the reverse was the case during the second year, and the average nitrates during the two years were practically identical.

Samples from the different depths in Filter No. 360 illustrate the continual increase in purification of the sewage as it passes through a trickling filter, and emphasize the desirability of deep filters. The average amount of free ammonia during the two years decreased from 3.75 parts per 100,000 in the settled sewage to 2.70 parts after passing through the first 2 ft. of material, to 2.39 after passing 4 ft., to 2.08 after passing 6 ft. and to 1.93 after passing the entire filter, a progressive reduction of 28, 37, 45 and 49 per cent, respectively. Nitrification also increased, almost in proportion to the depth of filter through which the sewage had passed. The average amount of nitrates in the effluent during the two years was 0.38 part after passing 2 ft. of material, 0.80 part after passing 4 ft. of material, 1.14 parts after passing 6 ft. and 1.25 parts after passing the entire filter.

The effect of uniform and unequal distribution is not so well shown as was hoped when Filters Nos. 360 and 361 were planned. The average effluents from both filters were satisfactorily purified and were much the same in quality. If anything, the effluent from Filter No. 361, upon which the sewage was uniformly distributed, was slightly inferior to that from Filter No. 360, having an unequal distribution of sewage. From this it should not be assumed, however, that uniform distribution of sewage upon filters of this type is unnecessary, as the effect of unequal distribution was evidently overballanced by other factors. The difference between the highest and lowest rates upon different portions of Filter No. 360 is much less than the differences in rates upon adjacent portions of trickling filters, to which sewage is applied by means of fixed distributing nozzles. Furthermore, the highest rate at which sewage was applied to any portion of Filter No. 360 averaged only about 2,000,000 gals. per acre daily, at which rate satisfactory purification has been obtained at times with other trickling filters at the station. With a larger filter and improved differential distribution and collection systems, the effect of unequal distribution would undoubtedly be much more strongly marked. The results illustrate to a certain degree, however, how the effluent from a filter may be a mixture of effluents from different portions of that filter in very different stages of purification. For example, the average effluent from the entire filter containing about 1.54 parts nitrates per 100,000 was a mixture of 52 per cent of the effluent from Section A, containing 1.14 parts nitrates; 32 per cent of the effluent from Section B, containing 1.89 parts nitrates, and 16 per cent of the effluent from Section C, containing 2.12 parts nitrates.

Filters Nos. 391 and 392 were put into operation on April 29, 1910, to study comparatively the purification by trickling filters of the settled sewage obtained at the experiment station and at the Andover filtration area. These filters were 1/80,000 of an acre in area, and were constructed of 8 ft. in depth of pieces of broken stone between ½-in. and 1½ in. in diameter. Filter No. 391 was located at the experiment station and Filter No. 392 at Andover. Each of these filters was operated at a rate of 1,000,000 gals. per acre daily until the end of October. Nitrification was somewhat slower in starting in the filter receiving the Andover settled sewage, but during the months of August, September and October, when nitrification was active in both filters, the nitrates in the effluent from the filter located at Andover averaged over 3 parts per 100,000, or about twice as great as in the effluent from the filter receiving the Lawrence settled sewage. These results apparently contradict the statements made in previous reports that poor purification of Andover settled sewage by trickling filters was in part attributable to the character of the sewage, and confirm the statements made elsewhere in this report that the purification of this sewage in a satisfactory manner by properly constructed trickling filters is largely a question of rates and of uniform distribution of the sewage over the surface of such filters.

TRICKLING FILTERS.

Systematic determinations of the putrescibility of the effluents from contact and trickling filters have been continued as in previous years. As stated in previous reports, filters constructed of coarse materials and operated at high rates cannot be expected to yield clear, bright effluents as is the case with sand filters. When properly constructed and operated, however, such filters may produce well-nitrified and nonputrescible effluents, which after clarification by a short period of sedimentation may be disposed of satisfactorily by dilution. Various methods of determining and expressing putrescibility are in use in different laboratories. At the station the procedure has been to note the production of odor or of blackening of the samples in completely filled glass-stoppered bottles during five days' incubation at 80° F. This method is believed to show true putrescibility, that is, putrefaction, and is not influenced by minor reducing actions within the sample, which in many other methods would influence the results.

During both years all of the samples from trickling Filter No. 135 and from secondary Filter No. 363 have been entirely stable, and the effluents from the trickling Filters Nos. 136 and 248 and from contact Filter No. 175 have been found to be putrescible or doubtful only at rare intervals. On the other hand, the effluents from the slate contact Filters Nos. 376 and 377 have been putrescible practically all the time, and the effluent from Filter No. 176, which was stopped at the end of 1909 because it was so badly clogged that reducing actions within the filter predominated over nitrification, was either putrescible or of doubtful quality about two-thirds of the time. The effluent from trickling Filter No. 362, constructed of large pieces of rough clinker, was of much better quality as regards stability than was the effluent of its companion filter, No. 361, of the same depth and operated at the same rate, but constructed of somewhat smaller and smoother pieces of broken stone. The effluents from the sections of trickling Filter No. 360 illustrate the effect of varying rates upon stability of the effluent. The chemical analyses show that the effluent from the section receiving sewage at the lowest rate, 700,000 gals. per acre daily or less, was stable 80 per cent of the time during its first year of operation and entirely stable at all times during its second year of operation; while the effluent from the section receiving sewage at the highest rate, 2,000,000 gals. per acre daily or over, was stable only 37 per cent of the time during the first year and only 69 per cent of the time during the second year. The effluent from the section of this filter receiving sewage at a rate intermediate between the other two sections yielded an effluent which was more often putrescible than that of the low-rate section, and more often stable than that of the high-rate section. It was noted that in spite of the improvement in nitrification in Filter No. 222, due to more uniform distribution of the sewage upon the surface, about one-third of the samples of the effluent were putrescible during each year. As stated in previous reports, the Andover settled sewage applied to this filter is very different in character and much more difficult to purify than is the settled Lawrence sewage applied to the filters at the station.

It has been stated frequently in preceding reports that, while it is theoretically possible to operate sewage filters in such a manner that non-putrescible effluents will be obtained even when the amounts of nitrates present are low, such operation is not practicable, and the experience at Lawrence has been that effluents which were nonputrescible were always highly nitrified, and *vice versa*. The figures in the table give additional confirmation to this opinion. In every case where the nitrates average over two parts per 100,000, all or practically all of the samples were nonputrescible. When the average nitrates were less than two parts but greater than one part per 100,000, with only one or two exceptions, from 10 to 50 per cent of the samples were putrescible, while those effluents with low average nitrates were putrescible during the greater part of the time.

REFILTRATION OF EFFLUENTS FROM TRICKLING FILTERS.

Filters Nos. 363 and 371.—Filter No. 363, 1/20,000 of an acre in area, is constructed of 4½ ft. in depth of pea-size metallurgical coke, and was first put into operation on Nov. 18, 1908. This filter has been operated as a trickling filter, and has received the effluents from Filters Nos. 135 and 136 at a rate of 4,000,000 gals. per acre daily seven days each week, these effluents being first clarified by sedimentation. Operating with effluents which were stable and well nitrified, this filter accomplished a still further reduction in the organic matters, and continued the nitrification so well begun in the primary filters.

Filter No. 371, 1/80,000 of an acre in area, and constructed of 2 ft. in depth of sand of an effective size of 0.23 millimeter, was first put into operation on May 20, 1909, and was continued in operation until Oct. 31, 1910. The combined effluents from Filters Nos. 361 and 362 have been passed through a settling tank having a capacity of about five and one-half hours' flow and then applied to this filter at a rate of 10,000,000 gals. per acre daily throughout the year. This filter has been operated continuously, much like continuous water filters, except that when clogged the whole body of sand in the filter has been washed in place by an upward current of water from below. The filter was washed 68 times during the year, the average quantity of water filtered between washings being about 39,000,000 gals. per acre.

The results obtained with this filter and settling tank furnish an interesting illustration of the further purification of trickling filter effluents by natural means. The nearly stable worked-over suspended matters coming from the trickling filters settle out readily in the settling tank, but these suspended matters were capable of further fermentation and disintegration as is shown by the fact that during the warm months, in spite of the frequent removal of sludge, there was some floating scum on the tank, with a certain amount of gas formation. This fermentation must not be confused with putrefaction, however, as no appreciable odors were produced. The clarification begun in the settling tank was completed in the filter, and the final effluent never contained more than a slight turbidity. The purification process going on in the settling tank and in the filter was the reverse of nitrification, the nitrates serving as the source of oxygen for further oxidation of the soluble matters. This is evident by the reduction in the amount of nitrates and increase in the nitrites and free ammonia in the applied effluents in their passage through the settling tank and through the filter. This was in a measure a retrograde process, but is undoubtedly the process taking place when such trickling filter effluents flow into water low in dissolved oxygen. The amount of nitrates remaining in the effluent, and the fact that this effluent always contained an appreciable amount of dissolved oxygen, insured a complete stability at all times, and this fact was confirmed by negative putrescibility tests throughout the year.

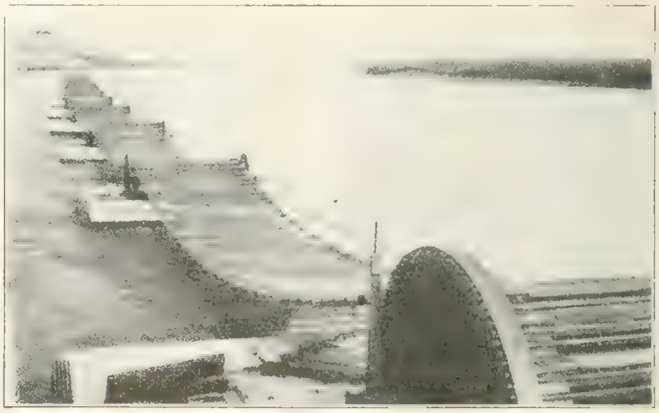
DRAINAGE AND IRRIGATION SECTION

A Novel Construction of Current Wheel for Irrigation and Its Failure.

(STAFF ARTICLE.)

Current wheels are among the oldest of devices for raising water for irrigation and drainage. When the conditions are favorable, namely a good current, a small lift, and a small quantity of water to be handled, permitting a wheel of small diameter and of "home made" construction, current wheels are exceedingly inexpensive pumping devices, and many such wheels are in use. There are also a number of larger wheels in use and frequently doubtless where their employment is poor economy. In form a current wheel is an undershot water wheel. Ordinarily the water raising device consists of a series of buckets attached to the rim, taking water from the channel at the lowest points of their travel and discharging it into a flume at the highest points. Frequently, however, the wheel is connected by gearing or chain drive to a pump of some sort. The wheel illustrated in the accompanying view is of the latter class. It is also a novel construction, in fact, in the ordinary sense, it is not a wheel at all. The designer describes it as a wheel with the spokes removed.

Referring to the illustration it will be seen that the device consists of an endless belt of paddles passing around a head shaft and extending down stream to a tail shaft carried on a barge. Intermediate barges support rollers or shafts which serve as idlers for the returning belt and keep it above the water surface. The outgoing belt dips beneath the water and passes under the floating barges. From head shaft to tail shaft the belt is 500 ft. long. It consists merely of a series of paddles carried on cables. In operation the lower line of paddles, dipping into the current, is carried downstream, thus rotating the head shaft from which the power is taken to operate the pumps. The paddles are 9 ft. long and 1 ft. wide, and there are 200 of them. By being mounted on barges, the adjustment of paddle submergence to stream level is automatic.



View of Current Power Motor Built for the Snake River Irrigation Works, Idaho.

Theoretically the current motor or "wheel" described is a sound design and practically it gave good power while its operation was unobstructed. In operation, however, the line of paddles travel slower than the current and, retarding the current under the belt, permit the water to deposit its sediment and form a bar. As the water shoaled the belt lost its power. The device was replaced by an electric motor for operating the pump.

Kansas City, Kan., during 28 months of municipal ownership of its water supply system, has made a profit of $102,317. The supply is said to be more abundant and of better quality than ever before.

Some Examples of Tidal Marsh Land Reclamation; Structures and Costs.

I.

[illegible]

Tidal marsh land reclamation presents certain advantages particularly [illegible] are its exemptions from [illegible] its general proximity to populous communities and the hygienic [illegible] comes from its drainage. It is also in large parts inherently fertile land. Tidal marsh reclamation too is being inquired into more actively as seaboard population increases and upland farms become more occupied. This journal has within the last twelve months published several articles on tidal marsh reclamation and in this issue it begins a series of half a dozen descriptions of specific works based on studies* made by U. S. Government engineers. These works are not presented as ideal examples of practice, in fact most of them are open to adverse criticism, but as studies the data from which are generally useful.

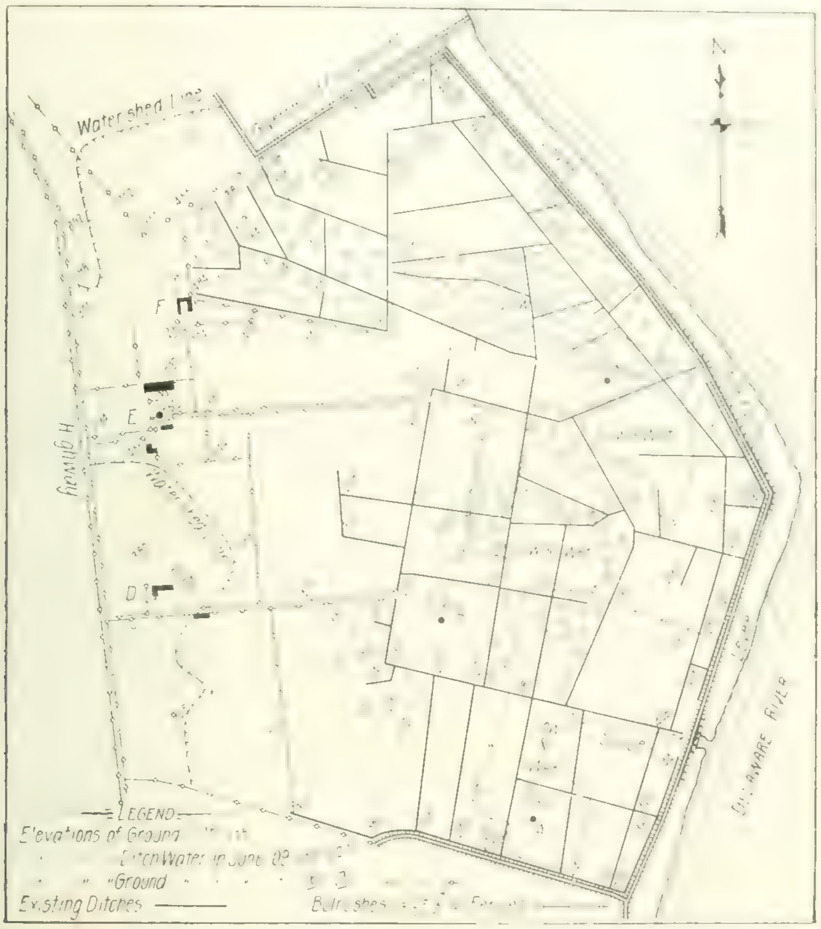


Fig. 1—Map of Reclaimed Tidal Marsh Land and Drainage System, Colburn Estate, Delaware.

COLBURN ESTATE DRAINAGE.

The accompanying map, Fig. 1, shows the drainage system covering some 488 acres of farms comprised in the Colburn estate, lying on the Delaware River south of Delaware City, Del. These works are as rebuilt in 1894, but the land has been reclaimed for [illegible] is a crescent-shaped basin whose surface is about 1.7 ft. above datum; behind this swale is the high land rising at the watershed to 9 to 11 ft. above datum. Outside the levee [illegible]

The plan of reclamation is conventional: [illegible] returns inland to the high ground; inside the levee is a ditch system draining to a sluice through the levee at the lowest land level. These structures, the levee, the sluice and the ditch system, will be described separately.

Levee.—Cross-sections of the levee at different points are shown by Figs. 2 and 3 and also by Fig. 4 which shows the sluice in longitudinal sections. In elevation the levee is irregular as it is in sectional profile, ranging from 9.1 ft. to 11.2 ft. above datum. The mean tide range is 5.9 ft., and about once a year it reaches 9 ft., and overtops the levee in places. The high water record is 11 ft., reached in 1878. On each side of the sluice for a short distance and for a longer stretch north of and around Reedy Point the water face of the levee is faced with stone.

Sluice.—As stated above Fig. 4 shows the sluice in longitudinal section. Figure 5 is a cross-section of the sluice. Figure 4 shows the elevations of the sluice opening with respect to the water levels. The gate construc[illegible] ness 2-in. unmatched plank flaps hinged at the top and unweighted. Near the center of each gate is 5x8-in. opening closed or opened by a horizontally sliding copper plate; this opening is to admit river water at times of drought. The gates served their purpose poorly, partly because they did not seal tightly and partly because careless oversight had allowed a strip to become missing on one of them, allowing the river water to flow through in quantity.

A study which was made of the sluice leakage is interesting as showing a common fault in the operation of tidal marsh drainage works and a fault which has contributed much to discourage such works. As the result of several observations the tide range and leakage and discharge curves shown by Fig. 6 were settled upon as showing the normal working of the sluice. Referring to the diagram it will be seen that during the 12-hour range there was a leakage of 163,447 cu. ft. and a discharge of 174,973 cu. ft.; the leakage was, therefore, nearly 94 per cent of the total discharge. As an average of all the observations made the discharge was found to be less than on the day selected for exhibition on the diagram. This average is 168,347 cu. ft. in which case the leakage would be 97 per cent of the discharge.

Tests were made to determine the coefficient of discharge *c* in the formula for sluice discharge,

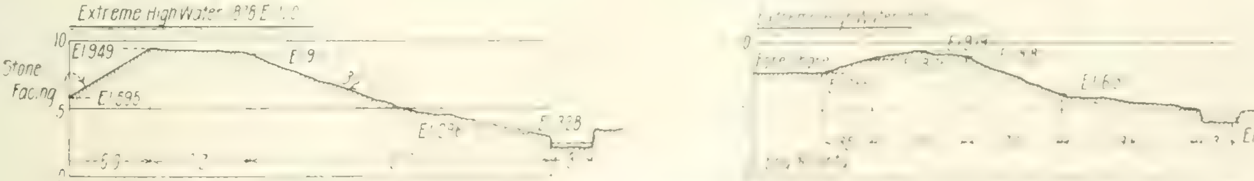
$$q = ca\sqrt{2gh},$$

in which q = quantity in second feet; c = coefficient of discharge; a = area of cross-section of flow in square feet; h = head in feet, and g = acceleration of gravity = 32.16.

It was concluded from the tests that for unweighted wooden flap gates in complete submergence, or where the emergence does not exceed 15 per cent of the vertical height of the gates, this coefficient has a value of 0.64. As the tide recedes further, the submergence and the buoyancy of the gates are diminished; gradually approaching the sealing position, successive inclinations and the dead weight of the gate became constantly increasing factors in the retardation of the flow. In consequence, the coefficient of discharge lessens rapidly and near low tide averaged about 0.46.

Ditch System.—The layout of the ditch system is clearly shown by the map, Fig. 1. There are 11.4 miles in the system, the ditches varying in width from 3 to 24 ft. and in depth from 6 in. to 4 ft.; the average ditch width is 12 ft., and the area occupied by ditches is about 5.3 per cent of the marsh land. A study was made of the ditch system to bring out the importance of clean ditches, that is, ditches free from silt, and from growths which choke the flow. These stoppages, due to poor maintenance, are one of the most commonly found faults in tidal marsh reclamation work and when coupled with sluice leakage often defeat very largely the purpose for which the works were provided.

To obtain specific data showing the effect of ditch silting and choking, gagings were made. It was found that [illegible] ear ditch at a point 3,600 ft. from the sluice, a movement of the water was observable 10 minutes after the gates began to open; in 12 minutes the flow was pronounced; in 30 minutes the mean velocity had risen to 15 ft. per minute; in 60 minutes the maximum mean velocity of 21.6 ft. per minute had been reached. For three hours while the gates were open the velocity of flow averaged about 15 ft. per



Figs. 2 and 3—Sections of Levee for Tidal Marsh Reclamation, Colburn Estate, Delaware

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*"Tidal Marshes and Their Reclamation," by George M. Warren, Bulletin 240, Office of Experiment Stations, U. S. Department of Agriculture.

minute and the water surface fell 1.12 ft. In a choked ditch only 300 ft. away from the clean ditch and 3,600 ft. from the sluice the water surface fell only ¾ in. during the three hours of sluice play. At another point 750 ft. further from the sluice the fall in water level was only ¼ in. In this ditch the water which started toward the sluice in 10 minutes after the gate was opened did not cover the distance of 3,600 ft. during the period of play.

While the above figures are for specific cases, they indicate what must occur in some measure anywhere that ditches are not maintained to their designed capacity. They may too be reasoned from to indicate what the drainage efficiency is certain to be of works similarly circumstanced. Referring to the preceding figures of sluice leakage we find a difference of only 4,900 cu. ft. per day between average sluice discharge and the leakage back into the ditch system. This 4,900 ft. represents the movement of upland ground water and the seepage from the river through the levee. Neglecting evaporation, this excess of discharge over leakage represents the removal of 10 cu. ft. of water per acre of drainage area twice each day. In case of rain, there exists the following conditions: A ditch capacity between elevations 0 and 1.6 ft. of 178,000 cu. ft., a leakage of 163,447 cu. ft. a percolation of 4,900 cu. ft., and a storage capacity of 9,453 cu. ft. [178,000 — (163,447 + 4,900) = 9,453]. Assuming 21 per cent runoff, a rainfall amounting to 1 in. in 24 hours would fill the ditches to elevation 1.6 ft. in 37 minutes and the flooding of the lowest areas would begin. As has been repeated, these figures are significant in a general way only as showing the direct consequences of the common faults of exclusive sluice leakage and of choked ditches.

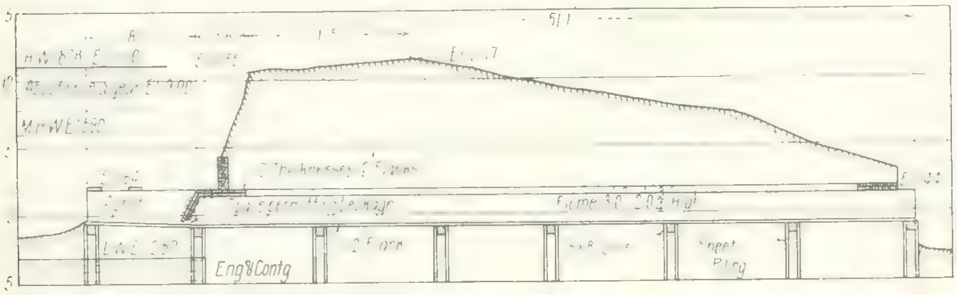

Fig. 4—Longitudinal Section of Sluice, Tidal Marsh Reclamation, Colburn Estate, Delaware.

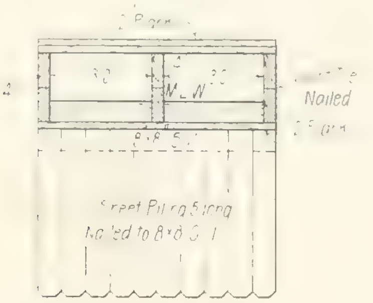

Fig. 5—Transverse Section of Sluice, Tidal Marsh Reclamation, Colburn Estate, Delaware.

Incidentally in the study of these drainage works records of the ground water level were kept from observations at six points lettered *A* to *C* on the map, Fig. 1. These records bring out one point of general interest which is that the water table is practically unaffected by the fluctuations of the tide during a single day.

Financial.—The financial side of the drainage works being considered may be stated about as follows: The cost of reclamation has been $16,552, divided as follows:

Item.	Cost.
7,216 ft. river levee at $1 per foot	$ 7,216
1,940 ft. return levee at 50 cts. per foot	970
725 cu. yds. stone facing at $2.10	1,523
64,440 cu. yds. ditch excavation at 8 cts.	5,155
Sluice	900
Contingencies, 5 per cent	788
Total	$16,552

On a basis of 488 acres the cost of reclamation has been $54 per acre. Only about 310 acres of this acreage is marsh, however, so that we may figure the cost as $54 per acre of marsh land. It should be noted also that the estimates of cost are based on wages and prices at the time the work was done, namely, $1 to $1.10 per day of 10 hours, and facing stone on the ground costing $1.25 per perch. Including the reclamation works the invested capital is as follows:

Original cost of land	$ 2,000
Cost of reclamation	16,552
Cost of buildings	10,000
110 head of cattle at $25	2,750
21 head of horses at $75	1,575
Machinery and tools	3,000
Total	$35,877

The income and expenditures are estimated as follows:

Income (average of five years)	$5,265
Expenditures:	
Interest	$1,794
Taxes	472
Insurance	50
Wages	1,650
Supplies	250
Repairs to buildings and fences	225
Maintenance of levee and ditches	250
Depreciation	50
Total expenditures	$4,741
Surplus	$ 524

The value of the reclaimed land is estimated to be as follows:

179 acres upland at $45	$ 8,055
256 acres high marsh at $30	7,680
53 acres low marsh at $20	1,060
488 acres. Total	$16,795

The improvement is giving according to these figures a fair return on invested capital and has increased the value of the land over eight times.

Cost of Pumping Plant and of Pumping Water for Irrigation, Minidoka Project, U. S. Reclamation Service.

The pumping plant for running irrigation water from gravity canals to high level canals on the Minidoka reclamation projects was described in our issue of July 26, 1911. In this description costs of operation were given, estimated very largely from records covering only short working periods. In a paper read before the Idaho Society of Engineers on Nov. 25, 1911, Mr. Barry Dibble, electrical engineer for the Minidoka works, gives further cost data secured from apparently later and more extended records. We extract the following information from this paper:

Power House.—The power house is a reinforced-concrete structure with steel roof trusses and purlins, covered by matched lumber and galvanized corrugated iron. It measures 149 ft. long by 50 ft. wide and 90 ft. high from the bottom of the tail-race to the peak of the roof. It contains five main generator units of the vertical type, each of 2,000-h.p. rated capacity, and operating under heads of 46 ft. from forebay to tail-race. There are also two 180-h.p. turbine-driven exciters. Each main unit consists of a single Francis runner, 54 ins. in diameter, operating at 200 r.p.m., direct-connected to a 3-phase, 2,200-volt generator. The costs of the power house is given in Table I.

Transmission Line.—There are 38.4 miles of transmission line of 33,000-volt capacity. Copper transmission cable is strung on wood poles spaced 250 ft. apart, except at certain river crossings with spans from 700 ft. to 1,100 ft., where steel towers are employed. The costs of this transmission line is given in Table II.

Pumping Stations.—There are three pumping stations, the first located at the end of the gravity canal and lifting the water to the first level, the second about 1.75 miles distant, lifting a portion to the second level, and the third, another 0.75 mile distant, raising a final portion to the third level. The first station has a maximum capacity of 600 cu. ft. per second at normal speed. The lift at this station and at each of the others varies from 30 ft. to 31 ft.

The buildings are reinforced concrete, 140 ft. long, 18 and 30 ft. wide and 45 ft. high. The first station contains four 125 cu. ft., and one 75 cu. ft., pumps; the second contains four 125 cu. ft. pumps, and the second contains two 125 cu. ft. and one 75 cu. ft. pumps. Each pump is operated by a 600-h.p. motor. The costs of the pumping stations are given by Table III.

Costs of Operating.—The costs of operating the pumping system are given by Table IV. Referring to this table a rate of depreciation of 5 per cent per annum has been applied to the stations and 10 per cent to the transmission lines. No interest is included, as the money for the work comes from the reclamation fund, which is practically loaned to the settlers without interest. In the table allowances for repairs, etc., has been increased over that so far needed, as this item will undoubtedly increase with time. It is not intended to include the item of depreciation in the annual charge made against the settlers. However, this item will have to be met as time goes on and the machinery wears out. This can be done by paying for replacements as they are needed, and in the meantime the settlers will have the use of their money, which is worth 10 to 12 per cent interest, whereas if the government collected a depreciation fund it would have to hold it without interest.

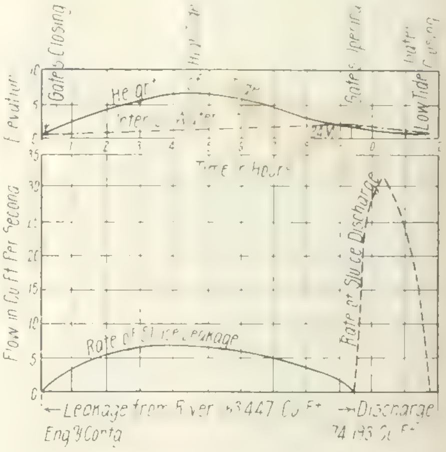

Fig. 6.—Diagram Showing Tide Movement and Sluice Leakage and Discharge, Tidal Marsh Reclamation, Colburn Estate, Delaware.

During the season of 1911, 114,000 acre-feet of water were pum[illegible] height of 66 ft., equivalent to 7,560,000 acre-feet lifted through 1 ft. The operating cost for this pumping was about $0.003 per acre-foot lifted through 1 ft., and the depreciation amounted to $0.006. Next year more water will be pumped at practically the same total cost, and therefore the unit cost will be reduced.

Summary of I[illegible]

Power house and accessories	[illegible]
Transmission line	[illegible]
Pumping stations with p[illegible]	[illegible]
Total investment on pow[illegible]	[illegible]
Investment per acre (48,000 acres)......	$19.00

Summary of Annual Charges.

Operation	[illegible]
Depreciation	44,400
Total	[illegible]
Per acre (48,000 acres)......	$1.40

A total of 14,000,000 kw. hours was delivered to the pumping stations during the year at a cost of $37,000, including depreciation, or $0.0026 per kw.-hour. If, as would be necessary in the case of a commercial company, interest, taxes, etc., amounting to, say, 10 per cent on the investment in the power house and transmission line, were added, the cost would have been $0.006 per kw.-hour.

TABLE I.—COST OF [illegible]-K.W. POWER HOUSE FOR PUMPING PLANTS, MINIDOKA IRRIGATION PROJECT.

	Total cost.	Per kilowatt.
Building	[illegible]	$11.70
Hydraulic machinery	73,000	10.40
Electric machinery	83,000	11.80
Freight and hauling	26,200	3.75
Erection	55,500	7.90
Tailrace	60,000	8.50
Roads and telephone lines	7,300	1.40
Camp and permanent quarters	23,200	3.30
Engineering and incidentals	11,100	1.55
Administration charges, etc.	15,000	2.10
Total	$433,300	$62.40

TABLE II.—COST OF TRANSMISSION LINE, MINIDOKA IRRIGATION PROJECT.

	Tower Line Cost.		Pole Line Cost.	
	Total.	Per mile of line.	Total.	Per mile of line.
Surveys and location	[illegible]	[illegible]	[illegible]	[illegible]
Clearing 100-ft. right-of-way	[illegible]	[illegible]	[illegible]	[illegible]
Pole and tower line complete, except conductors:				
Material	1,035	2,070	[illegible]	[illegible]
Freight and hauling	255	510	1,333	127
Labor	[illegible]	[illegible]	1,685	161
Conductors (transmission and telephone):				
Material	610	1,220	[illegible]	[illegible]
Freight and hauling	83	167	557	53
Labor	75	150	[illegible]	[illegible]
Superintendence and clerical	18	36	200	19
Miscellaneous	40	80	[illegible]	[illegible]
Engineering	23	46	220	21
Total	$2,960	$5,920	$10,377	$990

TABLE III.—COST OF PUMPING STATIONS AND EQUIPMENT, MINIDOKA IRRIGATION PROJECT.

	Number 1.	Number 2.	Number 3.
Excavation	$ 2,100	$ 5,300	$ 2,000
Building	35,000	40,000	19,500
Hydraulic machinery	[illegible]	23,000	16,200
Electrical machinery	44,700	42,800	17,300
Freight and hauling	[illegible]	9,600	5,500
Erection	[illegible]	14,600	9,300
Camp and permanent quarters	4,000	11,000	500
Engineering and incidentals	[illegible]	3,000	2,000
Administration charges, etc.	8,500	7,000	5,500
Total	$152,600	$156,300	[illegible]
Capacity—cubic feet per second	575	500	325
Cost per second-foot capacity	$265.40	$312.60	$239.40
Pressure pipes, including administration charges	$21,400	$16,500	$20,200
Total length of pressure pipes—feet	849	540	825
Cost per foot	$23.90	$30.30	$24.50
Cost per second-foot of capacity, including pressure pipes*	$303.00	$346.00	$301.00

*Average, $318.00

TABLE IV.—COST OF OPERATING AND MAINTAINING PUMPING SYSTEM, MINIDOKA IRRIGATION PROJECT.

			Pumping Stations.			
	[illegible] house.	Transmission line.	No. 1.	No. 2.	No. 3.	Total.
Operation:						
Labor	$ 5,700	$ 700	$ 2,100	$ 2,100	$ 2,100	
Supplies	950	100	200	200	150	
Repairs:						
Labor	900	600	600	[illegible]	[illegible]	
Supplies and material	300	100	100	100	80	
Superintendence, clerical, camp, etc.	1,700	200	700	700	[illegible]	
General expense and administration	450	50	150	150	100	
Total operating expense	[illegible]	$1,750	$3,850	[illegible]	$3,280	[illegible]
Depreciation	21,700	3,400	7,600	7,800	3,900	[illegible]
Total	$31,700	$5,150	$11,450	$11,650	$7,180	$67,130
Annual cost per acre, including depreciation	$0.660	$0.108	$0.239	[illegible]	$0.150	$1.40
Operating expense per acre (48,000 acres)	[illegible]	$0.037	[illegible]	$0.081	$0.068	$0.475

The Design of Outlet Conduits for High Earth Dams.*

The safety of earthen dams requires that the most careful consideration be given to the location and design of the sluiceway or outlet. Often great expense is borne in driving a tunnel outlet in the hillside rather than to take the hazard of placing the outlet in contact with the earth fill. A tunnel location is especially desirable if the stream bed offers but a poor foundation, while the hillside is a compact rock in place. The desirability of a tunnel location is unquestionable, but the right conditions of topography and rock formations seldom exist together, and the engineer is obliged to make his location upon the foundation of the dam.

If the water is to be passed down the old stream channel below the dam, the conduit is usually placed at about the level of the old channel, or a little above, to insure freedom from back water conditions at the outfall. If the reservoir is to feed a pipe line or a canal directly, the elevation of the conduit may be fixed by this condition. There are often local features that need to be considered in fixing the location of the conduit, such as the position of the intake and outfall and the alignment of the conduit itself.

The carrying capacity of the outlet of a reservoir on a natural stream bed is, in Colorado, subject to the approval of the state engineer as a protection to other water users on the stream below, who might be injured by a retention of water in the reservoir if the conduit could not carry the normal flow of the stream. To fix the carrying capacity of the conduit requires judgment, as it is difficult to estimate closely the probable time and amount of runoff during flood times over a particular water shed unless the stream flow [illegible] years. At altitudes above the cloud-burst areas particular streams, fed by mountain snows, are comparatively regular both as to time and amount of maximum runoff furnished. The annual high water floods under these circumstances seldom vary 50 per cent from the mean high water of a series of years, and the fixing of the carrying capacity of the outlet offers no great problem in this case, if the record of the stream flow is available.

The plains watersheds, subject to violent summer rains, have often a remarkably high runoff for a short period of time, and it is not reasonable to expect that the maximum flood of short duration be passed through the conduit without some temporary storage, which can later be turned down to the appropriators properly entitled to the water. Well constructed conduits are expensive, and it is only a fair concession to the reservoir builders from the direct appropriators that some latitude be allowed for temporary detention of the flood waters out of storage season.

When the discharging requirements of the outlet are determined upon, a tentative design is selected, and its carrying capacity calculated. The design can then be altered if necessary to bring it to required size. The carrying capacity of outlet is easiest computed by assuming velocities and then finding head required to give these velocities.

Thus for assumed velocity, v,

[illegible]

Where the terms on the right represent the various losses of head, all of which are functions of the velocity v. By calculating the total head corresponding at regular changes in velocity from zero to the velocity of about full reservoir, a table of discharging capacity for each foot in depth can be prepared.

The intake of the conduit should be located out of danger of land slips from the sides of the reservoir and from the dam itself. The tower intake with openings at different levels for admitting water to the conduit, often used on city supply reservoirs, is not usually a practical design for a dam on a stream where large volumes of water must be passed.

There are decided advantages in raising the weir of the intake above the bottom of the stream bed and thus forming a permanent pond above the outlet. These advantages are:

(a) Gravel and rocks can not be washed into the conduit to interfere with working the gates.

(b) Driftwood can be more easily handled and kept from the grates.

(c) There is more head available above the conduit and hence larger carrying capacity under low heads over the weir.

(d) The intake when elevated is less likely to be blocked by slides from the side hill or from the dam.

(e) The head offers a refuge for fish during low water.

All intakes should be equipped with grates to keep out driftwood, etc., and the net grate area should be much larger than the area of the barrel of the conduit. If fish screens are required they are placed inside the grating. A bell-mouth at the head of the conduit saves much of the loss of head at entrance.

For high heads, gate valves or iron gates with bronze seats are needed. Gates that cannot be raised in 20 minutes by one man should have power control, but all power operated gates should also be equipped for hand operation if possible. The water pressure against a 4 ft. by 5 ft. gate (weighing itself perhaps two tons) is 62.5 tons under a 100 ft. head, and even with the friction of lifting reduced to a minimum percentage of the hydraulic pressure it still takes heavy stems and substantial gate stands and gearing for proper operation.

Gates can be placed at the intake, at the center of the dam or at the outfall. The first and second positions require a gate tower to house the stems and stands ending above high water, while the latter does not. A gate tower within an earthen embankment is a source of weakness to the dam, but is more accessible than a tower above the intake, which would need to be reached by a bridge or boat. If the gates are at the outfall, the stands are mounted directly above the gates, obviating the necessity for long gate stems and tower.

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*A paper by Winfield Holbrook, Engineer, with George G. Anderson, Consulting Engineer, Denver, Colo., in the University of Colorado Journal of Engineering, 1910-11.

The barrel of the conduit should be of the most permanent construction. The conduit is stressed by the water and earth pressure from without, and also from within, by the hydrostatic pressure above the gates. Water tightness should be secured to keep water from passing in either direction through the walls. If the walls above the gates are pervious, water may be forced into the bank by the pressure within, and below the gates we would have water percolating through the masonry from the saturated bank. A safe design is one with cast iron pipe embedded in concrete. Wood stave pipe has been proposed as a substitute for the cast iron. Riveted steel pipe has often been used, but should be of rust resisting metal. The two latter are of course less costly than the cast iron pipe, and will often be used in its stead. Any such pipe lining should be tested under full pressure before the concrete or masonry cover is placed. Pipe lining of a conduit gives an additional margin of safety in case the masonry becomes cracked from settlement of the foundation. Collar walls and roughening the surface of the masonry outside both discourage the passage of water along the conduit. The writer's preference is for duplicate lines of pressure pipe embedded in masonry with gate valves at the lower end of conduit, in case the embankment and outlet are in contact. The duplicate lines allow one to be blocked from above during low water for inspection and repairs.

The main point in the design of the outfall is to provide against backwash. A good design is to carry a channel for some distance on a heavy grade until the water can be dropped into a natural or artificial pool. An artificial pool or "forebay" is sometimes built at the outfall, into which the water drops and is cushioned, and thence overflows at low velocity into the stream channel.

The Division of Costs in Relation to Drainage Systems.

Contributed by J. L. Parsons Drainage Engineer.

The construction of drainage works is a form of improvement which if properly planned involves the expenditure of large amounts of money, and which must be generally financed and paid for by the parties at interest or their representatives. The drainage engineer may plan the system with scientific accuracy and in the process will be importuned persistently by owners to plan smaller or larger tile, to substitute very large tile for open drains and to extend or shorten the drains, but oftentimes he is the only one who is cognizant of the tremendous differences in actual cost radical features of design would involve. Eventually the cost item becomes vital when the engineer with other commissioners have concluded the division of cost among the interested owners. And at that time becomes particularly apparent the importance of planning and managing drains so accurately and consistently that all operations will admit of reasonable explanations before the legal officers concerned, and if necessary the courts, even though the owners themselves may not in all particulars be satisfied.

The division of costs does not admit of uniform systematizing for all districts because of the various and complicated features incidental to each case. However, as in the application of any business scheme the fundamental principles are of more importance than the system, and the most complete system cannot be successfully applied without a comprehension of principles. Therefore in this discussion the underlying principles will be dwelt upon at length and the suggested system be stated with little comment. The basic principle to which all benefit assessments upon farm lands must directly or indirectly be referred is the elevation of the land in question in relation to the proposed drain. The natural or inherent advantage which relieves the owner of land of the necessity of expending proportionately large amounts of money for drainage is sufficient elevation to result in either natural drainage or easily and cheaply installed artificial drainage. It is this natural advantage which enhances the value of land, and any benefit assessment which unduly encroaches upon this advantage furnished by nature is confiscation. Therefore a benefit commission should not attempt to apportion costs before first acquiring a complete record of the elevation of every pond and low place in the watershed and sufficient elevations upon the adjoining slopes to indicate the lands possessing natural outlets independently of the drain under consideration. With this data at hand a commission should personally inspect each separate tract in the district, noting the classification of the land, its distance away from an outlet, its elevation and other pertinent information. It is not enough to pass along one side of or through a 40-acre tract, as appearances and areas are deceiving when viewed from a distance; hence it is necessary to view all parts of a forty carefully. Lands are customarily classed as swamp, wet, low and dry lands. Swamp lands may be defined as lands lying in a submerged condition in wet seasons and not usable for any agricultural purposes; wet lands as those lying above the swamp water level which are unfit for any purpose excepting for light crops of hay and second grade pasturing, and which require thorough drainage before being of any agricultural value; low lands as those intervening between the dry and wet lands which are not low enough to be valueless for cropping and still require a limited amount of drainage to insure annual crop production, and dry lands as those which are of sufficient elevation to render them tillable at all times. Under this system of division considerable high lands may be classed as swamp, wet or low, but as this method is usually more readily comprehended by commissioners it seems most practicable to classify according to the term dry instead of high. Proper considerations may be given to the natural elevation of the lands later during the office work. It is best in the process of thus classifying lands to recognize interior watershed divides and make separate classifications for the portions of tracts draining in different directions towards the main drain, especially if branches are extended into the tributary draws as a part of the district.

It should be the object of the commissioners to classify the included lands upon an equitable and similar basis, proper allowances being made for misleading appearances. Justice may be more nearly accomplished if part or all of the commissioners have been somewhat familiar with the lands during wet seasons in case the field work is prosecuted during a dry period. A more essential consideration is that at least a majority of the commission has had broad experience in this class of work, this being particularly true of the engineer member. In all cases the qualified commission may estimate with fair accuracy the condition of the lands in wet times from the general appearances of crops, weeds, etc., and classifications may be made accordingly. Common causes of confusion to commissioners is the appearance of well-farmed lands as compared to weedy, run-down lands, and of tiled as compared with untiled farms. To as nearly as possible insure uniformity due allowance must be made for these extremes and classifications be made such as to allow for them, the poorly and well farmed tracts being classed according to their probable condition, providing each were farmed with the same degree of care. In regard to the tiled and untiled tracts the imagination is taxed considerably in order to separate the tiled tract into the classifications which would be applicable were the farms untiled or in a state of nature. Much opposition and misunderstanding often arises from the application of this rule, but in no other way can comparative justice be attained than by placing all lands upon an equal basis as nearly as may be. To illustrate, two adjacent forties may naturally possess identical opportunities of drainage and be originally in about the same condition of wetness; one forty has been tiled as thoroughly as possible with the available outlet, the other one remains in its natural state. Their natural advantages are similar and they could be treated similarly which can only be accomplished by classing them upon a similar basis, and credit, if credit be due, be given later because of any natural elevation.

The various influencing factors upon just assessments which merit consideration are: the location of the tract with reference to the main drain; the location of the tract with reference to the outlet of the main drain; the comparative elevation of the tract; the relation of classification to assessments; the design of the main as affecting the tract; and the comparison of the costs of the drain in, and the requirements of, different sections of the watershed. In many cases districts have been assessed as units, the cost of the main and all branches being totaled and spread over the affected lands, justice being as closely approximated as possible. But since the various branches contained in a district are usually as independent of each other as though organized as separate districts, in justice they should be assessed as such. The logical method then must be to assess the cost of the main drain to all the lands in the watershed receiving benefit and the cost of each branch to the tributary lands separately, thus requiring each unit of lands or watershed subdivision to pay only for the actual costs incurred for outlet privileges and installation of the branch. Therefore any reference to main drains may be considered as applicable to any drain, although it may be tributary to some other drain.

The location of any particular tract of land with reference to the main greatly affects the benefits received. If traversed by the drain the benefits of direct drainage by one single line of drain is at once acquired, and in addition the outlet for laterals is furnished so conveniently that expensive collecting sub-mains are not so essential. The exact location of the drain across the tract bears upon the degree of benefits, as the direct benefit of a drain extending through the comparatively higher land of a tract is not so great as would result were it intersecting a wetter portion of the tract. The farther distant from a main that a tract is located the less the immediate benefits, even though the main is necessary for outlet purposes, as considerable funds must be expended to attain the benefits immediately accruing to the more adjacent lands. For comparative purposes estimates may be made of the direct drainage value by computing the cost of a 6-inch or 8-inch tile line of the same length as that of the main upon the tract and the cost of securing similar benefits by the installation of sub-mains if the tract is situated at a distance from the main. Such estimates are of value as means of comparing the resulting benefits between similar acreages in different locations. The question of distance of lands from mains must always be dependent upon other considerations previously mentioned, and is only the influencing factor when other conditions are such as to render the natural advantages of the tract otherwise equal.

Prominence is sometimes given to the location of lands in relation to the outlet of the main drain on the theory that the upper owner is dependent upon the owners below for outlet privileges and should purchase capacity throughout the length of the drain in addition to providing the more immediate necessary drainage. A serious difficulty of this plan, if applied regardless of other considerations, is that there is practically no limit that may be set upon the final cost to owners of land in the upper portions of a district in the process of the formation and extensions of districts which sometimes extend to the improvement [illegible] nels. The more general present and more reasonable view is that lands similarly located along a watercourse are mutually concerned in the cost of the main drain, other things being equal, as the upper lands cannot be successfully drained without an outlet, and the lower lands cannot be drained without the installation of a drain of sufficient size to care for all waters collecting from lands above. And even though a drain of such required size be located upon the lower land full benefits cannot be enjoyed because of the absence of the regulatory action which would result from the construction of the complete main and branches. Because of this interdependence of adjoining lands along natural drainage courses it is difficult to ascribe any especial advantage to particular lands for this reason alone. However, lands may be situated opposite the watercourse in such a location that credit should be given. It is more noticeably common in the larger districts to find sub-watersheds extending laterally from the main watercourse, often paralleling it or extending at an angle from it for long distances, which are of sufficient elevation to insure them from overflow from the lands lying above the junction of the lateral and main draws, and which may or may not require the improvement of the main watercourse for outlet purposes. Whatever the system of spreading assessments used, sufficient final adjustments should be made to insure that such lands do not bear too great a proportion. This may be ascertained by computing the lump sum that seems just for such a watershed to pay and comparing this with the total sum of the assessments upon the lands in question. This lump sum can only be approximated by computing the cost of the main from its outlet up to the point of outlet of these lands and estimate the proportion of this cost that should be paid by them. The farther towards the source that a branch watershed connects with the main watercourse the greater will be the share of the main cost apportioned to it. This rule is just and safe of application in all cases where subsidiary watersheds are not subject to overflow at times when floods occur in the main watercourse. In the latter case the overflowed lands come under the same class as do the lands adjoining the watercourse in that they are not independent of the water above their outlet and are naturally interested in the care of the flood waters both above and below the junction point. The degree to which they are affected is determined by their elevation and the consequent damage from occasional overflows or prevention of underdrainage. In estimating the proportion of main costs to be apportioned to sub-watersheds the actual cost of the main should not always govern, but more consideration should be given to the probable cost of a drain which would suffice for outlet purposes for the land in question, or the probable cost of a drainage district organized primarily to secure an outlet for these lands only. In such estimates it must be remembered that damage claims might necessarily be paid were such an imaginary district constructed and proper allowances made. Although the factor of outlet distance under discussion is especially applicable to the larger districts, it merits just as serious consideration in the case of all tracts, whether aggregating forty acres or thousands of acres.

As previously suggested, the comparative elevation of a tract of land is a governing factor in all assessment considerations. The courts generally decide assessment cases upon the theory that a tract possessing sufficient elevation to render it independent of the proposed drain for a drainage outlet is not subject to assessment. The interpretations of this rule are varied and difficult. Although a tract lying in the watershed may be successfully drained upon adjacent lands, it may be so surrounded by swampy, wet lands as to be partially inaccessible for agricultural purposes, which tract is without question directly benefited to a limited degree by the reclamation of adjacent swamp lands. However, if it is so situated that it is practically accessible and the bounds of the watershed. The only benefits in such cases result from increased value of the land because of the general improvement of the community, which constitute indirect benefits generally held to be inoperative. Although benefits assessed to lands of this character should in all cases be nominal in amount, the author holds that in justice all lands lying within the watershed of a district should be subject to some assessment for outlet privileges. In the determination of the question of the independence of particular lands, the elevation of the land should not absolutely govern, as the outlet may be into stagnant ponds or overflowed swales, which might not constitute legal watercourses. The liability of such lands for damages to the owners of the lower lands under the state drainage laws, were a drainage district organized only for them, should therefore influence the amount of benefits, as this damage liability is removed by the organization of the larger district. Although the fact that lands are classed as swampy is usually evidence of benefits, the measure of benefits of this class of land must largely depend upon the elevation of the swamps. The factor of depth largely influences the cost of both open and tile drains, and those low spots which require the greatest depths for outlet purposes are certainly most benefited because of the greater expense incurred to overcome this natural disadvantage. Not only must greater depth be provided for such areas, but greater capacity should also be designed for the very lowest points because of their tendency to serve as catch basins for the overflow from surrounding lands, which collected water, possessing no natural means of escape, must be removed by artificial means. The excess depth required for certain tracts may be readily computed and the cost estimated, which item of cost is certainly not an item of benefit to the adjacent higher swamps.

In regard to classifications of lands emphasis should be placed upon the natural state of the land as influencing the assessments, but classifications do not necessarily constitute the most controlling factor. Benefits must be largely measured by the cost of reclaiming the land and the resulting increase in the value of the land because of the installation of the drain. As the value of the land in its natural state is greater for dry lands than for wet, its benefits are consequently less. For these reasons the swamp lands being the lowest and of the least original value bear the greatest benefits, wet, low and dry lands bearing less in order. Thus classifications are important as an indication of benefit when considered in connection with all the other considerations already enumerated. Assessments per acre upon swamp lands should be the same for areas similarly located and of similar elevations. The classification of swamp should have little effect upon the assessment in case the swamp is of sufficient elevation to allow of successful drainage, in which case swamp lands deserve all the natural credit due dry lands. Wet lands are usually considered as receiving less benefit because of the facts that their natural value is greater and their elevation is such that ordinarily deep trench work and large drains are not so necessary to furnish them outlets. Low and dry lands in order should bear less ratios of the cost for similar reasons. Classifications of lands are popularly considered as being the principal influencing factor in the determination of benefit assessments. This is true when considered in connection with the elevation of the classified lands, the portion of the expense incurred for particular tracts and the proximity of the drain in question.

It sometimes occurs that drains are established and constructed which, because of an error in the field work, in design or in judgment or from expediency, do not furnish the full required outlet to certain tracts of land. In cases of drainage district organizations the owners are entitled to the belief that full benefits will be received, and grave injustice is done first if they are not properly advised of the facts before the establishment and assessment of the district, and second, if they are assessed for benefits which are not enjoyed. A benefit commission cannot be definitely informed as to what action future commissioners may take, but a reasonable assumption would be that in case of reconstruction the necessary costs would be proportioned most heavily to the lands then receiving the greatest benefits, which would be those tracts at that time requiring the reconstruction. Thus in the determination of the assessment upon such areas estimates of the proportionate cost to them of a system necessary to furnish them outlets should be made, and the probable additional expense to them of securing outlets in the future deducted from this estimated cost would in a measure indicate the fair assessments applicable to them. This point should not be of importance were all drains constructed in accordance with the requirements in all cases. But as many of the early districts in all communities do not furnish outlets to some of the affected lands, and as assessments in many cases have been rendered for full proportionate benefits the consideration of this question has been forced upon those later in charge with painful persistency, emphasizing the importance of proper design or of assessment credit in case of improper design.

After the cost of a drain is apportioned to all the affected lands, and during the process of apportionment certain comparisons are of value as indications of benefits received by the different portions of the watershed. As before mentioned the proportion fairly borne by sub-watershed areas may be estimated with fair accuracy. It often occurs that at some point in the course of the drain the fall is so great that all lands tributary to the main above this point could be successfully drained without the installation of such an expensive drain below as may be necessary for the drainage of the lower lands. Apparently the share of these lands so situated should be less than would be proper were their elevation such that an expensive drain were more necessary. In this way watersheds may be separated into units and comparisons made which will relatively indicate the fairness of assessments. Such comparisons are also applicable in cases where the outlet portion of drains are extended through lands in which watercourses exist of sufficinet depth and capacity to constitute legal outlets for drainage districts. The vital question is whether the land adjacent to the drain above the possible legal outlet is liable for any of this incurred cost. It would seem just that in case no benefits are deducable for any of the foregoing reasons the owner of the land should before the establishment of the district be allowed the privilege of deciding as to whether he is willing to bear the total cost of such an extension. If not the extension should not be constructed by the district unless necessary to its welfare, in which case the district lands should bear a portion of the cost.

It thus appears that the assessment of benefits cannot be reduced to a system, as the conditions vary so radically and the considerations affecting benefits are so interdependent that each benefit factor cannot be segregated and definite proportionate values assigned to it. But some method is necessary for the approximate derivation of assessments before comparisons and adjustments are possible. A system is here suggested by the use of which percentage values may be assigned to each of the class of benefits discussed and comparative assessments computed for each tract according to the benefit per acre. (See page 110.)

In the order listed the owner's name and description of the land is entered. Under the headings of "Kind of Land" and "Acres" the classification—swamp, wet, low and dry—and the number of acres of each class are noted. In the following list "Class of Land," a percentage is assigned according to the benefits accruing because of the natural condition of the land. The swamp lands of the lowest elevation or those requiring the greatest expenditure to effect an outlet are given 100 per cent, and proportionate less percentages

FORM FOR BENEFIT [illegible] UPON FARM LANDS IN DRAINAGE DISTRICT NO.

Name of Owner	Description	[illegible]	[illegible]	Class of Land.	Proximity to Drain	Proximity to Outlet.	Product. Sum.	Assessment.

are assiste[illegible] higher, the [illegible] val[illegible] the [illegible] up lands [illegible] to the percentage applicable to dry lands in case of elevations allowing of natural drainage outlets. Those wet lands lying in the main valley are usually given a uniform percentage of 50 to 60 per cent upon the theory that wet lands receive this proportion of benefits as compared to swamp lands, and that they require uniformly similar depths and sizes of drain. In case wet lands are so situated as to require excessive depths for any reason the percentages should be increased. Those wet lands upon the slopes should receive a less percentage as their elevation increases. Because of this natural advantage as regards sizes and depths and because of the less need of drainage, low lands are percented approximately 30 to 10 per cent and dry lands uniformly 10 per cent. Under the heading "Proximity to Drain" the percentages for all classes are listed at 100 per cent for those tracts through which the drain extends, and proportionately less percentages the farther distant a tract is situated from the drain, as lands 40 rods distant 70 per cent, 120 rods distant 50 per cent, and 200 rods distant 40 per cent. In small flat districts the author finds it unnecessary to make use of the column "Proximity to Outlet," but finds it useful in the assessment of the more extensive districts. In such cases allowances may be made for bodies of land in sub-watersheds or in the main watrecourse draw, which should bear less than the average proportion because of comparative independence of certain sections of the main drain. For instance, lands situated along the main watercourse of similar proportionate elevations should be rated at 100 per cent, those lands in sub-watersheds which might use only a portion of the main and not be subject to overflow at 10 per cent and upward, and those lands adjacent to the main which possess elevation advantages as mentioned under the topic, "Comparisons of Costs and Requirements for Different Portions of a Watershed," at 30 per cent upward, depending upon the natural advantages enjoyed. After these percentages are thus assigned to all the tracts these and the number of acres are multiplied together and the product listed in the column "Product" for each classification. Because of the large number of units in such a product it is convenient to simplify it by setting off about four decimal points for all products, which does not affect the final result. Then in order the products are totaled for each tract and listed under the heading "Sum," and the total sum of these results for all the farm lands in the district divided into the amount of funds to be raised gives as a quotient a common multiple, which in turn multiplied by the sum of the points for each tract results in the assessment for that tract. In computing the total assessments to be paid by the farm lands all assessments levied against highways, railroads and town lots must first be deducted from the total cost and the balance apportioned to the farm lands. It is best in estimating the total amount of funds to be raised to allow a liberal percentage in addition to the contract price to provide for all necessary incidental expenses, as future reassessments to provide for deficiencies are always productive of dissatisfaction. A commission experienced in the levying of assessments can accomplish surprisingly accurate results by the use of this system, and an incompetent commission very unjust results by the use of the same method. In all cases the resulting assessments should be copied upon the plat and comparisons made in the light of all influencing suggestions that can be made by the members of the commission. After such a review a commission will often find it advisable to revise the results in individual cases, which a commission should not hesitate to do if evidently just, as the percentages cannot be so fairly proportioned in all cases to render the results absolutely fair. If the office work is transacted at a considerable lapse of time after the completion of the field work, or if the district is large, final comparisons are best made after generally reviewing the lands of the district.

Town lots are included in the watersheds of some drainage districts, and it is oftentimes proper that because of the greater benefits to this class of property proportionately greater assessments should be levied. In case the drain extends through the town limits and additional capacity is designed to care for flood waters more rapidly, the excess cost incurred should rightfully be assessed to the town property affected. In all cases where drainage is necessary the resulting benefits are greater because of the benefits resulting from cellar and street drainage. But if the town property is of sufficient elevation to possess a natural outlet consideration should be given to this item as well as for farm lands. Town lots and streets are most conveniently assessed by determining the total amount to be borne by them and prorating it among the lots and streets according to their area, elevation and location. Highways and railroads are usually assessed on the lump sum basis, no rules being as yet set by state drainage laws for the determination of this sum. Comparisons may be made in both cases by computing the acreages affected and about the average assessment per acre for similar lands. But because of the different purpose for which the land is used the actual benefit or saving in construction and up-keep costs may justify a much greater assessment. In estimating the total economy that may be effected because of the construction of the drain in such cases it must be remembered that no greater percentage of total benefit is justifiable as an assessment than the assessment upon farm lands bears to the increased value of the farm lands arising from the installation of the drain. Although highways may better serve large communities outside of the district and railroads may receive greatly increased tonnages for transportation, such advantages can hardly be chargeable as benefits because of their indirect and speculative character. Proper benefit items for consideration in the case of highways are the removal of water or the making possible such removal from the road, resulting in fewer and smaller bridges, less necessity and cheaper maintenance of grades and the rendering of the roads more constantly passable. Railroads may be benefitted because fewer and shorter bridges and trestles and less maintenance expense may be required, grades may be rendered more stable by the removal of water and the consequent freedom from the action of burrowing animals and from the heaving and settling of the embankment because of freezing and thawing, the expense of the upkeep of fences, poles and ties may be considerably reduced, and generally the roadbed and all affected physical property may be benefited by reason of less maintenance and reconstruction expense. Highways and railroads are often so situated that the construction of the drain will not in any way affect their condition and maintenance, in which cases only a nominal assessment is permissible. As the determination of such assessments must largely be a matter of opinion and estimates often by parties unacquainted with railroad and highway costs, it is especially important that the commissioners carefully view such properties, noting all points affecting benefits and acquire all information available in order to insure fairly equitable assessments. In accomplishing this result estimates of all the economies affected per annum capitalized at the prevailing rate of interest indicates the amount of investment that would be necessary to accomplish this saving in expenditures.

The question of division of costs of drainage systems is interpreted in details as variously as there are communities and individuals connected with such duties. The differences in opinion have extended not only to details, but have been in many cases as divergent in regard to the basic principles. This is largely the result of the absence of literature on the subject and lack of instruction and of co-operation among drainage engineers in engineering schools and societies, conditions which the future promises to correct.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Some Costs of Laying Fiber Conduits in Paved Streets.*

Fibre conduit is the most recent addition in materials for subway distribution systems that has been developed to meet the new conditions of service. It has been in use about eight years and is formed in cylindrical shape from fibre or wood pulp under pressure. The wood pulp is thoroughly saturated with a bituminous compound and any vegetable matter or bacteria which would tend to promote decay is killed by the presence of about 6 per cent of creosote salts in solution. There are at the present time two types in general use, known as straight joint and bell and spigot joint conduit, made in four styles of joint to meet the general conditions of service, namely socket (mortise and tenon) joint, sleeve joint, drive joint and screw joint, furnished in either 1, 1½, 2, 2½, 3, 3½ and 4-in. sizes. It has been shown that fibre conduit will stand an average puncture test of 32,000 volts dry and 24,000 volts after immersion in water for 200 hours.

In the introduction of this material on the market there were objections to be overcome, the most serious being as to the life compared with the older styles of conduit which had been tried out, and during the eight years of development this point has been one of greatest discussion and observation, resulting in numerous laboratory and service tests. It is a well-known fact that objects have been disinterred and found to be wrapped in cloth saturated in asphalt, evidently having been buried for hundreds of years, the asphalt in the cloth showing no deterioration except to have gotten hard. Coal tar pitch and alleged wool felt, which is usually a combination of old rags, wood pulp, straw refuse, cotton and jute, was taken out of the subway which was built by the New York Central & Hudson River R. R. approximately 35 to 40 years ago, and found to be in perfect condition. However, there is no cause to wonder at this performance, simply because these bituminous substances preserve this material indefinitely when oxygen and the actinic rays of the sun are not a factor and destroying agent, and this is the case when a piece of conduit is buried in the ground.

*An article by William D. Ligon, submitted by the H. W. Johns-Manville Co., New York, N. Y.

TABLE [illegible] SHOWING COST [illegible]
WITH GRANITE [illegible]

[illegible] Sections									
Excavation, refilling, paving and removing surplus earth	.126	.163							
Concrete	.102	.133							
Cost fibre pipe [illegible]									
Laying fibre [illegible]									
Proving ducts	.005	.007							
Water, bridging and shoring	.007	.010	.011					10	.062
Tool repairs and replacement		.010	.012	.020	.025	[illegible]			
Incidentals	.010		.010						
Supervision, inspection and timekeeping		.061							
Total per [illegible]									

Furthermore, the creosote salts positively fumigate the material and stop mold and rot. There are roofs of buildings that have been [illegible] the sun, made of bituminous compounds similar to that which is used for impregnating fibre conduit, that have given good service for [illegible] It is [illegible] fact that railroad ties treated with an oil in which creosote occurs in sufficient quantity are immune to rot and decay and their life has not been determined, inasmuch as ties are now in service that were treated with carbolineum more than 25 years ago, and carbolineum is nothing more than creosote oil.

It has been found that about 90 per cent of all cable troubles are directly traceable to some injury to the lead casing when being drawn into the duct. Cable troubles are also due to high currents leaking through the joints, as a result of improper installation and the impossibility to secure perfect alignment. These objections are eliminated by the use of fibre conduit, due to the smooth interior and water-tight joints.

Fibre conduit is impervious to moisture, gases, acids or other corrosive elements, thus water, gas and stray currents cannot reach the cable protected by this material. It is a good non-conductor, doing away entirely with the trouble with stray currents, and is also an absolute prevention against electrolysis, which destroys many cables, gas and water pipes during each year. It is known that a pressure of five volts will destroy a water pipe or cable in about nine years, and there are few railways, light and power companies who have not been troubled with electrolysis. In the event of short circuit the wall immediately surrounding the arc may char but the fire will not spread, resulting in the easy removel of the cables from the ducts.

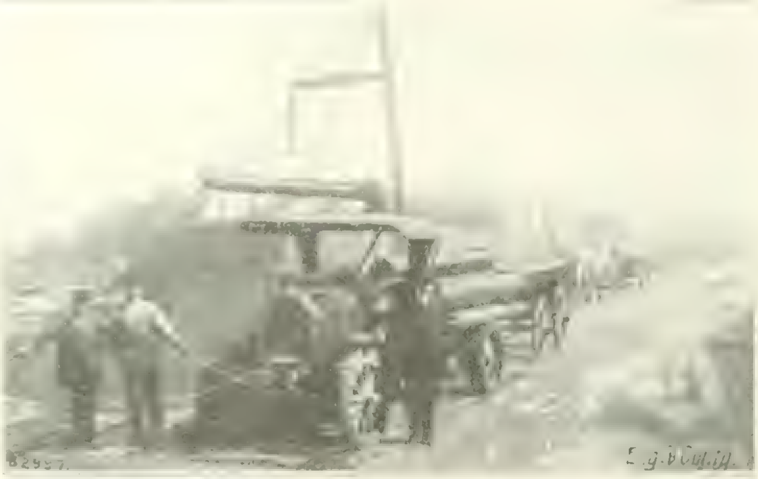
In figuring on subway installations, it has been fully demonstrated by experience of the largest operating companies that on account of the lightness in weight, large savings can be effected in freight, trucking, excavating, handling, laying and the amount of concrete necessary. In shipping and handling fibre conduit, breakage is practically nothing, due to the great tensile strength of the wall and the shock resisting properties of the material. Samples of conduit which were placed in an oven and the temperature greatly raised, show that at 135° F., softening of the compound began, and that at 205° the compound became very soft, but the mechanical strength of the material was such that the samples retained their shape, and the effect was on the impregnating compound only.

Fibre conduit has been known to withstand temperatures of 330° satisfactorily. However, in actual service, the high temperatures named are not likely to occur, as the cable insulation would give way, and the only purpose in giving these temperatures is to illustrate the heat resisting qualities of fibre conduit under conditions other than normal.

Economic Sewer Sections.—Mr. A. Schreiner, Designing Engineer for the Bureau of Sewers, Borough of Queens, New York, concludes from his experience in that office that, for local conditions, the economical sewer sections are as follows: Up to 24 ins. diameter, vitrified clay pipe; from 24 ins. to 4 ft., plain concrete; above 4 ft., reinforced concrete. These sections give greatest ease of construction, at lowest first cost.

A Motor Truck Equipped for Operating a Derrick.

[illegible] truck for loading cast-iron water pipe. The illustration leaves very little to be explained, but it may be noted that the truck equipment involved consists merely of the extension in front of the main shaft of the engine and the keying to its end of a nigger head. A hand line leading from the truck to the nigger head provides for the hoisting. In the work illustrated, the cast-iron pipe sections being loaded weigh about 1,400 lbs. each. It will be noticed, too, that the truck is hauling a trailer. It is evident that a device of the kind shown may be adapted to loading a variety of materials, and that almost any form of hoist-derrick, gin poles, gallows, frame, etc., can be operated by the truck engine.



Avery Motor Truck Operating a Hoist for Loading Water Pipe.

Method and Cost of Moving a 250 Ton Bucket Dredge.

The dredge, as described in the *Mining and Scientific Press*, was moved overland a distance of about one-half mile. The location of the work was at Emmaville, New South Wales. There was a choice of three methods —(1) to dismantle the dredge and transport it piece by piece; (2) to arrive at a satisfactory arrangement with the Great Britain Co. to work through its ground, which lies between the other company's property; and (3) to shift the dredge as a whole, along dry land, by means of its own power. Of these, the second method might possibly have proved the most economical, but the third was adopted, and the fact that the method is unique is the excuse for the description.

Operations were started about July 15, 1911, and the dredge successfully reached the site at the beginning of November. Calking operations were started, which required about a fortnight to complete. The buckets and tumblers were removed from the dredge for separate transport, but otherwise the barge was left intact. A track was roughly prepared along the hillside for the dredge to travel along. Trenches were then dug some 20 yds. ahead, and headers put in. Wire ropes with a suitable arrangement of pulleys were fastened to the gantry framing of the dredge, [illegible] to the head logs, and thence back to the main hauling winch of the dredge. The barge itself was run on skids about 10x10-in. hardwood, placed approximately 2 ft. apart. When these were laid in position the pull was commenced, when, all going well, the dredge began to move.

Great difficulties were encountered at first. The inclines from the dam to the road were very steep. Headers were not used at first, but trees and stumps were utilized instead, and in many cases were promptly uprooted. The haulage ropes also, at first, were much too light, and constantly broke at the critical time. The weight of the dredge is 250 tons, and the pull on the ropes was 60 tons. Progress for some time was very slow, but toward the end of the journey an average advance of 60 ft. per day was maintained. Trouble was experienced throughout the job by the tendency of the skids to shift to one side directly the weight came on them. The ground in some places also caused great delay, owing to its softness and consequent inability to bear a load.

The management claims that if the question of a further removal occurs again, the same method will be adopted, with the exception that many of the initial mistakes will be avoided by the experience which has been rather dearly bought. An improvement on the method would be to lay a line of rails and mount the dredge on small wheels, when progress would be greatly facilitated and much work saved in the moving of the heavy skids from length to length.

The cost of the work was about £800. The best method of moving, if terms had been agreed upon, would have been to work through the Britain ground. This could, at an outside estimate, have been done in a month, and although a sluicing plant had previously treated the ground, a certain amount of tin would have been obtained from the dredge as it worked through. With regard to dismantling, it must have proved quicker than the present method, but the dredge is old, and some difficulty would have been experienced in putting it together again. It could, however, probably have been dismantled, removed and rebuilt in three months. It is said that at first a contract was made to shift the dredge for £300 in three weeks, but the contractor had to relinquish the task, which was then taken up by the company's engineer.

The camps at Delhi Ridge, during the latest Durbar, were supplied with 2,000,000 gals. of water per day. About 44 miles of cast iron pipe, ranging in size from 16 ins. to 3 ins. in diameter, were laid to convey the water from the municipal reservoirs on the summit of Delhi Ridge.

Examination for Engineer of Bridge Construction and Repairs.—The city Civil Service Commission, Chicago, announces a competitive examination for engineer of bridge construction and repairs to be held February 6 and 7, 1912. The examination is open to all engineers regardless of residence. It will be the duty of the engineer of bridge construction and repairs to direct and supervise all the repair work on the bridges and viaducts under the jurisdiction of the city. It will also be his duty to supervise the bridge operation, as far as essential to the proper conduct of repairs and maintenance, of all the bridges and viaducts under the city's jurisdiction. The salary to be paid this year is $3,000. An appropriation of $4,600,000 has been made recently for the construction and repair of bridges.

Mr. Ivers Adams, a wealthy resident of Boston, Mass., will give a water supply system to his native town, Ashburnham, Mass.

PERSONALS.

Mr. Clarence W. Parsons, City Engineer of Louisville, Ky., has resigned.

Mr. Wm. L. Brown, of San Bernardino, Calif., has been appointed City Engineer of Rialto, Calif.

Mr. Clifford M. King has resigned as City Engineer of Sandusky, Ohio. Mr. King has held this position since 1908.

Mr. Howard C. Baird; M. Am. Soc. C. E., formerly Principal Assistant Engineer with Boller & Hodge, has been made a member of the firm.

Mr. Clifford M. King, Assoc. M. Am. Soc. C. E., has resigned his office of City Engineer of Sandusky, O., to enter private practice in the same city.

Jas. A. Green & Co., Inc., Engineers and Contractors, announce the removal of their Chicago offices from 226 So. La Salle St. to 111 W. Monroe St.

Mr. W. T. Wooley, formerly City Engineer of Auburn, N. Y., and recently connected with the State Highway Department, has been appointed City Engineer of Schenectady, N. Y.

Mr. F. L. Clapp, formerly Assistant Engineer of the Hudson River division of the Catskill Aqueduct, has been appointed Acting Division Engineer to succeed Mr. Wm. E. Swift, who has resigned.

Mr. Chas. D. Gregory, Designing Engineer of the Headquarters Department, Board of Water Supply, New York City, has resigned to accept a position on the engineering staff of the Borough of Manhattan.

Mr. Thomas W. Orbison has resigned as Vice-President of the O'Keefe-Orbison Engineering & Construction Co. of Appleton, Wis., and will enter private practice as a consulting engineer with offices in Appleton.

Mr. Caleb Mills Saville, M. Am. Soc. C. E., has resigned his position with the Isthmian Canal Commission and has accepted an appointment as Chief Engineer in charge of the water-works of the city of Hartford, Conn.

Mr. R. W. Edwards, Superintendent of Terminals of the Kansas City Southern Railway at Kansas City, Mo., has accepted a position in a similar capacity with the Pittsburg & Lake Erie R. R. Co., at Youngstown, O.

Messrs. D. P. Robinson, M. Am. Inst. E. E., President and General Manager of the Stone & Webster Engineering Corporation, and John W. Hallowell have become partners of the firm of Stone & Webster, Boston, Mass.

Mr. L. K. Sherman, Assistant Chief Engineer of the Sanitary District of Chicago, will leave the District Feb. 1 to be associated with Mr. George Donnersberger as engineers and contractors under the firm name of L. K. Sherman & Co.

Mr. Benj. E. Bush, President of the Missouri Pacific Railway, has been elected President of the Denver & Rio Grande R. R., also Mr. E. T. Jeffery, who formerly held this position, has been made Chairman of the Board of Directors, succeeding Mr. George J. Gould.

Mr. Severn D. Sprong has resigned his position as Chief Electrical Engineer of the J. G. White Co., Inc., and has accepted the position of Electrical Engineer of the Brooklyn-Edison Co. He will retain the relation of Consulting Electrical Engineer to J. G. White & Company.

Mr. C. A. Delaney, who for a number of years was Superintendent of the Dickson Works of the American Locomotive Co. at Scranton, Pa., and later Sales Representative at that place, has been appointed Western Representative with headquarters in the McCormick building, Chicago.

Major G. M. Hoffman, U. S. A., accompanied by his wife and family, returned to the Isthmus of Panama after a leave of absence. Major Hoffman is Assistant Engineer, Atlantic Division, of the Panama Canal, and is in charge of the construction of the Gatun Dam and Spillway.

Mr. C. A. Seley, Mechanical Engineer of the Rock Island Lines, delivered an address before the students and faculty of the College of Engineering of the University of Illinois, on January 4, 1912, on "Conference Committee Methods in Handling Railway Legislation on Mechanical Matters."

Mr. Benjamin S. Reynolds has assumed charge in the Chicago office of the elevating and conveying machinery line for the Chain Belt Company, Milwaukee, Wis. Mr. Walter B. Louer will still remain in charge of the Chain Belt Mixer. The Chicago offices of the company have been moved to 900-902 Old Colony Bldg.

Mr. D. W. Dodge and Mr. Arthur A. Prausnitz have been appointed to manage, jointly, the territory covered by the Pacific Coast head office of the Orenstein-Arthur Koppell Co. in San Francisco. The offices of the company were transferred on Jan. 15 from the Chronicle building to the Rialto building, Rooms 229-233.

Mr. H. A. Parker, formerly Instructor of Surveying at the University of Wisconsin, has been appointed Chief of Party by the Wisconsin Highway Commission, Madison, Wis. Mr. Parker was Assistant to Supt. F. K. Lyon with the Empire Engineering Corporation on Contract No. 5 of the New York State Barge Canal.

Mr. J. T. Harahan, former head of the Illinois Central system, and Mr. F. O. Melcher, vice-president of the Rock Island system, were killed in a railroad accident in the early morning of Jan. 22. The wreck occurred on the Illinois Central near Kinmundy, Ill. The officials' private car was attached to the Seminole Flier, which was standing, taking water, when struck by train No. 3.

Mr. Geo. W. Jackson and Mr. E. A. Clark announce the formation of a partnership under the name of Geo. W. Jackson & E. A. Clark Co. as engineers, and are prepared to make examinations and reports on subways, tunnels, conduits, water and sewer systems, power plants, heavy foundations, patents and mining properties. Mr. Clark has for some time been Tunnel Engineer of the Geo. W. Jackson Co. Offices are at 754-756 Jackson Blvd., Chicago, and 228 W. 42d St., New York City.

Mr. Jas. A. Scully and Mr. Geo. E. Jones have organized the Scully-Jones & Co. of Chicago, for the purpose of carrying on a business in foundry equipment and supplies, machinists' supplies, and railway appliances. Mr. Scully who was formerly Work Superintendent for the Whiting Foundry & Equipment Co., and Mr. Jones, who has had charge of Inspection, Superintendent of outside erection and complaint adjustments for the Whiting Foundry & Equipment Co., have tendered their resignations, which went into effect on January 6.

Civil Engineering Society Meetings.

Kansas Engineering Society. W. L. Gearhart, Manhattan Sec'y. Annual meeting at Manhattan, Jan. 23-24.

Ohio Engineering Society.—C. J. Knisely, New Philadelphia, Sec'y. Annual meeting at Cleveland, Jan. 24-26.

Canadian Society of Civil Engineers.—C. H. McLeod, 413 Dorchester St., Montreal, Sec'y. Annual meeting at Montreal, Jan. 24-26.

Indiana Engineering Society.—Chas. Brossman, Union Trust Bldg., Indianapolis, Sec'y. Annual meeting at Indianapolis, Jan. 25-27.

Iowa Engineering Society.—S. M. Woodward, Iowa City, Sec'y. Annual meeting at Davenport, Feb. 21-23.

Eastern Cement Show.—Annual show at Madison Square Garden, New York, Jan. 29-Feb. 3.

Engineering Society of Wisconsin.—John C. White, Madison, Sec'y. Annual meeting at Madison, Feb. 14-16.

North Dakota Society of Engineers. R. W. Livingston, Mandan, N. D., Sec'y. Annual meeting at Grand Forks, N. D., Feb. 16-17

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING & CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

The Machinery List, paper, 3¾ x 6 ins., 68 pp. A. H. Hitchcock, 1220 Caxton Bldg., Chicago, Ill.

This is the January number of the monthly reference list for buyers of saw-mill and wood-working machinery.

Mica Paints, paper, 3¼ x7 ins., 8 pp. J. C. Moore Mica Paint Co., 76 William St., New York City.

This pamphlet contains useful information regarding "Indestructible Liquid Mica Paint," which, it is claimed, will stand perfectly the salt air combined with the dripping from refrigerator stock cars or vibration of trains. The waterproof paste such as was used by the company's waterproofing department in the Pennsylvania Railroad tunnels at New York City will become a clinging elastic surface even under water, so that by its use a leaky roof could be stopped during a rain. Methods of its application by compressed air are of special interest.

Dixie Sand Dryer, paper, [illegible] ins., 4 pp. E. C. Sherwood, 50 Church St., New York City.

This pamphlet is illustrated with photographs of the Dixie Sand Dryer, showing the apparatus complete and in sectional views. The machine is made in different sizes from a capacity of 6 to 10 tons of sand per day.

Patent Forms for Curbing, Gutter and Sidewalks, paper, 3½ x 7⅜ ins., 8 pp. S. C. Smith & Son, Waverly, N. Y.

This folder illustrates and describes the Smith Patent Rail Clamp and Division Plates. The rail clamps and plates are used in connection with wood forms for facilitating the work. A price-list of plates and clamps and complete descriptions are given.

Gould Pumps, paper, 7¾ x 10¾ ins., 20 pp. The Gould Manufacturing Co., Seneca, Falls, N. Y.

Bulletin No. 109 illustrates and describes Gould's single acting Triplex Pressure Pumps used for special services. Illustrations showing pumps of different sizes with specifications, dimensions and capacities are given.

Bulletin No. 107 illustrates and describes deep well triplex pumps, giving complete illustrations, specifications, dimensions and capacities. This pamphlet also contains tables of friction of water in pipes, feed head of water and equivalent pressure, pressure and equivalent feet head of water, and barometric pressure at different altitudes.

Well Drilling Machinery, paper, 10⅝x7¾ ins., 12 pp. Williams Bros., Ithaca, N. Y.

This catalog contains full page illustrations showing details and methods of operation of various types of well drilling tools and machinery for operation. Complete lists of parts of each machine are given; also illustrations of bits, wrenches, pumps and special tools with prices.

Hammer Drills, paper, 6 x 9 ins., 12 pp. Ingersoll-Rand Co., New York City.

Pamphlet Form No. 4016 is descriptive of the "MC-22" Telescope Hammer Drill, which is of the "valveless" type. This tool is intended for stoping, raising, and to a limited extent, drifting. It is not recommended for steady work in holes at less than 20° from the horizontal, because of the difficulty of cleaning such holes. The catalog shows several views of the machine in sections and also a list of duplicate parts.

Valves.—Paper, 9x5¼ ins., 114 pp. Kennedy Valve Manufacturing Co., Elmira, N. Y.

This is a very complete catalog containing descriptions and sectional views of the different types of, "Gate Valves (30 pp.); Bronze Gate Valves (12 pp.); Iron Body, Bronze Mounted and All Iron (Steel Stems) Gate Valves and Indicator Devices for Automatic Sprinkler Systems (34 pp.); Renewable Disc Globe, Angle and Radiator Valves, Swing Check Valves, Back Water and Sewer Gas Valves (12 pp.); Hydrants for 150 Pounds Working Pressure Extension Valve Boxes, Floor Stands, Flanges (14 pp.); Tables of Diameters, Drilling and Bolting of Flanges of Valves, Pressures, Areas of Circles, Telegraphic Code (10 pp.).

Rock Drills.—Paper, 6x9 ins., 16 pp. Ingersoll-Rand Co., 11 Broadway, New York City.

Bulletin 4204 describes the "Arc Valve" Tappet Rock Drill. This drill has an arc-shaped valve which is moved on a circular seat by a rocking tappet, the sliding surfaces all being concentric with the rocker pin. The working pressure is on the back of the valve, forcing it to its seat. Catalog shows sectional views of drill and also gives list of duplicate parts, together with descriptive table of sizes and capacities.

Erie Dredging Pumps.—Paper, 6x9 ins., 16 pp. Erie Pump & Engine Works, Erie, Pa.

Bulletin No. 27 illustrates and describes Erie Sand-Gravel Dredging Pumps. Complete descriptions with illustrations of centrifugal pumps, operated by belts and direct connected to steam engines, are shown. A special portable outfit is also shown. Tables of specifications and prices are given.

Acme Nestable Corrugated Culverts.—Paper, 6x3½ ins., 20 pp. The Canton Culvert Co., Canton, O.

This folder is printed in Spanish and illustrates and describes the No-co-ro Metal Culverts. Illustrations of installations are shown, dimensions of thickness of metal is illustrated graphically, and a table of diameters, gage, weights, capacities and prices are given. The export office of the company is at the corner of Eleventh avenue and Twenty-second street, New York City.

Carbonized Coating.—Paper, 8x10 ins., 24 pp. The Goheen Mfg. Co., Canton, O.

This is a protective paint for the preservation of iron and steel structures. The catalog contains illustrations of steel structures which have been painted with this material.

CONTRACT NEWS SECTION

of

ENGINEERING & CONTRACTING

The Doings of the Week.

There [illegible] considerable [illegible] developments [illegible] which seem to make certain a large [illegible] construction [illegible] the present season. One of these developments was the sale [illegible] the Chicago, Rock Island & Pacific of a $20,000,000 issue of 25 year [illegible] bonds. This is the first important sale of long term bonds that has been made for a considerable period, and it suggests a revival of confidence on the part of large banking interests. The proceeds of this bond issue will be used for terminal improvements at Omaha, for a new terminal and a bridge across the Mississippi River at Memphis and for other purposes. In the way of immediate construction work, the largest contract which has come up the past few days appears to be the project of the Delaware, Lackawanna & Western R. R. for a new route from Clarkes Summit to Hallstead, Pa., a distance of about 35 miles. This work will involve much heavy grading and a considerable amount of concrete work, and it will cost about $15,000,000 to $16,000,000. It is understood that the grading contracts will be let about March 1. Two other smaller pieces of work are now open for bids. One of these calls for 275,000 cu. yds. of grading on the Stone City-Giddings branch of the Houston & Texas Central R. R. in Texas, and the other calls for 210,000 cu. yds. of grading for the Farley & Iowa Northern R. R. in Iowa.

Among the railroad construction contracts let recently are the following: Erickson & Long, Cloquet, Minn., for constructing two miles of track from Hawkins Junction, Minn., for the Great Northern Ry.; H. E. Culbertson Co., Citizens Bldg., Cleveland, O., for double tracking the Pennsylvania R. R. between Dublin and Dunreith, Ind., a distance of 12 miles; Sam Robertson, San Benito, Tex., for building a 9-mile railroad from Rivera, Tex., to Rivera Beach; Propst Contracting Co., Charlotte, N. C., for grading for three tracks to the plant of the Interstate Chemical Co. for the Seaboard Air Line Ry.; the Fidelity Construction Co., J. W. Hoffman, president, 618 Bryant Bldg., St. Louis, Mo., for building the new lines of the Missouri, Oklahoma & Gulf R. R. in Texas and Oklahoma.

In the way of drainage work the largest piece of work which has been advertised the past week is that of the Sanitary District of Chicago. This contract calls for the excavation and collateral work on Contract Section 3 of the Calumet-Sag channel, and includes 335,000 cu. yds. glacial drift excavation, 220,000 cu. yds. rock excavation and 13,400 cu. yds. of concrete retaining wall. Bids will be opened Feb. 15. The largest irrigation work for which bids have been asked the past week calls for the construction of an earth dam and auxiliary work on the North Platte project of the U. S. Reclamation Service. This work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earth fill, 157,000 cu. yds. gravelly material, 14,000 cu. yds. unscreened gravel, 11,500 cu. yds. screened gravel, and 14,000 cu. yds. concrete.

Another bill to secure government aid in the construction of highways has been introduced in the Senate. This bill provides for the construction of a government pike from Cumberland, Md., to the Pacific coast. The bill also provides for the creation of a national highway commission of five members and a board on national highway rules, to be composed of [illegible] tary of commerce and labor, secretary of agriculture and the chairman of the interstate commerce commission. Provision is made for an appropriation of $100,000 this year, [illegible]

A good sized New York state barge canal contract has just been awarded to James Stewart & Co., 30 Church St., New York city. This work calls for the construction of the canal between Morquit's bridge and Fox Ridge on the Seneca River. The contract price was [illegible]

Rail Orders in the Old Days.

At a hearing a couple of weeks ago of the Congressional Commitee of Inquiry on the U. S. Steel Corporation [illegible] ening illustration of the way rail orders were sometimes placed in the days when he was active in the steel industry:

[illegible] close friends in the railroad business. I re- [illegible] were out there. I walked over to Sidney Dillon [illegible] of something like $640,000 in Philadelphia, and they elected me and George M. Pullman directors. I told Dillon about the bids and asked him if the Carnegie rails were satisfactory. He said they were. I said "I want the Union Pacific to do business with me and I'll give you the lowest price." He said, "All right, Carnegie," and I got the 70,000-ton contract. Now, [illegible] such an influence as that?

Mr. Carnegie also related how he had given a credit to Collis P. Huntington, president of the Union Pacific, at a time when Huntington was "hard up": "He was my friend," said Carnegie. "What chance had a paid agent to compete under these conditions?"

Workmen's Compensation Act.

[illegible] Workmen's Compensation Act goes into effect. This act is of direct interest to contractors operating in this state. Under its provisions compensation is made a preferred claim. It fixes the responsibility of contractors. Should a subcontractor decline to pay the fixed benefits defined by the law it is provided that the principal contractor shall be held liable for payment. The act is specific in its definition of beneficiaries of workers who are killed, thus obviating the necessity of establishing in court or otherwise what constitutes dependence and what fixes its various grades. The act provides that should the employer decide to accept the compensation provision of the new law the employe may give notice that he does not agree to take for himself and his dependents the law's definite benefit for injuries or death but prefers the conditions under which the employer may make any of the common law defenses in court. Another provision of the act is that an agreement of settlement between the employer and the employe made within seven days after the injury shall be presumed to be fraudulent. It is further [illegible] serious or permanent disfigurement of hands or face even though the worker may not be disabled or prevented from working

Calling for Bids in Winter.

[illegible] municipal officials appreciate the advantage of calling for bids during the winter [illegible] for at least a part of their next season's work? The winter months in the cold weather belt are the dull season in the municipal contracting field. Most contractors have completed their contracts and are on the lookout for new jobs on which they can begin operations in the spring. They are glad of the opportunity to figure on new work and any letting at this time is pretty sure of attracting more attention than it would at any other season of the year. There is always a considerable amount of municipal work, especially street paving work, which could be put under contract now to the mutual advantage of the cities and the contractors.

Bill and the Supe.

It is with some misgivings that we reprint from the New York Times the following pome by Berton Braley. Perhaps it would be best to say that one of the chief reasons for doing this was that the exigencies of the printer's "make up" required something to fill out the lower right-hand column of this page.

Now listen to me, while I tell you,
The tale of the Supe an' Bill McGrue.

Bill he was takin' a little mope
After drillin' his holes in the stuffy slope.

An' settin' down on a timber car
He lights a match to a bum cigar.

He scurcely more than gits a light
When a guy in overalls heaves in sight.

"Takin' a rest?" says he to Bill.
"You bet," says William, an' sets right still.

"Ain't you got nothin' at all to do?"
"I have," says Bill, "when I'm ready to."

"What would you do," says the stranger guy,
"If the shift boss happened to wander by?"

"I'd set," says Bill, "like a tired bloke,
[illegible]

[illegible]

[illegible]
[illegible] the superintendent here"

[illegible]
[illegible] that's grand that's fine;

[illegible]
If I was you I would tend to it!"

Then Bill leans back on the empty car
An' goes on smokin' his bum cigar

* * * *

We have added the symbols at the bottom of the pome to indicate the presumable action of the Supe and what Bill saw following this action.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Surveys are being made for the proposed line of the Eufaula & Chattanooga R. R. Co. from Pittsview to Eufaula. It is expected that these surveys will be completed in six or seven weeks and the work then put under construction. Maj. D. B. McKenzie, Eufaula, Ala., is the Engineer.

The Georgia & Alabama R. R. Co. has been incorporated with a capital stock of $250,000, of which $10,000 has been subscribed. The headquarters will be at Wedowee, Randolph County, Alabama, and the company proposes to build and operate a railroad about 50 miles long from Tallapoosa, Ga., through Haralson County, Georgia, and Cleburne and Randolph counties, Alabama, to intersect with the main line of the A., B. & A. at or near Malone, Randolph County. The stockholders are C. R. Porter, T. J. Simpson, J. C. Porter, G. R. Hitchings and Alex T. Hamilton.

Arkansas.

The Crossett Lumber Co., Crossett, Ark., is understood to be considering extending its railroad from its present terminus near Lacey to Monticello, Ark.

The stockholders of the Kansas City & Memphis Ry. recently held their annual meeting at Rogers, Ark., and elected the following directors for the ensuing year: George D. Locke, J. W. Walker, R. C. Hobbs, W. B. Felker, F. F. Freeman, M. Hays, J. S. McLeod of Rogers, Ark.; A. L. Williams, Fayetteville, Ark., and Dick Rice, Bentonville, Ark. The completion of the Fayetteville extension of the road will be done about the first of April, which will give the company 58 miles of road in operation. Immediately upon completion of the Fayetteville extension, the construction work will continue toward Memphis, Tenn., and Little Rock, Ark. The directors met immediately following the adjournment of the stockholders' meeting, and elected the following officers for the ensuing year: W. R. Felker, chairman of the board; George D. Locke, president and general manager; A. L. Williams and J. W. Walker, vice president; W. B. Felker, secretary and treasurer; William Goodman, assistant secretary; R. C. Hobbs, traffic manager; W. W. Moody, auditor; Dick Rice, general attorney; M. Hays, chief engineer, and J. E. Felker, purchasing agent.

C. C. Godman, Fort Smith, Ark., General Manager of the Webber Falls, Shawnee & Western Ry., will probably confer with business men of Little Rock, Ark., on the matters concerning the construction of a railroad north from Little Rock, crossing at right angles the Missouri & North Arkansas, Iron Mountain line from the Ozarks to Memphis and paralleling the Frisco. Such a line would considerably shorten the distance from points in southern Missouri and northern Arkansas to Little Rock.

A meeting was recently held at Stuttgart, Ark., by the Board of Directors of the Stuttgart & Rice Belt R. R. and Judge G. C. Lewis, Stuttgart, Ark., was elected president; M. Schulter, Chicago, vice president and traffic manager, and J. W. Underwood, Stuttgart, Ark., secretary and treasurer. At the same time a meeting of the Board of Directors of the Stuttgart & Southern R. R. was held, and Judge Lewis was also chosen president of this corporation, with J. I. Porter, Stuttgart, Ark., vice president, and J. J. Reading, auditor of the Rice Belt, secretary. The Stuttgart & Southern is a line proposed to extend from Stuttgart south to the Arkansas River, penetrating a rich farming and timber section. The project is meeting with much encouragement, and the line will probably be built in the near future.

C. W. Dodson, General Superintendent of the Memphis, Dallas & Gulf R. R., has announced in Nashville, Ark., that work on the Hot Springs extension from Murfreesboro is progressing nicely. Contractor T. H. Slater has practically completed Miles One and Two and will shortly move his outfit to Five and Six. W. J. Murphy will have Three and Four completed in a short time and will take up Seven and Eight. More contracts will probably be let as soon as the weather improves.

California.

⊙R. H. VanSanta and Shirley Houghton, San Francisco, have been awarded the contract for constructing a 15-stall roundhouse at Riverbank near Modesta for the Santa Fe system. Work has been started and the contract calls for its completion by April 30. Provision is to be made for 10 extra stalls.

⊙Maney Bros. of Boise, Idaho, have taken a subcontract from the Mallon-Yoke Co., Princeton, Cal., on the grading work of the Colusa and Hamilton City branch of the Southern Pacific, and have established camps near Hamilton City for this work.

⊙The Mallon-Yohe Co., which has the contract for grading the Colusa-Hamilton City branch of the Southern Pacific Ry., mentioned in our last issue, is preparing to start work at once and push it to completion. From 1,500,000 to 1,800,000 cu. yds. of earth are to be moved. About 500 mules and 150 men will be put on the job. The road, which runs from Harrington in Colusa County on the main stem of the Southern Pacific to Hamilton City, on the Sacramento River in Glenn County, is 61 miles in length. The line is known to the Southern Pacific as the "Beet Line."

It is reported that the Santa Fe Railway System will shortly commence the construction of a reinforced concrete freight shed estimated to cost $100,000, at San Diego, Calif.

The following minor improvements are contemplated by the Santa Fe system in California: Installation of water plant at High Grove, cost covered by an appropriation of $5,000; the extension and repair of wharf warehouse at Stockton, to cost $2,800; construction of two tracks to serve the Gate City Ice and Precooling Co. at San Bernardino, approximate length 2,350 ft. each; construction of track at Gate City to serve the Gate City Ice and Precooling Co., at a cost of $1,765.

Colorado.

In a recent visit to Denver B. F. Bush, the newly elected President of the Denver & Rio Grande R. R., stated that there was "plenty of money" with which to make all necessary or needful improvements in the Denver & Rio Grande R. R., and that such improvements, "if any were needed," would be made immedately.

The San Luis Southern Ry., F. E. Brooks, President, Colorado Springs, Colo., is considering extending its line south from its present terminal and has surveys under way for this purpose.

It is believed here in Denver that the Hudson-Greeley cutoff of the Burlington route will probably be started some time during this summer and that rails will be laid on the grade already completed between Thermopolis and Powder River, Wyo., thereby practically completing the coast-to-gulf line.

Another conference of officials of the railroads interested in the union depot project is to be held shortly and it is expected that definite action on the plans for the new station will be taken. In the meantime H. W. Cowan, Denver, Chief Engineer of the Colorado & Southern, chairman of the engineers' committee, has called the meeting of the various engineers at Denver instead of Omaha as originally planned in order to facilitate a decision on certain features of the proposed plans. Those who will be in attendance will be F. T. Darrow, Lincoln, Neb., representing the Burlington; R. L. Huntley, Omaha, the Union Pacific; J. S. Owyn, Denver, the Denver & Rio Grande; C. F. W. Felt, Topeka, the Santa Fe, and J. B. Barry, Chicago, the Rock Island.

The Santa Fe system has appropriated $109,000 to cover cost of widening cuts and fills to standard width to receive ballast and insert 12 ins. of slag between La Junta and Nepesta, Colo.

Florida.

The Atlantic Coast Line Ry., E. B. Pleasant, Chief Engineer, Wilmington, N. C., is making good progress in buying the right of way for its proposed connecting lines from Dunnellon to Oldtown, 42 miles, and from Perry to Monticello, 33 miles.

Georgia.

The Atlanta, Waycross & Northern R. R. has completed surveys for its projected 200 mile extension from Kingsland, Ga., to Fort Valley, Ga. Bonds for construction purposes are now on the market. Contracts have not been let as yet. D. G. Edwards, Plainfield, N. J., is chief engineer. L. Johnson, 31 Marys, Ga., is president and general manager.

Davis & Hughes Bros., who have the contract for grading the first seven miles of the Green County R. R., which will run from Apalachee to Monroe, Ga., have started work. The contract calls for seven miles of grading from Bostwick to Goodhope, in Walton County, Georgia, and for the completion of this grading in 60 days. While this seven miles is let for actual building now, it is the purpose of the company to extend the line at both ends. The terminus will be at Good Hope temporarily, but the road is to be pushed on to Monroe and then to Loganville on the Seaboard Air Line. On the other end the road will be extended from Apalachee on the Central of Georgia, southward to Greensboro and Sparta. At Monroe the road will tap the Georgia R. R. and the Gainesville Midland, at Apalachee it will tap the Central road and at Greensboro it taps the Georgia R. R. At Sparta it taps the Macon and Camak branch of the Georgia R. R. The territory through which this road will go is rich farming section. W. D. Branon, Bostwick, Ga., is Vice President and General Manager of the railroad.

Illinois.

The Central Illinois Ry. Co., the incorporation of which was mentioned in our last issue, proposes to construct a railroad from Hawthorne at the outskirts of Chicago. The line will run directly to Plainfield, touching Plattsville, Wedron, Dimmick and Princeton, and will then run across the state to Muscatine.

Engineers of the Elgin, Joliet & Eastern Ry. have completed surveys for the proposed improvements at Rossville, Ill., including the construction of a new round house to accommodate 18 engines. A. Montzheimer, Joliet, Ill., is Chief Engineer of the E. J. & E.

The Milwaukee, Peoria & St. Louis R. R. Co. has increased the capital stock from $5,000 to $2,500,000.

Indiana.

⊙The H. E. Culbertson Co., Citizens' Bldg., Cleveland, O., has the contract for double tracking the Pennsylvania R. R. between Dublin and Dunreith, a distance of 12 miles. In connection with this the Culbertson Co. has about 50,000 cu. yds. of team work which it would be glad to sub-let.

The Evansville Rys. Co. has secured the capital for its projected 10-mile line from Evansville, Ind., to Henderson, Ky. The new line will be made by electrifying the Illinois Cen-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

tral tracks between the above cities. The Evansville Rys. Co. will do this work with its own forces. W. A. Carson, Evansville, Ind., is General Manager.

The Louisville & Southern Indian Traction Co., J. Insull, Gen[illegible] Albany, Ind., is considering extending its interurban line from Jeffersonville to the Walnut Ridge cemetery near that place.

Iowa.

✣The Farley & Iowa Northern R. R. Co. is now asking bids for the moving of 210,000 cu. yds. of earth on its first section of 12 miles between Farley and Luxemburg, Ia. Profiles, etc., are with S. G. Durant, Dyersville, Ia. This new line is planned to extend from Farley on the south from a connection with the Illinois Central and Great Western railroads to Waukon on the north, a distance of about 80 miles. Construction estimates on this new line were completed last summer and were based on a survey made several years ago by trunk line interests, who, it is understood, then had plans in view of building to the north from Farley practically over the same route the new road has now concluded to build over. The new road will tap a section of country rich in agricultural possibilities and will serve districts now without adequate transportation facilities.

The Cedar Rapids & Iowa City Railway & Light Co., Wm. G. Dows, President, Cedar Rapids, has surveys underway for its proposed interurban line between Cedar Rapids and Mt. Vernon.

The Iowa Short Line Railroad Co. has been incorporated at Wilmington, Dela., with a capital stock of $5,000,000, planning the construction of a railroad in the state of Iowa. The incorporators are S. E. Robertson, M. L. Rogers and H. W. Davis, Wilmington, Del.

Kansas.

The Kansas City & Fort Scott Electric Ry. Co. has surveys underway in Linn County near Pleasanton, and has already completed surveys through Wyandotte, Johnson and Miami counties. This company proposes to build an electric line from the end of the Metropolitan's Rosedale line in a straight line south to Fort Scott. The right of way is being donated by farmers through whose land it runs and the farmers are to capitalize the road. It is expected the line will connect at Fort Scott with the Joplin-Pittsburg electric railway, which now extends to Mulberry, 17 miles from Fort Scott. A connection between the two lines would afford through trolley connection with the mining district of Kansas and Missouri. The officers of the company are as follows: W. T. Quarles, Stanley, Kan., president; J. Frank Smith, postmaster of Pleasanton, Kan., vice president; W. E. Brooks, mayor of Fort Scott, secretary; John C. Forester, secretary Fort Scott Industrial Association, assistant secretary; J. H. Schrader, Stanley, Kan., treasurer.

At the annual meeting of the stockholders of the Topeka Southwestern Ry. Co. at the office of C. K. Holiday, Topeka, Kan., it was announced that the necessary capital was not available for the construction of a line from Topeka to Council Grove and nothing definite had been decided. The stockholders chose a new board of directors for the current year. The officers chosen are C. K. Holliday, Topeka, president; W. H. Davis, Topeka, first vice president; W. H. Melrose, Eskridge, second vice president; E. B. Merriam, Topeka, secretary and treasurer. The executive committee includes C. K. Holliday, W. H. Davis, E. B. Merriam, W. C. Stephenson of Topeka, and W. H. Melrose, Eskridge; W. F. Shamleffer, Council Grove, and John R. Tomson of Dover. The attorney is Edward A. Austin of Topeka. The new board of directors includes: From Topeka, C. K. Holliday, C. W. Merriam, E. B. Merriam, E. H. Crosby, H. A. Auerbach, W. C. Stephenson, W. L. Taylor, W. H. Davis, George W. Crane, H. W. McAfee, Peter Heil and E. A. Austin; Dover, T. B. Babst, John R. Tomson; Eskridge, W. H. Melrose, W. C. Hamilton,

Kentucky.

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The Grand Trunk Ry., through its subsidiary company, the Southern New England Ry. Co., has petitioned the state legislature for leave to enter Boston from the northwest, coming down through New Hampshire. A further part of the same petition is that the Palmer extension may have authority to enter the city of Worcester. By these petitions the railroad has asked permission to construct a road from a point on the Central Vermont railway in the Connecticut valley, across New Hampshire and Middlesex county, to Boston, and also to build a line from Blackstone to Boston, another from Douglas to Worcester, and petitions for authority to own and operate steamships. The Southern New England Ry. was originally organized to build a branch line from the Central Vermont Ry. at Palmer, Mass., to Providence, R. I. Surveys for this branch have been made and it is understood that all arrangements have been completed so that construction work can be started in the spring. H. R. Safford, Montreal, Que., is Chief Engineer of the Grand Trunk Ry.

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RAILWAYS, STEAM AND ELECTRIC

Alabama.

Surveys are being made for the proposed line of the Eufaula & Chattanooga R. R. Co. from Pittsview to Eufaula. It is expected that these surveys will be completed in six or seven weeks and the work then put under construction. Maj. D. B. McKenzie, Eufaula, Ala., is the Engineer.

The Georgia & Alabama R. R. Co. has been incorporated with a capital stock of $250,000, of which $10,000 has been subscribed. The headquarters will be at Wedowee, Randolph County, Alabama, and the company proposes to build and operate a railroad about 50 miles long from Tallapoosa, Ga., through Haralson County, Georgia, and Cleburne and Randolph counties, Alabama, to intersect with the main line of the A., B. & A. at or near Malone, Randolph County. The stockholders are C. R. Porter, T. J. Simpson, J. C. Porter, G. R. Hitchings and Alex T. Hamilton.

Arkansas.

The Crossett Lumber Co., Crossett, Ark., is understood to be considering extending its railroad from its present terminus near Lacey to Monticello, Ark.

The stockholders of the Kansas City & Memphis Ry. recently held their annual meeting at Rogers, Ark., and elected the following directors for the ensuing year: George D. Locke, J. W. Walker, R. C. Hobbs, W. B. Felker, F. F. Freeman, M. Hays, J. S. McLeod of Rogers, Ark.; A. L. Williams, Fayetteville, Ark., and Dick Rice, Bentonville, Ark. The completion of the Fayetteville extension of the road will be done about the first of April, which will give the company 58 miles of road in operation. Immediately upon completion of the Fayetteville extension, the construction work will continue toward Memphis, Tenn., and Little Rock, Ark. The directors met immediately following the adjournment of the stockholders' meeting, and elected the following officers for the ensuing year: W. R. Felker, chairman of the board; George D. Locke, president and general manager; A. L. Williams and J. W. Walker, vice president; W. B. Felker, secretary and treasurer; William Goodman, assistant secretary; R. C. Hobbs, traffic manager; W. W. Moody, auditor; Dick Rice, general attorney; M. Hays, chief engineer, and J. E. Felker, purchasing agent.

C. C. Godman, Fort Smith, Ark., General Manager of the Webber Falls, Shawnee & Western Ry., will probably confer with business men of Little Rock, Ark., on the matters concerning the construction of a railroad north from Little Rock, crossing at right angles the Missouri & North Arkansas, Iron Mountain line from the Ozarks to Memphis and paralleling the Frisco. Such a line would considerably shorten the distance from points in southern Missouri and northern Arkansas to Little Rock.

A meeting was recently held at Stuttgart, Ark., by the Board of Directors of the Stuttgart & Rice Belt R. R. and Judge G. C. Lewis, Stuttgart, Ark., was elected president; M. Schulter, Chicago, vice president and traffic manager, and J. W. Underwood, Stuttgart, Ark., secretary and treasurer. At the same time a meeting of the Board of Directors of the Stuttgart & Southern R. R. was held, and Judge Lewis was also chosen president of this corporation, with J. I. Porter, Stuttgart, Ark., vice president, and J. J. Reading, auditor of the Rice Belt, secretary. The Stuttgart & Southern is a line proposed to extend from Stuttgart south to the Arkansas River, penetrating a rich farming and timber section. The project is meeting with much encouragement, and the line will probably be built in the near future.

C. W. Dodson, General Superintendent of the Memphis, Dallas & Gulf R. R., has announced in Nashville, Ark., that work on the Hot Springs extension from Murfreesboro is progressing nicely. Contractor T. H. Slater has practically completed Miles One and Two and will shortly move his outfit to Five and Six. W. J. Murphy will have Three and Four completed in a short time and will take up Seven and Eight. More contracts will probably be let as soon as the weather improves.

California.

⊙R. H. VanSanta and Shirley Houghton, San Francisco, have been awarded the contract for constructing a 15-stall roundhouse at Riverbank near Modesta for the Santa Fe system. Work has been started and the contract calls for its completion by April 30. Provision is to be made for 10 extra stalls.

⊙Maney Bros. of Boise, Idaho, have taken a subcontract from the Mallon-Yoke Co., Princeton, Cal., on the grading work of the Colusa and Hamilton City branch of the Southern Pacific, and have established camps near Hamilton City for this work.

⊙The Mallon-Yohe Co., which has the contract for grading the Colusa-Hamilton City branch of the Southern Pacific Ry., mentioned in our last issue, is preparing to start work at once and push it to completion. From 1,500,000 to 1,800,000 cu. yds. of earth are to be moved. About 500 mules and 150 men will be put on the job. The road, which runs from Harrington in Colusa County on the main stem of the Southern Pacific to Hamilton City, on the Sacramento River in Glenn County, is 61 miles in length. The line is known to the Southern Pacific as the "Beet Line."

It is reported that the Santa Fe Railway System will shortly commence the construction of a reinforced concrete freight shed estimated to cost $100,000, at San Diego, Calif.

The following minor improvements are contemplated by the Santa Fe system in California: Installation of water plant at High Grove, cost covered by an appropriation of $5,000; the extension and repair of wharf warehouse at Stockton, to cost $2,800; construction of two tracks to serve the Gate City Ice and Precooling Co. at San Bernardino, approximate length 2,350 ft. each; construction of track at Gate City to serve the Gate City Ice and Precooling Co., at a cost of $4,765.

Colorado.

In a recent visit to Denver B. F. Bush, the newly elected President of the Denver & Rio Grande R. R., stated that there was "plenty of money" with which to make all necessary or needful improvements in the Denver & Rio Grande R. R., and that such improvements, "if any were needed," would be made immedately.

The San Luis Southern Ry., F. E. Brooks, President, Colorado Springs, Colo., is considering extending its line south from its present terminal and has surveys under way for this purpose.

It is believed here in Denver that the Hudson-Greeley cutoff of the Burlington route will probably be started some time during this summer and that rails will be laid on the grade already completed between Thermopolis and Powder River, Wyo., thereby practically completing the coast-to-gulf line.

Another conference of officials of the railroads interested in the union depot project is to be held shortly and it is expected that definite action on the plans for the new station will be taken. In the meantime H. W. Cowan, Denver, Chief Engineer of the Colorado & Southern, chairman of the engineers' committee, has called the meeting of the various engineers at Denver instead of Omaha as originally planned in order to facilitate a decision on certain features of the proposed plans. Those who will be in attendance will be F. T. Darrow, Lincoln, Neb., representing the Burlington; R. L. Huntley, Omaha, the Union Pacific; J. S. Owyn, Denver, the Denver & Rio Grande; C. F. W. Felt, Topeka, the Santa Fe, and J. B. Barry, Chicago, the Rock Island.

The Santa Fe system has appropriated $109,000 to cover cost of widening cuts and fills to standard width to receive ballast and insert 12 ins. of slag between La Junta and Nepesta, Colo.

Florida.

The Atlantic Coast Line Ry., E. B. Pleasant, Chief Engineer, Wilmington, N. C., is making good progress in buying the right of way for its proposed connecting lines from Dunnellon to Oldtown, 42 miles, and from Perry to Monticello, 33 miles.

Georgia.

The Atlanta, Waycross & Northern R. R. has completed surveys for its projected 200 mile extension from Kingsland, Ga., to Fort Valley, Ga. Bonds for construction purposes are now on the market. Contracts have not been let as yet. D. G. Edwards, Plainfield, N. J., is chief engineer. L. Johnson, 31 Marys, Ga., is president and general manager.

Davis & Hughes Bros., who have the contract for grading the first seven miles of the Green County R. R., which will run from Apalachee to Monroe, Ga., have started work. The contract calls for seven miles of grading from Bostwick to Goodhope, in Walton County, Georgia, and for the completion of this grading in 60 days. While this seven miles is let for actual building now, it is the purpose of the company to extend the line at both ends. The terminus will be at Good Hope temporarily, but the road is to be pushed on to Monroe and then to Loganville on the Seaboard Air Line. On the other end the road will be extended from Apalachee on the Central of Georgia, southward to Greensboro and Sparta. At Monroe the road will tap the Georgia R. R. and the Gainesville Midland, at Apalachee it will tap the Central road and at Greensboro it taps the Georgia R. R. At Sparta it taps the Macon and Camak branch of the Georgia R. R. The territory through which this road will go is rich farming section. W. D. Branon, Bostwick, Ga., is Vice President and General Manager of the railroad.

Illinois.

The Central Illinois Ry. Co., the incorporation of which was mentioned in our last issue, proposes to construct a railroad from Hawthorne at the outskirts of Chicago. The line will run directly to Plainfield, touching Plattsville, Wedron, Dimmick and Princeton, and will then run across the state to Muscatine.

Engineers of the Elgin, Joliet & Eastern Ry. have completed surveys for the proposed improvements at Rossville, Ill., including the construction of a new round house to accommodate 18 engines. A. Montzheimer, Joliet, Ill., is Chief Engineer of the E. J. & E.

The Milwaukee, Peoria & St. Louis R. R. Co. has increased the capital stock from $5,000 to $2,500,000.

Indiana.

⊙The H. E. Culbertson Co., Citizens' Bldg., Cleveland, O., has the contract for double tracking the Pennsylvania R. R. between Dublin and Dunreith, a distance of 12 miles. In connection with this the Culbertson Co. has about 50,000 cu. yds. of team work which it would be glad to sub-let.

The Evansville Rys. Co. has secured the capital for its projected 10-mile line from Evansville, Ind., to Henderson, Ky. The new line will be made by electrifying the Illinois Cen-

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tral tracks between the above cities. The Evansville Rys. Co. will do this work with its own forces. W. A. Carson, Evansville, Ind., is General Manager.

The Louisville & Southern Indian Traction Co., J. Insull, General Manager, New Albany, Ind., is considering extending its interurban line from Jeffersonville to the Walnut Ridge cemetery near that place.

Iowa.

✣The Farley & Iowa Northern R. R. Co. is now asking bids for the moving of 210,000 cu. yds. of earth on its first section of 12 miles between Farley and Luxemburg, Ia. Profiles, etc., are with S. G. Durant, Dyersville, Ia. This new line is planned to extend from Farley on the south from a connection with the Illinois Central and Great Western railroads to Waukon on the north, a distance of about 80 miles. Construction estimates on this new line were completed last summer and were based on a survey made several years ago by trunk line interests, who, it is understood, then had plans in view of building to the north from Farley practically over the same route the new road has now concluded to build over. The new road will tap a section of country rich in agricultural possibilities and will serve districts now without adequate transportation facilities.

The Cedar Rapids & Iowa City Railway & Light Co., Wm. G. Dows, President, Cedar Rapids, has surveys underway for its proposed interurban line between Cedar Rapids and Mt. Vernon.

The Iowa Short Line Railroad Co. has been incorporated at Wilmington, Dela., with a capital stock of $5,000,000, planning the construction of a railroad in the state of Iowa. The incorporators are S. E. Robertson, M. L. Rogers and H. W. Davis, Wilmington, Del.

Kansas.

The Kansas City & Fort Scott Electric Ry. Co. has surveys underway in Linn County near Pleasanton, and has already completed surveys through Wyandotte, Johnson and Miami counties. This company proposes to build an electric line from the end of the Metropolitan's Rosedale line in a straight line south to Fort Scott. The right of way is being donated by farmers through whose land it runs and the farmers are to capitalize the road. It is expected the line will connect at Fort Scott with the Joplin-Pittsburg electric railway, which now extends to Mulberry, 17 miles from Fort Scott. A connection between the two lines would afford through trolley connection with the mining district of Kansas and Missouri. The officers of the company are as follows: W. T. Quarles, Stanley, Kan., president; J. Frank Smith, postmaster of Pleasanton, Kan., vice president; W. E. Brooks, mayor of Fort Scott, secretary; John C. Forester, secretary Fort Scott Industrial Association, assistant secretary; J. H. Schrader, Stanley, Kan., treasurer.

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Minnesota.

•[illegible] & [illegible], Cloquet, Minn., [illegible] on their contract for constructing two miles of track from the Hawkins Junction for the Great Northern Ry.

The Scandinavian R. R. Co., projecting a 21-mile line from Rushton on the Great Northern R. R. to Lake Sheteh, is understood to be planning to have construction work started in the spring. Surveys for this line have been completed as was noted in our Nov. 29 issue. John Bond, Marshall, Minn., is President.

Some idea of the plans of Minneapolis & St. Louis Ry. for its extension work is given in a circular recently issued by Newman Erb, President of the road. An outline of these plans, according to the circular, is as follows: The western terminus of the road, at Le Beau, S. D., on the Missouri River, has no western connection. On the south the Iowa Central at Albia connects with the Wabash R. R., which, while interchanging traffic on friendly terms, has other connections to serve as well. Under these conditions the properties were dependent almost solely upon the development and prosperity of the immediate territory served, and were highly competitive and without proper advantage of their 1,560 miles as a connecting link to territory beyond their own termini. Notwithstanding these adverse conditions, the gross earnings have been steadily increasing, exception being limited to two unusual crop failures recently. The extension to the International Canadian boundary now contemplated will enable the company to add to its tonnage the business to and from the Canadian Northwest. A connection is contemplated with the Missouri, Kansas & Texas at or near Moberly, Mo., which will make a north and south line from Canada to the Gulf, adding still more tonnage movement without any corresponding increase in the overhead or terminal charges. The extension to the Canadian border will take about eighteen months to build. The connection with the Katy will be, it is intended, provided through trackage contracts. Arrangements are also under consideration for making the Peoria line, by a very modest amount of new construction and by connections at Peoria, an east and west line to Omaha.

It is reported that the Backus-Brooks Co., Andrus Bldg., Minneapolis, Minn., has under consideration the building of a new railroad from International Falls to Thief River Falls, a distance of 160 miles. It is intimated that concern's railroad interests are being bonded for $3,000,000 with this project in view, and that preliminary surveys have been already made, with the object of beginning work at as early a date as possible. The line would be an extension of the Minnesota, Dakota & Western, which now skirts the Rainy River for 22 miles to Loman and is operated as a logging road by the International Lumber Co., a Backus-Brooks subsidiary. From Loman it would pass through Koochiching, Beltrami, Marshall and Red Lake counties, to Thief River Falls, practically making a cross railway for the northern portion of this state. It would open up for development an entirely new heavily timbered country, with a territory varying from 20 to 50 miles on either side at present unserved by any road. At Thief River Falls it would connect with the Great Northern and the Soo line, thus affording another outlet for the Backus-Brooks paper and lumber products.

Mississippi.

The Mobile & Ohio R. R. has purchased 15 acres of land in the Armour addition of Meridian and will install switching tracks and shops facilities to cost $250,000. B. A. Wood, Mobile, Ala., is Chief Engineer.

In answer to an inquiry of the City Council of Biloxi, President B. F. Winchell of the Frisco has stated that the company was not contemplating extending the line to Biloxi or Bay St. Louis at present.

Missouri.

[illegible] the cost of repairing a slide and building berms at bridges 453 and 450, Missouri division, and at bridge No. 482, Missouri division, the Santa Fe system has appropriated $[illegible].

The Kansas City Terminal Ry. Co., J. V. Hanna, Chief Engineer, Kansas City, Mo., is reported to have awarded the contract for retaining walls along the Belt Line tracks from Grand Ave. east to 18th St., and for concrete abutments for thirteen viaducts between these two points. The contract amounts to about $500,000.

As mentioned in our last issue, the Missouri, Arkansas & Gulf Ry. has executed a mortgage to the St. Louis Union Trust Co. to secure an issue of $1,600,000 of 5 per cent gold bonds to provide funds for the completion of the Ozark Short Line from Rolla to Bakersfield, Mo. Work has begun on the first eight miles of the line, which will traverse Phelps, Dent, Texas, Howell and Ozark counties. The line will pass through one of the richest farming sections of the Ozark country, not heretofore touched by railroad, and when completed will be 125 miles long. The section is now reached by stage coach

Kansas City, Mo., and Vicinity.

(SPECIAL CORRESPONDENCE.)

⦿J. B. Dorris was awarded about 150,000 yds. of team work by the Kansas City Southern Ry. Co. in Oklahoma. Mr. Dorris will do the work with his own forces entirely and expects to start on his contract as soon as the weather will permit. The work lies near Ballard, Okla., and is adapted to graders.

Wyandotte county will spend more than $10,000 for macadamizing roads in the county this year; $9,000 of this amount will be spent in preparing the Leavenworth road bed so the Leavenworth-Kansas City (Kas.) road can be finished by the convicts. The commissioners will grade the road and furnish the stone with which it will be macadamized. The work will start as soon as the weather permits. The commissioners will also spend $27,000 on the Muncie-Bonner Springs road. That amount will cover the cost of macadamizing the road between Muncie and Edwardsville, three and one-half miles. Contracts for this work also will be awarded soon. What other money is spent will be for the macadamizing of the Reidy road. The commissioners intend to start macadamizing the road at Indian Springs, a mile west of the city limits, and continue the work as far as the money will last. They intend eventually to macadamize the road to the end. Samuel Clark, county commissioner, said the commissioners are expecting more road work to be done this year than ever before, because of the Hodges law. The cost of the Moore road, the only road Wyandotte county has finished under that law, proved to be so reasonable to the farmers who paid for it, Mr. Clark said, that many owning farms adjacent to the intersecting roads are expected to apply for new roads this year.

Three possible extensions of the Atchison, Topeka & Santa Fe railway are being discussed in railroad circles here, and while there is no official confirmation of the proposed plans, railroad men assert that within the next two years the Santa Fe will be at work on extensive building of new lines. The three proposed extensions are: Building through Arkansas and to New Orleans from Joplin, Mo.; extending the Superior branch from Superior, Neb., to Grand Island, Neb., and possibly into the Dakotas; extending the Barnard branch from Barnard to Osborne and possibly farther west. It is known among railroad men that the Missouri, Kansas & Texas is planning to extend its branch from Junction City northward to the Dakota wheat fields. It was asserted at the time the Missouri, Kansas & Texas asked permission last summer to issue 100 million dollars in bonds that the building of that line would be one of the uses for part of the money. The Atchison, Topeka & Santa Fe has had a longing for an entry into New Orleans and reports of purchases of short lines have been made at various times. It is asserted that the Santa Fe now has controlling interests in several short lines in the Mississippi valley and that practically half of the line from Joplin to New Orleans is constructed and operated as separate railroads. It is also asserted that the Santa Fe owns these lines and will build the connecting links.

A renewed agitation in Kansas City, Kas., for an electric line between Kansas City, Kas., and Bonner Springs, Kas., has resulted in the undertaking of plans for building the line next year by business men of those two cities. The men have been working quietly the past two months sounding the sentiment regarding the line. One of the representatives said enough encouragement had been received to make the building of the line a certainty.

Ransom & Cook are busy these days preparing to start work on their contract in western Kansas. They have about 60 miles of new line to build for the Santa Fe Railway Co. Work will start the first minute that the weather will permit. This is for the most part admirably suited for Fresno and Wheeler outfits. Contractors desiring that class of work would do well to get in touch with Ransom & Cook at Ottawa, Kas. This would be particularly good for contractors having outfits idle in western Kansas or adjacent to that section.

Wm. List is on a trip to the west coast to look over several propositions in that part of the country.

We regret to report that W. P. Wood of the firm of Wood, Bancroft & Doty is reported as seriously ill at his home in Omaha, Neb. Pneumonia is the trouble. We trust sincerely to be able to report Mr. Wood's complete recovery by the next issue.

Sten Lund reports that work has started nicely on the stripping proposition which is being done by the Sternberg-Lund Construction Co., near Pittsburg, Kas. This company has a very large revolving shovel with which to do the work. The work is all casting and the average depth of the coal vein is about 20 ft. below the surface. A 65 ft. boom is used on the shovel, which enables the company to handle the material to good advantage

St. Louis Items.

BY A. E. KOENIG

⦿The Meyers Construction Co. and Frank L. Aymond of St. Louis secured the contract from the Kinser Construction Co. for driving 416,000 lin. ft. of piling on the new levee across the river here. They will begin work about March 1 if the ice and river permits. The Griffin Lumber Co. of St. Louis will furnish the piling.

⦿The Board of Local Improvements of East St. Louis have let contracts for the improvement of the sidewalks on Broadway from Fifth to Tenth streets. Granitoid walks will be laid. The contract went to the Murphy Construction Co., for $15,596.75. The board ordered City Engineer Harper to prepare plans and specifications for the improvement of Fifth St., from Ohio to Collinsville Ave., and Sixth St., from Summit to Pennsylvania Aves., and over to Collinsville Ave.

The following changes are announced by the management on the Frisco System, effective Feb. 1: W. B. Drake, vice-president and general superintendent of the Frisco lines in Texas, and is succeeded by J. S. Pyeatt, superintendent of the River and Cape Divisions of the Frisco. Mr. Pyeatt is succeeded by O. H. McCarty, superintendent of the Southwestern Division by W. G. Koch, assistant superintendent of the Eastern Division. Mr. W. B. Drake has been with the Frisco for a considerable period and he resigns to enter the contracting business. Mr. Pyeatt, who succeeds Mr. Drake, entered the service of the Frisco, May, 1911, and was formerly with the Pere Marquette. Prior to that time he was with the Missouri Pacific during the Harding administration at St. Louis headquarters.

The Illinois Traction system will build different new roads in the near future as follows: The east and west route as finally determined upon, begins at East St. Louis and runs east through Collinsville, Troy, St. Jacobs, Highland, Beaver Creek, Patoka, Kinmundy, Oskaloosa, Louisville, Sailor Springs, Newton an [illegible] Haute, Ind. Readers who are familiar with the railroads in Central Illinois will doubtless observe that this route splits the territory between the Vandalia on the north and the Baltimore and Ohio Southwestern on the south It does not parallel existing steam roads like many electric roads do. The north and south line, as agreed upon, runs south from Springfield, through Pawnee, Raymond, Butler, Hillsboro, Donnellson, Greenville, Beaver Creek, where it crosses the east and west line; Carlyle, Posey, Nashville, Pinckneyville, Duquoin, Bush, Herrin, Marion, Harrisburg, Ridgeway and Mount Vernon, to Evansville, Ind. The entire system is divided as follows: From East St. Louis to the crossing of the two lines near Beaver Creek is called the St. Louis Division, and is 50 miles long. The crossing is called the St. Louis junction. From St. Louis Junction to Springfield is called the Springfield Division, and is 80 miles long. From St. Louis Junction to Terre Haute the division is 140 miles long. From St. Louis Junction to Evansville is called the Evansville Division, and is 160 miles long. The line from Herrin, through Carterville and Carbondale to Murphysboro, is called the Murphysboro Division and is 20 miles long. An extension of this division to the Mississippi River is in contemplation. The St. Louis Division will have a double track, so that trains from any other division running either way can meet and pass without side-tracking. The road is to be built in accordance with the best railway practice today. It will have 85-pound rails, standard ties, reenforced concrete culverts, steel trestles and bridges, the best possible equipment, commodious stations and terminals and will give hourly service on its local trains throughout this locality. It is intended to develop the coal and other freight traffic and with this end in view the entire system will be equipped in the best manner possible.

Montana.

Nels Roman, Belt, Mont., who has a subcontract on the Great Northern's Lewiston-Great Falls line, has shipped lumber and other supplies to the camp site, 7 miles down Spring Creek. The equipment will be shipped later. The job includes considerable heavy rock work and will require a force of about 50 men.

The Gilmore & Pittsburg R. R. has had surveyors at work cross-sectioning a survey of the road from Grant to Twin Bridges and it looks very much as if they were trying to get ready to begin construction work as soon as spring opens. This survey just being completed is a new one that will give a more direct route from Horse Prairie to Twin Bridges than a previous route via Dillon. If the road is built over this latter route it will miss Dillon about 10 miles. The route of the new survey branches off at Grant, going via Bannack, crosses the divide near George Gray's ranch, in the Grasshopper valley, passed close to Argenta, through the Fryingpan basin and hits the Beaverhead valley proper just below the Point of Rocks. T. H. Bacon, Armstead, Mont., is Chief Engineer.

Nebraska.

The sale of the Chicago, Rock Island & Pacific Ry. Co., of $20,000,000 of bonds, is of particular interest to Omaha, as announcement has been made that part of the proceeds will be used to build additions to the terminal properties in this city. Part of the money will also be used for the new terminals and bridge across the Mississippi River at Memphis, Tenn., mentioned elsewhere in this issue.

Arrangements have been completed with David Richie, Salina, Kan., attorney of the Winnipeg, Salina & Gulf R. R., whereby the citizens of Deshler, Nebr., will subscribe $20, [illegible]

[illegible] north and south [illegible] that place.

New Jersey.

[illegible] ate to allow the Pennsylvania R. R. Co. to [illegible] measure was presented last year, but it failed in passage. The company plans to facilitate its passenger and freight traffic, and if the legislative consent is secured, to acquire a right of way 150 ft. wide instead of 100 ft.

Among the reports in New Jersey railroad circles is one to the effect that the Lehigh & New England R. R. will construct an 18- [illegible] wood, N. J., giving it access to the New England states over its new line. F. W. Gilcreast, [illegible] company.

Engineers of the Philadelphia & Reading, according to reports, are making preliminary surveys in connection with tentative plans for the construction of the Atlantic City R. R through Ventnor and Margate to Longport, N. J., giving the Reading direct service to the lower end of Absecon Island.

New Mexico.

The Santa Fe system has appropriated $179,000 to cover cost of widening cuts and fills, doing ballasting and laying 65 lb. rail between Baca and Perea on the Aubuquerque division.

New York.

Engineers from the office of County Supervisor of Highways, Frank E. Borgardus, Syracuse, have started preliminary surveys for the proposed switch from the Delaware, Lackawanna & Western R. R. tracks to the Penitentiary stone quarries at Jamesville. C. E. Wickham, Buffalo, N. Y., Division Engineer of the Lackawanna, will be in charge of the work for the railroad.

The Public Service Commission, 2nd District, will hold a hearing on Feb. 1 at the Court House, Syracuse, on the application of the Syracuse, Binghamton & New York R. R. Co. to abolish the three grade crossings just south of Jamesville. The tracks are operated by the Lackawanna. The highway, which is to be improved under the county system, crosses the railroad at three points, and it is proposed to change the route of the road to cut out two of the crossings by keeping on the west side of the tracks. The third, which is furthest south, will be eliminated by an overhead passage. To do this the highway will cross at a new point where there is now a small cut, which will make unnecessary a sharp grade at the approaches.

The New Central & Hudson River R. R. may possibly begin work this year on making its line 4-track to Poughkeepsie. This work would require a considerable amount of excavation from the mountains facing the track and would also require some little filling along the Hudson.

The Board of Trade of Ilion, N. Y., has taken up the matter of securing the construction of an electric built line to that city. As proposed the line will be about four miles long and will cost about $50,000. John Harrison is Secretary of the Board of Trade.

North Carolina.

⊙The Propst Contracting Co., Charlotte, N. C., has been awarded the contract by the Seaboard Air Line Ry. to grade the tracks for the Interstate Chemical Co. Three tracks will be laid to the plant of the company. Work will be started at once and will be completed by March 15.

North Dakota.

Ordinance has been introduced before the City Commission of Minot, N. Dak., to grant a 20-year street railway franchise to Joseph Roach, President of the Second National Bank, James Johnson, Erik Ramstad, A. J. Brunner and L. J. Palda. The ordinance provides that three miles of the system shall be in operation within three years, and the bal- [illegible]

Information has been received at Jamestown, N. Dak., that $6,000,000 is available for the construction of the Midland Continental Ry., of which H. L. Duncombe, Jamestown, N. Dak., is Assistant Manager. The money was raised in Paris by officials of the road and active operations in completing the line will be commenced in the early part of April. The amount raised will be used on the road from Jamestown to Winnipeg, and eventually the line will be extended to the Gulf of Mexico. The proposed line running through North Dakota taps some of the richest country in the state and will be of inestimable value to certain sections of the country which at the present time are inaccessible to a rail- [illegible]

Ohio.

The Pennsylvania R. R. has submitted its plans to the City Council of Piqua, O., for the elevation of its tracks through that city. It is intended that the work will cost about $1,500,000, and the company is said to be ready to begin construction as soon as the city has approved the plans.

The Lake Erie & Ohio River R. R. is to be the name of the railroad being organized at Wellston as mentioned in our last issue. This company proposes to build a steam railroad from Sandusky to the Ohio River by way of Lancaster, Allensville, Hamden and Wellston to the Ohio River. The same parties also propose to erect large cement plants and open coal mines. The parties behind the new companies are said to have options on large quantities of land in Jackson, Vinton, Scioto and Lawrence counties comprising over 100,000 acres. E. B. Bingham, J. M. Partridge and W. B. Cherrington, Wellston, O., are interested.

A resolution has been presented to the city council of Dayton, O., providing that the City Engineer, Gaylord Cummin, prepare plans and specifications for the construction of a belt line around that city It developed at a recent meeting of the council that there was an almost unanimous sentiment favorable to the improvement.

All work on the Youngstown & Northern R. R., a short line between the Ohio Works and the McDonald Mills, has been completed and is ready for operation.

The Cleveland- Barberton Ry. Co., Joseph Breitinger, promoter, Schofield Bldg., Cleveland, O., is reported to be planning to begin grading work as soon as weather conditions will permit. The company is said to have secured the entire right of way for its projected 170 mile line. The first section to be built will extend from Cleveland to Orrville, 52 miles.

Oklahoma.

⊙The Fidelity Construction Co., 618 Bryant Bldg., St. Louis, Mo., of which J. W. Hoffman is president, is reported to have been awarded the contract for constructing the new lines of the Missouri, Oklahoma & Gulf Ry. in Oklahoma and Texas.

The Sand Springs Interurban R. R. Co., of Tulsa, has begun work on the extension of its interurban line through the heart of the city to complete a belt line which will touch every railroad entering Tulsa.

Citizens of Alva have voted to donate $150,000 to aid the project of the St. Louis, Oklahoma & Pacific R. R., to build a new line from Alva to Des Moines, N. Mex., through the Panhandle and by way of Buffalo and Hooker. It is stated a French banking firm of Paris will provide the larger part of the capital required to put through the proposition, which will run into several millions. The headquarters and the shops of the company will be located at Alva.

The Wichita Falls & Northwestern R. R. has been completed to Fort Supply, Okla., and sidings are being installed. As soon as the small bridge at that place is completed the road will be pushed on to May, 15 miles further up the North Canadian, where construc-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

tion work will stop for the winter. May is [illegible] The W[illegible] the Kansas line, Liberal being the objective point, it is said. The road will ultimately be built into Denver. It now operates north from Wichita Falls, Texas, to Woodward, Okla., with branches from Altus, Okla., to Wellington, [illegible] miles.

Oregon.

A [illegible] sideration by J. J. Hill to construct an independent passenger depot and terminal for the Great Northern and North Bank system and allied lines in Portland, Ore. The improvement involves the bringing of all passenger trains both steam and electric into the terminal at grade.

Pennsylvania.

It is likely that the Pennsylvania R. R. will let contracts this spring for the double tracking of its line from Sunbury, Pa., to Honeyport yard. Engineers for the company, since the completion of the Northumberland yards, have been engaged on work along the division from Sunbury to Wilkes-Barre, Pa., looking to the double tracking of the division this summer. Deep and long cuts into the hill sides and filling in along the river will be necessary for the new track. All the culverts and bridges built on the division during the past eight years have been made wide enough to accommodate the extra track.

The Pennsylvania & Maryland Street Ry. Co., Elk Lick, Pa., is understood to have reached a decision regarding the extension of its trolley line from Garrett, the present terminus, to Johnstown. Two routes for the extension have been under consideration. One of these would take the line from Garrett to Berlin, to Somerset and via the Stonycreek valley to the lines of the Johnstown Traction Co. at Paint Creek. Another route after leaving Somerset would take the line to Boswell and then down the Benscreek, where a junction with the lines of the Johnstown Traction Co. system would be effected.

The Pennsylvania R. R., Alex C. Shand, Chief Engineer, Philadelphia, Pa., is having plans prepared for a concrete pier, 150 by 600 ft., which will be erected at Christian St. wharf, Delaware River, Philadelphia.

The Delaware, Lackawanna & Western R. R., G. J. Ray, Chief Engineer, Hoboken, N. J., will let contracts about March 1, for the grading work for a new route from Clarkes Summit to Hallstead, Pa., a distance of about 35 miles. The work will include several concrete bridges.

Tennessee.

A committee of the Commercial Club of Centreville, Tenn., has begun a campaign to secure the necessary right of way in Hickman and Perry counties for the extension of the Middle Tennessee R. R., John White, Chief Engineer, Williamsport, Tenn., from Leatherwood to Perryville. It is stated that the committee has received assurance from eastern capitalists that as soon as rights of way had been secured they would take hold of the proposed enterprise and put it through.

Organization of the Arkansas and Memphis Railway Bridge & Terminal Co., formed to construct the proposed Rock Island bridge and terminals at Memphis, was effected last week at a meeting in the offices of Wright & Wright, attorneys, in the Memphis Trust Bldg. A board of five directors was elected, as follows: J. T. Harahan, E. E. Wright, J. A. Riechman, B. L. Mallory and C. H. Raine. The newly elected directors met immediately and chose the following officers: J. T. Harahan, president; George H. Crosby, secretary and treasurer; E. E. Wright, vice president, and W. H. Borsie, assistant secretary and treasurer. Mr. Harahan, the president, formerly was president of the Illinois Central railroad, and maintains residence here and at Chicago. Mr. Crosby, the secretary and treasurer, is also the secretary-treasurer of the Rock Island board, and lives in Chicago. The other directors are Memphis men. The directors adopted constitution and by-laws, and formally accepted the charter issued by the state of Tennessee. The company is incorporated at $1,000,000, but the improvements will far exceed this sum.

The Southern R. R. is understood to be making good progress with its plans for building a double track from Bulls Gap to a point about half way between Russellville and Morristown, and a branch line from there to the Asheville line near Roe Junction.

Texas.

✣Bids will be received until noon, Feb. 5, by E. B. Cushing, Chief Engineer Construction, Houston, Tex., for the construction of the roadbed of Stone City-Giddings branch from the East Yegua River to the town of Caldwell, Tex., a distance of about 10 miles. The work will require the removal of about 275,000 cu. yds. of material.

⦿Sam Robertson, San Benito, Tex., has been awarded a contract by Theodore F. Koch, Houston, Tex., for building the railroad from Rivera to Rivera Beach, mentioned in our Jan. 10 issue. The line will be nine miles long, and 300 tons of steel rails for it have already been purchased.

Surveys for the Fort Worth-Cleburne interurban line were completed to Cleburne on Jan. 15.

The Panhandle, Pecos River & Gulf R. R. projecting a 350-mile line from Farwell, Tex., to Pecos, Tex., and from Texico, N. Mex., to the Colorado coal fields, has completed surveys for the first 150 miles and has secured about 70 per cent of the construction capital. The construction work is now open for bids. M. J. Healy, Texico, N. Mex., is President.

Northern capitalists have made a proposition to the cities of Brenham and LaGrange looking to the construction of an interurban line between the two places.

According to the terms of an agreement signed recently with the City Council of San Angelo, the San Angelo Street Ry. Co., J. D. Suggs, Vice President, San Angelo, will build two miles of additional lines in the city.

The St. Louis Southwestern Ry., C. D. Purdon, Chief Engineer, Tyler, Tex., has negotiations underway for securing additional land at Hamilton on which to erect a new depot and for additional tracks. It is expected that about $100,000 will be expended.

The Gulf, Texas & Western Ry. Co., B. B. Cain, General Manager, Dallas, has laid a proposition before the citizens of Mineral Wells for the construction of about 20 miles of road from Jacksboro to a connection with the Weatherford, Mineral Wells and Northwestern, at or near Oran.

The Quanah, Acme & Pacific Ry. has completed surveys for its projected 50 mile extension from Paducah, Tex., to Plains. The date for letting construction contracts, however, is indefinite. Sam Lazarus, St. Louis, Mo., is president, and C. E. Ensminger, Quanah, Tex., is chief engineer.

The following minor improvements are contemplated by the Santa Fe: Construction of spur tracks on Fourth St. at Fort Worth, cost $4,000, covered by appropriation; construction of raised concrete platform and brick storage house at Galveston, to cost $21,000, cost covered by appropriation; construction of train supply houses at Temple and Brownwood; construction of transfer track at McGregor; increase of drainage facilities at Somerville, estimated cost $3,200; construction of spur track and cotton platform at Pettibone.

Virginia.

The Virginia Railway & Power Co., T. Norman Jones, Jr., Engineer, Richmond, Va., is considering the extension of its Moran Ave. line at Norfolk to serve the Greater Ghent section of that city.

Washington.

Bids were opened Jan. 10 by the Board of Public Works of Seattle for constructing Division A of the municipal electric car line, the work including about 7½ miles of track, the bids received being as follows: Jahn Construction Co., Seatle, $148,927; Graff Construction Co., Seattle, $172,488; Stillwell Bros., Seattle, $211,800. A. R. Dimmock is City Engineer.

It is rumored at Wallace, Idaho, that the Chicago, Milwaukee & Puget Sound R. R. is preparing to enter the Coeur d'Alenes and to build an extension to Spokane, Wash., and that surveyors are already locating a route. According to the rumor, this transcontinental road has taken an option on the right of way and concessions of the Waliace-Spokane & Interstate Company, a corporation consisting largely of Wallace stockholders, which holds franchises over practically all the distance between there and Coeur de'Alene city, by way of Fourth of July Canyon.

Amended articles of incorporation have been filed with W. H. McKenna, County Recorder, Clinton, Ia., by the Wenatchee Valley & Northern Ry., increasing the capital stock to $400,000. The company's property is located in the state of Washington. L. Lamb and C. B. Mills, Clinton, Ia., are interested.

A contract has been signed by Assistant Attorney General S. H. Kelleran, Olympia, Wash., and the Great Northern whereby the latter is to have the use of State Road No. 10, from Wenatchee to Pateros, on condition that the railroad build the state a new and better road in its place. The contract binds the railroad to provide sufficient turnouts, screens and guard rails to protect the traveling public.

West Virginia.

According to information received from Cincinnati, O., the Rupert & Northeastern R. R. Co., recently incorporated in West Virginia, will be a connection of the Baltimore & Ohio. The road, which will be about 30 miles long, will extend from Rupert, Greenbrier County, to a point near Fenwick, W. Va., in Nicholas County. It will cross the highlands between the headwaters of Big Clear and Laurel Creeks, and will traverse a rough country.

Wisconsin.

Advices from Madison, Wis., state that the Fairchild & Northeastern Ry. Co. has increased its capital stock from $50,000 to $100,000 to provide funds for purchasing a line from Fairchild, Wis., to Owens and Greenwood and for extending its own line from Fairchild to Eau Claire and Dunn counties, a distance of about 30 miles. W. Foster, Fairchild, Wis., is General Manager of the company.

Canada.

The Alberta, Peace River & Eastern Ry. Co. will apply to parliament for an extension of time for construction. A similar application will be made by the Rainy River Radial Co.

Announcement has been made that the Canadian Pacific Ry. would expend at least $20,000,000 this season in improving its system west of the Great Lakes. The work will include much double tracking in the congested districts. A second track will be laid along the route between Regina and Chaplin, Sask.; between Hammond, B. C., and Vancouver, and between Alyth and Senalta, Alta. Considerable extension to the terminal facilities at Vancouver, Calgary, Swift Current, Moose Jaw, Outlook, Regina, Broadview, Brandon and Fort William, will be made. A new terminal will also be built this summer at Coquitlam, B. C. Improvements are also contemplated at Winnipeg and two alternative surveys are underway, one looking to a cutoff from Reaburn, while a new terminal may be built so that freight trains would not have to pass through the city as at present. At Fort William a coal handling plant, new freight sheds, steel docks and increased elevator capacity, will be provided. A large number of branch lines will also be built. A line from Viceroy to Weyburn will be built, while 85 miles will be added to the line northwest from Swift Current. Construction will also be started from a point [illegible] of Medicine Hat in a [illegible] Four hundred and seven[illegible] will be replaced by 80-lb. rails.

The construction pr[illegible] Trunk Pacific Ry. [illegible] to call for the expendi[illegible] 000. This will be spent [illegible] miles of branch lin[illegible] line from Winnipeg to the Rocky Mountains and touching such centers [illegible] gina, Moose Jaw and [illegible] cludes completing the main line toward Prince Rupert, leaving only [illegible] 1913, and the building of a $750,000 hotel at Regina. Branch lines will be built to Prince Albert and to [illegible] States boundary.

Moore & Pethick [illegible] Victoria, B. C., will sublet to subcontractors or station men a considerable part of the work on their contract on the Canadian Northern Pacific Ry. near Duncan, Vancouver Island. This contract was let a short time ago, as noted in these columns. It covers [illegible] comprising clearing, grubbing, close cutting, grading, culverts and trestles.

The Canadian Pacific R. R., according to reports, at the present time, has the following program of construction and improvement actively under way: Relaying the 160 miles of old Manitoba & Northwestern division with standard 80-lb. rail; double-tracking between Port Arthur and Fort William; construction of three new steel bridges east and west of Calgary; double-tracking the Portage la Prairie-Brandon division [illegible]

[illegible] according to [illegible]

[illegible] incorporate the Glengarry & Stormont Ry. [illegible] westerly through the Townships of Charlottenburgh and Cornwall to the town of Corn[illegible] tensions along the route and to connect with the C. P. R., G. T. R. and O. & N. Y. Ry. and other railways that may be built. The C[illegible] branch line to Cornwall under consideration for some time and the fact that private parties are after a charter may arouse now the C. P. R. to the importance of prompt action.

A party of English and Canadian capitalists presented a petition at the recent meeting of the Legislature, Quebec, requesting permission to construct the proposed Ot[illegible] tawa, near Hull, northwards through Wright County and Pontiac County to a point near [illegible] and northwest to a point near James Bay. The petitioners were Abraham Mordecai Ledeco, financial agent, London, England; [illegible] O'Reilly, broker, Ottawa.

Mexico.

[illegible] the first six months of the present fiscal year, indicates a gross income of $32,427,328, Mexi[illegible] $14,111,937. After all fixed charges are paid [illegible] interest, the surplus is $5,393,601. The showing for the six months is considered very sat[illegible] Mexico are rapidly assuming an entirely nor[illegible] crease in business generally.

The Southern Pacific Ry. of Mexico, after two years of construction, has completed its main line tracks into the city of Tepic, Mex., and a general celebration in honor of the event was held on Jan. 20. Regular train service will be established Feb. 5.

Col. Epes Randolph, Tucson, Ariz., President of the Southern Pacific Ry. Co.'s lines in Mexico, is quoted as making the following statement: "The West Coast R. R. will be [illegible] construction will then be pressed to Guadalajara, where connection will be made with the Mexican Central, giving the Harriman system a virtual steel circle of the North American continent. On the east coast this company has bought the Mexican National.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received until 2 p. m., Feb. 7, by Board of Clark County Commissioners, Grove Hill, Ala., for grading, draining and resurfacing with sand clay approximately 6 miles of state aid road. W. S. Keller, Montgomery, Ala., is State Highway Engineer.

⊙The McCartin Contracting Co. has been awarded the contract by the City Commission of Birmingham, Ala., for the paving of 30th St., from Highland to Highland Ave., with bitulithic at $1.25 per sq. yd.

⊙The Marion County Board of Commissioners, Hamilton, Ala., has let the contract for the construction of a pike road from Hamilton to Guin for the sum of $17,350, to A. F. Bearden of Birmingham. Work will begin within 20 days.

An election will be held [illegible] County, Ala., on Feb. 6 for the purpose of voting on the proposition to issue bonds in the sum of $100,000 for building and maintaining good roads. Greensboro is the county seat.,

Arkansas.

The directors and members [illegible] District No. 6, city of Helena, Ark., recently held a meeting for the purpose of taking up matters pertaining to the paving of 25 or 30 blocks along Arkansas and Biscoe Sts.

California.

⊙The City council of Riverside, Cal., has awarded the contract for constructing a fill across Terquesquite Arroyo, 100 ft., in width at the top, and approximately 1,000 ft. in length, requiring approximately 142,000 cu. yds. of material, to the Star Cement Co., 566 Sixth St., Riverside, for $.177 per cu. yd. Bids were opened Jan. 9.

The San Diego County Highway Commission has recommended to the Board of Supervisors of that county that the right of way of the Escondido and Riverside highway be located as follows: Beginning at the west boundary line of Escondido, thence west through Richland and San Marcos; thence northeast through Bonsall and Fallbrook; thence northeast through Red Mountain and Rainbow to the Riverside county line. The Board of Supervisors was asked to secure the right of way where it is not already available by instituting suits of condemnation.

The City Council of Fresno, Cal., has adopted specifications for the resurfacing with bitulithic pavement of Tulare between I and J; I between Tulare and Mariposa; J between Fresno and Tulare, and Mariposa between H and J and where there are car tracks within 2 ft. from them.

Connecticut.

At a town meeting held in Southbury, Conn., on Jan. 16 it was voted to rescind a previous action not to ask for a loan of $20,000 for the building of highways under the new law. Good roads building will be started early in the spring.

Florida.

✣Bids will be received until 2 p. m., Feb. 7, by city of Daytona, Fla., for the improvement of road in St. Lucie County, Fla. C. M. Rogers is City Engineer.

✣Bids will be received until Feb. 17 by Board of Walton County Commissioners, De Funiak Springs, Fla., for the construction of approximately 60 miles of public highway of sand and clay. Bids received Jan. 15 for the work were rejected and plans and specifications will be amended. Charles Gordon is Clerk.

⊙Mattair & Young of Jacksonville, Fla., have been awarded the contract by the Board of Duval County Commissioners, Jacksonville, for the paving of the road from Atlantic Blvd. to the city limits of Mayport with Interlachen gravel. The contract price is $.99½ per sq. yd.

Georgia.

The citizens of Quitman, Ga., on Jan. 16 voted against the issuance of bonds for the construction of street pavement.

Idaho.

An election is to be held in a section of Ada County, Ida., on Febr. 10 for the purpose of deciding whether or not the Independent Highway District No. 1 is to be organized, as petitioned for recently. Stephen Utter, Clerk, Board of County Commissioners, Boise, Ida.

Illinois.

⊙The Board [illegible] wardsville, Ill., H. P. Hortz, Pres., on Jan. 18 received bids for the construction of a considerable amount of pavement, the contracts being awarded to O. T. Dunlap of that city, with the exception of the last named district, which was awarded G. R. Hyten of Edwardsville at $4,010. Chas. A. Sheppard, City Engineer: Fillmore-Buchanan Paving District, $27,466; Grand-Elm Improvement District, $10,986; Schwarz Paving District, $8,391; Union Connecting Improvement District, $5,939; Park-Benton Paving District, $15,122. The last district, Commercial-College Paving District.

The Board of Public Improvements of Monmouth, Ill., will improve East First Ave., from the east line of South First St. to the west line of South Eighth St.; South Third St., from the south line of the proposed pavement on East First Ave. to the north line of the pavement on East Second Ave., and South Fourth St., South Fifth St., South Sixth St. and South Seventh St., each from the south line of the pavement on East Broadway to the north line of the paving on East Second Ave. The resolution calls for a paving 24 ft. in width. City Engineer Ralph Ferguson has estimated the cost of the improvement as follows: 5,170 cu. yds. excavation (4,300 cu. yds. to be wasted) at $0.28, $1,448; 15,096 sq. yds. 6-in. gravel base at $0.38, $5,736; 15,096 sq. yds. 1-in. sand cushion at $0.08, $1,208; 15,096 sq. yds. paving block pavement with sand filler at $0.94, $14,190; 12,117 lin. ft. concrete curb and gutter at $0.64, $7,755; 252 lin. ft. concrete curb at alleys at $0.38, $134; 524 sq. ft. gutter at alleys at $0.15, $79; 3 manholes at $50, $150; 7 catch basins at $37.50, $263; 10 intakes at $16, $160; court costs, $75; Commissioners' fees, $135; advertising and mailing, $25; Engineer's fees, $100; inspector's fees, $160. Total, $31,617.

The City Commission of Moline, Ill., is considering five ordinances providing for paving

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

improvements, the total cost to be $79,924. The ordinances provide for 28 blocks of asphalt paving and two blocks of brick paving as follows: Asphalt paving 25 ft. wide, on 14th Ave., Ninth to 15th St.; 11th St., 12th to 16th Ave.; 11½ St., 14th to 16th Ave.; 14th St., 14th to 16th Ave., at an estimated cost of $31,634. Fourteen blocks. Asphalt paving on 14th Ave., 16th to 18½ St., and on 18½ St., 12th to 14th Ave. Five blocks at a cost estimated at $17,322. Asphalt improvement for 14th St., between 16th and 23d Aves. Seven blocks at a cost estimated at $20,675. Pavement to be 25 ft. wide. Twenty-five foot asphalt paving on 12th St., 17th to 19th Ave.; estimated cost $7,388. Brick pavement, 18 ft. wide, on 15½ St., between 8th and 10th Aves. Cost estimate, $2,905.

A movement is on foot among some of the farmers of Blount and Middlefork townships, according to advices from Potomac, Ill., for the construction of a paved thoroughfare between Potomac and Danville, the proposed highway to pass through the southeastern part of Middlefork and through all of Blount townships.

The City Council of Rock Island, Ill., has specified brick instead of asphalt for the paving of Fourth Ave., between 16th and 20th Sts.

The Board of Local Improvements of Freeport, Ill., has decided to pave Float, Benton and Delaware Sts. with brick with sandstone curb. The estimated cost is $25,000.

The City Council of Joliet, Ill., has adopted the estimate of the Board of Local Improvements providing for the macadamizing of Glenwood Ave., from Raynor Ave. to Prairie Ave., at an estimated cost of $3,350.

The Board of Public Works of Waukegan, Ill., has adopted a resolution providing for the paving of Ridgeland Ave. with macadam at an estimated cost of $8,670. The Board is also preparing resolutions for the paving of Washington St., Belvidere St. and North Ave.

Indiana.

✣Bids will be received until Feb. 5 by Board of Warren County Commissioners, Williamsport, Ind., for the construction of graved roads in Steuben and Jordan townships. D. H. Moffitt is County Auditor.

⦿Nicoson & Pierce of Alexandria, Ind., have been awarded the contract by the County Commissioners, Portland, Ind., for the construction of the Bortner et al. stone road in Richmond township for $15,250. The Commissioners also awarded the contract for the grading, draining and paving with crushed stone the Schaefer county line road between Jay and Adams Counties to Teeters & Teeters of Portland, for $25,487. Bids were opened Jan. 18.

Petitions are before the City Council of New Castle, Ind., asking for the paving of Grand Ave., West Broad St., South 11th St., and Indiana Ave. Indiana Ave. will be paved from 5th to 17th Sts., West Broad and South 11th to the city limits. Other streets being considered for improvement are Main St., south of Bundy Ave.; Circle St., Church St., Central Ave. and North 16th St.

At a recent special election the citizens of Morgan Township, Porter County, Ind., voted to build 20 miles of gravel road. Valparaiso is the county seat.

Iowa.

⦿The City Council of Council Bluffs, Ia., has awarded the contract for the repaving of South Main St., from First to 16th Ave., to E. A. Wickham & Co. of that city for $2.04 per sq. yd., with asphalt filler at $.19 per sq. yd. extra. The brick for the improvement will be furnished by George D. Ouren Co. of Galesburg, Ill.

The City Council of Davenport, Ia., has passed an ordinance providing for the draining, grading and paving of 14th St. from 9th to 15th St.; 11th St., from 12th to 16th Ave.; 11½ St., from 14th to 16th Ave., and 14th St., from 14th to 16th Ave. City Engineer Lyle Payton has estimated the cost of the work at $31,634. It is probable that bids for the work will be received Feb. 6.

Residents of West Hill, city of Muscatine, Ia., have asked the City Council to extend the city paving on Lucas St. to the city limits. The Council contemplates paving or repaving the following streets during the year: Third St., from Mulberry to Oak St.; 4th St., from Mulberry to Oak; Orange St., from 2d to 10th St.; 4th St., around the reservoir; 8th St., Poplar to Cypress; Cypress St., from 8th to Dale St.; Grandview Ave., from Hershey to the railway tracks; Cedar St., from 8th to Fulliam Ave.; 9th St., from Cedar to Mulberry; Bartlett St., from Cedar to Mulberry; Mulberry Ave., from the present terminal of the paving extension to the site of the new Geneva Golf and Country Club.

The City Council of Sioux City, Ia., has passed resolutions declaring the advisability of laying pavement on Morning Side Ave. It has been estimated that this improvement will cost $60,000.

The City Council of Oskaloosa, Ia., has adopted resolutions of necessity for the paving or the repairing of paving already in on the following streets and avenues: High Ave. and First Ave., between Market St. and F St., or the M. & St. L. Railway, reconstruction; 4th Ave., between 7th St. and D St., new work, 10 blocks; North A St., between High and A. Aves., new work; South A St., between 2d and 4th Aves., new work; 3d Ave., 2 blocks between A St. and 1st St., new work; F Ave., between C and D Sts., new work; Rock Island Ave., between 1st and 2d Sts., reconstruction; South 6th St., between 1st and 3d Aves., new work; A Ave., between B and D Sts., new work. Bids will shortly be asked for this work on brick, concrete, bitulithic, asphalt and creosote block.

The City Council of Eagle Grove, Ia., has declared it necessary to pave and curb Broadway St. and portions of Lucas Ave. and Commercial Ave. C. H. Currie has been employed as Paving Engineer. S. A. Middleton is City Clerk.

Kentucky.

✣Bids will be received until 1 p. m., March 8 (readvertisement of work), by Monroe County Judge, Tompkinsville, Ky., for the construction of 4 miles of pike from Tompkinsville toward the Cumberland River.

✣Bids will be received, it is reported, by the Board of Public Works, Louisville, Ky., until 2 p. m., Jan. 30, for the construction of asphalt pavement with vitrified block gutters for the following streets: Thirty-fourth St., from the south line of Chestnut St. to the center line of Magazine St.; 34th St., from the center line of Magazine St. to a line 132.1 ft. south of Magazine St.; Alta Ave., from the northeast line of Bardstown road to the center line of Everett Ave., extended; Alta Ave., from the center line of Everett Ave., extended, to the center line of Barney Ave.; Alta Ave., from the center line of Barney Ave. to to the southwest line of the way known as Park boundary road; Sherwood Ave., from a line 830 ft. northeast of Bardstown road to the northeast end of Sherwood Ave.; Bonnycastle Ave. from the northeast line of Bardstown road to the center line of Chichester Ave., extended; Bonnycastle Ave., from the center line of Chichester Ave., extended to the center line of Everett Ave.; Bonnycastle Ave., from the center line of Everett Ave. to the center line of Barney Ave., extended; Bonnycastle Ave., from the center line of Barney Ave., extended, to the southwest line of the Park boundary road; Barbee Ave., from the east line of First St. to the west line of Brook St.; Rosewood Ave., from the southwest curb line of Baxter Ave. to a line 466 ft. southwest of Baxter Ave.; Bolling Ave., from the west line of 18th St. to the center line of 21st St.; Bolling Ave., from the center line of 21st St. to a line 321 ft. west of 21st St.

⦿The Board of Public Works of Louisville, Ky., has awarded the contract for paving the Bardstown road, from Bonnycastle Ave. to Woodburn Ave., to the American Standard Asphalt Co. for $1.90 per sq. yd. The total cost of the work will be about $48,000.

According to an estimate of Civil Engineer James S. Caldwell of Paducah, Ky., who made the survey, the Jefferson Davis highway will cost about $750,000. The plans, specifications and maps for the proposed road have about been completed. There are 237 miles of the route which will need complete reconstruction. The remaining 87 miles are modern pike roads and will need but little work.

From Danville, Ky., comes a report that the Louisville & Nashville Railroad will build several miles of turnpike connecting Mitchels and Parksville. This is to be done with a view of reducing the number of dangerous grade crossings.

Louisiana.

The Mayor and City Council of Crowley, La., have secured the consent of a sufficient number of property owners on Parkerson Ave. to assure the paving of the street from the Southern Pacific tracks to the northern side of Courthouse square. The work will cost about $50,000. The Police Jury has agreed to pay for the work.

The citizens of Lake Charles, La., have made plans for the paving of Ryan St., from Pithon Coulee to Shell Beach Drive. Standard paving, macadam or asphalt will be used.

Caddo Parish, La., has decided to construct 25 miles of gravel or broken stone roads annually for a period of five years at an estimated cost of $500,000. Contracts will be let probably in March or April. W. F. Crawford of Shreveport is the official in charge. J. F. Bullen, Box 772, Shreveport, is Parish Engineer.

Maryland.

A new road law for St. Mary's County, Md., authorizng the County Commissioners to float $75,000 in bonds for the purpose of building new roads is under consideration by the St. Mary's delegation. Leonardtown is the county seat.

Mexico.

Eduardo R. Puerto, representing the department of communications, Mexico City, Mexico, recently arrived in Merida for the purpose of surveying the Yucatan roads and opening a general road that will connect Merida with Oaxaca, running through the Quintana Roo territory and giving access to Mexico City.

Michigan.

✣Bids will be received until 8 p. m., Feb. 5, by B. Tellman, City Recorder, Muskegon, Mich., for the construction of approximately 3,533 sq. yds. of Tarvia, Taroid, asphalt macadam, Pioneer road asphalt, Bermudez asphalt or equal, bituminous macadam or brick on Washington St., on a 6-in. concrete or crushed stone base.

Plats and diagrams are now being prepared by City Engineer H. A. Johnston of Kalamazoo, Mich., for street improvements of a permanent kind. The engineer has estimated that the contemplated work will cost $132,143. Estimates have been filed on the following streets: Burdick St., from Axtell creek to south line of Reed St.; street improvement, $9,475; city improvement, $7,320. Douglass Ave., from north line of North St. to north line of Alamo Ave.; street improvement, $10,112; city improvement, $14,401. West St., from north line of North St. to north line of Paterson St.; street improvement, $9,677; city improvement, $7,320. East Ave., from Gilbert Ave. to east line of Phelps Ave.; street improvement, $9,475; city improvement, $8,344. Harrison St., from Main St. to north line of Gull St.; street improvement, $4,800; city improvement, $2,827. Gull St., from Harrison St. to bridge; street improvement, $4,145; city improvement, $3,925. Walbridge St., from Kalamazoo Ave. to north line of Willard St.; street improvement, $3,031; city improvement, $3,055. Third St., from Portage St. to Grand Rapids & Indiana Railway; street improvement, $8,526; city improvement, $3,705. Newton alley; street improvement, $418; city improvement, $200. Bates alley; street improvement, $660. Taylor St.; street improvement,

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] city improvement, [illegible] street improvement, $1,411; city improvement, $1,113. Portage St., from Reed St. to Bryant St.; street improvement, $3,520; city improvement, [illegible]

The taxpayers of the village of Trenton, Mich., have approved a [illegible] for the improvement of Washington Ave. through the village from north to south

Missouri.

•W. W. Williams of Joplin, Mo., has been awarded the contract by the City Council of Carterville, Mo., for the construction of combined curbs and gutters on both sides of Main St., from Hatcher to Allen.

Nebraska.

The City Council of Hastings, Neb., has passed an ordinance creating paving district No. 1. The district comprises Second St., from the west side of St. Joe Ave., to the east side of Burlington Ave.

The City Council of Omaha, Nebr., has directed City Clerk Dan B. Butler to advertise for bids for the paving and curbing of streets in a recently created paving district, for which plans and specifications have been prepared by City Engineer Geo. W. Craig Bids will be received on asphalt, stone, vitrified brick, vitrified brick block artificial stone, macadam and creosoted wood block

New Jersey.

•The Borough of Beach Haven, N. J., has issued $18,000 in bonds to build a boulevard, 100 ft. wide, the full length of the beach, and has awarded the contract for the work to Elmer King of Beach Haven. The township of Long Beach has also voted to issue bonds to build the road outside the borough, and is asking Ocean county and the state aid.

New York.

•The contract for paving Elk St., from South Salina St. to the property of the Delaware, Lackawanna & Western Railroad Co., has been awarded by the Board of Contract & Supply of Syracuse, N. Y., to Fred J. Baker at $11,570. The Board also awarded the contract for paving Granger St., from Gifford to Saymour St., with asphalt, to the Warner-Quinlan Asphalt Co., for $1,460.

According to advices from Hornell, N. Y., the courts have sustained the decision to appropriate $850,000 for good roads in Steuben county and also the decision to appropriate $500,000 for the State road from Hornell to Olean. The road in Steuben county will be built from Addison to Dansville, and also one through the Cohocton valley. Work on all roads will be commenced in the spring.

Alderman James R. Watt has presented an ordinance to the Common Council, Albany, N. Y., providing for the improvement of lower State St. The ordinance calls for an appropriation of $500,000 for the widening and straightening of the street and the erection of a bridge to the improved pier.

North Dakota.

The Park Commissioners of Fargo, N. Dak., have decided on improving the driveway between the North Side and the South Side parks and of making many improvements in the park system of the city.

The Park Board of Minot, N. Dak., has passed resolutions to issue bonds in the sum of $31,000 for park purposes.

Ohio.

✣Bids will be received until noon, Feb. 15, by Smithfield-Hopedale Free Turnpike Road Commissioners, at the office of the County Auditor, Steubenville, O., for grading, sewering and macadamizing the Smithfield and Hopedale free turnpike road.

✣Bids will be received until 1 p. m., Feb. 1, by Board of Portage County Commissioners, Ravenna, O., for the construction of brick pavement in Section No. 1 of the Ravenna-Randolph road, in Rootstown and Ravenna townships, length 4.63 miles, width of pavement, 12 ft.; estimated cost, $61,299.12. Also [illegible] Sec. No. 2, length 3.21 miles; width of [illegible]

✣ [illegible]

[illegible] over the Little Miami river at Milford, in [illegible]

[illegible] has awarded contracts for street improvements [illegible] ler Bros., $4,073; Grace Ave., paving, Miller Bros., $6,952

The Village Council of Madison, O., and the township trustees have declared in favor of the paving of Perry-Unionville road on the South Ridge. It is reported that 35,000 of the 58,000 ft. frontage has already been secured.

Following low bids have been submitted to the Service Director of Youngstown, O., for street improvement contracts: Walnut St., paving, brick—A. O'Horo, $12,583; Charles Harris, $12,630. Hazel St., repaving, brick—W. E. Gartland, $2,753; Kennedy Bros., $3,173; sheet asphalt, Cleveland Trinidad Co. [illegible] James McCarron, $1,170. Glenaven St., paving—Miller Bros., $4,073; M. Fleming, $4,104 Grace St., paving—Miller Bros., $6,952; James McCarron, $6,967

Representative Francis of Martins Ferry, O., has introduced a bill in the Senate providing for the construction of [illegible] to the Pacific coast. The bill also provides for the creation of a national highway commission of five members and a board on national highway rules, to be composed of the attorney general, secretary of war, secretary of commerce and labor, secretary of agriculture and the chairman of the interstate commerce commission. Provision is made for an appropriation of $100,000 this year, $3,000,000 in 1913, [illegible] proposed road will traverse in Ohio: Bridgeport, St. Clairsville, Cambridge, Zanesville, Columbus and Springfield.

Oklahoma.

Preliminary work for the construction of five miles of road in Springer and Hartzell townships, Oklahoma County, Okla., that will connect the overland route from Oklahoma City with Jones City, was perfected at a recent meeting in Jones.

Tennessee.

✣Bids will be received until noon, Feb. 15, by Washington County Board, Jonesboro, Tenn., it is reported, for the construction of that part of the Memphis-to-Bristol highway in Washington County, including about 21 miles of roadway.

✣Bids will be received until 10 a. m., Feb. 1, by Board of Shelby County Commissioners, Memphis, Tenn., for the following turnpike work: Hauling and spreading gravel on the State Line road, gravel to be hauled from switch at Germantown. Approximate amount of gravel to be hauled about 2,500 yds., and the distance from one to four miles. Bond for the payment of any labor used or expense incurred by the contractor in doing any of this work will be required. A forfeit of $200 must accompany each bid D. H. Pope is Secretary of the Commission

Texas.

✣Bids will be received until 8 p. m., Jan. 27, by City of Houston Heights, Texas, at the Houston Heights School, for the paving of the Boulevard from White Oak Bayou to the north line of 19th Ave., with brick, creosoted blocks, asphalt, bitulithic or concrete. The class to be determined after the bids are [illegible] be sent to D. Barker, 505 Kiam Bldg., Houston, Texas. The work consists of approximately 47,200 sq. yds. of paving with all work incident thereto. Plans and specifications can [illegible] Wise, 722-723 First National Bank Bldg., Houston, Texas, and in the office of D. Barker, Mayor of Houston Heights, 505 Kiam Bldg., Houston, Texas

✣Bids will be received until noon, Jan. 27, by John B. Ashe, County Auditor, Houston Texas, for paving Houston Heights Blvd. from Washington St. to White Oak Bayou with bitulithic, concrete, wood blocks, brick and asphalt

The Victoria County Commissioners' Court, Victoria, Tex., has made provision for the issuance of the $200,000 road bonds recently voted for improvements in Victoria district. Civil Engineer L. A. Gueringer of Victoria [illegible]

The city of Houston, Texas, has placed an order for 1,000,000 paving brick. A portion of these brick will be used in paving German St., from the International and Great Northern tracks to Buffalo St., while another part will be used in paving the portion of Houston Ave. soon to be widened. Some new paving will also be laid along San Felipe St.

According to advices from Sherman, Tex., preliminary work has been started in Improvement District No. 2, on the 19 roads leading out from Sherman. This work will require about six weeks to accomplish. All legal work preparatory to the issuing of bonds will be ready to bring before the February term of the Commissioners' Court at Sherman

The County Commissioners at Fort Worth, Tex., have adopted a formal order authorizing the issuance of the $1,600,000 road and bridge bonds approved at the December election. Of the amount, $1,000,000 will be used for highway work.

The Attorney General at Austin, Tex., has approved the $21,500 bond issue by the city of Harlingen, Tex., for the construction of good roads.

The taxpayers of Houston, Tex., will vote Feb. 15 on the proposition of adopting the proposed amendment to the city charter. The amendment provides for the improvement of highways in the city by filling, grading, raising, paving or repaving same with any permanent or durable materials, or by the construction, reconstruction or repair of curbs and gutters and laying out, opening, widening, narrowing, straightening or otherwise establishing, defining or locating any highway or sidewalk

The Commissioners' Court of McCulloch County, Brady, Tex., has sold the $75,000 road bonds and are now negotiating for the machinery and tools necessary for beginning the road building. It is expected work will begin by Feb. 1.

The election which was to have been held in Reeves County, Tex., including the city of Pecos, on Jan. 19, for the purpose of voting on the issuance of bonds in the sum of $100,000 for good roads, was not held owing to the fact that the law was not complied with in the matter. It is probable that another call will be made shortly.

A petition has been circulated among the property owners on Holmes St., between Pennsylvania and Romine, city of Dallas, Tex., calling for the paving of that street with asphalt macadam, together with concrete curbs and gutters.

Utah.

[illegible] Commission of Utah, $500,000 will be available for improvement work on state highways during 1912. W. D. Beers is Engineer of the Commission.

Virginia.

[illegible] the Virginia Highway Commission, and associates have started a survey of a highway across Washington County, from Bristol, Va.,

✣ [illegible] work [illegible] • [illegible] a contract let recently to be [illegible] of the proposed highway between Bristol and Washington. The work is being promoted by the Bristol-to-Washington Highway Association, which was organized last summer.

The Board of Supervisors of Rockingham County, Harrisonburg, Va., at the request of 300 voters will ask Judge [illegible] to call a special election to vote on a proposed $30,000 bond issue for a macadamized road from Broadway, Rockingham County, westward to the West Virginia line.

Senator Martin of Virginia on Jan. 16 introduced bills in the U. S. Senate to provide money for the following purposes: To construct a public highway on the south side of the Potomac river, from Washington to Mount Vernon; a highway from the new bridge across the Potomac river to the National Cemetery at Arlington, and a road from Arlington to the Federal Experimental Farm. For these roads Mr. Martin would appropriate $120,000, $75,000 and $10,000.

Washington.

⊙R. M. Westover, it is reported, has been awarded the contract by the County Commissioners, Everett, Wash., for the remainder of the Everett-Edmonds-Seattle road, for $6,297.

Bids will be received until 2 p. m., Feb. 5, by the Board of Adams County Commissioners, Ritzville, Wash., for the construction of Permanent Highway No. 1, in Adams County. The maps, plans, profiles and specifications are on file in the office of the County Engineer of said county at Ritzville, Adams County, Washington, and also in the office of the State Highway Commissioner at Olympia, Washington, where they may be examined and inspected. The date set for the completion of this highway is June 1, 1912.

Wisconsin.

The White Construction Co. of Milwaukee, Wis., at $17,827, submitted the lowest bid to the Common Council of Kenosha, Wis., for the paving of Exchange St., between Pearl and Deming Sts. Other bidders were Chris. Petersen, $18,365; James Cape & Sons, Racine, Wis., $18,870; McCugo-Bullock Co., Waukegan, Ill., $19,371; Western Improvement Co., Racine, $20,130.

The Wisconsin Highway Commission, created by an act of the last legislature appropriating $350,000 annually for an indefinite period of years for state aid for highway construction, has announced that $1,250,000 will be expended in that state during 1912 for highway improvement as the result of the granting of state aid. The details of the expenditures reported are as follows: Stone roads, 220 miles; gravel roads, 150 miles; shale road, 25 miles; dirt road, 250 miles, a total of 645 miles.

The Milwaukee County Commissioners, Milwaukee, Wis., are planning the building of the Janesville plank road to a width of 150 ft. for a distance of six miles. It is also planned to park the road. The improvement, it is estimated, will cost about $500,000.

Canada.

✣Bids will be received until noon, Feb. 16, by City Commissioners, Saskatoon, Sask., for the construction of approximately 125,750 sq. yds. of pavement. Further information may be had of George T. Clark, City Engineer, Saskatoon. James Clinkskill is one of the City Commissioners.

✣Bids will be received until noon, Feb. 16, by the City Commissioners, Saskatoon, Sask., for the construction of approximately 621,000 sq. ft. of concrete sidewalk and 100,950 lin. ft. of curbing. All information may be had of George T. Clark, City Engineer, Saskatoon, Sask.

BRIDGES—STEEL AND CONCRETE

Alabama.

The Board of Revenue and Road Commissioners recently conferred with representatives of the Mobile & West Shore Traction Co., at Mobile, Ala., on the proposition of building a bridge over Dog River and a viaduct over the Louisville & Nashville R. R. track on the Fulton road at Neshota. It was decided to take the matter up with officials of the L. & N. R. R.

Arkansas.

⊙The Chicot County Court, Lake Village, Ark., has awarded the contract for the construction of a steel and concrete bridge over the Bayou Macon, on the Eudora Grand Lake road, to the Vincennes Bridge Co., Vincennes, Ind., at $4,192. The structure will be 208 ft. long, consisting of a 100-ft. and two 54-ft. spans.

California.

⊙The contract for the construction of the trestle over Dry Creek has been awarded by the Board of County Supervisors, Merced, Calif., to W. H. McElroy, Merced, Calif., at $1,097. Bids were opened Jan. 9.

⊙The Board of County Supervisors, Merced, Calif., has awarded the contract for the construction of a bridge over South Slough including wooden and concrete work, to William Radike, San Jose, Calif., at $795.

Plans have been approved for the construction of a second bridge over the Tule River at the foot of F St., Porterville, Calif.

The following bids were recently received by the City Council of Riverside, Cal., for the construction of a fill over the Arroyo in the Magnolia Ave. extension project, including approximately 143,000 cu. yds. of earth; Star Cement Co. (Riverside), 16.7 cts.; Mesmer & Rice, 18.5; Russell-Greene-Foell Co., 18.9; Hauser Contracting Co., 21; Standard Construction & Development Co., 24; A. W. Bessemyer, 25; Robt. Sherer Co., 25; Rife & Frenwell, 25; Occidental Construction Co., 25.5; R. R. Coleman, 26; P. A. and C. H. Howard, 27.5; Hannafin & Hayes, 28; Grant Bros. Cement Co., 29.5; J. C. Beacher (San Jacinto), 30; T. J. McGovern, 30; Shattuck-Edinger Co., 32.5; R. H. McCray, 39; F. F. Prendergast, 43.

D. K. Adams, Superintendent of Streets, San Diego, Cal., has plans under way for opening First St. by the construction of a bridge over the canyon at Nutmeg and Laurel Sts. As proposed the structure will be a suspension bridge and will provide for street railway traffic if the street railway company agrees to pay a portion of the cost.

As nothing definite was decided upon at the recent conference of the Colusa and Sutter Counties' Boards of Supervisors with the officials of the Northern Electric Railroad in regard to the construction of a joint bridge at Meridian, Cal., the matter was deferred to a later meeting. It is estimated that the structure will cost about $240,000.

Colorado.

⊙The Board of Mesa County Commissioners, Grand Junction, Colo., has awarded the contract for the construction of a bridge across Grand River at the foot of Main St. to the Patterson Bridge Co., Denver, Colo., at $67,215. Construction work will be started immediately, it is said.

Commissioners of Mesa County at a recent meeting, Grand Junction, Colo., decided upon the erection of the proposed Gateway bridge, estimated to require an expenditure of $3,000. Engineer Fisk and the rate board will visit the site as soon as the weather permits.

Georgia.

. The Bridge Committee received the following bids Jan. 15, at the office of R. M. Clayton, Chief of Construction, Atlanta, Ga., for the construction of the steel bridge with reinforced concrete approaches at Bellwood Ave.: Foster-Creighton-Gould Co., $62,500; George A. Clayton, $56,933; Nichols Contracting Co., $64,500; J. S. Donaldson, $66,000; J. W. Ash, Austell, Ga., $53,000; Southern Ferro Concrete Co., $61,950; Thomas Sheahan, $62,950; Mackle-Crawford Co., $53,377; Dysard Construction Co., $53,589; Griffins Construction Co., Atlanta, Ga., $49,000; Case & Brine, $60,888; J. R. Cothran, $59,725; Joliet Bridge & Iron Co., $60,400.

Idaho.

Commercial Club of Lewiston, Idaho, and farmers of the section lying north of the city across the Clearwater river recently met to take steps toward the construction of a free wagon bridge over Hatwai creek, about 5 miles east of the city. A committee was appointed to meet with the County Commissioners the latter part of this month.

Illinois.

✣Bids will be received at the County Surveyor's office, Ottawa, Ill., up until 1 p. m., Feb. 1, for the construction of a reinforced concrete superstructure on old stone abutments, in Dayton Township, La Salle County. E. J. Belrose, Town Clerk, Wedron, Ill. Zellers Bridge—Clear span, 24 ft.; roadway, 18 ft.; estimated concrete in superstructure, 30 cu. yds.; reinforcing steel, 5,550 lbs. The existing masonry substructure is to remain undisturbed with the exception that the abutment walls and wings outside of the superstructure are to be capped with concrete 22½ ins. high, 12 ins. thick and 6 ft. long to retain the embankment. Estimated amount of concrete, 2.6 cu. yds. Gravel may be obtained in bed of Indian Creek, 2½ miles from bridge site, for about 25 cts. per load. Contractor to provide temporary bridge during construction. Work to be completed on or before May 25, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 A. M., Jan. 27, for furnishing and delivering at the various bridges, viaducts, etc., white pine, Norway pine, yellow pine and white oak lumber as may be required until December 31, 1912. Bridge No. B-1152 on the Valley Division of the Santa Fe, at present a 1,648-ft. open deck pile trestle will be renewed by a 70-ft. ballast deck pile to be placed on the east end, with a 612-ft. fill, the balance of the bridge, 966 ft., to be renewed with a ballast deck, estimated cost $47,200. Bridges Nos. A-182, A-186, B-186 and B-24, Los Angeles Division of the Santa Fe, are to be renewed at a cost of $5,000.

⊙The Joliet Bridge & Iron Co., Joliet, Ill., has been awarded the contract for repairing the Illinois River bridge at Havana, Ill. The work will include cleaning and repainting all steel, new stringers and new creosoted timber and new floor. The contract price was $2,952.

The State Engineering Department, Springfield, Ill., has been called upon to prepare plans for the construction of an 850-ft. concrete viaduct at Danville, Ill. A. N. Johnson is State Highway Engineer.

Engineer Bilger of the State Highway Commissioner's office, Springfield, Ill., recently inspected the site of the proposed new bridge at Old Texas and conferred with the Highway Commissioners of Middleport and Concord townships. As proposed the structure will be 150 ft. long. It is hoped to have an estimate of the cost made in order that the proposition may be submitted to the voters at the Spring election.

Indiana.

✣Bids will be received until 2 p. m., Feb. 6, by Board of Rush County Commissioners, Rushville, Ind., for the [illegible] bridges on Rush-Hancock county line. J. M. Stone is County Auditor.

Iowa.

⊙The Lucas County Board, Chariton, Ia., has awarded the contract for the construction of county bridge work to Cyrus Bell, Whitebreast township, at $1.90 per lin. ft.

Kansas.

✣Bids will be received until Feb. 5, by Commissioners of Cloud County, Concordia, Kan., for the erection of stone arch bridges, one to be 6 ft., one 12 ft. and one 16 ft. Stone is to be furnished to the contractor in the quarry 1½ miles from the bridges. R. A. Short is County Clerk.

A petition asking for a Congressional appropriation for the construction of a free bridge over the Missouri River at Leavenworth is being circulated at Weston, Mo., a town opposite Leavenworth, Kan.

Kentucky.

A bill has been introduced in the Senate at Washington, D. C., by Senator Lea, authorizing the Lewisburg & Northern Ry. Co., subsidiary to the Louisville & Nashville R. R., to construct a bridge over the Cumberland River. J. H. Peyton, Louisville, Ky., is Chief Engineer of the new company.

Louisiana.

It has been announced by the Clerk of Court, Baton Rouge, La., that construction work will be started immediately on a new steel bridge over the Comite River on the Greenwell Springs road. N. S. Hasie, Dallas, Texas, has the contract for the work. The cost is $5,200.

According to information received from W. L. Burke, Secretary, Police Jury, Iberia Parish, La., the construction of the proposed steel bridge over Bayou Teche, at Oliver, has been deferred indefinitely. The project was [illegible] in our Jan. 3 issue.

Massachusetts.

✣Bids will be received until 9:30 a. m., Jan. 30, by Essex County Commissioners, Salem, Mass., for the reconstruction of Fox Hill bridge over the Saugus River between the city of Lynn and the town of Saugus, Essex County, Mass. The work will consist of building a temporary pile bridge, removing the old structure and building a reinforced concrete bridge of four spans, each 35 ft. in the clear, supported on granite piers and abutments, with a steel rolling lift channel span, pile fender guards, operator's house, etc., a part of the new structure to be a solid fill. Plans may be seen and specifications may be obtained at the office of the County Engineer at Salem Mass. Prospective bidders may obtain plans of B. L. Makepeace, 387 Washington St., Boston. Each bid must be accompanied by a certified check for $1,000.

Minnesota.

✣Bids will be received until 2 p. m., Feb. 2, by Auditors of Marshall and Beltrami Counties, Warren, Minn., for furnishing and delivering corrugated culverts to points within the territory of No. 11 designated in the specifications of the following amounts and sizes: About 1,000 of 12-in. culverts; 800 ft. of 18-in. culverts; 650 ft. of 24-in. culverts; 650 ft. of 36-in. culverts; 800 ft. of 36-in. culverts; 700 ft. of 48-in. culverts; 250 ft. of 48-in. culverts; 200 ft. of 60-in. and 250 ft. of 72-in. culverts.

✣Bids will be received until 2 p. m., Feb. 2, by Auditors of Marshall and Beltrami Counties, Warren, Minn., for furnishing the material and erecting 12 steel I-beam bridges, ranging from 28-ft. to 48-ft. spans, across the main ditch, branch No. 1 and branch No. 200 of Judicial Ditch No. 11. Plans and specifica- [illegible]

The Mankato [illegible] Co., Mankato, Minn., has under consideration the con- [illegible] tion company.

Missouri.

✣Bids will be received until noon, Feb. 6, by the Sullivan County Court, Milan, Mo., for the construction of an all-steel bridge, 75-ft. span, with 30-in. steel piers, across Main Locust Creek, near Leander Montgomery's farm. Plans and specifications on file with the County Clerk. W. G. Kent is Highway Engineer.

The City Council of St. Joseph, Mo., at a recent meeting instructed the Board of Public Works to employ Hedrick & Cochrane, Kansas City, Mo., to prepare plans for the construction of the proposed Sixth St. viaduct mentioned in a recent issue of this paper.

Montana.

Engineers of the Great Northern Ry. are making surveys for the construction of the bridge necessary to span the Judith River at the Powell ranch near Lewistown, Mont.

Nebraska.

✣Bids will be received until noon, Feb. 8, by Board of Otoe County Commissioners, Nebraska City, Nebr., for the construction of bridges according to plans on file with L. J. Stutt, County Clerk. Separate bids will be received for bridges as follows: 40, 50, 60, 70, 80, 90 and 1,000 ft. steel span superstructures. Steel I-beam bridge superstructures, 16 to 32 ft. in length; steel approaches to steel bridges; wooden pile bridges 16 to 80 ft. in length; 30 and 36-in steel tubes and 30 and 36-in. Wilson reinforced concrete tubes. Separate bids will also be received on concrete bridges and also on concrete work. A certified check in the sum of $500 must accompany each bid.

✣Bids will be received until noon, Feb. 20, at the County Clerk's Office of Morrill County, Bridgeport, Nebraska, for the construction of two bridges with earth approaches and fills across the North Platte, one bridge to be located at the site of the present wagon bridge about three-fourths of a mile north of the town of Bridgeport, and the other bridge to be located about one and one-half miles south of the town of Bayard. Bids will be received for both of the above bridges on alternate designs as follows: First—One reinforced concrete girder bridge, composed of 33-ft. spans, approximately 800 ft. in length, all as per plans and specifications. Second—One reinforced concrete arch bridge, composed of 50-ft. spans, approximately 800 ft. in length, all as per plans and specifications. All plans and specifications for the above bridges are on file in the office of the State Engineer, Lincoln, Neb., and the County Clerk's office, Bridgeport, Neb. Earth fills on the ends of both Bridgeport and Bayard bridges will be made 7 ft. high and 1,500 ft. in total length for each bridge, and contain approximately 19,000 cu. yds. of earth per bridge. Surfacing with gravel 1 ft. deep will be made over the roadway of both bridges and 16 ft. wide on all fills, being approximately 12,000 cu. yds. of gravel per bridge. Bids may be submitted separately on the bridge, earth work and surfacing. All bids must be sealed, and those on the bridges or on the entire project complete must be accompanied by cash deposit or certified check for $1,000. Bids on earth work and surfacing to be accompanied by cash deposit or certified check for $200. All certified checks to be made payable to Mr. Jess Minshall, County Clerk of Morrill County. Copies of plans and specifications may be had upon application and payment of $5.00 at the office of the State Engineer.

✣Bids will be received until noon, Feb. 12, by E. F. Urzak, Clerk Colfax County, Schuyler, Nebr., for the construction of all steel, concrete and wooden bridges during the year. A certified check for $500, payable to the County Clerk, must be filed with each bid. Official advertisement will be found elsewhere in this issue.

The Board of Sherman County has applied to the State Engineer, Lincoln, Neb., for state aid in the construction of a bridge over the Loup River at Loup City. The proposed structure will be 500 ft. long and will cost, it is estimated, about $14,000.

A movement is being agitated in the cities of Council Bluffs, Ia., and Omaha, Neb., toward the construction of a new free bridge across the Missouri River to accommodate railroad traffic, street car lines, wagons and pedestrians. The proposed free bridge, according to the present plans, is to be located opposite the lower end of First Ave., or between First and Second Aves. C. O. Lobeck, Omaha, Neb., is interested in the project.

New York.

The Kensington Business Men's and Taxpayers' Association, Buffalo, N. Y., recently adopted resolutions favoring the construction of a bridge over Cattaraugus Creek on Moselle St.

The Grade Crossing Commission, Buffalo, N. Y., recently held a hearing on the question as to whether the crossing at grade at Austin, Amherst and Tonawanda Sts. over the Erie, Central and Lackawanna tracks should be eliminated by subways or viaducts. A number of petitions signed by the residents of Black Rock protesting against subways were filed.

North Dakota.

✣Bids will be received until 1:30 p. m., Feb. 20, by Board of Pembina County Commissioners, Pembina, N. Dak., for the construction of all bridges ordered during the year of 1912. Plans and specifications are on file at the office of W. W. Felson, County Auditor.

Ohio.

✣Bids will be received until 11 a. m., Feb. 3, by Board of Medina County Commissioners, Medina, O., for the construction of the superstructure of a highway bridge in Guilford township, also for a superstructure of a highway bridge on the Cleveland pike in Medina township. L. Garver is County Auditor.

✣Bids will be received until 1 p. m., Jan. 31, by the Board of Licking County Commissioners, Newark, O., for the construction of a bridge over Clay Creek in Madison township. C. L. Riley is County Auditor.

✣Bids will be received until noon, Feb. 16, by Board of Hamilton County Commissioners, Cincinnati, O., for the construction under Specifications No. 230 of concrete bridge and fill on River road at Dunlap Creek road in Colerain township. Plans and specifications are on file at the office of the Board. Albert Reinhardt is Clerk of the Board.

✣Bids will be received until 11 a. m., Jan. 29, by Board of Summit County Commissioners, C. I. Wirth, Clerk, Akron, O., for making fill necessary to complete the approaches to the George Highway bridge, so-called, over the Cuyahoga river, in the village of Cuyahoga Falls and Portage township, said fill to be made in accordance with the plans, profiles and specifications therefor now on file in the office of the County Auditor. The material for making the fill will be taken from the hog-back between the highway and street railroad south of said bridge, which shall be excavated to such a depth as said Board shall indicate, and if sufficient material is not contained in said hog-back, the balance shall be taken from the hillside north of said bridge, at such point as said Board shall indicate. The estimated quantity of fill to be made is approximately 19,400 yds., to be paid for as measured in the fill after completion of the same and after allowing 10 per cent for settling and shrinkage. Work will be commenced on said fill as soon as the contract therefor is let and must be finished within 45 days from the date of the contract.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

⊙The Board of Control, Dayton, O., has awarded the contract for the construction of the bridge over the canal at Sperling Ave. to Al. S. Fox at $1,707.

The Butler County Commissioners, Hamilton, O., have approved the plans for the construction of a 5-ft. extension to the Grand Boulevard bridge, and the same were submitted to the State Department for approval.

Lionel Evans, Superintendent of Parks, Youngstown, O., has recommended the construction of four new concrete bridges in Lincoln Park, estimated to cost $1,000 each. The construction of a new concrete wall at that park, estimated to cost $3,500, was also recommended.

Oklahoma.

It is reported that the Missouri, Oklahoma & Gulf Railway Co., J. J. Harrison, Muskogee, Okla., Chief Engineer, has contracted for the construction of four bridges along the proposed line between Wagoner and Joplin. The structures will be of steel and will span the Grand and Spring rivers.

Oregon.

The fact that the Portland, Eugene & Eastern Ry. Co. has secured an option on the old factory site of the Combination Manufacturing Co. leads it to be believed the railroad will construct a bridge shortly over the Willamette from the foot of State St. at Salem, Ore.

Panama.

✣Bids will be received until 10:30 a. m., Feb. 15, by Maj. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 675, the necessary Lifting Trusses, Lifting Mechanism, Electrical Equipment, Signals, etc., for the complete construction and erection of a single-track, single-leaf bascule, same to be installed by the commission on the 103½-foot steel girders now on hand at bridge 140, relocated line, Panama Railroad.

Pennsylvania.

Councilman William Wirth introduced at a recent session of the city council, Scranton, Pa., an ordinance granting a franchise to the Scranton & Lake Ariel Ry. Co., which proposes, among other improvements, the construction of a viaduct at River St. instead of the trestle, as at first planned.

The Washington County Board of Commissioners, Washington, Pa., has appointed viewers to investigate the site for the construction of the proposed bridge on the Charleroi-Twilight road.

The Grand Jury has recommended that the Commissioners of Luzerne County, Wilkesbarre, Pa., construct a new bridge over the Susquehanna River from Port Griffith to Wyoming.

Commissioners of Cambria County, Ebensburg, Pa., plan to inspect the proposed site for the construction of the bridge between Cambria City and Minersville, and it is believed that the project will take definite shape shortly. The cost of the structure will amount to about $25,000.

Texas.

County officials recently met at Houston, Texas, to discuss the proposed construction of a bridge over Little White Oak Bayou to connect Montgomery Ave. and Houston Ave. on a direct line and for straightening out Montgomery Ave. The cost of the bridge would be, it is estimated, about $15,000.

Washington.

✣Bids will be received until 2 p. m., Feb. 2, by Board of County Commissioners, Spokane, Wash., for the construction of a county bridge located and described as follows: On the Lyle road across Spokane River in the n. e. ¼ of Sec. 20-26-42, consisting of one steel Pratt Truss span 199 ft. 10 ins. wide, approach spans of reinforced concrete, with earth approaches and rock riprap.

✣Bids will be received until 2 p. m., Feb. 2, by Board of Spokane County Commissioners, Spokane, Wash., for the construction of a county bridge located and described as follows: Bridge No. 126, on the Boston road across Peone Creek in the e. ½ of Sec. 3-26-43, consisting of 6 riveted steel Warren trusses, each span 70 ft., and 3 tower spans, each 17 ft. 6 ins., on concrete pedestals and abutments with earth approaches. R. W. Butler is Clerk of the County Court.

✣Bids will be received until 4 p. m., Jan. 30, by W. J. Roberts, State Highway Commissioner, Olympia, Wash., for the substructure for a bridge across the North Fork of Lewis River in the n. w. ¼, Sec. 19, Twp. 5 north, Range 1 e., W. M. Plans and specifications are on file in this office and in the office of Bowerman & McCloy, Consulting Engineers, Central Bldg., Seattle, Wash.

✣Bids will be received until 2 p. m., Feb. 2, by Board of Spokane County Commissioners, Spokane, Wash., for the construction of two county bridges located and described as follows: Bridge No. 15 on the Latah Creek road across Latah Creek in s. w. ¼ of Sec. 32-22-44, and Bridge No. 18, on the Roberts road across Latah Creek in n. w. ¼ of Sec. 12-21-44, each consisting of 1 riveted steel Pratt Truss, span 122 ft. 6 ins., on concrete abutments with earth approaches and rock riprap. R. W. Butler is Clerk of the Board.

✣Bids will be received until 2 p. m., March 4, by Board of Lewis County Commissioners, Chehalis, Wash., for the subgrading, draining, constructing a 20-ft. reinforced concrete culvert, and hard-surfacing 16 ft. in width, 5,280 ft. of the Cowlitz and Olympia road, commencing at the East end of the present State Aid Road No. 51. Located about 3 miles from Chehalis. H. H. Swofford is County Auditor.

Commissioners of Spokane County, Spokane, Wash., have approved the plans for the construction of four new bridges which will be built during the coming year. The structures will be of steel, according to the plans prepared by C. L. Graves, County Engineer, and the largest one will be over Peone Creek, just north of Mead, and will be 80 ft. high and 473 ft. long. No. 4 bridge will be built at Seven Mile, over the Spokane River, and will be 200 ft. long. Bridges Nos. 15 and 18 will be near Waverly. One will be built above Waverly and the other just below. Each will be 122 ft. long and will be the same in all particulars.

Petitions are being circulated by the citizens of Aberdeen, Wash., asking for the construction of a $75,000 bridge connecting South Aberdeen with the main part of the town.

The following bids were received by the Board of Public Works, Seattle, Wash., Jan. 12, for the construction of a viaduct on Fremont Ave. from Lake Washington Canal to Ewing St.: Sloane Bros., $46,335; Stillwell Bros., $56,941; F. S. Misho, $46,733; McRae Bros., $58,230; T. Ryan, Sullivan Bldg., M 1760, $46,323; Jahn Cont. Co., $47,569; Stanley Bros., $59,160; Butler Const. Co., $52,680. Lance & Peters, $53,935; Sparger Conc. Co $59,327; Chamberlain Const. Co., $49,720; Graff Const. Co., $48,587; Kaburtz, Smith & Roundtree, $59,044; Pearson Const. Co., $47,631. Specifications on the above included 81 M ft. lumber; 700 ft. galvanized iron railing; 2,099 cu. yds. concrete; 315,180 lbs. steel; 2,435 sq. yds. brick pavement; 60 cu. yds. sand and gravel; 430 ft. 8-in. sewer pipe; 435 ft. cast iron drain pipe; 240 lbs. cast iron footing plates; 3,000 lbs. pole sockets; 1,700 lbs. steel plates.

Lincoln County Commissioners, Davenport, Wash., have awarded the contract for the construction of metal culverts in the county during the year of 1912 to Wylie Bros., Portland, Ore., at $3,500.

The Commissioners of Lewis County, Chehalis, Wash., and the residents of Randle, Wash., have entered an agreement whereby the latter will furnish $2,627 toward the necessary $21,000 for the construction of a bridge over the Cowlitz River at Randle.

Advices from Spokane, Wash., state that definite information as to when the Oregon-Washington Railroad & Navigation Co. will ask for bids for the constructon of the proposed bridge crossing the river above the Monroe St. bridge will be made public within a short time. W. H. Davisson, Spokane, Wash., is Principal Assistant Engineer.

As a result of the recent inspection of the Green River Pipe Line of Tacoma, Wash., by Commissioners and Engineers, it will probably be necessary for the city to construct a bridge over the Green River to replace the under river crossing. The cost of the improvement is estimated at about $23,000.

Wisconsin.

City Council of Eau Claire, Wis., is to again take up the matter of building a new bridge over the Chippewa River from Bridge to A St. As proposed the structure would be 17 ft. long and would necessitate an expenditure of about $60,478. The site will probably be the same as that of the old wagon bridge which spanned the river years ago.

The State Highway Commissioners at Madison, Wis., have appropriated $1,250,000 for the construction of roads and 140 bridges in number of townships.

The State Railroad Commission of Wisconsin, Madison, Wis., has instructed the Eastern Wisconsin Electric Railway Co. and the city of Oshkosh to build a new bridge over the Fox River at West Algoma St. to replace the present structure, which is pronounced unsafe for traffic. The railway company will pay 7 per cent of the cost and the city will bear the balance.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

California.

⊙J. D. Niman, Turlock, Cal., has been awarded the contract at about $9,000 for constructing Cross Ditch No. 2 for the Turlock Irrigation District of Turlock, Cal. The work includes the excavation of a ditch about 4 3-5 miles long, 107 cu. yds. reinforced concrete drops and 78.8 cu. yds. concrete lining.

Idaho.

A committee has been appointed by the settlers and land owners of the Sunnyside Tract to investigate sources of water supply and to report on a plan for the promotion of a district to irrigate the 67,000 acres in the tract. There are four sources, any one of which, it is said, would give the district ample water for all purposes. These streams are Fall Creek, Lime Creek, south fork of the Boise, or Salmon River. Either of these sources would contemplate a reservoir site in the Long Tom basin with a capacity of 330,000 acre ft., which would water 120,000 acres of land. The reservoir would have to be dammed at the mouth by a structur 210 ft. high and 270 ft. long at the base, or surface length of nearly 1,000 ft. The committee consists of J. M. Wise, Dr. R. I Nourse and Judge Carl A. Davis, all o Boise.

City Council of Pocatello, Idaho, has bee petitioned to build a levee along the bank of Portneuf River, where it runs throug North Johnston Ave., between Greely an Young St.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Illinois.

✣Bids will be received until 9 a. m., Feb. [illegible] sub-district of the Little Wabash Drainage District, Coles County, at the office of James W. and E. C. Craig, Mattoon, Ill., for the work of constructing a covered drain including [illegible] in. vitrified sewer pipe, and 6 lamp holes; all of which vitrified sewer pipe is to be laid at an average depth of 6 ft. Maps, profiles, plans and specifications of the work may be seen at the office of the clerk of the county court of Coles County, Illinois, and at the office of Claude L. James, the engineer of the drainage district, and at the office of James W. & Edward C. Craig, in Mattoon, Ill. Bids will be received on the work as a whole covering the furnishing of the vitrified sewer pipe, hauling the same, and the digging, laying and backfilling. A certified check for $100 must accompany each bid.

✣Bids will be received until noon, Feb. 15, by I. J. Bryan, clerk of the Sanitary District, American Trust Bldg., Chicago, Ill., for the excavation and collateral work on Contract Section 3 of the Calumet-Sag channel. The work will include the following approximate quantities: 335,000 cu. yds. of glacial drift, 20,000 cu. yds. of rock excavation, 182,300 sq. ft. of channeling, 13,400 cu. yds. of concrete retaining wall, 5,000 sq. yds. rip rap slope. Official advertisement will be found elsewhere in this issue.

⦿Bids were opened at Harrisburg, Ill., Jan. 16 by the Middle Fork Special Drainage District for the construction of a 15-mile main outlet ditch and a 2-mile lateral ditch. The contract, involving about 557,600 cu. yds. of excavation, was awarded to John McMann, Goshen, Ind., at 8 cts. and 5.97 cts. per cu. yd.

⦿The Myers Construction Co. and Frank L. Aymond, St. Louis, Mo., have been awarded a sub-contract by the Kinser Construction Co. for driving 416,000 lin. ft. of piling for the new levee at East St. Louis, Ill.

All bids received Jan. 17 by the Commission of the Sny Island Levee Drainage District, Pittsfield, Ill., for enlarging the main drainage canal of the district were rejected. The work on which bids were taken involved about 1,000,000 cu. yds. of excavation. E. J. Chamberlain, Pittsfield, Ill., is the Engineer.

Indiana.

The Commissioners of Allen County have ordered the establishment of the Junk ditch in Wayne County. Ralph Guenther, County Surveyor, Fort Wayne, Ind., in charge

Iowa.

✣Bids will be received until 2 p. m., Feb. , by Board of Supervisors, Kossuth County, Algona, Ia., for the contract for drainage improvement comprising one continuous open itch 14,962 ft., 8-ft. base, average depth 6.50 ft., estimated yardage 50,000 cu. yds.; 74,144 ft. of tile ranging from 6 to 24-in.; 10 per ent check to accompany bid. S. E. Norton is Auditor of Kossuth County at Algona, Ia.

✣Bids will be received until Feb. 5, by A. Peterson, County Auditor, Webster City, Ia., for the construction of tile portion of Ditch No. 93 in Hamilton County requiring the following quantities of salt-glazed vitrified tile: 1,500 ft. 30-in. tile, 1,800 ft. 26-in. tile, 1,400 ft. 24-in. tile; 2,000 ft. 22-in. tile, 400 ft. 20-in. tile, 1,400 ft. 18-in. tile, 2,250 ft. 16-in. tile, 5,263 ft. 14-in. tile, 2,580 ft. 12-in. tile, 1,240 ft. 10-in. tile, 2,200 ft. 8-in. tile. Maximum depth, 11 ft. Certified check for) per cent required with each bid. E. S. oudinot of Webster City, is the Engineer [illegible]

✣Bids will be received until 9 a. m., Feb. 1, by Board of Winnebago County Supervisors, Forest City, Ia., for the construction of Drainage District No. 11, to consist of approximately 3,200 ft. 24-in. tile, 2,500 ft. 20-in. tile, 600 ft. 18-in. tile, 2,700 ft. 16-in. tile, 4,600 ft. -in. tile, 6,700 ft. 14-in. tile, 7,800 ft 12-in. tile, 11,485 ft. 10-in. tile, 2,600 ft. 9-in. tile, [illegible]

Neils Spur, Iowa, [illegible] Thompson, Iowa, about four miles [illegible] Nelson, County Auditor.

⦿[illegible] der, County Auditor, Clarion, Ia., for constructing tile drain No. 70 of Wright County, the contract being let to L. H. Thompson, Holmes, Ia., at $12,387. The work includes furnishing and laying 2,010 ft. 12-in., 2,000 ft. 14-in., 900 ft. 16-in., 4,700 ft. 18-in., 2,000 ft. 20-in., 2,500 ft. 22-in., 3,100 ft. 24 in. tile; tile to be No. 1 salt glazed vitrified farm drain tile.

Michigan.

⦿The following contracts were recently let by E. W. Redman, Ithaca, Mich., County Drain Commissioner of Gratiot County, for work in No. 254 Drain in Pine River Township. Sec. 1—136 rds., 16 rds. of 18-in. pipe with shallow open drain above and 120 rds of open drain, 4ft. bottom with average cut of 5.1 ft., to Ira Moody, at $3.30 per rd.; Sec. 2, 289.2 rds., 150.6 rds. of 12-in. tile and 138.6 rds. 8-in. tile, average cut of 4 ft., to Ira Moody, at $1.10 per rd.; Sec. 2 includes 1 head wall and 4 catch basins. Branch No. 1 186.08 rds., 139.44 rds. of 12-in. tile, 46.64 rds. of 8-in. tile and 16 rds. of open drain, average cut of 4 ft., contract, including 1 head wall and 4 catch basins, to H. McLean, at $1.09 per rd.; Branch No. 2, 90.48 rds. of 6-in. tile, average cut 5.2 ft., contract, including 1 catch basin, to H. McLean, at $1.69 per rd. Above tile contracts are for all labor only, except for head walls and catch basins where materials are furnished also. The contract for hauling tile about two miles was let for $57.00. Contract for furnishing No. 1 vitrified tile for the above, including 23 special pieces, was let to the Michigan Branch of the American Sewer Pipe Co. of Jackson, Mich., to be furnished f.o.b. cars at Forest Hill, for $993.19.

The survey for cleaning out and straightening of No. 111 drain, 10.8 miles in length, located in Arcade, Sumner and New Haven Townships, in Gratiot County, has just been completed. The bottom width of this drain will vary from 4 ft. to 10 ft. It will probably be let some time in March. E. W. Redman, Ithaca, Mich., is County Drain Commissioner.

Minnesota.

✣Bids will be received until 2 p. m., Feb. 3, by G. C. Smith, Isanti County Auditor, Cambridge, Minn., for digging and constructing the Ditch No. 10, including 81,145.7 cu. yds. of material, 10 acres of clearing, building 5 highway bridges and replacing floor on one bridge and two culverts. The cost of the improvement is [illegible]

✣Bids will be received until Feb. 7 by C. J. Hemmingson, Hallock, Minn., for the excavation of about 66,975 cu. yds. of material; also two steel bridges of the corrugated arch type, four large culverts with concrete bulkheads, for County Ditch No. 20, Kittson County.

✣Bids will be received until 3 p. m., Feb. 5, by S. G. Bertilrud, Auditor of Roseau County, Roseau, Minn., for digging and constructing Ditch No. 10 by sections of 100 ft. each, or as a whole. The following is the estimate by V. B. Chapin, Badger, Minn., Engineer: One main ditch, three laterals, one branch and three sub-branches—all open ditches, and in all about 17½ miles, and containing 110,625 cu. yds. of excavation. Estimate cost of excavation, $12,099.33; estimate cost of culvert, $1,167.00; estimate cost of clearing, $435.00; estimate cost of leveling roads, $712.00; clearing creek, $50.00; total estimate cost, $14,463.33. Main ditch—Average cut, 3.5; maximum cut, 6.0; minimum cut, 2.0; base, 5.0; berm, 5.0; slope, 1 to 1. [illegible] 6.1; min. cut., 1.7, base, 5.0; berm, 5.0; slope, 1 to 1. Lateral No. 2—Average cut, 4.0; max. cut, 5.8; min. cut, 2.5; base, 5.0; berm, 5.0; slope, 1 to 1. Lateral No. 3—Average cut, 4.3; max. cut, 5.6; min. cut, 3.0; base, 5.0; berm, 5.0; slope, 1 to 1. Branch No. 1, average cut, 3.3; max. cut, 5.3; min. cut, 1.1; base, 5.0; berm, 5.0; slope, 1 to 1. Branch 1 of Branch 1—Average cut, 2.1; max. cut, 4.5; min. cut, 1.3; base, 5.0; berm, 5.0; slope, 1 to [illegible] max. cut, 4.6, min. cut, 2.2; base, 5.0; berm, 5.0; slope, 1 to 1. Branch 3 of Branch 1—Average cut, 3.0; max. cut, 3.6; min. cut, 1.4; base, 5.0; berm, 5.0; slope, 1 to 1. All dirt on laterals 2 and 3, and branch 1, and the three sub-branches, to be placed on one side and smoothed off for road purposes.

⦿King & Eichmiller, Frazee, Minn., have been awarded the contract at $19,726 for constructing Judicial Ditch No. 8 in Beltrami county, bids for which were opened Jan. 18 by J. L. George, County Auditor, Bemidji, Minn. The work calls for the excavation of a 14½-mile canal involving the excavation of approximately 102,797 cu. yds. The average cut is 4.5 ft.

⦿Bids were opened Jan. 18 by J. L. George, County Auditor, Bemidji, Minn., for the construction of Judicial Ditch No. 6 in Beltrami County, the contract being awarded to the National Drainage Co., Alexandria, Minn., at $18,540. The work calls for an 11-mile ditch

Nebraska.

✣Bids will be received until 2 p. m., Feb. 28, by U. S. Reclamation Service, Mitchell, Neb., for the construction of an earth dam and auxiliary works on the North Platte project, about 9 miles north of Minatare, Scottsbluff County, Neb. The work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earthfill, 157,000 cu. yds. gravelly material, 14,000 cu. yds. unscreened gravel, 11,500 cu. yds. unscreened gravel, 14,000 cu. yds. concrete and 12,000 cu. yds. brule clay excavation, besides 45 acres of sod stripping, 600 ft. of wells and casing, 3,200 lin. ft. of drains and the handling and placing of 250,000 pounds of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Neb.; 519 Commonwealth Bldg., Denver, Colo., or Washington, D. C. F. H. Newell, director. Official advertisement will be found elsewhere in this issue.

Petition has been presented to the County Commissioners at Trenton, Neb., for the organization of the Frenchman Valley Irrigation District.

New York.

⦿James Stewart & Co., 30 Church St., New York city, has been awarded Barge Canal Contract 5 A at $317,597. This work calls for the construction of the canal between Mosquito Point bridge and Fox Ridge on Seneca River. Bids were opened Jan. 17 by Duncan W. Peck, superintendent of public works, Albany, N. Y.

Memphis and Vicinity.

[illegible]

C. D. Smith & Co., Memphis, are preparing to start a fourth locating party on the Memphis to Pensacola survey and just as soon as enough of the line has been prepared, it is the intention of Chief Engineer Bullet to begin actual operations in the construction line. With Memphis as the distributing point for this new road, and for the line being built from Memphis to Jackson and from Jackson to Dyersburg, and with the new $12,000,000 bridge at this place under way, the city will be in a bustle, while engineers and contractors will be numbered in many figures.

And speaking of the new bridge which will grace the city of Memphis and form another connecting link between Arkansas and Tennessee, its promoters are not living as if on a bed of roses. Delegations from Arkansas and committees from Memphis are urging this wrinkle and that modification in the original plans; some want two roadways, one

✣ **indicates work now open for bids.** ⦿ **indicates a contract let recently.**

for traffic going east and another for traffic coming west, while the approach from the Arkansas shore should not be decided on until every citizen of Crittenden is satisfied and has approved same. But meanwhile, Congressman McKeller of Tennessee and Macon of Arkansas have introduced the bridge bill in the House as was planned by the Rock Island road and the chances are that the bridge will be built as President Mudge of the latter road desires. J. T. Harahan, President of the Memphis and Arkansas Bridge and Railway Co., which organization, controlled by the Rock Island Railroad, will have the actual building of the bridge in hand, states that he will be glad to meet all committees and go over the situation with them, for it is the desire of his company to endeavor to give the people of Memphis and of Crittenden County, Arkansas, what they desire in so far as is possible.

Representative Mercer of the Gallion Iron Works was in Memphis last week looking over sites for the establishment of his plant in this city. It is the intention of the Gallion people to locate here and manufacture all sorts of grading machines and dump wagons. The future of this line of business seems particularly bright just now, when the prospect of much railroad and road work during the coming year is so roseate, and with Memphis as a distributing point any firm so located should do a world of business during 1912. The presence of J. A. Cordeal of the Western Wheel Scraper Co. in Memphis last week was significant of the interest his firm takes in the big amount of work in and about Memphis scheduled for the coming season and bears out the shrewdness of the Gallion people in turning their eyes on Memphis as the center of operations.

The extremely bad weather has greatly interfered with the grade work on the electric line between Jonesboro and Nettleton, Ark., and according to Mr. Hatcher, who is in charge of the work, it is rather hard to state just when the laying of track can begin, but with a good spell of weather, much can be accomplished in this line.

President Markham of the Illinois Central has asked all roads at present occupying the I. C. station at Memphis to vacate not later than March 1, when their leases expire, to the end that the work on the new $1,000,000 edifice may start April 1. In the meantime bids will be asked for the new station, which will be one of the prettiest of its sort in the south. Memphis has long been promised the new structure and many statements as to its erection have been made public by Illinois Central officials, but perhaps the latest word of Mr. Markham has been taken the most seriously by all concerned. The new building will be of steel and concrete and many of the larger firms in this line of construction have asked for tentative plans to examine.

J. H. Weatherford has just been re-elected city engineer for two years, and announces that he is prepared to spend about $1,000,000 in real, hard cash for new streets in this city during the year 1912. Maybe this news did not make the street makers sit up and take notice! And if the city commissioners do not interfere too much with Weatherford, the majority of the new roadways will be asphalt. The best feature about city of Memphis work is the fact that all estimates are paid in cash, the contractor not being forced to worry with bonds or front foot certificates, as is the case in so many other towns.

The many friends of Charles Lowrance, head of the big levee firm of Lowrance Brothers & Co., will be glad to know that he has fully recovered from a severe spell of la grippe and is able to be about town once more. Charley states that the reports he receives from his Red River levee project are most encouraging, the recent bad weather having but little effect on the progress of that contract. Lowrance Brothers and Bob Leonard, who is also interested in the Red River work, have about 250 teams on the line.

There is a report, very confidential as yet, that the Frisco Ry. has decided to build a piece of new road from their connection at Kansas Ave. in Memphis to the property owned by the South Memphis Land Co., a distance of about four miles. The work will be quite heavy in pieces and should prove an excellent team proposition.

Going on the supposition that West Memphis, just across the Mississippi River from Memphis, will be quite a town within the near future, some of the wiser minds have been purchasing property in the little town across the river in the belief that some day not far distant their holdings will be of great value, and that the railroad companies must eventually have the majority of the land for yard purposes. This supposition is not at all far fetched, it would appear. With the construction of the huge new bridge, containing a wagon roadway and track for an electric line, West Memphis will be most accessible to the big city across the stream and living there will not be so inconvenient as it now is. Of course a levee must be built around the town, but steps have already been taken by Harry Pharr, formerly chief engineer of the St. Francis Levee Board, to accomplish this. In fact, a few years ago Mr. Pharr had all his plans ready for the big dike and only lacked the corporation of some moneyed interests to enable him to start the actual work of construction. It is barely possible that the Rock Island R. R. may want to levee West Memphis, inasmuch as such an embankment would be a big protection for their present yard at that place, aside from furnishing a most ideal protected spot for a bridge approach.

Memphis will also be a busy city in the building line during the year 1912. Already several people have taken out large permits and several other individuals and firms announce that they intend to erect certain buildings within the near future. Brinkley Snowden has just arranged to start work at once on a $1,000,000 theater building on Main St., while Isele Brothers are arranging to begin on the $300,000 hotel on the corner of Third and Madison streets. Isele Brothers own and operate the beautiful Ribideux hotel in St. Joseph, Mo., and that hostelry bears testimony to the sort of structures the Isele boys believe in building. Joseph Newberger, the millionaire cotton man of Memphis, has just purchased at a cost of one cool million 250 ft. of land on the beautiful Parkway in this city and will erect on the site what is said will be the most splendid home in the South. Just across from the Newberger property and on the beautiful Park drive also, W. P. McCadden of the railroad firm of Roach & Stansell will erect a beautiful home during the coming year, and with the other improvements made public to date Memphis will indeed be a hustling city this year, and a place where a vast number of laborers and experts will find employment.

A very interesting point of law was raised in Memphis last week in regard to an asphalt plant being a nuisance. The Roach-Manigan Paving Co., which has several large contracts here for asphalt streets, was enjoined by the property owners near its plant on South Bellevue Ave. and the N., C. & St. L. R. R. from emitting smoke, dust and fumes on the premises of those seeking to do away with the evil. Lacking but a hundred feet of completing Dunlap St., the Roach-Manigan Co. prayed that the chancellor allow it to lay the few remaining yards on this street before forcing it to suspend operations pending the hearing of the injunction, proving by the city engineer that it was most important that Dunlap be completed at once and while the weather permitted work. Chancellor Heiskell, after a full hearing, dissolved the injunction, not because it was so important for the work to be carried on, he held, but because an asphalt plant was not considered a nuisance par se in Tennessee and that before an injunction could be granted it must be shown conclusively that such a plant was a nuisance. The counsel for the property owners are now preparing to prove that the fumes of asphalt are injurious to health, inasmuch as this seems to be their only ground for argument, the smoke ordinance of the city taking care of the other facts in the case when it has been complied with. The Roach-Manigan Paving Co. is preparing also for a determined fight and has sent to New York and Kansas City for experts to testify to the fact that the asphalt smell is not harmful, but in some cases really beneficial. The case promises to be a very interesting one and the decision will have a far reaching effect, not only in Memphis, but in other cities where the same question is likely to come up.

Texas.

✤Bids will be received until Feb. 15, by J. A. Harrison, Chairman, Board of Commissioners, Matagorda County Drainage District No. 3, Bay City, Matagorda County, Texas, for the construction of the Matagorda County Drainage District No. 3. Plans and specifications may be obtained of G. G. Lovering, Palacios, Texas, Engineer in charge. Bids will also be received for the sale of $27.950 worth of the company's bonds.

✤Bids will be received until 7:30 p. m., Feb. 5, by Judd Wright, city secretary, Paris, Texas, for raising and strengthening a dirt dam at the city lake. The work will include the removal of approximately 35,000 cu. yds. of dirt. J. W. Crook is city engineer. Official advertisement will be found elsewhere in this issue.

Arthur Stiles, State Drainage Commissioner, Austin, Tex., will shortly undertake surveys in Fort Bend and Brazonia Counties looking to the construction of levees to protect the state convict farms from overflows of the Brazos River.

Cameron County Drainage District No. 2 has voted a $105,000 bond issue for the construction of a drainage system. This work will require about 519,200 cu. yds. of excavation. J. W. Davis, Vivier Bldg., Brownsville, Tex., is Engineer.

Surveys are to be made for a proposed drainage district in the vicinity of Mauriceville. About 30,000 acres are included in the district and it is proposed to hold an election to vote on issuing $30,000 of bonds for installing a drainage system. L. F. Daniell, Beaumont, Tex., is the Engineer.

Canada.

An appropriation of $5,500,000 has been authorized for the continuation of the Canadian Pacific Ry.'s irrigation project near Calgary and for colonization, etc. J. S. Dennis, Calgary, Alberta, is in charge of this work for the Canadian Pacific.

WATER-WORKS

Alabama.

✤Bids will be received until noon, Feb. 14, at the office of W. G. Franz, Union Trust Bldg., Cincinnati, O., Consulting Engineer, for the construction of a complete new water supply system for the Tuskegee Institute, Tuskegee, Macon County, Ala. R. Taylor is director of industries of the Tuskegee Institute.

Appropriations for new improvements which aggregate $110,000 and which will be started at once have been received by J. C. Maben, Jr., vice president of the Sloss-Sheffield Steel & Iron Co., according to advices from Birmingham, Ala. Among the improvements contemplated is the installation of a water-works system at Flat Top.

Arkansas.

⊙The Will F. Plummer Co., Union Nat. Bank Bldg., Spring[illegible] ed the contract for the installation of a complete waterworks system at Berryville, Ark. It is expected that work will be started about March 1.

California.

The city officials of Modesto, Cal., are planning reconstruction of the water system, primarily the distributing system. An election will probably be called the latter part of next month to vote on the issuance of bonds for the improvement.

Colorado.

The city of Wray, Colo., will construct a hydro-electric water and light system at an estimated cost of $60,000. An election will be held early in February to vote on the issuance of bonds for the improvement. Thomas S. Sheppard, Gas & Electric Bldg., Denver, Colo., is Engineer.

Connecticut.

Plans are being prepared by Engineer Caleb M. Saville of Brookline, Mass., for the construction of an extension to the Hartford, Conn., waterworks system. This work will include a 42-in. pipe line about eight miles in length, two concrete dams, and a 4,000-ft. tunnel. The work will cost approximately $3,000,000. R. N. Clark is City Engineer.

Georgia.

An election will probably be held in Cordele, Ga., in the near future for the purpose of voting on the issuance of bonds in the sum of $50,000 for the construction of a waterworks system.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Feb. 1, for furnishing all the labor, material, patterns, etc., necessary to manufacture and deliver to the various streets cast iron water pipes, as follows: 19,757 tons 36-in.; 1,430 tons of 30-in.; 1,090 tons of 24 in.; 1,617 tons of 20 in.; and 966 tons of 12-in. The castings shall be made cast iron, of good quality, of metal of even grain and soft enough to admit of drilling and cutting. Weights and thickness of pipe as specified are: 36-in., 1.15 in. shell, 454.2 lbs. per ft.; 30-in., 1.03-in. shell, 333.3 lbs. per ft.; 24-in., .89-in. shell, 233.3 lbs. per ft.; 20-in., .80-in. shell, 175 lbs. per ft.; 12-in., .62-in. shell, 82.7 lbs. per ft. Cash or certified check for 5 per cent of total bid must accompany proposal.

✣Bids will be received [illegible] Commissioner of Public Works, Chicago, Ill., until 11 a. m., Jan. 27, for furnishing and delivering to the Bureau of Engineering at the various pipe wards, pumping stations, cribs, etc., approximately 225,000 ft. B. M. of lumber, consisting of white pine, Norway pine, yellow pine, hemlock, white or bun oak, Oregon fir, maple, white wood, shingles, lath, cedar posts, flooring, siding, ceiling, etc.

✣Bids will be received until 2 p. m., Jan. 30, by Board of Local Improvements, at the office of J. L. Hammond, City Clerk, Anna, Ill., for the construction of a water works system which, according to plans and estimates of C. Brown, Jacksonville, Ill., Engineer, includes the following approximate quantities: 6,688 ft. 8-in., 8,665 ft. 6-in., 7,996 ft. 4-in. cast iron pipe, forty-three hydrants, twenty-five valves and twenty-five valve boxes; also for the erection of a steel water tank, 28 ft. high, 22 ft. in diam., with hemispherical bottom, supported by a steel tower, 70 ft. in vertical height from top of the cap stones to the junction of the vertical sides of the tank and the hemispherical bottom.

✣Bids will be received until 7 p. m., Jan. 10, by Board of Local Improvements, Park Ridge, Cook County, Ill., for extending water service system in Greenw[illegible] work will include 715 lin. ft. of iron pipe, cylindrical in shape and with 4-in. internal diameter, and 2 hydrants with connections in place complete [illegible] of the Board [illegible]

✣[illegible] S. Welch, Clerk, [illegible] for improving [illegible] ter main therein. H. A. [illegible] is City Engineer.

•[illegible] Wis., for the sinking of a 200-ft. well for [illegible] will cost $1,200.

•[illegible] two 90-ft. 10-in. wells at the Collinsville water works plant, Collinsville, Ill. Collinsville contemplates purchasing a vacuum pump to replace the two electric pumps now in use.

The Hamilton Water Co. of Marissa, Ill., has been incorporated with a capital stock of [illegible] waterworks system for Marissa, located on the Illinois Central Railroad, southeast of Belleville. The incorporators are: J. A. Ham[illegible] Henry J. Fink of Belleville.

Following are the low bids submitted Jan. 18 to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the waterworks shops, 2304 S. Ashland, 250 tons of hydrant and stop valve castings, consisting of 2½ in. double hydrants complete, 4-in. double hydrants complete, 4 in. valves, 6 in. valves, and 8 in. 12-in., 16 in., and 24 in. valves. American Brake Shoe & Foundry Co., 332 S. Michigan Av., $39.85 per ton; T. A. Cummings Foundry Co., 1338 Clybourn Pl., $40.83 per ton. The contracts have not been awarded.

Following is the low bid submitted, Jan. 18, to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing, delivering and erecting complete one Hawley Down Draft Furnace at the 22d St. pumping station, 22d St. and Ashland Av., and the removal of the present furnace. The Hawley Down Draft Furnace Co., 736 W. Monroe St., submitted a bid of $690.

Following are the low bids submitted Jan. 18 to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the various yards as shown, cast iron water pipes in quantities as follows: 1,000 pieces 6-in. pipe, 12,500 pieces 8-in. pipe, and 2,225 pieces of 12-in. pipe, total quantity approximately 5,000 tons. To be delivered as follows: Avers Av. and Wabansia Av., 2352 S. Ashland Av., 68th St. and Yates Av., and 104th St. and Stewart Av.: United States Cast Iron Pipe and Foundry Co., 122 S. Michigan Av., $23.40 per ton; Jas. B. Clow & Sons, 544 S. Franklin St., Chicago, $24.25 per ton. The contract has not been awarded. Bids opened [illegible]

Following are the low bids submitted Jan. 18 to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering approximately 300 tons of special castings for cast iron water pipe to the various pipe yards: T. A. Cummings Foundry Co., 1338 Clybourn Pl., $40.44 per ton; E. J. Walsh Foundry Co., $46 per ton. The contract has not been awarded.

Following are the low bids submitted Jan. 18 to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the following pipe yards approximately 300 tons of cast iron valve basin and fire cistern covers: Yard A, Avers Av. and Wabansia Av., 30 per cent; B, 2354 S. Ashland Av., 35 per cent; C, 49th Pl. and Union Av., 10 per cent; D, 68th St. and Yates Av., 5 per cent; E, 104th St. and Stewart Av., 15 per cent. American Brake Shoe & Foundry Co., 332 S. Michigan Av., $23 per ton; Bates Machinery Co., Joliet, Ill., $23 per ton. Bids [illegible] been [illegible]

Indiana.

The City Council of Terre Haute, Ind., has named a committee of citizens to aid the councilmen in carrying out the plan to take over the waterworks plant under a provision of the franchise. The plant is controlled by N. W. Harris of Chicago, Ill.

The City Council of Newcastle, Ind., has decided that the waterworks should remain in its present location and that steps should be taken to improve the system, in accordance with plans to be made by Charles Brossman of Indianapolis and O. L. Price, Supt. of the [illegible]

Kansas.

•The Will F. Plummer Co., Contracting Engineers, Union Nat. Bank Bldg., Springfield, Mo., has been awarded the contract at Seneca, Kans., for the construction of three and one-half miles of water mains, for which bids were opened Jan. 12; Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., Engineers. The unit bid is as follows:

Specification.	Quantity.	Per.
[illegible]		0.12
[illegible]	[illegible]	
[illegible]	[illegible]	1.50
[illegible] valves		[illegible]
		[illegible]

[illegible] urnishing cast iron pipe:

Specification.	Quantity	
[illegible]	[illegible]	
[illegible] in. C. I. pipe, tons	41 6	27.55
[illegible] I. specials, lbs	13,500	.03½
		.$12,910

The Western Valve [illegible] Chicago, Ill., secured the contract for furnishing hydrants and valves, as follows:

	Quantity.	
[illegible]	12	
[illegible]		6.10
[illegible]		9.10
[illegible]		3.12
		[illegible]

Kentucky.

The Common Council of Henderson, Ky., and the Board of Commissioners have decided to have plans drawn and estimates made by engineers for the construction of a public filtration plant in Henderson. It is thought the plant will cost between $60,000 and $70,-[illegible]

The Calloway County Court, Murray, Ky., has upheld the validity of the issuance of bonds by the city of Murray in the sum of $23,000, to erect a water and light plant.

Maryland.

The Mayor and Council of Hagerstown, Md., will ask the legislature to authorize the city officials to purchase the plant of the Washington County Water Co., capitalized at $660,000, of which $340,000 is stock and $320,-[illegible]

Michigan.

•The Board of Water Commissioners of Flint, Mich., has awarded the following contracts for the furnishing of high service pump, three low service pumping units, one blower and generator set for which bids were opened Nov. 28, and Wm. G. Clark, 1048-50 The Spitzer, Toledo, O., is Engineer: Snow Steam Pump Works, one 12,000,000-gal. horizontal, cross compound, condensing, opposed type pump, $21,200; Dravo-Doyle Co., 3 low service pumping units, each consisting of one 12 in. double suction, horizontal, DeLaval, Class A, steam turbine at a total price of $5,125; P. H. & F. M. Roots Co., one No. 3 blower, $897. All other bids have been rejected.

Minnesota.

✣Bids will be received until Feb. 15, it is reported, by Board of Water Commissioners, Stillwater, Minn., for the construction of a steel standpipe. L. W. Clark is Engineer.

Mississippi.

The city of Vicksburg, Miss., plans the construction of a new waterworks plant at an estimated cost of $390,000, the supply to be secured from the Mississippi River. The work will include mains, hydrants and station. The contract will be let some time this summer. Bonds will be sold for the improvement. C. R. Twiss of Vicksburg is Engineer.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Missouri.

No contract was let by the Board of Fire & Water Commissioners, E. B. Harrington, Secy., Kansas City, Mo., for the cleaning of 18,000 ft. of 36-in. cast iron pipe, for which bids were opened Jan. 10. The city will probably do the work itself.

Nebraska.

✣Bids will be received until 11 a. m., Feb. 15, by Quartermaster, Fort Omaha, Nebr., for the construction of a filtration plant at that post.

New York.

City Comptroller Edward S. Osborne of Rochester, N. Y., has sold $165,000 worth of waterworks improvement notes to Goldman, Sachs & Co., of New York City. Bonds in the sum of $890,000 will be sold Jan. 25 for waterworks improvement.

Ohio.

At a recent meeting of the Men's Club of Lebanon, O., plans were discussed for increasing the municipal water and electric plant one-third in capacity. C. C. Eulass is Secretary-Treasurer of the Club.

Plans are being prepared by Engineer H. L. Maddocks, 504 Newark Trust Bldg., Newark, O., for the construction of a waterworks system in the city of Byesville, O., at an estimated cost of $50,000. Bids will probably be asked in the spring. E. Green is City Clerk.

The city of Seneccaville, O., will construct a waterworks system in the spring at an estimated cost of $40,000. Plans are now being prepared by Consulting Engineer H. L. Maddocks, 504 Newark Trust Bldg., Newark, O.

Oklahoma.

⊙The Benham Engineering Co., American Nat. Bank Bldg., Oklahoma City, Okla., has been awarded the contract by the city of Kingfisher, Okla., for the installation of a waterworks and for making extensions to the electric light system. The letting of the contract for the furnishing of material for the work has been postponed from Jan. 15 to a later date. Plans and specifications for this work were also prepared by the Benham Co.

⊙Kennedy & Fleming of Oklahoma City., Okla., have been awarded the contract by the Town Council of Porum, Okla., E. W. Sanders, Town Clerk, for the construction of a complete waterworks system and electric light plant for $33,000. M. A. Earl & Co., Flynn Bldg., Muskogee, Okla., are Engineers. Bids were opened Jan. 16.

All bids received Jan. 10 by the City of El Reno, Okla., for the sinking of a 3,000-ft. well were rejected. The work will soon be re-advertised. F. T. Stackpole is City Clerk.

Canada.

⊙The ratepayers of Victoria, B. C., at the general municipal election on Jan. 11 approved the by-law authorizing the award of the contract for the construction of the Sooke Water Supply. Bids for this work were opened Dec. 15, and the contract was awarded to the Westholme Lumber Co., Ltd., Victoria, B. C., at $1,169,720, as noted in our Dec. 27 issue. The general scheme of the work is to utilize the waters of Sooke Lake, which lies in the Malahat district to the northwest of Victoria, at a distance of about 18 miles as the crow flies. The present elevation of the lake is 655—Victoria datum—or 555 ft. above sea level. The lake level will be raised 12 ft. by means of a concrete and earth-filled dam at the southern end of the lake, affording by this means a storage of some over 13,000 acre ft. The catchment area tributary to this source is about 31 sq. miles, and the average annual rainfall about 70 ins. From the lake to the pressure reservoir at, or near Goldstream, there will be constructed a reinforced concrete pipe, 40 ins. in diameter, laid on a grade approximately 1 ft. in 1,000. The pipe will be about 24 miles in length and extremely crooked. It will be without pressure, and will empty into the pressure reservoir at elevation about 500. From this elevation the water will cascade into the reservoir, which will have its normal full level at elevation 480. This pressure reservoir will contain approximately 130,000,000 imp. gals., and to retain this quantity there will be constructed a concrete dam containing about 8,000 yds., and about 400 ft in length, with a maximum height of approximately 50 ft. above bedrock. From the pressure reservoir a 36-in. riveted steel pipe will convey the water to the city, where a connection will be made to the existing distributing system. The entire work is being carried out under the general direction of Wynn Meredith, of the firm of Sanderson & Porter, New York and San Francisco, with E. E. Carpenter and H. Hartwell as resident engineers. The following itemized bids were received on the work, (1) standing for bid of the Westholme Lumber Co., Ltd., Victoria, B. C.; (2) for bid of the Grapp Construction Co., Seattle, Wash.; (3) Naylor Bros., Vancouver, B. C.; (4) Norton, Griffiths & Co., Ltd., Vancouver, B. C.; (5) Holt & Jeffrey, Seattle, Wash.; (6) Victoria Machinery Co., Victoria, and Porter Bros., Portland, Ore.; (7) George C. Deitrich & Co., Seattle, Wash.; (8) Sound Construction Co., Seattle, Wash.; (9) P. J. McHugh, Seattle, Wash.; (10) average of tenders.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Schedule "A"											
Exc. drain channel, earth	100 yds	$ 1.50	$ 3.18	$ 1.50	$ 0.82	$ 0.80	$ 2.00	$ 1.00	$ 1.00	$ 0.80	$ 1.40
Exc. drain channel, rock	350 yds	7.50	3.20	3.00	4.40	3.00	[illegible]	3.60	3.00	5.00	4.20
Clearing	300 ac	150.00	364.00	400.00	316.00	150.00	[illegible]	240.00	250.00	290.00	276.00
Clearing, submerged	80 ac	50.00	67.50	500.00	352.00	250.00	150.00	120.60	200.00	290.00	242.40
Wagon road	11,600 ft	1.50	1.70	1.00	1.00	1.58	.72	.60	1.25	1.00	1.14
Haley's bridge		500.00	520.00	500.00	390.00	1,000.00	283.00	600.00	[illegible]	500.00	510.00
Total Schedule "A"		$ 85,675	$136,278	$173,300	$136,572	$ 84,530	$ 120,085	$ 90,520	$ 106,950	$ 124,130	$ 117,560
Schedule "B"											
Dam exc., earth	[illegible] yds	$ 0.70	$ 0.69	$ 1.00	$ 1.16	$ 1.00	$ 1.50	$ 1.00	$ 2.00	$ 0.70	$ 1.08
Dam exc., rock	1,300 yds	4.75	3.50	3.00	4.10	3.00	4.50	3.60	5.00	2.00	3.94
Concrete in foundations	520 yds.	11.00	11.60	12.00	12.85	10.00	12.00	9.60	10.00	14.00	11.40
Concrete in foundations	10 yds	15.00	16.30	14.00	17.50	11.00	16.00	18.00	10.00	20.00	15.30
Concrete in foundations	10 yds	13.00	14.60	13.00	15.00	9.00	16.00	14.40	10.00	14.00	13.20
Dam and intake		30,000	31,006	25,000	40,500	24,000	28,129	34,290	35,763	21,902	30,065
Total Schedule "B"		$ 43,855	$ [illegible]	$ 37,810	$ 55,621	$ 35,700	$ 46,639	$ 46,686	$ [illegible]	$ 33,802	$ 44,014
Exc. earth pipe bed	26,500 yds.	$ 0.60	$ 0.64	$ 0.60	$ 0.75	$ 0.75	$ 1.10	$ 0.96	$ 1.00	$ 0.70	$ 0.79
Exc. rock	69,000 yds.	1.75	1.93	1.75	2.08	1.75	4.03	3.60	3.00	2.00	2.43
Clearing right of way*	23 mls	2,400	2,300	1,500	2,520	2,500.00	3,800.00	2,400.00	545.00	500.00	1,900.00
Clearing right of way†					...	......	2,400.00	.	....	.....	....
Trestles, 5-ft. bents, per bent		52.00	91.00	55.00	65.00	40.00	100.30	114.00	90.00	66.00	3,125.00
Trestles, 10-ft. bents, per bent		60.00	104.00	60.00	85.00	45.00	113.00	192.00	110.00	85.00	4,745.00
Trestles, 15-ft. bents, per bent		80.00	169.00	65.00	95.00	50.00	139.60	216.00	130.00	120.00	1,656.00
Trestles, 20-ft. bents, per bent		100.00	182.00	95.00	130.00	60.00	161.30	288.00	150.00	170.00	1,782.00
Trestles, 25-ft. bents, per bent		140.00	273.00	100.00	155.00	65.00	223.90	336.00	170.00	190.00	1,469.00
Trestles, 30-ft. bents, per bent		180.00	286.00	115.00	185.00	75.00	250.50	384.00	190.00	320.00	882.00
Trestles, 35-ft. bents, per bent		215.00	300.00	125.00	195.00	80.00	277.20	432.00	210.00	330.00	481.00
Culverst, 12-in., per ft		1.10	1.43	.75	2.50	2.00	1.25	2.40	2.00	2.50	2,478.00
Culverts, 24-in., per ft		3.20	3.90	3.00	4.50	3.00	3.00	3.00	6.00	6.00	3,560.00
Culverts, 40-in., per ft		6.00	5.20	[illegible]	5.70	4.00	6.00	3.60	12.00	15.00	3,472.00
Ravine crossing	150	97.00	97.00	45.00	110.00	60.00	120.00	72.00	150.00	250.00	16,683.00
Wood stave pipe	118,000 ft.	2.47			3.20	4.90	4.27	4.02	4.60	11.00	573,726.00
Steel rivetted pipe	120,000 ft.	5.25			..	8.60	3.74		12.00	14.00	....
Concrete pipe	125,000 ft.	2.53	2.72	2.85	3.14	4.50	3.74	3.84	6.25	11.25	566,944.00
General		7,000	17,066	7,000	11,750	5,600.00	11,423.00	17,720.00	7,250.00	10,000.00	10,534.00
Totals Sched. "C" with wood stave pipe		$171,950			$649,715	$ 804,475	$ 952,262	$ 866,708	$ 848,045	$1,544,020	$ 857,085
Totals Sched. "C" with steel rivetted pipe		$890,490				$1,258,475	$1,275,402	....	....	....	....
Totals Sched. "C" with concrete pipe		$546,740	$601,465	$556,160	$664,615	$ 788,975	$ 883,702	$ 872,348	$1,086,495	$1,652,270	$ 850,303
Schedule "D"—											
Earth excavation	5,300 yds.	$ 0.65	$ 0.49	$ 1.00	$ 1.44	$ [illegible]	$ 1.70	$ 0.96	$ 1.50	$ 0.70	$5,412.00
Rock excavation	750 yds.	4.00	1.80	2.00	4.30	2.00	5.00	3.60	3.00	2.00	2,391.00
Clearing reservoir	40 ac.	350.00	490.00	350.00	360.00	180.00	500.00	1,170.00	750.00	225.00	19,445.00
Gravel bottom	10,000 yds.	1.00	1.21	2.00	2.50	2.00	1.25	2.10	1.50	2.50	17,845.00
Concrete foundations	200 yds.	12.50	8.55	14.00	14.70	12.00	12.00	18.00	12.00	14.00	2,616.00
Concrete, Class "B"	10 yds.	10.00	7.10	13.00	12.60	9.00	10.00	14.00	11.00	12.00	110.00
Concrete, Class "C"	500 yds.	9.25	6.15	12.00	9.90	7.50	8.00	9.60	10.00	10.00	4,578.00
General		33,000	77,586	110,000	130,000	91,500.00	73,217.00	110,418.00	92,209.00	100,000.00	90,881.00
Total Schedule "D"		$ 70,670	$118,089	$159,730	$188,273	$ 131,165	$ 124,977	$ 194,546	$ 154,919	$ 147,130	$ 143,278
Schedule "E"											
Earth trench	54,000 yds.	$ 0.60	$ 0.70	$ 0.60	$ 0.98	$ 0.60	$ 0.90	$ 0.96	$ 1.00	$ 0.70	$42,666.00
Rock trench	[illegible] yds	3.00	2.35	2.00	4.33	3.50	4.03	3.60	4.00	2.00	31,810.00
Trench backfill	50,000 yds.	.15	.27	.25	.50	.25	.30	.48	.30	.25	16,250.00
Concrete piers, Class "B"	600 yds.	9.00	11.00	15.00	12.70	16.00	20.00	18.00	15.00	11.00	9,072.00
Concrete piers, Class "A"	10 yds.	20.00	11.80	15.00	15.00	11.00	20.00	18.00	20.00	15.00	173.00
Concrete piers, Class "C"	10 yds	18.00	9.40	12.00	8.00	8.00	15.00	9.60	12.50	12.00	115.00
Lap welded pipe	54,000 ft.	7.00	8.32		7.25	9.45	7.03	8.30	10.00	14.00	477,600.00
Steel, rivetted, 5/16-in.	19,000 ft.	5.25	7.75		7.25	11.40		8.26	9.00	....	156,777.00
Steel rivetted pipe, ⅜-in.	35,000 ft.	6.25	9.10		8.52	13.10		9.17	9.50	...	327,700.00
Lock bar pipe	54,000 ft	6.80	8.65	7.00	....	7.20	7.02	[illegible]	9.00	13.00	448,500.00
General		22,000	27,390	48,000	30,200	21,200.00	36,589.00	36,480.00	29,229.00	13,000.00	32,408.00
Totals Sched. "E" with lap welded pipe		$482,280	$558,282	....	$550,770	$ 621,190	$ 532,559	$ 607,596	$ [illegible]	$ 846,170	$ 609,491
Totals Sched. "E" with steel rivetted pipe		$427,780	$[illegible]	.	$[illegible]	$ [illegible]	....	$ 637,286	$ 651,054	....	$ 616,371
Totals Sched. "E" with lock bar pipe		$471,480	$576,102	$500,170	....	$ 499,690	$ [illegible]	$ 590,316	$ 633,554	$ 792,170	$ 580,394

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Oregon.

⊙The Gould Co., of Portland, Ore., has [illegible] Board of Portland, Ore., for the furnishing of 200,000 lbs. of Selby pig lead, f. o. b. Portland. The contract for furnishing 20,000 lbs. of leadite was not awarded. Bids were opened Jan. 9.

Pennsylvania.

⊙The Water Commission of Erie, Pa., has awarded the contract for the erection of a standpipe for the high service district in accordance with plans and specifications of Chester & Fleming, Hydraulic Engineers, Pittsburg, Pa., to the Chicago Bridge & Iron Works of Chicago, Ill., for $10,275, work to be completed in 16 weeks, and the contract for the foundation for the standpipe to O. S. Rivlet for $1,156, work to be completed in 18 weeks. Bids were opened Jan. 12.

The Montgomery County Court, Norristown, Pa., has been asked to appoint three disinterested civil engineers as appraisers of the plant of the West Conshohocken Water Co., with a view by the borough of West Conshohocken to purchase. The plant was recently offered to the city for $40,000.

The Pennsylvania State Water Supply Commission, Harrisburg, has approved the agreement for consolidation of the Citizens' Water & Gas Co. and the Williamsport Water Co., as the Williamsport Water Co., and the application of the Sholola Falls Hydro-Electric Co. for a plant in Sholola township, Pike County, and the Hooversville Water Co., for a dam near Hooversville, Somerset County.

Tennessee.

The Board of Public Works of Nashville, Tenn., has introduced a bill in the City Coun- [illegible]

[illegible] plants.

Engineer C. G. Williams, assistant to Consulting Engineer James H. Fuertes, 140 Nassau St., New York City, is making a preliminary survey and analyses of the water furnished by the pumping stations in the city of Dallas, Tex., preparatory to a visit by Mr. Fuertes, when an approximation of the cost of the purification plant and recommending the site for its establishment will be made.

Washington.

The city of Granger, Wash., will sell bonds on Jan. 23 for the purpose of installing a waterworks system. After the bonds have been sold the city will immediately call for bids for the construction of the plant. N. W. Avery is City Engineer.

West Virginia.

The Board of Control of Wheeling, W. Va., will consider estimates submitted for the installation of the proposed new filtration plant.

Wisconsin.

✣Bids will be received until about March 1, by city of Durand, Wis., for the construc- [illegible] in. 16,000 ft. of mains for the waterworks extension. S. G. Gilman, Mondovi, Wis., is Con- [illegible]

The City Council of Ashland, Wis., has decided to order the installation of a temporary sterilizing chemical plant at the water company's pump house, to insure the purity of the drinking water.

Canada.

•The contract for the furnishing of 1,800 tons of cast iron pipe for the Lake Woodsworth water scheme in the city of Prince Ru- [illegible] Guthrie & Co., for $63,111. Other bidders for the pipe were: Evans, Coleman & Evans, [illegible] ward Le Bas Co., $66,619; Robertson, Godson Co., $71,171; Beverley, Robertson & Co., $71,615; C. Handyside, $72,153; Hofius Steel & Equipment Co., $74,900; Canadian Foundry Co., $76,955; R. D. Wood & Co., $78,437.

The city of Dunnville, Ont., will let contracts in the spring for the construction of a new pumping plant and for extensions to the water mains, at an estimated cost of $24,000. The work will include two natural gas engines, two turbine pumps, one steel elevated tank, 100,000 imp. gal., 128 ft. to top, pumps each capable of 500 imp. gals. per minute at 230 hd. fire pressure or 500 imp. gal. per minute at 130 hd. domestic. Alan Mair Jackson, P. O. Box 196, Dunnville, is Engineer.

The City Council of Kamloops, B. C., has approved a by-law providing for $60,000 for improvement and extension of the city waterworks. The proposition will be submitted to the people at the coming municipal election.

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

The Town Council of Bay Minette, Ala., is considering a proposition to install a sewerage system during this summer.

Arkansas.

✣Bids will be received until 3 p. m., Feb. 17, by Commissioners of Sewer District No. 15, at the office of W. Parkes, Citizens Bank Bldg., Pine Bluff, Ark., Engineer, for the construction of a sanitary sewer system. T. A. Wilson is Chairman of the District Commissioners.

✣Bids will be received until Feb. 15, by Sewerage Commissioners, District No. 15, Pine Bluff, Ark., for the construction of a system of sewers. J. Parks is Engineer of the district.

⊙The Commissioners of Sewer Districts No. 43 and No. 46, city of Little Rock, Ark., have awarded the contract for the improvement of the septic tank at 19th and McGowan Sts. to Nick Peay. The capacity of the tank is to be doubled.

Mayor Taylor of Little Rock, Ark., proposes that the city issue $1,325,000 in bonds for sewers, fire department buildings, grounds and equipment, city lighting plant, hospital and parks.

California.

⊙The Board of Public Works of San Francisco, Cal., has awarded the contract for the construction of Section C of the Ingleside outlet sewer to the Contra Costa Construction Co., for $60,500. Eight bids were received on the work.

The Board of Trustees of Venice, Cal., has decided to call a special election at an early date for the purpose of floating a bond issue of $43,000 to install a new garbage incinerator at an expense of $23,000, and the extension of a new outfall sewer for $20,000.

The City Council of Oakland, Cal., has passed an ordinance appropriating $82,000 for the main outlet sewers for Sanitary Districts Nos. 1, 2, 3 and 4 of the annexed district, plans having been drawn up for the completion of the sewers. Work will be commenced in the near future.

Following bids were received Jan. 8 by Lieut.-Col. George McK. Williamsoon, Deputy Quartermaster General, Fort Mason, San Francisco, Cal., for the extension of the sewer system at Fort Winfield Scott, Cal.: (1) Standing for bid on entire work, and (2) for alternative bid: J. Thomas Company, 475 Monadnock Bldg. (1), $1,550; (2), $1,006. W. A. & C. C. Terrill, 3631 17th St. (1), $1,600; (2), $1,475. Westdahl Mesnessey Co., 246 Monadnock Bldg. (1), $2,814; (2), $1,944. Pringle, Dunn & Co., 338 Pine St. (1), $874; (2), $745. W. A. Burdick, 515 "A" St. (1), $1,895; (2), $1,676. Stevens & Stanbrough, 47 Bush St. (1), $1,160; (2), $1,200. J. H. Belser, 472 Monadnock Bldg. (1), $934; (2), $827. James Stanley, Jr., 821½ 19th St., Oakland (1), $698; (2), $588. Francis Szoke, 45 Kearny St. (1), $900; (2), $925. K. Ehrhart, Monadnock Bldg. (1), $1,300; (2), $1,360. American Construction Co., 438 Merchants' Exchange (1), $1,475; (2), $1,475.

The citizens of San Dimes, Cal., are planning the installation of a sanitary sewer system. The Board of Trade has appointed a committee to outline the project.

The Board of Supervisors of San Francisco, Cal., has passed the following sewer ordinances: Section C of the Ingleside outlet sewer, at a cost not to exceed $70,000; sewers and appurtenances in Brannan St., between First and Embarcadero, and in Beale St., between Bryant and Brannan, at an estimated cost of $38,000.

The Board of Supervisors of San Francisco, Cal., has passed ordinances ordering the construction of sewers and appurtenances in Brannah St., between First St. and the Embarcadero, and in Beale St., between Bryan and Brannan Sts., estimated to cost $38,000, and the construction of sewers and appurtenances in Section "C" of the Ingleside Outlet Sewer, estimated to cost $70,000. W. K. Hagerty is Clerk of the Board.

The East Sacramento Improvement Club, Sacramento, Cal., is agitating the installation of a sewerage system in that section of the city. It is proposed to issue bonds for the improvement.

The cities of Pasadena, South Pasadena and Alhambra have appointed a tri-city Commission to evolve plans looking to the solution of the inter-city problems relating to public utilities and report its findings to the respective bodies. Investigations will be made as to the installation of sewers, light, power, water, adequate fire protection, park systems, etc.,

Connecticut.

The Town Council of West Hartford, Conn., has called a meeting of the citizens for the purpose of discussing the proposed sewer system as to size, etc. Ford, Buck & Sheldon, Hartford, are Engineers.

Idaho.

An election has been called in Kellogg, Idaho, on Feb. 15 for the purpose of deciding whether or not bonds in the sum of $25,000 shall be issued for the construction of a sewerage system.

Illinois.

✣Bids will be received until 10 a. m., Jan. 30, by Board of Local Improvements at the office of City Clerk J. E. Hammond, Anna, Ill., for the construction of a sewer system and septic tank, including, according to the estimate of C. Brown, Jacksonville, Ill., Engineer, the following approximate quantities: 3,440 ft. of 15-in., 1,228 ft. 12-in., 1,300 ft. 10-in., 15,080 ft. of 8-in., 580 ft. of 6-in. sewer pipe, 51 manholes, six single flush tanks with connections, and one septic tank.

✣Bids will be received until 10 a. m., Jan. 29, by Board of Local Improvements, William [illegible] provement of Broadway St. by constructing a sewer therein. H. A. Stevens is City Engineer.

● [illegible] awarded the contract by the city of Waco, Tex., for the construction of sanitary sewers [illegible] Stephen Turner is City Engineer.

⊙The Dixon Engineering & Contracting Co., of Toledo, O., was recently awarded a contract by the city of Aurora, Ill., for the construction of a garbage crematory at $9,316. The work includes furnace and brick stack.

The city officials of Alton, Ill., are considering a plan for the building of two sewer systems to drain the eastern and western sections of the city. City of Upper Alton drainage is contemplated in the East Side system.

City Engineer Lee L. Harper of Belleville, Ill., has just completed plans for the Crystal place sewer improvement, the estimated cost of which is $9,462.

Property owners along Chestnut St. and Short Horsman St., east of Kent Creek, have petitioned the Board of Local Improvements, Rockford, Ill., for the construction of a sanitary sewer, a distance of four blocks. Estimates will be prepared by City Engineer Main.

The East Side Levee & Sanitary District, East St. Louis, Ill., has prepared plans for the construction of a new outlet for the Granite City, Ill., sewer system which will cost in the neighborhood of $3,900.

Engineer C. D. Hill of the Board of Local Improvements of Chicago, Ill., has been appointed consulting engineer by the Town Council of Geneva, Ill., for the construction of a new sewerage system.

The Board of Local Improvements of Rockford, Ill., has ordered the construction of the Harlem Ave., sewer, from Logan to Auburn Sts., at an estimated cost of $3,050.

The City Council of Park Ridge, Ill., has adopted an ordinance providing for the construction of house-drains and water service pipes in Clifton Ave., Chester Ave., Third St., Prairie Ave., Des Plaines St., and Crescent Ave., at an estimated cost of $8,653. W. H. Malone, 138 N. La Salle St., Chicago, Ill., is Mayor.

Indiana.

⊙Charles Rietdorf, 2411 Fox Ave., Fort Wayne, Ind., has been awarded the contract by the Board of Public Works of that city for the construction of the following improvements: A sewer in and along the alley between Columbia Ave. and Edgewater Ave., from the brick sewer on Morton St. to the alley east of Delta Blvd. and in the alley east of Delta Blvd., from Columbia Ave. to Edgewater Ave.; a sewer in and along the alley between Lake Ave. and Tilden Ave., from a point 180 ft. west of Walton Ave. to the alley east of Walton Ave. The contract price is $.63½. Bids were opened Jan. 11.

⊙Lee & Everroad, 1321 Franklin St., Columbus, Ind., have been awarded the contract by the City Council of that city for the construction of the Maple Grove sewer system at $32,225. The work includes 22,044 ft. of pipe from 8 to 54 ins. in diameter, 906 ft. of 36-in., 1,546 ft. of 42-in., 1,920 ft. of 48-in., and 2,120 ft. of 54-in.; pipe to be furnished by the Reinforced Concrete Pipe Co., Jackson, Mich. Wm. H. Rights is City Engineer. Bids were opened Jan. 9.

The Board of Public Works of South Bend, Ind., has ordered preliminary resolutions for the construction of 11 sewers on the following streets: Bowman Creek, Michigan St. trunk sewer between Monroe St. and La Salle Ave., North Olive, Ford, South Main, Clover, Johnson, North Eddy, South Francis, Birdsell and Quincy Sts., and Portage Ave.

Engineer Truman has presented a plan to the Board of Works of La Fayette, Ind., for sewerage south of Williams St., in Fourth St., from Williams to Murphy, and laterals on Hickory, Central, Third and Fifth Sts.

Iowa.

⊙Rogers-Wood Co., 2325 Broadway, Council Bluffs, Ia., has been awarded the contract by the city of Cameron, Mo., for the laying of 12,280 ft. of 8-in. sewers, 36 manholes, and 3 flush tanks for $9,249. Bids were opened Jan. 5.

The City Council of Sioux City, Ia., on Jan. 27 will consider a resolution declaring the advisability of laying a sanitary sewer at Leeds, a suburb. It is proposed to make this improvement in connection with the extension of the water mains there in the spring.

Councilman Zel Roe of Des Moines, Ia., is planning the construction of an intercepting sewer commencing at 16th and Locust Sts., and the furnishing of sewer facilities for Northwest Des Moines.

The Iowa State Board of Health is urging the prompt carrying out of present plans for the better disposal of the sewerage of Mason City, Ia. F. M. Norris is Mayor.

Kansas.

⊙The city of Seneca, Kans., has awarded the contract for the construction of 12 miles of pipe sewers and a complete disposal plant, to the Will F. Plummer Co., Union Nat. Bank Bldg., Springfield, Mo., for which bids were opened Jan. 12, and Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., Engineers. The unit bid on the work is as follows:

[illegible]	8-in. vit. sewer pipe	$[illegible]
4,293	10-in. vit. sewer pipe	.20
1,664	12-in. vit. sewer pipe	[illegible]
[illegible]	15-in. vit. sewer pipe	[illegible]
11,655	0- 6-ft. excavation	.12
[illegible]	6- 8-ft. excavation	.14
[illegible]	8-10-ft. excavation	.16
[illegible]	10-12-ft. excavation	.22
[illegible]	12-16-ft. excavation	.60
[illegible]	16-20-ft. excavation	[illegible]
[illegible]	6-in. on 8-in. Y's	[illegible]
6	6-in. on 10-in. Y's	.43
[illegible]	6-in. on 12-in. Y's	.48
[illegible]	manholes	[illegible]
[illegible]	flush tanks	[illegible]
[illegible]	lampholes	10.00
[illegible]	concrete	[illegible]
0	rock excavation	[illegible]
0	lumber	40.00
24	8-in. C. I. pipe	2.00
[illegible]	earth excavation	[illegible]
[illegible]	Portland concrete	[illegible]
[illegible]	steel bars	[illegible]
[illegible]	angle bars	[illegible]
[illegible]	▲ mesh	[illegible]
8	M. H. castings	9.00
3	8-in. sluice gates	26.00
1	12-in. sluice gates	32.00
900	lbs. C. I. specials	.04
5	8-in. C. I. pipe	1.50
32	M. H. steps	.15
1	tide valve	[illegible]
1	special M. H.	45.00
1,130	E. excavation	.30
112	Concrete	7.50
400	steel bars	.04
355	broken stone	2.75
250	12-in. vit. pipe	.30
150	10-in. vit. pipe	.25
64	8-in. vit. pipe	.20
175	6-in. vit. pipe	.14
[illegible]	4-in. vit. pipe	.12
750	4-in. drain tile	.07
1	[illegible] gate valve	[illegible]
1	Control device	[illegible]
1	Control house	200.00
	Total sewers	$27,884
	Total disposal	$ 5,054
	Grand total	$[illegible]

⊙The City Council of Atchison, Kans., has awarded the contract for the construction of the West Atchison sewer to Williams & Sample of Kansas City, Mo., for $22,561. Other bids received were: Kelley & Kelley, St. Joseph, $22,696; Olson-Schmitt, St. Joseph, $22,700; McGuire & Stanton, of Leavenworth, $23,137; F. W. Keller, Webb City, Mo., $23,253; Intermountain Const. Co., Tecumseh, Neb., $23,569; Thomas Beattie, Atchison, $24,438.

A petition is being circulated in Topeka, Kans., for an extension of the city sewer system of the East Side. It will be presented to the City Commissioners soon.

The City Council of McPherson, Kan., has ordered City Engineer H. A. Rowland to prepare plans for sanitary sewers for the first and second wards. The bids are to be ready in the spring.

The City Council of Lawrence, Kans., has passed ordinances providing for the construction of three more sections of sewer in the district in West Lawrence that will cost approximately $7,000.

The city of Columbus, the county seat of Cherokee County, Kans., has issued $14,000 worth of bonds for the purpose of constructing a new sewer system.

Following bids were recently received by the City Council of Fort Scott, Kans., for the construction of the two sewers which will cover almost the entire part and much of the south part of the city: Plunkett & Yale—Dist. 2, $90,703; Dist. 3, $22,868. Geiger Con. Co.—Dist. 2, $100,223; Dist. 3, $28,267. R. J. Boyd—Dist. 2, $94,081; Dist. 3, $27,878. Midland Con. Co.—Dist. 3, $25,121. F. R. Stone—Total, $95,800. Thogmartin & Gardiner—Dist. 2, $76,880; Dist. 3, $24,710. Concrete Eng. & Con. Co.—Dist. 2, $79,362; Dist. 3, $20,420. McGuire & Stanton—Dist. 2, $90,339; Dist. 3, $25,481. W. F. Plummer & Co.—Dist. 2, $90,011; Dist. 3, $26,421. J. W. Smith & Son—Dist. 2, $68,072; Dist. 3, $17,697. J. A. Green & Co.—$114,905.

The City Council of McPherson, Kans., has decided to construct a sewer in that part of the city lying north of the Santa Fe R. R. between Chestnut and Oak Sts., and east of the Rock Island, between Simpson St. and the first alley south of Kansas Ave.

The City Council of McPherson, Kans., has instructed the City Engineer to prepare plans, specifications and an estimate of the cost of constructing a sewage disposal and a purification plant at the mouth of the sewer south and east, near section line.

Kentucky.

City Engineer L. A. Washington of Paducah, Ky., in his annual report to the Mayor and City Council, recommends additional sewer construction.

Louisiana.

According to advices from New Orleans, La., Supt. Earl of the Sewerage & Water Board will shortly advertise for bids for the construction of a lined and covered canal on Claiborne Ave., from Lafayette Ave., to Elysian Fields St.

Maryland.

⊙It is reported the McDermott Construction Co., 101 N. St. N. E., Washington, D. C., has been awarded the contract by the Board of Awards of Baltimore, Md., for the construction of the high level interceptor, beginning at Park Ave. and Centre St. and continuing to Myrtle Ave., and Saratoga Sta., at $183,156. A list of the bids received appeared in our last issue.

Plans for a new section of the sewerage system of Baltimore, Md., to connect Bayview and Sydenham with the general system of Baltimore, have been approved by the Sewerage Commission. The sewer is to connect with the outfall sewer at Bayview Junction. Specifications for the contract have been laid before the Board of Awards. Calvin W. Hendricks is Chief Engineer of the Commission.

Michigan.

✣Bids will be received until 4 p. m., March 4, by Peter F. Gray, City Clerk, Lansing, Mich., for the construction of sewer in Herbert St., from the south line of Parker St. to Norman St., and in Isbell and other streets, being a part of sewer known as a sewer in Cedar, Baker, Herbert and other streets, in accordance with the plans and specifications on file in the office of the City Engineer. Each proposal must be accompanied by a certified check for $2,000.

Minnesota.

Residents of the southern portion of the East Side have petitioned the City Council of St. Cloud, Minn., for a new sewer in that section. The course of the proposed sewer is from Seventh Ave. and Seventh St. southeast, running easterly two blocks, thence northerly two blocks on Wilson Ave., south to connect with the sewer constructed during the summer at the corner of Fifth St. and Wilson Ave. southeast.

Missouri.

✣Bids will be received [illegible] 26, by Board of Public W[illegible] Mo., for the construction of joint sewer districts 320, 321 325 and [illegible] No. 5 [illegible] L. Purcell is [illegible]

⊙The Board of Public Works of St. Joseph, Mo., has awarded the contract for the construction of a sewer in District No. 55 to E. F. Mignery, and the contract for a sewer in District No. 80 to the Kelley Construction Co. The latter firm submitted the lowest bid for a sewer in District No. 96.

The City Council of Hannibal, Mo., has passed an ordinance providing for a sewer district known as District No. 200 and including a greater part of the First Ward. Bids will be asked during the month of February.

The Business Men's Club of Fayette, Mo., has voted in favor of the proposed installation of a sewerage system. It is estimated that the proposed system will cost $25,000. Rollins & Westover, Kansas City, Mo., it is reported, are Engineers.

Engineer H. C. Westover of the firm of Rollins & Westover of Kansas City, Mo., has estimated that a complete modern sewer system for the city of Fayette will cost $29,675. The estimate of the system were divided into the following items: 37,740 ft. of 8-in. pipe laid $21,195; 95 standard manholes, 21 single flush tanks, and 2 double flush tanks, $5,168; railroad crossings, $300; septic tanks, $1,600; engineering and supervision, $3,313.

The Board of Public Works of St. Joseph, Mo., proposes to construct sewers, pave and grade in the following-named streets: McDonald St., Shady Ave., Hamburg Ave., Concord, Monroe, Madison, Green, Logan and Randolph Sts., and Roosevelt Ave.; also the alley between St. Joseph Ave. and Seventh St., McDonald to Moss St.

⊙Robert Wycoff, 3642 McRee Ave., St Louis, Mo., has been awarded the contract by the Board of Public Improvements of that city, for the construction of sewers in Manchester Road Sewer District No. 4, embracing sewers of the materials, lengths and sizes as follows, to-wit: 212 ft. of 27-in. inside diameter pipe sewer, 210 ft. of 24-in. inside diameter pipe sewer, 447 ft. of 18-in. inside diameter pipe sewer, 1,620 ft. of 12-in. inside diameter pipe sewer. With sewer inlets, manholes and appurtenances. The contract price is $3,715. Bids were opened Jan. 12.

No contracts were awarded by the City Council of Springfield, Mo., on Jan. 15 for the construction of sewage disposal plants at the outlets of the two main sewers of the city. The work will be readvertised.

Nebraska.

No contract was awarded by the City Council of Holdredge, Nebr., on Jan. 18 for the construction of 1,296 ft. of 8-in. sewer with manholes and flush tanks. The work will be readvertised some time in March. S. C. Heliker is City Clerk.

Nevada.

The City Council of Fallon, Nev., has rejected all bids received Jan. 6 for the construction of the proposed sewer system. The work will be done by day labor. W. H. Reavis is City Clerk.

New Jersey.

⊙Michael Garafano has been awarded the contract by the Millburn Township Committee, Millburn, N. J., for the construction of lateral sewers in the Brantwood and Wyoming sections of Millburn. The work includes the laying of 6,310 lin. ft. of pipe, 22 flush tanks and 9 manholes. The contract price is $5,824.

The City Council of Beverly, N. J., recently held a meeting for the purpose of discussing plans for the installation of a new sewerage system.

New York.

City Engineer John A. Giles of Binghamton, N. Y., has filed with the State Department of Health plans for the construction of a trunk sewer in the First ward, to connect with the Lestershire sewer system. Bonds to [illegible] the city's share of the cost.

[illegible] has reported to the Board of Village Trustees the preparation of all the necessary surveys, maps and detailed statements for the municipal sewer system. Civil Engineer Charles Ingersoll has estimated that a complete system, including disposal plant, could be installed at a minimum cost of $150,000, or a maximum cost of $175,000.

The Commoun Council of Oswego, N. Y., is considering the plans prepared by City Engineer Snyder and approved by Consulting Engineer Chalkley Hatton of Wilmington, Del., for the construction of a sewer system.

Ohio.

⊙The Board of Control of Canton, O., has let the contract for the construction of the South Harrison Ave. sanitary sewer to Peter Christiansen for $2,145. Other contracts were awarded as follows: Harrison Ave., storm sewer, Downs Construction Co., $722; Shorb St., sanitary sewer, Press Campbell, $468; North Cherry, Hiram and Lake Sts. sanitary sewer, John Skeeles, $949.

⊙Thos. J. Kelly of Toledo, O., has been awarded contracts for the construction of local sewers 1126, 1127, 1128, 1129 and 1131, in Toledo, for $1,025, $1,540, $292, $1,498 and $1,704, respectively. Bids were opened by the Department of Public Service on Jan. 5.

Plans have been completed by Engineer G. E. Arnold for the installation of a sewerage system in New Philadelphia, O., at an estimated cost of $100,000. The work will include approximately 11 miles of sanitary sewers, 3 miles of storm sewers, and 4,100 ft. of 14-in. cast iron pipe. Bids for this work will be asked immediately. The city is also contemplating the installation of a sewage disposal plant at an estimated cost of $40,000.

The Council Committee on Finance, City of Cleveland, O., has voted an appropriation of $150,000 instead of the $133,000 originally asked for, to enable Director Springborn to work out a new system of garbage collection which will require the establishment of four stations and the services of big auto trucks with four trailers for long hauls to the central station on Canal road.

The City Council of Athens, O., has sold bonds to Tillotson & Wolcott Co., of Cleveland, O., in the sum of $10,500 for storm sewer improvements and in the sum of $14,989 for street improvement.

City Engineer Phil Weber of Canton, O., has reported to the City Council that the cost of constructing a sewer to drain the public square of storm water, together with recurbing the square, will be $1,090.

A resolution calling for plans and estimate of the cost of constructing sanitary sewers in all of Ohmer Park, city of Dayton, O., has been introduced in the City Council.

An election was held in Xenia, O., on Jan. 16, for the purpose of deciding whether or not bonds should be voted for the construction of a sewerage disposal plant. Consulting Engineer A. Elliott Kimberly, Columbus Savings & Trust Bldg., Columbus, O., has estimated the cost as follows: Main sewer extension, $2,100; screens, settling tanks and sludge bed, $2,350; sand filter beds, $34,200.

The report of R. W. Pratt, sanitary expert, employed by the city of Cleveland, O., to work out the sewage disposal problem suggests that before definite conclusions can be drawn regarding the most economical plan for treating the sewage, there should be conducted during a period of about a year, series of actual tests and experiments on the various feasible methods.

Oklahoma.

A delegation of citizens of El Reno, Okla., recently called upon the City Commissioners to ask for the construction of sanitary sewers in Lake View addition. Petitions are now being circulated for the improvement.

Pennsylvania.

✣Bids will be received, it is reported, until Feb. 15, by City Council, Scranton, Pa., for the construction of a number of sewers in that city in accordance with plans and specifications on file with the City Engineer, William A. Schunk.

Plans for a sewage system that will embrace Roselawn and Eldorado are being prepared by Former City Engineer Harvey Linton of Altoona, Pa., under the direction of S. Morris of Altoona.

City Engineer Edmund B. Ulrich of Reading, Pa., in his annual report to the Mayor and City Council, makes the following recommendations relative to sewer work: Construction of 38 additional storm sewers; new 10,000,000-gal. sewage pump, or two smaller ones, with a similar combined capacity; operate sewage pumps by electricity; utilize spare land at sewage purification works for crops.

The residents of Tamaqua, Pa., at a recent special election decided to allow a loan of $40,000 to be made for improvements to that town, chief among which will be a $12,000 sewerage system.

Plans are in preparation by Consulting Engineers Herring & Fuller, 170 Broadway, New York City, for the construction of a sewage disposal plant for the city of Altoona, Pa.

Consulting Engineer Leo Hudson of Haverstraw, N. Y., has presented plans and specifications to the City Council of Beaver Falls, Pa., for the installation of a sanitary sewerage system. These plans have been approved by Paul Hooker, Engineer of the State Department of Health.

The city of Erie, Pa., is about to erect an experimental plant for sewage disposal near the mouth of Mill Creek. Plans have been [illegible] $250,000. The proposed site for the plant is a piece of land bordering on Presque Isle bay in the northern part of the city, located on the north side of the Philadelphia & Erie R. R. tracks, and between Mill Creek and the Soldiers & Sailors' Home grounds. The method of treatment, adopted and worked out in the prepared plans, consists in a clarification of the raw sewage by screening and sedimentation, and purification of the clearified effluent by dispersion and dilution in the waters of Lake Erie.

It is reported the City Wastes Disposal Co., 156 Fifth Ave., New York City, has been retained by the Town Council of Pottstown, Pa., to make a preliminary survey of the town for a sewerage system. Chas. Brooke is Burgess.

Rhode Island.

Following bids were received Jan. 6 by the chief of the Bureau of Yards & Docks, Navy Department, Washington, D. C., for the construction of a sewer and outfall at the naval hospital at Newport, R. I.: M. A. Gammino & Ricci Contracting Co., 233 Federal St., Providence, R. I., [illegible]; P. H. [illegible], [illegible] Edwards St., Newport, R. I., $1,732; rock excavation, $450; total, $2,182. Darling & Slade, 52 Bridge St., Newport, R. I., $2,378; Noel Construction Co., 79 Milk St., Boston, Mass. $2,474. R. L. Whipple & Co., 306 Main St Worcester, Mass., $2,077.

Tennessee.

Richard C. Huston of Memphis, Tenn., has been employed by the Board of Mayor and Aldermen of Lexington, Tenn., to survey the town and make estimates of the amount of piping and other material required to install the $50,000 water, light and sewerage system which the city has decided to install.

Plans are being made for the construction of about four miles of new sewers and one or two septic tanks, to cost between $17,000 and $30,000, for the city of Lebanon, Tenn. A. J. Casey is the official in charge.

Texas.

⊙H. C. Gass of Independence, Kans., has been awarded the contract by the City Commisoners of Waco, Tex., for the making of extensions to the sanitary sewer system for

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] the [illegible] sewer system [illegible] be considered for some time.

[illegible] considered [illegible] sewer system of Austin, which will mean the addition of 85 miles of sewer in the city, which, according to estimates, would cost approximately [illegible]

The Board of Municipal Commissioners, Dallas, Tex., has adopted the report of Water Commissioner Nelms recommending extension of the sanitary sewer to serve the district between Cedar Springs road, Lemmon Ave., and Douglas St., extending west to the city limits.

Virginia.

Plans are being prepared for the construction of a new sewerage system for the city of Staunton, Va., which provide for a trunk tunnel running from the lower end of the city westward to the park, parallel with the creek. Laterals will be laid.

Washington.

⊙The Board of Public Works of Seattle, Wash., has awarded the contract for the construction of sewers in N. 78th St., to Johnson & Co., 929 Blewitt St., Seattle, for $13,031. Other bidders on the work were: Ward & Scherer, 111 Pine St., $15,180; Will Kopta, 1422 27th Ave., $16,206; R. J. Barter, 2832 Harvard Ave., N., $15,746; J. Ruthe, 131 W. Kilbourne St., $15,405; Becker & Walker, $17,202; Krogh & Jessen, 1418 24th Ave., $14,137; Dalstrom & Rodal, 2437 W. 56th St., $14,718; Young & Ulrich, 703 American Bank Bldg., $14,457; Erickson Bros., Pioneer Bldg., $15,646; Hayden & Sons, 4642 Easton Ave., $13,552.

The City Council of Arlington, Wash., contemplates the installation of a sanitary sewerage system.

The City Council of Toppenish, Wash., has secured an option on five acres of land upon which an outlet will be built for the new sewer system being put in that city. The property is on a slough, southeast of the city, near the river. D. R. Redman is City Engineer.

Wisconsin.

The finance committee of the City Council of Milwaukee, Wis., has approved a bond issue of $50,000 for the West sewerage district and one of $100,000 for the South sewerage district.

The City Council of Marinette, Wis., has passed a resolution for the extension of the main brick sewer during the present year. The Board of Public Works has been asked to take action as soon as possible.

Canada.

⊙The City Council of Vancouver, B. C., has awarded the contract for the construction of the Kerrisdale sewer to McAdam & Co., for $27,413. Cameron & Cleveland, Winch Bldg., Vancouver, are Engineers.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

⊙J. G. White & Co., Inc., 43 Exchange pl., New York city, and San Francisco, have awarded a contract to the National Tube Co. for 124 miles of 12 in. steel pipe to be used in building a natural gas line for the Midway Gas Co. in California.

⊙The Mervy-Elwell Co., Oakland, Cal., has been awarded a contract by the American-Oriental Oil Co. to construct a 1,000 ft. wharf into the bay at Martinez.

Haviland & Tibbetts, Alaska Commercial Bldg., 310 Sansome St., San Francisco, Cal., are to make surveys, soundings and estimates for the construction of the inner harbor project for the city of Redmond, Cal.

Recommendation has been made to the Supervisors of Alameda County that $3,500 be appropriated as a fund for preliminary work looking to the building of the subway under Oakland harbor to connect the cities of Alameda and Oakland. John F. Mullins, Oakland, Cal., Chairman County Supervisors; Mayor Frank K. Mott, Oakland, and Mayor W. H. Noy, Alameda, are members of the committee.

City Trustees of Sacramento have voted to appoint a committee of five to examine into and report upon the best plan for a spillway or canal to conduct the water from the American River into the Sacramento, from a point near Brighton or Perkins, the ultimate aim being to remove the danger of the city from flood.

City officials of Long Beach are reported to be considering increasing the capacity of the municipal dockage at a cost of about $25,000.

Bids were opened Jan. 11 by the Harbor Board of San Francisco for the construction of Pier 17 at the foot of Union St., 800x120 ft. and a new bulkhead. The Healy-Tibbitts Construction Co., San Francisco, was low bidder, it submitting four propositions, ranging from $267,400 for a pier with bituminous floor and a shed to $229,000 for a wharf with a wooden floor without a shed.

Bids were opened Jan. 5 by the City Council of Oakland for the completion of the 1,915 ft. of estuary quay wall, the bids received being as follows, (1) standing for lump bid for a portion of the wall and (2) the bid per lineal foot for the balance of the wall: Healy-Tibbitts Construction Co., San Francisco (low bidder), (1) $3,640, (2) $147.35; Raymond Concrete Pile Co., New York, two alternatives—$225,000 or $250,000 for the entire work; Thos. F. Dodd, (1) $8,500; $155 and $153 per foot; San Francisco Bridge Co., (1) $5,900 and (2) $158 per foot; Thompson Bridge Co., (1) $8,500 and (2) $170 per foot; Robert C. Storrie & Co., (1) $7,500 and (2) $158 per foot.

Bids have been received by the California Debris Commission, San Francisco, for the construction of two suction dredges to be used in the so called Rio Vista project, involving the deepening and widening of the mouth of the Sacramento River. The lowest bidder was the Ellicott Machine Co. of Baltimore, Md., whose bids were $205,000 for one dredge and $356,000 for two. Other bidders were the Yuba Construction Co. of Marysville, $231,000 and $439,000; Moore & Scott, San Francisco, $241,500 and $471,000; San Francisco Bridge Co., $248,000 and $484,000; Union Iron Works, San Francisco, $367,750 and $517,100. The Rio Vista project will be the first step toward the accomplishment of the scheme of flood control which the government engineers have mapped out for the Sacramento and San Joaquin valleys.

Plans are under way for two additions to be made to the ferry building in San Francisco. Each of the additions will be 150 ft. wide and 300 ft. long and will permit the construction of from four to six more ferry slips. Nat Ellery, Sacramento, Cal., is state engineer.

The Harbor Commission of Los Angeles has been instructed to prepare at once comprehensive plans for the improvement of the inner and outer harbors. In the preparation of these plans the Harbor Commission is to have the services and aid of City Engineer Homer Hamlin and Harbor Engineer E. D. Vincent.

The harbor commissioners of San Francisco are stated to be readvertising for bids for furnishing 150,000 bbls. of cement, to be delivered during the next two years.

District of Columbia.

✣Bids will be received until Feb. 11, by Chief Signal Officer, Washington, D. C., for furnishing under Proposal No. 656, 30 miles single conductor cable intermediate, type 44, in accordance with specification 419-B, 96-B and drawing 106, and 150 miles cable, single conductor, deep sea, type 45, in accordance with specifications 420-A, 96-B and drawing 106, to be coiled and crated in closed freight cars. For further information address R. J. Burt, captain, signal corps, U. S. Army, disbursing officer.

✣Bids will be received until noon, March 20 (extension of date from Feb. 20), by Beekman Winthrop, Assistant Secretary of the Navy Department, Washington, D. C., for constructing by contract one submarine tender.

✣Bids will be received until 10:30 a. m., Jan. 26, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 674, wrought iron or steel pipe, pipe fittings, stovepipe, brass tubing, copper ferrules, valves, hose nozzles, hose couplings, grease cups, horseshoes, steel or iron wire, files, wrench parts, tacks, carriage bolts, cross-arm braces, cross arms and pins, insulators, packing, gaskets, sheeting, cheesecloth, sash cord, wool waste, scythes, corn brooms, fire brick, steel tapes, pitch, putty, turpentine and Japan drier.

Bids as follows were received Jan. 8 by Col. W. C. Langfitt, U. S. Engineer, Washington, D. C., for dredging in Anacostia River, D. C.: Sanford & Brooks Co., Baltimore, Md., 5.48 cts. per cu. yd.; Atlantic, Gulf & Pacific Co., New York, 5.89 cts. per cu. yd.; Miner Engineering Co., Washington, D. C., 6.65 cts.; American Dredging Co., Philadelphia, Pa., 7.6 cts.; Maryland Dredging and Contracting Co., Baltimore, Md., 7.8 cts.; E. N. Graves, Cleveland, O., 8.92 cts.; Howard K. Stokes, 11 Pine St., New York city, 9.1 cts.

Florida.

✣Bids will be received until 1 p. m., Feb. 23, by Lt.-Col. G. D. Fitch, U. S. Engineer, Montgomery, Ala., for dredging in Carrabelle Harbor, Fla. Official advertisement will be found elsewhere in this issue.

Illinois.

✣Bids will be received until 3 p. m., Feb. 29, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping heating apparatus, electric conduits and wiring and interior lighting fixtures of the U. S. Post Office at La Salle, Ill. The building is two stories and basement and has a ground area of approximately 4,400 sq. ft.; non-fireproof construction; stone facing and tin roof.

✣Bids will be received by Wm. Carroll, City Electrician, Chicago, Ill., until 11 a. m., Feb. 1, for furnishing and delivering to the Department of Electricity supplies and materials as follows: 750 dozen outer globes for arc lamps, 625 dozen inner globes for arc lamps, 120,000 incandescent gas mantles, 150 gross mica chimneys, 1,000 boxes glass sides (44 lights in a box), and 600 boxes glass tops (64 lights in a box).

Indiana.

✣Bids will be received until 3 p. m., Feb. 28, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures, of the U. S. Postoffice at Ellwood, Ind. The structure is to be one-story with mezzanine, 4,600 sq. ft. in ground area, faced with granite to the first floor and with limestone or sandstone a[illegible] proof construction throughout.

✣Bids will be received until 10 a. m., Jan. 27, by Depot Quartermaster, Jeffersonville, Ind., for furnishing a qua[illegible] khaki paulins.

✣Bids will be received until 10 a. m., Jan. 25, by Depot Quartermaster, Jeffersonville, Ind., for furnishing about 30,000 lbs. light steel horseshoes.

Iowa.

✣Bids will be received until 10 a. m., Feb. 1, by Nicholas Kass, Secretray, Board of Directors of the Independent School District, Remsen, Ia., for furnishing all the labor and material, including heating plant and plumbing work, for the erection of a new school house for said school district at Remsen, Iowa, in accordance with the plans and specifications therefor prepared by Martin Heer, Architect, and on file at the office of the Secretary.

Louisiana.

✣Bids will be received until 11 a. m., Jan. 30, by Lt.-Col. Lansing Beach, U. S. Engineer, 125 Customhouse, New Orleans, La., for furnishing and delivering piles and lumber on the river bank or wharves in Southwest Pass, Mississippi River.

Mayor J. H. Eastham of Shreveport, La., has instructed City Engineer George Wilson to prepare plans and estimates of the cost of erecting a salt water public natatorium, 400 by 200 ft., on the state fair grounds. It is planned to have the amusement ready for use next summer. The traction company has agreed to give at least $5,000 towards building the natatorium and the city is expected to give the remainder.

Outline plans for a new school to replace the present structure at Peters Ave. and Coliseum St., New Orleans, have been submitted to J. M. Gwinn, Superintendent of Schools of New Orleans, by City Architect Christy. The building will be two stories and basement of brick construction, will have 21 rooms and will cost about $100,000.

Massachusetts.

✣Bids will be received un[illegible] Supply Department, 826 Tremont Bldg., Boston, Mass., for furnishing crushed stone and stone dust for the year ending Feb. 1 1913.

✣Bids will be received until noon, Jan. 31, by Supply Department, 826 Tremont Bldg., Boston, Mass., for furnishing 730,000 lbs. iron castings.

✣Bids will be received until noon, Feb. 6, by Supply Department, 826 Tremont Bldg., Boston, Mass., for furnishing about 2,900 tons iron pipe and about 25 tons of special castings.

✣Bids will be received until noon, Feb. 5, by Supply Department, 826 Tremont Bldg., Boston, Mass., for furnishing bank gravel and sand between March 1, 1912, and Feb. 1, 1913.

✣Bids will be received until noon, Jan. 26, by Public Works Department, Boston, Mass., for furnishing and installing bushings on post hydrants in Hyde Park.

The following bids per cu. yd. were received Jan. 11 by Col. Frederic V. Abbott, U. S. Engineer, Boston Mass., for the removal of about 2,183 cu. yds. of material, believed to be granite, from Gloucester Harbor, Mass.: John J Fitzpatrick & Sons, Plattsburg, N. Y., $8.88; The Massachusetts Contracting Co., Worcester, Mass., $29.25; Thomas Fitzgibbon, Beverly, Mass., $24.65; Johnston & Virden, Lowes, Del., $25.30; Eastern Dredging Co., Boston, Mass., $19.60.

Minnesota.

✣Bids will be received until 7:30 p. m. Jan. 26, by Henry N. Knott, City Clerk, Minneapolis, Minn., for furnishing the city an auto-patrol of the Police department. A certified check for $200 payable to C. A. Bloomquist, City Treasurer, must be filed with each bid.

[illegible] stone [illegible] Theater Bldg., Omaha, Neb., is the architect The reinforced concrete system was let to [illegible]

New Jersey.

✣[illegible]vy, Lighthouse Inspector, Philadelphia, Pa., for furnishing material and labor necessary to complete concrete filling of foundation and erect the superstructure, etc., of Miah Maul Shoal Light Station, Delaware Bay, N. J.

✣Bids will be received until 3 p. m., Feb. 8, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for pneumatic door operating devices at the United States Postoffice, New York, N. Y. Specifications may be had of McKim, Mead & White, 160 Fifth Ave., New York City, at the discretion of the Supervising Architect.

✣Bids will be received until 11 a. m., Feb. 15, by Lieut. Col. J. G. Warren, U. S. Engineer, 540 Federal Bldg., Buffalo, N. Y., for removing steel sheet pile cofferdam, Black Rock Shiplock at Buffalo, N. Y.

✣Bids will be received until Jan. 30, by Commanding Officer, New York Arsenal, Governors Island, N. Y., for delivering at Pier 12, East River, New York, N. Y., 600 gals. pure turpentine in 1-gal. cans.

✣Bids will be received until Jan. 30, by Commanding Officer, New York Arsenal, Governors Island, N. Y., for delivering at Pier 12 East River, N. Y., 1,200 gals. hydroline oil packed in 5-gal. cans.

Pennsylvania.

✣Bids will be received until 10 a. m., Jan. 30, by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the Navy yard, Philadelphia, Pa., a quantity of naval supplies, as follows: Sch. 4247: Electric blue-print machine. Sch. 4248: Acetylene generating and compressing equipment.

Texas.

✣Bids will be received until 9 a. m., Jan. 31, by School Board, J. F. Austin, President, Frankston, Anderson County, Texas, for the erection of a 6-room, 2-story brick school building to be erected at Frankston. C. A. Watson, Austin, Texas, is Architect.

Plans have been adopted for a new 5 story Masonic temple to be erected at Main and Pearl Sts., Dallas, at a cost of $150,000. The building will be of concrete, steel reinforced, and construction will be started shortly. Lang & Witchell, Dallas, are the architects. W. M Holland, Dallas, is chairman of the building committee.

Washington.

✣Bids will be received until noon, Jan. 31, by Maj. J. B. Cavanaugh, U. S. Engineer, Seattle, Wash., for furnishing and delivering brush fascines, piling and grillage poles at Gray's Harbor, Wash.

⊙Misho & Grant, 330 Globe Block, Seattle, Wash., have been awarded the contract at $84,000 for the construction of the Franklin County court house at Pasco. The building will be 2 story and basement, 80x120 ft., and will be of steel and reinforced concrete construction.

McDermott & Comidy, Alaska Bldg., Seattle, at $21,528, were low bidders for constructing a tunnel at Ruston, Wash., for that city. Bids for this work were opened the first part of January.

Gould & Champney, American Bank Bldg., Seattle, Wash., have been selected as the architects for the new Y. W. C. A. building to be erected at 5th Ave. and Seneca St., Seattle. Construction work on the building, which will cost about $400,000, will probably be started in the spring. It will be six stories and basement of reinforced concrete construction.

The Bush Terminal Co., Irving T. Bush, president, 100 Broad St., New York city, is understood to have practically completed negotiations for the purchase of the entire Harbor Island at Seattle, lying in Elliott Bay between the east and west waterway. The company is said to plan to expend over $5,000,000 in dock, warehouses and freight handling facilities before 1915.

Wisconsin.

The Island Woolen Co., Baraboo, Wis., contemplate building a 250 ft. long and 15 ft. high concrete dam this coming spring.

Canada.

✣Bids will be received until 11 a. m., Feb. 1, by Chairman of the Board of Control, Winnipeg, Man., for the manufacture and delivery f. o. b., Winnipeg, of an electric vehicle. Specifications may be had of the General Manager, City Light and Power Department, 54 King St. M. Peterson is Secretary of the Board.

The main estimates of the dominion government for the coming fiscal year include the following items: Welland ship canal, $50,000 for surveys; Ottawa departmental buildings, $780,000; Port Arthur and Fort William harbor and river improvements, $1,000,000; Quebec harbor, $716,000; St. John harbor, $1,000,000; Tiffin harbor, $137,000; Victoria harbor, Ont., $160,000; and Victoria and Vancouver harbors, B. C., $500,000 each.

PROPOSALS

CALUMET-SAG CHANNEL EXCAVATION.

[illegible] CHICAGO.

[illegible] for Excavation and Collateral Work on Contract Section Three of the Calumet-[illegible] the Clerk of the Sanitary District at the office of the District, on the 15th floor of the American Trust building, Chicago, Ill., un[illegible] 1912, and will be publicly opened by the [illegible] or the first meeting thereafter.

The work for which tenders are invited consists of the excavation and collateral [illegible] Calumet-Sag Channel of the Sanitary District of Chicago, in the Township of Palos, County of Cook, State of Illinois.

The approximate quantities for the comparison of bids are:

(a) 335,000 cu. yds. of glacial drift excavation.

[illegible]

(c) 182,300 sq. ft. of channeling.

(d) 13,400 cu. yds. of concrete retaining wall.

(e) 5,000 sq. yds. of rip-rap slope.

Specifications and plans may be obtained upon application at the office of the said Sanitary District.

All bids must be upon blank forms of proposal furnished by said Sanitary District and shall be made in accordance with and to conform to all the terms and con[illegible]

The Board of Trustees of said Sanitary District reserves the right to reject any and all bids.

[illegible] CAGO

By Thomas A. Smyth, [illegible]

Attest: T. J. Bryan, Clerk.
Chicago, January 10, 1912.

✣ [illegible] work [illegible] contract let recently

PROPOSALS

STORM SEWER.

PROPOSAL FOR BUILDING DAMS AND CONDUITS FOR A STORM SEWER SYSTEM FOR WATERVLIET, N. Y.

Sealed proposals for the construction of [illegible]er, together with levees, overflow and outlet works, concrete and brick conduits, and storm drains and other appurtenances, will be received by the Watervliet Storm Sewer Commission, at No. 1[illegible] Broadway, Watervliet, N. Y., until 2:00 o'clock p. m., on the 15th day of February, 1912.

The work will consist of approximately 80,000 cu. yds. of earth fill, concrete overflow and outlet works, together with 9,100 lin. ft. of concrete conduit, from 3 ft. 0 ins. to 8 ft. 6 ins. in diameter, and 1,000 ft. of terra cotta sewer pipe.

Alternate bids are asked on buttress type, reinforced concrete dams, and on concrete pipe.

Each proposal must be accompanied by a certified check payable to the Watervliet Storm Sewer Commission, to an amount equal to 5 per cent of the bid as a guarantee that the contract will be entered into if awarded. A bond of fifty (50) per cent of the contract price will be required. Payments will be made in cash on monthly estimates.

Plans and specifications are on file at the office of the Watervliet Storm Sewer Commission, and also at the office of Solomon, Norcross & Keis, Engineers, 1622 Candler building, Atlanta, Ga., and with the Engineering News, 220 Broadway, New York City. Bidders may obtain copies from the engineers by enclosing check for twenty-five dollars ($25), payable to the engineers, and to be held by them until return of plans and specifications. The Watervliet Storm Sewer Commission reserves the right to reject any and all bids.

WATERVLIET STORM SEWER COMMISSION.
John D. Browne, President.
Thomas Conway, Secretary.
Watervliet, N. Y.
Solomon, Norcross & Keis, Engineers,
Atlanta, Ga.

WATER WORKS.

Sealed proposals will be received by the Board of Water Commissioners of the Manhasset-Lakeville Water District, Manhasset, L. I., until 8 o'clock p. m., February 15, 1912.

The work will consist of two (2) eight-inch driven wells, brick pumping station, three (3) sets of fuel oil engines, triplex pumps and accessories; oil tank and accessories; water tower and foundations; twenty-one (21) miles of cast iron pipe, four (4) to ten (10) inch, laid; one hundred and seventy (170) hydrants, necessary valves and boxes set in place.

Plans and specifications will be on file at the Town Hall, Manhasset, and copies may be obtained at the office of Johnson & Fuller, Consulting Engineers, 150 Nassau St., New York City, by depositing five ($5.00) dollars.

All inquiries must be addressed to the Consulting Engineers.

All bids must be accompanied by a certified check made payable to the Manhasset-Lakeville Water Commissioners, for eight thousand ($8,000) dollars.

The right is reserved to reject any or all bids.

BOARD OF WATER COMMISSIONERS. MANHASSET-LAKEVILLE WATER DISTRICT.
Daniel S. Woolley, Chairman
Owen P. Kennedy.
John M. Belknap.

PAVING.

Sealed bids will be received by the Board of Public Works of Boise City, Idaho, for paving with asphalt, asphaltic concrete, bitulithic, Westermite asphalt, dolarway, hassamite, plain concrete, concrete with cement top, granocrete, hassam or brick pavement (with brick along street car tracks) in all streets and parts of streets in Paving District No. 17, approximating 328,200 square yards, with necessary excavation, gutters, and appurtenances as provided for by ordinance No. 991. Said bids will be received up to 2 p. m., February 2nd, 1912, and immediately opened publicly by the Board of Public Works in the City Hall of said city.

Said pavement to be laid and constructed according to plans and specifications which may be seen at the office of the city engineer.

Each bid must be in accordance with the form of proposal furnished by the Board of Public Works, and accompanied by a certified check on some local bank, payable to Boise City, for the sum of two thousand ($2,000) dollars, to be forfeited if the successful bidder fails to enter into a contract and furnish a good and sufficient bond, in a sum equal to twenty-five (25%) per cent of the total amount of his bid for the faithful performance of each and every covenant in the contract.

The right is reserved to reject any and all bids, or to let the work as a whole or in parts, or for one or more kinds of the above pavements, as may appear to the best interests of the city.

By order of the Board of Public Works of Boise City, Idaho, this third day of January, 1912. KARL PAINE,
President.

WATERWORKS.

Sealed bids will be received by the Commissioners of the City of Chamberlain, S. D., at the City Hall in that city up to 8 o'clock p. m., Jan. 29th, and then opened for the construction of an intake crib, receiving well, pumping plant, including two 40 H.P. oil engines, two 350-gal. triplex pumps, with all necessary piping and fittings, approximately 3,000 lin. ft. 10-in. water main, fire hydrants and appurtenances.

After Jan. 10th plans and specifications may be seen at the office of the City Auditor, at the office of the Missouri Valley Engineering Company, 406 Western National Bank Bldg., Mitchell, S. D., or may be secured by making deposit of $10.00, which will be returned upon return of plans and specifications in good condition. Check for $500.00 to accompany bid.

December 29, 1911.
F. K. BERRY, Mayor.
J. H. BINGHAM, City Auditor.

MISSISSIPPI RIVER COMMISSION, 1st and 2nd Districts, U. S. Engineer Office, Memphis, Tenn., Jan. 8, 1912. Sealed proposals for furnishing one locomotive crane will be received at this office until 12 o'clock, noon, Feb. 8, 1912, and then publicly opened. Information on application. Clarke S. Smith, Major, Engrs.

U. S. ENGINEER OFFICE, Seattle, Wash., Jan. 5, 1912. Sealed proposals for dredging and excavating in Lake Washington Canal right of way will be received at this office until 12 M., February 15, 1912, and then publicly opened. Information on application. J. B. Cavanaugh, Maj. Engrs., Agent for the State of Washington and King County, Wash.

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STEEL, CONCRETE & WOODEN BRIDGES.

Sealed proposals will be received at the office of the County Clerk at the Court House in the City of Schuyler, Colfax County, Nebr., up to 12 o'clock of the 12th day of February, 1912, at which hour the bids will be opened, publicly read aloud, for a yearly contract of building steel, concrete and wooden bridges.

Bids will be received as follows:

For superstructure as per plans and specifications now on file in the office of the County Clerk.

For lumber in place for caps, sways, backing and wings.

For piling in place for bridge substructure and wings.

For pile straps in place for any work.

For steel caps as per plans.

For tubular piers as per plans.

For concrete bridges complete as per plans.

For extra concrete per cubic foot.

For putting lumber and piling in place for repairing old bridges.

Said bids must be accompanied by a certified check on some bank in Schuyler, Nebr., for the sum of $500.00, and payable to the County Clerk of Colfax County, Nebr.

The successful bidder will be required to enter into a good and sufficient bond in the sum of $2,000.00 for the faithful performance of his contract.

The Board reserves the right to waive any defects and reject any and all bids for any reason they may deem sufficient.

By order of the Board of County Commissioners of Colfax County, Nebr., this 16th day of January, A. D. 1912.
ED. F. VRZAK,
County Clerk for Colfax County, Nebr.
(Seal.)

DAM.

Paris, Tex.

Sealed bids will be received at the office of the City Secretary until 7:30 o'clock p. m., February 5, 1912, for raising and strengthening a dirt dam at the City Lake. It is estimated that 35,000 cu. yds. of dirt will be moved. Each contractor will accompany his bid with a certified check for 5 per cent of the amount bid.

The right to reject all bids is reserved.
ED. H. McCUSTION, Mayor.

DEPARTMENT OF THE INTERIOR—UNITED STATES RECLAMATION SERVICE.—Washington, D. C., Jan. 15, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Neb., until 2 o'clock p. m., Feb. 28, 1912, for the construction of an earth dam and auxiliary works, on the North Platte Project, about nine miles north of Minatare, Scottsbluff County, Neb. The work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earthfill, 157,000 cu. yds. gravelly material, 14,000 cu. yds unscreened gravel, 11,500 cu. yds. screened gravel, 14,000 cu. yds. concrete, and 12,000 cu. yds. brule clay excavation, besides 45 acres of sod stripping, 600 feet of wells and casing, 3,200 lin. ft. of drains, and the handling and placing of 250,000 lbs. of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Neb.; 519 Commonwealth Bldg., Denver, Col., or Washington, D. C. F. H. NEWELL, Director.

WAR DEPARTMENT, U. S. ENGR. OFFICE.—Montgomery, Ala., Jan. 24, 1912. Sealed proposals for dredging in Carrabelle Harbor, Fla., will be received at this office until 1 o'clock p. m., Feb. 23, 1912. Information on application. G. D. FITCH Lt. Col., Engrs.

WANTED—Railroad contractors' bids on 210,000 cu. yds. earth work on Farley-Luxemburg section of new Farley & Iowa Northern R. R.; construction to commence early in the spring. Profiles, maps, etc., ready for inspection now to base estimates on. S. G. Durant, Dyersville, Iowa. 4-2t

Engineering & Contracting

Devoted to the Economics of Civil Engineering Design
and to Methods and Cost of Construction

Publ[illegible]
EDITORS: H. P. [illegible] Burt.
SUBSCRIPTION RATES: [illegible]

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Agricultural Contracting.

Agricultural engineering is a recognized specialty. There is a flourishing organization of agricultural engineers and it publishes each year a sizable volume of papers and discussions. Only a few years ago ridicule would have been the lot of one who contended that there was a place for engineering in farming. Therefore we are emboldened to suggest that a still newer avocation lies open to another class of our readers in agricultural contracting. The agricultural contractor is quite as logical a personality as the agricultural engineer; if there is in farming, work which warrants the planning skill and judgment of the engineer there is also in farming, work which warrants the constructing skill and equipment of the contractor. We need not depend upon such general reasoning, however, for proof. Specific evidence is plentiful and measurably conclusive.

Concrete is appealing strongly to farmers as a construction material. They appreciate its permanence, its fire resistance, its sanitary advantages. Concrete is a successful substitute for nearly all masonry and timber structures employed in farming. Buildings, walks, floors, troughs, tanks, silos, fences are being built of concrete. Concrete construction is particularly a class of work which warrants special skill and equipment and which repays their employment.

Ditching and tiling are a continuing and increasing class of farm work. Contract work has an established field here; the farmer has already recognized the contractor's claims on the field because of his skill and equipment. As time goes on and machine ditching crowds out the pick and shovel as it is doing, the right of the trained and equipped contractor will become more completely acknowledged.

Clearing and grubbing must precede the opening to cultivation of vast areas of farm land in the older states once wooded, in the far western states now being harvested of their timber, in the timbered lands being and about to be reclaimed by drainage. The economic removal of stumps, is a problem well worthy of the best constructing skill and plant equipment.

Preparing land for irrigation calls for grading operations of no mean order and of considerable expense. After irrigating water is brought to an arid tract it costs in construction work alone from $5 to $20 an acre to apply the water to the land. Of these sums the bulk is grading cost, the earth moving required to bring the surface to even grade and build the laterals, checks, basins, furrows, etc. Very crude methods generally characterize this construction, compared with the tools and methods employed, say in park and landscape work, the operations in which are of no greater magnitude and require less certain skill. There is opportunity for the contractor here.

Blasting operations are another class which the contractor can perform to better advantage than the farmer. We are informed by one of the largest manufacturers of explosives that there has grown up a large agricultural demand for dynamite, a demand so promising that powder mills are likely to have ultimately the chief outlet for their product among farmers and orchardists. Besides the familiar farm uses for breaking up boulders and removing stumps, dynamite is being demanded for tree planting, subsoil plowing, ditching and similar soil loosening operations. According to the manufacturers quoted above the chief obstacle to the development of a very heavy consumption of dynamite for agricultural purposes is the fear of the farmer of handling the explosive. This the manufacturer states is the opportunity for the contractor, and those contractors who have entered the field of agricultural blasting are securing all the work they can do.

Traction engine plowing and hauling is another field for agricultural contracting. The farming journals are giving great publicity to traction engine plowing and it is being promoted by tests and demonstration by the colleges of agriculture. Recently an important journal devoted to sugar cane growing, vigorously advocated editorially that sugar planters should contract for all their plowing and thus cut down the peak load force and plant required during a few weeks of the year and at no other time. Contractors would, the editor argued, equip themselves with traction plowing plants were they assured of a general demand for contract plowing.

The examples we have mentioned of opportunities for farm work of a kind warranting special construction skill and plant are doubtless not all that might be cited. They, however, are enough to show that there is nothing absurd in the idea of contracting in farming. Indeed, it seems to us that the idea is not only sensible but is decidedly practical and promising. The big farmers of the day are by no means dull to see the advantages of improvement and innovation and their sons are coming back from the agricultural schools year after year with minds even more open and enlightened. A fact, too, that cannot be lost sight of is the effective advertising by manufacturers among farmers to create a demand for better structures and improved methods which will open a market for these manufacturers' [illegible]g use of concrete for farm constructions is entirely a development brought about by the vigorous publicity campaigns of the cement manufacturers. Or take the equally vigorous advertising work of the manufacturers of explosives to popularize dynamite for stump removal, tree planting, subsoil plowing, etc. One manufacturer writes us that this publicity campaign is bringing to him from 200 to 600 inquiries a day from farmers. Obviously when such work as this is being done among farmers the field for agricultural contracting is being thrown open.

The farmer should make a satisfactory customer for contract work. He is less apt to figure prices down to the minimum competitive basis. He, too, is quite certain to be prompt to pay for work, because as a class his habit is to save for an improvement. He has, too, another habit which is perhaps the most serious obstacle there is to the development of agricultural contracting, the habit of seldom thinking of his own and his family's labor in terms of money. He will for example remove stumps by crude and back breaking methods if it involves little cash outlay, though the expenditure of his own and his sons' labor runs into many days, because this labor "costs nothing." Naturally this view point changes as the extent of the farming operations exceed the possible family labor output and hired labor has to be utilized.

The Need of Uniformly Edited City Reports, and of More Specific Information of General Interest in Such Reports.

For many years a few city officials have appreciated the value of uniformly arranged annual reports. The subject has long been under discussion. Commendable efforts toward uniformity have been made and gratifying progress has followed.

The annual reports of water works departments serve very well to illustrate the points to which we have reference. During the year several hundred such reports are received in this office. All are examined with interest, and an effort is made to compare the statistics given. The number of permutations and combinations in which these statistics are presented is surprising. Even in this office, where work with statistics of various sorts is a part of the day's business, the editors often are unable to find time to extract a single, usable fact from some of these reports, or to draw a single helpful comparison between the results of management of two water systems as indicated in [illegible] reports. We [illegible] office.

[illegible] should [illegible] two purposes. First, the receipts and expenditures of the department should be so arranged and presented in such detail that the tax payer, who cares to inform himself, can see to what uses the funds of the department have been put; second, the statistics should [illegible], and the [illegible] conditions so described that helpful comparisons may be drawn between the management and efficiency of similar departments in other cities. Present reports fulfill the first requirement fairly well. It is the second requirement of which we wish to speak.

This latter point had been considered sufficiently, prior to 1885, to cause the New England Water Works Association to draw up a standard form for the summary of water works statistics, in that year. The form then adopted was slightly modified in accordance with the recommendation of the Committee on Uniform Statistics, and the revised form now in [illegible] adopted in [illegible]. Notwithstanding the fact that the form has proven satisfactory to all who have adopted it, and to others, it is now used by only one hundred of the members of the association. Perhaps this form will be amplified somewhat as time goes on, but even in its present form its adoption merits the careful consideration of all water works men. In this connection it is interesting to note that the American Water Works Association is adopting a uniform system of accounts which will include a form similar to the one adopted by the New England association. Final action on this matter will be taken at the coming convention of the association.

What we have said of water departments applies with equal force to other departments. Uniform statistics relating to sewerage, water and sewage purification, sidewalk and paving construction, etc., would be of great value. To take another illustration from the departments just named, it is agreed among sanitarians that uniform and authoritative statistics showing the operating results of sewage purification works now in use, is a matter of immediate, vital importance. We believe that all city officials should work toward more uniformity in the matter of arrangement of statistics in annual reports.

In addition to the summary already mentioned much toward increasing efficiency of operation by comparison can be accomplished by incorporating specific information of general interest in annual reports. If a water works superintendent, for example, has introduced an economy in the operation of his plant, he should devote a page or two of the report to a description of the new methods employed and the saving effected. A single illustration will serve to show the class of information to which we refer.

In the annual report of the Board of Water Commissioners of an American city, issued during the past year, two interesting pictures occupy facing pages. The pictures show the old and new way of hauling cast iron water pipe in that city. The old way consists of the famous "old army" combination of a Senegambian, a light wagon, and a mule. The new way shows two modern motor trucks, each manned with a crew of three men. We would be interested to know the cost of hauling pipe per ton mile by the two methods. A careful search through the report fails to uncover that bit of specific information. It seems to us that a third page giving the costs by the two methods would have added much to the value of the two pages already mentioned.

CONCRETE AND REINFORCED CONCRETE SECTION

Reinforced Concrete Gate Tower for the Morena Dam, San Diego, Cal., Water Supply.

[Staff Article.]

The Morena rock fill dam which impounds water to be delivered 30 miles to the city of San Diego, Cal., was described in our issues of Jan. 19, 1910, and Nov. 15, 1911. Figure 1 is a view of the dam in process of construction. Figures 2 and 3 show the reinforced concrete gate tower, the following description of which is compiled from a paper by Mr. M. M. O'Shaughnessy, Chief Engineer, in the Proceedings of the American Society of Civil Engineers, and partly from data furnished this journal by Mr. O'Shaughnessy.

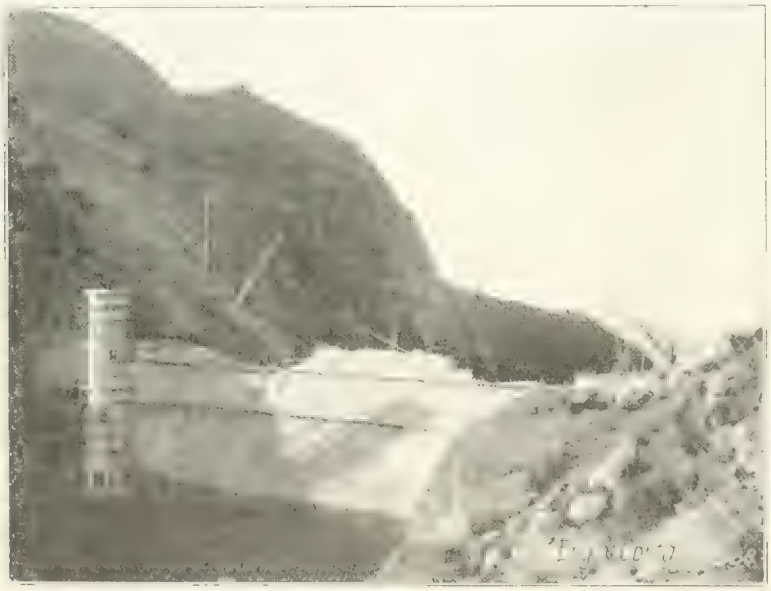


Fig. 1—View of Morena Rock Fill Dam Under Construction.

A tunnel 387 ft. [illegible] ft. high was carried through the dam at the 30-ft. contour. This tunnel is in solid bed rock and connects with the base of the tower. The gates which are operated for drawing off the water from the reservoir are operated through the tower. The tower is 15 ft. 6 ins. external diameter with walls varying in thickness [illegible] operating deck of reinforced concrete from which the outer gates are regulated. These gates are of the Coffin Valve Co.'s sluice type with vertical stems controlled by guides let into the concrete. There is a screen around each gate to prevent drift from entering the 24-in. pipes. The 24-in. circular cast-iron pipes connect with a 30-in. down pipe in the tower which discharge into the tunnel. Water may also be admitted through other intake pipes at different levels as shown by Fig. 2. These inlets to the tower are 28 ft. apart vertically. Between each opening and the down-pipe there is a curved, removable, bolted, flanged casting to enable the gates to be easily removed, if it is ever found necessary. Each is attached to Crane gates which are operated from platforms inside the tower at the different levels, and are used for emergency purposes only. The admission of water through the outer sluice-valves relieves the leaf-valves from any chattering effect developed by the spouting water which discharges into the down-pipe and flows freely through the tunnel. There is also an independent 24-in. cast-iron pipe which will be used for washing out the sediment which, in the future, may accumulate near the base of the outlet tower. This pipe passes through the foundation of the tower and is connected with the tunnel. The inner 75 ft. of the tunnel—in solid granite—is lined with concrete; it is connected with the base of the tower, and encloses the pipes which discharge at the floor of the tunnel, so that every precaution has been taken to obtain, at a moderate expense, as simple and safe an outlet as possible.

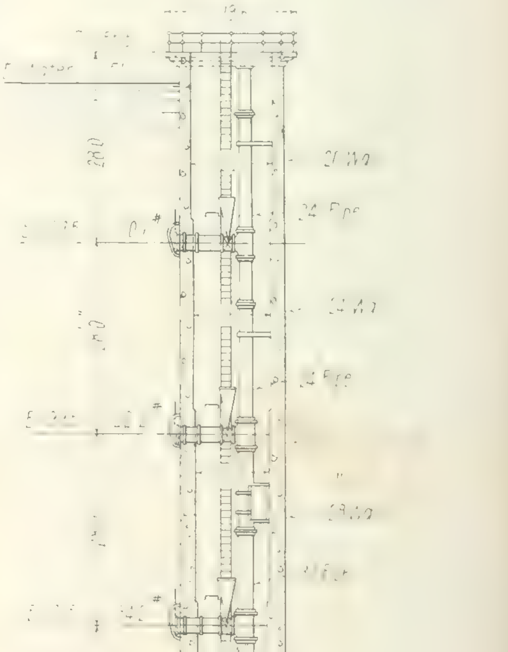


Fig. 2—Details of Reinforced Concrete Gate Tower, Morena Dam.

In the construction [illegible] tower scaffolding, Fig. 3, [illegible] and concrete, was used. This scaffolding consisted of five vertical 6x6 in. posts bolted together and braced by 2x8 [illegible] horizontally on 5 ft. centers. One set of exterior forms did the whole work. [illegible] of segments 4 ft. high by about 10 ft. long curved to the arc of the tower. These segments were made of 1x6 [illegible]

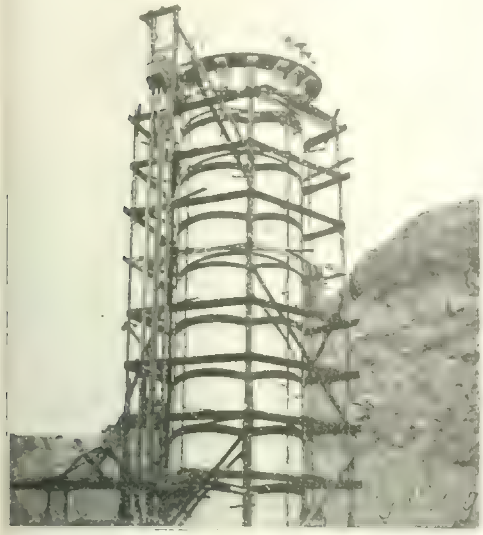


Fig. 3—View of Scaffolding and Concrete Hoist for Constructing Gate Tower.

braced by three rows of 2x8 [illegible]. The ends of these ribs had bolt holes for joining. The tower was poured in 4 ft. sections and the forms left on for about a week until the lower form was removed by unbolting the segments and hoisted up to position with a derrick which commanded the tower. Tapered blocks made of 4x6 in. wood were placed on the surface of each layer of concrete so as to form a groove about 4 in. deep and 6 in. in from the outer surface. These wooden blocks were removed when the concrete was partially set, and were cleaned and scraped and washed with cement mortar before the succeeding 4 ft. section was poured.

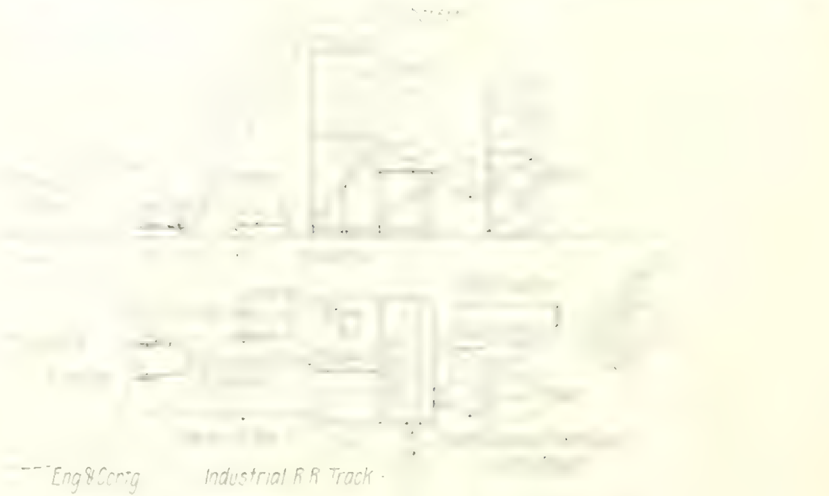
A small proportion of lime water was also used in mixing the concrete and all those precautions were taken to make the tower perfectly dry on the inside, and it does not show any leakage or dampness now under a head of [illegible] of water. The ends of the vertical reinforcing rods were bent and lapped and all rods were brushed free from all rust with wire brushes before being placed. As the granite rock from the crusher had considerable mica and quarry dust, it was washed as it came out of the crusher by a small stream of water from a hose, the fine material dropping through a perforated metal flume with three 3/16 in. holes on ⅝ in. centers. The sand was also carefully screened so that a first-class job has been accomplished.

A Compact Concrete Plant Lay Out for Constructing Concrete Flumes.

The design of any concrete mixing plant must of necessity depend upon local conditions such as the character of the country, the distance the raw materials have to be hauled, the class of construction, as well as the time in which the job is completed and the amount of money in the [illegible]. In cases where the general [illegible] are practically the same the details [illegible] will be more or less different. Therefore as there is no hard and fast rule or plant layouts the contracting engineer can do no better than study successful and economical concrete plant designs before deciding upon any arrangement.

As an example of a compact [illegible]

[illegible]

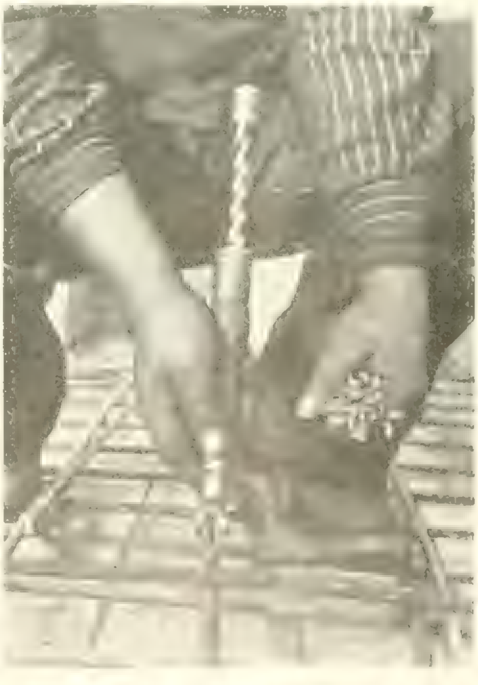


Concrete Mixing Plant's Layout for a Confined Space

[illegible] by side dumping cars running on an industrial [illegible] mixer. The crushed stone is raised by an elevator to the bins as shown and by one of two chutes is fed into an independent side dumping car on the same industrial track as the sand and cement cars.

The cement and sand are received, proportioned, and dumped into the mixer and then follows the stone from its car. Thus there are two operations for each batch. The mixed concrete is finally raised in the tower by a double drum hoist and deposited into the carts that deliver it to the point under construction. The concrete is proportioned generally 1:2:5.

The closeness of quarters is appreciated when it is noted that the extreme width of the mixing plant is 18 ft. and the length over all only 51 ft.



A Device for Wiring Reinforcing Rods at Intersections.

A Quick Operating Device for Wiring Reinforcing Bars.

[illegible] vice for wiring reinforcing rods at intersections [illegible] with the ends looped to form eyes. The tie [illegible] simply drawing the slide handle back twists the wire tight. This method of wiring gives a uniform and always secure connection, and [illegible] three times as rapid as the ordinary method. Any ordinary workman can use the tool. This tyer is manufactured by Clifford L. Miller & Co., New York city, and has been used by a number of railways and concrete contracting concerns.

Directions and Suggestions for the Inspection of Concrete Materials.

[illegible] Mich.

Although concrete is today used to advantage in several hundred different commercial forms, ranging from great engineering structures, containing thousands of cubic yards of material, to a fencepost containing only a very small fraction of a cubic yard, it is somewhat difficult to find in print a series of rules and directions to be followed in inspecting concrete work, which are based on current practice. It is generally assumed by writers that standards or methods of construction in this class of work have been long ago established and have become common knowledge. The series of articles of which this is the first has been planned in opposition to this assumption. The articles will describe current practice in the inspection of concrete work. This first article relates to the inspection of concrete materials. It will be followed by articles on the proportioning and mixing of concrete; forms and centering; steel reinforcement; transporting and placing of concrete; finishing concrete surfaces; and waterproofing concrete work.

Concrete is ordinarily composed of a matrix of cement mortar and an aggregate of broken stone or gravel, or a combination of broken stone and gravel. In other words, the ingredients of which the concrete is generally composed are cement, sand, broken stone or gravel, and water. Appreciating the value of more careful inspection, engineers should make a greater effort to familiarize themselves with the methods of determining the quality of the various materials used in concrete, and be able to intelligently pass upon their quality. If the quality of any one or more of these materials is poor, an inferior concrete is protunity for engineers more carefully to qualify themselves to pass upon the relative quality of concrete materials, so as to be able to determine by ocular examination and simple tests their comparative value for concrete work.

Cement.

Although there is a tendency among cement manufacturers to improve the quality of their material, yet this does not relieve the necessity of careful inspection of cement delivered for important concrete work. Engineers should not consider the careful inspection of cement purely as an additional refinement in connection with concrete construction, but as an absolute necessity, and should establish the unconditional rule of not permitting any cement to go into their work until they are fully satisfied by careful inspection that the cement is of good quality and capable of giving them the very best results.

Brand and Approval.—Before any cement is allowed to be used, the brand and name of the maker should be submitted to and receive the approval of the engineer in charge of the work, and no cement should be used that is not in all respects satisfactory to him.

Delivery of Cement.—All cement should be furnished in the original package, either in first-class barrels or in stout paper, cloth or canvas bags, which should be plainly marked with the brand or trademark of the manufacturer of the cement. It must be delivered in good condition, perfectly dry and free from lumps. Each barrel should be properly lined with paper or other material so as to effectually protect the cement from dampness. Any cement damaged by water to such an extent that the damage can be ascertained from the outside should be immediately rejected in toto and the barrels unopened. Barrels containing a large proportion of lumps should also be rejected. It is sometimes customary to count broken barrels, if otherwise satisfactory, as half-barrels. The cement may also be furnished in stout cloth or canvas sacks. The sacks should be good quality and sound. Sacks made of open material, or worn, should with their contents be rejected, or at the option of the engineer, accepted as a fractional sack.

Storage of Cement.—In order to allow ample time for the inspection and testing of cement, it should be stored in a suitable house or houses, provided by the contractor for that purpose. The houses should be sufficiently large so that the different lots of cement can be kept separate and readily accessible. The floor should be raised above the ground so as to keep the cement dry, and the sides and roof should be watertight to protect the cement from rain or the injurious effects of the elements. The cement should be piled in tiers in the storehouse in such a manner as to permit easy access for proper inspection, sampling and identification of each shipment. Each lot or consignment received should be piled by itself and its date of receipt plainly indicated. No sample should be taken by the inspector until cement is piled as herein directed.

Storage of Cement in the Open.—Storage of cement in the open should be limited to small quantities to be used immediately in the work. Bags of cement should not be piled on wet ground, but on planking, sidewalk, pavement, etc., so that no part of the package will be nearer than 4 ins. to the ground or pavement, and they should be stacked in compact piles which can be covered with tarpaulin in case of showers. The inspector should see that tarpaulins are provided and are ready for immediate use. The cement must not be allowed to become wet or damp under any circumstances and must be effectually covered so that rain cannot reach it.

INSPECTION AND TESTS OF CEMENT

All cement should invariably be inspected. It may be inspected either at the place of manufacture or on the work, or both, as may be ordered by the engineer. It may also be stopped in transit, on line of road, for a sufficient length of time to allow the lot to be sampled.

Lumpy Cement.—When used in the work, the cement must be free from lumps and partially or wholly set cement. If the cement becomes lumpy before being used, it may be thoroughly pulverized before mixing with sand. Lumps which cannot be broken up with a light blow of the shovel should be picked out, and any cement that has caked so as, in the opinion of the engineer, to be injured should be rejected, and immediately removed from the neighborhood of the site, in order to avoid all possibility of its being used on the work.

Uniformity of Product.—When a given brand of cement has been tested for some time and found to be fairly uniform in its action under the different tests, a sudden wide variation from this normal action in any kind of test should be looked upon with suspicion and should lead to more extended and longer time tests.

Extended Tests.—The engineer should make any other tests, or use any other means in his power, to gain information as to the quality of cement, and should by all means reject any cement which he is not fully satisfied is suitable for the work for which it is intended.

Adulteration.—The question of adulteration of cement may be determined either by chemical analysis or by inspection of the process of manufacture at the factory.

Sampling of Cement for Testing.—Samples for testing should be furnished at such times and in such manner as may be required. The selection of the sample for testing, the number of packages sampled, and the quantity taken from each package, must be left to the discretion of the engineer, but each sample should be a fair average of the contents of the package from which it is taken. Any cement showing by sample higher tests than those given should be required to maintain the average so shown in subsequent deliveries. The samplings may be thoroughly mixed together when taken so as to constitute as nearly as possible a fair average sample of the whole lot represented. For determining the characteristics of a carload of cement the individual samples may be mixed and the average tested; where time will permit, however, each sample may be tested separately. Many specifications state that cement drawn from several samples shall not be mixed or mingled, but the individuality of each sample package must be preserved. All materials taken from the same sample package may, however, be thoroughly mixed or mingled and the tests be made therefrom as showing the true character of the contents of the sample package. Cement in barrels may be sampled through a hole made in the center of one of the staves, midway between the heads, or in the head, by means of an auger or a sampling iron similar to that used by inspectors of flour or sugar. If in bags, the cement should be taken from the surface to center. The contractor should afford the engineer all reasonable facilities for sampling cement.

Tested Cement.—The inspector should receive a written approval from the engineer before permitting concrete to be made from any cement delivered and it should be his duty to make certain that only tested cement is used in the work.

Engineer's Decision.—The decision of the engineer to reject any cement should be considered final. In reaching a decision he may, according to his own judgment, assign to all or any of the tests such relative importance as he may consider proper under the existing circumstances.

FIELD INSPECTION AND TESTS

Tests of cement received upon the work in progress should be made to ascertain whether the article supplied is cement of a brand previously tested and accepted, and whether it is reasonably sound and active cement that will set hard in the desired time, and give a good hard mortar. No cement should be inspected unless delivered in suitable packages properly branded as stated above.

Cement Testing House.—The contractor should be required to furnish a small, rough board building or room on the work for cement testing, furnished with shelving, racks, benches and work table. A steam pipe should be run into the same and sufficient heat furnished to prevent freezing during the day or at night in cold weather. The expense of such, together with the fitting up and warming of the same, will, of course, be included in the whole work.

Simple Field Tests.—In addition to the usual tests the inspector should be required, from time to time, to make pats and balls of pure cement, and of cement mixed with sand, in order to satisfy himself that the cement going into the work is uniform in character and has not been injured by exposure to weather or in any other way.

Setting Qualities.—The setting or hardening qualities, as determined roughly by estimating time and by pressure of the thumbnail, should be observed; the hardness of the set and strength, by cracking the hardened pats or cakes between the fingers, and by dropping the balls from the height of the arm upon a pavement or stone and observing the result of the impact. The inspector may reject any cement which fails to set properly in sample pats.

Change of Volume.—Pats should be placed in water as soon as hardened sufficiently then raise the temperature to the boiling point for a few hours and observe the character and color of the fracture after sufficient immersion. This will give some idea of the character of the material—whether hydraulic, a Portland or Puzzolan, whether too fresh or possibly "blown," may be speedily and quite well ascertained without measuring instruments. When subjected to such tests, the cement should show no tendency to swell or crack.

Marking Packages.—Every bag or barrel of cement should be marked by the inspector, or other precautions may be taken so as to identify the lot from which it is taken and to insure that no cement is delivered for use in the work which has not passed the required tests. Any packages of cement which cannot be so identified may be rejected.

Cement Inspection.—The following method of inspecting cement has been successfully employed in a number of cities and is here stated for its simplicity. As soon as a carload of cement arrives for the contractor, the engineer should be notified at once. The bin in which the cement is placed may be tagged with white cards, about 4x6 ins. in size, bearing a serial number in large-size type and the word "HOLD," together with spaces for car number, number of bags in the car, and the bin number and date sampled. When the cement has passed the necessary laboratory tests, the white card may be removed and a pink one substituted, bearing the word "RELEASED." The inspector can thus see at a glance whether or not the contractor is using cement from an approved lot. When the bin is empty the pink card should be returned to the laboratory or to the engineer, as the case may be. It is customary every Saturday for the inspector to mail to the laboratory or the engineer a postcard stating the number of bags used from each bin or his work. Records are kept at the laboratory or in the engineer's office and the number of bags turned in checked up with the original number unloaded into the particular bin. If an additional precaution is considered necessary by the engineer in order to insure the use of tested cement only, the following method may be employed: The inspector should be required to attach a numbered tag, say 2 ins. long, to each bag of the carload in question. The number should be the same for the whole carload. When the carload is approved by the laboratory or the engineer the inspector is given the lot number of the released car. As the cement is used the tags are torn off by the inspector and at intervals turned in to the laboratory or to the engineer, where they are counted and recorded.

LABORATORY TESTS

Should the simple field tests stated above give unsatisfactory or suspicious results, then a full series of tests should be carefully made by professional inspectors [illegible] from the cement, either at the place of manufacture or on the work, in a manner analogous to that customary among engineers in the purchase of structural steel. The laboratory should be selected by or subject to the approval of the engineer. [illegible] pense of all tests should be borne by the contractor.

[illegible] ples sent to the testing laboratory [illegible]. Each sample must be accompanied by a manifest giving complete data [illegible] preserved in packages which thoroughly protect the cement from the atmosphere. No accurate results consist with the quality of the cement as it exists in the barrel or bag at the time of sampling will otherwise be possible.

Methods of Making Tests.—[illegible] eral, should be made in accordance with the methods proposed by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers, presented to the Society Jan. 21, 1903, and amended Jan. 20, 1904, with all subsequent amendments thereto, except where otherwise noted or required by the engineer.

Chemical Test.—A chemical analysis of the cement should account for at least 99 per cent of its component parts.

Fineness of Grinding.—A test to [illegible] the fineness of the cement should be made by thoroughly sifting about 2 lbs. of cement through a covered nest of sieves composed of No. [illegible] on top and a No. 100 [illegible] then weighing the quantities of cement retained on each of the two sieves. Fineness of grinding is to a great extent a direct measure of the cementing value, and with a well-burnt cement the high adhesive strength is developed by fine grinding that will intensify the activity of the greater proportion of the cement in the processes of solution, hydration, and crystallization that are operative in the hardening.

Time of Setting.—A test to establish the setting time of cement should be made by mixing the cement with sufficient water to make a stiff paste and determining the time within which "initial" set should take place and the limits of time within which "final" or "hard" set must occur.

[illegible] cement must be constant in its volume, so that when the product once hardens it will retain its normal volume and not be subject to internal reactions, tending to cause a retrogression in the strength of the concrete. The decisive test of this property should be, that pats of neat cement, made on a glass plate and kept in a damp atmosphere for 24 hours, and afterwards immersed in cold water or subjected to the atmosphere of the laboratory, will not show any signs of warping or cracking at the edges, even after the lapse of a considerable period.

Tensile Strength.—Tests to ascertain the tensile strength of the cement should be made both of neat cement and by mixing one part of cement to three parts of sand into briquettes, which are to remain in the molds for 24 hours, and then to be placed in water where they are to be kept for 27 days.

Results of Tests.—The results of the tests made in the laboratory should be accepted as a final criterion for the acceptance or rejection of any particular shipment of cement.

MILL INSPECTION AN[illegible]

When so required by the engineer, cement may be inspected and tested at the place where the same is being manufactured or stored, and before it is shipped for delivery.

[illegible] *Tests.*—The [illegible] be tested in the presence of and under the direction of the engineer or his authorized representative and in accordance with the specifications as interpreted by the engineer.

Records to be at the Disposal of the Engineer.—All records kept by the manufacturer and which relate to the matters subject to inspection should at all times be at the dis[illegible]neer.

[illegible] of the quantities of the raw material used in [illegible] for calcining, the calcining, the selection of clinkers for grinding, the grinding, the stor[illegible] the making of the barrels, the weight of the barrels ready for delivery, and the loading and shipment.

Scope of Mill Tests.—Tests may be required to be made to establish the identity and chemical characteristics of the raw materials used, of the degree of heat reached in calcining, of the chemical characteristics of the finished cement, fineness of grinding, setting qualities, constancy or soundness of volume, and last but not least of its tensile strength. The tests should conform to the standard requirements proposed by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers, as stated above for laboratory tests.

Test Samples.—The cement to be tested at the mill may be taken from the bins before barreling or from the cement after barreling, this being left entirely to the discretion of the engineer.

Routine of Mill Inspection.—The routine of mill inspection will consist of the manufacturer furnishing the cement in bulk or package, at option of the engineer, in sufficient time and quantities to permit all tests being performed before the cement will be required for shipment.

Cement Furnished in Bulk.—If cement is furnished in bulk, arrangements should be made which will permit of securing a sample satisfactory to the inspector. Provisions should also be made for sealing the spouts leading to and from the bins sampled.

Cement Sampled After Being Packed.—If the cement is sampled after being packed, each package should be plainly marked by the inspector for the purpose of identification, and should be so stored that it will be possible to obtain the packages represented by any one sample without it being necessary to handle others.

Setting Aside Special Bins.—The cement may be stored in bins set aside for the use of the purchaser. In case the manufacturer of cement has not the necessary facilities for setting aside special bins for this purpose until the time of shipment, samples may be taken while the cement is being packed, in which case the packages should be sealed immediately afterwards.

[illegible] of storing, sampling and shipping must be such as will meet the approval of the engineer or the inspector. When accepted cement is packed ready for shipment each package of cement should be sealed by the inspector with a leaden seal for identification. In some cases, it is customary for the city or railroad company to furnish the leaden seals. In order to guard against substitutions in transit, the cement should invariably be loaded under the eye of the mill inspector and the car may be sealed by him or the shipment otherwise marked by him in such a manner that any tampering with the individual packages or with the shipment as a whole can be easily detected.

Rejection of Accepted Cement.—In case cement is accepted on tests made on samples taken at the mill, it should be immediately rejected on its arrival at the work if it shows any signs of damage from moisture or other causes. In case packages already sealed are rejected, the seals should be immediately removed by the manufacturer or purchaser of the cement when notice of rejection has been received by him.

Field Inspection.—In cases where special conditions made inspection at the place of manufacture impracticable, inspection at the job may be substituted, subject, however, to the approval of the engineer. Field inspection has been discussed above.

[illegible]

No cement should be used in the work until it has been accepted by the engineer. The requirements to be fulfilled by the cement in order to be acceptable for construction work will not be stated in this article. The reader is referred, however, to the Specifications for Cement proposed by the Committee on Uniform Tests of Cement of the American Society of Civil Engineers, presented to the Society Jan. 21, 1903, and amended Jan. 20, 1904, and also later amendments.

Additional Requirements and Modifications.—All cement should be required to meet such additional requirements as to "hot water," "set," and "chemical" tests, as the engineer may deem advisable. The requirements for "set" may be modified where conditions are such as to make it advisable. In other words, in addition to the usual tests, all cement furnished for the work should be subject to such other tests as may be necessary to determine whether the cement possesses the proper qualities for the particular work for which it is designated.

Extended Tests.—The engineer may direct that tests be made, from time to time, of tensile strength and soundness, extending over longer periods than 28 days; if cement so tested shows a reduction of strength with increased age, or at any time fails in respect to soundness, the engineer may prohibit the future use of that brand of cement and require that another brand be substituted.

Sand, Broken Stone and Gravel.

The quality of the aggregate, is certainly of equal importance to the quality of the cement, and it is to be regretted that engineers have not more generally acquainted themselves with the value of various aggregates, as regards their adaptation for use in concrete work. It cannot be too strongly insisted that every possible precaution be used in the selection of materials which go into the concrete. While the selection is ordinarily governed by the materials obtainable in the locality, careful consideration should be given to the character of the work and the desired qualities in the finished construction. Local materials should invariably be carefully tested and not employed if found unsuitable, unless their inferior quality is taken into account in designing the structure.

[illegible]

Use of Material Without Screening.—If it is suitable for the purpose, material direct from the crusher or bank may be used without screening and subsequent mixing, but only with the permission of the engineer.

Impure Sand or Gravel.—Impure sand or gravel may be used provided the impurities be removed by washing, to the satisfaction of the engineer. The washing for small jobs may be done in almost any type of batch concrete mixer by simply revolving the mixer and letting the hose play inside without stopping. When the mixer overflows, the water will carry off the foreign matter. For larger jobs, however, other arrangements should be made subject to the approval of the engineer.

Platforms.—Platforms should invariably be provided upon which all sand, gravel and broken stone may be placed when brought upon the line of the work, and kept there until used, and any not so placed should be rejected by the inspector. This precaution is especially important in street pavement work, for if sand, broken stone or gravel are deposited directly upon the earth, it is difficult to avoid taking up earth and mud with the materials, especially when the street is wet and muddy.

Samples of Aggregate.—Samples of the sand, broken stone and gravel should be kept in the engineer's office as a standard for comparison during the progress of the work.

[illegible]

Fine aggregates may consist of sand, crushed stone or gravel screenings. Good sand and screenings being an important ele-

[illegible] following [illegible]

[illegible]—The sand should [illegible] of any moderately hard rock that is perfectly sound. Any sand showing any indications of chemical decay should be unconditionally rejected.

Sea Sand.—Sea sand, if used should be freed from salt, or the concrete will effloresce. In marine concrete construction this objection does not apply and sea sand is almost invariably used. Salt does not affect the strength. When sea sand is used for plastering or any work where the salt is liable to come to the surface and show, it should be thoroughly washed.

Selection Between Round and Angular Grains.—In the event of selection between round or angular grains, preference should generally be given to the round grained sand as it packs more closely, affords no opportunity for bridging and gives minimum percentage of voids.

Size of Grains.—The sand should be well graded from coarse to fine so that when mixed with the cement required it will produce a dense and compact mortar. That is to say, the sand should consist of a mixture of coarse and fine grains with the coarse grains predominating. The largest grains should pass when dry a screen of ¼-in. mesh, and in such proportion that the voids, as determined by saturation, should not exceed 33 per cent of the entire volume. No more than 6 per cent of fine aggregate should pass a sieve having 100 meshes per lineal inch. Fine sand should be avoided (it is difficult to mix evenly and this generally leads to poor results). If there is a large quantity of fine sand handy, get a coarse sand and mix the two sands together in equal parts; this mixture is as good as coarse sand alone. Sand should not contain an unreasonable amount of coarse particles.

Foreign Matter.—The sand must be free from quick sand, clay, loam, mica, sticks, organic matter, and other impurities. The sand may be moist but not wet. Under no circumstances should sand contain more than 3 per cent of perishable matter, nor enough clay or loam to render it unsuitable for the work. The sand may contain occasional pieces of small gravel. Sand containing mica should be rejected. No sand should be used for the outside finish of any concrete which contains small particles of coal or lignite, although sand of this character may be used in the interior portion of heavy pieces of concrete work.

Some engineers require that sand shall not contain clay or loam to the extent of more than ½ per cent when used for reinforced concrete work and shall be absolutely free from any other foreign matter. An addition of clay and (so-called) loam to sand, however, has been found in many instances to produce an actual increase in strength. The supposition is that it is because of the voids being more perfectly filled than if the sand was clean and sharp.

Color.—All sand used in concrete that will be exposed to view should be of a bright uniform color.

Screenings as a Substitute for Sand.—Screenings from crushed stone containing all the dust of fracture should not be used as a substitute for sand, without the permission of the engineer.

Crusher Dust or Screenings.—Crusher dust, passing a ¼-in. screen, from broken stone or gravel, may be substituted for a part or all of the sand provided the product thus obtained passes the prescribed requirements for natural sand. If the product of the crusher is delivered to the mixer so regularly that the amount of dust (as determined by frequently screening samples) is uniform, the screening may be omitted and the average percentage of dust allowed for in measuring the sand.

Testing Sand.—Sand should be tested for foreign matter, for adhesion of cement, for crushing resistance and also for fire resistance when used in building construction. In sampling the sand, care should always be taken to obtain an average sample.

Rejection.—In all cases the engineer should decide as to whether any sand offered by the contractor shall be used on the work. At any time, however, if the sand, crushed stone or gravel screenings delivered does not fully meet the requirements as stated above, it should be immediately rejected. Any sand or screenings showing signs of disintegration should be unconditionally rejected. The presence of any clay whatsoever may be sufficient ground for rejection. Sand containing over 5 per cent of mica or laminated particles may be rejected at the discretion of the engineer.

BROKEN STONE AND GRAVEL

Coarse aggregate generally consists of inert material, such as broken stone or gravel. In some cases gravel is preferable to broken stone as so many stones have a flaky cleavage and the rounded pebbles make a more even and sounder concrete than these flaky pieces, owing to the ease with which the sand and cement can fill the voids.

Quality of Broken Stone.—The crushed or broken stone should consist of pieces of hard and durable rock, such as trap, limestone, granite, or conglomerate and should be quarried from ledges and have a specific gravity of not less than 2.6. Aggregates containing soft, flat or elongated particles, should be excluded from important structures. Stone should be broken in cubical forms with angular fracture.

Granite.—Granite should be fine and uniform in grain and color, perfectly sound and free from sap, seams, dries, cracks and defects of any kind calculated to impair its strength, durability or appearance.

Limestone.—All limestone should be of the best quality of gray limestone, capable of standing without failure a pressure of at least 1,200 lbs. per square inch. It should be perfectly sound and free from sap, seams, dries, cracks or defects of any kind calculated to impair its strength or durability. Soft, white limestone should be excluded. When considerable fire-resistance is essential, i. e., reinforced concrete buildings, limestone and like materials liable to disintegrate or become calcined under the action of fire should not be used.

Sandstone.—Sandstone should be in strength, quality and freedom from defects fully equal to the limestone specified above.

Use of Either Broken Stone or Gravel.—Either gravel or broken stone or both may be used for the aggregate of the concrete. Whichever material is used should be hard enough and sound enough, in the judgment of the engineer, to be suitable for the work.

Size of Broken Stone or Gravel.—The size of broken stone or gravel should be proportioned to the sizes of the members in which the concrete is to be placed. In columns, slabs and small beams the maximum size of the stone or gravel should not run over 1-in., preferably not over ¾ in. and the minimum should be approximately ⅛ in. In members of larger proportions 1¼-in. broken stone or gravel may be used and in massive work 2-in. (or sometimes 2½-in.) broken stone or gravel may be used and where permitted by the engineer, rubble stone may be embedded in the concrete. A graduation of sizes of the particles should invariably be insisted upon. The maximum size of the coarse aggregate should be such that it will not separate from the mortar in laying and will not prevent the concrete fully surrounding the reinforcement or filling all parts of the forms.

Cleanliness of Broken Stone.—Broken stone should be clean and free from dust, dirt and other foreign matter, but may consist in part of fine screenings and medium-sized pieces. Disintegrated stone or broken stone containing mica should be rejected. When it is desired to use screenings with the crushed stone the proper proportion of sand to be used should be determined by analysis.

Cleanliness of Gravel.—The gravel should be clean and free from dust, dirt and other foreign substances, and washing of same should be required when considered necessary by the engineer, in order to render it sufficiently clean. In other words, gravel should be composed of clean pebbles free from sticks and other foreign matter and containing no clay or other material adhering to the pebbles in such quantity that it cannot be lightly brushed off with the hand or removed by dipping in water. When containing sand in any considerable quantity the amount per unit of volume of gravel should be determined accurately to admit of the proper proportion of sand being maintained in the concrete mixture. The gravel should be entirely clean and ready to mix into concrete when unloaded from the wagons.

Mixed Aggregate.—A mixture of gravel and broken stone may be used. Gravel when specified to be moved with broken stone, should be mixed with the broken stone in the proportion not exceeding 50 per cent; but it is preferable not to use this mixed aggregate in any reinforced concrete work.

Natural Mixture of Bank Sand and Gravel.—Naturally mixed bank sand and gravel are sometimes found in the right proportions for making concrete. Great care should be exercised in using this class of material, owing to the likelihood of there being far too much sand for the gravel. Frequent tests should be made to see that the proportions of the coarse and fine grains are correct. Generally it is far more satisfactory to screen the sand out of the gravel and prepare the materials in the usual way.

Testing.—Broken stone or gravel should be tested for adhesion to cement, crushing resistance and also for fire resistance when used in building construction.

Rejection.—At any time, however, if the broken stone or gravel delivered does not fully meet the requirements as stated above, it should be rejected. Piles or heaps having any admixture of dirt or stone of a larger size than specified should be unconditionally rejected. Any stone which shows a tendency to break into flat, thin pieces, should also be rejected. No soap stone or rotten stone should be allowed whatever.

MISCELLANEOUS MATERIALS

Slag.—Only the best quality of hot pot slag, free from dust and foreign matter, should be used. Slag for concrete work should be nearly free from sulphur or other injurious agents and must be hard and not spongy. Judging a slag from the analysis of a small sample is not safe, because its composition varies with changes in the operation of the furnace or in the nature of the materials being smelted. A slag some months old is preferable, as aeration has had opportunity to remove the sulphur.

Cinders.—Cinders should be composed of hard, clean, vitreous clinker, free from sulphides, unburned coal, or ashes. Cinders for reinforced concrete should be a good quality of steam cinders containing not more than fifteen per cent of unconsumed coal.

Burned Clay.—Hard-burned clay should be made from suitable clay, free from sand or silt, burned hard and thoroughly. Absorption of water should not exceed 15 per cent.

Crushed Slate or Shale.—Crushed slate or shale should not be used in reinforced concrete construction.

Water.—Only fresh, clean water, free from ashes and other impurities, should be used. The water used in mixing the concrete should also be free from oil, acid, strong alkalies, or organic matter. Water carrying in suspension considerable quantities of mineral or vegetable matter should be unconditionally rejected. It must also be free from iron or other impurities that tend to discolor the concrete. Water should by all means be free from mineral salts which are detrimental to cement work. Sea water should not be used for mixing concrete. In case it becomes necessary to use sea water, where pure water cannot be obtained, the latter may be used, but careful tests must be made at all times. The use of water strongly impregnated with lime weakens the strength of the concrete and should be avoided wherever possible.

Method of Estimating Cost of Standard Reinforced Concrete Highway Bridges of Illinois Highway Commission Through Girder and Slab Types.*

[illegible] papers presented [illegible] by Mr. [illegible] N. Johnston [illegible] the Illinois Highway Commission [illegible] Clifford Older and H. [illegible] of the Department, have [illegible] manner in which engineering services are rendered on bridge matters by the Illinois Highway Commission to the various township, county and municipal officials throughout the state.

The purpose of this paper is not to discuss the practice of the Illinois Highway Commission in the design of concrete highway bridges, but to develop a ready [illegible] the approximate number of cubic yards of concrete in a completed structure of a known span, height of abutments and length of wings, as well as to develop a means of making preliminary estimates of the cost of completed structures without calculating the quantities in detail.

The bridge work of the Commission requires a personal inspection of the bridge site with the local officials, and at this meeting the necessary data are obtained for the design of the bridge. Almost invariably the officials expect that an estimate of the cost of the proposed work be given them at this time. Consequently, it is desirable to be prepared to give an estimate of the proposed bridge that will closely approximate the one that is made from the detailed drawings. This is usually a somewhat difficult matter unless the time is taken to compute the number of cubic yards that will be in the bridge.

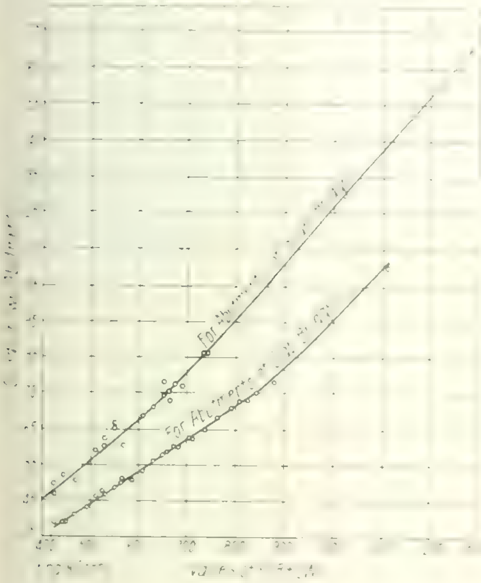


Fig. 1.

With the increased interest in concrete bridge work the past four or five years, it is needless to say that the Commission has been called upon for engineering assistance more frequently each year, until today it is almost impossible to meet all the requests. For this reason a system of [illegible] devised and all computations tabulated. This greatly improved the office efficiency and made it possible to answer a larger number of requests.

[illegible] in our office it has [illegible] to do considerable figuring to determine the best make up for a bridge. Frequently a series of small slabs on piers would sum up much cheaper than the larger spans, and vice versa. It is sometimes advisable to compare a steel bridge for the same site. With the curves that were worked out by Mr. H. E. Bilger and presented to this Society last [illegible] cost of a steel bridge complete. It, therefore, became desirable that some ready means be [illegible] ber of cubic yards in concrete slab and girder bridges for both office and field use.

From the large number of computations we have made of various concrete bridges, it was thought possible that a complete tabulation of quantities or a system of curves could be [illegible] mine readily the contents of either the slab or the girder type of bridges. It is proposed, therefore, to correlate all computations and data on the flat top type of bridge, and to arrange it in a convenient form for both office and field use in determining the number of cubic yards in ordinary bridges, besides obtaining an approximate estimate of the cost. Before proceeding, however, it may be well first merely to outline in a general way the slab and the girder bridges as designed by the Illinois Highway Commission, and give a few dimensions that you may better understand the types of bridges under consideration.

For reinforced abutments for slab bridges the main wall is made 12 ins. thick from top to bottom, the steel reinforcing being placed on the stream side, and the percentage of steel increased as the height increases. The abutments rest on an 18-in. reinforced footing, which is made of sufficient size to allow but 3,000 lbs. per square foot bearing on the foundation. When a soft foundation is encountered, this same size footing is usually sufficient to permit the proper spacing of the required number of piles. The reinforced wings for slab bridges are of the standard cantilever type, the base being 33 per cent of the total height. The wing wall proper is 12 ins. thick for heights up to 16 ft. For greater heights the base of the wall increases in proportion to the height. Nearly all wings for this type of bridge have a drop of 18 inches to 5 ft. at the end to conform to the 2 to 1 slope on the sides of the road. I may say here that the cantilever type of wing for extreme heights has been found much more satisfactory than the buttress type, as the increased thickness at the base and the large percentage of steel does not equal the extra cost of forming necessary for the buttress type.

Reinforced concrete slab bridges are designed with various roadways, ranging from 16 ft. upward. The side rails usually average 8 ins. thick and 3½ ft. high. On this type of bridge the slab and the side rails come flush with the back of the abutment walls. The top of the wings comes up along the outside of the rails to catch the side slope on the road. In determining the thickness of the slab, its entire dead load is considered, the load of the cushion wearing surface, and 24-ton engine live load. Excluding temperature stress, the steel is figured at 12,000 lbs. per square inch; the compression in the concrete is assumed at 800 lbs. per square inch.

For the reinforced abutments for girder bridges, the general type is the same as that for the slab bridges, with the exception that all abutment walls proper are 18 ins. thick, and the width of base for the wings is 40 per cent of the total height. The extra thickness in abutments is for bearing of the girders. The extra width of base under the wings is for stability, as the wing walls are cut away from the abutment walls proper by a 1-in. partition to allow for expansion of the superstructure. They can, therefore, receive no support from the abutments, as is the case with wings on slab bridges. The wings on this type of bridge also come up on the sides of the girders and drop several feet at the ends to follow the general side slopes on the road.

The reinforced concrete girder superstructures are designed with roadways from 16 ft. to 30 ft. The roadway usually required from 4 ft. to 6 ft. in height, and 16 ins. to 30 ins. wide on the top. On the side girders there are heavy depressed points to lighten the web and to give the proper appearance to the finished bridge. The floor slab and side girders on this type of bridge also extend to the back side of the abutment wall. The floor slab is designed to carry its own dead load, the cushion wearing surface and a 24-ton engine live load. The side girders are designed to carry the entire dead load of the superstructure, plus a live load of 125 lbs. [illegible] engine, whichever gives the greater moment.

For the purpose of determining off-hand the approximate yardage in a pair of reinforced concrete abutments for either slab or girder bridges, Fig. 1 has been prepared, and is applicable within the specific cases used. For abutments of slab bridges, 40 different designs were taken from the files of the commission, and the number of cubic yards in the two abutments of each design was plotted against $H\ (R + 2W)$. H is the distance from the finished roadway to bottom of footings, R is the clear roadway of the slab bridge, and W is the length of one wing measured on the steam side. R was taken as the clear roadway of the bridge, as this figure is always secured at the preliminary inspection of the bridge site. W, the length of the wing, can always be assumed in the field or computed in the office, knowing first the general conditions of the bridge site.

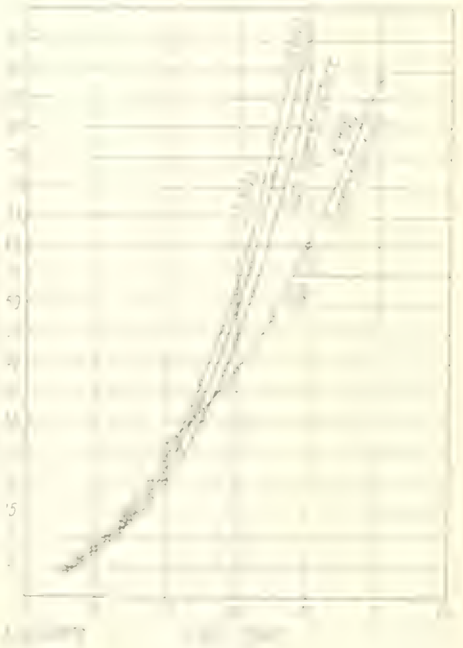


Fig. 2.

It will be noticed that the number of cubic yards in the two abutments varies approximately as the height of the abutments; also, that the maximum deviation from the curve does not exceed 2 cu. yds., and more often it is less than 1 cu. yd. In fact, for heights of abutments up to about 16 ft., or where $H\ (R + 2W)$ does not exceed 900, the quantities so plotted follow practically a straight line, and might be represented by the straight line formula, cubic yards $= .09 \times [H\ (R + 2W)] - 1.37$, which often times is convenient when the curve sheet is not at hand.

For a particular bridge, suppose the distance from the crown of finished roadway to bed of stream is 10 ft., and the footing should [illegible] Then, $H = 14$ ft. Now assume the wings are each to be 13½ ft. long, and that our finished bridge will have a 16 ft. clear roadway. We have now $H\ (R + 2W) = 600$, the value to be read at the bottom of Fig. 1.

It will be seen by locating the point on the curve and going across to the left-hand side that there are about 53 cu. yds. in the two abutments. Where the quantity at the bottom of the figure exceeds 900, we readily see that the curve begins to rise above the straight line. This is expected, as abutments exceeding 16 ft. in height have the base of the wings spread to allow for the proper per cent of steel. This extra width of base is added to the back of the wing wall by a batter, the batter extending up from the footing 4 ft. to 8 ft., according to the height of the wall. This batter does not extend to the top of the wall, as the drop at the end of the wing would increase its thickness at the end, and this does not give the best appearance to the finished bridge. The abutment walls remain 12 ins. thick up to 21 ft. high, and from here on the thickness increases as the height increases. The slight variation from the curve in solving specific cases may be attributed to the difference in the angle of the wing with respect to the abutment, and the difference in width of footing for bearing. The more nearly the direction of the wing approaches a parallel with the center line of the road, the higher will be the wing at the end, thereby increasing the number of cubic yards, but as the corner formed by the intersection of the abutment wall and wing is measured twice, these two quantities tend to compensate one another.

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*[illegible] paper [illegible] before the Illinois Society of Engineers and Surveyors, [illegible]

For the reinforced abutments on girder superstructures 25 designs were taken from the files of the commission, and the number of cubic yards in the two abutments plotted against $H\ (R + 2W)$, the notation being the same as before.

It is to be noted here that the number of cubic yards is somewhat greater than the number of yards in the abutments for slab bridges. This is due to the extra thickness of the abutment walls proper, to give the desired bearing and to the extra width of footings under the wings. It will be noted on this curve that some of the specific cases used had a wide variation from the mean. This can be attributed to the fact that some of the abutments had extremely long wings that were level on top and also the different length of spans requires a little different width of footing under abutments to take the required bearing. A curve of this kind could not take into account all of these conditions, and while several points fall several yards off of the curve, the mean is close enough for the purpose that it is to meet.

For a particular case, take the same dimensions that were considered before; clear roadway 16 ft., height 14 ft., and length of wings 13½ ft. We now have 600 to read off at the bottom of Fig. 1. Getting the intersection with the curve for girder substructures, we find that the two abutments contain 67 cu. yds. instead of 53 cu. yds. in case of the slab substructure, a difference of 14 cu. yds. in favor of the slab bridge. Fig. 1 then is a ready means of comparing the substructures of the two types of concrete bridges and to determine the approximate number of cubic yards in each.

The next thing of importance is to determine the number of cubic yards in the superstructures of the two types of bridges. For this, Fig. 2 has been prepared, and is applicable for the flat top type of bridges up to 50 ft. in span. For slab superstructures 48 designs of different roadways and spans were taken from the files of the Commission, and the total number of cubic yards in the superstructure was plotted against the clear span length, the curves drawn through the points having 16 ft., 18 ft. and 20 ft. roadway. The three curves will meet the requirements of a majority of highway bridges. Occasionally a special case arises, such as a skew, or extra wide roadway, and then it is necessary to make special computations to determine the number of cubic yards. For a specific case, assume a bridge to have a 30 ft. clear span and 16 ft. roadway. We readily see the number of cubic yards to be about 43.2.

We may wish to consider for the same site the 30-ft. girder type with 16-ft. roadway. Here we see that the number of cubic yards is about 38.6, or a difference of 4.6 cu. yds. in favor of the girder superstructure. But you will notice for the same height substructure the difference in all cases is in favor of slab bridges. If it should happen that for a single span the girder bridge and the slab bridge should have the same yardage, an advantage still rests with the slab type, as it has been found that contractors usually bid more favorably on this type. There is also another very important point in favor of the slab type. If for any reason there should be any defective material placed in the rail, or poor alinement in its construction, it may be torn down and replaced without disturbing the floor, even after the false work has been removed.

Having found the expression that is the measure of the number of cubic yards in the abutments and superstructures of concrete slab and girder bridges, the next step is to combine the quantities with a unit price that we may determine the approximate cost of each type. For this purpose Fig. 3 has been prepared.

It has been found from the cost data of a large number of slab and girder type concrete bridges that have been built under the supervision of the Illinois Highway Commission, that it is possible to get a very close figure on each individual item that goes to make up the cost of the bridge. (1) the cost at the bridge site of sufficient cement to make one cubic yard of 1:2½:4 concrete. (2) the cost of the necessary lumber for forming one cubic yard. (3) the cost of reinforcing steel per cubic yard of concrete. (4) the labor cost in mixing and placing 1 cu. yd. of concrete. (5) the cost of sufficient aggregate to make 1 cu. yd. of concrete. (6) the cost per cubic yard of concrete to make the necessary excavation to start the concrete of the footings. The two items that largely control the cost of a structure of this kind are the excavation and the necessary aggregate for the concrete. We find that the cost per cubic yard of concrete for cement, forms, reinforcing steel, and the mixing and placing, have narrow limits of variation.

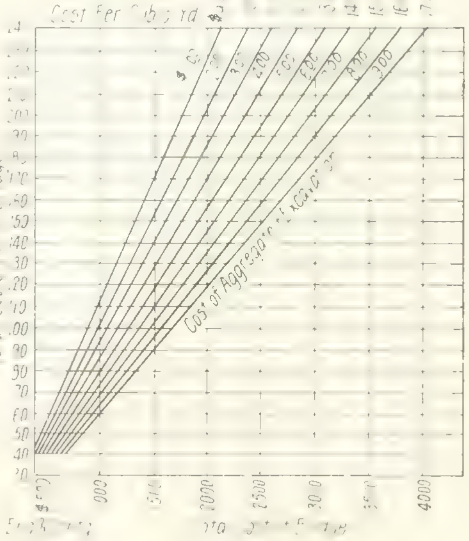


Fig. 3.

It, therefore, appears possible that some definite quantities may be fixed to the first four items and a curve plotted for the last two, combining them in such a way that the total cost may be readily determined after we have learned the number of cubic yards in the bridge.

The cost at the bridge site of sufficient cement to make one cubic yard of concrete for a 1:2½:4 mixture may vary from $1.75 to $2.10. While the price of cement, the distance it has to be hauled, and the amount required for some aggregates, vary slightly, the extreme variation would not be over 20 cts. per cubic yard from the average. From a general average of all cost data on this item, it would seem that we are probably safe in choosing for cement about $1.90 per cubic yard of concrete.

The cost of forms includes all the necessary false work, bracing and from lumber for completing the bridge. While this item varies somewhat for different localities, and will vary again where the contractor can use some of his old lumber, it will fall between the limits of 75 cts. and $2.50. Experience has shown that about $1.50 for the ordinary type of bridge is usually sufficient and might well be chosen for this cost curve.

The reinforcing steel varies from 50 lbs. per cubic yard for substructures to 170 lbs. per cubic yard for superstructures, or an average of about 110 lbs. for the two combined. This steel delivered at the bridge site under ordinary conditions and bent ready for placing in the structure will cost about $2.10.

The item for mixing and placing concrete might vary from $1.50 per cubic yard for crushed rock concrete mixed by hand to possibly as low as 40 cts. for gravel concrete mixed by machinery. This item should also provide for the necessary work in spading the concrete next to the form and securing the desired finish. In spite of the possible wide variation, we find the cost of this item varies but little from the fixed amount of $1.25. While all these quantities given above may seem somewhat in doubt as to their reliability, yet experience has determined that they are not far from the correct figures for normal conditions on the average bridge.

The item of excavation, which includes also cribbing, sheet piling, pumping, and all necessary work to start the concreting of the footings, has been found from the cost data on file to vary from 50 cts. to $5 per cubic yard of total concrete in the bridge. The 50 cts. per cubic yard is found only in some very favorable cases, and on the smaller spans, for there is practically no cribbing, sheeting or pumping necessary. On the other hand, the cost of $5 per cubic yard of concrete is caused by a soft, seepy soil where cribbing, sheet piling and excessive pumping are necessary. Quite often the wide variation in the item for excavation is due to poor management on the part of the foreman in charge. This item, therefore, may vary considerably, but with experience with the excavation that is to be handled and with the type of bridge that is to be built, one is able to estimate this item sufficiently close for all practical purposes.

It will be seen that the cost of the aggregate delivered to the bridge site is the second item determining the price per cubic yard of concrete. Under the most favorable conditions with respect to location of a satisfactory aggregate supply, it would likely cost at least 50 cts. per cubic yard to haul it to the mixing plant. On the other hand, the cost of aggregate at the bridge site might exceed $4 per cubic yard, as the structure may be isolated from a railroad station, and it may be necessary to ship in either gravel or crushed rock and sand, besides hauling it several miles into the country. In the light of the wide range on these two items, Fig. 3 has been prepared to give the total cost of the bridge complete, including profit to the contractor under conditions where the cost of excavation, plus the cost of aggregate at the bridge site, might vary from $1 to $9.

For a specific case, we will assume that a concrete bridge has 120 cu. yds. of concrete. We will next investigate the condition of the foundation, and assume the cost for completing this part of the work, and express it as so much per cubic yard of concrete. We then approximate the cost of delivering at the bridge site the necessary aggregate to make 1 cu. yd. of concrete. For convenience let us say that these two quantities amount to $3 per cubic yard of concrete. Entering Fig. 3 with 120 cu. yds. at the left hand side, and following this across to the $3 curve, or the $11 per cubic yard, which is the same thing, and then to the bottom of the figure we find the cost of the bridge complete to be $1.300. The total cost per cubic yard of concrete is shown at the top for aid in determining the unit price.

From the figures heretofore given, we are able to determine approximately the number of cubic yards in either the slab or the through girder type of bridges, besides having a ready means of determining the probable cost. While the curves here developed apply only to the slab and through girder [illegible] bridges, similar curves might [illegible] veloped for the deck girder, [illegible] der floor beam type, or the [illegible]

EARTH AND ROCK SECTION

A New Type of Scraper Bucket and Excavator Engine.

The Aetna Sand & Gravel Co., of Chicago, have recently secured a new type of drag scraper bucket and an improved type of engine, designed especially for the severe duty entailed by drag scraper work. This equipment is to be used on their new excavator at their plant near Algonquin, Ill. The bucket is known as the Holcomb Back Dumping Drag Scraper Bucket, and is made by the Clyde Iron Works, Duluth, Minn. One of these buckets has been in operation during the past year at the Grayselon Farms, and also near West Duluth.

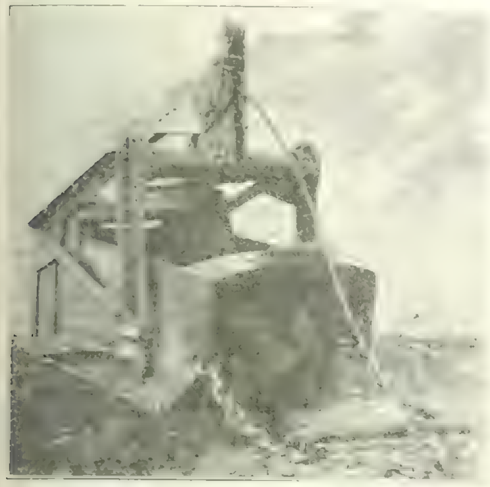


Fig. 1—View of Holcomb Back Dumping Drag Bucket.

Evidently the primary reason for designing the bucket was to avoid the trouble experienced with the front dumping types because of the excavated material's sticking and packing in the back of the bucket, necessitating delays for cleaning out. The bucket has been worked in exceedingly sticky red clay, but no trouble was experienced or delays occasioned by the material's adhering to or packing in the bucket, as each succeeding bucket load pushed back any material adhering to the inside of the bucket and it passed out when the next load was dumped. Another feature is that the material being discharged from the rear of the bucket passes out in the same direction that the bucket is moved when being swung out—that is, it dumps away from the machine instead of towards it, thereby gaining from 10 to 15 ft. in the working radius of the machine. The bucket may also be cast out beyond the point of the boom for taking a load, in the same way as is done with other buckets.

The bucket is illustrated in Figs. 1 and 2, showing closed and open positions. The scoop is open in front and is suspended from the boom by a line attached to the steel frame, as shown. The frame carries a heavily re-enforced steel plate which covers the back end of the scoop when in closed position. As will be seen, the operation is very simple. The carrying frame is trunnioned on pins located ahead of the center of gravity of the scoop so that when tension on the digging line is released, it tips back, thus opening the rear end and discharging the load. There is no operating mechanism in contact with the material being excavated that can become clogged or inoperative.

The bucket is regularly built with a manganese steel cutting lip. Either manganese or tool steel teeth may be attached, if desired. T[illegible] manganese steel. The buckets are made in six sizes ranging from ¾ to 3 cu. yds capacity.

Several of the features of the engine are also worthy of mention, as they mark a step in advance in the design of engines for this

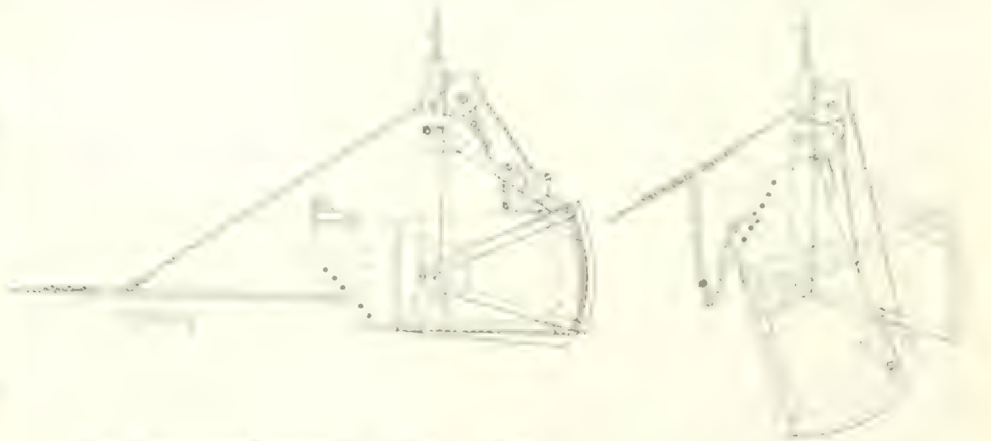
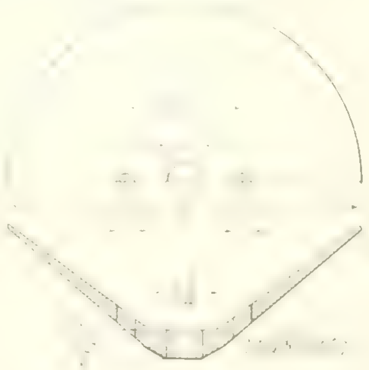


Fig. 2—Sketches Showing Closed and Open Positions of Holcomb Bucket.

class of service. When the drag scraper type of excavator first came on the market, the ordinary hoisting engine was used for pulling [illegible] for such hard service; an engine was then brought out having the front drum only compound geared and having outside band type of frictions instead of the cone type; but as later tests and experience habe shown that there are periods in the cycle of operations when the load on the hoisting line is as great as that



Disc Anchor for Mooring Floating Plant.

on the digging line, the Clyde Iron Works have brought out this new engine having both the digging and hoisting line drums compound geared. As the digging and hoisting drums are geared alike, the engine can be used with either a drag scraper or a grab bucket. The drums of this engine are extra large and are operated by frictions of the outside band type, set by oil pressure in thrust cylinders located on the gears.

It has been customary heretofore to line the inside of brake bands with a renewable block or bfire-rubbing surface; but in this engine the asbestos fibre-rubbing surface is secured directly to the circumferential face of the drum flanges, thereby preventing the cracking of the glaze on the surface of the fibre, and, as the frictional contact is on the outerside of the fibre instead of the underside, with only the metal band over it, the energy transformed into heat in braking the load is radiated much more readily to the atmosphere.

Mounted between the cylinders at the back of the engine is a peaking drum operated by power through a self-locking worm and worm wheel. This enables the operator to raise or [illegible] permits the working radius of the boom to be varied under the load, when it is desired to use the excavator as a power derrick in dam construction. The power connection to the worm shaft can be thrown out of mesh by the shift of a lever. On the outboard end of the drum shaft is mounted a ratchet wheel and ratchet, by the use of which the boom can be raised or lowered by hand when the machine is idle, without the necessity of getting up steam.

A very important feature from the standpoint of the contractor in the construction of the engine is the fact that not only the gearing, but the main frames, cross-girts, ratchets and drums are all made of Open Hearth Cast Steel, which makes the engine lighter and easier to handle and avoid breakdowns and delays. The Clyde Iron Works manufacture this engine in three sizes, namely, 7x10, 9x10 and 10x12ins. The main sales office is at 318 Fisher Building, Chicago, Ill.

A Disc Anchor for Mooring Floating Plant Upper Mississippi River Improvement.

Contributed by E. F. Linderman, U. S. Engineer Office, Dubuque, Iowa.

Disc anchors are effectively and economically used by the U. S. Government engineers in mooring dam building and hydraulic dredging outfits, improving the upper Mississinei River. The former methods of mooring outfits were the use of common two-fluke anchors weighing from 700 to 1,000 lbs. each, timber cribs filled with rock, brush mats loaded with rock, and piles; all of which were more or less expensive as to money cost and time required in placing and removing them. In nearly all cases, also, the moorings had to be removed to avoid any possibility of them becoming an obstruction to navigation.

The disc anchors used are made of cast iron in the shape of an inverted mushroom, weigh about 50 lbs. and are 20 ins. in diameter, the metal tapering in thickness from 1½ ins. at the center to ¼ in. at the edge, with a center hole of 2 ins. for the insertion of the jet pipe and two holes of 1 in. in diameter 3 ins. from and opposite the center for the wire [illegible] ¾ [illegible] cable is used, [illegible] and fastened at the anchor with [illegible] the free end provided with a [illegible] iron ring in which manila ropes are fastened.

A 30-ft. pipe, attached with rubber hose to a deck pump (with which all steamboats are equipped), and supplied with a short nozzle (to be inserted in center opening of anchor) [illegible] necessary in planting the anchors. The weight of the pipe holds the nozzle in position while lowering the anchor by the cable to the bed of the river and follows with its position unchanged as the action of the jet of water buries the anchor in the sand. The pipe is raised as soon as the pump is stopped, leaving the anchor embedded in the sand. A buoy attached to the free end of the cable indicates the location of the anchor. Ordinarily, in sand, the scouring effect of the jet of water is sufficient to allow the anchor to be buried 12 to 15 ft. deep in ten minutes from the time of starting the pump. The anchor is easily raised by winding the cable on a capstan until in a perpendicular position, down which the jet of water is guided until anchor is free.

The holding power of the above-mentioned anchor, embedded in 12 to 15 ft. of solid sand, on a horizontal pull, is greater than the breaking strain of a high grade ¾-in. wire cable.

ROADS AND STREETS SECTION

Some Results of a Statistical and Economic Investigation of Road Conditions in the United States.

The U. S. Office of Public Roads has completed an investigation to ascertain the mileage of improved and unimproved roads in the United States and the cost of the various types of construction. This investigation was begun in November, 1909, and was completed about June 30 last. The last government figures regarding road mileages in this country were for the year 1904. According to the 1904 statistics there were 2,151,379 miles of public roads in the United States, not including Alaska and insular possessions, but, according to the 1909 figures, there were 2,199,387 miles. In 1904, 153,531 miles of roads were reported as improved, but in 1909 there were 190,467 miles improved. In other words, the percentage of all roads improved has increased from 7.14 per cent in 1904 to 8.66 per cent in 1909. The improved-road classification includes only such roads as have been properly graded, drained, and surfaced with hard material, such as stone, gravel, sand-clay, brick, shell, slag, etc., as well as those which have been surfaced with hard materials and treated with bituminous preparations.

During the spring of 1910 an investigation was begun by the Office of Public Roads to ascertain the economic effect of road improvement upon communities. In this work counties were selected in which the roads were exceedingly bad and in which bonds had been issued for the purpose of improving the main roads. A preliminary study of these counties was made after the bonds had been issued and the roads selected, but before the actual work of improvement had begun. The amount of bonds issued and the names of the counties included in this investigation are as follows: Spottsylvania County, Va., $100,000; Dinwiddie County, Va., $105,000; Lee County, Va., $364,000; Wise County, Va., $700,000; Lexington Township, Davidson County, N. C., $100,000; Beat No. 1, Lauderdale County, Miss., $200,000; Russell County, Ala., $100,000; Dallas County, Ala., $250,000; Manutee County, Fla., $250,000; Wood Township, Clark County, Ind., $10,000; Riverton Township, Mason County, Mich., $20,000. The total amount of bonds issued in these counties is $2,268,120. A personal investigation and study is to be made in each of these counties and townships each year until the roads have been improved, and until the beneficial effects from such improvement can be clearly ascertained. The results already accomplished indicate that the final report on this project will be a powerful argument for road improvement.

Reports received from the principal shipping points in most of these counties indicate that the incoming shipments of farm produce far exceed the outgoing shipments. At the county seat, which is the principal shipping point of one of these counties, the incoming shipments of farm produce, as ascertained from the railroad company, in 1909 were 13,042,803 lbs., while the outgoing shipments were only 4,434,380 lbs. At another point in one of these counties the incoming shipments of farm produce during 1910 amounted to 13,120,986 lbs., while the outgoing shipments amounted to only 1,471,937 lbs. At the principal shipping point in another county the incoming shipments amounted to 8,262,724 lbs., while the outgoing shipments were 1,200,704 lbs.

The agricultural lands in the counties above referred to are considered fertile and, with improved roads, it is believed that they would not only produce enough for local consumption but would create a supply for shipment to other points.

A careful study is to be made in all of these counties before and after the roads are improved in regard to the value of the land, the character of crops hauled to market, the size of loads, the distance the various products are hauled to market, the cost of marketing crops, the areas under cultivation, the condition of schools and farm life, the efficiency of rural mail delivery, etc. A careful photographic record is to be made of each of the roads. These photographs will show the condition of the roads before and after improvement, the methods of construction employed, as well as the character and extent of traffic before and after improvement.

In the counties where this investigation has now been in progress for two years it has been found that the price of land lying along the improved roads has already increased in value from 50 to 100 per cent. Heretofore the roads have been so bad that it has been a common practice in many of these counties to open the schools in August and close them during the early winter, so as to avoid the bad roads.

Extensive mining operations are carried on in two of the counties included in this investigation. The mining towns afford an excellent cash market for farm produce, but the local production does not begin to supply the demand. In fact the records of the railroad companies show that the incoming shipments of food products exceed the outgoing shipments at the rate of about 10 to 1, and that they are of the kind that could be produced in the counties to which they are shipped. One of the reasons for this condition of affairs is that the roads are so bad that hauling can not be done at a profit during a considerable part of the time.

Determination of Free Carbon in Bituminous Compounds by a Centrifugal Method.

The methods for the determination of free carbon in bituminous compounds, as ordinarily employed, depend generally upon the solution of the soluble bitumen in carbon bisulphide, benzol or other volatile solvent, filtering out the free carbon and weighing same. This requires usually four weighings and the handling of a considerable quantity of the solvent, especially for the washing, with the danger from fire accentuated with the use of the most usual solvent, carbon bisulphide. In addition, time is sometimes an important factor, so that a method that will enable the determination to be made within a half hour with practically no solvent exposed to the atmosphere and with reasonable accuracy, would seem to be of value to the chemist.

At the recent convention of the American Association for the Advancement of Science, Mr. W. H. Fulweiler, Chemist of the United Gas Improvement Co., describes a method for the determination of free carbon which is fairly accurate and on account of its rapidity and freedom from danger of explosion may prove of value for control work. In this method Mr. Fulweiler has endeavored to utilize the centrifugal precipitation of the free carbon and its estimation from the volume occupied in a cube of small bore.

In carrying out this method the bitumen is weighed out into the usual form of tube that is used in the centrifugal method for the determination of phosphorus. The quantity of bitumen is varied according to the amount of free carbon expected, so that the volume of the precipitated matter will always be approximately the same. For the oils and oil asphalts about two grams are used; refined water gas tar one gram; natural asphalts one-half gram. For the refined coal tar, one-tenth of a gram. 50 c.c. of carbon bisulphide is poured in and the tube stoppered and allowed to stand for three or four minutes, is then briskly shaken until the bitumen has dissolved. This requires three or four minutes more. The tube is then filled up with carbon bisulphide, shaken to insure admixture, and put into the centrifuge and whirled for 15 minutes at from 2,000 to 2,200 revolutions. The free carbon is precipitated in the end of the tube and its volume may be readily read off. The time of centrifuging varies somewhat with the speed of the centrifuge, and this must be determined experimentally by increasing the time until the volume of the free carbon ceases to contract.

For a rough approximation using 1 gram of material, 1 cubic centimeter of the precipitated free carbon will be equivalent to 24 per cent by weight. It is difficult to get the tube accurately calibrated by calculation from its volume so that it is much simpler to run several determinations on a standard sample whose free carbon content is known, and thus experimentally calibrate the graduations at the end of the tube into per cents of free carbon.

It is very essential that the interior of the tube should be absolutely clean, so that it is best before using the tube to clean it with a few c.c. of fuming nitric acid.

The following table gives some comparative results that have been obtained, using the centrifugal method and the so-called 15-minute cold flask method on different classes of material.

It will be noted that the tubes must be calibrated for the different classes of material that are to be used as the volume of a free carbon, for a given percentage varies with the class of material. The precipitate from the natural asphalts occupying only about one-third of the space per unit per cent as that from the coal tar.

	Per cent					
OIL ASPHALTS.						
Free carbon gravometric method	.15	.22	.27	.28	.61	.67
Free carbon centrifugal method	.16	.22	.28	.20	.53	.55
REFINED WATER GAS TARS						
Free carbon gravometric method	.40	.51	.90	1.23	1.19	
Free carbon centrifugal method	.58	.45	.90*	1.65	1.32	
NATURAL ASPHALTS.						
Free carbon gravometric method	3.25	3.98	4.22	4.45	4.87	
Free carbon centrifugal method	3.25*	3.61	3.85	4.80	5.20	
REFINED COAL TAR.						
Free carbon gravometric method	20.00	21.85	23.33	26.60	28.75	
Free carbon centrifugal method	20.00*	19.75	21.35	27.15	30.65	

*Used for the calibration.

Experiences at Chicago With Creosoted Wood Block Pavement Constructed With a Cement Grout Filler.

The first creosoted wood block [illegible] Chicago was laid on Michigan [illegible] of the Auditorium Hotel. This pavement was laid without specifications [illegible] Park Board as a sample pavement. The blocks were set on loose cement. The joints were filled with a cement grout and expansion joints 1 in. wide were provided along the gutters only. The blocks were made from long leaf yellow pine timber treated with 16 lbs. of oil of specific gravity 1.03 to 1.06; 50 to 75 per cent of the oil evaporated at 315°C. The courses were laid at an angle of 45° with the center line. No bleeding of the blocks occurred and no trouble with the expansion of the blocks was experienced.

In 1910 an alley between 48th Pl., 49th St., Grand Blvd. and Vincennes Ave. was paved with creosoted blocks. The blocks were made from long leaf yellow pine and were set on 1 in. of sand. The treatment consisted of 16 lbs. of oil, with a specific gravity [illegible] and not over 40 per cent evaporation at 315°C. The courses were laid at an angle of 45° and expansion joints were placed at the ends; and ½-in. transverse joints every 25 ft. The balance of the joints were filled with cement grout. A great deal of trouble was caused by expansion but no bleeding occurred. Until the building in 1911 of the Lake Ave. pavement to be described below, the above were the only recorded pavements of creosoted wood block filled with cement grout in Chicago. The construction of this Lake Ave. pavement was in charge of Mr. A. J. Schnafmayer, Division Engineer of the Board of Local Improvements of Chicago. In an interesting paper presented at the last annual meeting of the Illinois Society of Engineers and Surveyors, Mr. Schnafmayer describes his experience with this pavement, and from his paper we have abstracted the matter in this article.

The following are some provisions from the Lake Ave. pavement ordinance and specifications: The size of the blocks was to be 3¾ ins. x 4 ins. x 6 ins. to 12 ins. They were to be made from long leaf yellow pine, tamarack or black gum, and were to be treated with 16 lbs. of oil with a specific gravity of 1.10 to 1.13 at 25° C. and a maximum distillation at 315°C. of 40 per cent. The courses were to be laid at an angle of 45°. Longitudinal expansion joint of 1 in. at the gutter were specified, and transverse joints ½ in. wide at intervals of 50 ft. were called for. The filler was to be cement grout mixed 1 to 1 and applied in two or more courses. The top dressing was to be ¼ in. of torpedo sand. A clause was also inserted providing that if any excess of oil or pitch appeared on the surface, due to bleeding, within the guarantee period, the contractor should remove it or top dress the surface again at that joint within three days of receiving notice from the Board of Local Improvements.

It will be observed from these various provisions that it was intended to provide for all the usual qualities of the creosoted wood block pavement with the special purpose of eliminating or greatly reducing the bleeding of the blocks, and the annoyance of the residents caused by tracking the pitch into their homes and upon their rugs in the hot weather.

Upon starting construction a combined curb and gutter with 18-in. gutters was built for a 18-ft. roadway between the face of the curbs. A foundation of 6 ins. of Portland cement concrete was built [illegible] which was spread a sand [illegible] thick and the blocks were laid upon it. The blocks were manufactured from long leaf yellow pine at Grenada, Miss. They were treated with 16 lbs. of oil ranging in specific gravity from 1.1264 to 1.1279 by test and were inspected at the plant by an inspector from the Board of Local Improvements. The blocks were laid at an angle of [illegible] placed moderately close but not driven tight. The contractor commenced laying blocks at [illegible] time it was feared that the expansion joints [illegible] joints of ½ in. every 50 ft. would not be adequate. It was agreed at that time to increase [illegible] crease the interval of the transverse joints from 50 ft. to 25 ft., and to increase their width to ¾ in. Accordingly the street was [illegible] with the cement grout filler applied as provided in the specifications. Traffic was kept off of the new pavement for seven days and before the expiration of that time the blocks were up in ridges at many of the transverse joints. A couple of heavy rains, followed by very hot weather increased the expansion until at some of the worst places the pavement had buckled up over a foot above the original surface.

A close examination was made of many of these "blow-ups" and it was found that in almost every case the cement grout filler had found a low place in the joint and had become set there, keying it open. There appeared to be two causes for this condition: First, the pitch used to fill the expansion joint had subsided somewhat in cooling and left open a portion of the joint from ½ in. to 1 in. in depth and from a few inches to a few feet in length. Second, the workmen after removing the strip with which the joint is formed, place small sand dams in the joint at certain intervals before pouring the hot pitch to prevent it from running along the joint before cooling. These dams are supposed to be removed after the pitch has cooled before the next interval is poured. Owing to the carelessness of workmen sometimes this sand is not entirely removed. In either case when the cement grout is swept over the surface it fills the part of the expansion joint not previously occupied by pitch and when it has set, it keys the joint open at that point.

In the first case mentioned it generally extends a few feet along the joint and keeps it open at the top while the bottom of the blocks can come together. This is apparently just what happens when expansion occurs and the pitch squeezes out beneath the blocks while the joint comes up in a ridge. In the second case the grout soaks in the sand to the bottom of the joint and wedges it open its full depth, but only for a very short distance along the joint. Then when expansion occurs the pitch is forced out on each side and the pavement around this wedge "blows up" in a formation somewhat dome shaped.

It was also noticed in examining the pavement that in expanding, the blocks moved along the courses beside each other, shearing the thin films of cement grout in the joints between them and shattering the bond of the cement. After the pavement had adjusted itself by moving in this manner a few days, the grout was scarcely any more impervious to water than so much sand. This demonstrated to the engineers the futility of diverting the traffic from the street for seven days.

Repairs were made upon the buckled areas of the portion laid and when the blocks were taken up along the gutters it was found that in places the curb and gutter had been forced back from the concrete foundation a distance of 2 ins. and the expansion joints were entirely closed. In this connection it may be of interest, although anticipating slightly, to state that when measuring the pavement after completion, the distance between curbs which was originally 38 ft., then measured 38.1 ft. at the point of greatest expansion.

Meanwhile construction was carried on with the same system of longitudinal and transverse expansion except that the width of the transverse joints was increased to 1 in. and that rigid care was exercised to see that all joints were filled flush with pitch and all sand dams removed. In addition traffic was permitted upon the new pavement after the second day. This accelerated the shattering of the bond of the cement and enabled the blocks to move beside each other more freely. In this way a payment was secured that buckled in only one or two places. It was observed, however, that the blocks were under very great pressure and that the curbs were being forced back to such an extent that in front of carriage walks and of sidewalks at intersections, where an outward movement was obstructed, the back of the curbs was being sheared off or else the walks were being broken and cocked up at an angle. Therefore it was decided, upon the suggestion of C. C. Lakin, General Manager for the Contractor, to lay an experimental pavement one block long eliminating the transverse expansion joints, as they appeared to be elements of weakness, and also to increase the width of the joints at the gutters to 2 ins. This was done and no trouble occurred and so the same plan was followed in the succeeding blocks until the pavement was completed, making a little over a mile laid by the last method. In this distance only a very few "blow ups" occurred. In addition, at one or two intersections which were paved with asphalt, the blocks forced the asphalt up in a ridge at the joint. This was partially due to the fact that Lake Ave., being a diagonal street, some of the courses at the wings were very long and expanded in proportion. Only one case has been noted so far on this part of the pavement where the curb and gutter was thrust out enough to shear off the back of the curb.

At the present time the pavement appears to be in excellent condition. One of the chief objects has been attained to date, as no bleeding of the blocks has occurred so far. However, the most severe tests of bleeding will probably come on some of the hot days next summer.

Although one would not be justified in drawing any final conclusions from the limited number of facts presented in the foregoing statements, they do seem to indicate three probable points for consideration, other things being equal, between a cement grout filler for creosoted wood block pavement on one hand, and pitch or sand filler on the other hand. They are as follows:

The use of a cement grout filler seems to increase the amount of expansion to be provided for in designing the pavement. This can be further illustrated by a simple calculation. Assume a 35 ft. space between gutters, and courses laid at a 45° angle. This gives a total length of the course of 49.5 ft. Assume the average length of the paving blocks at 8 ins., making a total of 75 joints in one course. Then assuming that with a pitch filler, 1/16 in. expansion is available in each joint between adjoining blocks, there would be 4¾ ins. available in the entire course. Practically none of this could be utilized when using a cement grout filler. Undoubtedly this difference would be decreased in comparing cement with sand filler but would still be of considerable amount.

The use of cement grout in this case greatly increased the amount of care required in forming and inspecting the expansion joints to prevent the grout from getting in and keying them open.

The use of cement grout filler also seems to reduce the annoyance caused by accumulations of pitch and oil on the surface.

Cement Drain Tile Production in Iowa.—[illegible] Cement Tile Manufacturers' Association, Mr. Charles E. Sims, Worthington, Minn., gives the following estimate of cement tile production in 19 Iowa counties during 1912:

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Humboldt	1,250,000	2
Kossuth	2,500,000	1
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Carroll	500,000	2
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Surface Treatment of Park Roads in Washington, D. C.*

The greatest friend of the American road builder of today, the much maligned and loudly abused automobile, has undoubtedly been the chief single factor in the wonderful advance that has taken place during the last decade, both in the art and in the extent of our road making. Through the instrumentality of the motor car many thousands of our most influential citizens have had carried home to them the conviction that the necessity for good roads is not merely a local issue but is a question of nation-wide importance, and never before in our history has the interest in it been so great nor have such large sums been spent in the making and upkeep of our roads. But while other factors than the automobile have contributed an important share towards achieving this result in the general case of country and suburban roads, the improvement that has taken place in our park roads during the last few years can be attributed almost solely to the automobile. Until its advent the traffic on these roads was in most cases confined exclusively to light vehicles, so that ordinary macadam, or even well compacted gravel roadbeds, met all requirements.

Here in Washington our roads were thoroughly gone over and all defects repaired once each spring, and this, with frequent watering, sufficed to keep them in good condition for many years—in fact, they never seemed to wear out. The yearly repairs cost comparatively little, the chief item of expense of maintenance being the watering. This averaged about 3.2 cents per sq. yd. of road surface per annum. No watering was done during the three winter months, while in the early spring and late fall the roads were watered once a day in dry weather. During the remaining six months of the year the watering carts went over each road twice a day during dry weather, and three times a day in periods of drought. As long as the roads were kept fairly smooth and reasonably free from dust, everyone was satisfied. No attempt was made to clean the roads, though gutters were swept from time to time.

But this happy state of affairs ended with the coming of the automobile. The number and average weight and speed of the vehicles using the parks rapidly increased, the combination of horses' hoofs and driving-wheels with wide soft tires quickly ravelled the road surfaces, and at the same time their users became more particular—they wanted not only dustless but mudless roads and could not see why a hole which developed in the fall had to wait for the annual spring cleaning to be repaired. They even complained when a road became occasionally dusty during the winter months. In other words, they wanted the park roads to be good at all seasons and in all weathers, and that is what we are now trying to give them.

In the new roads that have been built and in the old roads that have been resurfaced in the last few years a heavy oil or tar binder has been used with most satisfactory results, the penetration method being employed in applying the binder. But most of our work has consisted in the surface treatment of existing macadam roads. We have never attempted to apply any treatment to the old gravel roads but are resurfacing all of these as fast as possible with broken stone. For our surface treatment we have experimented with emulsions, with waste sulphite liquor, with coal gas and water gas tars, and with asphaltic oils, and have come to the conclusion that, under present conditions, the latter give the best results.

Our experience with emulsions has not been very extensive. We found that the effect of each application lasted only two or three weeks, the time depending largely on the amount of rain, and we soon reached the conclusion that the cost of labor and material for the repeated applications that were necessary made the cost of this method greater in the end than of the others. It has the advantage that the road never has to be closed to travel even while the material is being applied, though there is some objectionable tracking for about a day afterwards.

We have also used sulphite liquor to only a limited extent, owing to the fact that the first cost of the material is much greater than that of either oil or tar while its effect is not so lasting. It possesses the advantages of allowing the road to be used immediately after application, of not permanently darkening the color of the road surface, and of not staining.

In this market, water gas and coal gas tars cost about the same, but the former has given better results in use on roads, as the coal gas tar does not retain its elasticity and so does not have as good binding power. We have used the same method in applying water gas tar and light asphaltic oil, and have found the effect to be about as lasting in each case, one application a year being sufficient to keep the road in good condition. The oil has, however, been slightly cheaper than the tar in this market, and requires a smaller quantity to be used per square yard on the second application; it is also more absorbent of the triturated material that forms on the surface of the road under traffic, and so makes a more nearly dustless road. For these reasons we now prefer it to tar, though I confess to some misgivings as to the ultimate effect of the crust formed upon the road surface by the commingled oil and dust. Even now where the traffic is heavy the crust is picked up in places, forming occasional ruts and waves.

Our method of applying oil to macadam roads is as follows:

All ruts and holes in the surface of the road are first repaired by cleaning out the cavity, filling it with coarse stone which is covered with a coating of hot, heavy, asphaltic oil, then sprinkling a light coat of screenings over the oil, and finally compacting the mass by ramming. When all holes have been repaired, the surface of the road is thoroughly cleaned with rattan brooms, care being taken to remove all loose materials and caked dirt or dust so that the stone forming the wearing surface of the road shall be exposed and clean.

When the road is entirely free from moisture, and during warm, dry weather, if possible, a light asphaltic oil is spread without being heated over its surface by means of special sprinkling wagons. One-third to one-half gallon of oil to the square yard usually forms this first application. To allow it to penetrate into the surface, the road is closed to traffic for at least 48 hours after the first application.

At the end of this time the surface of the road is covered with a thin coating of clean, coarse, sharp sand or broken stone screenings, free from dust; it is then rolled and traffic allowed to go over it. A cubic yard of sand or screenings usually covers from 75 to 125 sq. yds. of road surface.

In this climate and under the conditions of traffic obtaining on our park roads, the oiling treatment described above keeps the surface in excellent condition for a year. It is never dusty and is only muddy when for a few hours after a heavy thaw the skidchains of automobiles tear up the surface. The subsequent passage of automobiles without chains soon irons out the roadway. At the end of the year the surface of the road is again thoroughly cleaned, from ¼ to 1/6 gal. of oil to the square yard under normal conditions is spread over it, and the road closed for 48 hours and covered with sand or screenings as before. This treatment is continued from year to year.

Instead of handling the oil in barrels, we have found it much cheaper to buy it delivered in tank cars, from which it is unloaded into the sprinkling wagons. A pressure-tank wagon was used to advantage for the first application of oil to the road surface, but ordinary sprinkler wagons with an oil distributing attachment and a squeegee fixed behind the distributor were found more economical and equally efficient in spreading the oil the second year. To ensure coating all parts of the road with an oil layer of uniform thickness, men with stiff brooms followed the sprinkler.

The following are the specifications under which we have been purchasing asphaltic oil for the surface treatment of park roads:

1. The oil shall be a viscous fluid product, free from water and showing some degree of adhesiveness when rubbed between the fingers.
2. It shall have a specific gravity of not less than 0.940 at 25° C.
3. It shall be soluble in carbon bisulphide, at air temperature, to at least 99 per cent and shall show not over 0.2 per cent of inorganic matter insoluble.
4. It shall contain not less than 3 per cent, nor more than 10 per cent, of bitumen insoluble in 86° paraffin naphtha at air temperature.
5. When 240 C. C. of the oil is heated in an Engler viscometer to 50° C. and maintained at this temperature for at least three minutes, the first 50 C. C. shall flow through the aperture in not less than ten minutes, nor more than twenty minutes.
6. When 20 grams of the material is heated for five hours in a cylindrical tin dish approximately two and one-half inches in diameter by one inch high, at a constant temperature of 163° C., the loss in weight by volatilization shall not exceed 20 per cent. The residue should be decidedly sticky.
7. Its fixed carbon shall be not less than 3.5 per cent.

The following table (Table I), taken from the year's report of the Office of Public Buildings and Grounds, shows the cost of surface treatment of the macadam roads in the Washington parks under that office from July 1, 1910, to June 30, 1911, oil or tar being the material used.

In the table the cost of the sand or of the stone screenings used after the application of the oil has not been taken into account, as

TABLE I.—COST OF SURFACE TREATMENT OF MACADAM ROADS IN WASHINGTON PARKS.

No. of road.	Material used.	Quantity. Gals.	Area of road. Sq. yds.	Length of road. Feet.	Sq. yds. treated per gal.	Cost of oil and applying per sq. yd. Cents.	Remarks.
1.	Oil	2,300	7,500	1,300	3.26	2.8	2d and 3d applications
	Oil	4,000	19,000	3,500	4.75	2.2	2d application.
3.	Oil	1,000	3,400	650	3.40	2.7	2d application.
4	Oil	700	8,560	2,300	12.23	1.2	2d application.
5.	Oil	5,000	25,000	7,000	5.00	2.1	2d application.
6	Oil	10,600	43,560	9,000	4.11	2.2	2d application.
7	Oil	3,400	19,450	[illegible]	5.72	1.9	2d application.
8	Oil	350	4,000	1,200	11.43	1.3	2d application.
9	Oil	1,000	1,680	700	1.68	4.6	1st application.
10.	Tar	6,000	11,400	3,500	1.90	4.4	1st application.
11	Tar	650	1,500	1,600	2.3	3.8	1st application.
12	Tar	1,600	3,560	[illegible]	2.23	3.8	1st application.
13	Tar	2,580	7,740	[illegible]	3.00	[illegible]	1st application.
14	Tar	2,400	8,160	[illegible]	3.40	[illegible]	1st application.
	Tar	875	2,000	700	2.28	[illegible]	1st application.
	Total	43,455	166,490	38,650	*[illegible]	*2.5	

	Cents.
Cost of labor per square yard	0.8
Cost of oil per gallon	6.5
Cost of tar per gallon	6.8
Average cost in past years of watering roads, per square yard	3.2

*Average.

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*Paper by Spencer Cosby, Col. U. S. Army, in Charge of Buildings and Grounds, Washington, D. C. Presented before Section D. of the American Association for the Advancement of Science on Dec. 29.

it is considered part of the cost of repair of the road.

Road No. 1 in the table had been worn down so that the crown had practically disap[illegible] leaving the road [illegible] water did not readily drain off. This did no special harm in warm weather but the alternate freezing and thawing that occurred during the winter months allowed the heavy traffic on this road to churn up the surface, so that it became necessary to give it a second application of oil in the early spring. The small amount of oil applied to road No. 4 was due to the light traffic on this section, while on road No. 8 an unusually heavy application of oil, 1½ gals. to the square yard, had been made the year before, a few months after the construction of the road. The large amount of oil absorbed by the new road on the first application made only a light second application necessary.

It is only fair to add that one reason why our park roads have been in so much better condition since we started the use of the surface treatment I have described is that we have abandoned the old method of repairing them once a year and now have a system of regular and frequent inspection and repair. Supplies of broken stone, screenings, oil and tar are kept constantly on hand in the vicinity of the roads, and holes and ruts are repaired as rapidly as they develop, usually before they have become large enough to be noticeable to traffic. We have practically no hills on our roads, so the greatest amount of repair work has to be done on the few sharp curves. The roads are also kept clean, being swept by hand sweepers at fairly frequent intervals.

I have confined myself to giving a brief description of the methods we have tried and the results we have obtained in the surface treatment of the roads in the parks within the city limits of Washington. It is almost needless to say that the conclusions we have now reached should not be considered as final or of general application; they represent simply the result of a limited number of experiments carried on for a limited time under the conditions existing in the Washington parks. The value we have provisionally found for *x* in the solution of our road problem may be quite a different one from that arrived at in another locality where the quantities entering the equation are not the same. The whole matter of road construction is in the development stage, and it is only by feeling our way carefully and comparing the results of many and varied experiments that we can hope to approach a final decision.

Notes on Road and Street Work.

Brick Paved Country Roads in Illinois.—Se[illegible] townships in Illinois [illegible] the construction of brick paved country highways. A description of several of these roads was given by Mr. W. T. Blackburn in a paper presented at the last annual meeting of the Illinois Society of Engineers and Surveyors, and from his paper we have taken the matter in this note. In Newman Township a 4-mile brick paved road was constructed in 1910. The first 1,500 ft. was 14 ft. in width, and the remainder 9 ft. wide. The road was built so as to leave the 12 ft. of earth roadway on one side and a 3-ft. berm of earth on the other, thus making a roadway 24 ft. between drainage ditches constructed on either side. This improvement was paid for from a levy voted against the property of the township under the hard road act. It cost $32,000, or $8,000 per mile. This roadway was contracted for by J. W. Roller, a large land holder, and probably built at somewhat less cost than such roadways could be built in the same locality and under different conditions. It has given perfect satisfaction and a petition is now being [illegible] asking that [illegible] taken for the extension of this road system in a similar manner and with the same material as their first experiment. At Harrisburg, Ill., the Commissioners there have begun to build 2½ miles of 9-ft. brick road, with 4-[illegible] side. This road has also an earth road at one side and was contracted at about $9,000 per mile. This contract was only about one-half completed last Fall. At Hoopeston the brick road extending north to the cemetery, 3,925 ft. in length and 18 ft. wide, was built in 1910. This road was built needlessly wide and expensive, the cost being $15,777. The width might have been reduced to 14 ft. without in the least impairing its value and usefulness. The cost was made greater by the addition of the interest, as no bonds were issued and contractor took non-interest bearing tax certificates as pay. The Batestown road at Danville, Ill., was built about 1905. As first built it was 2½ miles in length; in 1911 ¾ of a mile was added. The portion of this roadway first constructed was surfaced with No. 2 brick and filled with a sand filler. These bricks were burned hard and even with the excessive haul from the coal mines, it has proven very satisfactory. The specifications for these roadways have required a 4-in. concrete base, with a 4-in. by 12-in. curb flush with the brick on either side, and with the interstices between the brick filled with cement grout composed of 1 part of sand and 1 part of cement. The surface was built to a true plane, the curb on the side nearest the gutter was so constructed as to allow a slope of 5/16 in. to the foot in cross section, to provide for drainage. As these roadways were built through a flat country, their grade was but slight and made practically uniform throughout their length. A number of townships are now contemplating brick highways to be petitioned for at the spring election. The cost of such roadways is about $1,000 per foot of width per mile.

Apparatus of Illinois Highway Commission for Applying Bituminous Binder.—The Illinois Highway Commission during the past four years has made considerable use of bituminous compounds in the construction of experimental roads. At the last annual meeting of the Indiana Engineering Society Mr. A. N. Johnson, State Engineer of the Illinois Highway Commission, in a paper on bituminous macadam construction, gave the following description of the apparatus used by the Commission in applying the bituminous binder for these roads: The device consists of a tank wagon, holding about 500 gals., supplied with a fire chamber. The tank, which is cylindrical, is sufficiently strong to withstand a pressure of 60 to 80 lbs. if found needful. The tank wagon is fastened behind a roller or tractor, to which is attached a Westinghouse air pump with a metal hose leading from the air pump to the distributing tank, on which is a gauge so that the pressure may be controlled by the operator of the tractor. Leading from the tank wagon is a metal hose which ends in a nozzle made of a 2-in. iron pipe with a right-angle bend, in the end of which a plug is screwed, having an opening about ½ in. in size; on the inside is a small cone, so that by screwing the plug more or less tight the size of the orifice can be regulated. Leading into the 2-in. pipe forming the nozzle there is introduced a ½-in. steam pipe which is connected back to the boiler of the tractor. The steam pipe extends within the nozzle to just above the orifice. When in operation the pressure is applied to the wagon, thus forcing out the bituminous binder. The steam is turned into the nozzle as the binder issues, which tends to spray and break the bitumen into very fine particles, the effect being a sort of mist which can be very nicely regulated so that any given amount of material, from a mere wash to any quantity desired, can be applied. It is important that all hose connections for this work be of metallic type, as lighter hose or hose of any other material will soon become rotted or burned by the high temperature necessary, for most of the bituminous compounds used. The complete outfit also includes an extra heating tank of the same capacity as the distributing wagon, which, as soon as empty, may be readily filled from the auxiliary tank. To do this the air pump is reversed, creating a partial vacuum in the distributing wagon and the binder sucked back through the distributing hose, which is inserted into the auxiliary wagon. With one auxiliary kettle and one distributing wagon, each of 500 gals. capacity, 1,500 to 2,000 gals. per day can be applied. Additional auxiliary heating kettles would increase the output. Working continuously, a maximum of 500 gals. per hour can be applied. On most jobs, however, where but one roller is available, 1,500 to 2,000 gals. per day will be about as fast progress as can be handled efficiently.

One advantage noticed with the steam jet in connection with the operation of this apparatus is that the force of the steam seems to blow the dust from the surface of the stone and thereby insures a cleaner surface for the binder.

The Slipperiness of Tarred Roads.—There has been considerable criticism by horse owners in England of the slipperiness of the tarred roads of that country. In the main these complaints had reference to the condition of the roads in frosty weather. The English Roads Improvement Association has suggested that this slipperiness may be due to either of two causes: The use of calkins on horse shoes, or a method of "topping" the road. *The Surveyor* in an editorial discussion of this subject states that while one or both of the above conditions may be the cause of the very bad state of some roads, neither of them can be held responsible for the slipperiness of the very large milage of roads which have either been slippery in frosty weather or slippery in muddy weather since the breaking of the summer. *The Survey's* discussion of this subject brings out a number of interesting points and we are reprinting it below practically in full: Probably the bad state of the roads this winter—and they seem to be much worse than last winter—is largely due to the fact that the long spell of dry weather prevented partial anticipations of the present and recent muddiness, and the partial removal of the slimy materials by heavy rains in summer and autumn. Added to this, we have the fact that the large amount of tarring done, without a proportionate increase in staff and machinery, led to a considerable mileage of the roads being tarred very late, and much after what is usually regarded as the proper time. So, altogether, the tarry matter had not worn off as much as usual. This led to the roads on which the film was well preserved, or those in which there was an unusually large amount of tarry binder near the surface, being more than usually slippery when the weather was frosty—this more especially on exposed roads. On the other hand it led, during spells of drizzling or gentle rain, to the formation of greasy mud—this more especially on roads in cuttings or in narrow streets. There are three more contributing causes in the case of such roads. In narrow streets the lack of circulation of air and the concentration of traffic made matters worse, while a great many roads in cuttings and on hillsides were subjected to the action of seepage water, sometimes oozing onto the surface, sometimes entering the crust from below, and in other less severe cases making the subsoil so wet that there was no draining away of the water, which began to penetrate the crust where it was broken, or from puddles. It may also be noted that on account of the cost of making wide cuttings the road is often narrowed where it is in cutting, so that we have concentration of traffic in these places. The slipperiness due to greasiness has been worst, other things being equal, where the traffic has been heaviest; and on days when it was hardly safe to ride a bicycle on the urban roads, or in parts of main roads, where traffic is increased by large local contributions, the secondary roads have been in a much better state, and the tarred roads with light traffic better still. Another cause of the greasiness has, however, to be taken into account—namely, late retarring, either complete or in patches. The tar which had been only a short time on the road worked up into an emulsion under concentrated traffic more readily than did the tar which had been left long enough to set, and the greasiness was worse, because a smaller amount of gritty stuff had been worked into the tar. We do not think that it has been usual to sharpen horse shoes or to put in studs in wet weather, and if the tarring of roads is leading to this being done, that it is a matter which demands serious consideration. Horseshoes are sharpened, not in black frosts, as a rule, we believe, but when long, rimy frosts make hard roads become slippery under the action of traffic, and more especially when partly melted snow is being beaten into an ice sheet by the traffic, or soft snow has fallen to some depth; and, of course, when a hard frost begins at a time when the roads are very wet and slushy. Some roads in the South of England have been very slippery in the short frosts which we have already had, and slipperiness with large quantities of greasy mud has given much more trouble. Probably the main idea to keep in mind is the advantage of tarring early and tarring only once, even if that leads to there being a few dusty weeks in the autumn. Without giving up the idea of forming a carpet layer by successive coatings, at any rate in flat country, the more immediately useful principle seems to be that of tarring early, and lightly, with a view to the tarry matter being worn in and worn off by the winter sufficiently to prevent the roads being considerably more slippery than are waterbound roads, either in frosty weather or in drizzling, rainy weather. The absence of heavy showers of rain at intervals during drizzling weather has been an unfavorable feature of the late autumn and early winter, and this may be counted as a contributory cause of the unusual greasiness of the roads.

WATER-WORKS AND SEWERS SECTION

The Need of Well Considered Design and Efficient Operation of Sewage Disposal Plants.*

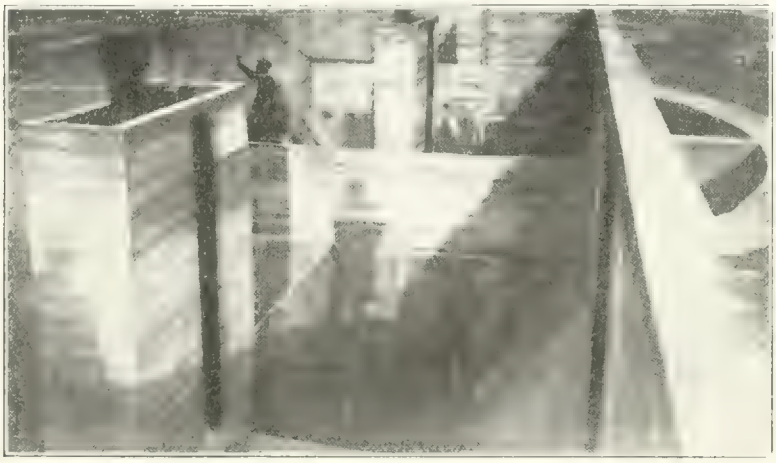
Fig. 1—Interior of Emscher Tank at Atlanta, Ga., December, 1911.

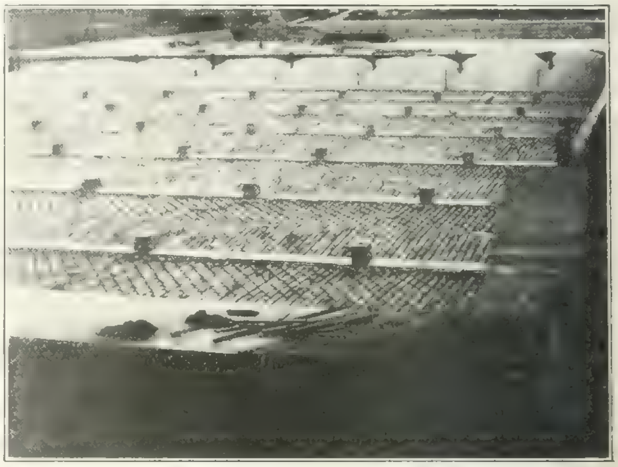
Fig. 2—Peachtree Creek Sprinkling Filters, Atlanta, Ga., Under Construction, Dec., 1911.

Fig. 3—Sludge Drying Bed, Peachtree Creek Plant.

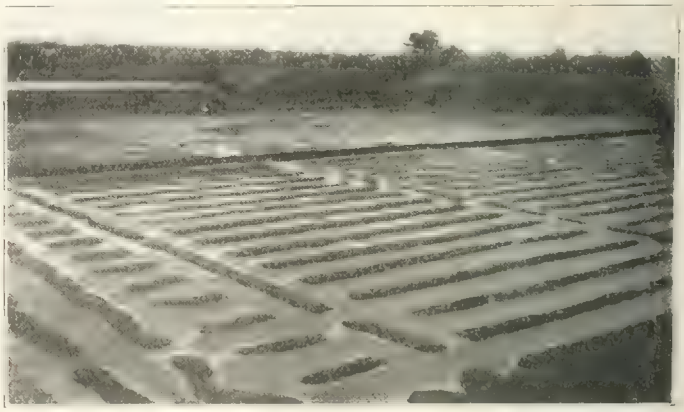
Fig. 4—Intermittent Sand Filters, Brockton, Mass., Operating in Winter.

The general conclusion of sanitarians is that each particular problem of sewage disposal must be solved with reference to the conditions appertaining thereto, in a broad gage fashion. The economic theorem, which frequently has been overlooked, is—that solution is the best which confers the greatest benefit on the largest number of people at the least cost. To illustrate the number of interests concerned, take the case of the Sanitary District of Chicago, a municipal corporation containing over 2,225,000 people. Here is a wide range of economic factors to balance, and that balance has not been found yet. There is first, the question of the Illinois River, its pollution, fish life, etc.; second, the relation to the water supply of Chicago; third, the benefit of the power development; fourth, the effect of withdrawing water from Lake Michigan.

Most of the rivers in this country are so situated that they will have to serve as sewers for all time. The question before us will be: How much sewage should be permitted in a river? What is the point where sewage purification should begin? And to what extent should it be carried? In most cases where a water supply is polluted, the purification of the water is the most immediate step to be taken, to protect against all forms of pollution. The problems are broad, and the policy to be pursued will, I believe, necessarily be broad, too. Injury to special interests, as well as by them, must be balanced with the questions of cost and condition.

Our problem in the Sanitary District is, to extend the capacity of the canal in the future, when the amount of water for diversion is agreed upon by the Government. If we secure 10,000 cu. ft. per second, we shall exhaust our capacity by 1920, and must then be prepared with treatment. However, we believe some treatment is required before that time, since the industrial wastes bring too heavy a load on our available dilution.

From various experiments conducted by our chemist, Dr. Lederer, at the 39th St. Testing Station, the conclusion has been reached that settling with a sewage (from domestic sources in large dilution) makes an improvement in the liquid of about 25 per cent from the standpoint of putrescibility, when from 50 to 60 per cent of the suspended matter is removed. This would enable us to extend the capacity of the canal 25 per cent at least. However, I feel that the actual improvement will be somewhat greater in our case, since the formation of sludge banks in the channel will be prevented by the removal of the settling suspended matter.

Although from the standpoint of total cost per capita, the purification to a high degree of a small quantity of sewage is less costly than the purification, to a less degree, of a much larger quantity (in our case four times as much), we are in favor of beginning with

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*Abstract of paper by Langdon Pearse, Assistant Engineer, the Sanitary District of Chicago, in charge of sewage disposal investigation, before Illinois Society of Engineers and Surveyors, Jan. 17, 1912.

[illegible] suspended matter [illegible] I [illegible] the cost [illegible] higher than for [illegible] Eng. & Contg., Nov. [illegible], 191[illegible] the expenditure [illegible] the [illegible] results [illegible] In other words, we believe the [illegible] is a most efficient means for settling the settleable suspended matter, and [illegible] Yards and Packingtown. I feel the conditions demand [illegible] matter.

Study of the progress [illegible] sewage disposal leads me to believe that certain broad principles will always be of service. [illegible] sewers with good grades [illegible] self-cleaning velocities; (2), the use of double-deck tanks, separating the settling material and digesting the sludge in separate compartments; (3), the treatment of the effluent as required on a sufficient bacterial surface in the presence of oxygen. The im[illegible] the [illegible] age, particularly by dilution, has been generally overlooked of late years. The improvements to be made will largely come through more efficient operation, and the economies to be made in special procedures for special conditions. For instance, the policy laid down for the Sanitary District, is settling, to be followed later by more thorough treatment on sprinkling filters or otherwise. Now, it may be possible to so handle the settled sewage, by aeration, or otherwise, that the improvement would suffice in our case, where operating costs on a large scale would reduce the cost per million gallons. Such a scheme might not be at all available for a small town.

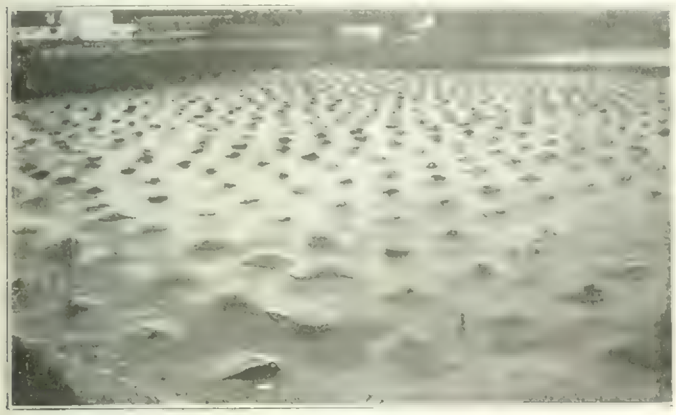

Fig. 5—Intermittent Sand Filters, Worcester, Mass., Operating in Winter.
(Showing hillocks in sewage filters [illegible]

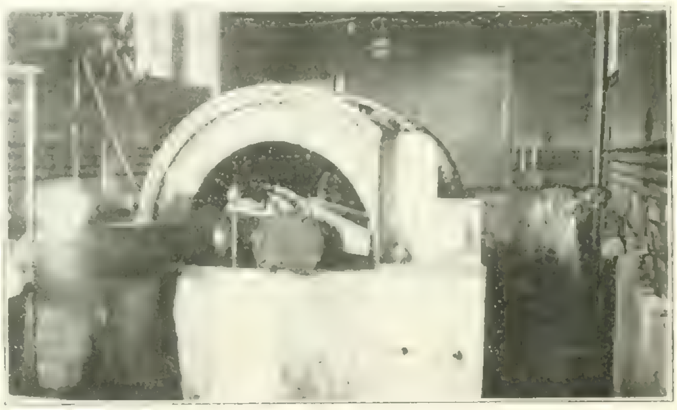

Fig. 6—Inlet End of Sewage Screen of Weand Type, at Brockton, Mass.
(Showing [illegible])

Again, in the question of settling devices. The Emscher tank, at its present stage of development, gives a well settled effluent, free from the deleterious effect of the unloading sludge which characterises the usual septic tank of the type developed some ten years ago. The Emscher tank also gives a minimum of sludge, and a sludge which will dry readily on drying beds. Various other styles of tanks are being talked into this country, for instance, the Hampton tank, and modifications of the older rectangular settling basins. What merit there is in these schemes, test alone will show. Comparative tests under similar working conditions are highly desirable. Even on the moot question of sludge disposal the larger plants will [illegible] benefit, if a means can be found to utilize the sludge for commercial purposes. The small plants today can find ample area to dispose of their sludge.

A word of caution at this time seems opportune. It is most important, in scrutinizing the claims of different installations, to have a thorough knowledge of their working capacity, as well as the results obtained from the analytical standpoint. The character of sewages varies so, abroad and in this country, but also in the character of the industrial [illegible] fully in one place which might not be at all [illegible] fer, boldly, the results obtained in one local[illegible] tion of all the circumstances, not only of the watershed and sewerage system, but also the [illegible] plant. Often, in scrutinizing printed results, it is wise to obtain a knowledge of the characteristics of the men who did the work, as [illegible] figure in studying the accuracy, as well as the honesty, of results. I am bringing this point before you, since the situation for the last few years has been clouded by a multiplicity of claims and counterclaims, for different processes, and will probably be more so in the future. The principles should remain clear cut throughout, in your mind. Hence, the problem resolves itself largely to a question of the best devices, or combination of processes, applicable to a given case.

I deem it essential, for an improvement in the sanitary conditions throughout this State, that more be known of the workings of the sewage disposal plants which have actually been built during the past ten or fifteen years. Practically nothing is known today. Some have been abandoned. Some are struggling along without any attention, giving indifferent results. One of the most valuable features of the work of the State Water Survey, or Board of Health, should be a survey, or a series of tests, of the different plants, extending over 24 hours or more, in each case, in order that their characteristics might be determined. The time is quickly coming when, in many cases, the existing facilities will not be adequate, and extensions, or entire rebuilding, in accordance with modern practice, will become necessary. Care and attention are vital.

The tests of a sewage disposal plant are exacting when the data for comparison are to be obtained. Mere clearness of effluent, or lack of odor, do not, of themselves, indicate that a plant is working well. In some cases, as for instance, a coarse grained sprinkling filter, a very clear effluent long maintained, may indicate trouble in the filter; in other words, retention of the solids which should be unloaded. Exact data are required—the population handled per acre, and per cubic yard of material, the quantity of sewage, the strength of the sewage, as indicated by chemical analyses, as well as the physical construction of the plant and its operation and maintenance. Of the character of the effluent, the nitrification and the putrescibility test (as made with methylene blue) are very good indicators. Bacterial results, in sewage disposal, are of minor importance, and at present can only be secured by the liberal use of chloride of lime as a sterilizing agent.

[illegible] able to visit a few plants, some new, some old. As standards here are rising, I think you will be interested in the pictures I have to present, illustrating the most modern plant, as well as the care and maintenance of the older plants.

[illegible] tures (see Figs. 1, 2 and 3). The city has been divided into three districts, each provided with a sewage disposal plant. They [illegible] The salient features are a bar screen, with [illegible] open grit chamber, capable of being drained from the bottom, followed by Emscher tanks. The effluent of the tanks is to be treated on a roughing filter, or by a fine screen of the Weand rotary type, before discharge on the sprinkling filters. The material of the filters is crushed granite, the cheapest and most available material in that region. I am indebted to Major Clayton, the City Engineer, for the privilege of showing these pictures.

In order to bring out, more clearly, the care taken in operation in the East, I shall show you the winter conditions on sand filters in Massachusetts, illustrating the two methods in use for operating sand filters during the winter. In the one at Brockton furrows were made, see Fig. 4; on the other, at Worcester, the surface material is scraped into piles at the beginning of winter to form a series of hillocks which support the ice-sheet, see Fig. 5. The Brockton sand filters are run with very slight preliminary treatment. Recently a rotary screen, of the Weand type, similar to the one at Reading, Pa., has been installed, see Fig. 6. On a fresh sewage from a population of about 60,000 people, the screen is able to remove a considerable amount of coarse suspended matter, far more than would be possible on an area as large as that of the 39th St. Pumping Station. The use of the screen has improved the operation of the beds. At Worcester, the sewage is treated—one-fourth by a short period of sedimentation followed by intermittent filtration on sand beds; the other three-fourths by chemical precipitation, using lime. The sludge is collected from shallow settling basins into sludge reservoirs, allowed to settle, and is then filter-pressed with the addition of a small amount of lime to make the pressing more easy. The resulting cake is dumped on vacant land. An experimental plant is also in operation, comprising Emscher tanks and sprinkling filters, from which interesting results are to be expected. The sewage of Worcester is strong, and contains a deal of acid waste from the large wire mills. The pictures of the Worcester and Brockton works are shown through the courtesy of Mr. Gault, Commissioner of Sewers of Worcester and of Mr. Felton, City Engineer of Brockton.

In conclusion, I would point out that today, in the East, the most pressing problem seems to be to determine the economic alignment of sewage disposal, particularly where water supply and sea-food are concerned, rather than the manner of treatment.

Diagrams for Determining Friction Loss in New Cast Iron Pipe.*

Diagrams for Determining Losses in New Straight Cast Iron Pipe.—Calculations for friction loss in pipes are at best somewhat uncertain, since the properties of flow are more or less indefinite. The roughness of the pipe, the workmanship in laying, and other variations in hydraulic conditions act to give rather wide variation of flow under the same head. This is shown in the results of carefully made experiments which are accepted as standard work. Moreover, the difficulty of making experiments on pipe of medium and large diameters at high velocities has prevented the accumulation of as complete a set of data as could be wished. The best that can be done is to use the formulas and tables which most closely conform to well established data. Fortunately, it is generally not necessary to know the friction loss within close limits.

In Figs. 1 and 2 the loss of head in feet per 100 ft. of new straight cast-iron pipe for the discharge indicated by the abscissas has been plotted to logarithmic scale. Fig. 1 is for pipe having internal diameters from 3 ins. to 10 ins. and Fig. 2 for pipe having internal diameters from 8 ins. to 24 ins., though the extreme sizes in each diagram have little range of discharge. With a little practice, interpolation between lines may be made fairly accurately.

These diagrams are based upon the general formula for pipe friction, $h = \frac{fl}{d}\frac{v^2}{2g}$ where h is the head lost in friction in 1 ft. of pipe, d is the diameter in feet, and v is the velocity in feet per second; f is a factor, depending upon the size and roughness of the pipe, and varying with the velocity of the water; g is the acceleration of gravity in feet per second per second. The values of the coffiecient f used in preparing the diagrams are those given in Merriman's Treatise on Hydraulics. For the sizes above 6 ins. the results are substantially the same as may be obtained from the formula, loss in 100 ft. $= 0.044\frac{v^{1.8}}{d^{1.2}}$. The results for pipe of sizes 8 to 24 ins. agree very closely with those obtained from the tables of Williams and Hazen for a pipe after approximately three years of service and also with the results of the excellent diagram given in Turneaure and Russell's Public Water Supplies. They also agree with the formula of Unwin, a noted English authority. The value found by the tables and diagrams just referred to do not differ from the values given by the diagram of Fig. 1 and 2 for the sizes named by more than about 5 per cent. It may be noted that this difference is much less than the variation in the results of experiments made at different times and places, and that a far greater difference may be expected with slight changes in the condition of roughness of the pipe. For sizes smaller than 8 ins. the agreement of the several formulas is not so close. It is believed that the diagrams conform as closely to the results of experiments as any tables which have been published.

The values for head lost given by the diagrams for sizes from 8 to 24 ins. diameter are generally smaller than those given by the Ellis and Howland tables and by the Darcy formula. A further difference is that these tables and formulas assume the head lost to vary as the square of the velocity, or nearly as the square, while the diagrams use 1.8 power. It seems that for high velocities Ellis and Howland and Darcy give a lost head which is higher than experiments show. The excellent form of the Ellis and Howland tables, as presented in the catalogs of the Addyston Pipe & Foundry Company, R. J. Wood & Co., and others, and the convenience of Weston's Tables, which are based on the Darcy formula, have made these two sets of tables favorites for general use. It must be borne in mind, however, that for sizes above 6 ins., the lost head given by them is high at the higher velocities.

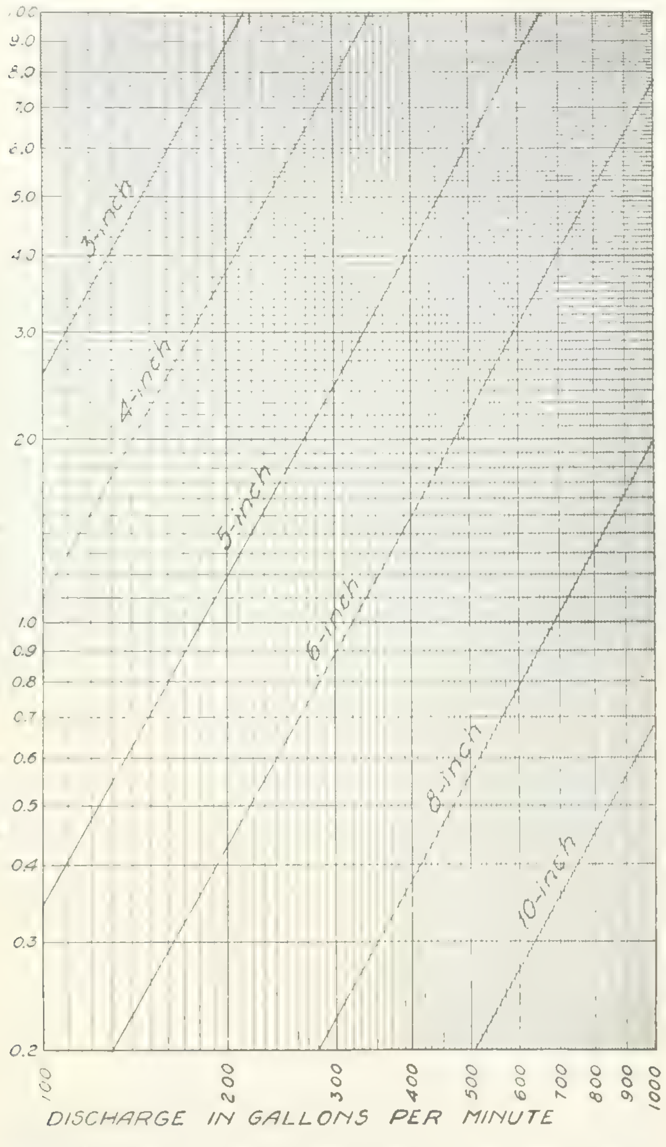

Fig. 1—Loss of Head in New Straight Cast Iron Pipe.

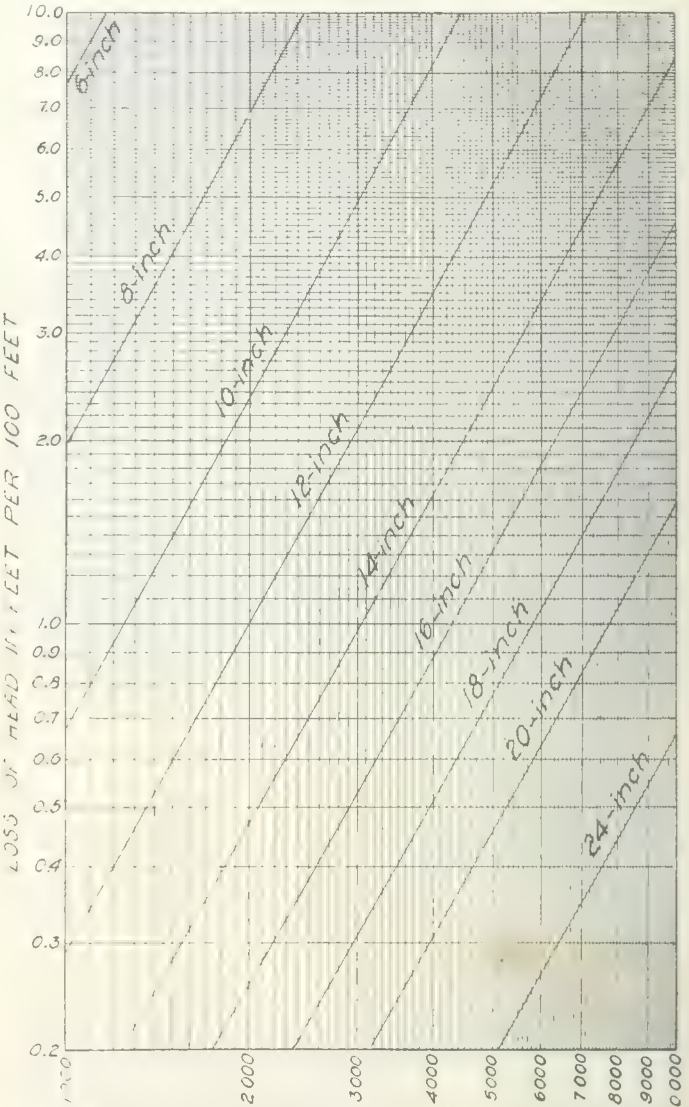

Fig. 2—Loss of Head in New Straight Cast Iron Pipe.

Diagrams for Velocity Head and Loss in Elbows and Tees.—In Fig. 3 are plotted values of the velocity head $\frac{v^2}{2g}$ corresponding to discharges in gallons per minute through pipes having internal diameters of 8, 10, 12, 14, 16 and 18 ins. Although the scale is small, the values may be obtained with sufficient accuracy for ordinary uses.

With an assumed coefficient of entrance head, m, this diagram may also be used for finding the loss at entrance by merely multiplying the velocity head for the given discharge by the assumed coefficient. For ordinary forms of entrance this coefficient may be expected to be about 0.5, but it is not uncommon to use 1.0 for the coefficient, expecting that the larger value will cover other losses.

Figure 3 also gives the loss of head in elbows of six sizes for given discharges in gallons per minute. The upper diagram is for elbows having a radius of curvature of axis of elbow equal to 1.5 diameters and the lower diagram for elbows having a [illegible] 3 diameters. The values are those selected by the Committee on Water Service of the American Railway Engineering and Maintenance of Way Association as representing the maximum results of tests. Few data on large sizes and high velocities are available, but the values given in the diagrams are probably conservative, and may be used until supplanted by more trustworthy [illegible].

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*Abstract of paper by Prof. A. N. Talbot and M. L. Enger, before the Illinois Water Supply Association.

Figure 3 also gives the loss of head in tees of six sizes for given discharges per minute, as presented by the Committee on Water Service. Information on the hydraulic properties of tees is even more incomplete than for elbows, but the diagrams probably give the best results now available.

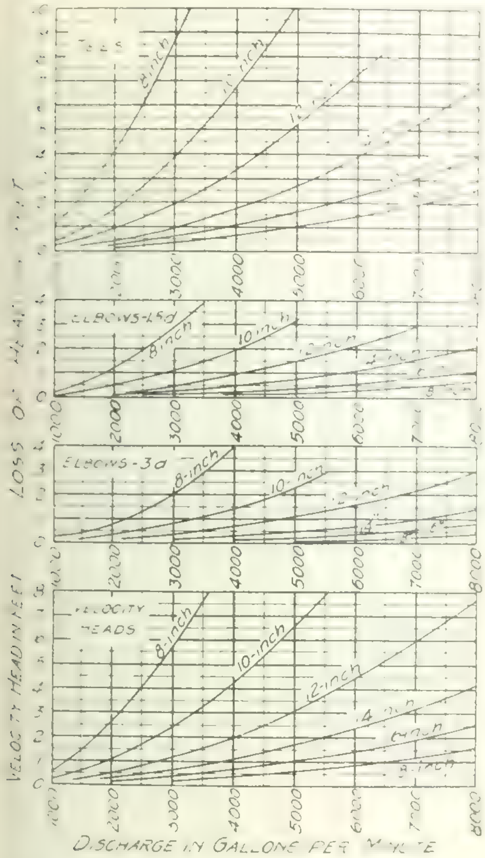

Fig. 3—Diagrams for Velocity Head and for Loss of Head in Elbows and Tees.

U. S. River and Harbor Work in Progress.—In an address before the National Rivers and Harbors Congress in December last, Brig.-Gen. William H. Bixby, Chief of Engineers, U. S. Army, gave the following summary of river and harbor work in progress under Federal direction:

> Few people realize the amount of river and harbor improvement work already adopted or under consideration by the Federal Congress. To complete the projects already favorably reported by the United States Engineer Department and already adopted by Congress will require the further appropriation and expenditure of over $200,000,000. In addition, the Engineer Department has already recommended about [illegible] worth of new work which has not yet been adopted by Congress, and which is therefore as yet entirely without appropriation. The preliminary examination and survey reports ordered by the last two river and harbor bills will be presented to Congress at its coming session with recommendations for projects (including those for canals along the [illegible] from New England to Texas) which will probably total about $90,000,000 worth of new additional work, and many of these projects will probably receive favorable action by Congress. All totaled together there are, therefore, nearly $320,000,000 worth of projects already or soon to be before the country. Even at the rate of $40,000,000 per year every year, it will take at least eight years of consecutive annual river and harbor bills to complete appropriations for these projects already started or called for.

Some Engineering Problems Connected With Biological Sewage Treatment in Canada—The Lethbridge Designs.*

All recent research and experimental work [illegible] certain defined principles which are now being held in common by most authorities. The subject of sewage disposal, instead of being conglomerate, may be said to be, at least, approaching the crystallized stage.

Prominent among the engineering problems affected by recent scientific investigation are the following:

(1). The immediate removal of settled solids from contact with the fresh flowing sewage, so as to avoid a septic liquid, and yet obtain all the benefits due to a septicized sludge.

(2). The equal distribution of a settled sewage liquid over the surface of a filter bed, avoiding saturation and the consequent exclusion of air.

(3). The protection of various parts of a biological sewage plant from frost conditions.

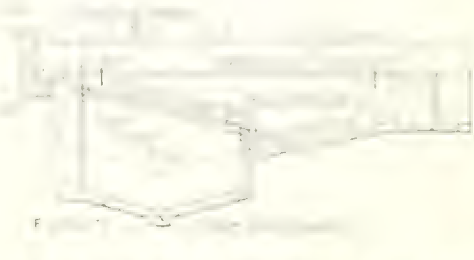

Fig. 1—Longitudinal Section of the Lethbridge, Alberta, Sludge Sedimentation and Separation Tank.

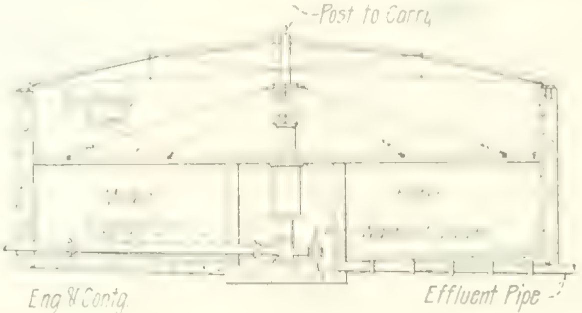

Fig. 3—Method of Carrying Roof Over Sprinkling Filters, Utilizing Revolving Distributor.

[illegible]

Last year in designing sewage disposal works for the city of Lethbridge the author, with reference to separation of suspended solids, determined to meet, as far as possible, the following problems: (a) The maximum removal of suspended solids. (b) The immediate separation of the settled solids from contact with the supernatent liquid in the sedimentation area. (c) The production of septicized sludge and the production of a non-septic settled liquor. It is considered that these problems are solved in the "Lethbridge" tank, which, under this name, has been patented.

Referring to the sketch, Fig. 1, it will be seen that the tank is of the usual rectangular shape. A sludge apron projects into the tank, overlapping a sludge storage basin. The apron is given a steep grade to allow settled solids to slide to the forward base; the forward base is also given a steep grade to allow solids to gravitate to the sludge storage basin. The apron and forward base are lined with wire reinforced glass for the purpose of reducing friction and ensuring immediate delivery of the settled solids into the sludge basin. The capacity of the sludge basin is made equal to three months' storage of sludge at 80 per cent of water. The gases given off from the putrefying sludge rise and impinge against the under surface of the apron and follow up the inclined plane, and are drawn off by vent-pipes to the outside of the tank. The overlap of the apron over the forward base makes it impossible for the septicized sludge or its products to come into contact with the supernatent sewage liquor in the sedimentation area.

[illegible]

The equal distribution of sewage liquor over the whole surface of a filter, and at the same time the avoidance of saturation, has presented a somewhat difficult problem to the sanitary engineer. The contact bed was the first attempted solution. That every particle of the filter media came into contact with the sewage was ensured by simply filling the filter. This, unfortunately, also ensured the total exclusion of all air, and enabled the Royal Commission to report that collected data proved that a cubic yard of filtering media in which air is constantly present will oxidize twice as much sewage as a cubic yard in a contact bed.

Fig. 2—Method of Draining Sprinkling Filter Floor to Center.

Various designs of distributors to provide a continuous sprinkling of sewage over the filter area have been put on the market, and have given the name of "sprinkling" or "percolating" filter to such types. Distributors may be divided into "fixed sprays," "revolving" or "traveling" distributors.

Fixed sprays have been used more generally in America, and revolving or traveling distributors in Great Britain. There is a decided tendency to adopt the latter type in preference to the former. With fixed sprays it is practically impossible to obtain equal rates of distribution. As a rule, only from 80 to 90 per cent, and sometimes less, of the filter area is in operation. Further, fixed sprays are apt to cause an odor nuisance by the liberation of gases.

It has been felt that moving distributors are more likely to be affected by frost conditions than fixed sprays. However, the cities of Moscow and St. Petersburg have lately adopted these types, and in the Canadian West, Regina, Lethbridge and Calgary are also adopting them, while Moose Jaw and Swift Current are adopting the fixed Stoddart type. Comparative efficiency data will be collected as soon as possible with reference to frost conditions in this country.

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*Abstract of paper read before the Canadian Public Health Association, December, 1911, by [illegible]

The question of avoiding saturation is to be of extreme importance in connection with a sprinkling filter. Filtering material in its voids has two capacities, viz., its water-retaining and air-containing capacity. Water-retaining capacity is obtained by filling a filter with a measured quantity of water to saturation, measuring the quantity run off, the difference representing the amount retained by adhesion. Air capacity is represented by the measured quantity run off. The finer the filter material, the less will be the air capacity, and the coarser the filter material, the less will be the water-retaining capacity. Filtering material may be so fine that practically no oxidation will take place. On the other hand, the air capacity may be so great that no greater efficiency in oxidation will take place than by spraying the sewage through an equal area of atmosphere.

In a well-constituted biological filter three processes take place, viz., retention, absorption and oxidation. An equilibrium must be maintained, otherwise immediate difficulties arise. At equilibrium a filter is capable of lasting 14 to 16 years without renewal. The choice of filtering material relative to size and character forms one of the most important problems in connection with biological sewage treatment. No fixed rule can be laid down. Everything depends upon the character of the sewage and the efficiency of the primary removal of suspended solids. It may, however, be taken that with a domestic sewage of average strength, representing a per capita water supply of 50 gals., a well-settled liquor, from which from 60 to 70 per cent of the solids have been removed, may be treated on percolating filters at the rate of 150 gals. per cubic yard of filter area with material ranging from 2 to 3 ins. in cube.

FROST PROBLEM.

The question of frost interference appears to trouble many minds in this country. Well, we have frost, and we have got to have sewage disposal. If it is possible to overheat houses, hotels and railway cars, it may also be possible to spare a little of this superheat to warm up a filter bed. The question is, does the biological treatment of sewage lend itself to a cold climate? It certainly does, because it occupies less area than any other system. Every part can be easily roofed in, from the detritus chamber to the final humus basin.

Certain modifications in structure are, however, advisable. For instance, on referring to the sketch of the percolating filter designed for Lethbridge, see Fig. 2, it will be observed that the usual method of draining to the perimeter into an open channel is departed from, and the sub-drainage is taken to the center of the filter. Also, it will be noted that an improvement has been effected in the design of the central drum of the distributor by enlarging it so that a stationary metal standard is carried through to carry an iron structural roof, see Fig. 3. The latter contrivance reduces the roof cost by 40 per cent.

The best form of covering for the detritus and sedimentation chambers will usually be met by providing reinforced concrete roofing, either arched or beamed, while the filters can be cheaply covered with iron constructional frame work and timber or corrugated iron roofing.

The question of the necessity or otherwise of artificial heat cannot yet be answered, as we have no data in the colder parts of Canada, as yet. It may be possible to do without artificial heat when we consider that sewage is usually delivered at about 42° F.

In conclusion, let us remember that any biological system for the treatment of sewage will do only so much and nothing more. By ditritus chambers and sedimentation tanks a large proportion of the solids can be retained, and have to be dealt with subsequently. By biological filtration the settled liquid can be rendered non-putrescible. Do not expect a more clarified effluent from the filter than the influent. The object of the filter is not to clarify, but to oxidize. A clarified effluent means the retention of the 20 to 30 per cent of solids not retained by the sedimentation tank and the eventual chokage of the filter. A good filter effluent should show an apparent amount of solids in the form of humus, which is easily settled out.

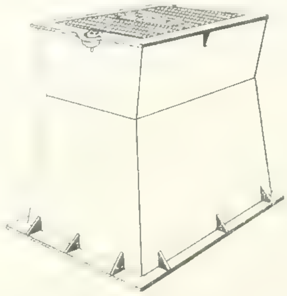
It is important to remember that the effluent is not yet fit to turn into a water source used as a domestic supply. All that has been done is to remove that which will cause an aesthetic nuisance. The pathogenic nuisance yet remains, and the germs of disease particularly associated with sewage can be eliminated only by disinfection or a further effort in the shape of sand filtration. What has been done is to obtain an effluent which can be easily and economically rendered non-pathogenic.

An Improved Water Meter Box.

(STAFF ARTICLE.)

A sketch of the driveway pattern of the Andrews Meter Box is shown in the accompanying cut. The box is made in three sections, a base section, top section, and lid. It is made of cast iron coated with asphaltum dip.

This box is made in two styles: one for use in lawns and parking, and the other for use in pavements, driveways and sidewalks. The base section is the same in the two types. This facilitates a change in types if that becomes necessary. The base section, which contains the meter, is supported on wide flanges, and is independent of the risers between which the meter is set. Drainage of the box is provided for.



Improved Water Meter Box.

The upper section of the lawn box covers the top of the base section like a lid. A rectangular extension from the center of this lid extends to the ground surface. This opening is closed by means of a loose fitting wood plug surrounded with felting. The upper section of the sidewalk box is separated from the lawn section by an 8x12 in. board, with felt around its edges. This construction protects the meter from frost. The base section is made of two depths, 12 ins. and 18 ins., for use in warm and cold latitudes. For very cold climates a telescoping extension top is provided. This box was placed on the market recently by the Modern Iron Works of Quincy, Ill.

A Method of Waterproofing Sewers Successfully Employed at Summit, N. J.

Contributed by John S. Stiger, City Engineer.

Experiments were made by the writer during the winter of 1909-10 on waterproofing sewers. These experiments resulted in getting a flexible water-tight joint material that would remain water-tight under pressure when deflected to a very great degree. This property is of great value not only in lessening the liability to injury of the joint when constructing the sewer but later when settlement is so apt to occur. This material, known as Jointite, manufactured by the Marbleoid Co. of New York City, is heated to a temperature of 400° or more and poured into joints in similar manner to lead and can be safely handled in all kinds of weather without danger of cracking tile or of poor results.

One of the peculiarities of the material, which is of great value, is that it adheres to a wet pipe apparently dispelling moisture in the form of vapor produced by the heat of the mixture. I have often in my work at Summit poured joints in from 4 to 6 ins. of water with apparently the same good results as if poured on dry pipe. Lines so run stood both an outside and inside water test. However, I do not of course advise pouring joints in water where it is practical to pump, which is usually the case, and in fact almost always necessary in order to handle the excavation economically. On 8 in. deep and wide socket tile pipe I specify 3 lbs. of compound to a joint and as the cost of the material is $105 per ton or 5¼ cts. per pound it would make the cost of these water-tight joints including labor of running, about 7 cts. per foot, or slightly less than $370 per mile. Engineers differ as to the cost of cement joints but I think all will agree with me that $100 per mile would be a very low estimate. This makes the additional cost of $270 per mile for sewers that will remain water-tight under all conditions, as I have proven during the past two years on over twelve miles of sewers laid throughout the city of Summit.

As half the sewage in Summit has to be pumped, I estimate that the saving in cost of pumping alone would pay the additional cost of water-tight joints in less than five years. Based on the average infiltration of 140 miles of sewers throughout the small towns in Massachusetts, as reported by Mr. Kennith Allen, of 40,000 gals. per mile daily, the cost of pumping this infiltration would amount to as much in one year and two months as the additional cost of making tight joints. Summit's infiltration is much less than most towns owing to the hilly or rolling surface and porous sub-soil, therefore it would be less important to make water-tight sewers here than in most towns, were it not, as I have already stated that we have to pump half our sewage and are also limited to capacity in joint trunk sewer. However, nearly all towns are either similarly situated or have purification plants which make it equally important to prevent infiltration owing to the additional cost of treating.

I would further state as my experience that in quicksand work or in any ground where much water is encountered, it is not only better but cheaper to use Jointite than cement if only sufficiently tight joints are desired to prevent quicksand entering through them. In all work at Summit I specify Jointite whether in wet ground or dry, as I consider it as important to prevent the sewage from getting out and polluting the subsoil, as to keep ground water from coming into the sewer. I have found in several of our old sewers that joints made in dry ground were not only polluting the subsoil in dry times, but were getting a large amount of infiltration during the wet months and in the dry time the sewer gets very foul owing to lack of water to carry the solid and waste materials down the line.

Construction of Levee at East St. Louis.—Yale & Reagan, contractors of Chicago, are engaged in the construction of the East Side Levee at East St. Louis, Mo. Their work consists of widening the present levee from 15 to 40 ft. top width. The material used is clay and this material is obtained by making a railway haul of some 22 miles. The contractors are using 80 automatic Western Dump cars for the work, which are loaded by a 70-ton Bucyrus shovel. The railway company runs the 40 car trains onto a side track at the levee, from which they are handled by the contractors' locomotive.

Explosives.—According to the revised regulations for the transportation of explosives issued by the Interstate Commerce Commission in January, 1912, shippers are required to inform themselves as to the requirements as in case of other laws. It is necessary therefore, for shippers of dangerous articles to purchase copies of the regulations, as the carriers are no longer required to furnish these free of charge. A number of publications have been prepared by the bureau and such of these as desired may be secured through Col. B. W. Dunn, chief inspector, Bureau of Explosives, 30 Vesey street, N. Y.

DRAINAGE AND IRRIGATION SECTION

Methods of Preparing Land and Applying Water for Irrigation.

[illegible]

Most land has to be prepared [illegible] The [illegible] irregularities [illegible] down and the surface [illegible] slopes and levels. [illegible] tion, trees and stumps [illegible] frequently, however, clearing involves only the removal of small growths [illegible] [illegible] [illegible] Wh[illegible]

[illegible] the method of applying the water has to be worked out with equal care to meet the main controlling conditions. These are the manner in which the water is delivered, the climate, the character of the soil, the nature of the land surface, and the character and variety of the crops.

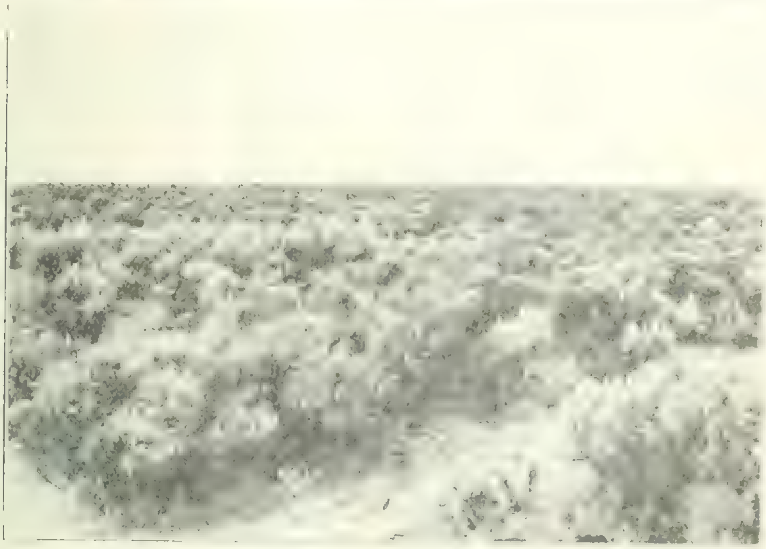


Fig. 1—Typical Sage Brush Plain, Yakima Valley, Washington.

Formerly in America, irrigation engineers [illegible]erned themselves but little with methods of preparing land and applying water for irrigation. They considered their task finished with the design and construction of work for [illegible] and conveying water to the [illegible] erritory. There has in recent years been a onsiderable change. Irrigation engineering as come to include problems of water disribution and application to the soil. For this hange we must credit in large measure the ngineers of the Government Service conerned in irrigation development. The preparation of land for irrigation and methods of istributing and applying irrigation water are [illegible] their engineering nature [illegible] applying irrigating water to land. Practice in the United States will be alone considered. [illegible] their repetition. The articles will at least form a framework to which to attach the more special discussions by experts which it is our purpose to present from time to time.*

[illegible]

The clearing of timbered land involving the felling of trees and removal of stumps [illegible] this journal and will not be considered here. It is rare that heavy clearing is required, though some of the irrigable lands of the [illegible] and small trees. Next in order comes the heavy sage brush lands of which the view Fig. 1 is a fair example. Then there are cactus lands and finally grass lands. Only lands of the first and second classes involve real clearing operations before being graded and leveled; deep plowing will prepare the grass and cactus lands for grading.

[illegible]

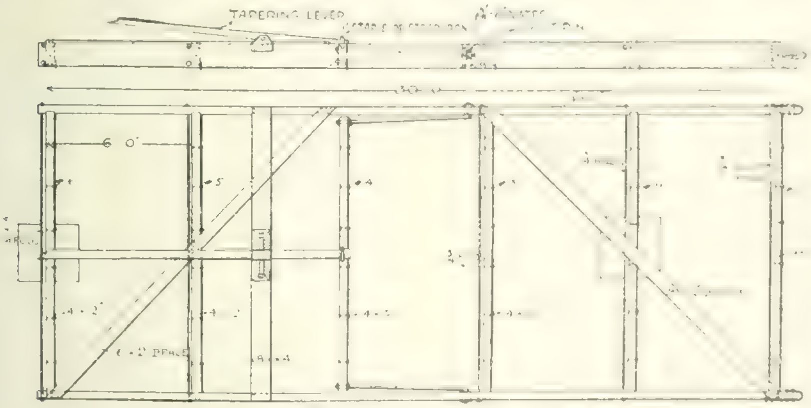


Fig. 2—Rectangular Leveler for Heavy Grading.

[illegible] followed in clearing sage brush lands depends upon the size and thickness of the growth and upon the time that can be allowed for removal [illegible] with moisture and frequently, particularly where the growth is light, the land is irrigated for a season. This watering either kills or weakens the growth so that the labor of clearing is greatly lessened. The watering naturally increases the growth of weeds and grass and often these are allowed to dry and [illegible] and still further reducing the labor of clearing.

[illegible] either by grubbing or by dragging. There are two methods of grubbing, one is to cut the roots out with mattocks and the other is to plow up the ground. After being grubbed out the roots and brush are raked together in windrows or piles and burned. In contract work it is estimated that one man will grub one acre a day by hand and, with the aid of a team and plow, that he will double this area. Grubbing by hand or plow including burning the brush, will range in cost from $2 to $3 per acre. If the brush is heavy and strong, dragging is employed. This consists in dragging a railway rail or a heavy timber sidewise over the land. Sometimes a straight rail is used and sometimes a rail bent to V-shape. When the V-drag is used a team is hitched to each arm of the V and it is hauled open end forward breaking down and up-rooting the brush. There is not much difference in cost between grubbing and dragging but the later method is more rapid. It is almost always necessary to follow dragging with hand grubbing to remove the roots not sufficiently loosened to be gathered by the rake. The usual practice in dragging is to cover the land twice.

Though the methods of clearing sage brush and mesquite lands which have just been described appear tedious and crude they are practically the only methods employed. The apparatus required is simple and cheap and these qualities count when each small farmer must do his own clearing. With only a small acreage to clear no owner is warranted in going to much expense for tools or machines for the work. In fact the average small homesteader seldom has the money to spend if he would. Could it be managed to arrange for the clearing of large areas (many homesteads) at one time a saving could doubtless be made over present methods, but there are many practical difficulties in the way of securing any such arrangement.

[illegible]

Grading land for irrigation does not necessitate bringing it to a level but it requires the securing of a uniform grade by removing irregularities. Only comparatively simple earth moving operations are called for and the usual scraping and grading machinery used everywhere is adapted to the work. As a matter of fact, however, preference is given in actual practice to home-made devices of various sorts and it is these as being the less familiar that are more particularly described

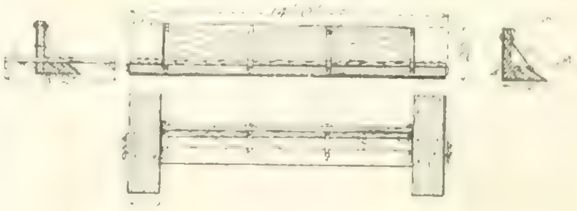


Fig. 3—Planer for Smoothing Graded Land.

here. Though offering no complexities in earthwork, grading for irrigation necessitates care and some skill. The land surface has to be brought to an even plane so that water turned onto it will spread evenly across the fields and not collect in pools. Frequently the extreme care is taken of turning the water on after grading to disclose unevenness and then regrading to remedy the defects.

The nature of the grading operations and consequently the kind of grading outfit employed is in a measure determined by the topography. Where the irregularities of the surface are somewhat uniform and are small the usual grading operation consists in planing down the ground to an even surface, working over considerable areas at one time. If on the other hand the irregularities consist of somewhat sizeable and isolated hummocks the grading operations consist of separate operations cutting down individual hillocks and filling in hollows. There are seldom very heavy cuts and fills to be made in grading for irrigation; land requiring such is not profitable for ordinary crops.

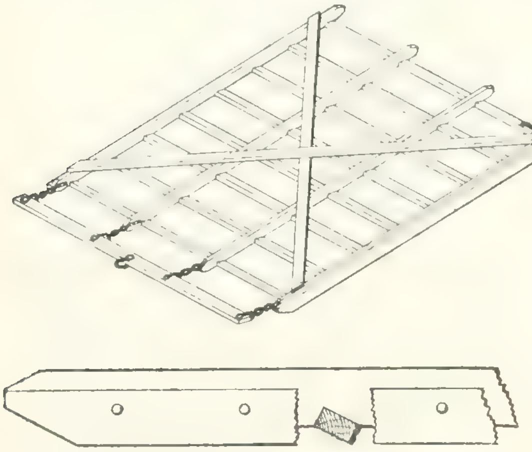


Fig. 4—Grid Iron Drag for Heavy Grading.

Grading with Scrapers.—Scrapers are employed for grading more particularly where the work consists in removing isolated hummocks. All ordinary commercial forms are suitable as in similar earthwork elsewhere, but more commonly slip scrapers and in California Fresno scrapers are used. A scraper is a rather light tool for soil containing many roots, and where mesquite abounds grading with either a slip or a Fresno is rather tedious work, and heavier tools are commonly used except where as stated above sizeable knolls or hummocks have to be cut down and here scraper work is about the only thing practicable. Grading lands of this character will range in cost from $3 to $5 per acre, with labor at $1.50 per day. Where the hummocks are small and somewhat uniform in size and distribution, strictly scraper work is more expensive than "levelers" or "planers." The following are descriptions of some of the tools used for leveling and planing.

Rectangular Leveler.—Figure 1 shows a leveler commonly used in California. It is a heavy tool requiring from eight to ten teams to haul, but it will cut down small hummocks removing shrubs, roots and all. Briefly described it is a rectangular frame about 12x30 ft. made of 4x12 in. timbers. There are besides the two end pieces four other cross pieces one of which is arranged to be moved up and down by means of a lever. The frame is hauled endwise and the scraping or leveling is done by the cross timbers. Five of these are fixed by being bolted at the ends to the side timbers. A tie rod from side to side at the rear of each cross timber keeps the frame from spreading and there is also diagonal bracing. The cross pieces are shod on their cutting faces with ⅜x6-in. steel plates, and No. 4, as stated, is hinged so it can be lowered at will and practically the whole weight of the machine thrown onto one scraper to cut down hard knobs. Heavy chains and eveners are employed to hitch the teams to the leveler and these are of considerable service in breaking down any shrubs that may be growing on the land. Altogether the weight of this leveler is not far from a ton including the driver and lever operator, both of whom ride on the machine. The rectangular leveler does the best work where the knolls are regular in size and position. Such lands are commonly worked over in bands or strips a half-mile to a mile long and 300 to 1,000 ft. wide.

Modified Buck Scraper or Planer.—This device shown by Fig. 3 is designed particularly to give the finishing grade following the rough grading done with scrapers or with the rectangular grader, Fig. 2, hence the name planer. It is L-shaped in section, being made up of a horizontal 4x12-in. plank 14 ft. long and a back board of 2-in. plank 18 ins. high. The bottom and buck are bound together by the steel plate with which the base is shod and by strap iron brackets. The front edge of the base plank is beveled to a cutting edge. The back board is 1 ft. shorter than the base at each end to provide for the standing boards on which the drivers ride. There are two drivers each handling a four-horse team hitched to each end of the base. By throwing their weights onto the front or rear ends of the foot boards the cutting edge is tilted down or up to shave off a strata of earth or to ride over and distribute the soil smoothly. The whole manipulation of the planer including turning is simple and easy. As ordinarily used the planer follows the rough grader like that shown by Fig. 2. When the grader has uprooted and removed the brush and the major irregularities, the planer is employed to do the final smoothing or planing. Records of work in California give the cost of removing brush and hummocks by the rectangular grader as $1 to $1.20 per acre; the final planing costs from $1 to $1.50 per acre more, making a total cost of $2 to $2.75 per acre for complete grading.

Grid-Iron Grader.—Figure 4 illustrates a home-made grader used in Montana. The outside longitudinals or runners are 16 ft. long and are made up each of two 2x6-in. pieces set one higher than the other as shown by the detail drawing. Between these runners and running across the grader are set eight 2x4-in pieces which are shod with steel plates to form scrapers. The inclination of the 2x4-in. scrapers is to be noted; also the intermediate longitudinals and the diagonal bracing.

Wheeled Planer.—For smoothing the ground after grading the device shown by Fig. 5 is an approved tool. This is also a Montana device. The main structural features are shown by the drawings; it may be noticed, however, that the frame is raised about 14 ins. by the wheels and that the scraper blade is steel shod. This planer is hauled by three to four horses and under competent handling will level from 10 to 20 acres of graded land per day.

Miscellaneous Grading Devices. — Besides the graders and levelers described, there are a multitude of others ranging from a log fitted with a tongue and dragged sidewise over the ground to buck scrapers. Often these last named devices are made as long as 24 ft. and require twelve horses to operate. Plows and harrows are used. In conclusion, as already stated, any of the various commercial scrapers and graders can be and in varying numbers are used.

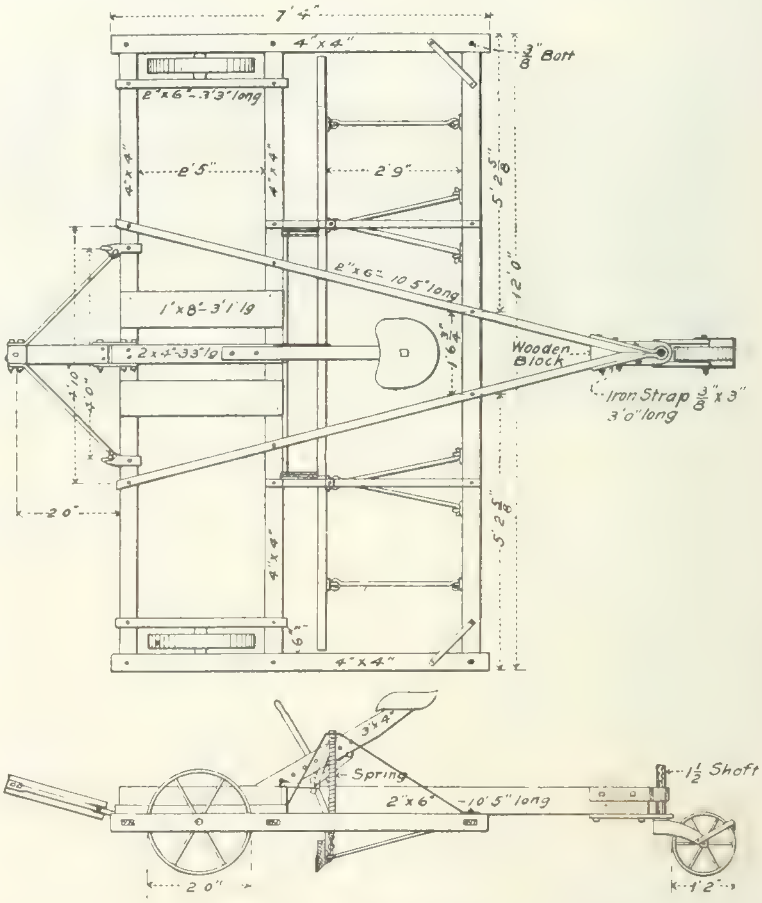


Fig. 5—Wheeled Leveler for Smoothing Graded Land.

Cost of Preparing Land for Irrigation.—In the preceding paragraphs a few costs of grading and clearing land for irrigation have been given. General figures of cost are uncertain guides but they may nevertheless be given. Assuming the clearing to require only the removal of sage brush the cost of preparing land to receive water not including laterals, checks, furrows, etc., but merely clearing and grading proper will range from $2.50 to $5 per acre. Bulletin 145, Office of Experiment Stations gives the average cost in Colorado and Wyoming of preparing land for irrigation as follows:

Item.	Per acre.
Grubbing sage brush	$1.50
Plowing	2.50
Harrowing	0.50
Grading	1.00
Total	$5.50

Some Examples of Tidal Marsh Land Reclamation; Structures and Cost.*

II.

(STAFF ARTICLE.)

Tidal marsh land reclamation presents certain advantages particularly its own. These are its exemption from prolonged drought, its general proximity to populous communities, and the hygienic improvement which comes from its drainage. It is also in large part inherently fertile land. Tidal marsh reclamation too is being inquired into more actively as seaboard population increases and upland farms become more occupied. This journal has published within the last twelve months several articles on tidal marsh reclamation and in this issue it continues a series of half a dozen descriptions of specific works based on studies made by U. S. Government engineers. These works are not presented as ideal examples of practice, in fact most of them are open to severe criticism, but as studies, the data from which are generally useful.

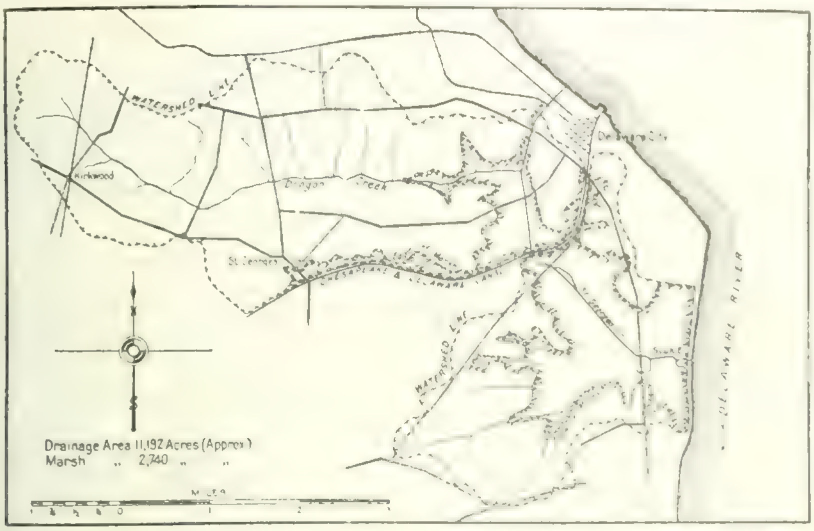


Fig. 1—Map of Drainage Area Tributary to St. George's Marshes, Delaware.

ST. GEORGES MARSH CO. DRAINAGE WORKS.

The reclamation works of the St. Georges Marsh Co., though falling short to a great extent of their possible value, merit brief description for two reasons: They are among the oldest marsh land reclamations in America, having been begun in 1762, and they control a drainage basin whose extent and character present possibilities which will some day be realized.

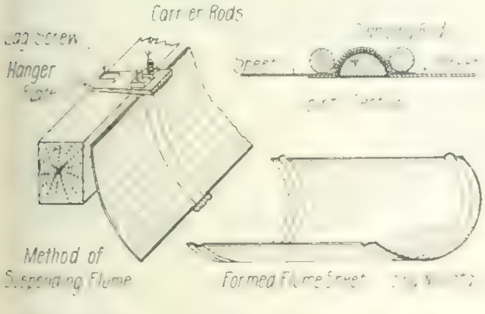


Fig. 1—Details of Lennon Metal Flume for Irrigation.

The map Fig. 1 shows the drainage basin of St. Georges Creek and its companion stream, Dragon Creek. The total area of this drainage basin is 11,192 acres and the area of marsh included, shown by hutched boundaries, is 2,740 acres. The land is located on the west bank of the Delaware River south and west of Delaware City, Del. Incidentally it encloses the reclamation works of the Colburn estate described in Article I of this [illegible] Colburn estate. As will be noticed, the river frontage is very narrow in proportion to the area reclaimed. About 1½ miles of levee only are required to enclose a marsh area of 2,740 acres. The levee existing is shown in section by Fig. 2. Just inside the levee there is a narrow strip of land ranging from elevation 2 ft. at the creek to elevation 5 ft. at the southern extremity and being generally from 3 to 4 ft. above datum. Proceeding westward the ground level drops, and west of the first north and south road shown on the map there are areas of many hundreds of acres ranging in elevations from 0.75 ft. to 1 ft. From this low basin the land westward rises to elevations of 60 ft. to 80 ft. It will be noticed that Dragon Creek has no connection through North Drain to the river; this drain was closed up by the breaking of the levee north of Delaware City and the flow now enters the St. Georges marsh.

The drainage works at St. Georges marsh have been simply to close off the river frontage with a levee and to remove the interior water by a ditch system and sluice. At present the works, except the levee, have fallen into a state of neglect. The levee is 8,125 ft. long and for 6,400 ft. of its length is stone paved. A section is shown by Fig. 2. The height above mean high water is from 4 to 8 ft. The rock facing is 3½ ft. thick at the base and rises by a curved batter to a height of 8 ft. and a top thickness of 1 ft. The levee is in good repair. The sluice and ditch system are out of repair and indeed serve little useful purpose at present.

The problem of improvement is about as follows: By cleaning out the old ditches and rebuilding the sluice will reclaim a large area of the higher marsh lands. To reclaim the lower marsh lands pumping will be necessary. The land which has been reclaimed is fertile and raises good crops.

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*"Tidal Marshes and Their Reclamation," by George M. Warren, Bulletin 240, Office of Experiment Stations, U. S. Department of Agriculture.

Two Types of Metal Flumes for Irrigation Conduits.

Rolled metal sections are coming to be used quite extensively as a substitute for timber in flume construction for irrigation conduits. The metal sections are rolled plates, sometimes corrugated and sometimes plain, bent to a semi-circular trough and lapped together end on end with a clamp and filler joint of some form. The metal used is some of the forms of non-corrosive irons such as is more commonly employed for metal culverts. Indeed the use of metal flumes seems to have grown out of the practice of constructing culverts of metal. In our issue of Aug. 2, 1911, we described the Maginnis metal flume used on an important irrigation works and there follow descriptions of two other flumes constructions that are being used in the west.

[illegible] flume is made of rolled sheets of pure iron or of acid resisting steel; two styles of sheets are employed, corrugated and plain, but the method of supporting and jointing them is nearly identical, so that only one style need be illustrated. The drawings of Fig. 1 show the construction of Lennon plain metal flumes. As will be seen the semi-circular sheets are hung in yokes suspended between two side timbers. The details of the yokes and of their connection to the side timbers are explained by the drawings. The joints between sections of flume are made by lapping the ends so that the circumferential corrugations rolled into the ends will fit or nest together. The two yoke rods embrace the corrugation which is projecting on the outside and dishing on the inside of the sheets. To make a flush joint and also further to stiffen the joint a bar of semi-circular section is set into the corrugation, just filling it. This bar is clamped in place by the hanger plates.

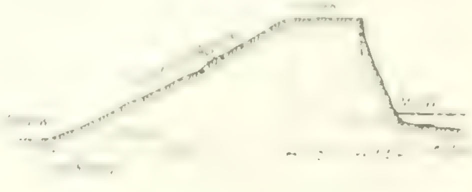

Fig. 2—Section of Levee, St. George's Marshes Reclamation.

This construction as will be seen from the drawings leaves the top of the flume entirely unobstructed. To erect the sheets, the side timbers being in place, the hanger plates are spaced and fastened and the yoke rods are set loose. The sheets are then set in sequence nesting the corrugations, inserting the filler bar and clamping all tight by drawing up the yoke bar nuts. The sections are 3 ft. long and when very large diameters are required an additional yoke is placed between joints. In figuring the capacity of smooth flumes Kutter's formula is employed with $n = 0.011$. Expansion is all taken care of by the joints. When corrugated sheets are used instead of plain, greater allowance has to be made for the rougher surface in figuring capacity. The structures carrying the flumes are made of steel or timber bents of any height the ground surface calls for. Tables of capacity and standard trestle designs are furnished by the manufacturers, The Colorado Ingot-Iron Pipe & Flume Co., Colorado Springs, Colo.

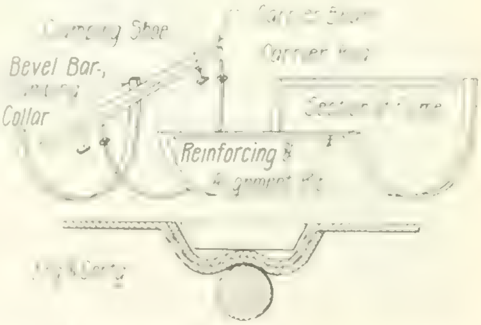

Fig. 2—Details of Hess Metal Flume for Irrigation.

The Hess Metal Flume.—The Hess flume is made of rolled plates of "Toncan" metal, familiar for its non-corrosive properties and its extensive use for culverts. The sheets are rolled smooth except for a circumferential joint corrugation of each end. Figure 2 shows the component parts of the flume and a detail of the joint construction. As will be seen the carrier rods are hung from carrier beams of wood which span the flume and rest their ends on the side sills or other supporting structure. Referring to the joint section it will [illegible] that the corrugation is not a circular arc, but has a reverse curve which forms a [illegible] to engage the carrying rod, and [illegible] a stiffer joint. Inside the flume the groove formed by the corrugation is filled flush by a bevel bar or clamping collar. Another feature is the reinforcing rib along the upper edge of each section. For very large diameters a stiffening angle is riveted along each edge. The other details are so clearly shown by the drawings that explanation is unnecessary.

This flume is made by The Hess Flume Co., Denver, Col.

Reclaiming of Minnesota's Swamp Lands: General Statement of Problem and of Progress of the Work.

I.

Contributed by George A. Ralph, State Drainage Engineer, Minnesota.

The drainage of wet and overflowed lands is a problem of such a nature that its proper solution requires the consideration and taking into account not only the lands which require immediate drainage but all the lands lying in the river basin or watershed in which such wet lands are situated. It is therefore apparent that the question of drainage is one which not only affects a township, a county or a state but one which may affect many states.

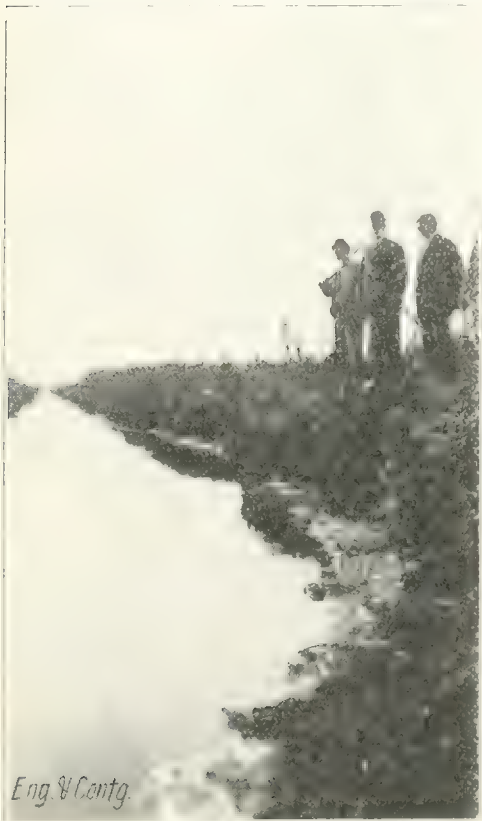

Fig. 1—A View Showing a Typical Ditch in the Tamarac Swamp Drainage District, Northern Minnesota.

The Mississippi River and its tributaries form the greatest natural drainage system on the American continent. The overflowing of this river for many miles back from its mouth has been a question of serious moment for many years and millions of dollars have been spent in diking and otherwise improving this river channel with a view to preventing the overflow of millions of acres of land lying along the lower reaches through the states of Louisiana, Mississippi, Arkansas, Missouri and Tennessee. Any interference with the natural order of things on this stream or its tributaries above these low lying lands that would cause a greater flood of water down the stream would work a serious hardship and an added burden to the land owners along the lower reaches of the river.

What is true of the Mississippi is true of the Minnesota River, the Red River of the North and in fact any other stream along which there are lands that lie dangerously close to the high water mark. Consequently, as I have stated before, the question of drainage must be considered as one great problem embracing the entire watershed.

For many years efforts have been made by congressmen and others to have the Federal Government reclaim the swamp lands of the United States in the same manner that the arid lands are being reclaimed. At the present time there seems to be very little prospect of the Federal Government undertaking the work for the reason that in the states where the largest areas of wet lands are found there is little if any land owned or controlled by the Federal Government. Furthermore, in nearly all of these states large grants of swamp lands have been made to the state with the understanding and agreement that the state should use the proceeds from the sale of such lands in reclaiming the same. It therefore seems to be up to the several states to work out their own reclamation projects.

In our own state a great deal of work has been accomplished along this line. The state has had a State Drainage Commission for over ten years and prior to that time much work was done under the direction of what was known as the Red River Valley Drainage Commission. Under the present laws the commission consists of the Governor, Auditor and Secretary of State, who employ a chief engineer. This commission has recognized from the very beginning the necessity of cooperation with the counties in carrying out important drainage work. Much of the early drainage work that was carried on by the counties throughout the state was done without any proper consideration of what effect the water that was drained off would have on the streams or rivers into which the ditches were discharged and as a result much complaint has been made to the Drainage Commission and to the state legislatures of the great injustice that was being imposed on land owners who happened to own land in river valleys which in the natural order of things was safely above the high water line but which under the changed conditions brought about by drainage was rendered worthless in times of high water.

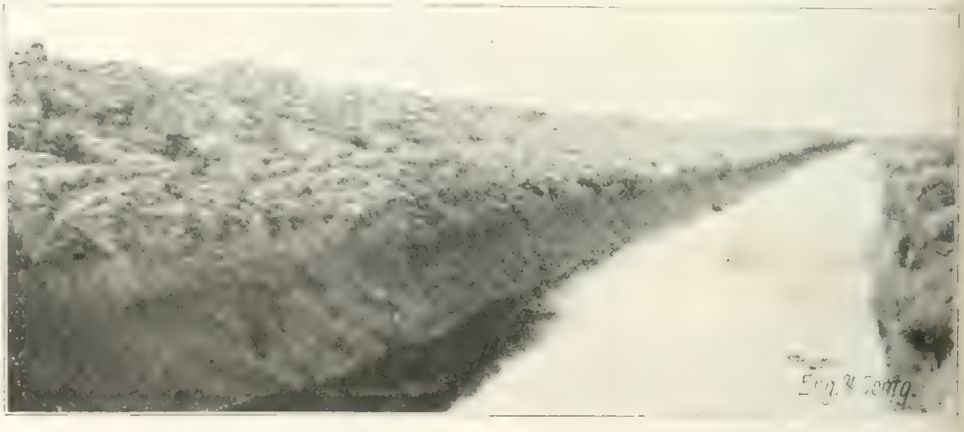

Fig. 2—State Ditch No. 69, Rosseau County, Minnesota.

Minnesota in her natural state had an area of over 10,000,000 acres of swamp land. These areas were scattered over nearly every county in the state, the larger tracts being found in the northern counties. St. Louis county contained 1,392,160 acres; Beltrami, 1,451,520 acres; Koochiching, 1,000,000 acres; Lake, 798,600 acres; Itasca, 590,600 acres; Roseau, 533,680 acres; Aitkin, 529,880; Cass, 316,240; Pine, 293,000; Marshall, 258,240; Clay, 230,000, with Kittson, Ottertail, Polk, Crow Wing and Cook each containing upwards of 100,000 acres. Up to the year 1895 but little had been accomplished in the way of reclaiming these wet lands. A drainage survey of the Red River Valley counties made in the year 1886, showed that the drainage of the wet lands of the valley was not only feasible but could be accomplished at small cost compared with drainage projects elsewhere. Several attempts were made to enact laws authorizing the state to undertake the drainage of her wet lands; these efforts were only partially successful; small appropriations were made by the legislature of 1893, 1895 and 1897, amounting in all to $162,500, or about enough to pay for one ditch such as State Ditch No. 91, now being constructed by the State Drainage Commission in Roseau County. The legislature of 1901 appropriated $50,000, 1903, $50,000, and 1905, $65,000, making a total of $327,500, appropriated by the state for the construction of drainage ditches up to 1907. Nearly every legislature since 1889 has passed some kind of a drainage law. It remained for the legislature of 1897 to enact the first comprehensive and practical drainage law, which is known as the "Grindeland Drainage Law," named after its author, Judge Grindeland of Warren, Minn., who was a member of the State Senate at that time. This drainage law is without doubt one of the very best general drainage laws ever enacted in any state. It has been thoroughly tested in the courts and has invariably been upheld. The present State Drainage Law and the Judicial Ditch Law are patterned after the Grindeland Law.

Upon the passage of the Grindeland law drainage projects were begun in almost every county in the state; the work has increased with each succeeding year. At the present time over 8,000 miles of drainage ditches have been constructed at a cost of $10,008,608, requiring the excavation of 68,506,615 cu. yds. These ditches drain 6,250,000 acres of swamp land. The estimated benefits derived from these ditches is $18,778,915. This estimate of benefits was made by appraisers appointed for this purpose on each ditch and is undoubtedly much lower than the actual benefits derived; if the latter figures were multiplied by two they would be more nearly correct. Kittson County had 184,000 acres of land too wet for cultivation 15 years ago. Since that time the reclamation of these lands has been carried on with increased activity from year to year and today almost every acre of this vast area has been drained or will be when the ditches now under construction are completed. Drainage of the wet lands in Kittson County required the construction of upwards of 150 miles of drainage channels, at a cost of nearly $300,000. Roseau County had 533,680 acres of swamp land when the county was organized. When the ditches now under construction have been completed, Roseau County's wet land area will have been reduced more than 400,000 acres. Marshall County started in with 258,240 acres of wet land to drain and several thousand more which was too wet in wet seasons for successful cultivation. This county has constructed hundreds of miles of drainage channels and when the drainage projects now underway are completed, the county will have [illegible] of drainage channels and the wet land areas will have nearly all disappeared.

The counties of Polk, Red [illegible] Clay and Wilkin have all made wonderful changes in their natural features during the past 15 years. Polk county [illegible] drained nearly all her wet lands but has also constructed ditches to carry off all surplus water (in times of extraordinary storms) from the more level lands in the western part of the county. There has been 660 miles of ditches constructed in Polk County at a cost of $850,000. Red Lake County has drained practically all her wet lands; the county and state ditches in this county have an aggregate length of 250 miles. Norman County has 160 miles of public ditches which cost $207,000. Nearly all of the wet land areas of this county have been reclaimed; the county is now working out plans for the improvement of the channel of the Wild Rice River the principal natural outlet for the drainage of the county. When this troublesome stream has been prepared to carry off the waters from its drainage basin, Norman County's drainage system will be quite complete. Clay county has constructed over 200 miles of drainage ditches in the past five years and has in all 220 miles of public drainage ditches which cost $350,000. These ditches drain practically all the wet land areas of the county. The estimated number of acres benefited being 260,000. Wilkin County has 220 miles of public ditches; the drainage system of this county is practically complete. More than 200,000 acres of land have been reclaimed or benefited by the construction of these ditches; the total expenditures being $238,290.

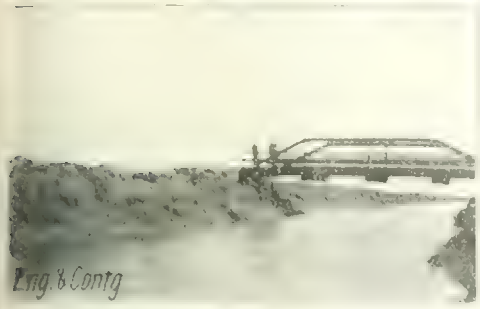

Fig. 3—State Ditch No. 51, Rosseau County, Minnesota.

Beltrami County has just gotten fairly launched in the business of draining her wet lands. Twenty-five miles of ditches have been constructed and nearly 100 miles more are underway.

Aitkin County has expended a little over $100,000 in drainage ditches. The state has constructed or under construction in this county 103 miles of ditches which will cost when completed $135,000.

St. Louis County with a larger area of swamp lands than any other county in the state except Beltrami, has yet to construct her first county ditch. The state has constructed four ditches in this county, the aggregate length of which is 49 miles.

In the southern part of the state the counties of Martin, Redwood, Fre[illegible] K[illegible]ohi, Lac qui Parle, Brown, Chippewa, Jackson and Faribault lead in the order named in drainage work.

Martin County has expended $327,519 in public ditches. Redwood has expended $298,[illegible]43; has constructed 297 miles of ditches and reclaimed 93,436 acres of land. Freeborn county has expended $291,486 for drainage work; has dug 100 miles of ditches and drained 29,545 acres.

The Rice Lake and Moscow ditch of this county is one of the largest drainage channels in the state. The lower part of this ditch has an average width of 80 ft. and a depth of 12 ft.

Lac qui Parle County has 232 miles of ditches which cost $280,331 and drain 20,823 acres.

[illegible] drain 38,521 acres.

[illegible] digging 220 miles of ditches which reclaim 22,291 acres.

[illegible] construct 109 miles of ditches which drain 15,515 acres of land.

Faribault County has expended $153,139 in constructing 59 miles of ditches which drain 10,000 acres.

Besides the large amount of open ditch work which has been carried out in all parts of the state there has also been hundreds of miles of tile drains laid. Tile drainage up to the present time has been largely confined to the southern half of the state. The State Experimental Farm at Crookston has made some very interesting experiments in tile drainage which prove that fully as good results can be obtained from tile drainage in northern Minnesota as in southern Minnesota, Iowa or Illinois.

There are at the present time 15 clay tile factories in Minnesota; the largest of which is at Austin; this plant expects to turn out enough tile next season to lay from 800 to 1,000 miles of tile drains. Cement tile factories are found in all parts of the state and while the cement tile up to the present time does not meet with the popular approval that is accorded clay tile, nevertheless, most of the cement tile factories turn out an excellent product.

It is evident that Minnesota will accomplish in twenty years, as much drainage work as Illinois, Indiana or Ohio have in fifty years. At the present rate of progress in drainage work, Minnesota's wet lands will practically all have been drained in 10 years hence; as a direct result of this work farm land values have increased very rapidly.

Lands in southern Minnesota which 10 years ago could be purchased at from $35 to $50 per acre, are selling today at from $75 to $100 per acre. Lands in Redwood, Lyons, Yellow Medicine, Lac qui Parle and Chippewa counties which could have been purchased 10 years ago at from $20 to $30 per acre, were sold last summer at from $60 to $75 per acre. In the Red River Valley counties lands that could be purchased at from $15 to $25 per acre, 8 and 10 years ago, are selling readily today at from $35 to $60 per acre. This increase in land values is sure to continue and when the lands in Minnesota are as well provided with drainage channels, both open channels and tile drains, as the lands of Illinois, farm lands in Minnesota will command as high a price as lands in Illinois. Judging from the great activity in tile drainage work in southern Minnesota, it may be set down as a pretty safe estimate, that good farms well tiled drained will be selling in southern Minnesota in 1920 at $200 per acre. The drainage work that is being carried on in newer counties in northern Minnesota is a greater factor in opening up and developing this section of the state than any other one thing.

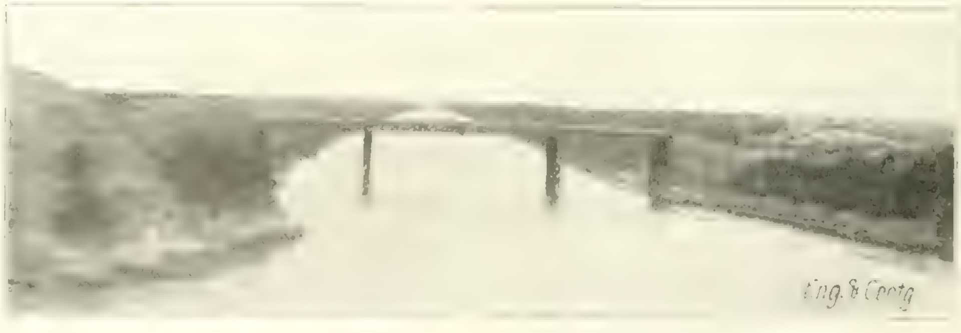

Fig. 4—Mouth of Judicial Ditch No. 11, Marshall County, Minnesota.

Marshall County's Judicial Ditch No. 11, which is the most extensive system of drainage under one drainage project, will not only completely drain 140 square miles of rich meadow and prairie land which owing to the absence of natural water courses was too wet in wet seasons for successful agricultural uses but will also provide in connection with the ditches nearly 500 miles of graded roads, which will be constructed from the earth excavated from the ditch. The same is true of Roseau County's drainage ditches.

State Ditch No. 91 drains 125,000 acres of as rich land as there is in the state and when this system is completed there will be over 100 miles of road constructed along the banks of the several ditches making up the system.

State Ditches Nos. 69, 72, 95 and 98 are all large section line systems, each of which will drain from 70,000 to 120,000 acres. Nearly every mile of ditch will have a road along the bank thereof, and when those five big ditches are completed, Roseau County will not only be pretty thoroughly provided with drainage channels but will also have a very extensive system of good roads. The cost of these roads when constructed in connection with ditches, varies from $75 to $125 per mile.

A great deal of the work of the Drainage Commission during the past ten years has consisted of improving natural channels so as to make ample provision for the increased flow of water from the drainage of the wet lands lying in their water sheds. In this connection surveys have been made of all the important streams and rivers of the state and plans devised for the proper improvement of their channels. The State Drainage Commission has co-operated with the counties in the improvement of the following named streams: Roseau River, Roseau County; Two Rivers, Roseau County; Two Rivers, Kittson County; Thief River, Marshall County; Snake River, Marshall County; Lost River, Polk County; Sand Hill River, Polk County; Leaf River, Wadena County; Wild Rice River, Norman County; Ottertail River, Wilkin County; Crow River, Kandiyohi County; Rush River, Nicollet County; Crane Creek, Steele County; Zumbro River, Wabasha County, and many other smaller streams. Maps, plans and estimates showing the manner and cost of improving nearly every stream in the state with a view to preventing overflows prepared by the engineer of the commission. This information is furnished the counties upon application.

The State Drainage Commission has succeeded in getting the work that has been carried out under their management done at a very low figure. The average price per cubic yard for state drainage work covering a period of six years has been 8.8 cts. The cost of state work has averaged much lower than the cost of work under county management. This is largely due to the fact that the State Drainage Commission has a permanent organization and is enabled to carry out work in a much more comprehensive manner than work done under county management and by letting the work in large amounts or in letting several contracts at one time they have been enabled to secure much more active competition. The cost of the state ditches in many of the counties of the state runs from 30 to 40 per cent lower than the cost of similar work done by the counties. The work carried on by the State Drainage Commission has not only been an incentive for county work but has also acted as the regulator or balance wheel on cost of doing the work.

The commission always insists on all work being performed strictly according to contract and it is a remarkable fact that not a single complaint has ever been filed with the commission criticizing unfavorably any state ditch that has been accepted and paid for. Some complaints have been made of ditches that were in process of construction. These complaints in nearly all cases were due to a lack of knowledge of what would be required before the work would be accepted and paid for. Of course the state drainage work, like all public work of great magnitude, has its knockers. Fortunately for drainage work these knockers invariably consist of fellows who were disappointed in getting exorbitant claims allowed by the commission or in getting special favors not permissible under good business management.

The contracts for state work have been let at uniformly low figures and wherever the state has co-operated with the county authorities in letting ditches, very low prices have been secured. Nicollet County co-operative ditch was let for 6.7 cts. per yard; 12 cts. per yard was the prevailing price for ditch work in this county prior to this time. Steele County's big ditch was estimated by the county authorities to cost $72,000. By co-operating with the State Drainage Commission the work was let for 5.9 cts. per yard, or a total of $36,000. Kandiyohi County, by co-operating with the State Drainage Commission, let a contract for Judicial Ditch No. 1 for 6.2 cts. per cubic yard. Had this work been let at the prices that prevailed for county work it would have cost the taxpayers $36,000 more than it did.

Great improvements have been made during the past ten years in ditching machinery. Ditching machines designed to dig any kind of a ditch can now be procured—machines that will excavate ordinary ditches at a net cost of from 2.5 to 4 cts. per cubic yard.

The greatest activity in drainage work all over the state is in a large measure attributable to the state's excellent drainage laws. Minnesota has the most equitable and practical drainage laws of any state in the Union. It would be hard to prepare a drainage law that would be more applicable to the various conditions met with in carrying out drainage work throughout the state and which would give more satisfactory results, than judicial ditch law. It is the result of much hard work on the part of some of the best lawyers, most practical business men and best drainage engineers of the state. It has been upheld in all important parts by the supreme court and is far superior to the drainage laws of any other state in the Union.

The law under which the State Drainage Commission constructs ditches is a very practical one. In the construction of 50 state ditches under this law there is but one instance where an appeal was taken from the court's order establishing the ditch.

The federal drainage law, known as the Volstead Act, authorizes the taxing of all wet lands owned or controlled by the Federal Government for the construction of drainage ditches. This, I am informed, is the first law enacted by Congress authorizing the assessment of special taxes against government lands. It is the first instance where the Federal Government has made provisions for the payment of the cost of constructing drainage ditches. It is looked upon by its author as an entering wedge towards securing from the Federal Government an appropriation for carrying on drainage work throughout the United States. Under the terms of the Volstead Act the citizens of any county in the state in which the government lands are located, may proceed to drain these lands, tax the cost of doing the work up to all lands benefited in proportion to the benefits received, and when the taxes become due they are authorized to place these lands on the market, sell them, and reimburse the county out of the proceeds of the sale, the only condition imposed is that the government shall be paid $1.25 per acre, and that the purchaser shall be a qualified entryman under the land laws of the United States. Estimating the cost of drainage at $2 per acre, the amount to be realized when these lands are offered for sale, in order to make the county and government whole, would be $3.25 per acre. The poorest lands in northern Minnesota, when properly drained, should sell readily at from $8 to $10 per acre.

With the excellent drainage laws now on our statute books the people of northern Minnesota can reclaim and place on the market all lands that will be benefited by drainage. A petition signed by one or more interested land holders starts the machinery in motion for a drainage system costing thousands of dollars, and if the proposed ditch will be of a greater benefit than the cost of construction, will be of public utility and promote the public health, it is mandatory upon the court to order the ditch.

Counties engaged in drainage work in the state of Minnesota up to the present time have had little difficulty in disposing of bonds issued for the payment of the work, at low rate of interest. The state investment board has invested all available funds in ditch bonds bearing interest at the rate of 4 per cent. Owing to the large amount of work being carried on all over the state, there has not been nearly enough state money to purchase all the bonds offered, but I am informed by the State Auditor that it is quite probable that in one or two years at the farthest, there will be sufficient funds at the disposal of the state investment board to take up all the ditch bonds that may be offered.

Northern Minnesota counties have it within their power to lay out and construct ditches and highways across their swamp land areas and a very large proportion of the cost of doing the same can be taxed up to the government and state lands. The people of southern Minnesota fully appreciate the great benefits to be derived from proper drainage and are not only putting in open ditches for outlet drains wherever necessary, but a large amount of tile drainage work has been carried on all over southern Minnesota. Tile factories in different parts of the state are taxed to their utmost capacity to supply the demand for tile.

The State Drainage Commission has prepared and published for free distribution a complete compilation of the drainage laws of the state, with full instructions as to just how to proceed. Any one desiring such information will be supplied with a copy of the publication upon application.

The state legislature at its last session authorized the State Drainage Commisison to make surveys of the water resources of the state. The Drainage Commission, on co-operation with the department of Geological Survey of the Federal Government, is now making surveys and stream measurements of all the important streams of the state. These surveys when completed, will not only show the available water power of the state, but will also show all feasible sites for storage reservoirs. A report covering the work will be submitted to the next state legislature.

The results obtained from these surveys up to the present time would indicate that it is entirely feasible to construct storage reservoirs on some of the most important streams of the state, in addition to those already constructed, and that sufficient water can be stored therein to not only prevent in a large measure damage from floods, but serve to equalize the flow of the streams of the state, so as to largely increase the value of all water powers now developed or which may be hereafter developed.

The State Drainage Commission was also authorized by the legislature to make topographic surveys of the various water sheds of the state for the purpose of securing data from which proper drainage plans might be prepared, and when these surveys are completed, to prepare and file with the county auditors of the several counties of the state complete drainage plans for each county, such plans to be adopted by the county in all future drainage work. Topographic surveys are now being made by the State Drainage Commission, in co-operation with the Department of Geological Survey, Washington, D. C. These surveys, owing to the very thorough manner in which they are executed, will require several years' time to cover the state. It is expected that surveys covering about ten counties will be completed by the close of the year 1912. Topographic surveys had already been made covering nearly all the northern part of the state, and considerable territory around St. Paul and Minneapolis.

Reports of these surveys will be ready for distribution from time to time as the work progresses. Reports from the water resource survey will be ready for distribution after Jan. 1, 1913. One-half the cost of these surveys is borne by the Federal Government.

No part of the state offers greater returns for money invested in the reclamation of wet lands than northern Minnesota. An excellent object lesson, showing what can be accomplished, is seen at the Island Farm, in St. Louis County. Mr. Hartley, the owner of this farm, has now under cultivation 1,500 acres of land which five years ago was an impassable swamp. This land is worth not less than $50 an acre and it is probably held at a much higher figure. Such land can be purchased throughout northern Minnesota in its natural state at from $8 to $15 per acre. The cost of drainage is about $2 per acre, the cost of clearing and cultivating varies from $2 to $15 per acre, dependent upon the amount of timber or brush to be cleared off.

The season of 1912 promises to be one of unusual activity in drainage work in Minnesota. Hundreds of miles of tile drains will be put in and from 60 to 75 large machines will be engaged on open ditch work.

Mechanical Engineering Problems in the Drainage of River Bottom Lands.*

The rather general impression in the mind of the average person that the drainage of farm lands is not an engineering problem of much importance, is accounted for by the fact that the early drainage in this country was carried out in a most hap-hazard manner, without any adequate knowledge of the carrying capacity of the main ditches, and no particular regard for the future extensions of the system. The results from this method of drainage soon brought the civil engineer into contact with this problem, but the mechanical engineer did not become associated with it until the drainage of overflowed lands, without a natural gravity outlet, was undertaken.

Of the odd 70,000,000 acres of swamp and overflowed lands within the boundaries of the United States about 20,000,000 acres lie in the Mississippi River valley, and a large percentage of this area is so situated, topographically, that it cannot be successfully drained, except by means of pumping. Much of the early work along the lines of drainage by pumping, in this locality, might be called experimental in its nature, and the results in many cases were far from encouraging. However, as these early installations were put into service, the importance of the mechanical engineering problems involved in the proper design and operation of such plants became apparent, and thus the mechanical engineer, as well as the civil engineer, has been brought into the field of drainage engineering.

During the last several years a large number of drainage districts have been organized in the Mississippi River valley, and their drainage systems designed and constructed. The most glaring faults of the earlier pumping plant installations have been eliminated, but many problems in connection with their most efficient design and operation still remain unsolved.

It is not within the province of this paper to discuss the history and development of drainage by pumping, but rather to emphasize the most important features of the problem, which are undoubtedly worthy of high-grade mechanical engineering talent and investigation.

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*A paper by John J. Harman before the Illinois Society of Engineers and Surveyors.

In this connection, it might be well to mention that a very comprehensive treatise on this subject has just recently been issued by the Drainage Investigation Division of the Office of Experiment Stations of the U. S. Department of Agriculture, entitled Bulletin No. 243—"Land Drainage by Means of Pumps." This bulletin is on the free distribution list at present and can be secured by applying to the Director of the Office of Experiment Stations.

The two main features of the problem of drainage by pumping are as follows: (1). The design of drainage pumping plants with a view to certainty of operation at any time, economy of operation and low cost of maintenance. (2). The maintenance and operation of these pumping plants in such a manner as to insure certainty of operation at any time, and the best possible plan efficiency under the various conditions of head.

In taking up the problem of design, the first matter to be considered is the choice of the type of prime mover and pump which should be used. The conditions which govern their selection vary considerably in different localities, chiefly on account of the difference in head conditions, and the relative accessibility of the plants. In some places these plants have to be installed at points which are so difficult of access that the cost of delivering fuel is greater than the purchase price, and in such cases, of course, the demand for high economy is more accentuated.

Another factor of great importance in the selection of the type of machinery is a proper regard for the availability of operatives capable of handling the machinery, who will be willing to live at an isolated plant, away from fellowship to which they have been accustomed. In most cases, except where the pumping plant is in an easily accessible location, it has been found advisable to employ a man of family as the station engineer, and provide him with a comfortable home at the site of the pumping plant.

In selecting the type of prime mover, consideration should be given to internal combustion engines, electric motors and steam engines, all of which have been used to some extent in this class of work. The internal combustion type of prime mover, such as producer gas and oil engines, have some strong arguments in their favor, but before deciding on an installation of this kind, the availability of proper operatives must be given most careful consideration. Electric motors fit in very nicely for small plants located near an available supply of electric current, and the convenience of operation will often offset the increased cost of power, even in plants of considerable size. Properly designed steam engine driven plants have a very good fuel economy, together with considerable overload capacity, and can be readily operated at the various speeds necessary to the economical operation of the pumps under different pumping head conditions.

Several types of pumps have been used for this class of work, including the propeller lift pump, the paddle or scoop wheel, and the low head centrifugal pump. Rotary and piston pumps have also been tried, but these are subject to rapid deterioration from the cutting action of the gritty water which they are required to handle. The propeller lift pump and the paddle wheel pump, as installed in this country, are not a permanent type of construction, and it seems probable that they will have to be constructed in a more permanent manner, so that they can be properly maintained if they hold their position in this kind of service.

Scoop wheels of a permanent type of construction have been used quite extensively in England and Holland. These plants operate quite economically at low pumping heads, but are expensive to install properly and have not been developed for the extreme ranges of head encountered in the Upper Mississippi River valley.

Taking all these things into consideration, the type of prime mover and pump, which at the present time appears to be best adapted to our average conditoins, are the steam engine and the low head centrifugal pump, respectively.

Having determined upon the proper equipment for a given drainage pumping plant, assuming, of course, that the design of the plant is such as to allow the full economy of the apparatus to be realized, the next problem of importance is the maintenance and operation of the pumping plan from year to year. This is a matter which falls upon the shoulders of the drainage commissioners at a time when the most of the parties interested consider that their troubles are over, and it, consequently, in a great many cases, does not have the importance attached to it which it deserves.

After a drainage district has been organized, and the many preliminary difficulties surmounted, the drainage system properly designed and constructed, the construction contracts all closed up, and the services of the engineer dispensed with, the affairs of the drainage district are left entirely in the hands of its commissioners, who, in most cases, are not versed in the proper maintenance and economical operation of power plants. Most power plants are a vital part of the operations with which they are connected and no particular anxiety is felt by the owners on that account, but the conditions surrounding drainage pumping plants are so entirely different from those surrounding the average power plant that the operation becomes a matter of serious consideration.

Experience shows that the average drainage commissioner has a tendency to economize in the maintenance of a plant to such an extent as to endanger its operation at the time when water conditions are the worst, and the demand on the plant is at a maximum. This false economy has in many cases resulted in immense damage to the crops within the district, and has shaken the confidence of investors in projects of this character. Great savings can properly be made, however, by always operating the plant at its most economical point, and it is readily seen that any savings which can legitimately be made are of vital importance, in view of the fact that this expense of operation is a perpetual tax against the lands.

Lack of authentic information regarding the capacity and efficiency of low head centrifugal pumps at various heads and speeds seriously complicates the problem of determining the most economical operating conditions and even when correct information regarding the pump is available, the friction of suction and discharge piping is usually such a large percentage of the total head that each plant becomes more or less a problem of its own, and should be studied individually.

The firm with which the writer is associated has been in constant contact with this problem for a number of years, and its experience indicates that the only proper method of determining the most economical pump speeds and steam pressures for the various operating conditions is by making a series of tests on the pumps, engines and boilers, with various speeds and steam pressures at the different heads encountered in practice. Having secured these data an operating chart can be made up for the plant, showing the proper operating conditions for the different heads. On account of the difficulty in securing proper test conditions, it is necessary to be in readiness for testing at all times, and to make the tests without delay when the proper conditions arrive.

The following example from actual practice illustrates very forcibly the extent of the loss, due to inefficient operation, which may be reasonably expected when the plant is operated without regard for the proper operating speeds for the different pumping heads. Recent tests made on a 45-in. low head centrifugal pump, operating against a total head of approximately 3.5 ft., showed a pump efficiency of 40 per cent at 110 r.p.m. and 26 per cent at 135 r.p.m. Up to the time the tests were made the plant had been operating at 135 r.p.m. and was delivering to the pump almost twice as much power, per gals. of water pumped, as would have been required at 110 r.p.m. In determining the most economical speed, however, the efficiency of the engine must also be taken into account, as the amount of water delivered by the pump falls off rapidly at the decreased speed, and the consequent reduced load on the engine is attended with the customary loss, due to the increased cylinder condensation, throttling, etc. The station engineer at this plant is as experienced, intelligent and faithful as any drainage district could hope to employ, and it is practically impossible to employ and keep at the plant the quality of talent necessary for the most economical plant operation at all times.

The experience of many drainage districts indicates that it would be highly profitable to the land owners, as well as affording them greater security against break-downs at the plant, to place the operation of their drainage pumping plants in the hands of a competent drainage engineer who would make tests from time to time, purchase the necessary fuel and supplies for the plant, keep the accounts and pay the bills, as well as supervise the operation of the plant and look after its proper maintenance. Such an officer should, of course, be required to furnish acceptable bond in an amount sufficient to secure the drainage district against any pecuniary loss. He should also make written reports to the commissioners at their regular meetings, setting out in more or less detail the conditions in the drainage district and at the pumping plant, including a financial report of all expenses incurred subsequent to the preceding report. A full report for the year should be made at the end of the year's operation in which the cost of operation, pumping conditions, amount of water pumped, and other items of interest should be reported on in detail so as to make a full and complete record of the year's operation.

In order to carry out his duties properly, the drainage engineer should keep in constant touch with conditions in the drainage district and at the pumping plant, and should secure from the station engineer complete daily reports of the operation so that the amount of water pumped, the head pumped against, the fuel consumed, and the efficiency of the plant can be determined daily. Such reports are an invaluable guide in the proper operation of the plant and when preserved for a series of years from a number of different plants should add much to our store of knowledge regarding the drainage of river bottom lands by means of pumps.

Track Mover.—Mr. Samuel A. Taylor, in a recent address before the Railway Club of Pittsburgh, described the construction work at Panama and incidentally gave a description of a track moving machine which is used on the earth dumps. The operation is described as follows: "When the fill has been made to such a width that they wish to move the track over, the track mover, consisting of heavy chains and hooks hanging from the end of a boom, takes hold of the track and lifts it until the ties are clear of the ground. Then a side arm, in which is placed a pulley on which a wire rope passes, having hooks attached to the end, is then fastened to the rails. This rope is operated by a small engine, which swings it over to its new position. That machine displaces a great deal of labor and is very economical in cost of operation."

St. Louis Municipal Bridge.—The last pin of the last span of the St. Louis municipal bridge was driven at midnight, Jan. 23, 1912.

The Mississippi has been frozen over for some time, but owing to several days of warm weather, and a partial movement of the ice on January 20, full movement has been daily expected, which threatened the falsework and span. Every effort is now being made to clear the span from falsework. The bridge is being built by the American Bridge Company. The resident engineers are Brenneke & Fay of St. Louis, with Mr. S. W. Bowen as their representative in the field.

GENERAL ARTICLES AND CLASSIFIED ITEMS

The Vertical Posts of Bridges.*

There [illegible] in the design of steel structures more loosely defined in specifications and in the standard practice of the profession than the design of compression members for bridges.

Very many careful tests have been made as to the testing machine strength of the common combinations of structural shapes, and lately a great deal of money and labor has been spent to widen the range of these tests to include very large compression members.

This work is very valuable and very necessary. When it is completed, however, there will still be a lack of accuracy in our design of these members. The following questions will still be unanswered:

(a) What is the amount of the secondary stresses?

(b) What is the proper free length to be used in correlating a given design to test formulae?

Practice in regard to the second point varies widely. In the case shown in Fig. 1 most designers prefer to use L_1 for truss plane free length, and L_1 for cross plane free length. These assumptions are very reasonable if one works under the specification of unsupported length, instead of free buckling length. It might, however, be urged that this post is supported in the cross plane at the foot of the knee brace and at the top of the floor beam. For L_2 equal to 16 ft. 0 ins., L_3 might well be 13 ft. 0 ins. and L_4 be 17 ft. 6 ins. The assumed free length might then vary from 156 ins. to 210 ins. For a radius of gyration of as much as 3 ins. the permissible fibre stresses would be, by the common straight line formula.

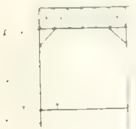

Fig. 1.

Fig. 2.

Fig. 3.

$$16000-70 \times 210/3 = 11{,}100 \text{ lbs.}$$
$$16000-70 \times 156/3 = 12{,}360 \text{ lbs.}$$

This difference of 10 per cent between the permissible fibre stresses calculated on the basis of two different interpretations of the specification would seem to be rather important. If the short length is correct the smaller permissible fibre stress is wasteful.

A much more serious ambiguity exists in the term "free length." In Schneider's Specifications, where "effective length" is used instead of free length, the author specifies that it shall be taken as one-half the distance between connections if the ends are fixed, two-thirds if one end is hinged, and the whole distance if both ends are hinged.

A theoretical definition of fixity might be stated as follows: A condition in which the neutral axis is prevented at the given point from changing direction on account of the tendency to buckle under a compressive load.

But who has determined when this condition shall have been fulfilled? Does a floor beam firmly riveted to the post fix the direction of its neutral axis, and, if so, at what point of its attachment? Does a latticed strut with a knee-brace fix the neutral axis of the post, and, if so, where—at the bottom of the strut, at the bottom of the knee-brace, or at some point between?

If in the post of Fig. 1, dimensioned as above, complete fixity were assumed at top of floor beam and at feet of kneebrace, we should have a free length, by Schneider's Specifications, of $L_3/2 = 78$ ins., and the permissible fibre stress would then be:

$$16000-70 \times 78/3 = 14{,}180 \text{ lbs.}$$

This is an increase of 30 per cent over the most unfavorable assumption.

Mr. C. T. Morris, in the *Engineering News* of November 2, calls attention very forcibly to the uncertainty in regard to the assumption of fixity. He appears to assume, however, that the presence of secondary stress and the accompanying point of contra-flexure requires the free length to be measured from the point of contra-flexure to the point of fixity. To this the present writer can not agree. It appears to him that while the position of the free buckling length would be changed on the post, that its amount would be unchanged. The presence of secondary stress in a member is to be considered, not because it lowers the permissible fibre stress, but because it increases the actual existing fibre stress.

Still more serious than the uncertainty as to the point at which fixity may be assumed to exist, is the uncertainty as to whether the empirical formulas into which we substitute are derived from tests on free or hinged end columns. If they are so derived, there would be little question as to the propriety of compensating in the length for fixed end conditions. Obviously we may not substitute half length in fixed end conditions (if we have them, and know it), in a formula arrived at from tests upon flat end columns. Even tests upon hinged end columns can not be considered to show the strength of columns absolutely free to turn at the ends, and should, therefore, not be adopted to fixed end conditions by reducing the length with the factors one-half and two-thirds.

Without excessive difficulty, tests upon members braced in manner as the vertical posts of bridges could be so contrived as to throw enough light upon the subject to enable a committee of one of the national professional societies to draw up a defining specification.

The secondary stress in the cross plane is very easy to determine theoretically. The engineer should not think, however, that these theoretical results are exactly true. The *Engineering News*, in a very able review of the practical aspects of secondary stresses, notes that truss plane secondary stresses are self relieving. It is also to be noted, in regard to cross plane secondaries, that the warping of the truss as a whole, which must take place when a series of posts is bent from the floor beam action, causes the inside half of the diagonals to take a disproportionate stress, which tends to develop an outward bending in the post. The eyebar, or diagonal angle *CD*, in Fig. 2, will have a stress appreciably greater than that in *AB*. This excess, multiplied by the arm *CD*/2, produces a bending moment opposite to that produced by the bending of the floor beam.

It is certainly not possible in contracts with small allowance for engineering, to compute the relief of the secondary stress from this cause. The secondary itself is not expensive to compute. The amount of this relief can never exceed one-half the secondary stress, since it is the imposition of a uniform moment upon a moment varying from zero to a maximum.

There is, however, one thing that the secondary stress calculations for vertical posts can teach us, which is worth while bearing in mind when designing these members. In two examples in Hirei, "Statically Indeterminate Stresses," pages 167-8, the moments M_1 and M_0 are computed for a railway and a highway bridge bent. The change of moment between top and bottom of the post is found to be 52,000 lbs. and 36,000 lbs. respectively. For heights of 20 ft. and 16 ft., the value of S_1 in these bents is 2,600 lbs. for the railway bridge and 2,250 lbs. for the highway bridge. Remembering that a certain amount of the wind load on the top chord is certain to be carried down the posts, it seems quite possible that there may be a shear of about 4,000 lbs. in the post.

If, then, this post is latticed in the cross plane with single-rivet lattice bars, each rivet of the latticing throughout the whole length of the post must endure a considerable stress. For a shear of 4,000 lbs., and with two systems of 60° lattices, this stress would be 2,000 lbs. × 1.15 = 2,300 lbs. This is not a very large stress for a single rivet, if only it were the average stress in a joint of several rivets. Here, however, the safety of the whole structure depends upon the ability of each of a great number of rivets to bear alone a load of over one ton. Such a reliance upon single units of construction is contrary to the principles of good design.

The conclusion which I wish to draw from these considerations is that the latticing of vertical posts of bridges should all be in the truss plane, in spite of the loss in pin plate metal. Where channels are turned with their webs in the truss plane a web plate should be used to connect them.

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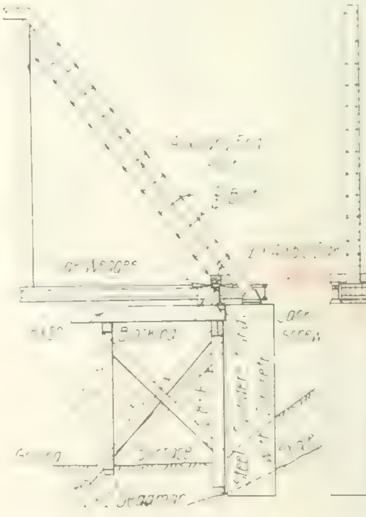
*Paper by Prof. Albert Smith, Purdue University, Lafayette Ind., before Indiana Engineering Society, Jan. 25.

Method of Raising a 168-ft. Steel Truss.*

The 23d St. viaduct in Denver was raised in 1909 to give more headroom over about 40 tracks which passed under the viaduct. The viaduct is some 2,600 ft. long and consisted of one through pin-connected steel Pratt truss, a similar truss 134 ft. long and about 2,300 ft. of timber trestle. This structure was replaced with one consisting of four steel spans each 136 ft. 6 ins. long, 570 ft. of steel trestle and 184 ft. of new timber trestle.



Sketch Showing Scheme for Jacking Up 168-ft. Truss.

In order to lift the south end of the 168-ft. truss from its seat it was necessary to take hold of it somewhere in front of the pedestals. To accomplish this a heavy shoring up bent was built immediately in front of the cylinders. This bent was made of two 8x20-in. timbers for a cap, and of two 8x16-in. timbers for each of six posts with a lighter post in the middle. The sill of this bent rested on shale. This shoring up bent was cross-braced to another bent placed about 14 ft. away, as

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*Abstracted from an article by C. C. Williams, Assistant Professor of Civil Engineering, published in the Journal of Engineering of the University of Colorado.

[illegible] was done from these stringers.

[illegible] bolted two 8x20-in. timbers cut to fit exactly [illegible] plate was made and from it the upper sides of the timbers were notched to fit precisely the lace-bars of the steel post. This was done so that the strain would be distributed along the total length of the post as much as possible. Every third rivet was removed from the upper side of the post and holes drilled in the lower flange to match. Through these holes the timbers were bolted on the under side. They were also bolted together with filler blocks between. The bottom ends of these timbers were cut horizontal. Inasmuch [illegible] lower chord of the first panel, it was necessary to have the supplementary posts extend as low as possible on the steel posts in order to prevent excessive bending strains in the latter. However, by using an oak cross piece 12x14 ins. with the 14-in. dimension horizontal and thus limiting the moment arm to about 11 ins., it was possible to prevent undue bending stress. The oak cross piece mentioned above was placed under the ends of the supplementary posts and above the lower chord, which was a 20-in. built up I section. The jackscrews were placed under the oak cross-pieces and on the 20-in. stringers described above.

To do the lifting, four Norton ball-bearing jacks were used, two 70 tons' capacity each and two 35 tons' each. The heaviest load lifted at this end was on the track side of the viaduct and amounted to about 80 tons. The oak cross-piece was long enough to allow blocks to be placed under it beside the jacks and, consequently, the end of the bridge was never off a secure bearing at any time, for it was followed up with blocks and oak wedges all the way.

The sides of the bridge were raised alternately about 2 ins. at a time. There was no difficulty except that a deflection of about ½ in. was noticed in the end post at the middle. Inasmuch as this deflection did not increase and the whole structure was safe according to computed stresses, no additional precautions were taken. The other truss pedestals were raised in a similar manner.

The Relative Advantages of Land Surveying Methods, With Reference to Speed, Accuracy and Applicability.*

There are three distinct methods of land surveying: (1) The traverse method, using transit and tape or transit and stadia. (2) The radiation method, using transit and tape or transit and stadia. (3) The intersection method, using transit and tape. Each of the methods will be briefly described, then discussed, and finally the methods will be compared.

TRAVERSE METHOD.

The traverse method is the one almost universally used in farm surveying, because it is the oldest and the best-known, and surveyors use it as a matter of habit without a thought as to whether or not the same results might be obtained in an easier and a quicker way by another method. Under the régime of the compass, the traverse method was undoubtedly the only practicable one, and since the introduction of the transit it has continued to be used without it being realized that the limitations that prompted its use have disappeared.

As its name implies, this method consists in running a traverse around the land to be surveyed. From the data thus obtained the area is computed usually by the method of latitudes and departures. A traverse station is required at each corner of the field, and if the sides of the field are very long or if the topography is rough one or more intermediate stations will be necessary. Since it is immaterial whether the traverse lines are taken inside or outside of the field, that arrangement should [illegible] cutting of trees, hedges, etc. The distance between the fence or boundary line and the transit line need be only enough to allow the transit to be set up comfortably, and usually from 3 to 10 ft. is sufficient. This distance can best be measured with a flag pole, some even foot being taken, for in this way one man can both measure the offsets and drive the hubs.

The transit stations may be located at random near the corners, but, if this is done, the traverse lines will not be parallel to the sides of the field, and the small areas between them will be irregular in form and difficult of solution. Since the bearings of the boundary lines are not obtained in the field, they must be computed in the office.

It is much better to make the traverse lines parallel to the boundary lines, so that the angles at the traverse stations will be the same as the angles at the corners of the field itself. Ordinarily the distances between corners can be measured directly along the fence lines without appreciable error; but if this can not be done, the traverse lines can be measured and a correction applied so as to obtain the lengths of the boundary lines of the field. In this way the area of the field is obtained without having to make allowance for the small areas between the traverse lines and the boundary lines.

The traverse method requires at least as many set-ups as there are corners to the field, and the surveyor has no sure check on his work until all the angles are measured. If the magnetic bearings of the lines at each point be taken, a blunder of over 15 minutes is readily discovered. By doubling each angle, and noting both single and double readings, an error of one minute may be detected, and the value of the angle can be obtained more accurately than by a single observation. But if these precautions are not taken and a large error is made, the angles must be re-measured until the error is discovered. A stadia reading should always be taken as a check on a chained distance, regardless of the method used in making the survey.

RADIATION METHOD.

The radiation method is used in topographic surveying with the plane-table, but so far as the writer knows it has never been applied to farm surveying with the transit, and it is the principal purpose of this paper to show how this method may be used most efficiently for farm surveying, and the advantages that are derived therefrom. In the radiation method the transit is set up at one or more central points and the angles at these points formed by lines radiating to the corners of the field are measured, as are also the radial lines.

Fields surveyed according to this method may be divided into four classes. Class 1 embraces fields whose corners are visible from a central point. The longer axis of the field should not be more than one-half mile, and hence fields containing up to 160 acres may be surveyed in this way. Under Class 2 come those fields whose topographical features are such that all the corners are not visible from any one point, so that two instrument points are required. The size and shape of fields coming under this class are about the same as those in Class 1, but larger fields may be surveyed in this way if the topography permits. Under Class 3 come long, narrow fields whose widths are under 2,000 ft. Two or more central points are taken and the field is divided into smaller fields. Under Class 4, come all fields containing over 320 acres except those that come under Class 3. This is a modification of the traverse method, as a small traverse is run inside the field, its lines being about a quarter of a mile from the boundary lines. From one-third to one-half of the instrument work is eliminated by this method and the distances chained are decreased by 2,000 ft. When the radiation method is used the sum of the angles about each transit point is a direct check on the accuracy of the instrument work, and should a mistake be made it can be found while the instrument is still over the point, causing little delay. On the other hand, an error in chaining will remain undiscovered unless the surveyor is familiar enough with the shape of the field to notice the error when the field is platted to a large scale; but small errors will not be detected in this way. To avoid making blunders in the chaining, a stadia reading should be taken for a check. If the field itself is divided into parts and the areas of these are wanted, it requires very little time to secure the additional data from one or more of the transit stations. Both the instrument work and the chaining are reduced to a minimum by the radiation method. If topography is wanted, it can be taken while the instrument is set up at each point.

[illegible] METHODS OF LAND SURVEYING [illegible]

[illegible]	Triangulation	Traverse	Radiation	Intersection
[illegible]			410.85	410.93
[illegible]			558.17	
[illegible]			598.12	598.18
[illegible]			834.74	834.69
[illegible]			752.01	752.09
[illegible]			1371.00	1371.02
[illegible]			867.84	866.12
[illegible]			671.64	671.76
[illegible]		[illegible]	N 07 30' 00"	N [illegible]
[illegible]		[illegible]	30 12' 00"	[illegible]
[illegible]		E		[illegible]
[illegible]		[illegible]	76 30' 30" E	[illegible]
[illegible]		[illegible]	46 38' 30"	
[illegible]		[illegible]	65 59' 00"	65 00' 55" W
[illegible]		[illegible]	35 11' 00"	N
[illegible]		[illegible]	[illegible]	54.906 acres.
[illegible]		[illegible]	6343.49 ft.	

[illegible] COMPARATIVE SPEED AND ACCURACY OF TRAVERSE AND RADIATION METHODS OF SURVEYING FIELDS OF [illegible] AND [illegible] ACRES.

[illegible]	Method	[illegible]	[illegible]	[illegible]	[illegible]	Time Spent In [illegible]	[illegible] Work	[illegible]	Total	Difference in Time Min.	Difference in Time Pct.	Area Sq. Ft.	Area Acres.
		8,392.0				[illegible]	125	[illegible]				4,194,743	96.08
		6,275.0	2,117.0	[illegible]		[illegible]		60	[illegible]	65	22.4	[illegible]	[illegible]
		8,391.15				60	[illegible]	100	[illegible]			4,193,784	96.06
		6,253.90	2,137.25	25.4		[illegible]	[illegible]	70	220	60	21.4	4,193,764	96.06
	T					120	[illegible]	150	[illegible]			9,694,270	222.04
		8,818.3	[illegible]	[illegible]		[illegible]	155	115	[illegible]	100	21.5	[illegible]	[illegible]
	T	11,952.0				115	185	[illegible]	450			9,693,429	222.02
		8,800.4	3,151.60	26.4		90	[illegible]	110	355	95	21.1	9,694,509	222.05

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*Abstract of paper by G. W. [illegible] before the Illinois Society of Engineers and Surveyors.

The radiation method divides the field into triangles, two sides and the included angle of each being measured. The area of each triangle is computed from the formula, area = ½ bc sin A, and the sum of the areas of the triangles is the area of the field. This method of computation is much quicker than the latitude and departure method; but if a description of the field is wanted, each triangle must be solved for the third side and the two angles at the base. To do this requires more time than to solve for the area by the latitude and departure method, where the small areas between the traverse lines and the boundary lines are eliminated; but if these small areas have to be computed, the computations required by the radiation method are less than those required by the traverse method.

INTERSECTION METHOD.

This method consists in establishing and carefully measuring a base line from each end of which all the corners of the field are visible, and in measuring all the angles around each end formed by lines radiating to the corners. If the field is a small one and the topography permits, one base line is sufficient; but in the case of a large one, two or more base lines will be necessary. The base line is taken inside the field when it is possible, as the length of sights is thereby reduced to a minimum; but it is not essential that it be so taken, and may be all outside of the field or partly inside and partly outside. The only imperative condition—using one base line—is that all the corners must be visible from each end of the base line.

In locating the base line, care must be taken to avoid small angles, as the sines of small angles change rapidly. In the case of a rectangular field the best location for the base line is parallel to the short axis of the field and midway of the long axis. This arrangement should be followed as closely as the topography will permit. The more irregular the field, the harder it is to avoid small angles, and more time and thought are required in the selection of the base line than in the case of the rectangular field. The length of the base line depends upon local conditions. In general, the longer the base line the more accurate the results; but it should never be less than one-third the length of the average sight. This is based on the assumption that the instrument used reads to 30″ and that each angle is doubled on the limb.

In order that a clearer idea may be had of the relative accuracy of the different methods as well as the time required by each of them, the following examples are given:

Example 1. The field used in this survey is bounded by lines connecting points 17, 12, 11, 16, 15, 21, 22 and 18; these points are part of the triangulation system of the University of Illinois, and were chosen because the area embraced within them is known to the one thousandth of an acre. It is seldom in practice that a field as small as this is bounded by eight sides. The number of sides that a field has is of small moment as far as the distances chained are concerned if the traverse method is used; but in the radiation method each additional corner means an additional radial distance to chain. The triangulation points are marked by concrete monuments 8 ins. in diameter and 30 ins. long, with an iron rod ⅝ in. in diameter embedded in their centers. This field was surveyed by the writer with the help of one man by each of the three methods and the results obtained are shown in Table I. In the second column of this table are given the lengths and bearings of the sides of the field as determined by triangulation. The lengths are correct to the nearest hundredth of a foot, and the bearings are correct to the nearest 5″, so these values may be taken as correct and used as a basis of comparison for the other methods. In the succeeding columns are given the results obtained by the traverse, radiation, and intersection methods. The traverse method required 2 hours and 30 minutes to locate the transit stations and to chain the distances between them, and 1 hour and 30 minutes to measure the angles. While a traverse could have been run around the points themselves, offsets were taken so as to conform as nearly as possible to the conditions found in actual practice. The area of the field by triangulation is 54.887 acres, while the area obtained by the traverse method was 54.898 acres, a difference of 0.011 acre. The survey by the radiation method was made under the same conditions as the first survey, and required one hour each for the chaining and the instrument work. The area obtained was 54.894 acres, which differ from the triangulation area by 0.007 acre. The intersection method required 2 hours and 20 minutes, of which 40 minutes were spent in locating and measuring the base line. The base line was measured twice with a steel tape, the corrections were made for slope and temperature, and the average of the two measurements was taken as correct. The area by this method was 54.906 acres, which differs from the triangulation area by 0.019 acre. In a rectanglar field this method would have given the most accurate results, but in the field under consideration it was impossible so to select a base line as to avoid small angles.

Examples 2 and 3. The results obtained in these two fields are shown in Table II. These surveys were made by Mr. M. F. Connelly and Mr. Paul Kircher, two civil engineering seniors, in connection with thesis work, and Table II is taken from their thesis on "The Relative Efficiency of Land-Surveying Methods." The first field contained about 96 acres and the second one about 222 acres. In order to make the results more trustworthy, two surveys were made of each field by the traverse method and the radiation method. As may be seen from the table, the radiation method required 25 per cent less chaining and 21.5 per cent less time.

The three methods of land surveying will be compared with respect to: 1st, speed; 2d, accuracy, and 3d, applicability.

1st. Comparison With Respect to Speed.—(a) Time spent in chaining. The time required by the intersection method is much less than that required by either of the other two. In the large majority of cases the radiation method requires less chaining than the traverse method, and in most instances the difference amounts to 20 per cent.

(b) Time spent in instrument work. As regards the instrument work, the radiation method requires one-half as many set-ups as the intersection method, and about one-fourth as many as the traverse method. But the number of angles read in the traverse method is the same as in the radiation method, and is one-half that required by the intersection method. Taking all the field work into consideration, the intersection method is the quickest, with the radiation method second, and the traverse method third.

(c) Time spent in computing results. As far as determining the acreage is concerned, the radiation method requires the least amount of computation, while the intersection method requires the most.

2d. Comparison With Respect to Accuracy.—Since larger errors are made in chaining distances than in measuring angles, that method which requires the least amount of chaining is the most accurate. Consequently, the intersection method is the most accurate provided that the base line is so taken that small angles are avoided. Angles under 15° and over 165° must be obtained to the nearest 10″, which can be done by trebling the angle on the limb of the transit. The radiation method is second with respect to accuracy, and the traverse method comes last. The above arrangement is based on the assumption that no blunders are made in the work. All blunders made in measuring angles can be readily discovered in the field, but those made in chaining can not be except in the traverse method, where a large error of closure indicates that a mistake has been made. There is no chance of making a blunder in the intersection method, as the base line is measured twice with unusual care. In the radiation method no check is had on the distances chained unless a stadia reading can be taken. A stadia reading for distance is as good a check as could be desired, but it can not always be had, as frequently only the very top of the flag pole is visible, and a stadia intercept can not be obtained; but if a gradienter attachment is used a blunder may be detected at a distance of 1,000 ft. if only a foot of the rod is visible. A reference to Table I shows that any one of the three methods is accurate enough for all practical purposes.

3d. Comparison With Respect to Applicability.—The traverse method is applicable to any field regardless of the crops or topographical conditions. There is always a strip of land along the fence lines that is not cultivated, and an open sight may be had along this strip, and the distance between corners may be chained without interfering with the growing crops. The radiation method can be used equally as well, provided that the growing crops do not interfere with the chaining or obscure the lines of sight. Farms are generally surveyed upon changing hands, and the principal thing to be ascertained is the acreage. Possession is taken in the spring before the crops are put in and hence the surveyor is not limited in his choice of methods. The intersection method can be used only in level open country, as all the corners of the field can seldom be seen from both ends of a base line in hilly wooded country. Hence, with respect to applicability, the traverse method has a slight advantage over the radiation method, and both of these are far ahead of the intersection method.

CONCLUSIONS.

Which method of surveying should be used in any given case depends entirely upon the conditions peculiar to that particular case. Each of the methods is best in some instances. The use of the intersection method is limited, it is true, by topographical features, but it is the most accurate of all, and it should be used when the nature of the country will permit. The radiation method should be given equal standing with the traverse method, for its saving in time more than compensates for its slightly limited use. Frequently the sides of the field have to be measured in order to re-locate the corners, and in such cases the traverse method is the quickest and should be used. As any one of the methods is accurate enough for all practical purposes, the one that is most applicable to the case in hand should be used.

Civil Engineering Society Meetings.

Eastern Cement Show. Annual show at Madison Square Garden, New York, Jan. 29-Feb. 3.

Maine Society of Civil Engineers.—Frank E Pressy, Augusta, Sec'y. Annual meeting at Lewiston, Feb. 7.

Connecticut Society of Civil Engineers.—J. F. Jackson, New Haven, Sec'y. Annual meeting at New Haven, Feb. 12-14.

Engineering Society of Wisconsin.—John C. White, Madison, Sec'y. Annual meeting at Madison, Feb. 14-16.

Indiana Sanitary and Water Supply Association.—Dr. W. F. King, Indianapolis, Sec'y. Annual meeting at Indianapolis, Feb. 15-16.

North Dakota Society of Engineers.—R. W. Livingston, Mandan, N. D., Sec'y. Annual meeting at Grand Forks, N. D., Feb. 15-16.

Iowa Engineering Society.—S. M. Woodward, Iowa City, Sec'y. Annual meeting at Davenport, Feb. 21-23.

Western Cement Show.—Coliseum, Chicago, Feb. 21-28.

Interstate Cement Tile Manufacturers' Association.—Chas. E. Sims, Worthington, Minn., Sec'y. Annual convention at Chicago, Feb. 21-23.

National Association of Cement Users.—Edw. E. Krauss, Harrison Bldg., Philadelphia, Sec'y. Annual convention at Kansas City, Mo., March 11-16.

Kansas City Cement Show.—Convention Hall, Kansas City, Mo., March 14-21.

PERSONALS.

Mr. Walter L. Eyres has been appointed City Electrician of Austin, Texas.

Mr. F. N. Downer has been appointed City Engineer of Painesville, Ohio.

Mr. W. W. Phelps has been appointed City Engineer of Santa Monica, Calif.

Mr. Geo. Schuyler Davis died in Cleveland, Ohio, on January 24. Mr. Davis was, at the time of his death, editor of the "Chicago Traction Weekly" of Chicago. He was well known throughout the railway field.

CONTRACT NEWS SECTION

of

ENGINEERING & CONTRACTING

The Doings of the Week

Developments of the past week indicate that a number of the older railways are planning new financing in order to secure funds for construction work. The Delaware, Lackawanna & Western has announced that it will issue $12,000,000 of new stock for construction work in Pennsylvania, most of which will probably be expended on work on the new cut-off from Clark's Summit to Hallstead, Pa. The Wabash R. R. is to issue $5,000,000 of receiver's certificates to be used to pay for improvements, and the stockholders of the San Pedro, Los Angeles & Salt Lake R. R. are to vote on March 4 on an increase of capital stock of $10,000,000. It is said that this increase will be used to make improvements and to build extensions. The above are but a few of the new developments which seem to confirm the general belief that the present year will see much construction work.

A considerable amount of new construction work has already been signed up, and bids on two or three other large contracts have been taken. Among the latter is the work of constructing the Point Defiance line of the Northern Pacific in Washington. Bids on this were received a few days ago, but at last reports the contract had not been awarded. In the way of immediate construction there is the 300 miles of extensions for the Missouri, Oklahoma & Gulf Ry. in Texas and Oklahoma. This contract was let to the Fidelity Construction Co. of Kansas City, Mo., and Muskogee, Okla. The profiles for the work will be ready for inspection about Feb. 10 or Feb. 15. The contract calls for the completion of the work within one year.

Among the railroad construction jobs let in the past few days are the following: C. F. Betz, Sioux City, Ia., for constructing the 15th St. and Indiana Ave. subways at Kansas City, Mo., for the Kansas City Terminal Ry., the work involving a large amount of concrete and some 100,000 cu. yds. of earth work; Angus Sinclair, Toronto, Ont., for constructing 230 miles of the Canadian Northern Ry. between Onwatin and Pembroke, Ont.; L. P. Mallarky, Montreal, Que., for constructing that portion of the Canadian Northern Ry. between Pembroke and Ottawa; Burwell & Hillyer, Jacksonville, Fla., for terminal work at the foot of Hogan St., Jacksonville, for the Seaboard Air Line Ry.

In the way of irrigation work the principal job on which bids were opened the past week appears to be the one for constructing the west canal of the Uncompahgre project for the U. S. Reclamation Service. Maney Bros. & Co., Boise, Idaho, at $78,363, were the low bidders on the work.

An estimate of the cost of a barge canal to connect the Delaware and Chesapeake Bays has been completed by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del. The cost is estimated at $5,500,000, for a canal to be 12 ft. deep and to have a width of 90 ft. on the bottom. This estimate is exclusive of the cost of acquiring the present Chesapeake and Delaware Canal, which has been appraised at $2,514,288.

A new $15,000,000 county court house is planned for the City of New York. Last week the Board of Estimate of that city voted to condemn a site just north of City Hall Park for the new building, which will replace the present structure. The cost of the land is estimated at $6,000,000 and the cost of the building $9,000,000.

Bids on the largest piece of drainage work which has come up for letting in some years were opened on Jan. 25 at Osceola, Ark. This work called for the construction of a drainage system for Drainage District No. 9 of Mississippi County, and involved about 14,000,000 cu. yds. of excavation. There was considerable competition for this contract, but at this writing we are unable to give the name of the successful contractor. Another good-sized drainage job which will probably be put under contract this spring calls for the construction of a system for the Back Swamps and Jacob Swamp Drainage District in North Carolina. The viewers and engineer have made final report on this proposed system, but it will be about 45 days before bonds can be issued. The estimated cost of the system is $130,000 and it will require about 1,300,000 cu. yds. of earth excavation.

Representative Borland of Missouri has introduced a bill in the House of Representatives providing for a 60-ft. national highway from Washington, D. C., to Olympia, Wash., and one from Washington to San Francisco. The cost of the proposed roads is to be equally divided between the federal and state governments and each state is to stand a proportionate share of the cost of construction.

Water Works and a Mule.

Kindness to dumb creatures is not entirely monopolized by members of the Society for the Prevention of Cussing Animals, as the following touching little incident goes to show. Out in a small Kansas town a railroad obtains its water supply by means of a 1-mule power pumping station. That is, a mule furnishes the power for raising the water into the tank. It is a well trained animal and is left alone all day going around and around pumping the water. The mule is blind, and it has been arranged that when the tank is full the water will splash over on a sheet of zinc, which is the signal for the mule to stop. When water is taken from the tank by an engine the mule starts pumping again. Last spring the citizens of the town proposed to issue bonds for installing municipal water works. This, of course, would have thrown the mule out of a job, but only one man seemed to think of this. "What will become of that poor, blind, dumb animal," said he, "if you cut off his only means of making a living; how will he earn his fodder? where will he sleep?" So this man got out and worked earnestly against the bond issue, and partly as a result of his efforts, the plan was defeated at the election. The only thing that prevents this man being elected a life member of the S. P. C. A. is the fact that he owns the mule.

Railway Construction in Canada.

If the present plans of the three great railways of Canada are carried out the western provinces of that [illegible] more construction work than at any previous time in their history. The announced plans of these three railways—the Canadian Northern, the Grand Trunk Pacific and the Canadian Pacific—call for the expenditure of nearly $60,000,000 for railroad construction in the four western provinces. The lines to be built will cover about 3,000 miles, this mileage being about evenly divided between the three companies. A considerable portion of this new line will be composed of branches. The Canadian Pacific alone will build several hundred miles of these to serve as feeders for its main line. This road will also expend millions for betterment work on its existing line. The Canadian Northern and the Grand Trunk Pacific will continue their contest to determine which will be first to complete a through line to the coast. Both companies will be at work from both ends between Edmonton and the Pacific. This construction work will require an immense number of men, but it is not probable that these will be recruited from the States. The Canadian government's regulations provide that each laborer from this country must have $50 in cash, and when the average hobo gets this amount he probably would much rather prefer going to some other place than Canada.

Buying in American Market.

An indication of the remarkable resources of the United States for the cheap production of steel and the advantages of buying this kind of material in the American market are shown by the experience of a large contracting company in placing an order for 124 miles of 12-in. steel pipe to be used in building a natural gas line in California. Quotations were asked from British, German and French manufacturers, and the best foreign price was that of a British firm. This price, exclusive of duty and freight, was approximately double that at which the contract was let to an American firm.

The Wop.

The hobo needs no outside poet to sing his prais- [illegible] But his humbler brother, the Wop, if his deeds be recounted in verse, must depend on the magazine versifier. Judging from the following poem by Braton Braley, which appeared in a recent issue of the Saturday Evening Post, the Wop has found his "poet lariat":

[illegible]
  [illegible]
[illegible]
  [illegible]
  [illegible]
  The hunkies who work till they drop.
And so, in the dust and the thick of it,
  [illegible] the Wop!

[illegible]
  They are the fellows who plan;
But the backbreaking strain and the sweat of it
  Fall to the laboring man—
Dago and Russ and Hungarian—
  All of the immigrant crop.
Where is the job we could carry on—
  Save for the Wop?

Subject for scorn and bedeviling;
  Victim of fraud and [illegible]
Still, with his spade, he is leveling
  Routes over mountain and plain.
Progress? His soul is the breath of it;
  Lacking his hand, it would stop.
Facing the danger and death of it,
  Here is the Wop!

[illegible]
  He knows the hard-driven toil,
[illegible]
  [illegible]
[illegible] him—
  [illegible]
Progress is stained with the blood of him—
  [illegible]

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The [illegible] & [illegible] Ry. has completed surveys [illegible] for the construction of its proposed 3½ mile railroad at Gadsden. No decision has been reached as to the time for awarding construction contracts. Louis Hart, Gadsden, Ala., is interested.

The Louisville & Nashville Railroad, according to information received from Fort Deposit, Ala., has decided to construct another side track at that place. The new track will be about 800 yds. long and in order to obtain a solid roadbed a big ditch running along the main line [illegible] St. will be filled.

Arizona.

Engineers of the El Paso & Southwestern R. R. are reported to be running surveys for the construction of a branch line from Tucson to the Copper Queen property at Camp Apache. According to present surveys the line will start from the previously determined crossing over the Southern Pacific tracks near the Davis school, cut across into the line of the old narrow gauge road, which it will follow through most of its length, cut off into the Canyado del Oro and follow the canyon to its head. A project to tunnel under the hill, passing under the mine property owned by Francis M. Hartman and associates, and thus get in close to the Camp Apache mine of the Copper Queen, is being considered. J. J. Campbell, El Paso, Texas, is Engineer of the E. P. & S. W.

Arkansas.

The Kansas City & Memphis Ry., projecting a 250 mile line from Fayetteville to Memphis and Little Rock, has construction work under way on part of its line. The W. R. Felker Construction Co., Rogers, Ark., has the contract as was noted some time ago. Geo. D. Locke, Rogers, Ark., is President and M. Hays, Rogers, Ark., is Chief Engineer.

The Board of Trade of Russellville is taking steps to raise a $40,000 bonus for the construction of the proposed line of the Russellville, Dover & Northern R. R. Co., from Russellville to Dover, 10 miles north. W. H. Garanflo, President of the State National Bank, Little Rock, Ark., is President of the railroad.

California.

⦿The Mallon-Yohe Co., Inc., Princeton, Cal., which has the contract for the construction of the Colusa & Hamilton R. R. (Southern Pacific line) as noted in previous issues, will sublet much of the work. The work is located on the west side of the Sacramento River and extends from Hamilton City south to Arbuckle, 61 miles. The contract includes 20,000 cu. yds. earth excavation, 1,750,000 cu. yds. embankment, concrete bridges and wood trestles.

The city officials of San Francisco are reported to have decided to complete the reconstruction of the Geary St. municipal railroad (electric) by contract instead of by day labor as was at first intended. M. Marsden is City Engineer.

The Laton & Western R. R., which was placed in operation from Laton to Lanare, 15½ miles, early this year, has started surveys for an extension from Lanare through the Grant and Summit Counties. It is understood that construction work will be started so that the extension can be completed this year. L. A. Nares, Fresno, Cal., is President.

The Central California Traction Co., San Francisco, is stated to have secured rights of way for a branch line from its main Sacramento line at Galt road to Galt, and proposes to extend the branch line through Thornton and on to Walnut Grove, on the Sacramento river.

Among the numerous reports concerning projected work of the Southern Pacific Railway is one to the effect that work will be started in the Spring on a new passenger station at Sacramento, Calif., to cost $350,000. William Hood, San Francisco, Calif., is Chief Engineer.

Preliminary surveys have been made for the proposed line of the Sacramento Valley West Side Electric Ry. Co., between Woodland and Red Bluff, and right of way agents are now busy in the field securing options on the necessary property for right of way, terminals, etc. The Dozier Construction & Engineering Co., Nicolaus Bldg., Sacramento, Cal., is the engineer.

The Oakland, Antioch & Eastern Ry. Co. has filed its articles of incorporation with the county clerk at Fairfield. This company, as previously noted, proposes to build a line from Oakland to Sacramento and from Oakland to Stockton. The incorporators include A. W. Melby, Concord, Cal., and A. L. Napthaly, Lawrence Amistein, John R. Selby and A. J. Krutmeyer of San Francisco.

Colorado.

The people of Montrose and the country between Montrose and the Paradox, are agitating the question of a railroad from Montrose to the Paradox Valley, and have started various subscription lists to raise money to have a careful report made, showing the resources of the country, with the possible tonnage that would be given to a railroad, and, later, to make a preliminary survey of the proposed route. As noted in our Jan. 12 issue the Montrose-Paradox Railroad Construction Co. has been organized to have charge of the preliminary work. K. D. Heguembourg, Naturita, Colo., is a director of the company.

Florida.

⦿Burwell & Hillyer, Jacksonville, Fla., have been awarded a contract for the terminal work at the foot of Hogan St., Jacksonville, for the Seaboard Air Line Ry. The work will cost about $250,000 and will include the construction of two storage houses 500x110 ft. each and a dock.

Georgia.

Burke & Joseph, Gainesville, Ga., who have the contract for grading and tracklaying for 35 miles of line for the Gainesville & Northwestern Ry., from Gainesville, have some slip and wheel scraper work to sublet.

The Georgia, Alabama & Western Ry. Co. has been chartered in Georgia and proposes to construct a railroad from Milltown, in Berrien county, over to the Alabama line near Blakely, in Early county, a distance of about 150 miles. It will probably also be extended into Alabama. This railroad will pass through the counties of Lowndes, Berrien, Brooks, Thomas, Grady, Mitchell, Miller and Early. The incorporators are E. H. Beck, T. A. Rozier and F. B. Walker of Barney; W. W. Webb, L. M. Stanfield and Robert Barfield of Hahira; J. E. T. Bowden and G. W. Deen of Waycross, and J. Frank Harris and John A. Kennedy of Pavo.

Actual work has been started clearing the right of way for the proposed line of the Elberton & Eastern R. R. preparatory to starting grading. President W. O. Jones has announced that the steam graders and other machinery will arrive shortly when dirt will be broken on the first section which will extend from Elberton to Tignall in Wilkes County, Ga. At the annual meeting of the stockholders of the Elberton & Eastern, W. O. Jones was re-elected president; T. W. Shelton, of Norfolk, vice president; J. H. Blackwell, secretary and treasurer. The overtures made recently by the Seaboard for trackage arrangements in Elberton and the personnel of the foreign members of the board of directors [illegible] has given rise to the rumor that the Seaboard is behind the Elberton & Eastern.

Illinois.

The Decatur-Pana Traction Co., which proposes the construction of an interurban line from Decatur to Pana, has filed its articles of incorporation at Decatur. The incorporators include L. J. Ashcraft, Howard Hodgkins and John H. Martin, all of Chicago.

The Chicago, Burlington & Quincy R. R. has had engineers in the field for several weeks running a line for a cross-country line through Alton and across the Mississippi River to connect the St. Louis terminals of the Chicago Burlington & Quincy R. R. at West Alton with the Burlington coal line in Southern Illinois. The plans for the improvement are understood to call for a new steel bridge over the Mississippi river at Alton, Ill., and an extension of its system southeasterly by a cross-country line from Alton, through Centralia, Ill., and Paducah, Ky., to Birmingham, Ala., including the erection of a steel bridge over the Ohio river at Paducah.

Iowa.

The Cedar Rapids & Iowa City Ry. (electric), William G. Dows, President, Cedar Rapids, Ia., expects to build an extension of about 15 miles to Mt. Vernon this spring.

Kansas.

As previously noted in these columns the State Public Utilities Commission of Kansas has granted permission to the Wichita & Denver Air Line R. R. Co. to issue bonds for its proposed railroad. This company is projecting a [illegible] mile line to extend from Wichita, Kan., to Denver, Colo. Surveys have been made and part of the construction capital has been secured. The Air Line Construction Co., Kinsley, Kan., has the construction contract. W. F. Brown, Iuka, Kan., is President; J. E. Thayer, Macksville, Kan., is Chief Engineer, and H. P. Ketelson, Kinsley, Kan., is Secretary.

An election will be held, according to advices from Lincoln, Kan., on Feb. 8, to vote on the proposition of issuing bonds to assist in the construction of the Salina, Tipton & Northern railroad.

The Missouri, Kansas & Texas (Katy) Railroad is reported to have plans under way for the construction of a line north from Junction City, Kan., into Nebraska and probably the Dakotas.

Kentucky.

F. E. Engle, Chief Engineer of the Sandy Valley & Elkhorn Railroad, has announced that construction work on the line from Shelby to Jenkins, Ky., will be completed shortly.

Maryland.

The Northern Central Ry. (Pennsylvania line), J. H. Nichols, Principal Assistant Engineer, Williamsport, Pa., is reported to be planning to begin work April 1 on its terminal improvements at Frederick, Md. These will include the laying of new tracks and in rearrangement of the yards.

Michigan.

The Port Huron & Northern Ry. Co., as mentioned in our Jan. 17 issue, is planning the construction of a 50-mile line to extend from Port Huron northwest into the Thumb District. William E. Bolles, 501 Wayne Bank Bldg., Detroit, Mich., is Treasurer.

Good progress is being made on the plans for an electric line from Bristol, Ind., to Three Rivers and Kalamagoo, up the St. Joseph Valley. It is proposed to build three dams at and near Mottville, Mich., to develop power for the line. H. E. Bucklen, Chicago, Ill., is interested in this project.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Duluth and the Ranges.

[illegible]

The Bucyrus Company, [illegible] steam shovels have opened [illegible] city, and have appointed Mr. E. C. Hingston as northern sales agent for this territory. This move of the Bucyrus Company proves the extensive business that is done in this territory, and undoubtedly their intention is to be right here on the job.

[illegible] Co., stripping contractors, Hibbing, Minn., spent a few days here [illegible] The [illegible] Range, and at [illegible] of men repairing their equipment and getting it into shape so as to start on their work early the coming Spring.

F. A. Baxter, the railroad contractor, is one of the very few contractors that is working on railroad work in this vicinity at the present time He has some work on the Soo Line in Wisconsin.

A. G. Osman, General Contractor, was a caller a few days ago, and stated that he was not doing anything at the present time; but [illegible] weather permitted.

Paul Bains, General Superintendent for the Drake & Stratton Co., stripping contractors on the Iron Range, was here for a few days this week. They have closed down their operations for this season, and do not expect to resume until about April 1st. At the present time they are busily engaged overhauling their plant.

Captain Harry Roberts, of the Roberts-Kingston Contracting Co., who have a large stripping contract on the Iron Range, returned from a trip to the Twin Cities last week. He states that they have closed down their operations for the winter.

The writer is in receipt of a letter from the Weir Junction Coal Co., Cherokee, Kan., in which they state that they have a contract that they wish to let to someone to load coal by the ton, and to strip coal by the yard. This is a contract for someone who has a steam shovel. Anyone interested in this matter should take it up direct with the company.

The writer returned from a week's trip to St. Paul and Minneapolis, and while the contractors that he called on were not very busy at the present time, still they were quite optimistic as to the outlook for the coming season. Business in general in these two cities seemed to be very good, and the business men interviewed, all stated that 1912 in their opinion would be a very prosperous year.

In regards to the labor situation at Duluth and vicinity would say that there is a scarcity of men here. The wages have gone up some but it seems to be impossible to get the number of men required for the work that is offered. Quite a number of the foreigners in this section of the country, foreseeing that the winter season would not be very good, went to Europe, and many thousands of laborers left for Canada to engage on construction work there; and, owing to the fact that there has not been very many new men coming in here, it leaves this market in a very stringent condition; and, I predict that unless a large number of men start to come in here, there will be a scarcity of men to start the coming season's operations

Mississippi.

A $1[illegible] New York City proceeds of which will be used to extend the Summit & McComb Motor Line (electric) to Magnolia. The extension will be about seven miles long. Ted Blackmore, Summit, Miss., is President.

Missouri.

The Butler County R. R., William N. Barron, General Manager, Poplar Bluff, Mo., on Jan. 20, received bids for the construction of nine miles of railroad grade, the contract calling for 200,000 cu. yds. of grading, including all clearing and grubbing, at 22 cts. per cu. yd. All bids were rejected as being excessive. Th[illegible] Engineers [illegible] pany.

Kansas City, Mo., and Vicinity.

[illegible] last week [illegible] the past few days on business While here Mr. Foulke expressed the opinion that the coming [illegible] tracting world "All sections of the country seem to show activity," he said. This seems [illegible] pen to drop in our office. Prospects certainly [illegible] will be mighty scarce. This is our opinion at [illegible] shall, Needles, Cal. The Santa Fe work on [illegible] is about finished, but he expects to land other contracts in that section in all probabilities. It is needless to add that Mr Marshall has made splendid progress on the work in which he has been engaged—he always does that

While it has not been officially announced as yet, still it is pretty well understood that work on the M. O. & G. will begin next month. Rumor has it that 250 miles of new road will be constructed. It will be our endeavor to keep our readers fully informed as to the project. Probably next week something of importance can be announced.

Wm. List of the firm of List & Gifford is in St. Paul this week attending the Northern Pacific letting at that place. We hope to announce that Mr. List secured a nice piece of work. There is a large amount of work to be done, running well up to the millions of yards.

"Pete" Gifford was in Kansas City last week from the List & Gifford work in Arkansas. Everything seems to be moving along nicely on that contract and is well on the way to completion.

Connelly Bros. expect to secure some nice work in the west within the next few weeks. In order to be prepared for the work in the proper manner they have placed their order for a new shovel. All of Connelly's friends hope they will be highly successful in their steam shovel venture. Their address will be Ogden, Utah, within a very short time.

⦿C. F. Betz of Sioux City, Ia., was awarded a large contract here last week. The Kansas City Terminal Ry. Co. let a contract for the 15th St. and the Indiana Ave. subways. Mr. [illegible] preparing to do the work. There is a large amount of concrete in this, besides 100,000 yards of earth work

The writer called at W M. Spencer's camp the last week. It will be remembered that Mr. Spencer is doing work on the Excelsior Springs line. The contract presents a busy aspect these days in spite of the frigid weather we have been having. Both a 70 and a 40 ton shovel are being worked and the dirt is certainly being moved rapidly.

Mr. H. F. Riley of Clapp, Norstorm & Riley, Chicago, stopped over here on the 27th. It certainly imbues one with confidence in the grading world to get to talk with this gentleman. Riley is one of those men to whom there never is a dark side to the future. His friends —and they are numbered by the score—will be glad to know of his continued prosperity.

It certainly is with great pleasure that we announce the marked improvement in the condition of Mr. A P. Wood of the contracting firm of Wood, Bancroft & Doty. Pneumonia is always a serious matter and at Mr. Wood's [illegible] that it seems only a question of a few days when he will be up and around once more

Mr. Ed Burke of Chicago is in Kansas City at the present writing. Frank Burke, his brother, who has a nice contract on the St Joe electric line, is with him here, and the indications are that together they are figuring on one of the several propositions now open. Of this we can probably write later.

St Louis Items

[illegible] cold weather and gone to Hot Springs with Mrs Conroy to spend the balance of the winter He expects to return when the geese and ducks are coming and finish his levee work at Granite City, Ill.

[illegible] wardsville, Ill., received bids on six improvement districts authorized by the City Council to be constructed this spring at a cost of about $75,000. The work includes about two miles of paving with a small area of cross [illegible] work only three filed bids. The bidders were O. T. Dunlap and G. R. Hyten of Edwardsville, and John Cherry of Jacksonville. The Edwardsville men were low in every instance. The low bids were as follows: O. T. Dunlap Fillmore-Buchanan Improvement District, $27,465.67; Grand-Elm Improvement District, $10,986.30; Schwarz Paving District, $8,390.70; Union Connecting District, $5,939.10; Park-Benton Paving District, $15,122. G. R. Hyten —Commercial College Improvement District, $1,337.50. The bids are below the estimate of City Engineer Charles S. Sheppard. The work will commence about March 15, and when complete will give Edwardsville about ten street miles of paving.

Dave Johnson of Johnson Bros., Cedar Rapids, Ia., passed through St. Louis on his way to New Orleans. The Johnson Bros. are at work in Canada and Dave says they have enough work to hold them for a while

Sub-contracts aggregating $1,250,000 were announced by the Westlake Construction Co. on the new $4,000,000 22-story Railway Exchange building to be erected on the present site of Barr's. The work of clearing away the buildings is expected to be completed by Mar. 5. Demolition of the Barr building proper began January 20. The contracts awarded to date are: Jones & Laughlin Steel Co., Pittsburg, Pa., 10,000 tons structural steel, $400,000; Winkle Terra Cotta Co., of St. Louis, 5,000 tons of terra cotta, $250,000; Continental Portland Cement Co. of St. Louis, 75,000 bbls. of cement, $100,000; Union Sand and Material Company of St. Louis, sand and gravel for foundations and interiors, $300,000.

Joe Flick came in from the northwest, posted us up on a few things and left here for Alabama. We may report him having another contract in next issue.

Extension of the Chain of Rocks water plant is planned by the city of St. Louis, and Water Commissioner Wall has announced that the work of building a new intake tunnel will commence as soon as the weather moderates. The improvements will cost about $3,000,000. New boilers costing $30,000 and a purifying and settling basin costing $75,000 are among some of the proposed improvements. An ordinance covering the improvements will be introduced in the Assembly. The expenditure for the tower and tunnel to the pump well will amount to more than $500,000 Ordinances are pending for extensions of the mains to cost $2,000,000 and [illegible]

The first of the 15 new Pacific type of locomotives for fast through passenger train service, the order for which was placed last August, have been received by the Missouri Pacific-Iron Mountain. These engines are larger and heavier than any passenger engines now in service on those lines. The cylinders are 26 by 26 inches. The boiler is equipped with superheated and combustion chambers, and will carry a steam pressure of

180 pounds. The engines weigh 205 tons each, and the tenders will contain 8,000 gallons of water and fourteen tons of coal. The driving wheels are 73 inches high, and while capable of attaining a speed of seventy-five miles an hour, the engines are able to handle a heavily loaded train. Tests show that they can haul a train of eleven cars over a 1.5 grade at a good speed. Electricity is used for illuminating the cab and headlight. The new passenger cars ordered some time ago are also being received. All are of steel construction and are equipped with all steel trucks and wheels. The chair cars and day coaches are finished in the interior in Mexican mahogany. They are lighted by electricity, furnished by a dynamo placed on the axle of the car. Steam furnished by the engine is used exclusively in heating the cars. The steel mail cars are fitted with all sanitary appliances for the occupants.

J. W. Skinner has started on his pile-driving work across the river here.

All the general offices of the Burlington railroad in St. Louis are to be removed to the new National Bank of Commerce building after March 1. A long-term lease was closed for the third floor of this building. The departments, which will occupy these quarters includes the general passenger and general freight offices now in the Liggett building and the operating department, now in the Third National Bank building. The general offices were separated two years ago, but this arrangement has not proved satisfactory. For a time the Burlington officials were considering making a lease for quarters in the Railway Exchange building, which is in course of construction and will be the home of several railroad systems.

Sealed proposals for the construction of the roadbed for a railroad between the East Yegua river and the town of Caldwell, Tex., a distance of about ten miles, will be received until noon Monday, Feb. 5th. Work will require the removal of about 275,000 cu. yards of material. Profile and specifications can be seen at the office of E. B. Cushing, chief engineer construction, Houston, Tex.

Failure to provide sufficient wagon space on the roadway of the municipal bridge may be corrected by abolishing one of the two footpaths across the bridge. The wagon roadway can be widened six feet by using the space allotted one of the two walks. Delegate Lahiv called up his resolution in the House of Delegates here last week seeking to direct the city officiales to make the change. The resolution was adopted.

Following a conference of city officials in the office of the Board of Public Improvements, it was announced 800 self-draining fireplugs will be installed down town. These plugs are put in to prevent a repetition of the recent losses occasioned by the fire plugs being frozen. The plugs will cost $30 apiece, including installation.

H. F. Riley and Mr. Karner arrived here last Monday on their way to Texas. Train changed time: Riley and Karner got left; came down town; entertained Koenig the balance of the day; left that night not feeling as bad as they did in the morning when the train pulled out with their valises and trunks. Riley has a lot of new stories. Get him to tell you the one about Detroit. It's a good one.

Ground will be broken at Second and Utah streets next week preparatory for the erection of the plant of the Busch-Sulzer Bros.-Diesel Engine Co. This company owns the American rights to the Diesel engine and will erect a $500,000 plant for its manufacture. The site, an eight and one-half acre plot, was purchased by the company several weeks ago. Seven hundred workmen will be employed at the start.

The Board of Public Improvements announced hearings February 9 for improving and reconstructing the following streets: Improvement— Abner place, St. Louis to Ashland; Northland avenue, Union eastwardly about 515 feet; Tennessee avenue, Itaska to Osceola; Vermont avenue, Eichelberger to Virginia; Clarence avenue, Kossuth to Lee; Belt avenue, North Market to St. Louis; De Soto avenue, Penrose to Florissant; St. Louis avenue, Belt to Clara; Blow street, Pennsylvania to Virginia; St. Louis avenue, Euclid to about 430 feet eastward; Alabama avenue, Bates to Delor; John avenue, Von Phul to Blair; Roosevelt place, Clara to Goodfellow; Gustine avenue, Potomac to Utah; Anderson avenue, Newstead westward about 650 feet; Iowa avenue, Arsenal to Gravois; Beethoven avenue, Gravois to Morgan Ford; Wise avenue to Chilldress; Minnesota avenue, Haven to Bates; Arkansas avenue, Wyoming to Arsenal; Fair avenue, Natural Bridge to Kossuth. Reconstruction—Cabanne avenue, Union to Hamilton; Twenty-fifth street, St. Louis to Palm; Ninth street, Barton to Park; Penrose street, Twentieth to Florissant; Hebert street, Eleventh to Twenty-first; Pine street, Twelfth to Nineteenth; Franklin avenue, Fourth to High; Olive street, Twelfth to Fourteenth; Benton street, Twentieth to Jeffereson; Linden street, Twelfth to Thirteenth; Delmar boulevard, Taylor to King's Highway..

The following changes are announced on the Frisco, effective February 1, 1912: W. B. Drake, vice-president and general superintendent of the Frisco lines in Texas, resigns and is succeeded by J. S. Pyeatt, superintendent of the River and Cape divisions of the Frisco. Mr. Pyeatt is succeeded by O. H. McCarty, superintendent of the Southwestern division of the Frisco, and Mr. McCarty is succeeded as superintendent of the Southwestern division by W. G. Koch, assistant superintendent of the Eastern division. Mr. Drake has been with the Frisco for several years and resigns to enter the contracting business. Mr. Pyeatt, who succeeds Mr. Drake, entered the service of the Frisco May, 1911, and was formerly with the Pere Marquette. Prior to that time he was with the Missouri Pacific.

There has been quite a number of articles in the St. Louis dailies about the new Burlington extension from Alton to Centralia, Ill.; also from Metropolis south. None of these stories can be verified. Burlington officials in a position to know, inform us that these stories are a little premature. If the Burlington R. R. Co. does any work this year it will be more than likely cutting down some of their heavy grades on their line between Hannibal and Laclede, Mo.

M. L. Windham secured the contract for building a coal mine spur for the Burlington Railroad at Centralia, Ill. Will start work as soon as frost is out of ground.

Bids were opened at Osceola, Ark., on Jan. 25 for the construction of 14,000,000 yards of earth excavation, 17 wooden bridges, one concrete spillway, one pile and timber spillway, also for 22 steel bridges for Drainage District No. 9. Up to the present writing no contracts have been awarded. The following is a partial list of the contractors offering bids: Chapman Brothers, New Market, Ia.; Willis Williams, Paragould, Ark.; H. E. Gibbons, Celina, Ohio; Lewis Mayo, Paragould, Ark.; E. S. Willis, Paragould, Ark.; T. J. Dilley, Hilbron, Ind.; W. S. Depoy & Sons, Winimac, Ind.; J. W. Foohey, Fort Wayne, Ind.; P. S. Morrow, Omaha, Neb.; W. N. Sherwood, National Drainage Co., Alexandria Minn.; Kochtitzky & Crumpecker, Moorehouse, Mo.; Weage & Tier, Coldwater, Mich.; Forestal & Freyen, St. Paul, Minn.; Husmer Construction Co., Marion, Ohio.; Halton & Burgett, Britt, Ia.; Sternberger & Coralh, Chicago, Ill.; Doyle, St. Cloud, Minn.; American Steel Dredge Co., Fort Wayne, Ind.; South Bend Drainage Co., South Bend, Ind.; R. L. Brugler, Bellefontaine, Ohio; Canal Construction Co., Chicago, Ill.; Adams & Co., Wilson, Ark.; D. L. Dilley, Hilbron, Ind.; H. A. Mansfield, Mansfield Engineering Co., Indianapolis, Ind.; Mr. Stillwell, Madison, Ind.; J. S. Kennedy, Falls City, Neb.; Clyde A. Walls, La Grange, Ind.; Harold A. Kech, Goshen, Ind.; R. H. & G. H. McWilliams, Chicago, Ill.; M. C. McGinnis & Co., Bement, Ill.; South Bend Drainage Co., South Bend, Ind.; Engle Bros., Jonesboro, Ark.; A. C. Johnson, Houston, Miss.; Davis Bros., Kewanee, Ind.; Harness & Douglas, Monticello, Ind.; O. O. McDonald, Elaine, Ark.; O. P. Herrick, Des Moines, Ia.; Reynolds & Crews, Caruthersville, Mo.; Sternberg & Sons, Council Bluffs, Ia.; P. C. Draper, Kansas City, Mo.; Graves & Stephens, Cleveland, O.

The East St. Louis Railway Co., a branch of the East St. Louis & Suburban Railroad Co., which is owned by the Clark Bros. of Philadelphia, will file a petition before the City Council, Feb. 5, asking a franchise to construct a street railroad on Missouri avenue, from 18th St. to 34th, which means an extension of the Broadway line to the city limits. John J. Faulkner, President of the Board of Local Improvements, when asked about the proposed franchise, said he thought it would meet with popular favor. L. C. Haynes is Vice-President and General Manager.

L. J. Smith of the L. J. Smith Construction Co. spent several days in town here on business. He reports their work in Arizona as all covered and getting along nicely.

Maxime Reber, President of the Board of Public Improvements, announced Thursday that the expenditure of $8,000,000 in construction work eliminating 233 grade crossings in St. Louis will be recommended in a report to be made to the Municipal Assembly by the Board of Public Improvements early next week. The report will not embody an additional estimated expenditure of $8,000,000, that would probably accrue as consequential damages. Just when the B. P. I. report is to be made to the Municipal Assembly has not been announced, but it is known that the draughting staff of the Board of Public Improvements is hard at work on plans and estimates. Railroads and the city will share in the expense of the grade crossing elimination program. The Poplar St. crossing is to be given considerable consideration in the report, it is said. The report will embody a two-fold suggestion, one that the tracks be depressed by tunnel, and the other that the line be rerouted. The rerouting suggestion also will be two-fold, the first that the line be run from 8th and Gratiot Sts. under the Free Bridge approach to the old station at 4th St. and Chouteau Ave., the other by the Oak Hill branch, which winds through Tower Grove around to Ivory St. The Rock Island grade crossing at Skinker road also is to be eliminated. The Wabash surface crossings, 11 in number, include crossing at Union, De Baliviere, Delmar and Maple Aves. For the Union Ave. crossing a depression of tracks and the construction of a viaduct by the city is proposed. The same is true of De Baliviere. At the Delmar and Maple Ave. crossings, however, the report will give estimates for track elevations. The Terminal Belt crossings in North St. Louis—across Marcus, Bircher, King's Highway, Union, Calvary and Goodfellow—also are considered in the report, as are the Missouri Pacific and Frisco crossings south of Forest Park. The Tiffany line crossing of the Missouri Pacific, scene of many street car collisions, is a problem that the city already has taken up with the railroad, an ordinance having been passed requiring the road to construct a viaduct at that point. The Compton Ave. viaduct, constructed by the Terminal, Frisco, Wabash, and Missouri Pacific, is nearing completion. The estimates to be furnished in the B. P. I. report will put the cost of damages and construction against the city in some cases and against the railroad in others. The depression of railroad tracks at Tower Grove station was ordered in the Wells administration, but the railroads to date have fought the order.

J. H. Samples, Engineer in charge of the Memphis-Marianna cut-off of the Iron Mountian R. R., was at St. Louis one day last week. His headquarters are at Marianna, Ark.

Walter Frein, Engineer of Water Service of the Chicago, Burlington & Quincy R. R., spent a couple of days in town with his family.

Montana.

⦿The Chicago, Milwaukee & Puget Sound Railroad is reported to be planning considerable extension work in eastern Montana. A contract was recently let to D. J. Burke for work east of Lewistown.

Nebraska.

The Chicago, Rock Island & Pacific is said to be considering the construction of a cutoff from Fairbury, Nebr., to Clay Center, shortening the line from Omaha and McFarland 10 miles.

New Mexico.

Citizens of Briscoe County, [illegible] ing with Moody and West representatives of the Altus & Roswell R. R. at Silverton, signed up a bonus of $70,000 to induce the company to build its proposed line from Memphis to Roswell, N. Mex., by way of Silverton.

New Jersey.

The West Jersey & Seashore R. R. Co (Pennsylvania line) is understood to be planning to start work this spring on its proposed cutoff to Seven Mile Beach. It is believed that the cutoff will run from Seaville station to Avalon on the north end of Seven Mile Beach. F. L. Sheppard, Jersey City, N. J., is general superintendent.

New York.

The State Public Service Commission has authorized the Catskill Traction Co., H. C. Cowen, President, Catskill, N. Y., to extend its line from Leeds to Cairo, a distance of seven miles.

The North Buffalo Railroad Co., Buffalo, N. Y., has been incorporated with a capital stock of $100,000 to construct a steam railroad. The incorporators are F. H. Wickwire, Jr., H. T. Dunbar, H. D. Miles, Buffalo, N. Y.

Ohio.

The Erie R. R. has purchased a large tract of land at Kenwood, near Akron, on which to erect car shops.

The receiver of the Wabash R. R. has made application for permission to issue about $5,000,000 of receiver's certificates, the proceeds to be used to provide needed equipment and increased track facilities.

The city council of Portsmouth has been petitioned to extend the franchise of the Portsmouth Street Ry. & Light Co., Portsmouth, which expires in six years. It is said that if this extension is granted the company will extend its tracks to Wheelersburg and Hanging Rock.

The Toledo & Indiana Traction Co., Toledo, O., is understood to be considering building an extension from Bryan to Montpelier.

The Youngstown & Southern Ry. Co. (electric), Youngstown, O., is stated to be planning to have construction work started in the spring on an extension from Columbiana through New Waterford to East Palestine.

The New York, Chicago & St. Louis R. R. is reported to be considering the construction of double track between Erie and Ashtabula, O., and later to Cleveland and other points. The work would necessitate the construction of a new bridge over the gully east of the city of Ashtabula. E. E. Hart, Cleveland, O., is Chief Engineer.

The Pennsylvania Railroad, according to reports from Canton, O., is ready to start construction work on the proposed track elevation through that place as soon as the City Council amends the plans submitted for its approval.

Oklahoma.

⊙Work will be commenced sometime in February on the construction of 300 miles of line in Oklahoma and Texas for the Missouri, Oklahoma & Gulf Ry. The contract for this work was let to the Fidelity Construction Co., Muskogee, Okla., as noted in our last issue. J. J. Harrison, Muskogee, Okla., is Chief Engineer of the Missouri, Oklahoma & Gulf Ry., and Wm. Kenefick, Bryant Bldg., Kansas City, Mo., is President.

C. L. Berry, Pawnee, Okla., has revived the project for building an east and west railroad through the northern counties of Oklahoma. He suggests that the towns through which the railroad would pass should raise a promotion fund to finance preliminary arrangements. This proposed line of railroad would traverse the bottom land of Salt Fork river.

The Beaver, Mead & Englewood R. R. Co. of Beaver, Okla., has been incorporated with a capital stock of $25,000, the incorporators being Fred C. Tracy, John W. Webb, William T. Quinn, Elbert Clift, Robert McFarland, Levi S. Munsell and Frank Laughlin, all of Beaver.

Oregon.

[illegible] Electric Ry. Co., Portland, Ore., has taken steps preparatory to securing right of way for a branch from the Albany-Eugene line to Corvallis. This branch line will leave the Albany-Eugene line at a point five miles south of Albany and run almost in an air line to Corvallis. It is said that the Oregon Electric has made an arrangement with the County Court of Benton county for joint use of the wagon bridge which that court is preparing to erect across the Willamette at Corvallis this summer.

The Valley & Siletz R. R. Co. has been incorporated with a capital stock of $300,000, and proposes to operate a line from Falls City to Simpson, near the coast. The incorporators are F. S. Belcher, H. A. Packard and E. V. Littlefield.

Panama.

The firm of C. G. Young, Engineers-Contractors, 60 Wall St., New York, have been engaged as Consulting Engineers to design and supervise the construction of the system of the electric tramways to be installed in Panama City, Republic of Panama, with extensions in the Canal Zone. Mr. Young made the examination and report last year upon the basis of which the tramways are to be built. The work is being put in hand at once and contract has already been given out for the local construction work. The system will comprise about 10½ miles of tracks and about 15 motor cars.

Pennsylvania.

The Philadelphia & Western Ry. Co. (electric), Upper Darby, Pa., has secured a franchise through East Norriton township, necessary to connect the new road from Bryn Mawr to Norristown with the Lansdale trolley road.

No bids were received Jan. 20 at the receiver's sale at Lancaster for the purchase of the Lancaster, Oxford & Southern Ry., a narrow gage road in the southern end of the county, running from Oxford to Peach Bottom, with a branch from Fairmount to Suarryville, 28 miles in all. Another effort to sell the road will be made in two weeks.

The Coraopolis & Woodlawn Interurban Street Ry. Co., of Coraopolis, has been chartered with a capital stock of $60,000 and proposes to build a 10-mile line. The directors are E. C. Dithrick, President, Coraopolis; C. B. Ferguson, J. E. Helm, W. T. Treadway, H. J. Thomas, W. J. Dithrich, J. W. Arros and F. H. Stark, Coraopolis; J. E. Schell, H. McAfee, U. G. Marks and Charles Gibson, Jr., Pittsburg, and E. E. Laughner, South Heights.

Arrangements are reported under way for the construction of a trolley line from Newville to Chambersburg, a distance of about 19 miles. At Newville the new line would connect with the line of Cumberland Ry. Co. Samuel M. Hetzmiller, Shippensburg, vice president of the Cumberland Ry., is the promoter of the new line.

Construction work has been started on the last section of double track between Woods, Pa., and Culmerville, a distance of 4 miles, by the Bessemer & Lake Erie R. R. To complete the work will require at least two years, as there are five deep gulleys which will have to be filled, doing away with that many bridges, among which is the big viaduct, over Bull Creek, which is the largest viaduct along the road, with the sole exception of the bridge which spans the Allegheny River. H. T. Porter, Greenville, Pa., is Chief Engineer.

South Carolina.

According to an announcement reported to have been made by President M. W. Potter, Carolina, Clinchfield & Ohio Ry., 24 Broad St., New York City, work will be commenced within two months on coal piers and terminals at Charleston, S. C., to cost about $600,000. Nothing definite has been decided, however, in regard to the construction of the extension of the line from Dante, Va., to a connection with the Chesapeake & Ohio Ry. at Elkhorn City, Ky.

Tennessee.

It now looks as though work would be started about March 15 on the subways to be constructed under Railroad avenue at Main and South Third Sts., and under the Illinois Central tracks at Carolina Ave., at Memphis. Tentative plans for this work were discussed recently by the representatives of the interested railroads and the city. Heiskell Weatherford is City Engineer of Memphis

Application has been made to the city commissioners of Chattanooga for a franchise over certain streets for an interurban line proposed to be built from that city to Cleveland, a distance of 30 miles. J. W. Adams, promoter of the Eastern Tennesse Power Co., and associates, are forming the company.

Texas.

The directors of the Frisco are understood to have authorized the construction of a 35-mile extension of the Orange & Northwestern R. R. north of Newton, Tex. The extension will cost about $600,000 and it is planned to build about 20 miles of it this spring.

J. W. Harris, El Paso, Tex., has started grading work for the double-tracking of a portion of the Texas & Pacific R. R. between Fort Worth and Mineral Wells. It is expected that the grading will be done so that the track can be laid by late spring.

Surveys will be completed in a few days for an extension of the Port Boliver Iron Ore R. R. of Longview, from Ore City to Naples. This road was recently placed in operation from Longview to Ore City, 30 miles. E. W. Davis is Engineer.

It is reported that construction work will be started in about six months on the projected railroad from San Antonio to Brownsville by way of Corpus Christi. Col. Uriah Lott, Brownsville, is the promoter.

The San Antonio Traction Co., San Antonio, has filed an amendment to its charter increasing its capital stock from $1,000,000 to $1,210,000.

The Texarkana Gas & Electric Co., Texarkana, Ark., has completed arrangements for building a 2-mile extension at Texarkana, Tex.

The San Antonio & Aransas Pass Ry. will in the near future relay about 45 miles of 50-lb. rail with 70-lb. A. R. A. section Series B. rail. The question of contracting this work is under consideration. Hans Helland, Yoakum, Tex., is Superintendent Maintenance of Way.

The Chamber of Commerce of San Antonio, Tex., has accepted a proposition of J. E. Franklin, president of the Bankers' Trust Co. of St. Louis, Mo., for the building of a railroad which will give San Antonio a direct line to the gulf. The proposition calls for right of way through Bexar county to the South, $50,000 when the road is completed to Campbellton and $50,000 when it is in operation to Aransas Pass. A committee of four members from the chamber of commerce was appointed to undertake the task of raising the $100,000 bonus required. The pledges must be secured before February 1, as subscriptions have been obtained from other towns along the proposed route contingent upon Mr. Franklin filing a $100,000 bond pledging the construction of the road within two years, the specified time. Mr. Franklin is president of the Crystal City & Uvalde R. R., now operating 94 miles of line in Texas.

The International & Great Northern Railroad has taken up a proposition to extend its line to Fredericksburg by way of Stonewall, Johnson City and Dripping Springs. It is understood that each of these places have up considerable bonuses for the road, and will raise more, if necessary. Fredericksburg, Texas, [illegible] Slaton [illegible] City has pledged a bonus of $[illegible] other intervening towns have [illegible] support. O. H. Crittenden, Houston, Texas, is Chief Engineer.

Tracklayers of the Kansas City, Mexico & Orient R. R. have reached Granada, 132 miles from San Angelo, Texas, and the extension will be placed in operation immediately. The contract for grading 50 miles south of Alpine will be let early in February, it is said. C. H. Webster, Sweetwater, Texas, is Chief Engineer.

President H. Leon Miller, President of the Winnipeg, Salina & Gulf, Salina, Kan., has received information to the effect that farmers in Beaver and Texas counties in Oklahoma are giving free of charge a right-of-way through their farms to the proposed north and south line through central Kansas. Besides this each of the counties has raised a bonus of $15,000 to be paid when the road is completed. The company projecting this line was recently given permission to issue bonds in the sum of $30,000,000. Five parties will be working on construction by the middle of March, it is said.

Providing the city of Cuero, Texas, is made the division terminal and shops are located there the citizens of Cuero, Texas, offer to furnish free right of way through DeWitt County and Cuero and a cash bonus of $75,000 for aiding the construction of the proposed railroad from Fort Worth to Aransas Pass and Kingsville with a western branch to Eagle Pass and Del Rio. Uriah Lott, Brownsville, is promoter.

Virginia.

The Virginia Railway & Power Co., Richmond, Va., has purchased for $36,000 property upon which modern car barns and repair shops at Norfolk will be erected at an approximate [illegible] of $2[illegible].

The Board of Aldermen of Richmond has given its approval to the proposed sale of the Seven Pines line to the Richmond, Urabanna & Peninsular Ry. Co. of Richmond. This company proposes to build a new electric line to the Parnunkey River. Under the agreement it is to begin surveys for the new road within 90 days, and actual construction in nine months.

Washington.

The C. D. Danaher Co., Tacoma, Wash., has purchased a large acreage of fine timber land, saw mill and the railroad operating between Placerville, Calif., and Camino, formerly owned by the El Dorado Lumber Co.

The Northern Pacific Ry. Co., as recently announced, plans the reconstruction of its line between Snohomish and Everett, Wash., this summer. The change in grade will start in the middle of the G. A. R. Cemetery trestle and will run on a level to the Snohomish station. It is predicted that the company will lay four tracks, one for the interurban line, and three for the joint use of the Northern Pacific and the Canadian Pacific, after the Arlington-Everett cut-off is built.

The Highland Park & Lake Burien R. R. Co. has filed with the Secretary of State at Olympia, Wash., certificate showing its proposed route as follows: To begin at intersection of First Ave. South and West Michigan St., Seattle; thence southwesterly through Hales Gulch to Ninth Ave. South and Kenyon St., south to Henderson St. west to 16th Ave. Southwest; thence southerly along the most practical route to where the new county road crosses the line between sections 18 and 19, township 23 north, range 4 east; thence to northwest corner of northeast quarter of southeast quarter of section 24, township 23 north, range 3 east; a total distance of eight miles. As mentioned in our issue of Oct. 4, 1911, the contract for constructing first section of the line was awarded to Dibble-Hawthorne & Co., Tacoma, Wash. Reitz, Storey & Duffy, Northern Bank Bldg., Seattle, Wash., prepared plans for the road.

An announcement is reported to have been made by J. D. Farrell, President of the Oregon-Washington R. R. & Navigation Co., that the company will construct an extension from Seattle, Wash., to Vancouver, giving the Union Pacific System a direct line from Vancouver, B. C., to the middle of Mexico.

The Willapa Harbor Ry. Co., which was recently incorporated as noted in our Jan. 10 issue, has about completed its proposed 5-mile line in and between Raymond and South Bend, Wash. Jay D. Crary, Aberdeen, Wash., is President, and Ray Fletcher, Raymond, Wash., is Chief Engineer.

The Puget Sound Electric Ry. Co., Tacoma, Wash., has applied to the Commissioners of King County at Seattle, for a franchise to operate an electric car line over County Road No. 8 and other county roads and streets in the vicinity of Kent and Auburn.

West Virginia.

It is believed that the Baltimore & Ohio Ry. will shortly construct the proposed short line in the vicinity of Buckhannon, W. Va. It is reported that the company recently purchased several acres at South Buckhannon for siding purposes. It is stated the shops at Weston will be removed to Buckhannon this fall. The proposed line will go up French creek, instead of Brushy Fork, and come down the river from Hampton. The grades will be much easier than those on the route now in use. All the timber and coal on the Richwood branch will then be shipped through Grafton, with practically a water grade.

The Twin Mountain & Potomac R. R. of West Virginia is rushing grading work on the line from Burlington, W. Va., to Keyser. Most of the work is now completed and unless extremely bad weather conditions prevail it is expected that the road will be in use by early spring to Burlington and Twin Mountain, the southern terminus in May. The first preliminary survey was made last June and several miles of tracks have now been laid.

The Mannington, Wadestown & Blacksville Ry. Co., of Mannington, W. Va., has been incorporated with a capital stock of $50,000 and proposes to construct an electric railway from Mannington to Blacksville. The incorporators are S. B. Harker, S. Clarke Steele, of Wana; Samuel Eakin, M. J. Garrison, of Wadestown; E. C. Martin, of Mannington.

Wisconsin.

The Chicago & Northwestern Ry. is reported to be planning to have work started in the early spring on the first 30 miles of the 60 miles of proposed double tracking between Eau Claire and Northline.

The Fairchild & Northeastern Ry., William Foster, Vice-President and General Superintendent, Fairchild, Wis., is now receiving materials for the construction this summer of the first half of its proposed extension. The construction contract has not yet been let; it is expected, however, that everything will be in shape so that the contract can be let about March 1. This extension will be about 42 miles long and will extend from Fairchild in Eau Claire County to Caryville in Dunn County, making connections with the Omaha Line and the C., M. & St. P. Ry.

Wyoming.

Engineers of the Chicago, Burlington & Quincy R. R. are reported to have surveys under way at Ulm, Wyo., for the new location of the main line and passing tracks at that place.

It has been announced at Thermopolis, Wyo., that the Chicago, Burlington & Quincy R. R. will start tracklaying on the extension south of that city about the middle of March.

A movement has been started at Basin, Wyo., and at Otto, Burlington and Germania, to build an electric railway connecting the three towns with Basin. The road would cost about $1,000,000 and it is planned to raise a large bonus to be given a company to build and operate the line.

Advices from Shoshone, Wyo., state that contractors are preparing to resume work on Feb. 1 on the grade of the Burlington between that place and the Big Horn Canyon. It is expected that this piece of roadbed will be made ready for track laying March 1. The grade will be built from Powder river east as fast as men and teams can do the work. It is stated that the Burlington expects to begin running trains between Galveston and the Puget Sound country not later than Aug. 1. The Burlington will use its own tracks the entire distance, except for a stretch of 125 miles between Orin Junction and Powder river, where the company has entered a traffic arrangement with the Chicago & Northwestern and Wyoming & Northwestern.

Canada.

✣The City Commissioners of Saskatoon, Sask., will receive bids until noon Feb. 23, for the construction of the substructure for a subway under the Canadian Northern Ry. Co.'s track at 23rd St., in the city of Saskatoon. Information may be obtained on application to W. L. Mackenzie, C. N. R. bridge engineer, Winnipeg, and George T. Clark, city engineer, Saskatoon.

⦿Angus Sinclair of Toronto, who has been awarded the contract for constructing 230 miles of the Canadian Northern Ry. between Onwatin and Pembroke is stated to be letting subcontracts for the first 100 miles east from Onwatin. The contract for that portion of the line from Pembroke to Ottawa has been let to L. P. Mallarky of Montreal.

The Grand Trunk Ry. is planning to increase its yardage accommodations at Port Colborne, Ont., and has leased from the Dominion Government all the Government land lying between the Grand Trunk Welland line and Welland St. The company has also taken up options, which it held on private properties.

The Lake Erie Coal Co., Walkerville, Ont., has made a proposition to the Civic Board of London, Ont., for the lease of the London & Port Stanley R. R. on the expiring of the lease held by the Pere Marquette R. R. next year. If the lease is secured the coal company proposes to electrify the line at a cost of about $300,000.

The Toronto Suburban Street Ry. Co., G. C. Royce, General Manager, West Toronto, is planning to extend its Western line to Woodbridge, a distance of eight miles. It is hoped to have construction work started this spring.

The Toronto Suburban Street Ry. Co., 1688 Dundas St., W. Toronto City, is to apply to Parliament for permission to build a line from Guelph to Berlin and Hamilton, and to increase its capital stock and issue bonds for terminals, bridges and stations.

The Buffalo & Fort Erie Ferry & Ry. Co., F. J. Weber, President, 730 Main St., Buffalo, N. Y., now operating four miles of steam line has submitted a proposition to the Niagara, St. Catherines & Toronto Ry. Co. (electric), St. Catherines, Ont., in connection with the extending of the line from Port Colborne to Crystal Beach and Fort Erie Beach. The ferry company proposes building a new ferry terminal at Fort Erie Beach at an estimated cost of $300,000 and double-tracking the road from Fort Erie to and beyond the Beach and erecting new terminals. The Niagara, St. Catherines & Toronto Co. would furnish the rolling stock and operate its cars over the ferry company's right of way, under a traffic arrangement.

Now that the Minister of Railways has finally decided to authorize J. D. McArthur of Winnipeg, Man., to go ahead with his contract to build 185 miles of the Hudson Bay R. R. from The Pass to Split Lake, plans are being perfected to furnish the road with valuable feeders. The Canadian Northern proposes to build from Prince Albert east, through the country north of the Saskatchewan to join the Hudson Bay road at Split Lake; and also to extend its Winnipeg-Oak Point branch northward between the lakes to a junction with the main line, giving Winnipeg a more direct road to the Bay. The McArthur contract was let last summer, and work was ordered stopped on Oct. 11. There were four bidders on the work, but that of W. A. Deller, of New York, was ruled out as being irregular. The other three tenderers were J. D. McArthur, of Winnipeg, at $3,078,354.5

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

for the section from [illegible] portage, Shore & [illegible] of Winnipeg, at $3,858 [illegible] and M. J. O'Brien [illegible] frew, at $3,368 [illegible]

The Grand Trunk Pacific has [illegible] that its Winnipeg [illegible] Springfield, where a start has been made, and sufficient acreage has been secured by the company for [illegible] for some time to come. It is the intention of the company that all freight trains [illegible] through Winnipeg [illegible] Springfield, where the yards are located. [illegible] in order to avoid congestion [illegible] may result from the running of the freight trains through the city, it is [illegible] to build a [illegible] the main line enters the city over the Red River through St. Boniface direct to the yards in Springfield.

Some further details are now available regarding the construction [illegible] year by the Canadian Pacific in the Western Provinces. Work will be carried on actively this year on the line from Swift Current, northwest which was begun last year. On this branch 85 miles will be built during 1912, thus carrying the terminus to a point very close to the junction of the Red Deer River with the South Saskatchewan. It is now stated that the line will cross the South Saskatchewan close to the point of junction with the Red Deer river, and that it will then be carried a distance of 150 miles to Coronation, a terminal point on the road running from Lacombe to Kerrobert. From Coronation a new line will be built northwest to Sedgwick, a point on the present main line from Edmonton to Winnipeg. There will also be a line from Coronation to Camrose, from which point it is the intention of the C. P. R. to build a direct line into Edmonton. The construction of these various lines will give the Canadian Pacific a direct through line from Edmonton to Swift Current. From [illegible] until it meets a line running southwest from Moose Jaw, south of Lake Johnston. When [illegible] made between this new line and the line run[illegible] rent to Weyburn, from which terminal point there is a through line to Portal and thence [illegible]

[illegible] tions have been completed for the building of the Central Railway of Canada. The first section from Montreal to Ottawa will be completed by the end of the present year, while the further portion, from Ottawa to the Georgian Bay, will be built shortly after. The company has changed its original plan, and the route, instead of passing through St. Benoit, will follow along the shore of the Lake of Two Mountains, passing through St. Placid and Oka, crossing from the mainland to Ile Jesu at St. Eustache, and reaching the Island of Montreal at Cartierville. It will then parallel the Riviere des Prairies, crossing the Canadian Pacific tracks at Jacques Cartier Junction and reaching the Harbor Commissioners' line on the waterfront at Tarte Pier. This will be the first freight entrance into Montreal. A passenger entrance is planned from the west, and it is expected that the terminus will be the Grand Trunk Railway's new Bonaventure Station.

Surveys are being completed and it is expected that within a month or so bids will be asked for the extension of the Temiskaming & Northern Ontario Ry., into the Elk Lake District. No announcement has been made as yet regarding the route of the new line, but it is considered probable that it will branch off from the main line near Earlton, following the general direction of the present wagon road. The final choice lies between this route and the Charlton one. The latter has been surveyed and would involve considerably less outlay, the Charlton extension from Englehart being closer to Elk City than Earlton. The Earlton route, however, would be somewhat more direct for traffic between Toronto and the Elk Lake camp. S. B. Clement, North Bay, Ont., is Chief Engineer.

The Canadian Pacific Ry. is understood to have taken over the Alberta Central Ry., the charter of which provides for a line running in a straight line from Red Deer, Alberta, to [illegible] The road will run to the Brazeau coal fields, [illegible] Active construction work was started in 1910. Some grading was done east of Red Deer, and west of that town a considerable amount of grading has been done and some steel has been laid. It appears that active construction work east and west from Red Deer will be carried on this year.

Mexico.

It is now stated that work on the electric lines to connect the City of Mexico with Puebla and Toluca will probably be started within the year. Extensive surveys have been made, but it has not been decided whether the route to Puebla will pass through Xochimilco or a little to the north and east. The Mexico Tramways Co., which will build these lines, has experienced considerable difficulty in securing a right of way to Mexicalzingo and for that reason may not build to Ixtlapalapa. In this event the short line to the City of Angels would pass either through Xochimilco or a little east of the Country Club. The company has ordered 2,520 tons of "T" rails and twenty-five miles of trolley wire for suburban use and also a large stock of material on hand. Harro Harrsen, Apartado, 124 Bis, City of Mexico, is general manager.

ROADS, STREETS AND PAVEMENTS

Alabama.

•D. B. Lacy & Son, of Birmingham, Ala., have been awarded the contract by the Calhoun County Road and Revenue Commissioners, Anniston, Ala., for the building of the Alexandria section of the model road, for which state aid has been appropriated. The road will be approximately three miles long. Engineer R. H. Cobbs will have charge of the work.

Arkansas.

The Benton County Road Commissioners, Bentonville, Ark., have decided upon a comprehensive system of modern highways covering hundreds of miles. The roads to be built are as follows: From Missouri state line via Beatty and Gravette to Hiwassee; road from Beatty to Missouri state line; road north and south connecting Sulphur Springs, Gravette, Decatur, Gentry and Siloam Springs; road running north and south from Southwest City to Siloam Springs along Oklahoma state line; road connecting Bentonville, Centerton, Gravette, Decatur. Road connecting Bentonville and Cave Springs; road from Cave Springs to Siloam Springs via Wagoner, Logan and Robinson; road connecting Cave Springs and Gentry, via Healing Springs, Highfill and Springtown; roads from Maysville to Gravette; road from Cherokee City to Gentry, via Bloomfield; road from Siloam Springs to Bentonville via Springton. Road from Rogers to Decatur; road from Bentonville to Missouri state [illegible] Pea Ridge to Rogers; road from Pea Ridge to Garfield; road from Garfield to Rogers; road from Rogers to Prairie Creek; road from Rogers to Van Winkle ferry; road from Hickory Creek to Monte Ne; road from Monte Ne to Lowell; road from Rogers to Lowell; road from Lowell to Cave Springs; road from Cave Springs to Elm Springs.

California.

⊙Following bids were recently submitted to the Board of Supervisors of San Joaquin County, Stockton, Cal., for highway improvement work: French Camp road, specifications No. 91—Oxsen & McDonald, $3,921; Ross Construction Co., $1,865.72; J. N. Jones, $3,921; Will Moreing, $5,758; A. A. Sturgeon, $3,375; H. B. Munson, $3,429; Frank C. McIntire, $3,752; J. J. Sinai & E. B. Carlson, $3,[illegible] Oxsen & McDonald, $3,756; J. J. Sinai & E. B. Carlson, $3,349; H. B. Munson, $4,344; Will Moreing, $3,982 and Frank C. McIntire, $3,964. The bids were referred to the Highway Commission. The bid of A. A. Sturgeon for work under specifications No. 91 and the bid of J. J. Sinai & E. B. Carlson for work under specifications No. 92 were accepted.

The Trinity County Board of Supervisors, Weaverville, Calif., has recommended the following as the most desirable route for the state highway to extend from Redding to Weaverville and thence to Peanut to connect with the state road now under construction: Commencing at Redding, Shasta County, California, thence by way of Middle Creek, Shasta, Stella, Oak Bottom, Tower House and thence Lewiston turnpike to the top of Trinity mountain, thence by new piece of wagon road to be constructed to Deadwood, thence by present road down Deadwood Creek to Lewiston, thence by way of Rush Creek and Murser hill wagon road to Weaverville, thence from Weaverville to Peanut on the public wagon road now existing between said points or such improved route as may be selected by the state highway commission between Weaverville and Peanut.

The San Joaquin County Highway Commission, Stockton, Cal., upon recommendation of Engineer R. M. Morton, has ordered that all highway improvement work be done under the lump sum bid method instead of the unit price bid method.

Connecticut.

The Town Council of Suffield, Conn., has appropriated $20,000 for the construction of state roads in accordance with the new state law in regard to highways. Edward Halladay is Town Clerk.

Georgia.

✣Bids will be received until noon, Feb. 14, by Board of Public Works, Rome, Ga., for the paving of East First St., between Second and Third Aves. and Third Ave. between Broad and East First. The work will include 17,000 sq. yds. of pavement and 6,500 lin. ft. of curb. Bids are asked on wood block, Hassam compressed concrete, asphalt-macadam, sheet asphalt and bitulithic. The specifications, plans and profiles are on hand at the office of the Board of Public Works in the city hall.

The Sumter County Commissioners, Americus, Ga., contemplate issuing bonds in the [illegible] proved highways.

Idaho.

✣Bids will be received until 8 p. m., Feb. 6, by City Clerk, Lewiston, Idaho, for the construction of pavement in District No. 3.

Illinois.

⊙The Board of Local Improvements of Danville, Ill., has awarded the following contracts to J. C. Poll: For paving Washington Ave., between Harrison and Williams St., at $1.65

per sq. yd.; for paving the alley between Vermillion and Hazel St., from North St., to Harrison St., at $1.67 per sq. yd.; for paving Oakwood Ave., for a distance of 1,200 yds., at $1.65 per sq. yd., and for constructing a sewer south of Lincoln Park, a distance of 1,160 ft., at $0.68 per lin. ft.

The Board of Local Improvements of Freeport, Ill., has decided to improve Iroquois St. with brick and sandstone curbing, to a width of 28 ft. The improvement will cost from $3.40 to $3.50 per running ft.

The Board of Local Improvements of Rockford, Ill., has been petitioned by property owners on Railroad Ave. for the macadamizing of that thoroughfare. The estimated cost of the improvement is $10,000.

The Board of Local Improvements of Mt. Carmel, Ill., has taken the preliminary steps towards paving Walnut, Third, Fourth, Sixth, Seventh and Eighth Sts., next summer.

The City Council of Belleville, Ill., has passed an ordinance providing for the improvement of Switzer St., from Main St. to Centerville Ave., by paving. City Engineer L. L. Harper has estimated the cost of the work at $7,006.

A resolution has been passed by the Board of Local Improvements of Rock Island, Ill., providing for the paving of Fourth Ave., from 16th to 20th Sts., with brick. Wallace Treichler is City Engineer.

The City Commissioners of Ottawa, Ill., have been petitioned for the improvement of Madison St., from the sidecut west to Fisher St.

The Board of Local Improvements of Waukegan, Ill., has passed a resolution providing for the paving of Steele Court and Cory Ave., with brick; also Lawn Court with brick. The improvements will cost approximately $16,000. Gilette Ave., from Sheridan Road north to North Ave., will also probably be paved with brick, at an estimated cost of $8,000.

The City Council of Lincoln, Ill., has passed an ordinance providing for the paving of Elm St., from Eighth to 10th Sts., to a width of 29 ft.

The citizens of Stockland Township, Iroquois County, Ill., contemplate circulating a petition for the building of hard roads, 12 miles in all. Watseka is the county seat.

Indiana.

✣Bids will be received until 10 a. m., Feb. 7, by Board of Public Works, Indianapolis, Ind., for the following contracts: For improvement of Cornelius Ave., from curb line 39th St., to south property line 40th St., by grading and paving the sidewalks; for improvement of Washington St., (north side) from east curb line Wallace St., to west curb line De Quincy St., by grading and paving sidewalks; for the improvement of 39th St., from west property line Cornelius Ave., to east property line Rockwood Ave., by curbing outer edges of roadway; for the improvement of Miley Ave., from north property line New York St., to south property line Vermont St., by grading, graveling and rolling the roadway; for the improvement of 39th St., from west property line Cornelius Ave., to east property line Rockwood Ave., by grading and paving the sidewalks; for the improvement of Miley Ave., west side, from north property line New York St., to south sidewalk of Vermont St., by grading and paving the sidewalk.

✣Bids will be received until 10 a. m., Feb. 5, by Board of Public Works, Indianapolis, Ind., for the following contracts: For the improvement of Oakland Ave., from the west property line of English Ave., to the south curb line of Newton Ave., by grading and paving sidewalks; for the improvement of Garfield Drive, north side, from the west curb line of Shelby St., to the east property line of New St., by grading and paving the sidewalks; for the improvement of Sherman Drive, from the south sidewalk of Washington St., to Pleasant Run bridge, on the east side, and from north right-of-way of Pennsylvania railroad, to Pleasant Run bridge, by grading and paving sidewalks; for the improvement of Robson St., from the east curb line of Rural St., to the west curb line of Oxford St., by grading and paving sidewalks; for the improvement of Bradbury St., from the east property line of Shelby St., to the west property line of Draper St., running north by curbing the outer edges of the roadway; for the improvement of Bradbury St., from the east curb line of Shelby St., to the west property line of Draper St., running north by grading and paving the sidewalks.

✣Bids will be received until 10 a. m., Feb. 2, by Board of Public Works, Indianapolis, Ind., for the following contracts: For the improvement of Kealing Ave., from the north sidewalk of New York St., to the south property line of Michigan St., by grading and paving sidewalks; for the improvement of Reno St., from the east cement sidewalk of Schurman Ave., to the west property line of first alley east of Schurman Ave., by grading and paving the sidewalks; for the improvement of Reno St., from the east property line of Schurman Ave. to the east property line of the first alley east of Schurman Ave., by grading, graveling and rolling the roadway; for the improvement of Centennial St., from the north property line of Michigan St., to the south property line of Walnut St., by grading and paving the sidewalks; for the improvement of Kenwood Ave., from south property line of 40th St., to south curb line of 39th St., by grading and paving the sidewalks; for the improvement of Kealing Ave., from the north property line of New York St., to the south property line of Michigan St., by grading, graveling and rolling roadway.

✣Bids will be received until 10 a. m., Jan. 31, by Board of Public Works, Indianapolis, Ind., for the following contracts: For the improvement of first alley east of La Salle St., from the north property line of Roosevelt Ave., to the south property line of 23d St., by grading and graveling the alley to a uniform width of 12 ft. as shown on plans; for the improvement of Cornell Ave., from the north property line 34th St., to the south property line of 36th St., by grading and paving the sidewalks; for the improvement of Jones St., from the east property line of Belmont Ave., to the west property line of Lee St., by grading and graveling the roadway; for the improvement of Jones St., from the east property line of Belmont Ave., to the west property line of Lee St., by grading and paving sidewalks; for improvement of St. Clair St., from the west curb line of Highland Ave., to the C., C., C. & St. L. Ry. tracks, by grading and paving the sidewalks; for the improvement of Herbert St., south side, from the west sidewalk line of Gent Ave., to the east sidewalk line of Sugar Grove Ave., by grading and paving the sidewalks.

✣Bids will be received until 2 p. m., Feb. 29, by Board of Grant and Wabash Counties' Commissioners, Marion, Ind., for the construction of a highway on the line between Waltz and Liberty Townships in Wabash County and Richland and Pleasant Townships in Grant County. E. H. Kimball is County Auditor.

✣Bids will be received until noon, Feb. 5, by Board of Carroll County Commissioners, Delphi, Ind., for the construction of a macadam road in Deer Creek Township, gravel roads in Burlington and Jefferson Townships. M. G. Haun is County Auditor.

✣Bids will be received until 10 a. m., Feb. 7, by Board of Tippecanoe County Commissioners, Lafayette, Ind., for the construction of a free gravel road 2½ miles long. George W. Baxter is County Auditor.

✣Bids will be received until Feb. 7, by City Council, Seymour, Ind., for the construction of five blocks of concrete pavement on North Chestnut from Third to Eighth St., about 2,000 lin. ft., 32 ft. wide. E. B. Duglass is City Engineer.

⊙The Vigo County Board of Commissioners, Terre Haute, Ind., has awarded the contract for the construction of the Zora Parker road, nearly three miles in length, to McGuire & Son, of Brazil, Ind., for $13.673, and the contract for the construction of the M. J. Lake road, over one mile in length, to Austin Shattuck for $6,225.

⊙The County Commissioners at La Porte, Ind., have awarded the contract for the construction of the Dunham gravel road in Noble Township, to Hutchinson & Ackerman of Michigan City and La Porte, Ind., for $43,700, and the contract for the construction of the Krueger gravel road in Dewey Township to Wm. T. Smith & Co., of Rensselaer; Ind., for $25,540. Other bidders on the first named road were: Globe Construction Co., Kalamazoo, Mich., $45,800; Wm. T. Smith & Co., $47,490; John G. Young, La Porte, $45,450; Crown Point Construction Co.. Crown Point, $46,400, and Jacob Quigley, Knox, $45,387. Other bidders on the second road were: Crown Point Construction Co., $23,100 and Jacob Quigley, $26,287.

⊙Geo. T. Miller of North Meridian, Lebanon, Ind., has been awarded the contract by the City Council of that city for the construction of pavement on North Meridian St., cement walks, 12-in. sewer with manholes and catch basins, curb, gutters, etc. The contract price is $20,035. Bids were opened Jan. 8.

The property owners on Ewing St., from Seventh to Ninth, city of Seymour, Ind., have asked for a concrete street about 800 lin. ft., with an average width of about 30 ft. E. B. Duglass is City Engineer.

The contract for the construction of a gravel road on the line between Marion and Hendricks Counties, Ind., a distance of 8,900 ft., for which bids were opened Jan. 25, by the Commissioners at Indianapolis, Ind., has not been awarded on account of a mistake in advertisement. The work will be readvertised some time in February.

Iowa.

✣Bids will be received until 2 p. m., Feb. 6, by Board of Public Works, Davenport, Ia., furnishing labor and material for paving the following streets: Ripley St., Ninth to 12th St., Brick; Rusholme St., Iowa to Farnam St., brick; College Ave., Fulton Ave. to Valley, concrete; Oneida Ave., East River St. to Fulton Ave., brick; Myrtle St., 13th to 15th St., concrete; Myrtle St., Hamilton to Seventh St., concrete; Rusholme St., Rock Island to Iowa St., asphalt; Pine St., Fourth St. to Telegraph road, asphalt; 15th St., Warren to Marquette St., asphalt.

✣Bids will be received until 7:30 p. m., Feb. 13, by William C. Chubb, City Clerk, Corning, Ia., for curbing, guttering and paving portions of Quincy St., Sixth St., Eighth St., Ninth St., Nodaway St., and Davis Ave. The work will include approximately 13,869 sq. yds. of brick block paving, vitrified; 457 sq. yds. alley paving; 11,463 lin. ft. of combined curb and gutter; 2,500 cu. yds. of grading. All paving to consist of one course of vitrified paving blocks, placed on a sand cushion two inches thick, the latter resting on a concrete base 4 ins. thick. All of said guttering to consist of concrete gutter on cinder drainage base 3 ft. in width on each side of said described brick block paving. All of said curbing to be of concrete 6 ins. thick and of such depth as to show a suitable exposure in each particular location, joined to and made a part of the concrete gutter above described. All concrete paving for alley approaches to be made of one part Portland cement, two parts sand and three or more parts of gravel or crushed stone, wet mix, tamped in place until free mortar flushes to the top and given a floated or broomed finish as the engineer may direct.

The Keokuk Water Power Co., Keokuk, Ia., will shortly begin surveys for an extension of the lake shore boulevard on both sides of the river on northward to Fort Madison.

Kansas.

✣Bids will be received until 5 p. m., Feb. 20, by City of Manhattan, Kan., for the construction of about 40,000 sq. yds. of several kinds of pavement. Brick or asphalt concrete is favored. O. E. Noble is City engineer.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

The Wyandotte Coun[illegible] Kansas City, Kans., have instructed County Engineer O. K. Williamson to prepare an estimate of the cost of a survey, plans and engineering work upon the proposed River Drive along the Missouri from Kansas City, Kans., to Fort Leavenworth. The building of the road is provided for under a bill introduced before the Kansas legislature by Representative W. O. Thomas of Wyandotte County.

Kentucky.

✣Bids will be received until Feb. 8, by Board of Public Works, Louisville, Ky., for the construction of vitrified brick pavement on 10th St.

✣Bids will be received until 2 p. m., Feb. 7, by Board of Public Works, Louisville, Ky., for the construction of vitrified block pavement on a number of city streets. The cost of the work is estimated at [illegible]

Louisiana.

The citizens of Rapides Parish, La., will vote Feb. 27 on the subject of levying a 5-mill tax to be used on one of three propositions as follows: To build roads in the parish; to build roads and bridges or to buy or build a traffic bridge over Red River at Alexandria, the parish seat.

Maryland.

The City Council of Baltimore, Md., has adopted an ordinance providing for alternative bids for materials to be used in paving the Annex out of the new loan of $2,500,000.

The plans and plat for the condemning and widening of Reisterstown road, which was recently taken over by the State Good Roads Commission, from Fulton Ave., to Kate Ave., or the northern limits of the city of Baltimore, Md., have been submitted to the Commissioners for Opening Streets of that city. The plans call for a street 95 ft. in width from building line to building line. The widened street is to be paved with improved paving.

At a recent mass meeting of the taxpayers of Wilcomico County, Md., held in Salisbury, the county seat, it was voted in favor of the proposition to issue bonds in the sum of $100,000 for the building of good roads.

Michigan.

✣Bids will be received until 8 p. m., Feb. 5 (readvertisement), by City Recorder, Muskegon, Mich., for grading and paving with tarvia, taroid, asphalt, pioneer road asphalt, Bermudez asphalt, bituminous macadam or brick on 6-in. concrete base, 4,956 sq. yds. on Clay Ave., from Pine to Ottawa St. B. H. [illegible]llman is City Recorder.

It is reported the citizens of Alma, Mich., on Jan. 22 voted in favor of paving by the issuance of bonds to the amount of $30,000. The City Council recently passed a resolution providing for the improvement.

The Board of Supervisors, Adrian, Mich., has voted to submit the good roads proposition to the people of Lenawee County for a vote at the next general election in April.

It is reported the Ottawa County Supervisors, Grand Haven, Mich., have recommended a proposition to bond the county for $600,000 to secure funds for improved highways. An election will probably be held in the spring.

Minnesota.

Plans are on file in the city of East Grand Forks, Minn., for a considerable amount of paving work to be done on the business streets, amounting to $40,000. The City Council is considering the proposition.

The City Council of Minneapolis, Minn., has authorized the Street Commissioner of the Third Ward to purchase one street flushing machine at a cost not to exceed $1,100.

It is reported that the Minnesota State Highway Commission at a meeting held in St. Paul on Jan. 23, approved the proposed construction of the road from Duluth to St. Vincent, Duluth to Moorhead, Duluth to Twin Cities and the International Falls to St. Paul

Missouri.

◉[illegible] City, Mo., has been awarded the contract by [illegible] Sts., at $1.87 per sq. yd., and White St., from Anderson to Independence road, at $1.90 per sq. yd. Trinidad asphalt will be used.

◉Jas. Reynolds of De Soto, Mo., has been awarded the contract by the City Council of that city for the improvement of six blocks of Third St., with macadam pavement, concrete curbs and gutter, at $6,196. The work will include 1,600 cu. yds. of excavation, 55 cu. yds. of earth, 1,012 cu. yds. of macadam, 506 cu. yds. of gravel, 2,000 cu. yds. of en[illegible] gutter of concrete, 1,500 sq. ft. of gutter at street intersections, and four inlets. Bids were opened Jan. 22.

The City Council of Kansas City, Mo., has passed resolution providing for the grading of the following: Ewing, 18th to 19th; Bales, [illegible] wood; alley between Colorado and Hardesty, Thompson to Smart; 58th St. Ter., Indiana to Swope Parkway; Denver, Ninth to Belt Line; Archibald, a point to south of Archibald St. to Central; Krauthoff Ct., Wornall to Mill Creek Parkway; Broadway, 4[illegible] to 44th; 54th, Holmes to Troost; 59th, Prospect to Elmwood; Woodland, 55th to 57th; Northwestern, 21st to Milwaukee; Cambridge, 18th to 19th; Montgall, 39th to 40th; McGee, Admiral to Ninth; 26th, Forest to Pasco; Eighth, Grand to Oak; Agnes, 36th to 39th; 19th, Newton to Ewing; Hughe, Belmont to Ewing; Newton, 27th to 30th; Norton, 27th to 30th; 50th, Blue Springs Road to Swope Parkway; Brooklyn, 55th to 58th; alley between Walnut and Grand, 15th to 16th; alley between Main and Walnut, 13th to 14th; Independence, Forest to Tracy; alley east of Prospect, Ninth to Tenth; McCoy, 22d to 23d; 38th, Prospect to Agnes; 46th, Holly to Summit; alley between Oak and Locust, 13th to Irving Pl.; alley south of 25th, Agnes to a point.

City Engineer B. F. Smiley, of Hannibal, Mo., has made up a district for brick paving which comprises Third St., Collier to North; Hill St., First to Third; Bird St., First to Fourth; Center St., First to Fourth; Church St., First to Fifth; Lyon St., First to Fifth; Collier St., Main to Ledford; Third St., South Side; Broadway, Main to river front. This paving will be on a 5-in. concrete base, with pitch filler. The estimated cost is $2.25 per yd. Resolutions for the improvement will be offered at the February meeting of the City Council.

Montana.

✣Bids will be received until March 4, by City of Helena, Mont., Charles W. Helmick, City Engineer, for the construction of the following work: 19,000 cu. yds. of grading, 94,000 sq. ft. of concrete walks, 2,500 lin. ft. of concrete cross walks, 16,200 lin. ft. of concrete curbs, 127 one lamp ornamental lamp posts, 600 trees for street parking, 565 sq. yds. granite pavement in alley. Bids will probably be taken about June 1st for 15,000 sq. yds. of brick pavement on concrete base.

New Jersey.

◉O'Reilly Bros. have been awarded the contract by the Board of Street & Water Commissioners of Jersey City, N. J., for widening and improving Bergen Ave., between Montgomery St., and a point 100.40 ft. north of Montgomery St., at 100 per cent of standard. Wood blocks will be used. Bids were opened Jan. 22.

New York.

✣Bids will be received until 11 a. m., Feb. 7, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for furnishing and delivering 8,000 cu. yds. of paving sand, to be delivered as follows: 3,000 cu. yds. to the Wallabout Corporation Yard, Wallabout Basin, foot of Hewes St. 2,000 cu. yds. to the N. 8th St. Corporation Yard, N. 8th St., near Union Ave. 1,000 cu. yds. to the DeKalb Ave. Corporation Yard, DeKalb Ave., near Irving Ave. 1,000 cu. yds. to the Hopkinson Ave. Corporation Yard, Hopkinson Ave., near Marion St. 500 cu. yds. to the 67th St. Corporation Yard, 67th St., near 18th Ave. 500 cu. yds. to the Neck Road Corporation Yard, Neck Rd. and Gravesend Ave. The time for the delivery on or before Dec. 31, 1912. The amount of security required will be $1,500.

✣Bids will be received until 11 a. m., Feb. 7, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for furnishing and delivering 1,300 tons of 2,000 pounds each of refined asphalt, to be delivered at the Municipal Asphalt Plant, at 7th St. Basin, between 6th and 7th Sts., near 2d Ave. The time for the delivery is on or before Dec. 31, 1912. The amount of security required will be $10,400. Also for furnishing and delivering 700 tons of 2,000 pounds each of refined asphalt, to be delivered at the Municipal Asphalt Plant, at 7th St. Basin, between 6th and 7th Sts., near 2d Ave. The time for the delivery is on or before Dec. 31, 1912. The amount of security required will be $5,600.

✣Bids will be received until 11 a. m., Feb. 7, by Borough of Brooklyn, President Alfred E. Steers, for regulating, grading, curbing and laying sidewalks on Bay Ridge Ave., from 5th Ave. to 13th Ave., in the Borough of Brooklyn (contract of Robertson & Gerehart Contracting Co., declared by the President of the Borough of Brooklyn to have been unnecessarily delayed as per section "Q" of the contract), together with all work incidental thereto. The Engineer's estimate of the quantities is as follows: 13,730 cu. yds. earth excavation. 4,230 cu. yds. earth filling—not to be bid for. 8,430 lin. ft. cement curb—1 year maintenance. 42,950 sq. ft. cement sidewalk—1 year maintenance. The time allowed for the completion of the work and the full performance of the contract will be 80 working days. The amount of security required will be $5,000.

✣Bids will be received until 8 p. m., Feb. 5, by Mayor of Auburn, N. Y., for the construction of 1,700 ft. of sewers and 12 storm water inlets; also for pavement as noted under Roads and Streets.

✣Bids will be received until 8 p. m., Feb. 5, by T. H. O'Neill, Mayor, Auburn, N. Y., for the construction of pavement on East Genesee St., including approximately 12,350 sq. yds. of pavement, 4,050 lin. ft. of cement curb. E. Aldrich is City Engineer.

Village Treasurer John H. Cowin of Seneca Falls, N. Y., has sold bonds to the amount of $31,000 for street paving work. About $20,000 of the amount will be used for paving early in the spring.

The Board of Estimate and Apportionment has given final authorization for the following improvement in the Borough of Queens, New York City: Paving with asphalt block the boulevard from 14th St. to Nott Ave., Long Island City, estimated cost $6,200.

Senator Thomas H. Bussey of Perry, N. Y., has introduced two bills into the Senate for the improvement of two important state highways in Wyoming County. One bill will be for the improvement of what is known as Route No. 16, 20 miles long, beginning in the town of Pavilion, in the northern part of the county, running south through the village of Pike and village of Warsaw to the Allegany County line; costing about $10,000 a mile. The other bill is to improve 12 miles of road from Pavilion, connecting with the road from Rochester to Letchworth Park by way of Perry and Castile. Warsaw is the county seat.

The Wayne County Board of Supervisors, Lyons, N. Y., has adopted a recommendation for the construction of a road, commencing at the Sodus town line and extending south on what is known as the Lyons-Sodus Point road, a distance of three miles, to connect with the road built in 1911 and with two mi [illegible] state road built in the town of Sodus.

The Town Board of Irondequoit, N. Y., has submitted a bid of $10,000 to the Board of Contract & Supply of Rochester, N. Y., for replacing and maintaining the pavement in the Summerville Blvd. The Rochester Vulcanite Pavement Co., at $48,122, submitted the lowest bid for the construction of asphalt pavement on Ridgeway Ave.

The business men of Pulaski, N. Y., are planning to construct a brick road in Salina St., near the gristmill, running thence up the Bridge St. hill and to Jefferson St., ending near the North Park. William J. Peach is President of the village.

The Common Council of Syracuse, N. Y., has adopted ordinances declaring intention to order the re-surfacing of about two and a quarter miles of asphalt pavements and the laying of nearly a mile of new pavements.

North Dakota.

The City Council of Grand Forks, N. Dak., has adopted plans and specifications prepared by City Engineer G. H. Lykken for the paving of DeMers Ave., from the DeMers Ave. bridge to the Northern Pacific railroad tracks at the end of the street. Bids are to be asked on seven different kinds of paving.

Ohio.

✣Bids will be received until 2 p. m., March 9, it is reported, by O. Boggs, Village Clerk, Richwood, O., for grading, draining, curbing and paving a portion of Ottawa St.

⊙Chas. W. Flynn, 1252 Chase Ave., Cincinnati, O., has been awarded the contract by the Board of Hamilton County Commissioners, Cincinnati, for the repairing of Forest Ave., under Specifications No. 288, from a point about ½ mile west of Springfield Pike, 2,750 ft., westward in Springfield Township, for $1,164. Bids were opened Jan. 19.

The City Council of Ashtabula, O., has instructed the engineering department to prepare plans and specifications for the grading, draining and paving of Lake St., and for the improvement of Aunger Ave. to Oak St.

The Village Council of Rocky River, O., has rejected all bids received Jan. 5 for the construction of concrete walks on Wooster road, for which W. H. Evers Engineering Co. is Engineer. W. M. Dean is Village Clerk.

Oklahoma.

The Department of Highways of Jones City, Okla., is planning the construction of five miles of good roads out of that city. The work will be done under the supervision of Commissioner of Highways Sidney Suggs.

Oregon.

A new road district has been created in Clackamas County, Ore., termed the Liberal District, and made from parts of the Macksburg, Molalla and Needy districts. Will Steve is Supervisor. Oregon City is the county seat.

The City Council of Springfield, Ore., has made arrangements for the macadamizing of K, L, M, N, Laura and Water Sts., and Kelly Blvd.

Tennessee.

The citizens of White County, Tenn., on Jan. 27, it is reported, voted the issuance of bonds for the construction of good roads. Sparta is the county seat.

Texas.

✣Bids will be received until 11 a. m., Feb. 5, by John M. Murch, County Auditor, Galveston, Texas, for grading, shelling, bulkheading, etc., of the Avenue S road down the island from Seventh to 13th mile post. Plans and specifications are on file at the office of the county auditor. A certified check for $2,000 must be filed with each bid.

⊙The Board of Municipal Commissioners of Dallas, Tex., has awarded the contract for paving with asphalt-macadam Collett Ave., from East Side to Columbia to the Standard Engineering & Construction Co., for $1.21 per [illegible]. The same company, for the same price, was awarded the paving of East Side Ave., from Fitzhugh to Garrett with asphalt-macadam.

⊙The City Council of Paris, Tex., has awarded the contract for the paving of North Main St., to the Western Paving Co., of Oklahoma City, for $30,760, and the contract for the paving of Washington St. to J. A. Gregory for $8,487.

J. R. Johnson of Sherman, Tex., has been selected as engineer in charge of the good roads work to be commenced in the Sherman precinct, at Sherman, Tex. Work will be commenced as soon as the bonds are sold.

The county of McCullough, Tex., on Feb. 1 will begin the construction of good roads leading out of Brady, the county seat, following the recent bond issue for that purpose. All machinery and tools used will be supplied by local dealers.

County Engineer J. F. Witt, Dallas, Tex., is working on his report to the County Commissioners, in which he will advise them as to the expenditure of the $500,000 bond money recently received by the county from the sale of bonds voted last July. This money will be used on road work.

The Johnson County Commissioners, Cleburne, Tex., have been petitioned to call a bond issue election for the purpose of voting on the issuance of bonds in the sum of $300,000 for road work.

Individual subscriptions have been secured for the macadamizing of the Denton-Bartonville road from the city limits of Denton, Tex., to Hickory Creek to insure $2,600, together with the county's donation. The estimated cost of the road is $3,000.

The Attorney General, Austin, Tex., has approved $84,000 of Leon County road improvement district bonds, and as soon as the bonds can be sold work will commence on good roads. Centerville is the county seat.

The City Commission of Fort Worth, Tex., has ordered the paving of West Fifth St.

Virginia.

D. Tucker Brown, chief locating engineer of the department of highways in Virginia, has just completed a survey of what is termed the northern route for a state road between Bristol and Abingdon, and will now survey two other routes between the same points. This road will eventually be constructed between Bristol and Washington, inaugurated by the Bristol-to-Washington Highway Assosiation, of which W. H. Aston is president.

Washington.

✣Bids will be received until Feb. 5 by Mason County Auditor, Shelton, Wash., for the construction of about 1 mile of permanent road.

✣Bids will be received until Feb. 6 by Town Clerk, Castlerock, Wash., for grading in District No. 4.

✣Bids will be received until 1 p. m., Feb. 6, by J. M. Shields, Auditor of Skagit County, Mt. Vernon, Wash., for the construction of 5,728 ft. of Aspland road.

✣Bids will be received until 2 p. m., Feb. 15, by Board of King County Commissioners, Seattle, Wash., for the construction of the North trunk boulevard, 16,488 ft. long.

✣Bids will be received until 8 p. m., Feb. 13, by City Council, Pasco, Wash., for the construction of paving, sidewalks, etc. An approximate estimate of the work to be done under this improvement is as follows: 8,175 sq. yds. of pavement; 30,881.9 sq. ft. concrete sidewalks; 428.8 lin. ft. plain curb; 2,857.1 lin. ft. combination curb; 10 catch basins; 900 lin. ft. storm sewer, 8 in. pipe; 65 lin. ft. storm sewer, 6-in. pipe; 4 monuments; 360 lin. ft. headers; 743 cu. yds. excavation; 81 cu. yds. retaining wall concrete; 3,456 pounds reinforcement; 458 lin. ft. iron railing with fittings; 200 lin. ft. 1 in. conduits; 3.36 cu. yds. concrete for steps. L. H. Koontz is City Clerk.

The South End Improvement Club of Tacoma, Wash., recently held a meeting to discuss the possibilities of a paved road to South Tacoma. The estimated cost of the road, $200,000, is proposed to be equally shared by the county and property owners.

The Whatcom County Commissioners, Bellingham, Wash., have authorized the purchase of a pile driver, grader, roller, traction engine and scarifier. The estimated cost is $7,000.

Bids were received Jan. 19 by the Board of Public Works of Seattle, Wash., as follows, for the grading and curbing of 22nd Ave. N. et al.: L. H. Goerig, 836 Shelby St., E., $18,766, and W. F. Manney & Co., $20,933. The work includes clearing and grubbing eight acres, 43,600 cu. yds. of earthwork, 118 M ft. of lumber for curbs and gutters, box drain and wood walks, 2 sq. yds. of concrete walks repaired, 26-ft. manholes rebuilt, 50 ft. of 6-in. pipe, 100 ft. of 3-in. tile drain, 25 ft. of 6-in. sub-drains, 5 cu. yds. of rock pockets, 2 cu. yds. of gravel, 2 cu. yds. of extra excavation, and 2 slants.

Following bids were recently received by the Board of Public Works of Seattle, Wash., for the grading and curbing of 37th Pl.: J. H. Cullen & Co., $1,096; DeLong & Heltborg, $1,169; Robt. J. Barter, 2832 Harvard Ave., N., $1,042; L. H. Goerig, $1,241; J. A. Zinkan, $1,418, and John L. Stanley, $1,242. The work includes 2,173 cu. yds. of earthwork, 9.8 M. ft. of lumber for curbs, gutters, box drain and wood walks.

Plans have been approved by the Board of Public Works of Seattle, Wash., for $317,850 worth of street improvements, bids on which will be called for at once. This work provides for the paving of Whatcom Ave., at a cost of $240,000; sewers on Brooklyn Ave., at a cost of $50,000, and will include over 39,000 ft. of sewer pipe, 9,598 sq. yds. of concrete, 61,890 sq. yds. of concrete pavement, 11,493 ft. of granite, 3,000 ft. of lumber, etc.

Wisconsin.

✣Bids will be received until 2 p. m., Feb. 3, by Board of Public Works, Oshkosh, Wis., for grading, curbing and repaving Light St. from Church to High Sts.; for grading, curbing and repaving 13th St. from Oregon St. to the Soo tracks; for grading, curbing and repaving Waugoo St. from Broad St. to State St. Creosote blocks, tar macadam or sarcolithic pavement is favored.

⊙The Milwaukee County Board, Milwaukee, Wis., it is reported, has awarded the contract for the improvement of Wisconsin Blvd., west of the Grand Ave., viaduct to R. W. Forrestal for $22,441. A bitulithic macadam pavement will be laid over a surface of 26,600 sq. yds.

According to State Highway Commissioner George White, Madison, Wis., preliminary work for the good roads campaign in Chippewa County will commence at once. Chippewa Falls is the county seat.

Canada.

W. R. Braden, M. P. P. for Rossland, B. C., has asked of the provincial government the sum of $4,000 for the improvement of the upper Trail road.

Representative Borland of Missouri has introduced a bill in the House of Representatives providing for a 60-ft. national highway from Washington, D. C., to Olympia, Wash. and one from Washington to San Francisco. The cost of the proposed roads is to be equally divided between the federal and state governments and each state is to stand a proportionate share of the cost of construction. The name of the highway is to be the National Old Trail Road, and it proposes to embrace the Braddock road, Cumberland road, national pike, Boom and Lick road, Kearney's road, the Santa Fe trail, the Oregon trail and other famous highways of the early pioneer days. This highway will then join the proposed Pacific highway to run from California to British Columbia so that a veritable triangle will be formed.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

BRIDGES—STEEL AND CONCRETE

Alabama.

[illegible] in the vicinity [illegible] petitioned the County Road [illegible] Commissioners, Mobile [illegible] struction of a wagon bridge [illegible] Co.

[illegible] at Birmingham, [illegible] will request that the Southern Ry. Co. construct a viaduct or subway in Norwood to eliminate the 15th St. grade crossing and also to repair the bridge at 12th Ave.

Arkansas.

The Bridge Commissioners of [illegible] counties, [illegible] Nashville, Ark., have [illegible] the construction of two joint bridges over the Saline river.

California.

A meeting was held at [illegible] engineers of the Northern Electric Railroad [illegible] representatives [illegible] ties to discuss the proposed changes in plans for the construction of the new steel bridge at that point. A. D. Schindler, San Francisco, Cal., is general manager of the electric railway.

The City Engineer of San Francisco, Cal., has recommended to the Board of [illegible] Works the construction of a steel bridge over Beale St. at Harrison to cost about $32,000.

Delaware.

The Delaware River Contracting & Construction Co., of Camden, Del., has been incorporated with a capital stock of $100,000 and proposes the construction of docks, wharves, piers, bridges, etc. The incorporators are F. MacKinnon, F. L. Mills, S. R. Landers and F. H. Bradley, Camden, Del.

Georgia.

The Board of Commissioners of Sumter County, Americus, Ga., is reported to have under consideration the construction of steel bridges on Lee St. and Smithville roads, to replace structures damaged by recent floods.

Idaho.

✣Bids will be received by the Board of Kootenai County Commissioners, Coeur d'Alene, Idaho, for the construction [illegible] steel draw bridge over the St. Joe River at St. Maries, Idaho.

Illinois.

✣Bids will be received at the clerk's office, Greenup, Ill., up to 1 p. m., Feb. 10, for the construction of a reinforced concrete viaduct, between Union and Cottonwood Townships, Cumberland county. George Walters, acting clerk, Greenup, Ill. Ryan Bridge: Length over all, 217 ft.; roadway, 16 ft., made up of four 50 ft. deck girder spans, resting on three plain concrete abutments. Distance from finished roadway to bottom of footings, 31½ ft. Estimated, Class B concrete in piers, 198.7 cu. yards; estimated Class A concrete in abutments and superstructures, 457.2 cu. yds. Estimated reinforcing steel, including expansion rollers and plates, 70,870 pounds. Commissioners say that gravel may be [illegible] k for 15 cts per cu. yard, ¾ of a mile from bridge site. Character [illegible] known. Nearest railroad station is Janesville on the Illinois Central, 6 miles; Bradbury, 5¼ miles. Roads, fair. Average [illegible] town, about 3,200 pounds. Footings of pier will average 2 ft. below bed of stream; piles will probably be necessary. Excavation on abutments will average 25 ft. in sand, loam and clay. Average depth of water, 6 ft. and 127 ft. wide, high water 24 ft. [illegible] ft. wide. Commissioners [illegible] native piles can be laid down at bridge site for $1.50 apiece. No bridge at present on this site. Work to be completed [illegible]

[illegible]

Highway Commission, Springfield, Ill.

⊙[illegible] Edgewood Bridge in Princeton township, Ill. [illegible] Park, Chicago, Ill., at $6,850. The bridge will [illegible] ments. Bids for the work were opened Jan. [illegible]

⊙The Illinois Street Bridge Co., Jacksonville, Ill., has been awarded the contract for the construction of the Mann's Ferry bridge [illegible]

Westcott & Ronneberg, 1107 Security Bldg., Chicago, Ill., have prepared plans for the construction of a 200-ft. reinforced concrete arch bridge in Maywood, Ill., for Proviso township. The structure will consist [illegible] proaches and will have one pier. The floor will be paved with brick. It is planned to let the contract for the work some time in April.

Indiana.

Steps are being taken by the county officials of Green Castle, Ind., to induce the Terre Haute, Indianapolis & Eastern Traction Co. to build a bridge over its tracks west of that city.

Board of Public Works, Marion, Ind., has instructed the Pennsylvania Railroad to erect a bridge over the tracks at Western Ave. and to grade and improve the north approach. The structure will be of steel and concrete.

Iowa.

The Chicago, Milwaukee & St. Paul Railroad, according to advices from Sioux City, Ia., is planning the construction of a bridge over the proposed West Fork Drainage Ditch southeast of Hornick, Ia. The cost of the structure as proposed, will be about $16,500.

Bids were opened Jan. 16 by Street Committee, Ottumwa, Ia., for cleaning and painting the Market St. bridge and reconstructing the floor system and final action will be taken [illegible]

Kansas.

Amended plans for the construction of the proposed Mill St. viaduct in Kansas City, Kan., have been placed before the Commissioners and representatives of the Engineering Departments of the Union Pacific and Chicago, Rock Island and Pacific Railways. The structure will be 1,600 ft. long extending from Nuncie boulevard to Kansas Ave. It will cost approximately $90,000 and will be of reinforced concrete construction.

Kentucky.

The City Council of Paducah, Ky., has decided to repair the old bridge over Island Creek at Sixth St. instead of replacing it with a new structure as recommended by L. A. Washington, City Engineer.

Louisiana.

An ordinance has been prepared for presentation to the City Council, directing City Engineer, W. J. Hardee, New Orleans, La., to prepare plans and specifications for the erection of the bridge over the Peoples Ave. Canal at Gentilly Road. The appropriation for the improvement is $4,000. Bids for the work will probably be advertised for soon.

All bids received Jan. 22 by the Harvey Canal Land & Improvement Co., Harvey, La., for the removal and repair of steel traffic bridge over the canal, have been rejected.

An election will be held Feb. 27 to submit to the voters of Rapides Parish the proposi- [illegible] build roads in the parish; to build roads and bridges; or to build or buy a traffic bridge over the Red river at Alexandria, La.

Maryland.

⊙The contract for wrecking the old bridge [illegible] roe St., Baltimore, Md., has been awarded to McClintic-Marshall Construction Co., 1201 Morris Bldg., Philadelphia, Pa., at $17,575. H. K. McCay is City Engineer. Bids for the [illegible]

Massachusetts.

✣Bids will be received until noon, Feb. 20, by Department of Public Works, for rebuilding Chelsea bridge North. Frederic H. Fay, Room 60, City Hall, Boston, Mass., is Engineer, of the Bridge and Ferry Division.

Michigan.

⊙The contract for the construction of the steel viaduct over the Pere Marquette Railroad at Park St., St. Joseph, Mich., has been awarded to the Elkhart Bridge & Iron Co., Elkhart, Ind., at $3,538. The structure, as planned, will have 18 ft. roadway, one 5-ft. sidewalk with 150 ft. lattice rail, will rest on concrete piers and abutments and will have a [illegible] Jan 17. W. J. Cleary is City Engineer.

Missouri.

⊙The Board of Linn County Commissioners, Linneus, Mo., has awarded the contract for the construction of 14 steel bridges to the Monarch Engineering Co.

The County Court at Carthage, Mo., has been petitioned for the construction of a bridge over Center Creek, between Joplin and Oronogo. Yank Stultz, Oronogo, Mo., is interested in the improvement.

The upper house of the City Council, Kansas City, Mo., has adopted a resolution asking that the Kansas City Terminal Railway Co., complete the south end of the Main St. viaduct at 23d St.

Nebraska.

✣Bids will be received [illegible] by J. R. Roberts, County Clerk, Seward, Neb., for the construction and erection of substructure, superstructure and approaches of all new bridges during the coming year.

⊙The Union Pacific and Great Western Railroads are reported to have awarded the contracts for the construction of the iron work for the new Bancroft St. and 11th St. viaducts to the Paxton & Vierling Iron Works, Omaha, Neb. The Bancroft St. viaduct contract amounts to about 400 tons of iron, and the Eleventh St. viaduct to about 300 tons. About 140 men will be put to work at once by Paxton & Vierling to get out the iron work for the new viaducts.

According to advices from Omaha, Neb., plans for the construction of two viaducts in that city during the year of 1912 have been completed. One is the Nicholas St. viaduct, to be built by the Missouri Pacific and the Omaha Railroads. The other is the viaduct on Bancroft St. to be erected by the Union Pacific, the Great Western and the Burlington. Plans for the reconstruction of the Eleventh St. viaduct have been approved and work is expected to begin soon as the viaduct must be completed in April. The reconstruction of the Eleventh St. viaduct alone will cost in the neighborhood of $40,000, according to engineers. The Nicholas St. viaduct will be 300 ft. long and the Bancroft will be 400 ft. in length. The total cost of the two structures will approximate $200,000. The plans have been drawn by the railroad architects and will be submitted to the city engineering department for approval.

It is expected that a contract will be let about March 15 by D. D. Price, State Engineer, Lincoln, Nebr., for the construction

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

of a state aid bridge over Loup River at Loup City in Platte County. The kind of structure has not, as yet, been determined.

New York.

A bill is to be introduced in the State Legislature of New York, jointly by Senator L. H. White, Schenectady and Assemblyman G. H. Whitney, Saratoga, for the erection of a state bridge over the Mohawk river at Vischer Ferry.

The State Department of Public Works, Albany, N. Y., has submitted plans for the necessary repairs to the bridge over the Mohawk river, connecting Canajoharie and Palatine bridge. The structure has been closed to traffic for several months.

Ohio.

✣Bids will be received until Feb. 10 by Board of Erie County Commissioners, Fremont, O., for the construction of nine small concrete bridges estimated to require an expenditure of about $3,000.

✣Bids will be received until noon, Feb. 19, by Board of Ross County Comissioners, Chillicothe, O., for the construction of a reinforced concrete culvert in Concord township. Plans and specifications are on file with the County Engineer.

✣Bids will be received until noon, Feb. 12, by Board of Ross County Commissioners, Chillicothe, O., for the reconstruction of the Bridge St. bridge over the Scioto river at Chillicothe. Bids will be received at the same time for the construction of the concrete substructure of the Downs bridge in Green township. R. Alexander is County Auditor.

The New York, Chicago & St. Louis (Nickel Plate) Railroad is, according to reports from Ashtabula, O., planning the construction of a new bridge over the gully east of that city. As planned the structure will accommodate double tracks. G. H. Tinker, Cleveland, O., is Bridge Engineer.

R. S. Oliver, assistant secretary of the War Department, Washington, D. C., has notified F. R. Lander, Cayuga County Surveyor, Cleveland, O., that plans and specifications for the construction of the span of the new high level bridge at that city has been completed.

A resolution was introduced and passed its first reading at a recent meeting of the City Council of Columbus, O., providing that a special election be held May 21 to vote on the issuance of $850,000 bonds to provide funds for the construction of a viaduct connecting North Third St. with the North Side.

It is reported that the Lake Shore & Michigan Southern Railroad has approved the plans submitted by the city of Youngstown, O., for the construction of a viaduct over the railroad to eliminate the Oak St. grade crossing. The matter will now be taken up with the County Commissioners.

Pennsylvania.

⊙Directors of the Long Beach Turnpike Co. of New Jersey recently held a meeting at Philadelphia, Pa., and awarded a contract to the General Contracting & Engineering Co., of New York, for the construction of a roadway and bridge across Barnegat Bay, New Jersey, from Manahawken, on the mainland, to the island of Long Beach, on the ocean. This point on Long Beach is about seven miles from Beach Haven, and the roadway and bridge will connect with the ocean boulevard on the mainland and with the Long Beach boulevard on the island. This new bridge and roadway will parallel the Pennsylvania Railroad tracks from Manahawken to the island, and will be located just 300 ft. southward of these tracks. The bridge will cost in the neighborhood of $75,000 and is being built by private capital.

Plans are being formulated by the County Commissioners, Hollidaysburg, Pa., for the construction of a bridge over the Junita river at Union Furnace. It is also planned to erect a bridge across Dry run at that place.

Included in the proposed plans for the construction of the new line from Clarkes Summit to Hallstead, Pa., by the Delaware, Lackawanna & Western R. R. is the building of a reinforced concrete bridge near Nicholson, Pa., to replace the present tunnel at that place. A. E. Deal, Hoboken, N. J., is Bridge Engineer of the Lackawanna R. R.

Viewers have been appointed by the Washington County Commissioners, Washington, Pa., to pass upon the construction of the proposed bridge over Chartiers creek in South Franklin township. As proposed the structure will be located on the road leading from Ten Mile Plank road at the Jolley Schoolhouse to the "S" bridge.

A meeting was recently held at the rooms of the Chamber of Commerce, Johnston, Pa., by representative citizens of the Third, Fourth, Fifth and Sixth wards to take up the matter of having a bridge built over Stony Creek at Haynes St., connecting Fourth and Fifth wards. The cost of the structure, as proposed, will not exceed $50,000.

City Council of Scranton, Pa., and committee of the West Scranton Board of Trade recently held a meeting for the purpose of considering the construction of a viaduct over Tripp's Crossing over the Lackawanna Railroad tracks.

South Dakota.

✣Bids will be received until 2 p. m., Feb. 20, by Oliver Munsen, Union County Auditor, Elk Point, S. Dak., for the construction of bridges and bridge repair work during the year of 1912.

Plans for a new concrete bridge for Capital St., over the Rhine river are on file at the office of the city engineer, Yankton, S. Dak.

Tennessee.

Actual construction work on the proposed bridge over the Mississippi river at Memphis, Tenn., will be started some time during the summer by the recently incorporated Memphis Bridge & Terminal Co., mentioned in ENGINEERING & CONTRACTING. Plans for the structure have not yet been completed and a bill is now before Congress authorizing the improvement.

Texas.

✣Bids will be received until Feb. 15, by Commissioners of the Matagorda County Drainage District No. 3, Bay City, Texas, for approximately 300 lin. ft. of bridge work in connection with excavation work, mentioned in our Drainage columns. Official advertisement will be found elsewhere in this issue.

At an election recently held at Clavert, Tex., the proposition to issue bonds for the construction of county bridges, was carried.

At a recent election held in Robertson county, according to advices from Franklin, Tex., it was voted to issue bonds amounting to $25,000 to provide funds for the construction of bridges.

It is believed in Waco, Tex., that active steps will be taken shortly in regard to matter of constructing the proposed viaducts at 11th and 18th Sts. to abolish the grade crossings at those places.

Washington.

✣Bids will be received until 2 p. m., Feb. 12, by Snohomish County Commissioners, Everett, Wash., for the construction of pile trestle bridge on Elliott Bay Iron Works road near Edmonds, being about 300 lin. ft. P. T. Lee is County Auditor and clerk of the Board.

⊙The Board of King County Commissioners, Seattle, Wash., has awarded the contract for the construction of the Patten bridge to P. J. McHugh, 3d and Merced Sts., Seattle, Wash, at $13,310. Bids were opened Jan. 16. N. Wordall is clerk of the Board. The structure will consist of a 204 ft. steel span.

The following itemized bids were received Jan. 17 by W. J. Roberts, State Highway Commissioner, Olympia, Wash., for the construction of the substructure of a bridge over the Skagit river, near Mt. Vernon, Wash. (A) standing for D. M. Stevenson, Portland, Ore.; (B) N. C. Heinemann; (C) Quigg Bridge Co.; (D) Lance & Peters; (E) Stratton & Smith; (F) J. A. McEachern; (G) Arvid Rydstrom; (H) H. Chase; (I) Graff Construction Co., Seattle, Wash.; (J) Butler Construction Co.; (K) Pearson Construction Co.:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
Furnishing and placing 8,000 lin. ft. natural bark piles in approach, protection, etc., per lin. ft.	$ 0.21	$ 0.22	$ 0.10	$ 0.18	$ 0.28	$ 0.18	$ 0.25	[illegible]	[illegible]	[illegible]	$ 0.12
Furnishing and placing 8,000 lin. ft. peeled piles in approach, protection, etc., per lin. ft.	.215	.24	.13	.18	.30	.195	.25	.27	[illegible]	[illegible]	.22
Furnishing and placing 152 M. ft. B. M. timber in approach and protection, per M. ft. B. M.	9.00	22.00	30.00	18.00	25.00	21.60	24.00	[illegible]	26.00	[illegible]	[illegible]
Furnishing labor, forms, excavating, material (excepting piling), for 6 concrete piers—											
1,410 cu. yds. concrete above elevation 19, per cu. yd.	6.60	6.90	10.00	7.26	8.25	11.30	10.00	12.00	12.40	[illegible]	12.30
350 cu. yds. concrete below elevation 19, per cu. yd.	10.40	9.50	8.00	14.67	14.00	12.75	15.00	17.50	14.16	22.00	19.60
Furnishing and placing 10,000 lin. ft. natural bark piles under concrete piers, per lin. ft.	.25	.22	.25	.20	.28	.31	.35	.35	[illegible]	[illegible]	.295
Furnishing and placing 10,000 lin. ft. peeled piles under concrete piers, per lin. ft.	.255	.24	.35	.20	.30	.325	.35	.37	[illegible]	.30	.305
Furnishing and placing 350 cords live fir brush mattress around piers as directed by Engineers, per cord	2.00	4.00	2.25	5.00	4.00	3.00	4.00	4.50	[illegible]	[illegible]	5.20
Furnishing and placing 800 cu. yds. good, sound broken stone on mattress around piers, per cu. yd.	2.50	2.75	2.38	3.00	2.00	3.60	3.00	3.00	5.60	4.50	[illegible]
Jetting piles, 2,000 lin. ft., per lin. ft.	.12	.05	.30	.05	.35	[illegible]	.30	.15	.55	.40	.145
Furnishing and splicing shoes on piles—											
5,000 lbs. forged, per lb.	.12	.09	.05	.08	.10	.05	.075	.15	.19	.15	.085
5,000 lbs. cast iron, per lb.	.06	.055	.03	.04	.05	.05	.06	.08	.13	.10	.075
Totals, considering bark piles and cast iron shoes	$29,494	$30,033	$33,001	$34,824	$37,722	$40,048	$42,198	$47,520	$49,256	$49,517	$51,768

The Municipal Commission, Tacoma, Wash., has authorized an expenditure of $25,000 for the construction of the proposed steel bridge over the Green river, near the head works of the gravity water system project for the pipe line crossing, mentioned in our last issue.

Lewis County Commissioners, it is reported, are planning the construction of a $25,000 bridge over the Cowlitz river at Randle, Wash. Tully & Morse of that place are interested in the improvement.

West Virginia.

The House of Representatives, Washington, D. C., has passed a bill providing for the construction of a bridge over Tug Fork of the Big Sandy at Glen Hays station, Matewan station and Williamson, W. Va.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Wisconsin.

The Council Finance C[illegible] kee, Wis., has decided to re[illegible] at $175,000 of bonds for the [illegible] a new bascule bridge at [illegible] Klug is superintendent of [illegible] buildings.

Canada.

✣[illegible] tion of a steel bridge with three 150-ft. spans and 30-ft. roadway resting on con- [illegible]

✣Bids will be received until [illegible] 15, by [illegible] Division, Canadian Pacific Ry., Winnipeg, Can., for extending the piers and abutments of the Red River bridge at Winnipeg. Plans and specifications are on file at the office of the engineer.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

California.

•Lewis M[illegible] ported to have been awarded a sub-contract by the Utah Construction Co., Ogden, Utah, for constructing 20 miles of canal for the Oakdale irrigation system.

Colorado.

The Commissioners of Rio Blanco County, Meeker, Colo., have made an appropriation for changing the course of White River a mile below town to prevent future damage from ice gorges. Bids for the [illegible] at once.

The Kelly Lake Irrigation & Power Co., according to advices from Greeley, Colo., has been chartered with a capital stock of $250,000 to do a general irrigation and power business, operating in Jackson, Larimer and Weld counties. The incorporators are Charles L. Winscom, M. M. Ketchum, A. A. Hunt and Montie Blevins.

Commissioners of El Paso County, Colorado Springs, Colo., have set Feb. 14 for the election on the proposed bond issue of $500,000 to create an irrigation district in Fountain valley.

The following bids were received Jan. 23 by the U. S. Reclamation Service, Montrose, Colo., for the excavation of the west canal of the Uncompahgre project: (1) bid for schedules 2-12 (all schedules), (2) bid for schedules 2-7 inclusive, (3) bid on schedules 2, 3, 4, 6, 7, 8, (4) bid on schedule 5 (tunnel schedule: Maney Bro. & Co., P. O. Box 1126, Boise, Idaho (1), $78,363; The Young-Crook Construction Co., 316 Cooper Bldg., Denver, Colo. (1), $96,252; Dennis Gibbons, 429 W. Colfax Ave., Denver, Colo. (1), $96,609; Maurice A. Wogan, 1215 1st Nat. Bank Bldg., Denver, Colo. (1), $98,565; W. P. Leonard & T. J. Sayler, Lamar, Colo. (1), $106,838; M. H. Keefe & Son, 65 Highland Ave., Yonkers, N. Y. (2), $51,634; G. S. Green, 221 Century Bldg., Denver, Colo. (3), $44,620; Enstrom & Palmgren, Montrose, Colo., (4), $19,037; Mid-West Eng. Co., 310 McCague Bldg., Omaha, Neb. (4), $19,786; Ellsworth & Klaner Construction Co., 412-413 Central Block, Pueblo, Colo. (4), $23,835; James A. McIlwee, 1707 Glenarm St., Denver, Colo. (4), $47,864.

Idaho.

✣Bids will be received until 2 p. m., March 1, by United States Reclamation Service, Boise, Idaho, for furnishing rock crusher, ball mills, tube mills, a rotary dryer, and a mixing and weighing machine for sand-cement plant on the Boise project, Idaho. F. H. Newell, Washington, D. C., is Director. Official advertisement will be found elsewhere in this issue.

Illinois.

⊙The following bids were received Jan. 24 at Paxton, Ill., for cleaning out, deepening and enlarging by dredge boat of approximately 8 miles of ditch in the Vermillion special Drainage District in Ford and Livingston counties, Ill. Bottom width of ditch 20 to 60 ft., and estimated yardage 184,860 cu. ft.: R. H. & G. A. McWilliams, Chicago, 12 9/10 cts. per cu. yd.; Wolcott Dredging Co., Wolcott, Ind., 19 cts.; John McAndrews, Kankakee, Ill., 13½ cts.; N. C. McGinnis & Co., Bement, Ill., 12 cts.; M. J. O'Mara, Cullom, Ill., 13 45/100 cts. The contract was let to N. C. McGinnis & Co. C. E. Helman, Paxton, Ill., is the engineer.

•[illegible] been awarded the contract for drainage work for the Richland Drainage District of which D. I. Kirkham, Olive Branch, Ill., is Secretary. The contract prices were as follows: 94,141 cu. yds. dredge work at 12½ cts.; 15,360 cu. yds. team work at 25 cts., and 320 rods 10-in. and 12-in. tile at $2.20 per rod. Bids were opened Jan. 22.

The Trustees of the Sanitary District of Chicago and a commission representing the interested municipalities will work out a plan for an improvement of the sanitary conditions of North Shore municipalities by providing a drainage system that will prevent overflows into the lowlands.

Indiana.

Petition has been filed with the Lagrange County Commissioners, Lagrange, Ind., for a 2-mile open and tile ditch in Clay Township.

Iowa.

✣Bids will be received until 2 p. m., Feb. 21, by Board of Carroll County Supervisors, at the office of G. A. Poeppe, County Auditor, Carroll, Ia., for the construction of sections 3 to 22, inclusive, and sections 27, 28, 32, 33, 47, 48 and 50 of Storm Creek Drainage District No. 23. The work will include about 2,062,712 cu. yds. of material. I. W. Hoffman, Carroll, Ia., is engineer.

Surveys are to be made for a proposed drainage district petition for which has been filed with the County Supervisors at Spirit Lake, Ia., by H. H. Rowe and others. L. A. Wilson, Sibley, Ia., is the engineer.

Michigan.

Surveys have been started for dredging Sauger Lake in Antrim Township to a depth of 4 ft. The Cedar River will also be dredged. Walter Carven, Mason, Mich., Drain Commissioner of Ingham County, is in charge of the work.

Minnesota.

✣Bids will be received until 2 p. m., Feb. 2, by A. G. Lundgren, County Auditor, Warren, Minn., for the construction of Judicial Ditch No. 11. W. R. Hoag, Rollis, Minn., is engineer.

Mississippi.

Work is well under way on the construction of the Tuscumbia River drainage canal of Alcorn and Prentiss Counties, Mississippi, and the contractors, N. C. McGinnis & Co., Bement, Ill., have already completed five miles of the main canal and one tributary. Government engineers commenced work on the design of this drainage system over two years ago and finally decided to abandon the present channel entirely. The new channel as adopted is 28 miles long, with a bottom width ranging from 10 ft. at the upper end to 30 ft. at the lower end. The old channel is 40 miles long and as it runs the entire length through timber, it is almost completely damned up in several places with logs and drift. The canal as designed has an average depth of 8 ft., with a fall of 3½ ft. per mile. This channel is estimated to be about two-thirds the size required to carry the water, but owing to the fall and the character of the soil it is thought that natural abrasion will double the size of the channel in a short time. There are 13 tributaries to the main canal, varying in size from 6 ft. to 10 ft. bottom width, with an average depth of 7 ft., and a fall of from 3 ft. to 10 ft. per mile. The contract for the entire work was let to N. C. McGinnis & Co., of Bement, Ill., the contract price being $85,000. This includes the clearing of right of way which along with the blasting of stumps on line of canal is estimated to cost in the neighborhood of $15,000. Three floating dipper dredges are at work on the construction of the main and tributaries. The upper 8 miles of the main is being done with a 1 yd. machine on an 18-ft.x68 ft. hull, and the lower [illegible] 75-ft. hull. The tributaries are being cut with a 14-ft.x45-ft. steel hull, ¾-yd. gasoline machine, which is moved from one tributary to another by dismantling and dragging overland by its own power. The time for the contract expires one year from Feb. 1st, and with no bad luck will be completed some time in advance. This will open up 120,000 acres of some of the most fertile and productive land in Northeastern Mississippi.

Montana.

✣Bids will be received until March 1, (postponement of date) by Glen Lake Irrigation District Commissioners, Eureka, Mont., for divisions 1 to 8 inclusive, of the district.

North Carolina.

The viewers and engineer have made final report on the proposed drainage system for the Back Swamps and Jacob Swamp Drainage District. It will be about 45 days before bonds can be issued. The estimated cost of the system is $130,000 and it will require about 1,300,000 cu. yds. of earth excavations. The acreage is 33,000. F. F. Wetmore, Lumberton, N. C., is the engineer.

Ohio.

Clark County Commissioners, Springfield, O., have decided to construct a levee along Mad River in Mad River Township. Robert Netts, County Surveyor, Springfield, is to report on the project on Feb. 1.

Texas.

✣Bids will be received until Feb. 15 by Commissioners of Matagorda County Drainage District No. 3, Bay City, Texas, for the excavation of approximately 158,000 cu. yds. of earth, and about 300 ft. of bridging. Plans and profiles may be obtained of C. A. Marshall, Secretary of the District, Blessing, Texas. Official advertisement will be found elsewhere in this issue.

⊙Charles Clarke & Co., Galveston, Tex., have been awarded the contract for repairing the north jetty at the mouth of the Brazos River for the U. S. Government. The contract amounts to approximately $21,000 and the work involves the placing of approximately 1,000 tons of small riprap, and concrete blocks involving the use of 735 cu. yds. of broken stone, 280 cu. yds. of sand and 650 bbls. of cement.

Washington.

✣Bids will be received until 2 p. m., Feb. 16, by Paul W. Hauser, Secretary, Duwamish Waterway No. 2, Renton, Wash., for dredging 300,000 cu. yds. The work, it is estimated, will require an expenditure of $90,000.

Wyoming.

The Buffalo Canal & Reservoir Co. of Buffalo, Wyo., incorporated with a capital stock of $1,200,000, has filed its articles of incorporation.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

WATER-WORKS

Alabama.

The Berry Compressor Manufacturing Co., at $11,836, submitted the lowest bid to the Board of City Commissioners of Montgomery, Ala., for the furnishing of an air compressor for hydraulic pumping purposes at the Court Street supply plant of the municipal water works system, with electric motors for the operation thereof, installed and complete. Bids were opened Jan. 16.

Arizona.

The Town Council of Nogales, Ariz., has purchased the water plant at present in operation in that city from the Nogales Water Co., for a consideration of $60,000. A considerable amount of money will be expended on improvements to increase the water supply. The plant will be taken over on Feb. 1.

California.

The Upland Foothill Water Co., according to reports from San Bernardino, Cal., has been incorporated with a capital stock of $89,000, $53,500 of which has been subscribed by Jacob P. Wedel, C. A. Hanson, L. D. Temple, William Rohrig, C. E. Sarles, O. W. Kankel, R. N. Leahy, A. J. Ruth, O. L. Galbreth, S. P. Wiegner, J. J. Atwood and J. D. Wilson.

The City Council of Modesto, Cal., will probably call a special election some time during February for the purpose of voting on the issuance of bonds in the sum of $82,500 for the improvement of the municipal water system. The plans virtually mean the entire rebuilding of the system, including new mains to cost in the neighborhood of $41,725; additional hydrants, $3,411; additions and changes in the pumping plants, including the purchase of the Cressey pump at the old gas works, extensive improvements at the Eighth and 17th streets, and Wisecraver stations, $22,000; other improvements, including two tanks of a capacity of 100,000 gallons each, $11,900.

The Patton & Longley Co., of Los Angeles, Calif., is about to let contracts for the installation of a water system on a tract near Hollywood, which will include a pumping plant. The work will cost about $30,000.

Florida.

The city of Tampa, Fla., has notified the Tampa Waterworks Co. that the city will make use of its privilege of buying the plant of the company after giving the company the notice provided for in its charter. An election will shortly be held to vote upon the proposition. D. B. McKay is mayor.

Georgia.

The City Council of Atlanta, Ga., is considering an ordinance providing for the expenditure of $20,000 of the bond money for private water mains now used by the city, and for the expenditure of $12,000 of bond money to build a small reservoir to take care of the muddy water from the filters.

The Water Board of Columbus, Ga., has recommended to the City Council Chattahoochee river as the source of supply for the proposed municipal waterworks system. Bonds in the sum of $150,000 were recently voted for waterworks; additional bonds in the sum of $350,000 will shortly be voted upon. L. H. Chappell is mayor.

The city of Helena, Ga., recently awarded the contract to the J. B. McCrary Co., Empire Bldg., Atlanta, Ga., for the installation of a waterworks.

Idaho.

✣Bids will be received until 8 p. m., Feb. 6, by City Clerk, Lewiston, Idaho, for furnishing iron pipe and other materials for the water works system.

Plans are being prepared by Consulting Engineer C. H. Green of Spokane, Wash., for the installation of a waterworks system in the city of Preston, Ida., which, it is estimated, will cost between $60,000 and $75,000. W. Chatterton is City Clerk.

The citizens of Stites, Ida., at a recent special election voted the issuance of bonds in the sum of $5,000 for the installation of a gravity waterworks system. Work will be started about April 1.

Illinois.

✣Bids will be received until 2 p. m., Feb. 19, (postponement of date) by City Clerk, Anna, Ill., for the construction of a steel water tank and tower at that place. Work was mentioned in our last issue.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Feb. 10, for furnishing materials, labor, etc., necessary to construct, deliver and erect at Lake View pumping station, two centrifugal pumps, each driven by a condensing steam turbine, with auxiliaries, appurtenances, etc.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Feb. 3, for furnishing labor, material, etc., necessary to design, deliver and erect in place a pneumatic ash removal system at the 68th St. pumping station. The plans include an extra heavy steel pipe conveyor, dust collector, a Connersville, or its equal, positive blower, and a motor designed for 220 volt direct current service.

⊙The Hall Construction Co., of East St. Louis, Ill., has been awarded the contract by the city of New Athens, Ill., for the laying of a system of water mains for $17,039. The work includes mains with valves and hydrants. Bids were opened Jan. 23. The contract for constructing a pumping station and steel tower with 50,000-gal. tank will be let later. Geo. C. Probst is mayor.

Following are the low bids, as submitted by The Pratt & Cady Valve Co. of Hartford, Conn., to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the water pipe extension bureau, single stem inside screw valves in sizes and quantities as shown: 100 3-in. valves, $3.20 each; 30 4-in. valves, $4.60 each; 20 6-in. valves, $7.00 each; 10 8-in. valves, $11.00 each; 2 10-in. valves, $20.00 each, and 12-in. valves at $25.00 each. Bids were opened Jan. 23.

The City Council of Rochelle, Ill., has decided to replace the present 4-in. water mains on seven blocks of the streets to be paved this season with 8-in. mains.

The City Council of Amboy, Ill., is considering the plans prepared by City Engineer J. M. Egan for the extension of the city water system, estimated to cost $35,000. The improvement will include a pumping station, new steel water tower and extension of the mains to provide adequate fire protection for the entire city.

Bids were opened Jan. 20, by L. E. McGann, Commissioner of Public Works, Chicago, for furnishing and delivering to the pipe yards, located in various parts of the city, approximately 100 tons of pig lead, according to specifications. The Gardner Metal Co., 1364 W. Lake St., Chicago, submitted the lowest bid, $4.57 per 100 lbs.

Bids were received Jan. 20 by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the various pumping stations engine oil according to specifications. Magir Bros. Co., 155 N. Canal St., submitted the following bids which were low, 9450 gallons No. 1 cylinder oil, 17 cts. per gallon; 700 gallons No. 2 cylinder oil, 20½ cts. per gallon; 6,750 gallons No. 1 engine oil, 13¾ cts. per gallon; 150 gallons No. 2 engine oil, 14½ cts. per gallon; empty barrels to have a return value of 65 cts. each.

The following low bids for furnishing and delivering corporation ferrules to the City of Chicago at the water pipe yard, 2352 S. Ashland Av. were received Jan. 24 by L. E. McGann, Commissioner of Public Works: The Glauber Brass Manufacturing Co., Cleveland, O., 15,000 ¾-in., 57 cts. each; 100 1-in., 77 cts. each; 100 1½-in., $2.41 each; 200 2-in., $3.75 each; 400 1-in. ferrules without couplings, 62 cts. each; 400 1-in. octagonal head galvanized iron caps, 7 cts. each.

Bids for furnishing and delivering 32,000 lbs. of white cotton waste to the various water pumping stations as specified, were opened by L. E. McGann, Commissioner of Public Works, Chicago, Ill., on Jan. 23. The bid of Crerars Adams, 259 E. Erie St., Chicago, 8⅛ cts. per lb., was accepted as low. The contract has not been awarded.

Bids for furnishing the water pipe extension division of the Department of Public Works with approximately 10,000 lbs. of plumber refined solder, consisting of 63 parts lead and 37 parts tin, were received by L. E. McGann, Commissioner of Public Works, Chicago, on Jan. 20. The Gardiner Metal Co., 1364 W. Lake St., submitted a bid of 19.36 cts. per lb., which was low.

Bids were opened by L. E. McGann, Commissioner of Public Works, Chicago, Ill., on Jan. 20, for furnishing to the waterpipe extension division cylindrical lead pipe and delivering same to the waterworks shops, 2352 S. Ashland Av. The bid of E. W. Blatchford, 230 N. Clinton St., Chicago, $4.985 per 100 lbs., was low, based upon the following standards, internal diameter ½ in., 1¾ lbs. per lin. ft., ⅝ ins., 2½ lbs. per lin. ft., ¾ ins., 3 lbs. per lin. ft., 1 in. 4 lbs. per lin. ft., 1½ ins., 7½ lbs. per lin. ft., 2 ins., 10½ lbs. per lin. ft. No coil of pipe to vary more than 2 per cent from the standard. The contract has not been awarded.

Indiana.

E. M. Kerlin of Vincennes, Ind., representing a corporation, has advised the City Council of Sullivan, Ind., that he would accept the proposition of supplying Sullivan with an adequate supply of pure water from driven wells in the gravel beds of the Wabash river, 10 miles west of the city. The installation of the new system will require an expenditure of about $100,000. Work will begin as soon as the weather permits.

Iowa.

An election will be held in Keokuk, Ia., on March 25 for the purpose of voting on the proposition of purchasing the present waterworks system.

Kentucky.

Improvements are contemplated in the waterworks department of Covington, Ky. Engineer J. J. Weaver, in an address before the Council, favors the building of an auxiliary reservoir in Devon Park and placing a main, now over the C. & O. bridge, under the Licking river.

Louisiana.

M. E. Norman, chairman of the Finance Committee, town of Morgan City, La., will sell bonds Feb. 17, in the sum of $80,000 for the purpose of constructing a waterworks system and sewerage system.

Maryland.

At a recent mass meeting of the citizens of Gaithersburg, Md., it was decided that the Legislature should be asked for authority to bond the city for new streets, sidewalks, electric lights, water and sewer system and fire protection. A committee was put in charge, consisting of Carson Ward, J. W. Walker, J. W. Briggs, C. D. Owen and Dr. H. B. Haddox.

Michigan.

A resolution has been adopted by the Common Council of Saginaw, Mich., which authorizes the Water Board to enter into contract with some firm to install two 4,000,000-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

gal duplex pumps, to afford [illegible] tion in case the Gaskill pump at the east side waterworks should break.

Minnesota.

The Burns & McDonnell Co., Hydraulic & Sanitary Engineers, Scarritt Bldg., Kansas City, Mo., is making a valuation and appraisement of the water, light and [illegible] Virginia, Minn., where municipal ownership is contemplated. The city has voted to purchase the plant at the appraised valuation.

Missouri.

• The city of St. Charles, Mo. [illegible] the contract for the construction of two concrete lined reservoirs to Bull & Wofield of St. Charles for $20,144, and the contract for furnishing and laying 5,155 lin. ft. of 12-in. cast iron water pipe, 631 ft. of cast iron pipe with fire hydrants, valves, etc., to John Schulz of St. Charles for $8,000. Each reservoir will be 85ft.x70ft.x26ft., with connecting pipe and valves. Carr Edwards is City Engineer. Bids were opened Jan. 22.

Plans are being prepared by Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., for the construction of a waterworks and sanitary sewers for the city of Hermann, Mo.

The House of Delegates of St. Louis, Mo., has passed a bill carrying an appropriation of $25,000 for meters for the Water Department.

The City Council of Tarkio, Mo., has passed an ordinance to submit to the voters a proposition to buy the water plant for the sum of $22,000. Providing the plant is puchased improvements will be made at an estimated cost of $5,000.

Montana.

The City Council of Billings, Mont., is in favor of the proposition to issue bonds for the purchase of the present waterworks system.

Nebraska.

The Town Board of Rosalie, Neb., is contemplating putting in a system of waterworks in the spring. Suggestions are being received from different companies as to the best plan.

New Hampshire.

Consulting Engineer Charles H. Bartlett is preparing plans and specifications for the making of extensions to the waterworks system of Wolfeboro, N. H., at an estimated cost of $12,750.

New York.

✣Bids will be received until 2 p. m., Feb. 7, by Department of Water Supply, Gas and Electricity, 12-21 Park Row, New York City, for hauling and setting fire hydrants and appurtenances in various streets in the borough of The Bronx; for furnishing and erecting sheds at gate house No. 5, Jerome Park reservoir, borough of the Bronx; for furnishing and installing equipment in the machine shop and carpenter shop at the 179th St. pumping station; for furnishing and delivering valves. H. S. Thompson is Commissioner.

✣Bids will be received until 8 p. m., Feb. 15, by Commissioners of the Manhasset-Lakeville Water District, Manhasset, L. I., N. Y., for the construction of a system of waterworks. W. B. Fuller, 150 Nassau St., New York City, is Consulting Engineer.

The citizens of Geneseo, N. Y., at a recent special election voted in favor of the proposition for the construction of a new reservoir and the purchase of a new site. The work will be in charge of the Board of Water Commissioners.

The City Council of Newburgh, N. Y., contemplates calling a special election for the purpose of voting on the issuance of bonds in the sum of $125,500 for making improvements to the waterworks system.

North Carolina.

⦿Tucker & Laxton of Charlotte, N. [illegible] have been awarded the contract by the City Council of Washington, Ga., for the construction of an electric light plant, an addition to [illegible]

Oklahoma.

✣[illegible] mains, etc. Plans and [illegible]

• [illegible] for $15,945. The Western Engineering Co., Oklahoma City [illegible]

The Western Wells Co., of Kiowa, Kans., [illegible] a day, pursuant to a contract with that city. The contract extends for 18 months, after which the city may renew the [illegible] purchase the entire outfit for $10,000, or terminate the written agreement

Oregon.

⦿The Joacbsen-Bade Co., of Portland, Ore., has been awarded the contract by the city of Jacksonville, Ore., for the installation of a water distributing system for approximately $27,000.

Recorder Will J. Hayner of Sutherlin, Ore., [illegible] for the construction of a waterworks.

Pennsylvania.

The Water Commissioners of the city of Erie, Pa., have authorized Chester & Fleming, hydraulic engineers, Pittsburgh, Pa., to pre[illegible] gal. filtration plant for the city waterworks.

South Dakota.

The city of Aberdeen, S. Dak., will spend an additional $10,000 during this year in the laying of water mains.

Several meetings were recently held by the citizens of Kimball, S. Dak., for the purpose of deciding upon plans for extending the municipal waterworks system and increasing its capacity.

Tennessee.

The City Council of Knoxville, Tenn., has instructed the Water Commissioner to extend the water mains to the property of the Island Home Park Co. The contract ratified by the Council provides that the water mains on the north side of the river bank be extended east of McCammon Ave., and thence directly across the river to Island Home Park Co. property. S. G. Heiskell is mayor.

Texas.

The citizens of Alice, Tex., Jim Wells county, some time ago voted to construct a waterworks system at an estimated cost of $21,000. It is reported that construction work will be started shortly.

Consulting Engineer Alexander Potter, 114 Liberty St., New York City, has submitted a proposal to the city of San Antonio, Tex., for a thorough investigation into the physical and financial affairs of the San Antonio Watersworks Co.

Virginia.

⦿Perry W. Ruth & Co. have been awarded the contract by the Norfolk County Water Co., Norfolk, Va., for the laying of 10 miles of pipe line, part wooden and part iron, from its new source in Gum Swamp to its present main near the city lakes. The contract calls for the laying of 24,500 ft. of 24-in. wooden pipe from the new source, near North Landing river, across Princess Anne county to Kempsville. From Kempsville to the present main 28,635 ft. of 16-in. iron pipe will be laid. The contract also includes the erection [illegible]

[illegible] nassas Business League, Manassas, Va., to se[illegible] town. An election will shortly be held for the purpose of voting on the issuance of bonds [illegible] which will also include sewers.

Resolutions were recently introduced in the City Council of Norfolk, Va., to appropriate $22,731 to parallel the Norfolk County Water [illegible] fire hydrants; also from the Local Board of the 7th ward asking for a loan of $9,000 to further extend water mains in the 7th ward.

G. W. Stevens, Richmond, Va., president of [illegible] to have announced that filtering plants will be installed wherever there is a water tank along the lines of the company owing to trouble being experienced with the water system. At Peru, Ind., it is proposed to put in an extensive water system, drawing the supply from Pipe Creek, two miles south of the division [illegible]

Supt. Eugene E. Davis of the waterworks of Richmond, Va., has suggested two alter[illegible] the bed of James river to connect South Richmond with the central water supply of the city. The Council Committee has recommended an appropriation of $12,000 to repair Marshall reservoir.

West Virginia.

The Bellepoint Waterworks Co., Bellepoint, W. Va., has been incorporated with a capital [illegible] J. A. Woodrum, Ben. D. Keller, C. L. Miller, D. A Halsted and others.

Wisconsin.

✣Bids will be received until 8 p. m., Feb. [illegible], by J. C. Williams, president of the board, care of H. Claussen, Secy, Fox Lake, Wis., for steel tank and tower erected, and for pumping machinery, pipe, hydrants, valves and all materials and supplies f. o. b. cars and for any and all parts of the work, complete and in detail, for system of waterworks according to plans and specifications therefor on file in the office of the village clerk in Fox Lake and of George Cadogan and Arthur M. Morgan, engineers, Chicago, Ill., where full information can be obtained.

The Sheboygan Water & Light Co., Sheboygan, Wis., is making arrangements for the reconstruction of its water tower, recently destroyed by the cold weather weakening the supports of the tower. The tower is to have a capacity of 250,000 gals. The cost is esti[illegible]

The plans and specifications for the well system as approved by the special water committee have been adopted by the City Council of La Crosse, Wis., and the Board of Public Works has been authorized to advertise for bids and let contracts for the work. Contracts will be let some time before March 1. A. T. Maltby of Chicago, Ill., is engineer.

Canada.

✣Bids will be received until 11 a. m., March 1, by chairman, Board of Control, Winnipeg, Man., for supplying and installing a 5,000,000-gal. horizontal turbine pump driven by an induction motor direct connected. M. Peterson is secretary of the Board.

✣Bids will be received until 11 a. m., Feb 8, by chairman, Board of Control, Winnipeg, Man., for supply and installation of 3-50 k.w. transformers and accessories at Well No. 3. Specifications are on file with the city engineer, 223 James Ave. M. Peterson is secretary of the Board.

Waterworks Engineer Black of North Toronto, Ont., has submitted a report to the Water, Fire & Light Committee of the Town Council regarding the water supply and suggested that weeping-tile be sunk in the water-bearing soil to increase the supply. Town Engineer E. A. James advised the sinking of a new well to cost $1,500, the new well to serve as a collecting basin and storage well

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

It is thought that the preliminary survey for the construction of a sewerage system in the city of Oxford, Ala., will be completed within a week, after which bids will be asked for its construction. The citizens recently voted bonds in the sum of $12,000 for this improvement.

It is reported the City Commissioners of Mobile, Ala., have decided upon the construction of trunk sewers, planned to relieve the overflow of the southern, western and northern districts of the city. The estimated cost of the work is placed at $250,000. The engineering department has practically completed the plans.

Arkansas.

The City Council of Texarkana, Ark., has been petitioned for the establishment of another sewerage district on the West Side and that the necessary plans for the carrying out of the work of levying the tax and laying the mains be arranged at the earliest possible time. The proposed district embraces Rose Hill.

California.

The Board of Trustees of Hemet, Calif., held a town election on Jan. 17 for the purpose of voting on the issuance of bonds in the sum of $30,000 for the construction of a sewerage system and farm. It is reported the proposition carried.

Carl F. Schader of Santa Monica, Calif., is advocating the installing of a municipal sewerage system for both Venice and Santa Monica. It is proposed to vote on the issuance of bonds for the improvement.

Colorado.

The City Council of Ordway, Colo., is contemplating the installation of a sewerage system.

Georgia.

Fifty-four ordinances providing for the laying of new sewers in the city of Atlanta, Ga., have been introduced in the City Council. The following are the streets upon which new sewers will be laid under the ordinances already introduced: Flora, from La France to Hardee; Whitefoord Ave., from Hardee to East Fair; La France, from Mayson Ave. to DeKalb Ave.; Mayson Ave., from DeKalb Ave. to near La France; Connecticut Ave., from Delaware Ave. to DeKalb Ave.; Arizona Ave., from McLendon to DeKalb Ave.; Delaware Ave., from Arizona Ave. to Connecticut; Clifton, from DeKalb Ave. to Euclid Ave.; Whitefoord Ave., from Hardee to DeKalb Ave.; Hardee, from Whitefoord west to trunk; East Fair, from near Stovall to near city limits; Leggetts Ave., from Walthall to South Moreland; South Moreland, from Hardee to Leggetts; Weatherby, from near Kirkwood Ave. to Wylie; Trinity Ave., from near Washington to Central; Esten, from near Kirkwood Ave. to Wylie; Walthall, from Leggetts to Wylie; Kirkwood Ave., from Holtzclaw to Selman; Oliver, from Wylie to Kirkwood Ave.; Manigault, from Leggetts to Walthall; Kirkwood Ave., from near Leggetts to Moreland; McMillan, from near Marietta to Hemphill Ave.; Groves, from West 10th to West 14th; Sycamore, from Hemphill to Gallatin; Lee, from near Curran to Greenfield; Hemphill Ave., from near Fifth to near 10th; Gallatin, from McMillan to Hemphill Ave.; Curran, from near Marietta to West 10th; Bradley, from Exposition to near Curran; Greenfield, from near 10th to trunk sewer; Fielder, from Bradley to West 10th; Howell Mill road, from Marietta to near 10th; Exposition, from Hampton to Howell Mill road; West 10th, from crest of hill west of Howell Mill road to Curran; Cleveland, from crest of hill south of Kirkwood Ave. to Wylie; Exposition, from Hampton to end of street east of Hemphill Ave., thence across private property to State St.; Wylie, from crest of hill west of South Delta to Francis St., thence east across private property to Leslie, thence south and east along Leslie St. to Whitefoord Ave.; Page, from Muriel to McLendon and through private property from Page St. 300 ft. north of McLendon to trunk on Euclid Ave.; Dewey, from Mary to near Arthur; Karwisch, from Holtzclaw to Stovall; Kirkwood Ave., from Holtzclaw to Gibson; Gibson, from Kirkwood Ave. to Leggetts Ave.; Stovall, from Karwisch to Leggetts Ave.; Leggetts, from near Wylie to Porter; Hobson, from Mary to Rockwell; Gardner, from Hobson to near Stewart Ave.; Mary, from near McDaniel to Stewart Ave.; Kirkwood, from South Delta to Selman; Rockwell, from near McDaniel to Summit St.; Humphries, from near Glenn to Rockwell; Allene Ave., from Pierce to Lillian; Gibson, from East Fair to near Kirkwood Ave.; Stovall, from near Northen to near Leggetts; Summit St., from Rockwell to Gardner.

Idaho.

The citizens of Wardner, Ida., at a recent election, voted against the issuance of bonds in the sum of $19,000 for the construction of a sewerage system jointly with the city of Kellogg. The citizens of Kellogg will vote Feb. 15 on the issuance of bonds for the improvement. Plans and specifications were prepared by Engineer C. H. Green of Spokane, Wash.

Illinois.

✣Bids will be received by the Board of Directors of the Municipal Tuberculosis Sanitarium at their office, 1514 Fort Dearborn Bldg., Chicago, Ill., until 11 a. m., Feb. 9, for furnishing material, labor, tools, etc., to construct outside sewerage lines, and inside work in connection with hot water lines, ejector tank, bilge pumps, etc.

⊙David Mitchell, Sherman St., Lincoln, Ill., has been awarded the contract by the Board of Local Improvements of that city for the construction of a vitrified pipe sewer 15 ins. in diameter in and along the center line of Ninth St., 1,050 ft., for $817. Bids were opened Jan. 17.

City Engineer Main of Rockford, Ill., has submitted plans to the Board of Local Improvements for a sewer system extending north to Rock River, instead of the usual direction southward. The territory proposed for the improvement is in the southeast end of the city, comprising all of the streets south of 14th Ave. The estimated cost of the system is $70,000.

Bids for furnishing the water pipe extension bureau of the Department of Public Works, Chicago, Ill., with vitrified salt-glazed sewer pipe, were opened Jan. 23 by L. E. McGann, Commissioner of Public Works. Wm. E. Dee & Co., 30 N. La Salle St., Chicago, were low bidders, prices being as follows: 15,000 pieces 4-in. pipe, 3½ cts. per lin. ft.; 800 pieces 6-in. pipe, 5 cts. per lin. ft.; 600 pieces of 9-in. pipe, 10 cts. per lin. ft.

Following are the low bids submitted to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the bureau of sewers at their various yards vitrified salt-glazed clay sewer pipe. Bids are shown as the percentage off the western list price, 175 pieces 6-in., 76%; 1,000 pieces 9-in., 76%; 225 pieces 12-in., 76%; 150 pieces 15-in., 76%; 50 pieces 18-in., double strength, 71%; 25 pieces 24-in., double strength, 71%; 90 half traps (9-in.), 76%; 200 curved pieces, 76%. All pieces 2 ft. in length. N. A. Williams & Co., 1306 Chamber of Commerce Bldg., Chicago, were low bidders and it has been recommended that the contract be awarded upon this basis. Bids were opened January 23.

Bids for furnishing 1,600 bbls. of natural cement and 120 bbls. of Portland cement to the various yards of the bureau of sewers were opened January 23 by L. E. McGann, Commissioner of Public Works, Chicago, Ill. Wm. E. Dee & Co., 133 W. Washington St., submitted a bid of 86 cts. per bbl. for natural cement and $1.40 per bbl. for Portland cement; Thos. Connolly, 118 N. La Salle St., $1.28 for Portland and 87 cts. for natural. Owing to the small difference between the total bids it has been recommended that Thos. Connolly be awarded the contract as his submitted brands of cements have proven more acceptable in the past.

The following bids were submited to L. E. McGann, Commissioner of Public Works, Chicago, Ill., by the Bates Machine Co., Joliet, Ill., for furnishing and delivering to the yards of the bureau of sewers manholes, curb, lids, etc. 68 tons manhole curbs, $22 per ton; 90 tons catch basin curbs, $22 per ton; 1,000 manhole lids, standard diameter, 150 manhole lids, 22½ ins. diameter, 150 manhole lids, 22 ins. in diameter, 150 special deep lids, $22 per ton; 225 inlet grate boxes and 350 inlet grates, $26 per ton; 50 lawn cover curbs, 50 lawn cover lids, standard, 75 lawn cover lids, 79 ins. in diameter, 75 lawn cover lids, 20½ ins. in diameter, $27.20 per ton. It has been recommended that the contract be awarded. Bids opened January 23.

Indiana.

⊙The Board of Public Works of Elkhart, Ind., has awarded the contract for the construction of the Richmond Ave. sewer to Frank Miller, representing the Elkhart Bridge & Iron Co., for $1,237.

A resolution has been introduced in the Board of Public Works of Elkhart, Ind., providing for the construction of a trunk sewer from Wolf to Flusher Ave., including a large territory extending beyond the city limits.

Iowa.

✣Bids will be received until Feb. 20, by City of Tipton, Ia., for the construction of 10½ miles of sanitary sewers and disposal plant. A certified check for $500 must be filed with each bid. Plans and specifications are on file with the city clerk or Iowa Engineering Co., Chase Block, Clinton, Ia., Engineers.

✣Bids will be received until 2 p. m., Feb. 6, by Board of Public Works, Davenport, Ia., for furnishing the labor and material necessary for laying a sewer main from Farnam St. in Oxford Ave. to a point 260 ft. east.

The City Council of Des Moines, Ia., has approved plans for the new Seventh Ward sewer to cost $125,000. This system will involve the establishment of a disposal system which will cost the city $15,000.

The City Council of Fort Dodge, Ia., has passed a resolution of necessity for a sanitary sewer starting at the river and Second St., north to 11th Ave., south and thence east to Third St. The new sewer will be 8-in. pipe with two manholes, three lampholes and one flush tank.

Kansas.

✣Bids will be received until 2 p. m., Feb. 15, by City of Girard, Kan., for the construction of sanitary sewers and sewage disposal works. Burns & McDonnell, 821 Scarritt Bldg., Kansas City, Mo., are Engineers.

⊙The City Council of Lawrence, Kans., has awarded the following contracts for the construction of sewers: Sanitary sewer under ordinance No. 813, Graeber Bros., $5,506; Tennessee storm sewer, Graeber Bros., concrete work, $6,327; W. J. Gilmore, brick work, $3,193, and W. T. Keller, Kansas City, Kans.,

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

tile work, $2,718, the sect [illegible] McCook storm sewer, Gra [illegible] All bids on the other section [illegible] McCook sewer were rejected [illegible] the city engineer's estimate.

Kentucky.

•The City Council [illegible] awarded the contract for the laying of the pipe to take the sewerage to the river to Edward Manion at $0.89 per lin. ft. The Council is taking steps to [illegible] the sewage of [illegible]

Maryland.

✣Bids will be received until 11 a. m., Feb. 7, by Board of Awards, Baltimore, Md., for the construction of trunk sewers in Frederick Ave., under Contract 79. Charles England, 904 American Bank Bldg., is Chairman of the Sewerage Commission.

Massachusetts.

✣Bids will be received until [illegible] 5, by Department of Public Works, Boston, Mass., for cleaning about 6,600 catch basins throughout the city. Frank A. McInnes is Engineer of the Sewer and Water Division.

⊙Mayor Fitzgerald of Boston, Mass., on Jan. 26 signed the acceptance of the proposal of the Boston Development & Sanitary Co., for the disposal of garbage in Boston for 10 years, beginning with July 1 of the present year. The bid of the company was $1,432,000 for 10 years, the city to provide a site on Spectacle Island and the company to erect a building and wharfs, all of which will go to the city at expiration of the contract.

Minnesota.

✣Bids will be received until 2 p. m., Feb. 6, by State Board of Control, St. Paul, Minn., for sewerage and sewage purification of the State Asylum, Anoka, Minn.

✣[illegible] Board of Public Works, St. Paul, Minn., for [illegible] gineer.

✣[illegible] 1, by Board of Public Works, St. Paul, Minn., [illegible] including manholes. Oscar Claussen is City Engineer.

•[illegible] Minn., has awarded the following sewer contracts: Park Ave., between Litchfield and Manitoba Sts., J. J. Connolly, $619; Farring- [illegible] Ave., Christ Johnson, $323; Eva St., from Indiana Ave., to a point near Chicago Ave., Christ Johnson, $355. All bids for sewers on Chatsworth St., and Dunedin terrace were rejected.

New Jersey.

✣Bids will be received until 7:30 p. m., Feb. 6 (readvertisement), by Common Council, Summit, N. J., for the construction 8 in. vitrified pipe sewer in Mountain Ave. J. S. Stiger is City Engineer.

New York.

✣Bids will be received until 11 a. m., Feb. 7, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for furnishing all the labor and material required for constructing sanitary outlet sewers and storm outlet sewers in bay 35th St., from Bath Ave. to Benson Ave.; in Benson Ave., from Bay 35th St. to Stillwell Ave.; crossing Stillwell Ave. to Avenue V, and in Avenue V, from Stillwell Ave. to W. 11st St., and a 24-in. force main in Avenue V, from W. 11th St. to Stillwell Ave., across Stillwell Ave. to Benson Ave.; and in Benson Ave., from Stillwell Ave. to 21st [illegible]

Texas.

•The Greenville, Tex., City Council has awarded the contract for the construction of [illegible]

Ohio.

✣Bids will be received until noon, Feb. 8, by Director of Public Service, New Philadelphia, O., for furnishing necessary labor and material for the construction of sanitary sewer and siphon line. T. L. Aughinbaugh is Clerk.

✣Bids will be received until noon, Feb. 14, by Director of Public Service, Salem, O., for the construction of a sewage disposal plant at that place. L. E. Chapin, Frick Bldg., Pittsburgh, Pa., is Engineer.

✣Bids will be received until noon, Feb. 20, by Henry Appleton, Village Clerk, Kennedy Heights, Cincinnati, O., for furnishing the necessary labor and material for constructing sanitary sewers in certain streets and highways in that part of the general plan of sewers for Kennedy Heights. Bids must be made in [illegible] J. A. Stewart, Engineer, which plans and specifications are now on file at the office of the clerk and at the office of J. A. Stewart, No. 1112 Traction Bldg., Cincinnati, Ohio.

Oregon.

⊙The Executive Board of Portland, Ore., has awarded the contract for the laying of a sewer in Morrison St., from Fifth to West Park, to E. W. Riner for $3,611.

Virginia.

⊙The American Boulevard Corporation have awarded to Guild & Co. of Chattanooga, Tenn., a contract to build complete modern sewer system, approximately four miles, at Lochhaven, a suburb of Norfolk, Va.; work to be completed in 90 days. Arthur C. Freeman, Arcade Bldg., Norfolk, is Engineer.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

⊙The Healy-Tibbitts Construction Co., San Francisco, has been awarded the contract at $263,400 for constructing Pier No. 17 at San Francisco for the Harbor Board.

Illinois.

✣Bids will be received until noon, Feb. 1, by I. J. Bryan, clerk, Sanitary District of Chicago, 1500 American Trust building, Chicago, Ill., for dredging of the East and West Arms of the South Fork of the South Branch of the Chicago river in the city of Chicago. The work is estimated to require the removal of approximately 94,262 cu. yds. of material.

✣Bids will be received by the Board of Inspectors of the House of Correction, 26th St. and California Ave., Chicago, Ill., until 2 p. m., Feb. 2, for furnishing, delivering and erecting in place upon their grounds, structural steel works for elevator towers and bridge for quarry hoist. Certified check for $300 must accompany proposal.

Indiana.

✣Bids will be received until 10 a. m., Feb. 13, by Depot Quartermaster, Jeffersonville, Ind., for furnishing 150 escort wagons, complete as per specifications 1908, modified Dec. 19, 1911, and standard sample at Detroit.

The Indiana National Life Insurance Co. of Indianapolis has announced plans for the erection of a modern 8-story business block in Meridian St., opposite University Park, at Indianapolis. The building is to cost more than $500,000, and work on it is to begin next spring. The building, which will have a frontage of 85½ ft. in Meridian St. and a depth of 195 ft., will have an exterior finish of white terra cotta on the Meridian St. front and pressed brick on the other sides.

Kentucky.

It is quite probable that a new building for the First Presbyterian Church, Mayfield, Ky., will be erected this year. Architects should write to W. V. Gregory, Attorney at Law, Mayfield, Ky.

Maine.

Bids as follows were received Jan. 15 by the U. S. Engineer, Portland, Me., for placing stone in breakwater near Bar Harbor, Me.: P. H. Doyen Co., of Portland, Me., 83 cts. per ton; The Breakwater Co., of Philadelphia, Pa., 77½c per ton; Rowe Bros. Co., of Richmond, Me., $1.13 per ton; E. S. Belden & Sons, of Hartford, Conn., 93 cts. per ton.

The following bids were received Jan. 15 by the U. S. Engineer, Portland, Me., for dredging St. Croix River, Me.: Bay State Dredging Co., of Boston, Mass., 32¼ cts. per cu. yd.; J. S. Packard Dredging Co., of Providence, R. I., 37.4 cts. per cu. yd.; Eastern Dredging Co., of Boston, Mass., 33.9 cts. per cu. yd.

Maryland

✣Bids will be received until noon, Feb. 14, by Board of County Commissioners, Towson, Md., for street lighting with arc and incandescent lamps for Catonville and surrounding territory. E. Stanton Bosley is Chief Clerk of the Commission.

Massachusetts.

✣Bids will be received until noon, Feb. 7, by Boston Transit Commission, George G. Crocker, 15 Beacon St., Boston, Mass., chairman, for furnishing 190 tons square twisted and 10 tons square plain rods of open hearth steel.

✣Bids will be received until noon, Feb. 7, by Boston Transit Commission, George G. Crocker, Chairman, 15 Beacon St., Boston, Mass., for furnishing 5,000 to 50,000 barrels of Portland cement.

✣Bids will be received until 10 a. m., Feb. 7, by Boston Transit Commission, B. Leighton Beal, secretary, 15 Beacon St., Boston, Mass., for furnishing and delivering 5,000 to 50,000 barrels of Portland cement.

✣Bids will be received until noon, Feb. 7, by Boston Transit Commission, B. Leighton Beal, secretary, Boston, Mass., for furnishing and delivering 190 tons of square cold twisted rods and for 10 tons of square plain rods, both kinds to be open hearth steel.

Minnesota.

✣[illegible] Mar. 1, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures of the United States Postoffice at Virginia, Minn. The building is to be approximately 3,900 sq. ft. in ground area, one-story and basement, with stone and brick facing and terra cotta cornice and of nonfireproof construction.

Nebraska.

✣Bids will be received until 4 p. m., Feb. 13, by J. S. Dales, secretary, Board of Regents, University of Nebraska, Lincoln, Neb., for the construction of a law college building, also for heating and ventilating apparatus, plumbing and electric wiring for the same. The total cost of the work estimated at $30,000. Bids must be marked as follows: Bid for construction of Law College building. Bid for heating and ventilating apparatus, [illegible] plumbing [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

College building. Bids for electric wiring, Law College biulding.

New York.

✣Bids will be received until 11 a. m., Feb. 15, by Lt. Col. J. G. Warren, U. S. Engineer, 540 Federal Bldg., Buffalo, N. Y., for removing steel sheet jute cofferdam, Black Rock Shiplock, at Buffalo, N. Y. The work to be done is removing the steel sheet pile cofferdam and clay filling therein surrounding the Black Rock Shiplock. This includes removing and leveling of the high crest of the rubble stone embankment along the inner face of the east cofferdam wall, and the excavation of the approach channel at the lower end of the shiplock. The removal of the cofferdam implies final disposal of the steel sheet piles and channels forming it, which will be effected by the sale of the steel sheet piles and channels, after they are extracted from the cofferdam, to the contractor or to another bidder at the price bid. The cofferdam is 947 ft. long by 260 ft. wide, outside dimensions; was constructed by the United States April 1908—March 1909; and consists of interlocking steel sheet piling in lengths from 41 to 50 ft., driven to bed rock in water 1 to 15 ft. deep, projecting 5 ft. above mean river level and penetrating 25 to 40 ft. of fine sand, gravel and clay to bed rock. The cofferdam is formed of two parallel walls of the piling 30 ft. apart, connected at intervals of 30 ft. by cross walls or bulkheads of the same piling similarly driven. A waling formed of standard 15-in. 40-lb. steel channels is bolted along the inside sheet pile wall about 1.75 ft. above mean river level, and braces of similar channels are bolted on a diagonal, slope of about 1 on 2, to one face of each cross wall, upper ends about 4½ ft. above and lower ends 8 to 10 ft. below mean river level. The quotations are as follows: Clay filling to be excavated and deposited along lock walls, 13,000 cu. yds. place measure; clay filling to be excavated and disposed of on dumping grounds, 12,000 cu. yds. place measure; steel channels in walings and braces, 143 pieces, steel sheet piles, 6,414 piles; broken rock in removing embankment, 1,000 cu. yds. scow measure; sand gravel, clay, etc., for channel excavation, 15,000 cu. yds. scow measure.

✣Bids will be received until noon, Feb. 7, by Department of Docks and Ferries, Calvin Tomkins, Commissioner, Borough of Manhattan, New York City, for Contract No. 1311, for furnishing all the labor and materials required for dredging in the Boroughs of Manhattan, Brooklyn, Queens, The Bronx and Richmond. The time for the completion of the work and the full performance of the contract is on or before Dec. 31, 1912. The amount of security required is as follows: Class 1, for dredging about 250,000 cu. yds. on the North River, Borough of Manhattan, the sum of $15,000; Class 2, for dredging about 75,000 cu. yds. on the East and Harlem Rivers, Boroughs of Manhattan, Brooklyn and Queens, the sum of $7,500; Class 3, for dredging about 15,000 cu. yds. on the East and Harlem Rivers, Boroughs of Manhattan and The Bronx, the sum of $2,500; Class 4, for dredging about 25,000 cu. yds. on the East River, Borough of Brooklyn, South Brooklyn, and in the Borough of Richmond, the sum of $2,500.

✣Bids will be received until noon, Feb. 7, by Department of Docks and Ferries, Calvin Tomkins, Commissioner, Borough of Manhattan, New York City, for furnishing under contract 1315, all the labor and materials required for furnishing and delivering oak piles. The amount of security required is $750.

Ohio.

✣Bids will be received until noon, Feb. 19, by Maj. J. C. Oakes, U. S. Engineer, 415 Custom House, Cincinnati, O., for constructing one steel derrick boat hull for Kentucky River, Ky

Oregon.

✣Bids will be received until 3 p. m., March 2, by M. P. White, Architect, 1917 1st St., Baker, Ore., for the construction of additions and alterations to basement and for the erection of a 3-story superstructure of stone and brick on same for the new St. Elizabeth Hospital, Baker, Ore.

Plans will be readv this spring for a new fireproof Supreme Court building to be erected at Salem. W. C. Knighton, Salem, Ore., is the Architect.

Pennsylvania.

✣Bids will be received until 11 a. m., Feb. 17, by R. C. Holliday, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for building for reforming plant at the naval magazine, Fort Miffin, Pa.

⊙Neal Brannigan of Jeddo has been awarded a contract for the driving of a short rock tunnel in the Highland No. 5 mines of the G. B. Markle Co.

A syndicate has purchased Old Point Breeze track at Philadelphia, and will, it is reported, transform it into an amusement park on the order of Willow Grove and Electric Park at Baltimore. It is believed that T. H. Silverman, 605 Land Title Bldg., Philadelphia, Pa., one of the owners of the Southwestern Street Ry., which passes the property, is interested in the syndicate.

South Carolina.

✣Bids will be received until 3 p. m., Feb. 27, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas-piping, heating apparatus, electric conduits and wiring and interior lighting fixtures, of the United States Postoffice at Union, S. C. The structure will be one-story and basement of approximately 4,117 sq. ft. ground area, brick faced with stone trimming and tin roof.

✣Bids will be received until noon, Feb. 19, by J. D. Newcomer, architect, Charleston, S. C., for the construction of the Baker-Craig Sanatorium, 70x128 ft., brick, basement and three stories high, at Charleston, S. C.

Tennessee.

✣Bids will be received until 11 a. m., March 18, by Maj. H. Burgess, U. S. Engineer, Nashville, Tenn., for the construction of concrete locks B and C, Cumberland River.

Texas.

✣Bids will be received until 3 p. m., March 2, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas pipng, heating apparatus, electric conduits, wiring, and interior lighting fixtures, of the United States Postoffice and custom house at Corpus Christi, Texas. The building is to be 4,400 sq. ft. ground area, 2 stories and basement, stucco finish with tile roof.

✣Bids will be received until 11 a. m., Feb. 5, by J. M. Murch, County Auditor, Galveston, Texas, for the delivery of not to exceed 15,000 cu. yds. of mudshell at stations in Galveston county alongside the G., H. & H. and G., C. & S. F. railroads. Specifications are on file with the county auditor.

✣Bids will be received until 2 p. m., Feb. 8, at the office of C. H. Page & Bro., architects, Austin, Tex., for the installation of heating, plumbing and wiring in a college building and servants' building at Seguin, Texas.

Virginia.

✣Bids will be received until 10 a. m., Feb. 15, by Capt. R. R. McBride, Constructing Quartermaster, Fort Monroe, Va., for the construction of an addition to the hospital at Fort Monroe, Va. The work will include plumbing, heating and electric wiring and fixtures.

Wisconsin.

✣Bids will be received until 5 p. m., Feb. 2, by Board of School Directors, F. M. Harbach, Secy, Milwaukee, Wis., for furnishing a 2-passenger roadster, completely equipped to cost not over $1,000.

⊙J. H. Keith Co., Manitowoc, Wis., has been awarded the contract for building a 400-ft. long, 50 ft. wide dock at Algoma for the Merchants Dock Co.

Canada.

✣Bids will be received until 11 a. m., Feb. 16, by Chairman, Board of Control, Winnipeg, Man., for supply of steel casement sash, linen chute doors and elevator doors for the King George Isolation Hospital. Plans and specifications may be obtained at the office of Mr. H. B. Rugh, Architect, 928 Union Bank Bldg. M. Peterson is Secretary of the Board.

⊙Page & Co., Toronto, Ont., have been awarded the contract for constructing an addition to the power house of the Electrical Development Co. at Niagara Falls. About $200,000 to $300,000 will be expended for the addition.

TRADE NOTES.

On Feb. 1st the interests of the Empire Iron & Steel Co. of Niles, O., will be absorbed by the Brier Hill Steel Co. of Youngstown, O. The new merger involves several large independent steel interests of the Mahoning valley. Officers will be elected Feb. 1st.

The Chain Belt Co., Milwaukee, Wis., has opened a Chicago office at 900 Old Colony Bldg. Mr. Benj. S. Reynolds, who for some years has been a member of the engineering staff at the home office in Milwaukee, will be in charge of the Chicago office. Mr. Reynolds will not only handle engineering problems, but will also be sales representative and will handle a line of elevating and conveying machinery, Chain Belt sprockets, buckets, set collars, etc. The Chain Belt Co. has completed a new structural shop which will be devoted entirely to the manufacture of conveying and elevating machinery. This addition more than doubles the former capacity.

The MacArthur Concrete Pile & Foundation Co., 11 Pine St., New York, has been awarded the following Pedestal Concrete Pile contracts: Foundations for a manufacturing building, Saginaw, Mich., for Hammond-Standish; Architects, Coles & Mutcheller, Saginaw. Foundations for a warehouse building at Hamilton, Ont., for Oliver Chilled Plow Works, Ltd., of Canada. This is the second contract for the Oliver Chilled Plow Works. Prack & Perrine are the architects. The third contract is for a foundation for a three-quarter million dollar court house for Fulton County, Atlanta, Ga.; over 1,200 Pedestal Piles are being driven. A. Ten Eyck Brown & Morgan & Dillon are the architects.

The J. I. Case Threshing Machine Co., Racine, Wis., has increased its capital stock from $5,000,000 to $40,000,000 and will add several new lines to its already big output of farm machinery and engines. The details of the expansion policy and what it will include have been held in reserve by the officials of the Case company, but it is generally known that a new gas tractor will be put on the market this year. The Case gas engine experts have been at work on the new product for some time, experimenting and testing, and now it is claimed the new tractor is ready for marketing. Several additions will be made to the big plant of the Case company in addition to those already in the course of building. The new gas tractor home will be one of the most complete in existence and will be completed in 1912

It is sometimes difficult to secure an original and effective display for exhibition purposes from sheet steel and metal products. At the recent International Fair held at San Antonio, Tex., the Peden Iron & Steel Co. of San Antonio, Tex., in conjunction with the Stark Rolling Mill Co. of Canton, O., succeeded in making an attractive exhibit, using the Toncan Metal Product of teh latter concern, which landed the first premium in the Exposition Department. The display was in the form of a handsome building, constructed entirely of Toncan metal products. There was a Toncan metal tile roof with elaborate Toncan metal cornices. Toncan metal Greek Doric columns added to the beauty of the structure. Included in the display in the building were the various styles of metal roofing, siding, shingles, eaves trough, pipe, elbows, nails, bolts, rivets, etc. The non-corrosive and rust-resisting properties of Toncan metal were effectively exhibited. The Peden Iron & Steel Co. is the distributor of Toncan Metal in the southwest.

PROPOSALS

EXCAVATION AND BRIDGING.

Bids will be received at Bay City, Tex., until Feb. 15, 1912, by the Commissioners of Matagorda County Drainage District No. 3 for excavation of approximately 158,000 cu. yds. of earth and about 300 ft. of bridging. Bidders to furnish bond buyer. Plans and profile can be obtained from C. A. Marshall, Secretary, Blessing Texas.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

DEPARTMENT OF [illegible] United States Reclamation Service. Washington, D. C., Jan. 25, 1912. Sealed proposals will be received at the office of the United States Reclamation Service. Boise, Idaho, until 2 o'clock p. m., March 1, 1912, for furnishing a rock crusher, ball mills, tube mills, a [illegible] mixing and weighing [illegible] cement plant on the Boise Project, Idaho. For particulars address the U. S. Reclamation Service, Boise, Idaho, or Washington, D. C. F. H. NEWELL, Director.

MISSISSIPPI RIVER COMMISSION, 1st and 2nd Districts, U. S. Engineer Office, Memphis, Tenn., Jan. 8, 1912. Sealed proposals for furnishing one locomotive crane will be received at this office until 12 o'clock, noon, Feb. 8, 1912, and then publicly opened. Information on application. Clarke S. Smith, Major, Engrs.

WAR DEPARTMENT, U. S. ENGR. OFFICE.—Montgomery, Ala., Jan. 24, 1912. Sealed proposals for dredging in Carrabelle Harbor, Fla., will be received at this office until 1 o'clock p. m., Feb. 23, 1912. Information on application. G. D. FITCH, Lt. Col., Engrs.

WANTED.

Dyersville, Iowa.

Railroad contractors' bids on 210,000 cu. yds. earth work on Farley-Luxemburg section of new Farley & Iowa Northern R. R.; construction to commence early in the spring. Profiles, maps, etc., ready for inspection now to base estimates on.

S. G. DURANT.

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DAM.

Paris, Tex.

[illegible] fice of the City Secretary until 7:30 o'clock p. m., February 5, 1912, for raising [illegible] City Lake. It is estimated that 35,000 cu. yds. of dirt will be moved. Each con[illegible] bid.

The right to reject all bids is reserved [illegible]

DEPARTMENT OF THE INTERIOR UNITED STATES RECLAMATION SERVICE.—Washington, D. C., Jan. 15, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Neb., until 2 o'clock p. m., Feb. 28, 1912, for the construction of an earth dam and auxiliary works, on the North Platte Project, about nine miles north of Minatare, Scottsbluff County, Neb. The work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earthfill, 157,000 cu. yds. gravelly material, 14,000 cu. yds. unscreened gravel, 11,500 cu. yds. screened gravel, 14,000 cu. yds. concrete, and 12,000 cu. yds. brule clay excavation, besides 45 acres of sod stripping, 600 feet of wells and casing, 3,200 lin. ft. of drains, and the handling and placing of 250,000 lbs. of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Neb.; 519 Commonwealth Bldg., Denver, Col., or Washington, D. C. F. H. NEWELL, Director.

U. S. ENGINEER OFFICE, Seattle, Wash., Jan. 5, 1912. Sealed proposals for dredging and excavating in Lake Washington Canal right of way will be received at this office until 12 M., February 15, 1912, and then publicly opened. Information on application. J. B. Cavanaugh, Maj. Engrs., Agent for the State of Washington and King County, Wash.

STEEL, CONCRETE & WOODEN BRIDGES.

Sealed proposals will be received at the office of the County Clerk at the Court House in the City of Schuyler, Colfax County, Nebr., up to 12 o'clock of the 12th day of February, 1912, at which hour the bids will be opened, publicly read aloud, [illegible] concrete and wooden bridges.

[illegible]

[illegible] specifications now on file in the office of the County Clerk.

For lumber in place for caps, sways, backing and wings.

[illegible] ture and wings.

For pile straps in place for any work.

For steel caps as per plans.

For tubular piers as per plans.

For concrete bridges complete as per plans.

For extra concrete per cubic foot.

For putting lumber and piling in place for repairing old bridges.

Said bids must be accompanied by a certified check on some bank in Schuyler, Nebr., for the sum of $500.00, and payable to the County Clerk of Colfax County, Nebr.

The successful bidder will be required to enter into a good and sufficient bond in the sum of $2,000.00 for the faithful performance of his contract.

The Board reserves the right to waive any defects and reject any and all bids for any reason they may deem sufficient.

By order of the Board of County Commissioners of Colfax County, Nebr., this 16th day of January, A. D. 1912.

ED. F. VRZAK,
County Clerk for Colfax County, Nebr
(Seal.)

FOR SALE—AERIAL TRAMWAY (Built by John A. Roebling's Sons Co.

Double Rope Tramway.
Length of line 11,800 feet. Hourly capacity 60 tons.
Power at loading terminal. One Flory double cylinder 14x18″ engine.
140 Carriages complete with Roebling's patent steel grips and tip buckets of 10 cubic feet capacity.
At present operating with 36 intermediate towers (timber).
Loading terminal 37′ long, discharging terminal 100′ long, two intermediate terminals each 100′ long (iron work).
Main loaded cables 1⅛ to 1⅝″ (32 wire cast steel tramway strand).
Empty main cable ⅞ and 1″ (19 wire cast steel tramway strand).
Traction rope 24,000′ ¾″ (6x19 cast steel wire rope).
Complete with switch rails (at terminals), counterweight ropes, cable fittings, sockets, etc., anchor irons and all necessary bolts and washers for towers and terminals.
Complete set of drawings for erection.

Tramway was constructed by the Roebling Company in June, 1910, and has been handling cement and sand. Is in perfect order. Is offered for sale only because contract work has been completed. Can be seen in operation at High Falls, Ulster County, N. Y., and released when required.

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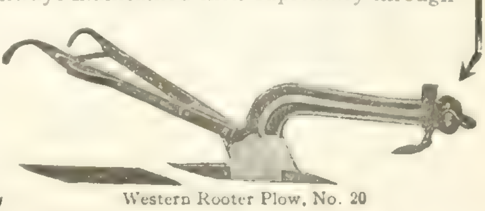

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1—2000 lbs. Pile Hammer, new	25
1—Nipper Block for above Hammer, new, never used	10
8—No. 2 Wheeled Scrapers, fair condition, will do a lot of work yet, each	10
1—Light Road Grader, A1 condition	60
6—Fresno Scrapers, new, used one week, each.	7
700 ft. 2" Manila Rope, new, used on one job	40
1—Single and 1 Double Hartz Steel Blocks for 2" rope, both	15
2—Hose Power in good condition, each	25
5—Dump Carts, good and stout, A1 condition, each	20
1—Lot of 1" Wire Guys, galvanized, 5 cents per ft.	
3—Derrick Crabs, each	$ 5
1—35 H. P. Engine in good condition	175

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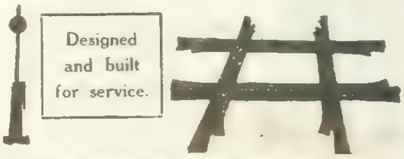
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SUBSCRIPTION RATES [illegible]
[illegible] Panama, Canal Zone [illegible]

Volume XXXVII. No. 6. February 7, 1912.

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Entered as second-class matter, April 17, 1907, at the Post Office at Chicago, Illinois, under act of [illegible] Copyright 1911 by the Myron C. [illegible]

Motor Trucks for Contractors' Use.

We give considerable space in this issue to illustrations of motor trucks for contractors' use. The motor truck is destined to replace [illegible] hauling in many [illegible] [illegible] we belie[illegible] it is doubtful that the substitution will be immediate or sudden, as motor enthusiasts have asserted. If for no other reason, the contractor will proceed slowly because he is doubtful of his ability to buy wisely. He knows by experience how, or at least feels certain of his qualification to select teams and wagons suited to his purposes. Of motor trucks he knows little, and with perhaps a hundred makes to choose from and a score or more of sizes and types, he feels that his opportunities for going astray are too wide to warrant any lack of caution. This is not the only reason, nor is it perhaps the main reason why the motor truck will not take sudden prominence in contract work, but it is a reason which supports the point we wish to make here: The education of the contractor in regard to the essential construction and operating requisites of a successful contractor's motor truck.

We do not propose at this time to discuss these requisites, but as an illustration of our meaning we may cite the necessity of the contractor having a clear understanding of the importance of keeping a truck continuously working. The charges per day on a motor truck are greater than on a team and wagon, but the truck will make more trips and carry a greater load per trip than will the team and herein alone is its economy. If one is excavating earth or consuming cement and gravel no faster than a team can haul either, then without question team transportation is cheaper than motor truck transportation, but if one is doing either of the things named faster than several teams can do the hauling then the motor truck surpasses the teams as an economic method of transportation. This is equivalent to saying that quick loading and unloading are essential requisites to the economic use of motor trucks, as well as sufficient quantity of work to keep them busy. If the contractor does not fully appreciate this truth which we have outlined, his successful use of a motor truck will be endangered, and since his experience with team hauling is the only precedent he has to reason from, he is likely not to appreciate it.

The education of the contractor to an understanding of the requisites of sound motor truck design and construction and of the requisites of economic truck operation is one of the first essential tasks toward securing a [illegible] hauling. In a general way, we believe, manufacturers appreciate this. They have not as a body, however, done all that they might wisely have done to materialize their beliefs into works. Of all the literature put forth on motor truck development and accomplishment we have found very little that takes a grip on the contractor, and first and last a great volume of this literature passes under our eye. Doubtless considerable work is done that is never brought to the surface by publication, but the material evidence of this work is not strong. There are reams of printed matter on commercial motor vehicles directed to the merchandiser but almost none directed to the contractor. In this matter directed to the merchandiser there are many data which the contractor can use but the directness of their application is not readily apparent to him

The article which we publish on another page of this issue indicates clearly that the contractor has not been overlooked by the manufacturer of motor trucks. Indeed, it will surprise most contractors, we imagine, to learn how much the manufacturer has done. The article indicates clearly too by the examples given of contractors' use of motor trucks that these machines have a distinctly useful place in contractors' plant. In succeeding issues we shall publish other examples of contractors' motor truck work. We shall also from time to time describe and illustrate in some detail the design and constructional features of selected makes and types of contractors' motor trucks. We believe that a study of these article by contractors will be of value to them.

Further Evidence of the Neglect of Sewage Disposal Plants.

We have commented repeatedly on the inefficient operation of small sewage disposal plants due to neglectfulness on the part of municipalities. In this issue we have two articles bearing directly on this point. One article states the specific problem arising from the failure of one of these small plants. The chemical analyses of the effluent of this plant, at different times, are given. The other article is an excellent summary of the factors which lead to the misuse of sewage plants. It is written by a man who has had wide experience in designing sewage purification plants in many cities in the Middle West, especially in Missouri, Kansas and Oklahoma. Mr. Smith has formed his opinion of the best stand for engineers to take on this question, from his direct observation of conditions as [illegible] that he considers state control of these plants essential to efficient operation. Mr. Pearse also urges the imperative need of state inspection of operating conditions and results. In the study and discussion of such subjects as this a state engineering society is fulfilling its highest function, and is rendering a service of great value to the citizens of the state

Land Reclamation by Pumping; Engineering Efficiency.

The growing importance in drainage work of the services of the mechanical engineer was discussed by Mr. John J. Harman in our issue of last week, and this week we publish another article which illustrates this same fact. Drainage by pumping is quite as much a mechanical engineering problem as it is a civil engineering problem. We believe that we are not much in error in making this statement, and as time goes on land reclamation by pumping will be more common. Large areas of river bottom lands and tidal marsh lands cannot be drained at all and other large areas can be drained only in part by gravity sluices. Pumping is absolutely essential in much of the possible land reclamation of the future, and studies of pumping plant design and pump efficiency are mechanical engineering problems. They are moreover mechanical engineering problems of a new sort, because of the peculiar characteristics of drainage hydraulics.

Drainage pumping is not in its entirety a backward art. It has been practiced with a fair measure of engineering skill in Holland and in the English fenlands for many years A study of the pumping plants that have succeeded one another in these European works shows that they have each been a fair example of the best practice at the time in pumping engineering. Neither have we in general much to be ashamed of in America. It is true that the highest development in drainage pumping work has been largely the labor of a few engineers, but also the demand for land reclamation by pumping has been so small that it has required the work of only a few engineers to meet it. The intention of the foregoing statements is not to indicate that close perfection has been reached in the engineering of drainage pumping, but that drainage pumping engineering as exemplified by its best practitioners does not rank greatly inferior to the standards of pumping engineering in general.

Drainage by pumping was first practiced extensively in this country in the lowlands culti-

-tated [illegible] The crudity of the [illegible] used as a subject of [illegible]. It is crude in many and perhaps the majority of, but not in all cases, but it is crude only in the measure that most examples of land reclamation of earlier days in this country are crude. For illustration, of the various examples of tidal marsh reclamation which we began to describe in our issue of June 14, [illegible] drainage engineering work. Drainage pumping engineering practice can be judged from modern engineering standpoints only on its record of at most the last ten years. Land reclamation by pumping in the Illinois river and in the middle Mississippi river valleys practically did not exist prior to 1900. Since that time recent figures show that reclamation by pumping projects aggregating an area of 235,000 acres have been completed, or put under construction. There are few of these projects that do not rank fairly well as engineering works, and some of them we believe, may be ranked as model engineering works.

The contention made in what has been said is that general practice in drainage by pumping is not wholly in the backward state that certain recent off-hand critics have placed it. There is unquestionably much yet to be learned and many problems yet to be solved, and these are indicated better in our last week's issue by Mr. Harman and again in this week's issue by Prof. Woodward than any necessarily brief statement here can indicate them. Both of these papers do much toward assembling scattered data and the records now being kept of recent plants will have supplied in a few years many of the data now lacking. In conclusion we believe that only a beginning of the ultimate development of land reclamation by pumping has been made in the work so far done. Hardly a guess can be made of the area of river bottom and tidal marsh land that is reclaimable by this method, but only a superficial examination is needed to show that it is a very large area.

A $250,000 REINFORCED CONCRETE VIADUCT

The Reinforced Concrete Viaduct at Gilbert Avenue, Cincinnati.

Contributed by Frank L. Raschig, Assistant Engineer, Department of Public Service, Cincinnati, Ohio.

The first complete plans for a structure for the extension of Gilbert Ave. to Broadway, Cincinnati, O., were made in the year 1892. No doubt the question of building this structure was investigated several years before this so that the project is at least 20 years old. The direction of this improvement and the ground to be occupied by it was the same as it is today, although an attempt was made later to have the line of the viaduct changed. The first plans above mentioned were for steel plate girder construction, with buckle plate floor. It was to be 75 ft. wide over all, with a roadway 50 ft. wide and two sidewalks each 12 ft. 6 ins. wide. No provisions were made for street cars. The roadway was to be paved with granite resting on a base of bituminous concrete.

The next plan was made in 1906 and was adopted in 1907, and on this plan the property necessary for the structure was condemned. The structure was a steel structure; the viaduct proper consisting of six deck arches of 120 ft. span. The structure was to be 79 ft. 9½ ins. wide over all with a roadway of 57 ft. 3½ ins. wide, and two sidewalks each 10 ft. 3 ins. wide.

Bonds were issued to the amount of $550,000 to defray the cost of construction and for the purchase of the necessary property. The estimated cost of the structure was $280,000 and for the property $270,000. The final cost of the property was a great deal more than estimated, the whole, including damages, amounting to $430,000, leaving only $120,000 with which to build the structure, an amount entirely insufficient. This delayed the construction of the viaduct until more bonds could be issued. The city had almost reached its limit for issuing bonds and it was not until the spring of this year that the necessary funds were provided, when $250,000 worth of additional bonds were issued.

In 1906 considerable opposition to the location of the viaduct as proposed was encountered from a firm whose entire plant was to be appropriated. This firm employed an engineer to make plans for another structure located where it would not interfere with its plant. The plan submitted was considered to be not nearly so good, both as to location and structurally, as the plan adopted and the original plan was therefore adhered to.

While waiting for the necessary funds to be provided, it was deemed advisable to substitute a reinforced concrete structure for the steel structure adopted. Accordingly in 1909 plans were commenced for this kind of structure following the lines of the structure adopted in 1906; the viaduct proper consisting of six reinforced concrete arches, with roadway over them of column, beam and slab construction of reinforced concrete. This plan was later abandoned and new plans were made which are now being followed.

The structure being built is strictly a viaduct consisting of short spans of column, girder and beam construction rather than a bridge of several long arch spans. This type was adopted in preference to the other for two principal reasons. It was thought that in the locality where the viaduct is being built the arches would not show to advantage as they would be close to the ground and, being surrounded by buildings, the whole structure would not be seen at one time. A bridge of several arch spans appears to the best advantage when the whole structure can be viewed at a distance. With short spans, several can be viewed at once from a short distance, giving in themselves an idea of completeness. Besides it is not necessary in this locality to use long spans except over Eggleston Ave., as it would be over a stream or deep valley. The second reason for using the viaduct construction was that it was thought that the cost would be a great deal less and this has since been borne out by the low bids received. There was a great saving in the foundation work, as the dead weight of the structure as planned is about half the weight of the arch construction and in a place like this where piling is required, the cost would be very much reduced. The quantity of concrete is also about half the amount required in the arch type and the simplicity of construction, which is somewhat on the order of building work, makes it familiar to all local builders.

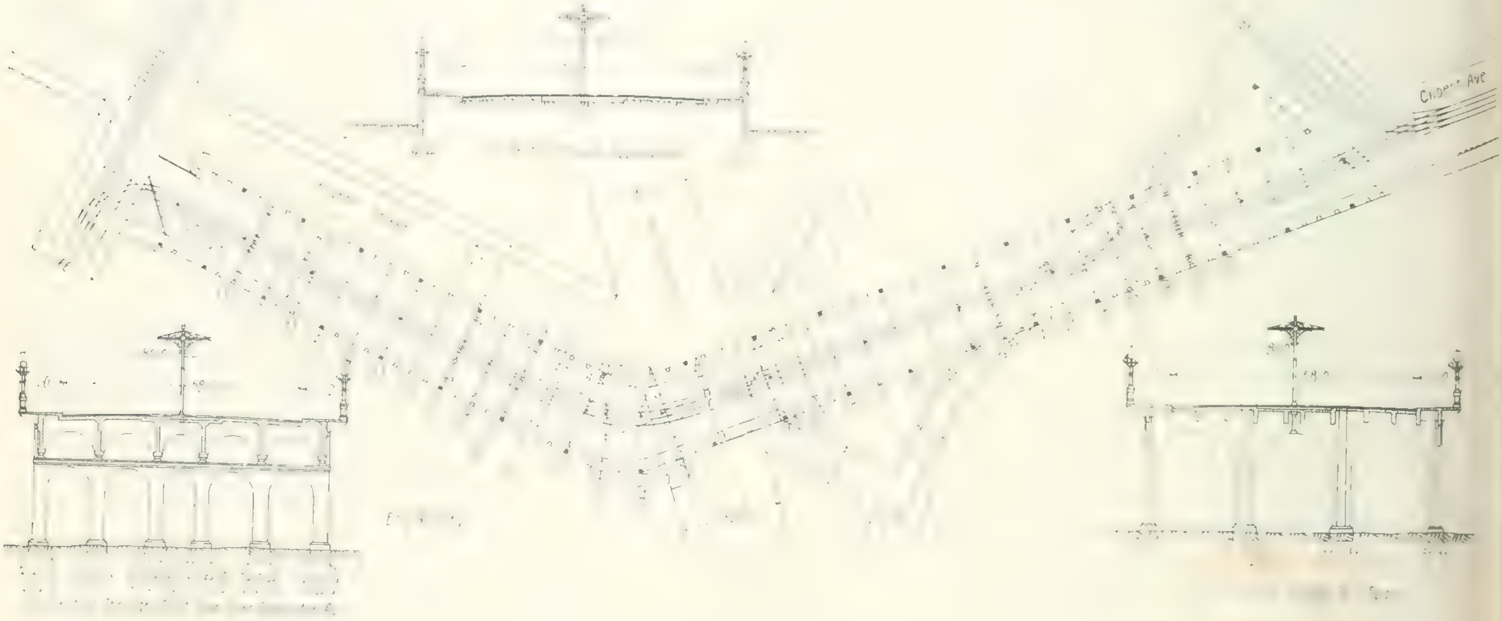

Fig. 1—General Plan and Sections of Gilbert Ave. Viaduct, Cincinnati, O.

The viaduct extends from the intersection of East Court St. and Gilbert Ave. in a direct line with the present Gilbert Ave. to Eighth and Eggleston Aves. The structure at this point makes an angle of 47° with the first described portion and extends along the south side of Eighth Ave. to Broadway.

The total length of the improvement is about 1,200 ft.; the viaduct proper being 1,036 ft. long. There will be a short earthwork ap-

[illegible] crete retaining walls.

[illegible] spans, of reinforced concrete construction. The span over Eggleston Ave. is 100 ft. and consists of six plate girders encased in concrete. The structure is 80 ft. wide over all, with roadway 58 ft. wide and sidewalks on each side 11 ft. wide. The roadway will be paved with wood blocks. Double tracks for street cars are provided with trolley wire posts in the middle of the roadway. The structure will be illuminated by Tungsten lamps in clusters of five lamps supported on concrete lamp posts. The clusters will be 60 ft. apart on each side of the viaduct in the railing.

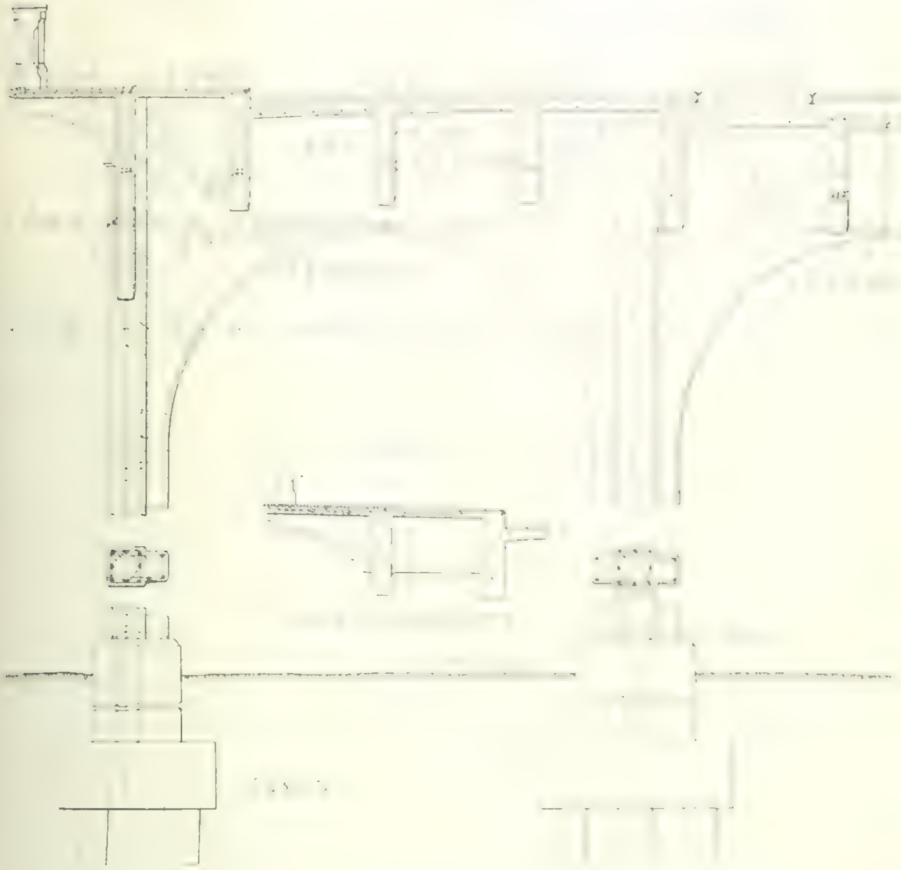

Fig. 2—Cross Section of 30-ft. Spans Showing Columns, Gilbert Ave. Viaduct.

Commencing at the Gilbert Ave. end, the viaduct will ascend with a grade of 2.5 per cent to a point about 60 ft. from Eggleston Ave., where the grade will change to 1.557 per cent ascending. Over Eggleston Ave. the grade will be 1 per cent, ascending, and at the bend in the viaduct the grade will be level. From the bend the grade will be 1.7 per cent descending for 32.5 ft. and from thence to Broadway the grade will be 3 per cent descending. At Broadway the roadway will be widened and it is proposed to purchase the property at the southwest corner of Eighth and Broadway still further to widen the approach. The structure at its highest point at Eggleston Ave. will be 32 ft. above the street, giving a minimum clearance under the girders of 21 ft.

The ground in the vicinity is an old fill; the deepest portion being on the west side of Eggleston Ave. where the depth is about 58 ft. From Eggleston Ave. toward both ends of the viaduct the fill gradually runs out. Duck Creek originally ran through the deepest part of the valley. The material making up the fill is much better than at first thought as shown by the excavations recently made. The fill was supposed to be made up of all kinds of debris, but perhaps only 10 or 12 ft. are of this class of material, the remainder being soil of various kinds having been in place perhaps over 40 years.

to be carried by one pile is 27.5 tons, the consisting of the dead load and the full live load from the structure. Considering the dead load only, the maximum load per pile is 22 tons. The piles are to be driven to a penetration of not more than ½ in. under the drop of a 3,000-lb. hammer falling 15 ft., which would give a safe load of 30 tons, using the *Engineering News* formula for computing the safe load. The footings resting on shale were designed to give a bearing of 3 tons per sq. ft., dead load and full live load.

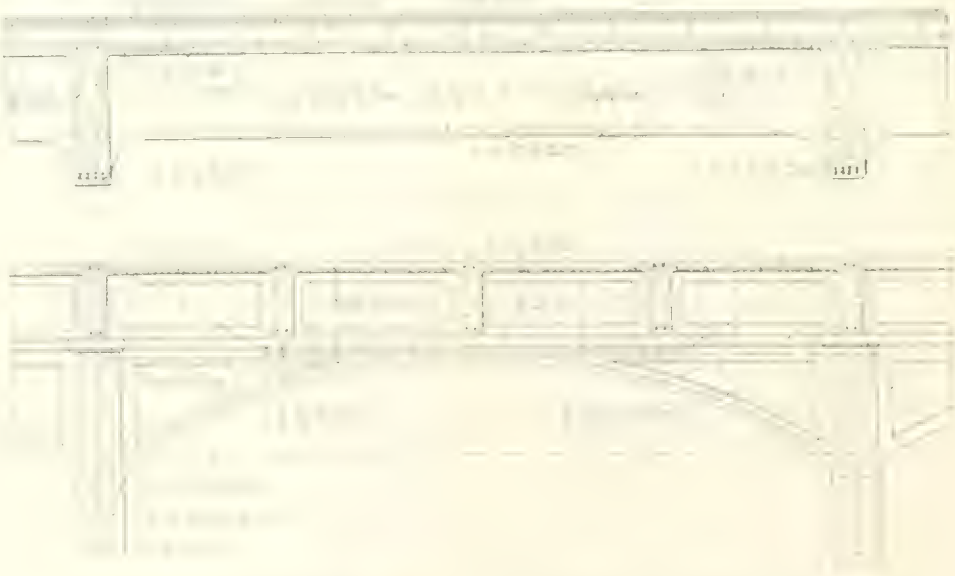

Fig. 3—Typical Longitudinal Girders for 30-ft. Spans, Gilbert Ave. Viaduct.

Crossing the line of the viaduct at Culvert St. 40 ft. from the surface, is an old stone sewer. This sewer will be filled with concrete for 50 ft. on each side of the structure, with the exception of a 3 ft. circular section in the bottom to allow for any drainage that still comes through the sewer. This filling of concrete will prevent any cave in that might occur [illegible] to carry the footings down to the sewer. The piles will be driven at this point as in the regular construction and will rest on the sewer if they should strike it.

An interesting method was used to fill this sewer with concrete. Vitrified stoneware pipe, 3 ft. in diameter, was first laid in the bottom of the sewer. The steel shell used in the construction of the Simplex piling was then driven from the surface through the top of the sewer and through this shell the concrete was poured, filling the remainder of the sewer not occupied by the vitrified pipe. The concrete used was a lean mixture consisting of 1 part Portland cement, 3½ parts sand and 7 parts stone of 1-in. size and under.

The piles are to be spaced 3 ft. apart on centers. On top of the piles and encasing them for the top foot of their length is to be placed a reinforced concrete footing or cap 3 ft. thick. On this footing is to be constructed a pier extending about 18 ins. above the ground. On top of this pier the columns of the super- [illegible]

As stated before the greatest part of the viaduct is made up of 30-ft. spans. Each span is to be supported by a row of four columns, the two interior columns being 24 ins. square and the two exterior columns being 22 ins. square. The columns are to be reinforced with eight round bars and with square hoops 6 ins. apart. Between the columns are what we might call "arched girders." These girders extend along the columns as a kind of wing down to the piers. These girders were designed as straight and rectangular beams, no account being taken of the arch and of the slab adjacent to the beam. They are to be reinforced with square twisted bars, half of them being bent up over the supports. Two bars are to be placed along the intrados of the arch, ¾ in. square twisted U-bars or stirrups doubled or four strands to each set are to be used to assist the concrete in taking the diagonal tension. The roadway is to be supported by ten beams, those under the car tracks being 12 ins. x 40 ins., and those under the remaining portion of the roadway being 12 ins. x 32 ins. These beams are to be reinforced with six square twisted bars, three of them to be bent up over the supports, two in the first eighth, and one in the second eighth of the span

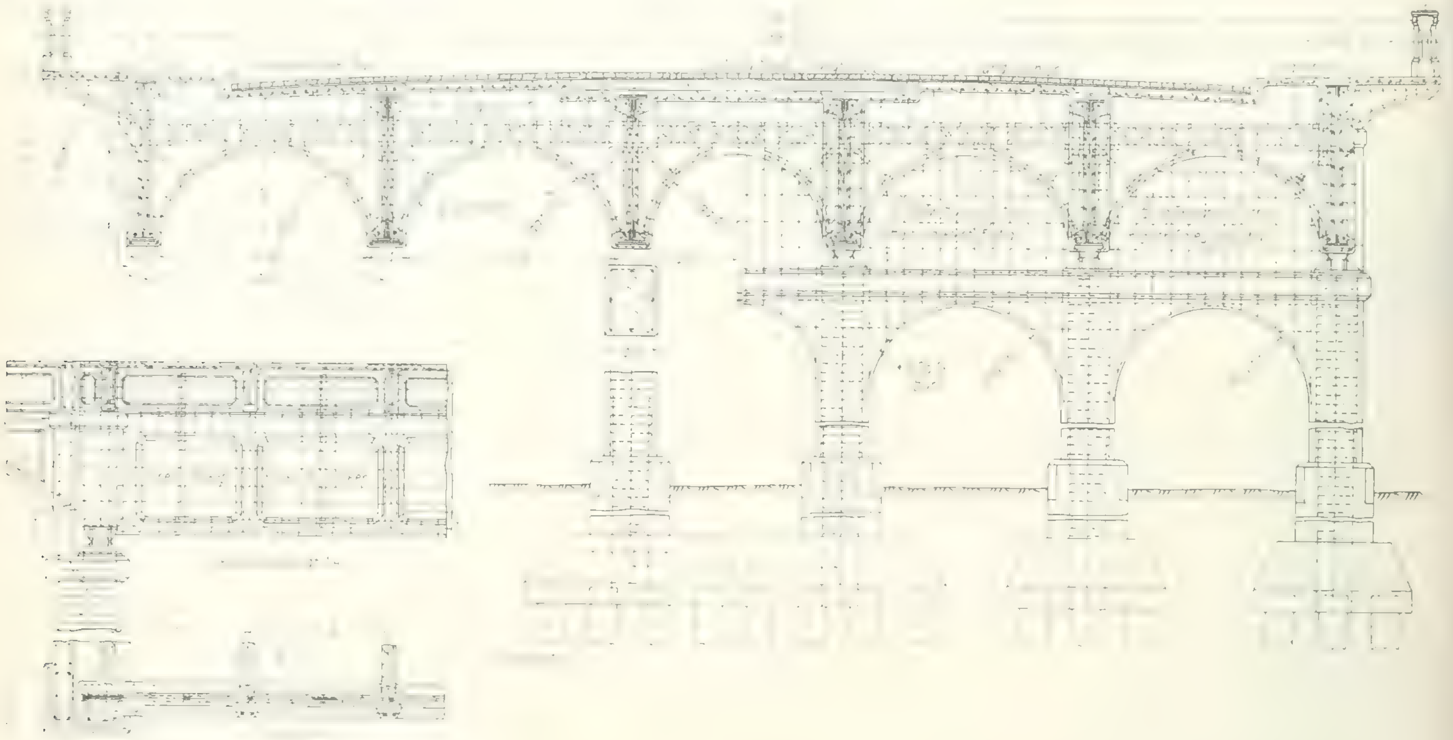

Fig. 4—General Details of 100-ft. Concrete Encased Plate Girder Span, Gilbert Ave. Viaduct.

length at each end. Two bars are to be placed in the top of the beams as a support to the U-bars or stirrups, no steel being needed for compression. The concrete is sufficient to take the diagonal tension, but double 5/16 in. square U-bars or stirrups are to be placed 12 ins. apart. The roadway beams are to be straight beams except at the ends which are to have a curve of small radius. The outside beams under the sidewalks are to have curved bottoms, the curve being a circular arc. Curves of small radius join the bottom of the beam with the columns. From this beam cantilever brackets spaced 7 ft. 6 ins. apart support half of the sidewalk. The outside faces of the beams are to have panels ⅞ in. deep.

The car track construction is to be constructed independently of the structural work, a depression 12 ins. deep being left in the center. In this the rails, which are to be made of the grooved girder type 7 ins. deep and weighing 116 lbs. per yard, are to be laid on Carnegie steel ties, spaced 3 ft. apart. The tracks are to be bedded in concrete ballast; rails to be 60 ft. long and to have joints of continuous type.

The roadway slab is to be 6 ins. thick and the sidewalk slab 5 ins. thick, including a 1-in. wearing surface of cement mortar. The entire top surface of the roadway slab is to be water proofed with 4-ply felt laid in hot tar. The roadway is to be paved with wood block laid according to the city standard specifications.

In the design of the various members of the reinforced concrete construction the following loadings were used: Dead loads, wood block, 1 lbs. per sq. ft.; sand cushion, 10 lbs. per sq. ft.; concrete including steel, 150 lbs. per cubic ft. For slabs in the roadway a live load of 600 lbs. per sq. ft. uniformly distributed was used, for sidewalk slabs 100 lbs. per sq. ft. To determine the maximum moment to be used in the design of the beams under the tracks the maximum moment produced by each of the following cars, using two cars en train, were found:

Cincinnati Traction Company single truck cars, length 2 ft., wheel base 7 ft., weight of cars 27,300 lbs.; capacity, 95 persons at 150 lbs., each making a total weight of 21 tons or a load of 10,500 lbs. on each wheel, to which was added 25 per cent for impact, making a total load per wheel of 13,000 lbs.

Cincinnati Traction Company double truck car, length about 42 ft., trucks 17 ft. 6 ins. on centers, wheel base 4 ft. 6 ins., weight of cars 40,000 lbs., capacity 120 persons at 150 lbs. each, making a total weight of 29 tons or a load of 7,300 lbs. on each wheel, to which was added 25 per cent for impact, making a total load per wheel of 9,100 lbs.

Interurban Double Truck cars, length about 45 ft., trucks 19 ft. 6 ins. on centers, wheel base 4 ft. 6 ins., weight of cars 60,000 lbs., capacity 140 persons at 150 lbs., making a total weight of 40.5 tons or a load of 10,000 lbs. on each wheel, to which was added 25 per cent for impact, making a total load per wheel of 12,500 lbs.

Interurban Express Car (double truck), length about 50 ft., trucks 33 ft. on centers, wheel base 7 ft., total weight loaded 50 tons; load per wheel 13,300 lbs., with 25 per cent impact, making a total of 16,600 lbs. per wheel.

A 20-ton road roller with front and rear rollers 11 ft. apart was also investigated. Of the above, two 50-ton Interurban express cars en train gave the greatest moment.

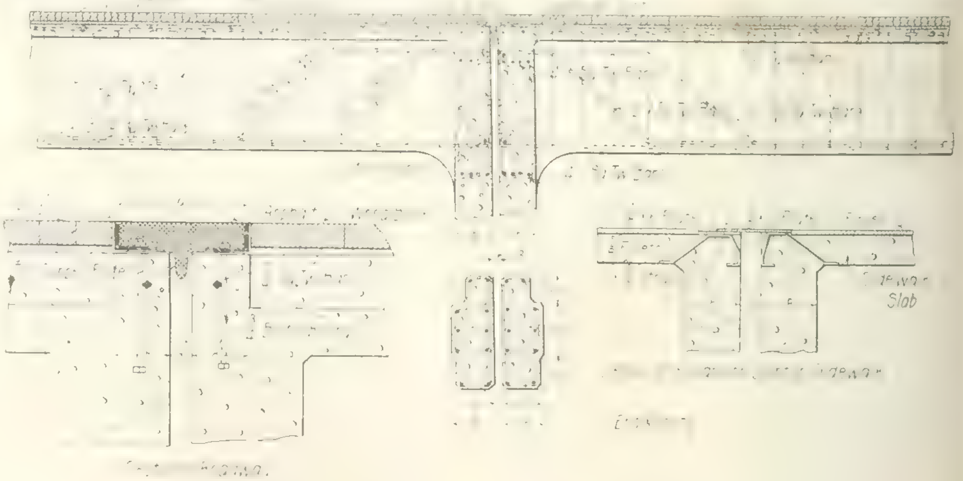

Fig. 5—Details of Expansion Joints, Gilbert Ave. Viaduct.

For the roadway beams on each side of the track beams a 20-ton road roller with 25 per cent added for impact gave a greater moment than a live load of 150 lbs. per sq. ft. uniformly distributed over the whole span.

In finding the shear at various sections the maximum end shear and the maximum shear at the center under the above loadings was found and the shears for sections between the center and end taken as varying directly between these.

The following were the maximum unit stresses used in the reinforced concrete design.

Concrete in compression (extreme fibre stress) in slabs and beams 600 lbs. per sq. ft.; in girders 700 lbs. per sq. in.; direct compression in columns, inside columns 500 lbs. per sq. in., outside columns 40 lbs. per sq. in.; concrete in shear in the ordinary sense 150 lbs. per sq. in., diagonal tension 65 lbs. per sq. in.

These values were never exceeded except in one case. In fact, nearly all the stresses are well below these limits, the stress in the steel in the track beams being 16,000 lbs. per sq. in. The case mentioned above as exceeding the limits was for the stress in the steel in track beams under the supposition that a 100-ton car was moving over the structure. In this case the stress in the steel would be 19,000 lbs., still a safe value. A car of this weight will probably never pass over this structure.

The slabs were designed as continuous over supports. The beams were designed as T-beams, the slabs taking the entire compression.

Account of the continuous action of the beams was taken for the dead load only. Girders were designed as rectangular beams, no account being taken of the adjacent slabs.

The structure at the expansion joints is split from the top of the piers, leaving a 3-in. space, giving a double row of columns and girders, entirely separating the two adjacent portions of the structure. These joints are about 200 ft. apart. This really makes the viaduct consist of a number of independent structures each about 200 ft. long.

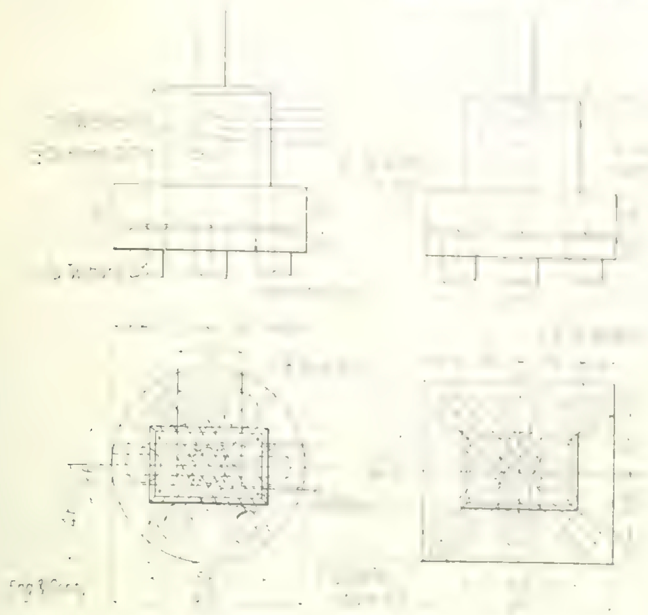
Fig. 6—Typical Column Footings, Gilbert Ave. Viaduct.

The long span over Eggleston Ave., which is 100 ft., was made necessary on account of the number of sewers, water pipes, conduits, the canal raceway, in the street, which would be difficult to avoid not to speak of a possible danger of washout in case of a break.

This portion of the viaduct will consist of six steel deck plate girders entirely encased in concrete. Holes are to be punched in the stiffener angles through which reinforcing bars will be drawn. A portion of the sidewalks is to be supported by steel cantilever brackets riveted to the outside girders. The girders are to be braced transversely by angle struts, laced, and knee braces curved to a circular curve. These struts and braces are also to be encased in concrete. The slab of the roadway will span between these struts. The girders vill rest on cast steel shoes, the west end being xed and the east end will rest on rollers un-er the shoes. The ends of each girder will e supported by reinforced concrete columns ith arches between them. These columns ill be 3x4 ft. The bottoms of the footings esting on the piles will be 17 or 18 ft. below [illegible]

2 ins. back to back of flange angles, while those under the sidewalk will be 9 ft.

The girders under the tracks were designed for a live load of 250 lbs. per sq. ft., 10 ft. wide over the entire span. For the remainder of the roadway 150 lbs. per sq. ft. over the entire span was used, and for the sidewalks 100 lbs. per sq. ft. Extreme fibre stress used in the steel was 16,000 lbs. per sq. in. in tension and compression on the net area in both cases. One-eighth of the web area was included in the flange area. Steel in shear was taken at 10,000 lbs. per sq. in.

The ground on the north side of the east approach is very much lower than on the south side. The viaduct was continued as far as possible on the north side, while for a third of the width of the viaduct on the south a fill is to be made. This bill is to be supported by retaining walls supported between the columns. A separate retaining wall is to be built along the south side of this approach to retain the high ground above. The stairways on each side of the viaduct at Eggleston Ave. are to be 5 ft. wide in the clear on the inside of the railings. These stairways are to be supported entirely independent of the structure.

The railing is to be of massive design, being 12 ins. wide at the top with posts 20 ins. square. The sides will be deeply paneled. The railing is to be constructed in steel or sheet iron forms. In the top rail is to be placed a 3-in. galvanized iron pipe through which all electric wires are to be drawn. The entire railing will be built of concrete consisting of Portland cement and light gray granite screenings ¼ in. in size and under, with dust removed. The surface will be finished by brushing while the concrete is still green.

Lamp posts constructed of the same material as the railing and of classical design will be placed on the posts of the railing 60 ft. apart. Each post will have a cluster of five Tungsten lamps in opalescent globes; the top globe being 14 ins. in diameter. Each cluster will be controlled by a separate cutout switch at the base of the post.

The poles supporting the trolley wires will be of ornamental resign and will be placed in the center of the roadway, thereby doing away with the ugly suspension wires across the viaduct. Wires of all kinds will be kept off the structure and from crossing over it.

The expansion joint in the roadway is somewhat different in design than on our present viaducts. Two angles will be bolted down to the concrete slab 19 ins. apart back to back and filled with a special asphalt. To retain this asphalt a heavy bent copper plate will be placed under the angles and bent down into the opening. A joint like this is easily repaired, the city having its own asphalt plant. In the sidewalks, the joint will consist of a plate sliding on top of another and covering the opening.

The corners of the curbs will be protected by Wainwright galvanized iron curb bars and will be held in the concrete by bent bars.

The entire reinforced concrete work will consist of concrete composed of 1 part Portland cement, 2 parts sand and 4 parts stone.

The cement used for both substructure and superstructure will be "Lehigh" cement and will be thoroughly tested at the mills before acceptance. The crushed stone will be that which passes through a 1-in. screen with the dust screened out. Crushed gravel may be used if 50 per cent of the material is fractured. Wherever surfaces are to be bushhammered, selected crushed quarry stone is to be used and will contain no crushed gravel or crushed boulders.

Reinforcing steel is to be made by the open hearth process and properties must conform to the following limits:

Structural steel is to conform to the manufacturers' standard specifications.

There is to be no mortar facing but all the outer surfaces, such as sides of columns, sides and bottoms of arched cross girders, outside faces of the outside curved beams, brackets and bottoms of sidewalk slab, are to be bushhammered with a pneumatic tool. A draft is to be left in all corners which will give a kind of panel effect. No special treatment is to be given the remaining surfaces except to remove board marks and rub down rough places with carborundum bricks and then given a coat of neat cement paint.

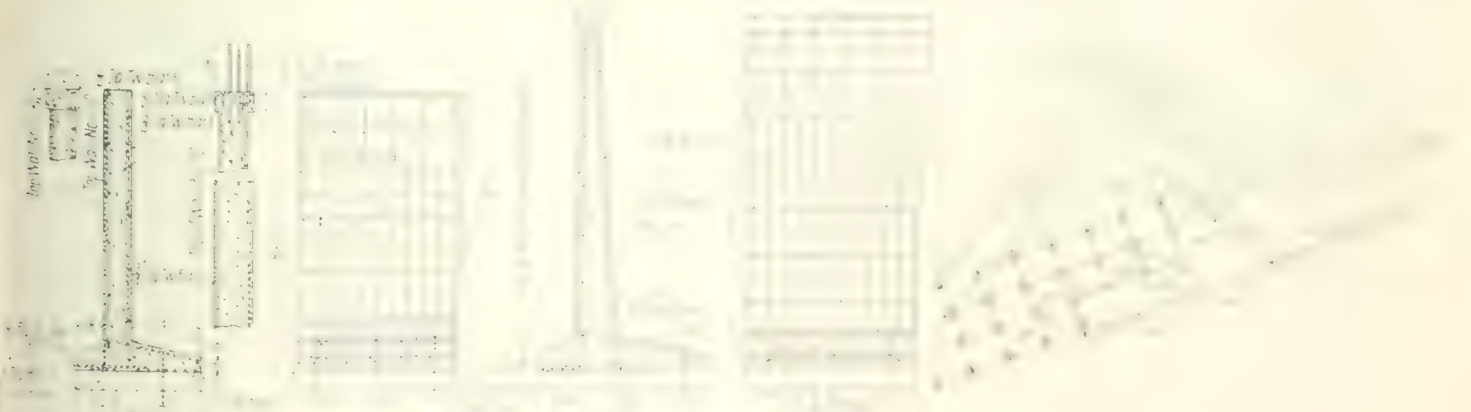
Fig 7—Typical Retaining Wall Sections, Gilbert Ave Viaduct

The work is to be divided and let in three contracts:

1st. The substructure work, which consists of the piling, footings and piers for columns and for retaining walls; *2d,* the superstructure; *3d,* miscellaneous street work necesary at the entrances of the viaduct, sidewalk work, wood block paving on the structure, etc. Of these the substructure and superstructure contracts have been awarded. The remainder is still to be let.

The chief item in the substructure work is the concrete piling and in advertising for bids on this work the specifications were made open allowing the contractor to bid on any of several types. If he did not choose to bid on any of these types, he was allowed to bid on any other type provided the bid was accompanied by a complete specification of the concrete pile bid on and meeting the guarantee named in the specifications, namely: That the piles must be able to sustain a load of 45 tons without exceeding a settlement of ½ in., the load having been left in place for two weeks.

The type of piling to be used was to be selected by the Director of Public Service after the bids were opened. This method of bidding made the competition very keen and the prices were low. The Engineer's estimate on piling was $1.25 per lin. ft. and the following were the bids received on various kinds of piling, the total estimated quantity being 34,000 lin. ft.

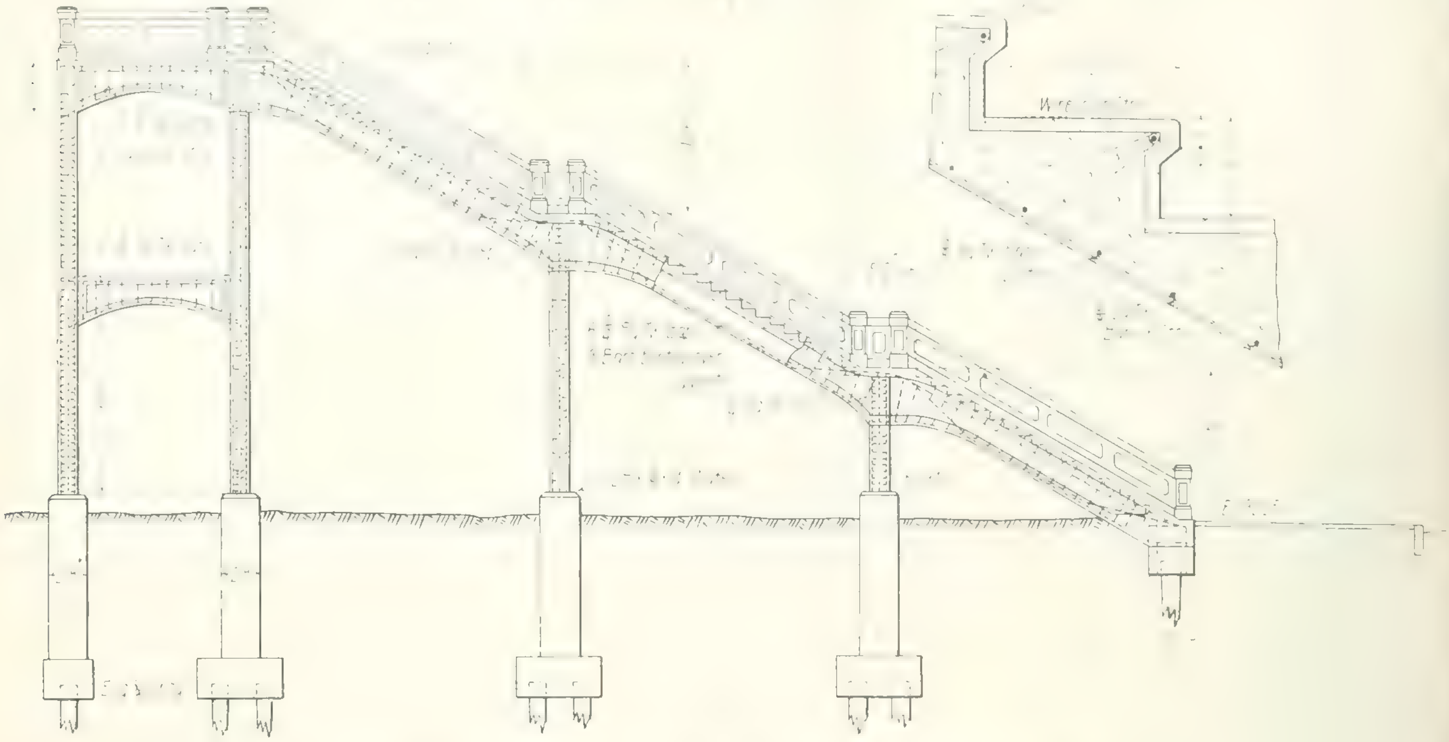
Fig. 8—General Details of Stairway Construction, Gilbert Ave. Viaduct.

Simplex	$0 83
Peerless, taper without shell	0.85
Peerless, straight with reinforced concrete shell	1 14
Peerless, taper with reinforced concrete shell	1.26
Peerless, with corrugated iron shell	1.20
Raymond	1.25
McArthur pedestal pile	1.10
Gilbreth, corrugated, and Chenoweth	0.95

Prices for concrete in footings and piers, of which the estimated quantity was 1,800 cu. yds., varied from $6 per cubic yard to $8 per cubic yard. Prices for excavation for footings, of which the estimated quantity was 5,000 cu. yds., were from 50 cts. to 75 cts. per cubic yard. Reinforcing steel for footings and piers, estimated at 80,000 lbs., brought bids from 2.4 cts. per pound to 3 cts. per pound.

The bid accepted was the lowest bid and submitted by the Cranford Construction Co. of Cincinnati, Ohio, and Pittsburg, Pa. The piling they bid on was Simplex piling. The total amount of the bid was $50,160, or $18,000 below the Engineer's estimate due to the low bid on piling.

The prices on the substructure work varied from $149,999 to $191,000; eight bids being submitted. The lowest bidder was the Kaps-Brehm Co., of Cincinnati, Ohio, and they were awarded the contract. The accepted bid of $144,999 was $46,000 below the Engineer's estimate, keen competition again bringing very low prices.

The following are approximate quantities of various classes of work and material involved in the construction of the superstructure:

Concrete, cu yds	6,000
Forms, sq. ft	300,000
Reinforcing steel, tons	450
Structural steel, tons	240
Bush-hammering, sq. ft	90,000
Street railway rails, ties, etc., tons	135
Railing, lin. ft	2,700
Lamp posts	44

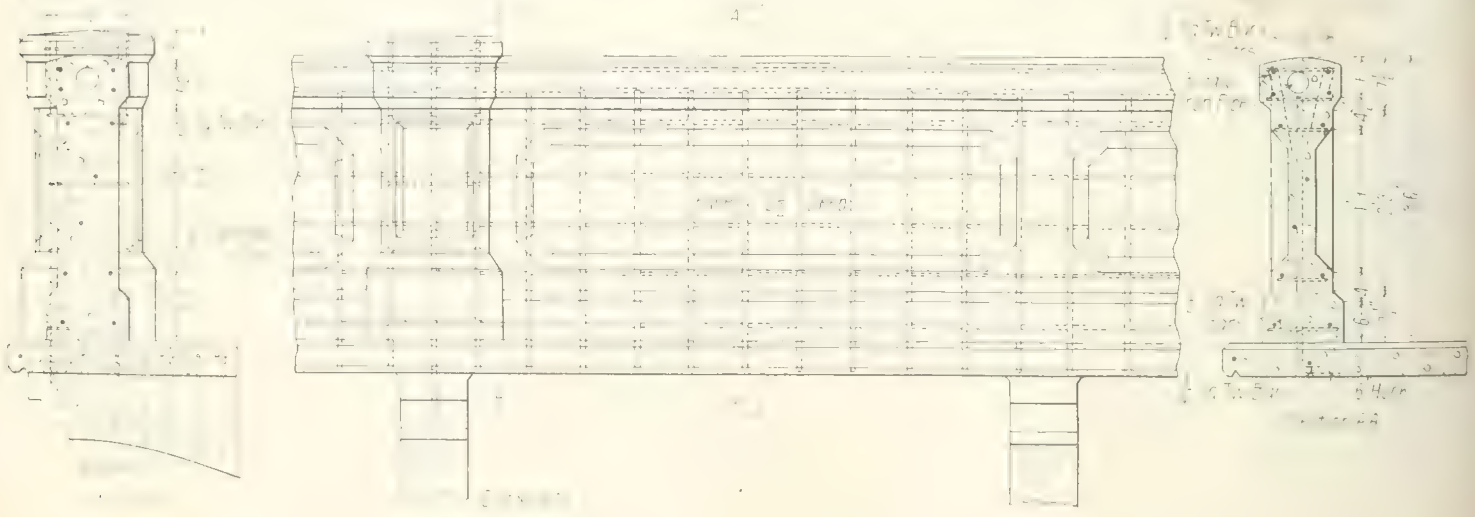
Fig. 9—Reinforced Concrete Railing, Gilbert Ave. Viaduct.

The amount of the third contract is not expected to exceed $50,000, so that the whole structure complete will cost about $250,000, or about $2.60 per square foot, a very low cost indeed for a structure of this magnitude.

The substructure work is now half completed; the portion between Eggleston Ave and East Court St. being in place. It will take about two months' time to complete the remainder. The whole substructure would have been almost completed at the present time, but some of the occupants of the condemned buildings on Eighth Ave. between Eggleston and Broadway were so slow in moving out that the work was very much delayed.

As stated before, a great deal of driving of piling under columns in the portion already built was abandoned on account of the nearness of shale to the surface. Wherever piles were used they were driven to the shale, very many of the piles being driven to a penetration of ⅛ in. on the last blow of a 3,000-lb hammer falling 15 ft.

A test is now being made of four piles loaded with 180 tons, but the test has not progressed far enough to report any results. Quite a number of the piling has been excavated for several feet and all have been in good shape.

No work has as yet been done on the superstructure, but the contractors have been notified to proceed. It is hoped that by this time next year this structure will be open to the public and that the citizens of Walnut Hills will realize their desire for better entrance to their suburb.

Preliminary Estimate of Portland Cement Production in 1911.—Complete statistics for the year 1911 were received by the United States Geological Survey during the month of January from about 7 per cent of the Portland cement manufacturers in the United States. Based on these returns, an estimate has been made by Ernest F. Burchard of the U. S. Geological Survey of the entire output for the year. It is believed that this estimate is within 2 per cent of the exact quantity of Portland cement manufactured in 1911. There was apparently a slight increase in the production of 1911 over that of 1910, amounting to about 1,300,000 barrels, approximately 77,877,236 barrels having been made in 1911, as compared with 76,549,951 barrels in 1910. This represents an increase of only 1.7 per cent as compared with the increase of 17.7 per cent that occurred in 1910 over the previous year. The figures for 1910 and 1911 are so close that when complete returns are received possibly a slight decrease in production may be shown. The average factory price per barrel, not including packages, was 86.7 cts. in 1911, as compared with 89.1 cts. in 1910 a decrease of 2.4 cts. per barrel, or 2.68 per cent. An attempt has been made to estimate the shipments of cement by districts for 1910 and 1911, but with regard to such statistics there are fewer data and the figures are not regarded as quite so accurate as those of production. Nineteen hundred and eleven was the first year in which inquiries have been made by the Survey with regard to stocks on hand. According to returns received there were decreases in production in the following districts: Lehigh, Kentucky and southern Indiana and in the great plains and mountain states. The increases recorded were in New York, Ohio and western Pennsylvania, Michigan and northeastern Indiana, Illinois and northwestern Indiana, the southeastern states, Iowa and Missouri and in the Pacific coast states. Slightly better prices were realized in the Lehigh district, New York, and on the Pacific coast, but in Michigan and northeastern Indiana, Illinois and northwestern Indiana and in the Great Plains and mountain states the average price was lower than in 1910, but in western Pennsylvania and Ohio, southern Indiana and Kentucky, the southeastern states and in Iowa and Missouri the price remained about the same.

New Water Filtration Plant in Canal Zone in Service.—Water from the new filtration plant at Agua Clara Reservoir, which supplies the villages of Gatun, New Gatun, and Spillway, was turned into the mains on December 29 and the carts, which had been delivering distilled water to the houses for drinking and domestic purposes, were dispensed with on January 5. Water for all purposes is now drawn directly from

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Civil Service Examination.—An original entrance examination for architectural drafts- [illegible]

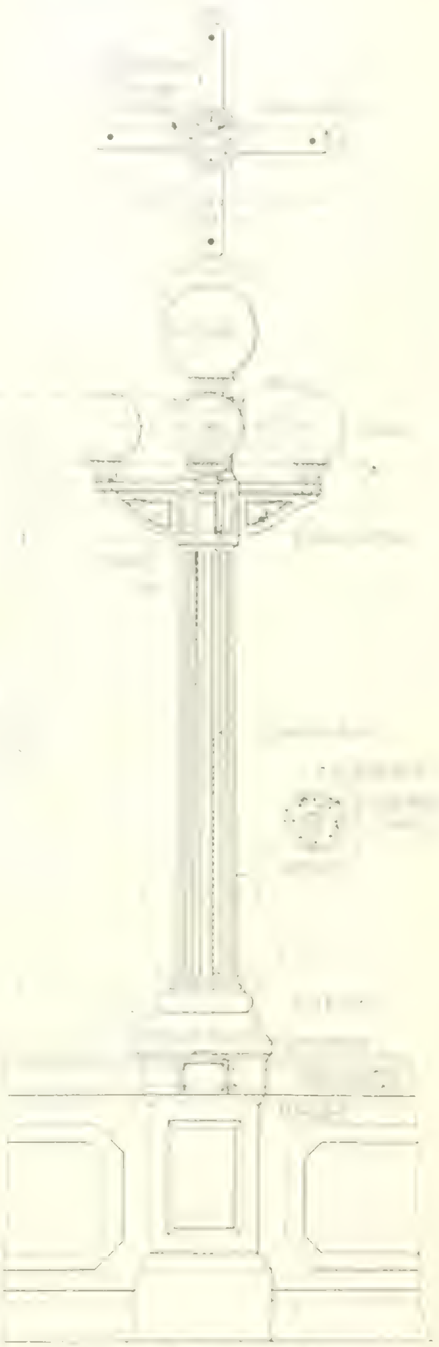

Fig. 10—Reinforced Concrete Lamp Post. Gilbert Ave. Viaduct.

Feb. 14, 1912. The duties of the architectural draftsman will be to prepare layouts and sketches of park buildings, fences, and other simple structures, the checking of architects' plans, the preparation of specifications and estimates, and other general office work in connection with these. Application blanks may be obtained by addressing the Civil Service Board of the West Chicago Park Commissioners, Room 706 Wendell Bank Building, Madison St. and Ogden Ave., or by applying at the fieldhouse of the West Side Park Playgrounds. All applications must be filed in the office of the Board before 5 o'clock p. m. of Feb. 13, 1912

Proportioning and Mixing Concrete.

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The series of articles on the inspection of concrete work, of which this is the second, has been planned in opposition to the general assumption on the part of writers that stand- [illegible] long ago established and have become common knowledge. The first article on "Directions and Suggestions for the Inspection of Concrete Materials" appeared in this journal for Jan. 31, 1912. The following article re- [illegible] crete. It will be followed by articles on forms and centering, steel reinforcement, transporting and placing of concrete, finishing concrete surfaces and waterproofing concrete work.

Proportioning Concrete.

It is not alone sufficient, in connection with the selection of aggregate, to examine the mineralogical nature of the aggregate to ascertain its hardness and density and freedom from loam and other impurities that would detract from its quality, but greater and more careful attention must be given to the volume and comparative grading. In other words, with the proper materials selected, the next step is to properly proportion them so as to produce a concrete in which the mortar will fill all the voids and when rammed in place, free mortar will flush to the surface. Proper proportioning is very important for reinforced concrete so as to give the uniformity and homogeneity which cannot be obtained without careful attention to the proportions and grading of the aggregates.

Grading of Aggregates.—The sand should be well graded from coarse to fine, the coarse particles predominating, so that when mixed with the cement required will produce a dense and compact mortar. The coarse particles should not exceed ¼ in. in diameter. The advantage of grading is to minimize the voids and reduce the actual surface area of the aggregate to which the cement must adhere. This advantage applies with equal emphasis to the larger aggregate, such as broken stone or gravel.

[illegible]

As stated above, the fine and coarse aggregate should be used in such relative proportions as will insure maximum density. In unimportant work it is sufficient to do this by individual judgment, using correspondingly higher proportions of cement. In other words, it is sufficiently accurate to select the proportion of cement to sand which will give the required strength to the concrete, and then use twice as much gravel or broken stone as sand. For important work, these proportions should be carefully determined by density experiments as described below, and the sizing of the fine and coarse aggregates should be uniformly maintained, or the proportions changed to meet the varying sizes. It pays from an economic standpoint to make very thorough studies of the materials of the aggregate and their relative proportions, especially for important structures. If the gravel is used without screening, it should be examined from time to time, and in case its composition is not such as to give the required proportions, sand or broken stone should be added as may be necessary. As a rule, the proportion of sand to gravel of broken stone should be 1:2, depending upon the character of material used, and the exact proportion should be found before concreting by making a small test beam. This allows only sufficient fine material to grade down and fill the voids of the coarser grains.

[illegible] The factor that determines the actual strength of concrete is most correctly the strength of the mortar or binding matrix, and accordingly the greatest care must be taken in the selection of the sand or finer aggregate, to contribute the maximum strength. The proportions of cement to sand and stone should be chosen after a very careful study of the local conditions and the available materials. For reinforced concrete construction a density proportion based on 1:6 should generally be used, i. e., 1 part of cement to a total of 6 parts of fine and coarse aggregates measured separately. Since cement is generally the most expensive ingredient, the reduction of its quantity, which may very frequently be made by adjusting the proportions of the aggregate so as to use less cement and yet produce a concrete with the same density, strength and impermeability is of the utmost importance.

Determination of Amount of Cement to be Used With Aggregates.—A theoretical correct concrete should consist of sand and gravel or crushed stone or a combination of them, containing any amount of cement equal to the voids in such combination. In other words, voids (the space existing between particles of sand, crushed stone or materials of which an aggregate is composed) should be filled with mortar. To state this in another way, if the concrete is made up of sand and gravel, such proportion of cement should be used with the sand as is equal to the voids in the sand, and such quantity of this resulting mortar of sand and cement should be used with the crushed stone or gravel as will fill the voids in the crushed stone or gravel. Restating this in a few words, the cement should fill the voids in the sand and the resulting mortar should fill the voids in the aggregate.

Interpretation of a 1:2:4 Concrete.—When a specification requires a 1:2:4 concrete, it should be understood that the strength of the binding matrix is to be equivalent to the strength of the 1:2 mortar, with a finer aggregate of a granulometric composition most perfectly adapted, consist with practical conditions, to give the greatest strength. A very frequent mistake is made in the interpretation of a 1:2:4 concrete as equivalent to 1 part of cement and 6 parts of inert aggregate, entirely disregarding the volumetric composition. A typical instance may occur in the substitution of a natural mixed gravel on work requiring a 1:2:4 mixture. Frequently the contractor assumes the liberty of using six parts of gravel, ignoring the interpretation of a 1:2:4 specification as requiring the strength of a 1:2 mortar, and that gravel correctly should only be used in proportion so as to provide two parts of the finer aggregate.

Accurate Proportioning.—The inspector should make certain that the specified proportions are accurately and uniformly adhered to. Any variation from these proportions must be with the written consent of the engineer. The inspector should constantly bear in mind that while splitting hairs is not warranted by the exactness of the process of concrete making as it is conducted in practical construction work, shipshod and careless methods or practices in proportioning the ingredients of concrete should not be tolerated.

Dispute Regarding Quantities of Aggregates.—Should there be any dispute in regard to the quantities of aggregate to be used for each bag or barrel of cement, it should be decided by a test.

Changing Proportions of Concrete.—After the proportions have been established from time to time, they should not be changed during any period of twenty-four hours, unless the contractor desires to use materials of widely varying characteristics, and the proportions determined at any one time should continue to be used until the next determination is made and the contractor ordered to change the previous proportions.

II.—EXPERIMENTING FOR VOIDS.

It will generally be necessary to experiment with different proportions of varying sizes of sand and gravel or broken stone in order to ascertain the best mixture of the available materials at hand to secure the desired ends.

Gravel Containing Sand.—When gravel containing considerable quantities of sand is used several trials should be made to determine the proportion of sand it contains that will pass through a No. 4 screen (four meshes to the inch) and a corresponding deduction should be made from the sand used in making the mortar, so that the final proportions of the cement and sand in the complete mixture shall be as specified for mortar. Only the gravel remaining after screening out the sand should be treated as aggregate during the experimenting for voids referred to later.

Aggregate Composed of Broken Stone and Gravel.—When the aggregate is composed of both broken stone and gravel they should be mixed in such proportions (to be determined by experiment) as will give the least per cent of voids when mixed.

Amount of Mortar Mixed With Aggregate.—In general, the amount of mortar mixed with the aggregate should be at least 10 per cent more than the voids in the loose aggregate, which should be determined by experiment.

Measuring Ingredients.—When the cement is packed in barrels the barrel should be the basis of measure for the sand and also for the aggregate. But when cement is packed in sacks, 3½ cu. ft. should be considered a barrel of sand or aggregate. In experimenting for voids, where possible, the method of weights should be used, assuming the weight of dry gravel and broken stone to be 165 lbs. per solid cu. ft. and excluding from the aggregate the sand which occurs in the gravel.

Proportions of Cement and Sand in Mortar.—The amount of mortar made by a given amount of cement and sand should be determined by experiment, but in the absence of such experiments for special cases the following may be used as an approximation, the units of cement being a barrel of 380 lbs. net for Portland and 265 lbs. net for natural cement.

Portland cement.

Proportions	1 to 1	1 to 2	1 to 3
Cement, bbl	1	1	1
Sand, cu. ft.	3.5	7	10.5
Resulting mortar, cu. ft.	6	8	10.7

Natural cement.

Proportions	1 to 1	1 to 1½	1 to 2
Cement, bbl	1	1	7
Sand, cu. ft.	3.5	5.25	7
Resulting mortar, cu. ft.	5.7	6.9	7.8

Determination of Voids.—To determine the voids in the sand, or the material to be used as an aggregate, what is known as the "Water test" may be employed. In preparing for this test, the sand or gravel should be perfectly dry. Sand has a greater volume when wet. A recepticle holding a known amount, such as a quart jar, may be filled with the material to be tested, sand, for example, and into this receptable should be poured as much water as the sand or other material will absorb. The water should be measured. The amount of water absorbed indicates the voids, and also indicates the exact amount of cement which is necessary to use in order to produce a solid concrete.

Determination of Voids on a Larger Scale.—The following elaborate method of determining voids in materials is that given by Ernest McCullough, in his book on "Engineering Work in Towns and Small Cities," page 137.

> Use a box containing about 5 cu. ft. and fill it flush with the stone, or largest sized aggregate. Pour in water gently in order that no air will be trapped and measure the water as it goes in. The amount of water used determines the amount of finer material necessary to exactly fill the voids. Empty the box on a platform and spread the material in a thin layer, allowing the water to run off. Then cover it with the next smaller size aggregates as determined by the amount of water used to fill the voids and turn the whole mass over with shovels until well mixed. Then shovel it into the box, tamping it so the whole amount will go in. Should it more than fill the box screen the remainder to separate the sizes and remove from the box enough of the smaller size material to permit the surplus of the screened larger material to go in. In this way all the coarser material will be in the box and enough of the smaller material to pack the voids. Fill the box again with water. This amount of water represents the amount of the next smaller sized material necessary. Take for example that stone, gravel and sand are being used. The first aggregate tested for voids was the stone. The second test was the stone and gravel. The third test is for stone, gravel and sand. The material necessary to fill the voids, after screening surplus, must be placed on a memorandum. The amount was found by using water, but when placing in the box it will be found that on account of the sizes of the smaller sized aggregate some will not pack in like sand or cement. Having filled the box again with water empty on the platform and spread the aggregates. Cover them with the amount of sand indicated by the water test and turn over thoroughly until mixed. Then place in the box in small amounts and tamp into place. Having filled the box, after screening surplus as above directed, and ascertained the amount of stone, sand and gravel, pour in a measured quantity of water again until the box is filled. This last amount of water represents the amount of cement paste necessary to finally fill all the voids. By proceeding in the above manner with graded sizes of materials the voids can be reduced as low as 7 per cent. In drawing up specifications the amount of each size of aggregates used can then be specified and the mixing will do the rest.

Definite Proportions.—In all cases the proportions should be reduced to such a basis that they can be stated as follows in terms of the actual materials as delivered on the ground for use: One bbl. cement to ....cu. ft. sand to .... to cu. ft. gravel .... to cu. ft. broken stone.

Description of Experiments, Approval, Etc.—The proportions so stated, together with descriptions of all experiments leading thereto, should be submitted to the engineer for approval, and after approval must be followed in measuring the materials until there is reason to change them through change in condition of materials received. The necessity for such change should be determined by the inspector and approved by the engineer.

Adjusting Proportions of Aggregate.—The relative proportions of sand and coarse aggregate should be adjusted periodically, based on determination of the voids in the materials used in mixing the concrete.

Cost of Work Governed by Proportioning Concrete.—If the proportions as stated in the specifications are not suitable for the broken stone furnished, the engineer should determine the proper proportion. If the change in proportion alters the cost of the concrete, the difference should be paid for and deducted as the case may be.

Tests of Voids as Work Progresses.—Tests of the voids in the aggregate should be made from time to time under the direction of the engineer and instructions given as to the per cent of mortar of the specified composition to be used. No extra allowance should be made to the contractor for such tests.

III.—PROPORTIONS FOR DIFFERENT CLASSES OF WORK.

The concrete should consist of 1 part cement, 2:4 parts of sand, and 4:10 parts of broken stone or gravel measured by loose volume. (The proportions must vary to suit the character of the work and the requirements which the concrete must meet.) The following list is presented to be used as a rough guide to the selection of proportions for different classes of work. The relative proportions of fine to coarse aggregate may be varied to suit the materials. The proportions should be determined by the strength or wearing qualities in the different classes of construction.

Rich Mixture.—In columns and other structural parts subjected to high stresses or requiring exceptional water-tightness, rich mixtures should be used in proportion of 1:4½, i. e., 1 part of Portland cement to 1½ parts of sand to 3 parts of coarse aggregate measured separately.

Standard Mixture.—In reinforced floors, beams, girders and columns, in arches, in reinforced engine or machine foundations subject to vibrations, in tanks, sewers, conduits, or other water-tight work, standard mixtures should be used in proportion of 1:6, i. e., 1 part of Portland cement to 2 parts of sand to 4 parts of coarse aggregate measured separately. (This mixture may [illegible] good, strong concrete as practically [illegible] used for any piece of Portland [illegible] concrete of appreciable bulk.)

Medium Mixture.—In [illegible] foundations, retaining walls, abutments, piers, thin foundation walls, building walls, ordinary floors, sidewalks and pavements, and sewers with heavy walls, medium mixtures should be used in proportion of 1:7½, i. e., 1 part Portland cement to 2½ parts of sand to 5 parts of coarse aggregate measured separately. (This mixture may be considered as giving a concrete of sufficient strength when of proper dimensions, for any ordinary masonry construction, and, at many times and places, ample for very heavy work.)

Lean Mixture.—In unimportant work in masses, in heavy walls, in large foundations supporting a stationary load, and in backing for stone masonry, lean mixture should be used in proportion of 1:9, i. e., 1 part of Portland cement to 3 parts of sand to 6 parts of coarse aggregate measured separately. (This mixture may be considered as giving a concrete of sufficient strength, when of proper dimensions, for much ordinary plain work in favorable positions.)

[illegible] *Natural Cement* [illegible]

For natural hydraulic cement concrete a good mixture of 1 part cement, 1 part sand and 2 parts broken stone or gravel may be considered as good, strong concrete, as practically can be made with natural cement; and 1 to 2 or 4 or 4½ may be considered as poor and weak concrete as practically should be made with natural cement, to be used in any work to be classed as durable and sufficient for loads usually placed upon masonry of ordinary dimensions.

Usual Proportions.—The usual proportions unless otherwise particularly shown upon the drawings, or called for by the specifications, applying to the particular piece of work should be: Plain or massive concrete: One (1) part cement. Two and a half (2½) parts sand. Five (5) parts broken stone or gravel. Reinforced concrete: One (1) part Portland cement. Two (2) parts sand. Four (4) parts broken stone or gravel.

Cinder Concrete.—Cinder concrete may be composed of 100 lbs. cement, 2 cu. ft. gravel or coarse sand, and 6 cu. ft. of cinders.

Slag Concrete.—Slag concrete may be composed of 100 lbs. cement, 2 cu. ft. gravel or coarse sand, and 6 cu. ft. of slag.

IV.—MEASURING INGREDIENTS.

Methods of measurements of the proportions of the various ingredients, including the water, should be used, which will secure separate uniform measurements at all times. The proper amount of the several kinds of material should be measured in some way which is entirely satisfactory to the engineer or inspector in charge of the work, so that they may be satisfied that the requisite proportions of each kind of material are delivered for each batch of concrete.

Approximate Method.—The inspector should not under any circumstances permit an approximate method of measuring to be used which may yield an excess of sand and broken stone over cement. If an approximate method is used, same must provide for not less than the proper proportion of cement with the possibility that this proportion will overrun. By this is meant that if the barrows of sand and broken stone or gravel are heaping the proper amount of cement will be used. The usual course of providing a struck barrow of cement and heaping barrows of sand and broken stone or gravel must not be permitted.

Measurement of Materials.—The measurement of materials may be by weight and volume. Concrete should, as a rule, be proportioned by weights. The materials should be measured loose in a uniform manner, easy to control either by workmen or superintendent, without likelihood of frequent error. Fine and coarse aggregate should be measured separately as loosely thrown into the measuring receptacle.

Measuring Receptacles.—The measurement of materials may be by bottomless boxes in [illegible] a bin chute, or by the use of suitable carts or [illegible]

[illegible] ft. of cement. Cement lighter than above should be counted of proportionately less vol- [illegible] should be taken as 3½ cu. ft. shaken down.

[illegible] ages counted, instead of weighing on scales, since bags or barrels of cement have standard weights. If bags received from the manufacturer contain less than 94 lbs. net of Portland (or natural) cement the contractor should be required to bring up the weight with additional cement. If the bags weigh uniformly more than is here called for the contractor should be allowed to remove the excess cement provided each bag thus altered is altered by weight. The inspector should weigh at least one bag in forty as the cement is received, in order to check weights. Every facility must be given to the inspector to properly supervise the process of weighing. If the cement is turned out of the bags or barrels for the purpose of storing, it should be weighed again as rebagged or packed, and each bag or barrel must contain no less weight of cement than the above mentioned unit.

Measuring Sand, Broken Stone or Gravel.—The sand and broken stone or gravel should be actually measured in bulk. The measurement of sand and broken stone or gravel in the ordinary shallow round bottom wheelbarrow should not be considered satisfactory, and should not be permitted. The use of barrels or boxes without heads and bottoms, into which the sand and broken stone or gravel may be cast, the containing vessel then being removed, may be considered satisfactory, or preferably the use of square and uniform sized wheelbarrows built specially for this service. No counting of shovelfuls or other approximations should be allowed. In measuring sand and screenings, proper allowances should be made for variations in moisture, and the contractor should be required to make such moisture tests and allowances in measurement as directed.

Proportioning by Volumes.—The proportion may, however, also be done by volumes, using approved boxes or other receptacles and when not packed more closely than by throwing them in the usual way into a barrel or box. Proper measuring boxes specially constructed for the purpose, should be provided by the contractor as directed by the engineer. Care must be taken at all times to keep the cement box perfectly clean and dry. Each of these boxes should when filled and struck level contain the prescribed proportions by weight, which should be proved by a reliable scale. If other methods of measurement are permitted, the measurements should be based on the measurement of the cement in the original package, and not after being removed therefrom.

Measuring in Wheelbarrows.—The contents for each batch should be carefully mixed in a measuring box until the workmen have become accustomed to filling their wheelbarrows in the required manner, and the inspector should require all material to be measured in boxes, if in his judgment the measuring in barrows is not sufficiently accurate. Where barrows are used, they should be of the straight top type and should all be of one size or the size should be plainly marked if more than one size used. The measure of the size should be the cubic contents of the barrow "Struck Flat" with a straight edge. No heaping should be allowed.

Heaping Wheelbarrows (Alternate Clause).—The use of iron barrows may (with the engineer's consent) be permitted for measuring the broken stone and sand, provided they are constructed as to contain, when heaped to their utmost capacity, exactly the correct proportions as determined from time [illegible]

[illegible] ment is permitted, no allowance should be made for material which may fall from the barrows in conveying the same to the place [illegible]

[illegible] size that they can be proportioned without using fractions of measures. If compelled to use fractions of bags, said fractions should be weighed upon the assumption that the neat cement weighs not less than 94 lbs. per cu. ft. The amount of water to be used be accurately measured for each batch.

Measuring Water.—The contractor should provide suitable means for controlling and accurately measuring water for mixing concrete.

Verification of Measures.—The accuracy of the measuring boxes, hoppers, etc., must be verified to make sure that each holds the amount intended. This may be done by using a known measure to fill the measuring box, etc., employed, or the volume of the measuring box, etc., may be computed mathematically. Tests should be made by the contractor with the carriers—whether wheelbarrows, boxes or cars—used by him so that the required proportion of concrete may be maintained as nearly as possible; and the engineer should supervise these tests and fix said proportions for the kind of carrier used at each piece of work. No extra allowance should be made to the contractor for such tests.

Accurate Measuring.—Accurate measurements are of the greatest importance, and should require (1) that definite measuring units be employed; (2) that the accuracy of the measuring boxes, etc., be verified as stated above; (3) that the filling of the measuring boxes, hoppers, etc., be exact, and (4) that when two or more boxes or hopperfuls, etc., go to make up a batch, the exact number is employed for each and every batch. The operations of measuring should follow a regular routine or sequence which should not be varied from and a double check system should be used by which the cement man and the mixer operator check the number of measures.

Measuring Materials for Reinforced Concrete Work.—No chances which vigilance and caution can avoid should be taken in measuring and charging the cement content of concrete for reinforced concrete work. The measuring and feeding of the cement should be done under the direction of a superintendent, inspector or foreman, having at least two years' experience in handling reinforced concrete. They should by all means be made to understand that safety, life and property depends on the accuracy of their work. The method of measuring the ingredients of the concrete should be subject to the approval of the engineer.

Automatic Measuring Devices.—When automatic measuring devices are used to proportion the concrete, it should be required (1) that they are regulated to give the proper proportions; (2) that the materials do not clog, choke or arch in the feed hoppers; (3) that the feed hoppers are kept amply supplied with materials.

Mixing of Concrete.

I.—GENERAL REQUIREMENTS.

Concrete mixing is seemingly so simple an operation that it is often neglected by the inspector, and poor workmanship escapes detection. Concrete may be mixed either by machines or by hand, depending upon the volume of concrete to be mixed and the relative cost of the two methods. In either case the methods and manner of mixing should be satisfactory to the engineer and subject at all stages to his approval. The mixing of the concrete should be done as rapidly as possible. Concrete should not be mixed in larger quantities than is required for immediate use. The contractor should be required to exercise great care with the mixing of concrete and see that it is thoroughly [illegible] allowed to [illegible] de-posited in the forms.

[illegible] mixed in the presence [illegible] inspector and the contractor should be required to notify the engineer in advance when mixing is to be done. Concrete mixed in the absence of the inspector should be subject to rejection at the will of the engineer. Any time the inspector sees any of it slighted he should reject it at once, or have it mixed over. The inspector should satisfy himself that the proper proportions of cement, sand and broken stone or gravel are used, checking from day to day or from time to time with the total amount of each which is received and used.

Engineer's Directions.—The greatest care must be taken thoroughly to mix all mortar and concrete so as to obtain the very best results. The engineer's directions must be implicitly followed at all times in this respect, and the engineer should feel at liberty to vary his directions from time to time as the work progresses, so as to insure the accomplishment of this object, and the contractor must forthwith cause such instructions to be obeyed.

Consistency of Reinforced Concrete.—The materials should be mixed wet enough to produce a concrete of such a consistency as will flow into the forms and about the metal reinforcement, and which, on the other hand, can be conveyed from the mixer to the forms without separation of the course aggregate from the mortar. In other words, the consistency of the concrete should be soft and wet without being sloppy, and in general should be such that after dumping the concrete in the forms it may be consolidated and worked into place with spades or shovels and a slight quaking secured with little or no tamping. A good concrete worker can tell whether the concrete allows of easy tamping and runs freely around the steel bars. The mixture should be moderately wet, and no very wet nor very dry concrete should be used without special permission. Care must be taken that the concrete is not too wet, so that the stone and sand settle under the water during its transportation to the forms, although what is usually known as a wet mixture should be used for all reinforced work.

Consistency of Concrete for Various Structures.—(a) A medium or quaking mixture of a tenacious, jelly-like consistency, which quakes on ramming should be used for ordinary mass concrete, such as foundations, heavy walls, large arches, piers and abutments. (b) Wet or mushy concrete, so soft that it will flow when agitated, but not so wet as to produce a separation of the materials in transferring to the work, should be used for rubble concrete, and for reinforced concrete, such as thin walls, columns, floors, conduits and tanks. The concrete should be so mixed that it must be handled quickly or it will run off the shovel, or so that it will assume a level surface when dumped into a wheelbarrow and wheeled about 25 ft. Concrete should not be mixed too wet and the cement drowned out. The mixture must not be so thin that it will seep through the joints in the forms.

"Dry" and "Wet" Concrete.—Concrete should be used "wet" wherever practicable and "dry" only when the nature of the work renders such use unavoidable. The consistency of the concrete should be as required by the engineer.

Wetting Stone and Gravel.—The aggregate should be wet, if required, before being mixed. Stone and gravel used in the concrete should not be drenched in the vehicles used to deliver it upon the platform or to the mixer, unless proper arrangements are made to drain the receptacles, but should be wetted before they are placed therein. Stone and gravel should contain no loose water in the heap when added to the mortar in the proper proportion.

Failure to Mix Concrete Properly.—Failure to mix concrete to the required consistency should be sufficient cause for immediate stopping of all work pertaining to the operation in question.

Quantity to Be Mixed.—Concrete should not be mixed in larger quantities than is required for immediate use (generally one barrel of cement at a time). It should not be allowed to lay, and then remixed with water and used.

Dirt to Be Kept Out of Concrete.—At all stages of the work, concrete and mortar must be kept entirely free from dirt of all kinds, and if unavoidably mixed with dirt, shall be removed and replaced to the satisfaction of the engineer.

Mixing Coloring Matter.—In using coloring matter with concrete, the color should always be mixed with the cement dry, before any sand or water is added. This mixing must be thorough, so that the mixture is uniform in color. After this mixing the combination should be treated in the same manner as ordinary cement.

Amount or Quantity of Water.—The concrete, except where required by the engineer to be deposited dry, should be mixed with a quantity of water which will produce a mixture of satisfactory consistency of the wetness required. The amount of water used in mixing concrete should invariably be approved by the engineer. The amount of water per batch should be determined in consultation with the superintendent and when so determined, the contractor should be required to keep the consistency unvarying. In other words, the water should be measured and when the proper consistency has been found the exact same amount for each batch should be used. An excess of water, causing the materials to separate, should be avoided, no more being used than necessary to unite the materials. No water should be put by means of a hose. The proper amount of water can be determined only by experience, and must be varied from time to time to suit the conditions of the weather and the nature of the work. It is very important that Portland cement should have sufficient water for its complete hydration. Natural cement requires less water for hydration than Portland.

Remixing.—When the concrete has to be transported a long distance in cars, and the water has separated from the solid matter, the concrete should be remixed before being placed in the forms. That is to say, concrete which may become compacted or segregated during transportation should be satisfactorily remixed before being placed in the forms.

Retempering.—Mortar, grout or concrete which has been allowed to stand until initial set has taken place should not be used; retempering, i. e., remixing with water, should not be allowed for partially set concrete unless by special permission of the engineer, who may, at his discretion, require additional cement to be used in retempering

Failure to Place Concrete Before Setting.—No concrete should be used after it has begun to set; when setting commences, the material thus injured should be immediately wasted. If in the opinion of the engineer the contractor fails to take due precaution against such injury, he will charge to the contractor and deduct from the estimate the value of the cement in the material.

Freezing Weather.—Concrete should not be mixed at a freezing temperature, unless special precautions are taken to avoid the use of materials containing frost. The amount of water should be decreased when the weather is cool or freezing.

Wet Weather.—Concrete should not be made when rain is falling on it.

Approval of Concrete.—A competent foreman should be in constant attendance to give his approval of every batch of concrete before it is used.

Hot Weather.—In hot weather the sand and gravel, or broken stone, must be kept wet in order to reduce the time of initial set to as near the normal as possible. If necessary, the sand and broken stone or gravel piles should be protected from the sun.

II.—MACHINE MIXING.

Wherever the amount of work to be done is sufficient to justify it, and for all work exceeding 1,000 cu. yds., approved mixing machines, either cubical steel or iron boxes, sometimes called malaxators, measuring (say) 5 ft. on the edge, and capable of mixing (say) two-barrel batches of concrete at one time, or continuous rotary mixers of approved design, should be used.

Type of Mixer: Approval.—The contractor should notify the engineer of the style of mixer proposed to be used, and the engineer's approval of same should be obtained before mixing is begun. That is to say, the type of mixer to be used must be approved by the owner or city or its engineer, who shall also control as to the method of feeding materials to the machine. The mixer should be erected and operated in such a manner that the charging, mixing, discharging and regulation of the materials is uniform, efficient and certain. It should feed the ingredients in their proper proportions at all times. If at any time the mixer fails to perform the mixing in a satisfactory manner, it must be repaired or removed and another machine substituted.

Batch Mixer.—A batch mixer in which the materials are charged, mixed and discharged in batch units, should be given preference at all times for reinforced concrete work. The machinery should consist in part of a box or receptacle in which a definite volume of water, cement, sand and broken stone or gravel not exceeding a total of (say) 2 cu. yds. in any one batch may be placed and there mixed by stirring or revolving for an indefinite length of time. The process of charging the machine and mixing the concrete should be conducted in accordance with instructions of the engineer.

Testing Batch Mixer.—The mixer should be tested, and the batch of concrete, of the size that will give the best results should be used.

Charging Batch Mixer.—The ingredients should be placed in the machine in a dry state and in the volumes specified, after which clean water should be added and the mixing continued until the wet mixture is thorough and the mass uniform, every particle of stone or gravel being completely coated with mortar. The proper measures of ingredients should be emptied into the charging box in the following order: First, sand; second, cement; third, broken stone or gravel; fourth, water; the proportion of water being so regulated that the concrete can be thoroughly compacted and will show merely a thin film of moisture upon the surface. Care must be taken to run each batch till it is thoroughly mixed dry before beginning to wet up. Water must be measured so that exactly the same amount is used for each batch. Water should not be put into the mixer with a hose, as this invariably results in a lack of uniformity in the fluidity of the mix. Care should be exercised in adding water to obtain the proper consistency. Water must at all times be added by measure. A thorough system should be employed for insuring beyond doubt that not less than the specified amount of cement goes into each batch.

Charging Batch Mixer (Alternate Method.)—In mixing, the broken stone or gravel may be placed in the mixer first, thoroughly wet. The cement and sand should then be dropped into the mixer in alternate layers and mixed thoroughly until an amalgamated concrete is obtained, in which the broken stone or gravel is suspended in a thick paste of mortar.

Charging Batch Mixers Without Automatic Measuring Devices.—Proper precautions should be taken to see that the requisite proportions of the different ingredients are used. If machines are used which are not provided with devices to deliver each of them, the process of making the concrete should generally be as follows: The proper amount of sand, cement and broken stone or gravel for a batch not to exceed 1 cu. yd. of concrete should be delivered on the platform and roughly mixed together so that when the dry mass is cut down and delivered to the mixer by means of shovels, proper amounts of each of the ingredients are handled in each shovelful. It should not be regarded as a satisfactory process to deliver broken stone or gravel, sand and cement at random to the mixer without taking some special means, as above described, to insure the delivery of the proper quantities of each ingredient as nearly as may be simultaneously. Before starting work, the inspector should mark lines on the wheelbarrows, above which sand and broken stone or gravel shall not be filled.

Number of Turns.—The requisite number of turns for batch mixers should be determined by trial mixing of a few batches and when once determined that number should be set as the minimum allowable. The product is improved by longer mixing, and all the time less than period required for initial set, available between deliveries required at the forms, should be utilized for extra turns to the mixer. Some mark should be placed on the mixer so that the number of turns of the mixer can be counted. The time required for each operation should also be checked, in order to obtain uniform results.

[illegible] each batch should be carefully noted as it comes from the mixer. Uniformity of color should be insisted upon. The concrete leaving the mixer must be uniform in appearance and the mixing process must be carried on until this condition is obtained. The entire batch must be discharged each time.

Checking Operations in the Mixer.—The operations of placing the materials in the mixer should be carefully checked and an inspector should be especially detailed for this work.

Batch Record Cards.—An accurate account should be kept of the number of batches mixed, the same to be recorded on a printed card for that purpose. These batch record cards should be preserved and filed for future reference.

Discharging With a Drop.—Concrete, in discharging the mixer, should not drop or fall for any considerable distance.

Cleaning Mixer Platform.—At least once every twenty minutes the mixer should be stopped and the platform upon which the concrete is being fed should be entirely cleared, so that no concrete shall remain long enough to attain its initial set.

Attendance at the Mixer.—A competent foreman must be in constant attendance at the mixer to give his approval of every batch which leaves the machine. He should be responsible for speed in feeding the mixer, speed in removing concrete, for accuracy of measurements, amount of water used, cement used, etc. The laborers placing the materials in the mixer should be selected for their intelligence and ability to understand the directions given them.

Continuous Mixers.—Continuous mixers in which the materials are charged, mixed and discharged in a continuous stream, should be used only under special conditions, and then only on mass work, like retaining walls, foundations and dams. A continuous mixer in the operation of which the proper proportions of the ingredients depend upon the shovelers should be subject to the special approval of the engineer.

Charging Continuous Mixers.—Materials should be fed evenly into the mixer in the proper proportion. If the mixer has an automatic measuring device, it should be kept amply full and the material must not be allowed to clog in the mixing drum. If the mixer is fed by shoveling, it should be done from properly proportioned piles of cement, sand and aggregate, and each shovelful should contain a proper mixture of materials. Shoveling must be done at a uniform rate as it is essential to good results from a continuous mixer. (The chief fault of continuous mixers is the difficulty of charging them properly.)

Testing Continuous Mixers.—[illegible] concrete should be measured out in the desired proportions and run through the machine to see if it feeds correctly. After the concrete comes through it should be examined to see if it is thoroughly mixed and if too wet or dry. If not mixed right, it should be run through again or mixed by hand. The inspector will check the run of the mixer with measured wheelbarrows from time to time as he desires.

Gravity Mixers.—If the portable gravity

[illegible]

When from any cause resort to hand mixing is necessary, this should be done thoroughly and to the satisfaction of the engineer. The mixing should be performed as expeditiously as possible and with the use of a sufficient number of skilled men. The contractor should be allowed to use his own method of mixing, provided it gives the desired results. Mixing on the ground should not be permitted.

[illegible]

Hand mixing should be avoided for reinforced concrete work if possible, but when allowed in an emergency, the inspection should be rigid in order that the work be done deliberately and carefully. Hand mixing as done for ordinary mass concrete work will not do for reinforced concrete work. To secure good results the mixing must be thorough.

Mixing Platform.—A suitable platform must be provided on which to do the mixing. The planking should be tight enough to prevent leakage of water carrying cement. The platform should be of sufficient size to accommodate men and materials for the progressive and rapid mixing of at least two batches of concrete at the same time. Batches should not exceed one cubic yard each. The mixing platform should be boarded off to prevent the wind blowing the cement away while it is being turned dry.

Proportioning Materials.—In proportioning the ingredients, it is poor economy to make allowance for insufficient mixing or improper handling of the materials. The additional cement will be much more expensive than the extra time expended by workmen in securing a homogenous mass. All material for concrete should be accurately measured in suitable boxes. No counting by shovels or other approximation should be allowed. To determine the proper proportions, a barrel of cement weighing not less than 400 lbs. gross should be taken as measuring 3½ cu. ft.

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Method of Hand Mixing.—A correct proportion of gravel or broken stone should be evenly spread upon the mixing platform, and in no case more than 8 ins. deep. In a suitable box, the correct proportion of sand and cement should be mixed dry until the whole mass is one even color. The gravel or broken stone should then be wetted and the mixture of dry sand and cement should be evenly spread over it. Commencing at the corners, the men should, with shovels, turn the mass over away from the center, and coming back, turn it to the center. In addition to the thorough wetting of the stones, if, in the judgment of the engineer, it will be necessary, sufficient water should be added to the mass by a rosehead sprinkler to enable the material to become thoroughly incorporated, and the process of mixing should be continued until the surface of each stone is well covered with mortar. Sand and cement should not be mixed up in advance, because the natural moisture which all sands contain will make the cement set and cake.

Hand Mixing (Alternate Method).—The sand may first be spread in a thin layer on the platform, and the cement spread over this and the whole turned until homogenous in appearance and color. The water necessary to mix a thin mortar is then added and the mortar spread again. The broken stone or gravel, which have been previously wet, should then be added to the mortar and the whole turned until all the particles are coated with cement and the mixture is of uniform consistency. Or, at the option of the engineer, the coarse aggregate may be added before, instead of after, adding the water.

Water for Mixing.—Water should be moderately sprinkled on the material from a sprinkler nozzle, care being taken not to wash out the cement or to put on at any time an excess of water and to leave the concrete too dry rather than too wet. Water must not be dashed or thrown upon the mass in buckets or large quantities, or by means of a jet. Concrete should be wet to that degree that after thorough ramming the mortar will flush to the surface.

[illegible] When a natural mixture of sand and gravel is used, the material should be handled the same as sand, that is, it should be spread evenly and [illegible] then wet.

Care in Mixing.—Mixing must be done on a clean mixing board. Special care must be taken to prevent the incorporation of any dirt or foreign matter into the concrete. Care should also be taken to keep the sand and broken stone or gravel in distinct and separate bins or piles. That is to say, the shovelers should always maintain a clear space between piles. The mixing must be conducted in a manner which will not permit of the loss of cement through the running off of surplus water.

Size of Batch in Hand Mixing.—The quantity of concrete in each batch should not be greater than the quantity that, under the conditions, can be mixed and deposited in permanent position in the work before the cement begins to set. Batches should not exceed one cubic yard, and smaller batches are preferable, based upon a multiple of the number of sacks to the barrel.

Number of Turns.—The number of times concrete should be turned over will depend upon the method of handling it, the nature of the sand and broken stone or gravel, also the amount of water added. Merely shoveling the material from one part of the platform to another should not be considered a proper method of mixing. The whole mass should be turned over with shovels at least three times (not counting the shoveling off the board), until thoroughly incorporated. With experienced laborers, the concrete should be mixed after three such turnings; but if it shows streaky or dry spots, it should be turned again. The engineer may prescribe the number of times the mixture shall be turned, dry and wet, if he considers it necessary.

Order of Turning Materials.—The order of turning should be so regulated that the last turn made will place the material in a single pile at or near the center of the board, preparatory to its removal to the place for it in the work.

Removal of Concrete From Platform.—In removing the concrete from the platform, care must be taken to preserve the incorporation, which can best be done by shoveling it from the base at the edges of the pile, toward the center of it, and at the same time cutting the apex of the pile with a hoe or shovel, in such manner as to avoid an accumulation of loose stones.

Cleaning Platform.—At night the mixing platform should be left clean and if any mortar or concrete is not used it should be thrown out to prevent it from being remixed again in the morning.

Tools for Hand Mixing.—In mixing by hand the men should be provided with long-handled, square-bladed shovels, as they can reach the center of the pile better and will not tire themselves as with a short-handled shovel. The use of a rake or hoe may be permitted in mixing sand and cement, but not after stone has been added.

Mixture of Mortar Having an Excess of Water.—Any mixture of mortar having an excess of water (of which the engineer or inspector should be judge), should be rejected, and must be removed from the platform and evenly spread on top of the finished concrete, where and as directed, or if, in the judgment of the inspector, it may be used in the concrete, it should be his duty to see that at least two or three measures of broken stone or gravel are omitted from the batch.

Removal of Mortar From Platform.—If any mortar is removed from the platform for any purpose, it should be the inspector's duty to see that at least one or more measures of broken stone or gravel are omitted from the batch. Mortar required for other purposes should be prepared separately, as each batch of concrete must have its full proportion of cement.

EARTH AND ROCK SECTION

Some Notes on the Development of Motor Trucks for Contractors' Service, With Data Concerning Operating Cost.

(STAFF ARTICLE.)

The motor truck for contractors' hauling has been materially improved during the past year. This statement is justified by a study of the exhibition of commercial motor vehicles now being made in Chicago. At this exhibition there are 81 manufacturers represented, as compared with 57 exhibiting one year ago, and an estimate based on returns from these 81 exhibitors indicates that the output of commercial motor vehicles for 1912 will approximate 25,000 vehicles. The kinds of service for which these vehicles are destined is pretty much a speculation, but it is stated by the exhibitors that a very large percentage of those making inquiries is composed of contractors and builders. In the following paragraphs we describe, therefore, several types of trucks adapted more or less particularly to contractors' and builders' hauling.

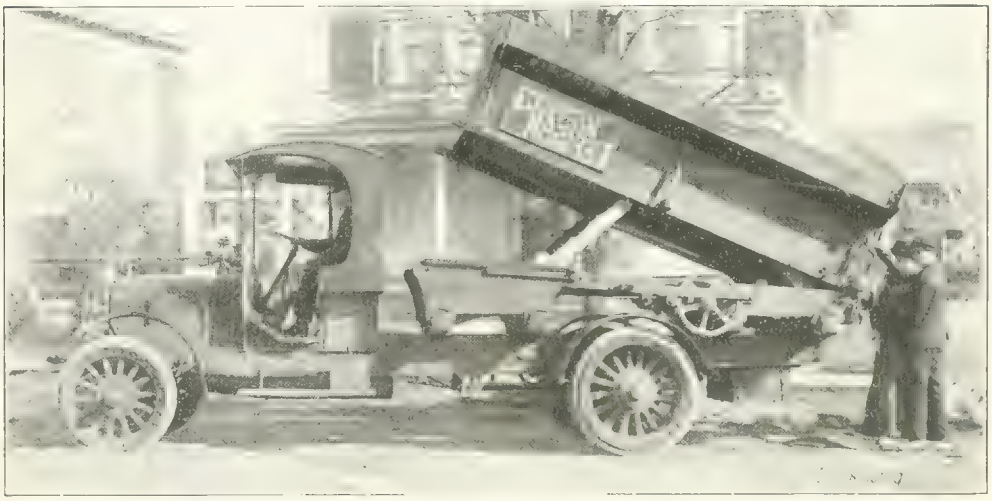

Fig. 1—A Five Ton Pierce-Arrow Worm Drive Truck at Hartford, Conn., with Body Arranged for Dumping at a Higher Level than the Sidewalk.

TYPES OF TRUCKS

There are several types of motor dump trucks for use by contractors and others who handle material in bulk. These trucks are so made that the body, together with its load of from three to ten tons can be raised at the front end and the load slid out or else raised vertically to a sufficient height to permit chutes to be used. One of these trucks has a body that is raised at the front end by a pair of chains moved by a train of gears driven from the transmission set of the truck. Another is similarly operated, except that the chains are wound up on the drums, which are worm driven from the primary shaft just back of the clutch.

There is also a dump truck that is operated by compressed air. A valve on the dash is opened to admit compressed air to a long vertical steel cylinder behind the seat. This raises a plunger whose rod is connected to the top of the front end of the body, thus hoisting the body with the load. Releasing the air from the cylinder allows the body to settle back to normal position. The compressor is operated by the vehicle engine. A new and valuable feature of some of the dump trucks is the automatic tail boards with which they are equipped. These are hung on trunnions at the top and so connected to a system of toggle arms at the lower corners that they open automatically as the front end of the body is elevated, thus enabling the driver to dump the load without leaving his seat. Upon lowering the body the tail board closes and is locked into position. As an example of a truck which is raised vertically to provide for chuting out the load, Fig. 2 may be observed. Though designed for coal hauling, this truck might be adapted to handling sand or broken stone, chuting them into basement bins for building work.

Besides the trucks suitable for general contractors' and builders' hauling illustrated in Figures 1 to 9, there are a variety of trucks for special purposes, such as hauling lumber, refuse removal and for department purposes. In future articles we shall describe more in detail selected contractors' motor trucks. In what follows we give such data as have been collected on the cost of motor truck operation.

COSTS OF MOTOR TRUCK OPERATION

Costs of motor truck operation specifically for contract work are somewhat rare, but they have been obtained in two cases which follow. Operating costs as compiled by manufacturers and as given for other lines of work than contractors' hauling are, however, nearly as serviceable and a number of examples follow.

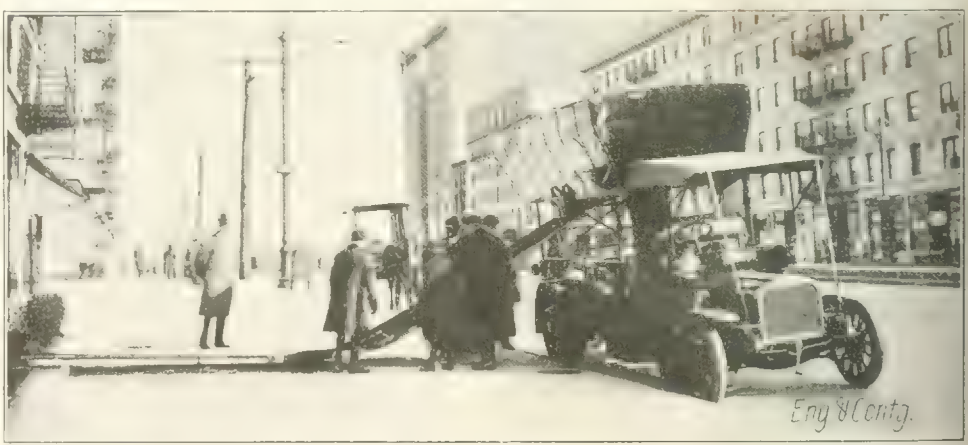

Fig. 2—A Six and a Half Ton Saurer Truck With Body Arranged for Discharge from High Level.

Manufacturers' Averages.—From data made public by manufacturers and covering often several years of operation, the following averages have been compiled:

A tabulation compiled by one motor truck builder shows that the daily cost of a two-ton truck that averages 70 miles a day is $10.60; that of a three-ton machine averaging 62 miles a day, $12.20; of a four-ton truck averaging 55 miles a day, $13.80, and of a five-ton truck averaging 50 miles a day, $15.

Another company has compiled a similar cost table covering a period of more than six years. This shows the average daily cost of running a one-ton truck to be $8.07, of a two-ton truck $10.25, a three-ton truck $11.30, five-ton truck $14.80, seven-ton truck $16.45 and of a ten-ton truck $18.50 a day. The figures given for the trucks of one to ten tons capacity include all items properly chargeable to the hauling service, both actual running expenses and overhead expenses. Drivers' wages are figured at $16 to $22 per week; gasoline at 12 cts. a gallon, oil at 30 cts.; garage at $225 to $300 a year; tires at $275 for a one-ton machine to $1,650 for a ten-ton truck; overhauling and general repairing at $300 to $550; depreciation at 15 per cent; interest at 5 per cent, and fire and liability insurance at $150 to $240 per annum.

One of the electric commercial vehicle companies furnishes the general average operating costs for the three models which it makes. Fixed charges on the delivery wagon amount to $303 a year for interest and depreciation on non-wearing parts;; maintenance for maximum service to $389 a year, and garaging, including charging current to $108. This amounts to $800 a year, or $2.66 per working day, not including drivers' wages. At $15 a week, wages would bring the total daily cost to $5.16. On the same basis the total cost of running the light truck is $5.63 a day and that of running the heavy truck $6.91 a day. Larger and heavier makes of electric trucks cost from $7 to $8 a day to operate.

Contractors' Cost of Hauling Blasted Rock.—The following data on motor truck work hauling blasted rock are furnished by the Charles P. Boland Co., engineers and contractors of Troy, N. Y. The contract called for the excavation and removal of 23,000 cu. yds of rock. The rock was blasted and hauled in two Packard 3-ton trucks of the type shown by Fig. 3. These trucks were equipped with patent dumping bodies and were used continuously, day and night shifts. The excavated material was hauled in some cases a distance of 1½ miles. The records show that these trucks carried about twice the amount usually hauled in a 1½ cu. yd. dump wagon and made the trip to the dumping ground and return in just half the time required for a team to make it. Experience proved that it was necessary to keep the trucks continuously on the move in order to work them economically, and with this idea in mind large steel bottom dump buckets were used in loading the trucks; thus no time was lost in loading as several buckets were full at all times and the operation of reloading the trucks took only the time required to hoist the buckets over the trucks. The actual loading operation required but a few minutes.

In the hauling of materials from the freight house to the building site, the records show that hauling cement cost about 1½ cts. per bag or 30 cts. per net ton. Eighty bags were carried on each trip and eight trips were required to unload a car containing 640 bags. Increased efficiency was obtained by having at least six laborers to do the loading, as little time is lost if the loading force is large enough. The average record of each car of cement from the freight house to the site of operations, a distance of about 1½ miles, was as follows:

Laborers, 6 hrs. each day at 15 cts.	[illegible]
Chauffeur, 6 hrs. each day, at 2[illegible] cts.	[illegible]
Fuel, oil, etc.	[illegible]
Percentage of maintenance charge	[illegible]
Total	$8.37

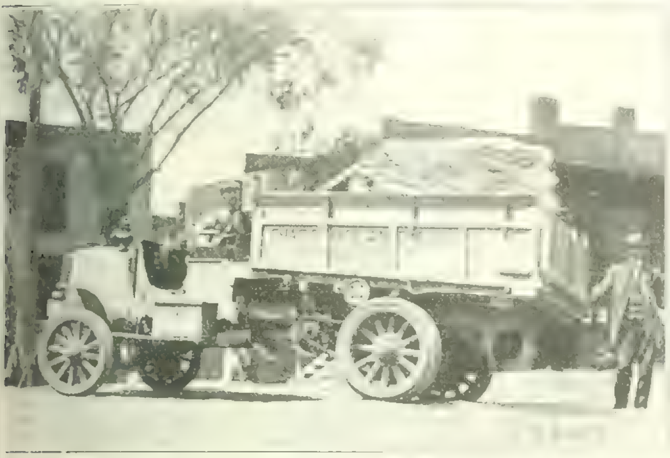

Fig. 3—A Three Ton Packard Dump Truck Used in Rock Excavation Work.

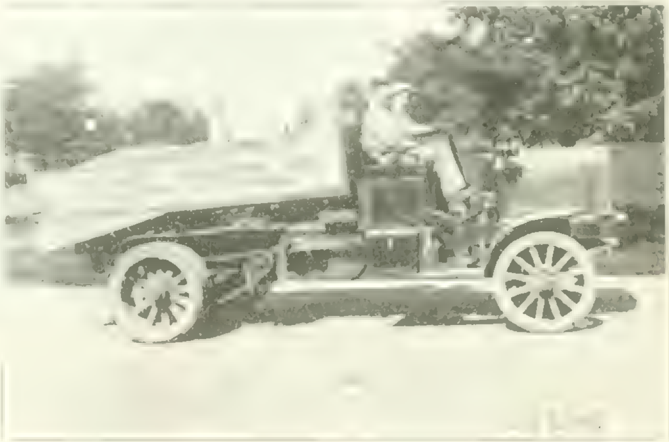

Fig. 4—A Three Ton Packard for Hauling Gravel.

Referring to their experience on this work the contractors write as follows:

In the case of an automobile truck, our experience has taught us that it is economy to keep every part well lubricated at all times. A cheap or an inferior grade of oil should not be used, as the carbon forming qualities of a cheap oil more than offset the saving in the price. Where more than one truck is in use at least one chauffeur should be employed who is a thoroughly practical man. This will enable him to have each truck carefully looked over

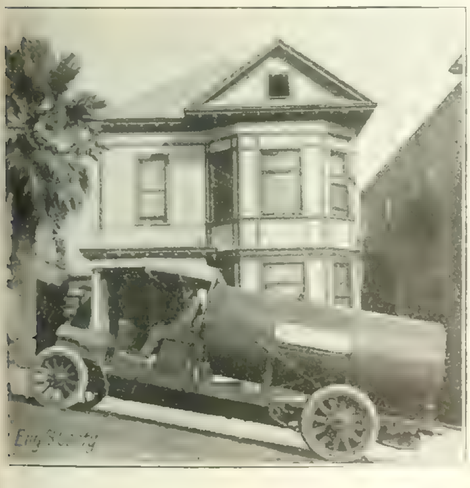

Fig. 5—A Saurer Tank Truck on a 20 Per Cent Grade.

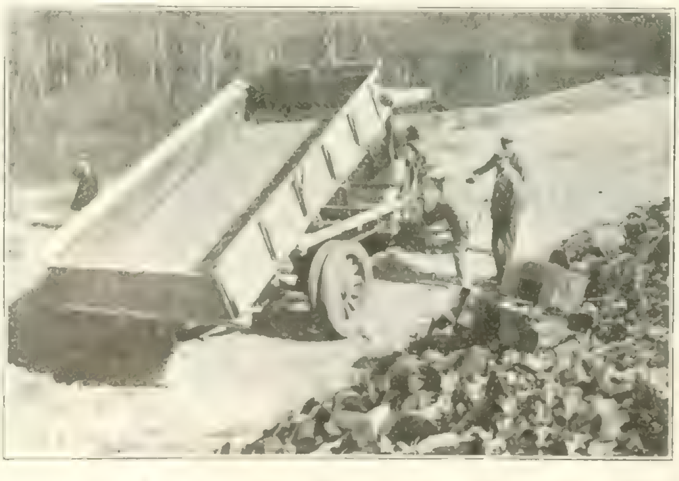

Fig. 6—A Four Ton Peerless Rear Dump Truck.

	1st Car.		2d Car.		3d Car. 15,651 Miles.	
	Total cost.	Cost per mile.	Total cost.	Cost per mile.	Total cost.	Cost per mile.
[illegible]	[illegible]	[illegible]	$106.75	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	20.85	[illegible]	34.27	0.002
Tires	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.016
[illegible]	[illegible]	[illegible]	[illegible]	0.0078	76.43	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	$508.78	[illegible]

[illegible] no trouble with these trucks. The main expense in connection with the maintenance of the [illegible] service. The company referred to sells these [illegible] renewals are necessary before the mileage is completed, a replacement is made by them and [illegible] obtained.

[illegible] Cost of Hauling Building Material.—Figure 4 shows a Packard truck operated by the Tacoma Trading Co., Tacoma, Wash., for hauling building materials. The company reports that this truck is very well adapted to the business of hauling sand and gravel, as it is loaded by gravity from the bunkers, which takes only two or three minutes. It is equipped with a dumping bed so that it can be dumped on the job and is ready to go inside of two or three minutes. Further, it only takes one man to run it, so that the expense of operation, including everything, repairs, depreciation, gasoline, oil and driver's wages, will amount to between $10 and $11 a day [illegible] ured. The amount allowed for repairs and depreciation is estimated, as the truck has been in service only about eight months.

Referring to the illustration, Fig. 4, it will be noted that the bed sets on rollers attached to a wooden frame which is in turn bolted to the chassis. It is held in position by a large [illegible]. When the dump is [illegible] the bed rolls off the chassis by gravity, as it is on an incline in its normal position. The skids which extend below the main part of the bed at the rear are really bumpers to take the weight of the bed as it strikes the ground. After the material has run out the driver winds the bed back on with a windlass, which cannot be seen in the picture, as it is on the opposite side of the truck. Under normal conditions the driver is able to unload the load and start again in two or three minutes.

[illegible] *Operation.*—The following data on the cost of operating motor trucks are condensed from a paper by L. R. Dutton before the American Gas Institute:

Electric Trucks.—One company reporting five one-ton trucks (all of one make) 1½ years old, one ½-ton truck, and one 2-ton truck, in use only a few months, furnishes the following operating costs. Total mileage of the 7 cars, 39,507:

Cost.	Total.	Per mile.
Battery [illegible]	[illegible]	[illegible]
Battery maintenance	595.71	0.015
Chains and sprockets	146.58	0.004
Chassis repairs	54.09	0.001
Current	282.38	0.007
Generating plant	133.21	0.003
T[illegible]	[illegible]	[illegible]
Wagon repairs	17.00	0.000
Wagon washing	587.83	0.015
Miscellaneous	[illegible]	[illegible]
	[illegible]	[illegible]

Insurance	$ 539.90	$0.014
Battery maintenance accrued.	984.57	0.025
Tires depreciation accrued....	199.08	0.005
Depreciation at 10 per cent...	2,054.00	0.052
Interest at 8 per cent.........	1,739.40	0.044
Total cost	$9,411.82	$0.238

The following figures are given on a 2-ton electric truck covering two years' service:

	Total cost.	Cost per mile.
Current at 2½ cts. per k-w....	$ 253.88	$0.0275
Labor for maintenance	486.78	0.0528
Maintenance and repairs......	1,130.04	0.1225
Total expense.............	$1,870.70	$0.2028

Miles traveled, 9,225.

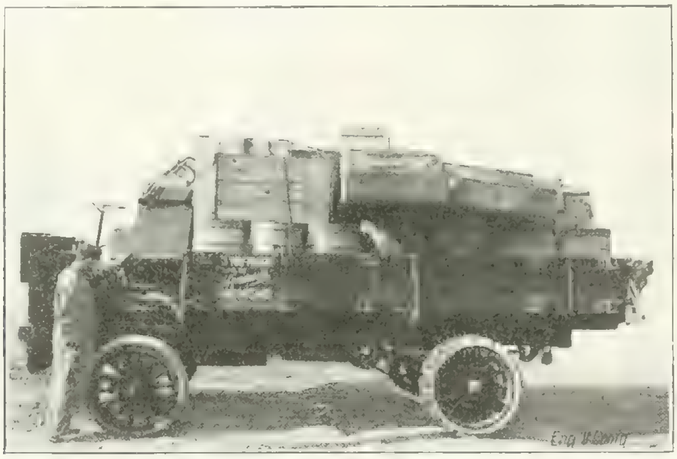

Fig. 7—A Four Ton Speedwell Truck with Motor Under Seat.

This truck is reported out of service for maintenance in the two years, 12½ per cent of the working hours. The same company reports the following summary of expense on a 1,000-lb. electric truck, covering a period of 2½ years' service—total mileage 10,274.

	Total cost.	Cost per mile.
Interest on $1,668 at 6%	$ 250.20	$0.0244
10% depreciation on the value of the wagon................	244.20	0.0237
Maintenance and depreciation of batteries	601.02	0.0586
Tires and repairs..............	210.00	0.0204
Wagon expense, repairs.......	145.12	0.0142
Miscellaneous charges.........	48.54	0.0047
Total expense	$1,499.08	$0.1460

It will be noted that the owner of this vehicle suggests different depreciation values on various parts of an electric machine. He divides it as follows: First, depreciation on wagon; second, depreciation on tires; third, depreciation on batteries.

These expenses are complete, because the expense is included up to the point where the truck has a new set of tires, and is in good condition except that the wagon needs painting. It also had a new battery installed during the past year. Valuable information (Table I) on the operation of electric vehicles can be obtained by consulting the Report of the Committee on Electric Vehicles, National Electric Light Association, June, 1911.

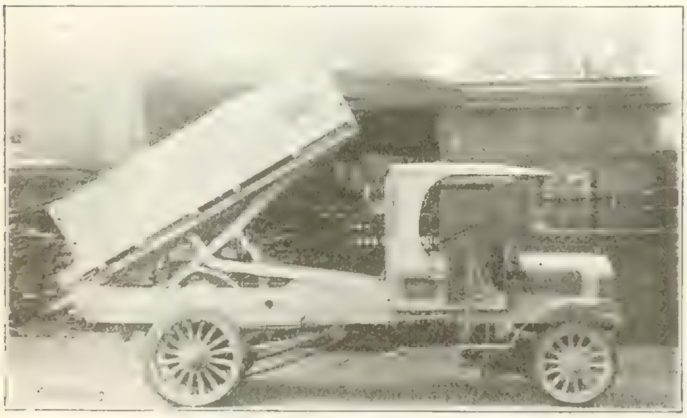

Fig. 8—A Three Ton Mack Truck with Dump Body.

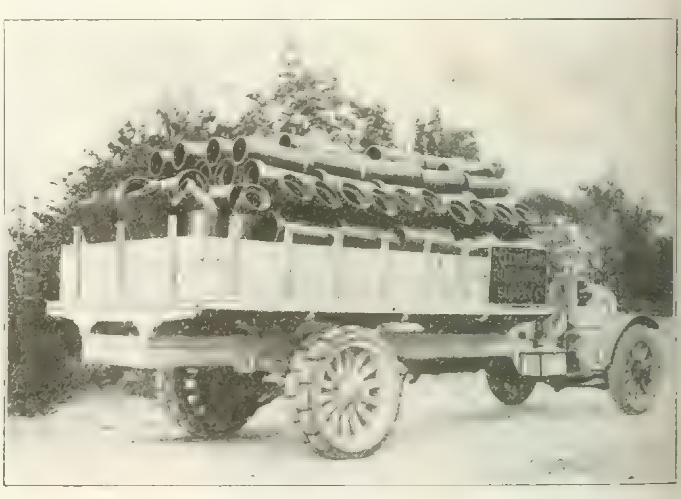

Fig. 9—A Five Ton Peerless Truck of the Cleveland Builders' Supply Co.

TABLE I.—COST OF OPERATING 1,500-LB. AND 3,000-LB CAPACITY DELIVERY WAGONS.

Fixed Charges and General Expense.	Average Cost Per month.	Total.	Per mile. Cents.
Drivers' salary..........	$ 65.00	$ 5,687.50	9.0
Supervision	5.22	456.75	0.7
Garage rent............	5.18	453.25	0.7
Wheel tax.............	2.67	233.62	0.4
Washing, oiling, etc....	13.00	1,137.50	1.8
Interest at 5%, taxes at 1.5%, and insurance at .5% on total cost of wagon	14.58	1,275.65	2.0
Depreciation:			
Batteries, 66¾ per year on $255	14.17	1,239.87	2.0
Tires, 100% per year on $225.60	18.80	1,645.00	2.6
Balance of wagon, 10% per year	15.99	1,399.13	2.2
Total general expense and fixed charges.....	$154.61	$13,528.27	21.4
Total supplies and repairs	29.44	2,575.44	4.0
Grand total expense..	$184.05	$16,103.71	25.4

Gasoline Cars.—The following is the cost of operation of three 30 hp. cars used by superintendents and managers of a gas company. They cost, new, somewhat less than $2,000 each.

One company reports the use by salesmen of three cars costing $750 each. Being low-priced cars and covering only from 500 to 800 miles per month, the depreciation was high. The amount charged for depreciation was the actual amount, because the cars were sold at the end of the year and the loss was known. The operating expense on the first car was 4.8 cts. per mile; on the second, 10 cts. per mile; on the third, 10½ cts. per mile. If these cars were used by only one salesman it would indicate that the cost was unusually high.

A well-known company in another line of business, having salesmen in various parts of the country, furnished 14 of its men with runabout cars costing $1,000 each. The cars average four months operation; mileage of car 3,830. Item of expense: Gasoline, oil and grease, repairs to motor, depreciation, 25 per cent per annum. Total cost per mile 14.9 cts.

Gasoline Trucks 1,000 lbs. Capacity.—Cost of operating five 1,000-lb. trucks of a well-known make, costing $750 each, with large wheels and solid tires:

	Mileage.	Cost per mile.
Truck No. 1....................	2,000	0.0926
Truck No. 2....................	9,210	0.042
Truck No. 3....................	8,160	0.045
Truck No. 4	3,565	0.045
Truck No. 5	3,924	0.045

The cost of the above trucks include gasoline, oil and grease, tire repairs and sundries. The average is very uniform, except with car No. 1, the additional expense originating from a broken motor caused by an inexperienced driver learning to operate. The different companies operating these trucks all state that the depreciation cost is very high. In most cases the truck can only be kept in use a few months or a year and traded in for a new one. At least 50 per cent depreciation should be charged the first year. A practically similar experience was reported by a company with a truck of the same capacity and low cost, built by a different concern.

One Ton Trucks.—Three companies report on the use of 1-ton trucks of different makes. Company No. 1 reports on *two 1-ton* trucks; total mileage, 18,550; cost per mile, 10 cts. This includes gasoline, oil, tires and motor repairs. The opinion of the owner is that the depreciation is 33⅓ per cent per year. Company No. 2, reports on *three 1-ton* trucks. The report covers gasoline, oil, tires and repairs. The owner estimates depreciation 15 per cent. Truck No. 1, 6,060 miles; cost per mile, 11 cts., truck No. 2, 6,300 miles; cost per mile, 10 6/12 cts.; truck No. 3, 8,000 miles; cost per mile 8.6 cts.

Company No. 3 reports on the operation of one 1-ton truck.

The expenses on 2,600 miles are as follows:

	Total cost.	Cost per mile
Gasoline, at 11 cts. per gal....$	34.05	$0.013
Oil, at 50 cts. per gal.........	8.45	0.003
Tires (accrued)	48.00	0.018
Repairs, none.		
Total	$ 90.50	$0.034

The item of tires mentioned above was owing to the rear tires being too light. They were removed and 1 in. heavier solid tires installed, at the above cost. The motor is of the two-cycle type.

One and One-half Ton Trucks.—Only one company has reported on a truck of this capacity and similar make. The report covers a total of 11,150 miles and the truck was in use 14 months.

	Total cost.	Cost per mile.
Gasoline, at 15 cts., 7 mil. per gal. ....$	236.70	$0.0212
Oil, at 35 cts. per gal.........	35.00	0.0031
Tires and repairs.............	150.00	0.0134
	35.10	0.0031
Total expense	$ 456.80	$0.0408

The owner believes 12½ per cent depreciation should be charged on this truck. Its makers have reports from the owners of hundreds of these cars and claim the operating costs to average 8 cts. per mile, made up as follows: Five per cent interest on investment; depreciation, 25 per cent; gasoline, oil, tires, motor repairs and maintenance, 70 per cent.

Two-ton Trucks.—From the reports received only three companies are using the same make. One of the three furnishes detailed costs of operation, which report is very complete. Truck was owned 14 months, or 352 working days; days in use, 227; days idle for repairs, 75, or 21 per cent. The owner reports that, although this car has been on the market for several years, an unusual amount of time was lost because of poor service rendered by the manufacturers and agent, owing to delays in obtaining repair parts. When parts were received they either did not fit the machine or were not perfect. Time lost was due as follows, in days: To springs, 5; to tires and wheels, 13; to motor, 33; to transmission, 15; to radiator, 9. The mileage was 11,300; gallons gasoline used, 2,250, or 5 miles per gallon; miles traveled daily, 41. A summary of the operating expense of this truck is shown as follows:

	Total cost	[illegible]
Gasoline	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Tires and repairs	[illegible]	[illegible]
Car repair and sundries	370.22	0.0328
[illegible], cleaning, etc.	[illegible]	[illegible]
Total	$1,716.00	$0.1522
Standing Expense.		
[illegible]	[illegible]	[illegible]
Depreciation, 2% month	653.90	0.058
	$2,428.30	[illegible]

It should be noted in connection with this ruck that a common fault was found of nstalling tires under capacity on the rear vheels. The wheels also were too light for he load, owing to the overhang of pipe and oles from the rear of the truck. When the roper equipment was installed it was found hat good service was received. The same lifficulty was experienced with the springs., out they were changed to heavier type. It vould appear that this make of truck would rove very satisfactory, after taking care of he usual difficulties experienced, by having it roperly equipped for the work to be perormed. The second year's operating should rove much more economical.

Ten 3-Ton Trucks.—Carefully compiled figures show that 3-ton trucks, covering 40 miles day, and operating 300 days a year, can be naintained and run at an average cost of 9.75 per day. The items making up this harge of an establishment of 10 trucks, 3 ons capacity, are:

Wages, 10 drivers at $2.[illegible]	[illegible]
Wages, repairmen, helper and washer	7.00
Gasoline, 80 gals at 12 cts	[illegible]
Lubricant, 1 ct. per mile	4.00
Maintenance 10% per year	[illegible]
Superintendence	[illegible]
Incidentals, light, heat, tools, etc	2.87
	$61.67
[illegible] expense per [illegible]	[illegible]
Interest at 6%, depreciation at 20%, insurance at [illegible], all on [illegible]	[illegible]
Storage, 200 sq. ft. at 50 cts. per year	0.33
[illegible] for 2 spare machines	[illegible]
Total operating and maintenance cost per day	[illegible]
Total operating and maintenance cost per mile	[illegible]

The tabulated cost of four 3-ton trucks, 4 ears old, operating 40 miles per day in Chi- [illegible] n horses formerly used:

Standing Expense.	Per day	Per mile
Interest on $3,500	[illegible]	[illegible]
Insurance	0.28	0.007
Running Expense.		
Gasoline [illegible] gals at $0.11	[illegible]	[illegible]
Oil and grease	[illegible]	[illegible]
Tires and general repairs	2.00	0.050
Machine cleaning	1.31	0.32
Total	[illegible]	[illegible]

Five-Ton Trucks.—Only two companies report on 5-ton trucks. These have both been in use a year and the exact cost has been ascertained. The trucks are manufactured by different concerns. The operating costs are shown as follows:

First 5-Ton Truck.

	Total	Cost
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Maintenance and repairs	87.36	0.0145
[illegible]	[illegible]	[illegible]

Annual mileage 6,000 miles per day 22 miles.

It is interesting to note that the owner of this truck states it has depreciated only 5 per cent, and that the truck performs the same work as a horse equipment costing $14.15 per day.

Second 5-Ton Truck.

	Total cost.	Cost per mile.
Gasoline, 3 mile per gal. at 10 [illegible]	[illegible]	[illegible]
Oil, at 55 cts. per gal	140.00	0.013
[illegible]	[illegible]	[illegible]
Repairs and maintenance	1,400	0.133
Total	[illegible]	[illegible]

Annual mileage 10,500 miles=35 miles per day.

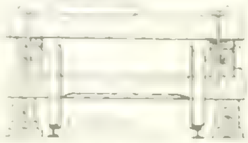

Fig. 1—Detail End Elevation of Truck Under Mast.

It is interesting to note that the owner of this truck estimates 24 per cent depreciation. The worm drive which has been adopted by builders of motor vehicles abroad is installed in this truck. Very little attention has been given to it by American builders, although the housing of the worm drive in the rear construction, its simple design, easy lubrication, and noiseless running, should favor its high efficiency and long life.

A Truck Mounting for Stiff-leg Derricks.

Contributed by David Taylor, Keokuk, Iowa.

In the operation of stiff-leg derricks, where the work is spread over considerable territory, moving becomes quite a large item of cost. With the derricks in use on the Iowa division of the water power development, now in process of construction, at Keokuk, Iowa, this problem has been taken care of in a very satisfactory manner. The derricks here are used to remove rock, and to place concrete and forms, and it is found necessary to move them very frequently. To facilitate this operation they have been mounted on trucks, which run on two parallel railroad tracks of standard gage. A detailed description of these trucks, and the method of mounting the derricks, may be of interest to others having similar working conditions.

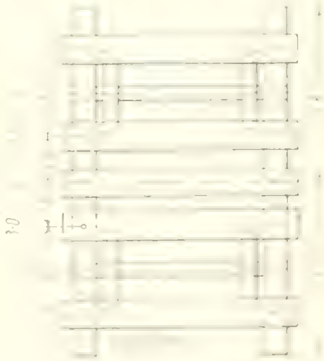

Fig. 3—Plan of Truck Under Leg.

Figure 1 shows an end view of the truck under the mast. The end views of the other two trucks will be identical with this, except that the trucks under the legs have additional timbers placed on top parallel to the sills to bring the sides up level with the top of the sills and allow the flooring for the weight boxes to extend right across over the sills. Figures 2 and 3 are plans of the mast and leg trucks respectively. Two sets of axles and wheels are placed under each truck, making four wheels to each truck. These axles are 5 ft. apart under the mast truck and 6 ft. apart under the leg trucks. The sills of the mast truck are 2 ft. long, and those of the leg trucks are each 12 ft. long. All timbers are 10x12 ins. except a 3x10-in. plank on each

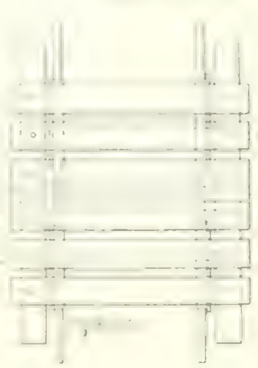

Fig. 2—Plan of Truck Under Mast.

still to give the wheels clearance. Other sizes might be used if they could be more conveniently obtained. The only precaution necessary is to provide sufficient strength and get clearance for the wheels. On the truck where the derrick sill lies crosswise, another cross timber is necessary in the center, where the sill crosses. All timbers are bolted together by one ¾-in. bolt passing clear through at each intersection. The wheels are provided with straight bearing boxes outside the wheels. These boxes are bolted to the sills with two ⅞-in. bolts to each box. A view of one of these derricks is shown by Fig. 4. This gives an idea of how the weight boxes are built and also shows the truss supporting the engine house and floor. The front of the engine house is supported by a heavy double breast beam. A cross beam passes through between the wheels of each truck, under the sills. This is to block up tender, to take the weight off the wheels when the derrick is in operation. Two short bents are built down under the middle of each sill. These are to make it easy to block up at these points, and so stiffen up the whole affair when in use.

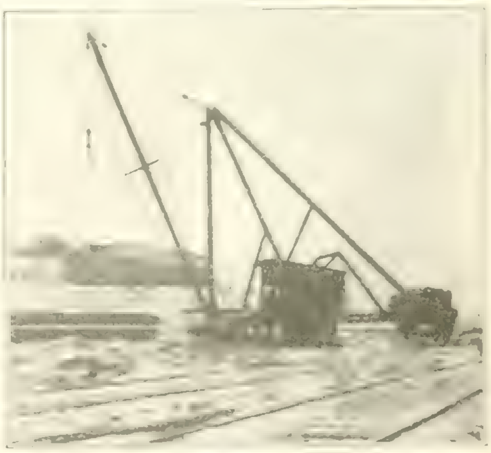

Fig. 4—View of Derrick Showing Weight Boxes and Truss Support for Engine House.

With this arrangement the large derricks in use here may be moved 100 ft. or more in a very few minutes. The motive power used is the derrick's own engine, by means of a set of blocks and line attached to the mast truck and the track and led to the niggerhead. The track over which they move may be either straight or curved. If the curves are not too sharp, and the whole affair may be shifted crosswise to a track parallel to the first by emptying the weight boxes, and jacking up the sills and turning the trucks crosswise to their original position, then running along a temporary track to the desired location, thus changing back to the original position.

A set of these trucks may be built in a day by six or eight handy men.

ROADS AND STREETS SECTION

Suggestions on Methods of Lighting Streets and Comparative Costs of Various Methods.

Street lighting is discussed by J. M. Bryant and H. G. Hake of the University of Illinois Engineering Experiment Station in a recently published bulletin. This bulletin describes the various lamps employed for street lighting, explains photometry, measurement of illumination, distribution curves and derives equations for calculation and from all this are compiled a series of 14 tables showing light distribution of various street lamps, etc. The bulletin concludes with a discussion and cost comparison of various lights for streets and this portion of it is given with some omissions here.

STREET LIGHTING

Street lighting in different parts of a city must serve various purposes. For utility and safety, the business streets require a different treatment from the residence streets and suburban districts. Parks and open places require a still different arrangement of lights. A good various lamps studied there is reproduced here a curve diagram comparing the horizontal distribution of light at street surface of these division of the city is the following: (A) Principal business streets; (B) important cross streets and boulevards; (C) residence streets; (D) outlying districts.

Business Streets.—In the principal business streets, the illumination should be more or less brilliant. It should be as uniform as possible, and of sufficient intensity to enable one to read ordinary sized print, i. e., at least .25 to 1 foot candle.* In many cities in Europe, the inclined carbon flame arc is used for these streets. The lamps are suspended over the center of the street from tall ornamental poles on both sides, and at a height of from 40 to 50 ft. They are spaced from four to five times their height. These produce a very beautiful effect, and the street is brightly illuminated. With the reflection from buildings, the illumination averages about 2 ft. candle. This lighting is also carried out for short distances into the cross streets. In this country, the flame arc has not met with favor on account of the high operating cost for the short burning arc. With the advent of the more modern long burning flame arc, this objection can not be made, since, in lighting from large units spaced comparatively near together, the number of the lights will be nearly inversely to the mean lower hemispherical candle power. This will be more apparent later. The standard for such lighting has not yet been set in this country. There is now a strong tendency towards clusters of tungsten lights, or arc lights on ornamental poles, placed low on both sides of the street. It is claimed justly that the best lighted streets attract the crowds and hence merchants are insisting upon brighter and better illumination on their streets, even assisting the city in meeting the additional cost of mainttenance.

Cross Streets and Boulevards.—The boulevards and cross streets require a much less brilliant illumination. The principal cross streets do not usually have shade trees, and may be lighted either by high intensity lamps suspended high or low intensity lamps more closely spaced and supported low. The general characteristics of the streets will indicate the type of lighting to be used. In such streets, heavy slow moving traffic is usual. The boulevards, on the other hand, are usually shaded and require the lights to be suspended low unless the streets are very wide. For shaded streets, lights upon ornamental poles at the sides of the streets are preferable to those suspended over the center, on account of the character of the street. By this is meant that since such a street is used mostly for light vehicles, moving more or less rapidly, lights should not be hung so as to blind the drivers. The appearance of such a street is improved by side lighting, or lights suspended fairly high over the center of wide streets. Probably from .10 to .5 ft. candle is a good figure to use.

Residence Streets.—Residence streets should have one light at each street crossing, for the safety of vehicles and pedestrians approaching these crossings, as collisions are more liable to occur at such points. These streets are usually rather narrow and densely shaded, thus requiring the lights to be supported not over 15 to 25 ft. above the street surface. The maximum illumination should not be too high or the minimum too low. The general average of the illumination should, however, be low. The character and color of the surface has a marked effect upon the lighting of such streets. It is well known that a street with snow upon its surface appears much better lighted than the same one when the snow has disappeared. It is usual in dim illumination to see nearly all obstructions as dark objects against the lighter background of the lighted street. Such a contrast is more distinct if the background is lighter. A macadamized road or asphalt pavement needs much more illumination than one paved with light bricks. Lights will not give good illumination at the middle of blocks 400 ft. long, if the lights are 25 ft. or less above the street. The illumination in the immediate neighborhood of most arc lights is also higher than necessary for this class of street. In crooked streets or where the surface is uneven or hilly, lights must be spaced more closely than at every street crossing. Residence street lighting is the particular field for the incandescent light. In choosing a light for this class of service, the economic limit comes in the ordinary spacing of poles on the street, and the lowest value of illumination allowable immediately below the light. A street having many small lights, hung low and spaced rather closely together, has long been associated with the narrow street of the poorer quarter with its dingy appearance. The brilliant effect and white light

TABLE I—COST AND OPERATING CHARACTERISTICS OF ARC LAMPS

	ITEMS	Open arc, D. C., twin carbon	Enclosed arc, D. C.	Enclosed arc, A. C.	Enclosed arc, A. C.	Magnetite arc, D. C.	Magnetite arc, D. C.	Flame arc, D. C., inclined carbon	Flame arc, A. C., inclined carbon	Flame arc, D. C., vertical carbon, long burning	Flame arc, A. C., vertical carbon, long burning
1	Voltage across lamp terminals	50	72	72	72	80	80	55	55	70	70
2	Current	9.6	6.6	7.5	6.6	6.6	4.0	10	10	5.5	5.0
3	Terminal watts	480	475	480	425	528	320	550	467	385	350
4	Maximum candle power value	1250	525	350	275	1600	730	2400		2575	1925
5	Maximum candle power angle with vertical	45°	65	40°	40	80°	80°	0°-30°	..	70°	85°
6	Mean lower hemispherical candle power (H. S. C. P.)	800	468	298	214	1170	457	1785	850	1800	1485
7	Watts per H. S. C. P.	.6	1.01	1.61	1.71	.45	.70	.31	.55	.26	.24
8	Kind of glassware, inner globe	None	Opal	Opal	Opal	None	None	None	None	Clear	Clear
9	Kind of glassware, outer globe	Clear	Clear	Clear	Clear	Clear	Clear	Opal	Clear	Opal	Clear
10	Curve sheet, figure	3A	4C	4B	4A	3B	3C	5D	.	5C	...
11	Life positive electrode, hours	17	125		...	1500	4000	17		70	100
12	Life negative electrode, hours	17	125	100	110	100	175	17	17	70	100
13	Life inner globe	.	400	400	400	...		.	.	300	300
14	Life outer globe	1000	2000	2000	2000	2000	2000	1000	1000	2000	2000
15	Cost of lamp, dollars	15.00	34.50	20.00	20.00	40.00	40.00	60.00	60.00	60.00	60.00
16	Cost of positive electrodes, dollars per trim			.	...	.50	.45	...	...	...	...
17	Cost of negative electrodes, dollars per trim	.015	.021	.022	.022	.06	.05	.14	.14	.25	.25
18	Cost of inner globe, dollars each		.15	.15	.15	.			..	.50	.50
19	Cost of outer globe, dollars each	.50	.50	.50	.50	1.00	1.00	1.00	1.00	.75	.75
20	Cost of labor in trimming, etc., per trim	.06	.06	.06	.06	.06	.06	.06	.06	.06	.06
	A. Fixed Charges, Annual—										
21	Interest on investment at 6 per cent	.90	2.07	1.20	1.20	2.40	2.40	3.60	3.60	3.60	3.60
22	Depreciation at 10 per cent	1.50	3.45	2.00	2.00	4.00	4.00	6.00	6.00	6.00	6.00
23	Total annual fixed charge	2.40	5.52	3.20	3.20	6.40	6.40	9.60	9.60	9.60	9.60
	B. Maintenance Charges Per 1000 Hours—										
24	Cost of electrodes, dollars	.89	.17	.22	.20	.93	.40	8.23	8.23	3.56	2.50
25	Cost of inner globes, dollars	.	.37	.37	.37	...	..	..	...	1.67	1.67
26	Cost of outer globes, dollars	.50	.25	.25	.25	.50	.50	1.00	1.00	.37	.37
27	Cost of trimming and inspection, dollars	3.54	.48	.60	.55	.60	.34	3.54	3.54	.85	.60
28	Cost of rectifier renewals, dollars	..	.50		.	.50	.50	.50	.	.50	...
29	Cost of repairs, dollars	.50	.50	.50	.50	.50	.50	.50	.50	.50	.50
30	Cost of maintenance, total, dollars	5.43	2.27	1.94	1.87	3.03	2.24	13.77	13.27	7.45	5.64
	C. Cost of Energy, Per 1000 Hours—										
31	At 1 cent per kilowatt hour	4.80	5.42	4.80	4.25	6.05	3.65	6.25	4.67	4.40	3.50

*Line 31 has been computed from line 3, considering the rectifier efficiency.

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*A foot-candle is the normal illumination produced by one unit of candle-power at a distance of 1 ft.

TABLE II.—COST AND OPERATING CHARACTERISTICS OF TUNGSTEN LAMPS

	Items.	[illegible]					For Suspension at Side of Street				
1	Candle power horizontal	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	350
2	Terminal watts	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	71	118	236	413
3	Watts per mean horizontal candle power	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
4	Mean hemispherical candle power (with reflector)	[illegible]	[illegible]	[illegible]	[illegible]	471	[illegible]	[illegible]	[illegible]	227	471
5	Watts per H. S. C. P.	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
6	Maximum candle power, value	45	84	140	280	490	45	84	140	280	490
	Maximum candle power, angle with vertical	70°	70°	70°	70°	70°	70°	70°	70°	70°	70°
7	Curve sheet, figure										
8	Life of lamp, hours	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1350	1350	1350
9	Cost of lamp, dollars	1.00	1.00	1.20	2.44	3.75	1.00	1.00	1.20	2.44	3.75
10	Cost of labor for inspection and cleaning, annual	.40	.40	.40	.40	.40	.40	.40	.40	.40	.40
11	Cost of fixtures, dollars	1.50	1.50	2.00	2.50	2.50	5.00	5.00	5.00	5.00	5.00
12	Cost of lamp and fixtures	2.50	2.50	3.20	4.94	6.25	6.00	6.00	6.20	7.44	8.95
	A. Fixed Charges, Annual—										
13	Interest on investment at 6 per cent	.15	.15	.17	.30	.37	.36	.36	.37	.45	.52
14	Depreciation at 10 per cent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.74	.87
15	Annual inspection charge	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.40	.40	.40
16	Total annual fixed charges	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.59	1.79
	B. Maintenance Charges Per 1000 Hours—										
17	Cost of lamp renewals, dollars	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.80	2.80
18	Cost of repairs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.15	.15
19	Cost of maintenance total	.79	.79	.88	1.90	2.90	.89	.89	.98	1.95	2.95
	C. Cost of Energy Per 1000 Hours—										
20	At 1 cent per kilowatt hour	.38	.71	1.18	2.36	4.13	.38	.71	1.18	2.36	4.13

from the tungsten light has done much to dispel this prejudice.

Outlying Districts.—In the outlying districts, either the tungsten light or an arc light having low operating cost may be used. It is seldom that a community can afford to have an arc light at each street intersection in such a district. Hence for protection and safety, the tungsten light may be used to good advantage. A difference here may also be made between streets connecting trade centers and cross streets. The former may be treated as boulevards or as residence streets, according to the traffic conditions.

It is thus seen that no specific rules can be laid down in street lighting. Each case to be handled is more or less special. However in choosing a general lighting scheme for any city, the central station furnishing the power must also be considered. It would, of course, not be feasible to specify a variety of lights, requiring varied generating apparatus. In any system, the station apparatus should be interchangeable from one circuit to another for continuity of service and low first cost and maintenance. Thus, if direct current lamps are chosen, they should all have the same current consumption and this should also fit well with incandescent lamps on the market. On the other hand small compensators may be supplied with each alternating current lamp to adapt it to any alternating current circuit. Wires in series circuits have a voltage upon them at the station, dangerous to personal safety. The circuit may become accidentally grounded at some point, either by contact with a telephone wire or the limb of a tree when wet. In such case, the full voltage may exist between the other wire and ground. Hence, for safety to persons, these wires should not be allowed too near the ground. They are usually required to be strung on the upper cross arm of the poles. If they are brought down to incandescent lamps, suspended too low or strung on low poles, serious accidents are liable to occur. To avoid this, especially low poles should not be used for series lighting. For such service, tungsten multiple 110 volt lamps may be used from special feeder circuits or series lights on ornamental posts fed from armored cables buried in the ground. This latter applies especially to ornamental park lighting.

The choice of a lamp for a given class of street lighting depends upon the illumination which may be obtained from the lamp and upon its cost of operation. A flat rate is usually made for street lighting; i. e., a charge of so many dollars per lamp per year. The items which enter into a consideration of these charges are: (A) Fixed charges; (B) maintenance charges; (C) energy charge.

These items, together with the number of hours of operation, or schedule, determine the rate to be charged for the service. These will be considered in the order named.

Fixed Charges.—In this item is considered a charge of 6 per cent, covering interest on the capital invested, taxes, insurance, etc., and a depreciation charge of 10 per cent. This latter charge, if deposited at 5 per cent in a sinking fund, would replace the equipment in from eight to nine years. With the present rapid advance in the development of lamps, this figure seems conservative. It means that replacement is due to advance in the art, rather than to the complete deterioration of the apparatus. On the other hand, the depreciation charge depends also upon the life of the city ordinance. If the ordinance is for five years, the depreciation should be 18 per cent instead of 10 per cent, since the city may require an entire change of its system at the end of the contract or award the contract to some other competing company.

Maintenance Charges.—In the following table, this charge is itemized and computed on the basis of 1,000 hours' operation. It covers the cost of renewals, due to the consumption of electrodes, breakage of glassware, repairs to the mechanism of the lamp, and a charge for labor in trimming, cleaning of glassware and reflectors, inspection, store room charges, etc. These figures represent an average installation, say of 400 arc lamps or their equivalent in incandescent lamps. The trimming cost for tungsten lamps is low on account of the long life of these units. The arc lamps are supposed to be cleaned and inspected by the trimmer. In the case of the tungsten lamps, it is assumed that the reflectors will be thoroughly inspected and cleaned each time the lamps are renewed and also at regular intervals, say four times per year, independent of the schedule. Hence this cleaning charge is placed as an annual charge instead of on the basis of 1,000 hours.

Energy Charge.—Energy is usually computed upon the basis of the kilowatt hours consumed. For convenience of comparison, the cost of energy at the lamp terminals, rather than at the station switchboard, is considered here. The energy charge will then cover the cost of delivering this power, such as depreciation on station apparatus, poles, wires, etc., and the maintenance charges on the same. In order to compare direct and alternating current lamps operated from the same station, the cost of the rectifier outfit is included in the cost of the direct current lamps, and its depreciation charge is placed there also. The efficiency of a rectifier outfit may be taken as 87.5 per cent. The loss of energy must therefore be charged to the direct current lamps. This charge is made by increasing the cost of energy in line 31, Table I, inversely in the ratio of the efficiency to 100 per cent. These values are then used in Tables III and IV and in

TABLE III.—OPERATING COST ON 4000-HOUR SCHEDULE.

	Items.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Center Suspension					Side Suspension				
	For 1000 Hours from Table.																				
1	Annual fixed charge	[illegible]	[illegible]	[illegible]	3.20	6.40	[illegible]	[illegible]	9.60	9.60	[illegible]	.80	.80	.84	1.19	1.40	1.36	1.36	1.39	1.59	1.79
2	Maintenance for 1000 hours	[illegible]	[illegible]	[illegible]	1.87	3.03	2.24	13.77	13.27	7.45	5.61	.79	.79	.88	1.90	2.90	[illegible]	[illegible]	[illegible]	1.95	2.95
3	Energy per 1000 hours at 1 cent per K. W. hour	4.80	5.42	4.80	[illegible]	[illegible]	[illegible]	[illegible]	4.67	4.40	3.50	.38	[illegible]	[illegible]	[illegible]	[illegible]	.38	.71	1.18	2.36	4.13
	Annual Cost 4000 Hour Schedule.																				
4	Annual fixed charge (1)	[illegible]	[illegible]	[illegible]	3.20	6.40	6.40	9.60	[illegible]	9.60	9.60	.80	.80	.84	1.19	1.40	1.36	1.36	1.39.	1.59	1.79
5	Maintenance, 4×(2)	21.68	9.08	7.76	7.48	12.12	8.96	55.08	53.08	29.80	22.56	3.16	3.16	3.52	7.60	11.60	3.56	3.56	3.92	7.80	11.80
6	Energy at 1 cent, 4×(3)	19.20	21.70	19.20	[illegible]	24.20	11.60	25.20	18.68	17.60	14.00	1.52	2.84	4.72	9.44	16.52	1.52	2.84	4.72	9.44	16.52
7	Energy at 2 cents, 2×4×(3)	38.40	43.40	38.40	[illegible]	48.40	29.20	50.40	37.36	35.20	28.00	3.04	5.68	9.44	18.88	33.04	3.04	5.68	9.44	18.88	33.04
8	Energy at 3 cents, 3×4×(3)	[illegible]	[illegible]	[illegible]	[illegible]	72.60	43.80	75.60	56.04	52.80	42.00	4.52	8.52	14.16	28.32	49.56	4.56	8.52	14.16	28.32	49.56
9	Energy at 4 cents, 4×4×(3)	[illegible]	[illegible]	[illegible]	[illegible]	96.80	58.40	100.80	74.72	70.40	56.00	6.08	11.36	18.88	37.76	66.08	6.08	11.36	18.88	37.60	66.08
10	Energy at 5 cents, 5×4×(3)	[illegible]	[illegible]	[illegible]	85.00	111.00	73.00	126.00	93.40	86.00	[illegible]	7.60	14.20	23.60	47.20	82.60	7.60	14.20	23.60	47.20	82.60
	Total Annual Operating Cost.																				
11	Total cost per lamp, 1 cent per K. W. hour (4)+(5)+(6)	43.28	36.30	30.16	27.68	42.72	29.96	89.88	81.36	57.00	46.16	5.48	6.80	9.08	18.23	29.52	6.44	7.76	10.03	18.83	30.11
12	Total cost per lamp, 2 cents per K. W. hour (4)+(5)+(7)	62.48	58.00	49.36	44.68	66.92	34.56	115.08	100.04	74.60	60.16	7.00	9.64	13.80	27.67	46.04	7.96	10.60	14.75	28.27	46.63
13	Total cost per lamp, 3 cents per K. W. hour (4)+(5)+(8)	[illegible]	[illegible]	[illegible]	61.68	91.12	59.16	140.28	118.72	92.20	74.16	8.52	12.48	18.52	37.11	62.56	9.48	13.44	19.47	37.79	63.15
14	Total cost per lamp, 4 cents per K. W. hour (4)+(5)+(9)	[illegible]	101.46	87.76	78.68	105.32	73.76	165.48	137.40	109.80	88.16	10.04	1532	23.24	46.55	79.08	11.00	16.28	24.19	47.15	79.67
15	Total cost per lamp, 5 cents per K. W. hour (4)+(5)+(10)	120.08	123.10	106.96	95.68	129.52	88.36	190.68	156.08	125.40	102.16	11.56	18.16	27.96	55.99	95.60	12.52	19.12	28.91	56.59	96.19

TABLE IV.—OPERATING COST ON 2,500-HOUR SCHEDULE.

	ITEMS.	Open arc twin carbon, D. C.	Enclosed D. C.	Enclosed, A. C., 7.5 amp.	Enclosed, A. C., 6.6 amp.	Magnetite, 6.6 amp.	Magnetite, 4.0 amp.	Flame, D. C., inclined.	Flame, A. C., inclined	Flame D. C., vertical, long burning	Flame A. C., vertical, long burning.	Center Suspensions: Tungsten, 32 C. P.	Tungsten, 60 C. P.	Tungsten, 100 C. P.	Tungsten, 200 C. P.	Tungsten, 350 C. P.	Side Suspensions: Tungsten, 32 C. P.	Tungsten, 60 C. P.	Tungsten, 100 C. P.	Tungsten, 200 C. P.	Tungsten, 350 C. P.
	For 1000 Hours from Table.																				
1	Annual fixed charge..........	2.40	5.52	3.20	3.20	6.40	6.40	9.60	9.60	9.60	9.60	.80	.80	.84	1.19	1.40	1.36	1.36	1.39	1.59	1.79
2	Maintenance for 1000 hours......	5.42	2.27	1.94	1.87	3.03	2.24	13.77	13.27	7.45	5.64	.79	.79	.88	1.90	2.90	.89	.89	.98	1.95	2.95
3	Energy per 1000 hours at 1 cent per K. W. hour.................	4.80	5.42	4.80	4.25	6.05	3.65	6.25	4.67	4.40	3.50	.38	.71	1.18	2.36	4.13	.38	.71	1.18	2.36	4.13
	Annual Cost 2500 Hour Schedule.																				
4	Annual fixed charge (1)..........	2.40	5.52	3.20	3.20	6.40	6.40	9.60	9.60	9.60	9.60	.80	.80	.84	1.19	1.40	1.36	1.36	1.39	1.59	1.79
5	Maintenance, 2.5×(2)	13.55	5.67	4.85	4.67	7.57	5.60	34.42	33.11	18.62	14.10	1.97	1.97	2.20	4.75	7.25	2.22	2.22	2.45	4.87	7.37
6	Energy at 1 cent, 2.5×(3)........	12.00	13.55	12.00	10.62	15.10	9.14	15.70	11.67	11.00	8.75	.95	1.77	2.95	5.90	10.32	.95	1.77	2.95	5.90	10.32
7	Energy at 2 cents, 2.5×2×(3)....	24.00	27.11	24.00	21.24	30.20	18.30	31.40	23.34	22.00	17.50	1.90	3.54	5.90	11.80	20.64	1.90	3.54	5.90	11.80	20.64
8	Energy at 3 cents, 2.5×3×(3)....	36.00	40.70	36.00	31.86	45.30	27.40	47.10	35.01	33.00	26.25	2.85	5.31	8.85	17.70	30.96	2.85	5.31	8.85	17.70	30.96
9	Energy at 4 cents, 2.5×4×(3)....	48.00	54.30	48.00	42.48	60.40	36.50	62.80	46.68	44.00	35.00	3.80	7.08	11.80	23.60	41.28	3.80	7.08	11.90	23.60	41.28
10	Energy at 5 cents, 2.5×5×(3)....	60.00	67.70	60.00	53.10	75.50	45.70	78.60	58.35	55.00	43.75	4.75	8.85	14.75	29.50	51.60	4.75	8.85	14.75	29.50	51.60
	Total Annual Operating Cost.																				
11	Total cost per lamp, 1 cent per K. W. hour (4)+(5)+(6)......	27.95	24.74	20.05	18.49	29.07	21.14	59.72	54.38	39.22	32.45	3.72	4.54	7.99	11.84	18.97	4.53	5.35	6.79	12.36	19.48
12	Total cost per lamp, 2 cents per K. W. hour (4)+(5)+(7).......	39.95	38.30	32.05	29.11	44.17	30.30	75.42	66.11	50.02	41.20	4.67	6.31	8.94	17.74	29.29	5.48	7.12	9.74	18.26	29.80
13	Total cost per lamp, 3 cents per K. W. hour (4)+(5)+(8).......	51.95	51.89	44.05	39.73	59.27	39.40	91.12	77.78	61.22	49.95	5.62	8.08	11.89	23.64	39.61	6.43	8.89	12.69	24.16	40.12
14	Total cost per lamp, 4 cents per K. W. hour (4)+(5)+(9)......	63.95	65.49	56.05	50.35	74.37	48.50	106.82	89.39	72.22	58.70	6.57	9.85	14.84	29.74	49.93	7.38	10.66	15.64	30.06	50.44
15	Total cost per lamp, 5 cents per K. W. hour (4)+(5)+(10)......	75.95	78.89	68.05	60.97	89.47	57.70	122.62	101.06	83.22	67.45	7.52	11.62	17.79	35.44	60.25	8.33	12.43	18.59	35.96	60.76

line 31, Table I. No accurate information is available as to the energy charge for the different stations of this State. Tables I and II have been computed with an energy charge of 1 per cent per kilowatt hour. From Tables I and II, Tables III and IV have been computed for two schedules and an energy charge from 1 ct. to 5 cts. per kilowatt hour. There are many factors which affect the cost of energy in different cities. Some of these are the following: (A) Cost of coal delivered at the power plant; (B) available water power or natural gas; (C) cost of the land on which the plant is located and taxes on the same; (D) amount of power developed and the load factor; (E) available market for steam heat; (F) cost of delivering the power to the consumer (under this item will come type of construction, whether pole lines or conduits and taxes or rentals on the same; (G) interest and depreciation on the equipment.

These items vary so widely in different localities that the writers have not attempted to make any definite statements.

Schedules.—There are numerous schedules in use in this country. The "all night and every night," or 4,000 hours per year schedule is used in most cities having a population of 20,000 and over. In smaller cities and suburban districts, various moonlight schedules are in use, the average of these being about 2,500 hours per year. This latter schedule is supposed to approximate moonlight every night in the year. The intensity of illumination at the first or last quarter of the moon is only about one-tenth of that at full moon instead of one-half as might me supposed. Hence the moonlight schedule should be more nearly three-fourths of the all night schedule, instead of from one-half to five-eighths that amount. In small cities, where only a few circuits are necessary, and where a duplicate set of station equipment cannot be afforded, the all night and every night schedule may be approximated by allowing four nights each month near full moon when the lights on certain circuits may be turned off, allowing the necessary repairs to be made. Many other schedules are also in use but are not listed here. Calculations covering the cost of operation of lamps may be made in a manner similar to those for Tables III and IV.

COST TABLES.

To illustrate how the values in Table III are derived the following problem is chosen: Assume a 6.6 amperes, alternating current, enclosed arc lamp to be operating on a 4,000 hour schedule, the energy costs being 3 cts. per kilowatt hour. What will be the cost of operating this lamp for one year?

For 1,000 hours and 1 ct. per kilowatt hour (see Table I):

Annual fixed charges	$3.20
Maintenance per 1,000 hours................	2.30
Energy per 1,000 hours at 1 cent...........	4.25

For 4,000 hours at 3 cts. per kilowatt hour:

Annual fixed charges..................	$ 3.20
Maintenance charges for 4,000 hours=4× 2.30=	9.20
Energy for 4,000 hours at 3 cents=4×3× 4.25=	51.00
Total charge per lamp per year..........	$63.40

A total charge of $70 per lamp per year would represent a fair profit to the central station.

An analysis of the three factors entering into the operating cost of street lamps may be made from Tables II to IV. It is at once apparent that none of the factors may be omitted safely for any of the lamps. The greater the number of hours burning per year, the less the importance of the fixed charge. On the other hand, the shorter the schedule, the more important the fixed charge, and the less the importance of the maintenance and energy charges. Another fact clearly shown is the effect upon annual cost of the length of life of the electrodes per trim. The item of labor and supplies is large for the open arc, and for short burning flame arcs. In fact, the maintenance charge on these lamps is nearly equal to the total operating charge on some of the other lamps. This is not offset by a proportionately greater amount of light. In the tungsten lamps, the energy charge is rather more important than in most of the arc lamps, but the fixed and maintenance charges are low on account of the long life of these lamps. Although the cost of each renewal is rather high, only very few renewals have to be made each year.

In the case of cities where a lighting system using series lights is already installed, the question arises as to the proper rate to be agreed upon in a new ordinance. This is usually computed on the basis of the lights at present in use, or these lights replaced by the same number of lamps of some different type. In fixing the rate for these new lights, Tables III and IV will be of direct application, since the rate will be in proportion to the cost per lamp per year. A comparison of the lamps on the basis of street distribution will show whether the new lamp is equivalent to the old one in illuminating power. It will be seen that with 4 per cent energy, a saving of $4 per lamp per year may be expected by replacing 6.6 amperes alternating current lamps with 4.0 ampere magnetites. At the same time, the street illumination is improved. For 100 lamps, this means a saving of $400 per year

TABLE V.—ANNUAL COST OF LIGHTING ONE MILE OF STREET FOR .02-FT. CANDLE HORIZONTAL ILLUMINATION.

ITEMS.	Illumination in Foot Candles: Spacing 400′ Max.	Spacing 400′ Min.	Spacing 200′ Max.	Spacing 200′ Min.	Spacing 100′ Max.	Spacing 100′ Min.	Annual Cost: 1 Lamp	Per Mile of Street 4000 Hr. Schedule: 14 Lamps 400′	27 Lamps 200′	53 Lamps 100′	1 Lamp	Per Mile of Street 2500 Hr. Schedule: 14 Lamps 400′	27 Lamps 200′	53 Lamps 100′	For .02 ft. Candle Minimum: Distance apart	Lights per pole	Foot Candle Max.	Foot Candle Min.	Cost: 4000 Hr.	Cost: 2500 Hr.
Enclosed D. C. 6.6 ampere..................	.36	.003	.372	.023			79.80	1120	2150	4230	51.89	727	1400	2750	200	1	.372	.023	2150	1400
Enclosed A. C. 7.5 ampere..................	.336	.0016	.34	.012			68.56	960	1820	3635	44.05	617	1190	2330	[illegible]	2	.68	.024	[illegible]	[illegible]
Enclosed A. C. 6.6 ampere..................	.28	.0014	.28	[illegible]			61.68	[illegible]	1660	3270	39.73	556	1083	2100	200	2	.56	[illegible]	3300	[illegible]
Magnetite D. C. 6.6 ampere..................	.80	.009	.85	[illegible]			91.12	1275	2460	4830	59.27	830	1600	3140	400	2	1.8	.018	2550	166
Magnetite D. C. 4.0 ampere..................	.56	.004	.564	.033			59.16	827	1595	3130	39.40	552	1065	2090	200	1	.564	.033	1595	106
Flame D. C. 10.0 ampere inclined..........	3.81	.008	3.82	.07			140.28	2000	3850	7450	91.12	1275	2460	4830	100	2	7.62	.016	[illegible]	[illegible]
Flame D. C. 5.5 ampere long burning......	1.26	.012	1.27	.084			92.20	1290	2490	4880	61.22	857	1650	3240	400	2	2.52	.024	[illegible]	171
Tungsten 200 C. P. center suspension......	.362	.003	.365	.023	.366	.068	37.11	520	1000	1968	23.64	331	638	1250	200	1	.365	.023	[illegible]	63
Tungsten 350 C. P. center suspension......	.37	.002	.37	.025			62.56	875	1690	3311	39.61	[illegible]	1070	2100	[illegible]	1	.37	.025	16	10
Tungsten 32 C. P. side suspension..........	.....	.....	.06	.002	.06	.01	9.48	133	256	503	6.43	90	174	341	100	2	.12	.02	1006	68
Tungsten 60 C. P. side suspension..........	.....	.....	.11	.003	.11	.021	13.44	188	363	713	8.89	126	243	477	100	1	.11	.021	713	47
Tungsten 100 C. P. side suspension.........	.....	.....	.181	.055	.183	.034	19.47	273	525	1032	12.69	178	342	673	100	1	.183	.034	1032	67
Tungsten 200 C. P. side suspension.........	.362	.003	.365	.023	.366	.068	37.71	528	1020	2000	24.16	338	652	128	200	1	.565	.023	1020	65
Tungsten 350 C. P. side suspension.........	.575	.002	.6	.02	....	....	63.15	884	1700	[illegible]	40.12	561	1080	2120	200	1	.6	.02	1700	108

Height 25 ft. for arcs and 350 C. P. tungstens.
Height 20 ft. for all others.

on the 4,000 hour schedule. The 200 c. p. tungsten light would give as g[illegible] as the 6.6 amperes alternating current, on account of its steady light, and at a saving of $3,200 per year for the 100 lights.

It has been shown, from the comparison of Tables III and IV, that the high cost of maintenance for short burning lamps makes their yearly cost very high on any schedule or cost of energy, in comparison with the long burning lamps. This can be compensated for only by the use of fewer lamps. It will be seen, however, that for residence districts, the illumination is so low at the minimum point that none of the lamps can be spaced at a greater distance than 400 ft., or one block. Hence the comparison of arc lamps for this class of service must be made upon this spacing. The illumination on such streets can be improved only by using smaller units spaced closer together. This is the special field for the tungsten lamps. To show this more clearly, the following comparison has been made:

Problem.—To light a shaded residence street one mile long, 400 ft. blocks, energy being assumed at 3 cts. per kilowatt hour and the 4,000 hour schedule. Using only the lower cost lamps, Table V has been computed. It is seen that a good minimum and low maximum illumination can be produced by using tungsten lamps. There will be required 14 [illegible] at 400 ft. or 27 lamps at [illegible] lamps at 100 ft. This is assuming that poles are spaced conveniently for this arrangement. It will be seen that nearly as good illumination is produced by 60 c. p. tungstens, spaced 100 ft. apart, as by any of the arc lights, except the 6.6 amperes magnetite, and at a cost of only $713 per year, compared with $3,220 for the 6.6 alternating current enclosed. Probably the 200 c. p. tungsten would be selected at 200 ft. spacing, costing $1,020, since the street would appear much more brilliantly lighted than with the 60 c. p. Other comparisons will doubtless suggest themselves, depending upon local conditions.

Distributing Machines for Applying Bituminous Material.*

There are two distinct classes of distributors, namely gravity and pressure distributors. A gravity distributor is really nothing more than a large viscosimeter. A pressure distributor differs from the viscosimeter principle in that it has the added feature of pressure which forces the material through the opening. In the bituminous material laboratory a viscosimeter is an instrument for measuring the consistency of a material when fluid. Essentially it consists of a receptacle holding a definite quantity, in which the material can be placed and heated to any desired temperature. The bottom of the receptacle is provided with an orifice for emptying. The measure of the test depends upon the time consumed for a certain quantity of material to run through this outlet. A distributor consists of the tank and the valved distributing pipes which are provided with slots or holes through which the material must pass. In the laboratory the principal variation made in the tests of different materials is that of temperature. In a distributing machine, however, the temperature of the material and the size of opening, and the pressure, if a pressure machine, have to be taken into account. In order to distribute a definite amount of material per square yard the speed at which the machine travels also has to be reckoned with.

In the gravity machine the material ultimately flows through a slot which extends the full length of the distributing device, through holes bored in pipes or through nipples fitted in the pipes at small distances apart. The slot is adjustable so that larger quantities of material can be applied by opening the slot wider. Using certain grades of material and quantities above ½ gal. per sq. yd. the slotted distributing pipe will apply the material in an unbroken sheet, if proper care is taken to prevent the parts from becoming clogged. In the [illegible] pipes provided with holes, since the size of holes cannot be changed, larger quantities of material are supplied either by bringing into use more pipes or by changing the temperature of the material. Such machines are generally provided with two or three such pipes. The flow of the material, however, will consist of a series of small streams which do not unite on the road surface unless a large quantity of material is being used or unless the dis- [illegible] characteristic of some of the foreign types. If the separate streams impinge on a splash board it will serve to unite them to a large degree when applying quantities over ½ gal. [illegible] with nipples at small intervals apart is about the same as in pipes with bored holes. By inserting different sized nipples in the pipe, however, the machine can better be accommodated to applying different grades and quantities of material, than can the machine provided with pipes without the nipples.

Pressure distributors can be divided into two distinct classes: those in which the distributing device is fixed to the tank wagon and those in which it is separate from the tank wagon. These machines which consist of a pressure tank and flexible hose will not be considered in this paper. Pressure may be derived in a variety of ways: by rotary pumps, by duplex pumps, by air or by steam. Power for the pumps is obtained by steam from a steam roller, by gasoline engine or by a chain drive from a sprocket attached to the rear wheel of the tank wagon. The distributing device consists of a horizontal pipe to which are fixed special forms of nozzles spaced 6 ins. and more apart. Some machines have two horizontal pipes with the nozzles of the two pipes staggered. The nozzles are bored so as to give a fan or a cone shaped spray. In some of the machines the gasoline engine and rotary pumps are fixed to the back of the tank wagon together with the distributing pipes. Again all the distributing apparatus may be mounted on a separate truck which trails after the tank wagon. When a steam engine is used to run the pumps, the engine, pump and distributing pipes are generally mounted on a separate truck. In the case of sprocket drive machines the pumps and distributing pipes are fixed to the tank wagon. When the pressure is obtained by the contact of the steam or air with the material in the tank a specially designed tank wagon must be used capable of containing steam or air under pressure, the distributing pipes being attached to the tank. Up to the present time all of these machines, with the exception of one or two types, have dealt with the application of bituminous materials which range from a fluid to a semi-fluid state of consistency at ordinary temperatures.

There is one instance of which the writer is aware that one of the machines applied successfully a semi-solid material. This would not have been possible except that live steam was turned through the distributing pipes, thoroughly warming them before the application of the material.

A very essential part of any distributing machine is the tank. Some of the distributing devices are meant for attachment to any type of tank wagon, while others are fitted with a specially designed tank. It has been the practice in this country to use tanks with a capacity of about 600 gals. This is contrary to the practice in Europe where the largest tanks are about half of this size. The tanks in this country are generally cylindrical. In Europe they are rectangular and shallow. The principal advantage of large tanks is that more material can be handled at one time and in the case of long hauls fewer tanks will be needed Where a distributing machine is used which either trails after the tank or is detachable the changes from one tank to another will not be so frequent, hence not so much time will be lost for this reason as when a smaller sized tank is used. The disadvantages are that unless the wheels are provided with tires at least 6 ins. wide they will rut the surface in certain kinds of work; the temperature of the material is harder to control, frequently involving lost time in raising the material to the required degree of heat. A great many of the tank wagons in use are the old type of watering carts made over. As these are usually not fitted with means of heating the material, the work of the machine is limited to applying those materials which either require very little heat or no heat at all. The time will come when, in the writer's opinion, practically all of the materials used will be of such a consistency that they must be heated and kept hot. Obviously then some means of heating the tank must be provided. This is done now by placing steam coils inside the tank, by coal or wood fire, or by an oil burner under the tank. The direct fire is probably the better if it can be controlled since it is more rapid and avoids the use of a boiler. Although the tanks may be furnished with a heating apparatus it will generally be found more economical to first heat the material to the desired temperature in kettles or tank cars, depending on how it is shipped, and then to transfer it to the distributor tank where it may be kept hot by the heating apparatus of the tank. There are several pumps now on the market which handle the different materials readily so that the operation of transfer does not involve much time. On some of the distributors where a gasoline engine is attached to the tank, the engine may operate the pump so as to fill the tank.

In examining these different types of distributors there are several points which are of interest.

Those distributors which consist of a steam engine, pump and distributing pipes mounted on a truck trailing after the tank wagon require the use of a steam roller or tractor to furnish steam for the pump engine. The roller, tank wagon and distributor truck, together extend along the road for a distance of about 30 ft. If the trucks were not provided with a steering apparatus independent of the tank and roller considerable difficulty would be experienced in keeping the distributor in its proper place. A disadvantage of this type is that it necessitates the use of a roller when in operation, which is an expensive item This machine is also clumsy for operation on city streets, where short stretches one or two blocks in length have to be treated, thus requiring the frequent reversing of the machine

Distributors in which the pressure is obtained by contact of air or steam over the material in the tank, the distributing pipes being fixed to the tank wagon, also require the use of a roller or tractor. The tank in order to contain the pressure is built of heavier material and is hence more expensive than one not so designed, besides being harder on the horses which haul it from the point of supply to where the material is being applied. The expense item is increased by the use of the roller as in the case of the type mentioned above. When certain grades of asphaltic materials are applied by this distributor it is necessary to equip the roller with an air compressor for furnishing the pressure, since live steam in contact with certain grades of asphaltic materials will cause the latter to foam. This type of distributor and the preceding are the only pressure machines at present capable of handling the heavier binders since they are provided with steam for cleaning and heating the distributing pipes when so desired. There is a possibility of stalling the roller or tractor wih this type of machine when distributing heavy materials on account of the inability to furnish the requisite amount of steam to both heat the material and furnish the pressure.

Distributors in which the pressure is obtained by gasoline engine and pump, either fixed to the tank wagon or mounted on a truck trailing behind the wagon, may be drawn by horses. They are compact and suitable for work on city streets. It may be necessary in some localities, however, to employ a licensed engineer to operate the gasoline engine.

Distributors in which the pressure is obtained by means of a pump operated by a sprocket drive are compact and do the work with equally as good results as those machines in which the gasoline engine is used. They require no skilled labor to operate and may be drawn by horses, thus being the cheapest form under certain conditions as far as operating expense is concerned. These machines are limited, however, in the amount of pressure obtained, since the sprocket drive acts as a brake on the wheel. Two horses have drawn a 600 gal. tank wagon with 500 gals. of material up a grade of about 4 per cent and maintained a pressure of 15 lbs. On level ground it requires three horses to pull the machine without unduly tiring the horses when a pressure of 30 lbs. is used. The two types just mentioned have only been used for distributing the lighter grades of bituminous materials.

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*From a paper by Henry B. Drowne, Instructor in Highway Engineering, Columbia [illegible] Presented before Sec. D of the American Association for the Advancement of Science.

At this point it might be well to consider why some machines operate under 15 lbs. pressure while others use a pressure varying from 40 to 90 lbs. The resistance to flow depends upon the consistency of the material and the size of the holes through which it must pass. Sufficient pressure must be obtained to overcome this resistance and to also force out the quantity desired. In distributing the same amounts of material the more viscous the material the more pressure is necessary. The writer believes that the correct amount of pressure to use is that which will insure a uniform distribution of the material in the requisite quantity and that anything over this amount is wasted energy. Unless a machine is provided with interchangeable nozzles of different sizes the pressure must be varied in order to obtain the desired distribution of different grades of material. The relation between the size of the nozzle, the pressure and the amount of material distributed can only be obtained by exhaustive experiments for different grades of material. Pressure will eliminate any variations in the flow which may be occasioned by difference in head as is experienced in some of the gravity machines.

As was mentioned in a previous part of this paper the speed at which the distributor travels has to be taken account of in getting on the desired quantity of material. No matter how nicely the other parts of the machine may be related a variation in the speed will upset all calculation as to quantity applied. With mechanical tractive force this point can well be taken care of after sufficient experiments. With animal tractive force, although it is a little more difficult it is not impossible to obtain uniform speed.

The extent and nature of the work to be done will determine the kind of a distributor to use. For repair work on isolated stretches a small capacity machine similar to some of the European types could be used to advantage. For flush coats on bituminous pavements, which are to be applied simultaneously with the construction of the pavement, a hand drawn gravity distributor will be found economical since only short stretches will be covered at one time. For extensive superficial treatments or for penetration work a distributor of the large type can be used, the particular kind chosen for the work depending upon the character of material to be used, the location of the work and the quantity to be applied.

WATER-WORKS AND SEWERS SECTION

The Statement of a Problem in Sewage Purification Arising From the Neglect and Failure of a Septic Tank.*

A certain suburban town of 3,500 inhabitants, well to do, and demanding civic beauty as well as utility in its public works, is located on three slopes of a circular hillside, draining to a low flat basin which has an outlet of slight grade extending southerly and then westerly to a small branch of the DuPage river, distant about four miles.

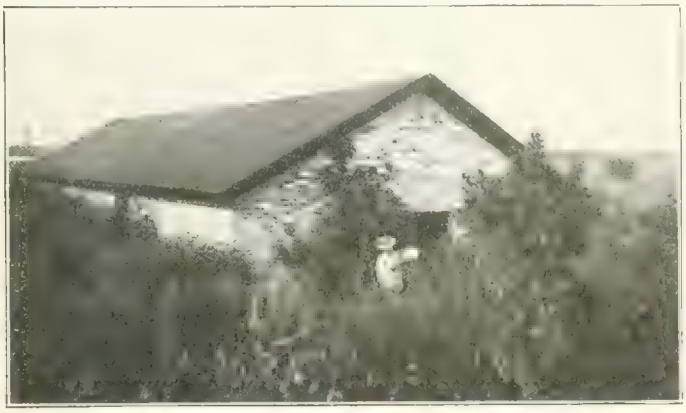

Fig. 1—Exterior View of a Neglected and Inefficient Septic Tank in an Illinois Town.

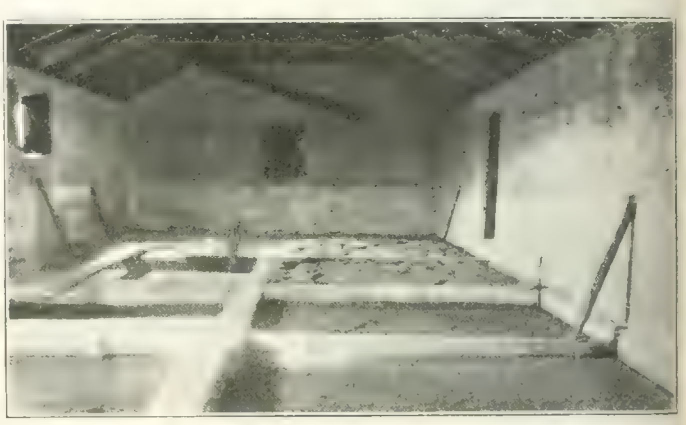

Fig. 2—Interior View of Sewage Tank Shown in Fig. 1.

In 1904 the late Wm. B. Ewing prepared plans for and superintended the construction of a separate system of sewers. The sewage carriers being of vitrified pipes from 8 in. to 15 ins. in diameter, and storm drains of the same construction from 10 ins. to 30 ins. in diameter.

The grades in the collecting systems are comparatively steep and in the mains very flat. The average distance of travel in the pipes is a little less than a mile. As the streets have been improved and the area covered by buildings increased, the main storm drain has become inadequate and will be replaced by a main outlet of concrete 6 ft. in diameter.

The sewage flow passes through a septic tank, constructed under the Cameron patents, which was located at the time of construction over a half mile from residential property The tank is divided into two equal compartments, each being approximately 9 ft. wide by 55 ft. long and 8 ft. deep, and holding 33,000 gals. The daily dry weather flow as measured was 80,000 gals., considerably less than the usual average. When the ground is saturated the flow is about doubled by the addition of seepage.

The effluent from the septic tank discharges into an open ditch at the outlet of the storm drain. The dry weather flow in the storm drain is about equal to the sewage flow and contains considerable laundry waste and at storm times considerable refuse from the streets.

The open ditch extends south, then westerly, passing through golf grounds, country estates and very desirable future residence property. The grade of the ditch is very slight, falling only 2 ft. in the first 4,000 ft., 4 ft. in the next 2,000 ft. and then at a rate of 1 in 2,000 to the outlet.

Considerable nuisance was complained of and spurred by threatened damage suits, the authorities sought relief. The existence of the nuisance was very evident and it was found to have several contributing elements.

First: The ditch was overgrown with grass and weeds and small obstructions lodged at intervals, forming pools of stagnant water.

Second: The tank had not been cleaned since its construction. Half of the compartments at the inlet end was filled with a humus like scum nearly to the bottom; in fact, one side was choked completely. The bottom of the outlet half of one compartment was filled nearly to the baffles or scum boards with heavy black septic sludge, so solid that a scantling ⅞ in. by 3 ins. could not be pressed through by hand to the floor. An attempt to loosen it up and pump it out with a centrifugal pump was a failure. In the other compartment the sludge was not so dense. The heavy scum was removed, placing both compartments in operation. The tank was unloading sludge almost equal in quantity to the undigested solids flowing in.

Third: The laundry waste and the street refuse from the storm lodged in the stagnant pools and decomposed rapidly.

Fourth: Mosquitoes found the pools and adjacent grass and weeds to be a favorable breeding place.

Pending final disposition, the grass and weeds were cut along the ditch and the obstructions to the flow removed. The unusual rainy autumn furnished relief by partial flushing and by increasing the flow in the storm drain diluted the tank effluent. The tank has been given a thorough cleaning which will be repeated at intervals to prevent the sludge unloading. The construction of sludge drying beds has been recommended and also the remodeling of the tank so as to facilitate cleaning and rearrange the scum boards and baffles to give a fresher effluent and prevent the gases from mixing the septic sludge with the effluent or disturbing the settling process.

Ultimately the dry weather flow from the storm drain must be pumped to the septic tank and the effluent from the tank treated by aeration and oxidation in sprinkling filters or on sand filter beds. On account of the encroachment of residential property on the site of the present tank, it seems inadvisable to expend much money for works at this location. Sewage facilities will soon be demanded along the ditch and it is probable that a new site will be selected some two miles farther down. Before the final details have been worked out, it may be found desirable to extend the storm drain or to provide a closed carrier for the dry weather flow beyond the district from which the complaints now come. The situation is unique in that a fresh, strong, domestic sewage must be transformed unobstrusively into a clear, odorless equivalent to fresh spring water without the aid of any diluting medium.

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*Abstract of paper by F. L. Stone before Illinois Society of Engineers and Surveyors, Jan., 1912, with discussion by Langdon Pearse.

Mr. Stone's paper was discussed by Mr. Langdon Pearse, who is in charge of the experimental disposal plant of the Sanitary District of Chicago, and who is associated with Mr. Stone in the study of the problem above stated. The accompanying illustrations of the present conditions at the septic tank were furnished this journal by Mr. Pearse. The discussion follows:

Mr. Stone has given you a very good description of the points which confront us in making our solution of the problem. In order to make the paper complete, I am submitting analytical data which may be of interest to those who have to scrutinize sewage disposal plants, but this data is also of interest because it would indicate that the number of people connected up to the sewers are by no means equal to the population given in the census. We have estimated that the census population, in 1911, was about 3,654 at the time of our tests. Figuring from the amount of the chlorine in the average of the sewage over 24 hours on the Saturday and Sunday during which the calculation was made, on a basis of 10 gms. per capita, about 2,200 people were using the sewers at that time. Further data on this point is desirable in order to see whether the sewage flow was abnormally weak at that particular time. On the basis of the census population the flow would be about 22 gals. per capita per day, and on the basis of the chlorine determination about 37 gals. per capita per day. Owing to the entrance of some drainage water into the storm sewers, as well as laundry waste, the flow through the tanks is not the entire flow from the town.

Observations of flow and collections of samples for chemical analysis were made every half hour. The record of the flows are as follows: Starting on September 9th (Saturday): 7:00 a. m. to 2:30 p. m., 59 gals. per minute; 3:00 p. m. to 10:30 p. m., 69 gals. per minute; 11:00 p. m. to 7:00 a. m., 40 gals. per minute. Average rate, 55 gals. per minute during the 24 hours. The analysis of crude sewage is given in Table I.

TABLE I.—ANALYSIS OF CRUDE SEWAGE.

	Parts Per Million:			
Determination:	7 am to 2:30 pm	3 pm to 10:30 pm	10:30 pm to 7 am	Weighted average 24 hrs
Suspended matter—				
Total	336	180	88	213
Volatile	228	122	50	142
Fixed	108	58	38	71
Oxygen cons'ed	113	72	42	79
Nitrogen as				
Organic nitro'n	18.3	13.1	7.1	13.4
Free ammonia	40.0	27	26	31.5
Nitrites	0.0	0.0	trace	0
Nitrates	0.0	0.0	0.0	0
Chlorine	78	66	77	72
Alkalinity ($CaCO_3$)	470	478	444	467
Flow, gals. per min.	59	69	40	55

The analysis of the effluent of the tank is given in Table II for the two later periods. The sample collected during the period from 7 a. m. to 2:30 p. m. was broken in transit, so that no determination could be made.

TABLE II.—ANALYSIS OF EFFLUENT.

Determination:	3 pm to 10:30 pm.	10:30 pm to 7 am.
Suspended matter:		
Total	166	136
Volatile	104	82
Fixed	62	54
Oxygen consumed	64	60
Nitrogen as		
Organic nitrogen	[illegible]	[illegible]
Free ammonia	[illegible]	[illegible]
Nitrites	0	0
Nitrates	0	0
Chlorine	66	[illegible]
Alkalinity ($CaCO_3$)	512	[illegible]

In order to study the operation of the tank in its condition at the time of the test I have tabulated the data on the suspended matter in order to show the actual condition. As will be seen from Table III, during the period of 3 to 10:30 p. m., there was a reduction in the total suspended matter of 7.8 per cent. From 11 p. m. to 7 a. m. there was an in[illegible] per cent; in other words, the tank was unloading suspended matter. In general, in passing through the tank, the free ammonia increases and the organic nitrogen decreases, as would be expected. There was slight change in the oxygen consumed.

[illegible]

*Increase.

At the time of the report the tank was from ½ to ⅔ full of sludge, some of which was fairly liquid in the last compartment. The material in the first third of the tank was a peaty, fibrous, scum, filling practically the entire depth of the tank, i. e., about 8 ft. deep. From what we could learn the tank had never been wholly cleaned in its history, only a small portion of the sludge having been removed which would flow through the sludge pump on the flat floor. The analysis of the material is as follows: For the peaty scum the specific gravity could not be determined in the usual way, and was omitted. The percentage of moisture was 53.2. On the dry basis the percentage of the constituents was as follows: Volatile matter 41, fixed matter 59, organic nitrogen 3.6, ether soluble matter 1.8.

The material appeared dry, contained some pieces of paper, rags, leaves, matches and was full of worms and maggots.

The liquid sludge from the second and third compartments, nearest the outlet, was very black, with a strong odor. The analysis is as follows: Specific gravity 1.05, moisture, 89.1 per cent. Percentage on dry basis: volatile matter 34, fixed matter 66, organic nitrogen 3.44, ether soluble matter, 3.9.

An analysis of the water from the storm drain was not made at the same time, but at a later date, which proved it to be very weak. The results, however, may be of interest.

	Parts per million.
Suspended matter:	
Total	48
Volatile	22
Fixed	26
Oxygen consumed, total	[illegible]
Organic nitrogen	4.6
Free ammonia	[illegible]
Chlorine	47
Alkalinity	380

The writer presents these data to supplement the paper of Mr. Stone, in order to bring out clearly the fact that a septic tank may become a very undesirable proposition, particularly for such a place as the location under discussion, where the unloading of the partly digested sludge is a very prominent factor in causing a nuisance in the dry brook. The construction of the tank also emphasises, by contrast, the improvement which has been made in designs, so that they can readily be cleansed, in many designs, without drawing down the liquid, appreciably. Figs. 1 and 2 show the conditions at the septic tank, when the present study was begun.

The writer is of the opinion that many other plants in this State will be found to be in a similar condition, if still running, and he believes that it should be a prominent part of the work of the Water Survey or some other State Commission, wherever the power may lie, to make investigations of such plants over a period of several days during 24 hours continuously in order to determine the actual working conditions and the limitations of the designs in current use in this State. Such data, when secured, will probably bring out the fact that many plants are not treating the population ascribed to them. In this particular case, the city engineer estimates that probably over 500 people are not connected to the sewer system. Further analysis and study may show that this estimate is too low. The conclusions reached by Mr. Stone and the writer were based on a study of all the economic factors, the trend of real estate development, as well as the sewage disposal problem itself, and the recommendations were made accordingly.

The Use and Abuse of Sewage Disposal Plants.*

There have been many methods of sewage disposal advanced and experimented upon during the last 20 years. Some have proven fail[illegible] and others have given very good results. All of these, even the failures, where the plants were taken care [illegible] and the defects noted, have helped in the advancement of the methods. However, where well designed plants have been neglected and abused, not only the individual municipality has lost the value, efficiency and protection of the plant, but science has lost the value of principles that might have been proven or new ones discovered. In some cases such plants have been detrimental—discouraging to engineers as to results and causing a popular aversion to any similar plant.

At the present time we have nearly every type and combination in use in this country. Some are giving excellent results, others are not doing what they are capable of, and others are failures and really a nuisance or detriment. We have some very good data upon the results of operation of some of the plants in the Eastern States, but in many cases they are from plants of larger cities where the composition of sewage is materially different, owing to the chemical properties of the water supplies and the large amount of manufacturing wastes, than that we have to meet in this section of the country. Very little is known of the exact results and performances of our plants. Usually if the plant is not causing a nuisance, nothing is reported, but if it is, there is a report and a loud one.

It has been quoted that "Necessity is the mother of invention." The same has been true in the advancement of sewage purification. It has been the increased demand and necessity that has caused cities to spend thousands of dollars and prominent engineers and scientists to give almost their entire time in study and experimenting for the best solution in sewage disposal methods. Few people outside of sanitary engineers, physicians, chemists and bacteriologists, realize the danger of sewage pollution and the real necessity of sewage disposal. The average city or individual considers a sewage disposal plant a novelty or unnecessary expense, and they only build them when a threat of damage suit arises and then only to appease the wrath of the plaintiff, or in the case of some States, meet with the seemingly useless requirements of the State Board of Health. Then any sort of plan or device prepared or proposed by an engineer or concern will do, as long as it is not too expensive. As soon as it is built they will feel satisfied as having done their duty. Efficiency and operation matters little as long as it causes no nuisance or damage. In a few years the city officials that were in office during the construction are out, private citizens have forgotten there is a disposal plant. It is allowed to deteriorate and become useless, a nuisance and a menace. A damage suit springs up—or an epidemic breaks out traceable to the abused plant. Where lies the blame? Public opinion says it was no good in the first place, even if it was of the best known design. Scandal is hinted, councils and engineers accused of graft, the State Board of Health censured and accused of wanting to display their authority, or of neglect of duty. As a consequence, sewage disposal plants in general are given a bad name. Something must be done. If the plant is well designed and has been allowed to depreciate from neglect, or is outgrown and requires extension, or has minor faults in design, it takes a daring, intrepid engineer to face the public and council to recommend any money to be spent to place it on its real working efficiency. They look upon any suggestion of remodeling or recommendation relative to the old plant with distrust and would rather spend several times the amount for any other plan or solution of the problem. The writer had almost this same experience a couple of years ago. The old plant was of faulty design, but had never been given a fair trial of operation. For approximately $5,000 it could have been remodeled and placed in a satisfactory working condition. An alternate proposition costing $16,000 gave a relief from disposal for perhaps six or eight years, but will require some sort of disposal at the end of this time, and then on account of the disadvantageous location, will be more expensive to construct and operate. Public opinion or prejudice prevailed, even though the city was hard pressed to raise the extra money and the former investment was lost.

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*Abstract of paper before the Kansas Engineering Society, Jan. 24, 1912, by Chester A. Smith, Assoc. M. Am. Soc. C. E., Kansas City, Mo.

Engineers are also to blame at times when disposal plants fall from grace. These are sometimes due to faulty design, frequently minor faults that can easily be remodeled at small cost if carefully noted during operations. Some failures are due to too radical departure from established design or principles, and from incorporating new ideas without proper trial or experiment as to their efficiency. One of the most common faults is the over zealousness of the engineer in disquieting or allaying the doubts of the efficiency of the proposed plant. Too much is expected and when it does not prove up to expectations or anything does go wrong, the reaction of faith is greater.

For instance, municipalities are sometimes told, or led to infer, from preliminary descriptions or reports, that the effluent from a septic tank will be odorless, non-putrescible under all circumstances even capable of purifying the sewage to a potable water supply. When actual operation commences and such is not the case, the tank is condemned as being worthless.

Complete purification plants suffer from the same cause. When properly and intelligently operated odors emanate from the decomposition of sewage, no matter what type of plant is employed. These are not particularly offensive and not harmful, but when a plant is located too near a public highway or dwelling, the imagination of some people leads them greatly to exaggerate the offensiveness of the odor and danger to health. Thus the judgment of engineers and municipalities must not let a few hundred dollars saving influence the location of a plant, if there is an alternative.

The foregoing has shown that sewage disposal has been developed and installed through necessity, and though not in every instance, yet one may safely say in the majority of smaller installations, they are practically forced, or installed as a matter of convenience, without a clear understanding of their real value, and after installation, with no ideas of operation. The non-scientific man, the layman, must be taught that the real value of sewage disposal is not all of convenience and abstract duty, but also the more important factor of public health. Also, that after installation, to obtain the full value and usefulness of a plant it must be maintained and operated intelligently, the latter being very important. No matter how well designed or equipped, or to what efficiency the plant is capable of, it must have atention. The value of this must be impressed upon the city officials. This does not mean that on the average type of disposal plant of small towns and cities of this State and surrounding States, they must keep a force of men on constant duty or pay high wages to a chemist or bacteriologist for conducting laboratory tests, but the water works superintendent, city engineer, street commissioner or whoever the city may depend upon, can observe the operations and soon can tell by the character of the effluent if the plant is operating satisfactorily and up to the efficiency required. Simple tests for putrescibility may be made, such as collecting samples in bottles and leaving them stoppered for a week at a temperature from 95° to 100°, and noticing the odor. Determine the daily flow of sewage and adjust the capacity of the tanks for the right period of retention or sedimentation. Sewage of different localities vary in strength according to the relative amounts of house sewage, infiltration, flush water and manufacturing wastes. A little experimenting will soon decide upon the proper period for retention in tanks, the number of doses per day on filter beds, the time of contact of contact beds, to gain the highest efficiency of purification for that particular sewage. Adjustment should be made for the change of temperature in the seasons, bacterial activity being less in the winter and greater in the summer. Care must be taken to see that the inlets of the tanks are not stopped up, overworking one compartment and not enough for another; that the filter beds are getting an even distribution of sewage and do not allow unnecessary dirt or foreign material to collect on the beds and gradually work into them, causing them to clog up and reduce their capacity. Clean both beds and tanks at the proper time when the limit of safety as to capacity and efficiency is reached.

The correct operation of a sewage disposal plant many times is far more important than the operation of a water works or an electric power plant. A water main bursts and for a short time the people suffer the inconvenience of being without water at their right hand. Inconvenience and fear of possibility of fire loss urges prompt action for repairs. A generator burns out or stops at the power house; inconvenience and small financial loss causes immediate action to resume operation. A sewage disposal plant becomes clogged or is allowed gradually to become worthless—no one cares much. A water supply is polluted, an epidemic occurs, then how much loss can be estimated from loss of time, sickness and perhaps a few deaths?

In conclusion, it is assumed that this Society of Engineers understands and realizes the necessity and use of sewage disposal plants; also those who have had any experience in this line can realize the abuse the plants are submitted to. It is for those who are in this particular branch of sanitary engineering to consider well all local features and conditions to be met and all details well arranged in design. It is the duty of this body of engineers to put our shoulders together and co-operate with the State Board of Health to impress the value and necessity of disposal plants and especially their maintenance and operation upon the cities and towns where they are or should be installed. Stand behind the State Board of Health in their decisions and work to give them increased censorial powers in regard to all sanitary conditions. Give them your aid; work to give them ample means to carry on such experiments and investigations as may be necessary; place them above the reach of politics as an unbiased, non-influenced guardian of health. Differ in opinion with them, if you will, but they will stand ready to listen to argument and readily acknowledge their error if there is one. With your help and that of the State Board of Health, sewage disposal plants will be understood and properly taken care of; the profession and science will be advanced and the State and Municipality will be greatly benefited.

DRAINAGE AND IRRIGATION SECTION

Data on Pumping Machinery for Land Drainage with Examples of Pumping Plants.

The reclamation by pumping of river bottom lands subject to overflow comprises three main classes of constructions: (1) A levee inclosing the land and shutting out the flood waters of the stream; (2) a ditch system to collect the interior drainage and to convey it to the pumping plant; (3) a pumping plant to lift the drainage water and throw it beyond the levee into the stream. Numerous tracts in units of from 5,000 to 20,000 acres have been thus reclaimed along the Illinois and Mississippi rivers in Illinois, Iowa and Missouri. Until recently, however, inadequate study has been given, generally speaking, to the problem of pumping plant design and almost no adequate records have been kept of plant performance. These facts lend especial interest to the recent collection and publication* of data by the drainage engineers of the Government service, and we present important parts of these data here:

PUMPING PERIODS AND RUN-OFF

Before discussing in detail the conditions determining the size needed for a pumping plant it will be illuminating to describe the general method of operation of such a plant in the latitude of Illinois. In the late summer and fall, since the precipitation is slight and is more than balanced by evaporation, the pumps are not run. During the winter storms are more frequent and evaporation is small, so that gradually the ground becomes completely saturated and the ditches full. Some districts pump occasionally throughout the whole winter; others start the pumps at some date in the spring and operate them continuously night and day for several days to remove the accumulation of water stored up during the winter months. Gradually the water level in the ditches is lowered, and when the desired minimum is reached the machinery is stopped during the night. The water will rise in the ditches perhaps 2 or 3 ft. during the night. When the pumps start up in the morning the water level at the pumping plant quickly drops a foot or more and then less slowly for the rest of the day. At points some distance away the effect of starting the pump is less quickly seen in the morning, but the lowering of the water is gradual throughout the day. After a few days of such operation the supply of water diminishes and the pumps are not run the whole day.

Later, since it is troublesome to start up a big plant for only a few hours of operation, the speed of the engine and pump is reduced to diminish its discharge or, if there is more than one pump in the plant, only one may be run. At last, days are skipped and pumping ceases entirely. After every rain of any importance, the pumps are started and a similar cycle of operations transpires, extending over a longer or shorter period, according to the amount of water to be removed. In some districts pumping for the season ends in June, and drainage is by gravity for the remainder of the summer. In others no gravity drainage is available, and the pumps must be run later in the season. Thus it is clear that, though the pumps must constantly be in readiness for use, their operation is very intermittent. The total time of running in a whole year never exceeds 60 to 90 days of 24 hours each. In some seasons it is not more than 15 to 20 such days.

Size of Plant.—The size of pumping plant required for any particular district depends upon a variety of conditions, among which are the size and slope of the drainage district and of any other area from which drainage water is received; the amount of storage capacity available in ditches and reservoirs; the system of interior drains used and the method of construction adopted for the levee; the nature of the soil and subsoil; the method of operation of the pumping plant; the kind of crops raised and the degree of drainage required; and the amount and distribution of the rainfall throughout the year.

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*Bulletin No. 243, Office of Experiment Stations, U. S. Department of Agriculture, prepared by S. M. Woodward, Drainage Engineer.

In the vicinity of Illinois the weight to be given to some of these factors is very small, and in the present state of our knowledge no definite allowance can be made for them. Yet, notwithstanding our ignorance concerning some of them, it may be profitable to discuss briefly the nature of the effect of each. This is a field in which much careful study is still needed and must be carried out to secure the complete knowledge necessary for the most satisfactory design and management of the pumping machinery of drainage districts.

Along the Illinois and upper Mississippi rivers the majority of pumping plants already installed have been planned to have a maximum pumping capacity sufficient to remove in 24 hours ¼ in. in depth of water over the entire district. This is equivalent to 6.74 cu. ft. per second per square mile of drainage area, or 0.0105 cu. ft. per second per acre.

It is doubtful whether any change should be made in the ¼ in. coefficient solely on account of change in the size of the district; however, where some portions of the district are materially higher than others, the coefficient might be increased to prevent danger to the lower portions from the run-off from the higher areas. Where drainage from higher land flows into the district a larger run-off coefficient must be used for the higher area. The proper amount depends upon the nature of the country. For rolling pasture land f[illegible] from undergrowth, or for cultivated [illegible] [illegible] an increase of [illegible] per cent in the coefficient, or a total of ⅜ in., for such upland areas is none too great. Where feasible, the drainage from such higher areas should be diverted around the district instead of being brought to the pumping plant.

With a considerable reservoir storage area within the district, the size of the pumping plant may be materially reduced. If the storage area equals 5 per cent of the total area, a 2-in. rainfall, all running into the reservoir, would raise its level only 40 ins. Therefore, if a rise of 3 ft. in the reservoir can be permitted it would seem that the capacity of the pumping plant could certainly be reduced by one-third and possibly to one-half of what would otherwise be required.

If tile drainage at a depth of 3 ft. or more is extensively used, the demand upon the pumping plant will be somewhat reduced, for the tiled land will act like a reservoir in storing a large amount of water and will deliver it only slowly to the ditches. On the other hand, an extensive system of shallow open field ditches will deliver the rainfall rapidly and may thus damage any especially low areas unless the capacity of the pumping plant is increased. If the levees have been properly constructed, as previously described, the amount of seepage through them can never be sufficient to affect the pumping plant. Cases have been known, however, of levees so poorly built that the quantity of water coming through them was sufficient not only to endanger the stability and safety of the levees themselves, but also to increase appreciably the amount of water to be pumped.

If the soil is very stiff and tenacious the surface run-off after a heavy summer shower will be greater than from a porous open soil. During a time of flood in the river, a sandy subsoil may develop springs and boils, not only in the bottoms of the ditches, but sometimes even in the fields. The quantity of water that may be received in this way is very uncertain but it is not probable that it is ofen sufficient in amount to affect the pumping plant.

A pumping plant that is designed to operate night and day may, of course, be smaller than one intended to operate only in the daytime. Practically all plants are expected to run nights occasionally, when needed. Pumping plants are operated chiefly during the months from March to June. One of the times of longest continuous operation during the whole year is always at the beginning of pumping in the spring, because if there has been no pumping during the fall and winter the rains and snows w[illegible] saturated the [illegible] danger of [illegible] damage to crops, still it is best to pump [illegible] during the winter so as to maintain the ground water constantly at a low level, and thus secure the great advantage of early drying of the soil in the spring and the opportunity for early cultiva- [illegible] normal ground-water level is kept below the surface, the less will be the damaging effect of a severe storm.

It should be clear from the foregoing discussion that a district which gives especial care and attention to its pumping, running throughout the winter as needed and frequently during the growing season, so as to maintain a minimum ground-water level while there is any danger from the occurrence of heavy and sudden rains, will require a smaller pumping plant than would otherwise be needed.

From a surface covered with a growing hay or grain crop the run-off is less rapid than from land in corn. For corn and hay the ground water must be kept at a lower level than is necessary for grain. Corn is considered the most profitable crop in the region under consideration, and where the soil can be kept sufficiently dry it is raised as frequently as is consistent with a proper crop rotation necessary for maintaining the fertility of the soil. Much land can be observed, however, which is not sufficiently drained for the most successful raising of corn and which therefore is devoted to wheat and oats instead.

Rainfall and Pumping Records. — The amount and distribution of the rainfall are the chief factors determining the size of pumping plant required in a given location, and we shall proceed to a detailed discussion of all the evidence that it has been possible to gather bearing upon this point. From a consideration of all the data, the conclusion seems justified that in the present state of our knowledge the run-off coefficient of ¼ in. in depth over the whole drainage district in 24 hours is the correct [illegible] Illinois and upper Mississippi rivers. Direct observations on numerous plants in actual operation for a series of years will be needed to settle the question finally.

In the region referred to, though some pumping on an inadequate scale has been carried on for more than 10 years, all the older plants until recently had troubles with their ditches and levees which prevented their pumping experience from furnishing conclusive data, and from no plant has it been possible to obtain definite records going back more than two years. Now, though there are nearly a dozen large plants in operating condition, it is still surprising to learn that some of these neglect to keep even the simplest, most fundamental records, such as would determine whether the plant is operating economically or wastefully—records which would be of great use to others as well as to the district immediately concerned.

As indirect evidence it may be stated that for many years in central Illinois the ¼ in. coefficient has been used in designing ditches for the drainage by gravity of flat lands and has been found adequate and satisfactory. For a much longer time in Holland and in the fens of England the coefficient of ¼ in. or a little more has been the basis used in the designing of pumping plants. Although their total annual rainfall is about the same as in Illinois, their climate is otherwise quite different. In England and Holland there are many more rainy days, so that the rainfall is much more evenly distributed than in this country. In these countries, too, there is much less sunshine and hot weather in summer and therefore less rapid evaporation. On the other hand, they do not have such violent and excessive rains falling during brief periods as we have.

From two districts on the Illinois River valuable data were obtained. During the history of its pumping, extending over nearly 20 years, the Pekin-La Marsh levee and drainage district, near Pekin, has used in succession four different sources of power, including two sizes of steam engine, a producer gas plant, and electricity. It has also used at least four different sizes of centrifugal pump. In March, 1908, the producer gas pumping plant was tested by men connected with the faculty of the University of Illinois and the 26-in. centrifugal pump was found to be discharging 28.7 cu. ft. per second. Although the nominal rated capacity of the pump is about 37 cu. ft. per second, from all that can be learned it seems probable that the average discharge of the pump, when run by the producer gas engine, could not have exceeded 30 cu. ft. per second. Since the drainage area of the district is about 3,000 acres, this is equivalent to 1 cu. ft. per second for 100 acres of land, or a capacity sufficient to remove 0.24-in. depth in 24 hours. In 1909 this plant started March 10 and operated intermittently, as required, until July 25, during which time it kept the district satisfactorily dry. A rough daily memorandum kept by the engineer in charge shows a total operation during this period of 1,098 hours equivalent to 45.7 24-hour days. The total depth of water removed was 45.7 times 0.24, equal to 11 ins.

During this period the most severe test of the capacity of the plant was four days' steady operation, July 7-10, followed by seven hours on July 11, or a continuous run of 103 hours. This was necessitated by a heavy rain on July 5, 6 and 7, the representative character of which will be discussed later. In October the district began pumping by electricity, and, to June 20, 1910, had run a total of 1,365 hours, equivalent to 56.9 days. It is quite certain that, as operated by the present electric motor, the pump has a higher speed and a greater discharge than when operated by the producer gas engine. But in default of precise information, if we assume the same discharge as be-

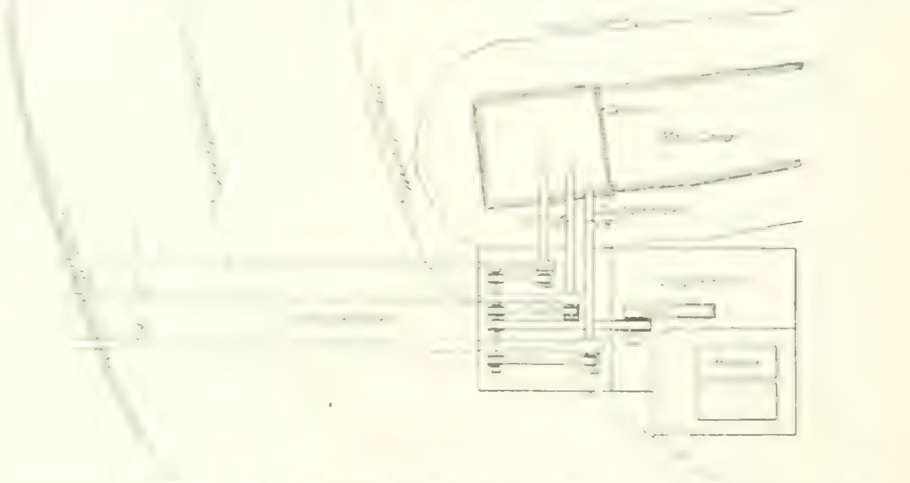

Fig. —Sketch Plan of the Coal Creek Drainage and Levee District Pumping Plant.

fore, the total water removed between Oct. 15, 1909, and June 20, 1910, was equivalent to 13.6 ins. in depth over the whole district. During all this period the electric pump was never run more than, and very seldom as much as, 12 hours in one day. As will be shown later, the year 1909, although not an extreme one, was rather wetter than the average, while 1910 has been remarkably dry. The Pekin-La Marsh district is generally considered to be the best and most completely drained district on the Illinois River, and is in an entirely satisfactory condition so far as drainage is concerned.

The Coal Creek levee and drainage district, near Beardstown, Ill., has been practicing pumping for a number of years, though not with entire success previous to 1909. The equipment includes one 24-in. centrifugal pump with a nominal rated capacity of 33.5 cu. ft. per second and two 15-in. pumps rated at 15.5 cu. ft. per second each, or a total capacity of 64.5 cu. ft. per second. The area of the district is 6,700 acres, hence the nominal capacity of the pumping plant equals $\frac{64.5}{6700 \times 0.042} =$ 0.23 in. in depth in 24 hours. The three pumps are run by one Corliss condensing engine which has been in operation about 10 years.

Since July, 1909, accurate and detailed daily records have been kept of the operation of this plant by its owners. Between July 1, 1909, and July 1, 1910, the only times when it was necessary to run all three pumps continuously night and day were once in July, 1909, and twice in May, 1910. The rainfall is measured at the pumping plant by means of a Weather Bureau pattern rain gage. On July 7, 8 and 9, 1909, the total rainfall was 2.8 ins., causing all the pumps to be run continuously for 57 hours, after which one of the smaller pumps was stopped and the other two were operated during the third night. No more night running was required by this storm.

May, 1910, was a particularly wet month at this station, the total precipitation having been recorded as 6.8 ins., though there were no single remarkably heavy showers. On the first two days of the month 1.4 ins. fell; on the 7th, 1.4 ins.; on the 11th, 1.2 ins.; from the 15th to the 17th, 0.8 in. To meet this steady wet period all three pumps were run continuously for 72 hours from the 13th to the 15th and again for 42 hours on the 18th and 19th. The large pump was run every day during the month and during over two-thirds of the nights. At least one of the small pumps was run nearly every day and nearly as many nights as the large pump. The total operation of all three pumps, taking due account of the different sizes, was equivalent to operating all the pumps together for about 70 per cent of the time during the whole month. The elastic arrangement of the pumps in this station illustrates very well the advantage of having separate units in such a pumping station.

The pumps are frequetly run at a decreased speed when the quantity of water to be lifted diminishes. Taking this into consideration, as well as the fact that as practically operated all such pumps when actually measured almost invariably show a capacity considerably below their nominal capacity, it seems probable that the pumps do not exceed 80 per cent of their theoretical discharge. With this conclusion the owners of the Coal Creek plant agree. Using, therefore, 12.5 cu. ft. per second as the discharge of each of the smaller pumps and 25 cu. ft. per second as the discharge of the large pump, the total amount of water removed from the district, according to the records kept at the plant, between July 1, 1909, and July 1, 1910, was equivalent to 24.3 ins. in depth over the whole district, though in the first part of the season of 1909 some land was under water and much was too wet for satisfactory cultivation, this stored-up excess of water was removed and the whole district was maintained in proper condition. On account of the wet condition at the beginning of the season, the amount of water removed was greater than would have been necessary if the pumps had previously been operated satisfactorily. There are no data for determining how much the total depth removed (24 ins.) would have been reduced by normal operating conditions. The greatest amount removed during any one month of the year was 3.7 ins. in May, 1910, when the rainfall was 6.8 ins. The owners of the plant are convinced that its capacity is ample for the drainage of the district.

It remains to show how nearly representative were the rainfall conditions during 1909 and 1910, for which the pumping data obtained at the Pekin-La Marsh and Coal Creek pumping plants have been discussed above. A United States Weather Bureau station is located at Peoria, on the Illinois River. From the record for the last 10 years of the annual rainfall for each month in which the precipitation exceeded 3 inches, it is found that the greatest annual rainfall was 49 ins. in 1902. The only other year in which 40 ins. was exceeded was 1909. The only months in which the precipitation exceeded 6 ins. were: June, July, August and September, 1902; August, 1903; September, 1904; August, 1907; May, 1908; and April, 1909. From this it is evident that a pumping plant to be satisfactory must be able to handle a monthly rainfall of 6 or 7 ins., and that this will be sufficient.

From the daily rainfall records a list was made of all the storms occurring at Peoria between January 1, 1902, and July 1, 1910, lasting one or more days, during which the total rainfall for the whole storm was 2 ins. or more, but leaving out of the calculation all days on which the precipitation was less than ¼ in. There were 28 such storms, in ten of which the total precipitation exceeded 3 ins., and in four of the latter the precipitation exceeded 4 ins. Hence a pumping plant should be able to handle a downfall in one storm of at least 4 ins. One of the above-mentioned four storms was long drawn out, covering six days in January, 1907. Probably much of the precipitation was in the form of snow, and it does not require further consideration as affecting drainage.

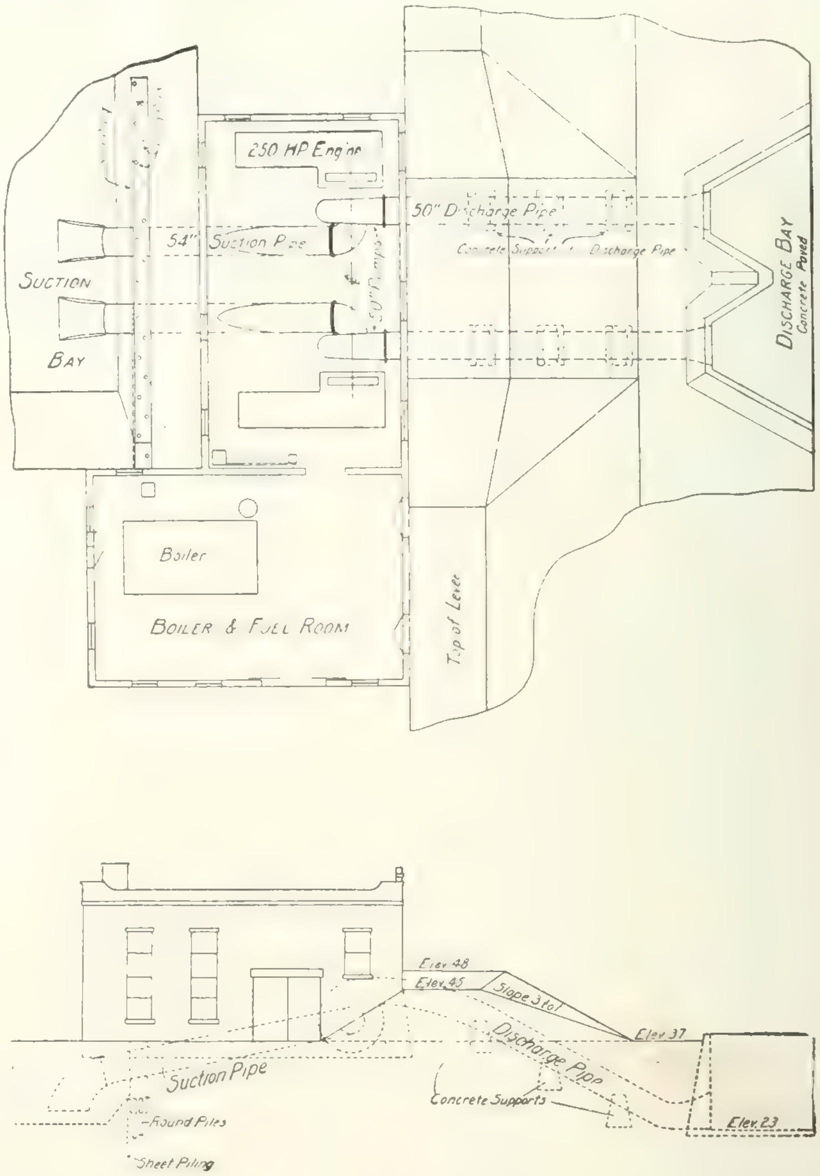

Fig. 2—Sketch Plan and Section of the Pekin-La Marsh Levee and Drainage District Pumping Plant.

The Pekin-La Marsh pumping plant, located about 10 miles from the Peoria Weather Bureau station, handled satisfactorily the storm of July, 1909. As this rain was not a sudden shower but a slow, steady rain extending over much of the state, we seem justified in assuming that the Peoria record represents the actual rain at Pekin. Just eleven days before this rain another rainfall of over 1 in. had occurred. It seems fair to conclude that the Pekin plant is able to take care of a 4-in. storm. The only other storm which was plainly and definitely more dangerous than the one just discussed is the one of July, 1902. Preceding the latter by just a week there had been a rain of 2 ins. No other equally severe storm has occurred in 10 years, and it does not seem justifiable to make special provision for such a rare occurrence. On several occasions the rainfall on a single day has exceeded the greatest given above, 2.5 ins., but on the whole these other storms have not been so violent as the ones already described. On no occasion has a single day's rainfall exceeded 3 ins.

To sum up: Since the Pekin plant handled successfully a storm of over 4 ins. in July, 1909; also a rainfall for the month of April, 1909, of 7.2 ins.; and since the Coal Creek plant handled satisfactorily a rainfall of 6.1 ins. for July, 1909, and 6.8 ins. for May, 1910, all the experience so far available seems to show that for this region a pumping capacity sufficient to remove ¼ in. in depth in 24 hours is sufficient.

TYPES OF PUMPING MACHINERY

Since pumps are to be depended upon to remove promptly surplus water, whose presence may endanger a whole crop, it is of the utmost importance that the pumping plant be able to work with certainty and reliability whenever needed.

The annual cost of a pumping plant is made up of three main items: (1) The charge for interest on the original cost of the plant and for depreciation; (2) the cost of fuel; and (3) the cost of labor. Certain general principles concerning the mutual relations of these different items must be understood before taking up the comparison of the different types of machinery available for pumping.

The interest upon the original cost of the plant goes on every year whether the plant is operated much or little. Depreciation also takes place whether the plant is operated or not, and for such installations as are under discussion it probably does not depend much upon the length of time the plants are in operation each year. What amount to allow for depreciation is a difficult matter to decide. The length of time before such machinery will wear out depends chiefly upon the original quality of the installation and the care that is taken of it afterwards. We can not, in general, assume that such machinery will last more than 20 or 25 years. Much of it will be discarded sooner, either because it is outgrown or worn out. With proper care it is probable that such machinery may be made to endure twice as long as it will last if it is carelessly treated. It is customary to include with depreciation an item for repairs. This should be very small during the first few years of the life of a well-constructed plant, but will grow larger as the plant becomes older.

The cost of fuel per year depends to a considerable extent upon the kind of machinery used and also upon the amount of time the plant is run. Whenever a steam plant starts there is a certain consumption of fuel in preparation before starting, and likewise a similar loss after stopping. Hence, since the operation of a pumping plant is very intermittent, the fuel consumption is not strictly proportionate to the time run. The amount of fuel used also depends largely upon the skill of the fireman. An unskillful man may easily use 25 per cent more fuel than is really necessary. Different types of equipment require different amounts of fuel to produce the same result; that is, some types are more economical of fuel than others. The cost of the labor at the pumping plant depends upon the class employed and the length of time it is required.

In general, in a given location, that type of pumping plant will be best which requires the least annual cost, including all the elements enumerated above. To a certain extent, variations in these different elements tend to offset each other. For example, a highly efficient plant from the point of view of fuel economy is complicated and expensive, and hence will have a relatively high charge for interest and depreciation. Likewise, it will require skillful and high-priced attendance, but may, on the other hand, in a large plant, require fewer men. If cheap labor is employed, the coal and repair bills will be increased and the deterioration of the plant will be more rapid. The advantage of fuel economy is relatively more important in locations where fuel is especially high and in a large plant than in a small one, but in any plant it diminishes in importance as the time of running per year decreases or becomes much interrupted.

The above principles have long been regarded as fundamental in the science of mechanical engineering design. Applying them to drainage pumping, since the work will usually be confined to a small portion of the year, since the labor available will be cheap and unskilled, and the other conditions not favorable for careful preservative care of the plant, the fundamental requirements in a drainage pumping plant are reliability and simplicity.

[illegible] the kind most often used for drainage. It is [illegible] in all sizes. Its disadvantages are that it must be primed in starting, it can operate satisfactorily under a particular set of conditions only within a narrow range of speed, and its efficiency when operating under practical conditions is not high. In order to work economically, the speed must be varied as the head under which it operates changes. The size of a centrifugal pump is usually given as the diameter of the suction or discharge opening—that is, a 24-in. pump is one having suction and discharge pipes 24 ins. in diameter. Most large pumps are made with a horizontal shaft and are called horizontal pumps. When larger than 24 ins., they frequently have a double suction—that is, water entering at the center on both sides of the impeller. This has the advantage of balancing the side thrust on the impeller and shaft. Without this arrangement some automatic balancing device must be used in connection with the impeller and a collar thrust bearing on the shaft.

The capacity of a pump is usually reckoned by assuming the water to have a velocity of 10 ft. a second through the suction and discharge openings of the pump. While it is possible to obtain this discharge by using sufficient power and speed, as the pumps are usually operated in practice the discharge is considerably—often 20 per cent—less than the theoretical rating. In this respect a centrifugal pump differs greatly from engines and boilers. An engine or boiler from any reputable maker can, in an emergency, be made to do 25 per cent more than its rated output—that is, it is said to have an overload capacity of 25 per cent. On the contrary, the rated capacity of a centrifugal pump is just about the limit to which it can be pushed and it has no overload capacity, but usually operates at a lower figure.

Rotary displacement pumps and plunger pumps have been occasionally used for pumping drainage water, but are well adapted to this use. They may have a very high mechanical efficiency, but their cost more than offsets this advantage. Scoop wheels have been extensively used in England and Holland, and to some extent in this country in Louisiana. They may be made to have a higher efficiency than centrifugal pumps, especially for very low lifts, but they are not so well adapted for a location where the head is subject to wide fluctuations.

Sources of Power.—Steam is the source of power best for general use. In Illinois soft coal is abundant and cheap for fuel, though in some places crude oil or natural gas may be found more available. A suction gas producer with a gas engine has been tried, but such a plant requires hard coal or coke for fuel, which greatly increases the expense. Furthermore, such a type of plant is not adapted to intermittent working. Electricity is by far the most convenient source of power where it is available, but in general it will be considerably more expensive than using coal to produce steam. Its convenience may perhaps offset its cost, especially for a small plant.

Return tubular, marine, locomotive type, and water-tube boilers have all been used. For a small plant the locomotive type or the simple return tubular boiler is simplest and cheapest. For plants of over 200 h. p. water-tube boilers have decided advantages, though they may cost somewhat more than the simpler fire-tube boilers. The boilers of all large plants should be kept constantly insured by some reliable boiler-insurance company.

Kind of Engine.—Either vertical or horizontal engines may be used. When possible, it is best to have the pump directly connected to the engine. This is usually not feasible for a pump smaller than the 24-in. size, because such a pump would require too high a speed of the engine. In this case the pump must be driven by a belt or a rope. The engine should be condensing and, if large, should be compound. A high-speed automatic engine is more difficult to operate with inexperienced labor than a slow-speed engine, but it has the advantage of being smaller and lighter for the same power than the slow-speed engine of the Corliss or some similar type. In general, however, the high-speed engine is not as economical of steam as the slow-speed type. The engine should be provided with a governor able to keep it from racing if the entire load is suddenly removed. The engine should be adjustable for a considerable range of speed, should be able to carry a considerable overload, and should work as economically as possible through a wide range of load. As will be explained more fully below, it is especially desirable that an engine for this work should be capable of very flexible operation.

Auxiliaries.—The plant will require the usual auxiliaries. A surface condenser will furnish pure feed water, but some form of jet condenser is simpler and cheaper. For priming the pumps a steam ejector is the simplest arrangement, though an air pump may be used. Separators and traps, filters, and heaters should be used as needed for safe and economical operation. Piping and boilers should be well covered to reduce as much as possible the amount of radiation and condensation of steam. In large plants boilers, engines, and pumps should all be divided into two or more equal-sized units, so arranged that they can, when necessary, be operated independently, and the auxiliaries should be installed in duplicate.

CALCULATION OF THE SIZE OF PUMPING PLANT

To illustrate the method of determining the size of machinery to be installed in a pumping plant, the calculation will be made for a district of 10,000 acres. To remove a depth of water of ¼ in. over the whole district in 24 hours will require a capacity of 105 cu. ft. per second. For such a district it will be best to use two separate pumps, which should be identical in size. A 30-in. pump will be rated at about 49 cu. ft. per second; a 32-in. pump at about 56 cu. ft. per second; and a 36-in. pump at about 71 cu. ft. per second. In this case it would be best to use two 32-in. pumps, which would seem to have a slight margin of excess capacity. However, since pumps of this style so frequently fail to have the capacity assumed, they should be taken only under the guaranty of the manufacturer, and subject to a thorough test after they are installed. The pumps will need to be run at about 200 revolutions per minute and hence may be directly connected to two separate engines.

Assume that the difference between the river-surface level outside the district and the desired ground-water level within the district will vary from a possible maximum of 20 ft. during spring floods to nothing in the late summer. The machinery must have sufficient power to pump against the highest head, although much of the time it will run against a lower head. This advantage so far as the efficiency of the machinery is concerned, because every engine runs most efficiently at about its rated capacity, and if it is either overloaded or underloaded its efficiency is reduced. The actual head against which the pumps must force the water, sometimes called the dynamic head or the hydraulic head, is always greater than the difference in water level as described above, which is called the static head. This increase is due to the friction of the water in the suction and discharge pipes and the so-called velocity head—that is, the head necessary to start the water into motion in the pipes. The friction in pipes carrying water at a high velocity is greatly affected by the kind of pipe used and the smoothness of the interior surface, and hence can not be predicted with certainty. For a velocity of 8 ft. a second, the friction in 200 ft. of 48-in. pipe would probably amount to 2 ft. of head, and in a 24-in. pipe to at least 6 ft. of head. A bend of 90° adds probably a foot to the friction head. The velocity head amounts to about 1 ft., and if the water passes around a sharp edge in entering the suction pipe there is probably a loss of another foot of head.

To be safe, then, we should assume the addition of at least 6 ft. to the static head to give the head on the pump. Another small amount might be added to the lift, on account of the lowering of the water level in the supply ditch when the pumps are being operated. But it is probably better to ignore this last addition and assume that during the short time when the river is at maximum flood stage the water level in the district will not be pumped quite to its normal level rather than to provide extra capacity for the very short and infrequent periods of maximum river floods.

With a total head of 26 ft. the hydraulic horsepower is calculated by multiplying together the lift—26 ft.—the number of cubic feet of water per second—105—the weight of 1 cu. ft. of water—62.5 lbs.—and dividing by 550. In this case the result is 310. The power required of the engine will be greater than this amount, depending upon the efficiency of the pumps, which for these conditions should be at least 60 or 70 per cent. For this case probably manufacturers would be willing to guarantee an efficiency under test of 70 per cent. Accordingly the maximum brake horsepower required of the engines would be 440. Engines suitable for this work should be able to carry continuously an overload of 25 per cent without an increase of speed and without a great loss in steam economy; hence, if 440 h. p. puts this overload on the engines, their normal rating would be 350 brake horsepower. They should develop this power at the speed at which the pump has the best efficiency for a static lift of 15 ft. or a dynamic lift of 21 ft. When the pumps operate at the maximum lift, their speed should be increased in order to maintain the discharge and the efficiency of the pumps, and the engines should be adjustable and so constructed as to run safely at the higher speed. Since increasing the speed of itself increases the power developed by the engines, this gives a margin of safety in the capacity of the engines. If two separate engines and pumps are used, each engine should have a brake horsepower of 175. Its indicated horsepower will be from 10 to 20 per cent greater. An engine should run fairly economically down to three-fourths of its rating. These units, then, would be economical of fuel down to a static lift of 10 ft. But when the lift falls below 5 or 6 ft., the steam used by the engines will be much increased in proportion to the useful work actually performed in lifting the water. This disadvantage is not very important, however, because the amount of water to be lifted under such conditions is small.

The boiler capacity required would depend upon the particular engines used, upon the number and kind of auxiliaries, and upon the quality of coal to be used. For a plant of this kind, however, the nominal boiler horsepower should be at least as large as the rated engine horsepower. The boilers must have a capacity amply sufficient to supply safely all the steam needed by the engines when operating at their maximum overload. This may be secured by additional boilers or by forcing the boilers when necessary through appliances for producing an artificial draft. In general, large engines of the best types require less steam per horsepower than smaller ones. In a very large plant the nominal boiler horsepower may be less than the engine horsepower.

In designing such a plant all the elements must be carefully calculated to secure in each the necessary maximum capacity. It is especially needful that the auxiliaries be large enough. A deficiency in some single comparatively slight but essential element may hinder the operation of the whole plant. Durability and reliability in workmanship and materials may be secured to some extent by specifying that the boiler shall be capable of operating at a higher pressure than its regular working pressure, and that the engines shall be able to run with higher steam pressures and at higher speeds than the normal.

ARRANGEMENT OF SUCTION AND DISCHARGE PIPING.

Proper arrangement of the suction and discharge pipes is very important for the economical and reliable operation of the plant. A sketch plan of the Coal Creek drainage and levee district pumping plant, showing the general arrangement of the pumps and pipes with regard to the main ditch and the levee, is given as Fig. 1. The pipes should be as direct and straight as possible. All bends should be of long radius and the interior of the pipe should be as smooth as practicable in order that the lost work due to friction may be small. Since the head consumed in overcoming friction varies as the square of the velocity, the larger the piping the less the friction loss. Where the piping is long this is the more important. The piping should be made large enough to reduce the velocity in the pipe down to as near 5 ft. per second as practicable. All changes in size and direction of the piping should be gradual, and at no point should the water be permitted to flow around a sharp corner.

The suction pit should be carried to a greater depth than the main canal, even though this results in some danger of excessive seepage and of the opening of springs or boils through the lower layers of soil from the river when the suction pit is close to the river bank. This has been a frequent source of difficulty in pumping plants, and on this account the pipes to and from the pumps should be made longer than would otherwise be necessary. In the smaller plants the lower part of the suction pipe is usually vertical or nearly vertical, and has above the vertical portion a right-angle turn connecting to a horizontal piece of pipe leading to the pump. Where this arrangement is used the edge of the lower end of the pipe is made in a horizontal plane. This end should also be expanded so as to provide for a gradual contraction of the stream of entering water. The curvature of the expanded end may be relatively abrupt, but should be smooth so that the water may not flow swiftly past any sharp edge or angle. In general, in contracting a stream there is no loss of head, even if the reductions in cross section are comparatively sudden, so long as the surfaces are smooth and curved without any sharp angles. On the other hand, in expanding the cross section of a stream so as to reduce its velocity, the changes must be very gradual or there will be loss of energy due to the impact of the rapidly moving stream striking against the more slowly moving mass of water.

The horizontal edge of the entrance to the suction pipe must be at least as low as the lowest level to which the water is to be reduced in the main ditch, and below this edge there should be a clear distance to the bottom of the suction pit equal to one or one and a half times the diameter of the suction pipe. It would be better if the end of the pipe were a foot lower than the level mentioned above. If the entrance to the suction pipe is expanded to such a degree that the velocity of the incoming water past the edge of the pipe is not more than 2 ft. per second, the water level can be drawn down to the end of the suction pipe without trouble from sucking air. Without such expansion, while the level of the water is still a considerable distance above the end of the pipe, much air will be drawn into the pump, with a consequent waste of power and danger of stopping the pump. Neglect to provide ample water way around the entrance to the suction pipe has been a source of much annoyance to pumping plants.

Though a suction pipe with a vertical portion at its lower end is probably most easily given a rigid support in the suction pit, a better arrangement for a large plant would be to place the suction pipe on a uniform slope from the pump to its open lower end in the suction pit. This slope should be flat enough so that the pipe can be supported rigidly. The suction pit should be of concrete throughout, re-enforced where necessary, shaped so as to form a suitable gradually curved entrance to the suction pipe, and provided at its outer end with a steel screen and with vertical ways for inserting stop planks. The gate openings and the screen openings should be of such size that the velocity through them under normal conditions would not be more than 1 foot per second. In order that the suction lift may be kept low, the pump should be set as low as is consistent with securing good foundations, ease of installation, and safety after installation. The suction pipe must be perfectly air-tight and strong enough not to collapse under the greatest suction that will be put upon it.

The discharge pipe should be gradually expanded immediately after leaving the pump so as to reduce the velocity to as near 5 feet per second as seems practicable. If the velocity is not lowered to this amount the outlet should be expanded an equivalent amount. Practice is not uniform as to the best method of preventing water from flowing back through the pipes into the district from the river when the pumps are not operating. Some prefer to carry the discharge pipe through the levee above high-water line and then down, with its end opening below low water, so as to secure a water seal. This is necessary in order that the pipe may act like a siphon and that hence the head on the pump may be only the difference in level between the water in the canal and the water in the river. In this case the pipe must have an opening of ample size at the highest point for use in priming the pump. This is opened to prevent water flowing back by siphon action when the pump is stopped. Others prefer to carry the discharge pipe from the pump through the levee on a level. This necessitates the installation of a gate valve in the pipe next the pump. If the pipe is not over 2 feet in diameter a flap valve may be used on its outer end, but such a valve is never entirely reliable and certain in its operation. A gate valve, if such is used, must be of a slow-closing type, as it is very dangerous to the plant to close such a large valve quickly. The outlet end of the discharge pipe must have an adequate masonry protection against river wash and against undercutting by the pump discharge.

COST OF PUMPING.

The cost of installing a pumping plant will depend upon its size, location, the kinds of machines adopted, and the market conditions at the time, so that it is impossible to determine a definite normal price; probably the entire plant, including pumps, engines, and boilers, can be installed and a suitable building provided in most places for not over $90 per nominal horsepower. Under favorable circumstances the cost may be materially lower. For the plant used as an illustration, above 1 h. p. was required for each 30 acres. Hence, the cost of the pumping plant complete should not exceed $3 per acre. With interest at 6 per cent and an allowance of 4 per cent for depreciation, the total fixed charges would amount to 10 per cent per annum or 30 cts. per acre of land per year. This charge is, of course, constant every year, whether the plant runs much or little, or not at all.

The annual cost of operation will depend upon how much water the pump raises during the year. Continuing the use of the same illustration as before, with liberal assumptions so as to be on the safe side, to remove during the year a depth of 1.5 ft. of water over the district of 10,000 acres against an average static head of 16 ft. will probably require 1,700 tons of coal which, at a cost of $2.50 per ton, would amount to $4,250. One man might well be employed to take care of the plant throughout the year at $100 a month; the expenditure for all other labor probably need not exceed $800. This would make a total of $2,000 per year for labor. The total cost of operation, then, might approximate $6,250 or about 60 cts. per acre, which with the charge of interest and depreciation would make the total annual charge 90 cts. per acre. This is a liberal estimate and in dry years would be much reduced.

A further loan of $6,000,000 is to be granted to the Harbor Commissioners of Montreal, Que., to enable the Commission to complete the terminal facilities according to plans already approved by the Government. The plans for the harbor work call for a total expenditure of nearly $2,000,000.

Statistical Summary of the U. S. Reclamation Service Work.

The following general summary of expenditures and progress in the work of the U. S. Reclamation Service was given in the reports of the Secretary of the Interior for the year ending June 30, 1911.

The act of Congress approved June 17, 1902, known as the "reclamation act," set apart as a fund for the reclamation of arid lands all moneys received from the sale of public lands in certain of the Western states and territories, excepting the 5 per cent of the proceeds of such sales set aside by law for educational and other purposes. The actual receipts from this source to June 30, 1910, were $65,584,801, and the estimated total receipts to June 30, 1911, including $213,998, from sale of town-site lots, are $71,717,990. The net investment of this fund in reclamation works on June 30, 1911, amounted to $60,940,834.

The act requires the Secretary of the Interior to determine and return to the reclamation fund the estimated cost of construction, and entrymen and private landowners receiving water from reclamation projects are therefore required to contribute their proportion of the cost of construction, operation, and maintenance of the project wherein their lands are situated. The cash receipts from this source to June 30, 1911, were:

Water-right building charges	$1,533,175.63
[illegible] operation and [illegible] charges	[illegible]
Total	[illegible]

In addition, sales of water to towns and cities, leases of power developed in projects, rentals for irrigating water, miscellaneous services and sales, etc., have produced an additional revenue of $3,288,719, which, under the respective laws authorizing these transactions, is credited as a reduction of the cost [illegible] derived [illegible] primary projects had been undertaken, the [illegible] amounted to $59,989,158, as is shown in the following table.

[illegible]	[illegible]
Idaho:	
[illegible]	[illegible]
Nevada: Truckee-Carson	4,103,346.71
[illegible]	[illegible]
North Dakota:	
[illegible]	[illegible]
Oregon:	
[illegible]	[illegible]
South Dakota: Bellefourche	2,683,345.01
[illegible]	[illegible]
Wyoming: Shoshone	3,580,249.28
Total	$59,989,158.46

In addition, there had been invested in secondary projects, June 30, 1911, $586,988; in town-site development, $12,997; in Indian irrigation (reimbursable), $317,392; and for general expenses, $34,297, making a grand to[illegible] areas of land included, the magnitude and expense of the engineering work necessary to provide for their reclamation, and of the importance to the waiting settler and land-owner that water be applied to the land and reclamation effected as soon as possible, the efforts of the Department have been directed toward the completion of projects already undertaken, rather than the search for or undertaking of new projects. The following table contains a summary of the results of the reclamation work from June 30, 1902, to [illegible]

[illegible]

[illegible]	[illegible]
Class 2, cu. yds.	5,136,331
Class 3, cu. yds.	4,353,765
[illegible]	[illegible]
Available reservoir capacity, acre ft.	4,747,770
Number of tunnels	68
Aggregate length of tunnels, ft.	101,365
[illegible]	[illegible]
Canals carrying from 50 to 300 second-feet, miles	942
Canals carrying from 300 to 800 second-[illegible]	[illegible]
Canals carrying more than 800 second-[illegible]	[illegible]
Canal structures costing less than $500	22,226
Canal structures costing from $500 to [illegible]	[illegible]
Canal structures costing over $2,000	529
Number of bridges	2,223
Aggregate length of bridges, feet	47,310
Riprap, cu. yds.	336,056
Paving, sq. yds.	344,891
Cement used, bbls.	1,245,827
[illegible]	[illegible]
Telephone lines, miles	1,694
Telephones in use	724
[illegible]	[illegible]
Barns and storehouses 225	
Area of lands for which water can be supplied, acres	1,025,609
[illegible] way	3,101,450

GENERAL ARTICLES AND CLASSIFIED ITEMS

Report of the Annual Meeting of the American Society of Engineering Contractors.

(Contributed by J. R. Wenilinger, Secretary.)

The third annual meeting of the American Society of Engineering Contractors was held in New York City Jan. 9, 1912. In the forenoon, members of the society visited, in a body, the new Grand Central terminal, at the invitation of Mr. W. L. Morse, terminal engineer of the New York Central & Hudson River R. R. Co. They were escorted by Mr. E. D. Sabine, first assistant terminal engineer; Mr. W. C. Goddard, terminal architect's engineer, and their assistants. It is needless to say that great interest was evinced by the members who were fortunate enough to view the remarkable work accomplished and still going on, which work will result in probably the greatest railroad terminal in the world. Particular interest was manifested in the method of coating all the steel columns, beams, etc., in the lower level with cement. The mortar which is applied directly through the "Cement Gun" by the agency of a blast of compressed air.

At the afternoon session, which was devoted to a business meeting, the address of the retiring president of the society, W. R. Harris, was read. Mr. Harris who, for nearly one year, has been located in the Canadian Northwest at Regina and Saskatoon, Sask., was unable to be present. He stated that even in those distant provinces much interest is evinced regarding the work undertaken by this society, which is about to be manifested by the organization of branches.

We read and hear much these days relative to workmen's compensation for injuries sustained. Undoubtedly, many superficial observers show little interest in this question unless directly affected in legislation of this character with the result that many laws have been passed which, if enforced, will be bound to affect seriously contractors and, ultimately, the public. It goes without saying that every added expense saddled on the contractor through such laws are not going to be assumed by him, but must be paid by the owner, whether he be an individual or the public. This is simply a business proposition.

Mr. Harris related that during the last session of the local parliament in Saskatchewan a law was passed whereby all workmen except farm laborers are entitled to compensation for injuries, whether sustained through carelessness or not. This is class legislation of the worst kind, because the farmer, who employs the larger part of his force only a short time each year, is not affected, while the manufacturer and the contractor are liable. Furthermore, the law is unfair in its effect on the bids of various contractors. The man who is responsible and, therefore, is able to obtain liability insurance must pay the higher premiums caused by this act and, necessarily, must include such cost in his bid. On the other hand, the contractor who, because he is not financially responsible, or for some other reason, does not secure such insurance, would not have to figure on such an additional expense and is thereby able to reduce his bid accordingly.

The remedy is an organization like this society which, when necessary, will oppose reckless legislation and insure that, if general compensation statutes of this kind are deemed necessary, each man who employs labor shall be affected equally.

A point of interest to all engineers who have to specify tests for cement is one brought out by Mr. Harris. He stated that, under the present specifications, tests required for cement fail to provide the safeguards anticipated. For instance, while the usual method of taking one barrel in every ten of a shipment as a sample of the material, the method of mixing the samples is not satisfactory. It is provided that, to determine the characteristics of a shipment, the individual samples may be mixed and the average tested. This may not be objectionable where the cement is used in massive concrete subject to compression only. In reinforced concrete, however, because comparatively thin members are used, this method should not be allowed.

The reasons given by Mr. Harris for his position are as follows: It is acknowledged that 80 per cent good cement will carry 20 per cent poor cement. If the average sample of a shipment shows only 20 per cent bad material it is, according to standard specifications, allowable. However, the mixing which is done with the samples is, of course, not repeated with the bags of cement since it would be impracticable to take a carload shipment, mix it and remeasure it to secure the proper proportion.

The result is that where mixing up a batch of concrete, the sacks used may contain as much as 50 per cent bad cement, and just as likely as not this concrete may be placed in a portion of the structure where only the best material should be used. Again a shipment of cement may contain the products of different mills, cement which may be different in regard to setting time, fineness, etc. It is bad practice to use two brands of cement in the same concrete mixture, but if the products of several mills are placed in sacks of a common brand, it is impossible to tell by looking at the sack whether the contents of a car would run uniform or not, except by individual tests.

This question is of much importance to architects, engineers, contractors and manufacturers of cement or cement products. Mr. Harris recommended concerted action by this society with other technical societies to eliminate the foregoing defects of the present specifications.

After Mr. Harris, address was read, the result of the election of officers was declared. The following officers were elected: President. Major C. E. Gillette, of Philadelphia, Pa.; first vice-president, H. J. Cole, of New York, N. Y.; second vice-president, John Marshall, of Regina, Sask., Can. Directors— W. B. Banford, of Belmar, N. J.; Carl Weber, of Los Angeles, Cal.; C. A. Mees, of Charlotte, N. C.

President Gillette then assumed the chair and after some introductory remarks he called for a report of the treasurer, which was presented. This was followed by a report of the secretary, in which he outlined the work accomplished by the society during the past year. Among other things, the secretary stated that 130 new members had been added to the rolls of the society during 1911, an increase of 20 per cent of the active membership.

This was followed by discussions relative to various features of the work to be done by the society, among which is the gathering of cost data. Mr. Shannon of Jersey City, and Mr. Bosch of Harrisburgh, both contractors, stated that, in their opinion, it could not be expected that contractors, generally, would care to divulge their cost since they usually consider this information as their personal property, or what may be called their trade secrets. Mr. Frank B. Gilbreth, the well-known contractor, however took the view that contractors are bound to benefit from interchange of ideas and publication of costs. He stated that if many of the contractors who bid on construction work, only knew more about costs there would be less ruinous bidding than there is at the present time. It has been the experience of large manufacturers that they have benefited from the publication of their costs in full detail, by the fact that competitors could see for themselves that the margin of profit was not so large as to allow great risk to be taken. It was agreed, however, that cost data of itself has not much value unless together with it is given full details of the method of doing the work, the character of labor, hours of work and an explanation of all conditions that would affect the cost.

At the evening meeting the elected president, Major C. E. Gillette, delivered an interesting address in which he pointed out that the society, although it is an association of contractors and engineers, is, primarily, organized to do something for the public good. Major Gillette also pointed out that, whereas every class of labor or industry is organized, contractors alone are not. He stated that this society should take steps to point out and eliminate waste in large works, waste which is often due to errors in design. Very few designs are made from the point of view of final cost, and in that respect much benefit should result from co-operation and interchange of ideas between engineers and contractors. Another feature in contracting work, which causes the contractors great loss, and which, ultimately, affects the public, is unreasonable inspection. This requires attention, because unfair inspection has been the cause of much trouble in contract work. The United States government, particularly, suffers from that trouble, and it is doubtless the reason why it must pay much more for structures of any kind than private individuals or corporations.

Major Gillette recommended that the society use its best efforts to write on the statute books of at least one state, a good, complete real law that will require fairness, and the avoidance of favoritism and graft in public, government, state and municipal contracts. By doing that one thing, the society will have justified its existence over and over again. Of course, it is appreciated that it is not possible to legislate honesty into public officials, but, at least, a valid and comprehensive law of this kind, backed by the active influence of a large organization, will doubtless serve to make the way of the transgressor much harder than it is at the present time.

The next point that the speaker referred to was the question of practical specifications. Only too often specifications are written that woudl require a miracle to carry out, in fact, they are an absolute impossibility; yet contractors are constantly asked to bid on such specifications and they must do it, if they want work. The result is that no end of trouble is experienced. Ultimately the cost must be shouldered by the public, who is powerless to prevent it. Therefore, it behooves an organization like this society to avail itself of the unexcelled opportunity that is now available to accomplish something of lasting benefit not only to contractors, but also to the public.

The remainder of the evening was devoted to a talk by Mr. J. R. Wemlinger, on "Methods and Costs of Driving and Pulling Steel Sheet Piling." This was illustrated by means of lantern slides showing all known methods of installing sheet piling of all kinds in United States and foreign countries.

Civil Engineering Society Meetings.

Maine Society of Civil Engineers.—Frank E. Pressy, Augusta, Sec'y. Annual meeting at Lewiston, Feb. 7.

Connecticut Society of Civil Engineers.—J. F. Jackson, New Haven Sec'y. Annual meeting at New Haven, Feb. 12-14.

Engineering Society of Wisconsin.—John C. White, Madison, Sec'y. Annual meeting at Madison, Feb. 14-16.

Indiana Sanitary and Water Supply Association. Dr. W. F. King, Indianapolis, Sec'y. Annual meeting at Indianapolis, Feb. 15-16.

North Dakota Society of Engineers.—R. W. Livingston, Mandan, N. D., Sec'y. Annual meeting at Grand Forks, N. D., Feb. 15-16.

Iowa Engineering Society.—S. M. Woodward, Iowa City, Sec'y. Annual meeting at Davenport, Feb. 21-23.

Western Cement Show.—Coliseum, Chicago, Feb. 21-28.

Interstate Cement Tile Manufacturers' Association.—Chas. E. Sims, Worthington, Minn., Sec'y. Annual convention at Chicago, Feb. 21-23.

National Association of Cement Users.—Edw. E. Krauss, Harrison Bldg., Philadelphia, Sec'y. Annual convention at Kansas City, Mo., March 11-16.

Kansas City Cement Show.—Convention Hall, Kansas City, Mo., March 14-21.

PERSONALS.

Mr. M. F. Cahill, Supervisor of Bridges and Buildings of the Seaboard Air Line Ry., has resigned.

Mr. J. W. Barnett has been reappointed City Engineer of Athens, Ga. He has held this position since 1890.

Mr. T. R. Cook has been appointed Assistant Engineer of the Pennsylvania Lines West, with offices at Pittsburgh, Pa.

Mr. A. M. Van Auken has resigned as Chief Engineer of the Memphis, Dallas & Gulf R. R. He is succeeded by Mr. W. F. Hart.

Mr. Francis E. Crane, who has held the position of City Engineer of Amsterdam, N. Y., since 1890, has again been reappointed to the office.

Mr. H. G. Raschbacher has opened offices in the Merchants Loan and Trust Bldg., Chicago, for the transaction of general consulting engineering work.

Mr. Thomas Wilson, formerly Engineer of Construction in the engineering department of the city of Atlanta, has been appointed Engineer of Highways of Fulton County, Ga.

Mr. Arthur O'Brien, formerly City Engineer of Utica, has been appointed County Engineer of Oneida County, N. Y. Mr. O'Brien has been connected in an executive capacity with a number of large engineering works in the State.

Mr. W. E. Harwig has accepted the position of Supervisor of Bridges and Buildings of the Lehigh & New England R. R., with headquarters at Bethlehem, Pa. Mr. Harwig was formerly Supervisor of Bridges and Buildings of the Lehigh R. R.

Mr. J. H. Nuelle, formerly Principal Assistant Engineer of the New York, Ontario & Western Ry., has been promoted to Engineer of Maintenance of Way, succeeding Mr. C. E. Knickerbocker, whose resignation was mentioned in a previous issue.

Mr. J. P. Canty, formerly Supervisor of Bridges and Buildings of the Boston & Maine R. R. at Fitchburg, Mass., has been promoted to the position of Supervisor of Bridges and Buildings of the entire road. His headquarters will be at Boston, Mass.

Mr. Benj. S. Reynolds, who for some years has been a member of the engineering staff of the Chain Belt Company at the home office in Milwaukee, has been placed in charge of a new office which the company has opened at 900 Old Colony Building, Chicago.

Mr. Geo. J. Henry, Jr., after an experience of 18 years with the Pelton Water Wheel Company, San Francisco and New York, during the last ten of which he has held the position of Chief Engineer, has resigned to open an engineering office at 737 Rialto Bldg., San Francisco.

Mr. W. J. Tuddenham has been appointed Superintendent of Public Works of Salt Lake City, Utah; Mr. D. H. Blossom has been appointed City Engineer, Mr. John Duder Principal Assistant to Mr. Blossom, and Mr. Charles F. Barrett, Superintendent of Water Works.

Mr. E. L. Cousins was appointed Harbor Engineer at a meeting of the Harbor Board of Toronto, Ontario. Mr. Cousins is at present Engineer in Charge of the roadway and special works department at the City Hall. The Board has decided to request the government to allow Mr. J. G. Sing, formerly Engineer, to become Consulting Engineer of the Harbor Board.

Mr. H. M. Byllesby, President of the H. M. Byllesby Company, Chicago, gave an address before the students and faculty of the College of Engineering of the University of Illinois on Thursday, January 18. The subject was "Organization in Engineering." Brief addresses were also made by Mr. Julius G. Gabelman, President of the Illinois Society of Engineers and Surveyors; Mr. W. L. Abbott and Mr. F. L. Hatch, Trustees of the University, and by Dr. W. F. M. Goss, Dean of the College of Engineering.

Mr. Austin B. Fletcher, State Highway Engineer of California, has announced the districts to which the Division Engineers in charge of preliminary surveys and construction are to be assigned. The names of the Division Engineers were given in a previous issue. The assignments are as follows: Mr. F. C. Sumner, Willits, Division No. 1; Mr. T. A. Bedford, Redding, Division No. 2; Mr. W. C. Howe, Sacramento, Division No. 3; Mr. A. E. Loder, San Francisco, Division No. 4; Mr. W. S. Caruthers, San Luis Obispo, Division No. 5; Mr. J. B. Woodson, Fresno, Division No. 6; Mr. W. L. Clarke, Los Angeles, Division No. 7.

General William Sooy-Smith, formerly of Chicago, and one of the most prominent engineers of the country, writes from Medford, Ore., that he is anxious to secure the passage of Senate Bill 3324, introduced by Senator Chamberlain of Oregon. The bill is for the purpose of placing Gen. Sooy-Smith on the volunteer army retired list. He is in very poor health and is over 80 years of age. He suggests that he craves the honor and needs the emoluments which his retirement will bring him. Gen. Sooy-Smith was graduated at Ohio State University in 1849 and settled in Chicago about the close of the Civil War. His career as an engineer in Chicago is well known. He originated the Chicago method of sinking caissons for heavy buildings to solid rock.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING & CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Valves, paper, 8½x11 ins., 8 pp. National Tube Company, Frick Bldg., Pittsburgh, Pa.

Bulletin No. 7 deals with regrinding valves which are made by the above company. This bulletin gives an illustrated description of these valves and shows a valve which was opened and closed 327,094 times before it began to leak. A description of the factory test on every valve is also given.

Bulletin No. 5 of the above company contains a paper which was read before the American Society of Refrigeration Engineers on Steel Pipe vs. Wrought Iron Pipe in Refrigeration Work.

Minneapolis Power System, paper, 7½x5¼ ins., 8 pp. Stone & Webster Engineering Corporation, Boston, Mass.

This artistic booklet contains an illustrated description of the new power system of the Minneapolis General Electric Co., which was constructed by Stone & Webster during the past year.

Blaw Steel Forms, paper, 6x9 ins., 24 pp. Blaw Collapsible Steel Centering Co., Pittsburgh, Pa.

Bulletin No. 48 contains illustrations and descriptions of steel forms for concrete wall construction. Interesting designs of steel forms for special work are given and also drawings of standard forms are shown.

Another bulletin, No. 49, contains a reprint of an article by S. P. Brown, describing the subway construction in New York City with the use of Blaw steel forms.

Turner System, paper, 6x9 ins., 72 pp. C. A. P. Turner, Consulting Engineer, 816 Phoenix Bldg., Minneapolis, Minn.

Bulletin No. 12 contains examples of the mushroom system of reinforced concrete construction and the work of contractors associated and doing business with C. A. P. Turner. Illustrations are given of buildings scattered from Portland, Maine, to Portland, Oregon, as well as from foreign countries. Descriptions of load tests and fire tests are given with other useful information.

CONTRACT NEWS SECTION

of

ENGINEERING & CONTRACTING

The Doings of the Week. Very little appears to have been doing the past few days as regard the letting of large railroad construction contracts. However, bids on several large jobs have been taken and are under consideration by the officials, and it is probable that by the time this issue appears some of these contracts will have been let. This refers particularly to some construction work on the Pennsylvania and to additional contracts for the construction of the Lewisburg & Northern R. R., the new line of the Louisville & Nashville. Several of the larger companies have taken steps during the past week to provide funds for construction work. The receivers of the Wabash R. R. have been granted permission to expend about $10,000,000 for rehabilitating the property. Of this amount about $2,954,000 will go for second track work. The stockholders of the Virginian Ry. have authorized an increase of capital stock from $36,000,000 to $65,000,000. It is believed that a large part of the proceeds of this increase will be used for building extensions and for betterment work.

Among the railroad construction contracts let recently are the following: John J. O'Heron & Co., Chicago, Ill., for the construction of retaining walls, viaduct foundations, etc., along the main line tracks of the Kansas City Terminal Ry. Co. between Grand Ave. and 18th St., Kansas City, Mo., the contract amounting to about $500,000 and cleaning up everything remaining in the way of concrete work between the two points mentioned; Thompson Brothers, Salt Lake City, Utah., for constructing a 7-mile branch for the Prince Consolidated Mining Co., from the mine to the main tracks of the Salt Lake Route below Pioche; the Degnon Contracting Co., 60 Wall St., New York City, at $2,355,825, for constructing Sec. 2 of the Broadway-Lexington Ave. subway in New York City, the work calling for the construction of about 2,800 ft. of 4-track subway; Porter Bros, Spokane, Wash., for constructing the Point Defiance line of the Northern Pacific in Washington.

Levee work which has been rather quiet for the past few weeks is beginning to open up again. The Caddo Levee District has begun calling for bids on some new work, and it is expected that other districts will follow suit shortly. The Caddo work calls for about 225,000 cu. yds. of levee on the left branch of the Red River. Bids on a good levee job were opened Jan. 30 at Little Rock, Ark. This work called for the construction of about 300,000 cu. yds. of river protection levee for the Fourche Drainage District. I. R. Bobbett, Delta, La., was the low bidder. At this writing the contract for the extensive drainage system, bids for which were opened on Jan. 25 at Osceola, Ark., have not been awarded. A list of low bidders on this will be found elsewhere in this issue.

In the way of highway work, the largest contract of the week appears to be the one now being advertised by the State Highway Commission of Virginia. This work calls for grading, draining and macadamizing about 113 miles of road in Clear Fork, Jeffersonville and Marden Springs Districts. A good sized brick paving job was let last week at Houston Heights, Tex. This work called for about two miles of vitrified brick pavement, the contract price being $114,000.

A resolution is to be [illegible] the House of Parliament of Canada pro- [illegible] treal to enable the commission to complete the terminal facilities of the harbor according to the plans already approved by the Government. The loan is made upon the same conditions as the previous loans advanced by the Dominion, which now aggregate some $12,000,000. The plans of the Harbor Board call for a total expenditure of nearly $20,000,000.

Country Road Widths. An early English traveler remarked of our country roads that, judging from the width of land appropriated for them evidently they were laid out with the idea that some time they would be the main streets of cities. When it is considered that the width of land appropriated for road purposes in this country varies from 49½ to 66 ft., and the width actually used for traffic purposes averages less than 20 ft., it will be seen that the Englishman had some ground for his remark. On most country roads the space between the fences and the roadway proper is a sort of "no man's" land. It is allowed to grow up weeds which, if not cut, scatter seeds to the adjoining cultivated land. A simple plan for making use of this waste land, and at the same time furnishing means for improving traffic facilities, has been suggested by Mr. Frank Whitly, a contractor, of Hillsboro, Tex. He suggests that on the average rural road four rods wide, one rod on each side be sold to the owner of the adjoining land, and that the proceeds be used in grading and shaping up the road. By this plan the farmer or farm owner might receive the advantages of two investments at the cost of one; that is by increasing his farming property, at a cost less than the price per acre of his adjoining farm, he would in addition secure improved roads.

Fire Signals in Survey Work. Some interesting theories regarding the ancient Roman roads in Great Britain were expounded recently in a lecture before the British Archaelogical Association. The lecturer endeavored to trace the original course of the more important Roman roads through London, basing his theories upon the numerous recorded Roman burials. The Romans, he explained, buried their dead, by preference, along their main roads, the rich being given a "front seat," so to speak, in death as well as in life. As is well known, the Romans generally built their roads in a straight line. In order to secure the straightness of routes, the lecturer stated that they no doubt laid out their lines at night by means of fire signals and staked out the intervening spaces by day. This was the first use of fire signals in highway survey work; perhaps its latest use was on the survey work for the Du Pont road in Delaware. In this work as there were no adequate maps of southern Delaware and as the country was exceedingly level, it was necessary in that portion of the state to evolve some scheme in order to connect desirable points without the necessity of running numerous random lines. This was accomplished by sending up rockets at night and obtaining a line of sight on them. The rockets were made especially for the work and were each equipped with a parachute, carrying a light of changing color and capable of sustaining itself in the air for nearly a minute. In one case a rocket was plainly visible at a distance of 14 miles and the line which was run from the sight taken struck the desired point within [illegible]

Lewis Kingman. Lewis Kingman, whose work as a locating engineer covers the southwestern part of the United States and Mexico from the frontier to the capital, died Jan. 23 in the City of Mexico. His early engineering work was mostly in New England and New York. In 1871 he was division engineer of the Atlantic & Pacific R. R. of Missouri. Later he was locating engineer for the Atchison, Topeka & Santa Fe and for the Atlantic & Pacific, and afterwards he was in charge of construction and chief engineer of the latter road. In 1884 he began his work in Mexico as chief engineer of the Chihuahua Division of the Mexican Central, and while with this road he located the route to Mexico City. After a short time in Mexico he returned to the States, where he held various positions, among them being that of city engineer of Topeka, Kan. He returned to Mexico in 1894 and became connected with the engineering department of the Mexican Central R. R., becoming chief engineer of this road in 1895, which position he held until the merger of the Central and National on Feb. 1, 1909. At the time of his death he was office engineer of the National Rys. of Mexico. Mr. Kingman was born in Bridgewater, Mass., on Feb. 26, 1845.

Spiking a Rumor. A few days ago newspapers of the Pacific Coast devoted considerable space to a report that the Chicago & Northwestern Ry. was planning to reach the Pacific Coast both at Portland, Ore., and Coos Bay. The dispatches stated that William A. Gardner, President of the Chicago & Northwestern Ry., was then in the Northwest to make immediate arrangements for beginning construction work. Inquiry made at the Chicago offices of the railroad elicited the following statement: "Excepting the fact that Mr. Gardner was at his desk in Chicago and has not been in the Northwest and that the Northwestern was not aware that it is contemplating any such steps as forecast, the report is correct."

Settling His Water Tax. Every respectable citizen, who has at some time received a water bill that made him think he had been running an aquarium, will sympathize with the bloody deed of Baptista La Stretto of Sausalito, Col. According to a veracious press dispatch Baptista's water bill for November was considerably higher than he thought it ought to be. He objected in no uncertain terms to the city treasurer but found that official inclined to disregard his argument. He then appealed to the City Council and was again disappointed. Baptista got mad. "If I can't reduce my bill," said he, "I can at least get my money's worth." So seizing an ax he went forth in search of the town's chief water main. He found it, and then succeeded in making a hole in it, and as the water spouted forth Baptista hied himself to parts unknown. Before the leak was plugged up some 30,000 gals. of water had escaped.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

The St. Louis & San Francisco and the Louisville & Nashville, joint owners of the New Orleans, Mobile & Chicago R. R., are stated to have secured options on two blocks of water front rights in Mobile, on which to erect a terminal station for the three roads. The property is valued at approximately $500,000.

Advices from Eufaula, Ala., state that one survey for the proposed line of the Eufaula & Chattahooche Valley R. R. has been completed and another will be made shortly after which details will be worked out and actual construction work started. D. B. McKenzie, Eufaula, Ala., is engineer of the company.

Arkansas.

A company has been organized at Blue Mountain, Ark., for the purpose of building a car line from that place to the hotel at the top of Magazine Mountain.

Preliminary meeting has been held at Hot Springs looking to the revival of the project to build an interurban line from Little Rock to Hot Springs. It is stated that the citizens of Little Rock will be asked to contribute $250,000 for the line and a similar amount will be sought from Little Rock. Louis Garrett, Little Rock, is reported to be interested.

California.

It is understood that the projected improvements for which funds will be provided by an increase of capital stock of $10,000,000 by the San Pedro, Los Angeles & Salt Lake R. R., E. G. Tilton, Chief Engineer, Los Angeles, will include a line from Daggett to Barstow, Cal., also the rebuilding of the road between Salt Lake City and Provo and the completion of the branch line now under construction from Moapa to St. Thomas, Nev., and later to St. George, Utah.

The Pacific Electric Ry. Co., Paul Shoup, Vice President, Los Angeles, is to construct a 5-mile double track extension from Santa Ana to Orange.

Construction work will probably be started in the early spring on a street railway system at Burlingame, franchise for which is held by Ansel M. Easton, a real estate operator.

Members of the Board of Trade of Redlands and the people of Bryn Mawr are taking steps to get an electric line connection between Redlands and Riverside.

Orders have been issued for the immediate broad gaging of the old San Pedro narrow gage line of the Pacific Electric Ry., Los Angeles, from the connection with the Redondo cutoff at Gardena south to the San Pedro Harbor.

It is reported that officials of the Santa Fe system have announced that specifications have been approved for relaying the entire stretch between Richmond, Cal., and Stockton with 90-pound rails. This work is to commence at once, and in addition all the cuts and tunnels of this division are to be widened and remodeled to allow for a second line of track. This will give the system a double tracked line into and through Richmond to the bay. It is expected that all of this work will be completed by May, and in the meantime the work of enlarging the piers and dockage facilities to accommodate ocean steamships at Richmond, is being pressed rapidly. A. G. Wells, Los Angeles, Calif., is general manager of the coast lines.

Amended articles of incorporation have been filed by the Oakland, Antioch & Eastern Ry., and reports are that the work of constructing the railroad will commence in the near future. The company, which is being financed by a number of San Francisco capitalists, is preparing to run a line from Oakland to Sacramento through Alameda, Contra Costa, Solano, Yolo and Sacramento counties, with a branch line running between Antioch and this city. The entire length of the road will be approximately 130 miles.

The Southern Pacific Ry. engineers have completed a survey, it is said, for a line from Dominguez Junction to a connection with the old narrow gauge of the Pacific Electric south of Gardena, Los Angeles County, Cal. According to the route selected, the line will run south of Aviation field and north of Nigger Slough. This route is half a mile longer than a more direct survey, but has the advantage of a saving of grade.

The Pacific Electric Ry. Co., G. E. Pillsbury, Chief Engineer, Los Angeles, is to have work started at once in improving the terminal facilities at 6th and Main Sts., Los Angeles. The work will cost about $100,000 and under it four tracks will be run into the basement of the building on the south side, connecting the main line tracks of the company from 7th and 9th Sts., partly over a private right of way, and for the use of all the south division cars.

Colorado.

The Denver, Laramie & Northwestern R. R., W. D. Hodge, Chief Engineer, Denver, Colo., is understood to have negotiations under way for placing a large block of bonds, the proceeds of which will be used for the extension of the line to the coal fields in Wyoming.

The Grand Junction & Grand River Valley Ry. Co. (electric), Mining Exchange Bldg., Colorado Springs, Colo., is considering a proposition to extend its line into the Paradox country.

Florida.

Advices from Pensacola, Fla., state that 3,000 tons of steel rails, bolts and fastenings have been delivered to the Gulf & Florida R. R., and tracklaying will be started at once.

Georgia.

The stockholders of the Georgia Railway & Electric Co. have approved the lease of that company to the Georgia Railway & Power Co., of Atlanta. This will result in the commencement of construction work this spring on the new trolley line to Stone Mountain. Surveys for this line are understood to be already under way.

Secretary of State, Atlanta, Ga., has granted an amendment to the charter of the Moultrie, Fort Gaines & Western R. R. The capital stock of the railroad was raised from $100,000 to $2,500,000, the company was authorized to extend the line from Fort Gaines to Valdosta and the name of the railroad was changed to the Valdosta, Fort Gaines and Montgomery railroad. It is understood that the company will begin work on both the Valdosta and the Alabama extension shortly.

Idaho.

Surveys have been completed and practically all right of way secured for the proposed Idaho Falls Electric R. R. As projected this line will be 40 miles long and will cost about $500,000. Philadelphia parties have offered to build the road when the entire right of way has been secured and stock subscriptions of $1,000 per mile obtained. Good progress has been made with this preliminary work and it is believed that construction will be started in the spring. The Idaho Falls Electric R. R. Co., of Idaho Falls, was organized about a year ago. Its officers are: President, J. L. Milner; secretary, H. S. Sewell; chief engineer and general manager, J. W. Springer.

Construction work will be resumed in the spring on the continuation of the connecting link of the Central Idaho R. R. between Prairie in central Idaho and Boise. Grant & Son, the contractors, who have been working on the Central Idaho R. R., have established winter quarters in Prairie and in the spring will resume work toward Boise.

The survey of the Oregon Short Line from Homestead to Lewiston, Idaho, has been completed and the engineers have returned to Salt Lake City, Utah. The survey notes show the line to be 120 miles in length and the maximum grade at any point is .4 of 1 per cent, while the maximum curvature allowed is 6 degrees. Estimates on the cost of construction compiled at the Salt Lake office from the engineers' notes show the average cost for the 120 miles to be $80,000 per mile, while at points the construction will reach $250,000 per mile. Carl Stradley, Salt Lake City, is assistant general manager.

Illinois.

✤The Kankakee & Urbana Traction Co., George K. Linton, Secretary, Flatiron Bldg., Urbana, Ill., is now calling for bids for the material and labor for construction of its proposed line. Bids will be opened Feb. 15 for 38,000 cross ties, etc., and on Feb. 20 for 14 miles of grading, the yardage including 31,195 cu. yds. excavation, 58,920 cu. yds. embankment, 30,245 cu. yds. borrow and 63,670 cu. yds. overhaul, hauled 100 ft. Bids will also be received for 290 cu. yds. concrete work, steel bridge work and furnishing culvert pipe. Bids will also be received until March 1 on 1,550 long tons 70-lb. Bessemer steel rails and 520 kegs spikes. C. J. Hays, Urbana, Ill., is Chief Engineer. The official advertisement will be found elsewhere in this issue.

Regarding the report that the Chicago, Burlington & Quincy R. R. was considering the construction of a line between Centralia and St. Louis, Mo., we are advised that this line has been considered in a general way, but that no surveys nor definite plans in regard to it have been made.

The Chicago, Milwaukee & St. Paul Ry., C. F. Loweth, Chief Engineer, Chicago, is understood to be planning a considerable amount of betterment work for the present season. For this work about $1,000,000 will be expended for grade revision and alignment on the Chicago & Council Bluffs Division and $1,500,000 for yard improvements at Chicago, Milwaukee and Seattle. The company is also understood to be planning the building of a number of branch lines to serve as feeders for the Puget Sound Ry.

The Gulf Lines Connecting R. R. Co. of Illinois has been incorporated and proposes to build a railroad from a point near Danville in Vermilion County, through the counties of Edgar, Clark, Crawford, Lawrence, Wabash, Edwards, White, Gallatin, Hardin, Pope and Massac, to a connection with the new bridge at Paducah, with a branch to a point on the Wabash River, opposite Mount Vernon, Ind., and a branch to Thebes and Cairo. The incorporators are: Paul A. Schlafly, N. P. Murray, Jr., Walter S. Louden, E. P. Keshner, Harry J. Hornberg, all of East St. Louis.

The Chicago, Paducah & Thebes R. R. Co. has been incorporated and proposes to build a railroad between Streator, in LaSalle County, and Brookport, Massac County, with a branch from a point in Clay County to Thebes. The incorporators are Clarence B. Long, Arthur M. Beckwith, Walter E. Beckwith, F. W. Boekenkroeger, William R. Brow, all of East St. Louis.

Indiana.

Surveys for the proposed extension of the Indianapolis & Cincinnati Traction Co.'s line from Greensburg will probably be completed to Harrison this month. After this survey is completed a line will be run from Rushville.

The Chicago & Wabash Valley Railroad Co is planning the construction of extensions to provide a short route from the steel mills at Gary, Ind., to the coal fields of that state. At present the northern terminus of the line is sixteen miles southwest of Gary, and it has a mileage of sixty miles, reaching to Mc-

Coysburg. O. A. Yeoman and N. Oliver, of Rensselaer, Ind., were recently in Gary looking over grounds for termin[illegible] right-of-way will bring the line into the steel city, but a franchise must be obtained before streets are crossed. By extending the road from McCoysburg to [illegible] Lake, Newton, Jasper, Benton [illegible] tain and Parke would be tapped [illegible] built fourteen years ago, but new capital has been added to it.

The Bluffton, Geneva & Celina Traction Co., R. F. Cummins, General Manager, Bluffton, is reported to have made such good progress with its plans for extending the line through to Celina and possibly to Ohio City that the work may be taken up this summer.

The Board of Public Works of Indianapolis, Ind., has adopted a resolution for the elevation of steam railroad tracks between Louisiana and South Sts., from the present elevation at Senate Ave. to a point 50 ft. east of Delaware St., and for the elevation of the tracks of the Pennsylvania, Central and Illinois Central railroads from the union station to Morris St. The work contemplated in the resolution is a little more than half of the work to be done in the track elevation scheme as originally outlined. While no detailed estimates of cost have been made of the work undertaken in the resolution, it is believed this part of the work will run in the neighborhood of $3,000,000. H. W. Klausmann is City Engineer of Indianapolis.

Iowa.

The Creston, Winterset & Des Moines Railroad Co., according to an announcement said to have been made by A. S. Lynn, Orient, Ia., secretary, will start work this summer on the first division of the line extending from Creston to Macksburg.

Kansas.

The Salina & Tipton Ry. Co. may let contracts about May 1 for the construction of its proposed line from Salina to Lincoln via Tipton. Hal W. Neiswanger, Osborne, Kan., is interested.

At a recent election held in Osborne and Mitchell Counties, Kan., the proposition to issue bonds for aiding the construction of the Salina, Tipton & Northern Ry., was carried by a good majority.

The stockholders of the Wamego & Rock Creek Valley R. R. chartered to build a railroad from Westmoreland, Kan., south, recently held a meeting and reorganized. C. E. Morris is president of the company. The company is now said to be in legal shape to build the proposed line and it is hoped to make a deal in the near future for the completion of the road.

Kentucky.

The Louisville & Nashville R. R. is securing right of way for double tracking its line between Paris, Ky., and Winchester, Ky.

The Frankfort & Owenton Traction Co., planning an electric line between Frankfort and Owenton, has not been incorporated as yet, nor has its formal organization been completed. Surveys for the line have not been made. Wm. Speed, Louisville, Ky., is Chief Engineer. Charles Strother, Owenton, Ky., is interested.

The Board of Works of Louisville, Ky., is to hold a conference with officials of the Southern, the Louisville & Nashville and the Louisville Ry. Co. to secure favorable action on the plan for the underpass at the intersection of Fourth Ave. and the tracks of the three companies. The work of construction will entail an outlay of approximately $150,000, and the cost will be prorated between the three roads and the city.

Maine.

The Rangeley Lakes & Megantic Ry. will probably let contracts in about a week for the grading work for about 11 miles of line from Oquossoc, Me., to Kennebago. This road is a subsidiary of the Maine Central Ry., of which T. L. Dunn, Portland, Me., is Chief Engineer.

Maryland.

[illegible] City Council of Baltimore, Md., authorizing the Pennsylvania R. R. to lay 19 additional tracks in [illegible]

[illegible] terests controlling the McCall's Ferry Power Co. are reported to have negotiations under way which may result in either the purchase or a lease of the Maryland & Pennsylvania R. R. and the Canton Co.'s water-front terminals on the east side of Baltimore's harbor. It is understood that owing to the increasing freight congestion at Baltimore because of the terminals under the city, the Pennsylvania would like to have a belt line around the city for through freight trains from the South for Philadelphia and New York. This could be secured through the Maryland & Pennsylvania Short Line and the Canton Co. The Susquehanna Water & Power Co., of Call's Ferry, is interested through the connection of a road which the Pennsylvania already owns, running from Philadelphia to the Susquehanna River at Octorora, with the Maryland and Pennsylvania, through the building of a bridge across the river at that point, and then a link of about eight miles to the angle in the Maryland & Pennsylvania where it runs nearest to the river.

Massachusetts.

Clearing work is now under way on the site of the $3,000,000 equipment and repair shops to be erected at Billerica, Mass., for the Boston & Maine R. R. The McClintic-Marshall Construction Co., Pittsburgh, Pa., has been awarded the contract to supply and erect 3,865 tons of steel for the shops.

The construction program of the Boston & Albany R. R., F. B. Freeman, Chief Engineer, Boston, Mass., for the current year is understood to call for the expenditure of $1,465,000, the principal items being completion of bridge and signal work and of the Worcester betterments, extension of four-tracking eastbound between Ashland and South Framingham, and building of passing tracks and sidings at various points.

Estimates on file with the Board of State Railroad Commissioners show that that portion of the proposed new line of the Grand Trunk Ry. from Palmer to the Rhode Island state line at Woonsocket will cost about $60,868 per mile. This line is to be a portion of the Southern New England Ry. by which the Grand Trunk will obtain an entrance to Providence, R. I. As surveyed the line in Massachusetts will be 58 miles long, the estimated cost of this portion being as follows:

Right of way	$ 192,380
Clearing and grubbing	16.031
Grading	1,163,287
Bridging	1,047,221
Drains	80,000
Track	536,769
Farm crossings, signs and cattle guards	2,610
Fencing	27,720
Station buildings, etc	26,000
Telegraph line	17,433
Signals	1,000
Water service	9,000
Track tools	5,811
Road divisions	8,050
Total	$3,133,312
Engineering, legal and general expenses 10 per cent	313,331
Interest on cost of construction for six months, ½ time of construction	86,186
Total	$3,532,829

The 58 miles of proposed road are divided in the engineer's plans into three sections. The first section, from Palmer to Sandersdale counties, through Hampden and Worcester counties, a distance of 24.93 miles, with an 18-ft. embankment and an excavation of 26 ft., will cost a total of $1,798,643, or an average cost per mile of $72,148. The second section, from Sandersdale to Mt. Daniel summit, in Worcester County, a distance of 15.61 miles, with an embankment in parts of 18 and 20 ft. and an excavation of 23 ft., will cost a total of $906,260, or an average of $58,063 a mile. The third and last section, from Mt. Daniel summit to the Massachusetts-Rhode Island [illegible] of $[illegible], or an average of $[illegible] per mile. All preliminaries for the construction of this line have been completed and it is believed that [illegible]

Michigan.

Citizens of Huron County, Mich., are advocating the construction of an extension of the Caro Division of the Michigan Central Ry. from Owendale north 9 miles to Elkton, thence east through Pinnebog to Kinde and southeast to Harbor Beach, a total distance of 46 miles.

Minnesota.

The Fargo & Moorhead Street Ry. Co. has completed surveys and construction work will probably be started in the spring on a 3½-mile extension from Moorhead to Dilworth, Minn. H. M. Byllesby & Co., Chicago, Ill., own and operate the railway.

Articles of incorporation for a new company to be known as the Chicago, Minneapolis, Red River Valley & Canada R. R. Co., capitalized at $5,000,000, are to be filed with the Secretary of State. The company plans to build a railroad from Fargo to Crookston, thence to Grand Forks and on to Winnipeg next summer. It is believed the line will be operated in connection with one of the trunk roads.

The Twin City Rapid Transit Co., 11th St. and Hennepin Ave., Minneapolis, Minn., is reported to be planning to expend $2,000,000 this year for extensions and improvements.

Mississippi.

Preliminary arrangements are reported to have been completed for financing the Natchez Eastern R. R. Co. This company was chartered last August, and proposed the construction of a line from Natchez to Meridian. It is reported that J. M. Sechrest & Co., Inc., Buffalo, N. Y., are handling the financial end of the project.

Missouri.

⊙The Kansas City Terminal Ry. Co. has awarded the contract for the construction of retaining walls, viaduct foundations, etc., along its main line tracks between Grand Ave. and 18 St., Kansas City, to John J. O'Heron & Co. of Chicago, Ill. The work embraced under this contract will cost in the neighborhood of $500,000 and will extend over a period of two years. This contract is intended to clean up everything remaining unlet in the way of concrete work between the two points mentioned.

The Kansas City, Clay County & St. Joseph Ry. Co. has filed with the secretary of state, Jefferson City, Mo., a certificate showing an increase of capital from $720,000 to $10,000,000. The company was incorporated March 22, 1911, by George Arnold and others of Kansas City, and W. S. Arnold, of Chicago, Ill., as mentioned in ENGINEERING CONTRACTING, March 29. A 72-mile line from Kansas City, through Clay, Platte and Buchanan counties to St. Joseph is now under construction.

A committee recently appointed by the City Council of Carterville, Mo., recently held a meeting to confer with the officials of the Kansas City Southern as to the probability of extending the road to Carterville.

The Butler County R. R. Co., W. N. Barron, General Manager, Poplar Bluff, Mo., which, as noted in our last issue, rejected the bids received Jan. 20 for constructing 9 miles of grade, has not as yet fully decided what future action will be taken in regard to this work. This work called for about 180,000 cu. yds. of grading.

It is probable that if the city of St. Louis will agree to pay the consequential damages, the Wabash R. R. will undertake the abolishments of the crossings at Lindell Blvd., Union Blvd., DeBaliviere Ave., Waterman Ave., Kingsbury Blvd., Delmar Blvd., Olive St. road and Maple Ave. It is estimated the contemplated work will cost more than $1,000,000.

An order has been signed by the Federal Judge at St. Louis, which will permit the receivers of the Wabash R. R. Co., A. O. Cun-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ningham, Chief Engineer, St. Louis, Mo., to borrow and disburse between $9,000,000 and $10,000,000 to rehabilitate the property. With the $1,600,000 in the treasury of the Equitable Trust Co. in New York, the receivers will expend a total of almost $11,000,000. These expenditures will include $3,525,000 for new equipment, $2,954,500 for second track work, and $1,010,000 for miscellaneous expenses.

Nevada.

⦿Thompson Brothers, Salt Lake City, Utah, have been awarded a contract by the Prince Consolidated Mining Co. for constructing a 7-mile branch from the mine to the main tracks of the Salt Lake Route below Pioche.

The Reno Traction Co., Reno, Nev., is considering building a line from Sparks to the mines in the Wedelkina District.

New Jersey.

⦿The contract for the construction of the Pennsylvania R. R. station at Summit and Sip Aves., Jersey City, N. J., has been awarded to the J. S. Rogers Co., Morristown, N. J., at $76,269.

New York.

⦿The Degnon Contracting Co., 60 Wall St., New York City, has been awarded the contract at $2,355,825 for constructing Sec. 2 of the Broadway-Lexington Ave. subway in New York City, bids for which were opened Jan. 22 by the Public Service Commission. The work calls for the construction of about 2,800 ft. of 4-track subway along Broadway to a point about 75 ft. south of the center line of Park Pl. The other bids received were as follows: The Cranford Co., $2,404,559; E. E. Smith Contracting Co., $2,436,425; J. F. Cogan Co., $2,437,724; Bradley Contracting Co., $2,530,304; Holbrook, Cabot & Rollins Corp., $2,537,852; Frederick L. Cranford, $2,576,034; O'Rourke Engineering Construction Co., $2,786,454; McArthur Brothers Co., $2,994,165; the United Engineering & Contracting Co., $3,106,361; Pittsburg Contracting Co., $3,198,375; Empire Engineering Corp., $3,337,811.

The Little Falls & Johnstown R. R. Co., a new company, has applied to the State Public Service Commission for authority to construct a road, 28 miles in length in Fulton, Montgomery and Herkimer counties, from Little Falls to Johnstown.

The Catskill Traction Co. has made surveys and has secured part of the capital for the construction of a 7-mile extension from Leeds, the present end of the line, through South Cairo to Cairo. It has not yet been decided when construction contracts will be let. Herman C. Cowen, Catskill, N. Y., is President and Chief Engineer.

North Carolina.

Preliminary surveys are under way by engineers of the recently incorporated Durham & Danville Railroad. The proposed route will run from Durham, N. C., via Yancey through Durham, Orange and Chatham counties to Danville, a distance of 76 miles. J. L. Morehead, Durham, N. C., is president of the company.

Ohio.

The Norfolk & Western Ry. will expend about $50,000 in laying additional tracks at Clare and Idlewild. Work is to be started in a few days.

It is rumored that the Baltimore & Ohio Railroad will, upon the termination of its contract with the C. A. & C. for right to use the tracks from Barberton to Warwick, construct a line paralleling the Erie from Barberton to Sterling, a distance of about 6 miles. F. L. Stuart, Baltimore, Md., is chief engineer of the company.

Practically all rights of way for the new line of the electric railway to connect Pittsburg and Cincinnati are stated to have been secured. It is reported that this project is being financed by English capitalists, who are represented by James E. Campbell of Columbus. Col. A. E. Cox, Huntington, W. Va., is the promoter.

The Baltimore & Ohio R. R., A. M. Kinsman, Engineer of Construction, Cincinnati, O., has set aside an appropriation for the construction of a subway at E. 28th St., Lorain, O. The subway will cost about $140,000.

The Pennsylvania R. R. is planning to lay four more tracks east and west through Ravenna to parallel the B. & O., over which the Pennsylvania now runs trains to Niles. These tracks will continue the Lake Erie & Pittsburg road, recently built through the north end of Summit County to Lorain and Cleveland, connection being made at Lake Brady.

The Springfield & Xenia Ry. Co., M. Ackerman, General Manager, Springfield, is understood to be making good progress with its plans for the construction of a line from Springfield to Dayton, 15 miles.

Oklahoma.

Engineers of the Chicago, Rock Island & Pacific Ry. and of Oklahoma City, Okla., will hold a conference shortly to decide definitely upon the proposition of elevating the tracks through that place and building a new depot. The preliminary plan used by the railway engineering department in making estimates was that the elevation should begin at Pennsylvania Ave. on the west and end at the Walnut St. viaduct on the east, reaching an elevation of twenty feet at the half-way point. The site of the new depot is the same as that of the present, the building to be of pressed brick and stone and one of the finest in the southwest. J. B. Berry, Chicago, Ill., is chief engineer of the railroad.

The Beaver, Meade & Englewood Ry. Co., has, as mentioned in our last issue, been incorporated in Oklahoma. The company proposes the construction of a line from Beaver, Okla., to Meade and Englewood, Kan., a distance of 80 miles. The incorporators are Fred C. Tracy, John W. Webb, William T. Quinn, Elbert Clift, Robert McFarland, Levi S. Munsell and Frank Laughrin, all of Beaver. The charter provides the company may use electricity, gasoline, steam, explosive, or any other available power, except that no surface conductor, third rail or other similar device for the transmission of power shall be used.

Oregon.

Announcement has been made that the Southern Pacific, G. W. Boschke, Engineer, Portland, will commence the electrifying of its West Side and Yamhill Division lines as soon as the matter of franchises in Portland is adjusted. These franchises are to come up before the City Council on Feb. 7. The electrification plans are understood to include all the West Side lines between Portland and St. Joseph, the Yamhill lines between the same points and the 3-mile extension to McMinnville, embracing in all 96.8 miles of tracks.

The Salem, Falls City & Western Ry., S. B. Taylor, Chief Engineer, Dallas, Ore., has filed with the Secretary of State resolutions of the Board of Directors for an extension from Salem to Oregon City via Silverton, Molalla and Mullino. The resolution also contemplates a branch from this extension to Stayton. The extension will require the construction of a bridge over the Willamette River from West Salem to Salem. Permission to construct this bridge has been secured from the State and the U. S. War Department, and it is believed that work on it will soon be under way.

Surveys have been started at Lebanon, Ore., by an engineering party from Walla Walla, and it is given out that the work is being done for an electric railroad up the South Fork of the Santiam. The work is in charge of E. S. Clark, with headquarters at Lebanon.

Deed has been filed for record at Yreka, Cal., transferring the entire holdings of the California Northeastern R. R., operating between Weed and Klamath Falls, Ore., to the Oregon Eastern Ry. Co., the consideration named being $5,200,000. The railroad was completed to Klamath Falls two years ago and is being extended on from there to Natron, through a country that is little developed at present, but which it is expected will develop rapidly when a railroad is in operation through it. This is a Southern Pacific project and both companies were organized by the Southern Pacific Co. The Oregon Eastern is to build a line across from east to west and will connect with the Deschutes River line running to Lakeview, Alturas and Susanville, which will in turn connect with a line from Fernley, Nev., to Vina, Cal.

Pennsylvania.

The Erie Traction Co., Downing Bldg., Erie, Pa., is understood to have plans under consideration for connecting Meadville with a more direct route to Erie. It is probable that a new line will be built from Severling's Corners.

The Philadelphia & Reading Ry., Wm. Hunter, Chief Engineer, Philadelphia, Pa., is preparing plans for the construction of two additional tracks south from Spring Garden St. to the existing yard at Callowhill St., Philadelphia. They will be constructed on the east side of the existing tracks, and it is hoped to be able to begin the work in the near future.

Advices from Ebensburg, Pa., state that it is believed that the Ebensburg Coal Co. at Colver, will shortly let a contract for the construction of a branch road from its Colver operations to Nanty Glo, where there is another coal mining operation. It is also reported that Anderson Bros., Altoona, Pa., have a contract for constructing a 6-mile line from the main line of the Blacklick & Yellow Creek R. R., at Priesser along a tributary of the Black Lick to Nanty Glo.

It is expected that the Pennsylvania R. R. will at an early date submit its plans to the City Council of Philadelphia for extensive terminal improvements in that city. These plans are understood to include the enlargement of the Broad Street Station; the building of a parkway frontage; the vacation of Filbert St. and the widening of Cuthbert St. and substituting that street for Filbert St.; the electrification of the suburban lines entering Broad Street Station; the widening of the bridge across Broad St. at North Philadelphia; the Broad St. subway; the new grain elevator and ore handling piers at Girard Point; the abolition of grade crossings in South Philadelphia, particularly those along Washington Ave.; the elevation of the tracks across the extreme southern part of Philadelphia to Greenwich Piers; the building of a belt line along the Schuylkill River front and League Island, to join with the present belt line, and the proposed steamship pier at Christian St.

Tennessee.

At a recent meeting of the City Council, Nashville, Tenn., a bill was considered authorizing the Nashville Terminal Co. to extend its tracks on Harrison St.

Texas.

The San Angelo Power & Street Ry. Co. has been incorporated with a capital stock of $100,000 and proposes to construct and operate a street car system at San Angelo. The incorporators include J. D. Suggs, San Angelo; C. C. Kirkpatrick and W. T. Bartholomew.

The International & Great Northern Ry. has advised the State Railroad Commission that it desires to issue $3,000,000 of bonds at the rate of $1,000,000 each year for the next three years. This road is planning a considerable amount of betterment work for the present season. O. H. Crittenden, Houston, Tex., is Chief Engineer.

Citizens' committee of Waco has signed the agreement with Missouri, Kansas & Texas Ry., S. B. Fisher, Chief Engineer, St. Louis, Mo., regarding the building of terminals in East Waco, and it is expected that the railroad will begin construction work in a few weeks.

The Crosbyton-South Plains R. R., now operating 39 miles of line, is understood to be planning to begin active operation Feb. 15 on the extension of the road from Crosbyton to Spur to a connection with the Stamford & Northwestern. J. M. Bassett, Crosbyton, Tex., is General Manager.

Practically all bridge and concrete work and grading for the Dallas-Waxahachie Interurban line, Ed. T. Moore, General Manager, Dallas, have been completed and track laying will be started shortly. Ties are now being treated at the creosoting plant at Lancaster and track laying outfits will start from that town, working both ways, toward Dallas and Waxahachie.

A project is under consideration for the construction of an interurban [illegible] Grange to Brenham. G. A. Heilig, La Grange, is interested.

Surveys for the projected 22-mile interurban line from Greenville to Blue Ridge have been completed and the stock for construction purposes is reported to have been subscribed. A R. Nicholson, Greenville, Tex., is the promoter.

The Palacios & San Antonio R. R. Co. is reported to have everything in readiness for beginning construction work on the proposed line. The general offices of the company are at Palacios.

The Northern Texas Traction Co., Fort Worth, has placed an order for 3,500 tons of steel rails and plates.

The Gulf, Texas & Western Ry. Co. has secured the capital for the construction of a 25-mile extension from Jacksboro southeastward and will let contracts in about 90 days. Surveys have not been made as yet nor has the chief engineer been employed. Ben B. Cain, Dallas, Tex., is Vice President and General Manager.

J. M. McDaniel, a civil engineer of Dallas, Texas, and a party of 10 assistants, have completed a survey for a railroad from Hillsboro to Peoria, Texas, and will proceed to Whitney on the Texas Central, a total distance of 12 miles. It is believed by some that the St. Louis-Southwestern (Cotton Belt) Ry. is back of the project contemplating a line from Hillsboro to Corsicana.

According to recent information from Victoria, Texas, officials of the St. Louis, Brownsville & Mexico Ry., have practically assured the construction of the proposed extension from Inari, Refugio County, Texas, or Green Lake, Calhoun County, to Tivoli, Refugio County, a distance of 15 or 17 miles. Construction work in charge of W. F. Sparks is already underway on the Victoria extension. C. B. Rogers, Kingsville, Texas, is general manager of the company.

W. P. McCoy, who has the contract for grading a section of the Giddings-Stone City line of the Houston & Texas Central Ry. has started work at Caldwell, Texas. The outfit includes 30 teams.

Additional plans have been announced at San Antonio, Texas, by H. W. Quinan, of the San Antonio, Rockport & Mexico Railroad, whereby a line of this system is to be constructed to Del Rio via Eagle Pass connecting with the Kansas City, Mexico & Orient Ry.

Utah.

The Ogden Rapid Transit Co., Ogden, Utah, has applied to the Commissioners of Weber County for permission to cross a county road and to use the highway at certain points for a roadbed. It is believed that this application was made with a view to extending the Ogden canyon line from the present terminus at the Hermitage resort to Huntsville.

The Salt Lake & Ogden Ry., S. Bamberger, President, Salt Lake City, now operating 50 miles of steam line, has filed an amendment to its articles of incorporation providing that the capital stock of the company shall be $1,500,000, divided into 5,000 shares of preferred stock and 10,000 shares of common stock of the par value of $100 each.

The Utah Coal Ry. Co. has been incorporated with a capital stock of $125,000 and proposes to construct a 125-mile railway in central Utah. The officers are: William M. Bradley, president; William Ashton, vice president; Robert B. Harkness, secretary and treasurer, all of Salt Lake City.

A. H. Mohler, president of the Union Pacific Ry., is reported to have announced at Ogden, Utah, recently, that the company had under consideration extensive improvements. The line is 75 per cent double-tracked between Ogden and Omaha, and will be double-tracked out of Ogden this season.

Right of Way Agent C. A. Black, of the [illegible] all the ground necessary for the double-tracking and changing its line, together with reducing the grade between Uintah, Utah, and Strawberry, a distance of about six miles. [illegible] made the road will occupy higher ground at [illegible] Uintah. Construction work will be started [illegible] Neb., is chief engineer.

Vermont.

[illegible] the Boston & Maine R. R., operating 22 miles [illegible] Barre, is planning a 1½-mile extension to reach a number of additional quarries. F. W. Stanyan, Montpelier, Vt., is General Manager.

Virginia.

The stockholders of the Virginia Ry., H. Fernstrom, Chief Engineer, Norfolk, Va., have authorized the increase in the capital stock of that company from $36,000,000 to $65,000,000, of which $29,000,000 is to be 5 per cent cumulative preferred stock and $36,000,000 common stock.

The Currier Lumber Co., operating mills at Glamorgan, Va., is planning the extension of a number of short line branches of its lumber road around the Kentucky border this year. One and the most important will be a 6-mile extension from Pound, near Pound Gap up Pound River skirting the State border to the headquarters of Pound into rich timber properties. Another will go down Pound five miles to Hettie, and still another will go up North Fork several miles.

Washington.

The Spokane, Portland & Seattle Ry. is reported to be considering a plan for building a cutoff from the Snake River junction point to Wallula, thereby cutting off about 20 miles to Portland.

Franchise has been asked at Bothell, Wash., by A. K. Rouse, said to be representing Chicago parties, for a franchise to construct an electric car line from the city to Seattle.

It is rumored in Wenatchee, Wash., that the contract for the construction of the Great Northern Ry. from Wenatchee to Oroville will soon be let and that actual construction work will be started the latter part of March. The total mileage of the Great Northern in Chelan County for this line will be 9 miles. The greater portion of the right of way will permit of rapid road building, but along the Columbia River banks, a few miles from Wenatchee, a large quantity of rock work will be encountered which will necessitate heavy blasts. A portion of the line from Oroville to Pateros has already been graded, the work having been completed about a year ago.

West Virginia.

The stockholders of the Wheeling Traction Co., Geo. O. Nagle, General Manager, Wheeling, W. Va., have decided to spend $1,000,000 to improve the power plant in South Wheeling, erect a new repair shop on the island, a new car barn at Glenova and add from 20 to 25 modern double-truck cars.

The town of Weston, W. Va., has voted to grant a franchise to the Clarksburg & Weston Electric Ry. Co., and it is expected that the 16 miles of line needed to complete the road from Mount Clare to Weston will be finished at once.

The Clarksburg & Philippi Traction Co. of Clarksburg has been incorporated with a capital stock of $300,000 and proposes to build a trolley line from Clarksburg to Belington and from Craigmoor to Buckhannon, W. Va.

Wisconsin.

The Wisconsin State Railroad Commission at a recent hearing granted the Chicago & Wisconsin Valley R. R. a certificate of necessity and convenience to build its line from Madison to Portage and also permission to increase its capital stock to $484,000. Allen T. Russell, Portage, Wis., is an officer of the railroad.

Wyoming.

As noted in our last issue, a plan is under consideration for building an electric railway to connect Basin with Otto, Burlington and Germania. M. Folcey and J. B. Thompson, Basin, Wyo., are interested.

Canada.

✣Bids will be received until noon, Feb. 20, by Board of Control, Toronto, Ont., for supply of track intersections and other special work layouts. G. R. Geary is Chairman of the Board. Specifications may be had of the Department of Railways and Bridges, City Engineer's office, Toronto, Ont.

The ratepayers of Edmonton, Alta., have endorsed the by-law for the expenditure of $600,000 for extensions to the municipal street railway. The City of Edmonton Street Ry. Department is operated by the city engineer and three commissioners.

The Montreal & Southern Counties Ry. Co., W. B. Powell, General Manager, 506 Canadian Express Bldg., Montreal, Que., has decided on the building of an additional 20 miles of track and the electrification of the old Granby & Waterloo Ry., a steam road with 15 miles of track.

Announcement has been made at Brantford, Ont., by President Muir of the Lake Erie & Northern Ry. Co. that the proposed route between Brantford and Port Dover had been fully ratified by the Dominion Railway Board, including the approval of all railway crossings between Brantford and Simcoe. Entrance to Brantford along the canal bank was confirmed.

The City Council of Stratford has decided to submit to the rate payers the latest proposal of the Canadian Pacific Ry. for securing an entrance to this city. It is stated that if an agreement is reached and the by-law passed without delay the work will be commenced this spring and finished possibly within the year. The line would be from Embro to Linwood via Stratford.

The Hamilton, Grimsby & Beansville Ry. Co. (electric), Hamilton, Ont., has plans well along for extending its line this year to St. Catharines, Ont.

Application is to be made at the present session of Parliament to incorporate a railway company under the name of "The Prince Edward & Hastings County Ry.," with power to lay out, construct and operate a line of railway from a point at or near Trenton, in the county of Hastings, to Gardenville, in Prince Edward County, thence in an easterly direction through or near Albury, Rednerville and Rossmore, and thence to Belleville, County of Hastings; leaving Belleville, going north to Frankford and then back to Trenton. A line will also be constructed near Albury or Rednerville to Wellington, Prince Edward County, and thence to Bloomfield and Picton. Another line at Picton will connect for Demorestville, Northport, Somersville and Ferry Point, in the County of Prince Edward.

The Canadian Government has approved the plans of the Esquimault & Nanaimo Ry., H. J. Cambie, Chief Engineer, Victoria, B. C., for its extension up the east coast of Vancouver Island, from Union Bay to Duncan Bay, north of the Campbell River. The company is understood to contemplate an early commencement of construction, the clearing of right-of-way and a beginning of the grading of the line being already in hand.

The Grand Trunk Pacific Ry. Co. is to apply at the present session of the Saskatchewan Legislature for an act to incorporate a company to be known as "The Grand Trunk Pacific Saskatchewan Ry. Co.," with the following powers: To lay out, construct, equip, maintain and operate in Saskatchewan the following lines of railway: From a point at or near the city of Saskatoon, westerly and northwesterly to a point at or near the town of Battleford; from a point at or near the town of Watrous, southwesterly through or near the town of Swift Current to a point on the international boundary between ranges 22 and 30 west of the third meridian; from a point at or near the town of Melville, northerly, northwesterly and westerly to a point at or near the city of Regina; from a point at or near the city of Saskatoon, southeasterly, southerly and southeasterly to a point at or near the city of Regina; from a point at or near township 36, range 8, west of the third meridian, southwesterly and westerly to join the Biggar-Calgary branch of the Grand Trunk Pacific Branch Lines Co.

The Canadian Northern Ry. has surveys under way for another line which will give a direct freight haul from Portage to the head of the lakes without having to go through Winnipeg, and also a more direct line to Emerson and through to Minneapolis. The projected line will go south from Winnipeg to Carman and then east to Morris, and from there will connect with the line at Calionte from Emerson to South Junction on the main line.

Plans are under consideration for the laying of about 13 miles of track this season for the Calgary Street Ry. This railway is owned by the city of Calgary, Alberta.

The third surveying party has started work on the proposed line of the St. John Valley Ry. between Fredericton, N. B., and Gagetown. The party which has been working on the survey for the Gibson & Minto Ry. has completed the work.

The Ontario Railroad Commission will this fall probably take up the matter of extending the Temiskaming & Northern Ontario Ry. northward beyond the junction of the Grand Trunk Pacific at Cochrane, until it reaches the shores of James Bay. Sidney Ellis has been commissioned by the railway commission to undertake a preliminary examination of the route that would be followed, but chiefly to gather data respecting James Bay and the country thereabouts. His report will be presented probably next September, and upon the information contained therein will largely depend the future course in regard to an extension of the Temiskaming & Northern Ontario Ry. northward to salt water.

It is reported that the Canadian Northern Ry. has taken over the Hamilton, Waterloo & Guelph Railway franchise and will build the proposed line, thus insuring the McKenzie-Mann company entrance to Hamilton, Can., behind Dundurn and Harvey Parks.

Advices from Port Colborne, Ont., state that the Grand Trunk Ry. will build a new Y and lay about 16 additional tracks in their yards at that place.

The Canadian Northern will, according to reports from Regina, Sask., start work some time this summer on large shops at that place.

The following statement is reported to have been made by George Bury, vice-president and general manager of the Western Lines of the Canadian Pacific, Winnipeg, Man.: This year the Canadian Pacific will spend $20,000,000 for improvements and betterments on its lines west of the Great Lakes. Double-tracking of main line will be done in all congested sections; a new coaling plant will be constructed at Fort William, together with new freight yards, steel docks and increased elevator capacity; a new terminal at Coquitlam, Vancouver Island; improved terminal facilities at Winnipeg, Vancouver, Calgary Swift Current, Moosejaw, Outlook, Regina, Broadview and Brandon. In addition to this work about 250 miles of new branch lines will be constructed, while about 470 miles of line are to be relaid with 80-lb. standard rails.

Representatives of the Canadian Northern Ry. are to apply to the Saskatchewan Legislature for the incorporation of a company with power to construct the following lines: From a point at or near Kipling westerly to a point at or near New Warren; from a point at or near Hampman, northerly to a junction with the Brandon, Saskatchewan, line of the Canadian Northern Ry.; from a point at or near Moose Jaw, easterly to a point at or near Regina; from a point on the Delisle branch of the Canadian Northern Ry., westerlay to the western boundary of the province; from a point at or near Chamberlain, southerly to Moose Jaw; from a point at or near Craven in a generally northeasterly direction to a point at or near Hudson Bay Junction with a branch from a point thereon to a point on the Rossburn branch of the Canadian Northern Ry. east of Yorkton; from a point at or near Humboldt, westerly to a point at or near Saskatoon; from a point at or near Langham, southeasterly to a point at or near Saskatoon; from a point at or near Melfort, northeasterly to the eastern boundary of the province; from a point at or near Hudson Bay Junction, southerly to a point on the Brandon-Regina line of the Canadian Northern Ry., west of Maryfield; from a point at or near Swift Current northerly to a point at or near Battleford; from a point at or near Chamberlain westerly and north to the North Saskatchewan River to the western boundary of the province; from a point at or near Prince Albert northeasterly to the eastern boundary of the province; from a point on the Prince Albert-Denholm line of the Canadian Northern Ry., westerly to a point on the North Battleford-Jack Fish line of the Canadian Northern Ry.; from a point at or near Moosomin, southerly to the southern boundary of the province.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received until 1 p. m., Feb. 21, by Commissioners of Randolph County, Roanoke, Ala., for grading, draining and surfacing with sand clay approximately 5 miles of road to be built with State aid. A certified check for $400 must be filed with each bid. W. S. Keller is State Highway Engineer, Montgomery, Ala.

At a recent meeting of the Board of Trade of Tuscaloosa, Ala., a resolution recommending the construction of a new highway from the Warrior River to Tuscaloosa was passed. The estimated cost of the road is $8,500.

Arkansas.

The Improvement Board of Paving District No. 7, city of Fort Smith, Ark., will shortly ask for bids on the paving of Garrison Ave. M. H. Reed is Engineer and Roy Johnson is Secretary of the Board.

California.

⊙The Board of Supervisors of San Joaquin County, Stockton, Cal., recently received the following bids for improving nine miles of the Roberts Island road with oil macadam. the route to be from the Roberts Island bridge to the Lathrop road south of French Camp: Ross Construction Co., $58,003; Cotton Bros. Co., $58,468; Cy. Moreing, Jr., $50,301; Frank C. McIntyre, $51,952. Bids were received at the same time for the graveling and oiling of a road between Tracy and Vernalis, a distance of 14 miles: Cotton Bros. Co., $55,294; Frank C. McIntyre, $52,893; Cy. Moreing, $51,132. Both contracts were awarded to Cy. Moreing.

⊙The Board of Supervisors of San Joaquin County, Cal., has awarded the contract for the improving of the Mariposa road from Collegeville to Escalon, a distance of 12 miles, to F. C. McIntyre for $42,957. Other bids on the work were: Cy. Moreing, Jr., $45,660, and Cotton Bros., $47,512. Stockton is the county seat.

According to advices from Fresno, Cal., a campaign is to be launched in Fresno County some time during this month for a $3,000,000 bond issue for good roads.

Specifications for the paving of 7 miles of the Jacobs road from the western limits of Stockton, Cal., across the island to the Santa Fe fence, near Holt station, and for the construction of a pile trestle on the French Camp road, have been adopted by the Board of Supervisors of San Joaquin County, Stockton.

The San Diego County Board of Supervisors, San Diego, Cal., has received the following bids for the construction of four miles of highway between Ramona and Mesa Grande: M. D. Goodbody, $16,718; Knight & Hyde Construction Co., $18,904.

Plans and specifications for improving Santa Clara St., from 12th St. to Coyote River, and Orchard St., from San Carlos to Auzerais Ave., have been adopted by the City Council of San Jose, Cal.

Colorado.

The Colorado State Highway Commission has sent an engineer to Grand Junction for the purpose of making a survey of the Grand Junction-Paradox Valley automobile road, via Unaweep cañon.

Georgia.

The Streets and Drain Committee of the City Council of Augusta, Ga., has asked the appropriation committee for an amount sufficient to pave May Ave. and Walton Way with some permanent material, also 12th St., from Broad St. to the city limits, also to pave Telfair, from Eighth to Ninth.

A good roads improvement club has been organized in Ware County, Ga., for the purpose of working for better highways through the Waycross section. The club will affiliate with the American Association for Highway Improvement. Dr. G. P. Folks of Waycross is president and Dan Lott of Waycross is secretary.

Illinois.

✣Bids will be received until 1 p. m., Feb. 15, at which time bids will be opened in A. H. Mueller's Hall, Highland, Ill., for: Trenton Road.—The proposed improvement begins at the south end of the existing macadam on the Trenton road and extends in a southerly direction. The amount of road to be built will be not less than 5,280 ft. nor more than 9,300 ft., and the contract will be awarded for as much of the work as can be constructed with the money available. It is expected there will be about $11,000 to be expended for this improvement. The beginning of the proposed improvement is by road approximately 1½ miles from the Vandalia railroad station in Highland, and there is a good macadam road the entire distance. Quantities: Seven thousand to 12,400 sq. yds. of finished macadam 8 ins. thick. Excavation: An average of one-fourth cu. yd. per sq. yd. of finished roadway. Separate bids are requested for water-bound macadam and bituminous macadam. Work to be completed on or before Nov. 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained, upon application in writing, from the Illinois Highway Commission, Springfield, Ill.

The Board of City Commissioners of Waukegan, Ill., has ordered the construction of new pavement on County St., between Madison and Franklin Sts., at an estimated cost of $10,000.

The Commissioners of Road District No. 7, Cairo, Ill., will construct a mile of macadam road running from Beech Ridge toward Willard this spring. Crushed stone will be used. Another stretch of road to be improved will be from the city limits north for one mile to the Country Club.

The Board of Local Improvement of Aledo, Ill., has passed a resolution adopting the

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

paving proposition. The [illegible] the Dolarway and consists [illegible] crete covered with ¼ in. of bitumen and sand. On College Ave., and in the business section the pavement will be 50 ft. wide and in the residence part 24 and 30 ft. wide. Mayor J. W. McRoberts has estimated that the work will cost approximately $110,905.

City Engineer R. L. M[illegible] Ill., recently estimated the cost of the proposed paving of Orchard St., from Water to Broadway and Cleveland Ave. The items in the estimate are as follows: Orchard St.—3,500 yds. of paving at $1.75; 2,600 ft. curb and gutter at 50c.; 2,700 yds. of excavation at 40c.; six brick catch basins at $35; one brick manhole, $25; 160 ft. 10 ins. sewer pipe at 50c.; 140 ft 12 ins. sewer pipe at 60c.; total, $9,629. Cleveland Ave.—6,400 yds. of pavement at $1.20; 4,300 ft. of curb at 40c.; 3,700 yds. of excavation at 40c.; 12 catch basins at $35; five manholes at $25; 1,300 ft. sewer pipe at 50c.; total, $12,799.

City Engineer John D. Arey of Sterling, Ill., has completed the estimates on all of the proposed streets for paving which will cost approximately $100,000. The Board of Local Improvements contemplates paving at least 56 blocks, probably with brick. An election will be held in the spring for the purpose of voting on the proposition.

The contract for the construction of approximately 30,000 sq. yds. of brick pavement on concrete base at Rochelle, Ill., will be let after March 1. Aetna Engineering Bureau, 17 La Salle St., Chicago, are engineers.

Indiana.

✣Bids will be received until 10 a. m., March 1, by Board of Hendrick and Morgan Counties Commissioners, Danville, Ind., for the construction of a road on the county line 21,102 ft. in length. L. W. Borders is Hendrick's County Auditor.

⊙The Board of Wells County Commissioners, Bluffton, Ind., has awarded the following contracts for the construction of four highways in Harrison Township and two in Chester Township, for which bids were opened Jan. 31: Thos. Turpin, Liberty Center, Ind., one road; Alva W. Woodward, Ossian, one road in Harrison Township; Wilson Woodward, Ossian, Ind., one road in Harrison Township; John N. Neff, Bluffton, Ind., one road in Harrison Township; James A. Crosbie, Bluffton, two roads in Chester Township, and L. O. Bears, Geneva, one road in Nottingham Township.

⊙The Board of Public Works of Michigan City, Ind., has awarded the contract for the construction of sheet asphalt on Detroit, Wabash and Spring Sts., to the Western Construction Co., of Lafayette, Ind.

An election will probably be held in Washington Township, Gibson County, Ind., this year to vote on a petition to improve 8 miles of public highway in that township. Princeton is the county seat.

Iowa.

✣Bids will be received until 8 p. m., Feb. 20 (readvertisement), by J. A. Dougherty, City Clerk, Carroll, Ia., for furnishing the necessary labor and material for the improvement of several streets by paving with creosoted block, brick and bitulithic pavements. The work will include approximately 9,000 cu. yds. of excavation, 8,500 lin. ft. of curb and combined curb and gutter and about 23,000 sq. yds. of pavement. A certified check for $3,000 must be filed with each bid. Official advertisement will be found elsewhere in this issue.

The City Council of Sheldon, Ia., has passed a resolution of necessity for paving 22 blocks of streets of Sheldon and has instructed the City Engineer to prepare plans and specifications for the work.

The City Council of Sioux City, Ia., on Jan. 27 received bids for paving in the Morningside district from Jensen & Krage, E. J. Hanion, Lewis & Leader, P. C. Habson and M. L. Flinn. The bids were received in three sections and in each section the bids of Jensen

[illegible]

Kentucky.

✣[illegible] m., Feb. [illegible], for the [illegible] concrete foundation [illegible]

[illegible] each of the contracts calls for the use of vitri[illegible] block, F. G. Breslin, $1.49 sq. yd.; Shelby St., [illegible] Walnut and Chestnut, vitrified block, L. R. Figg, $1.58 a sq. yd., Walnut St., between 24th and 26th, asphalt, Louisville Asphalt Co., $1.68 a sq. yd.

⊙W. C. Overly & Co., Joplin, Mo., have [illegible] County Judge, Tompkinsville, Ky., for the construction of four miles of pike from Tompkinsville toward the Cumberland River for $111,000. The paving will be of vitrified brick, approximately 17,200 sq. yds., with concrete gutter and all work incidental thereto. Howe & Wise, Houston, Tex., are Engineers. Bids were opened Jan. 27.

Maryland.

✣Bids will be received until noon, Feb. 20, by Board of Washington County, Hagerstown, Md., for the construction of about 1¼ miles of state aid road.

✣Bids will be received until 11 a. m., Feb. 14, by Board of Awards, at the office of the city register, Baltimore, Md., for grading, curbing and paving with sheet asphalt partly on concrete base and partly on present cobblestone surface, and with vitrified block and granite block on concrete base, sections of about 16 streets, arranged into following contracts: Contract No. 6, 57,156 sq. yds. sheet asphalt, 1,014 sq. yds. vitrified block; certified check $2,700. Contract No. 7—10,953 sq. yds. sheet asphalt, 661 sq. yds. vitrified block; certified check, $2,000. Contract No. 8—12,059 sq. yds. sheet asphalt, 3,126 sq. yds. vitrified block, 525 sq. yds. Belgian block; certified check, $2,500. Contract No. 9—8,350 sq. yds. vitrified block; certified check, $600. Contract No. 10—16,862 sq. yds. vitrified block, 793 sq. yds. Belgian block; certified check, $1,000. Contract No. 11—4,853 sq. yds. Belgian block; certified check $500. Contract No. 12—7,075 sq. yds. Belgian block; certified check, $800. Contract No. 13— 8,119 sq. yds. Belgian block; certified check, $800. Specifications and proposal sheets furnished upon application to office of Paving Commission, City Hall. Plans and profiles on file in office of H. Kent McCay, chief engineer; R. Keith Compton, chairman Paving Commission.

Michigan.

The citizens of Lake Township, Missaukee County, Mich., at a recent election voted the issuance of bonds in the sum of $12,000 for improvements on roads for the next two years. The levy will be from 7 to 12 mills.

The citizens of Winsor Township, Huron County, Mich., it is reported, on Jan. 27 voted to raise $50,000 to build 17 miles of stone road.

The citizens of Lowell, Mich., on Jan. 22 voted the issuance of bonds in the sum of $25,000 for paving. Specifications are being prepared by E. H. Christ for the paving of the main street with brick

Minnesota.

A petition has recently been granted for the construction of a new road beginning at the southeast corner of Koochiching County, State of Minnesota, and extending 10 miles south on the line between St. Louis and Itasca Counties. International Falls is the county seat of Koochiching County.

The Minnesota State Highway Commission, St. Paul, has decided to survey the proposed routes of the Brainerd and Moose Lake, Duluth and Moorhead, Deer River and Northome and the Duluth and St. Vincent highways, the last as far as the eastern boundary of Clearwater County. These roads are located in the northern part of the state.

Plans are being prepared by the Minnesota State Highway Commission, St. Paul, for a main highway from Duluth to St. Vincent, Duluth to Moorhead, Duluth to Twin Cities, International Falls to Twin Cities, Brainerd to Moose Lake, Deer River to Northome. Preliminary surveys are now under way on several portions of these roads and will be extended to all immediately after preliminary petitions and approvals by County Board are filed. The Commission will not take action on final approval until receipt of engineer's report. Geo. W. Cooley, St. Paul, is State Engineer and Secretary of the Commission.

Mississippi.

The city of West Point, Miss., will lay about 9,000 sq. ft. of macadam pavement on East Main St., probably Novaculite pavement will be used. D. Cottrell is Mayor. C. L. [illegible]

Nevada.

Surveys have been completed for the construction of the new road which the county of Washoe and citizens of Reno, Nev., and Sparks are constructing from Sparks to the mining district of Wedekind. The road will terminate at the Arkell mine.

New Jersey.

✣Bids will be received until 2 p. m., Feb. 13, By Board of Street and Water Commissioners, Jersey City, N. J., for the improvement of Lafayette St. from Van Horne St. to 100 ft. west of Woodward St. E. B. See is City Clerk.

New York.

✣Bids will be received until 11 a. m., Feb. 10, by Department of Public Works, Francis Ward, Commissioner, Buffalo, N. Y., for the construction of pavement on a number of city streets.

The citizens of the town of Greenwich, N. Y., at a recent meeting voted that $5,000 should be appropriated toward improving the highways, in consideration of the fact that the State pays 75 per cent of the cost.

The New York State Highway Commission, Albany, has included between 30 and 40 miles of state and county highway in its plans for improvement during the coming summer.

The City Council of Fulton, N. Y., has taken steps to secure the city's share of the cost of building a new road, part macadam and part brick, the entire length of West First St. The State will build a road the entire three miles of the street 16 ft. wide. The property owners are required to build an 8 ft. strip in the road.

On Feb. 5 the City Council of Albany N. Y., considered an ordinance providing for the conversion of Clinton square into a plaza.

At a meeting of the citizens of Pulaski, N. Y., on Jan. 29, Supervisor M. J. Terry, Village President W. J. Peach and W. H. Brown were appointed a committee to arrange for a special village election for a vote on a proposition for a brick pavement through the business section. Division Engineer Frederick S. Strong of Syracuse, N. Y., has estimated the cost of paving, curbing and catch basins at $22,000, of which amount the State would pay $4,800.

An amendment to the charter of second class cities has been introduced by Assemblyman Entwhistle of Utica, N. Y., by which municipalities are given authority to award contracts for "the collection and removal of rubbish and ashes and the cleaning of streets." It is understood that the amendment was offered especially for the benefit of Utica. It does not make contracting compulsory. The amendment adds the words quoted to the section which already gives cities authority to let contracts for water, light, railroad street sprinkling and the like, and states that the contracts be for one year.

North Carolina.

The citizens of Lee County, N. C., at a recent election voted in favor of the issuance of bonds in the sum of $100,000 for the improvement of the public roads. Sanford is the county seat.

North Dakota.

✣Bids will be received until Feb. 13, it is reported, by City Council, Grand Forks, N. Dak., for paving DeMers Ave., from the bridge to the Northern Pacific tracks at a cost of about $35,000.

Ohio.

✣Bids will be received until noon, Feb. 23, by Board of Hamilton County Commissioners, Cincinnati, O., for the improvement under specification No. 138, of Cornell Ave., from Lebanon pike to Montgomery pike, in Sycamore and Symmes townships. Bids must be accompanied by a bond amounting to $2,000. Albert Reinhardt is clerk of the Board.

✣Bids will be received until noon, March 1, by Board of Hamilton County Commissioners, Cincinnati, O., for the improvement under Specification No. 295, of the Harrison Pike, from the west corporation line of Cheviot to the C. & O. R. R. in Green and Colerain townships. Albert Reinhardt is clerk of the Board.

✣Bids will be received until noon, Feb. 9, by Director of Public Service, Cincinnati, O., for the grading, curbing and paving of Powers St., from Sylvan road to Fisher Ave.

⦿Spencer Bros., 12,960 Euclid Ave., Cleveland, O., have been awarded the contract by the Village of Cleveland Heights, H. H. Canfield, Clerk, for the necessary labor and material for the improvement of Ridgefield road from the north line of Mayfield road to the north end of the street, by establishing a grade, grading, draining and paving the same with brick. The contract price is $4,347. F. A. Pease Engineering Co., Williamson Bldg., Cleveland, O., is Engineer. Bids were opened Jan. 30.

⦿Morgan Bros., of Ravenna, O., have been awarded the contract by the Board of Portage County Commissioners, Ravenna, O., for the construction of brick pavement in Section No. 1 of the Ravenna-Randolph road, in Rootstown and Ravenna townships, length 4.63 miles, width of pavement, 12 ft., for $59,500; also for Section No. 2, length 3.21 miles, width of pavement, 12 ft., for $37,586. Bids were opened Feb. 1.

⦿The Board of Control of Toledo, O., has awarded the contract for the paving of the new market house on Erie St. to the Asphalt Block Paving Co., of Toledo, for $11,207. Other bidders were: Russell & Jennison Co., Toledo, $12,877; Toledo Contracting Co., $13,585; M. F. O'Sullivan, Toledo, $12,334, and Patrick Watters & Son, $13,663.

The Commissioners of Lawrence County, O., will sell bonds Feb. 20 in the sum of $100,000 for turnpike improvements. S. A. Bowman, Ironton, is County Auditor.

The Village Council of Genoa, O., has commenced the preliminary work to have Main St. paved its full length. Engineer Geo. Champe of Toledo, O., will prepare plans and specifications.

Hahn & Co. of Canton, O., J. C. Devine of Alliance, O., and G. M. Harris of Wheeling, W. Va., have submitted the low bids to the City Council of Sebring, O., for paving work, estimated to cost $25,000.

Oklahoma.

A delegation of citizens of Lawton, Okla., recently called upon State Highway Commissioner Sidney Suggs at Oklahoma City to ask that an engineer be sent to that place to lay out four miles of road from Lawton to Fort Sill.

Oregon.

⦿The City Council of Portland, Ore., has awarded the following contracts for street work: Paving Alameda Park tract with gravel bitulithic, Warren Construction Co., $147,000; grading and laying concrete curbs and sidewalks as follows: East 11th St., from Dunedin to Oak Knoll, Oregon Independent Paving Co., $2,089; Webster St., from East 13th to Scenic Park, Beehill Bros., $725; Sumner St., from Union Ave. to Scenic Park, Carter Bros., $6,139.

Following bids were recently received by the City Council of Portland, Ore., for grading and concrete curbs and walks in Knapp Ave., district: Elwodo Wiles, $9,723; Beehill Bros., $9,100; M. Hanson, $10,388; Stevens & White, $9,441; Joplin & Meeks, $9,409; Giebisch & Joplin, $9,207; Welton, Kibbe & Cochran, $9,653; Carter Bros., $9,191.

Pennsylvania.

✣Bids are being received for the construction of about 4½ miles of bituminous macadam road near Wilkesbarre, Pa. Further information concerning the work may be obtained at 610 Second National Bank bldg., Wilkesbarre, Pa.

Solicitor Isaac W. Baum, representing the Washington County Commissioners, has petitioned the County Court, Washington, Pa., for the improvement with brick of six stretches of road in the county. The total estimated cost of the proposed roads is $521,681. The petition will be heard at a meeting to be held Feb. 12.

Tennessee.

⦿J. G. Galloway, Court House, Memphis, Tenn., has been awarded the contract by the Board of Shelby County Commissioners, Memphis, Tenn., for the hauling and spreading of about 2,500 yards of gravel on the State Line Road. The contract price is $.36 per yd. Bids were opened Feb. 1.

Citizens of Dukedom, Tenn., and of Fulton, Ky., 10 miles west, have organized the Fulton & Dukedom Gravel Road Co., to build a gravel and automobile road from Dukedom to Fulton first, and afterwards extend the road east from Dukedom to the Tennessee River, and then west from Fulton to Hickman, Ky. H. V. Parrish of Dukedom is president and E. E. Carney is secretary of the company.

The Good Roads Committee recently appointed by the Sumner County Court, Gallatin, Tenn., to look into the question of buying the pikes and locating pikes on the north side of the county, has organized and elected Judge Geo. W. W. Jackson, chairman and W. W. Pardue, secretary. Plans for the work have been adopted. The committee will work in sections. Those on the south side will make recommendations as to the purchase of pikes and those on the north side will consider the location of roads in their section.

Texas.

✣Bids will be received until 11 a. m., Feb. 10, by Commissioners' Court, at the office of George L. Fearn, County Auditor, Dallas, Texas, for the construction and repair of the Garland and Housely road, from Centerville to a point near Housely, a distance of about 1½ miles; the Armstrong road, the Maple Ave. road, the Wheatland and Duncanville road from Duncanville to that part of the road now graveled, a distance of about 2 miles. A separate bid must be filed for the construction and repair of each road. A certified check for a sum equal to 10 per cent of the amount of the bid must accompany each proposal. Plans and specifications on file in office of County Engineer.

⦿C. L. Wilson has the contract to build 18 miles of county road in Upshur County, Gilmer, Tex., for the commissioners of that county. Mr. Wilson has purchased the county's grading outfit at a consideration of $4,000.

Road District No. 2, Grayson County, Sherman, Tex., has voted the issuance of bonds in the sum of $400,000 for road improvements. The district comprises 150 sq. miles. Bonds will probably be ordered issued at the February term of court, and will bear date of March 1, 1912. H. R. Wallace is County Auditor.

The Bexar County Highway League, San Antonio, Tex., expects to renew its activity in the construction of several highways leading out of San Antonio to points of interest. One is an improved road from San Antonio to Port O'Connor on the gulf of Mexico, which will pass through Southerland Springs, Cuero, Victoria and will be about 100 miles in length.

The county of Anderson recently sold bonds in the sum of $150,000 for road improvements to the S. A. Keane Co., of Chicago, Ill. Palestine is the county seat.

Property owners on Peak St., between Ross and Swiss Aves., have petitioned the City Commission of Dallas, Tex., for the paving of that portion of the street with pine blocks.

The City Council of Terrell, Tex., has passed an order for the paving of Moore Ave., and the connecting cross streets a distance of one block north and south. The street will be paved from Rockwall Ave. to the city waterworks plant.

The City Commission of Fort Worth, Tex., has issued an order for the paving of West Fifth St.

A petition is being circulated in Calvert, Tex., by E. J. McGuirk, secretary Young Men's Business League, asking the County Commissioners, Calvert, to order an election for the issuance of $150,000 good road bonds.

Dallas County Engineer J. F. Witt has filed his report with the County Commissioners, Dallas, recommending the expenditure of $344,050 on county roads and giving in detail the estimated cost of putting the four cardinal and eight intermediate roads in first-class condition. The sums necessary to be used on the roads to be built is given as follows: West pike, $35,169, Preston road $22,700, east pike $29,185, Lancaster road $22,093, Coppell road $35,649, Garland road $35,953, Seagoville road $30,659, Cedar Hill road $32,799, Denton road $26,203, Richardson road $19,680, Millers Ferry road $37,216, Beckley road $16,743. Last July the county of Dallas voted an issue of $500,000 bonds for road work.

Virginia.

✣Bids will be received until 11 a. m., Feb. 13, by P. St. J. Wilson, State Highway Commissioner, Richmond, Va., and Tazewell County Supervisors, Tazewell, Va., for grading, draining and macadamizing about 113 miles of road in Clear Fork, Jeffersonville and Maiden Spring district. D. B. Daniel is chairman of the supervisors.

Washington.

⦿L. H. Goerig, 836 Shelby St., Seattle, Wash., has been awarded the contract by the Board of Public Works of that city for the grading, curbing, etc., of 22d Ave., N., for $18,766.

Wisconsin.

The streets and alleys committee of the City Council of Milwaukee, Wis., has recommended asphalt street paving for the season of 1912, to cost approximately $100,000. In addition the committee has recommended that all the alleys flanking Grand Ave. be paved with asphalt. H. E. Briggs is Commissioner of Public Works.

The Marathon County Board, Wausau, Wis., has appropriated $10,000 for the purchase of road making machinery for the improvement of the highways of the county in accordance with the state aid highway law.

A state highway is to be built from the village of Amery, Wis., east 2¼ miles and south ¾ of a mile to connect with the Black Brook road. The width of the roadbed is to be 6 per cent, or 6 ft. to every 100 ft. The cost of the road will be covered by the sums obtained from the state, county and town, each paying 33 1/3 per cent.

Canada.

The ratepayers of Edmonton, Alta., have endorsed money by-laws totaling $1,800,000 for improvements, of which amount $200,000 will be for power plant improvements and to pay the city's share of paving, and $175,000 for improvements on the fair grounds.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

BRIDGES—STEEL AND CONCRETE

Arkansas.

•The Board of Craighead [illegible] sioners, Jonesboro, Ark., has [illegible] tract for the construction [illegible] over the lake at Lake City, to the Vincennes Bridge Co., Vincennes, Ind., at $64,900. The structure will be 4,000 ft. long [illegible] be started at once. Bids were [illegible]

California.

Officials of the Oakland & Antioch Ry., which has a line under construction to Sacramento, Calif., have according to information received from Martinez, Cal. [illegible] sion of the United States War Department to construct a bridge over the Suisun Bay, from Contra Costa to Solano County. According to the proposed plans the structure will be built via Chip's Island. The cost of the work is estimated at $600,000.

Colorado.

Commissioners of Las Animas County, Trinidad, Colo., have awarded the contract for the construction of a 50-ft. bridge over the Riley Canon arroyo on the Stonewall road. A contract for moving a ste [illegible] point near the ranch of J. Rosebaugh, below Hoehne, has been awarded to Hawkins & Barnett.

At the recent meeting of the supervisors of Colusa and Sutter counties, and the officials of the Northern Electric Co., at Colusa, Calif., mentioned in our last issue, a plan was adopted for the combination railway and highway bridge over the Sacramento River. Officials of the company are reported to have assured the supervisors that work on the Colusa-Marysville railroad and bridge would be started shortly. A. D. Schindler, San Francisco, Calif., is general manager of the company. The cost of the work is estimated at [illegible] $224,370.

District of Columbia.

✣Bids will be received until 2 p. m., Feb. 10, by Maj. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for furnishing single-track, steel-deck, Pratt type railroad bridges, each structure to have a span of 116 ft., 12-in. center to center of main trusses.

Illinois.

✣Bids will be received at 5 p. m., Feb. 14, by Street Committee of the City Council, at the office of J. F. King, City Clerk, Lake Forest, Ill., for the construction of a reinforced concrete bridge. Plans and specifications are on file with the clerk. J. Anderson, Jr., is city engineer.

✣Bids will be received at Green Valley, Ill., up to 2 p. m., Feb. 15, for the construction of two steel bridges, one in Colona Township and the other in Hanna Township, Henry County. Carl Lager, chairman of Bridge Committee, Geneseo, Ill. Potters Bridge—Span, 130 ft., riveted truss; 16-ft. roadway; reinforced concrete floor. Substructure, reinforced concrete; distance from finished roadway to bottom of footings, 20 ft.; wings, 18 ft. long. Estimated concrete in substructure, 162 cubic yards; reinforcing steel, 10,911 pounds. Bridge is located 4 miles east of Green River in Hanna Township; ¼ of a mile from Hennepin Canal. Roads, fair average load, about 4,000 pounds. Material will have to be shipped in by canal or railroad. Present structure, wood pile trestle, 115 ft. long. Excavation will average full depth of abutments in sandy loam. Piles will probably be necessary. Average flow of stream, 4 ft. deep and 90 ft. wide. Green River Bridge—Span, 150 ft., riveted truss; 16 ft. roadway; reinforced concrete floor. Substructure, reinforced concrete. Dimensions and general condition, same as above bridge. Estimated concrete, 16.7 cu. yds.; re- [illegible] lbs. Present structure, [illegible] about 18 ft. in sand [illegible] more detailed information may be had by an [illegible] prepared by the Illinois Highway Commission, [illegible] or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received at the Town Clerk's office, Raritan, Ill., up to 11 a. m., Feb. 15, [illegible] crete bridge in Raritan Township, Henderson County. James K. Barry, Town Clerk, Rari[illegible] ft. in the clear; roadway, 16 ft.; distance from finished roadway to bottom of footings, 20 ft.; wings, 18 ft. long. Estimated concrete, 231½ cu. yds.; reinforcing steel, 24,687 lbs. Nearest railroad station, Stronghurst, 5½ miles. Roads, fair; average load, 4,000 lbs. Commissioners advise that creek gravel can be laid down at the bridge site for $1 per cu. [illegible] its quality. [illegible] Excavation will average 16 ft. deep in sandy loam to coarse gravel. Average flow of straem, 3 ft. deep and 15 ft. wide. Work to be completed on or before June 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received at the Town Clerk's office, LaMoille, Ill., up to 1 p. m., Feb. 26, for the construction of two reinforced concrete bridges in LaMoille, Bureau County. J. H. Showalter, Town Clerk, LaMoille, Ill. Midwood Bridge:—Span, 50 ft.; roadway, 16 ft.; distance from finished roadway to bottom of footings, 16½ ft.; length of wings 16 ft. Estimated concrete in structure, 182.8 cu. yds.; reinforcing steel, 24,289 lbs. LaMoille, 2 miles; roads, fair. Average load, 3,000 lbs. Local gravel pit, one mile from bridge site; gravel 50 cts. per cubic yard at the pit, same will probably require washing and proportioning. Existing bridge is a 50-ft. wood pile structure. Excavation full depth of abutments. Average flow of stream, 3 ft. deep and 27 ft. wide. Flowers Bridge:—Two 50-ft. deck girder spans; 16-ft. roadway; reinforced concrete abutments and plain concrete piers; distance from finished roadway to bottom of footings, 19½ ft.; length of wings, 16 ft. Estimated concrete in the structure, 309 cu. yds.; reinforcing steel, 37,453 lbs. LaMoille, 4¼ miles; VanOrin, 3¼ miles. Gravel same as for above bridge; ½ mile from bridge site. Existing bridge is a 50-ft., steel on tubes with two 15-ft. wood approaches. Average flow of stream, 3 ft. deep and 50 ft. wide. Excavation will be full depth of abutments in sandy loam and gravel. Clay will probably be found from 3 to 4 feet below bed of stream. Work to be completed on or before September 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission which may be seen at the Town Clerk's office or may be obtained upon application in writing from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received at the Town Clerk's office, Perry, Ill., up to 10 a. m., Feb. 27, for the construction of one steel bridge in Perry Township, Pike County. John S. Felmly, Chairman of Bridge Committee, Griggsville, Ill. Lipkamon Bridge:—Span, 100 ft., riveted truss; roadway, 16 ft.; distance from finished [illegible] same will probably require washing. Nearest railroad station is Griggsville, 7½ miles; Perry, 1½ miles. Commissioners advise that teams can be secured for $3 per day; average load, about 2,000 pounds. No bridge was ever [illegible] average full depth of abutments in sandy loam [illegible] stream. Average flow of stream, 1 ft. deep and 20 ft. wide, adjacent to each abutment; sand bar in middle. Work to be completed on or before July 15, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

[illegible] Co., C. H. Cartlidge, Engineer of Bridges, 226 W. Adams St., Chicago, Ill., has completed surveys for the construction of a bridge over the Ohio River at Paducah, Ky., and Metropolis City, Ill. Permission has already been obtained of the War Department, but no definite date has been decided upon for commencing the work.

Officials of the Chicago, Burlington & Quincy Railroad are reported to have announced their intention to construct a new steel bridge over the Mississippi River at Alton, Ill. L. J. Hotchkiss, Chicago, Ill., is assistant bridge engineer of the Burlington route.

An election was held in the town of Waddamsgrove, Ill., to vote on the proposition of bonding the township to provide funds for the construction of bridges.

Iowa.

•The contract for the construction of 11 reinforced concrete bridges in Emmet County, Ia., has been awarded by the Board of Supervisors, Estherville, Ia., to N. M. Stark & Co., Des Moines, Ia., at $5,700. The work includes one 8-ft., three 10-ft., three 12-ft., one 16-ft., one 18-ft., and two 20-ft. spans. Charles A. Root is County Auditor and W. H. Gibbs is chairman of the board. Bids were opened Jan. 23.

Plans have been prepared by Engineer S. B. Gardner, for the construction of a bridge over the river at Eldora, Ia., estimated to cost about $25,000. The structure, it is said, will be about 1,100 ft. long.

Kansas.

The Kansas City, Kan., Mercantile Club approved the plans submitted by the Wyandotte County Commissioners for the reconstruction of the West Kansas Ave. bridge. The plans provide for the rebuilding of the bridge upon its present site at a cost of $97,000. The present structure will be moved 100 ft. east and three new spans will be added at the west end, in compliance with the requirements of the plans of the war department in regard to a 734-ft. channel. Eight new concrete piers and two abutments will be built to replace the defective caissons which froze and burst. A creosote block pavement will replace the plank floor.

The Board of Shawnee County Commissioners, Topeka, Kan., has practically decided upon the reconstruction of the brick yards bridge over the Kansas River west of Topeka. As planned, the structure will cost about $25,000, of which, it is reported, the Chicago, Rock Island and Pacific Railway will [illegible]

✣ indicates work now open for bids. ◉ indicates a contract let recently.

Louisiana.

⊙The Finance Committee of the New Orleans, La., City Council, has made a favorable report accepting the bid of the Midland Bridge Co., Kansas City, Mo., for the erection of a bascule bridge over the New Basin Canal at Hagan Ave., at a cost of $22,900.

Massachusetts.

The following bids were received Jan. 30, by the Essex County Board of Commissioners, Salem, Mass., for the reconstruction of the Fox Hill bridge over the Saugus River between the city of Lynn and the town of Saugus, Essex County, of which R. R. Evans is engineer: (1) Standing for William H. Ellis, Boston, Mass; (2) Holbrook Cabot & Rollins Corporation, Boston, Mass.; (3) M. McDonough, Swampscott, Mass.; (4) William L. Miller, Boston, Mass.; (5) George T. Rendle, Boston, Mass.; (6) Thomas E. Ruggles, Chelsea, Mass.; (7) Snare & Triest Co., New York:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Removing old structure	$ 372	$ 1,500	$ 2,000	$ 1,000	$ 3,600	$ 1,000	$ 3,000
Temporary bridge	6,500	8,500	7,000	[illegible]	8,725	9,060	6,800
Foundations	24,940	13,800	17,000	15,160	14,932	36,140	22,000
32,000 lin. ft. of piles	0.16	0.24	0.30	0.20	0.22	0.21	0.25
86,500 ft. B. M. timber in grillages	46.00	58.00	50.00	47.70	50.00	49.00	45.00
1,820 cu. yds. 1:2:5 concrete	7.60	7.50	9.00	7.70	9.50	6.75	6.00
860 cu. yds. 1:2:4 concrete	10.00	14.00	12.00	14.52	11.50	17.00	11.00
650 cu. yds. granite masonry	15.00	20.00	12.00	19.80	18.00	15.00	18.00
50 cu. yds. rubble masonry	3.50	6.00	9.00	8.80	8.20	5.00	6.00
126,000 lbs. steel rods	0.03	0.03½	0.05	0.044	0.03	0.02	0.03
Steel draw span	18,957	20,000	19,500	18,957	18,247	18,500	19,000
Wooden floor	1,446	700	2,000	1,200	1,000	700	550
Operator's house	600	400	600	450	557	700	400
Fender piers	5,675	6,700	7,000	5,506	6,622	7,095	5,640
3,500 cu. yds. rip-rap in embankment	2.50	2.75	3.00	2.47	3.10	2.00	2.00
2,000 tons rip-rap around piers	1.60	2.00	4.00	1.37	1.55	1.30	1.30
8,000 cu. yds. earth fill	0.75	0.65	0.75	0.82	1.00	0.80	0.50
2,500 sq. yds. macadam	1.40	1.00	0.75	1.58	1.20	0.80	1.25
310 sq. yds. granolithic	3.50	1.50	2.00	1.76	4.45	1.50	1.89
420 lin. ft. iron fence	1.25	1.50	1.50	1.10	1.28	1.60	1.30
1,350 lin. ft. wooden fence	0.70	0.40	0.40	0.44	0.75	0.20	0.70
740 lin. ft. curbstone	0.95	1.25	1.25	0.88	1.02	0.85	0.75
48 lin. ft. granite cap	5.00	2.00	2.00	1.50	3.00	2.00	2.00
1½ tons castings	60 00	40.00	70.00	40.00	69.00	80.00	70.00
Totals	$128,764	$131,738	$139,[illegible]66	$131,465	$136,999	$143,830	$124,972

Minnesota.

Board of Hennepin County Commissioners, Minneapolis, Minn., has been advised that permission of the U. S. War Department to construct a bridge over Carson's bay at Deephaven, Minn., is not required, owing to the fact that Lake Minnetonka is not a navigable body of water.

With the passage of bills by Congress authorizing the construction of bridges over the Mississippi River at 42d Ave., north, Nineteenth Ave. south, and Third Ave. south, it is reported that City Bridge Engineer Ousted, Minneapolis, Minn., is rushing plans for the structures.

Missouri.

At the regular election held at Independence, Mo., in April, the proposition to issue bonds amounting to $15,000, for the construction of bridges and culverts will be voted upon.

Plans have been completed by Hedrick & Cochrane, Consulting Engineers, Kansas City, Mo., for the construction of the proposed viaduct on South Sixth St., St. Joseph, Mo. Considerable legal procedure is anticipated before the matter will be in shape for the attention of prospective bidders. The law under which viaducts are built provides that railroad companies whose grade crossings are to be eliminated, bear the expense of the improvement. The construction will be done under supervision of the Board of Public Works. C. P. Hoff is assistant city engineer.

Bonds have been voted for the construction of a viaduct on High St., over Wears Creek, Jefferson City, Mo., and about $25,000 is available for the improvement. The kind of structure has not, as yet, been decided upon. Phil. C. Harding is city engineer.

At the suggestion of the Special Conference committee of the Municipal Assembly, St. Louis, Mo., plans will be made for an entirely new elevated East Side approach to the municipal bridge to extend 18,000 ft. from the river bank. The proposed approach will extend northeasterly and will extend to a point outside of East St. Louis city limits.

Members of the Adams St. Improvement Association, St. Louis, Mo., have presented the Board of Public Improvements a petition for a viaduct from the free bridge approach at Twenty-third and Gratiot streets, across the Mill Creek Valley to Twenty-third St. and Scott Ave.

Nebraska.

✣Bids will be received until 2 p. m., Feb. 20, by Dawes County Clerk, Chadron, Nebr., it is reported, for the construction of all bridges during the year of 1912.

✣Bids will be received until noon, March 6, by Board of Jefferson County Commissioners, at the office of C. H. Shaffer, Fairbury, Nebr., County Clerk, for the construction and erection complete of all bridges of 24 ft. or more in length.

✣Bids will be received until Feb. 12, by J. H. Jensen, Kearney County Clerk, Minden, Nebr., for the construction of all bridges during the year of 1912. Separate bids will be received on wood, steel or concrete.

D. D. Price, State Engineer, Lincoln, Nebr., has submitted plans and specifications for the construction of a State Aid bridge between Boyd and Holt counties over the Niobrara river to the commissioners, and it is believed that bids for the work will be asked shortly. S. A. Richardson, Butte, Nebr., is clerk of Butte county.

Board of Adams County Supervisors, Hastings, Nebr., rejected all bids received for the construction of county bridges during the year of 1912. The work will be readvertised shortly.

New Jersey.

The West Jersey & Sea Shore R. R., J. B. Hutchinson, Jr., Camden, N. J., Division Engineer, is reported to be planning the construction of a new concrete bridge on the line between Alloway and Quinton to replace the present trestle.

New York.

A resolution was recently introduced into the City Council of Syracuse, N. Y., asking that the Onondaga Legislators at Albany take up the matter of securing a new bridge over the Erie Canal at Beech St.

Ohio.

⊙The contract for the construction of substructure of the bridge over Clay Creek in Madison township, Licking County, O., has been awarded to William Moore, Newark, O., at $995. All bids for the superstructure were rejected. C. L. Riley is auditor of the county. Bids were opened Jan. 31.

⊙The Board of Summit County Commissioners, Akron, O., has awarded the contract for filling the approaches of the George Highway bridge over the Cuyahoga River in the village of Cuyahoga to T. W. Wakeman, Akron, O., at 20 cts. per cu. yd. C. L. Wirth is clerk. Bids were opened Jan. 29.

⊙The Board of Marion County Commissioners, Marion, O., has awarded the contract for the construction of the superstructure of a bridge over the Little Scioto River on the Radner pike in Green township to the Home Engineering & Contracting Co., Canton, O., at $1,990, and for the substructure to H. Sloop, Richmond, O., at $993. The contract for the steel superstructure of the bridge over the Little Scioto River on the Morris pike in Green Camp township has been awarded to Home Engineering & Contracting Co., at $2,750. Bids were opened Jan. 30. V. P. Garfield is clerk of the board.

⊙Board of Hamilton County Commissioners, Cincinnati, O., recently awarded the contract for the construction of the concrete bridge over Mill creek at 2d St., Carthage, O., to Charles F. Runck, at $12,300. Bids were opened Jan. 26. Albert Reinhardt is clerk of the board.

E. S. Smith, Surveyor of Mahoning County, Youngstown, O., recommends that plans for the proposed East End bridge be started at once in order that an estimate of the cost can be made.

A resolution has been introduced into the City Council, Dayton, O., providing that the city engineer prepare plans for the construction of a lift bridge over the canal at Valley St., in North Dayton, in accordance with the request of the North Dayton Improvement Association.

An agreement has been reached between the Cleveland, Alliance & Mahoning Valley Ry. and the allied companies, whereby the steam companies and the electric line will equally bear the expense of an immense concrete and steel bridge to be constructed next year in South Ravenna, Ravenna, O., to permit the interurban line to enter the city. The bridge will be 225 ft. long, with spans of 65 ft. on each side of the railroad tracks.

Oregon.

⊙The Benton County Court, Corvallis, Ore., has let the contract for metal structural material for a county bridge to the Coast Bridge Co., Portland, Ore.; bids for the piers and foundation will be received in March. The bridge will comprise three fixed spans and a draw span and will have sufficient capacity for any interurban railway that may wish to reach Corvallis from the Linn County side. The cost of the structure completed will amount to about $60,000.

The Salem, Falls City & Western Railway Co., has secured permission from the State of Oregon and the U. S. War Department to construct a bridge over the Willamette River from West Salem to Salem. S. B. Taylor, Dallas, Ore., is chief engineer of the company.

It is understood that the Portland Railway, Light & Power Co., Portland, Ore., has under consideration the construction of a bridge over the Clackamas River between the present structure near Oregon City, and the one at Estacada. F. W. Hild, Portland, Ore., is general manager of the company.

Pennsylvania.

City Council of Scranton, Pa., has passed an ordinance granting permission to the Erie Railroad Company to build five new bridges at Myrtle St., Adams Ave., Gibson St., and Washington Ave. cross overs, providing for proper protection for traveling public from drippings from the bridge. F. A. Howard, New York City, is engineer of Bridges and Buildings of the railroad.

The County Commissioners at Ebensburg, Pa. have decided nothing definite as yet in regard to the construction of the proposed bridge between Cambria City and Minersville. C. E. Troxell is clerk.

A resolution has been introduced into the City Council of Wilkesbarre, Pa., providing that the finance committee appropriate money for the construction of a bridge over the railroads from Butler St. to Kidder St.

The Municipal Art Jury, of Philadelphia, Pa., has rejected the plans submitted by the

Pennsylvania Railroad for the proposed new bridge across Broad St. north of the North Philadelphia station, and the company will be asked to submit plans for a more artistic structure.

Texas.

✣Bids will be received until 10 a. m., Feb. 13 by the City Council, Nacogdoches, Texas, J. R. McKinney, secretary, for the construction of two concrete bridges. Plans and specifications are on file at the office of the mayor. A certified check for $250 must be filed with each bid.

County Commissioners, through Judge John L. Young, Dallas, Texas, sold the remaining $200,000 of road and bridge bonds issued last year.

Virginia.

The Council Committee on Finance has recommended to the City Council of Richmond, Va., a revised plan for construction of Mayo's bridge acrosss Mayo's Island, agreed upon between the Street Committee and the Mayo Land and Bridge Company, together with an appropriation of $8,241.40, for the cost of retaining walls and construction proposed. The new plan proposes outlets for two streets to cross the bridge on a level with the main structure at right angles, it being planned to develop the island as a suitable place for warehouses and manufacturing sites, opening out on the bridge, and with ample railway facilities.

Washington.

• [illegible] River, near Mt. Vernon, Wash., bids for which were published in our last issue, has been awarded to D. M. Stevenson, Port-[illegible]

The Lewis County Commissioners, Chehalis, Wash., are, according to reports from that city, asking bids for the steel superstructure of a new bridge over the Cowlitz River at Randle in the eastern part of the county. The structure, it is estimated will cost $21,000. This improvement was mentioned in our last issue.

The Recreation Park Improvement Club of Spokane, Wash., at a recent meeting decided in favor of constructing an elevated viaduct at Rebecca St., over the International, Idaho & Washington and Inland Empire railroads.. J. C. Farrington is president of the club.

McCary & Willard have started work upon the steel bridge of the Northern Pacific across the Spokane River, near Trent, Wash. All the material for the structure is on the ground. It is the intention of the contractors to have the bridge completed about the middle of March, which will give the company a double-track line from Spokane to Otis, with two bridges across the Spokane River. The bridge will cost about $60,000.

Engineers of the Oregon-Washington Railroad & Navigation Co. are reported to have [illegible] construction of truss bridges to replace trestles within the city limits of Pullman Wash.

Wisconsin.

A special election will be held at New London, Wis., to submit to the voters the proposition of issuing bonds to the amount of $15,000 for the construction of a second bridge over the Wolf River.

Canada.

✣Bids will be received until noon, Feb. 18, by J. G. Sullivan, Chief Engineer, Canadian Pacific Ry., Winnipeg, Man., or at the office of Division Engineer, Calgary, and office of Assistant Engineer, Strathcona, for concrete substructures, excavation, etc., of overhead bridges and subway at Edmonton, Alta.

✣Bids will be received until noon, Feb. 17, by A. Malcolmson, Secretary-Treasury, Carman, Man., for the erection of two bridges over the Boyne River at that city. Bids will be received as follows: For the supply of piles, timber and lumber. For the supply of iron material. For the work in erection and construction of the two bridges. For the erection and construction of each bridge, contractor to supply all labor and material required. All material to be delivered at Carman not later than April 1st, 1912. For 25,000 ft. 2x8, 2x10 and 2x6 B. C. Fir, 16 ft. long. Plans and specifications for Bridges may be seen at the office of the Manitoba Government Engineer at Winnipeg, Man., or at the office of A. Malcolmson.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

Bids were opened Jan. 25 at Osceola, Ark., by Drainage District No. 9 of Mississippi County, for the construction of 292½ miles of ditches requiring the excavation of about [illegible] cu. yds. The work was divided into 16 contracts, the low bid on each contract being as follows:

No.	Yardage.	Low Bidder.	Price yard. Cts.
1	874,400	George W. McCarter, Warsaw, Ind.	7.99
2	1,117,500	George W. McCarter, Warsaw, Ind.	7.90
3	799,300	Canal Construction Co., Chicago, Ill.	6.57[1]
4	607,500	Chapman Brothers, New Market, Ia.	9.19
5	1,598,400	National Drainage Co., Alexandria, Minn.	5.93
		Wedge & Tyler, Coldwater, Mich.	5.93
6	[illegible]	Madison Construction Co., Anderson, Ind.	[illegible]
7	823,600	O. P. Herrick, Des Moines, Ia.	7.44
8	[illegible]	Otto Kochtitzky, Cape Girardeau, Mo.	[illegible]
9	189,900	R. F. & G. A. McWilliams, Chicago, Ill.	11.25
10	949,400	J. S. Kochtitzky, Cape Girardeau, Mo.	6.00[3]
11	1,044,600	Otto Kochtitzky, Cape Girardeau, Mo.	6.30
12	1,228,300	Otto Kochtitzky, Cape Girardeau, Mo.	6.35[4]
13	618,400	Engel Brothers, Nettleton, Ark.	6.84
14	1,863,000	Foohey Dredging Co., Fort Wayne, Ind.	7.00[5]
15	1,156,600	Otto Kochtitzky, Cape Girardeau, Mo.	6.30[6]
[illegible]	[illegible]	Forrestal & Feyon, St. Paul, Minn.	11.50

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[1] Condition that they get No. 5 at same price. [2] Condition that he get No. 12 [illegible] [3] Condition that he get No. 5 at [illegible] cts. [4] Condition that he get No. [illegible] at [illegible] price. [5] Condition that they get No. 13 at same price. [6] Condition that he get No. 11 at same price.

The Commissioners are now considering the bids received. Morgan Engineering Co., Memphis, Tenn., are engineers for the work.

Bids were opened Jan. 30 by the Fourche Drainage District for the construction of about 300,000 cu. yds. of river protection levee along the Arkansas River and Fourche Bayou, in Pulaski County, Ark. I. R. Bobbett, Delta, La., was the low bidder. Bids were also opened for clearing about 500 acres along Fourche Bayou in Pulaski County, Jos. McCoppin of Little Rock, Ark., being the low bidder on this work.

California.

• The [illegible] which has the contract for constructing 309 miles of [illegible] and laterals for the [illegible] Irrigation District, Oakdale, has placed the following sub-contracts: Moreing Bros., Sacramento, as noted in our last issue, for building the canals and laterals of sections 6 and 7 on the north side of the Stanislaus River; Ed. Stenson for the tunnels in the same division; A. H. Christensen, section 4; Wattis & Bechtel, sections 1 and 2, which start at the dam and continue the entire length of the canyon.

The Hallwood Irrigation Co., according to advices from Marysville, is to have work started at [illegible] water to irrigate the Hallwood and the Stahl holdings northeast of Hallwood. The work will cost about [illegible] labor.

Board of Trustees of San Mateo has instructed City Engineer Bromfield to draw up plans for levees to be constructed at Coyote Point to drain off the marsh lands to the south.

The Los Vergeles Land & Irrigation Co., according to advices from Marysville, which owns a large tract of land near Bangor in Yuba County, is making preparations to construct a dam on its property which will be used to impound water needed for the irrigation of the land.

Colorado.

[illegible] bonds. It is stated that the money from the sale will be available at once and work on repairing [illegible] Prowers will begin immediately.

Idaho.

✣Bids will be received until 2 p. m., March 1, by U. S. Reclamation Service, Boise, Idaho, for furnishing a rock crusher, ball mixers and weighing machine for sand cement plant on the Boise project.

The Pioneer Irrigation District, according to advices from Caldwell, will hold an election Feb. 9 for the purpose of voting bonds in the sum of $313,000 to be used for drainage purposes. There is a trifle over 34,000 acres of land in the district, all of which will be subject to assessment. The assessment will be $9 per acre. The proposed election is contingent to the release of the district from the Boise-Payette project. It is proposed to install two pumping plants and a number of ditches, thus increasing the amount of water available for irrigation purposes and at the same time relieve much of the land from surplus water.

Illinois.

✣Bids will be received until 10 a. m., Feb. 10, by Drainage Commissioners, at the Court House, Urbana, Ill., for the construction of an open ditch 45,877 ft. long for the Sangamon and Drummer Drainage District beginning near the west line of Gibson City, Ill., and having outlets 3 miles north of Fisher, Ill. The bottom width of the ditch at the lower end will be 50 ft. and at the upper end 8 ft. including approximately 381,373 cu. yds. of material. Plans and specifications may be obtained of the County Clerk at Urbana, or at the office of Ray, Dobbins & Dobbins, Champaign, Ill. Bids may be mailed to the latter office.

Indiana.

✣Bids will be received until 11 a. m., Feb. 15, by Allen Maggard, Drainage Commissioner, at the office of the surveyor, Scottsburg, Ind., for the construction of main ditch 5 and 6 ft. wide at bottom and average 6 ft. deep, slopes 1 to 1, length 27,180 ft., and two laterals 4 and 5 ft. wide, average depth 6 ft., slopes 1 to 1, length 22,693 ft., containing about 126,706 cu. yds. Estimated cost $16,801.50. Certified check for $200 must be filed with each bid.

Iowa.

✣Bids will be received until 1:30 p. m., Feb. 21 by Board of Dallas County Supervisors, Adel, Ia., for the construction of a drainage district embracing the following: 40,729 cu. yds. excavation in open ditch, 4 ft. bottom, side slope 1 to 1; 3,400 ft. of 28 in. tile; 2,500 ft. of 24 in. tile; 1,600 ft. of 18 in. tile;

✣ indicates work now open for bids. • indicates a contract let recently.

1,300 ft. of 16 in. tile; 1,000 ft. of 14 in. tile; 3,520 ft. of 12 in. tile; 2,900 ft. of 10 in. tile; 1,040 ft. of 8 in. tile; 1,100 ft. of 6 in. tile. Bids may be for tile and labor separately. Bids for tile may be either for cement or clay. Cement tile to be made according to specifications on file in the office of M. D. Finley, County Auditor of Dallas County. All tile to be subject to inspection of engineer, all work to be performed subject to approval of engineer and Board of Supervisors.

Work to begin on or before April 15, 1912, and be finished on or before December 1, 1912. T. S. Naiden, Engineer in charge.

✣Bids will be received until 2 p. m., March 4, by E. M. Callender, Wright County Auditor, Clarion, Ia., for the improvement of County open ditch No. 10, Belmont township. The work is divided in sections as follows: Sec. 1, 950 ft. 14 in. average cut 3.3 ft.; Sec. 2, 500 ft. 16 in. average cut 2.95 ft.; Sec. 3, 400 ft. 18 in. average cut 2.69 ft.; Sec. 4, 1,200 ft. 20 in. average cut 3.03 ft.; Sec. 5, 500 ft. 22 in. average cut 3.08 ft.; Sec. 6, 4,000 ft. 24 in. average cut 3.85 ft.; Sec. 7, 800 ft. open ditch, 250 cu. yds. Bottom of open ditch, 3 ft.; slope of sides, 1 to 1. A concrete bulkhead of about 8 cu. yds. is to encase the end tile at station 8. This is an improvement of main, county, open drain No. 10, and the tile is to be laid under the bottom of the present open ditch, excepting across Minneapolis & St. Louis Railroad right of way, where it is located at one side of the 4-foot iron pipe now there. The open ditch, section 7, consists of lowering the present bottom of open ditch. Work to begin on or before April 1, 1912, and be completed on or before October 1, 1912.

Louisiana.

✣Bids will be received until noon, Feb. 26, by T. H. Jackson, Capt., U. S. Engineer, Dallas, Texas, for the construction of a dam at the foot of Caddo Lake, La.

✣Bids will be received until noon, Feb. 14, by the Caddo Levee District, S. N. Kerley, Secretary, Shreveport, La., for the construction of the following new levee in the parish of Caddo, Red River, left bank: Twelve Mile Bayou to Cross Bayou, length of line, about 17,500 ft.; contents, about 225,000 cu. yds.; deposit required, $600. Bond required, $11,300; terms of payment for work, cash.

Michigan.

✣Bids will be received until 3 p. m., March 12, by Col. C. McD. Townsend, U. S. Engineer, 337 Federal Bldg., Detroit, Mich., for the construction of West Canal, Section 2, at Sault Ste. Marie, Mich. The work to be done is to build a portion of the new canal at St. Marys Falls Canal, including the excavation of a portion of the new navigation channel, and the building of canal walls and piers. The estimated quantities are as follows:

	Estimated Quantity.	Possible Variation, Plus or Minus %
Excavation Class A	85,000 cu. yds.	25
Excavation Class B (full rate)	470,000 cu. yds.	25
Channeling	78,000 sq. ft.	25
Crib construction, framing and placing timber	2[illegible],000 cu. ft.	25
Crib filling	3,500 cu. yds.	50
Concrete (exclusive of cement)	22,000 cu. yds.	33
Furnishing and delivering cement	27,000 bbls.	33
Furnishing and laying drain pipe	3,200 lin. ft.	33

The material to be removed consists chiefly of Potsdam sandstone bed rock, portions of which are hard and in strata 5 ft. or more in thickness, while other portions are soft, shaley, and freely seamed. The material overlying the rock consists of broken or soft rock, gravel, bowlders, hardpan, clay timbers, crib work, etc., all in unknown proportions.

Minnesota.

⊙Boyd Wyman, Morris, Minn., has been awarded the contract at $2,000 for constructing County Ditch No. 13, the work including 6,000 ft. of main ditch and three branches. 8-in., 10-in. and 12-in. tile will be used. Bids were opened Jan. 27 at Elbow Lake, Minn.

Missouri.

A plan is under consideration for diverting the channel of Turkey Creek by tunneling through Greystone heights to the Kaw River and to straighten the course of O. K. Creek. The improvement will cost $1,000,000, and the only way the money can be raised is an amendment to the charter to provide a benefit district. L. R. Ash is City Engineer of Kansas City.

New Mexico.

⊙W. J. Irwin & Son, according to advices from Roswell, N. Mex., have been awarded the contract at $6,018 for repairing the dam at Hagerman for the Acme Irrigation Co. The work includes driving 4,000 sq. ft. steel sheet piling; mixing and placing 200 cu. yds. concrete; 400 cu. yds. earth fill on apron, 2,000 cu. yds. earth on south bulkhead; 200 cu. yds. rock riprap. All material except steel piling is to be furnished by contractor.

North Carolina.

Steps are being taken for the formation of a drainage district for the cutting of main drainage canals to serve as outlets for smaller ditches for some 25,000 acres of land in Camden and Currituck Counties, N. C. The engineers of the viewers are now at work mapping the district, taking levels and locating the main ditches. They will probably finish their work by May next., and after their reports have been filed and approved by the court bonds will be issued and contracts let for cutting the main ditches. It is not probable that this work can be started before late next fall. The main outlets will probably be from 25 ft. to 30 ft. wide at the bottom and some 8 or 9 ft. deep. About 12,000 acres of this land are owned by Charles E. Sims, 921 Bank of Commerce Bldg., Norfolk, Va., and relatives, and these parties propose as soon as the main ditches are begun to cut smaller ditches on this tract. The smaller ditches are to be about 6 ft. deep, 30 ins. wide at the bottom and 8 ft. wide at the top. In connection roadways will be built on the ditch banks around every half section. The land is very similar to the prairie lands of northern Indiana, only perhaps more level, and with a greater depth of soil.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE.)

Walker Stansell, who is looking after the interests of his firm, Roach & Stansell, in Texas, passed through Memphis last week on return trip from New York, where he went for a conference with Mr. Lovett, chairman of the board of directors of the Harriman lines. Walker is glowing with good reports of the progress his firm is making on its contracts in the Lone Star State, especially so on the Medina irrigation job, which involves the movement of about 2,000,000 cu. yds. of excavation and a large amount of concrete dam work. While Walker Stansell refused to make public his conference with Robert S. Lovett, he stated it was in reference to matters of his firm which as yet were of a private nature.

J. W. Williams, who has been doing considerable grading for the Memphis Union Station Co., is now about to complete his contract and states that he is in the market for more grading work. J. W. makes it a rule to never lay up his teams and always says that no contract is too small for him, while few of too large proportions are encountered.

Jesse Nichols has moved his large outfit to the Speedway Land Co., contract recently secured by him in this city, and the men and mules are now hard at work grading for what will be one of Memphis' most beautiful sub-divisions. In addition to having his own outfit on the large contract, Jesse has sub-let a portion of the work to Price & Bryan.

The past week has seen a resumption of a goodly portion of levee work in this section, after an enforced idleness of over 30 days on account of high water and bad weather. Charlie Siler started on his Pecan Point contract for the St. Francis Levee Board, while Bill Stephenson and Henry McCarten began again on the Atherton Loop Levee. Pat McCadden commenced again near Wilson, Ark., and inasmuch as he is building a loop which is designed to protect the latter town from the ravages of the Mississippi River, great importance is attached to his operations at that point. Pat states that he is doing all in his power and that the weather will permit to complete his contract on time. Martin Jennings, who has been constructing some new levees above Vicksburg, Miss., has had fairly good success during the unusual bad weather which visited this section. Lowrance Brothers, working the same loop as Martin, have also done rather well considering all obstacles which they have had to undergo.

W. A. Shippey, at Enigma, Ga., states that his contract at that place is going on as well as one could expect, and that he hopes to finish within the original time mapped out by him. Bill Shippey is a hustler, and when he was on the Mississippi River, was considered one of the best levee builders that ever protected land from the floods.

The Yazoo & Mississippi R. R. have outlined a great deal of work for the year 1912, but as yet none of the proposed improvements have been made public. It is understood that about $300,000 has been appropriated for the Vicksburg, or Riverside Division of the latter road, a good portion of which will go for raising track on the Silver City-Kelso line. This latter line, by the way, was build by Memphis contractors after a terrible fight with rains and high water. The line goes through some of the worst swamps of Mississippi, in the Sunflower River bottom, and has been a constant source of worry to the Yazoo & Mississippi Valley officials, owing to the bad condition of the ground on which the line is built. It is now proposed by Engineer of Maintenance Baldwin to raise the track sufficiently high to be out of danger of the greatest possible flood which could occur in Sunflower bottom, and to haul in on cars a material which will be as nearly impervious to rain water as can be had. While the new cut-off at Natchez, Miss., has never been built, this, too, is on the program for future work, and it will not surprise those who are on the inside to have Vice President Park give the necessary word at any time.

City Engineer Weatherford states that he is through paying local contractors high prices for repairs to asphalt streets and for resurfacing work, and in order to remedy the difficulty, has purchased for the City of Memphis a spick and span new asphalt heating machine from a Milwaukee concern. Heiskell Weatherford states that while the new apparatus has cost the city $1,150, there is no way of beginning to estimate the large saving that may be effected by the city doing its own work. Then, too, explains Weatherford, many times the city wanted repairs to asphalt streets when there would be no contractors having a plant in operation at the time desired, so all around Heiskell believes he has done a good thing. The machine will be shipped at once, it is understood.

C. D. Smith & Co. report having just completed their contract at Hazelhurst, Miss., and are preparing to move their forces to other work which they have already contracted for.

The letting of the Fourche (Arkansas) Levee Commissioners held at Little Rock on Jan. 30, in which 300,000 cu. yds. of work was offered, was the most hotly contested bidding seen in this section for some time past, and at the present writing the award has not been made. I. R. Bobbitt, of Natchez, Miss., had the low bid of 12.94 cents, contingent, however, on being given until Sept. 1, 1912, to complete the work, the contract time being specified in the invitations as June 1. Mr. Bobbitt also had a bid in of 14.50 cents to do the work within the time limit of the specifications. This bid was just shaved by R. L. Leonard, who offered to do the work as per regular time for 13.50 cents. The commission is at this time considering whether to give the work to Bobbitt on his long time bid of 12.94 cts. per cu. yd., or to Bob Leonard on his short time figure of 13.50 cts., and the two [illegible] who are so deeply concerned in the decision are on the ground importuning the engineers and members of the commission to see the proposition from their viewpoint. Roach & Stansell were next in line on the job with a bid of 13.70 cts. while [illegible] Brothers of Arkansas City wanted 15.5 cts., both of the latter propositions being based on the regular time as outlined in the specifications. A number of other contractors had in bids, but those listed above were nearest to the figures which will receive final consideration. The prices per cubic yard were very low on this contract, as all of the levee builders admit, but the work is an excellent job, all in the field and out of danger from flood waters, and it has occasioned no surprise to see such low figures turned in, for most of the levee work let recently has gone very low, too low in fact, many contend, to allow the nearest profit possible, and the whole levee proposition has simmered down to working one's teams until something better would turn up, or that a sufficiently large amount of work was offered to permit of all the contractors in this section getting a share at a reasonable price.

On Feb. 7, G. M. Shaw & Co., architects for the new Police and Municipal Building just being finished by the city of Memphis, will receive bids for approximately 20,000 sq. yds. of brick pavement for alley ways and approaches to and around the new buildings. The work will be done according to the specifications of the city of Memphis for pavements of this sort and to the satisfaction of J. H. Weatherford, city engineer, and who will pass on the work done. The grade necessary in preparation of foundation will be done by the building commissioners, so the contractor need only submit a proposition on concrete foundation and the brick surface.

C. J. Lowrance, who was awarded part of the drainage work on the Mary Mac Plantation near Robinsville, Miss., is preparing to move one of his crack outfits on the job, at once, and will maintain a good force of teams until his contract has been finished.

News has just reached the city that E. B. Mosely, well known Memphis contractor, was painfully hurt by a premature explosion of dynamite at Alpine, Texas, about a week ago. Ed has had his outfit in Texas for about two years building some new lines for the K. C., M. & O., and paid a visit to his family in Memphis at Christmas. While Ed's wounds are painful, they are not believed to be serious and his friends are all hoping to see him well and himself soon again.

C. S. Miller, the popular young agent for the Western Wheeled Scraper Co. here, announces that all the contractors in this section are buying quite a lot of equipment, getting their outfits ready for the coming year's work, and says he expects to do a good lot of business.

St. George Richardson, county engineer, announces that the work on the Memphis to Bristol highway is progressing as well as could be expected with the recent bad weather in this section. Saint says as soon as spring opens, he will see that the forces on this job make things fairly hum.

On Feb. 1, the Shelby County Road Commissioners opened and made awards of bids for constructing and maintaining dirt roads in Shelby County for a term of four years. As usual, this letting, which is held every [illegible] and partly on account of the fact that the [illegible] farmers of Shelby County gathered at the [illegible] month and submitted bids. After careful tabulation, Supt. W. F. Gill announced the following successful contractors, stating that the price of the bids would be made known at a later date: First District, M. L. Thompson; Second, W. H. Bass; Third, [illegible] Ramsey; Sixth, B. F. Willford; Seventh, C. G. Goven; Eighth, Marion Zellner; Ninth, J. G. Galloway; Tenth, Dean Mann; Eleventh, J. P. Callis; Twelfth, R. L. Bartholomew; Thirteenth, W. W. Hutchinson; Fourteenth, William Tait; Fifteenth, W. A. Campl; Sixteenth, C. A. Galloway; Seventeenth, W. A. Massey; Nineteenth, W. B. Myers.

All the Memphis contractors are lamenting the fact that they were not able to keep Bre'r Groundhog out in the open air when he came out to look the situation over, as according to his prediction, they are in for six weeks more of winter weather.

Texas.

✣ [illegible] March 5, by Board of Directors, Union Irrigation District, A. T. Woodhouse, President, Raymondville, Texas, for the preliminary engineering, surveying, etc., for the irrigation system. Maps and all necessary data are on file with V. L. Conrad, District Engineer, Raymondville, Texas. F. S. Miller is Secretary of the Board.

W. G. Kleme, Cleveland, O., owner of the Bob Brennand Ranch of 120,000 acres in Upton, Crane and Crockett Counties, is to have a system of sub-irrigation installed and will colonize the land.

Citizens of Markham and vicinity have voted in favor of organizing Drainage District No. 2 of Matagorda County. This district extends from the Wharton County line south and lies west of the Colorado River and east of Trespalacois Creek, ending at the junction of this creek and Wilson Creek, near Ashby. The commissioners recommended by the voters are A. M. Anderson, Sig Brown and C. V. Cabaniss. Bay City is the county seat of Matagorda County.

A large section of land situated northwest of Orange on the Orange & Northwestern R. R. is to be opened up and planted in rice this year. New canals will be dredged from Cow Bayou and from Peveto's Canal. L. Miller, Orange, Tex., is interested.

Preliminary work is under way for the construction of a dam, which will impound water sufficient to irrigate 70,000 acres of land, across the Nueces River at a point seven miles north of Cotulla. The water is to be taken by gravity from the reservoir and distributed through canals over a large area of country not otherwise subject to irrigation, except on a small scale from shallow wells. It is proposed to extend the canal 18 or 20 miles east of Cotulla into a fertile section recently penetrated by the new Fowlerton R. R. When the feasibility of the project is fully determined it is proposed to bond the irrigation district for expense of construction. N. G. Simpson is at the head of the enterprise.

Washington.

The Kittitas Reclamation District is to proceed with the final surveys for the location and construction of its high line canal, and it is hoped to start construction work before June. A bond issue of $5,000,000 was voted at a special election on Dec. 16 last for the work. The total area covered by the canal is to be 91,000 acres. According to the preliminary surveys prepared by Frank C. Kelsey, Portland, Ore., Chief Engineer of the district, the main canal will have a capacity of 800 cu. ft. per second. The head of the canal will be about ½ mile from Easton, and 3 miles below [illegible]. The water will be diverted from the Yakima River at an elevation of 2,175 ft. by a concrete dam 150 ft. long and 50 ft. high. From this point the main [illegible] where it will divide the larger branch crossing the Yakima River to the north side, and the other branch continuing around the south side of the valley [illegible]. The Yakima River syphon will be 5,200 ft. long, consisting of 4,100 ft. of 96-in. wooden stave pipe, and 1,100 ft. of riveted steel pipe. The maximum head on the pipe will be 340 ft. The pipe will be carried over the Yakima River and the Northern Pacific R. R. on 140-ft. steel spans, 40 ft. above the bed of the river. The north branch canal, after crossing the Yakima River, runs [illegible] country, a succession of ridges and gulches. To follow the grade line would require heavy and expensive construction and there would be danger of the canal breaking. The line as located cuts through these ridges by tunneling with a syphon across the principal gulch. There will be three tunnels on this part of the line, having a total length of about one mile; on the balance of the line there will be one tunnel and three syphons. There will be two tunnels and three syphons on the south branch canal. The largest syphon will be across Taneum canyon. This will be a 5-ft. wooden stave pipe, 2,300 ft. long. The heaviest construction will be on the main canal, through the canyon where the line runs along the steep side hill. It will be necessary to put in a flume or line the canal on this part of the work to prevent excessive seepage, and danger of the canal washing out and also to reduce the amount of excavation which would [illegible] steepest slopes a concrete-steel flume will be used. The flume will be made of concrete reinforced with steel bars. It will require less excavation than any other construction. There will be about four miles of this flume on the main canal and one mile on the north branch. Wooden flumes will not be used except at creek crossings and at places where the line cuts across low places. The flumes will be supported on piles or on frame trestles with concrete piers and will have concrete connections with the canal, making the total length 90.5 miles. The principal quantities of work and material required in the construction of the canal are as follows: Excavation, 3,500,000 cu. yds.; concrete masonry, 90,000 cu. yds.; steel, 2,700,000 lbs.; tunnels, 12,000 ft.; syphons, 20,000 ft. The total estimated cost of constructing the canals, including the diversion dam, is $3,802,300. The headquarters of the Kittitas Reclamation District are at Ellensburg, Wash. C. W. Johnsone is Secretary of the District.

The Port of Grays Harbor Commission has asked R. H. Thomson, engineer of the Port of Seattle, and J. A. Lockwood, engineer of the Port of Tacoma, to come to Aberdeen and aid in the outlining of a plan for improvement of the harbor, either in conjunction with the government or separately. The government will give the harbor $500,000 for jetty work this year, and this will materially aid in the work of the commission. This money will practically complete the jetty and the depth of the water at the bar would then be 30 ft. mean low water.

Wyoming.

The State of Wyoming has secured the segregation of 300,000 acres of land in the center portion of the Wind River Indian Reservation. It is expected that State Land Commissioner Hopkins, Cheyenne, will now make efforts to secure the relinquishment of private rights in the Bull Lake reservoir site and rights of way for canals, etc. If this is done the state will probably contract for the construction of canals and furnishing water to settlers.

WATER-WORKS

Alabama.

Prof. Edgar B. Kay of the University of Alabama, Tuscaloosa, Ala., has been retained by the city of Fayetteville, Ala., to prepare plans and superintend the construction of a waterworks and sewerage system.

Arkansas.

According to advices from Argenta, Ark., the Arkansas Water Co. plans improvements to its waterworks in that city to cost approximately $30,000. A new reinforced concrete tank will be constructed, two water-tube boilers installed, etc.

California.

The Board of Public Works of San Francisco, Calif., received the following bids for the general construction of the second pumping plant for the auxiliary fire protection system, which is to be located at Fort Mason: Healy-Tibbitts Construction Co., $143,000; Charles C. Moore & Co., $128,000; Lange & Bergstrom, $111,515; Caldwell & Co., $110,000. For steel work at station: Pacific Rolling Mills Co., $14,600; Western Iron Works, $15,200; Dyer Bros., $10,945; Ralston Iron Works, $10,450; W. B. Kyle, $9,990; Berkeley Steel Co., $9,380, and Charles C. Moore & Co., $9,000.

Supt. H. R. Fay, of the Water Department of San Diego, Calif., has submitted a report to the City Council showing the proposed improvements for this year to the waterworks system of the city. A summary of the work is as follows: New pipe system, including 10-in., 12-in., 16-in., and 24-in. pipe, $265,873; Kalamein pipe replacement, $15,949; Upper Point Loma reservoir, $12,000; New reservoir in park, $35,000; Total, $329,422; Engineering and incidentals, $10,578; Grand total, $340,000.

Colorado.

The City Council of Aguilar, Colo., has taken steps to build a new water supply reservoir and a pipe line of such character as to supply a city of 25,000 inhabitants.

Plans for the construction of a water works system and a gas system for the city of De Beque, Colo., are being discussed by the Council. Bonds will be voted upon at a special election to be held in March. Charles A. Smith, of Denver, Colo., is engineer.

Connecticut.

The Plainville Water Co., Plainville, Conn., contemplates the construction of a covered reservoir having a capacity of 2,000,000 gals.

Georgia.

✣Bids will be received until noon, Feb. 19, by Board of Water Commissioners, Macon, Ga., for furnishing the necessary labor and material for the construction cast iron water pipe and constructing a 2,400,000-gal. reservoir. Plans and specifications are on file at the office of the board.

✣Bids will be received until noon, Feb. 21, by Board of Water Commissioners, W. H. Fetner, Chairman, Macon, Ga., for a new pumping station for the city. A certified check for $2,000 must be filed with each bid.

⊙The city of Macon, Ga., recently awarded a contract to the U. S. Cast Iron Pipe Co., Bessemer, Ala., for the furnishing of 2,500 tons of cast iron pipe.

⊙The United States Cast Iron Pipe & Foundry Co., Chattanooga, Tenn., has been awarded the contract by the Board of Water Commissioners of Macon, Ga., W. H. Fetner, Chairman, for the furnishing and delivering f. o. b. Macon, cast iron pipe and special castings. Bids were opened Jan. 25.

An election will be held in Meigs, Ga., on Feb. 27 to vote on the issuance of bonds in the sum of $15,000 for the installation of a waterworks system.

The ordinance committee of the City Council of Atlanta, Ga., has recommended to that body the expenditure of $20,000 of the bond money for private water mains and $12,000 of bond money for a small reservoir which had been set aside for a new clear water basin.

The City Council of Helena, Ga., has contracted with the J. B. McCrary Co., Empire Bldg., Atlanta, Ga., for the making of preliminary surveys for a waterworks and electric light plant. These improvements will necessitate the calling of a bond election.

Idaho.

⊙Y. H. Abercrombie, of Boise, Ida., has been awarded the contract by the Boise Artesian Hot & Cold Water Co., for the excavation of 12,000 cu. yds. of earth for the construction of a 5,000,000-gal. reservoir in Hull's gulch. The contract price is $2,640. The measurement of the reservoir is given as 150x300 ft., and 22 ft. in depth. The company expects to lay 6 miles of pipe line through the city, repairing part of the old material which is now in the ground.

The City Council of Boise, Ida., is considering an ordinance providing for the granting of a franchise to the Boise Natural Hot Water Heating Co., for the purpose of piping hot and cold water to the residences and buildings in Boise from a place about five miles up the Boise River.

Illinois.

⊙T. C. Brooks & Sons of Jackson, Mich., have been awarded the contract by the Board of Local Improvements of Anna, Ill., J. L. Hammond, City Clerk, for the construction of a water distributing system for $16,974. The work includes 6,688 ft. of 8-in. cast iron pipe; 8,665 ft. of 6-in. cast iron pipe; 7,996 ft. of 4-in. cast iron pipe, 43 hydrants, 25 valves and valve boxes. Bids were opened Jan. 30. The contract for the construction of a tank and tower will be let Feb. 19.

The Board of Local Improvements of Joliet, Ill., William S. Welch, Clerk, rejected all bids received Jan. 29 for the construction of a watermain in Broadway St. H. A. Stevens is City Engineer.

The Village Board of Piper City, Ill., is again agitating the question of installing a waterworks system.

Indiana.

✣Bids will be received until 7:30 p. m., Feb. 19, by City Council, New Castle, Ind., for furnishing approximately 350 tons of cast iron pipe; 10,000 lbs. of specials; 10,000 lbs. of lead; 400 lbs. of hemp; also for furnishing and erecting one 3,000,000-gal. pumping engine and accessories. Plans and specifications are on file with L. M. Johnson, City Clerk. Charles Brossmann, Union Trust Bldg., Indianapolis, Ind., is Consulting Engineer.

⊙George C. Mumma, of Decatur, Ind., has been awarded the contract by the City Council of that city, for the drilling of two or more deep wells at the sugar factory site, furnishing 400,000 gals. of water or more per day. The contract was let at $1 per ft. Other bidders were: J. O. Smith & Son, Decatur, $1; Western Construction Co., Fort Wayne, Ind., $1.19; A. C. Michaels & Son, Geneva, Ind., $1.50; D. J. Davies, Van Wert, Ind., $1.60; Thraser & Herman, Fort Wayne, $1.75; Calvin Neeley, Van Wert, $1.25; George Steele, Decatur, $1.45, and J. C. Burket, Geneva, $1.40.

Iowa.

✣Bids will be received until 10 a. m., Feb. 10, by City Clerk, Sioux City, Ia., for furnishing 3,000,000-gal. pumping engine. Specifications may be had of G. B. Healy, Supt. of Parks and Public Property.

The proposed extension of a new 20-in. water main on West Grand Ave., in Des Moines, Ia., by the Des Moines Water Co., will be done by the company's forces. Charles S. Denman is General Manager.

The citizens of Keokuk, Ia., will be asked to vote upon the question of municipal ownership of the waterworks plant of that city at the spring election on March 25. The valuation of the plant will be decided upon this month. J. F. Elder is mayor.

Kansas.

A syndicate of capitalists has offered to purchase the water works and electric light plant of the city of Winfield, Kans., for $500,000. The City Council has been asked to call an election to submit the question to a vote of the people.

Kentucky.

⊙The Common Council of Henderson, Ky., has awarded the contract for the boring of a test well in Atkinson Park, above the city, with the purpose of obtaining pure water, to E. F. Doudna, of Madisonville.

Louisiana.

⊙The Board of Mayor and Aldermen of Vidalia, La., has let contracts to Messrs. Layne & Bowler, of Houston, Tex., to bore a 10-in. well. The company guarantees to secure 200,000 gals. of water.

Maryland.

The Washington County Water Co., Hagerstown, Md., is having plans prepared for the construction of a dam. The company also plans the installation of an additional reservoir.

The Water Department of Farmington, Me., contemplates adding another supply line for the water works between Farmington and Varnum Pond; also the installation of a sewerage system.

Michigan.

The Board of Water Commissioners of Saginaw, Mich., has asked the City Council to provide the east side pumping station with two 4,000,000-gal. pumps, to protect the danger of a failure in water supply until permanent improvement of the water system is made.

Minnesota.

✣Bids will be received until 7:30 p. m., Feb. 9, by City Council, Minneapolis, Minn., for furnishing the following materials for the construction of the filter house at the filtration plant: Brick, terra cotta, millwork, lime. Henry N. Knott is city clerk.

✣Bids will be received until 7:30 p. m., Feb. 9, by City Council, Minneapolis, Minn., for furnishing structural steel for the construction of the buildings at the filtration plant. H. N. Knott is city clerk.

The City Council of Virginia, Minn., it is reported, has engaged an engineer to appraise the value of the Virginia Light & Water Co.'s plant preliminary to its prospective purchase by the city.

Missouri.

C. F. Street of the City Water Co., Maryville, Mo., has made an offer to the Board of Public Works to sell the Maryville plant to the city for $76,000. Bonds in the sum of $100,000 were recently voted by the citizens for the purchase of the old plant or the construction of a new one.

The City Council of Kirksville, Mo., has called a special election for the purpose of voting $95,000 in bonds to rebuild its water works and install a lighting system.

Montana.

✣Bids will be received until 7:30 p. m., Feb 19, by Town Council at the office of R. H. Dean, Town Clerk, Manhattan, Mont., for furnishing f. o. b. Manhattan, a Multistage centrifugal underwriters' fire pump with a capacity of 750 gals. per minute and a working pressure of 100 lbs. per sq. in., with pipe connections. C. M. Thorpe is Engineer, Bozeman, Mont. Official advertisement will be found elsewhere in this issue.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Nebraska.

The City Council of York, Nebr., has been petitioned to submit a proposition to the people to vote bonds in the sum of $125,000 for the purpose of erecting a municipal water, electric light and heating plant. The present water franchise expires next May.

New Jersey.

Engineer A. B. Rogers of Collingswood, N. J., has submitted plans and specifications to the Water Committee of the City Council of that city, for the installation of a water plant. The plans will be submitted to the State Water Supply Commission for approval.

New York.

✣Bids will be received until 2 p. m., Feb. 13, by H. S. Thompson, Commissioner of Water Supply, Gas & Electricity, 13-21 Park Row, New York City N. Y., for furnishing, delivering and laying water main in portions of Fulton St., 67th and 76th Sts., and in 7th and 11th Aves.

✣Bids will be received until 2 p. m., Feb. 9, by Henry S. Thompson, Commissioner of Water Supply, Gas and Electricity, 13 21 Park Row, New York City, for the following contracts: For furnishing, delivering and laying water mains and appurtenances in Center Elm, Farrington, North Jane, South Jane, Lawrence, Orchard, Prospect, Sherman, William, 3d, 10th, 11th, 14th, 19th, 21st, North 22d, 23d, 26th, 28th, 29th, 30th, 31st, 32d and 33d Sts.; in Bowne, Freeman, Jefferson, Payntar, Railroad, Sinclair, Vernon, Webster, Wilson, Wolcott, 6th, 14th, 15th, 16th and 18th Aves.; in Botanic Place and in Beechurst boulevard. The time allowed for doing and completing the entire work is 150 consecutive working days. The security required is $40,000. 2. For furnishing, delivering and laying a 30-inch water main and appurtenances in the Third Ward, Borough of Queens, along Fresh Meadow road and Union avenue. The time allowed for doing and completing the entire work is 125 consecutive working days. The security required is $60,000. 3. For furnishing the materials and labor required for alterations, repairs and improvements at the Bayside Pumping Station, Borough of Queens The time allowed for doing and completing the entire work is 100 working days. The security required is $5,000.

✣Bids will be received until 11 a. m., Feb. 20, by Board of Water Supply, 165 Broadway, New York City, for Contract 72, of the Catskill Aqueduct. The work includes clearing and grubbing the Ashkan reservoir in towns of Olive, Marbletown, Hurley, Woodstock and Kingston, Ulster County, N. Y. Joseph P. Morriessey is Secretary of the Board.

✣Bids will be received until 2 p. m., Feb. 13, by Henry S. Thompson, Commissioner of Water Supply, Gas & Electricity, 13-21 Park Row, New York City, for furnishing and delivering and laying water mains and appurtenances in portions of Broadway, Howard Ave. and Hopkinson Ave.

An appropriation of $30,000 is to be made from the bureau of water reserve for the installation of water meters in the residences of the city of Schenectady, N. Y. Fred. W. Bentley is superintendent of the waterworks.

John B. Sinclair, of Chatham, N. Y., is advocating municipal ownership of the water works and electric light plants of that village. The Village Trustees have been asked to call a meeting of the taxpayers to discuss the proposition.

George H. Beebe, Constructing Engineer for the Water Bureau of Syracuse, N. Y., is preparing plans for the extension of water mains during the coming year. The most important work will be the replacing of the 6-in. main in James St., from Oak to Dewitt Sts., with a 20-in. main, and the replacing of the 8-in. main in Gertrude St., from Lodi to Oak St., with a 20-in. main.

The Village Council of Wolcott, N. Y., has engaged Engineer C. C. Hopkins, of Rochester, N. Y., with a view to constructing a municipal water works system.

The Water Commissioners of Jamestown, [illegible] Pittsburgh, Pa., to prepare plans for and superintend the construction of a reinforced concrete reservoir, connections from reser- [illegible] system.

[illegible] Dakota.

The city of Bowbells, N. Dak., is planning making extensions to the water mains this spring.

The city of Ellendale, N. Dak., has decided to lay new water mains during this spring.

Ohio.

At a recent meeting of the Village Council of Baltic, O., it was decided to engage the services of an engineer to prepare plans and estimates for the installation of a new water works system. Fred Bartholmeh, H. C. Gerber and J. M. Rinehart have been appointed a committee to take charge of the work.

Oklahoma.

✣Bids will be received until 6 p. m., Feb. 14, by City of Pryor Creek, Okla., for water hydrants, valves and boxes, gate and check valves, horizontal tubular boiler, stack and feed water heater. Plans and specifications on file in the office of the City Clerk, Pryor Creek, Oklahoma, and in the office of The Benham Engineering Co., 812-13-14 American National Bank Bldg., Oklahoma City, Okla., who are consulting and supervising engineers for the city.

The City Commissioners of Ardmore, Okla., have passed a resolution to submit a $50,000 bond issue to augment the supply of water. Test wells will be dug and a pipe line will be laid to Caddo Creek and water pumped into the city reservoir.

The Sand Springs Power, Light & Water Co., Sand Springs, Okla., has been incorporated with a capital stock of $25,000. The directors are: Charles Page, C. F. Tingley, George W. Kinney and C. W. Knigsbury, all of Tulsa, Okla.

Oregon.

Following bids were received Jan. 15 by the city of Newberg, Ore., for the construction of a pumping plant and waterworks supply main and sewerage system, for which Louis C. Kelsey, 404-5 Selling Bldg., Portland, Ore., is Consulting Engineer:

	[illegible]	[illegible]	[illegible]	[illegible]
Welton, Kibbe & [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
K. Sauset, Corvallis, Ore.	15,278	3,225	1,300	1,729
[illegible] Co., Portland, Ore.	15,073	2,900	1,300	
Jas. Kennedy Constr. Co., Portland.	[illegible]	[illegible]	1,325	[illegible]
[illegible]	[illegible]	[illegible]	1,325	1,728
Gordon & Ambrose, [illegible]	[illegible]	[illegible]	1,285	2,299
Randales & Johnson, Portland, Ore.	16,605	3,225	1,300	. .
[illegible] & Joplin, Portland	16,861	2,855	1,355	1,889
[illegible] berg, Portland	17,258	2,850	1,350	1,723
R. D. Gould, Hood River, Ore.	21,838	3,430	1,843	1,960
Fairbanks, Morse & Co., Portland, Ore.	......	3,225	1,325	.....
Newberg Heating & Plumbing Co.	......	2,750	1,541	.....
Yamhill Electric Co., [illegible]			1,2[illegible]	...

The itemized bid of Welton, Kibbe & Cochran for constructing waterworks supply main and pumping plant is as follows:

Excavating and backfilling, per cu. yd.	$ 0.42
Furnishing and laying cast-iron pipe, per lin. ft.:	
[illegible]	.55
[illegible]	1.39
Furnishing and laying wire-wound wooden stave pipe, per lin. ft.:	
10-in., 250-ft. head	.48
10-in., 275-ft. head	.49
10-in., 300-ft. head	.52
[illegible]	[illegible]
Furnishing and setting hydrants, each	38.40
Furnishing and setting valves, each:	
[illegible]	[illegible]
Furnishing and setting iron valve boxes, [illegible]	[illegible]
[illegible]	[illegible]
Constructing sump, complete	180.00
Furnishing and laying vitrified sewer pipe, per lin. ft.:	
[illegible]	[illegible]
16-in.	1.29
Furnishing and laying Ys, each:	
12-in. by 8-in.	1.97
[illegible] pipe for drain, per lin. ft.:	
[illegible]	[illegible]
Constructing special manholes:	
6 ft. or less in depth, each	30.50
For additional depth, per lin. ft.	5.00
Constructing catch basin, complete	25.00
Constructing sluice gates, each	38.85

The itemized bid of Welton, Kibbe & Cochran for constructing sewerage system is as follows:

[illegible] pipe, per lin. ft.:	
[illegible]	[illegible]
Furnishing and laying Y's, each:	
[illegible]	[illegible]
Constructing manholes, each	45.00
Constructing standard flush tank, complete	70.00
[illegible] plete	47.50
Constructing septic tank, complete	225.00

The Yamhill Electric Co., Newberg, secured the contract for furnishing motor and pump.

North Carolina.

According to advices from Raleigh, N. C., the Wake Water Co. is planning the construction of a storage reservoir.

Pennsylvania.

According to advices from Easton, Pa., the stockholders of the Blue Mountain Consolidated Water Co., which supplies water to Nazareth and Pen Argyl, have acquired control of a large percentage of the stock of the South Easton Water Co. Water rights will be acquired in Bushkill township, and it is planned to build reservoirs and dams and run a pipe line to South Easton, 15 miles from the source of supply. The directors of the new corporation are William E. Crater, Edward G. Aicher, Joseph G. Slough, William R. Haytock, all of Easton; Frank Huth, of Nazareth; E. A. Speer, of Pen Argyl, and Milton Flory, of Bangor.

Engineer E. J. O'Brien of Latrobe, Pa., has submitted the plans and specifications for the construction of the proposed new water works system for the Borough of Blairsville, Pa., to the State Health Department at Harrisburg. The new system will cost between $30,000 and $40,000.

The citizens of Etna, P. O. Allegheny, Pa., at a recent election voted the issuance of bonds in the sum of $25,000 for improvements to the waterworks.

South Carolina.

✣Bids will be received until Feb. 14, it is reported, by City Council, Columbia, S. C., for overhauling and repairing the pumping plant. The work will include the resetting of pumps on new foundation, new shafting reboring water wheels, new pedestals for boxes, etc. F. C. Wyse is the engineer.

South Dakota.

Bonds to the amount of $17,000 will be voted upon by the citizens of Winner, S. Dak., in the near future for the construction of a municipal water works.

Tennessee.

⊙The Mayor and Board of Aldermen of Lexington, Tenn., has awarded the contract for the sinking of a well for the new water works system to the Southern Well & Con-

[illegible] pany proposed to install a 12-in. well for $6.50 per ft.

Texas.

⦿The recently incorporated Malone Water Co., Malone, Tex., has let a contract to R. H. Dearing & Sons, of Dallas, Tex., for the sinking of a deep well. The directors of the water company are: R. V. Reavis, L. T. Weeks, T. Staeton, A. D. Walling and W. Hamilton.

A movement is on foot in Terrell, Tex., to construct a pipe line from Club Lake to Terrell, to increase the city water supply.

The engineers for the city of Brady, Tex., have finished examinations and preliminary surveys of damsite locations, and report four sites on Brady Creek, all above the city, where an ample water supply may be impounded and stored for use by the municipality. The general plan of Consulting Engineer John B. Hawley, of Fort Worth, includes a modern filtration plant.

The Municipal Board of Commissioners of Dallas, Tex., has awarded the contract for the construction of the new concrete dam in the Elm Fork of the Trinity River, near Carrollton, known as the Carrollton dam, to M. S. Hasie, Jr., at $23,875. Other bidders were: George W. Sonnefield, $33,000; Tarrant Construction Co., $45,000; Trinity Engineering and Construction Co., $36,325; Heidburg & Dougherty, $32,345; Hunter & Hunter, $35,200; R. J. Estep & Co., $32,788; Dallas Lime and Gravel Co., $32,725; C. M. and F. F. Davis, $32,967.

Virginia.

Engineer J. L. Ludlow of Winston-Salem, N. C., is making surveys in the city of Rocky Mount, Va., for the construction of a water works and sewer system. The water supply will be secured from an artesian well.

Bonds to the amount of $17,000 for the installation of a waterworks system in Colonial Beach, Va., will shortly be voted upon.

Washington.

⦿The Board of Public Works of Seattle, Wash., has awarded the contract for the construction of a water main in Latonia Ave., from Woodlawn Ave. to E. 85th St., to the Jahn Contracting Co., 114 Railroad Ave., for $5,570.

Plans for a second water works system in White Bluffs, Wash., have been completed by Henry Mosebar of that city. A water tank will be erected on the highest point in the city limits and the water forced through the mains to the business sections and residences.

The Board of Public Works of Seattle, Wash., has approved the amended plans and specifications for the laying of a 30-in. supply main in N. 41st St. et al., at an estimated cost of $92,000. The work will include 10,000 ft. of pipe, 1,000 lbs. of special castings, 100 lbs. of shackle rods, etc. Plans and specifications have also been approved for the laying of a water main in Fifth Ave. S., from Main St. to Seattle Blvd., et al., at an estimated cost of $12,204.

West Virginia.

The citizens of Milton, W. Va., will shortly be asked to vote on the issuance of bonds in the sum of $10,000 for the construction of a waterworks system.

An election is to be held in Parkersburgh, W. Va., for the purpose of voting on the issuance of bonds to the amount of $100,000 for the construction of a 4,000,000-gal. reservoir to cost about $40,000, for the laying of larger water mains in the business section, estimated to cost $65,000, and for the making of necessary connections, estimated to cost $25,000.

Wisconsin.

✣Bids will be received until 10:30 a. m., Feb. 10, by Department of Public Works, Milwaukee, Wis., for furnishing the necessary labor and material for the construction of house drains and water service in portions of 11 streets. H. E. Briggs is commissioner of public works.

✣Bids will be received until 2 p. m., Feb. 8, by Board of Public Works, LaCrosse, Wis., for furnishing the necessary labor and materials for the construction of 10 15-in. wells, each to be 125 ft. in depth. J. T. Day is chairman of the Board.

Canada.

✣Bids will be received until 5 p. m., March 11, by W. Griffiths, Clerk of the Municipal Council, Edmonds, B. C., for supplying about 35 miles of steel pipe from 3 to 10-in. diameter. Cleveland & Cameron, 506 Winch Bldg., Vancouver, B. C., are Engineers.

The City Council of North Toronto, Ont., has asked the municipality of Whitchurch for permission to tap its springs in order to furnish North Toronto with an adequate water supply.

The finance committee of the City Council of Victoria, B. C., has decided to call for tenders for the $35,000 worth of fire apparatus required at once. This will include a combination hose and chemical wagon, an 80-gal. gas chemical and chassis for the present truck and engine.

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

Preliminary surveys for the installation of a sewerage system in Oxford, Ala., are being completed. The citizens recently voted bonds to the amount of $12,000 for sewerage.

Arkansas.

The City Council of Russellville, Ark., has passed an ordinance forming an improvement district for the construction of a sewerage system.

Arrangements were started at a recent meeting of the City Council of Texarkana, Ark., for the establishment of another sewerage district on the east side. The territory it is proposed to embrace in the district includes Rose Hill.

California.

✣Bids will be received from 11 a. m. until noon, Feb. 12, by Frank R. Thompson, City Clerk, Oakland, Calif. for the construction of a 6-in. sewer along the center line of East Thirtieth St. from the western terminus of the existing sewer (said existing sewer lying along the center line of East Thirtieth St. westerly from Twenty-third Ave.) to a point 155 ft. westerly from the center line of Twenty-second Ave. Also the construction of "Y" branches, having 5-in. openings, on said proposed sewer so as to provide one such branch for each 50-ft. lot, and fractional lot remaining, into which the abutting property frontage, taken block by block, is capable of being divided. Also the construction of 1 brick manhole, having a top of cast-iron, on said proposed sewer at the center line of Twenty-second Ave. Also the construction of 2 lampholes, of 8-in. pipe, having tops of brick and cast-iron, on said proposed sewer, as follows, to-wit: One at the western end of said proposed sewer, and one at the eastern end of said proposed sewer. Said proposed sewer and all of said proposed "Y" branches and lampholes shall be constructed of first quality, standard sewer pipe.

⦿The Board of Public Works of San Francisco, Calif., has awarded the contract to J. F. O'Brien Co., for constructing a sewer in Brannan St., between First St. and the Embarcadero. The contract price is $32,671.

⦿R. N. Nikeevich, 2824 Seventh Ave., Los Angeles, Calif., has been awarded the contract by the City Council of Pasadena, Calif., for sewer work on El Molino Ave., and other streets for $15,250. Other bidders were: Andrew Holloway, $16,254; Sako Zarubira, $18,200; John Radish, Los Angeles, $18,500; W. E. Moyle, $18,955; M. R. Fulmis, Los Angeles, $19,400; McGovern & Ryan, Los Angeles, $20,635.

City Health Officer Dr. Francis H. Mead, San Diego, Calif., has urged the City Council to construct sewers in the district bounded by National and Newton Ave., and by 16th St.

Plans and profiles have been adopted by the City Council of Fresno, Calif., for sewer district No. 4, west of Forthcamp. The Council also passed a resolution ordering a sewer in Diamond St., near the school house.

City Engineer Homer Hamlin of Los Angeles, Calif., has made surveys and accumulated the drainage data for the construction of all the storm sewer systems necessary for the entire city. The Board of Public Works contemplates issuing bonds in the sum of $10,000,000 for storm sewer work.

The City Council of Oakland, Calif., has adopted plans and specifications for the first main outlet sewer in annexed sewer district No. 1, and has authorized the City Clerk to advertise for bids on the work. The plans and specifications for the other three districts have also been completed. W. J. Baccus is Commissioner of Streets.

Idaho.

The city of Payette, Ida., has sold bonds in the sum of $15,000 for sewer district No. 2 to William E. Sweet & Co., of Denver, Colo.

Illinois.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, until Feb. 14 for constructing brick and tile pipe sewers in the following streets:

Street.	Length, ft	Int. diam., ft	Average depth, ft	Manholes	Catchbasins
[illegible]th St	[illegible]	1½*	12.0	17	24
La Fayette Av....	670	1½*	8.0	.	.
La Fayette Av....	674	1.0	7.0		.
[illegible]th St	330	1½*	[illegible]	6	0
[illegible]th St	340	1.0	8.0		.
Wing sewers.....	100	1.0	8.0		..
91st St..........	330	1.0	8.5	2	0
Roscoe St	[illegible]	[illegible]	14.0	[illegible]	[illegible]
Roscoe St........	1,240	2½*†	12.0		.
California Av	[illegible]	[illegible]	12.5		.
California Av	[illegible]	1½*	11.0		
California Av	380	1¼	10.0		
School St	700	1.0	9		.
Berteau Av.......	220	1.0	....	2	[illegible]
[illegible]th St	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
47th St..........	1,340	3†	12.5		
47th St..........	670	2½*†	12.0		.
Campbell Av......	670	1¼	9.5		
Maplewood Av....	670	1¼	10.5	..	..
Rockwell St	670	1¼	10.0		..
Rockwell St......	660	1¼	10.5	.	..
Talman Av........	660	1¼	10.0	.	..
Washtenaw Av...	660	1¼	10.5	..	..
Fairfield Av	660	1¼	10.0	.	..
California Av....	670	1¼	10.0	..	..
54th St..........	660	2.0*†	11.0	27	21
54th St..........	610	1.0	8.5	..	..
Hoyne Av........	830	1¼	10.0	..	.
Seeley Av........	330	1.0	9.0	..	..
Alley N. of Garfield Blvd.......	566	1.0	8.0	..	..
State St..........	670	2½*†	15.5		..
State St	670	2.0*†	15.0	[illegible]	62
State St..........	670	1½	12.5	..	..
State St..........	670	1¼	10.5		..
Wabash Av.......	670	1¼	11.5	.	..
Wabash Av.......	2,010	1.0	9.0	.	..
76th St..........	440	1¼	11.0	..	..
Bensley Av	670	1.0	7.5	15	16
Bensley Av.......	660	1¼	9.0	..	..
106th St..........	630	1.0	7.5	..	..
Haddon Av	480	1.0	9.0	4	4
Lake St..........	850	2.0*	12.0	11	0
South Blvd.......	460	2.0*	12.5	..	.
68th Ct..........	680	1¼	11.0	11	0
68th Ct..........	530	1.0	8.0	..	..

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*Double strength tile pipe. †Double ring brick. *†Double invert brick sewer.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

⊙The Board of Local Improvements of Anna, Ill., J. L. Hammond, City Clerk, has awarded the contract for the construction of a sewer system and septic tank, including the following work: 3,440 ft. of 15-in. pipe, 1,228 ft. of 12-in. pipe, 1,300 ft. of 10-in. pipe, 15,030 ft. of 8-in. pipe, 580 ft. of 6-in. pipe, 51 manholes and 6 flush tanks to Reeb Bros., of Belleville, Ill., for $18,879. C. Brown, of Jacksonville, Ill., is engineer. Bids were opened Jan. [illegible]

Civil Engineer J. E. Lowman, of Sycamore, Ill., has been engaged by the city of Genoa, Ill., to make a map of the city and take levels over the route of the proposed sewer system.

The Board of Local Improvements of Joliet, Ill., William S. Welch, Clerk, rejected all bids received Jan. 29 for the construction of a sewer in Broadway St. H. A. Stevens is City Engineer.

Iowa.

✣Bids will be received until 9 a. m., Feb. 14, by Horace Susong, City Clerk, Des Moines, Ia., for the construction of the sewer system in the Seventh Ward. The Seventh Ward sewer system will cost approximately $130,000. The system will be 78,400 ft. in length, and will drain a territory of 3 square miles. A septic tank will be located at East 30th St., south of the railroad tracks.

⊙Joseph Benson of Fort Dodge, Ia., has been awarded the contract by the City Council of that city for furnishing the necessary labor and material for the construction of a sanitary sewer beginning at the Des Moines River at the end of M St., extended thence west to center of Ave. A, West Dodge, to be 8-in. sewer pipe, thence west along M St. to the east line of Ave. B, to be 6-in pipe with one manhole, one lamphole and one flush tank. The contract price is $0.47 per lin ft. W. L. [illegible] is city clerk. Bids were opened Jan. 29.

Kansas.

City Engineer A. R. Young, of Topeka, Kans., recently inspected the sewage disposal system of Kansas City for the purpose of ascertaining the approximate cost of installing a similar system in Topeka. The City Council is considering the plan of equipping the sewers which empty into the Kaw with flood gates and installing a series of pumps to elevate the sewage over the south side dike and into the river. The engineer has estimated that it will cost approximately $150,000 to care for the sewage properly.

The City Council of McPherson, Kans., has decided to build a sewer in a section of the city lying north of the Santa Fe R. R. between Chestnut and Oak Sts., and east of the Rock Island between Simpson St., and the first alley south of Kansas Ave.

Kentucky.

The City Council of Bellevue, Ky., is considering the construction of a trunk sewer down Front St., and through private property to the culvert, or one down Washington Ave., and possibly another street to the low-water mark. The improvement, it is estimated, will cost approximately $60,000.

Louisiana.

✣Bids will be received until 11 a. m., Feb. 28, by Capt. A. J. Macnab, Jr., Constructing Quartermaster, 416 Hibernia Bank Bldg., New Orleans, La., for constructing roof over settling tanks, sewer connections to quarters and earth fill under elevated water main at Fort St. Philip, La.

At a recent mass meeting of the citizens of New Iberia, La., George G. Earle, Supt. of the New Orleans Sewerage and Water Board, advised the citizens on the best means of disposing of city sewerage. This city plans the installation of a sewerage system. J. S. Power is Mayor.

Chairman of the Finance Committee of the town of Morgan City, La., M. E. Norman, will sell bonds Feb. 17 to the amount of $80,000 for the construction of a sewerage system and waterworks system.

Maryland.

✣[illegible] 14, by Board of Awards, Baltimore, Md., for [illegible] level interceptor, under contract No. 81. Plans and specifications may be had of Calvin W. [illegible]

The Paving Commission, Sewerage Commission and a representative of South Baltimore, Baltimore, Md., will hold a conference Feb. 7 with a view to outlining some plan by which the sewers of South Baltimore can be laid in order to have the streets paved. Calvin W. Hendricks is Chief Engineer of the Sewerage Commission.

A bill has been introduced in the State Legislature of Maryland empowering the people of Laurel, Md., to vote upon a bond issue of $35,000 to be used, if ratified, in constructing a sewerage system and enlarging the present water supply.

At a recent mass meeting of the taxpayers of Salisbury, Md., it was agreed upon to issue bonds in the sum of $50,000 for street improvements and modern sewerage.

Minnesota.

City Engineer Lewis W. Clarke of Stillwater, Minn., has submitted plans and specifications to the City Council for the sewer and outlet systems of the South and the North Hills.

Michigan.

The City Council of Benton Harbor, Mich., has declared it necessary to construct a sewer in Territorial St., from Fair Ave. to Benton St., and Oden St., from Main St. to Territorial St., at estimated cost of $2,802. Bert Spaulding is city clerk.

Missouri.

✣Bids will be received until Feb. 19, it is reported, by City of Sedalia, Mo., for the construction vitrified pipe sewers in District No. 22.

⊙Leon H. Jordan, of Kansas City, Mo., has been awarded the contract by the Board of Public Works of that city, for the construction of joint sewer districts Nos. 320, 324, 325 and 329 in Sewer District No. 5, for $27,682. E. Purcell is secretary of the board. Bids were opened Jan. 26.

An election is to be held in Mound City, Mo., on Feb. 20, for the purpose of voting upon the proposition to bond the city in the sum of $15,000 to install a sewerage system and extend the waterworks system, $9,500 for the sewerage system and $5,500 for the waterworks.

The improvement committee of the City Council of Hannibal, Mo., recently held a meeting to consider the proposed boundaries of Sewer District No. 100. This sewer will be constructed from Bear Creek to the river.

Consulting Engineer Alexander Potter, 114 Liberty St., New York City, is preparing plans and specifications for the construction of a sewerage treating plant at the sewer outlets, in the city of Springfield, Mo. Plans will be ready about March 1, when bids will probably be asked. H. G. Horton is City Engineer.

. The Burns & McDonnell Co.; Civil Engineers, Scarritt Bldg., Kansas City, Mo., is preparing plans and specifications for the installation of sanitary sewers and waterworks plant at Hermann, Mo.

Nebraska.

An election is to be held in the city of Crawford, Nebr., this month for the purpose of deciding whether or not bonds in the sum of $12,500 shall be issued to construct sewers.

Nevada.

⊙The City Council of Fallon, Nev., has awarded the contract for the installation of a new sewerage system to the Western Engineering & Water Works Supply Co., of Oakland, Calif., and the contract for furnishing the pipe to L. H. Kent Co., of Fallon, Nev.

New Jersey.

The sewer committee of the City Council of Longport, N. J., recently held a conference with the State Board of Health at Trenton to arrange some plan for getting the construction of the new sewerage plant under way. Bonds are to be issued for this improvement.

New York.

Plans are in preparation by the City Engineer, John A. Giles, Binghampton, N. Y., for sewers on Park Ave., Sherwood Ave., Rush Ave., and Cross St. Bids for their construction will be asked by the Board of Contract & Supply as soon as the plans are completed.

The State Department of Health, Albany, N. Y., has approved the plans of City Engineer John A. Giles of Binghamton, N. Y., for a sewer draining the Downsville district of the First Ward through Lestershire.

The Common Council of Oswego, N. Y., has adopted a resolution authorizing the Mayor to appoint a sewer commission to devise and frame a proper, adequate and comprehensive system of sewerage for both the east and west sides of the city. Plans have been prepared by Consulting Engineer T. Chalkley Hatton of Wilmington, Del. D. D. Long is Mayor.

The Board of Estimate and Apportionment of New York City has authorized the construction of a sewer in Newtown road, from 13th Ave. to 18th Ave., Long Island City, at an estimated cost of $3,100; also a receiving basin at southeasterly corner 14th St., and the Boulevard, Long Island City; estimated cost $300.

A preliminary authorization has been given by the Board of Estimate and Apportionment of New York City, for the following list of sewers in the Degnan Terminal & Realty Co.'s tract on the Hunter's Point meadows, Borough of Queens: Orton, Vandam and Meadow Sts., from Thomson Ave. to Hunter's Point Ave.; in Manly, Mount and School Sts., from Nott Ave. to Hunter's Point Ave; in Anable Ave., from Orton St. to Vandam; Nott Ave., from a point midway between Mount and School Sts. to Vandam St.; Hunter's Point Ave., from Greenpoint Ave. to Vandam St., together with a storm water sewer in Hunter's Point Ave., from Vandam St. to Dutch Kills Canal and a sanitary sewer in Hunter's Point Ave., from Vandam St. to a point 350 ft. west of Orton St.; estimated cost $121,300. Also in Dutch Kills place, from Meadow St. to Nott Ave.; Manly St., from Thomson to Nott, and in Mount St., from Thomson Ave. to Nott St.; estimated cost $5,100. Also in same section in Creek St., from Nott Ave. to Hunter's Point Ave., in Nott and Anable Aves. and Pearson St., from Meadow to Creek St.; in Davis St., from Pearson St. to Hunter's Point Ave., together with a storm water sewer in Hunter's Point Ave., from Hayward St. to Dutch Kills Canal, and a sanitary sewer in Dutch Kills Canal to Creek St.; estimated cost $15,100. Also in the Blissville section, in Hunter's Point Ave., from Greenpoint Ave. to Van Pelt St.; in Van Pelt St. and Greenpoint Ave., from Hunter's Point Ave. to Anable, an aggregate length of 3,000 ft.; estimated cost $17,400. Also for grading and curbing Prospect Ave., Ridgewood, from Metropolitan Ave. to Madison St.; estimated cost $10,700.

Engineer A. M. Scripture of New Hartford, N. Y., has completed plans for the installation of a system of sewers in a new district. The Sewer Commissioners will shortly advertise for bids for the work so that it can be started in the spring.

Ohio.

✣Bids will be received until noon, Feb. 26, by Director of Public Service, J. W. Chrisford, Lakewood, O., for furnishing all necessary labor and material for making collection of garbage and dead animals in the city, for a period of two years commencing March 1, 1912.

The City Council of Springfield, O., is considering the construction of a chain of sew-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ers known as the Maiden Lane system for this year. This system will benefit the entire northwestern section of the city and will cost from $38,000 to $40,000. Edward Mahr is chairman of the sewer committee.

The State Board of Health has notified the city of Canton, O., that the construction of the proposed sewer district No. 4 cannot be started until a new sewage disposal plant is put in.

The City Council of Urbana, O., is considering the proposed installation of a sewerage system. It is probable that plans for the system will be proceeded with shortly.

A resolution has been introduced in the City Council of Cincinnati, O., calling on the city engineer to make surveys and plats for a sewer system for the former village of Madisonville. The Council is also considering a resolution calling for a survey of the entire sewerage problem of the city.

The citizens of Xenia, O., at a recent election voted against the issuance of bonds for the construction of a sewage disposal plant.

Residents of Ohmer Park, city of Dayton, O., have petitioned the City Council for the construction of a sanitary sewer system throughout that district. The city engineer has been asked to submit plans and estimates for the work.

City Engineer C. S. Pratt of Urbana, O., has submitted plans and specifications to the City Council for the construction of a sewerage system. George McCrery is Chairman of the Sewer Committee.

Oklahoma.

✣Bids will be received until 6 p. m., Feb. 14, by City of Pryor Creek, Okla., for sewer pipe, wyes, manhole castings and covers, vitrified building brick, cement, 6-in syphon flush tank castings. Plans and specifications on file in the office of the city clerk of the City of Pryor Creek, Oklahoma, and in the office of The Benham Engineering Co., Consulting and Supervising Engineers, 812-13-14 American National Bank Bldg., Oklahoma City, Okla.

Oregon.

⦿Following bids were received recently by the City Council of Portland, Ore., for the construction of sewers: East Moreland district, Northwest Municipal Contract Co., $46,653; Jeffrey & Bufton, 42,952; William Lind, $42,905; Jahn Contracting Co., $38,920; L. Gerdes, $49,728; Lundstrum & Sandeberg, $44,490; Consolidated Contract Co., $44,728; James Kennedy Construction Co., $47,751; Pakuet, Giebisch & Joplin, $47,827; E. W. Riner, $45,470; Keating & McLean, $49,498. East Caruthers and East 32d Sts., John Keating, $652; E. W. Riner, $672; Bechill Bros., $613. East Madison St., E. W. Riner, $307; Bechil Bros., $606. East 58th St., Jeffrey & Bufton, $1,968; H. M. Johnson, $1,876; E. W. Rinerl, $2,188; James Kennedy Construction Co., $2,117; Elwood Wiles, $2,357. East 59th St., Taylor & McKittrick, $1,447; Jeffrey & Bufton, $1,340; James Kennedy Construction Co., $1,515; E. W. Riner, $1,494; H. M. Johnson, $1,398; John Keating, $1,588. East 36th St., James Kennedy Construction Co., 1,318; Jeffrey & Bufton, $1,150; E. W. Riner, $1,217; Bechill Bros., $1,108; John Keating, $1,263. Quimby St., Jeffrey & Bufton, $326; E. W. Riner, $313; John Keating, $334. Crescent Drive, Goddell Construction Co., $304; Bechill Bros., $294; E. W. Riner, $327. The contracts were awarded to the lowest responsible bidders.

⦿Welton, Kibbe & Cochran, of Portland, Ore., have been awarded the contract for the installation of a sewer system in the city of Newberg, Ore., for which bids were opened Jan. 15. Louis C. Kelsey, Selling Bldg., Portland, Ore., is engineer. The itemized bid for the work appears under "Water Works," this issue.

Plans for the first two sections of the Sullivan Gulch sewer extending from the river east to East 33d St., and for the Stark St. district sewer have been filed by the Engineering Department with the City Council of Portland, Ore. The contracts for this work will be let sometime this month. The estimated cost is $2,000,000. Tom Hurlburt is city engineer.

City Engineer Tom Hurlburt of Portland, Ore., has prepared plans for two trunk sewers, called the East Stark St., sewer systems Nos. 1 and 2, to serve the main portion of Rose City Park, part of Laurelhurst, Elmhurst, Belle Crest, Center Addition, North Mount Tabor, Montavilla, Kinzell Park, Belmont Villa and Eadendale, east of Mount Tabor. Trunk sewer No. 1 begins at East 21st and East Stark Sts., and extends to the Willamette River. The cost of concrete for this system is given at $83,910, and for brick and stone estimated at $89,675. East Stark St. sewer system No. 2 begins at East Forty-third and East Burnside and connects with the East Stark St. sewer system No. 1 at East First and East Stark Sts. The cost of this sewer is estimated as follows: Concrete, $144,428, and for brick and stone, $152,302.

The City Council of Burns, Ore., has secured data and estimates for the installation of a sewer and water system that will cost close to $100,000, which may be provided for at the city election in March.

Pennsylvania.

⦿Highway Commissioner Elmer E. Fritchey, Harrisburg, Pa., has awarded the contract for the construction of a sewer in 19th St., between Brookwood and Greenwood, city of Harrisburg, to Stucker Bros., of that city, for $1,844.

The Harrisburg, Portsmouth & Mt. Joy Railroad has granted the city of Harrisburg, Pa., permission to construct a sewer under the company's tracks at Sycamore St., known as the Paxton Interceptor.

The Walnut Street Business Men's Association, Philadelphia, Pa., has petitioned the Director of Public Works to urge the extension of the new 12th St. sewer southward from Locust St.

The City Council of Scranton, Pa., has passed an ordinance providing for the construction of a relief sewer in the 10th Sewer District, 17th Ward, and a relief sewer in Section A, Fifth Sewer District. The estimated cost of the sewers is $22,000 and $1,861 respectively. Ellsworth Kelly is city clerk.

The City Council of Lebanon, Pa., has granted the engineering department $2,000 to carry on the work of preparing for the section of the sewerage system. T. R. Crowell is City Engineer.

South Dakota.

✣Bids will be received until 8 p. m., Feb. 15, by City Council, Madison, S. Dak., for furnishing the material and labor for the construction of sewage disposal works and sewerage system.

The City Council of Sioux Falls, S. Dak., has practically completed negotiations for the sale of bonds in the sum of $300,000 voted some time ago for the purpose of extending the sewerage system and waterworks system of the city. Construction work will be started as soon as the weather will permit.

Texas.

The city of El Paso, Tex., is considering the advisability of running a pipe line from the lard refining station on the G. H. R. R., near Washington Park, to the new sewage disposal plant. The proposed line would be 1,800 ft. long. Herbert Nunn is City Engineer.

Washington.

Three different solutions for the Union Park Flood situation have been presented to the City Council of Spokane, Wash., by City Engineer Morton Macartney. One plan is to open the old natural channel by building a ditch at an approximate cost of $65,000; another to build an open ditch at a cost of $25,000, instead of following the old channel, and the third plan is to pave at a cost of $200 a lot, one of the streets leading from the overflow section to the river.

West Virginia.

The City Council of Warwood, W. Va., has employed a consulting engineer, it is reported, to prepare plans and specifications for the installation of a new sewerage system at an estimated cost of $20,000.

Wisconsin.

⦿The Common Council of Kenosha, Wis., has awarded the contract for the construction of a sewer on Charles and Avery Sts., and Bain Ave., to Robert Nelson, of Racine, Wis., for $13,685. The work includes the building of 1,000 ft. of 36-in. sewer, 1,300 ft. of 30-in. sewer, 600 ft. of 24-in. sewer. Other bidders were: Andrew Thompson, Racine, $15,750; Chris Johnson, Kenosha, $15,900; Michael Steinbach, Kenosha, $16,175; Bernard and Iverson, Kenosha, $16,795· N. F. Reichert, Racine, $17,750; John Green, Chicago, $19,700.

Plans have been completed by City Engineer G. H. Randall, of Oshkosh, Wis., for new sewers in Eighth, Harrison, 11th, 12th and Georgia Sts., and Osborne Ave. The Board of Public Works will hear objections to these sewers Feb. 27.

The Common Council of Racine, Wis., plans to build three systems of trunk sewers which will necessitate an expenditure of about $185,000 by the city. A resolution now before the Council provides for the building of trunk sewer systems on 21st St., from the lake to the west city limits; on Washington Ave., from west of Mound cemetery to Cedar Bend, and on the North Western road to the lake.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

✣Bids will be received until noon, Feb. 15, by W. W. Lavender, chairman of the Building Committee, care of Frank Lockwood, architect, Montgomery, Ala., for the erection of a brick dormitory for the State Normal College, at Florence, Ala. Plans and specifications are on file with Dr. J. K. Powers, President, Florence, Ala., or at the office of the Architect.

Charles W. Leavitt, Landscape Architect, 15 Courtlandt St., New York City, has been retained to submit plans for the beautification of the grounds of the several normal schools in the state of Alabama. His first work will be in connection with the preparation of plans for the grounds and buildings for the new normal school at Troy, Ala.

The Roden Hotel Co., incorporated last week, proposes the construction of a $1,000,000 hotel at 18th St. and 5th Ave., Birmingham. As proposed the structure will be of steel construction, 10 stories high, 150 by 140 ft. McDavid, Meyer, Goldman & Terry, Birmingham, Ala., are handling the project.

Arkansas.

✣Bids will be received until noon, April 9, by Maj. Clarke S. Smith, U. S. Engineer, Little Rock, Ark., for constructing the two steel hull, 24-in. pump dredges H. S. Taber and Robert McGregor. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until noon, March 14, by Capt. J. A. Woodruff, U. S. E. Engineer, Vicksburg, Miss., for furnishing and delivering about 284,500 lbs. of structural metal for Lock and Dam No. 6, Ouachita River, near

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Felsenthal, Ark., and for [illegible] at that work. Official advertisement will be found elsewhere in this issue.

California.

✣Bids will be received until 11 [illegible] 20, by Lieut.-Col. Thomas H. Rees, U. S. Engineer, 401 Custom House, San Francisco, Calif., for dredging in Suisun Channel, Calif.

Charles I. D. Looff, owner of the Hippodrome at Long Beach, Cal., is stated to be having plans prepared for a pleasure pier to cost about $1,000,000.

The Santa Cruz Portland Cement Co., Santa Cruz, Cal., which was recently voted a franchise by the citizens of Santa Cruz for a 3,000-ft. pier at that place, has been making soundings for the work.

The supervisors of Alameda County have appropriated $3,500 for preliminary work looking to the building of the tunnel under Oakland Harbor mentioned in our last issue. Preliminary surveys for this tunnel will be started at once by P. A. Haviland, County Surveyor, Oakland.

Petitions are being circulated at Hermosa Beach, Cal., calling for a special election to vote on issuing bonds for the construction of a municipal wharf. It is proposed to construct the wharf and pleasure pier of concrete, fully 1,000 ft. long and from 40 to 80 ft. wide, the entrance to be at the foot of Santa Fe Ave., where the present pier stands. The Hermosa Beach Water Co. has deeded 100 ft. of its water front for the project.

Connecticut.

Bids as follows were received Jan. 24 by the Board of Control and Supply of Hartford, Conn., for the construction of a municipal building, (A) standing for bid on granite base and marble facing (A1) alternate bid on A, (A2) alternate bid on A, (B) granite base and marble and terra cotta facing, (B1) alternate to Bid B, (C) granite base and limestone facing, (C1) alternate to bid C, (D) granite base and granite facing, (D1) alternate on Bid D: J. W. Bishop & Co., Worcester, Mass., (A) $389,501, (A1) $385,300, (A2) $[illegible], (A3) $376,800, (A4) $374,500, (B) $[illegible], (B1) $365,500, (C) $358,750, (D) $[illegible], (D1) $430,500; Willmarth, McKillopp, Inc., Pawtucket, R. I., (A) $371,467, (A1) $381,692, (A2) $385,317, (B) $351,497, (B1) $362,309, (C) $360,203, (C1) $352,863, (D) $411,236, (D1) $423,744; George A. Fuller Co., New York, (A) $349,500, (A1) $349,800, (A2) $387,000, (B) $327,000, (B1) $319,300, (C) $321,000, (D) $376,800, (D1) $385,200; A. E. Stevens & Co., No. 25 Madison Square, New York, (A) $330,000, (A1) $317,215, (A2) $331,100, (B) $306,868, (B1) $299,000, (C) $298,500, (C1) $307,600, (D) $364,000, (D1) $337,500; Norcross Builders' Co., Worcester, Mass, (A) $368,800, (B) $344,000, (C) $231,000, (D1) $389,000; H. Wales Lines Co., Meriden, (A) $395,300, (A1) $382,550, (A2) $387,050, (B) $373,200, (B1) $363,600, (C) $361,500, (C1) $369,500, (D) $421,700, (D1) $450,700; John C. Robinson, No. 1 Madison Ave., New York, (A) $347,000, (A1) $358,000, (A2) $350,000, (B) $336,000, (B1) $327,000, (C) $325,000, (C1) $333,000, (D) $371,000, (D1) $406,000. Mountain white marble, laid bedwise, $54,000. Florence white marble, laid bedwise, $350,000.

Delaware.

Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., has completed an estimate of the cost of a barge canal to connect the Delaware and Chesapeake Bays. The cost is estimated at $5,500,000, for a canal to be 12 ft. deep and to have a width of 90 ft. on the bottom. This estimate is exclusive of the cost of acquiring the present Chesapeake and Delaware Canal, which has been appraised at $2,514,288.

District of Columbia.

✣Bids will be received until 10:30 a. m., March 1, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 679, general control apparatus for the lock machinery, including starting panels for all motors, which are to be controlled from a remote point; limit switches, commutating switches used in the miter-Gate control, auxiliary cut-out switches for miter-gate strut, handrail conductors, miscellaneous remote indicators and indicator controllers, control switchboards for all locks and spill- [illegible] the chain fenders.

✣[illegible] by Lieut.-Col. W. C. Langfitt, U. S. Engineer, 920 17th St. N. W., Washington, D. C., for furnishing and placing riprap on the sea wall, Anacostia River, D. C.

✣Bids will be received until noon, Feb. 26, by Lieut. Col. W. C. Langfitt, U. S. Engineer, 920 17th St. N. W., Washington, D. C., for furnishing and delivering building stone and Portland cement.

✣Bids will be received until 10:30 a. m., Feb. 20, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing lumber and transformers.

Milburn, Heister & Co., Architects, Washington, D. C., have plans under way for the new Interstate Commerce Commission building to be erected at Washington. The building will cost about $350,000. It will have 10 stories, with a basement, and will occupy the entire lot between the American National Bank and Losekam's, on F St. It is to be fireproof, with steel framed electric elevators and steam heat.

Florida.

✣Bids will be received until 1 p. m., Feb. 23, by Lieut.-Col. G. D Fitch, U. S. Engineer, Montgomery, Ala., for dredging in Carrabelle Harbor, Fla.

Georgia.

⊙Contracts for work on the new court house at Atlanta, Ga., have been let as follows: Brick work and tile partitions, George A. Clayton, Atlanta, $64,229; exterior ornamental terra cotta work, Atlantic Terra Cotta Co., of Atlanta and New York, $123,000; common concrete and cinder fill, to George A. Clayton, at $12,988; exterior stone work, Stone Mountain Granite Co., at $105,000.

Illinois.

✣Bids will be received until 7:30 p. m., [illegible] City Clerk, Joliet, Ill., for furnishing the city with 1,000 ft. of 2½-in. cotton fire hose, double jacket with couplings to match present couplings. Pressure of the hose to be stated in bid.

✣Bids will be received until 11 a. m., Feb. 19, by Board of Administration, Springfield, Ill., for the remodeling of the ice plant at the Peoria State Hospital.

✣Bids will be received until 11 a. m., Feb. 19, by Board of Administration, Springfield, Ill., for constructing a system of concrete tunnels for heating system at the Peoria State Hospital. Plans and specifications may be inspected upon application to the managing officer of the Peoria State Hospital, Peoria, Ill., or at the office of Frank D. Whipp, Fiscal Supervisor, Springfield, Ill.

The following low bids for furnishing and delivering natural and Portland cement to the City of Chicago was received Jan. 23 by L. E. McGann, Commissioner of Public Works: Thos. Connolly, 48 N. La Salle St., Utica cement, 72 cts. per bbl.; Marquette cement, $1.28 per bbl., to be delivered as follows: 600 bbls. yard A, Avers Ave. and Wabansia Av.; yard B, 2354 S. Ashland Av; 1,000 bbls, yard C, 49th Pl. and Union Ave; yard E, 104th St. and Stewart Ave, 400 bbls.

Bids for furnishing sand for mason work during the year 1912 were opened Jan. 24 by L. E. McGann, Commissioner of Public Works, Chicago, Ill.: The American Sand & Gravel Co., 133 W. Washington St., Chicago, Ill., submitted a price of $1.05 per cu. yd., which was low.

Louisiana.

Following bids were received by the Orleans Levee Board, New Orleans, La., for constructing a creosated timber bulkhead, estimated to cost $11,000, from Egania St. to the St. Barnard Parish Line: John Riess, New Orleans, $8.57 per lin. ft.; Doullut & Williams, New Orleans, $8.24 per lin. ft., and Charles R. Corbett, New Orleans, $7.99 per lin. ft.

Maine.

✣Bids will be received until 9 a. m., Feb 13, by Trustees of the Bangor Public Library at the office of the Mayor, Bangor, Me., for the construction of a library building at that place as described by plans and specifications, which may be seen at the Mayor's office, City Hall, Bangor, Maine, or at the office of Peabody & Stearns, Architects, 53 State St., Boston, Mass.

✣Bids will be received until 9 a. m., Feb. 13, by High School Building Committee, C. W. Mullin, Chairman, at the office of the Mayor, Bangor, Me., for the construction of a high school building, as described by plans and specifications, which may be seen at the Mayor's office, City Hall, Bangor, Maine, or at the office of Peabody & Stearns, Architects, 53 State st., Boston, Mass.

Massachusetts.

The Bay State Dredging Co., Ltd., 247 Atlantic Ave., Boston, Mass., at the following bid, was the only bidder Jan. 22 for dredging in Weymouth Back River, Mass., for the U. S. Government: Dredging, scow measurement, 30½ ct. per cu yd.; removing boulders exceeding 2 cu. yds. each, $10.

Michigan.

⊙The Penn Bridge Co., Beaver Falls, Pa., has been awarded the contract at about $125,000 for lock gates for the locks in the Soo Canal at Sault Ste. Marie.

Missouri.

✣Bids will be received until 2 p. m., Feb. 23, by Board of Public Works, Kansas City, Mo., for furnishing and installing a 2-ton electric locomotive jib crane on Municipal wharf, track construction under separate contract. Further information may be had upon application to Assistant City Engineer, Kansas City, Mo.

✣Bids will be received until noon, March 4, by Maj. E. H. Schulz, U. S. Engineer, Kansas City, Mo., for constructing standard revetment on the Missouri River, 94 miles below Kansas City and 2 miles below Waverly, Mo. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until noon, Feb. 13, by Board of Public Improvements, 300 City Hall, St. Louis, Mo., for making gas connections to various apparatuses at the City Sanitarium.

⊙The Hill-O'Meara Construction Co., 1413 Syndicate Trust Bldg., St. Louis, Mo., has been awarded a contract at $808,000 for the erection of the Barnes Hospital on Kings Highway at St. Louis. Work is to begin as soon as the weather permits and the hospital is to be completed ready for equipment in 18 months. Theodore C. Link, 308 North 6th St., St. Louis, the architect, will supervise the construction. This will be the largest private hospital in St. Louis. Six buildings are to be erected at the present time, the plans being drawn with a view to extending the group eastward to Euclid Ave. at some future time. The main frontage will be on King's Highway looking south, where the buildings will extend for 600 feet. All of the buildings except one will be three stories high and all of the same design and construction. The exterior will be cream-colored brick, trimmed with granite and Bedford stone. Reinforced concrete will be used for the interior, making the buildings thoroughly fireproof. The exterior design is a simple treatment.

⊙The James H. Bright Contracting Co., 706 Chestnut St., St. Louis, Mo., is reported to have been awarded a contract at about $800,000 for the construction of the new medical school of Washington University at St. Louis. Theodore C. Ling, 308 North 6th St., St. Louis, is the architect.

Plans have been approved for the $100,000 chemistry building and the $65,000 agricultural chemistry building for the University of Missouri, Columbia and construction contracts will be let this spring. The buildings are to be of stone. James P. Jamison, St. Louis, Mo., is the architect.

Nebraska.

✣Bids will be received until noon, Feb. 10, by Addison Wait, Secretary of State, Lincoln, Nebr., for the construction of an additional building at the Tubercular Hospital, Kearney, Nebr. Plans and specifications are on file at the office of the Secretary, the Commissioner of Public Lands and Buildings, at the Hospital and at the office of Burd F. Miller, Brandeis Theater bldg., Omaha, Nebr., Architect.

New Jersey.

⊙The Turner Construction Co., 11 Broadway, New York City, has been awarded the general contract for the construction of a 5-story reinforced concrete building for the Robert Reiner Importing Co., to be erected at Gregory Ave. and Hackensack Plank Road, Weehawken, N. J. This building will be 122 ft. x 100 ft., and work is to be undertaken at once.

The following bids were received Jan. 26 by Maj. A. A. Raymond, U. S. Engineer, Wilmington, Del., for dredging in Salem River, N. J.: The Rickards Dredging Co., Philadelphia, Pa., 34 cts. per cu. yd.; River & Harbor Improvement Co., Philadelphia, Pa., 36 cts. per cu. yd.; American Dredging Co., Philadelphia, Pa., 29½ cts. per cu. yd.

Simon & Bassett, Architects, 1112 Chestnut St., Philadelphia, Pa., have plans under way for a steel pier, 1,500 ft. in length, to be built at Jersey Ave. and the Boardwalk, Atlantic City, for the Pier Realty Co.

New York.

✣Bids will be received until 10 a. m., March 2, by Quartermaster, Fort Wood, N. Y., for making repairs to the Statue of Liberty at that place.

✣Bids will be received until 3 p. m., Feb. 14, by State Commission in Lunacy, T. E McGarr, Secretary, Albany, N. Y., for three cottages and dining room buildings; and extensions to Group G and bakery; construction including heating, plumbing and electric work at the Central Islip State Hospital, Central Islip, N. Y.

✣Bids will be received until 2 p. m., Feb. 16, by E. L. Williams, Treasurer, Cornell University, Ithaca, N. Y., for constructing Auditorium and Laboratory building for New York State College of Agriculture and Clinic and Hospital building for the New York State Veterinary College, Ithaca. Green & Wicks, 110 Franklin St., Buffalo, N. Y., are Architects.

✣Bids will be received until noon, Feb. 15, by State Armory Commission, F. A. McNelly, Secy., 174 State St., Albany, N. Y., for repairs, improvements and betterments to the State Armory at Syracuse, N. Y.

⊙The Turner Construction Co., 11 Broadway, New York City, has been awarded the contract for a 6-story and basement press building to be erected at corner of 47th St. and 11th Ave., New York City. Ernest Flagg, New York City, architect and owner. This building will be 125 ft. x 105 ft. in plan, of reinforced concrete throughout. Work is to be undertaken at once.

⊙The Turner Construction Co., 11 Broadway, New York City, has been awarded the general contract for the erection of a 6-story warehouse for the Keystone Warehouse Co., Buffalo, N. Y. This building will be 130 ft. x 140 ft. in plan, of reinforced concrete with brick veneer. The work is to go ahead at once. Colson & Hudson are the architects.

The Board of Estimate of New York City has voted to condemn a site just north of City Hall park for a new $15,000,000 County Court house to replace the present structure. The cost of the land is estimated at $6,000,000 and the cost of the building $9,000,000.

North Dakota.

Pembina County is planning to erect a $63,000 courthouse and a $12,000 jail at Cavalier. The County Commissioners will meet at 1:30 p. m., Feb. 6, to consider selecting the architect to prepare the plans and specifications. Wm. W. Felson, Cavalier, N. Dak., is County Auditor.

Ohio.

✣Bids will be received until 1 p. m., Feb. 20, by W. H. Ortt, Treasurer, Central Branch N. H. D. V. S., National Military Home, O., for furnishing and delivering supplies.

✣Bids will be received until noon, Feb. 15, by W. J. Springborn, Director of Public Service, Cleveland, O., for furnishing one 5-passenger automobile, fully equipped. W. H. Kirby is Secretary.

✣Bids will be received until noon, Feb. 12, by Board of Lorain County Commissioners, Lorain, O., for furnishing the necessary labor and material for the construction of a pole line from the Cleveland Southwestern and Columbus Railway Power House in Carlisle township, Lorain County, to the County Infirmary building in that township. Charles Chandler is Clerk.

✣Bids will be received until 9 a. m., Feb. 13, by the Cuyahoga County Building Commissioners, Cleveland, O., for furnishing and delivering and setting in place, shades and hangings. J. J. Boyle is Secretary of the Commission.

✣Bids will be received until noon, Feb. 21, by Board of Trustees, Ohio State University, Carl E. Steeb, Secretary, Columbus, O., for furnishing the material and performing the labor necessary for the construction and erection of the following equipment of the Library Building: Approximately 500 ft. oak book cases; approximately 768 sections steel stacks; two electrically controlled elevators, in accordance with the plans and specifications prepared by Allen & Collens, architects, on file in the office of the Auditor of State. Said plans and specifications may also be seen at the office of architects in Boston, Mass.

✣Bids will be received until noon, Feb. 21, by J. H. Brown, director of Public Safety, Lakewood, O., for one combination automobile chemical fire engine which shall be adapted to carry 1,500 ft. of regulation fire hose, ladders, not less than six firemen, and said engine shall be first-class in its operation, construction, workmanship and materials, and guaranteed as such for the period of 5 years. Each bid must be accompanied by a certified check for $500.

Oregon.

⊙Johnson & Anderson, Portland, Ore., have been awarded the contract at $43,276 for extending the south jetty at the mouth of the Siuslaw for the U. S. Government. The same contractors were awarded the contract late last year at $200,686 for extending the north jetty.

Pennsylvania.

✣Bids will be received until 3 p. m., Feb. 8, Rudolph Blankenburg, Mayor, Philadelphia, Pa., for the erection of a Temporary Convention Hall on the lot of ground northeast corner of Broad St. and Allegheny Ave., in the city of Philadelphia, and having a frontage of 265 ft. on Allegheny Ave. and a depth of 407 ft. 9 in. on Broad st. and on Park Ave. Plans can be seen at the Builders' Exchange, No. 18 South 7th St., Philadelphia. C. P. Berger, 1416 S. Penn. Square, is Architect.

Bids were opened Jan. 20 by the U. S. Engineer, 815 Witherspoon Bldg., Philadelphia, Pa., for the construction of four dikes and for topping off one old dike in the Delaware River below Philadelphia, Pa. But two bids were received, the Breakwater Co., Philadelphia, Pa., bidding on all of the work, and Capt. J. J. Williams & Co., Chester, Pa., bidding $58,414 on rock filled type of dike at Old Mans Point. The bid of the Breakwater Co. was as follows, the first figures being for an all-stone type and the second for a rock-filled type: Chester Island Dike, $64,856, $68,547; Old Man Point Dike, $45,620, $54,237; Lower End of Artificial Island Dike, $147,340, $155,284; Reedy Island Dike Extension, $303,800, $316,089; Topping Off Old Reedy Island Dike, $105,380.

Texas.

✣Bids will be received until Feb. 27 by Board of Prison Commissioners, B. E. Cabell, Chairman, for furnishing of woodworking machinery. Specifications may be had by addressing J. A. Palmer, Secretary of the Commission, Huntsville, Texas.

✣Bids will be received until Feb. 12 by Judge Walter Perkins, Jim Wells County, Alice, Texas, for the construction of the county court house at Alice, Texas.

Virginia.

✣Bids will be received until 10 a. m., Feb. 24, by Capt. R. D. McBride, Post Quartermaster, Fort Monroe, Va., for alterations to forage house No. 73 at Fort Monroe.

✣Bids will be received until 11 a. m., March 2, by Bureau of Yards & Docks, U. S. Navy Department, Washington, D. C., for one shell house and one magazine building at the naval magazine, Norfolk, Va. W. M. Smith is Chief Clerk in charge.

Washington.

✣Bids will be received until 3 p. m., March 1, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits, wiring and interior lighting fixtures of the United States postoffice at Olympia, Wash. The structure is to be approximately 5,500 sq. ft. in ground area, two stories and attic, with granite facing to the first floor, limestone or sand stone above, and tin roof; the first floor only is of fireproof construction.

Bids as follows were received Jan. 11 by Maj. J. B. Cavanaugh, U. S. Engineer, Burke Bldg., Seattle, Wash., for the dredging of approximately 615,000 cu. yds. of material in Bellingham Bay. Tweedin & Jones, 16¼ cts., 16½ cts. per yd.; Standard American Dredging Co., 14.9 cts.; Puget Sound Bridge & Dredging Co., 14.4 cts.; International Dredging Co., 15.8 cts.

Plans are being proposed for a new high school building to be erected for the city for Vancouver, Wash. The building will be of concrete and will cost about $100,000. D. Nichols, Vancouver, is the Architect.

The Green River Hot Springs Co., W. S. Grinsfelder, President, 215 Epler Block, Seattle Wash., proposes to erect a 3-story brick and concrete hotel building at Green River, Hot Springs. The building will cost about $250,000 and plans for it are being prepared by Kingsley & Eastman, Architects, Empire Bldg., Seattle, Wash.

The Port Commission for the Gray's Harbor Improvement has engaged Virgil G Bogue, Consulting Engineer, 15 William St., New York City, to make a report on the proposed work.

City of Spokane will call for bids shortly for the construction of a 6-story city hall building to cost about $324,900. The structure will be of brick. Julius Zittle, Payton Bldg., Spokane, is the architect.

West Virginia.

✣Bids will be received until 11 a. m., (eastern time) Feb. 20, by Maj. F. Alstaetter, U. S. Engineer, Wheeling, W. Va., for furnishing and delivering about 25,000 barrels of American Portland cement for dam No. 28, Ohio River.

Wisconsin.

The city of Eau Claire, Wis., has decided to rebuild the Wilson Creek dam which was washed out by the high water at Menominee last fall. Half the expense will be borne by the Chippewa Valley Railway Light & Power Co., which uses power generated therefrom.

The Chicago & Northwestern Ry. is to expend $30,000 in repairing one of its ore docks at Ashland.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Canada.

J. D. Hazen, Minister of Ma[illegible] notice of a resolution in the [illegible] a further loan [illegible] Harbor Commissioners of Montreal to enable the commission to complete the terminal facilities of the harbor according to the plans already approved by the Government. The loan is made upon the same conditions as the previous loans advanced by the Dominion, which now aggregate some $12,[illegible] [illegible] the Harbor Board call for a total expenditure of nearly $20,000,000.

Plans are being prepared for a 10-story store and office building to be erected at Granville and Georgia Sts., Vancouver, B. C., for Birks & Sons. The building will be of steel and concrete construction and will cost about $450,000. W. Marbury, Somervall, Pacific Bldg., Voncouver, B. C., is the Architect.

The School Board of V[illegible] [illegible] planning to expend about $500,000 this year for the erection of additions and new school buildings.

The Public Markets Co., Ltd., has been organized at Winnipeg, and will this summer install stockyards in that city. The work of construction will be done by contract under the direction of J. Wordman, Engineer of the company, Winnipeg. W. Sanford Evans, Winnipeg, is Secretary of the company.

Mexico.

The Mexican Government will soon start improvement work for the Port of Guayamas. The work will be done for the Department of Communications of which Manuel Bonilla, City of Mexico, is Minister.

The Department of Communications, City of Mexico, will have work started shortly on the dredging of the bar in the harbor of San Blas, Tepic. The expenditure will be much less than that required to open other harbors of the republic to deep draught vessels.

TRADE NOTES.

Mr. G. P. Wern has resigned from [illegible] position of manager of the Hoisting Engine Department of the New York office of the M[illegible] Mfg. Co., and will devote himself to his own private interests.

The Cleary-White Construction Co., 17 N. La Salle St., Chicago and Zion City, Ill., has placed an order with the Milwaukee Concrete Mixer & Machinery Co., Milwaukee, Wis., for 13 No. 2 Milwaukee Mixers mounted on trucks and equipped with steam engines and boilers. In consideration of this order the Milwaukee Concrete Mixer & Machinery Co. takes the entire second-hand mixer equipment of the Cleary-White Construction Co. consisting of 1[illegible] mixers of various makes and sizes so that this construction company begins the 1912 season with complete new line of Milwaukee Mixers.

PROPOSALS

DEPARTMENT OF THE INTERIOR. United States Reclamation Service. Washington, D. C., Jan. 25, 1912.—Sealed proposals will be received at the office of the United States Reclamation Service, Boise, Idaho, until 2 o'clock p. m., March 1, 1912, for furnishing a rock crusher, ball mills, tube mills, a rotary dryer and a mixing and weighing machine for a sand-cement plant on the Boise Project, Idaho. For particulars address the U. S. Reclamation Service, Boise, Idaho, or Washington, D. C. F. H. NEWELL, Director.

WAR DEPARTMENT, U. S. ENGR. OFFICE.—Montgomery, Ala., Jan. 24, 1912. Sealed proposals for dredging in Carrabelle Harbor, Fla., will be received at this office until 1 o'clock p. m., Feb. 23, 1912. Information on application. G. D. FITCH Lt. Col., Engrs.

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PROPOSALS

RAILROAD CONSTRUCTION.

[illegible]

feet skew approaches thereto. Bids will [illegible]

164 lin. feet of 24-inch, 124 lin. feet of 30-inch, 96 lin. feet of 36-inch and 32 [illegible]

[illegible]

or 60 feet in length, with the necessary 24-inch continuous four bolt rail joint, [illegible]

of the above work, the prices for all materials to be f. o. b., Urbana, Illinois. Bids for grading and concrete work will [illegible] ten percentum of the value of the work [illegible]

Separate plans, details and specifications for grading, concrete and steel work are on file in the office of the Chief Engineer, a copy of either will be mailed to [illegible] order for $2.50.

The company reserves the right to re[illegible]

[illegible]

EXCAVATION AND BRIDGING.

Bids will be received at Bay City, Tex., until Feb. 15, 1912, by the Commissioners of Matagorda County Drainage District No. 3 for excavation of approximately 158,000 cu. yds. of earth and about 300 ft. of [illegible] buyer. Plans and profile can be obtained from C. A. Marshall, Secretary, Blessing Texas.

PAVING.

[illegible] Carroll, Iowa, as advertised in these columns on December 26th and 27th, 1911, have been rejected and the City Clerk instructed to readvertise. Said new bids will be received until 8 o'clock p. m., Feb- [illegible] be publicly opened and read.

[illegible] for constructing standard revetment on Missouri River 34 miles below Kansas City and 2 miles below Waverly, Mo., will be [illegible] application. EDWARD H. SCHULZ, Major, Engrs.

PROPOSALS

PROPOSALS FOR PUMP AND MOTOR.

[illegible] ary, 1912, for the furnishing, f. o. b. Man[illegible]

[illegible]

The right is reserved to reject any or all bids.

[illegible] 1912

R. H. DEAN, Town Clerk.

DEPARTMENT OF THE INTERIOR UNITED STATES RECLAMATION SERVICE, Washington, D. C., Jan. [illegible] Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Neb., until 2 o'clock p. m., Feb. 28, 1912, for the construction of an earth dam and auxiliary works, on the North Platte Project, about nine miles north of Minatare, Scottsbluff County, Neb. The work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earthfill, 157,000 cu. yds. gravelly material, 14,000 cu. yds. unscreened gravel, 11,500 cu. yds. screened gravel, 14,000 cu. yds. concrete, and 12,000 cu. yds. brule clay excavation, besides 45 acres of sod stripping, 600 feet of wells and casing, 3,200 lin. ft. of drains, and the handling and placing of 250,000 lbs. of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Neb.; 519 Commonwealth Bldg., Denver, Col., or Washington, D. C. F. H. NEWELL, Director.

U. S. ENGINEER OFFICE, Little Rock, Ark., Jan. 31, 1912. Sealed proposals for constructing the two (2) steel hull, 24-inch pump dredges H. S. Taber and Robert McGregor will be received here until 12 o'clock noon, April 9, 1912, and then publicly opened. Information on application. CLARKE S. SMITH, Major, Engrs.

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Published [illegible]

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Should Engineers for Concrete Structures Design the Framework?

The contention that engineers should prepare designs for forms for all concrete work or which they ask bids is made in another column by an experienced contractor for concrete structures. With individual exceptions his is not now the practice of engineers. Occasionally, just as he will now design some especially important bridge falsework, the engineer prepares form plans for some special concrete structure. The contention made in he article referred to above is that this occasional practice in special cases should become general practice within the limits of easonableness in all cases. The proposition nerits consideration.

The prevailing practice of making form deign the contractor's problem has come about erhaps from two principal causes. The first s that the engineer has conceived form work s being solely temporary construction plant ike a staging for brick work, and therefore problem which did not concern him beyond he point of seeing that the objects sought, namely, safety and certainty during construcion and a completed structure of acceptable quality and character, were reasonably well ssured. The second cause has been the great levelopment, particularly in reinforced conrete building work, of engineering-contracting organizations or firms which assume all probems of design and construction guaranteeing n acceptable product. Incidentally, in the vork of these firms we do have examples and bout the only ones of form work considered s a definite part of the engineer's designing problem. Elsewhere as already stated it is onsidered usually as purely a contractor's contruction problem. Whether or not this is the ogical viewpoint, it is the prevailing one. Should it remain so? The article to which ve refer above says it should not.

Form design is a problem which, without question, is worthy of the best engineering alent. The problem is not a simple one. It s not merely in any specific case a problem of lesigning a structure which will shape to limensions and support safely a certain volume and weight of concrete. It is rather the problem of designing a set of moulds for repeated use in forming and supporting successive similar units composing a complete structure. This involves much more than a mould which will properly shape and safely ustain one beam or bracket or column; it nvolves the making of a mould which can be erected, taken down, moved and re-erected many times, with the greatest speed and the east labor, to shape and support in succession a large number of beams or bracket, columns. It involves, too, not only the economic use of material by careful design but also economic consumption by design which will insure as high a salvage value as may be. Forms are not temporary structures in the sense that staging or falsework are, they are rather operating construction plant in almost the same sense as is a concrete mixing and handling plant.

Keeeping in mind what has just been said the question is: Is it better that the engineer should design form work or is it better that the contractor should? The answer is that it depends upon who the engineer is and who the contractor is. An engineer with an intimate knowledge of construction work and costs may easily be the best possible designer of form work. On the other hand an engineer lacking this special knowledge may just as easily be about the poorest one imaginable to design form work. The extremes in ability between contractors are almost as far apart. On the whole the contractor's training is more important to the task than is the engineer's. The contractor may fall short as compared with the engineer in knowledge of statics but the engineer seldom has the contractor's knowledge of practical operating conditions and costs. Frankly, we believe that on a cost basis the average contractor will prove a better designer of form work than will the average engineer. If this be so then it is the better engineering practice that the contractor should be the designer.

The application of designing thought and skill to concrete form work is not so complete as it should be. This is why there is so much variation in the cost of form work done under substantially similar conditions. It is not an uncommon thing to see a variation of 50 per cent in the cost of forms for two similar structures built at the same time in the same neighborhood but by different men. Some attention paid to the engineering of form work would correct this fault in large measures. As we have been frank in stating that we believe the average contractor will prove a better form designer than the average engineer, we shall likewise be frank in stating that a great many contractors show inexcusable stupidity in handling their form work. A contractor who will fuss his brain in choosing between dump cars or mixers to secure an advantage which will not affect costs 1 per cent will turn any jack carpenter loose on the form work which costs from a quarter to a third of the entire cost of his work.

Mr. Moore in his paper which we publish in another column has done a real service in calling to attention the importance to contractors of studying form design and construction. Coming from a practical concrete contractor his statements have particular force. We advise the study of his paper by contractors.

The Effect of Inaccurate Estimates of Cost on the Standing of the Engineer.

Engineers often have been criticised adversely for the inaccuracy of their estimates of cost. It has been admitted by engineers that nothing, save dishonesty, will so surely and quickly injure the reputation of an engineer as habitual inaccuracy. This refers, we take it, to the mistakes made in measuring, computing and designing. Employers of engineers insist that the same statement holds good with reference to the accuracy of engineers' estimates of cost. This is especially true of capitalists, as the following quotations will show:

> I think as I look back on the task of enlisting capital for this enterprise, the fact that stands out the worst in the whole experience is the amount of bitter feeling there is in the minds of capitalists all over the world against the engineering profession; and this bitter feel- [illegible] come out that engineers' estimates were nothing more or less than mere guesses, and 100 per cent of error is as common as fleas on dogs.

The quotation made was first published in the columns of a contemporary engineering journal, about a year ago. It was published without editorial comment except the statement contained in the caption that the quotation was from a personal letter to the editor from a well-known engineer. We repeat it here at this time because it is a concise statement of a condition which we frequently have heard engineers discuss.

It is not believed that there is a worldwide lack of confidence in engineers' estimates, but certainly there is sufficient lack of confidence, on the part of capitalists and the public, to warrant some consideration of the subject by engineers.

It is believed that estimates are far more accurate now than they were forty years ago. In earlier times engineers were more often concerned with finding a way to do a piece of work than in accurately estimating its cost. Now it is taken for granted, by the general public at least, that engineers can do anything conceivable in the way of construction, engineering and contracting being, of course, perfectly blended in the popular mind. The engineering achievements of today often excite greater wonder and admiration in the minds of engineers, who appreciate the difficulties overcome, than in the minds of laymen who have grown accustomed to continued engineering success and therefore take everything accomplished by the engineer as a matter of course. The engineering *feat* has survived only in the inexpressive, stereotyped, newspaper head-line.

This condition, as we have said, reflects the uniform success of engineering enterprises and really constitutes the highest tribute the profession could hope to receive. Since good engineering results are now more positive and engineering methods more precise than formerly, the engineer has found time somewhat to improve the accuracy of his estimates of cost. That there still is room for improvement hardly will be denied.

Much of the criticism which has been made of estimates has been directed at rough preliminary estimates based on insufficient data. In many cases such estimates are necessary, and the engineer will do well to impress on the minds of his client that the figures given are necessarily only roughly approximate. Unfortunately a direct statement to that effect seldom keeps the client from tenaciously clinging to the rough figures given. When detailed information is secured and an accurate estimate made no adverse criticism is likely to be made if the original estimate was too high. We need not comment on the opposite condition.

Some engineers point to the lawyer and mention his unwillingness to give an opinion until he has read the law, and suggest that engineers adopt a similar position and refuse to give rough estimates of cost. Preliminary estimates cannot be avoided in all cases, but, where possible, engineers will do well to avoid making them.

The detailed study of costs will enable engineers to improve the accuracy of their estimates. If all engineers would co-operate in the effort to collect and publish complete cost data, fully describing the methods employed on the work, the grade of labor employed, the hours worked, the conditions of soil, weather, etc., which influenced the costs, the profession soon would be able to make far more accurate estimates of cost than at present. The engineer would then enjoy the complete confidence of his client and the public.

CONCRETE AND REINFORCED CONCRETE SECTION

Cost of Constructing a Small Concrete Road Culvert Using Metal Forms.

The accompanying illustrations show construction views of a concrete culvert constructed with metal forms on the German or Deitz road near Rice Lake, Wis. Figure 1 shows the steel form in place and Fig. 2 shows the concrete work completed. The form used was a collapsible steel form of the type made by the Concrete Form & Engine Co., of Detroit, Mich. This form consists of two sections of semi-circular top or arch centers; four side pieces, and two end plates. The arch sections are carried on arms attached to the sides and connected with a lever by which they are "dropped" and so lower the center. In the work illustrated the culvert had a 48-in. arch and side walls 16 ins. high and was 20 ft. long. The following cost of constructing the culvert has been furnished to us by Simon S. Berg, Chairman Board of Supervisors, under whose direction the work was done:

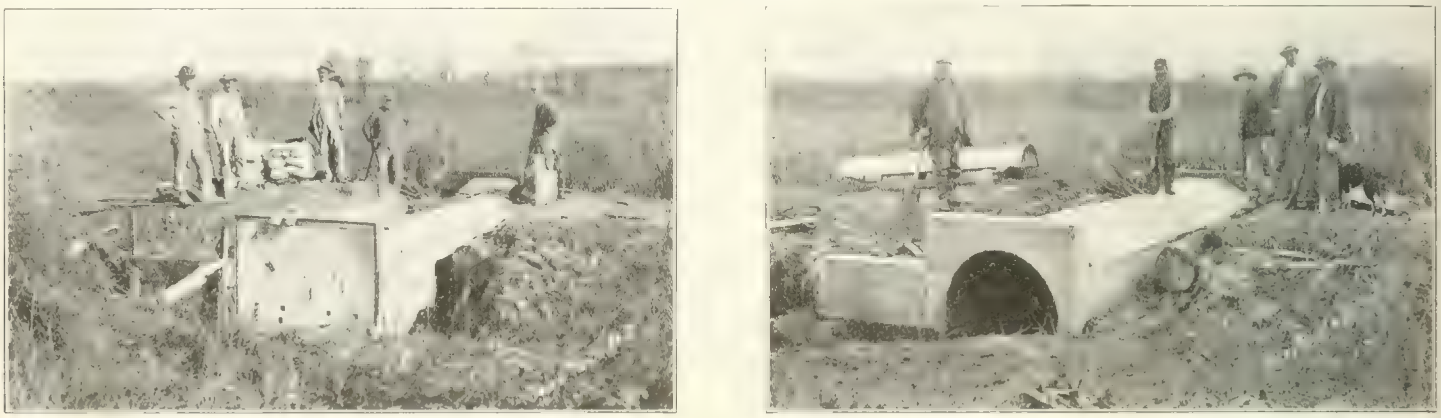
Item.	Cost.
Hauling [illegible] yds. sand	$[illegible]
Hauling 4 [illegible] yds. small field [illegible]	1.[illegible]
Hauling forms and cement	2.[illegible]
7½ bbls. cement at $1.[illegible]	10.12
9½ days labor at $1.75	16.62
Total	$[illegible]6.24

This total includes the cost of a ditch and putting in a dam to divert the stream flow during construction; this work cost probably about $1. The high cost of sand was due to a long haul; with sand close at hand the culvert could have been built for several dollars less.

Cost of Making Sewer Joints of "Jointite."—Mr. J. S. Stiger, City Engineer of Summit, N. J., advises that he has kept cost data on making sewer joints of Jointite, in his city, during the past year. The best contractors run joints on deep and wide socket pipe at a cost of 18 cts. for 8-in. pipe, 21 cts. for 10-in. pipe and 27 cts. for 12-in. pipe. The figures given cover the cost of material used.

A Discussion of the Economics of Practical Concrete Construction.*

This paper contemplates a practical study of concrete construction with particular regard for costs and efficient methods of construction, and no attempt will be made to enter into the theory of design.


Views Showing Highway Culvert Construction with Collapsible Steel Form, Rice Lake, Wis.

Concrete is a peculiar building material in that it is manufactured on the job, whereas, stone, brick, steel and wood are delivered on the site ready for installation into the structure. The cost of stone as delivered is determined by its quality and hardness, and by the distance of transportation and the cost of quarrying and dressing. The cost of the brick as delivered is determined by the quality of the clay from which it is produced, the methods of manufacture, the quality of the product, and the distance of transportation and also by the cost of labor to handle, sort, and select. The cost of steel is more nearly consistent, but even this material is affected by the character of the material, the shapes into which it is rolled, the sizes of such shapes, and the distance of transportation. The cost of timber is likewise affected by the character of the wood, the size of the pieces, the grade, and the distance of transportation.

In all of the foregoing standard building materials, no man would think of bidding without first ascertaining what was required and then obtaining a price from those who were qualified to furnish the specified material. In the case of concrete it would appear that the elements entering into its construction are in most cases entirely overlooked; that concrete is treated in the estimate without any regard to the varying character of materials and proportions entering into it. This is not as true now as it was a few years ago but it is still true in a great many proposals.

Selection of Gravel or Stone.—Most specifications allow either gravel or stone to be used. Where good gravel can be obtained it is preferable to stone, from a cost standpoint, and it is more easily handled throughout the entire operation of mixing and placing. Broken stone is usually obtained from quarries, and must be transported by railroad cars, unloaded by hand, and then hauled to the location of the work. Gravel, on the other hand, when loaded is hauled directly to the site of the work. From a cost standpoint we have therefore two reasons why gravel is preferable. (1) Under ordinary conditions there is less manual labor connected with its delivery; (2) there is less cost for manual labor due to the nature of the material; a laborer can shovel approximately 20 per cent more gravel than stone under the same conditions.

If the gravel is good, the resulting work is equal to or better than broken stone concrete. A good gravel for concrete should be of varying sizes wherein the sizes of the pebbles range downward from say, 2½ ins. to ¼ in. The proportions of sizes should be such that there is approximately 50 per cent of each size with reference to the next largest. Concrete made of such materials will be homogeneous, dense, and of great strength. Either gravel or stone should be watched very carefully for foreign materials, such as lumps of clay from stripping the hard pan strata, sticks, decayed matter, etc. So-called yellow gravel is not necessarily a sign of weakness, although such a deposit should be carefully examined. Many times such a surface discoloration is caused by leechings from deposits or strata of oxide of iron or other minerals.

Selection of Sand.—Much that has been said about gravel is true of sand except that sand is in a sense more important than gravel. Sand should be relatively clean and of varying sized grains. Such a sand is much better than when of even sized particles, and I think I am safe in saying that silt up to 5 per cen will not affect the strength of the resulting concrete. If, however, sand is silty to any such extent care must be taken that the work is cleaned every morning (this same remark applies to the gravel) for if this is not done there will arise to the surface of each day's work a soft slimy substance, which has no strength and which will form strata of demarcation between the successive courses. Other things being equal it is better to import sand at an increased cost, using local gravel, than to use local sand and import gravel and stone.

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*A paper by DeWitt V. Moore, Indianapolis, Ind., read before the Indiana Engineering Society: Meeting 1912.

Selection of Cement.—At the present time there are so many brands of Portland cement of recognized value that as far as quality and ability to withstand tests are concerned there is little choice. When it comes to large and important work, however, it is well to consider the capacity of the plant and be sure of its ability to deliver the cement on time and in the quantity required.

Selection of Machinery.—Various types of work naturally demand various types of machinery and arrangement, but in general it may be said that a small mixer is not economical. Use preferably nothing smaller than 18 cu. ft. mixer, which will deliver ½ cu. yd. of mixed concrete, and use a larger mixer than this if the work will justify it. Also in general it may be stated that each batch from the mixer should be handled as a whole as nearly as possible to the place of deposit. The wheelbarrow is no longer the primary method of transportation of concrete. There is no doubt as to the majority of opinion being in favor of batch mixers, but whatever the type adopted, it would be well in the long run to install 20 to 25 per cent more boiler and machine power than is specified by the manufacturer.

When Hand Mixing Is Justified.—Hand mixing cannot be expected to be as uniform as machine mixing, and yet if proper care is taken under intelligent supervision good results can be secured. From the standpoint of cost, hand mixing is preferable, when the work is so small as not to justify the installation of a machine. For instance, on a job of a couple of hundred cubic yards $100 would probably be expended in installing and rigging the mixer, or a cost of 50 cts. per cubic yard, and it is doubtful if hand mixing would cost any more than this difference. Again, hand mixing is preferable in connection with large work where in order to reach isolated portions of the work it is more economical to mix by hand than to wheel long distances. Hand mixing is most important when constructing floors, sidewalks and pavements in a natural gravel fundation where it is possible to shovel material directly upon the mixing board, mix and then shovel into place upon the opposite side. Under no circumstances can machine mixing compare in cost with this method where conditions will permit of its use.

Mixing Concrete.—For ordinary work, concrete should be mixed wet, soupy. From the standpoints of quality, ease of handling and manipulation, resulting finish, and cost of surfacing, there is absolutely no question as to this point. This choice of wet concrete applies to walls, bridges, reinforced concrete buildings, etc., but for sidewalks and pavements economy demands a dry mixture requiring tamping in order that the workmen [illegible] the finish may follow as quickly as possible after the depositing of the concrete.

Placing Concrete.—No concrete should be placed until it is definitely determined that the forms are correct and properly braced. It is cheaper to delay the work than to cut out work already done. Concrete should be placed as quickly as possible after mixing and not be disturbed thereafter. The placing of concrete is the point where the material is abused to the greatest extent. We take great care of a green brick wall but do not hesitate to walk over and conduct operations over concrete which has not reached its final set, thereby destroying the surface of the concrete for all time. While this may not be serious in some cases, it is certainly not desirable in thin concrete slabs. Concrete is better placed by chutes than by wheelbarrows, cars, etc., for the reason that by chuting, the material is constantly kept in the process of mixing until it is deposited in the work. With barrows or carts the heavier particles settle to the bottom and when the mixture is dumped into the work there is a separation. Chuting also allows the placing of the concrete with a mini-
[illegible]
work just completed

The ideal condition would be the comple-
[illegible]
this cannot be attained care should be taken in the location of and in the manner of constructing the connecting joints as the work progresses. Breaks should preferably be made at the center of slab spans and at the center of girders or over the center of columns tansverse of girders. Slab spans may be jointed longitudinally over centers of girders or beams, but this method should be considered a second choice. Columns should not be poured all at one time. Generally a height of 4 ft. should be allowed to set for three or four hours before the second pouring. Slabs, girders and beams should be poured continuously up to the determined joint where stop forms have been placed. The method of pouring girders up to the bottom of the slab and then afterwards placing the slab is not desirable. The method of pouring a slab and allowing the material to slope down over the girder and then beginning the next day gives a slip slab joint which cannot be recommended. In all concrete work stops should be made on horizontal and perpendicular lines at locations mentioned, the forms being carefully placed.

Finish of Concrete.—We are wrong in our present practice of finishing concrete surfaces. The surface finish of a piece of concrete should be an integral part of the main construction and of the same mixture and same composition. Time was when we were called upon to plaster and apply a surface coat to vertical surfaces. After a good many years of argument by the practical concrete workman we have reached a point where such surfaces are generally finished by spading so as to bring the finer particles to the surface and force the large particles back so they are not exposed. We are, however, following the old practice in respect to horizontal surfaces, applying a thin coating of a rich mixture on top of our cheaper concrete base. In order to secure the best results we should so manipulate our concrete as to bring our finish to the surface from the material of the concrete base. When we reach this point we will have less trouble with checking, insufficient bond, etc., etc., and such a finish can be easily obtained by the use of proper tools for tamping.

Construction of Forms and Centers.—If there is one element entering into the cost of concrete which is neglected it is the cost of forms and centers. So far as is known to the writer, no architect or engineer ever submits to a bidder a plan for this part of the construction. Even the specifications are vague and indefinite, leaving it to the individual contractor to plan his own work. Some go to one extreme and use a great deal more timber than is necessary, others to the other extreme and use so little and of such light construction that the work is out of line and out of plumb. When it is considered that the cost of forms and centers represent from 20 per cent to 33⅓ per cent in the cost of every cubic yard of concrete placed, under average conditions, it is hard to understand why the subject is not given more consideration.

Ordinarily it is left to the carpenter boss to put up something by rule of thumb and by his judgment based on past experience. There is nothing practicable about such a method. The designs for the forms of any structure should be carefully planned to accomplish the results with a minimum of material and labor, giving due consideration to the maximum amount of salvage in the material. It is our contention that accompanying the plans for any structure there should be prepared by the engineer and architect a sheet detail drawing showing how forms should be constructed thereby insuring quality of workmanship and placing all bidders upon the same basis. If this is done there is nothing to hinder any contractor from submitting an alternate design.

Types or Reinforcement.—Types or reinforcement now on the market may be classified as follows: (1) Plain bars either medium or high carbon steel; (2) plain bars deformed or cold worked to secure deformation. This classification includes cold twisted and hot twisted square bars; (3) special patented types of plain or deformed patented bars; (4) built up bars meaning thereby combination of various sized members in order to utilize the quantity of steel to the best advantage; (5) built up frames composed of bars of various sizes, generally used for beams, girders and columns; (6) floor slab reinforcement of sheet metal, sheared, punched or expanded in order to distribute the steel through the mass and delivered in sheets; (7) cold woven wire similar to fencing material delivered in rolls; (8) secondary reinforcement in the way of hoops or bands for columns, stirrups for beams, and spacers for rods; all which may be made of hoop iron or wire.

Selection of Reinforcement.—Considering the various types of reinforcement just mentioned and the many modifications now on the market it is a difficult proposition to select the best, and generally the selection is determined by the price submitted by the commercial engineers bidding under sub-contract to furnish the metal. To a certain extent this method is dangerous but it is hard to suggest a remedy. Individual preference and experience are always a very large element.

[illegible] Reinforcement.—The design of a concrete structure contemplates the placing of the reinforcement in exactly the position shown by the plans and cross sections of the various members. Designers are usually quite conservative in their allowance for protection of steel by fireproofing concrete below it, and the contractor better err on the safe side and take advantage of this allowance rather than to keep above same. Many times reinforcement and especially light bars, expended metal and wire fabric are laid upon the forms and then afterwards manipulated by a hook as the concrete is placed, jerking the reinforcement upward so that the concrete may flow underneath. This is dangerous inasmuch as there is no gage to determine the final position of the reinforcement and if the concrete flows under the reinforcement in too large a quantity it is almost impossible to replace the reinforcement without rebuilding the entire work.

Automatic spacers and devices for the accurate placing of the steel are readily obtainable and should be used. Naturally there is some increase of cost due to such a method but it is money well expended. Especial care should be taken in placing steel in girders and beams so to distribute and arrange the bars that each individual part may be incorporated within an individual part of the concrete. The reinforcement for columns should be accurately made and wired with the hoops and stirups in place before it is erected in place ready to build the column forms around it. While good results can be secured, from bar reinforcement the author is at this time in favor of built up columns of light structural shapes for the reason that the integrity of the whole building depends upon the column construction and a failure of any one column is liable to result in a failure of the entire building. Perhaps the most important reinforcing detail in respect to proper placing is top reinforcement or reverse flexure bars. No matter what the designer may have in mind in theory and how these bars are proportioned with reference to the main reinforcement at the center of the slab or beam, it is absolutely essential that these top bars be placed accurately and not disturbed thereafter. This is easier said than done. The main reinforcement is embedded in the solid concrete below the surface and is protected from disturbance.

The top reinforcement is close to the surface where it is affected by the future operations and also where the free ends project in case of a break at the joints in the progress of the work. These free ends if jarred will many times break the bond of the half bar extending into the work. The placing of loose stirrups is a task requiring very careful supervision and this is one of the strong arguments for built up sections wherein the stirrup shear members are rigidly connected. Finally the employment of an expert mechanic or steel worker at increased wages over common labor is justified by the importance of this part of the work.

Proportions of Concrete.—It is very usual to specify 1:2½:5 or 1:3:6 for the proportions of cement, sand and gravel, for plain or monolithic concrete work and the usual specifications for reinforced concrete is 1 part cement, 2 parts sand and 4 parts gravel; although some engineers specify a richer mixture for columns. Inasmuch as there still exists a general ignorance on this point whereby these specifications are understood as being 1:7½ or 1:9 or 1:6 respectively it would seem best that the specifications should read that a mortar should be mixed of one part of cement to so many parts of sand and this mortar should then be mixed with so many parts of the aggregate.

Proportions of Concrete for the Strength.—The ideal mixture of concrete assumes that the aggregate and mortar are mixed in such proportions that the most dense, solid and homogeneous mass is secured. This result may be secured by expert engineering supervision, but in reality the good common sense of the expert concrete laborer may be depended upon. The artisan who is accustomed to handle concrete can determine by the appearance of the concrete mixture and by working the mixture whether he is securing the best results and after a long experience the author is inclined to say that he would just as soon trust a practical common-sense laborer's opinion as to base his work upon the report of a so-called expert engineer.

Proportions of Concrete for the Cost.—If a 1:2:6 mixture will satisfy the necessary strength required for construction, there is no necessity of specifying a 1:2:4 mixture inasmuch as the first mixture will require approximately 1 bbl. per cubic yard, while the latter will require 1½ bbls., a difference of at least 50 cts. per cubic yard in actual cost. Many times for footings and monolithic work ¾ bbl. per cubic yard of concrete is all that is necessary. Why specify a rich mixture when one with a less amount of cement will answer the purpose? If the contractor is at all skilled in estimating, the extra cost will be included in his proposal.

Estimating a Proper Analysis.—No proposals should be made upon a concrete job until a proper analysis has been made of all the elements entering into the concrete construction. It is not sufficient to say or to guess that the cost of a cubic yard is so much but instead an analysis should be made of the cost of a cubic yard of concrete under the conditions specified. There are a great many elements entering into the cost determined by such an estimate which will be briefly stated in the following:

Cost of Materials.—Depending upon whether the concrete is to be made of a natural mixture of gravel or of stone and sand in various proportions will depend the cost of the aggregate. The amount of cement depends upon the proportions of the concrete, as also do the amounts of gravel, stone and sand. The cost of water for proper manipulation should not be overlooked. In cities the cost of water is determined by rates of 9 or 10 cts. per cubic yard. Outside of cities the cost depends upon the labor necessary toq secure the water.

Cost Affected by Locality.—Concrete work remote from populous centers cannot be done at the same price as when close to such centers, unless the work is so remote that a permanent camp can be constructed and the laborers held by the very remoteness of the work. Work that is at some distance from the point of supply must bear a charge for transportation, handling and hauling of raw materials. This is a labor charge which is chargeable to material inasmuch as the materials should be considered as f. o. b. the job, but nevertheless the cost is increased per cubic yard in the proposal.

Cost Affected by Character of Labor and Character of Work.—Good American labor will accomplish at least 50 per cent more per day than foreign labor. American labor, however, is scarce and preferential. American labor differentiates between clean cut concrete work under favorable conditions and concrete work under adverse conditions, excessive water and other disadvantages. The same work may cost a great deal more when built under unfavorable conditions than when built in town.

Cost of Work as Affected by Forms.—A wall of concrete 27 ft. thick may be retained by the same forms and the same amount of form labor as are necessary for a wall 1 ft. thick. In the latter case the cost per cubic yard of concrete is 27 times as great. It is, therefore, not safe to estimate the cost of forms on a basis of guess price per cubic yard of concrete. Each individual job should be estimated for the amount of timber work as carefully as for any other item. It does not matter whether the cost is estimated on the basis of floor foot or concrete surface or upon a basis of feet board measure of lumber, the result is the same inasmuch as this important branch of concrete construction receives individual consideration.

Cost of Work as Affected by Centers.—There seems to be a misunderstanding as to the separation of forms and centers. Forms properly speaking consist of the timber work to form those members of concrete construction, such as columns, girders, etc., which must possess a certain regularity of form and evenness of outline. Centers properly speaking consist of timber supports for floor slabs, bridge centers, etc. Where the great amount of labor on timber work is expended solely for the purpose of supporting the mass at a uniform or definite height the unit cost is much less than for forming for individual members.

Cost of Work as Affected by Reinforcement.—Fabricated reinforcement will cost much more delivered to the job than loose bars, but on the other hand, will cost much less to place in position. It is needless to say that a job where reinforcement is made up of small bars less than ¾ in., will cost much more per ton for labor than for large sections. Good judgment must prevail in this particular. It is very seldom that an estimate will be made based on the labor and the tonnage of each size bar. Rather it is the practice to strike an average labor price in harmony with the class of work to be encountered with reference to the different sizes of reinforcement. It is well to remember, however, that it takes practically as long for the steel man to place and wire a ⅜-in. bar as a ¾-in. bar, while the tonnage is only one-fourth as great, and this point should be kept in mind in making an estimate.

Cost of Work as Affected by General Charge Items.—There are a great many items of the cost of concrete work which are not included in the cost of materials, labor, forms and centers, reinforcement, etc. These costs consist of installing and removing machinery, coal, oil, repairs and fittings to machinery, general charge items such as rope and bolts, and the loss on petty tools such as shovels. Such costs may be determined on the basis of so much per cubic yard, or preferably they may be determined on the percentage of labor on different classes of work. No matter what the method of determination, the costs are real expenses and are as justly chargeable as those for the gravel, or cement entering into the work.

Summarized Detail Estimate of the Cost of One Yard of Concrete.—In the line with the foregoing remarks and the importance of the detail study of concrete we submit the estimate for a cubic yard of concrete which according to specifications should be of a 1:2:4 mixture to be used for purpose of building construction and making these estimates we desire to lay emphasis on the fact that no two jobs cost the same when itemized in this way.

0.9 cu. yds. gravel at $1.20	$ 1.08
0.45 cu. yds. sand at $1.00	.45
1½ bbls. of cement at $1.20	1.80
Water	.10
200 ft. B. M. of lumber at $20, used four times at 20 per cent less each time used, less 40 per cent salvage	1.08
Reinforcement, 150 lbs. per cu. yd., at 2½ cts.	3.75
Total cost of material	$ 8.26
Labor concrete	2.00
Labor forms, 80 ft. B. M. at $30	2.40
Labor centers, 120 ft. at $20	2.40
Labor reinforcement, 150 lbs. at 1½ cts.	.75
Total labor	$ 7.55
General charge items, proportion of labor 15 per cent	$ 1.13
Total actual cost 1 cu. yd. concrete	$16.94

Each individual job that is encountered should be estimated in this same manner. It might not be necessary to throw the cost of forms and centers, reinforcement, etc., into the cost per cubic yard of concrete but however the estimate is made it should consider all these items and in the end the result will be the same. If in addition there is to be applied a surface coat or finish its cost must be added.

If there is any one item which adds to the cost it is the form and center work. For instance, in the detail estimate just given, cost of lumber and form and center labor is $5.88. If the work had been twice as heavy the cost of this labor would only have been half as much per cubic yard. This should bring home to every estimater the importance of dealing with temporary structural timber work as a separate unit. Personally the writer would rather guess at the amount of reinforcement per cubic yard than to guess at the cost of forms and centers. The cost of labor is dependent upon the amount of concrete placed on the square foot of area of work covered inasmuch as the cost of placing depends upon the distance traveled and the amount handled. The greater the distance the less the quantity and the more cost per unit and the less the haul the greater the mass and the less the cost per unit. Such labor cost may reach anywhere to $5 a yard and it is suggested that a careful study be given each job to determine the amount of foot pounds of work necessary to complete it.

Recommendations as to Cost Records and Cost Accounting.—It is suggested and recommended that each separate and distinct job should be given a detail cost recording in line with the foregoing in order that future work may be properly estimated. It is a very simple matter to arrange a cost record book with a system of time reports so that such records may be obtained and recorded without increase in labor or cost.

Civil Service Examinations.—The New York State Civil Service Commission announces that competition is offered for the position of Examiner. It is desired to secure a list of eligibles between the ages of 25 and 38, of good address, and with practical experience in corporation accounting in ore or more of the following fields: (a) steam railroads; (b) street and electric railways; (c) electrical and gas corporations; (d) telephone and telegraph corporations. Separate eligible lists will be established for these groups. No written examination will be held, but candidates will be rated on submitted papers. The salary is $1,800 per annum, with expenses when engaged in the field. An examination will also be held for the position of statistical clerk, a position paying $1,200 to $1,500 per annum. Applications for the first mentioned position must be filed before Feb. 24, 1912, and for the other before Feb. 19, 1912, with the State Civil Service Commission at Albany.

Methods and Cost of Proportioning Gravel Concrete.*

The admission of gravel [illegible] mits of the economical use of concrete in practically all Illinois townships, however remote from stone supply. Gravel as nature provides it has, however, an infinitely varied mixture of sand, pebbles and stone. Gravel as known to local highway officials, and to most contractors, may in some cases contain stone from 3 ins. in diameter down, and in others it may be a material all of which will pass through a ⅜-in. or even a ¼-in. screen. It is all popularly known as gravel, and the standard mixture is 1 of cement to 6 or 7 of gravel.

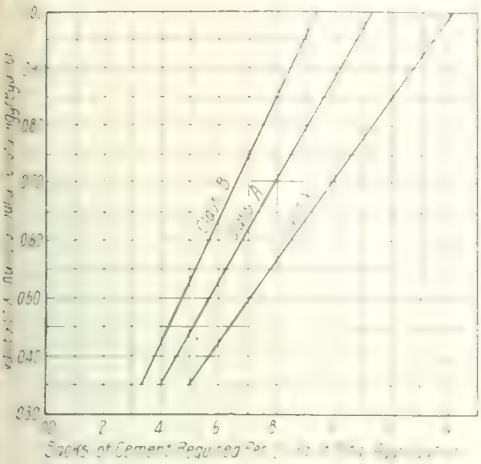

Fig 1—Quantities of Cement in Sacks to Use Per Cubic Yard of Total Aggregates.

The abuse of gravel concrete in small country highway work is astonishing. One local contractor, who was building a small bridge, insisted that a proportion of 1 of cement to 6 of gravel meant one sack of cement to six wheelbarrows of gravel.

The specification adopted provides for the use of broken stone and sand when available by stating the number of parts by volumne of each ingredient. Screened gravel is treated in the same way. Unscreened gravel is also permitted under certain conditions. The clay or loam content is limited by the specifications to 2 per cent of the sand. But few natural gravels will satisfy this requirement. Larger percentages are frequently allowed if the gravel is otherwise of good quality.

To secure the necessary strength, the cement is proportioned according to the amount of sand contained in the gravel; sand being defined as that part of the gravel which will pass through a ¼-in. screen. The only requirement as to relative proportions of sand and stone in the gravel is that the volume of sand must not fall below 0.6 of the volume of stone. Any gravel, therefore, having a sand to stone ratio greater than 0.6 may be used without modification, but for gravel so used the cement to sand ratio must be constant for a given class of concrete.

This provision permits the use of practically all gravels composed of satisfactory material. The resulting proportions stated in the usual form may vary, for a certain class of concrete, from 1 part cement to 2½ parts sand and 4 parts of stone to a mortar mixture of 1 part of cement to 2½ parts sand.

This method of proportioning is based on the assumption that if the sand and the stone are of satisfactory quality, and the ratio of sand to stone is equal to or greater than 0.6, the strength of the concrete will be satisfactory, providing the ratio of cement to sand, or in other words, the mortar, is always maintained constant for a given class of concrete. The specification for broken stone and gravel concrete reads as follows:

[illegible] Class B.

[illegible] screen and which will pass a 1 in. ring.

Class A concrete shall consist of 1 part cement [illegible] to pieces which will be retained on a ⅜ in. screen and which will pass a 1 in. ring.

Class B concrete shall consist of 1 part cement [illegible] pieces which will be retained on a ¾ in. screen and which will pass a 2½ in. ring.

Gravel may be used in the place of broken stone and sand for concrete and when so used shall conform to the following requirements:

Gravel used for concrete shall consist of clean, hard and sound stones, pebbles and sand, having a reasonably uniform gradation from the coarsest material allowable for the work specified to fine sand, and shall be used and proportioned in the following manner:

In proportioning gravel concrete, frequent tests will be made to determine the proportion of sand to stone. For Class X and Class A gravel concrete all material which passes a ¼ in. screen will be considered sand, and all material which is retained on a ¼ in. screen and passes a 1 in. screen will be considered stone. For Class B gravel concrete all material which passes a ¼ in. screen will be considered sand and all material which is retained on a ¼ in. screen and passes a 2½ in. screen will be considered stone. For any of the above named classes of concrete, should the volume of sand so found be less than 60 per cent of the volume of stone, sufficient sand shall be added to bring up the proportion of sand to stone to 60 per cent. Should the volume of sand be more than 60 per cent of the volume of stone, sufficient stone shall be added to reduce the proportion of sand to stone to 60 per cent or sufficient cement shall be added so that the volume of cement to sand shall be for Class X concrete as 1 to 2; for Class A concrete as 1 to 2½, and for Class B concrete as 1 to 3. In any case the proportion of cement to sand shall be as stated for the various classes of concrete.

In discussing the methods used in proportioning gravel concrete, the following definition and notation will be used:

Pit run gravel: A natural mixture of sand and stone. *Sand*: That part of pit run gravel which will pass through a ¼ in. screen. *Stone*: That part of pit run gravel which will be retained on a ¼-in. screen and which will pass through a screen of size indicated for the given class of concrete. *Total aggregate*: The mixture of sand and stone as it is to be used, with the addition of cement,, to form concrete. This may be pit run gravel alone or pit run gravel modified by the addition of sand or stone to form a more economical mixture.

Let x = volume of sand contained in a unit volume of pit run gravel expressed as a decimal, and [illegible] stone contained in a unit volume of pit run gravel expressed as a decimal. One barrel of cement = 3.8 cu. ft.

There are two general cases to be considered. First, when $\frac{x}{y}$ is less than 0.60. In this [illegible] the specifications so that $\frac{x}{y}$ in the resulting mixture will be 0.60. As gravels of this character are not often found, and the treatment is simple, no further comment is necessary.

Second, when $\frac{x}{y}$ is greater than 0.60. In this case sand is in excess and according to the specifications either of two methods of proportioning may be adopted. (1). The pit run gravel may be used without adding stone, by adding a sufficient amount of cement, so that the ratio of cement to sand always remains as required in the specifications for the class of concrete under consideration. (2). Sufficient stone may be added to the pit run gravel so as to make the ratio of sand to stone in the resulting aggregate = 0.60.

The following formulas may be used to determine the amount of cement to use, or the amount of stone to be added to the pit run gravel under the second general condition, that is, where the pit run gravel has an excess of sand.

For Class A gravel concrete the number of sacks of cement to use per cubic yard of pit run gravel $= \frac{27 \text{ times } x}{[illegible]} = 11.37\,x$ .... (1)

The number of barrels would be $\frac{11.37\,x}{4} = 2.84\,x$.

The number of cubic feet of stone to be added to each cubic yard of pit run gravel, if this method of proportioning is used, equals, $\frac{27 \text{ times } x}{0.6}$ [illegible] 27 [illegible] 27 [illegible] (2)

If stone is added according to this formula, the amount of cement to use per cubic yard of the modified aggregate can not accurately be determined without finding a new value of x. To find the new value of x, calling this value x_1, add to a given sample volume of gravel the proper amount of stone found by formula (2) and mix thoroughly. Knowing x, the actual volume of sand (Sd) in the sample used may be determined, and, if, after the stone is added, the volume (V) of modified aggregate may be measured, then x_1 equals $\frac{Sd}{V}$

As a comparatively large portion of gravel should be used, it may not be convenient to

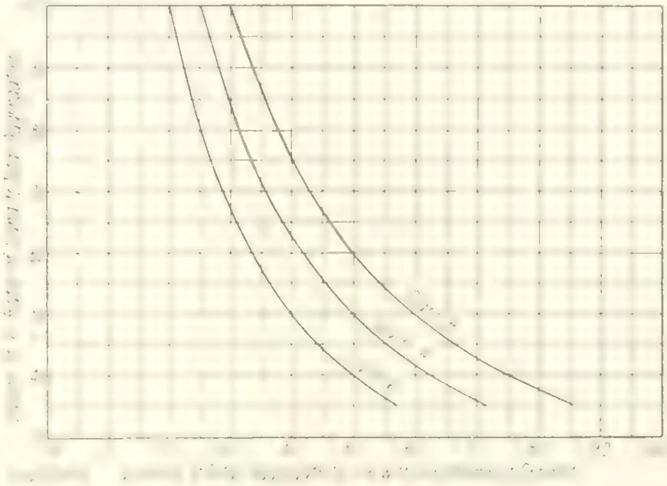

Fig. 2—Volumes of Total Aggregate to Use With One Volume of Cement.

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*Abstract of a paper by Clifford Older, Engineering Staff, Illinois Highway Commission, before the Illinois Society of Engineers and Surveyors.

measure the volume of the modified aggregate. In this case a definite portion of the modified aggregate may be screened and x_1 determined in the same manner as used in determining x for unmodified gravel. After finding x_1, the amount of cement to be used per cubic yard of modified gravel may be found by substituting x_1 for x in formula (1).

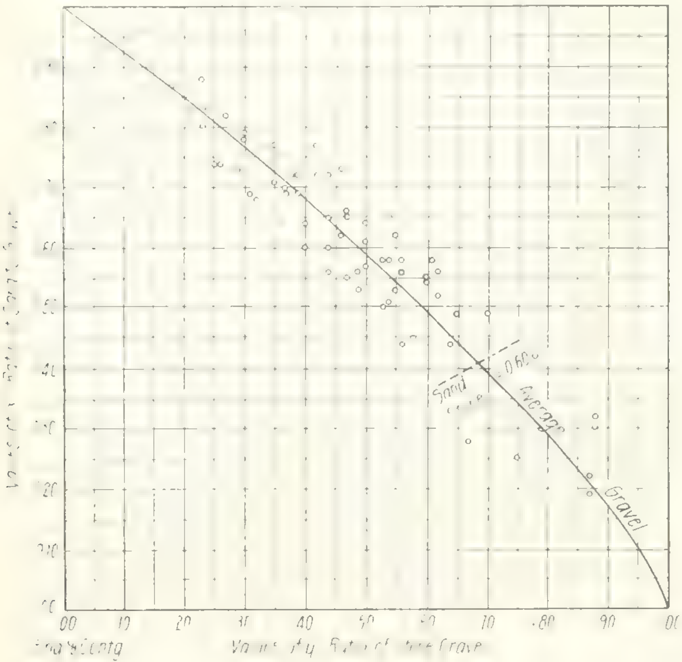

Fig. 3—Ratio of Sand to Gravel (x) and Stone to Gravel (y) per Seventy Samples of Gravel.

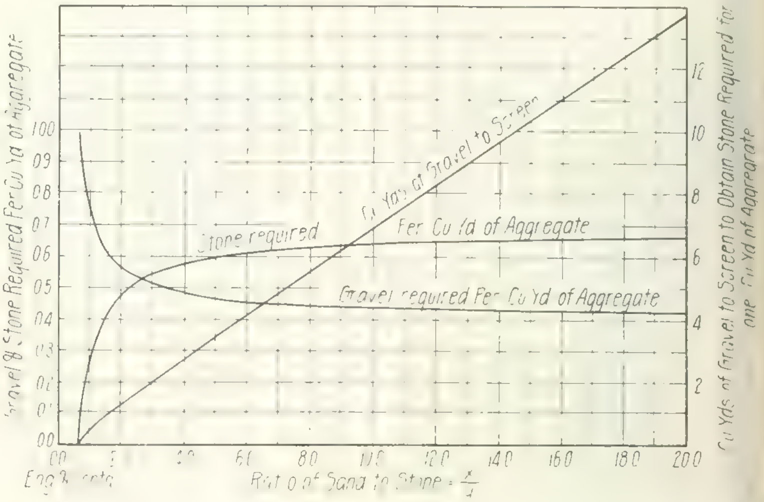

Fig. 4—Stone and Gravel Required Per Cubic Yard of Aggregate and Gravel to Screen to Obtain Necessary Stone.

For the other classes of concrete, similar formulas may be written.

Sometimes it is convenient to proportion gravel concrete by relative volumes of cement and total aggregate.

To determine this relation, first compute the number of sacks of cement per cubic yard of the aggregate as it is to be used in the mixture; then the volume in cubic feet of cement per cubic yard of aggregate equals 0.95 of the number of sacks and the proportion of cement to aggregate equals 27 divided by this quantity.

The following examples will illustrate the use of the above formulas:

Example 1.—Assume that it is decided to use, for Class A concrete, pit run gravel having an excess of sand, which is the usual condition; that the test measurements are made in a box having vertical sides; that the selected sample of gravel which should be dry and well compacted, fills the box to a depth of 10 ins.; and that the sand, after screening, fills the box to a depth of 7 ins. and the stone to a depth of 4 ins. As the sides of the box are vertical, then 10, 7 and 4 represent the volumes of gravel, sand and stone respectively.

The ratio of sand to stone equals $\frac{7}{4} = 1.75$.

This being greater than 0.60, sand is therefore in excess. $x = 0.7$. $y = 0.4$ and using formula (1), the amount of cement to use per cubic yard equals 11.37 times 0.7, or 7.96 sacks. Proportioning by volumes, the amount of cement to pit run gravel is as 1 to $\frac{27}{7.96 \times 0.95}$ or 1 to 3.6.

Example 2.—Assume that we have the same gravel, but that it is decided to add stone, so as to reduce the amount of cement necessary. Using formula (2) the amount of stone to add to each cubic yard of gravel equals 45 times 0.7 minus 27 times 0.4 or 20.7 cu. ft. Assume now that stone is added to a quantity of gravel at the rate of 20.7 cu. ft. to the yard of gravel and that upon screening we now find that in 10 ins. of gravel we have 4.5 ins. of sand and 7.5 ins. of stone. The ratio of sand to stone then equals $\frac{4.5}{7.5} = 0.60$. If this result should not come out about 0.60 it would indicate that some error existed in making the determination for stone. Some variation might be expected, however, because of the non-uniformity of the materials. x_1 now equals $\frac{4.5}{10} = 0.45$ and the amount of cement to use per cubic yard of the modified aggregate is 5.1 sacks.

Having determined x or x_1 for any given aggregate, the number of sacks of cement to use per cubic yard of aggregate or the number of volumes of total aggregate to one volume of cement may be taken from diagrams Fig. 1 and Fig. 2, respectively.

Diagram Fig. 3 shows the analysis of 70 samples of gravel. Values of x or ratio of sand to gravel being plotted as ordinates, values of y or ratio of stone to gravel, as abscissas. The average gravel curve is shown by a full line. The short dotted line passes through points having a ratio of sand to stone of 0.60.

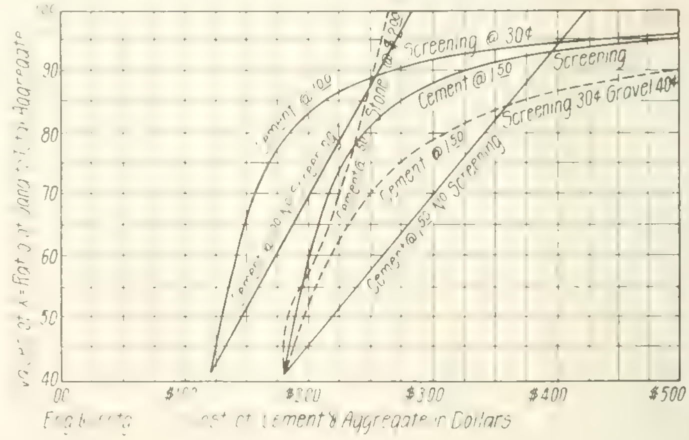

Fig. 5—Comparative Costs of Different Methods of Proportioning Class A Gravel Concrete.

Any gravel falling below 0.60 line is deficient in sand and sand must be added. Any gravel falling above this line has an excess of sand and additional cement must be used or the gravel modified by adding stone or by screening.

Diagram Fig. 4 is designed as an aid in determining the quantities of material to provide in case screening is resorted to or roc is to be added when sand is in excess.

Having determined x and y by screening sample of the gravel, find the value of $\frac{x}{y}$.

Entering the diagram with this value, the amount in cubic yards of stone and pit run gravel which will make 1 cu. yd. of aggregate having a ratio of sand to stone of 0.60 may be found by reading from the proper curve to the left of the diagram.

The quantities so obtained are closely approximate for any gravel which falls near the average line of diagram Fig. 3. The maximum variation, however, is not more than about 5 per cent for any of the gravels so far analyzed.

For all ordinary cases, therefore, these values are sufficiently close for ordinary materials. The quantities taken from diagram Fig. 4 are those which when mixed will make up 1 cu. yd. of aggregate. The cement when added to this cubic yard of aggregate may produce a somewhat greater volume of concrete, the amount of variation depending on the voids in the aggregate. The quantities obtained from this diagram, however, should be accurate enough for making an estimate of the amount of material to provide, as there is always some loss in hauling and handling.

It is oftentimes cheaper to resort to screening in order to obtain the stone necessary to modify the gravel to the 0.60 ratio than it is to add cement or purchase broken stone.

Entering diagram Fig. 4 again with the value of $\frac{x}{y}$ and reading from the curve marked

"Cubic yards of gravel to screen" to the right, the number of cubic yards of gravel necessary to screen to obtain the stone required per cubic yard of aggregate of 0.60 ratio may be obtained. The values so obtained are very nearly correct for gravels which fall close to the average gravel line of diagram Fig. 3. For other gravels the variation may be considerable, particularly for gravels having a value of $\frac{x}{y}$ not much greater than 0.60. If, therefore, the process of screening gravel to obtain the necessary stone, as determined in this way, does not show a marked economy, a more accurate determination of the number of cubic yards to screen should be made. To do this, find the amount of stone to add to make up a cubic yard of aggregate from the left of diagram Fig. 4 and calling this value *St*. Then the number of cubic yards of gravel to screen to obtain this amount of stone $=\frac{St}{y}$.

By using diagram Fig. 1 to determine the amount of cement required per cubic yard of pit run gravel and diagram Fig. 4 to determine the amount of stone to add so that the minimum amount of cement will be required, and finding the gravel to screen in order to obtain the required amount of stone from diagram Fig. 4 or the formula $\frac{St}{y}$ then the cost of cement, broken stone, gravel and screening a cubic yard of gravel being known the most economical method of proportioning may readily be determined.

Diagram Fig. 5 shows graphically the relative cost of the different methods of proportioning, the curves being based on the average gravel values taken from diagram Fig. 3.

With cement at $1 per barrel on the ground and 30 cts. as the cost of screening 1 cu. yd. of gravel, presuming that the gravel is free at the pit or that it is necessary to purchase only the amount of gravel hauled away, it will be seen that screening is cheaper than adding cement [illegible] on the ground at $1.50 per barrel and screening at 30 cts. per cubic yard; gravel being free at the pit or the material hauled away only being paid for, there is a very marked saving in cost by screening up to $x=0.93$ over the method of adding cement.

With cement at $1.50 per barrel, screening at 30 cts. and gravel at 40 cts., all gravel screened as well as that hauled being paid for at this rate, it is still cheaper to screen the gravel in order to find stone to add than it is to add cement up to values of $x=0.85$.

With cement at $1.50 and broken stone at $2 per yard delivered at the bridge site, the adding of broken stone is cheaper than adding cement, cheaper than screening, if all gravel handled must be paid for at the rate of 40 cts. per cubic yard and is cheaper than screening alone for values of x greater than 0.80.

An example of a case where the method of adding cement proved considerably cheaper than any other method of proportioning occurred as follows: A bridge located about nine miles from the nearest railroad station required about 350 cu. yds. of Class A concrete. Cement was delivered at the bridge site at cost of $1.35 per barrel. At the site of the bridge occurred a deposit of gravel containing but a small amount of stone, the sand, however, being of excellent quality. The gravel was had at the cost of shoveling it into wheel barrows. Broken stone at the nearest railroad station would have cost $1.75 per cubic yard, and the haul on account of the grades would have cost $4 per cubic yard, making the cost of broken stone at the bridge site $5.75 per cubic yard. The gravel in the creek bed tested 0.93 sand and 0.12 stone.

Using the gravel as it occurred in the creek bed required the use of 2.60 bbls. of cement per cubic yard of concrete, the cost at $1.35 per barrel being $3.51 per cubic yard. Had broken stone been added, it would have been necessary to purchase about 0.7 cu. yds. per cubic yard of concrete. This would have cost at the bridge site $4.02. The cement necessary would have been reduced to 1.2 barrels and would have cost $1.62 per cubic yard of concrete. The cost of cement and stone per cubic yard of concrete would have been about $5.64. The saving per cubic yard of concrete effected by adding cement at the rate of 1 of cement to 2½ of the contained sand amounted to $2.13. As there were 350 cu. yds. used, the total saving amounted in this case to $745. The resulting concrete appears to be excellent.

Screening was out of the question, as to obtain the stone required would have necessitated screening nearly 1,800 cu. yds. of gravel, and the visible supply was much less than this.

In general the specification for gravel concrete herein described, and which has been in use by the Illinois Highway Commission for several years, has resulted in satisfactory concrete, and made concrete structures available in many places where the cost would have been prohibitive had a fixed ratio of sand to stone been required in all cases.

EARTH AND ROCK SECTION

The Rate of Burning of Fuse.*

Fuse best fulfills its purpose when its rate of burning is uniform so that the interval of time between lighting the shot and the moment of explosion is definite for any kind and length of fuse.

There are conditions that cause variations in the rate of burning of fuse, some causing a marked retardation and others causing a decided acceleration. Conditions that are believed to be the most active in retarding or accelerating the rate of burning of time fuse have been investigated by experiments. The results are described herein and are classified under effects due to pressure, temperature, moisture, and mechanical injury.

In general, all types of fuse are similar in structure and in all of them the essential element is a core of fine-grained gun powder wrapped about by threads of hemp, jute or cotton. Fuse is divided into three main classes according to the work for which it is intended. Fuse of Class 1 is suitable for dry work, such as stump blasting and quarrying. Fuse of Class 2 is intended for damp or wet work, as in coal mining, or in surface work where mud, rain or dampness is encountered. Fuse of Class 3 is suitable for very wet work, such as may be necessary in tunneling, shaft driving, etc.

Cotton, hemp and single-countered fuse are of the first type, and consist of raw fuse that has been drawn through a bath of waterproofing material and finished with whiting, talc, or some similar substance to prevent the separate loops of a coil from sticking together. In cotton fuse the spinning threads as well as the countering are of cotton instead of jute. Single-tape fuse and double-countered fuse are of the second type, and consist of raw fuse that has been twice coated with waterproofing material, double countered or taped, and finished like fuse of type 1. Double tape, triple tape, gutta percha, and taped double-countered fuse belong to the third type. These consist of raw fuse that has been coated with waterproofing material and taped or double wound, and then finished with a coating of black varnish and whiting or talc, etc., or with a heavy coating of white china clay mixed with glue to form a paste.

Rate of Burning of Time Fuse.—The rate of the burning of fuse depends somewhat upon the composition of the powder used. An increase in the percentage of potassium nitrate increases the burning, whereas an increase in the percentage of charcoal decreases the rate of burning.

The degree of fineness of the powders used also affects the burning. In order to determine the effects due to this samples of fuse were made on the same machine containing powder which had been separated by sieves so as to contain portions of different granulation. In these experiments the fuse was of the double tape variety. The results were as follows:

Sample	Mesh	Rate of burning Seconds per ft
1	[illegible]	[illegible]
2	60-80	23.5
[illegible]	[illegible]	[illegible]

The tension applied to the spinning threads forming the first wrapping around the powder core is an important part of the manufacture of fuse. When gunpowder is placed within a tube having more or less extensive air space, the rate of burning is much more rapid than when the tube is completely filled. A type of so-called instantaneous fuse is, in fact, made upon this principle by leaving a considerable air space in the core throughout the entire length of the fuse. Such fuse burns at the rate of about 492 ft. per second.

The amount of gunpowder used in fuse, as well as the amount of tar, asphalt, or other waterproofing compound, varies rather widely in different types of fuse. The average amount of gunpowder found in several types of commercial fuse varies from 22 grains per foot to 24 grains per foot.

The relative percentage (by weight) of the different parts of triple-tape fuse is indicated in the following table:

Powder	[illegible]
Waterproofing	[illegible]
Cords and wrapping	[illegible]
	100.0

To determine the normal rate of burning of triple-tape fuse 14 samples were taken from separate rolls, and from each sample a trial length of 1 meter was cut. The time of burning of these samples is given in the following tabulation:

No. of sample.	Rate of burning Seconds per ft
Maximum	[illegible]
Minimum	27
Average	[illegible]

In order to determine whether the uniformity shown in the above table would continue when longer lengths of fuse were taken for tests, a series of experiments was carried out upon entire 50-ft. rolls of fuse, with results as follows:

No. of sample.	Rate of burning Seconds per ft
Maximum	[illegible]
Minimum	26
Average	[illegible]

The uniformity in the rate of burning of the above samples is very marked, but it should be mentioned that all of the rolls tested were the product of a single factory, and were made at about the same time. Evidently, where fuse is made from one lot of powder and with tape, cord, etc., from a single purchase, the product would naturally be more uniform than where fuse is made up at different times, from different lots of powder, and with different mixes of asphalt composition, etc.

In testing work of the Bureau of Mines, records have been taken regarding the average rate of burning of triple-tape fuse purchased by the Isthmian Canal Commission for use in work on the Panama Canal, and as these records cover samples taken from every shipment purchased during a period of several years, the figures show such variations as have occurred in fuse of this type during that period. The results of such timing tests of triple-plate fuse for a period of one year, before the rate of burning had been accurately adjusted, are given in the following tabulation:

No. of sample.	Rate of burning. Seconds per ft.
Maximum	[illegible]
Minimum	27.1
Average	[illegible]

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*Abstracted from Technical Paper No. 6, by Walter O. Snelling and Willard C. Cope, Bureau of Mines, Department of the Interior.

It will be noted that in the period of one year covered by this table the average rate of burning was 24.2 seconds per foot. The maximum rate of burning was 21 seconds per foot, and the minimum rate of burning was 27.1 seconds per foot. The maximum rate of burning shows an increase of 15.1 per cent over the average rate of burning. The minimum rate of burning shows a decrease of 11.7 per cent from the average rate of burning. These variations are greater than prevail in the best brands of safety fuse manufactured at the present time.

Separate samples of fuse of the same type should not show variations greater than 10 per cent above, or 10 per cent below, the average rate of burning. Variations up to 10 per cent above or below the average rate of burning are not excessive, and are only such as might be expected in any commodity manufactured upon a commercial scale, with the necessary slight variations in the materials used, and in the other conditions of manufacture.

It will be noted that some of the variations found in the above table can probably be accounted for by the fact that the timing tests on this fuse were made at different periods of the year, and differences of temperature in the outside air as well as differences in barometric conditions could bring about small variations in the rate of burning.

The normal rate of burning of several types of fuse is shown in the following tabulation:

Kind of fuse.	Rate of burning. Seconds per ft.
Cotton	25.9
Hemp	32.0
Single tape	30.0
Double tape	30.8
Triple tape	28.0
Yellow finished, double-countered fuse	31.6
Black finished, double-countered fuse*	40.0
White finished, double-countered, gutta-percha fuse*	32.3
White finished, double-countered fuse*	34.0
White finished taped, double-countered fuse (Brand C)	25.0
White finished, taped, double-countered fuse (Brand A)	30.4
White finished, double-countered, gutta-percha fuse	30.0

*European manufacture.

Influence of Pressure.—A considerable volume of permanent gases is produced by the burning of the gunpowder that forms the core of all types of time fuse. It is evident that if a considerable length of fuse lies within a shot hole, and if the stemming that is used around it is so impervious as to prevent the escape of the gases produced, or to allow their escape only with extreme difficulty, then the pressure upon the fuse will increase greatly. From experiments made by burning fuse in a closed vessel it has been found that 1 meter of fuse produces 3,388 cubic centimeters of permanent gas.

The first experiments made to determine the effect of pressure upon fuse were carried out within a cylindrical vessel 8 ins. in diameter, within which any desired pressure up to 60 lbs. per sq. in. could be produced. This cylinder was provided with a removable head, by means of which rolls of fuse could be inserted or removed, and this removable head was provided with gaskets to insure the cylinder being gas-tight. The arrangement of the cylinder was such that the desired pressures could be produced when the cylinder was filled either with air or with water, so that the influence of pressure upon the rate of burning could be determined either when the fuse was suspended in air or was submerged in water. The cylinder was provided with a pressure gage reading up to 20 atmospheres (approximately 300 lbs. per sq. in.) and with a relief valve by which the pressure within the cylinder could be reduced at any time, so that the excess gases produced by the combustion of the fuse could be allowed to escape and the pressure within the vessel be kept constant during the experiment.

Pieces of fuse 3 meters in length were taken, and a 3X blasting cap or detonator was affixed to one end of each piece of fuse. At the other end an electric igniting device was attached, so that by passing an electric current through the wires that entered the cylinder the ignition of the fuse could be brought about. When the fuse burned through to the detonator the resulting report could be readily heard, and the time between the moment the electric igniter was fired and the final report of the detonating cap was taken by a stop watch.

The first experiment made was with triple-tape fuse that, burning under normal conditions, had been found to have an average rate of burning of 28 seconds per foot. The rate of burning of four samples of this fuse at an indicated pressure of approximately 15 lbs. per sq. in. was shown in the following table:

No. of sample.	Rate of burning. Seconds per ft.
1	10.7
2	18.0
3	19.3
4	19.5
Average	16.9
Normal rate (under atmospheric pressure)	28.0

Throughout this paper pressures noted are gage readings and represent excess over atmospheric pressure.

In the test which showed the most rapid rate of burning the velocity of combustion through the fuse was found to be increased 161 per cent over the normal rate of burning. Even the piece of fuse burning the slowest shows an increased rate of burning 43.6 per cent over that of normal fuse.

Three samples of fuse were tested at approximately 2 atmospheres or 30 lbs. per sq. in., and in this case the rate of burning was somewhat greater than the average of the former experiments, as will be noted from the following tabulation:

No. of sample.	Rate of burning. Seconds per ft.
1	14.3
2	15.5
3	16.2
Average	15.3
Normal rate (under atmospheric pressure)	28.0

Eight samples of triple-tape fuse were tested under a pressure of 45 lbs. per square inch, and the most interesting results were obtained. A velocity as rapid as 6 seconds per foot was produced in one case, whereas other experiments gave rates of burning varying from this figure to 14.1 seconds per foot. The wide variation shown in this experiment is worthy of note. From the variations of the pressure gage as the excess of gas was allowed to escape it was seen, particularly in the case where the fuse burned more rapidly, that the rate of burning was very irregular, and that at times the flame "flashed" through the fuse with considerable rapidity. The degree of opening of the relief valve, which was usually found sufficient to allow the excess gases produced by the combustion of the gunpowder to escape, was for various short intervals of time entirely too small to allow the escape of the large volumes of gas which seemed to be almost instantaneously generated. This fact strongly suggests that some form of instantaneous or extremely rapid combustion of fuse was taking place.

When tested under a pressure of 60 lbs. per square inch results were obtained which also show wide variations. As difficulties were met in keeping the cylinder tight at pressure higher than these, no further experiments were made.

The results at the pressure of 60 lbs. per square inch are shown in the following tabulation:

No. of sample.	Rate of burning. Seconds per ft.
1	7.2
2	10.3
3	12.5
Average	10.0
Normal rate (under atmospheric pressure.	28.0

Some experiments were made to determine what pressure would be produced in experiments similar to those just mentioned if the relief valve were kept closed during the test, so as to allow the pressure exerted by the gas to increase. A 3-meter length of triple-tape fuse was used, and was ignited while contained within the vessel at an initial pressure of 45 lbs. per square inch. The pressure varied from 45 lbs. per square inch at the beginning of the experiment to 180 lbs. per square inch at the end. The rise in pressure was at first fairly uniform, and 75 seconds were required to bring about the initial increase of 1 atmosphere. Eighty seconds after igniting the fuse (and 10 seconds before the explosion of the cap showed the flame to have traversed its entire length) the pressure jumped from about 60 lbs. per square inch to 165 lbs. per square inch, and at the explosion of the cap the pressure rose to 180 lbs. per square inch. The rate of burning for the entire experiment was 9 seconds per foot, but manifestly at times the fuse flashed, and at such times the rate of burning was much more rapid than the average rate for the whole experiment.

Double-tape fuse, tested in the pressure tank in the manner just described, gave results as follows:

No. of test.	Initial pressure.	Rate of burning. Seconds per ft
1	15 lbs. per sq. in.	21.0
2	15 lbs. per sq. in.	21.2
3	30 lbs. per sq. in.	16.9
4	30 lbs. per sq. in.	16.8
5	45 lbs. per sq. in.	14.8
6		10.2

In test 5 the evolution of gas was very rapid just before the detonator was reached, showing that probably a portion of the fuse "flashed." A result similar in nature, though somewhat more marked in effect, was noted in test 6. The rapid rate of burning in these last two experiments shows clearly the effect due to increased pressure. The fuse used in the above experiments had a normal rate of burning of 31 seconds per foot.

A number of other types of fuse were tested in the pressure tank under conditions similar to those already mentioned. In all of these experiments an increase in the rate of burning was noticed with increased pressure. The results obtained are shown in the following tabulation:

Kind of fuse.*	Pressure.	Rate of burning. Seconds per ft.
Type 1	15 lbs. per sq. in.	15.2
	30 lbs. per sq. in.	10.5
	45 lbs. per sq. in.	9.1
Normal rate of burning 25.6 seconds per ft.		
Type 2	15 lbs. per sq. in.	19.4
	30 lbs. per sq. in.	10.3
	45 lbs. per sq. in.	8.1
Normal rate of burning 31.6 seconds per ft.		
Type 3	15 lbs. per sq. in.	17.4
	30 lbs. per sq. in.	15.4
	45 lbs. per sq. in.	11.0
Normal rate of burning 25 seconds per ft.		
Type 4	15 lbs. per sq. in.	24.3
	30 lbs. per sq. in.	21.3
	45 lbs. per sq. in.	19.0
Normal rate of burning 32.3 seconds per ft.		
Type 5	15 lbs. per sq. in.	24.4
	30 lbs. per sq. in.	20.5
	45 lbs. per sq. in.	18.4
Normal rate of burning 34 seconds per ft.		
Type 6	15 lbs. per sq. in.	30.3
	30 lbs. per sq. in.	26.8
	45 lbs. per sq. in.	25.2
Normal rate of burning 40 seconds per ft.		

*Kind of fuse used in above tests: Type 1. Cotton fuse. Type 2. Single-tape fuse. Type 3. White-finished, taped, double-countered fuse Type 4. White-finished, double-countered, gutta-percha fuse. Type 5. White-finished, double-countered fuse. Type 6. Black-finished, double-countered fuse.

In several of the above tests the phenomenon of "flashing" was noted, particularly at the pressure of 45 lbs. per square inch. From the tests made it is clear that the tendency to "flash" becomes much more marked at the high pressures, and at pressures higher than 45 lbs. per square inch would probably play a very prominent part in the rate of burning of fuse.

The next experiments were intended to show the pressure that probably is produced when fuse is burned in an ordinary drill hole, tamped in the usual manner. A piece of iron pipe 4 ft. long was used as the shot hole, and tests were made in which the pipe was filled with various stemming materials, such as dried fire clay, wet fire clay, and plaster of Paris. Wide variations in the rate of burning were noted, and were found to depend upon the degree of resistance that was offered to the escape of the gases produced by the combustion of the fuse. In many cases the channel left by the burning of the gunpowder core afforded a sufficient exit for the products of combustion of the fuse, so that little increase in pressure took place, and only a slight increase in the rate of burning of the fuse was brought about, whereas, in other exriments performed under similar condi-ons there were marked changes in the rate burning. With dried fire clay, for example, e rate of burning of triple-tape fuse was und to be 29.7 seconds per foot, as against normal rate of 31.6 seconds per ft. Hence, der the conditions, the dry fire clay as well the fuse itself allowed the gases to escape ith sufficient readiness to prevent any de-ded increase in pressure. When moist fire ay was used as stemming there was a con-derable increase in the rate of burning of e fuse. When 2 meters of fuse were placed ithin a tube, as before described, and tamped ith moist fire clay (12 to 13 per cent mois-re) the rate of burning of triple-tape fuse as increased from 29.4 seconds per ft. to .6 seconds per ft., or 59.2 per cent. In a cond test made under identical conditions still greater increase in the rate of burning as noted, and tamped with fire clay of the me type as before burned at the rate of 17.4 cond per ft. as against the normal rate of rning of 29.4 seconds per ft.

In experiments made to determine the ef-cts of different kinds of stemming, moist e clay produced the greatest increase in the te of burning, the results varying from 13 c. per ft. to 21 sec. per ft., as against the rmal rate of burning of the fuse used of 28 conds per ft. Dried sand, moist sand, and ried fire clay, when used as stemming, each roduced an increase in the rate of burning f fuse, but the increased rate of burning with ese materials was usually not greater than to 30 per cent, whereas with moist fire clay, s has already been noted, the increase was in ne case as great as 59 per cent. When a cast f plaster of Paris was used in a similar ex-eriment the rate of burning was found to be reatly increased, a sample of triple-tape fuse urning at the rate of 6.4 seconds per ft. as gainst the normal rate of burning for the ame piece of fuse of 28.2 seconds per ft.

The rate of burning of several types of use, encased in plaster of Paris, is given in e following table:

Sample.*	Ordinary rate of burning. Seconds per ft.	Rate of burning in plaster of paris Seconds per ft.
A	28.2	6.40
B	25.6	[illegible]
C	31.6	[illegible]
D	34.7	[illegible]

*Kind of fuse used in above tests: A, triple-ape fuse; B, white-finished, taped, double-ountered fuse (brand C); C, double-tape fuse;), white-finished, taped, double-countered fuse rand A).

It is of course evident that under actual nining conditions fuse would not be subjected o conditions similar to those produced in hese experiments with plaster of Paris. The esults are of value, however, in showing the reat increase in the rate of burning of fuse nder confinement. In a very long bore hole, ressures could be produced—especially if noist fire clay or similar stemming material vere used—which would effect a confinement ractically as great as in the experiments just nentioned.

Several tests were next made to determine whether fuse could be made to "flash" under ordinary conditions of temperature and pressure, solely by constricting some points in its length. Pieces of fuse of definite length were taken, and by means of pliers were held tightly at a number of points in such a way as to prevent the escape of gas beyond the constriction produced by the jaws of the pliers. In these experiments a somewhat increased rate of burning was noted 25 seconds per ft., as against a normal rate of burning of 28.8 seconds per ft., but in no case did the fuse flash entirely through or even for a considerable distance. There was always a sharp report caused by the gases suddenly bursting through the side of the fuse, but this appeared to be simply a local phenomenon. The break produced in the fuse provided at once an exit for the gases sufficient to prevent any further increase in the rate of burning. When constrictions were placed every 2 or 3 centimeters along a piece of fuse the rate of burning was not increased more than about 10 per cent.

Fuse with a dense outer covering or fuse that has been subjected to considerable pressure in the process of manufacture usually shows a greater tendency to "flash" than fuse of other types.

Influence of Temperature.—When tape fuse is heated the tar or asphalt composition used for waterproofing tends to become fluid. At ordinary temperatures the viscosity of the waterproofing compound is such that there is little or no tendency for the compound to be taken up by capillarity by the fibers of the jute or hemp cords surrounding the powder core. But as the temperature rises the waterproofing compound becomes less viscous, and the fibers of the wrapping about the powder core soon becomes saturated. When considerable waterproofing compound is present, as in types of fuse particularly designed for impermeability to water, the fluid waterproofing material extends completely to the powder core and tends, partly or wholly, to agglomerate the separate grains of powder into a solid mass. Even when only a small amount of waterproofing compound has thus extended through to the powder train there appears to be a decided change in the rate of burning of the fuse. When increasingly large amounts of asphalt composition have reached the powder core the change in the rate of burning becomes still more marked, and when tape fuse has remained for a considerable length of time at an elevatod temperature the amount of waterproofing composition that reaches the powder train will often be so great as to completely agglomerate the powder and entirely prevent the flame from traversing the fuse.

To outline roughly the change in the rate of burning that results from the heating of triple-tape fuse, two lengths were taken from a single roll of the fuse. One of these lengths was kept at a temperature of 140° F. for one hour, and the other was kept at a temperature of 194° F. for the same length of time. The fuse that had been kept at a temperature of 140° F. burned at the rate of 30 seconds per foot, and the length that had been kept at a temperature of 194° F. burned at the rate of 98 seconds per foot. These results show that exposure to this temperature for one hour causes a marked retardation in the rate of burning of triple-tape fuse, the time required for the flame to traverse a given length of fuse so treated being more than three times as long as the time required for the flame to traverse the same length of normal fuse.

Even fuse that had been kept at 140° F. burned at a rate somewhat slower than the normal. Experiments were made with a number of lenghts of triple-tape fuse which had been kept at a carefully regulated temperature of 140° F. for a number of hours. The results of these experiments were as follows:

Number of hours heated.	Rate of burning. Seconds per ft.
1	[illegible]
2	29.7
3	30.0
4	30.3
5	[illegible]
6	31.0
7	31.0
8	31.3
9	31.0
10	32.0

Since prolonged heating, even at a temperature as low as 140° F, causes a retardation in the rate of burning of fuse, it is obvious that in blasting operations care should be taken not to store fuse in too warm a place, as near boilers or steam pipes. Fuse may be seriously damaged by being kept in a tin box exposed to the direct rays of the sun, because the interior of the box may reach a temperature many degrees higher than the temperature of the surrounding air. A black metal box exposed to the rays of the sun in an open quarry has been found to reach a temperature high enough to modify greatly the rate of burning of lenghts of fuse kept therein.

When fuse is cooled below the normal temperature, as when used out of doors upon a cold day, the rate of burning differs from the normal rate. A series of tests made by placing lengths of fuse out of doors at various temperatures (equal lengths cut from the same rolls being kept at normal temperature) enabled the effects of small changes of temperature below the normal to be determined. For example, a 3-meter length of triple-tape fuse that had been exposed for about three hours to a temperature of 25° F. burned at the rate of 25.7 seconds per foot, whereas a similar length cut from the same roll of fuse and kept at the laboratory temperature of 64.5° F. burned at the rate of 27 seconds per foot.

It will be noted that exposure to a fairly low temperature for a short time tends to accelerate slightly the rate of burning of fuse, and this effect is no doubt the result of the increased firmness of the tar and asphalt waterproofing, which tends to become more rigid at low temperatures. When fuse is exposed to a decidedly low temperature for a considerable time just the opposite result is reached, because the tar or asphalt becomes so brittle as to break readily under even the slight pressure produced by the escaping gases and allows the gases more ready access to the outside air.

The following table shows the results of two experiments made with lengths of triple-tape fuse that had been kept at a temperature of about 14° F. for two days and with similar lengths of fuse cut from the same roll but kept at the laboratory temperature:

	Rate of burning	
No. of sample	At temperature of 18° C (64.5° F.). Seconds per ft.	At temperature of 10° C (14° F.). Seconds per ft.
1	29.7	43.1
2	28.5	41.6

It is evident from the above table that the increased brittleness at low temperatures of the tar or asphalt in triple-tape fuse has marked influence in determining the rate of burning. However, this matter is not of great importance, since in nearly all mines the temperature at the working face is constant throughout the year. In quarries, however, fuse probably burns much more slowly during very cold weather, and the amount of handling that the fuse receives while it is cold (and therefore while the tar is brittle) also influences its rate of burning.

Further experiments with triple-tape fuse at high temperatures showed that the rate of burning is retarded from a normal rate of 29.3 seconds per foot to a rate of 70 seconds per foot by heating four hours at 176° F. Fuse heated to this temperature often failed to burn completely through, and in several of the samples tested the powder grains were so agglomerated by saturation with the fluid waterproofing compound as to prevent entirely the burning of the powder core.

Triple-tape fuse that had been heated for five hours at 60° F. burned at rates varying from 110.7 seconds per foot to 125.3 seconds per foot, or over four times the normal time of burning. Only comparatively short lengths of the fuse would burn, the stoppages due to complete agglomeration of the powder being very frequent. In tests of types of fuse containing little or no tar or asphalt (cotton fuse, etc.) it was found that temperatures of 158° F., or less, had little or no influence on the rate of burning. This result was to be expected, because, as already noted, it is the increased fluidity of the tar or asphalt waterproofing of triple-tape and similar fuses that brings about the retardation in burning through agglomeration of the powder grains. With fuse containing considerable amounts of waterproofing material, wide variations were produced by heating to temperatures of 212° F. or less.

Table I shows the variations in several types of fuse heated at different temperatures for one hour.

Influence of Moisture.—If a small amount of moisture gains access to the powder core of fuse, it tends to retard the rate of burning of the fuse; if a large amount of moisture gets within the powder core, it will probably entirely prevent burning. If moisture has gained access to fuse, and the fuse has been dried in order to reduce the moisture present to about the normal figure, the rate of burning of the fuse is generally slower than was the original rate, and the tendency of the fuse not to burn completely through is pronounced.

Experiments with pieces of fuse that had

TABLE I. VARIATIONS IN SEVERAL TYPES OF FUSE HEATED AT DIFFERENT TEMPERATURES FOR ONE HOUR.

Name of sample *	At normal temperature. 64.5° F. Seconds per ft.	167°-178° F. Seconds per ft.	185°-191° F. Seconds per ft.	239°-257° F. Seconds per ft.
A.	25	25	24	25
B.	31	28	29	148
C.	32	37	63	162
D.	34	41	58	205
E.	40	38	68	191
F.	30	31	32	102
G.	31	31	63	†

*Kind of fuse used: A, cotton fuse; B, single-tape fuse; C, white-finished, double-countered, gutta-percha fuse; D, white-finished, double-countered fuse; E, black-finished, double-countered; F, white finished, taped, double-countered fuse (brand A); G, double-tape fuse

†Failed to burn through.

been subjected to mechanical injury (for instance, a cut such as would be made by the fuse striking a sharp edge of the tin lining of cases for export shipment), exposed to a moist atmosphere for 10 days, and then carefully dried at about 122° F., showed results decidedly different from those obtained with pieces of the same fuse which had not been so treated. In the case of triple-tape fuse the rate of burning varied from 30 seconds per foot to 35 seconds per foot, as compared with a normal rate of burning for the same fuse of 28 seconds per foot. With double-tape fuse the rate of burning was altered from 31 seconds per foot to about 40 seconds per foot, and with other types of fuse proportional variations were produced. In all cases it was noted that the effect of exposing the fuse to moisture, even when followed by careful drying, was to materially retard the rate of burning of the fuse. In no case was an acceleration noted, and whenever the fuse was exposed to moisture for any considerable length of time without being carefully dried afterwards, there was an entire failure of the fuse to burn completely through.

Because the waterproofing of fuse is quite as effective in keeping in water that has once gained access to fuse, as in keeping out external water, obviously fuse that has once become wet is difficult to dry thoroughly. Hence, both because of the variations that are produced in the rate of burning of such fuse after becoming moist and because of the greatly increased liability of misfires through such fuse failing to burn through at all, fuse that has been stored in a very damp place or has in any manner become wet should clearly not be used in mining operations.

Types of fuse differ greatly in regard to their ability to withstand exposure to moisture. "Cotton" fuse and "hemp" fuse are not designed for use in wet ground, and accordingly these types of fuse show little resistance to moisture. Ability to withstand water varies in accordance with the nature of the covering or the protection that is given to the "wrapped core." Gutta-percha fuse, triple-tape fuse, and taped, double-countered fuse show the highest resistance to water, and under favorable conditions any of these types of fuse will stand immersion for a number of hours.

Influence of Mechanical Injury.—When the fuse is under pressure sufficient to prevent the escape of the products of combustion of the gunpowder, the rate of burning is greatly increased. If fuse is compressed by a wedge or by tamping, the rate of burning may be increased 500 per cent.

In experiments made in connection with the present report, pieces of fuse 2 meters in length were forcibly inserted, with consequent bending, coiling and crushing, into a pipe 2 ins. in diameter. The normal rate of burning of this fuse was 28 seconds per foot, but the pieces that had been crushed into the pipe burned at the rate of 24 seconds per foot.

Some tests of fuse that had been subjected to such pressure as is produced by pounding, hammering, etc., gave interesting results; several lengths of fuse that had been thus treated showed a more rapid rate of burning than was noted even in the experiments relating to the influence of pressure. However, a moderate amount of mechanical injury, such as rolling or crushing, provided it is not sufficient to rupture the fabric of the fuse, usually has a slight retarding action on the rate of burning.

A piece of fuse that had been pounded with an ordinary hammer showed a rate of burning of 4 seconds per foot. The normal rate of burning of this fuse was 25 seconds per foot. A similar piece, which had been struck lighter blows and showed no abrasion of the outer wrappings, burned at the normal rate for about 18 m. and then "flashed." The rate of burning of this fuse was 18 seconds per foot. A piece of fuse that had been compressed by pounding at nine points along its length, the spaces compressed being 2 m. long and separated by 1⅛ in. intervals, "flashed" at seven of the nine compressed areas, and showed a rate of burning 21 seconds per foot. The normal rate of burning of this fuse was the same as that used in the former experiment, and the change in the rate of burning from 25 seconds per foot to 21 seconds per foot was due to the "flashing" at the compressed areas.

When fuse was subjected to a rather rough pounding with a hammer, the rate of burning was very rapid, and in these experiments a rate of burning of 3 seconds per foot to 7 seconds per foot was noted. In one experiment in which a piece of fuse had been pounded until it was decidedly flattened the remarkable rate of burning of 1 second per foot was observed. As such fuse can be considered to be practically "instantaneous," the use of fuse that has been injured by falling rocks, blasts, etc., is consequently dangerous. The length of fuse customarily used in lighting "adobe" shots is about 3 ft., and if this length of fuse were to burn in 3 or 4 seconds instead of in its normal time of about 90 seconds there would evidently be great possibility of accident. The falling of rock or similar causes would clearly not subject fuse to such a strain or pressure as was used in the above experiment, but those portions of the fuse which might be subjected to the direct blow of a falling rock or other similar source of pressure would burn with a rapidity comparable to that noted in the experiment just mentioned. When a number of adobe shots are to be lighted at one time, difficulty in the lighting of one or two of the pieces of fuse, frequently sufficient to cause a delay of 15 or 20 seconds, may manifestly become the cause of accident.

When fuse is sharply bent, as by drawing it around a rod, or when portions of fuse are injured by cutting, as by slashing with a knife, the rate of burning is only slightly affected. A piece of fuse 1 meter in length was drawn back and forth several times over a piece of pipe about 0.75 in. in diameter and the time of burning was found to be normal. Even when a similar experiment was tried with a smaller pipe the result was similar, and no decided variation from normal was noted.

The action of oil upon fuse is a factor that deserves consideration. Experiments made with various kinds of oil and grease showed that not only the lighter grades of fuse but also the waterproofed types were readily penetrade by oily substances, and fuse that had been in contact with oil or grease for a considerable length of time would often fail to burn completely through. The lighter lubricating oils brought about deleterious results more readily than the heavier oils.

Practical Conclusions.—Under ordinary conditions nearly all types of fuse show great uniformity in their rate of burning. Practically all types of fuse examined had a total variation in their rate of burning under normal conditions of less than 20 per cent and all would have been passed under the allowance of "no variation greater than 10 per cent above or 10 per cent below the average rate of b ing."

Under the influence of pressure practic all types of fuse are subject to wide varia in their rate of burning. Such pressure as readily be produced by the confinement the gases evolved by the burning fuse i is sufficient to increase the normal rate burning from 28.2 seconds per foot to seconds per foot. Thus, even confinement cause fuse to burn from three to four ti as rapidly as its normal rate. In experim made with fuse confined by stemming various kinds wide variations in the rate burning were noted, and whenever lengths fuse are confined by stemming or other m rials impervious to gas, a sufficient length the fuse should be used to allow for the creased rate of burning due to the press produced by the evolved gases.

High temperature causes a marked retar tion in the rate of burning of fuse, storage for even a short period of time n boilers, or wherever the temperature may high, is sufficient either to cause "misfires," to retard the rate of burning of the fuse much as to greatly increase the liability "holdbacks," delayed shots, etc. It is prob that many of the difficulties that are someti encountered in regard to fuse burning slowly and causing delayed shots are due, part at least, to such fuse having been k in too warm a place. Fuse that is not inten for use in wet places (cotton fuse, etc.), d not suffer marked change in its normal rate burning by reason of the effect of high te peratures, whereas the more completely wat proofed types of fuse show increasingly gr effects from heat. Even exposure to compa tively low temperatures for considera lengths of time causes marked retardation the rate of burning of such fuse, and expos to a fairly high temperature for even a sh length of time may cause certain types of f to burn from three to five times as slowly their usual rate. To insure the best resu fuse should always be protected from extren of temperature.

As a final summary it may be stated t ordinary fuse may under some conditions bu as fast as 1 second per foot, and under ot conditions it may burn as slowly as 227 s onds per foot. The former rate is more th 200 times as fast as the latter, and each widely removed from the normal rate burning of similar brands of fuse. Hence, condition and past history of any roll of f is an important matter, and in mining a blasting operations the safety of the mi demands that only fuse that has been carefu stored and kept from unfavorable conditi shall be used.

U. S. Civil Service Examinations.—T Civil Service Commission announces compe tive examinations to be held in the Spring 1912, among which are the following of i terest to engineers: March 13, 1912, Aid, Co and Geodetic Survey; civil engineer, Phil pine service; civil engineer student; draf men, topographic; junior engineer, Engine Department at Large; junior engineer (m chanical and also mining), Bureau of Min April 10, 1912, civil engineer, Departme service; civil engineer and draftsman; co puter, Coast and Geodetic Survey; draftsm mechanical and topographic, Isthmian Ca Service; engineer, Indian Service; junior e gineer, mechanical or electrical, Engineer D partment at Large; junior engineer (civi Engineer Department at Large; survey Philippine Service. Full information may obtained by addressing the U. S. Civil Serv Commission at Washington, D. C.

Cost of Dallas-Oak Cliff Viaduct.—T cost of the Dallas-Oak Cliff viaduct, a co crete structure 4,778 ft. long, between ab ments with a 44 ft. roadway, as represented the county books, is $654,867.03. This i cludes right of way, consulting engineer's fe engineering, legal expenses, contracts a extras. The cost per sq. ft. of roadway therefore $3.11.

ROADS AND STREETS SECTION

ecifications for and Cost of Replacing Wood Floors with Reinforced Concrete, for Highway Bridges.

ributed by Leroy C. Smith, Engineer, Michigan State Highway Department.

he Michigan State law provides that: "All lges shall have a clear headway of at least ft. and shall be capable of carrying a 10-ton ving load." In another place it provides: ere shall be no bridge, culvert or artificial dway of any kind constructed in any public hways of this State over any water course reof having a roadway of less than 16 ft. width, and the same shall be built of sufficnt strength to carry safely a 10-ton load." hese two sections provide practically the ne thing, except that in the last section the rd "moving" is omitted, which is, of course, al to the design of a bridge greater than ft. span.

he law, as seen above, provides for a 10- moving load, and the traction engines ich are sold in this State and used here y in weight from 9 to 18 tons, the larger cent being heavier than 10 tons, when alance is made for coal, water and engineer. n readily be seen that the township nty and village officers properly to protect lves against damage suits they must ld bridges which will safely carry a 10-ton tion engine, at least, and it does not take ch forethought to see that with the heavier ines, which are being made, the required rying capacity of bridges will be increased 15 tons. The up-to-date bridge engineer igns all bridges to carry at least a 15-ton tion engine or road roller.

he Michigan State Highway Department led for reports from the township highway nmissioners and county drain commissioners [illegible] the amounts expended on bridges the year of 1909. Ninety-seven per cent the highway commissioners reported an expenditure of $613,191.94; [illegible] county in commissioners reported an expenditure $52,206.78, making a total amount reported $665,398.72, and estimating those who failed refused to report in the same proportion, [illegible] total expenditure of $[illegible] for dges and culverts. Nearly $250,000 of this s spent for wood and metal culverts and ort span steel bridges with wood floors, ich will have to be repaired within five rs at the outside and more than likely will e to be totally replaced in 15 years.

)n account of the increased cost of oak nking, more or heavier traffic, shaky condin of old floors, the question of devising a manent, comparatively inexpensive country dge floor has become important. Many rly good long span steel and wrought iron hway bridges are going to pieces on acnt of no attention in regard to pointing ndations and to securing rigid floors.

Township, village, and county officials have orted to their old "consulting engineer," bridge agent. They have been told that ir bridges are not heavy enough to carry ncrete floors (meaning steel jack arches d 7 or 8 in. plain concrete floors). It falls the engineer in general practice to investite these old trusses and recommend, if posle, a form of floor which will be adaptable. t of ten or twelve bridges which have been estigated with an eye to putting on a thin inforced concrete floor, only four or five ve shown sufficient strength of member to ry safely such floor.

In examining an old bridge, the following ints should be taken into consideration: (1) ability of foundations and piers; (2) rustg or damaged members; (3) pin packing d floor beam connections, and (4) size of members.

In nearly every case, it is found that stone utments and piers need repointing at least, d in many cases old lime mortar is washed entirely. Facing walls must be built where old stone walls are in very bad repair. Only the best Portland cement mortar should be used in repointing

The writer has observed, by use of transit, center piers made of two 4-ft. steel tubes filled with concrete sway 2 or 2½ ins. when a light wagon crossed the bridge. Such conditions are caused by poor footings, oftentimes containing no piling and light bracing poorly tightened up. The piers can be stiffened up by tightening bracing and, where needed, building concrete footings, ramming the concrete under the tubes if the water can be lowered sufficiently.

Steel tubes have come into disrepute on account of faulty workmanship and dodging of specifications by contractors rather than on account of poor design. For highway work, tubes of large enough size set on piling under water and filled with good concrete are serviceable.

Oftentimes, old wood floors and dirt have held the water on the bases of main members until they are rendered unsafe for any kind of use. Many times members are found which have been bent or contorted by ice jams and straightened, making them unfit for carrying load. In case of a pair of eye bars in the lower chord, one may be bent or twisted until it carries the whole load. In such case, members must be replaced. The packing of pins should be noted and checked up to see if the least movement is obtained and if pins are large enough.

Floor beam connections are at once the most important and the poorest detail in highway bridge construction; U-stirrup hangers are used largely and, even when properly designed for size, are shaky and dependent upon threads for holding. These connections are subject to more rust than any other joints. Eye plates, firmly riveted to the floor beams, are the only sane connections.

In no case have I found an old bridge which had a floor system which would figure out to carry safely a 10-ton moving load with a factor of safety of four. Floor beams are sometimes not heavy enough to carry without reinforcing with new heavy cover plate or bottom flange.

Usually, wooden stringers are found and, in case where steel stringers are in, they are seldom more than 5 or 6-in. I-beams on a 12½ or 13-ft. span. In every case where I have recommended a concrete floor, it has been necessary to put in new steel stringers. All truss members must be measured up and checked, making allowance for loss in cross-section, due to rust.

There are some good well preserved wrought iron bridges in this State, both Pratt truss and Whipple double intersection types. These bridges figure out for carrying capacity better than some of the more modern steel bridges, which are being "dickered for" by local authorities today.

The following plan has been followed for assumed load specifications and computing stress in truss: (1) Concentrated wheel load of 5 tons on an area 12x28 ins. on floor slab. (2) Concentrated wheel load plus weight of slab on two stringers spaced not more than 28 ins. apart. (3) Distributed 10-ton load plus dead floor load on floor beams. (4) Ten-ton concentrated load tried on each panel joint plus dead load of whole bridge for the trusses.

In no case have concrete floors been recommended where the stress in the steel would be above 17,000 lbs., and in wrought iron above 13,000 lbs. per sq. in.

Steel.—Steel stringers shall be spaced not more than 28 ins. nor less than 24 ins. centers. For panel lengths, from 12½ ft. to 14 ft., and width [illegible] shall be used for three center stringers. On each side of these, two 7-in. 15-lb. I-beams, and in place of side channels 6-in. 12¼-lb. I-beams [illegible] be long enough to reach two panel lengths, and be laid so as to break joints. Stringers shall be bolted to floor beams securely with ½-in. bolts at each intersection. Stringers shall be connected [illegible] fish plates 14 ins. [illegible] to fit snugly between flanges. Fish plates shall be bolted with eight ½-in. bolts in each plate. Not more than ¼ in., not less than ⅛ in. shall be allowed between ends of stringers. All abutment and pier ends of stringers shall be bedded in Portland cement mortar mixed 1:3. All floor beams, sway bracing stringers and connections shall be coated with two coats of linseed oil paint. Tops of stringers must not be painted.

Forms.—Forms shall be placed between stringers close up under top flange. Tar or building paper must be used on forms to make them tight. Curb forms shall be securely fastened in place before any concrete is placed.

Reinforcing.—Expanded metal, No. 40, 3-in. U. S. or Kahn rib metal No. 3, or wire reinforcement having the same area of cross-section per foot width, shall be used. Reinforcing shall be laid with main members, running at right angles to stringers. Ends of reinforcing shall be bent up 3 ins. into curb. Strips shall be securely wired or clipped together. Reinforcing shall rest on top flanges of stringers and be not more than ½ in. nor less than ¼ in. from forms.

Concrete.—Gravel shall be from 40 to 60 per cent pebbles by weight, no stones larger than 1 in. An approved brand of Portland cement shall be used. Concrete shall be mixed in the proportion of one part cement to three parts gravel, wet mix. A batch mixer or very careful hand mixing shall be used. Concrete shall be spread uniformly 3½ ins. thick over tops of stringers On account of stringers being of different depths, finished roadway shall be crowned 2 ins. Concrete must not be trowelled, but smoothed off with a template. Curbs must be poured at same time as roadway.

Expansion Joints.—On top of every other floor beam an expansion joint shall be placed. This joint shall consist of two thicknesses of heavy tar paper. Work shali not stop in laying the floor at any place except at an expansion joint Surface shall be covered with sand or sawdust and be kept wet during first five days of drying Forms shall not be removed in less than three weeks No traffic shall be allowed on floor until four weeks after completion of concrete work.

Tar Top.—A skin coat of bituminous binder, mixed with sand, shall be spread on the concrete surface not to exceed ¼ in. in thickness.

COST.

A bridge floor was replaced at Montrose, Michigan, following the above plan. The span was 150 ft. and the width of roadway was 16 ft. Except for superintendence, which is not included, the itemized cost is as follows:

Items.	Total for item	Per sq. ft. of roadway	Per ft. of span
New 8-in. steel stringers..$	595.00	$0.248	[illegible]
Removing old floor........	15.00	0.007	0.10
Punching and erecting new steel	60.00	0.025	0.40
Lumber for concrete forms	65.13	0.028	0.43
Labor placing forms.......	10.00	0.004	0.07
Cement on the job........	90.00	0.037	0.60
Gravel on the job, ½ mile haul	18.00	0.008	0.12
Mixing and laying concrete	70.00	0.028	0.47
[illegible] sq. ft. expanded metal	112.90	0.047	0.75
Totals	.$1,036.03	$0.432	$6.91

The itemized cost of the 30 cu. yds. of concrete required was as follows:

Item.	Per cu. yd
Form lumber	$2.19
Labor on forms..................................	.34
Cement, 1:3 mix..................................	3.03
Gravel	.60
Mixing and laying..................................	2.36
Total	[illegible]

New oak floor would cost $50 per M ft. B. M., including laying, or for a wood floor 3 ins. thick, the cost would have been 15 cts. per sq. ft., or $360. To this must be added the steel stringers needed in either floor, which makes $360 plus $595, or $955. The difference in cost of the two floors would only be $80, without any consideration of the most important item, namely: How long will each floor last? The concrete floor will continue to grow stronger with age and on the other hand, the wooden floor would need repairs in five years. The concrete tends to stiffen the whole bridge and distribute the concentrated loads over a larger area, and the wood floor is at best a springy, shaky, roughriding and expensive proposition. An ordinary plank bridge floor weighs about 30 lbs. per sq. ft., while the concrete weighs 60 lbs. per sq. ft., both weights including steel stringers.

When a new bridge floor for an old steel or wrought iron bridge is needed, a competent bridge engineer should inspect the trusses and abutments and determine whether or not the bridge is sufficiently strong to carry a concrete floor. If the bridge is worth it or can be reinforced to make it sufficient to carry a reinforced concrete floor, it is by far the better floor to construct.

Results of 4-Year Service Test on the Experimental Wood Block Pavement at Minneapolis, Minn.

In 1906 the U. S. Forest Service in co-operation with the city of Minneapolis, Minn., laid an experimental wood pavement on Nicollet Ave., in Minneapolis, for the purpose of obtaining a service test of various species of wood blocks. The variables in this experiment, by means of which it was desired to gain information upon the points respectively involved, were: (1) Species of wood; (2) heartwood and sapwood; (3) length of blocks; (4) angle of courses. A description of this experimental pavement, together with some observations on its condition, were given in our issue of April 19, 1911. An official progress report on this work has been issued recently by the U. S. Forest Service. This report was prepared by Mr. Francis M. Bond, of the U. S. Forest Service, and in it he gives the results of the tests, after the pavement had been subjected to heavy traffic for four years. The following matter has been abstracted from Mr. Bond's report.

SPECIES OF WOOD AND CONSTRUCTION OF EXPERIMENTAL PAVEMENT.

The woods used in the experiment were longleaf pine, Norway pine, tamarack, Douglas fir, western larch, white birch and hemlock. The longleaf pine was included in order to provide a standard of comparison by which the behavior of the other woods could be judged. It was the purpose to lay equal amounts, approximately 15,000 ft. B. M. of each wood, or allowing for ordinary waste in manufacture, about 65 lin. ft. of pavement in a street 50 ft. wide. In the case of some of the woods, however, the full area allotted to them was not laid, the shortage being made up by other woods.

The character of the blocks of the different woods used was as follows: Approximately all heart: Longleaf pine, Douglas fir, and western larch. Mixed heart and sap: Norway pine and tamarack. Heartwood and sapwood indistinguishable: White birch and hemlock. It was considered unnecessary to make separate classes for this condition within the separate species, since any difference in resistance between heartwood and sapwood would become manifest in an uneven wearing of the blocks, rather than in a greater total wear. Therefore this variable would not obscure the results affecting the separate species.

The length of the blocks in the different species was as follows:

	Inches.
Longleaf pine, variable	6 to 10
Norway pine, variable	6 to 10
Tamarack, variable	6 to 10
Douglas fir, variable	6 to 10
Hemlock	6
Western larch, one-half	4
Western larch, one-half	6 and 8
White birch, one-half	4
White birch, one-half	6 and 8

The width and also the depth of all the blocks was 4 ins. The larch, birch, and hemlock were air-seasoned for several months before being used. Exact records of the time of seasoning of the other woods were not obtainable, but none of them were entirely green when used. Of the Douglas fir, a portion was from very rapidly grown stock, and it was feared that it would be so weak that it would not fairly represent the average of this timber. Therefore further separation on the basis of this factor was made for this wood, and the narrow-ringed and wide-ringed blocks were laid in separate portions of the pavement.

Nicollet Ave., on which this pavement is laid, is 50 ft. wide. There is practically no gradient. The street was so prepared as to give to the pavement a crown of 8 ins. The foundation was made of Portland cement concrete, composed of Portland cement, 1 part; sand, 3 parts; crushed limestone, 7 parts; and was 5 ins. in thickness. Over this as soon as it was sufficiently set was spread a 1-in. cushion of sand. The surface of the sand was carefully trued to grade, and upon this foundation the blocks were laid.

The area of the avenue between Washington St. and Second St. was reserved for the several species to be compared, and these were laid all at the same angle, 67½° with the curb. North of Second St. one wood, Norway pine only, was laid, and on this area different angles were used for the courses, one portion being laid at 90° to the curb, another at 45°, and a third at 67½°.

The body of the pavement was laid with close joints, the pavement being driven moderately after every dozen or so courses. At each curb was left a 1-in. expansion joint, between which and the body of the pavement was one longitudinal course of blocks. As soon as the pavement was laid it was thoroughly rolled with a steam roller. The expansion joints, which had been left open until the pavement should be rolled and thoroughly settled, were then filled with sand nearly to the top. The body joints and the top of the expansion joints were filled with pitch, heated to about 300° F., which was thoroughly broomed in with steel brooms. A light top dressing of sharp sand completed the pavement. As soon as thorough setting of the concrete was assured traffic was admitted.

The blocks were treated at the plants of the Republic Creosoting Co., and the Kettle River Co., co-operating in the experiment, under the specifications of the city of Minneapolis for wood block pavement which were in force during 1906. In brief, these specifications require that wood blocks be treated by a straight-pressure treatment with 16 lbs. per cubic foot of a coal-tar having a specific gravity of 1.09 at 20° C. However, the oil used in the treatment of the white birch and western larch blocks had a lower specific gravity than that specified. An impregnation of 20 lbs. per cubic foot was therefore used in the case of these species in order to compensate as nearly as possible for the discrepancy in specific gravity between the oil used and that specified.

At the time of inspection the city engineer department reported that since it had been laid the test pavement had been sprinkled with water six times per day during the sprinkling season and machine-swept each night. The department also reported that it was necessary to remove a few of the birch blocks which had failed from rotted heart, but that otherwise there had been no replacements.

Travel records of 12 hours' duration each were taken twice a month, a summary of which is given in Table I.

RESULTS OF INSPECTION.

The first formal inspection of the test pavement was made on August 17, 1910, by Mr. Ellis R. Dutton, assistant city engineer, city of Minneapolis, Mr. Frank Hussey, of the Kettle River Co., and Mr. Bond. The following observations were made:

In each section one block of apparently average wear was removed from a position midway between the curb and the center of the street and a second block from near the curb. The two blocks were measured, and the difference in their heights was taken as the average wear of the section in question, the assumption being that the blocks near the curb were not appreciably worn.* It was not thought best at the time of the inspection to remove a greater number of blocks from the general level of the sections. However, some additional blocks were removed from depressions.

TABLE I.—SUMMARY OF TRAVEL RECORDS TAKEN ON THE EXPERIMENTAL PAVEMENT.

	1906.	1907.	1908.	1909.	1910.
Av. tons per ft. of roadway	127.17	132.02	149.15	143.52	154.23
Estimated 90 per cent of travel on middle 25 ft. of roadway, average tons per ft.	228.94	237.65	268.46	258.50	278.00

In order to obtain the approximate areas of holes in the pavement, each member of the party carefully estimated the total number of square feet of depression below the general surface in each section of the pavement. The estimates were averaged for each section, and these averages were taken as the areas of the depressions of the sections.

Results of the inspection are given in Table II. Since only two sections of the pavement were in a bad condition, no general conclusion can be drawn. However, a number of interesting points were observed, and the results of the inspection enable a tentative comparison of species to be made.

Sections 7 and 8 (coarse and medium grain Douglas fir) were so badly worn that the blocks had to be removed during the following summer. The extreme depth of some of the depressions in the Douglas fir sections of the pavement requires some explanation, however, since the depth of depression does not in this case necessarily indicate the actual wear. Upon removal of several blocks from the lowest depressions it was found that the grain of the wood was no longer vertical but was inclined at a considerable angle, the blocks being separated into a number of pieces by longitudinal shear along the annual rings. This shearing and consequent inclination of the blocks must have taken place after the blocks had once become so reduced in depth by wear that their shearing strength could no longer resist the local tractive action to which they were subjected. The continual lessening of lateral support to the wood effected by wear and the continually increasing angle of inclination, of course, accelerated this action. Since the Douglas fir was of rapid growth and poor grade, it is questionable whether the results of this test are a fair indication of its wearing qualities when used as a paving material.

Table II shows that the other blocks appear to have worn fairly uniformly. Sections 5 and 6 (western larch) show a greater average wear and also a larger percentage of depression below the general level than the others. Section 9 (longleaf pine) shows the least average wear, and also presents a very uniform surface. Section 1 (Norway pine), section 2 (tamarack), and section 10 (eastern hemlock) showed equal average durability up to the time of the first inspection, and were only slightly below the longleaf pine; however, they showed a somewhat larger percentage of holes than the longleaf pine. The white birch, while showing little more wear and no more holes than the longleaf pine, had some replacement on account of heart rot. Since the Norway pine had all of its apparent depression below the general level in one spot, it seems

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*Table II shows that the white birch and western larch blocks manufactured at Sandstone, Minn., had a depth of 3 13-16 ins., and that the blocks of other species manufactured in Minneapolis, were 3 15-16 ins. in depth. While no records of the exact original depth of the blocks are available, it is recalled that the one lot of blocks was of slightly less depth than the other.

TABLE II—RESULTS OF THE FIRST INSPECTION OF EXPERIMENTAL PAVEMENT LAID IN MINNEAPOLIS, MINN., IN 1[illegible].

Section No.	Species.	Area of section.	Average depth of block.	Depth of block [illegible] section.	Average wear of section.	Area local depression [illegible] general level of [illegible]	Area local depression [illegible]	Area local depression [illegible] general level [illegible] total [illegible]	Remarks.
		Sq. ft.	Ins.	Ins.	Ins.	Sq. ft.	P[illegible]	Pct.	
1	Norway pine	44	3 15-16	3¾	3-16	10	2.0		[illegible] spot, possibly due to fire.
[illegible]	Tamarack	73	3 15-16	[illegible]	3-16	10	1.0		
[illegible]	White birch [illegible] in blocks)	1,609	3 13-16	[illegible]	3-16	8	.5		[illegible] blocks removed [illegible] decayed heart.
4	White birch (4-in blocks)	1,615	3 13-16	[illegible]	3-16	10	.5		Some [illegible] decayed heart.
[illegible]	Western larch (4-in blocks)	1,[illegible]	3 13-16	3½	5-16	33	2.0		
6	Western larch [illegible] in blocks	1,497	3 13-16	[illegible]	⅜	[illegible]	[illegible]	[illegible]	
[illegible]	Douglas fir	1,229	3 15-16	[illegible]	1 1-16		30.0	[illegible]	[illegible] rings per in.
[illegible]	Douglas fir	1,293	3 15-16	[illegible]	1 1-16		30.0	3.0	Coarse grain, 3 to 5 rings per in.
9	Longleaf pine	3,583	3-15-16	[illegible]	[illegible]	17	.5		
[illegible]	Eastern hemlock	[illegible]	3 15-16	[illegible]	3-16	35	1.0		

[1]Exclusive of local depression below the general level of the section

nlikely that this was caused by ordinary wear.)n this account, also on account of the small rea of the Norway pine section, and because he rest of the section was very uniform, it s hardly fair to give percentage area of depression below the general level any weight in his case.

Until further results have been obtained rom the test pavement, the species used may e tentativel grouped in accordance with the esults of this inspection in the order of their alue for creosoted paving material as follows:

1. Longleaf pine.
2. Norway pine, white birch, tamarack, astern hemlock.
3. Western larch.
4. Douglas fir.

No more definite comparison of the species an be made until the blocks have remained n the pavement long enough to exhibit greater ifferences in wear.

At the time of the inspection the pavement vas not examined for differences in wear due o mixed sapwood and heartwood, length of locks, or angle of courses. However, at a ater date an examination was made with these oints in view, but no appreciable differences ue to any of these variables were noted.

ELAYING THE ORIGINAL DOUGLAS FIR SECTIONS.—At the beginning of the summer of 1911, early five years after the laying of the test avement, the Douglas fir blocks were in such ad condition that it was necessary to remove hem from the street and relay this portion of he pavement. In one spot, comprising an rea of about 30 sq. ft., the blocks were so adly worn that they were completely shattered into small bits.

In view of the poor quality of the original ouglas fir blocks, it was decided further to est this species by relaying one of the worn-out sections of the pavement with a thoroughly good grade of Douglas fir. Accordingly, a quantity of grade A Douglas fir paving stock was procured for this purpose. It was the intention to replace the second worn-out section with a good grade of jack pine, but so much difficulty was encountered in procuring the timber that the plan was abandoned. Douglas fir blocks were laid over as much of the area to be repaved as the quantity secured would cover, and the remaining part was paved with the regular southern yellow-pine blocks then in use by the city and furnished by it. The Douglas fir was furnished by the Westside Lumber & Shingle Co., of Portland, Ore., and was manufactured into blocks and treated by the Republic Creosoting Co., of Minneapolis.

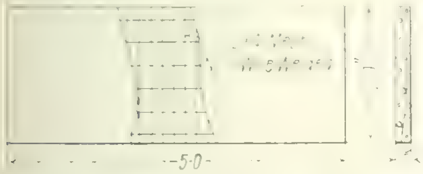
Both the Douglas fir and the southern yellow-pine blocks were practically all heartwood, straight grained, and of fairly uniform growth; the minimum average number of annual rings for any single block being 9 for the Douglas fir and 6 for the southern yellow pine. The depth of the blocks of both species was 3 15/16 ins. and the width approximately 4 ins. However, the Douglas fir blocks were all 8 ins. in length, while the southern yellow-pine blocks varied in length from 5 to 10 ins., with an average length of 8 ins. The Douglas fir paving stock was seasoned approximately two months, and the southern yellow-pine blocks one month, before being manufactured into blocks. The latter operation preceded the treatment by only a few hours in each case.

The blocks were treated at the Minneapolis plant of the Republic Creosoting Co. in two separate runs. The Douglas fir blocks were treated with 17.9 lbs. of creosote paving oil per cubic foot of wood; the specific gravity of this oil being 1.108 at 38° C. The southern yellow-pine blocks were treated with 17.3 lbs. of a similar oil per cubic foot of wood.

The relaying of the pavement began June 2[illegible], 1911. It was noted that the old blocks from the middle of the pavement were so badly shattered that they fell apart into small chips as they were being taken up, although the blocks from near the curb came out practically whole. The sand cushion and the foundation were found to be in apparently perfect condition.

The foundation was scraped clean of the original sand cushion, and fresh, clean, practically gravel-free sand was spread over its surface. This new sand cushion was then surfaced off by a long metal-shod "straight-edge" which was drawn across the street, its two ends resting on 1-in. boards which were laid across the foundation and which served as "distance strips." This operation left a cushion of sand on the foundation 1 in. in thickness, the surface of which was further prepared by the use of a small hand scraper. The new blocks were then laid in the same manner as the original blocks, except that the former were driven only enough to keep the courses straight, and that the hot pitch filler was brushed into the body joints with a wooden scraper or "squeege" instead of with steel brooms.

A Separately Molded Reinforced Slab for Gutter Boxes at Sidewalk Crossings.*



ig. 1—Plan and Section of Reinforced Concrete Gutter Box Cover.

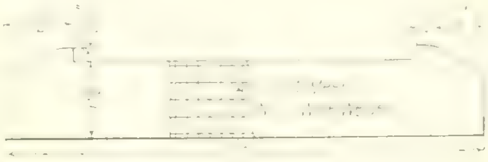


Fig. 2—Elevation of False Curb.

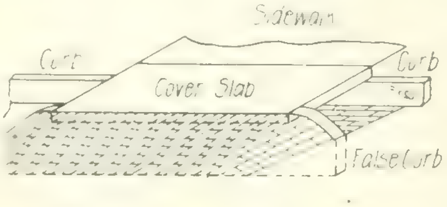


Fig. 3—Perspective View of Gutter Box.

The writer believes that some engineers favor raised or elevated sidewalk crossings and some do not. The subject will not be argued here. It is sufficient to say that the writer favors the raised crossing under certain conditions. Where it is used the objects to be accomplished are the following: 1st, to provide a continuously smooth sidewalk for pedestrians; 2nd, to keep pedestrians out of the water at the gutter; 3rd, to accomplish these things with as little inconvenience to vehicle traffic as possible, and 4th, to provide a sufficient waterway. These things are accomplished ordinarily by setting a false curb at a distance of 18 ins. or 24 ins. from each curb line, bridging the gutter thus formed by a plate of cast iron let into notches in the curb and false curb, and raising the pavement to the level of the false curb for a sidewalk crossing.

In the writer's city the raised crossings had never been used on paved streets, except in one case. In this case the gutter had been left uncovered, and after a feeble old man had fallen into it, it was considered a menace to public safety. It was decided to try the raised crossings on a certain street, and accordingly prices were obtained on a false curb of stone corresponding to the main curb, and a cover-plate of cast iron. The price for a single box, including cutting the notches in the curbs to receive the cover-plate, and the cover-plate itself, was $10. Economy being one of the chief considerations, a better price was sought in some other direction. Attention was first directed to concrete, the universal construction material. A sample design was prepared, the local market investigated for suitable reinforcing material and two experimental slabs were made for testing.

There was no testing-machine conveniently available, but it was decided that a test sufficiently accurate for the purpose could be made by testing a section of a slab as a beam freely supported at the ends with a concentrated load applied at the center, the load being gradually increased till the beam failed. The slabs were accordingly made 1 ft. wide and 3½ ft. long, so that the distance between supports in the test might be 3 ft.

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*Paper by L. E Curfman before Kansas Engineering Society, Jan. 24, 1912.

The first slab was made 2⅛ ins. thick. The reinforcement consisted of 2 in. x 4 in. rectangular mesh welded wire fencing, all wires being No. 11. The greater number of wires was placed longitudinally. The steel was placed about ⅜ in. from the bottom in the center of the slab and higher at the ends. The concrete mixture consisted of one part of Portland cement, one part sand and four parts Joplin chats. Practically all of the chats would pass a ½-in. screen and some of it would pass a No. 6 screen.

The second slab was 2¾ ins. thick. The reinforcement was of the same material, but two layers were used averaging ¾ in. from the bottom. The mixture was one part cement, one of sand and three of Joplin chats.

The slabs were tested when they were about 30 days old. They were supported on rollers 3 ft. apart and a box was suspended from the center, in which bricks were placed until the weight was sufficient to break the slab. The slab and the entire suspended weight were weighed and the dimensions of the slab were taken. No instruments for determining the deflection and deformation were available.

Both slabs failed by tension in the steel as would naturally be expected from the ratio of the area of steel to area of concrete. The concentrated loads carried at failure were 1,064 lbs. and 2,144 lbs. respectively. Although the position of the neutral axis is in doubt on account of the deflection and deformation being unknown, an attempt has been made to calculate the stresses in the steel and concrete at failure. The formulas given in Taylor and Thompson's "Concrete, Plain and Reinforced," were used. The calculations were based upon the assumption that the ratio of the coefficient of elasticity of the steel to that of the concrete was 15, and on the known quantities area of steel, area of concrete above steel, and depth of steel. The calculated stresses at failure were as follows:

First Slab—Steel, 85,000 lbs. per sq. in.; concrete, 2,300 lbs. per sq. in.

Second Slab—Steel, 81,000 lbs. per sq. in.; concrete, 3,100 lbs. per sq. in.

These figures appear satisfactory to the writer, considering that they are based upon an assumption and that there is chance for considerable error in working with small specimens of concrete. The test established the fact that slabs of approximately the dimensions used would be amply strong when used as covers for gutter boxes.

The gutter boxes were accordingly made as shown in Figs. 1, 2 and 3. A thin facing coat of 1 to 1½ mortar was placed on the top of the cover slab and on the exposed face of the false curb. The reinforcement in the false curb is necessary only to hold the slab togethe while it is being handled. It will be noticed tha the reinforcement is not placed most advantageously for this purpose. This was because the dimensions of the welded wire fabric were such that pieces cut the other way would not have been long enough.

Up to the present time 113 of these concrete boxes have been installed. Some of them have been in place nearly two years. The writer has never heard of one of them being displaced or broken since they were installed The city has been paying $4 per box for the slabs delivered where needed.

The following advantages are claimed for concrete over cast iron for tops: The concrete is not so slippery, not so easily displaced and not so easily broken as the cast iron, and there is a saving of about $6 per box over the ordinary stone and cast iron construction. Agains these advantages may be placed the possible disadvantages of the concrete being less nea in appearance on account of the cover being set on top of the curb, and the additional elevation of the crossing which this requires However, the writer does not give much weight to these disadvantages.

In conclusion it may be said that the people are well pleased with the concrete boxes and demand the continuance of their use. The writer has yet to hear the first word of adverse criticism of them from the people.

WATER-WORKS AND SEWERS SECTION

Properties of the Air Lift Pump—Its Advantages and Disadvantages.*

The essential structural features of the air lift pump are exceptionally simple and few in number, and this fact constitutes one of its principal advantages. In its simplest form, as shown in Fig. 1a, it consists of a pipe for the discharge of the water and a smaller pipe for conveying compressed air to it at a point near its lower end.

The Eduction Pipe.—The discharge pipe is designated by various writers as the eduction pipe, lift tube, lift pipe, and rising main. It should not touch the bottom of the well or reservoir from which it is to pump, but should be elevated above it, so as freely to admit the water or other liquid through its lower open end. This end of the pipe should, however, be submerged below the liquid surface a distance which, the Wisconsin experiments indicate, should be greater than the height above the water surface to which the liquid is to be lifted. This latter distance technically is called the lift of the pump. The distance from the water surface down to the point of admission of the air into the eduction pipe is known as the submergence of the pump. Submergence generally is expressed as a percentage of the total length of the pump, measured from the point of air inlet to the point of discharge. The discharge should be free into a reservoir at atmospheric pressure. Submergence and lift should be measured from the elevation of the water as it stands under working conditions rather than under static conditions.

The Foot-Piece.—In most air lift pumps the compressed air from the air pipe enters the eduction pipe through a casting designed to cause the air to enter in a special manner. The casting used for such a purpose technically is called a foot-piece.

Frizell's and Pohle's foot-pieces are cited as examples in design. In the former the foot-piece is an hour-glass-shaped, perforated casting, so designed for the express purpose of admitting the air in small bubbles. In the latter type the exit end of the air pipe is enlarged by bevelling off the inner edge thereof, in order to permit the free delivery of the air in mass or bulk, and thus to avoid the formation of air bubbles.

Quite a large number of different foot-pieces have been devised and patented, and, in most cases, extravagant claims have been made for them as regards their effect in increasing the efficiency of the pump.

The Wisconsin experiments indicate that changes in the form of the foot-piece have little if any effect on the efficiency and capacity of the pump, other than the effect due to the amount of obstruction of the water passages; a factor which differs in the various types.

Tail-Piece.—Most forms of foot-piece are arranged for the attachment of a pipe onto their lower ends, thus extending the eduction pipe some distance below the point of air admission, for the purpose of preventing the escape of compressed air from the bottom of the eduction pipe. The pipe used for such an extension is termed a tail-piece. The tail-piece is often made a larger size of pipe than is the remainder of the eduction pipe. The length and size to be used for a tail-piece are problematical.

A number of distinct types of air lift pump have been produced through the various methods that have been devised for piping the wells. The methods in most frequent use are illustrated in Figs. 1 and 2 and are described below.

Side Inlet Pump.—The side inlet pump, in which the air pipe is on the outside of the discharge pipe, is shown at (a) in Fig. 1. The air pipe is connected to the bottom of the eduction pipe by means of standard fittings, special castings, or one of the various patented foot-pieces. This method is used when the well is large enough to admit of the air and water pipes being placed side by side from top to bottom and is probably the most economical of the systems shown.

Annular Air Tube Pump.—Figure 1 (b) shows the annular air tube pump in which the well top is sealed and the air passes down through the annular space between the discharge pipe and the air pipe or well casing.

Many annular tube pumps have been built with no foot-piece or opening in the side of the pipe. In such pumps the air forces the water level in the well down until the bottom of the discharge pipe is uncovered. Air then enters the discharge pipe and the pressure in the annular space is lowered. This causes the fluid to rise again in the air space and discharge pipe until the pressures balance and then the operation is repeated. This causes the water in the well approaching the bottom of the eduction pipe to surge more violently than it would if it were allowed to rise in the well around the eduction pipe to its normal height, as it does in the side inlet system. It is claimed for pumps built in this way that this surging promotes the entrance of the water and air into the eduction pipe in a manner conducive of high efficiency.

Central Air Tube Pump.—Fig. 1 (c) shows the central air tube pump which uses the well casing as the discharge pipe, and introduces the air through a small pipe usually fitted with some special device or foot-piece attached at the bottom through which the air escapes. Usually a number of small holes are drilled, or a number of slits are cut into the lower joint of the pipe and the end plugged. An objection to this method is that when the well is cased for only a portion of the distance, the air and water may escape out of the well into fissures in the rock. The hydraulic radius of the water passage in the discharge pipe is reduced by the air pipe, which increases the frictional losses and so diminishes the efficiency, but in this method of piping the entire cross-section of the well, less the area of the air pipe, is available for use as a discharge pipe; so a well piped in this way will have a greater theoretical capacity than wells of the same size piped by the other methods; notwithstanding the obstruction caused by the central air pipe. This fact is shown by the following comparison of the three methods. Assuming in each case that the wells are 6 ins. in diameter, the largest eduction pipe which can be got into the well with a 1-in. air pipe beside it, is 3½ ins. in diameter, while in the annular tube method of piping a 4½-in. eduction pipe can be accommodated. In the central tube system it is assumed that a 1½-in. air pipe is used with the 6-in. casing serving as the eduction pipe. It may be noted from Table I that the hydraulic radius of the central air tube pump is less than that of the annular ciencies are obtained at the lowest rates of pumping.

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*Abstract of Bulletin No. 450, University of Wisconsin, by G. J. Davis and C. R. Weidner of the Department of Hydraulic Engineering

(7) By varying the percentage of submergence, and therefore the lift, the length of pump remaining constant, the maximum efficiency is obtained at approximately 63 per cent submergence for all rates of input or discharge.

(8) The lift remaining constant, the efficiency increases as the percentage of submergence increases, for all rates of input and all practical percentages of submergence.

(9) With the same size and type of pump, the percentage of submergence remaining constant, the efficiency increased as the lift increased for the small lifts experimented on; that is, up to about 24 ft. From a theoretical study, however, the indications are that a point will be reached from which the efficiency will decreased as the lift increases.

(10) Other conditions remaining constant, there is no advantage to be gained by introducing compressed air above the surface of the water in the well.

(11) The type of the foot-piece has very little effect on the efficiency of the pump, so long as the air is introduced in an efficient manner and the full cross sectional area of the eduction pipe is realized for the passage of the liquid. Anything in the shape of a nozzle to increase the kinetic energy of the air is detrimental.

(12) A diverging outlet which will conserve the kinetic energy of the velocity head increases the efficiency.

High Duty Pumping Engines.—An extended description is given of the Worthington horizontal, triple-expansion, high-duty pumping engine installed in the Hope Station of the Providence, R. I., water works, bulletin W-188, recently issued by Henry R. Worthington, 115 Broadway, New York. This engine has a capacity of 10,000,000 gals. per 24 hrs. against a head of 85 lbs. per sq. in. and its design represents the latest practice in pumping engines of this type. One of its especially interesting features is its high-duty attachment involving the use of compensating cylinders taking the place of a flywheel. The arrangement is preferable to a flywheel in that the power exerted increases in almost exact ratio with the decrease of the power of the expanding steam. The account given of the duty trials shows that the guaranteed duty was exceeded at full load by 4.5 per cent and at reduced capacity by 12.5 per cent. The actual duty at full load was 149,500,000 ft. lbs. per 1,000 lbs. of dry steam. The bulletin also shows and describes a similar engine installed at Fall River, Mass. The bulletin will be especially interesting to municipalities facing the problem of securing adequate pumping service economically.

The Design of the Sewage Disposal Plant at Winchester, Kentucky.

Contributed [illegible] Consulting Engineer, Philadelphia, Pa.

A sewage disposal plant consisting of an Imhoff tank and sludge bed has recently been placed in operation at Winchester, Ky., a town of 7,500 inhabitants, 18 miles east of Lexington. This tank, or some form of clarification of the crude sewage, was made necessary by the construction of a complete sanitary sewerage system which was put into operation at the same time as the tank. The plant is designed to purify 600,000 gals. of domestic sewage per 24 hours to such an extent that it may be discharged without creating a nuisance into a small creek which flows through the town and is tributary to Stoner Creek which empties into the Kentucky River. In summer this creek has a minimum flow of practically nothing.

The tank is an open top circular Imhoff tank, 30 ft. in internal diameter, and the depth to the small sludge pit at the lower end of the conical bottom is 35 ft. The small circular sludge pit below this depth is 4 ft. in diameter and 2 ft. deep, making a total depth of 37 ft. to the bottom of the small sludge pit. Figure 1 shows the tank construction.

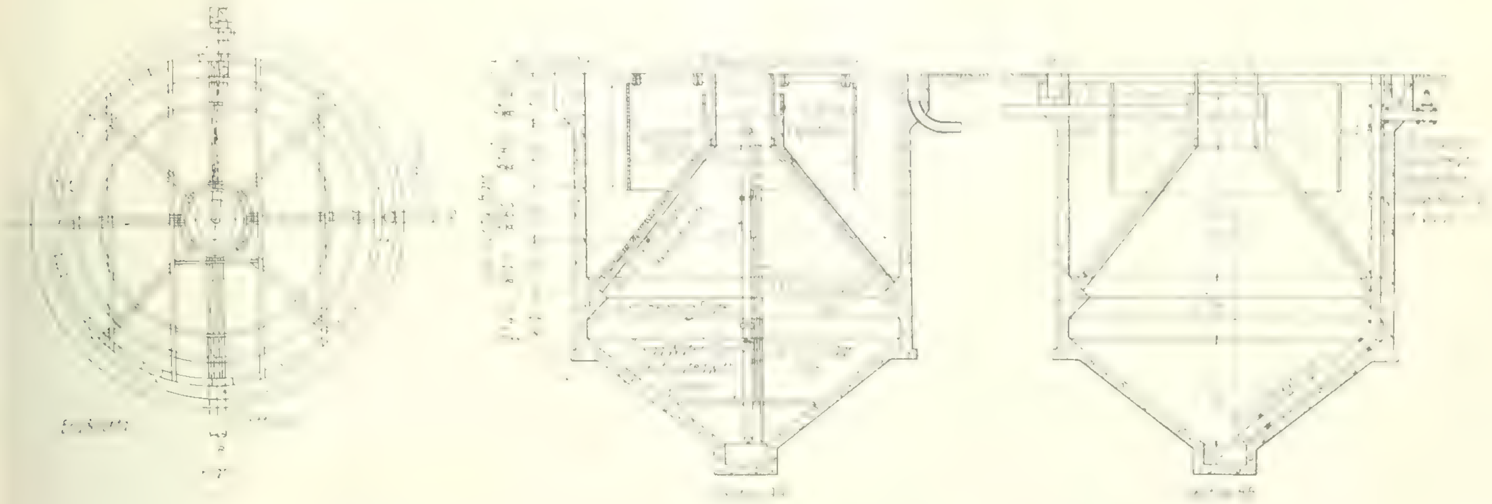

Fig. 1—Construction Plans of Imhoff Sewage Clarification Tank, Winchester, Ky.

The sedimentation compartment and the sludge digestion compartment are formed by means of a baffle or dividing wall, having the shape of a truncated cone with a small cylinder surmounting the truncated portion, which is uppermost. This small cylinder forms an opening into the digestion compartment at the center of the tank and permits the escape of the gas from the disintegrating sludge. A 10-in. cast iron pipe with valve control is provided for removing the sludge from the bottom of the tank and conducting it to the sludge bed. The sedimentation compartment will have a nominal storage of 2.6 hours and the sludge digestion compartment has a capacity of approximately 90 cu. yds. or a stor-

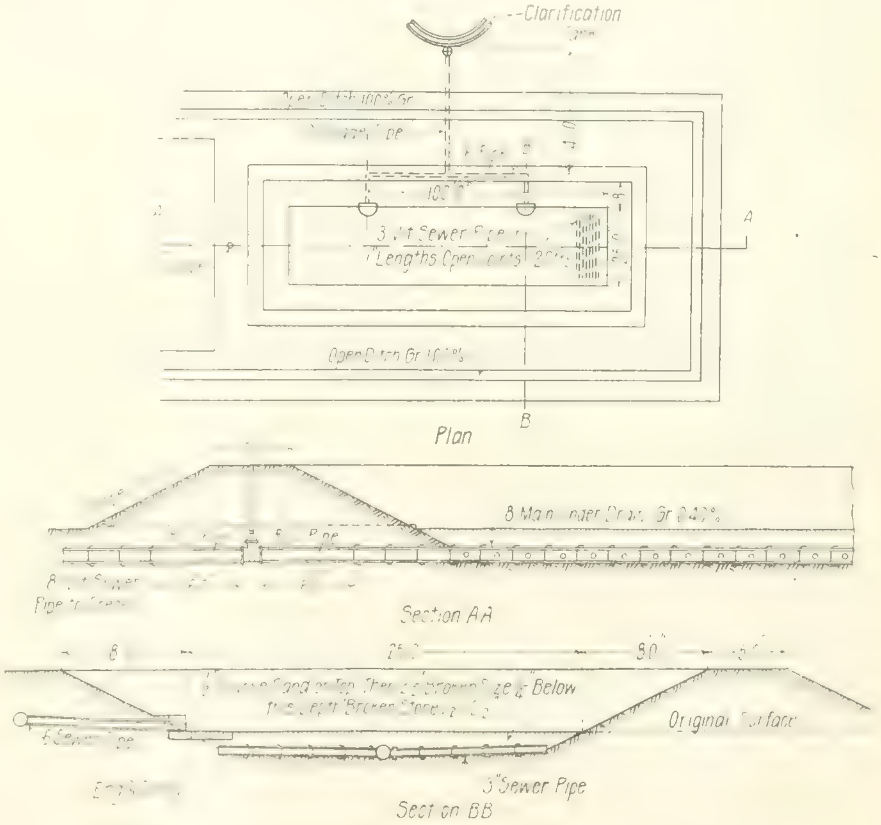

Fig. 2—Construction Plans of Sludge Drying Bed, Winchester, Ky.

age for the accumulation of sludge for about five months. The crude sewage is admitted through a cast iron pipe into an annular ring or trough surrounding the central cylinder referred to from which it passes outward over a thin concrete circular wall toward the periphery of the tank, but is not permitted, however, to reach the periphery direct, but is forced downward under a vertical baffle and up again passing out at the periphery through 14 wiers 2 ft. wide equally spaced around the tank into an effluent trough running nearly around and built as part of the wall of the tank. The wiers are introduced to insure an even discharge, as the depth of the flow will be much greater over each than it would be over a continuous wier. If the flow is found too small to regulate, each wier may be shortened.

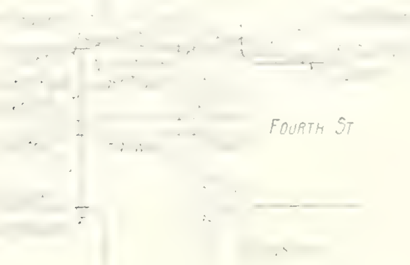

Fig. 1—Plan of Street Intersection Showing Location of Inverted Siphon.

The materials used in the construction of the tank are a combination of steel I-beams, reinforcing steel bars, expanded metal and concrete, but all steel beams are so placed that they are entirely enclosed in concrete so as to be protected against corrosion. The upper or main wall of the tank is constructed of reinforced concrete with sufficient reinforcement to take care of the bursting pressure, assuming the earth removed. The bottom of the tank rests on solid rock and is not reinforced. The vertical baffle, which is cylindrical in form, is constructed of concrete reinforced with expanded metal and vertical bars and is supported by attachment to the four 12-in. I-beams spanning the top of the tank. These 12-in. I-beams are enclosed in a 10-in. by 14-in. concrete beam for protection against corrosion. The dividing wall between the sedimentation compartment and digestion compartment consists of a 9-in. channel bent to a circle, which forms the collar at the top to which the eight 6-in. I-beams are riveted. The lower ends rest on bearing plates embedded in the side walls of the tank. Expanded metal forms the reinforcement for the concrete wall itself and 9-in. by 9-in. concrete beams enclose the I-beams for protection against corrosion.

Concrete for the tank was mixed in the proportions of 1 part Superior Portland cement to 2 parts sand to 4 parts broken stone. For walls 9-in. and over in thickness the broken stone was from ¾ in. to 2 ins. in size, while for the thin walls the stone was required to pass a 1-in. mesh and be retained by a ½-in. mesh screen.

Exposed surfaces of the tank were cleaned with a brush and hose and then given two brush coats of neat cement mixed to a paste as thick as could be worked with a brush. Digested sludge from the bottom of the tank is drawn off through a 10-in. cast-iron pipe and provision for loosening up solid material in the conical bottom of the tank is made by the insertion of perforated lead pipe connected with water pipes under pressure. Between the outlet of the tank and the top of the sludge bed there is an available head of 3.6 ft. with which to force the sludge out of the tank on to the drying bed.

The sludge bed is 25x100 ft. in plan, as shown by Fig. 2, and consists of a ½ in. layer of coarse sand over 2½ ins. of broken stone passing a ¼-in. screen. Below this was placed broken stone from 1½ to 2½ ins. in size to a depth varying from 9 ins. at the outer edges to 12 ins. in the center along the 8-in. main drain. For laterals 3-in. sewer pipe in 1 ft. lengths were laid up dry on 12-in. centers. The sludge bed is surrounded by an open drain to keep the bottom from becoming water-logged. The underdrain system is laid directly on top of the earth. Part sections of the sludge bed are shown by Fig. 2.

Plans and specifications were prepared by Charles E. Collins, Consulting Engineer, Philadelphia, Pa., and the construction was carried out under his direction, with Mr. S. H. Rutledge, City Engineer of Winchester, as resident Engineer. The Central Construction Co. of Lexington, Ky., was the contractor. Mr. Collins also recommended that percolating filters be constructed to filter the effluent from the tank, as soon as funds are available.

The Use of an Inverted Siphon in Street Drainage.*

The city of Pittsburg, Kansas, has no storm sewer or drainage system worthy of the name. There are a few isolated, short pieces of underground drain, but everywhere else the surface water is carried on the surface of the ground, usually in the streets, to the nearest ditch or natural drain. At all street intersections the water must cross one or both of the intersecting streets. On unpaved streets the water is usually carried across in shallow box culverts. On paved streets the method heretofore used in Pittsburg has been to depress the crown of the pavement and carry the gutter grade right across the intersecting street. Where there is a railway on the street crossed, this leads to serious difficulty. If the water is carried in an open gutter between the ties and under the rails this obstructs a considerable portion of the width of the street at a point where the full width is most needed—at a railroad crossing. The writer believes that all engineers will admit that an open gutter under these conditions is not good engineering practice. Then since a covered waterway is necessary there are two ways of building it; either the gutter grade may be followed right through the covered waterway, or it may be depressed more or less in the form of an inverted siphon.

Conditions like those mentioned above confronted the writer in the paving of Fourth street at its intersection with Olive street, see Fig. 1. Fourth street is the principal street leading to the country toward the west and has a single street railway track in the center. It carries practically all the traffic from the country to the west of the city. Olive street is a cross street and has in it a little-used steam railway track and for these reasons has very little traffic. The natural drainage is toward the west along Fourth street crossing Olive street. It was therefore necessary to carry the water across Olive street on both sides of Fourth or to carry it across Fourth and then across Olive street. The latter course was adopted on account of drainage conditions farther down the street. On account of the conditions mentioned above, an open gutter across Olive street was out of the question.

The depth of the gutter was 8 ins. If the uniform grade culvert was adopted the clearance would be only 6½ ins. and the clear width necessary to give as much waterway as the design finally adopted would be 35 ins. This would have made necessary the use of concrete or other masonry for the bottom and sides and cast iron for the top. The writer objected to this form of construction because of its first cost and because he feared trouble and possible danger from the displacing or breaking of the cast iron cover plates. After giving much thought to the subject the writer decided to try an inverted siphon. Inlet and outlet catch basins were all made alike except that the gutter was slightly depressed or dished at the inlet but not at the outlet, see Fig. 2.

The principal advantages of this form of construction over the shallow culvert covered with cast iron are a much lower first cost and freedom from the troubles due to the breaking or displacing of the cast iron cover plates. Another advantage is the possibility of using the catch basins and underground drain as part of the storm sewer system which the city must some day have. The only disadvantage which occurs to the writer is the possibility of the inverted siphon becoming stopped up with sediment and washings from the street.

In the design an attempt was made to guard against stopping up, and, in case it should become stopped up, to facilitate cleaning. The catch basins extend 2 ft. below the outlet tile to catch material heavy enough to settle. The outlet catch basin was built in the same way, on the supposition that some of the heavier material might settle here. Another reason for making the catch basins all as shown was to facilitate the use of sewer cleaning tools in case of a stoppage. The reason for believing that the tile would not stop up was that when the volume and velocity of the water on the street surface is sufficient to pick up and carry along the street dirt, the velocity through the tile is sufficient to keep the dirt moving. And conversely, when the velocity in the tile is not sufficient to hold the dirt in suspension the rainfall is not heavy enough to pick up street washings in troublesome quantities. The writer had sufficient faith in the arrangement, based on this argument, to give it a trial. With what degree of success is indicated below.

The pavement was constructed from the high toward the low end so that the water flowed from the newly constructed pavement through the siphon. A few days after the pavement was completed past the siphon a heavy rain filled the inlet catch basin up to the gutter level with sand from the newly paved street. Although the inlet catch basins were completely filled with sand it was found that the tile itself was not nearly full and the sand was blown out with a fire hose without difficulty. This occurred about July 1, 1910. The Commissioner of Streets informs the writer that the catch basins have been cleaned about four times since then and that the street has had a shovel cleaning five or six times. He keeps no convenient record of these things. This is all the cleaning the street and the siphon have received, and the siphon has never been stopped up but the one time mentioned.

The outlet was provided with a grating the same as those at the inlets and, although the outlet area was about 6 per cent greater than the combined area of the tiles, this was not always sufficient. The water at the outlet catch basin has been seen to exert a pressure upward on the cover slab. This was indicated by the water spurting out in jets from under the cover slab which was laid loosely on the wall without a mortar bed. This grating at the outlet has been removed because it was found to catch straws, leaves, etc., which had passed the inlet gratings and thus obstruct the outlet. The writer has had no chance to observe the operation of the siphon since the grating was removed but of course its efficiency is increased.

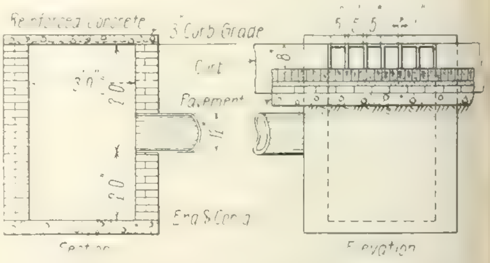

Fig. 2—Catch-Basin at Ends of Inverted Siphon.

Having seen the operation of the siphon and the velocity with which the water leaves the outlet, the writer is firmly convinced that there is very little danger of the siphon ever becoming stopped up, even if it should be neglected much more than it has been in the past. The velocity is such that only the larger articles of sand and pebbles settle in the atch basins, and nothing settles in the tiles ntil the catch basins become full enough artly to close the entrance to the tiles.

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*Paper by L. E. Curfman, City Engineer, Pittsburg, Kans., before Kansas Engineering Society, Jan. 24, 1912.

In conclusion, the performance of the siphon as exceeded the writer's expectation. With he outlet grating removed as mentioned he can suggest very little improvement. It would offer some protection to the tile to trap the entrance to the tile say by putting on a 90° elbow with the end turned down. This would prevent the heavier materials from entering the tiles, but it would also diminish the flow to some extent.

The writer is not a strong advocate of the use of the inverted siphon in street drainage and does not believe that it is always the best engineering practice. However, the experience described above will no doubt be of interest to some engineers.

DRAINAGE AND IRRIGATION SECTION

ome Examples of Tidal Marsh Land Reclamation; Structures and Cost*.

III.

(STAFF ARTICLE.)

Tidal marsh land reclamation presents certin advantages particularly its own. These re its exemption from prolonged drought, its eneral proximity to populous communities, nd the hygienic improvement, which comes om its drainage. It is also in large part herently fertile land. Tidal marsh reclamaon, too, is being inquired into more actively s seaboard population increases and upland arms become more occupied. This journal as published within the last twelve months everal articles on tidal marsh reclamation nd in this issue it continues a series of half dozen descriptions of specific works based n studies made by U. S. Government engieers. These works are not presented as leal examples of practice, in fact most of em are open to severe criticism, but as studs, the data from which are generally useful.

EEN HARBOR RIVER MARSH RECLAMATION MASSACHUSETTS.

The reclamation of the Green Harbor River arsh lands is one of very great natural oprtunity. Only 1,600 ft. of levee are required protect 1,334 acres of marsh, or 1,700 acres overflowed lands at higher tides, and the pland drainage is remarkably small. A map the river and marsh are given in Fig. 1. his map indicates the drainage ditch sysm proposed by Mr. Geo. M. Warren, Drainge Engineer. The dike shown was built in 372. Before that time and especially since, e river and marshes have been the subject much controversy, and this controversy is considerable historical interest. Here we all consider only the conditions and the ructures as they now exist and as they lend emselves to reclamation work.

Green Harbor River has a total drainage ea of about 7.5 square miles, while the tribary drainage area at the dike is 6.9 square iles. The upland watershed is covered with attered farms and woodland. The reclaimed arsh comprises 1,334 acres below the level ordinary high tide and a total of 1,696 res below the level of the very high tides ached several times in the course of a year. a direction perpendicular to the coast line e marshes are about 2½ miles in length and rallel the sea for about 1¾ miles. They e separated from the sea by a narrow strip land from 600 to 3,000 ft. in width, consting partly of two upland areas, the sites the villages of Brant Rock and Abington illage, and partly of shingly, sandy beaches d sand dunes. Both of these villages are mmer resorts and have few permanent resints. South of the river are the villages of uxbury Beach and Green Harbor, the former summer resort and the latter a small alle-year village inhabited principally by fisheren. The permanent population of the region out Green Harbor is small, probably not r from 200, while in summer the temporary sidents number several thousand. Near the nter of the reclaimed marsh is the farm rmerly owned by Daniel Webster, and near the burial place of the Great Expounder.

Tides.—The mean range of the tide is about ft., and the high tides which may be expected several times a year reach 3.6 ft. higher, or to about elevation 13. The great storm tides, April, 1851, when Minots Ledge lighthouse was destroyed, and November, 1898, when the steamer Portland with all on board were lost, probably reached to about elevation 14.5. It is known that the latter storm overtopped a portion of the dike and scoured a 50-ft. breach down to the level of the marsh, and also broke through the sand dunes separating the marsh from the sea at several points, carrying sand, gravel, and débris on to the meadow. The hardest storms come from the northeast, but without any considerable shoaling at the harbor entrance, because of the protection afforded by Bluefish Rock and the adjacent headland, a natural riprap of bowlders. South of the entrance stretches a sandy beach six miles in length to Gurnet Point. The harbor opening widely to the south and southeast is the natural receptacle for the sand caught up by the wind and wave of southeasterly storms along this six-mile stretch of beach.

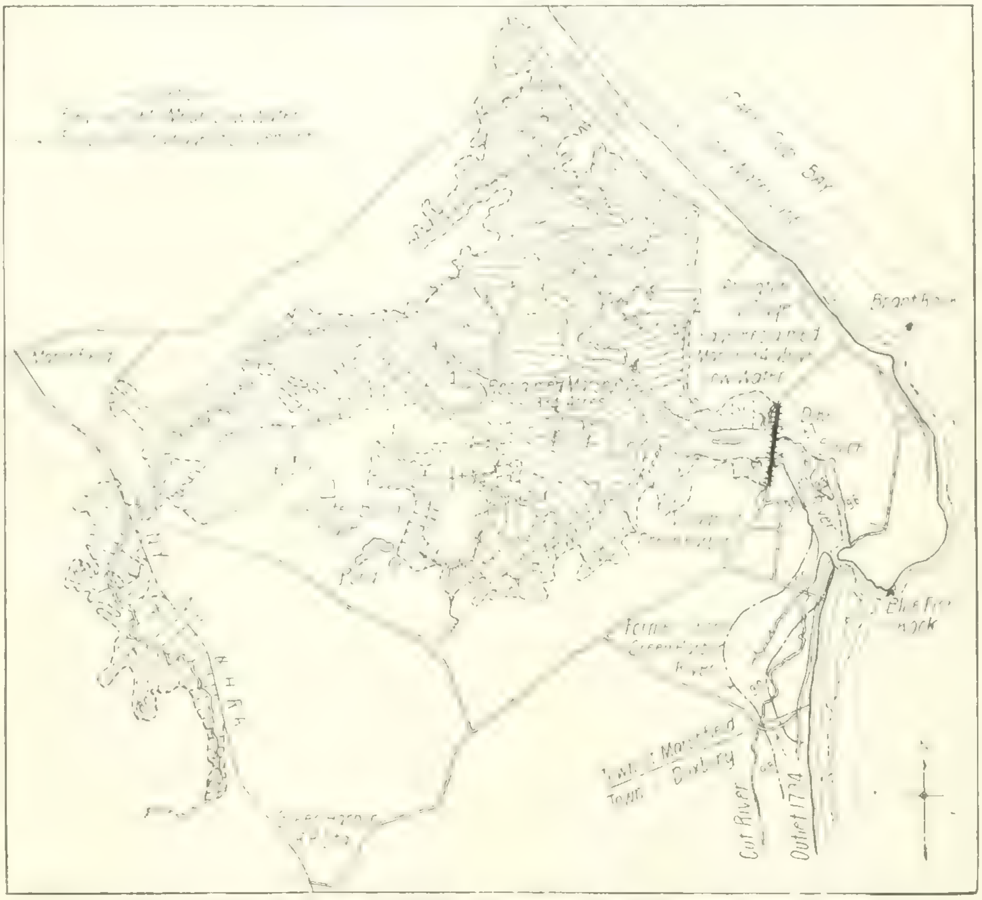

Fig. 1—Map of Green Harbor River and Reclaimable Marsh Land.

Drainage Conditions.—Drainage has been secured mainly by the natural river with its tributary creeks. Considerable ditching has been done, but it has not been systematic nor general, nor have the ditches been well maintained. At the dike the river is about 500 ft. in width; at Wharf Creek, 2,200 ft. above the dike, the river is 350 ft. in width; near Bass Creek, about 1 mile from the dike, it is 125 ft. in width; above this it narrows gradually until at the highway and railway bridges it is a very narrow stream, and the flow ordinarily feeble. Through the greater body of the marsh the bed of the river and of Wharf and Bass Creeks are below the level of mean low water. At the highway bridge the bottom is about 4 ft. above mean low water. The surface of the water in the river is practically level for a distance of over three miles from the dike, but above that point the gradient rises quite rapidly. From the investigations made during the summer and fall of 1908 it appears that the interior water was generally between elevations 3.75 and 4, substantially the same as in 1897. Below the dike the conditions were very different, for where in 1897 the surface of the water was held by sand bars or shoals at elevation 3.5 at low tide, in 1908 it averaged about elevation 1.6, or nearly 2 ft. lower. These figures demonstrate one or both of two conditions. Either the leakage of the sluice to the land has increased tremendously since 1897 or else the sluice opening is too small for the tributary drainage area. There is evidence that both conditions obtain. Below the dike the discharge from the sluice is apparently maintaining a basin or channel which, starting with a depth of about 4 ft. below mean low water near the gates, gradually shoals in a distance of 650 ft. downstream to about 1 ft. below mean low water.

Soil.—The reclaimed marsh is not now receiving, nor has it received for many years in the past, any considerable amount of deposit either from the uplands or the sea. The top 6 to 12 ins. is generally turf, beneath which is a layer of muck or peat from 1 to 3 ft. in thickness, the peat predominating in the upper part of the marsh where poor drainage has retarded decomposition. Near the larger creeks and adjacent to the sand dunes on the narrow barrier toward the sea there is a considerable percentage of sand. Beneath the 2 to 4 ft. of soil, which is largely of vegetable origin, is a stratum of blue silt clay from 3 to 6 ft. in thickness overlaying a firm sand bottom. The average depth to the sand bottom is about 8 ft., but at several places is from 20 to 25 ft. As would be expected in a soft, spongy, muck or peat soil, there has been a considerable and rapid shrinkage or subsidence of the marsh following reclamation.

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*"Tidal Marshes and Their Reclamation," by orge M. Warren, Bulletin 240, Office of Eximent Stations, U. S. Department of Agriture.

Mr. Herschel states in his report of 1871 that the marshes are "on a plane of about 8¾ ft. above mean low water." This is well confirmed by the testimony of old residents who say that the marsh was formerly about at the level of ordinary high water, but was submerged a foot or more by spring tides, and also by levels taken in 1897 by the engineers of the joint board. They found the unreclaimed marsh just below the dike to have an average elevation of about 9.1 ft. in 1897. The interior lands at the latter date were generally between elevations 7 and 7.5. It is apparent, therefore, that in a period of 24 years the subsidence has amounted on the average to about 20 ins., or at the rate of about 0.8 in. per year. In 1908 further leveling showed that the subsidence in 11 years had amounted to from 0.2 to 0.4 ft., or at the rate of about ⅓ in. per year. In 35 years following the completion of the dike the average settlement over the marsh has, therefore, been just about 2 ft. It is well known that certain areas have settled much more than this and others considerably less. The shrinkage of the soil is of course mainly due to the decomposition of the vegetable matter therein. The small roots and fibers contained in samples of the soil from the reclaimed marsh were generally much discolored and decomposed, while in samples from below the dike they were bright and in a state of vigorous growth. Tests made in 1897 by the State's Engineer indicated that flooding the shrunken soil would not cause the surface of the meadows to rise appreciably. Chemical examinations also showed that the water entering the marsh at the upper end contained only about 3 parts of chlorin per 100,000; that the water of the sea contained about 1,740 parts per 100,000, and that from samples collected near the bottom of the river and main creeks the latter was generally about 70 per cent sea water. Much of the turf and muck soil had a specific gravity less than that of water.

Dike and Sluice.—The dike it situated about 3,600 ft. from the present mouth of the river at a place where the uplands approaching on both sides narrow the stream to about 500 ft. in width. The top of the dike is about 22 ft. wide and 1,600 ft. long, and its average elevation is 14.6 ft. above mean low water. It is stated that a line of sheet piling was driven across the river and surrounded by a filling of stones, gravel, and marsh soil, built out from the upland on each side. The outer slope averages about 2½ to 1 with a facing of large and small boulders roughly placed. The sluice is 65 ft. long by 9.3 ft. wide, outside dimensions. It has two flumes, each 4 ft. high and 3.5 ft. wide inside, although the clear opening is reduced by the thickness of the 4-in. upright timbers spaced about 4 ft. apart along the inner sides and which sustain the side walls and partition. The top is 6-in. plank. The floor of the sluice is about 1.6 ft. above mean low water and is practically level. Each flume has two automatic tide gates, one on the outer end of the sluice and one within but near the inner end. It is said that at the inner end of the sluice there were formerly two gates to be operated by hand and intended to control the level of the interior water, but these have disappeared, leaving only the decaying framing timbers. The sluice is in poor repair, and is leaking very badly. Observations made in 1896 showed that the leakage amounted to about 150,000 cu. ft. at each tide, and it is stated to have increased since that time. The actual cost of dike and sluice in 1872 was as follows:

Land, gravel and stone	$ 2,435.20
Lumber and piles	2,842.46
Bolts, rods, spikes, etc	570.41
Labor	3,941.79
Pile driving	3,647.70
Gravel filling (two contracts)	12,049.01
Sluices and tide gates	1,520.64
Sundry expenses	960.84
Interest account	1,131.71
Legal expenses	582.00
Salary of commissioners and collector's fees	2,579.92
Total	$32,261.68

There was received for interest on deposits and petty sales, $170.89. In 1879, $3,000 was expended in widening the dike and making a road along the top.

Crops.—In October, 1910, the cranberry bogs were estimated at 125 acres, and the average yield was about 60 barrels per acre. The berries were large and of excellent quality and for a series of years should net a yearly profit of not less than $135 per acre. Timothy, redtop, Japanese millet, corn, onions, squashes, and rhubarb have all yielded splendidly the present season without fertilizer of any kind. Oats, rye, asparagus, and strawberries have been raised with pronounced success.

Financial.—From such information as is available it appears that prior to reclamation the salt marsh was assessed for about $12 or $13 per acre. In 1888 1,054 acres were assessed for $24,635, the valuations ranging from $13 to $32 per acre, but averaging $23.37. In 1895, 1,031 acres were assessed for $22,335, an average of $22.63 per acre, and in 1908 1,000 acres were assessed for about $30,000, an average of $30 per acre. The market value of the improved areas at the present time is from $80 to $100 per acre, and the cranberry bogs would probably run up to several hundred dollars per acre.

Conclusion.—The reclamation at Green Harbor is one of great natural opportunity. There are few localities where 1,600 ft. of dike will protect 1,334 acres of rich marsh or, taking in all the area to the level of the higher tides, nearly 1,700 acres, and where the upland drainage is so small. Reclaiming should add to the healthfulness and attractiveness of the locality and there can be no question but that the agricultural and financial success of the undertaking would have been very much greater than it has, had the marsh owners been allowed to remain in peaceable possession of their property. There should be a new sluice of larger capacity and set lower, and the land should be ditched in a systematic way. With these improvements well maintained, good management, and a better feeling in the community there is every reason to believe that thorough gravity drainage may be secured and a new era be opened up in the history of the Green Harbor reclamation.

A Discussion of Methods of Financing Irrigation Developments.*

Classifying broadly, there are three conditions which must be met in order to make a proposed scheme of irrigation a success; first, an available supply of unappropriated water so situated that it may be carried to cultivatable lands which are not available for agriculture except by the artificial application of water; second, a practical engineering plan for the carriage of the water to the land and its distribution thereon, so worked out that it makes reasonably sure that the system may be relied upon as permanent and able to fulfill year by year the purposes for which it was developed; and third, capital for the undertaking sufficient to complete it in good order, and at the same time, assured of ultimate return with interest for the period during which it has been tied up, and with additional profits that will properly compensate such capital for the risks taken.

I do not wish anyone to think that I would suggest that these profits should be small. Certainly, in the present stage of the irrigation industry, they should be large. The risks taken are unusual and there is always a chance of failure from any one of numerous causes beyond the control of man and which could not be foreseen based on the information available in advance.

For after all the study that has been given to the matter of the country's water supply, the data in regard to precipitation and stream flow in many places are meager, and do not cover a sufficiently long period to give an adequate forecast of what may be reasonably expected in the future, and therefore, of what is necessary in the way of storage and regulation. At the same time, the difficulties inseparably connected with the construction of irrigation works are so great that those who undertake to cope with the forces of nature must plan against the possibility of great expense arising from events which could not be foreseen or adequately guarded against.

The irrigation work of the federal government offers examples of these two classes of physical difficulties. In New Mexico, "the canals of the Hondo project were ready for operation in the spring of 1907, but since that date an unprecedented period of drought has existed and the flood waters of the Hondo River have been so small in quantity that but little use has been found for the reservoir." This statement in the last annual report illustrates the effect on the project generally of insufficient data concerning the water supply.

Again in Wyoming, the Pathfinder Dam was built on the North Platte River to store water in a reservoir which was to be extended and partly enclosed by earth dikes. When the dam was well along, but before the embankments had been raised, an unprecedented rise in the river threatened to overtop the low reaches in the rim of the reservoir. Because of the consequent peril to the valley below it was considered necessary to prepare to dynamite the dam should the river actually reach the danger level, while at the same time the construction of the dikes was rushed as rapidly as possible. Unplanned for work, or planned work performed at rush speed always adds to the cost.

If, then, as we have seen, the uncertainty of the water supply and the possibility of unforeseen engineering difficulties are usually present in irrigation enterprises, it becomes even more important that the projects be freed if possible from other embarrassments, particularly those arising from unwise methods in financing and management. Especially is this true since it is probable that the public estimation of irrigation securities will always hinge more largely upon the degree of confidence reposed in its financial management than upon belief or knowledge of soundness in the technical matters of water supply and engineering design.

Let us examine the financing of irrigation. I shall not attempt to describe the methods of all enterprises, nor claim that in detail the description will fit any particular promotion, but I shall hope to be fair to each by being fair to all in a description of general methods. And in so doing I will have in mind only those cases in which there is apparent the purpose to deal fairly by all concerned, with, of course, the legitimate and necessary fundamental that the enterprise shall produce in profits a handsome return to those who shall have put it through to successful completion.

The large irrigation developments have been financed almost exclusively by bond issues. One man or a group of men has found the necessary land and water and has acquired control thereof. These men have then invested some money in engineering surveys and designs and often in some development work. When the project has been brought to where its general feasibility seemed reasonably well assured, a corporation was organized to take over the proposition. For the actual cash expenditures made by the original developers they have frequently been paid in bonds or in cash derived from the sale of bonds. For the intangible assets, often consisting of the control of the water and through it of the land, by means of water appropriations which while not perfected and vested are temporarily good and susceptible of perfection—for those intangible assets it has often been the practice to issue all of the capital stock.

Thereafter the project has no means for

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*Extracts from a paper by Norman E. Webster, Jr., before the National Irrigation Congress at Chicago.

raising money other than by sales of bonds until it shall have reached the stage when it can begin to realize on the sale of land or water rights or both.

Up to the time of the bond issue the expenditures have been for preliminary surveys, designs and estimates; for organization and promotion expenses and for the acquisition of lands and existing irrigation systems. After the time of the bond issue the expenditures will be for the final engineering, including if properly complete, tographic and location surveys and structural design; for actual construction; for general administrative and legal expense; for one or two years' expense of operation and maintenance; and for interest on the bond issue.

An examination of the requirements for these several classes of expense would most certainly disclose some interesting facts, but the information could be obtained only from the private books of account of the irrigation companies. We have, however, the published reports of the United States Reclamation Service covering over 30 projects throughout the entire arid region. While the form of these reports is not quite that best suited for projects developed by private capital, a study of the figures seems to warrant these conclusions.

The expense of organization and promotion, together with the reimbursement of original promoters for their cash disbursements, may be estimated at 10 per cent of the cost of construction. The general administrative expense during the construction period may be estimated at 10 per cent of the cost of construction. The duration of the construction period, counting from the organization of the company, may be estimated at from two to five years. The additional time after the completion of the construction work for the delivery of water, before collections can be counted upon as a reliable income, will average two years. And as the money for construction must be provided in advance of expenditure requirements, an additional six months must be counted upon after bond sales before the funds are disbursed. These three elements of time indicate that the interest charges on the bonds during the construction period and two years of the operating period would, at 6 per cent, amount to from 21 to 30 per cent of the construction cost.

I have measured these items of expense in terms of construction cost because there is usually an engineering estimate of the construction cost, while there may be no estimate of the total cost including all other expense items.

From these figures we find that the three items of initial organization expense, general expense during construction, and bond interest together entail an outlay of from 41 to 50 per cent of the construction cost.

Moreover, it should be noted that the interest charges, as computed herein, are only on the money necessary for construction, so that if the cash for all purposes is to be provided from the bond issue, the total issue must at a minimum exceed the actual cost of engineering and construction by from 50 to 65 per cent, according to whether the project will require from two to five years for building.

And further these figures are based upon the sale of bonds at par. If, however, they net the company less than par, the amount of the discounts and commissions must be provided for by an increase of the foregoing excess over construction cost

Having investigated the financial requirements of irrigation, let us examine the security it has to put behind its bonds. The trust deeds usually mortgage all of the company's property, real and personal, both presently owned or thereafter acquired, and as collateral require the deposit of contracts for the sale of land or water rights or both to the extent of from 125 to 150 per cent of the amount of bonds issued, though this additional security is sometimes waived as to a portion of the issue.

Of course these two classes of security are mutually exclusive for, to the extent that each water right contract disposes of a portion of the entire supply available for sale, it reduces the equity of the company in the physical property which it has produced. In the final analysis, the lien which the water right contract gives on the land and water is the strongest security, but until the project is well along toward completion there is no assurance that this security will ever be perfected by providing the water which will give the land its possible value. Pending the time when completion is assured, the security rests wholly or mainly on the value of the property mortgaged, rather than on the land to be irrigated.

But if the funds for all purposes are derived from the bond issue then, as we have seen, the other expenses, not including bond discounts and commissions, will require from 50 to 60 per cent of that required for construction, so that, of the entire proceeds of such bond issues, only 66⅔ to 60 per cent will be available for actual building operations. Such an investment in tangible property does not of course offer a real security for the bonds, the safety of which then rests on the successful completion of the enterprise. They then lose the element of security which should be a prerequisite for a bond and become preferred speculative investments in the whole project. And yet there is no way to improve the security behind the irrigation bond during the construction period, unless provision can be made whereby these general expenses, and especially the bond interest, are provided for otherwise than from the sale of bonds.

How, then, shall irrigation be financed in order that projects shall be equal to carrying interest and general expense until water right contract collections are supplying an income sufficient to provide for such interest charges and a sinking fund for the bonds?

First, by a bond issue the proceeds of which shall be sufficient to provide for all construction and engineering, and for the purchase of lands and existing irrigation systems, and shall be restricted to such uses.

Second, by a preferred stock issue, the proceeds of which shall be sufficient to provide for the promotion and organization disbursements, the general administrative and legal expenses during construction and the bond interest until the latter is supplied from water right contract collections.

Third, by a common stock issue for the intangible assets acquired from the original promoters.

By this method the bonds will at all times have as security construction work and available cash equal to 100 per cent of the bond proceeds, while the water right contracts deposited as collateral will be a better security than now, inasmuch as the investment by the preferred stockholders will give increased likelihood of the efficient and speedy completion of the construction work. The preferred stock should be preferred as to assets, and guaranteed a fair return for the period of its investment and might properly be subject to retirement under prescribed conditions after the collections were sufficient to provide both interest and sinking fund for the bonds.

When thus retired the further profits of the undertaking would, as now, belong to the common stock. The plan herein proposed does not at all affect the status of the present stock. It does, however, distinguish between the investment and speculative features of the present irrigation bond by providing that the speculative element shall be assumed by the preferred stock, thus leaving the bond with a security whereby it could be styled an investment proposition.

Almost certainly the present depression in irrigation development is only temporary, and must eventually give way to renewed activity. And this will follow, not because promoters, bankers, engineers, contractors or even accountants desire it, but rather because the increased population and the popular demand for better living combine to make it necessary that large additional areas be placed under cultivation.

It is nothing new to call attention to the fact that the land available for agriculture as formerly practiced is largely exhausted. In this statement, repeated so often that it has become a platitude, is the hope of the irrigation industry. But as an important aid in putting irrigation on its feet again, a rehabilitation of its scheme of finance will play an important part.

STEAM AND ELECTRIC RAILWAY SECTION

Methods of Protecting Railway Embankment Along Streams from Current Action, With Some Costs.*

Vanishing river banks frequently threaten the foundation of a railway paralleling the stream. The only escape from destruction then lies either in changing the location of the railway or in preventing further encroachment of the errosive currents. Therefore, railroad embankment protection resolves itself oftentimes into a scheme for river bank protection.

Bank protection may be described roughly, as falling under three classes: (1) Where the banks and bottom of the stream are rock or consist of a substance not washable by the force of the current. In this case there would be no need of protecting the original bank or bottom of the stream but the location of a railway embankment within the reach of the river at high stages necessitates its protection against erosion; (2) Where the bank and bottom, or at least the bottom of the stream, consist of gravel or coarse sand and have considerable resistance to the washing power of the current; (3) Where the soil is alluvial and the river shifts its course at will.

For the protection of embankments of class 1, riprap and concrete slabs are applicable. In some cases a row of piling is effective against wave washing when the row of piling is planked to prevent a current from washing the material from behind the piles.

Riprap usually consists of stones laid, or dumped on the slope of the roadbed at points where injury is threatened. The size of the stones is governed by the velocity of the stream, the drift it carries, and the ice forming in it. Ordinarily the size of stones needed may be judged by the size of those left in the bed of the stream. If these are not larger than "one man stone" the embankment will be safe if protected by stones of that size. There is seldom any economy in using stone smaller than this size. Streams carrying large drift, or worst of all, streams which freeze deeply, present serious problems for riprap. Where ice forms a foot or more thick, the rising water will lift large stones from place. Under such circumstances only very heavy stone, placed with a derrick, will give adequate protection. The cost of riprap is given at 30 cts per square yard and also at $3.00 per cubic yard of material in place.

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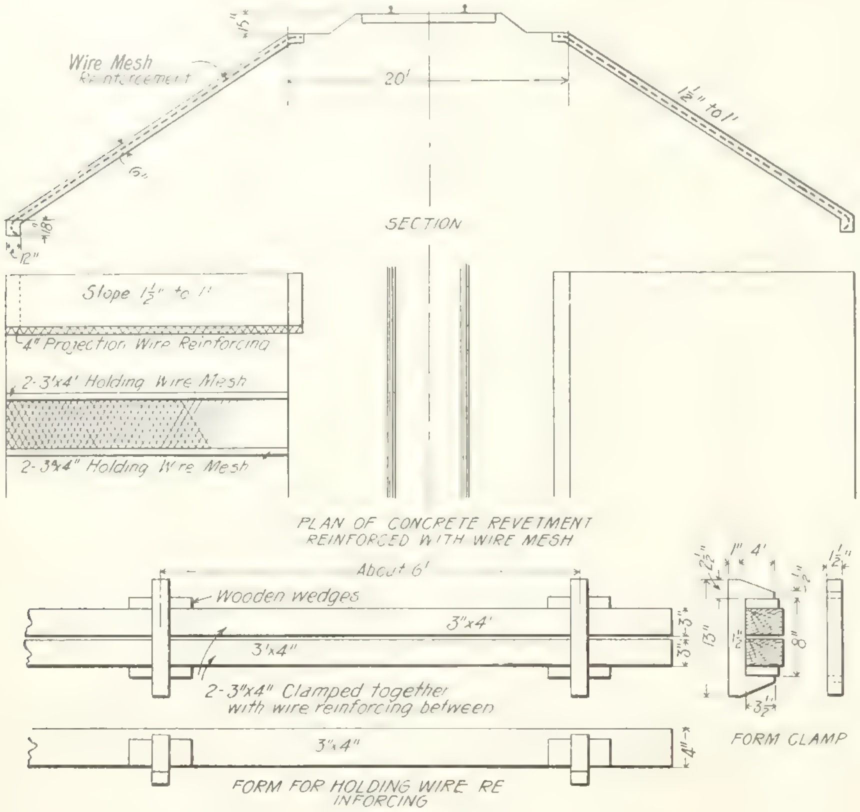
*Abstracted and rewritten from the report of the Committee on Embankment Protection, American Railway Bridge & Building Association



Wire Mesh Reinforcement
20'
1½" to 1"
6"
1½"
18"
12"
SECTION
Slope 1½" to 1"
4" Projection Wire Reinforcing
2-3'x4' Holding Wire Mesh
2-3¾4" Holding Wire Mesh
PLAN OF CONCRETE REVETMENT REINFORCED WITH WIRE MESH
About 6'
Wooden wedges
3"x4'
3'x4"
2-3"x4" Clamped together with wire reinforcing between
3"
3"
3"x4"
4"
FORM FOR HOLDING WIRE RE INFORCING
2½"
1" 4'
1½"
½"
13"
1½"
8"
3½"
FORM CLAMP

Fig. 1—Reinforced Concrete Slab for Bank Protection, Southern Pacific Railway Co.

In the case of streams of class 2, as described above, all of the methods of protection, described for streams of class 1 are used, and in addition cribbing or a slope pavement of reinforced concrete. On the Ft. Worth & Denver City Ry., cribbing is used with the best results on river banks. Cribs about 10 ft. wide are used and floored with old stringers or poles. The crib is built in the water and sunk by filling with stone as it is built up. It connects with the bank at the upper end and is built out into the stream pointing at an angle of about 30° down stream. The cribs are built 8 or 10 ft. above water. As the water rises the crib settles, in most cases, but it is built up and filled with stone as fast as it settles. After two or three floods the settlement ceases and a sand bar is formed at the back of the crib after which there is no further trouble. This work costs the company about $1.50 per cubic yard, including the stone placed in the crib and the material used for making the crib.

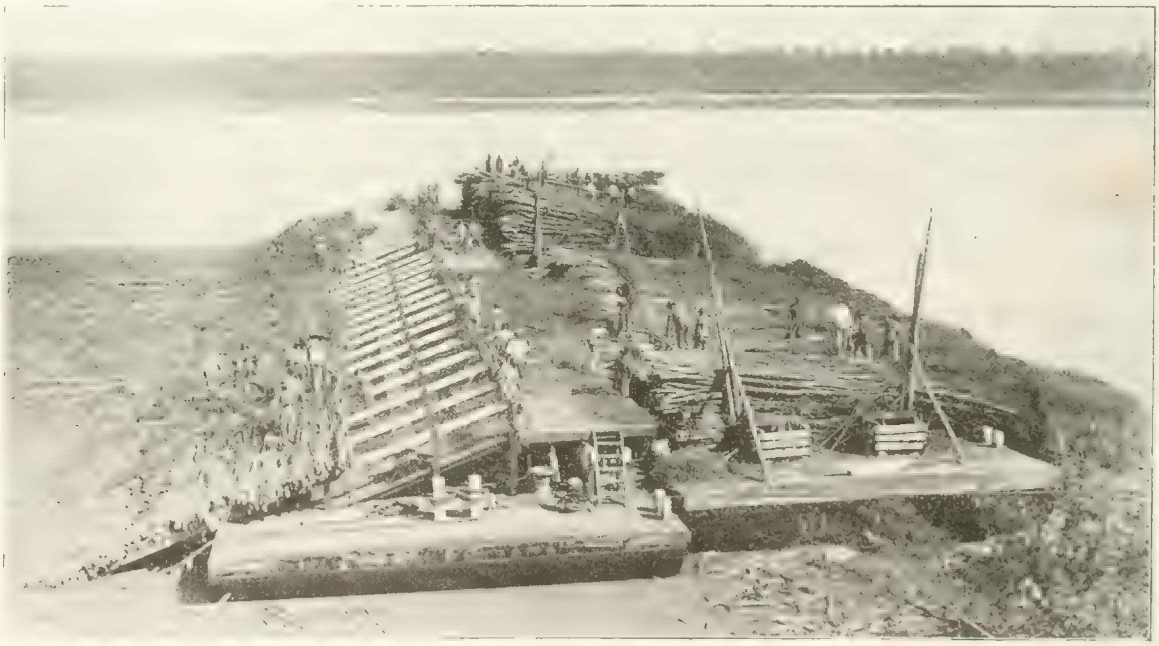


Fig. 2—Method of Weaving and Launching Mattress, Vicksburg, Shreveport & Pacific Ry. Protection.

The newest form of embankment protection and that which may be most successfully applied to streams of class 1 or 2 is reinforced concrete slope pavement. Such a protection is illustrated by Fig. 1. This has been used on the Southern Pacific and consists of a slab 6 ins. thick with a wire netting in the center as reinforcement. In one case where it was put on a new fill which settled badly, the concrete did not pull apart and did not allow the water to wash the fill.

A slab containing 376 square yards was constructed as follows: The bank was sloped 1½ to 1, and a 12x18 in. trench was dug along the foot of the slope. This trench was filled with concrete embedding the ends of the strips of mesh reinforcement. A strip of reinforcement was then stretched up-bank and its edges were clamped by forms as shown by Fig. 1. Braces driven between the edge forms made the mesh taut, and the forms held it 3 ins. clear of the slope surface. The space between forms was next concreted, the forms serving as templets for thickness of slab. When the concrete had hardened the forms were removed leaving a 4-in. selvage of mesh projecting beyond the slab edges. The next strip of mesh but one was then stretched and concreted and so on completing alternate sections of the slab. The intermediate sections were constructed by stretching the strip of mesh up-bank and wiring its edges to the selvage edges projecting from the completed slabs, and by concreting the open spaces. The cost of the 376 square yards of slab was as follows:

Materials:		Revetment. Per sq. yd
2 rolls fence wire, 50 rods, at 45 cts. per rod	$ 22.50	$0.0598
82 cu. yds gravel and sand at 30 cts.	24.60	0.0654
82½ bbls cement at $1.70	140.25	0.3731
Total material	$187.35	$0.4983
Labor:		
Building mixing platform	$ 11.50	$0.0305
Unloading gravel	25.00	0.0665
Unloading cement	10.50	0.0279
Putting up forms and wire	116.50	0.3099
Placing concrete	119.00	0.3165
Total labor	$282.50	$0.7513
Total materials and labor	$469.85	$1.2496

The work was done by a gang of eleven men working 10 hours per day at the following daily wages: One foreman, $4.50; one concrete mason, $3.25; six laborers, each, $2.25, and three laborers at $2.50.

On the Wisconsin and upper Mississippi rivers, where class 2 conditions are encountered, wing dams built of brush weighted down with stone, have given excellent protection. This construction is used at points where the stones used as riprap would soon be buried by their own weight sinking them into the sand.

For streams of class 3 there seems to be no best system for all cases. The forms of protection which have given entire protection successfully on these streams are two. The first, and undoubtedly the best, is the mattress. Where brush is procurable at a fair cost it is commonly used.

The only other system which has given any measure of protection in this class of stream is the permeable pile dike. This consists of from two to four rows of piling driven at right angles to the bank, framed together and braced to resist the [illegible] and drift. On the up-stream row are fastened two or more rails, much as are the rails of a picket fence, and to these are fastened, perpendicularly, poles which reach the bottom, and extend nearly or quite to high water. It is very much in form like the common picket fence. Its action is to retard the

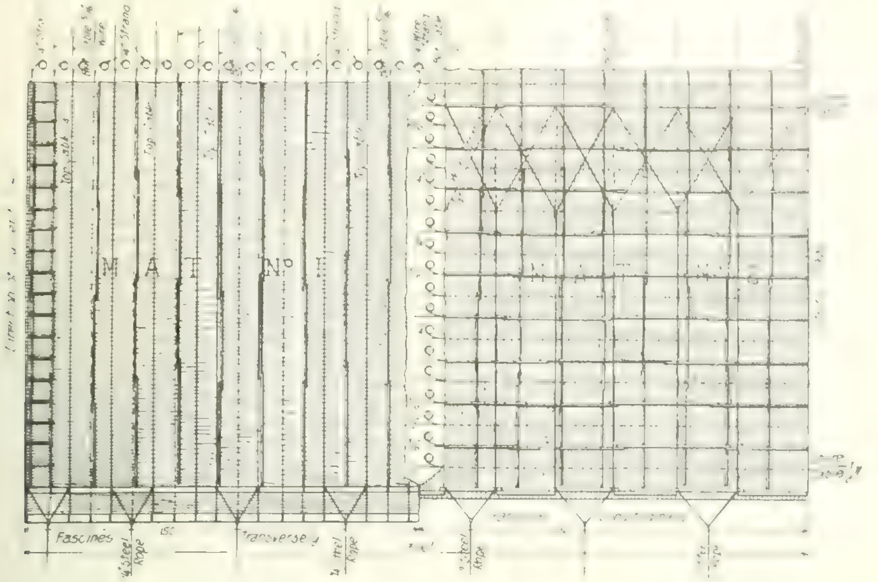


Fig. 3—Plan of Fascine Mattress.

low of the water, as it passes through it, and cause it to deposit silt in the comparatively still water below the dike thus building up a deposit or sand bar, and ultimately cultivable land. These dikes must be so close together that the eddy caused by one dike will be caught by the dike next below and broken; otherwise the eddy would wash out and destroy the deposit. A system of this sort was described and illustrated in ENGINEERING & CONTRACTING Dec. 7, 1910, in connection with work done by the Chicago, Milwaukee & St. Paul Ry. at the company's bridge across the Missouri river at Mobridge, S. Dak.

The mattress style of protection is best, but is more costly. Its only failures are where the protection was only partial. If the mattress does not go out to the central thread of the deepest water of the stream, the water will work under the edge and destroy the mat. If it does not extend to a point above, and to a point below, where the force of the stream strikes the bank, the water will cut around the ends of it and destroy it. Of course, the bank of the stream above low water, and extending to above high water, must be protected by riprap. With the permeable pile dike it is usually necessary to protect the bottom of the stream under the dike with a mat.

Among the railway embankment protections now being built is that at Delta Point, La., where the government is weaving and sinking a fascine mattress opposite Vicksburg, Miss., for protecting the right of way of the Vicksburg, Shreveport & Pacific Ry. Figure 2 is a view showing the method of weaving the mattress and indicating how the mattress is slid off the barge as fast as completed. Figures 3, 4 and 5 show the construction in plan and perspective.

A mattress 300 ft. wide by 1,200 ft. long represents an area of about eight acres and the placing of this on the bottom of a stream of from 40 to 100 ft. deep against currents from 5 to 8 ft. per second is not an easy task. A complement of men for a mat 200 ft. wide is 54 under a foreman, divided into three equal gangs each under a master laborer. Each gang consists of five men on the brush barge passing brush to the weaving party of twelve men, and one man on the mat mauling the brush tightly into place as the weavers push it down. Each gang builds one-third the width of the mat. The brush barge is placed below the mattress barge, about midway between the two ends and a barge loaded with poles is tied to each of the said ends.

A [illegible] in 1893 at New Madrid, Mo., is described below. The work consisted of a mattress 1 ft. thick x 250 ft. wide x 90 ft. long, and an auxiliary connecting mattress and shore paving of 4 ins. of spalls and 6 ins. of stone extended up the graded bank to the 27 ft. stage.

A set of platforms or fascine barges was used in addition to the mat barges, and joined to them longitudinally. The platform barges were ordinary barges with an extra deck raised to the level of the platform of the mat barge. Along the side of these, joining the mat barges, forms were built in which to construct the fascines, the tops of these forms being at the same elevation as the highest point on the mat ways. Under the platform of the mat barges were placed 19 reels 13 ft. apart, the two outside reels containing ⅜ in. and the others 5-16 in. galvanized steel strands, made of 7 wires each. These are the bottom cables, and the ends of each were made fast to the head and under the mat at right angles to the fascines. Each cable was in one piece, its length being determined by the length of the mat. Friction brakes were used on the reels to keep the cables taut.

The method of procedure during the construction of a fascine mat was: First a large head, about 3 ft. in diameter, was made of hardwood poles, the diameter of the butts of the poles being from 4 to 8 ins., and to this head were fastened the bottom cables. The weaving strands, which were ¼ in. galvanized steel strands, composed of seven wires, were also fastened to the head at the same place as the bottom cables, and hence they were nineteen of these 13 ft. apart.

The fascine was made by placing brush from 1 to 4 ins. in diameter at the butts in the forms and compressing them into round bundles or fascines 12 ins. in diameter, by means of the lever chains. While thus compressed they were tied together with No. 12 galvanized steel wire. Care was taken to keep the butts well scattered. The fascine was next raised out of the forms and pushed to the ways and down to the head, when the weaving cables were passed over the fascine, then down under the fascine, and the bottom strand up between the fascine and the head. Then a pair of 6 in. blocks, one end fastened to the mooring barges and the other (by means of a "Haven" clamp) attached to the weaving strand, and six men at each set of blocks pulled the fascine down to the head. While the strain was on the weaving strand it was either clamped to the bottom strand or held so that the fascine could not separate from the head, or one from the other, by driving a staple into the butt of a willow so as to take both the weaving and bottom cables. The weaving and bottom cables were clamped together, at every tenth fascine, besides being stapled, so that the fascines could not slip apart. This method was continued until the mat was built of the desired length.

The labor on the mat was divided into three parties: one party unloaded the brush off the barges; the second party carried the brush to the formers and made the fascines; the third party assisted the second in raising the fascines out of the forms down on the ways and tied them together. When the ways were filled, the friction brakes were raised and the launch made, the brakes being put on again just before the launch was completed, so as to get a uniform strain on each cable.

In order to strengthen the mat, five longitudinal wire strands, 26 ft. apart, were placed over its whole length. The first one was on the outside of the channel edge, and of ½ in. diameter, composed of 19 galvanized steel wires; the second was also ½ in. and the remainder were ⅜ in. diameter, composed of seven wires. These strands were fastened to the head of the mat at the same place as the other strands, and were clamped to the weaving strands at every tenth fascine, the clamps being so arranged as to come half way between those on the bottom of the mat.

The shackle straps were fastened to the mat by first taking a turn around the head, then encircling two or three fascines about 10 ft.

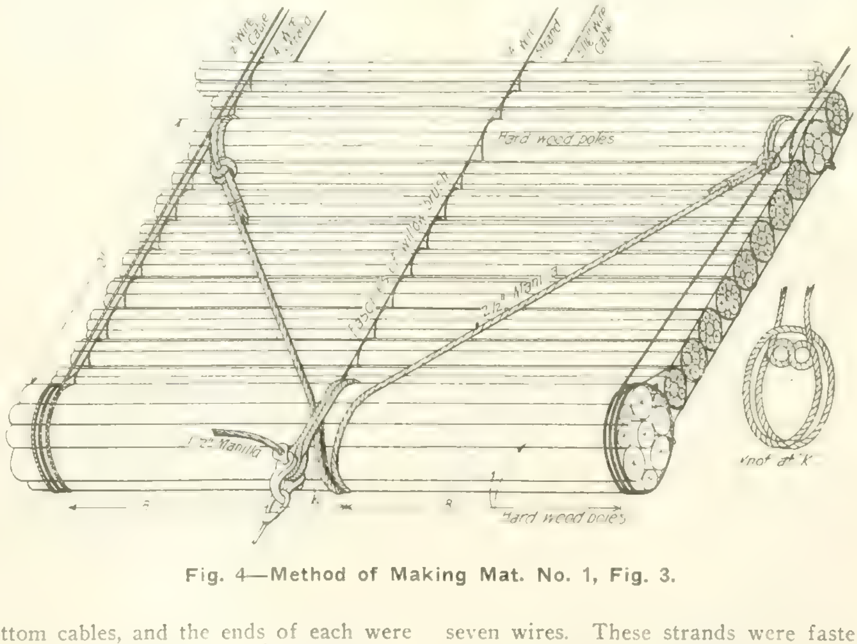


Fig. 4—Method of Making Mat. No. 1, Fig. 3.

from the head, and next clamping to the top strands. Seven shackle straps were used, the two nearest the shore not being backed up with a top strand. In order to give the mat the necessary rigidity in sinking, longitudinal poles of 3 to 8 in. diameter at the butt were placed over it, the rows being 13 ft. apart, and fastened to the mat with No. 12 galvanized wire and No. 9 copper wire. The ties were 4 ft. apart, one of copper and the next two of galvanized wire. These wires encircled a fascine and a pole. Care was taken to keep the galvanized and copper wires well apart, so that no chemical action could take place and destroy the wires.

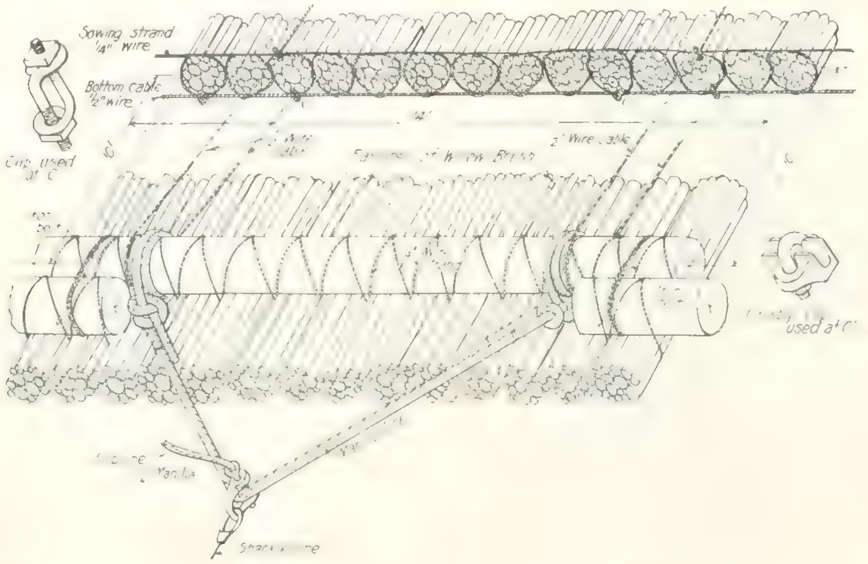


Fig. 5—Method of Making Mat. No. 2, Fig. 3.

The supply of labor was not abundant. White men subsisted by the government were employed in all responsible positions. At first the common laborers were white and self-subsisting but owing to hot weather and hard work they were replaced by negroes. The price paid was $30 per month and board. The self-subsisting laborer received $1.25 per day of 8 hours.

Brush and poles were obtained by contract at $1.05 per cord for the former and $1.50 per cord for the latter, and the source of supply was from 10 to 30 miles above the work. The deliveries were not sufficient, owing to the fact that the estimated quantity to be used per day was too small. Stone was obtained by contract from the quarries and stored on the bank during the spring.

At first the progress of the work was slow owing to the fact that the labor was untrained and that the fascine was then an experiment; but after the details had been worked out fairly good progress was made. Mattress construction was begun on July 27 and completed on August 16, when the mat was sunk. The cost data follow:

Brush used per square, cords	$1.60
Poles used per square, cords	.05
Stone ballasting, cu. yds.	.57
Total cost of mat per square	$6.25

There was not much grading to be done, as the bank had nearly a 1 on 3 slope, except at the upper end, where graders had to be used. Hydraulic grading began on Aug. 17 and was completed Aug. 25.

Bank graded, linear ft	360
Material moved, cu. yds.	2,154
Cost per cu. yd.	$0.08

The excessive cost was due largely to a pile of very compact sawdust which was removed with difficulty.

The narrow connecting mats were placed along the entire bank protected, as the river mat did not come up to the water's edge. These were built on the ways, of the old type of mattresses, and then launched in place.

Total length of connecting mats built, including laps, linear ft.	1000
Average width of connecting mats, ft.	15.15
Total built, 155.5 squares, sq. ft.	15,550

Brush and poles used per square of mat, cords	4
Stone (ballast and sinking) per square of mat, cu. yds.	2.50
Cost per square foot in place, cents	15.63

The quantity of stone used was large, as an extra mount was placed on the mat from the zero to the 10-foot contour.

Preparatory to paving, the grade was neatly dressed. Paving began at or near the 8 ft. contour and extended to the 27 ft. contour. The spalls used in paving were from 1 to 10 pounds in weight, and the stone weighed from 10 to 40 pounds. The average thickness of the paving was 10 inches, 4 in. of spalls and 6 in. of riprap. The length of the bank paved was 900 ft.; the area of bank paved 8,001 sq. yds. The total cost, exclusive of grading, was 8.35 cts. per square yard. The following is a summary of the cost:

	Per lin. ft.
River mat, 900 lin. ft., 2,250 squares, cost	$15.62
Connecting mats, 900 lin. ft., 155.5 squares, cost	2.32
Paving, 900 linear ft., 72,008 sq. ft., cost	7.58
Superintendence, care of plant, repairs, etc.	2.26
Total cost per linear foot	$27.78

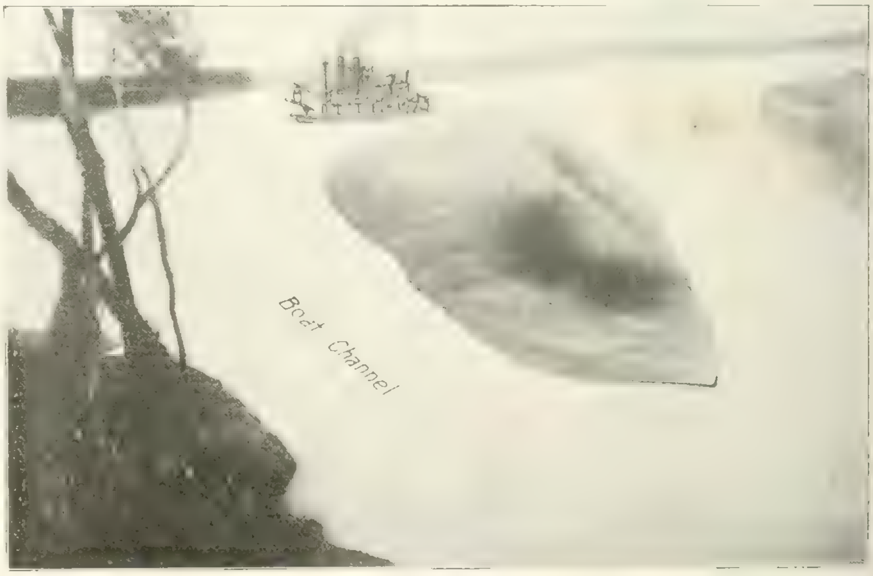


Fig. 6—View on Arkansas River Below Little Rock, Showing River Before Installation of Kerr Gabions.

Some of the work of the Kerr gabion system is shown in Figs. 6 and 7. Its design is shown in Fig. 8.

The gabion works on the law of sedimentation. A stream running rapidly carries much sand in suspension, sometimes as much as 50 per cent. If the flow or velocity of the stream is then reduced by the introduction of a pervious gabion jetty which allows, say 50 per cent of the water to pass through the same while the other half is shunted around, a corresponding reduction in the velocity of the stream is effected, and a deposit of the sand which it is not able to carry at the reduced flow. By varying the mesh of the lacing, one can secure different results in carrying the deposit of sand close to or far below the gabion, as may be desired by the conditions.

In the example of work illustrated the river was digging a very deep bend at the place toward which the steamboat is pointing and taking away land in large quantities, forming a new channel and slowly closing the old channel to the right of the middle bar shown in Fig. 6 by connecting it with the main bar on the opposite shore. The steamboat is just entering the new channel at low water, the old one being already too shallow for navigation.

At this juncture the owner of the land entered into contract with the River, Rail & Harbor Construction Co., of Jackson, Miss., for the installation of the Kerr gabion system. At a period when the river was high enough to carry a large amount of sand and make the shoal channel navigable, the jetty shown at the upper end of the sand bar in Fig. 7 was put into the swollen stream, with the result that the low water channel was within a few weeks filled with sand and within three months the immense sand bar shown in this picture was built. High water thereafter became more and more sluggish in the old bend and caving grew less and finally ceased. This bar is 1,700 ft. long, 400 ft. wide and the depth of the fill varies from 2 to 22 ft.

This gabion is graded in height from 8 ft. to 16 ft. and is 600 ft. long, being constructed entirely of oak and willow cut near the site. Occasionally steel arches are used in the construction to add weight to the structure, to sink it and hold it to the bottom. The very important feature of anchoring and holding this work in place is accomplished by sinking large concrete blocks into the sand by a hydraulic jet, to which are attached steel anchor cables made fast to the gabion.

The length of the bank protected in this case up to this time is 1,700 ft., not to mention the saving effects of the deflection of the current from the banks farther down the stream caused by the sand bar.

The design of the gabion jetty is such that this eddy is broken up into thousands of small eddies devoid of harmful effect. On a basis of the total contract this particular gabion would not cost more than $4,800, and a piling jetty of the same length would have cost $9,000.

The gabion work of the Kerr system in most cases has been made of willow and oak materials secured near the site of the work. Construction for the coast of the Gulf of Mexico, placed to protect a railroad from being washed away by the storms and for building up the beach of the coast along the railroad, which was built to stand the blows of the surf and the breakers during storm, was constructed of arches made of oak bent after steaming the timber, making it very stiff after it is braced on the inside. This work was laced with sawed dimension stripping, all of it being creosoted.

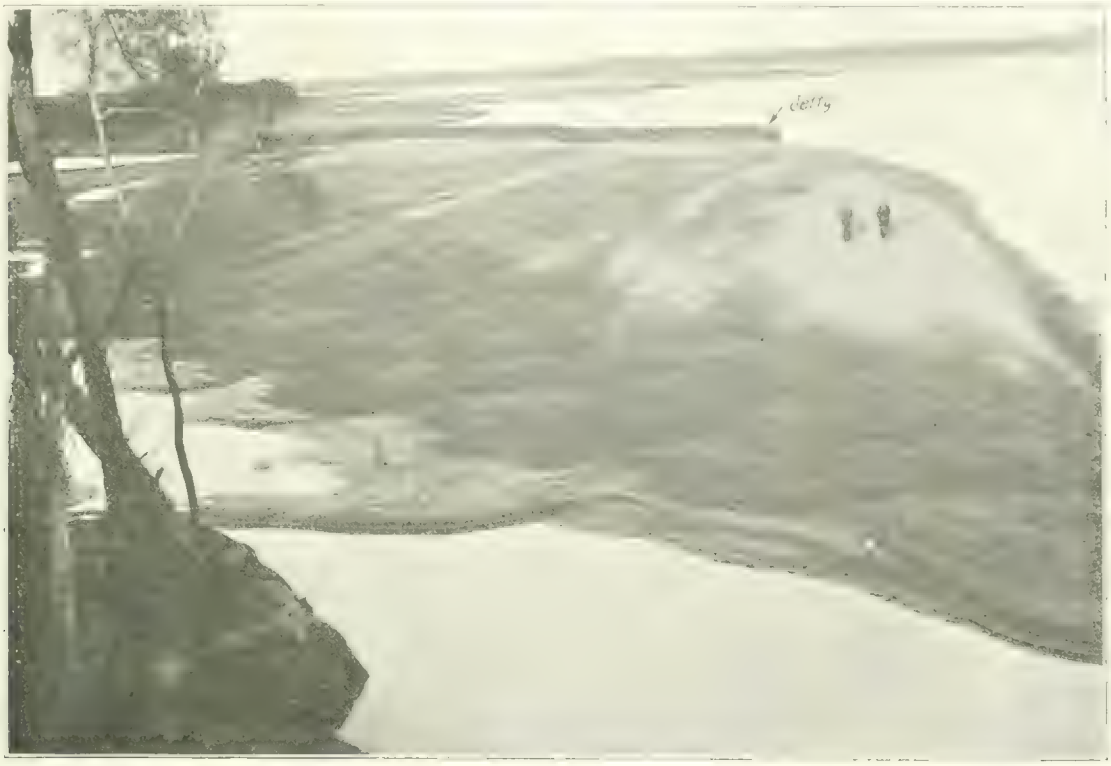


Fig. 7—View of River as Shown in Fig. 6 After Installation of Jetty of Kerr Gabions.

For emergency revetments the work is built cylindrical in form, Fig. 8, and the cylinders, one after another, are put to the bottom of the river, strung on cables which have previously been anchored in the bottom of the stream. These cylinders have cross-sectional partitions and they at once deflect the water, acting much as a mattress would act. These cylinders are made as a rule about 5 ft. in diameter and they soon fill up with sand and thus make a solid bank.

Much trouble could be prevented if the parties concerned would take action in the matter of protecting banks or protecting bridges in time to avoid the crisis, as, for instance, in the case where a river starts to dig a bend up-stream from a bridge, say a mile away, and it is getting deeper and deeper, and it is known that it is coming around behind the abutment of the bridge when it gets that far down. The proper thing to do is to take advantage of that mile and begin to work with the system, in small pieces. In this way 1,000 ft. of work will afford more protection than 5,000 ft. would do at the time of the crisis.

Maine Society of Civil Engineers.—At the annual meeting of the Maine Society of Civil Engineers, held at Lewiston, Feb. 7, the following officers were elected: President, Walter H. Sawyer, Lewiston; Vice-President, Prof. Harold S. Boardman, Orono; Secretary and Treasurer, Frank E. Pressey, Bangor; Directors: Cyrus C. Babb, Augusta; E. E. Greenwood, Skowhegan; C. A. Mixer, Rumford; J. C. Stevens, Portland; E. C. Jordan, Portland.

Economy in the Use of Treated Ties and the Cost of Treating Seasoned vs. Unseasoned Ties.*

When we speak of an unseasoned tie, we mean one freshly cut, or, at least, one that has been recently cut and has lost but a very small amount of the moisture which it origally contained; in other words, the sapwood is so completely filled with moisture that it would be impossible to thoroughly treat the tie until this moisture had been at least partially removed. A seasoned tie, therefore, is one that has been cut for some time and the moisture allowed to evaporate to a greater or less degree.

The time necessarv to season a tie so that it can be properly treated varies in different localities, as well as in different seasons. The kind of wood also is of considerable importance. Oak ties, in Illinois, must be air-seasoned six months or more, according to the time of year, before they can be properly treated. Some kinds of ties may be seasoned in three or four months.

For the purpose of illustration, and as a basis for argument, we will assume that it requires six hours to treat a charge of thoroughly seasoned ties and nine hours to treat a charge of unseasoned ties. Of course, the time may vary one way or the other, but we found this to be a fair average. (It should be stated here that the treatment referred to is with a mixture of creosote and zinc chloride, known as the card process.)

Assuming this to be correct, attention is called to the two tables following, one showing the cost of treating in a plant having a maximum capacity of 1,800,000 seasoned ties a year, and the other the cost of treating in the same plant, where the maximum capacity is reduced to 1,200,000 unseasoned ties a year.

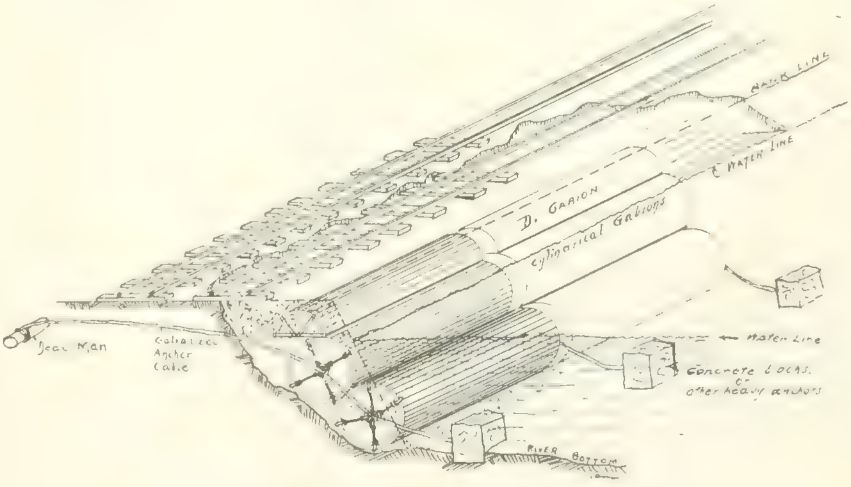


Fig. 8—Kerr Gabions Applied to a Washout.

TABLE I. – COST OF SEASONED TIES: TREATING CAPACITY OF PLANT, 1,800,000 PER YEAR.

Unloading from cars to ground to season at $0.0070 each	$ 12,600.00
Loading from ground to trains at $0.0055 each	9,900.00
Switching trains at $0.0020 per tie	3,600.00
Loading treated ties out at $0.0065 each	11,700.00
Fixed expenses	23,268.00
Preservatives at 15 cts. per tie	270,000.00

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*Abstract of a paper read by F. J. Angier, Superintendent Timber Preservation, Baltimore & Ohio R. R., read at the eighth annual meeting of the American Wood Preservers' Association at Chicago.

Fuel [illegible] less for seasoned over unseasoned ties)	5,600.00
Insurance carried on 1,000,000 ties (estimated)	[illegible]
Interest on [illegible] ties for six months, or 5 per cent on $250,000.00	12,500.00
	$353,168.00
600,000 more seasoned ties treated than unseasoned, worth $0.044 each (see statement)	[illegible]
	$326,768.00
Cost per tie	$0.1815

TABLE II. — COST OF UNSEASONED TIES; TREATING CAPACITY OF PLANT 1,200,000 PER YEAR.

Unloading one-fourth from cars to ground to enable prompt releasing of cars, at $0.0070	$ 2,100.00
Loading 900,000 ties from cars to trams at platform and 300,000 ties from [illegible]	[illegible]
Switching 300,000 ties from yard to retorts at $0.0020	600.00
Loading ties out at $0.0065 each	7,800.00
Fixed expenses	[illegible]
Preservatives at 15 cts. per tie	180,000.00
Fuel	8,400.00
Insurance carried on 300,000 ties (estimated)	1,200.00
Interest on 300,000 ties, or 5 per cent on [illegible]	3,750.00
	$233,718.00
Cost per tie	$0.1948

In each case the total cost of handling is shown from the moment the ties are received at the plant until they are loaded into cars for shipment. In the case of fixed expenses there are included the salaries of the superintendent, general foreman, office force, engineers, firemen, etc.; that is, all labor which would not change one way or the other, whether treating seasoned or unseasoned ties. This amounts to $0.0129 per tie when treating 1,800,000 ties per year, and $0.0194 when treating 1,200,000 ties per year. In the case of seasoned ties, where no steaming is done, it is assumed that insurance is carried on 1,000,000 ties for six months and that $250,000 will be continually invested at 5 per cent. In the case of unseasoned ties, we must assume that at least 300,000 will always be in the yard. This stock is necessary to provide against delay to plant at certain times of the year, when traffic is so great that company material cannot be moved with regularity. Also, at certain times of the year, ties will be received faster than they can be treated, necessitating the storing of a portion of them.

It is shown in the table that a treated tie is worth $0.044 to the company. This is obtained as follows:

Untreated Ties—

First cost	$0.50
Cost of putting in track	.15
Cost of tie in track	$0.65
5 per cent interest on investment for six years	.195
Second renewal, end of six years	.65
5 per cent interest on first investment for six years, and on second investment for six years	.39
Total cost of tie for period of 12 years	$1.885
Average cost per tie per year	$0.157

Treated Ties—

First cost	$0.70
Cost of putting in track	.15
Cost of tie in track	$0.85
5% on investment for 12 years	.51
Total cost of tie for 12 years	$1.36
Average cost per tie per year	$0.113

Saving per tie per year, $0.044.

Untreated ties are assumed to last six years, and treated ties twelve years. Assuming this to be reasonable, and that 600,000 more ties per year can be treated when thoroughly seasoned, deduct from the cost of seasoned ties the difference between 1,800,000 ties and 1,300,000 ties, or 600,000 ties, at $0.044 each, and we have a difference of $0.0133 per ties in favor of treating seasoned ties. This multiplied by 1,800,000, the number of seasoned ties treated per year, represents a saving of $23,940 in favor of seasoned ties.

In addition there would be a better penetration of the preservatives; therefore a longer life obtained for the ties and the lessened possibility of injury to the wood by steaming. When steaming there is always a large amount of sewage to dispose of, while in nonsteaming there is practically none. The disposition of sewage is a difficult problem at most plants, because no matter how it is handled some of it will get into the rivers or creeks and pollute the water to such an extent that damage suits may result. This is entirely avoided when using seasoned ties.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Methods of Channel Protection with a Description and Costs of a Special Method Employed at Devil's Island, Illinois.

Contributed by F. Y. Parker, U. S. Assistant Engineer, St. Louis, Mo.

Engineers, not conversant with river improvement, as well as laymen, may think that there is little if any variation in the methods used to maintain a required depth and stability of channel. The maintenance of this depth and stability could properly be called channel protection and will be thus designated in this article. Just here it seems proper to state that bank protection is one of the methods used to secure channel protection and not to protect the bank alone; although this may be done where a city, town or other valuable public property is endangered.

CHANNEL PROTECTION.

Channel protection may be accomplished by three methods, direct or in combination, viz., dams or dikes, hurdles, and bank protection.

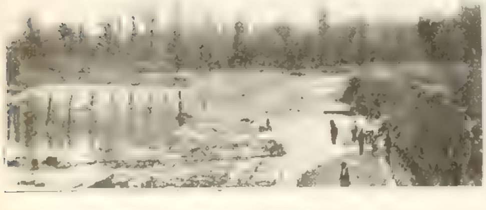

Fig. 1—View Showing Method of Bank Protection at Devils Island, Illinois.

Expedients by movable dams, dredging, and special methods are not considered, as the results obtained are, in a majority of cases, temporary. Neither are locks and dams, since their mission is to pool the water without reference to channel protection.

Dams or Dikes.—These may be of loaded timber cribs, weighted brush in layers, stone, concrete or any combination of these materials,—and they may operate either directly or indirectly: directly by contracting the width and thus increasing the velocity of the current at the conjested spot; indirectly by closing some chute or slough and turning this drain back to swell the volume of the parent stream. In the latter case the resulting benefit is less concentrated and moreover can only be used at infrequent intervals of river length.

In using a dam directly for channel protection the river width, velocity, and cross section should be carefully observed at different stages and the character, length and height of dam designed from this data. Too much contraction causes the opposite bank, if friable, to scour as well as the channel. Conversely should the bank opposite be composed of rock or hard-pan the channel will be deepened immediately down stream; but at the higher stages of the river the water will be shunted with more or less violence against this non-friable bank and rebounding will attack the opposite bank, sometimes two or three miles down stream. Likewise if the dike is too short results will not be commensurate for the time, money and labor expended. In any case the length is a greater controlling factor than the height. It is almost needless to say that an endless variety and combination of these dams or dikes can be constructed.

Hurdles.—Hurdles accomplish the same result as dams but by an apparently different method. This method although radically different from dams in construction really evolves into a dam in the end; since the hurdle collects drift, both large and small, which sooner or later become packed against the upstream side and sanded into the bottom. However in any and every case the end in view is the same, as with dams or dikes, viz., to contract the stream width or close some drain of the parent stream.

These hurdles have been constructed heretofore of wood; but within recent years one or two experimental hurdles of short length have been built of concrete with gratifying results. The time is rapidly approaching when the increasing cost of piles, considered with their comparatively short life, will necessitate a change to concrete.

In the case of both dams and hurdles local conditions control the height, length and strength; the strength of hurdles being secured by driving one or more rows of single piles; one or more rows of clumps or combinations of the above braced horizontally, inclined, or in combination. The remarks made about dams in regard to the importance of well considered length is equally applicable to hurdles.

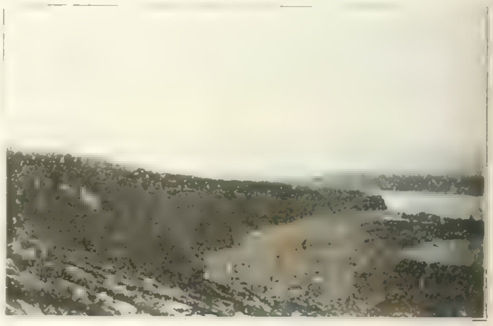

Fig. 2—View Showing Method of Bank Protection at Devils Island, Illinois.

Bank Protection.—More variety and combination of methods as well as considerable ingenuity is required, to cope successfully with an eroding bank, than in the two former methods of channel protection heretofore considered. In this case the engineer has not only swift currents and eddies to contend with, but the bank is usually composed of some easily erodable material such as sand, mud, clay or combinations; in strata of infinite variety and thickness; not only above but below the water level.

The bank protection proper consists of a subaqueous mattress, sunk along the shore to a stage of river suitable to conserve its life, in combination with rip rap or stone paving on the adjacent bank. This work is frequently supplemented by short hurdles in washouts and pockets along the bank.

Many varieties of mattresses have been used such as fascine; close woven (small brush); open weave (large brush) and lumber. In some cases the mattress has been nailed and wired together without attempting to weave; depending, as heretofore noted, on local conditions of current and [illegible]. [illegible] protection by means of concrete blocks, suitably connected, has been proposed, but thus far is in the embryo stage.

Various methods of bank paving have been used, those in general and successful use are as follows: Paving with "one man stone" by laying flat or leaning each stone against its upgrade neighbor; constructing a mattress on the bank and either weighting with stone or paving over it. In both of the above cases spalls may be used as a base, a filler, or both; and are frequently used alone as a paving material. Sundry variations, modifications and combinations of these methods are also in use. Concrete has been used to a limited extent; but no marked success has been scored. In all cases the bank to be paved should be given a grade suitable for the bank material and the paving to be used.

DEVILS ISLAND WORK.

In the latter part of 1911 the writer had charge of some protective work at Devils Island, Ill. (four miles east of Cape Girardeau, Mo.), Mississippi River improvement under Lieut. Colonel Chas. L. Potter, Corp of Engineers, U. S. A. At this place several hurdles had been built in years past. One of these had been completely destroyed, but as part of the stonework at the shore end was still intact it was considered advisable to try and hold it in place with a view to the ultimate restoration of the hurdle line when the depth of water would permit. Moreover the maintenance of the bank line at this particular place was a vital factor in channel protection at this locality.

Immediately above and below the old rip rap large pockets had formed in the bank; the upstream pocket had an approximate perimeter of 500 ft.; the downstream, one of 900 ft. These semi-circular, almost tangent, pockets left the old stonework at the outer end of a peninsula 300 ft. in length, from the bank line proper, and 25 ft. wide at the river end. The narrowness of the peninsula precluded grading and paving in the usual manner, hence a special method of protection had to be devised.

A continuous open weave brush mattress, 100 ft. wide, of the usual type, was built and sunk from the formation of the upstream pocket to a point 250 ft. on the downstream side of the peninsula. At the approximate center of the upstream pocket a hurdle was constructed from the bank to deep water and the shore end protected by a bank mattress weighted with stone, Fig. 1. From the downstream edge of this bank mattress—junction of peninsula with main bank line—the bank was graded, as far as the natural slope permitted, around the peninsula to a point 100 ft. on the downstream side. This grading was topped by a vertical bank averaging 11 ft. in height.

Willow poles not less than 4 ins. at the butt were settled 3 ft. in the ground and 5 ft. apart along the entire length of the graded bank so that they would lean against the top of the vertical bank at an approximate angle of 30°. To these willows, smaller willows were nailed from the ground to 7 ft. above. The bank was then paved with stone over the entire grade, particular attention being paid to covering the space, between the willows and the vertical bank, with a heavy rip rap of stone. After completing the stonework additional willows were nailed, side by side on the inclined willows, to within a foot of the top bank, and a single row at the bank line, Fig. 2. Wire cables leading from dead men or stumps on the bank were attached to the inclined willows every 40 or 50 ft.

On the downstream side of the peninsula a secondary pocket had formed in the large one. This pocket was 30 ft. across with vertical sides. Across the mouth a single row of piles was driven, close to the bank line, and the intervening space filled with brush. The stone paving and curtain mattress heretoforè described terminated at this brush filled pocket.

In the large downstream pocket a hurdle, similarly situated thereto and in all respects a duplicate of the upstream pocket hurdle, was constructed.

The cost of the curtain mattress—400 lin. ft. —4,200 sq. ft.—was as follows:

Materials:	
[illegible]	$[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Total materials	$[illegible]
Labor:	
1 [illegible]	$[illegible]
1 foreman [illegible]	[illegible]
[illegible] laborers [illegible]	[illegible]
Total labor	$[illegible]
Subsistence	[illegible]
Grand total	$[illegible]

This gives a cost of 2.8 cts. per square foot of mattress constructed.

Report of the Annual Meeting of the Kansas Engineering Society.

Contributed by [illegible] State Agricultural College.

The second annual meeting of the Kansas Engineering Society was held at the Agricultural College, Manhattan, Kansas, Jan. 23 and 24. A part of the second day was spent seeing the college and the new engineering shops and laboratories. The local members of the engineering faculty gave a smoker one night in the Commercial Club rooms and a luncheon the next day at the Domestic Science Department.

The new Kansas road law requires that the public highways be classified according to their utility and relative importance as state roads, county roads, mail route and township roads. State roads are roads designated as such by the legislature. County roads are roads designated by the county commissioners and are to be highways connecting cities and market centers and must be made as nearly continuous from one county to the next as possible. Mail routes are roads used by the postal service which have not been designated as state or county roads. All other public highways are known as township roads. The state and county roads are constructed and maintained at general county expense under the direct supervision of the county commissioners and county engineer. The mail route and township roads are constructed and maintained at township expense under the supervision of the township highway commissioners and the county engineer. Messrs. W. S. Gearhart, H. A. Rowland, C. C. Huntington, Fred R. Hesser and E. E. Clark presented papers on "How Roads Should be Classified and How the Different Classes Should be Constructed and Maintained." The general concensus of opinion was that the new law gives the most equitable distribution of the cost of constructing and maintaining public highways Kansas can have until the state is permitted to do internal improvement work. Also that the system of administration is commendable and that if the county commissioners use good, honest judgment in selecting their county engineer and in organizing their road forces the state and county roads can be made model highways throughout the state, reaching every community.

In discussing plain monolithic concrete retaining walls such as are used in track elevation work where the walls are heavily surcharged, J. M. Meade recommended that the width of base be made 0.65 of the height with a top width of not less than 18 ins. He cited a number of costly failures where a width of only 0.45 had been used. For reinforced concrete walls he stated it was common practice to use 0.6 of the height for the base width. He especially emphasized the importance of proper filling and drainage back of retaining walls.

L. E. Conrad presented a paper on "Some Observations of Retaining Walls" and stated that it is often claimed that engineering design must be on a sound basis, that if a bridge were improperly designed it would fail. In general, he said: "This may be true but unfortunately it is not always so." It was his opinion that probably the most powerful factor to be combatted by those advocating conservative designs is the fact that a great many poorly designed structures did not fail. A number of examples were cited of such structures. What bridge engineer has not investigated bridges that had no scientific reason for not failing but apparently stood only by force of habit. Mr. A. R. Mann, in discussing foundations, stated his observations led him to believe that either the resistance to shear of brick and concrete work is over-estimated or else the difference of amount of settlement of the different parts of a building is often under-estimated.

R. V. Leeson's paper on "Concrete Bridges" was especially interesting for his company has built more reinforced concrete highway bridges than any other company in the state.

Among the most interesting and valuable papers presented was one on "Field Methods, Office Practice and Supervision and Inspection of Paving Work in Topeka," by Messrs. A. R. Young, E. G. Gibson and C. A. Forter. Reinforced concrete slabs for gutter boxes at sidewalk crossings were highly recommended by Messrs. G. L. McLane and L. E. Curfman. In a report on "Inverted Siphons in Street Drainage," Mr. Curfman stated he was not a strong advocate of their use and believed that it is not always the best engineering practice. However, there are cases where they can scarcely be avoided and with a little attention they can be kept in good condition and by the use of oil no trouble would be experienced from mosquitoes.

Some interesting facts concerning the first use of concrete pavements, their present cost and how to construct them, was given in a paper by J. H. Titus. Joseph O'Neil, in discussing the maintenance of street pavements, states the sources of the greatest trouble in the maintenance of pavements are cuts made by plumbers and public utilities, unrestricted traffic, improper street cleaning, moving of buildings and heavy machinery without regard to injuring pavements, the burning of rubbish and the mixing of building materials on pavements. The worst of these is the cutting of the pavement by plumbers and utilities. The best solution of this problem, he believes, is to require them to make a cash deposit with the city which deposit is expended in making the necessary repairs by the city's skilled workmen. "Mixing concrete or mortar or building fires on pavements," he says, "should be made a misdemeanor."

A paper presented by C. C. Witt on the work of the Engineering Department of the Public Utilities Commission was especially interesting and brought out a good discussion. Clinton S. Burns in a paper on "The Management of City Utilities and Their Valuation," ably discussed the fundamental principles of making public utility valuations and the advantages of valuations and the factors necessary to insure successful, economical operation of these utilities.

The merits of the different systems of irrigation, especially those used in Kansas, were discussed by J. W. Mavity. The velocity of the flow of the Kansas River was treated in a paper read by V. R. Parkhurst. In a paper presented by W. J. Arnold, he recommended that the state make careful investigation of flood protection and the conservation of the excess water. H. B. Walker's paper on "The Engineering of Tile Drainage" should be of great value to the members who have not had a large experience in this work.

A paper presented by S. C. Loper on "The Contamination of City Wells" dealt with a series of examination made on fifty wells in the city of Lawrence and the deplorable condition he found in many cases. He also cited a number of other examples to verify the general statement that contamination of wells is in proportion to the density of surrounding life.

"The Use and Abuse of Sewage Disposal Plants" was discussed by C. A. Smith. He made a strong plea for the members of the Society to aid the State Board of Health and in closing, said: "With your help and that of the State Board of Health sewage disposal plants will be understood and properly taken care of; the profession and science will be advanced and the state and municipality will be greatly benefited."

A. A. Potter ably discussed the relative efficiencies of the different prime movers for electric power plants. He stated that each type of prime mover has its field of application in the generation of electricity and that no one of the commercial types will supplant all others for all purposes.

In a paper by R. S. Filkin it was urged that better system and organization on private and public work be established by engineers. J. S. Worley presented a paper on "Conservation and the Engineer." He urged that engineers should be leaders by reason of their special training in this great movement.

The retiring President, W. C. Hoad, gave an address on "The Spirit of Public Service in Engineering." He believes the cultivation of the spirit of disinterested service will bring its sure reward to the profession as a whole as well as to the individual members of it; that it is this rather than by the machinery of legislation or by the devices of the labor union that the standing of the profession and its reputation with the public can be most surely advanced and that the success that will come from this spirit of altruism will be of the highest type.

The election of officers resulted as follows: President, R. V. Leeson, Topeka; Vice President, J. M. Meade, Topeka; Secretary-Treasurer, W. S. Gearhart, Manhattan.

PERSONALS.

Mr. A. G. Baker has been appointed Chief Inspector of Streets of Pomona, Cal.

Mr. J. R. Gilhula, Superintendent of the Illinois Traction System at Springfield, Ill., has resigned.

Mr. E. P. Roberts, President of the Cleveland Engineering Society, has been appointed City Smoke Inspector.

Mr. Walter L. Drager has been appointed Assistant Engineer of the Department of Public Works at Schenectady, N. Y.

Mr. H. E. Phelps has been appointed City Engineer of Boulder, Colo., succeeding Mr. Fred R. Dungan, who has resigned.

Mr. William Jager, a prominent contractor of Bismarck, N. D., was killed Feb. 3 by the accidental discharge of a revolver.

Mr. Stoddard Jess has resigned as President of the Harbor Commission of Los Angeles, Cal., because of the pressure of private business.

Mr. W. A. Cross, formerly of Warren Brothers Co., Boston, Mass., has become a member of the Concrete Engineering Co., 141 Milk St., Boston, Mass.

Mr. W. O'D. Rockwell, formerly Assistant City Engineer, has been appointed City Engineer of Savannah, Ga., succeeding Mr. J. W. Howard, who has resigned.

Mr. Walter F. Brooks was appointed by the State Highway Commission as State Engineer of Highways in Blue Earth and Faribault Counties, Minnesota.

Mr. H. G. Smith, Formerly Assistant City Engineer of Salt Lake City, Utah, has taken a position in the engineering department of the Oregon Short Line R. R.

Mr. E. L. Cousins, formerly Railway and Bridge Engineer of Toronto, Ont., has left the city's service to become engineer for the Board of Harbor Commissioners.

Mr. Gervaise Purcell, Consulting Civil Engineer, has moved his offices to Rooms 1030 and 1031, Union Oil building, corner Spring and Seventh streets, Los Angeles, Cal.

At the annual meeting of the Canadian Society of Civil Engineers, held in Montreal on January 26, Mr. Wm. F. Tye was elected President, and Mr. Henry H. Vaughan, Vice-President.

Mr. J. C. Doxsee, Manager of the Horton Concrete Co., Kansas City, was killed by a switch engine while superintending work his company was doing for the Kansas City Terminal Co.

Mr. Alfred Solano, Consulting Engineer, has moved his office from Suite 902 Broadway, Central Building, to Suite 841 Title Insurance Building, corner Fifth and Spring streets, Los Angeles, Cal.

Mr. Ralph Bennett has resigned as Chief Engineer of the Great Western Power Co., San Francisco, to accept the position of Chief Engineer of the Dominguez Land Company, Title Insurance Bldg., Los Angeles.

Mr. Wm. Whitenton, General Manager of the Third District of the Chicago, Rock Island & Pacific R. R., with headquarters at Fort Worth, Tex., comes to Chicago as General Manager in place of Mr. Tinsman, promoted.

Mr. W. H. Tiedemann has been appointed Principal Assistant Engineer of the City of Seattle. Other appointments are Mr. C. B. George, Mr. O. A. Piper, Mr. W. O. Thompson and Mr. I. W. Embury, all District Engineers.

Mr. Everett K. Murray, connected for some time with the engineering corps of the Kansas City Terminal Railway Co., has been appointed by the Kaw Valley Drainage Board as Chief Engineer in charge of the work along the Kaw River.

Mr. John A. Fox has been appointed Commissioner at Large of the Panama California Exposition to be held at San Diego, Cal., in 1915. For a number of years Mr. Fox was an engineer engaged in levee work on the lower Mississippi River.

Mr. Charles Brinkley has been appointed Superintendent of Roads and Inspector of Bridges of Marion County, Indiana. This is a newly created position, the duties of which are to direct and inspect the work of the road supervisors.

Mr. A. Irving Brewster, formerly Editor "Insurance Engineering," has opened an office at Richmond Hill, Long Island, New York, and will accept assignments for the preparation of special articles relating to fire protection engineering.

Mr. D. W. Stradling, formerly Assistant Engineer, City of Indianapolis, has been appointed Assistant Professor of Civil Engineering at the University of Kansas at Lawrence, Kan., where he will have charge of the Railway Engineering courses.

Mr. H. D. Chapman, City Engineer of Richmond, presented his resignation at the meeting of the City Council January 29 and asked that immediate action be taken, as he had other business matters requiring his attention in San Francisco.

Mr. C. W. Powers, Resident Engineer of the Middle Division of the Grand Trunk Railway Co., has been appointed by City Engineer Rust to succeed Mr. E. L. Cousins as Railway and Bridge Engineer in the City Engineer's department of Toronto, Ont.

Mr. Charles F. Breitzke has resigned his position as Assistant Engineer with the New York Board of Water Supply and is now associated with Messrs Johnson & Fuller, Consulting Engineers & Sanitary Experts, 150 Nassau Street, New York City.

Mr. Semple S. Scott and Mr. H. Rose announce the organization of the Scott-Rose Company, with offices at 1651 Marquette Bldg., Chicago. They are prepared to serve clients as engineers in technical, mechanical, automobile and manufacturing.

Mr. R. V. Leeson of Topeka has been elected President of the Kansas Engineering Society. Other officers are: Vice President, J. M. Meade, Topeka; Secretary-Treasurer, W. S. Gearhart, Manhattan; Directors, H. A. Rowland, McPherson, and W. C. Hoad, Lawrence.

Mr. Lee D. Fisher, Chief Engineer of the Joliet & Southern Railway, died at Joliet on Feb. 8. Mr. Fisher was a young man and his death is said to have been the result of a nervous breakdown due to overwork. He has been Chief Engineer of the road since its incorporation.

Mr. Augustus Bouldin, City Surveyor of Baltimore, Md., for the past fourteen years, died at his home on February 7 as a result of heart failure. He was 82 years old. Mr. Bouldin was born in Baltimore in 1829 and his father and grandfather were City Surveyors for the city in their time.

Mr. W. B. Gatewood, Cincinnati, Ohio, has been appointed Division Engineer of the Chicago Division of the Chesapeake & Ohio R. R. Mr. Gatewood has been connected with the road for a number of years, and since 1910 has been in charge of the track-laying on the Chicago Division.

Mr. L. L. Griffiths has resigned his position as General Superintendent of the Texas Portland Cement Co. and opened up an office in Dallas, Texas, as President of the L. L. Griffiths Engineering Co., consulting, civil, mechanical and electrical engineers. Mr. Griffiths is retained by the Texas Portland Cement Co. as Consulting Engineer.

Mr. Wm. P. Parker has been appointed Engineer of Construction of the Galveston Causeway at Galveston, Texas, by the Board of Engineers representing the various interests concerned. Mr. Parker has been serving as Chief Engineer of the A. M. Blodgett Construction Co., contractors on the work, since the commencement of construction.

Mr. A. H. Koebig and Mr. A. H. Koebig, Jr., Consulting, Hydraulic & Civil Engineers, announce the removal of their offices from 902 Broadway, Central Building, to Suite 841 Title Insurance Building, Los Angeles, California, where they will continue in the general practice of engineering under the firm name of Koebig & Koebig.

Mr. Russell S. Greenman was elected President of the Albany Society of Civil Engineers at the annual election held in Albany, N. Y., Jan. 30. Other officers are as follows: C. C. Covert, First Vice President; Emory E. Bransow, Second Vice President; A. H. Parthesius, Third Vice President; Edward H. Sargent, Treasurer, and Clark Brown, Librarian.

Mr. Chas. Booth, who has been connected with the Chicago Pneumatic Tool Co. since its organization, has been appointed District Manager of the company's New England territory, with headquarters at 191 High St., Boston, Mass., vice J. M. Towle, resigned. Mr. Booth, up to Sept. 1, 1911, was Vice President of the company, at which time he was compelled to resign owing to ill health.

Mr. Geo. W. Patnoe, who has been connected with Dolese & Shepard of Chicago as Master Mechanic, resigned on Feb. 1st. Mr. Patnoe has taken an interest in the Holarn Stone Company at Cleveland, Ohio, and will assume the management of the company's affairs. Mr. Patnoe has, except for a four year period when engaged elsewhere, been connected with the Dolese & Shepard Company for 30 years.

Mr. Samuel H. Lea, State Engineer of South Dakota, and party recently inspected a new mountain road constructed a few miles out from Deadwood. The trip was made in sleighs in a blinding snowstorm, but was worth the discomfort, as an organization was later effected comprising an interstate road association to construct a road across South Dakota and Wyoming from Minnesota to the Yellowstone National Park. Mr. Lea read a paper at the meeting descriptive of the proposed road.

Mr. S. L. Fuller, formerly President and General Manager of the Friday Contracting Co., has been appointed as General Superintendent of the C. M. Neeld Construction Co., Oliver building, Pittsburgh, Pa. Mr. Fuller's wide experience, including the construction of some of the long span reinforced concrete bridges, will prove a valuable addition to the firm. The C. M. Neeld Construction Co. was organized last year to carry on a general contracting business, covering complete factory buildings, bridges, reinforced and plain concrete construction in general.

Mr. John V. Hanna, Chief Engineer of the Kansas City Terminal Railway Co., was elected President of the Kansas City Engineers' Club at the recent annual dinner. The other new officers elected are Mr. S. Waters Fox, Consulting Engineer, Vice President; Mr. Louis H. Egan, General Manager of the Kansas City Electric Light & Power Co., Secretary and Treasurer; Mr. Wynkoop Kiersted, Consulting Engineer, Second Vice President; Executive Committee are H. P. Treadway, Vice President Kansas City Bridge Co., J. S. Tritle, District Manager Westinghouse Electric Co., Arthur C. Everham, Assistant Chief Engineer Kansas City Terminal Ry. Co.

Mr. A. C. Ridgeway, Assistant to the late F. O. Melcher, Second Vice President of the Rock Island R. R., whose death in the Illinois Central railway wreck was noted in a previous issue, has been appointed Acting Second Vice President in charge of operation. Mr. Ridgeway came to the Rock Island from the Denver & Rio Grande two years ago, as Assistant General Manager. He had been Vice President and General Manager of the Rio Grande. Within a year he was appointed Assistant to the Second Vice President in charge of maintenance on system lines. Mr. W. S. Tinsman, General Manager of the Rock Island, has been promoted to Assistant to President H. W. Mudge. He will have charge of special work.

Mr. F. P. Gutelius, Chief Engineer of the Canadian Pacific, and Mr. George Lynch Staunton, K. C., of Hamilton, are expected to be named as a royal commission to investigate the expenditures on the National Transcontinental Railway to determine whether there has been a waste of public money as charged by the Conservatives when in opposition. The matter was discussed by the Cabinet on January 27 and the appointment practically agreed upon. The task will be a long and laborious one and they will be empowered to secure the assistance of all necessary help from experts, engineers, etc. Their report will doubtless not be completed until next year. Investigations will have considerable bearing on the suit now pending in the Exchequer Court to determine the rights of the contractors to recover upward of half a million dollars, which they claim has been illegally withheld by the commission in consequence of the report of the board of arbitrators as to over classification, etc.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING & CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Tools, paper, 6x9 ins., 32 pp. H. Channon Company, Chicago, Ill.

This contains illustrations and descriptions of contractors' tools and equipment. It is the regular monthly edition of Channon's Review.

Blystone Batch Mixer, paper, 6x9 ins., 24 pp. Blystone Machy. Co., Cambridge Springs, Penna.

This catalog contains illustrations and descriptions of the Blystone Batch Mixer containing the reverse spiral paddle system. Complete details are given. The catalog also shows gasoline engines, portable and stationary, and letters from users.

Goodwin Cars, paper, 6x9 ins., 64 pp. Goodwin Car Company, 96 Fifth Ave., New York City.

This catalog contains illustrations, dimensions and descriptions of the Goodwin Patent Dump Cars with line drawings showing their operation and a number of illustrations showing the cars engaged in various railway work. This is Catalog G.

CONTRACT NEWS SECTION
of
ENGINEERING & CONTRACTING

The Doings of the Week.

The past few days have seen the letting of many large railroad construction contracts, and the shaping up of much other work which will come up for letting in the new future. Many good prospects are now in view and judging from the happenings of the past week it looks now as though the present season will be the best ever. Two of the largest railroad jobs of the year have been let since our last issue. One of these was the work of constructing the Point Defiance line of the Northern Pacific in the state of Washington. This was a very large contract, involving some tunnel work, and something like 8,000,000 cu. yds. of excavation. Porter Bros., Portland, Ore., secured this work. The other large piece of work was the letting of contracts by the Louisville & Nashville R. R. for about 100 miles of its new Lewisburg & Northern line. These contracts will total about $7,000,000. Additional ones are to be let which will bring the total outlay for this road to about $13,000,000. Among the contractors who got in on this work are the following: Six miles south of Lewisburg, Tenn., W. J. Sparks, of Mount Vernon, Ky.; six miles more below Lewisburg, Leighton & Ambrose Co., of Knoxville, Tenn.; six miles at Holmes Gap, Ala., Langhorn & Waugh, of Lynchburg, Va.; ten miles at Cullman, Ala., J. C. Carland & Co., of Toledo, O.; ten miles at Hanceville, Ala., Anderson & Sullivan, of Louisville, Ky.; ten miles at Blount Springs, Ala., Thrasher & Hunter, of Knoxville, Tenn.; six miles at Warrior, Ala., the Callahan Construction Company, of Knoxville, Tenn., and six miles at Morris, Ala., the Ashville Dray & Fuel Co., of Asheville, N. C.

Among the other railroad construction contracts let recently are the following: M. W. Barnard, Minneapolis, Minn., for 25 miles of railroad for the Minnesota & Ontario Power Co., commencing at Little Fork, Minn., and running due south; M. E. Elkan, Macon, Ga., for constructing about 8,500 ft. of belt line at High Point, N. C., for the Southern Ry.; Foley Bros., Welch & Stewart, St. Paul, Minn., for finishing the grading for the branch line of the Minneapolis, St. Paul & Sault Ste. Marie Ry. from Fordville to Drake, N. Dak., 130 miles; McMillan Bros., 180 Maryland St., Winnipeg, Man., sub-contract from J. D. McArthur for 185 miles of the Hudson Bay Ry., commencing at LePas and extending eastward to a point west of Split Lake; Guthrie & McDougall, St. Paul, Minn., for elimination of curves on the Great Northern Ry. between Sandpoint and a point beyond Albany Falls, Idaho, a distance of 735 miles.

The principal news in the way of drainage work is the awarding of contracts for the 14,000,000 cu. yds. of excavation required for the construction of the system for Drainage District No. 9 of Mississippi County, Ark. These contracts were awarded as follows: George W. McCarter, Warsaw, Ind., contracts 1 and 2, 1,891,900 cu. yds.; Engel Bros., Nettleton, Ark., contract 3, 799,300 cu. yds.; Forestal & Fegan, St. Paul, Minn., contract 4, 607,500 cu. yds.; National Drainage Co., Alexandria, Minn., contract 5, 1,598,400 cu. yds.; Otto Kochitzky, Cape Girardeau, Mo., contracts 6, 8, 11, 12 and 15, 5,389,400 cu. yds.; J. S. Kochitzky, Cape Girardeau, Mo., contract 7, 823,800 cu. yds.; R. H. & G. A. McWilliams, Chicago, Ill., contract 9, 100,000 cu. yds.; National Drainge Co., Alexandria, Minn., contract 10, 949,400 cu. yds.; Foohey Dredging Co., Fort Wayne, Ind., contracts 13 and 14, 1,481,400 cu. yds.; Forestal & Feyen, St. Paul, Minn., contract 16, 252,200 cu. yds. The state of Maryland is now taking steps for the drainage of its swamp lands, and a bill is now before the legislature which will further the reclamation of part of the 328,000 acres of land in Maryland now too wet for agricultural use. The bill creates "drainage districts," and provides means by which all the lands within a prescribed boundary may be brought into a compact for the common good, including the right of condemnation for the right of way for all main drains and ditches, and for the widening or straightening of natural water courses.

It looks now as though the Canadian Government was planning to start construction work this spring on the new Welland Canal. It is believed that the supplementary estimates which are to be submitted to the House of Commons in a few days will contain a large item for this. Surveys have been under way for some time with a view to locating a new route and getting accurate estimates as to the cost, and it is likely that construction work will be started in the spring. Plans for the construction of the new canal, which will be the largest national undertaking since the National Transcontinental Railway was inaugurated, are now nearly completed. The total cost will, it is estimated, be in the neighborhood of $30,000,000.

In the way of highway construction the largest job coming up for letting in the near future appears to be the one for Dallas County, Texas. Bids are now being asked by the County Auditor at Dallas for improving four main and eight secondary roads of the county.

Something Doing.

Even a confirmed pessimist will have to acknowledge that the developments of the past few weeks indicate that there is something doing at least as far as the railroad construction field is concerned. Early in the year came the awarding of contracts by the Muskogee, Oklahoma & Gulf Ry. for some 300 miles of new line in Oklahoma and Texas. Then came the awarding of the contract for the construction of the Port Defiance line of the Northern Pacific, and now, as noted elsewhere in this issue, we have the awarding of contracts by the Louisville & Nashville for some $7,000,000 worth of double track work. This L. & N. contract is the largest one so far this year. It means the actual beginning of a $15,000,000 improvement undertaken by this road, which will eventually double track its lines below Birmingham, Ala., to the gulf coast. Sure there is something doing already, and every indication points to the fact that there will be much more during the next few weeks. If present plans are carried out, the Grand Trunk Ry. will begin work on a new line in New England from Palmer, Mass., to Providence, R. I., and a new line from Windsor, Vt., to Brattleboro, Va., and the Boston & Maine will commence some expensive cutoffs to offset the new Grand Trunk lines; the New Orleans, Mobile & Chicago will build new connecting lines which will give the Frisco a through route from Chicago to the gulf; the Minneapolis & St. Louis and the Iowa Central will commence construction on several extensions; the Norfolk Southern will begin the building of new lines to connect up several short railroads acquired recently; the Delaware, Lackawanna & Western R. R. will have work started next month on the construction of a 30-mile cutoff in Pennsylvania, which will involve the expenditure of about $15,000,000; and the Carolina, Clinchfield & Ohio Ry. will start work on its northern extension from Dante, W. Va., to Elkhorn City. The work of these few railroads above will call for the expenditures of something like $100,000,000. It would seen that the present season will be one in which the contractors will not be hunting for the jobs; instead the jobs will be hunting for contractors.

The Hobo's Warning.

Everybody that has had anything to do with the hobo has learned that he is amply able to take care of himself and defend his rights with a club, if necessary, or with the pen, as the following pome goes to show. This touching little ode was composed by some unknown bard who labored repairing roads in connection with the building of a power plant in California, for which the Mr. Hollingsworth mentioned in the verse was the superintendent of construction. The cause of the poetical outburst was an order that all workmen were to be at their work ready to start at 7 a. m. instead of leaving the camp at that time as previously had been the custom. This order was tacked on the bulletin board at the camp, and a few days later the following poem written with a pencil on a piece of paper bag was found pinned up beside the order:

There's a notice on the wall
  That's a warning plain to all
That our hours of toil are daily growing longer,
  Now that muckers are so thick
They are trying a new trick
  To rub it into us a little stronger.

But they will sing a different tune
  When the balmy days of June
Lure the mucker from his daily grind of labor;
  Then while Mike and Pat will rest
Drinking nothing but the best,
  Mr. Hollingsworth will write another order.

It will say "We'll raise your pay
  If you stiffs will only stay
Till we get our new power plant completed";
  But our memory will recall
How they used us other last fall
  And the ranks of labor will remain depleted.

So take warning Mr. Super—
  Please recover from your stupor,
And give us a square deal, one and all;
  Then we'll stay with you all summer
Instead of going on the hummer,
  And not quit you until the leaves begin to fall.

Social Engineers.

The Civic Center Committee of Berkeley, Cal., has opened up a new field of "Engineering." The Committee has voted to arrange for the hiring of a "social engineer," a man who would devote all of his time and energy to interesting the whole city in civic projects. It was stated that since the organization of the Civil Center the Committee work had become such an important factor in city affairs that the employment of a paid head was now necessary. It is proposed to have the "social engineer" arrange for public lectures, school room entertainments and the like.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

⦿ The Louisville & Nashville R. R. has awarded some extensive contracts for work on its new Lewisburg & Northern R. R. These contracts aggregate some $7,000,000 and cover 100 miles of the new 233-mile line. The contracts cover the heavy work and it is expected that additional contracts for the remainder of the line will be let by the time this appears. Among the contractors who secured the heavier work are the following:

W. J. Sparks, Mt. Vernon, Ky., 6 miles below Lewisburg, Tenn.

Leighton & Ambrose, Knoxville, Tenn., 8 miles out of Lewisburg

C. G. Kershaw Contracting Co., Birmingham, Ala., work at Hartsella Cut.

Langhorn & Waugh, Lynchburg, Va., 6 miles at Holmes Gap, Ala.

J. C. Carland & Co., Toledo, O., 10 miles at Cullman, Ala.

Anderson & Sullivan, Louisville, Ky., 10 miles at Hanceville, Ala.

Thrasher & Gunter, Knoxville, Tenn., 10 miles at Blount Springs, Ala.

Callahan Construction Co., Knoxville, Tenn., 6 miles at Warrior, Ala.

Asheville Dray & Fuel Co., Asheville, N. C., 6 miles at Morris, Ala.

The W. J. Sparks Co. has already sublet the concrete work on its contract to Frank Longmire, Mt. Vernon, Ky. The Leighton & Ambrose contract calls for about 500,000 cu. yds. of excavation and 9,000 cu. yds. of concrete. John Howe Peyton, Louisville, Ky., is Chief Engineer of the Lewisburg & Northern R. R.

The Tennessee, Alabama & Georgia Ry., E. F. Blomeyer, General Manager, Chattanooga, Tenn., will, it is believed, have construction work started the latter part of this month on its Birmingham and Atlanta extensions. The Birmingham & Chattanooga R. R. Co. has been incorporated as a preliminary step toward building the extension.

Regarding the projected extension of the New Orleans, Mobile & Chicago R. R., W. F. Owen, President, Mobile, Ala., now owned jointly by the Frisco and the Louisville & Nashville R. R., it may be stated that it is proposed to extend the line from Beaumont north of Mobile, about 70 miles to a point on the Louisville & Nashville near New Orleans, entering the city over Louisville & Nashville tracks; from Middleton, Tenn., to Lexington, Tenn., 50 miles, connecting with the Nashville, Chattanooga & St. Louis (Louisville & Nashville system); and from Paducah, Ky., to the Ohio River opposite Joppa, Ill., connecting at Joppa, via a proposed new bridge, with the Chicago and Eastern Illinois (Frisco System), and thus giving a direct through line from Chicago to New Orleans, or only 40 miles longer than the present Illinois Central route.

Arkansas.

The Missouri & North Arkansas R. R., E. M. Wise, General Manager, Eureka Springs, Ark., is reported to be planning securing an entrance to Memphis. It is believed that this will be done by a trackage arrangement with the Rock Island. If this cannot be obtained, it is understood that the Missouri & North Arkansas will construct 50 miles of new from Wheatley, Ark.

The Chicago, Rock Island & Pacific Ry. is understood to have tentative plans under consideration for the construction of shops and the enlargement of track facilities at Hulbert, Ark., a new town across the river from Memphis. It is thought that the shops will cost about $300,000, and that the expenditure will be included in the general bond issue recently made by the railroad for the purpose of improvements and the construction of a bridge at Memphis.

The Jonesboro, Lake City & Eastern R. R., W. H. Smith, General Manager, Jonesboro, Ark., has purchased the Wilson Northern Ry., running from Ross to Wilson. This road has been operated by the Jonesboro, Lake City & Eastern R. R.

The Chamber of Commerce, Pine Bluff, Ark., has received a proposition from A. B. Newman, Chicago, Ill., who recently purchased the holdings of the Clio Lumber Co., Clio, Ark., including the Anderson & Saline River R. R., to extend the line operating from Clio, Ark., to Millersville, Ark., to connect Pine Bluff and Leola, on the Rock Island.

The Wallace Construction Co., which has the contract for laying the track for the Fort Smith & Van Buren Ry., is reported to be making rapid progress, having finished the line to the proposed factory colony 2 miles north of Fort Smith.

At a recent meeting of the Board of Trade, Little Rock, Ark., Col. C. C. Godman, Fort Smith, Ark., presented his proposition for the construction of a 25-mile line north from the city. The town of El Paso, White County, has offered to furnish a cash bonus of $10,000 and right of way across the county providing the line will be built through that place or within a reasonable distance of it.

The Chamber of Commerce of Pine Bluff has a campaign under way to raise $300,000 with which to buy bonds in the several railroad enterprises now practically assured to Pine Bluff. The propositions contemplate a terminal association which is to hold terminal facilities for the various railroads now projected; a railroad south from Pine Bluff to connect with the Rock Island at Leola, and a railroad north from Pine Bluff to extend to Searcy, White County. The north line is promoted by Walter J. Miller of Lamar, Mo., prominent in St. Louis life insurance company circles. The south line is projected by Ben J. Altheimer of Chicago and Pine Bluff, incident to the recent acquisition of two lines south of Pine Bluff which would be links in the road. These lines were acquired by Chicago capitalists recently.

California.

The Business Men's Association of Martinez, Calif., is reported to be heading the movement and is willing to finance the project including the construction of a railroad along the water front to Bay point, a distance of 7 miles.

The Laton & Western R. R. is reported to have placed a bond issue of $200,000 for the extension of the road from Lanare to a point 10 or 15 miles west. The extension will cost about $15,000 per mile. L. A. Nares, Fresno, is President and S. Tielman is Engineer.

Construction work has been started on the railroad being built to Big Creek for the Pacific Power & Light Co. This road will be used to transport materials for the power plant now under construction for the power company. The road will connect with the Southern Pacific at Gordon Switch, about five miles east of Clovis, and will run along a new survey to a point four miles above Auberry, where it will connect with the Big Creek wagon road. The distance from Gordon to the connection with the wagon road above Auberry is about 30 miles. It is proposed to revise the grade of the wagon road and convert this into a right of way for the railroad, for with the completion of the railroad there will be no further need of the wagon road. Work on the altering of the wagon road will not be started until the first 30 miles of steel has been laid. An appropriation of $750,000 has been made for the railroad. The Stone & Webster Engineering Corporation is in charge of the work. J. M. Thebo is Chief Engineer. Construction offices are in the Forsyth Bldg., Fresno

The Pacific Electric Ry. Co., Geo. E. Pillsbury, Chief Engineer, 6th and Main Sts., Los Angeles, has preliminary surveys under way for an air-line railway from Monrovia to Dominguez for freight carrying alone. It is believed that as soon as the necessary plans and profiles are finished, the work will begin. The new line will come from Monrovia, tapping the Azusa district and the proposed San Bernardino extension of the system, crossing the present Covina line and the proposed Riverside connection, at or about the San Gabriel River station; the Whittier line at or near the Downey Road station; the Santa Ana line near Michigan avenue; then direct into Dominguez Junction, thus giving the company a direct line across all of its eastern branches into San Pedro, the Los Angeles harbor, and obviating the transfer and rehandling of freight of all kinds from the points reached by these lines, in Los Angeles.

Central America.

The firm of C. G. Young, Engineering and Construction, 60 Wall St., New York City, has been engaged to make an examination and report for a proposed electric railway system in Central America, due to Mr. Young's very extended experience in the electric railway field not only in this country but in Central and South America and many other foreign countries. One of the firm's engineers has sailed to make a study of the local conditions.

Colorado.

The Colorado-Kansas R. R. Co., Central Block, Pueblo, Colo., has completed some 12 miles of track for its Turkey Creek line, and expects to have the additional 11 miles completed early in the spring. At the recent annual stockholders' meeting it was stated that the company was planning to build out of Pueblo in other directions. The officers of this company are as follows: President, E. W. Wilson, Pekin, Ill.; First Vice President, Charles E. Sutton, Lawrence, Kas.; Second Vice President, C. W. Crews, Pueblo; Secretary, F. G. Kelley, Pueblo; Treasurer, Andrew McClelland, Pueblo.

The Chambers of Commerce, Sheridan, Wyo., and Denver, Colo., will probably cooperate in making an effort to have the Colorado & Southern and the Burlington "Gulf-Sound" line pass through Sheridan or to have the Denver, Laramie & Northwestern road take in Sheridan when it reaches that vicinity

It is rumored that the Union Pacific will extend its line from Fort Collins, Colo., to Hermosa connecting the main line at that point with the district terminals in that city and at Fort Collins.

It is reported that the Uintah R. R., extending from Mack, Colo., to Watson, Utah, a distance of about 50 miles, is planning the construction of an extension to Vernal, Utah, a distance of 50 miles. M. W. Cooley, Mack, Colo., is General Manager of the company.

It is expected that the Denver & Rio Grande R. R., J. G. Gwyn, Chief Engineer, Denver, Colo., will be in the market shortly for $5,000,000 to be expended in reducing grades and in standardizing narrow gage lines.

An agreement has been reached between the Burlington and the Union Pacific for the joint use of Blake and Market Sts., at Denver, for trackage purposes, and an ordinance has been introduced in the city council granting the Burlington the right to lay tracks on Walnut and Market, from 36th to 20th Sts. The construction will be begun as soon as the permit is granted. The Burlington and Union Pacific will share jointly the expense of the new tracks and will use them jointly. A bonus of $50,000 will be given the city for the permit. Storm sewers will be built and street paving done by the roads at a cost of $105,000. About $50,000 will be paid to property owners as rebates on special assessments for street improvements along the street where the tracks will be laid. The track itself will cost about $40,000, making the total cost $245,000. The Burlington has already spent $185,000 for

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

right-of-way from Sand [illegible] will meet the track at Walnut street.

Florida.

The main line of the Atlantic, Okeechobee & Gulf Ry. has been surveyed to Arcadia, Fla., and engineers are now at work laying out terminals, etc. From Arcadia the survey will be taken up and carried to Fort Lauderdale on the East Coast by way of Fort Thompson. One hundred and eighty miles of roadway has been surveyed. Of this 80 miles is on the main line, the balance on branch lines. Hiram McElroy is Chief Engineer of the company.

Georgia.

The Albany Terminal Co., Albany, Ga., has applied to the railroad commission for the approval of an issue of $15,000 stock to provide funds for the company's share of the expense of building a new depot at that place.

Idaho.

⊙The Great Northern R. R. has let the contract for the elimination of curves on the main line between Sandpoint and a point beyond Albany Falls, Idaho, a distance of 35 miles, to Guthrie & McDougall, St. Paul, Minn. Work will be started at once and not only will the curves be eliminated, but the sags will be taken out and the track will be raised to prevent any trouble from floods. A maximum curve of 3 per cent will be established and the grade line will be made uniform. The improvement will necessitate an expenditure of about $1,000,000.

The Oregon Short Line R. R. is understood to be contemplating extending its branch line, now reaching Rogerson, from the latter place to Contact, 35 miles. It is believed that the work will be undertaken this spring.

The Pacific & Idaho Northern Ry., L. Highley, Chief Engineer, New Meadows, Idaho, has filed an application and plats at the land office in Boise for extension of its right of way from Meadows to Riggins, in Idaho County, a distance of 35 miles.

Illinois.

Engineering Department of the Wabash R. R., C. V. Marshall, Engineer Maintenance of Way, Decatur, Ill., has submitted plans and specifications to the city commissioners of Springfield for a subway at Cook St. These are understood to be satisfactory to the city, and it is believed that construction work may be started early in April.

Plans for the construction of the proposed bridge at Metropolis, Ill., 12 miles below Paducah, Ky., by which five railroads will enter Paducah, are understood to have advanced far enough so that bids are being asked until March 15 for the construction of the bridge. It is reported that the plans include the build-ng of a union depot at Paducah, the con-struction of $1,000,000 yards and extensive hops. The railroads interested are the Chi-ago, Burlington & Quincy R. R., Illinois Cen-ral, Frisco, Louisville & Nashville and Big Four.

The Hillsboro Ry. Co., of Hillsboro, Ill., ias been incorporated with a capital stock of 50,000 and proposes to build and operate an lectric line. The incorporators are J. J. Frey, ames P. Brown and Frank H. Brown.

The Chicago, Joliet & Kansas City R. R. Co. has been incorporated with a capital stock f $5,000 and proposes to construct a line from hicago west to Keithsburg, Ill., and from ockford to Peoria. The incorporators are Villiam Garnett, Cyrus W. George, George I. Wilkins, R. W. King and Dion Geraldine, ll of Chicago.

The Keokuk, Nauvoo & Fort Madison Elec-ric Ry. Co., incorporated recently, as noted n our Jan. 17 issue, has completed its organi-ation by the election of the following offi-ers: President, Charles H. Petsch, of St. aul, Minn.; Vice President, Charles S. Crass-allen, of Jersey City, N. J., connected with he Commercial Trust Co.; Secretary, Palmer ushing, of New York City; Treasurer, E. C. isher, of Nauvoo. The issuance of $450,000 f bonds was authorized and the president was instructed to negotiate for construction [illegible]

The Chicago & Joliet Electric Ry. Co., J. R. Blackhall, General Manager, Joliet, is plan-[illegible] for the present season.

The Mount Greenwood & Worth Traction Co., of Chicago, has been incorporated with a capital stock of $10,000,and proposes to construct and operate street railroads. The incorporators are Jacob S. Hovland, Herbert W. Drew and John L. Poulton.

The East St. Louis & Interurban Ry. Co., of East St. Louis, is to apply to the council of that city for a franchise to lay tracks along St. Louis Ave. from Third St. to the city limits; Eighth St. from Trendley Ave. to Exchange Ave.; Tenth St., from Converse to Baker Ave., and Trendley Ave., from Baker to near Eleventh St.

The second track work for which the Wabash R. R. is to expend $2,954,500, as noted in our last issue, is understood to include the following: Oakwood to Romulus, Mich., 11 [illegible] $134,000 [illegible] Ohio, 11 miles, $146,000; Decatur to Knights, Ill., three miles, $46,000 (with gauntlet on bridge over Sangamon River); Taylorville to Litchfield, Ill., 32 miles, $552,000; Clarke Junction to Gary, Ind., five miles, $51,000; Worth to Orland, Ill., five miles, $370,000 (the double tracking in this case includes grade reduction and line revision); Bement to Lodge, Ill., 13 miles, $208,000; Bement to Tolono, 13 miles, $170,000; Fairmount to Danville, Ill., 11 miles, $143,000; Danville, Ill., to State line Indiana, five miles, $65,000; Poag to Worden, Ill., 15 miles, $210,000; Moberly to Clark, Mo., 11 miles, $147,000; Moberly to Huntsville, Mo., six miles, $84,000; Brunswick to Salisbury, Mo., 18 miles, $288,000; Excelsior Springs Junction to Birmingham, Mo., 14 miles, $237,000; Fort Wayne to New Haven, Ind., five miles, $73,000; Fort Wayne to Hugo, Ind., two miles, $30,000.

Kansas.

The Wichita Terminal Association, Ransom Stephens, Superintendent, Wichita, is to expend $20,000 within the next three months for improving trackage facilities at Wichita.

A considerable part of the grading work for the Dodge City & Cimarron Valley Line of the Santa Fe has been sublet and several outfits are moving onto the work. A large amount of material for this new line has been stored at Dodge City and Newton. Ransom & Cook, Ottawa, Kan., have the general contract for the grading of this line, and have opened an office at Dodge City, Kan., for the work. This office is in charge of L. A. Ames.

The Wichita Falls & Northwestern Ry., which now has some 150 miles of new line under construction, has made a proposition to the Commercial Club of Dodge City. According to this, if Dodge City will give $2,000 per mile in bonds and bond the city for terminal facilities, the railroad will be built from Beaver County to Dodge City, crossing the Rock Island at Meade.

Kentucky.

Engineers of the Kentucky Southwestern Electric Railway, Light & Power Co. have finished the survey from Paducah to Bardwell, and have begun on the line to Hickman, Ky. The line west of Paducah extends through Grahamville, Ragland, Bandana, Oscar, Barlow and to Bardwell. W. A. Calhoun, Buffalo, N. Y., is Consulting Engineer for this railway.

Louisiana.

Surveys are to be started shortly, it is said, for the projected line of the New Iberia, Lafayette & Northern R. R. This company was chartered some time ago with a capitol stock of $1,000,000, and proposes to build a line from New Iberia to St. Martinville, Lafayette and Eunice. F. M. Welch is the promoter. E. L. Estorge, New Iberia, La., is secretary of the company.

The Opelousas, Gulf & Northeastern Ry., H. Flanders, General Superintendent, Opelousas, La., has closed a deal with parties at Rayne for a right-of-way over their land located between the Southern Pacific and the O. G. & N. E. Ry. at that place, the purpose being to establish an interchange between the two roads as ordered by the railroad commission.

Good progress is being made with the construction of the electric railway of the Southwestern Traction & Power Co., which is to run from Jeanerette through New Iberia to Spanish Lake. About three miles of roadbed below New Iberia had been completed on Jan. 1. The construction work is in charge of Harry K. Johnson of the Chatham Construction Co.

Maine.

Two parties are now in the field and it is expected to finish preliminary surveys in March for the proposed line of the Eastern Maine R. R. from Bangor to Houlton, Me. No estimates have been made as yet as to quantities and no date has been fixed for receiving bids, that being in the future. The directors hope to push the work along as fast as practicable. Frederic Danforth, Gardiner, Me., is Chief Engineer.

Maryland.

The Baltimore & Ohio R. R. is to expend about $400,000 at Cumberland within the year. The work will include the enlargement of its round house.

The Hagerstown Ry. Co., Henry Holzapfel, Jr., President, Hagerstown, Md., is planning to construct a $250,000 power house. It will probably be located on Antietam Creek, two miles east of Hagerstown.

A bill has been introduced in the Maryland Legislature asking for a continuance of the charter of the Deer Creek & Susquehanna R. R. This charter was granted in 1882 and would have expired by limitation this year. The road has the right to build anywhere in Harford County and to cross the Susquehanna River into Cecil County for a connection with any railroad on the east side of the river. It is believed that either the Pennsylvania or the Reading is interested.

Michigan.

Application has been made to the Muskegon County Supervisors by a syndicate of Muskegon and Chicago and New York capitalists for a street railway franchise.

A committee consisting of Joseph Sahlmark, J. H. Rye and H. C. Hutton, of Ludington, has been appointed to solicit funds for meeting Ludington's share of $700 for the survey of the proposed Muskegon, Ludington and Manistee R. R.

Minnesota.

⊙M. W. Barnard, Minneapolis, Minn., has been awarded the contract by the Minnesota & Ontario Power Co., for 25 miles of railroad, commencing at Littlefork, Minn., and running due South. The line runs through the muskeg swamps and is good station work. Two or three hundred men will be required for this work.

The Minneapolis & St. Louis R. R., R. G. Kenly, Chief Engineer, Minneapolis, Minn., is to issue $2,000,000 terminal bonds, which will be secured by the property of the Minneapolis Ry. Transfer.

The directors of the Chicago, St. Paul, Minneapolis & Omaha Ry., C. W. Johnson, Chief Engineer, St. Paul, Minn., have authorized the issuance of $5,000,000 of debenture bonds for improvements.

Mississippi.

The Louisville & Nashville R. R. is to build a spur track from Laine, Miss., to the site of the paper and pulp mill on the Escatawpa River, one mile north of the town. The route has already been surveyed and construction work will be started as soon as the right of way has been secured. R. W. Sistrunk, Bay St. Louis, Miss., is Assistant Engineer.

Macartney & Schley, bankers, Mobile, Ala., are stated to have acquired the holdings and contract of the proposed Meridian & Memphis R. R. Co., and are said to have everything in

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

readiness for building the road from Meridian to Union, Miss., a distance of 50 miles.

Missouri.

The Illinois Traction System, Peoria, Ill., has purchased the plant of the Jefferson City Light, Heat & Power Co. at Jefferson City, and is now understood to have negotiations under way for the purchase of the Jefferson City Bridge & Transit Co., which operates the street railway.

E. E. Young & Co., Rolla, Mo., have the contract for constructing 35 miles of grade south out of Rolla, Mo., for the Missouri, Arkansas & Gulf Ry. The contract includes 161,666 cu. yds. earth excavation, 323,334 cu. yds. embankment, four 175 ft. long bridges and 8,000 cu. yds. concrete masonry. J. B. Payne, Rolla, Mo., has a sub-contract on this work.

Kansas City, Mo., and Vicinity.

(REGULAR CORRESPONDENCE.)

⊙Considerable interest has been manifested by the Kansas City contractors over the contract on the Northern Pacific R. R. recently secured by Porter Bros. While the work is in the far west, the quantity (reported to be 8,000,000 yards) is so large that all our friends here are investigating the matter to some extent. And on top of this it will be remembered that Porter Bros. have been doing work on the Kansas City Southern R. R. for the past year and maintain an office here. Their subs on the Kansas City Southern have been so thoroughly satisfied with the generous treatment received by them here that it is no wonder these same contractors have been looking carefully over the western contract just secured.

⊙Sten Lund announces that he has sold his entire interest in the Pittsburg, Kan., coal stripping contract, report of which has been made in this paper heretofore, to his partner, Mr. Herman Sternberg. Mr. Lund, however, is still in the contracting business, and even before the above sale was announced he was in St. Paul and had secured a large contract of the Grand Trunk from the Simms-Carey Co. of that city. Mr. Lund will put a large plant on the new contract and expects to be ready to commence operations in the new field as soon as the season for work opens.

On account of the unusual winter we have been having in this section of the country, work on the St. Joseph and Excelsior Springs electric lines, now in the process of construction, has been very light indeed. Grading has been an impossibility except with steam shovels. As most of the work mentioned is a team proposition, it will be several weeks yet before a full force can be put to work.

The announcement that the Wabash receivers had been permitted to raise $10,000,000 to be used for betterment work has given added confidence to the railroad situation throughout this section. It is thought that a substantial portion of this money will be expended on Missouri lines and if that proves to be the case, it means much to the railroad contractors in and around Kansas City.

On top of the Wabash rumor comes the report that the McKinley system has taken hold of the Kansas City-St. Louis electric line project and will build the proposed line across Missouri. The report can not be verified at this time, but circumstances surrounding the case seem to point to the fact that the McKinley people will eventually put this project through.

A remarkable explosion of dynamite took place in the Porter & Clarkson camp at Jaudon, Mo., last week. Ninety-two cases of the explosive combined to make the inhabitants of Jaudon think that a real earthquake was at hand. The cause of the accident was in keeping the dynamite from freezing. While considerable damage was done by the concussion, the remarkable thing was that no lives were lost. Joseph McGeer, the well known Kansas City labor agent, states that he distinctly heard the report at his home in Kansas City. Jaudon is 30 miles from here, but if Mr. McGeer states he heard the explosion, it can be set down as a positive fact—the explosion was heard.

French capital to the amount of $20,000,000 will finance the proposed Cherryvale, Oklahoma & Texas Ry. which is planned to connect Kansas City, Mo., and El Paso, Tex. Announcement to this effect was made yesterday by George Simons of Paris, France, who spent the day in the city and left that night with J. S. Worley of Worley & Black, engineers in the Reliance Bldg., for a trip over the proposed right of way. Mr. Simons represents Gubboy & Co., bankers in Paris. He is an engineer and is here to inspect the work already being done on the road. A stretch of 65 miles of track is now being built connecting Caney, Kan., and Vinta, Okla. Other parts of the line will be pushed with the break of winter. Worley & Black are the chief engineers in charge of the construction. The Cherryvale, Oklahoma & Texas Ry. was promoted by ex-Senator S. M. Porter of Caney, Kan. Mr. Porter obtained the French capital in Paris in 1909. The original plan called for a board of directors of 13 members, eight of whom were to be French.

F. H. Blodgett has moved his family to Kansas City and intends to make this his home. Mr. Blodgett will, of course, continue in the contracting business, and we expect to announce soon that he has secured some good contracts.

Mr. R. A. Sturgen having completed the location of a railroad through the Florida Everglades for W. R. Palmer & Co. of Kansas City, has returned home. He states that the line located is one of the finest propositions he has ever seen. The Kansas City address of the W. R. Palmer Co. is Dwight Bldg.

Mr. Wm. T. Murray of Corrigan, Murray & Spencer has concluded to put in a new shovel on his electric line work. Therefore within a few days another 40 R will be digging on the Excelsior Springs road.

A local coal dealer, W. G. Kellog, was talking to the writer a day or two ago and commenting on the increased coal business among contractors around this city stated that until a year or two ago it hardly paid to bother soliciting coal orders from this class of trade. Now a special man is required for this business and it is probable a second man will be required before the season is far advanced, all of which shows this section is developing rapidly and that no talk of dull times is allowed in this vicinity.

The Chicago, Milwaukee & St. Paul R. R. announce that their 1912 budget includes $1,000,000 for grade revision and alignment on the Council Bluffs division. It is impossible at present to learn how much larger an amount will be required to meet the 1912 budget, although it has been reported that the road intends to do some construction work.

Mr. Hugh McKay, the popular agent of the Western Wheeled Scraper Co., passed through the city last week. He dropped in our office, however, long enough to tell us that he is still hustling for "Western" goods and meeting with good success. Mr. McKay has been with his company nearly 14 years. He states that it is observation the approaching presidential campaign has no terror to the interests that develop this country, but that this promises to be a "banner year." We agree with Mr. McKay.

⊙Mr. List of List & Gifford announces that his company has just closed a contract for 250,000 yds. on the L. & A. R. R. Mr. Gifford will be in charge of the work. A standard gage plant will be moved from their Marianna, Ark., work to do this contract. All friends of List & Gifford join in wishing them success.

J. B. Dorris writes that his Kansas City Southern work at Ballard, Okla., has opened very nicely. It will be remembered he has 100,000 yds. of team work at that place.

Mr. L. J. Smith was in Kansas City this week as an arbitrator in a controversy over a contract. Mr. Smith has been in Kansas City most of this winter. His extensive interests keep him close to his office. His farm at Pleasant Hill, Mo., is his place of recreation and a more ideal farm would be hard to find, it is said.

St. Louis Items.

BY A. B. KOENIG.

⊙I. R. Bobbit was awarded the Fourche levee contract at Little Rock.

⊙Jos. McCoppin of Little Rock, Ark., secured the contract for clearing the right of way for the Fourche levee work at Little Rock.

Frank Neher, the well-known engineer of the Iron Mountain Railroad, spent a couple of days with his family here last week. Neher returned to Democrat, Ark., where he is looking after a part of the new work the Iron Mountain R. R. is doing between Memphis and Marianna, Ark.

Yale & Reagan expect to resume work this week on their levee job, near Venice, Ill.

C. L. Petersen and L. E. Hamblet of the Petersen & Fell Boarding and Commissary Co., left here one day last week for Kansas City and on their arrival there met a stranger who wanted to know at what theater they were going to show, also telling them that he saw their show in St. Louis and that it was great. Petersen is thinking very seriously now of getting hold of a show and play Hamlet.

The Webb-Kunze Construction Co., 5927 Fyler Ave., St. Louis, have about 85,000 yds. of steam-shovel work in the city to let.

T. C. Snider, one of the leading team contractors on the Pacific Coast, is piling up big estimates each month on the L. J. Smith Construction Co. job on the Santa Fe R. R. in Arizona and New Mexico. From all reports Snider is breaking records and making quite a reputation for his outfit.

We are in receipt of a postal from our old friend Mike Conroy at Hot Springs, Ark. Mike is driving a donkey attached to an old water cart. It is readily seen by the way he is holding the lines that he has not forgotten how to skin mules.

L. J. Smith of the L. J. Smith Construction Co., Kansas City, left for Arizona to look over their Santa Fe work there.

The labor situation is easy here, but we look for this to change as soon as the weather moderates and work opens up. Going wages 15 cts. per hour for railroad company work, 17½ cts. per hour for contract work.

Mayor Lambert of East St. Louis and John J. Faulkner, president of the board of Local Improvements, joined a public statement to the effect that they will proceed immediately with the State St. improvement, from Collinsville Ave. to the eastern city limits. Vitrified brick will be used and the street will be paved its entire width, the "boulevard" plan, which the street car company wanted, having been finally rejected. The street will be made 96 ft. wide for most of the distance, with a 24-ft. driveway on each side of the street car tracks, and the sidewalks 12 ft. wide. The street car tracks will be moved to the center of the street.

Plans of the expenditure of $15,000,000 in the South in improvement and extension of the service were approved at the annual meeting of stockholders of the Cumberland Telephone and Telegraph Co. in Louisville, Ky., on Feb. 1. The money will be raised by means of a bond issue, which was authorized at the meeting. W. T. Gentry of Atlanta, president of the Southern Bell Telephone Co.; J. Epps Brown of Atlanta, vice-president and general manager of the same company, and U. N. Bethell of New York, vice-president of the American Telephone and Telegraph Co. were the directors elected. Directors reelected were J. E. Caldwell of Nashville, now president of the Cumberland; W. H. Woolverton of New York, John W. Barr of Louisville, James S. Robinson of Memphis, Theodore N. Vail of New York, president of the American Telephone and Telegraph and president of the Western Union Telegraph Co.; A. G. Sharp of Atlanta.

A conference of drainage engineers and experts for the purpose of drawing up a bill to be submitted to the legislatures of states in the Mississippi Valley providing for uniformity in legislation on the subject of swamp land reclamation was held at the Maryland Hotel. The conference is the practical result of a meeting in Memphis last week. Its work will be passed upon by the National Drainage Congress in New Orleans in April. The Memphis conference appointed a committee to draw up a drainage bill modeled upon the Missouri law, which has successfully solved he problem in Southeast Missouri. The purpose of the bill is to start immediate steps for he reclamation of 80,000,000 acres of swamp and, principally in the Mississippi Valley south of St. Louis. The committee which met at the Maryland is composed of Edmund T. Perkins of Chicago, president of the Naional Drainage Congress; John H. Nolen of Jefferson City, Mo., secretary of the congress, ecretary of the Missouri Waterways Commission and chairman of the present commitee; D. E. King, industrial commissioner of he Missouri Pacific-Iron Mountain; R. B. Oliver, Cape Girardeau, Mo., counsel for the Little River Drainage District in Southeast Missouri; William A. O'Brien, engineer Litle River Drainage District; Jacob A. Harman, engineer, Peoria, Ill.; Tom K. Smith, epresentative of bond attorneys, Chicago, and of William R. Compton Bond and Mortgage Co., St. Louis. A deed was filed in the Recorder's office here transferring the property of the Fulton Iron Works, at the southeast corner of Second and Carr streets, to the Chicago, Burlington & Quincy R. R. The price was $300,000. The lot has a frontage of 386 t. 9 ins. on Second street. The lot, in connection with other property owned by the ailroad company, will be converted into team racks for freight business.

The bondholders of the Alton, Jacksonville & Peoria R. R. Co., of which Edgar M. Davis was president, have had a corps of engineers go over the property and make an appraisement to compare with the inventory made by he receiver, Frank L. Butler, which was reported to the Circuit Court. It is said the bondholders are preparing for immediate action on getting the electric line completed from Alton to Jerseyville and have it put in operation. The legal details have been adusted and it is said the court matters will be quickly settled.

Grant Wyatt of St. Louis, president of a ailway construction company, accompanied by E. E. Evans, president of the Bismarck Bellevue Valley & Western Ry. Co., are in Bismarck, Mo., with a corps of engineers locating the line into that city from the Washngton County line. The right of way has all been obtained and $55,000 subscribed by perons along the route. The arrangements are being completed to begin construction May 1. The Board of Public Improvements recommended the following ordinances for alley mprovements: To improve alleys in city block No. 4447 west, between Ashland and Lexingon avenues, Paris and Taylor avenue; cost to property owners, $3,880. To improve alleys in city block No. 2680, between Osceola and Chariton Sts., Michigan and Compton Ave.; ost, $3,745. To reconstruct alley in city block No. 473, from 13th St. eastwardly for a disance of about 412 ft., and between Rutger St. and Morrison Ave.; cost, $1,463. To improve lleys in city block No. 1515, between Chero[illegible] and Utah Sts., Ohio and Iowa Ave.; cost, $4,002. To improve alley in city block No. 259, from College Ave. to intersection of Varne Ave. and Adelaide Ave., and between Von Phul St. and Zealand St.; cost, $2,019. To improve alleys in city block No. 1506, beween Cherokee St., Utah St., Pennsylvania Aves. and Minnesota Ave.; cost, $3,246. To mprove alleys in city block No. 4515, beween Garfield Ave., N. Market St., Union Blvd. and Arlington Ave.; cost, $4,848. To mprove alleys in city block No. 2720, between Neosho St., Dakota St., Pennsylvania Ave. nd Minnesota Ave.; cost, $3,414; to improve lley in city block No. 4511, from Academy Ave. to Union Blvd. and between Theodosia Ave. and Cote Brilliante Ave.; cost, $2,913. To improve alleys in city block No. [illegible] from Penrose St. to Carter Ave. and between Gano Ave. and Prairie Ave.; cost, $2,857. To improve alley in city block No. 1341, from McNair Ave. to Missouri Ave., and between Allen Ave. and Geyer Ave.; cost, $2,769. To improve alley in city block No. 4163, from Oak Hill Ave. to Bent Ave. and between Connecticut St., from Juniata St.; cost, $2,877. To improve alley in city block No. 4940, from Thurman Blvd. to Klemm St. and between Flora Blvd. and Russell Ave.; cost, $2,723. To improve alleys in city block No. 1625, between Chippewa St., Winnebago St., Minnesota Ave. and Michigan Ave.; cost, $2,635. To improve alleys in city block No. 1642, between Winnebago St., Miami St., Ohio Ave. and Iowa Aves.; cost, $2,505. To improve alley in city block No. 5425, from Rosedale Ave. eastwardly for a distance of about 600 ft., and between McPherson Ave. and Kingsbury Ave.; cost, $2,194. To improve alleys in city block No. 2578 north, between Alberta St., Keokuk St., Arkansas Ave. and Grand Ave.; cost, $1,783. To improve alleys in city block No. 796, between Lami St., Shenandoah Ave., Seventh St. and Ninth St.; cost, $2,712. To improve alleys in city block No. 2594, between Montana St., Osage St., Louisiana Ave. and Grand Ave.; cost, $4,510. To improve alleys in city block No. 2910, between Fillmore St., Wilmington road, Virginia Ave. and Alabama Ave.; cost, $2,588. To improve north and south alley in city block No. 2411, from North Park place southwardly to the south line of the east and west alley in said city block, and between Eleventh St. and Blair Ave.; cost, $688. To reconstruct alley in city block No. 1092, from 22nd St. to 23rd St., and between Montgomery St. and St. Louis Ave.; cost, $2,409. To reconstruct alleys in city block No. 1805, between Lafayette Ave., Kennett place, 18th St. and Mississippi; cost, $2,682.

Philip W. Haberman, vice-president of the Alton & Mississippi River Belt & Transportation Co., has notified the East St. Louis City Council that his company will apply for a franchise to build an elevated structure or viaduct across Cook and Mississippi avenue to support its tracks to the municipal free bridge. Mr. Haberman says that the rails of the municipal free bridge are about 30 ft. above the ground at Cook and Mississippi Aves, and that a viaduct across those two streets will be necessary. The proposed tracks of the Alton & Mississippi Belt Railroad & Transportation Co., according to Vice President Haberman, will run eastwardly from the free bridge to the bluffs, thence north to the river, forming a complete belt around East St. Louis.

Whether the elimination of the Wabash R. R. grade crossings is accomplished without legal proceedings depends upon the attitude the Municipal Assembly assumes on the question of consequential damages. Officials of the railroad and members of the Board of Public Improvements conferred with Mayor Kreismann. Kreismann and the board favor payment of damages by the city. A majority of the Delegates and Councilmen believe the entire cost of depressing or elevating the tracks should be borne by the railroad. W. K. Bixby and E. B. Pryor, Wabash receivers, object to the road paying the consequential damages, and informed the city that it would not do so. The Assembly must indicate its attitude on the proposition before the Board of Public Improvements drafts an ordinance providing for the abolishment of the crossings. The two railroad committees will get an informal expression from the Assembly this week. The railroad will pay for the construction of viaducts over the tracks on streets where the tracks are depressed. If the viaduct approaches injure private property the damage will be paid by the city if the plan of the board is accepted. At the Delmar Blvd. crossing the boulevard will be elevated. The tracks will remain on the present grade. Elevating the street across the railroad tracks probably will injure property on each side for a considerable distance. The plan approved by the Board of Public Improvements is to depress the Wabash tracks westward from a point west of the Lindell Blvd. bridge in Forest Park. At the Lindell, Union De Balivier, Waterman and Kingsbury crossings the tracks will be depressed, if the board plans prevail. The railroad receivers approved the plan in the main. The railroad engineers, who suggested a slight change in minor details, will go over the engineering features together. Mr. Pryor declared that to abolish the crossings would cost the railroad about $750,000. The city officials estimate the consequential damages at $400,000. If the ordinances and work are rushed the work may be completed within three months. If the Wabash grade crossings are eliminated similar results are expected with other roads. The Wabash agreement is looked on as an opening wedge for the abolishment of all dangerous crossings.

A. W. Sullivan, former general manager of the Missouri Pacific-Iron Mountain, has been elected chairman of the Railway Association Committee on Railway Mail Pay, with headquarters at 75 Church St., New York City. The committee representing the railways comprises J. Kruttschnitt of the Union & Southern Pacific; Ralph Peters, Long Island; Charles A. Wickersham, Western Railway of Alabama; W. W. Baldwin, Chicago, Burlington & Quincy; Frank Barr, Boston & Maine.

Judge Elmer B. Adams in the United States District Court at St. Louis consolidated the two receivership suits against the Wabash Railroad Co. and authorized the receivers to expend $8,306,815.50. Additional orders, bringing the total desired expenditures to about $10,000,000, have been asked for. F. A. Delano of Chicago and W. K. Bixby and Edward B. Pryor of St. Louis, who were appointed receivers in the original proceedings, brought by the Westinghouse Airbrake Co. for an $18,000 debt, were appointed receivers under the consolidated suit. Former Judge Chester H. Krum of St. Louis was named by Judge Adams as special master and will hereafter be the intermediary for the receivers and the court. Judge Adams issued an order for the maintenance of the New York office of the Wabash, with a sufficient clerical force and made provision for the payment of the salaries of one vice-president and the secretary. The consolidated suit is styled: The Equitable Trust Co. of New York versus the Wabash Railroad Co. and James B. Forgan. Both parties to the defense filed acknowledgments of the facts cited in the bill of complaint and the petitions for orders. The bill of complaint filed stated bonds of the Wabash to the amount of $41,000,000 were outstanding and that interest on this amount to the sum of $921,000 is in default. The first expenditure authorized by Judge Adams was $483,705.50, to pay for 25 freight and passenger locomotives that have been ordered. They are to be paid for out of funds on deposit with the Equitable Co. as trustee for the $20,000,000 first refunding extensions mortgage bond issue. These engines are to bear name-plates labeled: "The Equitable Trust Co. of New York, owner—order of Jan. 30, 1912." Similar labels must be put on all other rolling stock purchased by the receivers. The second order issued provides for the payment of $333,550 interest on $8,000,000 bonds of the Wheeling & Lake Erie R. R. Co., part of the security for which is $3,500,000 of the Wabash first refunding and extensions mortgage bonds. The receivers are authorized to borrow the money to pay this interest. The receivers, in their petition asking authorization for expenditures for equipment and other improvements, amounting to $7,489,500, say the Wabash long has been deficient in equipment and that at least 130 of its locomotives are more than 25 years old. They also say the road at present has 1,750 cars rented at a yearly rental of $175,000, or about 5 per cent a year of the $3,525,000 they ask for new equipment, which, it is stated, can be purchased at an exceptionally low price just now. Seventeen items of double-tracking are planned, aggregating 180.8 miles and at an estimated cost of $2,954,500. In an exhibit attached to the receivers' petition these two plans for improvement are listed as groups A and B. A third group C, is devoted to miscellaneous improvements, such as track elevation, block signaling, telephone dispatching and replacing bridges. This includes the improving of the Delray engine house, near Detroit, Mich.; the laying of new rails between Chicago and St. Louis and improvements at Fort Wayne, Ind., in compliance with recent enactments of the Indiana Legislature. Judge Dyer issued an order authorizing these expenditures also. In commenting on their recommendations in the exhibit attached to their petition the receivers say:

The cash for the foregoing expenditures, if the expenditures were authorized early in January, would be required in installments during the period of March to December 1912. The double track work required could, with the possible exception of item 12, be completed during the summer season, and in time to get the benefit of it for the rush of business next fall. The new equipment could be purchased in time for us to get the benefit of it after July 1. All of the expenditures would be for improvements which would make a handsome return, either in increasing our capacity to do business or in diminishing the cost of doing it, or both. The memorandum of the list of expenditures recommended as important to be undertaken this season if possible is as follows: Thirty additional engines, $600.00 (this is in addition to twenty-five engines ordered last August and now being completed); 1,000 steel under-frame 80.000 capacity stock cars, $850,000; 750 80,000 capacity automobile cars, $675,000; 1,000 steel under-frame 40-ton box cars, $900,000; 200 steel hopper cars. 50 tons, $200,000; twenty passenger equipment cars, $300,000; second track work—Oakwood to Romulus, Mich., eleven miles, $134,000; Montpelior to Alvordton, Ohio, eleven miles, $146,000; Decatur to Knights, Ill., three miles, $46,000 (with gauntlet on bridge over Sangamon River); Taylorville to Litchfield, Ill., thirty-two miles, $552,500; Clarke Junction to Gary Ind., five miles, $51,000; Worth to Orland, Ill., five miles, $370,000 (the double tracking in this case includes grade reduction and line revision); Bement to Lodge, Ill., thirteen miles, $208,000 Bement to Tolono, thirteen miles, $170,000; Fairmount to Danville, Ill., eleven miles, $143,000; Danville, Ill., to state line Indiana, five miles, $65,000; Poag to Worden, Ill., fifteen miles, $210,000; Moberly to Clark, Mo., eleven miles, $147,000; Moberly to Huntsville, Mo., six miles, $84,000; Brunswick to Salisbury, Mo., eighteen miles, $288,000; Excelsior Springs Junction to Birmingham, Mo., fourteen miles, $237,000; Fort Wayne to New Haven, Ind., five miles, $73,000; Fort Wayne to Hugo, Ind., two miles, $30,000. Track elevation work in Fort Wayne, Ind., completing work already begun and required by ordinance to be completed within two years, $125,000; block signaling and telephone dispatching, part of which is required by law of the state of Indiana, $150,000; replacing bridges or strengthening existing bridges, first year, $100,000; miscellaneous industry sidings and passing tracks, $150,000; Delray engine house, property buildings and appurtenances, $75,000. On account of miscellaneous improvements already in course of progress, authorized under the old management, not completed or paid for, $250,000. Machine tools, various shops, $100,000. New rail for replacing Chicago-St. Louis line, 100-lb. rail being suggested, in order to bring our track up to the condition of that of competitors, 10,000 tons, or, say, $300,000; of this amount $60,000 will be chargeable as a betterment and carried to capital account, $50,000.

The "item 12" referred to in the receivers' comments is the second track work on the Worth to Orland (Ill.) stretch of five miles, to cost $370,000.

Montana.

Surveys have been started from Dixon for an electric railway, the general route of which starts north of the Northern Pacific depot, follows the line to the mouth of the Jocko River, where it crosses and starts on a general northward course across the reservation. It is stated that the power to operate the road will be secured from Hell Roaring Creek, west of the foot of Flathead Lake. The Flathead Power & Traction Co., of Dixon, T. Randolph Arnold, President, is projecting this line.

Surveys have practically been completed by engineers of the Butte, Anaconda & Pacific Ry. for the construction of the proposed branch from Anaconda to Georgetown, Mont. The contracts for the rock work will be let shortly, it is said. H. A. Gallwey, Butte, Mont., is General Manager.

Officials of the Gallatin Valley Ry., a branch line of the Chicago, Milwaukee & Puget Sound, have announced that work will be started this summer on the line surveyed a year ago between Three Forks and Helena, Mont., by way of Radersburg. The road will leave Three Forks from the north and run in a northerly direction toward Radersburg, swinging due north and crossing the Missouri River at a point between Toston and Townsend. It will then follow the river down the eastern side, crossing it again at Canyon Ferry, then connecting with the old Harlow grade and running into Helena. W. H. Penfield, Butte, Mont., is Chief Engineer.

The following information has been received from Lewistown, Mont., in regard to the construction of the Great Northern line between Lewistown and Great Falls, for which Sims-Carey, St. Paul, Minn., have the general contract: Three contractors are already on the ground with their outfits and other contractors are preparing to get in as soon as the weather will permit. Nels Roman, one of the contractors, has already started grading upon his allotment of the work, on Spring creek, about nine miles out of Lewistown. He is employing between 50 and 60 men and 15 teams, and already has been working upon his contract for about 4 weeks. Contractor Callahan, who has been given the job of making the cuts and fills at Judith River, about 12 miles from the Moccasion junction, already has several steam shovels at Moccasin, from where they are now being moved out to the work, and has several others on the road. There are several heavy cuts along the Judith River and Callahan expects to be operating his steam shovels at this task within a few weeks. Contractor W. H. Galusha has already unloaded his outfit, consisting of 20 teams and much machinery, at Moccasin, where he has been engaged for a week or more in moving to his camp. There is considerable heavy work along the proposed new line and the engineers do not expect to have the track laid into Lewistown before the first of December.

The Chicago, Milwaukee & Puget Sound R. R. is understood to be planning to begin work this spring on a line surveyed a year ago between Three Forks and Helena by way of Radersburg.

Nebraska.

Steel for the extension of the Kearney & Black Hills branch of the Union Pacific, from Callaway to Gandy, is being received at Callaway. Track laying will begin March 1, and it is expected by the company that the first locomotive will run into Arnold about April 1.

New Jersey.

The New Jersey & Pennsylvania Traction Co., now operating 40 miles of line, has been purchased by Battles & Co., of Philadelphia, Pa.

New Mexico.

The Navajo Lumber & Timber Co., backed by Chicago and English capitalists, will, according to advices from Albuquerque, N. Mex., commence early in the Summer, the building of the Navajo Southern R. R., a proposed 75-mile line from Holbrook, Ariz., on the Santa Fe, south to St. Johns, Ariz., tapping a large area of mineral, timber and agricultural resources. A big lumbering plant will also be erected probably at Holbrook, the northern terminus of the road. The railroad company is capitalized at $3,500,000. F. H. Bowen is president, W. H. Clark, secretary, and R. W. Hill, treasurer. E. S. Clark of Prescott, Ariz., being counsel for the co cern.

New York.

The United Traction Co., Albany, N. operating the street railway at Watervliet, understood to be considering asking the cou cil of the latter city for a franchise for t extension of its line to Temperance Hill, suburb of Watervliet.

The State Public Service Commission h held a hearing on the proposed consolidati of trolley companies to complete an elect railroad between Buffalo and Rochester. T roads to be consolidated are the Buffalo, B tavia & Rochester Electric Ry., Buffalo Williamsville Electric Ry., Buffalo & Depe Ry. and Buffalo, Genesee & Rochester Ry. C The application is for permission to conso date and issue stock and bonds.

North Carolina.

⊙M. E. Elkan, Macon, Ga., has been awar ed the contract for constructing about 8,5 ft. of belt line at High Point, N. C. Bids this work were taken early in January, noted in our Jan. 17 issue.

The Elkins & Allegheny R. R., which building a line of railroad from Elkin, N. via Sparta, N. C., and Jefferson, N. C., Mountain City, Tenn., has laid the rails a within 30 days will be operating regular tra on the first 14 miles. This takes the line the heavy timber belt of the Blue Ridge Mou tains. It is expected that the balance of t line will be completed as rapidly as possible

The directors of the Raleigh, Charlotte Southern Ry. Co., which was chartered the last legislature to construct a line fro Raleigh to Charlotte, have elected officials the Norfolk Southern R. R. as the officers the new company. It is believed that acti construction work will now be started shortl It is also believed that the Raleigh & Sout port, the Aberdeen & Ashboro and the Du ham & Charlotte Railroads, three short lin which have been acquired by Norfolk Sout ern interests, will be merged with the R leigh, Charlotte & Southern. F. L. Nicholso Norfolk, Va., is Chief Engineer of the Norfo Southern R. R.

North Dakota.

⊙Foley Bros., Welch & Stewart, St. Pa Minn., have been awarded the contract by t Minneapolis, St. Paul & Sault Ste. Marie R to finish grading of its branch line from For ville to Drake, a distance of 130 miles. Wo is to be completed July 1 and track to be la and line open for traffic by Oct. 1.

Officials of the Northern Pacific Ry. are r ported to have announced that it is probab that the Pingree-Wilton line will be extend to Valley City, N. Dak., by way of Hig line.

Ohio.

Plans have been prepared by the enginee of the Lake Shore & Michigan Southern R. for the extension of the company's yar at Air Line Junction at an estimated cost $2,000,000. The railroad officials have tak the matter up with B. Whitlock, Mayor Toledo, O.

It is reported that plans have been co pleted for the reorganization of the Detro Toledo & Ironton Ry. Co. Radical reductio are said to have been made in the compan capital, bond and stock issues aggregati $38,800,000, which have been cut down to $2 000,000. Stock issues of $25,000,000 are sa to have been cut in half.

The Cleveland Ry. Co., Cleveland, has tered into a contract with the North Rand Ry. Co., for street railway service to Randa The North Randall Co. is to build the trac and the Cleveland Ry. Co. is to operate ca

Oklahoma.

The Clinton & Oklahoma Western Ry., V. McClure, Chief Engineer, Oklahoma Ci now operating 22 miles of line, has start preliminary surveys for an extension fro Butler, Okla., to Canadian, Tex., a distance 100 miles.

is reported that the Fort Smith & West- er R. R. has decided upon the construction of n extension to Oklahoma City, Okla., this ye. The cost of the work is estimated at $1 0,000. W. M. Bushnell, Fort Smith, Ark., neral Manager of the mpany

ne Quapaw-Lincolnville Ry Co. of Miami, O ., has been incorporated with a capital st of $20,000 and proposes the construc- tic of a railroad. J. D. McIntyre, J. L. M racken, M. H. McCracken, and George D Stein, all of Miami, Okla., are the in- orators

Oregon.

ne Valley & Siletz R. R., recently incor- po ted, has completed surveys and has se- cu d the capital for the construction of a 30- m railroad, the route taking in the Willa- m e Valley, Ore., to Siletz Basin, Ore., south an west of Independence, Ore. The time for aw ding contracts has not yet been deter- m d. A. L. Porter, Falls City, Ore., is Cl f Engineer; F. S. Belcher, 517 Corbett Bl ., Portland, Ore., is President.

ne C. A. Smith Lumber Co., Marshfield, O ., is reported to have purchased the Coos B Roseburg & Eastern R. R., running from M shfield to Myrtle Point, 26 miles. The ne owners are said to intend extending the lir east toward Roseburg this spring to a la tract of timber belonging to them, and la to complete the line through to Roseburg or ome point on the Southern Pacific in D glas County. It is understood that the C . Smith Co. owns timber on the proposed ro in both Coos and Douglas Counties.

cording to an announcement reported to ha been made by officials of the Southern P fic Ry. in Oregon, the company will com- at once the construction of a line from Ore., to Fir, connecting Salem and h Woodburn and Springfield branches. D. W Campbell, Portland, Ore., is General Su- tendent of the Northern District of the rn Pacific.

Pennsylvania.

ne Hanover & McSherrystown Street Ry. C Robert E. Manley, General Manager, H over, Pa., is understood to have com- d plans for an extension from Hanover o ettysburg, 12 miles, and also plans for a h to New Oxford.

merger of the Sunbury & Selinsgrove, nbury & Northumberland, the Sunbury, urg & Milton, the Montandon & Mil- nd the Chillisquaque connecting street y companies has been approved. The mpany will be known as the Sunbury & S uehanna Ry. Co. The ratified agreement ha een submitted to the governor in appli- for a charter.

kholders of the South Easton & Phil- g R. R. will vote Feb. 29 on a pro- merger with the Mine Hill R. R., into high & Hudson River Ry., under the of the latter.

s been announced that the stockhold- the Delaware, Lackawanna & Western will be asked at the meeting Feb. 20 on a proposition to increase the cap- ck of the company from $30,277,000 to 7,000 to provide funds for the improve- f the lines in Pennsylvania. The ques- f leasing the Syracuse, Binghampton & York R. R. will also be taken up.

South Carolina.

klaying has been started at Greenwood, on the Piedmont & Northern R. R. and it is said, will be pushed as rapidly as e. The roadbed has been completed. Lee, Charlotte, N. C., is Chief Engineer company.

South Dakota.

rmers and freeholders between Blunt and hell, S. Dak., have agreed to subscribe $100,000 to either build a railroad or to e Chicago & Northwestern to build a tween the cities. According to J. B. the chief promoter of the scheme, it is ed to pay $100 for each quarter section which the new road will run and that as soon as $2,500 per mile is subscribed, construction companies will agree to build the line.

Tennessee.

The Chicago, Rock Island & Pacific Ry. contemplates the construction of two or more short branches from its main line just west of Memphis.

The St. Louis, Iron Mountain & Southern R. R., E. E. Hale, Engineer Maintenance of Way., Little Rock, Ark., has begun work on reballasting and otherwise improving its line between Memphis and Bald Knob. It is the announced purpose of the railroad company to practically reconstruct the stretch of track connecting Memphis with the main line, by putting in new ballast, relaying the track with heavier steel rails, lessening the grades and straightening out the curves. The estimated cost of the undertaking is $700,000.

Texas.

The San Antonio, Rockport & Mexican Ry. has submitted a proposition to build to San Angelo if citizens take $300,000 6 per cent first preference shares, furnish a right of way through the county, depot sites and 50 acres of terminal facilities. The offer is under consideration.

Negotiations are reported under way between the Missouri, Kansas & Texas and the International & Great Northern R. R. for a renewal of the contract whereby the former road will continue to use the International's tracks between San Marcos and Austin. It is stated that if no permanent agreement can be reached the Missouri, Kansas & Texas will build 30 miles of line between Austin and San Marcos.

The capital stock of the Crystal City & Uvalde R. R., at present operating 120 miles of line, is to be increased, and a new charter obtained, after which the road will be known as the Mexico, San Antonio & Gulf Ry. Extensive new construction work is planned, as indicated by the change of name. J. E. Franklin, St. Louis, Mo., is president and E. Breaker, Crystal City, is Chief Engineer.

The International & Great Northern Ry., O. H. Crittenden, Chief Engineer, Houston, Tex., is reported to have surveys under way for an extension from Laredo toward Rio Grande City.

An English syndicate represented by Edward Cowperthwaite, of London, is understood to have purchased the rights and property of the Asherton & Gulf operating a 32-mile line from Asherton, Tex., to Artesia Wells. It is understood that the new owners will build an extension from Asherton northwest via Eagle Pass to Del Rio, a distance of 150 miles, and will also build from Artesia Wells to Crowther, a distance of 60 miles. R. H. Gresham, Asherton, Tex., is Chief Engineer of the Asherton & Gulf Ry.

County Commissioners' Court at Houston, on Feb. 12, took action on an application for a franchise for a 1½ mile spur track from the main line of the San Antonio & Aransas Pass Ry. to the Rice Institute near Houston.

Advices from El Paso, Tex., state that the last of the steel for the Mexico Northwestern main line between Juarez and Chihuahua has been laid and train service has been started. F. S. Pearson, New York City, is President of the company.

The directors of the Brownwood North & South Ry., Brownwood, Tex., will meet March 10 to consider the proposition increase the capital stock of the company to provide funds for the extension of the line from May to a point 9 miles beyond Rising Star, a total distance of 17 miles.

The Santa Fe Ry. System has closed a deal for the purchase of 200 acres of land adjoining its right of way on the eastern edge of San Angelo, Tex. It is said the company plans to utilize the land for the construction of yards to accommodate 4,000 cars. This purchase is believed by many to signify that the Santa Fe will extend its Lometa cut-off from Eden to San Angelo, a line for which has already been run, and will continue construction on its Sterling City branch across the lower Panhandle to a connection with the Coleman cut-off. H. W. Wagner, Amarillo, Tex., is Principal Assistant Engineer of the western lines of the Santa Fe.

The City of San Antonio, Texas, according to its agreement with J. E. Franklin, President of the Bankers' Trust Co., St. Louis, Mo., has raised the $100,000 bonus to secure the construction of a railroad from that city to the gulf. By terms of the agreement $50,000 of the bonus is payable when his road is extended from San Antonio to Campbellton, a distance of forty miles, and is there connected with an extension of the Crystal City and Uvalde railroad to Fowlerton. The remaining $50,000 will be due when the road is extended to the gulf the exact port being left optional with Franklin, who is now conducting negotiations with both Corpus Christi and Aransas Pass. The road is to be completed and in operation in two years.

Utah.

A meeting was held early this month in the office of Simon Bamberger, president of the Salt Lake & Ogden Ry. Co., Salt Lake City, at which tentative plans were discussed looking to the immediate revival of the project to build an interurban electric railway system from Salt Lake to Nephi, taking in the principal towns of southern Salt Lake County, Utah County and Juab County. The project will be closely identified with the Salt Lake & Ogden Line and the Ogden Rapid Transit Co.'s system, which will give it entrance to practically all of northern Utah

Vermont.

Officials of the Central Vermont Ry. have submitted two new plans for the proposed station improvements on the lake front at Burlington, Vt. Hearing on the matter was started on Feb. 12 by the State Public Service Commission. The new station, as previously noted, will probably involve the construction of a fill or embankment on the lake front. J. M. Morrison, St. Albans, Vt., is Engineer of the Central Vermont Ry.

Virginia.

The Caroline, Clinchfield & Ohio Ry., Ward Crosby, Chief Engineer, Johnson City, Tenn., is understood to have financed its extensive construction plans, and it is probable that contracts for some of the work will be let in the near future. This work will be on its northern extension from Dante, W. Va., to Elkhorn City, Va. This 40-mile extension will be through a mountainous country and will involve much heavy work. This section probably will be let in 2-mile contracts.

Washington.

⊙As briefly noted in our last issue Porter Bros., Spokane, Wash., secured the contract for constructing the Point Defiance line of the Northern Pacific. This is a very large contract involving something like 8,000,000 cu. yds. Porter Bros. have an office at Portland, Ore., and also have an office at Kansas City, Mo., for their work on the Kansas City Southern.

Work of filling in the site for the new machine shops and roundhouse to be built at Centralia, Wash., by the Northern Pacific Ry. has been started. Two steam shovels are on the job and grading will be pushed to a speedy completion after which the construction of the buildings will begin.

S. H. Ansell, owner of the Metaline Falls townsite, according to advices from Spokane, Wash., has a plan under way to build a railroad running from the international boundary line south to Metaline Falls and thence across Ferry County in a southwesterly direction to Colville, a total length of 61 miles.

West Virginia.

Surveys have been started for 16 miles of new line to be built by the Fairmont & Clarksburg Traction Co., Fairmont, W. Va. This line is to connect Clarksburg and Weston, and has already been built from the former place to Mount Clare.

The incorporators of the recently formed

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Clarksburg & Philippi Traction Co., mentioned in our last issue, are as follows: I. L. Nutter, Clarksburg; E. R. Dyer, J. Creed Watson and J. R. Dunham, of Philippi; Charles C. Robb and P. J. Necessary, Fairmont.

Canada.

⊙McMillan Bros., 180 Maryland St., Winnipeg., Man., have secured a sub-contract from J. D. McArthur for 185 miles of the Hudson Bay Ry., commencing at Le Pas and extending eastward to a point west of Split Lake. The portion of the line covered by the subcontract is through muskeg, and very little rock will be encountered. The manner of putting up the grade will be very similar to the operations on the G. T. P. west of Edmonton, in which wheelbarrows are used extensively.

The betterment program of the Canadian Northern Ry., M. H. MacLeod, General Manager, Winnipeg, Man., for its western lines, so far as already announced, includes the following: Yard extension at Fort Rouge, near Winnipeg, and the building of new yards near Winnipeg; yard extensions at Dauphin, Port Arthur, Saskatoon, Edmonton and intermediate points, improvements of grades between Winnipeg and Fort Frances, erection of eight or nine new steel bridges between Winnipeg and Port Arthur, replacing of present steel between Portage and Kamsach, 220 miles with 80 lb. rails.

The Canadian Government is reported to have practically decided, as a result of the survey made at Port Nelson and Fort Churchill during the past summer and fall, that Port Nelson will be the bay terminus of the Hudson Bay road. It is stated that reports of the tidal and hydrographic surveys conducted with the greatest care indicate that both marine and land conditions at Port Nelson favor its selection as a safe and accessible harbor, while the topographical surveys favor the territory via the southern route as compared with the route to Fort Churchill.

The Canadian Northern Ry. has filed with the city solicitor of Toronto a revised plan of its proposed route through Etobicoke and York Townships and a part of the western section of Toronto. The new plan shows neither subways nor elevated bridges. The railway line will cross Jane St. north of the original route, and follow the Toronto & Niagara Power Company's right of way, and parallel the C. P. R., crossing the Humber south of the C. P. R.

The Canadian Northern Ry. has applied to the legislature for a charter to extend its Swift Current line north to a point at or near Battleford.

The Provincial Government of Alberta is planning to guarantee bonds for over 1,600 miles of railroad for that province. Resolutions are now before the legislature calling for a guarantee of the bonds of the railway companies in respect to construction in the province of Alberta under charters now held by the Canadian Northern Western, the Canadian Northern, Edmonton, Dunvegan & British Columbia, and Grand Trunk Pacific Branch lines companies. The lines will be guaranteed at the rate of from $13,000 to $20,000 a mile, the bonds bearing interest at 4 per cent and extending for 30 years. Of this construction, 1,405 miles will be built by Canadian Northern lines holding charters from provincial or Dominion governments, 350 represents the Edmonton, Dunvegan & British Columbia line construction as far as Dunvegan, near the boundary of the province northwest of Edmonton, while the Grand Trunk Pacific coal mines branch, 58 miles in length, running from Bickerdike southwesterly, is also to be constructed under a provincial guarantee. Of the Canadian Northern lines, 150 miles had been guaranteed by the province under Dominion charter. This guarantee will be repeated under the provincial charter. The total new construction provided for will thus be 1,255 miles of Canadian Northern line, and in all 1,663 miles. The guaranteed lines of railways will cover the province with a network extending from Fort McMurray, in the northeast, and Peace River Landing, in the northwest, to Pincher Creek, in the southwest, and the international boundary, south of Medicine Hat. On the Onoway branch of the Canadian Northern construction is to be guaranteed through to the British Columbia boundary, through the Grande Prairie country, while the new Pakan line through St. Paul de Metis, will be constructed to the eastern boundary of Alberta under the terms of the guarantee. Following are the lines of the Canadian Northern Western Railway for which a guarantee of securities is proposed: Onoway line, 250 miles, $20,000 a mile; from Athabasca Landing to Peace River Land north of Lesser Slave Lake, 100 miles, $15, from Athabasca Landing to Fort McMur 175 miles, $15,000 a mile; Lac la Biche bra from the above lines, 40 miles, $15,000 a m line north of Saskatchewan, through Pa passing by way of St. Paul de Metis to eastern boundary of province, 100 m $13,000 a mile; line from a point on the C R., near Bruderheim, passing through Bru heim and Vermilion, south to Medicine and the southern boundary of the provi 200 miles, $13,000 a mile; line west of Calgary and Edmonton Ry. from Strathc west of Pigeon Lake to Pincher Creek, miles, $15,000 a mile; from Camrose so east, 80 miles; Calgary to a junction with Brazeau line east of the Calgary and Edm ton Ry., 100 miles, $13,000 a mile; exten of the Brazeau line from the Calgary and monton southwest to connect with the G Lake extension of the C. N. R., 130 m $13,000 a mile. The province will guara bonds of the C. N. R. for the extension of Goose Lake line from the eastern boundar the province to a junction with the Vegrev Calgary line north of the crossing of the Deer River, at $1,300 a mile. The const tion of this line was first undertaken und Dominion charter. The Grand Trunk Pa branch line from Bickerdike, 58 miles, point on the Little Pembina River, wil guaranteed at the rate of $2,000 a mile. Edmonton, Dunvegan & British Colu road from Edmonton to Dunvegan, 350 m will be guaranteed at the rate of $20,0 mile. It is understood that the company tracts to commence construction immedi upon opening of spring and to complet least 100 miles in 1912.

Mexico.

Application has been made to the Mex Department of Communications by Edw Barrios, City of Mexico, for a concession the construction of a new railway line tween the city of Mexico and the City Puebla. The plans provide that the rail pass through Tlalmanalco, Contla, San Sa dor El Verde and Huejotzingo. The firs kilometers of the road are to be finishe one year, 40 more kilometers are to be cluded by the end of the second year and whole road is to be terminated and ready use at the end of three years.

ROADS, STREETS AND PAVEMENTS

Alabama.

The citizens of Walker County, Ala., will vote March 12 on the proposition to issue bonds in the sum of $300,000 for good roads. Jasper is the county seat.

Arizona.

The City Council of Phoenix, Ariz., has approved the specifications providing for future paving in the city which were submitted by the Paving Commission. All paving work is to be in the hands of the Commission.

Arkansas.

Plans have been prepared by W. T. Patterson of Pea Ridge, Ark., for the construction of 25 miles of road work in Benton County, Ark., at an estimated cost of $40,000. The roads will be mostly of dirt and gravel macadam. The work will be in charge of W. T. Patterson.

A petition has been presented to the Council of Lake Village, Ark., asking that body to create an improvement district of Main St., Court Square and a part of Lake Front Sts., for the purpose of putting in pavement.

California.

The Board of Kern County Supervisors, Bakersfield, Calif., has been petitioned for the construction of a road between Maricopa and McKittrick, a distance of about 26 miles. It is proposed to issue bonds in the sum of $60,000 for this improvement. O. P. Goode of Taft, Calif., is interested.

The California State Highway Commission, Sacramento, Calif., has ordered surveys, plans and estimates to be made in each highway division, seven in all, in the state. State Highway Engineer A. B. Fletcher has been directed to have the work done under the seven division engineers. The following routes were ordered surveyed: Division 1—The main road beginning at the Mendocino County line, near Cloverdale, thence to Hopland, thence crossing the east side of the river, passing through Ukiah and Willits. Division 2—Main road beginning at the southerly line of Tehama County, below Vina, and extending northwesterly to Tehama, Red Bluff and Anderson to Redding; also, the main road through Orland, Tehama, Kirkwood and Corning. Division 3—The main road beginning at Roseville, via Lincoln and Sheridan to Marysville. Division 4—Main road south of the city of San Francisco, San Jose and Gilroy to the southerly boundary of Santa Clara County, below Sargent's; also, the main Sonoma County road near Cloverdale and extending through Geyserville, Healdsburg and Santa Rosa to Petaluma. Division 5—Main road of San Benito County on the road between Gilroy to San Juan, thence to Salinas and to Soledad; also the road between King City and Bradley; also the main road be ning at the northerly line of San Luis Ob County, near San Miguel, and pas through Paso Robles, Templeton, Santa M garita and the Cuesta Pass to San Obispo. Division 6—Main road of San quin County, near Ripon, and extending southerly and easterly direction through desto, Merced and Berenda to Madera. vision 7—The main road of Ventura Co near Punta Gorda, and extending to tura, thence to Cahuenga Pass; also a passing through El Rio and Oxnard; also main Orange County road below San Capistrano, via Oceanside, Carlsbad, En tas to San Diego; also a possible line be ning near Saugus, in Los Angeles County Castaic canyon to Goose Lake.

The Trustees of Hillsborough, Calif., asked the people to vote on the issuanc bonds in the sum of $150,000 for an elab system of good roads covering the more t ly settled portion of the entire city.

Plans and specifications have been orde drawn by the City Council of Oakland, C for the paving of 14th St., between Jac and Oak Sts., a distance of two blocks. Council has also directed City Engineer P F. Brown to prepare proceedings for the provement of 27th Ave., between Foc Blvd. and East 22nd St., and Palmetto between Champion St. and Boston Ave.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Florida.

ids will be received until March 5, [illegible] i Daytona, Fla., for the construction [illegible] ds. The work will include approxi- [illegible] 100,000 cu. yds. of embankment and [illegible] cu. yds. of hard surface rock placed on oad. D. D. & C. M. Rogers, 117 N. Beh St., Daytona, Fla., are Engineers.

Idaho.

ls were opened Feb. 2 by the Board of [illegible] Works, Karl Paine, President, [illegible] City, Idaho, for 32,800 sq. yds. of [illegible]. In all 21 firms bid on this work. The [illegible] bidders on the different kinds of pave- ment appear to be as follows: Asphalt, P. J. Maugh, Third Ave. N. and Mercer St., [illegible] $1.49 per sq. yd.; asphaltic concrete, McHugh, $1.39 per sq. yd.; [illegible] to $1 on a stone base; [illegible] Inman Hassamite Co., Spokane, 5-in. concrete base, $1.05; 5-in. Has- se, $1.32½; plain concrete, G. A. He- St. Louis, $1, with macadam top, $1.15; te, Inman Hassamite Co., 5-ins. thick, 6 ins. thick, $1.70½; dollarway, Sto- Murphy, Boise, $1.85; bitulithic, Bar- Seattle, 4-in. stone base and 2-in. $1.76; same, concrete base, $1.95; 3½-in. [illegible] and 1½ in. top, $1.51½; same, [illegible] ase, $1.69; granocrete, Giebisch-Joplic rtland, $1.48; vitrified brick, Consoli- onstruction Co., Salt Lake, $3.25. It [illegible] that the contract will not be let until the coming election.

Illinois.

ls will be received until 1 p. m., Feb. [illegible] Board of Local Improvements, Lincoln, the construction of considerable pave- urb and gutter and for doing necessary g.

Bids will be received at the Town Clerk's of in Clay City, Ill., up to 1 p. m., March [illegible] earth work and for the construction of gates on the Clay City and Newton n Clay City Township, Clay County. ork to be done consists in the con- [illegible] an embankment 10,271 ft. long an average height of 6 ft. and 24 ft. n top, from material secured from [illegible] the roadway. The soil is a light Quantities: Sec. 1, 29,000 cu. yds. 14,392 cu. yds. Also 4 concrete flood [illegible] to be built at the Little Wabash Work to be completed on or before 1912. More detailed information may by an examination of the plans and ations prepared by the Illinois High- ommission which may be seen at the Clerk's office or may be obtained, upon tion in writing, from the Illinois High- ommission, Springfield, Ill.

ls will be received until 9 a. m., Feb. [illegible] by Board of Local Improve- [illegible] Rock Island, Ill., for grading, draining ving with brick on concrete foundation ock on 6th Ave. Plans and specifica- re on file with the city engineer.

ls will be received by L. E. McGann, ssioner of Public Works, Chicago, Ill., 11 a. m., Feb. 16, for furnishing and [illegible] at 15th place and Loomis St., 2 type steam rollers, according to speci- [illegible] The rollers must be of first-class and construction. Accompanying pro- bidders must submit photographs, total t, horse power of engines, single or engine speed at which it can be oper- steering arrangement, size of water ta., etc., of rollers they propose to furnish. Ca or certified check for $200 must accom- [illegible]

Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., 11 a. m., Feb. 16, for furnishing and ring at 15th Pl. and Loomis St., 2 three- weeled road rollers, according to specifica- tions on file at his office. Accompanying pro- must be specifications showing the fol- g information, total weight, horse power gine, size and face of wheels, character terials used and different parts of ma- size of steam dome, number of hours [illegible] between front and rear wheels, etc. Cash or certified check for $2[illegible] must accompany proposal.

✣[illegible] Commissioner of Public Works, Chicago, Ill., until 11 a. m., Feb. 16, for furnishing and delivering at the various ward yards located [illegible] 4,000 sq. yds. of cedar blocks, according to specifications. The blocks are to be cut from live cedar posts, free from bark and shall be 5 ins. in length and from 5 ins. to 10 ins. in diameter. [illegible] must accompany proposal.

✣B[illegible] 19, by Board of Local Improvements, Joliet, Ill., W. S. Welch, Clerk, for the construction of creosoted wood block pavement on Scott St. Plans and specifications are on file with H. A. Stevens, City Engineer.

⊙The City Council of Lewistown, Ill., it is reported, has awarded the contract for constructing 20 blocks of brick paving to the Fuller-Coult Construction Co., Chemical Bldg., St. Louis, Mo.

The Board of Local Improvements and the City Commissioners of Pekin, Ill., have adopted the plans and figures of City Engineer John R. Seibert for additional paving, as follows: Broadway District—Broadway from Eighth St. to the Chicago & Alton depot. Fifth, Fourth and Capitol District—Fourth St., from Market to Willow; Capitol St., from Market to Willow; Fifth St., from Market to Willow. Second and State District—Second St., from Court to State. State St., from Second to Eighth; Caroline St., from the P. & P. U. road to Second St. Seventh and Eighth St. District—Eighth St., from Park Ave. to Court St.; Seventh St., from Park to Court; Tharp Pl., from Sixth to Seventh Sts.; Sixth St., from Park Ave. to Washington; Hillyer St., from Sixth to Eighth St.; Haines Ave., from Hillyer St. to Tharp Pl.; McLean St., from Seventh to Eighth St. Court Street District—Court St., from Fifth to the east end of the Park curb line; Eighth St., from Court to Broadway; Ninth St., from Court to Washington; Tenth St., from Court to Washington; 14th St., from Court to Park Ave.. Margaret and Ann Eliza District.—Margaret St., from Third to Eighth; Ann Eliza St., from Third to Eighth; Capitol St., from Court to Market; Fourth St., from Margaret to Market; Fifth St., from Court to Market; Sixth St., from Court to Market; Seventh St., from Court to Market; Broadway, from Seventh to Eighth St.; Market St., from Fifth to Eighth. Front Street District—Elizabeth St., from Front to Third St.; St. Mary, from Front to Sabella; Front St., from Court to Sabella.

According to advices from Paris, Ill., a petition is being circulated with a view to submitting to the voters at the annual township election in April, a proposition for the experimental brick paving of several of the main traveled thoroughfares leading into Paris. The proposition carries a tax levy of $.80 on each $100 of assessed valuation, for the period of five years and the improvement of the following roads is contemplated: Chicago road, from the city limits to waterworks plant, pavement 14 ft. in width; Cherry Point road to Boatman corner, where bridge crosses Sugar Creek, pavement 9 ft. in width; Clinton and Marshall roads to township line, pavement 9 ft. in width.

Plans have been prepared by the Aetna Engineering [illegible] Chicago, Ill., for the construction of 27 blocks of brick pavement in the residence district of Rochelle, Ill., pavement to be of brick. The estimated cost of the work is $85,000. The contract will be let about April 1. W. B. McHenry is [illegible]

Plans have been prepared by Sheppard Morgan of Edwardsville, Ill., for the construction of 18,600 sq. yds of creosoted wood block pavement in the city of Venice, Ill., at an estimated cost of $106,966. The pavement will be laid on a Portland cement concrete foundation, with 1-in. sand cushion and pitch covered with 1½ in. sand. The work will also include 11,400 lin. ft. of combination curb and gutter and 7,500 cu. yds. of excavation. The contract will be let in about 40 days. J. E. Lee of Venice is in charge of the work.

The Board of Public Works of Aurora, Ill., is planning the construction of about five miles of street paving for this season. The streets to be paved are: Linden Ave., Fourth St. to Fifth St.; Maple Ave., Fourth St. to Fifth St.; Weston Ave., Lincoln Ave. to Fifth St.; Clark St., Fifth to Bevier Pl.; T St., Clark St. to North Ave.; Bevier Pl., Fourth Ave. to Benton St.; Fourth Ave., Fifth St. to Jackson St.; Jackson Pl., Fox St. to Main St.; Avon St., Fifth St. to Lincoln Ave.; South Broadway, Benton St. to the end; N. Broadway, from end of pavement to Pierce St.; View St., West Park Ave. to Plum St.; Garfield Ave., Montgomery Ave. to Calumet St.; Calumet St., Garfield Ave. to Downer Pl.; Calumet St., Garfield Ave. to new college; Union St., Fourth Ave. to Front St.; High St., Pierce St. to Forest Ave.

The Commissioners of Road District No. 7, Cairo, Ill., have decided to construct one and one-half miles of macadam road and reconstruct one mile of macadam. The Commissioners are Julius Serbian, William H. Wood and William F. Kessler.

The City Council of Venice, Ill., has confirmed the estimate and proposals for $106,000 worth of street paving, which the city proposes to install this summer. The plan is to pave with creosote blocks Broadway, Market and Madison Ave., over a stretch of streets from Main St., to the Madison corporation line.

The Board of Local Improvements of East St. Louis, Ill., has instructed City Engineer Edward F. Harper to prepare estimates of the cost of paving State St. from 38th St. to Edgemont Station, a distance of seven miles. It is probable that the Improvement Board of Belleville, Ill., will pave State St., from that city to Edgemont Station, thereby making the road 14 miles long. The improvement, it is estimated, will cost between $700,000 and $900,000.

According to advices from Hoopeston, Ill., petitions are being circulated among the property owners adjoining Cissna Park providing for the paving of the main roads running south and west of the village.

City Engineer F. M. Connolly of Galesburg, Ill., has estimated the cost of the proposed paving of East Main St., from the public square to a point 498 ft. east of the central line of Chambers St., at $43,878. According to the estimate, the work will require 6,800 cu. yds. of grading at a cost of $3,500; 3,050 lin. ft. of Portland cement concrete curbing, including circular corners at a cost of $1,479; 75 lin. ft. of Portland cement concrete marginal curbing at a cost of $11; 18,600 sq. yds. of brick pavement of one layer of No. 1 paving blocks set on edge at a cost of $36,456, and 14 manholes at a cost of $48 each.

Indiana.

✣Bids will be received until 10 a. m., Feb. 21, by Board of Public Works, Elkhart, Ind., for the construction of brick, asphalt and bitulithic pavement as follows: Five blocks on St. Joseph St., 3 blocks on Beardsly and 13 blocks on Oakland. The pavement will be laid on crushed stone and cement foundation and sand or asphalt will be used for filler. Stone or combination cement curb and gutter will be constructed. A. M. Smith is City Engineer.

✣Bids will be received until March 5 by the Board of Knox County Commissioners, Vincennes, Ind., for the construction of two gravel roads. John T. Scott is County Auditor.

✣Bids will be received until 2 p. m., March 5, by Board of Blackford County Coommissioners, Hartford City, Ind., for the construction of a macadam road in Harrison township. James Cronin, Jr., is County Auditor.

⊙The Board of Rush County Commissioners, Rushville, Ind., has awarded contracts totaling $123,998 for eight new highways in

✣ indicates work now open for bids. • indicates a contract let recently [illegible] their bids are: Thurston & Steel, two roads, $29,430; Nicholson & Pearce, two roads, $55,- [illegible] Bros., $9,440; J. B. Reasoner, $15,934, and [illegible]

⦿Snyder & Bamett of Frankfort, Ind., and Wm. Mahoney of Green Castle, Ind., have [illegible] Tippecanoe County Commissioners, La Fayette, Ind., for the construction of the J. W. [illegible] gravel road at $4,275, and E. H. Tower gravel road at $4,757. The last named roads being awarded to Wm. Mahoney. Bids were opened Feb. 7 by George W. Baxter, County Auditor.

⦿John J. Denny of Madison, Ind., has been awarded the contract by the Jefferson County Commissioners, Madison, Ind., for the construction of a stone road in Madison Township. The contract price is $5,707. Bids were [illegible] Auditor.

⦿W. O. Thomason of Pine Village, Ind., and Guinnup & Co., of Ambia, Ind., have been awarded the contract by the Board of Warren County Commissioners, Williamsport, Ind., for the construction of gravel roads in Steuben and Jordan Townships for $6,760 and $10,805 respectively. Bids were opened Feb. 5 by D. H. Moffitt, County Auditor.

⦿Joseph L. Vaughn & Reason E. Larkin, Cloverdale, Ind., have been awarded the contract by the Commissioners of Hendricks and Putnam Counties, Danville, Ind., for the construction of the John Masten et al. road, at $6,045. Bids were opened Feb. 1 by James A. Downard, Commissioner, Danville.

⦿Alva Harriman has been awarded the contract by the Board of Newton County Commissioners, Kentland, Ind., for the construction of a macadam road in Colfax Township for $12,981. The road will be graded, drained and paved with stone. Bids were opened Feb. 5 by E. R. Bringham, County Auditor.

⦿C. J. Sigman of Henryville, Ind., has been awarded the contract by the County Commissioners, Jeffersonville, Ind., for the construction of 2.18 miles of road in Monroe Township, Clark County, for $4,281. Bids were opened Feb. 5 by G. W. Stoner, County Auditor.

⦿The Commissioners of Adams County, Decatur, Ind., have awarded the following contracts for the construction of five macadam roads, for which bids were opened Feb. 5 by H. S. Michaud, County Auditor: N. Behberstine, Geneva, Ind., road No. 4; Erie Stone Co., Van Wert, O., $6,849; Jacob Musser, Berne, Ind., $2,850; J. H. Smith & Fred Matley, Geneva, Ind., $2,330 and $5,941. Bids were opened Feb. 5.

⦿James D. E. Golyer of Seymour, Ind., has been awarded the contract by the Board of Jackson County Commissioners, Brownstown, Ind., for the construction of gravel road in Hamilton Township, for $2,943. Bids were opened Feb. 5 by H. W. Wacker, County Auditor.

⦿The Board of Monroe County Commissioners, Bloomington, Ind., has awarded the contracts for the construction of 2½ miles of macadam roads in Perry Township and 2¼ miles of macadam roads in Beam Blossom Township to Wm. Walter Smith of Bloomington. The contract price is $11,738. Bids were opened Feb. 6 by Horace Blakely, County Auditor.

An organization has been perfected in Marshall County, Ind., to interest the Boards of County Commissioners, Plymouth, and the State Legislature in a movement to restore the Michigan highway extending from Michigan City on the north to Madison and the Ohio River on the south. The estimated cost of the road is $5,000,000.

No bids were received by the Board of Dearborn County Commissioners, Lawrenceburg, Ind., on Feb. 6, for the construction of a highway in Jackson Township. W. S. Fa- [illegible]

Iowa.

The City Council of Cedar Falls, Ia., has passed a resolution of necessity authorizing the laying of about 80 blocks of paving. The following streets will probably be improved: State St., between 2nd and 5th; North Main, from north end of bridge to I. C. R. R. branch; 6th St., Main to Wash St.; 7th St., State to Wash.; 8th St., Main to Wash; 9th St., Main to Wash; 10th St., Main to Wash; 11th St., Main to Wash; 13th St., from G. Western tracks to Washington St.; Normal St., 18th to 20th; Olive St., 2nd to 24th; Walnut St., 2nd to 24th; Iowa St., 22nd to 24th; 22nd St., from Normal to Werner Ave.; 23rd St., Olive to Normal.

The schedules of street improvements to [illegible] mitted to the City Council. Feb. 23 has been set as the date of hearing complaints and objections of the proposed work. The improvements proposed are: Curbing—West 44th St., Ingersoll Ave., to Harwood drive. Curbing—Woodland Ave., 44th St. to Harwood drive. Curbing—High St., 28th to 31st St. Asphalt paving—Crescent drive, Ingersoll Ave. to 34th St. and 34th St., from Ingersoll Ave. to Crescent drive. Asphalt paving—Ingersoll Ave., 31st St. to 38th St. Curbing and asphalt paving—West 41st St., University Ave. to Forest Ave. Asphalt paving—Ovid St., Sixth Ave. to Seventh St., and Seventh St., Ovid St. to Beckwith Ave. Concrete paving—Beckwith Ave., Sixth Ave. to Seventh St. Asphalt paving—W. 44th St., Kingman Blvd. to Chamberlain Ave. Curbing—Woodland Ave., 31st to 33rd St., and 32nd St., Woodland Ave. to Center St. Asphalt paving—Woodland Ave., 31st St. to 33rd St. Brick paving—W. Fourth St., Vine St. to Elm St. Brick paving—West Eighth St., Market St. to Elm St. Concrete paving—W. Grand Ave., Greenwood Park to 56th St. Asphalt paving—W. Fourth St., Forest Ave. to College Ave. Asphalt paving—Orchard St., Fourth St. to Fifth St. Asphalt paving—Clark St., Fourth St to Fifth St.

The City Council of Des Moines, Ia., has approved plans for the asphalt pavement on East 12th St., between Washington and Thompson Aves.

The City Council of Des Moines, Ia., has ordered the paving of Jackson St., from 30th to 39th St.

The City Council of Des Moines, Ia., has passed resolutions providing for the laying of two and one-half miles of new asphalt paving and curbing. The following streets will be paved: Crescent drive, from Ingersoll Ave. to 34th St.; Ingersoll Ave., from 31st to 38th Sts.; 41st St., from University to Forest Ave.; Ovid St., from Sixth to Seventh St; West 44th St., from Kingman Blvd. to Chamberlain Ave.; Woodland Ave., from 31st to 33rd St.; Beckwith Ave., from Sixth to Seventh St.; West Fourth St., from Vine to Elm St.; West Eighth St., from Market to Elm St.; West Grand Ave., from Greenwood Park to 56th St.; West Fourth St., from Forest to Orchard Ave.; West Fourth St., from Orchard to College Ave.; Clark St., from Fourth to Fifth St.; 32nd St., from Woodland to Center St.; Seventh St., from Ovid to Beckwith Ave.

Kansas.

✣Bids will be received until 2 p. m., Feb. 15, by G. H. Krienhagen, City Clerk, Independence, Kan., for grading and paving the alley in Block 56, including the following approximate quantities: Brick paving, 665 cu. yds.; curb, 630 lin. ft.; earth excavation, 163 cu. yds.; rock excavation, 54 cu. yds. Plans and specifications may be seen at the office of City Engineer A. D. Stivers.

Property owners on Lincoln St., city of Wichita, Kans., are contemplating a pavement for that thoroughfare from Emporia Ave., east to Hillside, a distance of nearly two miles.

Kentucky.

⦿The Board of Public Works of Louisville, Ky., has awarded the following paving contracts: Jefferson County Construction Co., paving Alta, Sherwood and Bonnycastle Aves., with asphalt, between Bardstown road and Cherokee Park, $67,341; Louisville Asphalt Paving Co., 34th St., from Chestnut St. to the first alley south of Magnolia Ave., $6,427; Barbee St., from First St. to Brook St., and Rosewood Ave., from Baxter Ave., 466 ft. south, $8,780, and Bolling Ave., from 18th St. to 321 ft. west of 21st St., $11,116, S. S Saxton Co.

Louisiana.

The city of Lake Charles, La., on Feb. 6, it is reported, sold bonds in the sum of $100,000 for paving.

Massachusetts.

The Board of Selectmen of South Hadley Falls, Mass., is having an estimate prepared of the cost of paving Bridge St., from Main St., where the paving blocks now end, to Lamb St.

Michigan.

✣Bids will be received until Feb. 29, it is reported, by City Council, Flint, Mich., for the construction of a pavement on East Second St., from Harrison to Crapo St. Bids are asked on all kinds of pavement. It is intended to pave the street in the spring, at which time the D. U. R. will pave between the car tracks which recently have been laid on the street. According to the plans, the pavement will be 32 ft. wide from Harrison to Clifford St., and from Liberty to East St., these blocks being narrow. The other blocks will have a pavement of 42 ft. in width.

✣Bids will be received until 10 a. m., March 1, by Board of County Road Commissioners, Petoskey, Mich., for the construction of a county road to be known as Petoskey Turnpike, Part 1. G. W. Dickinson, Petoskey, Mich., is Clerk of Emmet County.

The Genesee County Board of Supervisors, Flint, Mich., held a meeting Feb. 9 to consider the good roads proposition to bond the county for $500,000. The question will probably be submitted to the people at the spring election.

The city of Battle Creek, Mich., will construct 22,000 sq. yds. of brick pavement this year under the supervision of City Engineer E. A. Hunt. The pavement will be laid on a grout foundation with tar filler and cement curbs.

Missouri..

It is reported Consulting Engineers Worley & Black, Reliance Bldg., Kansas City, Mo., have submitted plans and specifications to the City Council of Rich Hill, Mo., for the proposed paving of Park Ave.

New Jersey.

✣Bids will be received until 2 p. m., Feb. 19, by John Prout, Chairman, Committee on Streets and Sewers, Jersey City, N. J., for the improvement of Woodlawn Ave., from Ocean Ave. to Hudson Blvd., in accordance with plans and specifications on file with E. B See, Clerk of the Board of Street and Water Committee.

✣Bids will be received until 2 p. m., Feb. 19, by John Prout, Chairman, Committee on Streets and Sewers, Jersey City, N. J., for the improvement of Fleet St. from Concord St. to Baldwin Ave. E. B. See is Clerk of the Board.

New Mexico.

All bids received Jan. 25 by Territorial Engineer C. D. Miller, Santa Fe, N. M., for the construction of clay road across the Mescalero sands, about 40 miles east of Roswell, have been rejected as being too high. W. M. Atkinson is Chairman of the County Commissioners at Roswell.

New York.

✣Bids will be received until 1 p. m., Feb. 24, by Frank E. Bogardus, County Superintendent of Highways, Syracuse, N. Y., for the construction of three county roads as follows: Dewitt-Cicero Road, Sec. 2, 7.49 [illegible]

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

g; Salina-Clay road, [illegible] g. Plans and specifications are on he superintendent.

will be received until 3 p. m., Feb. ard of Contract & Supply, Albany, or the improvement of McKinley en Manning Blvd. and Lincoln Ave. includes grading, curbing and pav- arriageway with re-pressed vitrified ng blocks on a concrete foundation, ncrete walks, building receiving ba- r services, etc. Isadore Wachsman ry of the Board.

ts will be let about April 1 by W. Village President, Pulaski, N. Y., onstruction of 7,040 sq. yds. of brick and 2,940 lin. ft. of curb. Plan- been prepared.

nnual appropriation of $3,000,000 Board of Estimate of New York rmitted to authorize under the char- treet repaving each year, has been Manhattan and Brooklyn each re- 00,000 for the purpose; Bronx and ach get $500,000 and Richman, $300,-

North Dakota.

y of Fargo, N. Dak., expects to con- out 120,000 sq. yds. of pavement e coming year. Bids will be asked classes of pavement. Frank L. And- v Engineer.

Ohio.

will be received until about Feb. 20, or of Public Service, Dayton, O., for rth Main St. from the present pav- corporation line at Hillcrest Ave.

will be received until noon, Feb. 17, missioners of Marion County, as Turnpike Directors, Marion, O., for g the Richland Pike, beginning at f the asphalt paving on Mt. Vernon nce east on the Richland pike to the on of same with the Claridon pike, a of 2,820 ft., according to the report, tion, specifications, etc., on file in the the County Commissioners of Marion Ohio. Estimated cost macadam, $1,- nated cost Carbo Via, No. 3, $1,003. iter is President of the Board.

will be received until 1 p. m., March unty Commissioners at the office of hittier, Surveyor of Delaware Coun- ware, O., for the following-named ads: County Line Road—The Ox- nty Line and Norton Road, begin- he east end of bridge over the Olen- ver on the county line, thence east to Mayfield's Corners. Oxford and Road—Beginning at the cross roads at Marlborough Township, thence east t end of the Olentangy River bridge, pping above-mentioned road to May- rners, thence beginning again and southeasterly crossing the Marl- line into Oxford Township to the in- of this road with the Mansfield g in all 3,362 miles in length. Felk- —This road is situated in Scioto and lies east of the village of Os- nd is 1.02 miles in length. These ll be improved by grading, drainage adamizing, according to the specifi- plats, profiles, cross sections, draw- on file at the County Surveyor's laware, O.

an Bros., Ravenna, O., who, as men- our last issue, were awarded the for the construction of brick pave- Section No. 1 of the Ravenna-Ran- ad in Rootstown and Ravenna Town- e asking bids for hauling 2,250,000 rick to be delivered on county road; the construction of 9,000 cu. yds. of se to be let in whole or in sections. dvertisement will be found elsewhere sue.

will be received until Feb. 27, by of Public Service, Lorain, O., for g the necessary labor and material mprovement of the following streets g to plans and specifications on file tor's office as follows: Pearl Ave., by paving from E. 8th St. to E. 34th St., with sheet asphalt, block asphalt or vitrified brick, together with the necessary excavation, drainage, curbing and foundation, etc. Eighth St., by paving from Washington Ave. to Oberlin Ave., with sheet asphalt, block asphalt, vitrified brick, together with the necessary excavations, drainage, curbing and foundation, etc. L. B. Johnston is Clerk.

✣Bids will be received at once by Director of Public Service, Alliance, O., for paving a portion of South Linden St., and a portion of South St.

✣Bids will be received until noon, March 1, it is reported, by the Village Council, London, O., for paving a portion of Maple St.

Plans have been prepared by Engineer George Champe, 610 The Nasby, Toledo, O., for the construction of 12,000 sq. yds. of brick, asphalt and bituminous pavement in West Unity, O., including stone and concrete curbs. The contracts for this work will be let March 7. Henry Reifel is City Clerk of West Unity.

The City Council of Fremont, O., has passed a resolution calling for the improvement of Jefferson St., from the north line of Hayes Ave., northerly to the south line of McPherson Ave., and from the north line of McPherson Ave., northerly to the north line of Birchard Ave., and thence to the east line of Jefferson St. This improvement calls for the laying of a 24 and 30-ft. pavement on Jefferson St. and Birchard Ave., respectively.

The City Council of Canton, O., has adopted a resolution providing for plans for the grading, curbing, flagging and paving of West Third St., from Lawn Ave. to Wertz Ave.

The city officials of Cleveland, O., are planning to expend about $90,000 of the proposed $350,000 bonds issued for park purposes in the completion of the boulevard from Ambler Park to Woodland Hill parks.

Oklahoma.

Plans have been prepared by City Engineer T. C. Hughes of Tulsa, Okla., for the construction of five blocks of brick pavement in that city at an estimated cost of $23,000. The work will include 5-in. concrete foundation, 6x18 concrete curb, asphalt filler, 1,600 cu. yds. of excavation and brick pavement. The contract will be let in about 15 days.

Oregon.

Josephine County, Ore., will expend $30,000 in road construction and improvement during 1912. Grants Pass is the county seat.

According to advices from Salem, Ore., Congressman Hawley has introduced a bill before the House of Representatives, providing for an appropriation of $13,500 with which to build a highway to the top of Mt. Ashland, through the Crater national forest.

Tennessee.

⊙The Shelby County Commissioners, Memphis, Tenn., have received the following bids for the maintaining of the county dirt roads for the next four years; contracts awarded Feb. 3:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible] Cts	[illegible] Cts.
1	M. L. [illegible]	550.00	75.00	20	[illegible]
	W. H. [illegible]	380.00	62.00	22	4.03
	Frank H[illegible]		68.00	17	
	J. I. Corbitt				
	Robinson & [illegible]		75.00	20	
	J. Paul Gaines	478.00	70.00	1[illegible]	
	*B. F. Williford		75.00	[illegible]	
	H. M. Anderson	575.00	75.00	19¾	3½
	C. G. [illegible]		75.00	20	
	*Marion Zellner	550.00	75.00	20	[illegible]
	Stewart & [illegible]den	700.00		[illegible]	
	[illegible] G. Galloway			[illegible]	
	G. F. Reid	725.00			
10.	[illegible] & M[illegible]	350.00	50.00	18	
	G. F. Reid	725.00	67.50	20	
11	*J. P. Callis	499.00	75.00	20	
	J. B. Sims		48.00	17	
	T. G. Th[illegible]	490.00	49.00	16	
12.	[illegible]				
	[illegible]		......	17	
	[illegible]		1.00	20	
	J. L. [illegible]				
	W. E. Stainback	20.00	7.00	18	
16	*C. A. Galloway	300.00	54.50	20	2½
	[illegible]	[illegible]	54.00	17½	[illegible]
	[illegible]		70.00	20	4
	[illegible]				
	C. C. Mauldin	345.00	66.66	30	5
	J. Paul Gaines	[illegible]	[illegible]	[illegible]	
	H. M. Anderson	200.00	[illegible]	[illegible]	
	F. S. Brown	300.00			
	J. H. Weatherford	450.00	[illegible]	[illegible]	
	[illegible]				

The citizens of White County, Tenn., at a recent election, voted the issuance of bonds in the sum of $90,000 for the purpose of constructing its section of the Memphis-to-Bristol highway. Sparta is the county seat.

County Engineer W. L. Dodds, Chattanooga, Tenn., has completed the survey of the new road from Sherman Heights to McCarty Station. The new road will cross the bridge about one-half mile north of the present road.

The Pike Commissioners of Jackson County, Gainesboro, Tenn., will receive bids Feb. 16 from civil engineers for the surveying of the various roads in the county for which bonds to the amount of $150,000 were recently voted. The surveying will begin about the first of next month. The road leading from Gainesboro to Double Springs, a distance of about 14 miles, to the Putnam County line, will be improved first.

Texas.

⊙The Harris County Commissioners, Houston, Tex., have awarded the contract for paving with creosoted block, that portion of the Houston Heights Blvd., lying between Washington Ave. and the White Oak bayou to the Creosoted Wood Block Paving Co., of New Orleans, La., for $22,349. Other bidders were: Roach & Manigan: Brick, $23,961; block, $23,113; asphalt, $20,179. Texas Grading Co.: Brick, $21,989; block, $25,496 H. D. Whiteside: Brick, $22,898. Horton & Horton: Brick, $22,292; block, $23,876. Kelso & Vautrin: Brick, $23,097. Texas Bitulithic Co.: Bitulithic, $22,215. Eureka Construction Co.: Brick, $23,821; block, $26,049; asphalt, $18,985. Defrees & Morse: Brick, $25,691; block, $26,801. Municipal Paving Co.: Brick, $24,654; block, $25,817; asphalt, $22,183. O. C. Chapin: Brick, $23,197. General Construction Co.: Brick, $24,027. Western Paving Co.: Block, $22,912; asphalt, $16,146 Ockander Bros.: Brick, $22,953; block, $24,098; hassam, $17,731. Rudolph Blome Co.: Granatoid, $19,375; granacrete, $14,764

⊙The Bexar County Commissioners, San Antonio, Tex., have awarded the contract for grading and graveling the Garrity road to W. A. Kelley Co., and the contract for re-topping the Austin road to the 12-mile post, and to grade the W. W. White road from the Austin to the Stahl road to J. B. Kelley. T. C. Nelson is County Road Engineer.

⊙W. C. Overly & Co., of Joplin, Mo., have been awarded the contract by the city of Houston Heights, Tex., for the paving of the boulevard from White Oak Bayou to the north line of 19th Ave., with vitrified brick for $114,000. The work will include two miles of road, consisting of 47,200 sq. yds. of brick with concrete gutter, etc. Howe & Wise, 722-723 First National Bank Bldg., Houston, are Engineers. D. Barker is Mayor. Bids were opened Jan. 27.

The Dallas County Commissioners' Court, Dallas, Tex., has instructed County Auditor George L. Fearn to call for bids for the improving of four cardinal and eight secondary roads in the county with a large part of the 80 per cent of the $500,000 recently voted for road improvements. It also ordered the improving of some of the roads in the remaining 20 per cent class, the cross connection roads. All the cardinal and secondary roads extend from the city limits of Dallas to the [illegible] County Engineer Jack F. Witt for the improving of the several sections are as follows: Cardinal roads—West Dallas pike, $35,169; Preston road, to the north, $22,700; Eastern pike, $29,185; Lancaster pike, to the south, $22,093. Secondary roads—Coppell road, $35,649; Seagoville road, $30,659; Cedar Hill road, $32,799; Denton road, $26,203; Richardson road, $19,680; Miller's Ferry road, $37,216; Garland road, $35,953.

The Port O'Connor-San Antonio Good Roads Association has been organized for the purpose of working for the construction of a road between the two cities. An election will be held in Port O'Connor on Febr. 24, to vote on the issuance of bonds in the sum of $100,000, the proceeds to be used in completing the 31 miles of road between that town and the Victoria County line. C. S. E. Holland, A. D. Powers and W. H. Vernor have been appointed a committee to arrange for a meeting Febr. 26 in Port O'Connor.

A mass meeting was recently held in Port Lavaca, Tex., for the purpose of discussing the proposition of ordering an election to vote on a bond issue for road improvements. The County Commissioners have appointed a committee to investigate the probable cost of the work and to ascertain the extra tax it would incur.

The Dallas County Commissioners, Dallas, Tex., through County Judge John L. Young, has sold the remaining $200,000 of road and bridge bonds issued last year, to W. N. Coller & Co., of New York City.

The city officials of El Paso, Tex., have been petitioned by property owners on Montana St., asking the paving of that street between Cotton and Piedras; also West San Antonio St., and for the grading of Indiana Ave.

The City Council of Bonham, Tex., has ordered the construction of 55 blocks of concrete sidewalks. City Engineer Thurmond has estimated the cost at $60,000.

Utah.

Petitions have been circulated in the city of Ogden, Utah, for the paving of Grant Ave., from 24th St. north to 21st St. It is also contemplated to pave Wall Ave., north of 24th St. to 21st St.

Virginia.

D. Tucker Brown, chief locating engineer of the State Highway Commission of Virginia, has completed the survey of three different routes for a state highway between Bristol and Abingdon, and will continue the survey across the counties of Southwest Virginia, with a view to interesting counties in the construction of the proposed Bristol-to-Washington highway between Bristol and Roanoke. Washington County will begin the construction of its part of the new road in May.

City Engineer Charles Bolling, of Richmond Va., has recommended another bond issue for the improvement of streets in the outlying territory of Richmond. It is estimated that $3,500,000 will be needed for all the proposed work.

Washington.

✣Bids will be received until Feb. 24, by Board of Pierce County Commissioners, Tacoma, Wash., for the construction of the Brown-Dash Point Boulevard, 5.56 miles long. The right of way has already been cleared.

✣Bids will be received until 2 p. m., Feb. 27, by Board of King County Commissioners, Seattle, Wash., for the construction of the Charles Schafer Road near the town of Vashon, Wash. Plans and specifications are on file with the county engineer. The work provides for clearing, grubbing and grading a 24-ft. road.

The Board of Public Works, of Seattle, Wash., announces the completion of plans and specifications for the construction of vitrified brick pavement in alley in block 17, John J. McGilvra's Second Addition. The estimated cost is $3,004; also for the grading of 2d Ave. South, from Alaska St. to Court t.; estimated to cost $14,730.

The City Council of Toppenish, Wash., as been petitioned by the property owner to order the paving of Toppenish Ave., f m Fourth St. to F St., about 11 blocks. L T. Parker is chairman of the council commi e.

The City Council of Cashmere, Wash., as passed a resolution providing for the const c-tion of sidewalks in the business district nd residence section of the city at an estim ed cost of $19,200, with an additional charge or grading. The walks in the business dis ict will be 10 ft. wide, while those in the si-dence section will be 6 ft. wide.

Wisconsin.

✣Bids will be received until 10 a. m., M ch 9, by Board of Public Works, Racine, s., readvertisement, for paving Kinzie Ave. nd constructing combined curb and gutter in V. 6th St. The work will include about 1 sq. yds. of pavement. P. H. Connolly is ty engineer.

The Board of Public Works of Manito c Wis., has reported plans and specification to the City Council for the paving work t e done this summer on five city streets. he specifications will call for bids on four di r-ent kinds of paving, together with bids n each street separately and for the job a whole.

The good roads committee of Iowa Cou y, Dodgeville, Wis., at a recent meeting for d an elaborate system of good roads along ll main thoroughfares in the county. Const c-tion work will be begun this season.

Canada.

Hon. Dr. Reaume, Minister of P ic Works, has given his approval to a chang in the county roads system of Peel Cou y that will open the way for a high-grade d from Toronto to Hamilton. The governm t will contribute one-third of the cost.

BRIDGES—STEEL AND CONCRETE

Alabama.

The City of Birmingham, Ala., and the Southern Railway Co. are still in controversy in regard to the matter of building a viaduct or subway in Norwood. M. Nicholson is city engineer.

Board of Escambia County Commissioners, Brewton, Ala., has decided upon the construction of two bridges over the Escambia River, one at Ferry Pass to cost, it is estimated, $102,000 and another at McDavid to cost about $15,000.

Colorado.

Plans are being prepared for the construction of a concrete bridge across Cherry Creek, Denver, Colo., at an angle between the west end of the Larimer St. bridge and the east end of the Market St. bridge, affording a direct approach to the Fourteenth St. viaduct from Speer Blvd. Such a bridge would relieve congestion on Fourteenth St. and the viaduct. The estimated cost of the bridge is $45,000. If money for this purpose is appropriated by the budget, work on the bridge will be begun as soon as the extension of the Speer Blvd. to Larimer St. is completed. J. B. Hunter is city engineer.

Delaware.

The Levy Court, Wilmington, Del., has directed the Finance Committee to instruct Philip L. Garrett, attorney for the court, to have the $150,000 bond issue printed. The construction of the bridge will be paid for out of that issue.

Illinois.

✣Bids will be received at the Town Clerk's office in New Athens, Ill., up to 10 a. m., Feb. 23, for the construction of one reinforced concrete bridge in New Athens Township, St. Clair County. D. M. Fullmer, Town Clerk, New Athens, Ill. Dry Lake Bridge—Span, 35 ft.; roadway, 16 ft.; distance from finished roadway to bottom of footings, 15 ft.; wings, 16 ft. Estimated concrete in structure, 125½ cu. yds.; reinforcing steel, 13,837 lbs. Nearest railroad station, New Athens, 2¼ miles. All material will have to be shipped in. Roads, fair; average load, about 3,000 lbs. Present bridge is 34 ft., wood structure. Excavation will average full depth of abutments, in loam and hard clay. Average depth of dead water, 5½ ft.; width, 33 ft. This bridge is on a channel between Silver Creek and Okaw River. Work to be completed on or before May 25, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office, or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Ill.

✣Bids will be received at the Town Clerk's office, Earlville, Ill., up to 2 p. m., Feb. 20, for the construction of one reinforced concrete bridge between Earl and Paw Paw Townships, LaSalle and DeKalb Counties. C. R. Moore, Acting Clerk, Earlville, Ill. Alexander Bridge—Span, 50 ft.; roadway, 16 ft.; distance from finished roadway to bottom of footings, 15 ft.; length of wings, 14 ft. Estimated amount of concrete in structure, 166 cubic yards; reinforcing steel, 22,525 pounds. Nearest railroad station, Earlville, 3½ miles. All material will have to be shipped in. Existing bridge is a 50-ft. pile trestle. Average flow of stream, 1 ft. deep and 20 ft. wide. Excavation will average about 10 ft. deep in loam to probably clay. Work to be completed on or before J e 15, 1912. More detailed information may e had upon examination of the plans and spi-fications prepared by the Illinois High y Commission, which may be seen at the T n Clerk's office or may be obtained upon ap-cation in writing, from the Illinois High y Commission, Springfield, Illinois.

⊙The contract for the construction o a 24-ft. reinforced concrete bridge resting n old stone abutments, in Dayton Towns , LaSalle County, Ill., has been awarded to I Woodward, Ottawa, Ill., at $450. Bids we opened Feb. 1. E. J. Belrose, Wedron, is Town Clerk.

It has been announced by Alderman Fr k Taylor, chairman of the Bridge Commit e that the City of Lacon, Ill., has let a cont for test borings to ascertain the condition the river bed where piers for the propo d bridge will be placed.

The Rock Island County Board of Sup-visors, Rock Island, Ill., will be urged at March meeting to make an appropriation the proposed Colona bridge. Henry Cou y has appropriated $30,000 for the Henry Cou y share of the cost. The Rock Island cou y board is not inclined to act on the bri matter for the present.

The Rock Island Bridge & Iron Works been incorporated with a capital stock $30,000 and general offices at Rock Island, and will engage in the fabrication and er-tion of iron structural work. The incor-rators are M. H. Kanary, Edward Manh and Walter C. Murphy.

Two Chicago bridge bills were favora reported in Washington by the Senate Co-mittee on Commerce. One bill authorizes City of Chicago to construct a bascule bri

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ss the Calumet River at 92d St. and the her authorizes the Lake Shore & Michigan uthern Ry. Co. to construct a bascule bridge ross the Calumet at South Chicago, to re-ace the present structure.

Indiana.

✣Bids will be received until 2 p. m., March [illegible] idges. John T. Stevenson is Auditor of pencer County.

⊙J. A. Britton, Rockville, Ind., has been varded the contract for the construction of new bridge over Big Raccoon Creek in [illegible]

• [illegible] eel bridge over St. Mary's River in Wash- [illegible] e Burke Construction Co., Newcastle, Ind., $17,490. H. S. Michaud, Decatur, Ind., is unty auditor.

⊙The contract for the construction of two uble-arch concrete bridges on the Rush-ancock County line has been awarded to the urke Construction Co., Newcastle, Ind., at ,700. Bids were opened Feb. 6. Jesse M. tone, Rushville, Ind., is auditor of Rush ounty.

⊙The contracts for the construction of two ridges in Vermilion County has been warded by the Board of County Commis-oners to the Central States Bridge Co., dianapolis, Ind., at $8,873 and $13,170. The rst structure will include one steel girder esting on steel piers, reinforced with con-rete, and having a concrete floor, total length 70 ft. The second will have steel girder, esting on steel piers reinforced with con-rete, and having a concrete floor, total length, 40 ft. Bids were opened Feb. 5. H. T. avne, Newport, Ind., is county auditor.

The Wabash County Commissioners, Wa-ash, Ind., have decided to construct two new ridges in Waltz Township, the Minnick No. and the Minnick No. 2 bridges in sections 5 and 26. The Logan bridge in Liberty ownship near Lafontaine, will also be re-[illegible]

Commissioners of Vigo County, Terre aute, Ind., have instructed Engineer Gibbons o draw plans for the construction of a 55-ft. oncrete arch bridge to replace the Jones ridge one mile north of Seelyville. It is lso planned to erect a 180-ft. concrete arch ridge over Broulette Creek in Fayette Town-hip, but this work will not be taken up until ext year.

The Council of Miami County, Peru, Ind., as made an appropriation of $12,000 to pro-ide funds for the improvement of bridges.

Iowa.

All bids received for reflooring the Market St. bridge with creosote blocks have been ejected by the Board of Aldermen, Ottumwa, a. The two lowest bids received were: . C. Blunk, $28,260, and A. W. Van Hafften, Minneapolis, Minn., $28,272. The work will e readvertised. John Brady is city engineer.

Mayor W. H. Jones, Marshalltown, Ia., has nstructed W. H. Steiner, city engineer, to prepare a new set of plans for the construc-ion of the proposed South Third Ave. via-luct over the Chicago & Northwestern rail-road tracks. The drawings will be filed with he State Railroad Commission in an effort to ecure the co-operation of the railroad com-any.

Kansas.

City Commissioners of Kansas City, Kan., and representatives of the railroads, have approved the plans for the Mill St. viaduct over the tracks of the Union Pacific and Chicago, Rock Island & Pacific railroads in Kansas City, Kas. The specifications will be completed soon. Then bids for the construction of the viaduct will be asked. The viaduct will cross the railroad tracks at Mill Street and will extend from Muncie Blvd. It will be built of re-enforced concrete and the estimated cost is $90,000.

Kentucky.

At a recent meeting of the City Council, Covington, Ky., the Louisville & Nashville Railroad Co. was granted permission to construct a steel girder double-track bridge to replace the present archway under the C., N. & C. Traction lines in South Covington. E. E. Kuersteiner, Louisville, Ky., is bridge engineer of the railroad.

Michigan.

The Village Council, Howard City, Mich., is planning the construction of a new concrete arch bridge over the Tamarac River at White St., estimated to cost about $2,000.

The City of Saginaw, Mich., William F. Jahnke, City Clerk, will shortly apply to the County Supervisors, for permission to construct a bridge for general highway purposes, across Saginaw River on the extension of Johnson St., westerly, to intersect Davenport Ave. The bridge will be of the following kind and description: 35 ft. 6 in. in width between handrails; 520 ft. 4 in. in length face to face of abutments. The face of the easterly abutment will be located on the easterly harbor or dock line. There will be a double lift span over the government channel of said river, giving a clear waterway of 90 ft. for the passage of boats and vessels, with two flanking fixed spans, one on each side of the lift bridge, giving each a clear waterway of about 77 ft. and three fixed spans on the westerly side of the river, giving each a clear way of about 69 ft. The foundation for said bridge will be of reinforced concrete supported on a pile foundation; the bottom of the girders of the fixed spans of said bridge will be about 13 ft. above the water. The type of bridge to provide an opening for the passage of boats and vessels, and the location of same to be subject to the approval of the Secretary of War.

Minnesota.

✣Bids will be received until 4 p. m., March 2, by the Auditors of Marshall, Polk and Pennington Counties at the Marshall County Court House, Warren, Minn., for the construction of about 12 steel bridges of the corrugated arch type, and about forty corrugated steel culverts of various sizes to be constructed with concrete bulkheads, and about forty small culverts without bulkheads, same to be constructed along Judicial Ditch No. 25 in the counties of Marshall, Polk and Pennington. A. G. Lundgren is Marshall County Auditor. J. H. Baugh is engineer.

⊙The contracts for furnishing culverts and bridges for Judicial Ditch No. 11 have been awarded to the Illinois Steel & Bridge Co., Chicago, Ill., and the Continental Bridge Co., of Chicago, Ill., respectively. Bids were opened Feb. 2, by A. G. Lundgren, County Auditor, Warren, Minn.

State Engineer George W. Cooley, Minneapolis, Minn., and Deputy Engineer C. E. Nagel, of the State Highway Commission, recently went over the site of the proposed new bridge over the Minnesota River, connecting Mankato and North Mankato, Minn. State Aid will probably be secured by the latter town.

An election was recently held at Grand Rapids, Minn., for the purpose of voting on the proposition to issue $10,000 of bonds for the construction of a bridge over the Mississippi River at the Narrows, one-half mile west of that place.

Missouri.

⊙W. E. Shandy, Atchison County Engineer, Rockport, Mo., has awarded the contract for the construction of a 70-ft. steel bridge on red cedar piles to the Monarch Engineering Co., Fall City, Nebr., at $647; also for the erection of a 40-ft. steel bridge to T. A. Dean, Rockport, Mo., at $120.

An election will be held in April at Independence, Mo., to vote on the proposition of issuing bonds amounting to $15,000 for the construction of the necessary bridges and culverts in the city.

New Jersey.

The New Jersey State Senate, Trenton, N. J., recently passed a resolution providing for a commission to act in conjunction with the New York State Commission to investigate the subject of building a bridge over the Hudson River between Jersey City and New York City, and also to investigate the question of building a tunnel under the river. The resolution also provides an appropriation of $25,000.

New York.

Plans have been prepared for the construction of a 110-ft. highway bridge in the town of Canajoharie, N. Y. The structure will consist of 4 spans, although but one will be erected at the present. The roadway will be 20 ft. wide and paved with brick on concrete and a walk will be built on each side. Irving Lathers, County Superintendent, Sprakers, N. Y., is in charge of the work.

Advices from Albany, N. Y., state that plans for the construction of five lift bridges over the barge canal at Adams Station, Spencerport, Brockport, Houvelton and Gasport have been approved by the state canal board at an estimated cost of $200,000.

North Dakota.

✣Bids will be received until 10 a. m., Feb. 26, it is reported, by Board of Stark County Commissioners, at the office of County Auditor, Dickinson, N. Dak., for the construction of steel bridges during 1912.

Ohio.

✣Bids will be received until 11 a. m., Feb. 26, according to reports, by Board of Holmes County Commissioners, Millersburg, O., for the construction of the superstructures of three county bridges. Plans are on file at the office of the County Auditor.

⊙The contract for the construction of a bridge in Salt Creek Township has been awarded by the Board of Jackson County Commissioners to the Brookville Bridge Co., Brookville, O., at $942. Bids were opened Feb. 5. H. W. Wacker, Brownstown, Ind., is County Auditor.

All bids received by the Board of Erie County Commissioners, Sandusky, O., for the construction of a system of pile bents for the reinforcing of the east and west approaches of the Huron River bridge at Huron, O., have been rejected. The work will not be readvertised. John Deist is County Auditor.

Oklahoma.

A mass meeting of citizens of Norman, Okla., and vicinity, was recently held to take action on the construction of a bridge over the South Canadian river. J. A. Fox, Norman, Okla., is chairman of the Board of Cleveland County Commissioners

Oregon.

The Columbia River Interstate Committee has been organized with Samuel Woodward, Kenton Station, Portland, Ore., chairman, and S. L. Osborne, Portland, Ore., secretary. The first step will be to obtain funds for preliminary soundings and surveys of the Columbia River, with tentative bridge plans on which to base the perspective of the proposed Oregon-Washington viaduct over the Columbia River.

Pennsylvania.

At a recent meeting of the Supervisors at Killinger, Pa., it was decided to make application for a county bridge across the Little Wiconisco Creek, and a petition will be circulated among the taxpayers asking for the improvement.

The matter of constructing the proposed viaduct over Tripp's Crossing over the Lackawanna Railroad is only under consideration, and no type of structure has been decided upon as yet. William A. Shunk is chief engineer, Department of Public Works, Scranton, Pa.

Board of Chester County Commissioner and County Surveyor Rambo, West Chester, Pa., recently held a conference with the Com-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

missioners of Montgomery County at Norristown, to make definite arrangements for plans for a new inter-county bridge over the Schuylkill River at Pawlings. Bids for the work will probably be advertised for shortly.

A petition signed by property owners of the Seventh and Eighth Wards, Johnstown, Pa., has been presented to the City Council, asking for the construction of a bridge over Stonycreek River.

The Art Commission has approved the plans for the proposed bridges at Hoeveler St., Murray Ave. and Atherton Ave., Pittsburgh, Pa. W. A. Magee is Mayor.

South Dakota.

✣Bids will be received until 10 a. m., Feb. 20, according to reports, by County Auditor, Deadwood, S. Dak., for the construction of bridges in Lawrence County during 1912.

The following bids were received Feb. 6, by Board of Butte County Commissioners, at the office of D. C. Barr, County Auditor, Bellefourche, S. Dak., for furnishing the necessary labor and material for the construction of steel bridges during 1912, in Butte County, of which Carl C. Adams, Scotney Block, Bellefourche, S. Dak., is engineer. (1) stands for Monarch Engineering Co., Falls City, Nebr.; (2) Canton Bridge Co., 400 Paxton Block, Omaha, Nebr.

Item.	(1)	(2)
Girder spans, 18 ft., per lin. ft.	$13.00	$12.60
Girder spans, 20 ft., per lin. ft.	13.00	[illegible]
Girder spans, 22 ft., per lin. ft.....	13.00	13.09
Girder spans, 25 ft., per lin. ft.....	18.00	17.80
Girder spans, 26 ft., per lin. ft.....	18.25	17.80
Girder spans, 28 ft., per lin. ft.....	18.00	17.60
Girder spans, 30 ft., per lin. ft.....	19.70	19.74
Girder spans, 32 ft., per lin. ft.....	19.80	19.74
Girder spans, 34 ft., per lin. ft.....	20.00	19.90
Girder spans, 35 ft., per lin. ft.....	21.50	21.12
Girder spans, 38 ft., per lin. ft.....	22.60	21.12
Girder spans, 40 ft., per lin. ft.....	23.00	22.68
Low truss, 45 ft., per lin. ft........	20.10	19.90
Low truss, 50 ft., per lin. ft........	20.20	19.90
Low truss, 60 ft., per lin. ft........	22.00	20.00
Low truss, 65 ft., per lin. ft........	23.00	21.50
Low truss, 70 ft., per lin. ft........	23.50	22.00
Low truss, 75 ft., per lin. ft........	24.50	24.00
High truss, 80 ft., per lin. ft......	26.00	25.00
High truss, 90 ft., per lin. ft.	[illegible]	[illegible]
High truss, 100 ft., per lin. ft......	28.00	28.11
High truss, 110 ft., per lin. ft......	29.50	.....
High truss, 120 ft., per lin. ft.	29.50	29.00
High truss, 130 ft., per lin. ft......	32.00	31.59
High truss, 140 ft., per lin. ft......	34.00	33.32
High truss, 150 ft., per lin. ft......	34.00	33.32
Tubes, complete in place, 24 in. dia. each, per ft..........................	8.75	7.67
Tubes, complete in place, 30 in. dia. each, per ft..........................	11.00	10.15
Tubes, complete in place, 36 in. dia. each, per ft..........................	12.75	12.30
Tubes, complete in place, 42 in. dia. each, per ft..........................	15.50	15.15
Tubes, complete in place, 48 in. dia. each, per ft..........................	17.95	17.72
Piling, steel I-beam, 8 in., per ft...	1.10	.87
Piling, H-column, 9 in., per ft......	2.40	2.30
Piling, box, per ft...................	2.47	2.40
Web bracing, per sq. ft..............	.....	1.14
Web bracing, per lb..................	.06½	.....
Piles, in tubes, per ft..............	.70	.70

Tennessee.

City Officials of Chattanooga, Tenn., are planning to have a new concrete bridge over the tracks of the Southern Ry. on Vine St. constructed in the near future. Robert Hooke is city engineer.

Texas.

✣Bids will be received Feb. 26, C. J. McKenna, Tarrant County, Auditor, Fort Worth, Texas, for services of first-class bridge engineer to design and supervise construction of two reinforced concrete bridges, estimated to cost $450,000.

J. T. Witt, who was recently granted a franchise by the Dallas County Commissioners' Court, Dallas, Texas, to build an interurban railway from Commerce St. bridge to a point 6 miles west of Dallas, has filed with the Commissioners' Court a proposition to join them in the construction of a new bridge over the Trinity River at the foot of Elm St. for the use of the interurban and the public.

At a recent conference between the County Commissioners, Fort Worth, Texas, and the Advisory Board in regard to the matter of bridge building provided for by the recently authorized bond issue, it was decided the greatest need existed for the construction of the big viaduct or bridge between Fort Worth and North Fort Worth, the Main St. bridge and the Riverside bridge connecting the city with that suburb on the east side. Both of these bridges, when constructed, will span the Trinity. It was also decided to get the names of several competent engineers and from that list select one to supervise the building of the new bridges the county will build near the city.

Washington.

✣Bids will be received until 1 p. m., Feb. by Lewis County Commissioners, Chel Wash., for the necessary steel for the construction of the bridge over the Colitz Riv at Randle, Wash. Plans are on file with county engineer. H. H. Swafford is coun auditor.

⊙The Board of Spokane County Commissioners, Spokane, Wash., has awarded contracts for the construction of Bridges No. 4, 15, 18 and 126 to the following bidde Omaha Structural Steel Works, Omaha, Nebr., No. 4 at $15,500; No. 15 at $5,600; 18 at $5,400; Portland Bridge & Iron Portland, Ore., No. 126 at $26,588. Bids the structures were opened Feb. 2. Chas Howard is clerk of the board.

An ordinance has been referred to Engineer A. R. Dimock, Seattle, Wash., thorizing the Board of Works to repair the Bridge and approaches between Lake Ave. and North Lake Ave., at of about $7,500.

The Street Committee of the City Coun Seattle, Wash., has recommended the pass of a bill appropriating $7,500 for the ne repairs on the Latona Ave. Bridge.

Wisconsin.

The Road and Bridge Committee of Crosse County, LaCrosse, Wis., has awar the contract for the construction of an break at Hunter's Bridge to the West Construction Co., at $1,100.

It has been announced that no appropriation has been allowed for the construct of the proposed Buffalo St. bridge, theref the work will not be taken during the yr of 1912. L. J. Klug, Milwaukee, Wis. Supt. of Bridges and Buildings.

Wyoming.

✣Bids will be received until 2 p. m., Ma 6, by U. S. Reclamation Service, Washingt D. C., for the manufacture, furnishing, ha ing and erection of one 100-ft. clear sp through truss, steel highway bridge for Shoshone project, Wyo. F. H. Newell director.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

⊙Bids were opened Jan. 30 by the Fourche Drainage District, Lund & Hill, Engineers, Little Rock, Ark., as noted in our last issue, for constructing river protection levee and for clearing about 500 acres of land. The river protection levee is to have a 6 ft. crown, 3 to 1 and 2½ to 1 slopes, and is to average 6 ft. in height. Sections 1 and 2 are in sandy soil; sections 3 and 4 in buckshot. Grubbing is to be paid for at price of filling holes. Section 1 called for 30,380 cu. yds. levee and 300 cu. yds. grubbing. Section 2 for 7,880 cu. yds. levee and 100 cu. yds. grubbing. Section 3 for 125,000 cu. yds. levee and 1,500 cu. yds. grubbing. Section 4 for 130,000 cu. yds. levee and 1,500 cu. yds. grubbing. The itemized bids on the levee work were as follows: I. R. Bobbett, Delta, La. (awarded contract), 12.94 cts. per cu. yd. for levee and grubbing for all sections (work to be completed Aug. 1, 1912) R. L. Leonard, Memphis, Tenn., 13.5 cts. per cu. yd. for all sections (work to be completed June 1, 1912); Roach & Stansell, Memphis, Tenn., 13.7 cts. per cu. yd. for all sections (work to be completed Oct. 1, 1912); F. H. Peters, Little Rock, Ark., 14.4 cts. per cu. yd. for all sections (work to be completed June 1, 1912); J. G. Sessions, Swiftwater, Miss., 14.48 cts. per cu. yd. for all sections (work to be completed Sept. 1, 1912); C. W. & W. Dodson, Hot Springs, Ark., 14.73 cts. per cu. yd. for levee and 20 cts. per cu. yd. for grubbing for all sections (work to be completed June 1, 1912; Lacey & Conley, Arkansas City, Ark., 14 cts. per cu. yd. for Sections 1 and 2, 15.9 cts. per cu. yd. for Sections 3 and 16.5 cts. per cu. yd. for Section 4 (work to be completed Jan. 1, 1913. For clearing right of way 100 ft. to 400 ft. wide through heavy timber and brush, material to be assorted and stacked on right of way, the following units were received: (1) Standing for bid of Jos. McCoppin, Little Rock, Ark. (awarded contract); (2) A. W. Gilmer, Little Rock, Ark.; (3) for C. W. & W. Dodson, Hot Springs, Ark.; (4) for J. P. Findley, Arkansas City, Ark.; (5) for C. E. Adams, Little Rock, Ark.

	(1)	(2)	(3)	(4)
Sec. 1, 100 ft. wide, with creek, 52 acres..........	$30.00	$25.00	[illegible]	$72.50
Sec. 2, 125 ft. wide, with creek, 28 acres..........	28.00	32.50	[illegible]	72.50
Sec. 2, 125 ft. wide, without creek, 9 acres.......	26.00	21.00	[illegible]	72.50
Sec. 3, 150 ft. wide, with creek, 27 acres..........	30.00	40.00	49.80	72.50
Sec. 3, 150 ft. wide, with creek, 4 acres..........	30.00	[illegible]	49.80	72.50
Sec. 4, 400 ft. wide, with creek, 46 acres..........	30.00	60.00	49.80	72.50
Sec. 4, 400 ft. wide, without creek, 83 acres......	25.00	[illegible]	49.80	72.50
Sec. 5, 400 ft. wide, with creek, 193 acres.........	30.00	75.00	[illegible]	72.50
Sec. 5, 400 ft. wide, without creek, 84 acres......	20.00	20.00	[illegible]	72.50
Sec. 6, 200 ft. wide, with creek, [illegible] acres	[illegible]	20.00	49.80	72.50
Sec. 7, 200 ft. wide, with creek, 50 acres..........	27.00	25.00	49.80	72.50
Sec. 8, creek bed, with creek, 40 acres...........	25.00	[illegible]	[illegible]	72.50

Surveys are now under way for the drainage system of the Chicot County Drainage District, Lake Village, Ark., and it is expected that maps and plans will be filed by June 1. It is thought that a $300,000 bond issue can be made about July 1, and that construction contracts can be let shortly after the sale of the bonds. It is proposed to construct two main drainage canals running north and south through the entire length of the coun. These canals are to be known as the Bayou Macon and the Big Bayou drainage can., each being 36 miles in length. These m canals, with connecting laterals.

California.

⊙Advices from El Centro state that J. Maxey, who has the contract for the raising and riprapping of the Volcano Lake lev., has sublet the earth work to Sanguinetti & Mulligan, who have assembled the stock and equipment at the site of the work. Maxey has also assembled his outfit t Volcano Lake levee.

Engineers have surveyed a large distr near Cibolia, Yuma County, Arizona, al work on a canal system will soon begin. A. Hamilton, 415 South Hill St., Los Angeles, at the head of the project.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Florida.

3ids were opened Feb. 1 by the Trustees f'ie Internal Improvement Fund, Tallahas- Fla., for the construction of Lock No. 1 he Miami drainage canal about 4 miles Miami, the contract being awarded to H. Crafts & Co., Dublin, Ga., at $10,210. work includes the following: Driving t piling, 50,000 ft.; driving round piling, lin. ft.; excavation, 400 cu. yds.; making [illegible]

Illinois.

Thornton & Michaels, Mattoon, Ill., have awarded the contract, at $761, for con- cting a covered drain for the Little Wa- Drainage District of Coles County. The k includes 520 ft. 12-in. pipe, 380 ft. 10-in. 2,000 ft. 8-in.

ds were opened Feb. 7 by the East Side e & Sanitary Drainage District, East St. is, for constructing a concrete tunnel in ion 2 of the river front levee, the Gould struction Co. at $2,544 being the low bid-

Indiana.

[illegible] lmer C. Williams, Construction Commis- er, Court House, Winamac, Ind., for construction of the following drainage k: Main Ketman Drain—Length 148,200 cubic yards excavation, 2,661,454. Branch [illegible] yds. excavation, 69,503. Branch No. 2, ucas Division—Length, 10,500 ft.; cu. yds. avation, 23,771. Branch No. 3, or Hen- Branch—Length, 5,557 ft.; cu. yds. exca- on, 14,169. Branch No. 4, or Zech Branch ength, 8,100 ft.; cu. yds. excavation, 95. Branch No. 5, or Little Monon— gth, 21,360 ft.; cu. yds. excavation, 55,066. nch No. 6, or E. P. Thompson—Length, 88 ft.; cu. yds. excavation, 90,009. nuch No. 7, or Hunter Branch—Length, 0 ft.; cu. yds. excavation, 7,580. Branch 8, or Agnew Branch—Length, 6,080 ft.; yds. excavation, 11,379. Branch No. 9, or sser Branch—Length, 5,300 ft.; cu. yds. avation, 8,755. Branch No. 10, or Franks nch—Length, 10,400 ft.; cu. yds. excava- [illegible]1,759

Iowa.

✣Bids will be received until 10:30 a. m., 16, by Board of Humboldt County Super- ors at the office of J. G. Devine, County ditor, Dakota City, Ia., for the construc- n of ditches and drains in Drainage Dis- t No. 2, which is divided into Sections 1 to 4.

✣Bids will be received until 1:30 p. m., b. 16, by Board of Humboldt County Super- ors, at the office of J. G. Devine, County ditor, Dakota City, Ia., for the construc- n of ditches and drains in Drainage District 33. Work is divided in Sections from to 8.

⊙Contract for the construction of Drainage strict No. 11 of Winnebago County, bids r which were opened Feb. 1, by C. K. Nel- n, County Auditor, Forest City, Iowa, have en awarded as follows: Tile work, Sargent le Ditches Co., Fort Dodge, Iowa, at 7,788; open work (70,219 cu. yds. of exca- tion) to Ajax Dredge Co., Glencoe, Minn., 9.95 cts. per cu. yd. The work calls for proximately 3,200 ft. 24-in. tile, 2,500 ft. 20- tile, 1,600 ft. 18-in. tile, 2,700 ft. 16-in. tile, 00 ft. 15-in. tile, 6,700 ft. 14-in. tile, 7,800 12-in. tile, 11,485 ft. 10-in. tile, 2,600 ft. 9-in. e, 11,620 ft. 8-in. tile, 4,704 ft. 7-in. tile, 4,386 6-in. tile; 9 concrete head walls, 5 cu. yds. ch; 1 20-in. catch basin (concrete); 1 24-in. tch basin (concrete); 34 ft. of 10-in. cast on pipe, 34 ft. of 8-in. cast iron pipe, and 7,000 ft. of open work, estimated 70,219 cu. ls. of excavation. The average haul from eils Spur, Iowa, Leland, Iowa, or Thomp- n, Iowa, about four miles.

⊙Bids were opened Feb. 8, by B. E. Norton, ounty Auditor, Algona, Ia., for constructing rain No. 63, contracts being let as follows: ile work, 74,144 ft., 6 in. to 24 in., to Sargent Tile Ditches Co., Fort Dodge, Ia., at about $30,000; open ditch, 14,962 ft. long, 8 ft. base, 6½ ft. deep, 50,000 cu. yds., W. H. Lawton, Newell, Ia., at about $5,500.

Louisiana.

⊙The Crescent Construction Co., Winamac, Ind., has been awarded a contract at about $63,000 for reclaiming by drainage about 7,000 acres of land in Terrebonne Parish, for the Bayou Cane Land Co., of New Orleans, La.

The Police Jury of Calcasieu Parish, Lake Charles, La., has taken the first steps to create two new drainage districts, Vinton District No. 1 and Rose Marsh District No. 1. The former contains 65,000 acres and the work is estimated to cost $500,000; the latter is between Kinder and Welch, and will redeem 15,000 acres at an estimated cost of $40,000. Commissioners for both were appointed and an election to levy a tax will be held soon. Two drainage districts have already been formed with the promise of excellent results near Iowa and west of Lake Arthur. Two others are being organized, one south of Lake Arthur and the other north of Kinder. These six districts will redeem 125,000 acres of low land in the parish now unfit for cultiva- [illegible]

Maryland.

A bill is now before the State Legislature which will further the reclamation of part of the 328,000 acres of land in Maryland now too wet for agricultural use. The bill creates "drainage districts," and provides means by which all the lands within a prescribed boundary may be brought into a compact for the common good, including the right of condemnation for the right of way for all main drains and ditches, and for the widening or straightening of natural water courses.

Minnesota.

✣But one bid was received Feb. 5 by S. G. Bertilrud, County Auditor, Roseau, Minn., for the excavation work, Ditch No. 10. This bid was 14.18 cts. per cu. yd., and was rejected and new bids are being asked until 3 p. m., March 5. The contract for the culvert work in connection with this ditch was let to the North Dakota Metal Culvert Co., Fargo, N. Dak. The open work on which bids are again being asked calls for one main ditch, three laterals, one branch and three sub-branches in all about 17½ miles, and containing 110,625 cu. yds. of excavation. V. B. Chapin, Badger, Minn., is the Engineer.

✣Bids will be received until 9 a. m., Feb. 26, by E. S. Shepard, County Auditor, Marshall, Minn., for the construction of Ditch No. 10, involving tile from 5 to 16-in., aggregating over 36,000 ft. The cost of the work is estimated at $7,815.

⊙Bids were opened Feb. 3 by G. C. Smith, Isanti County Auditor, Cambridge, Minn., for constructing County Ditch No. 10, the contract being awarded to Peter Scastrand at $8,675. The work includes 81,145 cu. yds. of excavation, 10 acres of clearing, building 5 highway bridges and replacing floor on one bridge and two culverts.

⊙Bids were opened Feb. 7 by C. J. Hemmingston, County Auditor, Hollock, Minn., for constructing Kittson County Ditch No. 20, contracts being let as follows: Brown & Hershey, Litchfield, Minn., at 12 cts. per cu. yd., for 66,975 cu. yds. excavation and five miles of road at $50 per mile; Valley Dredging Co., Stephen, Minn., for bridges; North Dakota Culvert Co., Fargo, N. Dak., for culverts.

Mississippi.

✣Bids will be received until 2 p. m., Feb. 19, by Drainage Commissioners, Carroll County, Vaiden, Miss., for the construction of a ditch or canal 7½ miles in length, 21 ft. wide and 7 ft. deep.

✣Bids will be received until noon, March 5, by Commissioners Black Creek Drainage District, at the office of Noel, Loothe & Pepper, Lexington, Miss., for the construction of drainage canal from point on Tchula Lake near Mileston; length about 5¾ miles; 10 ft. wide at bottom, with side slope of 1 to 1; depth will vary from 6 to 14 ft., there being 10,835.43 cu. yds. practically complete except as to embankment on south side, which has been broken in places and will require about 790 cu. yds. of dirt to repair same; will require about 93,037.27 cu. yds. of dirt to complete same on east end according to original map. Separate bids are to be made for completion of said canal with and without repairing levee or embankment; also for extension of said canal, beginning at east end thereof for distance of about two miles, exact route and distance to be decided by engineer during course of work. Plans and specifications are on file with chancery clerk of Holmes County at Lexington; James F. Fountain is engineer, Lyons, Miss.

Preliminary surveys have been started for the levee that is to be constructed from Fort Gibson to Tunica. John F. Jenkins, Natchez, Miss., is Chancery Clerk.

Nevada.

✣Bids will be received until 4 p. m., Feb. 26, by U. S. Reclamation Service, Fallon, Nev., for furnishing and delivering, f. o. b. shipping point one electric power shovel. D. W. Cole, Fallon, Nev., is project engineer.

New York.

A bill will probably come before the State Legislature for an appropriation of $75,000 for the further improvement of the Black River Canal. A $50,000 appropriation was made last year and was expended for work on the canal during the past summer.

Oregon.

The Labish District Improvement Co. proposes the construction of drainage ditches for the improvement of about 1,800 acres of land near Salem. The work will cost about $36,000. J. O. Hays, San Jose, Cal., is interested.

Memphis, Tenn., and Vicinity.

[illegible]

⊙The new $100,000 concrete building to be erected by the Hessig-Ellis Drug Co., was let at contract to Kausher, Hodges & Co., of this city, after a sharp competition with contractors from Chicago, Atlanta and New York. Work will be begun at once and completed by July 1st.

A big surprise was sprung in local railroad and construction circles a short time ago when Contractor M. J. Roach filed a general creditor's bill against the Lake View Traction Co. and asked that a receiver be appointed to take charge of the affairs of the latter company, alleging that same was insolvent and unable to pay its current bills. Chancellor Fentress appointed J. H. Sullivan receiver and directed that the affairs of the company be looked into closely. The Lake View Traction Co. was the first interurban railway in the vicinity of Memphis and was organized in 1907 under the most auspicious circumstances imaginable. Some of the most influential men in Tennessee became stockholders and directors and after casting about for some time, the company chose W. W. Hayden Chief Engineer. Bill Hayden was an old Illinois Central man of renown and under his auspices and direction the location of the lines was mapped out and most valuable franchises secured from the City of Memphis and the County of Shelby. The contract for the construction of the line from Memphis to Lake View, Miss., was awarded to M. J. Roach and in a very short time the grading was finished and the steel laid. Then dissention in the ranks began. The board of directors wanted one thing and the president another, while Bill Hayden, the practical engineer and responsible head of the whole company, pointed out what was the only feasible way to continue the contemplated construction of the remaining 125 miles mapped out in the beginning. But the warring factions could not agree and Bill Hayden resigned as Chief Engineer. Then things went from bad to worse and when the company, being in no position to pay for the balance due on construction of the original line, wanted to issue more bonds. M. J. Roach, himself a very heavy stockholder, asked that a receiver be appointed. There is some talk of a syndicate being organized in Memphis and St. Louis to buy out the properties of the old company, and if this is done, there is but little doubt that construction will proceed on the balance of the line and the original plans be carried out.

⦿The Morgan Engineering Company, of Memphis, have just made public the result of the big drainage letting held at Oseola, Ark., on January 25th, which involved about 14,000,000 cubic yards of drain ditch. It will be noted from the tabulation of bids below that the total amount of money necessary to do the work is $979,950.49 while the average price per yard is 7 cts., a most reasonable figure, so all the contractors admit. Work must begin on all contracts with the exception of Nos. 9 and 16 within six months, on these two the contractor is allowed one year to start the job. On all sections it is required that the minimum amount of yardage per month must be 25,000. The successful bidders on 22 steel bridges and 17 wooden structures will be announced at a later date. Below follows the tabulation of bids:

Contract No.	Contractor.	Price.	Yardage.	Total Cost.
1.	Geo. W. McCarter, Warsaw, Ind.....	7.90	874,400	$ 69,077.60
2.	Geo. W. McCarter, Warsaw, Ind......	7.90	1,117,500	88,282.50
3.	Engel Bros., Nettleton, Ark.	6.99	799,300	55,871.07
4.	Forestal & Feyen, St. Paul, Minn.....	9.00	607,500	54,675.00
5.	National Drainage Co., Alexandria, Minn.	5.93	1,598,400	94,785.12
6.	Otto Kochtitzky, Cape Girardeau, Mo.	8.00	1,012,600	81,008.00
7.	J. S. Kochtitzky, Cape Garardeau, Mo....	7.45	823,600	61,358.20
8.	Otto Kochtitzky, Cape Girardeau, Mo.	6.35	947,300	60,153.55
9.	R. H. & G. A. McWilliams, Chicago, Ill.	11.25	100,000	11,250.00
10.	National Drainage Co., Alexandria, Minn.	5.70	949,400	54,115.80
11.	Otto Kochtitzky, Cape Girardeau, Mo.	6.30	1,044,600	65,809.80
12.	Otto Kochtitzky, Cape Girardeau, Mo.	6.35	1,228,300	77,997.05
13.	Foohey Dredging Co., Fort Wayne, Ind...	7.00	618,400	43,288.00
14	Foohey Dredging Co., Fort Wayne, Ind...	7.00	863,000	60,410.00
15.	Otto Kochtitzky, Cape Girardeau, Mo.	6.30	1,156,600	72,865.80
16.	Forestal & Feyen, St. Paul, Minn....	11.50	252,200	29,003.00
	Totals		13,993,100	$979,950.49

Average per cu. yd., 7.00 cts

All bids for the construction of a drainage canal through the Big Muddy Creek bottom, in McNairy County, Tennessee, which were received on Feb. 3rd, were rejected by the Board of Directors. This canal is to be 7½ miles long, 23 ft. wide at top, 8 ft. wide at bottom and 7 ft. deep, and embraces approximately 197,717 cu. yds. of excavation. There were three bids on this work, from contractors of Minnesota, Missouri, and Illinois, the lowest bid being $20,200. Bids will be received again in a few weeks, and the work will be paid for from a bond issue of $20,000. This is the first drainage canal for McNairy County, and the outcome of the next letting will be watched with much interest. T. B. Whitehurst, Chairman of the board, has his office at Selmer, Tenn.

Robert Cheshire was in Memphis last week and returned to his Red River levee work with a carload of good laborers secured in the local territory. Bob is as cheerful as always and most enthusiastic over his new contract in Miller County, Ark.

Sam Bush is also on the big Red River levee and from the reports that emanate from his camp, is showing all the contractors on the line that he has not forgotten how to put dirt into a levee embankment, even if he has been doing only railroad work for the past two years. Sam, by the way, was most successful with his Rock Island railroad work at Kent, Ark.

When the good steamer Sadie Lee left Memphis last Thursday, she had on board, consigned to Bill Stephenson at Atherton, La., six of the best mules that have been shipped from Memphis for some time past, each costing $350 per. These dike climbers were supplied by H. T. Bruce and according to him are some of the best stock ever seen in Memphis. But Bill says he has a hard proposition before him in the Atherton Loop and needs good stock and that he can use his new mules to good advantage.

Confirming the report previously mentioned in these columns, Supt. Morris of the Illinois Central will arrange to start work on the new $3,000,000 station which his company will build at Memphis, about March 1st. By that time, the foreign roads now occupying the old depot will have moved and the work of grading will be begun. About 400,000 cu. yds. of grading will be necessary to complete the depot site, and for the most part will be steam shovel work. A number of buildings must be razed before the actual work of construction can begin, but a force has been ordered to raise the tracks of the Illinois Central at Iowa Ave., preparatory to starting the station work. According to reports going the rounds of the engineers, track raising and filling will begin on Feb. 14th. D. J. Brumley will have charge of the construction work for the I. C.

Daniel J. Brumley, Chief Engineer of Construction of the I. C. and Y. & M. V. R. R., passed through Memphis last Wednesday en route to Batesville, Miss., where he will inspect the new railroad between that point and Charleston, which was recently constructed by R. J. Darnell, a wealthy lumberman of Memphis, Jim Lewis and Harry Rodgers doing the grading for him. It is the intention of the Illinois Central, so say those who are supposed to know, to take over the new road and operate same as part of their system.

In the death of Edwin Hawley, master railroad builder, a severe blow has been visited upon many roads in which he was interested and had intended improving on a large scale within the near future. Only very recently a local railroad contractor had a conference with Mr. Hawley in which the latter outlined some of his extensive plans for some new lines in Texas. Being an active director in the K. C. M. & O. R. R. affairs, Mr. Hawley's career was watched with interest by several local firms which were vitally interested in the construction of the latter road and it is with a deep regret that realization of his death is received.

Mike Larkin states that he is about to finish his Union Ave. contract in Memphis. Mike started this work in early fall, but owing to the extreme bad weather his operations were seriously interfered with until but recently. Mike has done a pretty piece of concrete work and is to be congratulated.

Poke Roper is about finishing up all his work which was carried over from last year and is whittling his pencil to be ready for the first City of Memphis street letting to be offered in the near future. Poke has yet to do a little work on Greenwood and Tunis Aves. and when these are done with, he will have a clean slate so far as city streets are concerned.

Despite the cold and snow, the Roach-Manigan Paving Co. have been enabled to complete their contract for the Louisville & Nashville road in this city in most remarkable time. J. W. Coburn and Alle Bartee were in charge of the contract and let nothing interfere with the progress. Supt. Fisher of the L. & N. is congratulating himself on having secured such a quick job of brick paving in such bad weather.

The Memphis Asphalt & Paving Co., a local concern of much renown, has had forces in this city for the past three weeks going o some streets previously paved with asph under their maintenance contract with the c The Memphis company has just finished several good contracts in the City of Lit Rock. Billy McGehee is the head man in concern.

Stanton Palmer of Ft. Worth, Tex., pass through Memphis last week from St. L en route to Helena, Ark., to be present at brick letting held at that place on Feb. Stanton looks as young as ever and is p sessed of good health and spirits. He w bid in the interest of his firm provided the uation looks good to him.

Ed Manigan, one of the most prominent cal street pavers, has been forced to go Biloxi, Miss., on account of bad health a the chances are that he will be absent the balance of the winter. Ed has not joyed the best of health for several seaso the cold months, of course, being the hard on him. His many friends here and el where are hoping that he will rapidly rega his health and he soon numbered again one of the boys who go after the street wo in Memphis.

President H. U. Mudge and other Ro Island officials, including Chief Engineer B ry, were in Memphis last week conferri with Mayor Crump and the City Engineer the details of the new bridge to be built Memphis. President Mudge assured a co mittee of citizens who waited on him that was the intention of the Rock Island Syste to provide a wagon way on the new stru ture, but that the railroad company was n disposed to stand the cost of constructing t approaches to same. This is a problem, said, which the citizens would have to wo out themselves, pointing out the fact that placing a wagon roadway on the bridge wou cost the railroad $400,000 additional than t sum first outlined to be spent. While so of the citizens of Arkansas were not inclin to accept President Mudge's words with t best good grace imaginable, it is thought th in time all these details can be worked out the entire satisfaction of those concerned.

With the election of Mayor Taylor of Li tle Rock as president, an organization of ma ors of various towns in Arkansas was perfe ed last week to urge an amendment of the st constitution which will permit of cities 1,000 and over to issue bonds for public im provements. The measure will be draft and submitted to the people at the gener election in September under the initiative a referendum clause. The smaller cities of A kansas have just awakened to the fact th good streets contribute more than perha any factor to a town's success and growth a if the proposed amendment is carried, an u precedented amount of street work will started at once. Texarcana and Little Ro have heretofore been about the only tow that could afford to do much street wo without issuing bonds and the new law is i tended to relieve the smaller cities.

Tom Bruce, the popular Memphis mu dealer and friend of all levee men in this se tion, had a rather serious joke played on hi last week by one of the long ears he dispos of daily to the contractors. Last fall To sold a well known levee builder a mule stirling quality and the aforesaid levee build consigned the said mule to hard work for term of three months pulling a wheel scrap up a 30-ft. embankment. As all contractor know, levee work is the hardest trial live sto can be put to, and it was thought that th particular mule was beginning to fag some what at his daily task, so Mr. Levee-build shipped him to Tom Bruce and made a trad for a newer animal. Then Tom in turn wa showing the mule just taken in trade to prospective buyer, who desired an animal great power, but very tame. Of course To thought that the ex-levee mule would fill th bill entirely, for by all the rules of the game the levee work should have tamed him an yet not sapped the reserve power said to b possessed by these native Missourians. So

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

ro by the name of Morgan McNeil was ed to climb upon the back of old Mister ule and demonstrate his powerfulness, yet hal gentleness, to the prospective man with coin. When lo! That mule thought so ne and gentle took it into his head that none an old levee nigger must mount his back—al, to make a long story less long, Morgan Neil [illegible] ded with broken arms and legs and now m Bruce is defending a $5,000 suit for mages! Tom says that after this the con- ctor that tells him levee work tames a le will have to produce an affidavit to sup- t his statement.

Vhen City Engineer Weatherford an- nced recently that he was prepared to [illegible] mphis during the year 1912, the street con- [illegible] Mr. atherford comes out with a few of his ns which are even more extensive than was t imagined by local contractors. In a ten- tive outline of some of the big projects con- nplated, Mr. Weatherford said that it was [illegible] McLemore Ave. from mar to the Parkway a distance of about a le and a half and to pave same with the [illegible] h grade street. South Fourth Street will extended to McLemore Avenue, a distance over a mile, and paved with asphalt; Bel- ue will be opened from the South Parkway Jackson Avenue and paved with asphalt or [illegible] Mr. Weatherford has served tice on the N. C. & S. T. L. and the South- Railway that they must proceed at once [illegible] McLemore Avenue and is also the intention of the City Engineer the N. C. & St. L. road to start the work excavation its crossing, at the Parkway s spring. If one spoke of all the streets [illegible] Haskell Weatherford had on tap for 1912 it would be too long for these columns, but of course, all will be published as they are authorized. On the whole, Memphis will be a busy place this season for contractors. The serious question that many fear will develop is, Where will the necessary labor come from?

The prospects of railroad work in this section within the near future are coming in thick and fast. The latest project on top and that which will perhaps be given earliest attention is the new yards which the N. C. & St. L. will build at Berclaire a suburb of Memphis. A deal for 35 acres of land in Berclaire has just been closed and which, when added to the other property owned at the same place by the N. C. & S. L. will make a total of 100 acres. Hunter McDonald, Chief Engineer, was in town recently, and is rapidly preparing the necessary grading notes. It is planned to spend $100,000 on the new yards; the quantity of grading necessary has not been determined as yet, but local contractors say it will not be less than 200,000 cu. yds. When the new yards are finished the present terminal will be given over to freight sheds, the work on which will begin as soon as possible.

The work of extending the Jonesboro, Lake City & Eastern R. R. from Wilson, to Hopefield, Ark., a distance of approximately 30 miles will begin this spring according to R. E. Lee Wilson, president of the road. The amount of yardage involved in the extension will be very great and the completion of the new branch will open up one of the richest parts of the State of Arkansas. It will penetrade the heart of the St. Francis basin where so much drainage is now being planned, and will skirt the ridges until coming to a connection with the Rock Island and Frisco roads near Hopefield. It is the intention of the management of the road to start a surveying party as soon as conditions will permit. The J. L. C. & E. has just purchased the Wilson & Northern road, which has 23 miles of track and considerable rolling stock, thus providing an outlet to Dell, Ark., for freight moving from Hopefield, which is just across the river from Memphis.

J. Marshall Weir, Assistant Engineer of the Frisco Road, was in Memphis not long ago on inspection trip for his company. While here, Mr. Weir looked over the new Bellevue Yards which his company has recently completed and pronounced everything in good shape. Mr. Weir said he could not say what new work his company had in mind for the year 1912.

Aderholdt Brothers of Gunnison, Miss., state that they would like very much to secure some good grader work at once. They would consider moving to any point within a radius of 1,000 miles of Memphis. The Aderholdt boys have a good outfit and themselves are noted for their hustling qualities.

Canada.

It is believed that the supplementary estimates which are to be submitted to the House of Commons in a few days will contain a large item for beginning the construction of the new Welland Canal. Surveys have been under way for some time with a view to locating a new route and getting accurate estimates as to the cost, and it is likely that construction work will be started in the spring. Plans for the construction of the new canal, which will be the largest national undertaking since the National Transcontinental Railway was inaugurated, are now nearly completed. The total cost will, it is estimated, be in the neighborhood of $30,000,000. The work of construction, it is understood, will be in charge of the present superintendent of the canal, J. L. Weller of St. Catharines, Ont.

WATER-WORKS

California.

✣Bids will be received from 2 p. m. to 3 m., Feb. 21, by Board of Public Works, n Francisco, Calif. (readvertisement), for e structural steel and iron work of Class building located in Fort Mason Military servation for pumping station No. 2.

⊙Caldwell & Co., 1913 Van Ness Ave., San ancisco, Calif., have been awarded the con- act by the Board of Public Works of that y for the general construction of a Class A ilding to be located in the Fort Mason mil- ary reservation for the Auxiliary Water pply system for fire protection. The con- act price is $110,000. Bids were opened n. 24.

Illinois.

⊙The Water Board of St. Paul, Minn., has varded the contracts for new water mains d special castings to the U. S. Cast Iron pe & Foundry Co., of Chicago, Ill., for 22,000. The contract stipulates that the rge pipes shall be 24, 30 and 36-ins. and ipments must begin Feb. 15 and continue the rate of at least 150 ft. a day. The cretary, John Caulfield, of the board was thorized to advertise for bids for laying d drayage of the pipes.

Indiana.

⊙A. L. Swanson of Evansville has been varded the contract for the electric light uipment at the new filter station in the city Evansville, Ind., for $2,061.

Louisiana.

✣Bids will be received until Feb. 17, by W. Welsh, Mayor, Kentwood, La., for furnish- g and delivering f. o. b. Kentwood, La., y or all of the following articles: 50 tons in., 250 tons 6-in. and 100 tons 8-in. stand- rd cast-iron water pipe, class "B;" also 10 tons specials, 35 hydrants, 40 gate valves, 10 tons pig lead, 15 manhole frames and covers, and one carload of best Portland cement. Geo. F. Conant is engineer.

⊙The Board of Mayor and Aldermen of Vidalia, La., has let a contract to Layne & Bowler of Houston, Tex., for the boring of a 10 in. well. The company guarantees to secure 200,000 gals. of water per day. Work is just being started on the waterworks plant.

Maryland.

✣Bids will be received until 11 a. m., March 6, Baltimore, by Board of Awards, J. H. Preston, President, for the construction of a solid masonry dam with spillway elevation of approximately 186 ft. A. M. T., with appurtenances. The work will include the following: cofferdam; 35,000 cu. yds. earth and rock excavation for foundation; 4,600 cu. yds. of rock excavation cut off trench; 38,000 cu. yds. concrete and rubble concrete; 21,000 lbs. steel reinforcing bars; 70,000 lbs. steel bridge. Ezra B. Whitman is Water Engineer. Official advertisement will be found elsewhere in this issue.

Massachusetts.

✣Bids will be received until 2 p. m., Feb. 19, by Board of Public Works, Pittsfield, Mass., for furnishing approximately 2,700 tons of cast iron water pipe and special castings. A. B. Farnham is Engineer of the Board.

Missouri.

✣Bids will be received until noon, Feb. 20, by Board of Public Improvements and Water Commissioner for furnishing and delivering at the St. Louis, Mo., city pipe yard about 2,573 tons of 6-in. a, 12-in. a, 12-in. b, and 36-in. b, cast iron coated water pipe.

The citizens of Kirksville, Mo., on Feb. 6, voted against the issuance of bonds in the sum of $99,000 for the building of a water and light plant.

Missouri.

The citizens of Tarkio, Mo., have voted against the issuance of bonds in the sum of $22,000 for the purchase of the present waterworks. J. L. Watterson is City Clerk.

Nebraska.

The City Council of Palmer, Nebr., is considering the advisability of installing a water works system. Engineer W. E. Donner of Grand Island has been instructed to prepare plans and specifications for a tower and tank system, giving the approximate cost of material, construction and installation of engine and pumps and the laying of mains.

The city of Minatare, Nebr., is having preliminary plans prepared by Engineers Bruce & Standevin, Bee Bldg., Omaha, Nebr., for a waterworks system to cost $10,000. Bonds will be voted for this improvement.

Providing the citizens of Ainsworth, Nebr., vote in favor of the issuance of bonds in the sum of $21,000 for an extension to their waterworks system on Feb. 20, another election will be held to vote bonds for the installation of a sewerage system. Bruce & Standevin, Bee Bldg., Omaha, Nebr., are Engineers.

New York.

✣Bids will be received until 7:30 p. m., Feb. 27, by E. B. Talbot, Clerk of the Board of Water Commissioners, Cornwall-on-Hudson, for constructing a storage reservoir for the village. The following is an approximate estimate of the different classes of work to be done: 15,000 cu. yds. of earth excavation; 1,150 cu. yds. of rubble masonry; 125 cu. yds. of concrete; 10 acres of clearing and grubbing; 10 cu. yds. of clay puddle· 84 sq. rds. of soiling and seeding; 2,700 sq. yds. of stone

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

paving. Furnishing and laying 120 lin. ft. [illegible] 16-in. cast iron water pipe weighing 110 lbs. to the lineal foot, with one 16-in. iron body bronze mounted gate valve, also cover for gate-well fitted with hasp and lock. The work must be completed on or before the first dav of August, 1912. Each bid must be accompanied by a certified check upon a national or state bank, payable to the order of the Board of Water Commissioners for an amount of $1,000. Check to be delivered separately to the Clerk of the Board.

✣Bids will be received until 11 a. m., Feb. 23, bv Board of Water Supply, 165 Broadway, New York City, for Contract 114, Catskill Aqueduct, for furnishing and delivering 43 pressure-regulating valves, varying in size from 12 to 24 ins., for installation in connection with the City tunnel and the City pipelines of Catskill aqueduct, in New York City. J. P. Morrissey is Secretary of the Board.

Construction Engineer George H. Beebe of the Water Bureau, Syracuse, N. Y., is preparing plans for the extension of water mains during the coming year. The 6-in. main in James St., from Oak to Dewitt Sts., will be replaced with a 20-in. main, and the 8-in. main in Gertrude St., from Lodi to Oak St., with [illegible] main.

North Carolina.

⊙Johnson, Porter & Peck of Charlotte, N. C., have been awarded the contract by the Board of Water Commissioners of that city for the construction of the 65,000,000-gal. reservoir that is to be erected beyond the Hoskin village as a part of the new water system of the city. The contract price is $31,359. Other bidders were: Porter & Boyd, of Charlotte, $61,739; McCoy and Mayor of Richmond, Va., $55,400; The Propst Contracting Co. of Charlotte, $51,180; The Stobaugh Construction Co. of New York, N. Y., $48,159; The Edwards Construction Co. of Greensboro, $42,060; Abee Brothers & Hart of Hickory, N. C., $37,931; Lane Brothers of Altavista, Va., $68,676.

⊙Johnson, Porter & Peck of Charlotte, N. C., have been awarded the contract by the Board of Water Commissioners of that city for the construction of a reservoir for $31,359. The work will include 50,000 cu. yds. of embankment, 6,600 sq. yds. of concrete slope, 600 cu. yds. of concrete core wall and clearing and grubbing. Gilbert C. White, Charlotte is Engineer. Bids were opened Feb. 1.

⊙The Board of Water Commissioners of Charlotte, N. C., has awarded the contract for furnishing 35 water meters of the five-eighth in. disc type, to the Hersey Manufacturing Co. of South Boston, Mass., 25 meters by the Pittsburg Meter Co., Pittsburg, Pa., and 25 by the Worthington Manufacturing Co.

An election will be held in La Grange, N. C., on March 4 for the purpose of voting on the issuance of bonds in the sum of $30,000 for a waterworks, sewerage system, electric light plant, street improvements, etc. D. M. Fields is Town Clerk.

Ohio.

The city of Youngstown, O., contemplates a number of improvements during this season. Some of the larger ones are as follows: Elimination of Erie grade crossings, $2,165,000; Milton reservoir, $800,000; East End bridge, $200,000; Oak St., bridge, $140,000; city hall, $150,000; Delaware park reservoir, $100,000; park improvements will [illegible] amount to $20,000.

Oregon.

Plans, specifications and estimates of cost for both the permanent water purification and the sewage disposal plants for the city of Lima, O., are being completed by City Engineer Guy Crayton.

✣Bids will be received until 7:30 p. m., Feb. 19, by A. C. Chandler, McMinnville, [illegible] "I" Sts., from First to Fifth Sts., and will require approximately the following quantity of castiron pipe; 1,500 ft. of 14-in. pipe, 2,520 ft. of 8-in. pipe, 7,040 ft. of 6-in. pipe, together with necessary standard specials, gates, hydrants, etc. Detail plans, specifications, proposals, blanks, etc., may be obtained at the office of R. W. Jones, City Engineer. A. M. Peery is Chairman of the Water Committee.

Pennsylvania.

✣Bids will be received until Feb. 28, according to reports by Joseph Armstrong, Director of Public Works, Pittsburg, Pa., for the construction of a large reservoir in Shaler Township; a new brick pumping station at Aspinwall; 30-in. steel rising main.

Plans have been approved by the State Board of Health for the Borough of Blairsville, Pa. The water system consists of six or more 10-in. wells drilled near the Conemaugh River. Water from these wells to be pumped into a collecting reservoir of reinforced concrete type. A second reservoir is also provided for the purpose of taking water from the river, and at a lower elevation providing for a gravity flow from the river. An intake well is also provided at the river. Pumps take the main supply from the main receiving reservoir, but are connected to both. Washout lines to the river are also provided. The power plant consists of pumping engines, boilers, air compressors. The power house is of brick, with an additional coaling room. The force main leading from pumping station is 10 ins. in diameter and connects with one of the town mains, causing a direct pressure from the pumps along this line until it empties into a small storage reservoir on the highest point and from thence giving a gravity flow for the town. Another 2 500,000 storage reservoir is provided on the highest elevation north of town. It is supplied from a 10 in. force main leading from the pumping station having a length of about 9,000 ft., a gravity main from it connects with the north main of the town. This reservoir is of the embankment type and lined with reinforced concrete and is provided with a gate house for valve controllment and is also provided with a bypass and a washout line. Edward J. O'Brien, Latrobe, Pa., is Engineer.

Plans for a 3,000,000-gal. filter plant with reinforced concrete reservoir and auxiliary pumping machinery have been submitted by Chester & Fleming, Consulting Engineers, Pittsburg, Pa., in behalf of the Borough of Phoenixville, Pa., to the State Board of Health of Pennsylvania for approval.

South Dakota.

✣Bids will be received until 5 p. m., Feb. 23, by City Council, Winner, S. Dak., for constructing and equipping a system of water works in that city. A. L. Rawson is City Auditor.

⊙The city of Chamberlain, S. Dak., has awarded the contract for the installation of a waterworks system, for which the Missouri Valley Engineering Co., Mitchell, S. Dak., is Engineer, to the Black Hawk Construction Co. of Waterloo, Ia., for $15,945. Other bidders were as follows: Wm. Tunny, Joliet, Ill., $15,890; Des Moines Bridge & Iron Works, Des Moines, Iowa, $16,416; Roberts & Few, Brookings, S. D., $19,966; Cook Construction Co., Des Moines, Ia., $17,845; Geo. Corrick, Chamberlain, S. D., $19,648; Edmund T. Sykes, Minneapolis, Minn., $18,440; P. F. Cavanaugh, Vermillion, S. D., $18,379; T. G. Robertson, St. Paul, Minn., $21,760; Katz Construction Co., Omaha, Neb., $16,950.

At a recent meeting of the Monday Noon Club of Yankton, S. Dak., a movement was started through which a petition will be drafted calling for a vote at the regular spring election for a $60,000 bond issue to increase the size of the water mains and erect a new standpipe.

The City Council of Kimball, S. Dak., has indefinitely postponed action upon the question of extending the water mains and enlarging the system. H. Smith is City Auditor.

The citizens of Vermillion, S. Dak., [illegible] Feb. 15, will again vote on the propositi to issue bonds in the sum of $32,500 for the ur-chase of the present waterworks systen and improving it.

Tennessee.

⊙The Board of Water Commissione of Johnson City, Tenn., has awarded the on-tract for the laying of a pipe line fron Big Blue Springs to the city, a distance 13 miles, to F. R. Stone & Co., of Okla ma City, Okla., for $42,216. The contrac for the construction of the 4,000,000-gal. rese oir was awarded to Oliver & Hill of Kno lle, Tenn., for $16,177; also to Flynn & C of Chattanooga, Tenn., at $1,000 for the i ke. At the same time the Board awarded on-tracts for the furnishing of cast iron pe, gate valves, manholes, etc. J. B. Mc ar Co., Atlanta, Ga., is Engineer.

Texas.

⊙The city of Waco, Tex., has let a co act to the Des Moines Bridge & Iron Worl Des Moines, Ia., for the construction steel reservoir at Highland Place to 50,000 gals. The reservoir will be placed ft. above the ground on a steel trestle contract price is $3,500.

⊙Lane & Bowler of Houston, Tex., been awarded the contract by Charle Gates at Port Arthur, Tex., for the fur ing of artesian well water for the cit Port Arthur. Artesian wells will be su Port Neches.

The City Commission of Fort Worth, has authorized the city secretary to adv for bids for the purchase of the site o Parker County reservoir.

Wisconsin.

✣Bids will be received by George D. ards, village clerk, Owen, Wis., until 7 m., Feb. 20, for furnishing f. o. b. cars 1,300 ft. of 6-in. and 6,722 ft. of 8-in. pipe, Class B, 4800 lbs. of special casting hydrants, 3 8-in. and 7 6-in. valves, 8 boxes, 1,950 ft. of 24-in. and 14 ft. of vitrified sewer pipe; also for furnishing erecting a 40,000-gal. steel tank on an steel tower. Certified check 5 per cen bid. The right is reserved to reject an all bids. W. G. Kirchoffer, Engineer, son, Wis.

⊙The Board of Public Works of Sup Wis., has awarded the contract for the l of [illegible],000 ft. of 6-in. water main on East ond St., between Hennepin and Francis to Magnus Peterson for $1,163.

Canada.

✣Bids will be received until noon, Fel by Frank Ness, Secretary-Treasurer Mu pality of Assiniboia, Kirkfield Park, P. for sinking wells as follows: 1. On Lak opposite lot 17 in D. G. S. 12, St. James, 1106. 2. On the Road Allowance betv plans 1591 and 1594 at lot 10 in the out miles of 61-64, St. Charles. The best iron casing to be used.

✣Bids will be received until 5 p. m., M 11, by W. Griffiths, Clerk, Board of P Works, Burnaby, B. C., for the followin connection with the Burnaby water exten 49,300 ft. 3-in. pipe; 51,600 ft. 4-in.; 5 6-in.; 6,100 ft. of 8-in.; 12,600 ft. of 1 pipe. All will be included in one cont Plans and specifications may be had of gineers, Cleveland & Cameron, Winch B Vancouver, B. C. This work will cost $ 000.

✣Bids will be received until 11 a. March 1, by Chairman Board of Con Winnipeg, Man., for supply and delive f. o. b. Winnipeg, of a quantity of cast water pipe, gate valves and hydrants for tension of the Domestic water works sys Specifications may be had of the City gineer, 223 James Ave. M. Peterson is retary of the Board.

✣Bids will be received until 11 a. m., 22, by Board of Control, M. Peterson, Se tary, Winnipeg, Man., for supply of thre k.w. transformers, motor and accessories installation at Well No. 4. Specifications be had of the City Engineer, 223 James

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

•Bids will be received until noon, Feb. 15, h Board of Revenue, Jefferson County, Bir- ngham, Ala., for furnishing the material [illegible] les, Ala. L. H. Salter is Sanitary Engi-

Arkansas.

✣Bids will be received until 3 p. m., Feb. [illegible] Pine Bluff, Ark., at the office of W. J. kes, Engineer, 203 Citizens Bank Bldg., ne Bluff, Ark., for the construction of [illegible]

Indiana.

✣[illegible] Works, of Terre Haute, Ind., for the [illegible] cifications were prepared by City En- eer R. M. Burns. The estimated cost of [illegible]

Iowa.

✣The City Clerk of Sioux City, Ia., it is orted, is asking for bids for the construc- n of a storm water sewer in Jackson St., a distance of three blocks. The improve- nt will cost between $6,000 and $7,000.

⊙The Hubbel Construction Co., of Daven- t, Ia., has been awarded the contract by Board of Public Works of that city for laying of a sewer main from Farnam St., Oxford Ave., to a point 260 ft. east at 75 per ft., for 8-in. pipe and $0.65 for 6-in. e. Bids were opened Febr. 6.

Maryland.

✣Bids will be received until 11 a. m., Feb. by Board of Awards, Baltimore, Md., for ing house connections across footways in nitary District No. 14, Contract No. 85. e work will include the following approxi- te quantities: 1,430 houses to be con- cted, requiring 7,200 lin. ft. 5-in. heavy cast- n soil pipe, 4,125 lin. ft. 5-in. terra cotta e, 7,150 lin. ft. 6-in terra cotta pipe. Charles gland, chairman Sewerage Commission, om 904 American Bank Bldg., Baltimore, d.

Minnesota

✣Plans have been prepared by City Engi- er Lewis W. Clarke of Stillwater, Minn., r the construction of new sewers in that ty at an estimated cost of $32,000. The ork will include two outlet sewers and one teral sewer, about 7,300 ft. in all; vitrified pe from 6-in. to 36-in. in diameter, etc. The ntract for this work will be let March 4.

Plans and specifications are on file at the fice of the superintendent of the Anoka In- ne Asylum, Anoka, Minn., for the construc- on of a new sewer to take the place of e old and inadequate system now in use.

Missouri.

✣Bids will be received until noon, Feb. 16, Board of Public Improvements, C. A. Mo- no, Secretary, St. Louis, Mo., for letting o. 10441, for the construction of sewers in arlem Creek Sewer District Number Four, authorized by Ordinance No. 25334, em- racing sewers of the materials, lengths and zes, as follows, to-wit: 655 ft. of 24-in. side diameter pipe sewer. 660 ft. of 24-in. side diameter pipe sewer. 440 ft. of 18-in. side diameter pipe sewer, 530 ft. of 15-in. side diameter pipe sewer, 5,170 ft. of 12-in. side diameter pipe sewer, 495 ft. of 9-in. side diameter pipe sewer. With sewer in- ts, manholes and appurtenances. Deposit quired, $538.

Plans have been prepared by the Setiz- eterman Engineering Co. of St. Joseph, Mo., r a new public outlet for the sewer system Mound City, Mo., estimated to cost $9,500. he work will include 5,351 lin. ft., of 10-in. mains and 18 manholes. An election was held Feb. 10 to vote bonds for this improvement, as well as for making extensions to the waterworks system.

Nebraska.

⊙L. M. Meeker, 1940 C St., Lincoln, Nebr., has been awarded the contract for the furnishing of labor and material for the construction of lateral sewers for a distance of 4,050 ft., for $2,291. The sewers will be 8 ins. in diameter. Bids were opened Febr. 5

New Jersey.

⊙John J. McGrath of Summit, N. J., has been awarded the contract by the Common Council of that city for the construction of 8-in. vitrified pipe sewer in Mountain Ave. for $2,490. The sewer will be 1,300 lin. ft. long, construction partly through solid rock. Bids were opened Feb. 6.

Consulting Engineer George W. Fuller, 170 Broadway, New York City, has presented the plans to the representatives of North Plainfield and the Council of Plainfield, N. J., of the temporary survey, together with the cost of building a sewage disposal plant on the Cramer farm.

New York.

✣Bids will be received until 3 p. m., Feb. 19, by Board of Contract and Supply, Albany, N. Y., for the construction of the Osborne St. sewer. This work consists in laying a vitrified stoneware pipe sewer under the carriageway of Osborne St. from a point about 175 ft. west of Eagle St. to South Hawk St. The construction of the sewer includes the necessary bends, branches, house connections, manholes and other appurtenances. Isadore Wachsman is Secretary of the Board.

✣Bids will be received until 11 a. m., March 13, by Board of Contract and Supply, 37 City Hall, Rochester, N. Y., for the construction of Contract No. 4, including Division No. 8 and part of No. 7, of the Sewage Disposal System. The work will consist of furnishing and laying about 9,300 ft. of 66-in. pipe for the discharge of the effluent from the disposal work into deep water of Lake Ontario; 2,300 ft. will be laid in open trench, the remainder will be submerged and laid in dredged trench terminating in a timber crib located 7,000 ft. from shore and about 50 ft. deep. Plans and specifications are on file with City Engineer E. A. Fisher. F. X. Pifer is Secretary of the Board. Official advertisement will be found elsewhere in this issue.

The taxpayers of Hobart, N. Y., at a recent election voted to build a sewerage system and sewerage disposal works at a cost of about $25,000. The resolution provides for the construction of about four miles of sewers and the trustees are authorized to purchase the necessary rights of way and real estate at a cost not to exceed $27,000.

North Carolina.

Civil Engineer J. N. Ambler has completed plans for a large extension of the sewerage system in East Winston, Winston-Salem, N. C. The system as outlined embraces 12 miles of sewerage. Estimates of cost and details are being prepared for submission to the Board of Aldermen.

Ohio.

✣Bids will be received until Noon, Feb. 21, by Director of Public Service, Cleveland, O., for the construction of sewers in the following streets, avenues and thoroughfares: Madison Ave., N. W., between West 115th St. and a point about 300 ft. west of Berea Road N. W., and West 112th St., between Madison Ave., N. W., and a point about 1,345 ft. northerly. Davenport Ave., N. E., between East 18th St. and East 20th St. Each bid must be made in accordance with the plans and specifications which may be seen at the office of the City Engineer, Room 305 City Hall. W. H. Kirby is Secretary of the Department.

⊙The Department of Public Service of Canton, O., has awarded the contract for the construction of the Harrison Ave. sanitary sewer to P. Christiansen, for $2,145, and the Ceder St. improvement contract to F. A. Downs Construction Co., for $16,590.

Chief Engineer M. J. Bahin has been instructed by the sewer committee of the City Council, Springfield, O., to prepare plans and estimates on the laying of two storm drains in the natural waterways of Indian Run and Wheldon ditch for the relief of the property owners in the southeastern, southern and western section of the city.

Oregon.

The sewer committee at a recent meeting of the City Council of Eugene, Ore., presented plans for the installation of a trunk sewer, to cost approximately $100,000, to extend across the northern end of the city, parallel to the Willamette River. W. A. Bell is chairman of the committee.

H. G. Parsons, chairman of the sewer committee from North Albina, Portland, Ore., reports that the plans for sewerage on the Peninsula have been nearly completed by City Engineer Tom Hurlburt. The plans contemplate the use of Columbia Slough as an outlet.

Pennsylvania.

The field engineers of the State Health Department have approved the plans of the sanitary sewerage system for the city of Beaver Falls, Pa.

The Borough Council of Nazareth, Pa., has granted permission to A. R. Williams, of Nazareth Inn, and Palmer J. Young, of Young Bros., of that town, for the construction of a sewerage system to cover many principal thoroughfares. The pipe will be 10 in. in diameter, and the cost of the system is estimated at $20,000.

Tenenssee.

✣Bids will be received until 7 p. m., March 1, by City Commissioners, St. Elmo, Tenn., for furnishing necessary labor and material for building complete sewerage system, including the following: 14 miles pipe sewers, 8 to 21 ins.; 1 sewerage disposal plant; 1 bridge across Chattanooga Creek; 400 lin. ft. tunnel; let as a whole or in three sections as specified. Plans may be seen at office of engineers, and copies may be had on payment of $5. Specifications may be had on application to either H. B. Wilson, Mayor, or Cushman-Fairleigh Engineering Co., engineers, 724 James Bldg., Chattanooga, Tenn.

Mayor Crump of Memphis, Tenn., is agitating the construction in the near future of a new system of crematories for the consumption of garbage.

Washington.

The City Council of Cashmere, Wash., has passed a resolution providing for the construction of a sewer system at an estimated cost of $17,500.

City Engineer W. H. North, of Bellingham, Wash., has estimated the cost of constructing a trunk sewer on Broadway from Holly St to Broadway Park addition at between $12,000 and $12,250, the first estimate being for an independent and separate trunk sewer and the latter for a combination sanitary and storm sewer.

West Virginia.

Senator George Oliver of Pittsburgh, and Earl W. Oglebay, of Wheeling, have donated $16,000 to the town of Bethany, W. Va., to be expended in improvements to its streets and sewers. The gift, however, carries with it the stipulation that the municipality shall have bonds issued for $4,000, which will make $20,000 in all for the new improvements.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

✣Bids will be received until noon, March 8, by Maj. C. A. F. Flagler, U. S. Engineer. Mobile, Ala., for alterations to the seagoing hydraulic dredge Barnard now at Havana, Cuba.

✣Bids will be received until 3 p. m., March 7, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction of a wall on the premises of the U S. Post Office at Anniston, Ala.

District of Columbia.

✣Bids will be received until 10:30 a. m., March 6, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing lumber under Canal Circular 683.

✣Bids will be received until 10:30 a. m., Feb. 21, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular, chain, pipe fittings, cocks, sheet lead, twist drills, files, nails, galvanized buckets, clothes hampers, water coolers, truck handles, water closet seats, window glass, hose, gaskets, railway flags, emery cloth, sulphate of copper, red lead, burnt sienna, cab enamel, chrome green and burnt umber.

✣Bids will be received until 10:30 a. m., Feb. 23, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 680, structural steel, material for steel cylinders, rivets, bolts, nails, pipe wrenches, manila rope, canvas, metallic brown, black paint, wrapping paper, manila folders, thumb tacks, paste and ink.

✣Bids will be received until 10:30 a. m., March 8, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal circular 681, for motors, centrifugal pumps, float switches and pump motor starters for the canal locks and spillways.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Feb. 19, for furnishing and delivering a five-panel board to control the output of 2.75 kw., 240 volts D. C., turbo generators, turbo generators operated 3-wire system, balance being maintained by means of two balancer sets each having a capacity of 54.2 amperes.

✣Bids will be received by Chas. F. Seyferlich, Fire Marshal, Chicago Fire Department, until 9:30 a. m., Feb. 20th, for furnishing the department with building cement until December, 1912.

✣Bids will be received by Chas. F. Seyferlich, Fire Marshal, Chicago Fire Department, until 10:30 a. m., Feb. 20th, for furnishing building materials for term ending December 31st, 1912.

✣Bids will be received by Chas. F. Seyferlich, Fire Marshal, Chicago Fire Department, until 11:30 a. m., Feb. 21st, for furnishing and delivering lumber for term ending Dec. 31st, 1912.

Maryland.

✣Bids will be received until 2 p. m., Feb. 20, by Commissioners of the District of Columbia, Washington, D. C., for furnishing and delivering f. o. b. cars Chevy Chase, Md., 2,000 tons, more or less, crushed limestone and screenings.

Mississippi.

✣Bids will be received until noon, March 14, by Capt. J. A. Woodruff, U. S. Engineer, Vicksburg, Miss., for furnishing about 5,000 tons of riprap stone.

✣Bids will be received until noon, March 14, by Capt. J. A. Woodruff, U. S. Engineer, Vicksburg, Miss., for furnishing about 3,000 barrels of American Portland cement delivered at Felsenthal, Ark., in sacks.

✣Bids will be received until noon, March 14, by Capt. J. A. Woodruff, U. S. Engineer, Vicksburg, Miss., for furnishing and delivering about 384,500 lbs. of structural metal for lock dam No. 6, Ouachita River, near Felsenthal, Ark., and for erecting lock gates at that work. Official advertisement will be found elsewhere in this issue.

Ohio.

✣Bids will be received until noon, Feb. 21, by Board of Trustees, Ohio State University, Carl E. Steeb, Secretary, Columbus, O., for the construction and erection of the following equipment of the Library Building: 1. Approximately 500 ft. oak book cases. 2. Approximately 768 sections steel stacks. 3. Two electrically controlled elevators, in accordance with the plans and specifications prepared by Allen & Collens, architects, on file in the office of the Auditor of State. Said plans and specifications may also be seen at the office of said architects in Boston, Mass.

✣Bids will be received until noon, Feb. 21, by Director of Public Service, Cleveland, O., for furnishing weatherproof copper wire and cable for the municipal electric light plant of the city. W. H. Kirby is Secretary of the Department of Public Service.

✣Bids will be received until noon, Feb. 20, by Secretary W. H. Kirby, Board of Public Service, Cleveland, O., for furnishing 50,000 ordinary cap mantles, 4,000 16-in. boulevard glass globes, 1,000 14-in. boulevard glass globes, 50,000 gallon gasoline, engine or auto gas. Plans and specifications may be seen and blank proposals can be obtained at the office of the Superintendent of Lighting.

✣Bids will be received until 1 p. m., March 6, by Ohio State Board of Agriculture at the office of A. P. Sandles, Secretary, Columbus, O., for furnishing all material and performance of all labor to build and erect a storage barn, sanitary manure pits, farm barn, piggery, two frame cottages and water mains, at the Ohio State Serum Farm, located in Licking County, thirteen miles east of Columbus. Plans and specifications prepared by Dawson & Holbrook, architects, No. 44 East Broad St., Columbus, O., on file at the Auditor of State offices.

Texas.

✣Bids will be received until Feb. 16, by John F. Wright, Fire Commissioner, Waco, Tex., for 2,400 ft. of rubber-lined cotton hose, with couplings (bid on multiple woven and double jacket); f. o. b., cars at Waco, Tex.

✣Bids are to be asked by Commissioners Court, Chambers County, for furnishing the new court house and jail buildings at Anahuac, with all needed furniture from bottom to top, all departments, including everything necessary for up-to-date equipment in furniture, lighting plant, plumbing fixtures in place, an estimate for the installation of a sewer line from court house to connection with tide water in Turtle bay. What is desired is samples of furniture and fixtures to be submitted from which to select the kind desired, and when this is done a day will be set when the court will receive bids for the different lines of materials and attachments in place. For further information, address H. H. Jackson, County Judge, Chambers County, Anahuac, Texas.

Washington.

✣Bids will be received until noon, March 6, by Maj. J. B. Cavanaugh, U. S. Engineer, Burke Bldg., Seattle, Wash., for dredging Olympia Harbor, Olympia, Wash. The cost of the work is estimated at about $50,000.

✣Bids will be received until noon, Feb. 20, by State Board of Control, Olympia, Wash., for the construction of a 2-story 62x80 concrete and iron power house to be erected at Sedro-Woolley, Wash., at an estimated st of $15,000. The foundation and first floor ill be of reinforced concrete above this is t be of timber and corrugated iron. Saunder & Lawton, Alaska Bldg., Seattle, Wash., re Architects.

West Virginia.

⊙C. W. Hancock & Sons, Lynchburg, a., have been awarded a contract at about $[illegible],-000 for building substations at Bluefield nd Switchback, W. Va., for the Appalacan Power Co., of which Viele, Blackwell & B k, New York City, are the Consulting Engin s.

Wisconsin.

✣Bids will be received until 10:30 a. ., Feb. 19, by Department of Public Works, il-waukee, Wis., for furnishing the city 14 ft. of underground cable. H. E. Brigg is Commissioner of Public Works.

✣Bids are now being received by partment of Public Works, H. E. Bri s, Commissioner, Milwaukee, Wis., for furn ing and erecting complete in running or r, ready for use, on foundations to be furnis d by the city of Milwaukee, all the neces y machinery and appurtenances thereto, fo a municipal electric lighting plant on the pro-erty owned by said city, east of Davidson t., between Walker and Mineral Sts., accor g to plans and specifications. Bidders are re-quired to submit a separate bid for doing e several branches of the work herein be named. Bonds to accompany bids require n the penal sum as specified below, or in u of the mentioned bonds, the bidder may e-posit, with the Department of Public Wo s, in each case, 50 per cent of the amount of e bond in money or certified bank check. ll work to be completed within 90 days fr n the date of the award of contract, failing n which the contractor shall pay to the City i Milwaukee, as liquidated damages, the foll-ing named sums as specified below for e h and every day's delay in completing the s-eral branches of the work, respectively, -wit: No. 1 boilers—Bond, $4,000; liquidad damages per diem, $67.50. No. 2 steam t-bines and generators—Bond, $7,500; liquidad damages per diem, $125. No. 3 condenser d condensing apparatus—Bond, $4,500; li-dated damages per diem, $75. No. 4 bo r feed pumps—Bond, $360; liquidated dama s per diem, $6. No. 5, feed water heater—Bd, $300; liquidated damages per diem, $5. No , stokers—Bond, $1,500; liquidated dama s per diem, $25.

✣Bids will be received until 10:30 a. ., Feb. 19, by Department of Public Works, M-waukee, Wis., for furnishing the city ab t 34,000 lin. ft. of two-duct multiple and 3, lin. ft. of single-duct vitrified clay condu ; also 300 standard bends of such conduits f varying degrees of curvature, according o specifications. H. E. Briggs is Commissio r of Public Works.

Canada.

✣Bids are being asked for the construct n of a building for the Young Men's Chr-tian Association, Galt, Ontario. Full parti-lars may be obtained of William R. Co , General Secretary, Box 889, Galt, Ont.

✣Bids will be received until 11 a. m., F 20, by Chairman, Board of Control, Winnip , Man., for supply and delivery f. o. b., Win-peg, of the following crushing plant: C No. 3 gyratory crusher, without back g r driving attachment—to be fitted with chil i iron head and concaves. One No. 5 ste elevator, complete with buckets; length 60 One No. 6 revolving screen (complet , length 16 ft., in 3 sections, and dust jac t screen. Sections to be made of ¼-in. pl e and perforated as follows: First section, - in.; second section, 1¼ in.; third section 2 ins.; dust jacket, ⅜ in. M. Peterson is Sec-tary of the Board.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

PROPOSALS

FURNISHING AND LAYING SEWAGE OUTLET PIPE.

[illegible] N. Y.

Sealed proposals will be received at the office of the Secretary of the Board of Contract and Supply, No. 37, City Hall, until 11 o'clock a. m., March 13, 1912, for the construction of Contract No. 4, including Division No. 8 and part of No. 7 of the Sewage Disposal System.

The work will consist of furnishing and laying about 9,300 feet of 66-in. pipe for the discharge of the effluent from the Disposal Works, into deep water in Lake Ontario. About 2,300 feet will be laid in open trench, and the remainder will be submerged and laid in a dredged trench terminating in a timber crib located about 7,000 feet from the shore and in about 30 feet of water.

Separate proposals will be received for pipe made of steel, ingot iron and cast iron.

A certified check for $20,000.00 must accompany the proposal as an earnest of good faith. The amount of the certified check deposited by the successful bidder will become the property of the City of Rochester if such bidder shall fail to execute and deliver the contract and execute the required bonds for the work within ten (10) days after the contract is awarded to him.

The successful bidder will be required to execute to the city a surety company [illegible] faithful performance of the contract and the payment of all laborers' wages, which bond shall be approved by the Comptroller of said city.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Board that he is reasonably familiar with submarine work, and is fully prepared with the necessary capital, materials and machinery to conduct the work to be contracted for to the satisfaction of the City Engineer, and to begin it promptly on award.

All bids must be made upon the bidding sheets furnished by the City Engineer, and be indorsed with the title of the work to which they relate, the name of the bidder and his residence. Information relative to the work may be procured at the office of E. A. Fisher, City Engineer, where plans, specifications and bidding sheets may be obtained after February 17th.

The Board reserves the right to reject all bids.

F. X. PIPER, Secretary.

DEPARTMENT OF THE INTERIOR, United States Reclamation Service. Washington, D. C., Jan. 25, 1912.—Sealed proposals will be received at the office of the United States Reclamation Service, Boise, Idaho, until 2 o'clock p. m., March 1, 1912, for furnishing a rock crusher, ball mills, tube mills, a rotary dryer and a mixing and weighing machine for a sand-cement plant on the Boise Project, Idaho. For particulars address the U. S. Reclamation Service, Boise, Idaho, or Washington, D. C. F. H. NEWELL, Director.

WAR DEPARTMENT, U. S. ENGR. OFFICE.—Montgomery, Ala., Jan. 24, 1912. Sealed proposals for dredging in Carrabelle Harbor, Fla., will be received at this office until 1 o'clock p. m., Feb. 23, 1912. Information on application. G. D. FITCH, Lt. Col., Engrs.

U. S. ENGINEER OFFICE, Duluth, Minn., Feb. 5, 1912. Sealed proposals for building rubble mound at Ashland, Wis., will be received here until noon, March 5, 1912, and then publicly opened. Information on application. JOHN N. HODGES, Lt., Engrs.

PROPOSALS

MASONRY DAM.

City of Baltimore, Md.

Sealed proposals for the construction for the City of Baltimore of a solid masonry dam with a spillway elevation of approximately 186.0 feet A. M. T., with appurtenances, to be built according to the plans and specifications to be obtained at the office of the Water Engineer, will be received at the office of the City Register, City Hall, Baltimore, Md., until 11 a. m., Wednesday, March 6, 1912.

[illegible] envelopes, must be endorsed "Proposals for the Construction of the New Loch Raven Dam," and addressed to the Board of Awards of Baltimore City.

Plans and specifications, proposal forms, etc., may be obtained on and after February 12, 1912, at the office of the Water Engineer, City Hall, Baltimore, Md., on the payment of ten dollars ($10.00), which will be refunded on the return of same in good condition.

As an evidence of good faith each proposal must be accompanied by a certified check for twenty thousand dollars ($20,000.00) drawn on a Clearing House Bank to the order of the Mayor and City Council of Baltimore. These checks will be returned to the unsuccessful bidders on the awarding of the contract, and to the successful bidder when the contract shall have been signed.

The successful bidder will be required to give bond equal in amount to the contract price, for the faithful performance of the contract.

The Board of Awards reserves the right to reject any or all bids.

The estimated quantities of the principal items for the dam are as follows:

Cofferdam.

Earth and rock excavation foundation, 35,000 cu. yds.

Rock excavation cut-off trench, 4,600 cu. yds.

Concrete and rubble concrete, 38,000 cu. yds.

Steel reinforcing bars, 21,000 lbs.

Steel bridge, 70,000 lbs.

Approved Feb. 7, 1912.

EZRA B. WHITMAN,
Water Engineer.

JAMES H. PRESTON,
President Board of Awards.

PROPOSALS FOR PUMP AND MOTOR.

Sealed bids will be received at my office at Manhattan, Mont., until 7:30 o'clock p. m. on the 19th day of February, 1912, for the furnishing, f. o. b. Manhattan, Mont., a multi-stage centrifugal underwriters' fire pump with a capacity of 750 gallons per minute and a working pressure of 100 pounds per square inch, with pipe connections.

The pump shall be direct connected with an electric motor, in accordance with the specifications on file in my office. All bids shall be accompanied by a certified check in the sum of one hundred dollars ($100.00).

Specifications may also be obtained at the office of C. M. Thorpe, Engineer, Bozeman, Mont.

The right is reserved to reject any or all bids.

By order of the Town Council.

Dated at Manhattan, Mont., Jan. 29, 1912.

R. H. DEAN, Town Clerk.

PROPOSALS

PAVING.

All of the bids received on January 24th for the improvement of several streets in Carroll, Iowa, as advertised in these columns on December 20th and 27th, 1912, have been rejected and the City Clerk instructed to readvertise. Said new bids will be received until 8 o'clock p. m., February 20th, 1912, at which time they will be publicly opened and read.

EXCAVATION AND BRIDGING.

Bids will be received at Bay City, Tex., until Feb. 15, 1912, by the Commissioners of Matagorda County Drainage District No. 3 for excavation of approximately 158,000 cu. yds. of earth and about 300 ft. of bridging. Bidders to furnish bond buyer. Plans and profile can be obtained from C. A. Marshall, Secretary, Blessing, Texas.

U. S. ENGINEER OFFICE.—Kansas City, Mo., Feb. 3, 1912. Sealed proposals for constructing standard revetment on Missouri River 94 miles below Kansas City and 2 miles below Waverly, Mo., will be received here until noon, March 4, 1912, and then publicly opened. Information on application. EDWARD H. SCHULZ, Major, Engrs.

[illegible] S. Engineer Office, Vicksburg, Miss., Feb. 12, 1912. Sealed proposals for furnishing and delivering about 384,500 pounds of structural metal for Lock and Dam No. 6 Ouachita River, near Felsenthal, Ark., and for erecting lock gates at that work will be received at this office until 12 m., March 14, 1912, and then publicly opened. Information on application. J. A. WOODRUFF, Capt., Engrs. 7-4t

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U. S. ENGINEER OFFICE—Little Rock, Ark., Jan. 31, 1912. Sealed proposals for constructing the two (2) steel hull, 24-inch pump dredges H. S. Taber and Robert McGregor will be received here until 12 o'clock noon, April 9, 1912, and then publicly opened. Information on application. CLARKE S. SMITH, Major, Engrs.

DEPARTMENT OF THE INTERIOR—UNITED STATES RECLAMATION SERVICE.—Washington, D. C., Jan. 15, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Neb., until 2 o'clock p. m., Feb. 28, 1912, for the construction of an earth dam and auxiliary works, on the North Platte Project, about nine miles north of Minatare, Scottsbluff County, Neb. The work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earthfill, 157,000 cu. yds. gravelly material, 14,000 cu. yds. unscreened gravel, 11,500 cu. yds. screened gravel, 14,000 cu. yds. concrete, and 12,000 cu. yds. brule clay excavation, besides 45 acres of sod stripping, 600 feet of wells and casing, 3,200 lin. ft. of drains, and the handling and placing of 250,000 lbs. of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Neb.; 519 Commonwealth Bldg., Denver, Col., or Washington, D. C. F. H. NEWELL, Director.

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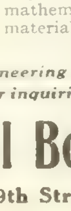

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Entered as second-class matter, April 17, 1907, at the Post Office at Chicago, Illinois, under act of March 3d, 1879. **Copyright, 1911, by the Myron C Clark Publishing Co.**

The Specialist Constructor of Reinforced Concrete

The reinforced concrete specialist, or more precisely, the engineering constructor who deals in the design and construction of reinforced concrete structures, has gained great prominence in America. America does not stand alone in this regard. In England there has been quite as pronounced if not so great a growth of the reinforced concrete specialist. Just now English engineers are discussing the proper position of these specialists in the engineering field and this discussion is so well presented in a paper by Mr. Lucian Serraillier in *Concrete and Constructional Engineering* that we reprint the paper here as follows:

The reinforced concrete specialist, a product of the last twenty years in this country, is the logical outcome of conditions which must necessarily arise from the introduction not of a new branch of engineering, but of a new material and method of construction which is applicable to the whole range of engineering and architectural work. And herein lies his *raison d'être*, for he has come not to oust the professional engineer or architect from his legitimate work, but to act as his ally. The architect's sphere is still the design of beautiful and appropriate buildings, and his reliance upon the specialist for the structural portion of the work is but the continuation of the policy he has followed in the past of reliance upon the structural steel specialist for the design and calculation of the girders, joists, stanchions, a form of construction which is now being rapidly superseded by reinforced concrete. It is this intimate association between art and science, between architect and specialist, which appears likely in the next few years completely to revolutionize our buildings, both in external appearance and internal disposition.

Reinforced concrete has possibilities, structural, artistic and economic, which far exceed any possessed by steel construction. We have long since reached the limitations of the latter, whereas the economic and structural advantages of reinforced concrete are only now being borne in upon us, and we are but on the threshold of what may be accomplished in the outward expression by form and color of this raw material. Here is the architect's opportunity, and far from a conflict of interests between him and the specialist, we discover rather a community of interests in the design and execution of structures which combine beauty with utility and practicability.

It is, of course, quite customary to specialize in engineering work. The engineer, after a general training and experience, frequently confines his activities as an expert to dock or railway work, to sewerage, waterworks or other of the many branches in the whole range of engineering practice. This practice is also immune from the intrusion of the reinforced concrete specialist, who does not encroach upon any of these departments, but merely specializes in what may become an adjunct common to all these branches, his function being merely to apply a new material to all classes of construction. The specialist, for instance, will design a reservoir, but does not profess to scheme out the water supply of a community, which is strictly within the province of the water engineer, whilst that of the specialist in this instance is to apply his knowledge to merely part of the general scheme. And so on with every class of engineering structures. For instance, the consulting engineer of a trading concern has to deal with the water supply, the lighting and ventilation and erection of machinery, as well as the construction of buildings. He must perforce consult these highly specialized branches of engineering, and there is no reason why he should not in like manner employ the services of a reinforced concrete specialist for the structural part of the enterprise. Thus we again possess all the elements of an alliance instead of a conflict of interests between engineer and reinforced concrete specialist, which certainly permits the former to consult the latter without derogation to his professional status. The function of the engineer may well be the co-ordination of the knowledge and experience of these various specialists rather than an attempt to know in detail every branch of engineering, an attempt which must necessarily fail.

The specialist, however, is still regarded by many as an intruder, and when he combines with the offer of his designing knowledge and experience the sale of some reinforcing material he is apt to be considered in the light of an iron monger. But these prejudices, arising chiefly from ignorance of the true function of the specialist, are rapidly disappearing, if one may judge by the amount of work which is now flowing into the offices of the various specialist firms established in this country.

There can be no two opinions as to the indebtedness of the community to the specialist firms who have been responsible for the introduction of reinforced concrete into this country. Had it not been for them the natural conservatism of both engineering and architectural professions would have delayed matters for many years. Experiments are costly, especially in civil engineering, where everything is on a large scale, and the very natural attitude of the profession, which has everything to lose in the way of reputation and practice by the introduction of an untried form of construction, was one of caution and maintenance along lines of proved safety. The question naturally arose, who is to be responsible for work done in accordance with this new method of construction? The specialist stepped bravely into the breach and backed his opinions by deeds, by the acceptance of financial responsibility. One may well lay stress upon this point, because the specialist has in most cases been criticised for confining the permission of constructing on his designs to a limited number of contractors, and thereby restricting competition. Such action was quite natural at the outset as a protection against a financial responsibility thrust upon him which no private professional firm would accept. This security was assured by restriction to a few approved contractors experienced in carrying out his designs, and, however obnoxious such an approach to a trust may be to the average Englishman, there is no doubt this wise policy has prevented disasters which would have retarded the industry for many years.

This limitation of contractors is now not only tending to disappear, but bids fair to drift to the other extreme, a system of unrestricted competition, with which it is now proposed to deal.

The opportuneness of the advent of the specialist and the services he is able to render to both professions will probably be generally admitted. The manner in which such services may best be utilized to mutual advantage is, however, a matter of some contention.

Briefly, two classes of reinforced concrete specialist firms exist: those which exploit patent systems, and those which sell patent bars or reinforcing material. The former derive their profit by charging a percentage on the value of a contract for their professional services, the latter by charging such a price for the bars they sell as will afford a profit equivalent to the percentage they also require for their professional services. This article does not purpose to deal with the relative merits and disadvantages of these two methods; each has its camp of adherents, but that they both render services is testified by the increasing work which is placed with them. This divergence is negligible, and is principally a matter of a slight difference in name. What is of importance is what is the best way in which to take advantage of the services offered by either class of specialist.

The general practice for the engineer or architect who has a scheme to be designed in reinforced concrete is to invite tenders from all and sundry, under the firm impression that an open competition will produce the best economic and structural results. With the object of obtaining the best work at the cheapest price, leading systems are invited, and each system has its array of contractors; in some cases the same contractor may tender on different designs from two or more competing specialist firms. It appears, however, that this object is not achieved, for in the first place it is generally difficult to adjudge the contract to any other than the cheapest tender, which is no criterion that the best design, which is of primary importance, has been obtained. Nor is the successful tender necessarily as economical as it might have been, for it certainly does not follow that the cheapest tender accepted could not have been cheaper had the same contractor tendered on the best design if the latter had been selected beforehand.

The element of chance enters too largely here, for the specialist firm which has submitted the best design may have been unlucky in the tenders of their contractors.

Again, the specialists who are invited to submit designs in competition with one another are all doing the same work, in which only one can be successful. The non-successful ones, therefore, are losing time and money. Specialists must live, and, since they thrive, it stands to reason that they must make good their loss in one direction by profits in another—that is, on jobs in which they are successful.

This remark applies equally to contractors, and, in fact, to all competitive work which is carried to an extreme. The problem is to strike a happy mean between indiscriminate and unrestricted competition and privileged monopoly. The mistake lies in mixing up the question of design with the question of tender.

The remedy is to select the specialist firm and system to be adopted and arrange their fee beforehand; or, if competition of design is desired, let it be limited to two or three specialist firms instead of allowing a job to be hawked about, which has a discouraging effect in the long run on competing firms. Having selected the design, the client should then, and only then, invite tenders from contractors on a proper bill of quantities. It is a well known fact that there is very little difference between the well-considered designs of various specialists for the same structure. The question of price, therefore, depends very largely upon the contractors, and it is conceivable that the best and most economical design may have been discarded because the tenders upon it happen to be too high. The tenders from one contractor on several competing designs for the same job do not show anything like the variations in prices that is shown by the tenders from several contractors on the same design. Hence the proper procedure is to select the design first, and then invite tenders upon it, instead of jumbling up the two essentially different processes as at present.

Another opportunity for improvement lies in extension of time for the preparation of plans. As a rule the time given is too short, and the result is hasty work which may contain mistakes which lead to friction between client, specialist and contractor. Too little consideration by a client is generally shown on this point, and the practice, hardly consecrated by justice or crowned by success, of attempting to hold the specialist responsible for the accuracy of the quantities of concrete and steel, does not conduce to economy; for the specialist, if pressed for time, will generally err on the generous side of his quantities rather than run the risk of having to make good out of his own pocket the deficiency due to under-estimating. Here, again, the client pays in the long run.

The method of payment to the specialist also leaves much to be desired. It should be made direct by the client, and not through the intermediary of the contractor. The specialist is selling his services, and this has nothing to do with the financial stability of the contractor, upon whose selection he generally has very little to say. For the contractor to pay the specialist is to deprive the latter of the control he should, on the contrary, hold over him. This consideration brings one to a recent departure which has occurred in the contracting world. Some contracting firms have recently joined the ranks of specialists by organizing a designing department in conjunction with their ordinary business as contractors, such departments being generally run by engineers who have acquired their experience among the original specialist firms. Such an arrangement is not desirable, since it attempts to assimilate two separate elements—execution and supervision. It is difficult to conceive how it can benefit any but the contracting firms in question, whilst from the client's point of view it is absolutely disadvantageous. The position of a contractor who tenders on his own design is anomalous. The prime object of a contractor is to obtain the contract, and he knows that price tells. The necessity of control is, therefore, all the more imperative when, as in this case, there is a temptation to cut things fine. For whether the client be professional or otherwise, the fact that he invites designs from a specialist implies a certain ignorance of the subject which, in the case of such a highly specialized subject as reinforced concrete, is not derogatory to his professional capacity, as has already been pointed out, but which undoubtedly weakens his control over the actual construction, if the designs have been prepared by the contractor. In the method suggested, whereby the specialist is first selected, the necessary control over the executors of the work—that is, over the contractor—is either shared by client or specialist, or at least delegated by the former, who still retains the ultimate power, to the latter. There is no doubt that suitable provision should be made for supervision of a reinforced concrete contract by the specialist, but when the contractor is his own specialist and supervisor he is beyond control and criticism, and the position becomes not only illogical but extremely dangerous.

Considerable expense on the part of specialists would be saved if clients would only limit their invitations for designs and tenders to jobs which are practically certain to mature. The nebulous schemes which are presented to the poor specialist—schemes which have the most slender chances of materialization—only go to swell the expenses of those firms, who must necessarily recoup themselves for this loss by increased profits in other directions.

The attitude of the local government board on the subject of reinforced concrete is both incomprehensible and illogical. Every other government department has recognized this new form of construction. Despite the numerous public buildings which are being erected everywhere, despite the proof of solidity, economy, durability and reliability which has been shown by reinforced concrete in structures which have stood the test of a quarter of a century, the L. G. B. generally refuses to authorize loans on the same terms as masonry or even timber structures. Reinforced concrete, it would appear, is still in the experimental stage, and the attitude of the L. G. B. remains early victorian. Time, of course, is the solution; the younger generation of advisers cannot fail to give reinforced concrete the same recognition it has received in all other quarters—commercial, professional and official. The long-suffering tax-payer is consequently called upon to pay for the more expensive forms of construction in the case of nearly every job in the country which is brought to an untimely end by the too stringent financial conditions of the L. G. B.

The future of the industry is, however, full of promise. A more thorough acquaintance on the part of the public with the conditions which surround the business of the specialist cannot fail to improve these conditions, possibly on the lines which have been briefly indicated in this article; and the attitude of a government department, based on obsolete traditions, cannot long continue to hamper the development of a form of construction which has received universal recognition.

The Need of Uniform State Laws t Govern the Making and Filing of City Plats.

There is a wide difference, as between th various states, in the matter of regulation governing the making and filing of city, town and village plats. The Michigan Plat Law ha served as a model for the past twenty year and it is surprising that all other states hav not enacted new plat laws similar to th Michigan law. In another part of this issu we are publishing some of the suggestion issued by the Auditor General's Departmen of Michigan, relating to the Michigan Pla Law. The suggestions as printed are not in tended to be a perfect manual containing a that is embodied in the law, but to call attention to points in which plats are most likel to be defective. It is with the belief that man state plat laws are crudely drawn that w reprint these suggestions at this time.

The Illinois law, for example, does no define the duties of the surveyor as fully a does the Michigan law. In Illinois the directions are of the most general character and the surveyor may well be in doubt as to hi duties after having read the various parts o the law which are scattered through a boo of 2,000 pages, and printed under variou chapter headings. Moreover a surveyor ma comply with all the requirements of the Illinois law and still turn out a poor piece o work. The same is true in Ohio and som other states. After having complied with th law in his state the surveyor usually can improve his plat by subjecting it to the test which would be applied to it if it were offere for record in Michigan.

The Michigan law differs from the Illinoi law, not only because it is more specific as to details, but because it requires that all plat shall be examined and approved by a stat officer before they can be filed legally. Thi is the feature of the law which other state would do well to adopt. In Illinois a plat ma be recorded legally after it has been approve by a board of trustees for a village. Jus how much that approval amounts to is a matter of chance. If the board is friendly to th surveyor his plat usually is approved, eve though it does not bear all the essential features of a good plat. Many lawsuits have resulted from this slack method of examining and approving plats. In cities of considerabl size councils usually appoint a plat examiner The appointment is a political one and naturally the best man for the place is not always secured.

As many of our readers doubtless will recall, an older set of suggestions, similar to the ones now given, were published and given wide circulation some years ago in an appendix to Prof. J. B. Johnson's Theory and Practice of Surveying. However, the writer recently has learned that many surveyors in states bordering on Michigan are not familiar with the Michigan law. Limitations of space will not permit us to publish the law in full The chief points of difference between it and other state plat laws are sufficiently well covered in the suggestions for its proper interpretation.

As we have stated the present method of examining plats in Illinois and some other states is not entirely satisfactory either to the land owner or the competent surveyor. Competent surveyors state that they often are subjected to great annoyance, expense and delay in trying to base a survey on an imperfect or incomplete plat. As long ago as 1886 the Michigan Engineering Society adopted resolu tions expressing their views relating to the making and filing of plats. The present law is largely due to the activity of this society. Other State Engineering Societies have an opportunity to do a similar service for their home states.

In its work of classifying and valuing the public coal lands the U. S. Geological Survey during January acted on nearly 3,000,00 acres of land which had been included in coal land withdrawals. Of this area 2,833,306 acres were classified as non-coal land and thus restored to public entry.

CONCRETE AND REINFORCED CONCRETE SECTION

Method of Constructing Gas Holder Foundations in Soft Soils With Some Costs.

Contributed by Hunley Abbott, Assoc. M. Am. Soc. C. E., McArthur Bros. Co., New York.

A gas holder foundation must support a load distributed over a large area, where any unequal settlement will cause leakage and failure of the steel tank and consequently this part of the structure must be designed with special care. The steel tank has been found to be 33 to 50 per cent cheaper than the concrete or masonry tank built in after an excavation of 30 to 40 ft. With the steel tank, however, it is important that the top of the foundation be above ground water level, to prevent corrosion. Before describing the foundations of the gas holder of the New Haven Gas Light Co. it will be of interest to refer briefly to the cost and character of several other gas tank foundations.

The handbook of American Gas Engineering Practice by Latta says: "The Stacy Manufacturing Co. cite a recent instance of a holder of about 1,500,000 cu. ft. capacity, erected upon soft ground at a cost for wooden piling of 75 cts. per square foot over the whole area of the same. These piles were capped with 2 ft. of concrete, but the foundations failed immediately upon the filling of the holder tank with water."

Mr. C. A. Learned describes in "A Holder Foundation on Quicksand," *American Gas Light Journal*, Feb. 24, 1902, the foundation of a holder 115 ft. in diameter, 103 ft. high, holding 700,000 cu. ft. of gas, carrying a total weight of 9,100 tons. The soil conditions were as follows: Five feet of loam on top, then a thin layer of cemented gravel and quicksand below that to a considerable depth. The foundation site was excavated down to the layer of gravel, and a concrete wall 5 ft. high was constructed around the circumference of the holder. Inside this circular wall was placed compacted gravel and sand and the whole capped with a 12 in. slab of concrete. The estimated cost of this foundation is 90 cts. per ton of load carried, but from the unit costs given by Mr. Learned it is quite probable that this foundation would today cost at least $1.10 per ton of load carried. No piles were used in this construction.

In the Oct. 26, 1905, issue of the *Engineering News* a typical gas holder is described. The tank was 195 ft. in diameter and 39 ft. 3 ins. high, holding 8,712,200 gals. of water. The total load of the foundation was something under 60,000 tons. "To construct the foundation 4,100 (wooden) piles were driven and capped, first with 12x12 in. timbers and then 6x12 in. planks laid tight. On this capping was laid a circular brick wall 5 ft. 6 ins. thick and 8 ft. deep, and having an outside diameter of 199 ft. The space within this wall was filled to within 18 ins. of the top with gravel, washed and rolled; the remaining 18 ins. was filled with concrete on which the steel bottom of 5/16 in. plate was constructed." The estimated cost of this foundation is about $1.50 per sq. ft. and about 80 cts. per ton of load carried.

Engineering Record for Dec. 23, 1911, contains an article describing the foundation of a 10,000,000 cu. ft. holder in New York city, located on the bank of the Harlem River. This foundation consisted of a circular horizontal reinforced concrete platform 4 ft. thick and 258¼ ft. in diameter, supported on the ground and on an annular concrete foundation wall extending down from 5 to 45 ft. to rock. This wall was 5 ft. thick for the first 15 ft. of its height and below that was increased to 10 ft. 7 ins. From the data given, the cost of this foundation must have been about $1 per ton of load carried.

A gas holder recently built by the New Haven Gas Light Co. of New Haven, Conn., provides a storage capacity of over 3,000,000 cu. ft. at 7½ ozs. pressure and the guide frame will have a [illegible] 206 ft. The diameter of the smallest of the five sections of the holder will be 149 ft. 10 ins., each section being 31 ft. deep. The water tank is 163 ft. in diameter and 35 ft. 3 ins. deep, with the bottom plate ⅜ in. excepting a ½-in. outer course, the side plates and fixed courses grading from 1⅛ ins. thickness at the bottom to ⅜ in. thickness for the upper course. The tank will hold practically 5,000,000 gals. of water and together with the height of this water and the weight of the rest of the structure the aggregate load upon the foundation is figured at 30,000 tons.

Before proceeding to describe the foundation of this holder, it will be of interest to point out the original plans and to note the great economy effected by the use of the type of foundation finally chosen, whose cost was about 59 cts. per ton of load carried. The first plan was based on the use of wooden piles. After excavating down below water level, piles were to have been driven, cut off and capped with concrete on which the tank was to rest. Surrounding the tank was to be a retaining wall. The bottom of the gas holder tank would have been considerably below ground level, and thus aside from the item of the cost of this type of foundation a serious drawback would lie in the fact that the tank would be subject to the corrosive action of drainage water. The type of foundation as actually used consisted of pedestal concrete piles, formed in the ground with large bases, and with the concrete slab at the surface of the ground well above ground water level.

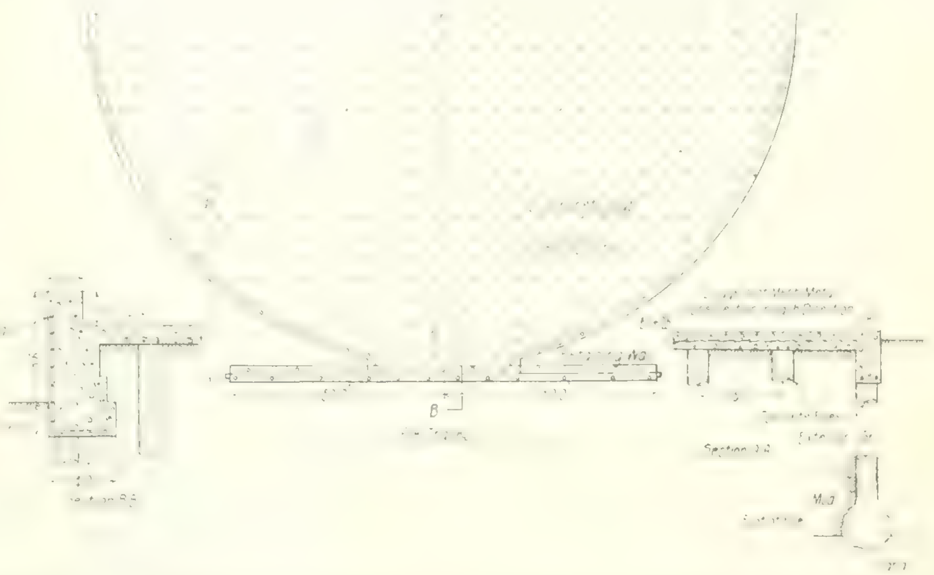
The site of the foundation was, years ago, a sandy beach over which a layer of mud from 0 to 12 ft. in thickness had been deposited with a fill over the mud of from 4 to 5 ft. of loose earth. The fill had been in place for a number of years. To the west of the site runs East St., and on the east of the site runs the track of the N. Y., N. H & H. R. R. The original surface of the ground sloped off from East St. to the railroad track with a drop of about 10 ft.

A half-plan view of the foundation is shown by Fig. 1. The site was first brought to a level grade, the cut on the up-side being used as a fill on the lower side and the surface thoroughly compacted by a steam roller. Over the whole area of the foundation, piles were then driven on 5 ft. centers in all directions, as shown, 966 in all being formed, each one to carry a load of 1¼ tons. The piles were of varying length, the casing and core which are used in formation being driven down to the sub-soil, a sufficient distance to insure the enlarged foot (which is bulged out in the process of making the pedestal pile) being thoroughly embedded on the same sub-soil. The pile columns are 17 ins. in diameter, with enlarged footings about 2½ to 3 ft. in diameter and the pile lengths vary from 10 to 30 ft.

The piles were all "cut-off" at a given elevation and two ¾ in. square twisted rods were run over the tops of each line of piles in both directions. Over these rods were spread two layers of 2x12 in. mesh, ¼ in. diameter Clinton wire cloth run in opposite directions, making two complete sheets of mesh metal over the whole foundation area. These rods and the cloth formed the reinforcing for the concrete slab disk 12 ins. thick and 166 ft. 8 ins. in diameter, completely covering the tops of the piles. At the outer edge of this disk is a concrete girder 18 ins. wide and 3 ft. deep, reinforced with two ¾ in. square twisted rods. This girder stiffens the slab on its edge where the steel tank superstructure rests and also goes in to the earth deep enough to prevent any lifting action from frost. All concrete for piles, slab and girder was a 1:2:4 mixture, using Alsen cement. The general layout of the piles may be seen in Fig. 1 and the details of the slab and girder construction are shown in the sketches.

On the side of the holder next to the railroad tracks the elevation of the foundation is about 4 ft. above the base of rail and therefore a concrete retaining wall 100 ft. long was constructed, tangent to the foundation disk and parallel to the tracks. A section through this wall at the point of tangency is shown. The wall is 4 ft. thick at the base and 2 ft. at the top and 8 ft. 6 ins. high. The pressure on this wall is, under ordinary circumstances, only that due to the action of the earth which it retains, but, owing to the possibility of a shock from derailment or other accidents along the adjacent railroad, steel reinforcing rods were placed, as shown.

On the north side of the foundation are two tunnels to carry the 30 in. inlet and outlet gas pipes. These tunnels are 37 ft. 9 ins. long and project under the holder foundation 24 ft. 4 ins. The inside cross section is 6x6 ft.; the bottom and sides are of concrete 12 ins. thick and the reinforced concrete foundation slab forms the roof of the tunnel. This roof is further strengthened by 15 in. I-beams at 4 ft. intervals along its length. At the outer end of the floor of the tunnel is a 4x6 ft. pit 2 ft. 9 ins. deep, in which the cut-off valve sits.



Half-Plan of Foundation for Gas Holder With Details of Concrete Piles and Retaining Wall.

The top surface of the foundation slab on which the tank rests was made level with a variation of not more than ½ in. over its whole area and an annular band around the outer circumference of the disc about 10 ft. in width was made level to not more than ¼ in variation. The top of the disc or slab was then covered with a mixture of dry cement and sand in equal parts, and the steel tank lowered upon this 1½ ins. thick layer. The cushion of dry cement insures a uniform distribution of the load of the tank to the surface of the slab. In time the cement will harden by the moisture in the air and will form a permanent foundation, taking up any irregularities in the tank and thus insuring an even distribution of the load over the whole foundation.

The cost of the pile foundations was about 59 cts. per ton of load carried and the cost of the reinforced slab about 44 cts. per square foot.

The MacArthur Concrete Pile & Foundation Co. of 11 Pine St., New York City, were the contractors for all the sub-structure work, including the pedestal pile foundations and the steel superstructure was designed, furnished and erected by the Cruse-Kemper Co. of Ampler, Pa. Mr. Robert E. Wyant of the New Haven Gas Light Co. was engineer of the work.

Methods and Costs of Construction on Contract Eleven, New York State Barge Canal.*

Contributed by E. J. Becker, Assistant Engineer in Charge of Contract Eleven, New York State Barge Canal.

Lock No. 4 is situated on a comparatively level space, the excavation for the foundation extending about 28 feet below the original surface. The excavation for the north wall was completed about September 1, 1908, but there still remained considerable excavation to bed-rock for the floor and south wall of the lock.

As the contractor was very anxious to proceed with the laying of concrete, it was evident that the tripper car used in Lock No. 5 could not be used here, consequently a belt conveyor trestle about 400 feet long was built in two sections, from the Haines mixer to a point about 150 feet from the breast wall of Lock No. 4. A hopper, similar to those used on the Haines mixer, was placed on the end of the belt conveyor and a track laid from under this hopper to the head wall of the lock. A trestle on which the track was run, was built over the foundation for the breast wall, at about the level of the ground and the bottom dump car used in the construction of the core walls of Lock No. 5 was placed under the hopper at the end of the trestle. The belts were then started and as soon as the car was filled, the door in the bottom of the hopper was closed and the car run out on the trestle and dumped, the hopper holding what concrete was delivered by the belt while the car was being dumped. About 1,500 cu. yds. of concrete were placed in this manner.

While this work was going on, a trestle built of 2 in. pipe was constructed directly over the foundation of the north wall of the lock, the center line of the trestle being about five feet from the face of the wall. Each bent was made of two 2 in. pipe about 30 feet long, spaced 4 feet apart and was braced with cross braces of 2 in. material, fastened to the pipe with "U" bolts, these braces being removed as the work advanced. The bents were anchored to the concrete plots at the same elevations and spaced 13 ft. apart.

Wrought iron pipe lent itself particularly well to this trestle-construction, inasmuch as it could be left imbedded in the concrete, and, by placing pipe couplings about 2 ins. below the surface, that portion of the trestle extending above the top of the wall, could be removed without difficulty. This trestle was then connected with the one running from the mixer, so that there was a continuous line of belt conveyor from the mixer to the lock. At the end of the trestle, a tower built of 8x8 in. timbers, was constructed to carry the motor and drive pulleys for the belt floor, down a chute into a dump car, the car was placed on the trestle. The car was built by the Robins Belt Conveyor Co. and is similar to other cars used in belt conveyor systems, except that there is a chute on both sides of the car, so that the load can be discharged on either side. The car was propelled by hand, with a crank on each side of it and two men could move it along as fast as they could walk.

The chutes on the car were just long enough to clear the trestle and had a slope of about 45°. Chutes made of sheet iron were hung vertically from the end of the tripper car chute to within about 5 ft. of the concrete. By swinging the chutes and moving the tripper car backward and forward, the concrete could be deposited in a fairly satisfactory manner, provided the chutes were not swung too far, which would throw the stone out of the mortar. At first, an attempt was made to send wet concrete over the belt, but when the concrete left the belt the stone went down one side of the chute and the mortar down the other side, due to the mortar sticking to the belt, while the stones were thrown out. To obviate this difficulty, the amount of water placed in the concrete at the mixer was diminished, until the concrete would not stick to the belt. Of course, this concrete could not be placed in the forms in a satisfactory manner without ramming, so a hose was placed on the car delivering the water in the chute in the form of a spray. A man was stationed on the car to regulate the amount of water needed and to see that it was uniformly distributed over the concrete in the chute. If the nozzle was deflected slightly to one side, the concrete on that side would be too wet, on the other too dry, but, with care, pretty fair results could be secured. About 7,600 cu. yds. of concrete were placed with this plant during November and up to Dec. 10, 1908, which completed the north wall as high as the trestle would reach, when the plant was closed down for the winter.

In the spring, a chute long enough to reach over the edge of the lock wall so that the concrete could be dropped over to build the floor was placed on the tripper car. With this device, that half of the floor next to the wall already built was completed.

In order to build the south lock wall, a tower about 10 ft. square and 30 ft. high was built of 8x8 in. timber and on top of it, a frame-work about 50 ft. long to carry a belt conveyor and motor for running the same. The whole was mounted on trucks that run on a 10 ft. gage track, that was spiked t 12x12 in. timbers about 20 ft. long, the ca being propelled by a capstan that was operate by five men. The chute from the small trip per car was long enough to discharge con crete in a small hopper which fed the belt o the big car. It was then carried across th lock by the belt conveyor on this big car an dumped off the end of the belt into a woode chute and from there into the form. Th small tripper car and the large one wer in no way connected. The men handlin the small tripper car kept it in such position that the concrete would drop in to the feeding hopper on the large car, a operation not as difficult as it would seem in as much as the latter would move onl about 6 ft. per minute.

This contrivance did not work as well a that on the south wall, owing to the fact tha there was only one chute on the big car, whil on the small one there were two. Wheneve the chute was swung a few feet from th vertical, the aggregate was separated fron the mortar giving very unsatisfactory results However, after no small amount of troubl with good, bad and indifferent concrete, th south wall was brought to about the sam elevation as the north wall. The belt con veyor was removed from the north wall, an a second pipe trestle high enough to reac the top of the lock was built on top of th one already embedded in the concrete. Con siderable mortar had dropped upon this con crete from the belt and it was necessary t remove it before new concrete could be lai on the north wall. The greater part of thi material was so hard that it could scarcel be removed with picks; moreover, some o the concrete which had been placed towar the close of the previous season had not bee properly covered and had frozen before i had set. It was found necessary to remov the top of this concrete to a depth of abou 4 ins. and the concrete was then placed i the north wall from the belt conveyor wit the small tripper car. The walls being muc narrower than at the bottom, there was con siderably less swinging of the chutes and th concrete was placed to much better ad vantage.

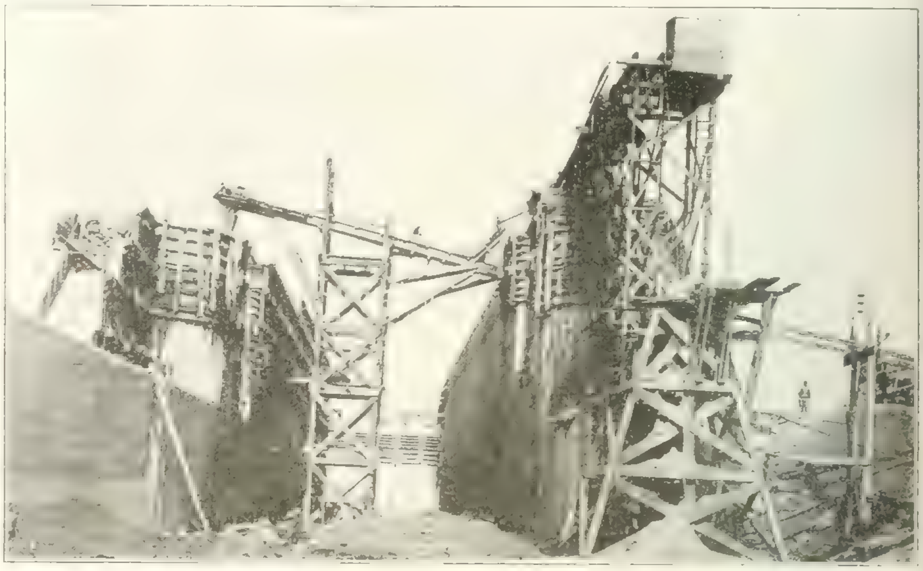


Fig. 1—Construction View of Lock No. 4, New York State Barge Canal, Showing Concreting Plant.

While the north wall was being completed the large car in the center of the lock was raised to a sufficient height to finish the concrete in the south wall. Considerable trouble was experienced in laying concrete in the breast wall and it was finished only after many experiments with all kinds of chutes, both open and closed, placed at all possible angles.

The belt conveyor was dismantled after being in operation at Lock No. 4 about nine months, (not including the winter months, when the plant was idle). During this time about 28,850 cu. yds. of concrete had been placed in the lock by means of it and there still remained about 1,400 cu. yds. to be placed in the floor. The next season, a trestle large enough for teams to drive on, was built across the lower approach to the lock, which is at about ground level and a narrow gage track laid from beneath it, through the entire length of the lock floor. Concrete was then brought from the mixer, in bottom dump wagons and dumped through an opening in the trestle door, down a chute into a dump car, the car being large enough to hold one wagon load. Considerable time and work were spent in cleaning up the lock floor, owing to the large amount of stones and mortar that had fallen off the belt while being carried across the lock.

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*This is the third article of a series covering the entire work of Contract 11. The first article was published Oct. 18, 1911, and the second Nov. 1, 1911.

Figure 1 shows the north wall finished and the south wall nearing completion, the Tables I and II show labor cost of placing concrete in the lock with the belt conveyor. The item "General Expenses" includes salaries of superintendent, time keeper and such expenses as are not directly chargeable to the other items.

TABLE I.

		Cost per
No. of cu. yds. placed	[illegible]	cu. yd.
General expenses	$[illegible]	$[illegible]
Mixing	5,230.14	0.172
Placing	[illegible]	[illegible]
Carpenters	[illegible]	[illegible]
Finishing	1,585.28	0.052
Erection of plant	1,693.31	0.056
[illegible]	[illegible]	0.027
Total	$[illegible]	$[illegible]

Table II shows the cost for labor of placing concrete in the floor of Lock No. 4, the concrete being hauled from the mixer with teams.

TABLE II.

		Cost per
No. of cu. yds. placed	1,400	cu. yd.
General expenses	$ [illegible]	$[illegible]
Mixing	353.15	0.252
Placing	287.49	0.919
Carpenters	318.00	0.227
Erection of plant	156.00	0.111
Total	$1,[illegible]	$1.[illegible]

The above tables do not include cost of any materials, but do include all costs of the erection of trestles and plant incident to the placing of the concrete in Lock No. 4.

Comparative Cost Estimates of Beam and Girder and Mushroom Types of Reinforced Concrete Construction.

[Contributed.]

Lockwood, Greene & Co., Boston and Chicago, architects and engineers for industrial plants, recently had occasion to make comparative estimates on the cost of reinforced concrete for a ten-story warehouse 580 ft. long by 109 ft. wide using beam and girder construction and a mushroom system. Unit prices were obtained from the records of work done in the vicinity in question and were as near correct as was possible to obtain for a preliminary estimate. It should be noted that the figures below do not include plant and tools or any items that would be common to both systems and therefore should not be taken in any way as an estimate of the cost of the building. The quantities in the following tables are based on one strip of floor 19 ft. 3 ins. wide and the height of the structure. It will be noted that the total cost per strip for the beam and girder system is $12,616 while for the mushroom design it is $12,432, leaving a net saving in favor of the mushroom system of $184 per strip or $5,520 for the entire building.

In estimating the cubic yard cost, 1:2:4 concrete was made up as follows:

1⅔ bbls. cement at $1.10 net	$1.80
½ cu. yd. sand	0.40
1 cu. yd. stone	1.00
Labor	1.00
Sundries	0.10
Total	$[illegible]

It was estimated that columns would cost 70 cts. more per cubic yard for labor and for 1:1½:3 concrete $1 more per cubic yard of concrete. The accompanying Tables I and II give the comparative estimated costs by items:

TABLE I.—MUSHROOM ESTIMATE.

Concrete, 1:2:4 interior cols., 97 cu. yds. [illegible]	[illegible]
Concrete, 1:1½:3 wall cols., 34 cu. yds. at [illegible]	[illegible]
Concrete in floors, including slab, capitals [illegible]	[illegible]
[illegible]	[illegible]
Interior wall, 20 sq. ft. at $2.00	40
Forms for floor, including slab and wall [illegible]	[illegible]
Steel reinforcing [illegible]	[illegible]
Steel lattice columns, 58 tons at $52.00	3,016
Erecting lattice columns, 32 tons at $5.00	160
[illegible] M. [illegible]	[illegible]
Windows, 2,990 sq. ft. at 30½ cts.	897
[illegible]	[illegible]
Total	[illegible]

TABLE II.—BEAM AND GIRDER ESTIMATE.

Concrete, 1:2:4 interior cols., 75 cu. yds. at $5.00	$ 375
Concrete, 1:1½:3 wall cols., 32.5 cu. yds at $6.00	195
Concrete in floor, inc. beams, girders and slabs, 550 cu. yds. at $4.30	2,365
Forms for columns, 6,300 sq. ft. at 12 cts.	756
Forms for floors, inc. beams, girders and slabs, 30,600 sq. ft. at 9 cts.	2,754
Handholes [illegible]	[illegible]
Steel reinforcing (cost, inc. placing), 63 tons at [illegible]	[illegible]
Bethlehem steel cols., 54 tons at $45.00	2,430
Erecting, [illegible] tons at [illegible]	[illegible]
Brickwork, 20 M. at $18.00	360
Windows, 2,700 sq. ft. at 30 cts.	810
Total	$12,616

Inspection of Forms and Centering.

Contributed by Jerome Cochran, C. E., formerly Designing Engineer, Trussed Concrete Steel Co., Detroit, Mich.

The series of articles on the inspection of concrete work, of which this is the third, has been planned in opposition to the general assumption on the part of writers that standards or methods of construction have been long ago established and have become common knowledge. The first article on "Directions and Suggestions for the Inspection of Concrete Materials" appeared in this journal for Jan. 31, 1912, and the second article on "Proportioning and Mixing Concrete" appeared on Feb. 7, 1912. The following article relates to the fabrication, erection and removal of forms and centering, no attempt being made to discuss their design, which is foreign to the purpose of this article. It will be followed by articles on steel reinforcement, transporting and placing of concrete, finishing concrete surfaces and waterproofing concrete work.

LUMBER FOR FORMS AND CENTERS.

The lumber for forms or centers should be of such quality, size and finish that there is absolute stability and perfect work at all times. It should be adapted to the structure and to the kind of surface required on the concrete. Whether or not lumber should be planed will be determined by the kind of surface desired. The writer is of the opinion that lumber for all forms should be planed on at least one side, as a smooth surface greatly facilitates marking, fabricating and erecting.

Kind of Lumber.—The kind of lumber to be used for forms depends upon the desired results and price. White pine, yellow pine, spruce, Oregon pine and redwood are suitable for forms. Yellow pine lumber is found to be excellent for forms; owing to the large amount of pitch contained, it absorbs water slowly and holds its shape. Norway pine and fir lumber is also suitable for forms for a similar reason. White pine should be used for cornice and ornamental work and may be used for fine face-work. For ordinary work, however, even for panels, white pine is generally apt to be too expensive ,and other lumber should be substituted for it. Hemlock is unreliable and should be used only when absolutely necessary and then only in the roughest kind of work. Oak is hard to nail, expensive and imprints grain marks on the concrete even when the form is thoroughly wetted.

Quality of Lumber.—The lumber should be free from decay, splits, wind-shakes, sawed true and out of wind, and square-edged, full-sized, free from large or loose knots or any other defects which would seriously impair its strength or durability. The lumber must not be so dry that when soaked by the concrete it will swell so as to bulge and distort the forms, nor so green that it will shrink so as to leave open joints that will show plainly on the face of the work. A slight tendency of this kind, however, may be checked by keeping the boards thoroughly wet with water until the concrete is placed. Kiln dried lumber, therefore, is not suitable for form construction because of its tendency to swell when soaked by the concrete and green lumber is undesirable on account of liability to check and warp. Partly seasoned lumber is therefore the best. When it comes to a choice between green and dry lumber green lumber is preferable because it is less affected by the water in the concrete. No warping or splintered lumber should be used. All lumber should be subject to the approval of the engineer in charge of the work.

Thickness of Lumber.—The size of the lumber should be such that it will not deflect, bulge or warp under the loads imposed upon it. Lumber should be straight and true and of even thickness. Wide boards should not be used for sheathing for the reason that they curl and split badly. Amply thick and heavy material should be used for forms, especially if they are to be used a number of times. Thinner material is easily broken, thus requiring more labor for repairs than would pay for the extra thickness. Thick planks will hold their shape better and last longer.

Dressed Surfaces of Lagging.—The form boards used on all exposed surfaces should be of dressed lumber and closely fitted in order to secure the best results in appearance and surface of the finish work. The lumber for face work should be surfaced on one side and two edges and dressed on the face side to even thickness, and may be tongue-and-grooved flooring or similar lagging. Tongued-and-grooved boards, however, are more expensive than boards surfaced on one side and on the edges, which will generally answer for most work. A principal objection to the use of tongue-and-grooved lagging is that there is no opportunity for it to expand and again the planks are particularly hard to place a second time.

Undressed Lumber.—For backing and other rough work undressed lumber may be used. Undressed lumber should be used where the concrete is to be plastered. In other words, forms for non-exposed surfaces may be rough lumber but should be water-tight.

Use of Old Form Lumber.—Form lumber which has been previously used should be cleaned before the lumber is again built into forms, and, if necessary, the sides and ends should be freshly jointed so as to make a perfectly smooth finish to the concrete.

FABRICATION AND ERECTION OF FORMS AND CENTERS.

The contractor should be required to furnish all plank, timber, braces and tie rods, or other material required in construction of forms for concrete work, for which no allowance should be made, nor for any scaffolding, nor centering on arches, nor other timber used in concrete construction, except such as is necessarily left in the work, the cost of all such material being included in the contract price per cubic yard of completed work or on a lump sum basis.

Type of Forms.—The contractor should be allowed to use such type of forms as he may desire, if in the opinion of the engineer the proper results will be obtained. If, however, it is apparent to the engineer that the forms are not properly constructed so as to give the desired results, the contractor should be required to make such changes as the engineer may deem necessary to give satisfactory results.

Steel Forms.—Metal forms may be used to advantage for the erection of small buildings, sewers, conduits, etc. Steel forms should be of acceptable design. They should be so rigid as to permit making the faces practically true planes in conformity with the plans, with variation of not more than ¼ in.

Economy [illegible] should be constructed with a view to economy in taking down rather than cheapness in erecting or in first cost. Greater economy will result in using forms over and over again, than in using poor lumber which rips to pieces when taken down, and unless they can be used many times, they are apt to be the largest single item of expense on a concrete building. With a little ingenuity and forethought this work can be most always arranged so that repeated use is made of each piece of lumber. Even for rough forms, plank planed one side may be economical to cheapen the cost of cleaning.

Workmanship.—Forms should be constructed by experienced and capable workmen only, and must be of first-class workmanship throughout. All forms should be made, put up and removed in a manner satisfactory to the engineer.

Loads on Forms.—All forms should have ample strength to support properly the loads they are called upon to carry. Loads on forms should be restricted to those for which the forms are designed. These loads generally comprise the weight of the concrete and such necessary construction loads as the weight of workmen, runways, wheelbarrows, etc. Storage of construction materials for future use on the forms should not be permitted under any circumstances.

Fabrication of Forms.—All measurements must be accurate, the lines true and square, the joints close, and the finish done in a neat and workmanlike manner. A maximum variation of ¼ in. only should be permitted from the sizes shown on the drawings. Forms should be finished to the exact height on top. Particular attention should be given to the piecing out of beam boxes, the alteration of column forms, etc. All forms should be arranged so as to be taken down in proper order without injuring the concrete. Cutting of the lumber should be avoided as much as possible.

Use of Sheet Metal.—Forms should present to the concrete on the surface afterwards exposed to sight a perfectly smooth surface, to be obtained by covering such portions of the forms with sheet metal, or by carefully planing the wood. Forms lined with sheet metal will show a wavy appearance unless heavy material is used. Sheet metal of No. 20 gage (.035 in. thick, 1.42 lbs. per square foot) has been used for this purpose, but where the same lining is used several times, a heavier sheet metal is preferable. A great many engineers object to covering wooden forms with metal as the metal is liable to break and tear when removing, and if the form is strained in the handling the metal covering makes it harder to put back in shape. Another objection to lining forms with sheet metal is that nail heads will show. The nails should be placed only around the edges of the sheet metal, which, if cut to a predetermined size, may have the edges covered by bevel pieces to give the finished surface the semblance of cut stone. The joining of one sheet of lining to another may present greater difficulties than the joining of planks, but joints will occur less frequently. If metal is necessary to permit easy removal or to give the concrete surface a smooth finish, a complete metal form may be used.

Water-tight Joints.—All joints in forms should be fairly tight, being close enough to prevent leakage of the liquid mass which will bleed the concrete of any material portion of its contents. In other words, the forms should be built as nearly water-tight as practicable, to prevent the escape of mortar. This applies to forms for wet concrete, as dry concrete does not require tight forms, since there will be no liquid mortar to run out of the cracks.

Covering Cracks in Forms.—Cracks in forms may be covered with sheet iron, but the use of paper for this purpose should not be permitted as it swells when damp and sticks to the concrete surface when the cement sets, so that it is almost impossible to remove it. It is also very difficult to keep the paper smooth, so that the final surface does not show wrinkles. Cracks may also be filled with putty or clay or plaster of Paris. The use of fire clay to close knot holes, etc., is recommended. Hennebique has made some of his forms with open joints and afterwards covered them with canvas, which absorbed the excess of water and gave a uniform surface finish to the concrete.

Caulking of Forms.—If necessary to obtain tight forms, caulking with oakum, or other suitable material, may be permitted. When thus treated the swelling of the boards does not cause trouble. Caulking of ¼-in. Manilla twine may be used to make forms tight at joints, if preferred by the contractor, or a plain joint may be made.

Improving Edges in Joints of Forms.—In all cases where it is evident that the joints between the individual boards of the forms will provide an excessive roughness, or unsightly board marks, in the exposed concrete, the edges of said joints of the forms should be removed and replaced or otherwise improved and repaired before concreting. In case two or more end joints in adjacent planks are in the same vertical plane, special precautions should be taken to prevent a lip or fin on the concrete. The edges of the plank should be dressed with a slight bevel, so that the planed surface is the widest; this is done to insure a tight form.

Exposed Concrete for Particular Work.—All exposed concrete (unless otherwise desired) should be made the subject of extra care, the forms being made from either tongued-and-grooved or beveled edged stuff free from knots and split edges with all joints driven tight and securely nailed and all imperfect pieces removed or properly repaired. Many concrete experts advise the use of beveled-edged stuff in preference to tongued-and-grooved as there is no opportunity to expand when planks of the latter swell. Joints should be made perfectly flush after they are built in place by planing off any unevenness or projections that occur; and any openings at joints or corners, or any knot holes or other voids, should be plugged flush with some stiff plastic substance such as fire clay mixed with plaster of Paris or sand. No tin patching is recommended. All face boards should start horizontally and be kept horizontal by drawing the boards down with a wedge, and each board should be securely nailed to every stud.

Lagging and Studs.—Studs should be of sufficient size and so spaced as to prevent the lagging or sheeting from springing between studs. The lagging should be surfaced, of uniform thickness and suitable width, and of selected material, and the edges surfaced so as to form tight joints when put in place, the object being to obtain concrete structures with even surfaces and true alinement. All lagging may be tongued-and-grooved or beveled-edged as desired. The studding for all work should be dressed or sawed to an even thickness in order that the alinement may be perfect. The planking forming the lining of the forms should invariably be fastened to the studding in perfectly horizontal lines. The ends of these planks should be neatly butted against each other, and the inner surface of the form should be as nearly as possible perfectly smooth, without crevices or off-sets between the sides or ends of adjacent planks.

Bolts and Sleeve Nuts.—Forms may be held in place by means of bolts, so made that the outer 3 ins. of the bolts can be removed after the forms are taken down, and the remaining holes filled with 1:3 mortar. This may be accomplished by sleeve nut connections which will permit the removal of the projecting ends of bolts or rods, etc., leaving only small holes in the concrete which can be stopped with mortar in the above or any desired proportions. Rods should be cut from 2 to 4 ins. shorter than the space between the forms and threaded, with a pumprod coupling placed on the threaded ends. Stubs threaded at both ends will finish out the bolt. When the forms are struck the stubs may be screwed out of the concrete and used again. The small hole left by the stub is easily filled with mortar by the finishing gang. Sometimes it is desirable to remove the entire bolt, and in such cases the bolt should be coated with heavy grease or other means taken to prevent adhesion of concrete to the bolt. Bolts must be absolutely straight or it may be impossible to remove them. The use of bolts will be discussed more fully under wall forms. Washers should be used under all bolt heads and nuts, and before proceeding with the concrete work forms should be brought true to line and grade and all bolts should be taut.

Use of Spikes and Nails.—The skillful superintendent or foreman may be easily recognized by the scarcity of spikes and nails he uses. Spikes and nails should be used sparingly, being partially driven so that they can be withdrawn without injury to the lumber. The pressure of concrete will generally hold temporary panel boards in place with scarcely any nailing. Clamps should be employed whenever practicable as the lumber will be rendered unfit for continued use by repeated nailing. All temporary nails should be removed just before the concrete is poured, so that portions of forms intended for easy removal will not be found tightly nailed when the workmen are ready to strip them.

Wire Ties.—Wire ties may be used freely to secure forms against pulling apart. They may be wound around opposite studs and then twisted with a stick, as a turn-buckle, until the studs are the proper distance apart. To remove the forms the wires are cut and then trimmed very close to the concrete surface. The use of wire ties will be discussed more fully under wall forms.

Steel Clamps.—Adjustable steel clamps for clamping and adjusting forms should be built on practically indestructible lines, giving rapid readjustment in all classes of forms. Clamps should be removed without the use of crowbars, hammers or other tools. Heavy C-clamps may be used to secure forms against pulling apart.

Bracing of Forms.—All forms must be securely braced to withstand the loads that come upon them and to preserve their alinement. Wooden pieces may be used for this purpose, generally 2x4 in. scantling. Wire ropes should not be used, as the stretch in these may be disastrous to the structure. Braces should be firmly fixed at the foot and top, and as many braces and supports used as may be necessary to prevent deflection from the working of the concrete. In other words, the posts and braces should be of sufficient strength to make a practically unyielding support to the sheathing. Several methods of bracing forms for heavy concrete work may be employed as follows:

(1) With outside inclined braces, leaving the interior of the form unobstructed.

(2) Tie rods across the interior of the form connecting opposite posts at frequent intervals.

(3) Each post trussed vertically and tied across at top and bottom only.

(4) Horizontal trussed wales outside of posts, spaced four to six feet apart in the vertical and tied across at the ends.

Inclined Braces.—If thin braces are employed, they should be in pairs, one on either side of the vertical post, and made to act together by cross pieces nailed to the two planks.

Bracing Forms With Cross Ties.—Another method of bracing forms is to construct them with cross ties between the front and back, these ties to be placed at frequent intervals above the lower portion of the form and to be removed as the concrete is built up, the studding out of which the forms are constructed being sufficiently long to extend above the top of the finished masonry, and at least one set of ties being used above this level.

Arrangement of Building Forms.—The arrangement of forms and centering in building construction should be such that the slab centering and sides of beams, girders and column forms, can be removed first, and then allow the bottoms of beams and girders to be supported for a longer time. The forms will thus be left a larger [illegible] under members subjected to the greater stress.

Swelling of Forms.—Forms should be so framed that swelling will not fracture the concrete or prevent easy removal. Care must be taken to prevent work from being thrown out of plumb by swelling of lumber in forms. The boards should be planed beveled on one edge, the full width being against the concrete, in order to prevent excessive pressure and heaving of forms due to swelling. The narrow edge of a board will then be brought in contact with the wide edge of the next and so on. A closer fit will then be secured.

Construction of Forms.—Forms should be so constructed that they can be removed without injury to the concrete, and they can be erected accurately. Construction which necessitates the use of heavy crowbars or hand sledging to take the forms apart should not be permitted. In other words, the forms should be so secured at all parts as to permit their removal without danger of injuring the concrete in any way.

Openings in Forms.—All forms should be so constructed as to be readily accessible for inspection at all places and at all times and to be easily cleaned. Openings should be provided in the forms at the proper places so as to permit of the ready inspection and cleaning of the spaces to be filled with concrete. All open joints must be effectually stopped to prevent the escape of water so far as practicable.

Beveled Corners.—Sharp corners should be avoided, especially on exterior angles, as it is difficult so to tamp the concrete as to make the corner perfect, and they are very likely to be chipped off. Corners of forms, therefore, should be beveled whenever possible, in order to facilitate their removal, and to improve the appearance of corners in the concrete. Beveled or rounded corners may be made on all exposed angles by introducing the proper triangular strips or round-corner molding pieces within the forms. Strips may be from 1 in. to 2 ins. wide. All exposed corners should invariably be beveled unless otherwise required. In other words, wherever there is no conflict with specific details, salient angles should be filleted and re-entrant angles chamfered.

Water Drips.—Water drips on projecting ledges of abutment copings, window sills, etc., may be formed by nailing a small half-round to the upper surface of the form a short distance back from the projecting face. A ridge is thus left at the edge of the under side of the projection so that water is compelled to drip from the edge, and not follow back to the main face of the wall.

Expansion Joints.—Beveled strips of wood may be inserted vertically (or horizontally as the case may be) at every expansion joint, leaving a notch about 1½ ins. wide and ¾ in. deep, thus avoiding irregular and saggy contact

Provisions for Pipes, Shafting Hangers, Etc.—Cores must be provided in forms for wiring, pipe and for any other purposes, as shown on the plans or as may be directed by the engineer in charge. Ample provisions must be made for shafting hangers in industrial buildings.

Forms Exposed to the Weather.—After the forms are built they should not be allowed to stand long in the sun or be exposed to the weather before being filled with concrete. Long exposure will throw the surface out of true, and open up the joints. Forms likely to be exposed to the weather for some time should be kept wet in order to prevent the formwork from being twisted out of shape. The falsework must be protected against severe temperature changes and against rain or snow. When it is found necessary to leave the formwork empty for any length of time, it must be gone over very carefully just before pouring the concrete, the open joints repaired, and the bracing and supports tightened up.

Alinement of Forms.—All forms should be erected as far as possible in exact alinement, both vertically and horizontally. Column and wall forms should be plumb. Girder boxes and wall forms should be without winds or twists and floor slab centers should be level, etc. If the forms stand any considerable time between erection and time of depositing the concrete, the alinement should be checked just before placing the concrete. The alinement should also be checked after storms and high winds. The alinement should be maintained during the placing of the concrete. In other words, the lines of all forms should be checked by the contractor and be brought to the correct lines, immediately before concreting. Keeping of forms plumb is the most difficult thing which develops upon the contractor. Forms may be provided with jacks or other suitable device to permit realinement during the progress of the work. Any extra expense incurred by faulty alinement or undue irregularities must be paid by the contractor.

Workmen may err on the side of poor alinement or more careful alinement than the structure requires. Mr. W. J. Douglas suggests as a general rule the allowance of "⅜-in. departure from established lines on finished work and 2 ins. on unfinished work." The latter may be increased indefinitely, depending on the size and nature of the work, but as a general rule the forms should be within 2 ins.

Rigidity of Forms.—Forms should be thoroughly braced or tied together so that the pressure of the concrete, or the movement of men, machinery or materials, will not throw them out of place. Wherever, in the opinion of the engineer, forms are not sufficiently stayed and braced or of sufficient strength in any way, the contractor should be required to make such additions and changes as the engineer may direct at the contractor's expense. In other words, forms should be amply strong to resist the pressure which will be brought upon them, namely, the ramming of concrete against their faces and the static pressure of the semi-fluid mass in the case of concrete laid wet. A great deal of work is badly marred by the lack of rigidity in the forms.

Removing Forms for Finishing.—Where the surface is to be finished by scrubbing or other process requiring the concrete to be still green, proper provision must be made, in the construction of the forms, for laying bare the concrete as fast as it reaches the required hardness.

Supply of Forms.—Sufficient forms should be furnished by the contractor to permit of pushing the work rapidly; and, if at any time the proper rate of progress is retarded by lack of forms, additional forms should be provided. In other words, no delays caused by waiting for concrete to harden before removing forms should be permitted, unless absolutely unavaidable, and sufficient form material must be provided to allow the concrete to progress without interruption.

Inspection of Forms.—The inspection of forms by the engineer or his authorized representative during or after the process of construction or any suggestion or assistance furnished by the engineer should not be construed as relieving the contractor of the entire or any part of the responsibility for the accuracy or sufficiency of any of said forms or for the satisfactory completion of work to any extent dependent thereon.

The inspector should be required to report to the engineer in charge of the work any undue cutting of washers into the forms. He should also report all form rods which have broken under the strain of the concrete.

Forms for Winter Concrete.—If concrete is done in freezing weather the forms may have light sheathing outside of the main vertical or horizontal beams or wales, or otherwise so arranged as to permit heating the main sheathing to a temperature of at least 35° F. and maintaining this temperature until the forms are removed and the finish completed.

Approval of Forms.—All details for forms should be submitted to the engineer for his approval before starting the work, but such approval should not release the contractor from any responsibility for the safety of his work and the work of other contractors.

[illegible] should be required in all cases to use proper care and diligence in building his forms, and in keeping them plumb, straight and true and in bracing and securing all parts of the work against wind, storm and frost, in as much as they may interfere with the stability and perfection of the work; also in all cases to judge as to the amount of diligence and care required for the same.

Rejection of Forms.—Should the forms lose their proper shapes and dimensions or should the surfaces become unduly roughened or dented, satisfactory forms shall be substituted. In other words, forms or centers shall be replaced by new ones when they lose their proper dimensions or shape; deformed or defective forms being removed from the work.

[illegible]

The forms for all walls should be of lumber planed on one side and double edged. One edge should be slightly beveled. This beveled edge may be placed against the straight edge of the next plank and driven to form a tight joint with an even surface. All forms should be studded carefully to avoid bending of boards between studs.

Erection of Wall Forms.—Wall forms should preferably be made and erected in units for convenience in handling and removal without injury to the completed work. The bottom board in wall forms should be placed last where practicable so as to permit cleaning the forms. Wall ties, either bolts, wire or steel should be put through at right angles, or square with the wall, otherwise the forms will be "skewed"; it should be of an approved design such that no ironwork is left exposed on completion of the wall.

Interior Support of Wall Forms.—Wooden struts, concrete struts or wiring may be usec for supporting wall forms from the interior while filling, and should be so spaced as tc prevent distortion. The struts should always be placed where the sheathing is supportec by a stud and the wire should loop the stud then by twisting the wire with a short bar or piece of wood the forms can be drawn anc held rigidly in place during filling. When the concrete has been placed to the level of the strut, it can be removed and the weight o the concrete will hold the forms apart. On removal of the forms the wires should be cu close to the concrete, the edges stove in with a punch and the surface smoothed over.

Exterior Bracing of Wall Forms.—Th forms, in addition to the interior bracing should be braced on the outside. This wi generally be accomplished by bracing to th earth or to adjoining structures. The exterio bracing must be relied on for holding th forms to alinement. Care must be exercise to prevent forms from lifting during filling In a wall section which has considerable ba ter, a hook made of reinforcing steel, im bedded in the foundation, may be used to t the forms, the tie being made with No. 8 wir In trench work where there is sufficient dept the upward or side movement of forms shoul be cared for by bracing to the sides of th trench.

Wire Ties and Spacers.—All wire ties fo wall forms should be in place and made ta so as to pull the sides close against th spacers. All spacers should be removed fro the forms as soon as the concreting reach them. The use of spreading strips una tached to the wire ties is probably the be and cheapest method of holding wall forn apart. The projecting ends of all wire ti used to hold together the sides of wall forn and left embedded in the concrete should cut off deep enough to keep rust spots fro showing on the face of the wall. No. 8 wi will generally fulfill the requirements of mo work.

Concrete Wall Spacers.—When the spa between forms is so narrow that the remov of struts becomes a troublesome task, co crete struts may be substituted. Concre struts should be placed in the same manner wooden and should be broken with a tamp when the [illegible] the proper level, or if they have been cast with a water stop, they may remain in the wall. Care must be taken to prevent a void immediately under the strut, or a water channel along the side of the strut. Concrete struts generally present a bad appearance in the finished wall, if allowed to remain. Where the appearance of the exterior surfaces on the walls is of great importance, concrete spacers may be used, composed of the same quality of concrete as the rest of the wall. These spacers may be about 2 ins. by 2 ins. thickness of wall, with a longitudinal hole ⅛ in. larger than the bolt to be used. The concrete struts may also be used as ordinary spreading strips, without having holes through them.

Tapered Wooden Spacers.—Tapered wooden spacers, bored to receive the bolt, may be used instead of concrete spacers, but should be well oiled and be driven out as soon as the forms are removed.

Bolt Ties and Spacers.—Bolts are better than wire for wall forms. They should be tightened against spacers set between the two sides of the forms inside. Bolts should preferably be enveloped inside the forms with sleeves or thoroughly greased, otherwise the bolt will stick and can be drawn out only by wrenching and injuring the concrete. Care should be taken to construct forms in such a way that tie-rods will not come closer than 4 ins. to a projecting corner or other detail or the concrete may be spalled off in pulling them. The writer would suggest that bolts through forms should not be within 1 ft. of a finished concrete edge if possible to place them elsewhere. They are likely to break the concrete during their removal, especially if not absolutely straight.

Projecting Ends of Wire Wall Ties, Etc.—All projecting wires, bolts, or other devices used for securing wall forms and that pass through the concrete should be cut off at least one (1) inch beneath the finish surface and the ends covered with mortar. Care should be taken to see that there is not a lot of wire ends left on the face of the concrete to ultimately rust and discolor it.

Removal of Tie Rods.—When it is desired to withdraw bolts or rods used to support thin wall forms, they may be thoroughly greased or wrapped with stiff paper before the concrete is placed. Use a tin tube or piece of pipe through which to pass the bolt or wrap it loosely in oiled paper, so as to make its removal more certain. The pipe, if used, will act as a spacer for the forms as well as a sleeve for the bolt.

Tie Rods Left in the Concrete.—When specified that tie rods are to be left in the concrete wall, they may be provided with sleeve nuts near the ends, which, when unscrewed, will leave the end of the rod within the wall not less than 2 ins. from the face. The hole left by the nut should be carefully filled with 1:3 mortar after the forms are removed.

Alinement of Wall Forms.—The alinement of edges, corners and sides of walls should by carefully preserved by frequent tying and bracing the forms and by the use of heavy stringers or rangers.

Foundation Walls.—Forms should be constructed for foundation walls in case the earth will not stand plumb in the excavation.

COLUMN FORMS AND BRACES

Column forms should be so constructed as to permit of their removal without disturbing the beam or slab forms. Forms may be held together by bolts or strong wire, so spaced as to prevent any distortion. They may also be held apart with separators which can be easily removed as the work progresses, or which may be incorporated in the concrete without injury to it.

Opening at Bottom of Forms.—An opening must be left at the bottom of all column forms for cleaning and for adjusting the steel reinforcement. This opening should not be closed until all is in readiness for pouring the columns.

Fabrication of Column Forms.—Column forms should be made up with plank not less than 1 in. thick, preferably 1½ ins. thick, and stayed at intervals of not more than 24 ins. vertically between bands or stays and must fit closely at the corner joints.

Circular Columns.—Forms for circular columns should be made of sheet steel of two semi-circular sections, flanged and bolted together. These forms are more economical than wood, especially where considerable repeated use can be made of them.

Beveled Strips.—All square column forms should have diagonal or bevel strips in the corners unless the corners of columns are protected by metal strips, otherwise they are liable to be chipped off. It is also difficult so to tamp the concrete as to make the corners perfect.

Spacing and Squaring Column Forms.—All column forms should be accurately spaced in all directions and should be set square with the lines laid down on the plans. Great care must be taken in starting the erection of a new set of forms to keep the form spacing perfect and centered over construction below.

Alinement of Column Forms.—Rigid care must be exercised in seeing that all columns are plumb and true, and are thoroughly braced to keep them so.

BEAM AND SLAB FORMS

Forms for concrete floors should be so constructed that the bottom of beam forms are independent of the slabs. That is to say, beam and girder forms should be so constructed as to permit of the removal of the sides before the bottom is disturbed in order that the condition of the concrete can be examined.

Beam and Girder Forms.—All beam and girder bottoms should not be less than 2-in. sized stock, and should be supported at close intervals to prevent deflection and to obtain a perfectly true lower surface. This heavy planking will serve to support the weight on the shores and allow the removal of the side sheeting in advance of the bottom supports. The sides of beam and girder forms should be splayed slightly in order that they may be readily removed and should be held tightly together by wedges, clamps or stiff braces, to prevent the pressure of the concrete springing them away from the bottom boards. The bottom board in the sides of beam and girder forms should be placed last where practicable.

Openings in Girder Forms.—A pocket should be left in the bottom of girders and where necessary to clean out chips, etc., after the columns are poured.

Diagonal of Bevel Strips.—All beam and girder forms should have diagonal or bevel strips in the corners. Triangular strips should be tacked along the corners of the forms as a fillet to cut off the corner by a plane making equal angles with the adjacent faces.

Camber of Beam Forms.—All beam and girder boxes should be given a camber of about ½ in. for every 10 ft. of span in order to provide for settlement under load. The bottoms of all beam and girder forms should taper off uniformly to each end and they should be rigidly to this line. The bottom of beam and girder forms are cambered so that any sag in the form will not give the appearance of sag to the beam or girder.

Slab Forms.—Forms for floor slabs should be made in units, say two or four pieces to a panel, or more if the panels are large enough to warrant them. For the under side of floor slabs generally 1 in. boards are used, with studding 16 to 24 ins. apart. All slab forms should be well braced to prevent any sagging. Joists for slab forms should be held up with a line of supports down the center line. Where joists abut on beam forms, wedges should be used. Tight fitting except by the use of wedges should not be resorted to. No spliced joists should be allowed at any point.

Bracing Floor Forms.—The shores or uprights should be stayed along the line of the joist at the top and longitudinally and transversely midway for stories 10 or 12 ft. in height. This prevents accidental dislodgment and swaying of the building. Shores should be set up and do their duty without hard driving, which is sure to injure the setting concrete under them. Additional shoring must be provided when necessary to prevent sagging of forms when receiving concrete. Shores should be cut to proper length for the work. The length being such that the cap and footing pieces can be placed and the double wedges can be started and tightened. The ends of all shores should be sawed of square so as to have uniform bearing on wedges.

Wedges.—Wedges should invariably be used to obtain the correct adjustment of shores and should be loosened and removed without producing undue strains in the floor system. Wedges should preferably be on the floor at the bottom of the uprights or shores, where they will be accessible when adjustments are necessary. After leveling up forms, the wedges should be nailed so that there will be no slipping. All wedges should be so constructed that the outside surfaces of any two wedges will be parallel and cut from 2x-in. scantling. Wedges are most convenien in tightening up falsework and removing i again afterwards without shock or vibration

Footings for Shores.—If the concrete floor is comparatively green or the ground is soft or a tile floor is used, the load from the floor above must be distributed by means of blocking, preferably of hardwood. If this is no done the supports or shores are sure to be pushed into the green concrete, into the ground, or to break the tile, causing a sag and possible cracks in beams and floor slabs No shoring should be erected over sof ground or concrete less than a week old (never over tile floors) without a footing block of ample size to properly distribute the load.

Caps for Shores.—The shores should also be properly capped with plank or scantling to distribute the pressure.

Covering Slab Forms With Paper.—Forms under floor slabs are sometimes covered with rosin sized sheathing paper lapped 1 in. at joints and tacked in place, but its use needs constant attention in order to secure satisfactory results. It is somewhat difficult to keep the paper absolutely smooth, so that the fina surface does not show wrinkles. Unless the paper is very oily it will adhere to the concrete, necessitating that it be burned off so as to effect its removal, as a thorough soaking very seldom removes the paper entirely.

ARCH CENTERS.

Suitable forms should be constructed to hold in place sections of arch ring being concreted. If the concreting is done in longitudinal sections, the forms should be set vertical and parallel with the face of the arch. If the concreting is done in transverse sections, the forms should be set in radial planes and straight across the arch at right angles to the face.

Settlement.—The crows of the centers should be raised above the intended height of the finished arches to allow for settling when the centers are being loaded and when struck. An allowance for settlement should be made equal to ¾ in. for each 30 ft. vertical height.

Rigidity of Arch Centers.—Arch centers should be perfectly rigid so that the arch will not be stressed in the slightest degree before the concrete attains a perfect set.

Striking Arch Centers.—Suitable means must be provided for striking or lowering the center without injuring the surface of the concrete and without straining the arch. The centers may be provided with striking wedges or sand boxes so that the lowering of the center may be effected slowly. Centers in all cases must be dropped away from the arch readily.

Bolting Centers.—In constructing centers for arches of more than 30 ft. span, no reliance should be placed upon spiking, but all main members should be bolted together at joints. In other words, no dependence should be placed in nails, except for fastening the lagging, for securing the wedges and for minor details.

Lagging.—Lagging should be of an even thickness and made smooth to give a good surface to the soffit of the arch. The lagging for the center may be in two or more thicknesses, but the top layer should preferably be tongued-and-grooved lumber, and the lower layer should be dressed to match the top surface when in place. Lagging should have a deflection under the full load of the arch, of not more than ⅛ in.

Wedges.—All wedges should be so constructed that the outside surfaces of any two wedges will be parallel. Wedges should have a slope or batter of 1 to 10, and the pressure on the same should not exceed 300 lbs. per square inch. The grain of wedges should run with the slope and their contact faces should be planed true and smooth for their entire width and length, and if so required, they should be lubricated to facilitate the striking of the centers without unnecessary jar and vibration. The wedges should be of straight grain oak only.

Sand Boxes.—If the contractor wishes to use sand boxes to lower the centers, he should be required to submit details of the same for the approval of the engineer in charge. Sand boxes should be waterproof and the sand used in the same should be thoroughly washed to remove all silt and thoroughly dried before using. Care must be taken to keep the sand dry during the entire construction.

Foundations.—Substantial foundations must be provided for the center. The foundations should preferably be of concrete and of such size as will not permit of a settlement greater than ¼ in. under the maximum loads they are designed to carry.

Workmanship.—All carpentry work should be the best class of heavy timber work. Care should be taken to see that all saw cuts are true, and surfaces of abutting timbers be adzed off to make a snug fit.

Shimming Joints.—Just before the centering is loaded it should be inspected and all joints which have opened up should be shimmed tight, using shingles or thin wedges. During the construction of the arch similar wedging should be done, as the settlement of the falsework may open joints.

ORNAMENTAL MOLDS.

Construction of Molds.—Iron molds for concrete newels, finials, rails, balusters, spinels, balls, cap and bases for piers, etc., should be so constructed as to be easily operated with perfect results without the use of unusual skill. They should be so constructed as to be removable piece by piece without injuring the casting.

Workmanship.—Molds should follow out the absolute perfeceion of architectural lines and artistic appearance.

Section Molds.—All molds made in sections should be carefully fitted and should be equipped with locking and squaring devices, which will accurately bring all molds into perfect alinement.

Rigidity of Molds.—Molds should have ample strength and rigidity to withstand tamping and other strains without distortion.

MISCELLANEOUS FORMS.

Forms for Dams.—On up-stream face of dam, forms need be only smooth enough to give good substantial work, free from voids. On crest and down-stream face, forms should have planed surfaces, so as to leave the finished work smooth.

Conduit Forms.—Forms must be well fastened down in order to prevent the forms from floating due to the upward pressure of the wet concrete. In order to prevent the rolling of conduit forms, care must also be taken in filling to keep a uniform level on both sides of the barrel. Thick lagging (generally 2-in. plank) should be used. Conduit forms should be made collapsible as far as practicable.

Anchoring Batter Forms.—Forms for retaining walls should be firmly anchored down to resist the upward thrust or floating effect of the semi-liquid concrete.

Sidewalk Forms.—Forms should be free from warp and of sufficient strength to resist springing out of shape. Surface lumber has advantage, but its use is not necessary. All mortar and dirt should be removed from forms that have been previously used. Forms should be placed in the manner necessary to outline both external edges of the walk accurately, the top of the frames being located to coincide with the established grade of the walk. The forms must be well staked tc the established lines and grades, the stakes alternating on either side about every 2 ft. At each slab division, cross-forms should be put in the full width of the walk and at right angles to the side forms. Thin strips of metal will be found convenient in forming curved lines.

[illegible]

Cleaning Forms.—Forms should be thoroughly cleaned of all sawdust, dirt, chips, ice and other foreign matter before placing concrete, and whenever necessary, forms should be cleaned out by a steam jet or other effective means, especially in freezing weather. The cleaning should be done just previous to placing the concrete. Adequate measures must be taken to prevent the adhesion of mortar to the forms. Especial care must be taken to prevent sawdust from lodging in the beam and column boxes. Too much care cannot be given the matter, as it is of far-reaching importance, and failure to properly look after this cleaning, damages the work in a way which is hard to rectify. Before closing the door at the foot of the column box, look through the box and see that no chips, blocks of wood or refuse of any kind has fallen into the box and become lodged in the reinforcing steel.

Previous Use of Forms.—All forms having been previously used should be thoroughly cleaned and prepared before being used again.

Adhesion of Concrete to Forms.—Concrete will adhere very strongly to forms if no special provision be taken to prevent it, and a great deal of force is generally necessary to separate the forms from the concrete. Many different methods are employed to prevent this adhesion as will be described below.

Wetting of Forms.—All forms, if not coated with some oil, should be thoroughly wetted before the concrete is poured. The water should be thoroughly applied to the boards until they take up no more moisture. In freezing weather steam must be used in place of water to drench the forms, immediately before placing the concrete.

Oil for Forms.—Better results can generally be obtained with petrolatum cut down with three parts of hot kerosene and then applied with a brush. The oil to be used in oiling forms should be thick and heavy enough to act as a filler for the forms. Care, however, must be taken not to get this on too thick, as grease spots in concrete leave an unsightly appearance. The quality of oil known as "sludge" at the oil refineries, or its equal, is recommended. The oil should be thin enough to flow and fill the grain of the wood. A slight oiling of forms will result in great economy in saving of forming lumber. An excess of oil must not be used. The oil must be applied every time the forms are set.

Use of Boiled Linseed Oil.—Forms which are to be used repeatedly may be given on the surface next the concrete three good coats of pure boiled linseed oil, applied with a brush, and each coat allowed to dry before the forms are used. If at any time the forms become rough, and there is danger of injury to the smoothness or appearance of the concrete, they should be cleaned, redressed and again given three coats of boiled linseed oil as above stated.

Soap Coated Forms.—Cheap soap boiled and applied hot to the forms gives very good results in preventing the adhesion of concrete to forms. Ordinary soft soap does not injure the surface or diminish the strength of the concrete. Forms for surfaces that are to be whitewashed, grouted, or plastered should be treated with soap boiled and applied hot, instead of oil or grease, as the oil or grease is apt to discolor the whitewashing or plastering.

Cold Water Paint.—Forms may be coated, after thoroughly cleaning, with cold water paint, and after they have been erected, should receive another coat.

Use of Shellac.—Applying shellac to the forms improves the appearance of the concrete surface.

Forms Lined With Metal.—When the forms are lined with sheet metal, the adhesion of concrete to the lining is generally more difficult to overcome. Ordinary oils will not adhere properly to sheet metal lining; fat salt pork has been found to give satisfactory results.

Removal of Forms and Centers.

[illegible]

Forms shall not be removed until the concrete shall have become hard enough to be unquestionably self-supporting. No forms should be allowed to be removed except in the presence of the inspector. The most important precaution in reinforced concrete construction, and whose importance cannot be overestimated, is *caution in the removal of the form work.*

Notification of Form Removal.—No forms whatever should be removed at any time without first notifying the engineer in charge of the work. But such notification should not be considered to relieve the contractor of responsibility for the construction and removal of forms.

Contractor's Risk.—Forms are removed from the concrete at the contractor's risk at any time, and should any of the concrete give way by such removal or become permanently injured, the contractor should be required to remedy same at his own expense. The contractor should be expected by suitable observations to know when the concrete in any section of the work is sufficiently hardened to bear its own dead load plus additional load as may be imposed by the work of installation and should not be relieved of responsibility for premature removal of centers. The engineer, however, may when he deems advisable, order the centering to remain for a longer time. The engineer's acquiescence in permitting removal of forms should not by any means relieve the contractor of responsibility for same.

Time of Removing Forms.—Under no circumstances should forms be removed until the concrete has attained sufficient strength to resist accidental thrusts and permanent strains which may come upon it. Forms supporting reinforced members should be left in place until the concrete rings sound and is readily chipped by a blow from a pick. Much attention must be given to this portion of the work, which is fraught with danger under incompetent direction. No exact time for the removal of form can be safely prescribed because of the varying character of the work, the variations in the setting of different cements and the influence of atmospheric conditions. Forms should, however, remain longer under beams and arches than around columns or walls, and longer under beams and arches of long spans than of short spans.

City Ordinances.—Removal of forms should comply with the city ordinances or regulations governing reinforced concrete construction and forms should not be removed until the approval of the engineer is obtained.

Foreman to Be In Charge.—A competent and experienced foreman should be in charge of the removal of forms at all times. At no time are more men to be engaged in the striking of forms than the foreman can fully direct and supervise. No foreman lacking the required experience in this line on high grade work, should be allowed upon the work.

Test Concrete Beams.—As an aid to judging when forms and supports may be removed safely, and when the concrete work may be used safely to carry extraneous weights or loads, test concrete beams about 4x6 ins. by 3 ft. in length, made of concrete taken from batches which are being placed in the portions of the structure under consideration.

Forms Not Supporting Loads.—Forms which do not support loads may be removed as soon as the concrete has taken its final set.

Minimum Time Limits for Form Removal.—(a) The minimum time for the removal of forms (not the supporting shores) should be as follows: For walls in mass work, 2 days; for thin walls, 3 days; for sides of lintels, girders and beams, 3 days; for bottom of slabs, 4 days; for spans of 6 ft. or less plus 1 day extra for each additional foot of span; for columns, 2 days.

(b) The minimum time for the removal of

shores should be as follows: for [illegible] beams and girders, 14 days, for spans of ordinary length.

(c) Should frost occur before the concrete has attained sufficient strength to enable the removal of the centering, the counting of time for this removal should start after the influence of frost has been entirely eliminated.

Freezing Weather.—When the necessary precautions are taken during freezing weather, the forms may be taken down at the usual time, if, in the judgment of the engineer, the test prisms made under the same conditions as the concrete is made, has attained sufficient strength. As a general thing, however, the forms must remain in place much longer than in warm weather. Special care must be used in removing centering when the concreting has been done in cold weather. Falsework must never be removed while the concrete is frozen. If necessary, artificial heat must be employed to thaw the whole mass and the set and hardness determined before removing false work. In other words, don't remove any forms until absolutely certain that the concrete is thoroughly hardened and that no portion is either soft or frozen. The only sure way of knowing when the cement is fully set and the concrete properly hardened, is to actually test it with a hammer for hardness. To do this, it is necessary to remove small portions of the formwork in each section of the structure to be certain that there are no soft spots.

Forms to Be Easily Removed.—Forms should be removed gently without chipping or jarring the concrete. Prying with bars or striking with a sledge must not be allowed as all jar and vibration must be avoided.

Manner of Removing Forms.—Forms when being taken down must not be dropped onto floors and knocked against columns and walls. The forms should always be eased down by a cable or other similar method. Always leave in place a few intermediate posts so as not to place the entire dead weight too suddenly on the beams and columns. A regular procedure should be followed in removing forms, and the work should be done by regular gangs so that the men become trained in the requirements and methods of the work. Care must be exercised and precautions taken to prevent large masses of forms from falling on floors. In other words, the work of removing the forms, molds, and centering should be done with great care so as to avoid injury to the concrete.

Cleaning and Piling Forms.—The forms upon removal should be thoroughly cleaned of all cement and any necessary repairs should be made and the forms piled in some convenient place.

Superimposed Loads On Forms.—When forms are being removed, there must be no load upon the portion of the concrete affected in excess of one-sixth of the live load for which the portion affected was designed, unless temporary shores are left in to take care of such load.

COLUMN FORMS.

Column forms, if removed first, should be so removed as not to disturb the beam and girder forms.

Time of Removal.—Column forms should not be removed in less than two days, in summer; in cold weather, four days; provided girders are shored to prevent appreciable weight reaching columns.

SLAB, BEAM AND GIRDER FORMS.

Floor Slabs and Sides of Beams.—Forms should not be removed from floor slabs of ordinary spans in less than seven days. Sides of beams and girders should not be removed in less than three days. The bottom of beam and girder forms should remain in place until after the side forms have been removed so as to inspect the sides of the beam without lessening the support of the beam against collapse. In all cases leave, at least, one line of shores in the center of the floor slabs when removing floor forms.

Beam and Girder Supports.—The original supports for all beams and girders should remain in place at least 14 days, but all beams and girders having more than 30-ft. span from center to center of support should be considered as special cases and should be subject to inspection of the Building Department before removal of supports.

Freezing Weather.—The time at which props or shores may safely be removed from under beams and girders will vary with the condition of the weather, additional time, however, should be allowed for each and every day that the thermometer registers any time during the day or night below 35° F.

Removal of Shores.—Before removing the shores under any beam or girder, the column supporting it should be stripped, so that columns may be examined on all sides, and at least one side of each beam and girder form should be removed in order to expose the concrete to view, so as to give evidence of the soundness and hardness of the concrete. The shoring underneath principal girders and beams should be the last to be removed.

Method of Removing Shores.—Shores should be removed without jarring the structure by properly pulling the double wedges at the bottom. Shores should be lowered gently and not allowed to drop heavily onto floors and thrown against columns. When shores are finally removed, they should be taken out for a beam or a panel at a time and under no circumstances must all shores under a floor be knocked down at haphazard or in rapid succession.

Removing Shores Before Forms.—While it is customary practice to some extent to remove shores one at a time and then put them back again in order to permit the removal of bottom boards of beam forms, etc., this practice should not be permitted. The reasons are obvious.

Precautions to Be Observed—In removing forms the falsework should be lowered to such extent as to permit the form to drop away an inch or two from the slab, in which position it should remain for 24 hours. While the wedges are being loosened the concrete must be carefully inspected.

WALL FORMS.

Massive Wall Forms.—Forms for massive concrete walls should not be removed in less than one day, or when the concrete will bear pressure of the thumb without indentation. If indented, the concrete is too soft to permit of removing the forms.

Thin Walls.—Forms for thin concrete walls should not be removed in less than two days for ordinary conditions; in cold weather, five days. If the wall is very thin and is to be

ARCH CENTERS.

Striking Centers.—The centers should be struck when directed by the engineer, which direction should not be given until the masonry above them has been completed up to the level of the bottom of the coping.

Time of Removing Centers.—Centers for arches of small size should not be removed in less than one week and for large arches with heavy dead load not less than one month.

Method of Removing Centers.—Arch centers should be removed without shock or jar to the arch ring. Centers should be lowered evenly and gradually, so that the ring can settle uniformly. For very long spans the engineer will provide special instructions for striking centers.

MISCELLANEOUS FORMS.

Conduits.—Forms for conduits may be removed within two or three days, provided there is not a heavy fill upon the conduits.

Sidewalk Forms.—Forms for cement sidewalks should be left in place until the concrete or mortar has set.

EARTH AND ROCK SECTION

Portable Magazines for the Storage of Explosives; Methods of Thawing Dynamite.

High explosives freeze at a temperature between 45° F. and 50° F., and should be stored in dry, well ventilated magazines and kept at a temperature above their freezing point. The magazine should be made bullet and fireproof or should be situated so as to be surrounded by high banks. All inflammable material such as brush, weeds and high grass should be trimmed back as far as possible from the magazine. It is also well to make two or three furrows with a plow encircling the magazine to prevent any grass fire from reaching it. Detonators and explosives should never be stored in the same magazine.

A cheap and successful magazine for storing explosives on the construction of the Catskill aqueduct is illustrated by Fig. 1. Several of these houses were used by the Degnon Contracting Co., 60 Wall St., New York, on their contract at Forest Glen in connection with the construction of Contract 47. Since the completion of the work the company has sold some of them and desires also to dispose of the others. Fig. 2 gives the plans and details of the magazine and Table I gives a bill of material for its construction.

In a recent catalog of the Dupont Powder Company useful information is given on the storage of explosives, together with illustrations of small magazines, some of which we reproduce here. A cheap magazine for contractors' work may be built of 1-in. boards nailed to studding. The inside should be lined

TABLE I.—BILL OF MATERIAL FOR POWDER HOUSE.

Size and kind. Inches.	No.	Length. Ft.	Ins.	F. B. M.	Description.
4×6	4	8	6	68	Corner posts.
3×8	1	12	0	24	Door trim
2×4	4	[illegible]	0	51	Purlins.
2×6	4	8	6	34	Studding.
2×6	11	7	0	77	Studs, wall plates and door braces.
2×6 dressed 1 side	80 lin. ft.			80	Door framing.
2×3	30 lin. ft.			15	Cleats.
1½ boards dressed		6	0	130	Lower shelves.
[illegible] dressed	[illegible]	6	0	[illegible]	Door trim.
1×6	26 lin. ft.			13	For doors.
1×4	2	6	0	4	Below lower door.
1×4	50 lin. ft.			17	For doors bevel in field.
1×4 D. I. side and 2 edges	125 lin. ft.			42	For doors and trim.
1×2	55 lin. ft.			9	Cleats.
1×1½	26 lin. ft.			3	Door trim.
1 boards		8	6	43	Roof.
1 boards		7	6	38	Floor.
1 boards D. I. side		4	0	[illegible]	Vert. of 1½" shelves.
1 T. and G.		7	6	36	Outside sheeting.
1 T. and G.		6	0	30	Inside sheeting.
1 T. and G.		[illegible]	0	220	Sheeting on sides and inner roof.
1 T. and G.				150	Sheeting for doors.
½ dressed		5	6	70	Upper shelves.
Total				1,182	

Hardware

[illegible] pipe [illegible]
1" pipe [illegible]
1" [illegible]
1" [illegible]

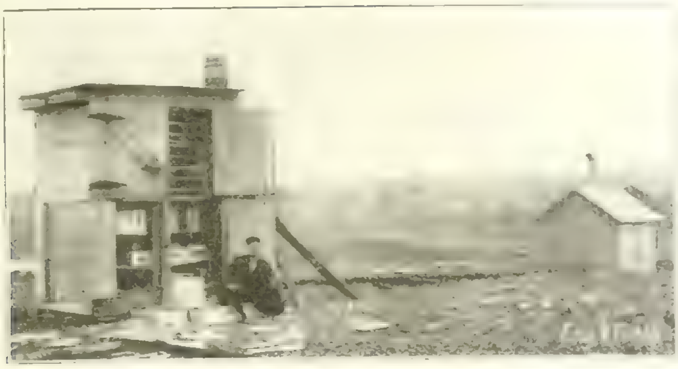

Fig. 1—View of Magazine and Thawing House Shown by Plans in Fig. 2.

[illegible] tee, with 1½" [illegible] outlet in center.
1" [illegible] tee left thread with 1" [illegible] outlet in center.
10 1" C. I. ells.
[illegible] return bends wide pattern, 4" center to center.
1" plugs.
1" left thread plugs.
1½" brass gate valve.
1 1" brass gate valve.
10 1" pipe straps.
12 9" strap hinges.
[illegible] padlocks, staples and clasps.
00 ft. corrugated iron, 5' lengths.
Tar paper, say 1 roll.

with 1-in. boards and the space from the sill o the plate filled with coarse sand. The outside should be covered with No. 24 or No. 26 black iron or galvanized iron. For making the walls bullet proof, 8 ins. of sand will stop a 30-30 Winchester, but it takes 11 ins. of sand o stop the high power Springfield rifle used by the government.

Portable magazines for temporary use can be set up in parts. The parts are spaced from 4 to 6 ft. on centers and are set in the ground below the frost line and are capped with a sill about 6x6 ins. The outside of the posts are boarded to the ground with 1-in. boards and covered with black or galvanized iron.

The magazine shown by Fig. 3 is provided with a heating system of pipes which may be supplied from the exhaust steam from an engine or a pump or with hot water. It is dangerous to use live steam or steam under pressure on account of the possibility of high temperatures. The house shown by Fig. 3 is designed to thaw 500 lbs. of dynamite in trays holding 50 lbs. each. Sawdust or dry sand is noted in the plans, for packing the walls. Dry sand is a good insulating material, but when used it is necessary to sheet with shiplap or tongued and grooved material to prevent the sand from coming out. Of course mineral wool would be superior to either sand or sawdust if the extra cost were warranted. Figure 5 shows a heater hours and a standard type of heating unit for small hot water systems. When installing this system, it is imperative that the heater house be enough lower than the thrawing house to permit a good gravity flow in the return pipe from the heating coil in the thawing house to the heater. The heater house should be built at a distance of from 30 to 50 ft. from the thawing house. Added distance increases the cost of construction, and diminishes economy of operation, while too close proximity to the thawing house adds to the fire risk. The pipes between the buildings should be covered with standard magnesia pipe covering, or placed in a sawdust filled box.

Fresh manure as a thawing agent is inexpensive and convenient, but is efficient only when plenty of time can be given to thawing, as the dynamite cartridges must not be exposed directly to it, but the closed cases buried in it or the walls of a specially designed box or magazine be lined with it.

Figure 4 shows a thawing box surrounded with manure, for 100 lbs. of dynamite in 50-lb. cases. A [illegible] made of 2-in. plank, with [illegible] galvanized iron. This box is placed in a pit large enough to receive it, and at the same time to permit the packing of sufficient manure between the box and the earth, on sides and bottom and also on top when the box is in use.

Method of Righting an Overturned Dredge.

A gold dredge operated by the Pacific Gold Dredging Co. was accidentally sunk on Nov. 22 last in 19 ft. of water. The dredge as described by Lewis H. Eddy in the *Engineering and Mining Journal* is a 7½ cu. ft. close connected bucket elevator type equipped with Bucyrus machinery. The hull is 95 ft. long, 38 ft. 6 ins. wide, 8 ft. 3 ins. deep and draws 5 ft. 9 ins. It sank in 26 ft. of water and listed to the port side. The sinking was caused by a leak aft of the well hole through [illegible] made by the spill from buckets sliding down back of the well and under the protecting plate, which, from a cause unknown, had bulged away from the well hole planking.

After divers had been sent down and repaired the leak an 8 in. pump was installed on the port pontoon, which was the most submerged part of the boat, divers cutting a hole in the deck and making a water tight entrance. Also a 6-in. pump was installed in the center compartment to keep down the water in that part of the hull as an aid to the larger pump.

Double triple-blocks were rigged to the bow gantry, the upper-tumbler gantry and the stern gantry. A 1½ in. hawser was employed in making a connection with the upper-tumbler, which is in the center of the boat and the place where it has the strongest pull. Because of the sinking of the dredge on the port side the main auxiliary winch on the main deck was out of water, and was employed in pulling. Lines were attached to the top of the structure, so as to assist in righting the dredge. A heavy strain was taken on all lines fastened to the gantries before starting the pumps and then the pumps were put in action and steady pulls were taken on all lines fastened to the top of the structure pulling them as evenly as possible. It was demonstrated that the lines were of sufficient strength to raise the dredge out of the pond, before the pumps were started, the operator recognizing that the tendency of the hull would be to settle farther over as it was relieved of the weight of the water within. It required only an hour and a half to float the dredge after the pumps were started.

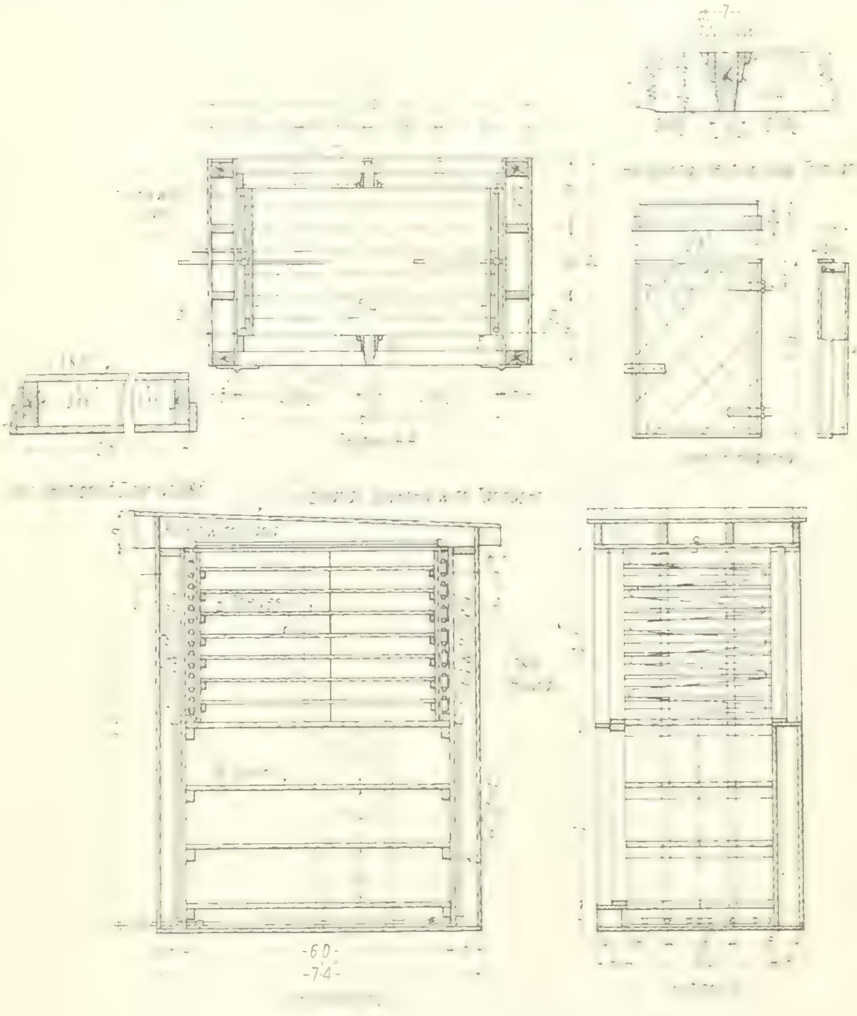

Fig. 2—Plans for Degnon Contracting Co., Magazine and Thawing House Using Steam or Hot Water Heat.

The International Clay Products Show.—An exposition of clay products will be given in the Coliseum, Chicago, March 1 to 12, inclusive. A space 170 ft. long and 70 ft. wide will be given over to the latest approved methods of city sanitation. A full size vitrified brick street will be shown and in this street a model sewer of vitrified salt-glazed sewer pipe will be under construction. This sewer will be absolutely water-tight—a point that is now being insisted upon by the leading sanitarians. Three or four methods of making these joints tight will be illustrated. A full size ditch will be shown under construction with steel sheet piling and newest methods of bracing. At the head of the ditch an Austin gasoline driven ditcher will be in operation and other machinery and devices now used by contractors will be displayed. The sewer shown will lead from a porcelain bath room and all the connections and equipment will be shown in full size, such as flush tanks, catch-basins, and manholes. There will be an exhibit of testing machines and these appliances will be used in tests on the various sewer pipe materials. A section of a 10-ft. sewer formed of vitrified segmental blocks will be shown. This form of construction permits the lining of the largest sized sewers with vitrified materials.

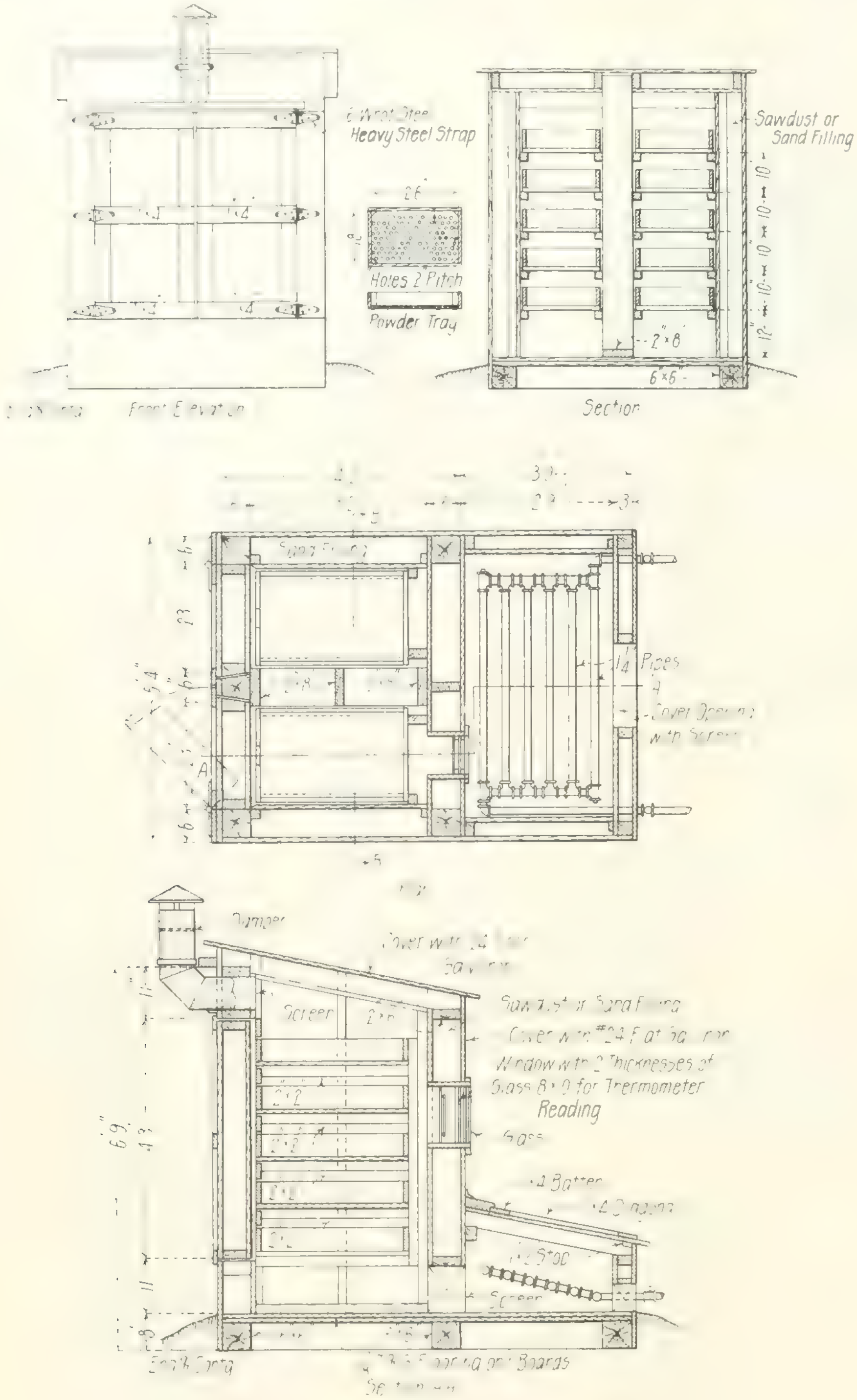

Fig. 3—Plans of DuPont Steam or Hot Water Thawing House.

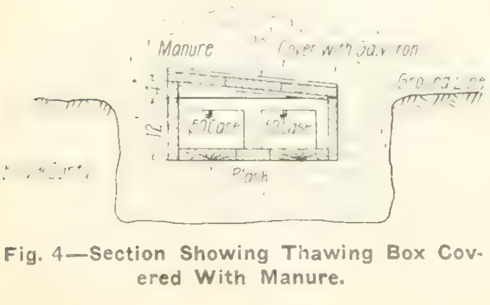

Fig. 4—Section Showing Thawing Box Covered With Manure.

The outer harbor plan for the City of Chicago has been advanced another stage. The City Council Committee on Harbors has taken favorable action for the construction of docks to cost $4,400,000, and bonds for this work will be voted on at the April election.

Instructions for Making and Filing City Plats in Michigan.*

1. In making the survey it is required that *permanent monuments* shall be located in the ground at all angles in the boundaries of the land platted, and at all the intersections of streets or streets and alleys as shown on the map or plat, and when there are permanent objects in the vicinity of such monuments the bearings and distances of such objects shall be noted. The character and dimensions of the monuments and the bearings and distances of such witness points or objects shall be distinctly given in the most convenient manner on the plat. The exact position of the monuments should be indicated on the plat by a small circle "O" or cross "X" and such monuments *must not be of wood.* They are to be *permanent.*

2. If the plat be of a town, city or village, the full name of such town, city or village must appear as the title or name of the plat; if the land platted be an addition to or a subdivision of a town, city or village already platted, then let the title of the plat include, with the name of such addition or subdivision, the name of the town, city or village, as the case may be, of which such platted land is a subdivision, or to which it is an addition. The name of the county in which land platted is situated should appear under the title.

3. The plat must be on a scale showing not more than 200 ft. to an inch, and on good muslin-backed paper 18x24 ins. in size; *all certificates must be written or printed on the paper on which the plat is made, and on the same side of the sheet.*

4. The sections and parts of sections platted must be designated by lines with appropriate letters and figures. In case of a subdivision of lots or blocks of a previous survey, the outlines of the original or previous lots or blocks so subdivided must be designated by lines, which must be marked with appropriate letters and figures. This must be done in such a manner as to show, without reference to the written description, the starting point and the course and length of each of the outlines. Where any of the outlines are identical and coterminus with the lines of a previous survey or plat, it will be sufficient to give the destination of such outlines as given in such previous survey or plat.

5. The land platted is to be fully described

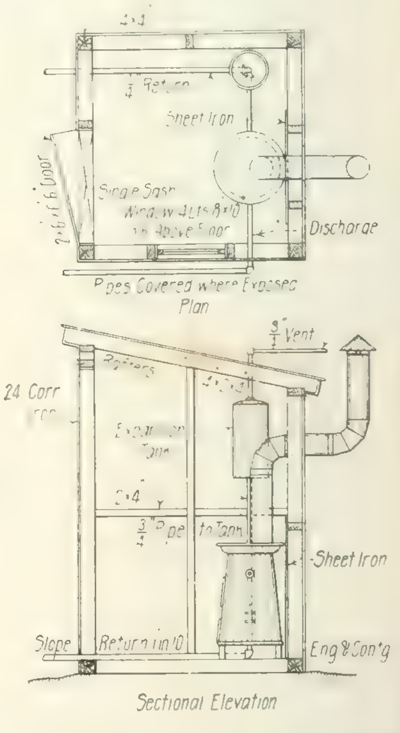

Fig. 5—Heater House for Hot Water Heated Thawing House.

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*Abstract of pamphlet issued by Audito General's Department.

in writing or printing upon the paper on which the plat is drawn. This description must be so complete that from it, without reference to the plat, the starting point can be determined and the outlines run. In connection with the description should be a short and simple form of dedication, which must be signed by the proprietors and their wives, whose signatures must be witnessed, and whose execution of the dedication must be acknowledged as deeds conveying land are required to be witnessed and acknowledged.

6. There must be drawn upon the plat a plain designation of the cardinal points and a correct scale.

7. Where all the lots in any block have the same dimensions it shall be sufficient to mark the precise length and width upon one tier thereof, but all gores, triangles, or other lots, which are not either squares or parallelograms, shall have the length of their sides defined by figures.

8. The streets must be named or numbered and their course and width designated. All public grounds and alleys must be properly designated.

9. The surveyor must certify that the plat is a correct one and that the monuments described in it have been planted as therein described.

10. Detached parcels cannot be included in one plat, nor can more than one plat be made on one sheet. Contiguous parcels owned by different parties may be embraced in one plat, all joining in the execution and acknowledgment, it is not necessary to specify the particular parcels belonging to each.

11. Before a plat shall be forwarded for approval, and before any copies are made therefrom, there must be *inscribed* upon the *original* the County Treasurer's tax certificate required by law. Also a certificate of approval of the city or village council, or township board, as the location of lands platted may require.

12. For the purpose of approval and recording, an exact copy is to be made from the *original* after certificates above referred to are *inscribed* thereon, and said *original* and *copy* forwarded to the Auditor General of the state for approval and record, together with $4.00 fee required by the statute. When the *original* plat has ben approved by the Auditor General the same will be forwarded from the Auditor General's Department to the Register of Deeds of the county in which lands are platted, for recording, together with fee required by statute, while the *copy* will be filed in the office of the Auditor General. Should proprietor wish to retain a *copy*, two copies of the *original* should be forwarded at the time of forwarding the *original* plat, one copy of which may be made on tracing linen, if so desired, which second copy will be returned to proprietor with proper certificates thereon.

13. The fee of $4.00 to accompany the original plat, as above required, covers a fee of $1.00 to the Register of Deeds for recording, and a fee of $3.00 to the Auditor General for the benefit of the State.

[illegible]

1. The term "as proprietor" or "proprietors" should appear after the name, or names of the owners, in the dedication.

2. Do not use rubber stamps for signatures.

3. All names in the body of dedication, acknowledgment and certificates should agree to the letter with signatures, as appended. A full name should not be used in one place and an abbreviation or initial substituted for it in another.

4. If the plat is made by a corporation, the corporate name should be used, followed by the names of its president and secretary and have impressed the seal of the corporation; if by an association, then president and secretary should sign with scroll seals after their signatures.

5. Building restrictions, franchise rights, and the like, have no place in the dedication. It is held that no "reversions" can be reserved in streets and other parcels dedicated to the public, even though an attempt is made to do so in the dedication.

6. It is desirable that a trustee should state his authority; similarly for an attorney-in-fact.

7. The caption should agree exactly with the title as printed in certificates. Correct spelling is very desirable in caption and title.

8. The law requires that in the drawing and in writing there shall be provided two separate, complete and independent descriptions of the land platted, which must be consistent with each other. This means that many items must be repeated, and of course it requires exact agreement in all cases where two recorded items signify the same thing. If the boundaries are described by bearings and distances, the "place of beginning" must be noted on the drawing and the bearings and distances noted on the drawing must agree exactly with those given in the written description.

9. The numbering of lots and blocks in every plat must be regular and continuous commencing with lot 1, block 1, dividing into blocks may be omitted (but not preferable).

10. Distinguish old survey lines, old lot and block numbers, preferably in ink of some other color than black.

11. Numerical dimensions should agree fairly well with scaled values. The length recorded on any boundary line should agree exactly with the aggregate of lot and street dimensions along that line.

12. The boundary of the platted portion should be represented by a continuous line, dotted if desired where it crosses streets.

13. Curved boundaries should be adequately surveyed and their curve elements recorded on the drawing.

14. [illegible] another lot.

15. Fully describe all "excepted" parcels.

16. All alleys, public walks and the like should be plainly designated as such.

17. The law requires that the plat be made by a competent person. This implies a workmanlike execution of the plat in every detail. Freehand linear drawing should not be attempted, nor should other principles of good surveying and draftsmanship be offended.

18. No plat will be examined at this Department that does not contain all certificates required by the statute.

19. No plat should be forwarded to this Department for examination without the name and address of proprietor or surveyor accompanying the same.

20. No plat will be examined or considered until statutory fee of $4.00 is received.

21. The examination of a plat by the Auditor General's Department does not presume to discover all mathematical errors, nor even to provide suggestions for remodeling the descriptive matter. All who submit plats should, at least, carefully review them when returned for correction. Sometimes errors are carelessly introduced in the very act of correction. If a similar error appears a number of times on the same plat only one mention may be made of its occurrence; but the sender of the plat should make sure that the correction is made wherever necessary

ROADS AND STREETS SECTION

Mileage and Cost of Public Roads in the United States in 1909.

In November, 1909, the U. S. Office of Public Roads began an investigation to ascertain the mileage of improved and unimproved roads in the United States. This investigation was completed about the close of the fiscal year, 1911, and a bulletin containing the results of it has been issued recently. The work of compiling the information in the bulletin was carried on by Mr. J. E. Pennybacker, Jr., Chief of Road Management, until he left the Office of Public Roads on Jan. 1, 1911, and was completed by Mr. M. O. Eldridge, Assistant in Charge of Road Management since that time. Previous to the publication of the bulletin the latest figures on public road mileage were those for the year 1904. The bulletin recently issued shows the mileage of improved and unimproved roads in the United States for the year ending Dec. 31, 1909. In addition it contains considerable general data on the cost of road building.

In the new bulletin it has been the intention to assemble the results of the investigation in such a way as to illustrate the progress in road improvements in the different states for the five-year period from 1904 to 1909. The statistics relate to country roads only, except in a few instances. The information was secured by correspondence, principally with road officials and partly with private citizens of the various states and territories, counties, townships, districts and other civil subdivisions of the United States. The magnitude of the task may be appreciated when it is understood that there are in the United States about 150,000 state, county and local road officials, and that it was necessary to correspond with most of these in order to secure the desired information. Every possible effort was made to verify the accuracy of the figures given, and when there was any doubt as to their correctness they were returned for correction or approval to the person from whom they were received or to some other person qualified to give correct information. Upon the completion of the tabulations for the various states they were submitted to the heads of state highway departments or geological surveys or to some well informed person in the state for correction and approval.

The total mileage statistics are based mainly on approximations or estimates from the various civil subdivisions of the United States, as there are very few states or counties where the roads have been actually surveyed and measured, and it will be impossible to secure accurate data in regard to total mileage until this has been done. The statistics in regard to the mileage of improved roads are based more nearly on facts than on estimates, although in many cases the mileage of improved roads was estimated. It is quite possible, therefore, that, in spite of the precautions which have been taken, some errors have crept in. The total mileage, as well as the mileage of improved roads, may be in some instances overestimated, and in others underestimated. In view of these facts, the Office of Public Roads can not vouch for the absolute accuracy of all of the figures it gives, but it is believed that, taken as a whole, they can be accepted as a fairly accurate record on which to base the progress of road building in the various states during the five-year period treated. It is believed, moreover, that these figures are more reliable than those presented for the year 1904.

Table 1 shows the public road mileage of the United States in 1904 and 1909. In this table and in fact throughout this article the term "improved roads" implies a road which has been graded, drained and surfaced with a hard material or a combination of materials, or to which some preparation has been applied, resulting in a reasonably smooth, firm, and durable surface. Macadam or gravel roads may be cited as examples of hard material applied to earth subgrades; the sand-clay road and bituminous macadam are good examples of the application of combinations of materials to effect the desired result, while the use of oil, tar, and other bitumens, principally on macadam roads, though occasionally on

TABLE I.—IMPROVED ROAD MILEAGE IN THE UNITED STATES IN 1904 AND 1909

State.	Total mileage.		Mileage of improved roads								Percentage of all roads improved.	
			Stone.		Gravel.		Other materials.		Total.			
	1904.	1909.	1904.	1909.	1904.	1909.	1904.	1909.	1904.	1909.	1904.	1909.
Alabama	[illegible]	49,639	392.5	683.50	1,261.5	1,398.43	66	1,182	1,720	3,263.93	3.43	6.58
Arizona	[illegible]	[illegible]	1		216	248	....	25	217	273	3.62	4.56
Arkansas	[illegible]	36,445	55	170	181	[illegible]		[illegible]	[illegible]	1,085.25	.64	2.97
California	[illegible]	[illegible]	418	[illegible]	5,843.5	6,054	2,541	1,954.50	8,803	8,587.75	18.87	17.87
Colorado	[illegible]	29,693	57	14	121	306.50	....	....	178	320.50	.59	1.08
Connecticut	[illegible]	12,583	463.5	665.62	1,896.5	774.40	....	1,590.52	2,360.1	3,030.54	16.75	24.08
Delaware	[illegible]	3,000	14	96.36	2	49	50	41.07	66	186.44	2.20	6.22
Florida	[illegible]	[illegible]	[illegible]	[illegible]	17.5	259.60	523	1,214.50	885.5	1,752.35	5.10	9.97
Georgia	[illegible]	[illegible]	[illegible]	[illegible]	659	880.50	537	4,575.50	1,634	[illegible]	2.86	7.27
Idaho	[illegible]	18,403	17	17	195	95.50	....	398	212	510.50	1.16	2.77
Illinois	[illegible]	94,141	1,106.5	[1]8,914	6,800	....	17.5	....	7,924	8,914	8.42	9.47
Indiana	[illegible]	67,996	3,295	4,398.25	20,582	20,508.75	....	48.75	23,877	24,955.75	34.96	36.70
Iowa	[illegible]	102,427	241	357.25	1,403	1,572.85	20	575	1,664	2,505.10	1.62	2.45
Kansas	[illegible]	98,302	111.7	136.95	158.5	27.75	3	210.01	273.2	374.71	.27	.38
Kentucky	[illegible]	53,744	8,078	8,709.25	1,408	1,404	....	1.70	9,486	10,114.95	16.60	18.82
Louisiana	[illegible]	24,962	....	....	26	82.50	8	247	34	329.50	.14	1.32
Maine	[illegible]	25,528	87.5	98.34	2,236	2,493.75	....	110.97	2,323.5	2,703.06	9.10	10.59
Maryland	[illegible]	16,773	840	1,222.80	480	488	250	431.50	1,570	2,142.30	9.36	12.77
Massachusetts	[illegible]	17,272	1,212.7	2,296.66	6,621.1	6,166.52	10	....	7,843.8	8,463.18	45.89	49.00
Michigan	[illegible]	68,906	248.5	747.81	6,777	3,770.58	....	2,382.15	7,025.5	6,900.54	10.14	10.01
Minnesota	[illegible]	[illegible]	[illegible]	[illegible]	6,179	4,228	1	1,051.50	6,247.5	5,416.85	7.87	6.83
Mississippi	[illegible]	[illegible]		[illegible]	109	165.75	40	124	149	342.25	.31	.86
Missouri	[illegible]	107,923	861.5	1,240.75	1,871.5	3,512.50	....	2.25	2,733	4,755.50	2.53	4.40
Montana	[illegible]	[illegible]		[illegible]	65	94.50	....	....	65	95	.28	.41
Nebraska	[illegible]	80,338	17	52.50	....	.50	6	195.55	23	248.55	.03	.31
Nevada	[illegible]	12,751	4	1	[illegible]	[illegible]			[illegible]	[illegible]	.51	.36
New Hampshire	[illegible]	15,116	118	201.82	1,175	1,246.66	....	....	1,293	1,448.48	8.56	9.58
New Jersey	[illegible]	14,842	1,901	2,594.09	481.5	572.44	39.8	211.33	2,422.3	3,377.86	16.32	22.76
New Mexico	[illegible]	16,920	....	25	2	8	....	71	2	104	.01	.61
New York	[illegible]	79,279	2,184	4,614.40	3,692	8,172.96	....	....	5,876	12,787.36	7.96	16.13
North Carolina	49,763	48,285	399	1,038.50	422	545	438	729 50	1,259	2,313	2.53	4.79
North Dakota	59,332	[illegible]			205	140	....	....	212	140	.36	.23
Ohio	[illegible]	88,861	7,160.5	9,687	16,159	14,188	140.5	231	23,460	24,106	33.79	27.13
Oklahoma	[illegible]	[illegible]		[illegible]		[illegible]		196		361	.....	.50
Oregon	[illegible]	29,475	209	451.25	2,235	1,871	145	477	2,589	2,799.25	7.56	9.49
Pennsylvania	99,777	87,386.79	2,160.8	2,764.01	....	436.10	....	168.65	2,160.8	3,364.76	2.17	3.84
Rhode Island	2,361	2,120.75	247	409.10	774.5	605	....	27.97	1,021.5	1,042.07	43.27	49.14
South Carolina	41,839	32,075	69	153.75	179	131	1,630	3,250	1,878	3,534.75	4.49	11.02
South Dakota	[illegible]	56,354	4	10	147	147	....	129	151	286	.25	.50
Tennessee	48,989	45,913	1,774	2,684	2,511	2,542.50	....	127	4,285	5,353.50	8.75	11.66
Texas	121,409	128,971	167	365.25	1,909	2,126	52	2,404.75	2,128	4,896	1.75	3.80
Utah	7,090	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		641	608	1,018	8.57	12.23
Vermont	14,521	14,406	281	466.65	1,672.5	2,183.98	....	....	1,953.5	2,650.63	13.45	18.40
Virginia	51,812	43,399	755	1,011.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,902.75	3.09	4.38
Washington	31,998	34,283.60	48.5	100.41	1,928	3,178.92	....	1,241.35	1,976.5	4,520.68	6.17	13.19
West Virginia	[illegible]	32,109	217	543.90	26.5	33.50	11	14	254.5	591.40	.97	1.84
Wisconsin	63,593	61,090	733.2	659.33	9,900	8,494	....	1,014	10,633.2	10,167.33	16.72	16.64
Wyoming	10,147	10,569			....	....	153	416	153	416	1.46	3.94
Totals and averages	2,151,379	2,199,645.14	36,818.4	59,237.35	109,905.1	102,870.44	6,806.8	28,372.52	153,530.4	190,476.32	7.14	8.66

[1]This includes gravel roads.

earth roads, illustrates the improvement of a road by the application of preparations.

It will be noted from Table I that the total mileage of gravel roads reported has decreased from the 1904 figure by 7,034 miles. This is due principally to the fact that in 1904 no information was collected in regard to sand-clay roads, except from the southeastern states, and it is quite probable that a number of the roads which were reported as gravel roads in 1904 were reported in 1909 as sand-clay roads. This discrepancy is also partly accounted for by reason of a reclassification of the roads in several of the states, by which many of the poorly built and poorly maintained gravel roads have been eliminated from the improved road class. An effort was made in this investigation to exclude all natural gravel roads from the improved class unless they were well graded and drained, but many of these were included in the 1904 statistics.

Table I contains the same states and territories as those reported in 1904, with the following exceptions: The District of Columbia has been eliminated on account of the fact that there are no roads in it which should be classified as country roads. Indian Territory and Oklahoma have since 1904 been combined to form the state of Oklahoma and a large number of counties have been organized from which it was impossible to secure reports in 1904. This has had the effect of increasing the total mileage of Oklahoma from 43,554 in 1904 to 71,325 in 1909. A number of new counties have been organized since 1904 in the Middle and far Western states, which has had the effect of increasing the total mileage in those states. The mileage of roads given in this table and the other tables does not include the streets and boulevards in incorporated cities or villages.

It will be noted also in Table 1 that a decrease in improved roads is reported from California, Michigan, Minnesota, and Wisconsin. This decrease may be explained as follows: The practice of improving the earth roads by the use of oil in California has been, to a large extent, discontinued, and this has had the effect of cutting down the mileage of that class of roads considerably and so of reducing the total mileage of improved roads. In Michigan and Minnesota the roads have been reclassified by the state highway departments and the mileage of roads which come under the improved class has been reduced. In Wisconsin the mileage of both stone and gravel roads is a little less than was reported in 1904, owing probably to a more careful classification of the roads than it was possible to make at that time. A reclassification of the roads is also responsible for the decrease in gravel roads in Connecticut, Indiana, Massachusetts, Ohio, Oregon, Utah and Virginia.

Statistics as to the mileage of sand-clay roads in the United States are given in Table II. In no other class of improved roads has the mileage increased so rapidly during the five-year period as in the case of sand-clay roads.

COST OF ROAD BUILDING IN VARIOUS STATES

The cost of road building depends upon a number of factors, the most important of which are the cost of grading, the value of labor and teams, the availability and kinds of materials, the method of construction, the cost of bridges and culverts, the character of the soil and the traffic, the method of supervision, and, to a certain extent, the climatic conditions. There are very few localities in the United States where all these factors are exactly alike, and consequently there are but few places where the cost of road building would be the same, even though the same type of construction be employed. Comparisons of the average cost of roads in two localities are of little value, therefore, unless all the conditions are taken into account.

In many parts of the United States the land is so level that no grading is necessary, except to prepare the foundation to receive the materials and to provide suitable ditches to dispose of surface drainage; but in other sections the cost of grading and the cost of bridges, culverts, and retaining walls often amounts to more than the cost of surfacing.

In the Southern States the cost of labor for road work ranges from 75 cts. to $1.25 per day, while the cost of double teams with driver ranges from $2.50 to $4 per day. In the North and West, however, laborers receive from $1.50 to $2 per day for this class of work, while the prices paid for double teams with drivers range from $3.50 to $5 per day. This partly accounts for the fact that roads of the same type frequently cost more in the North and West than in the Southern States, where the cost of labor is generally low.

The distance that road materials have to be hauled determines, to a large extent, the cost of the work. In many parts of the country material is so plentiful that the average haul does not exceed 1 or 2 miles, while in other parts of the country materials have to be transported long distances by rail or water and then hauled several miles by country road. This factor alone very frequently affects the cost to such an extent that a macadam or gravel road will cost considerably more in one part of a county than the same kind of a road will cost in another part of the same county.

In rolling and mountainous sections of the country the cost of bridges and culverts frequently amounts to as much as the cost of surfacing, whereas in level regions and especially where the rainfall is light this item of expense is very small.

At times the temperature falls as low as from 40° to 50° F. below zero in certain parts of the Northern States, while there are many places on the Pacific Coast and in the Southern States where the temperature rarely falls below the freezing point. It is obvious, therefore, that heavier and more expensive types of road are required in regions where the ground freezes several feet below the surface than in those sections where the ground is seldom frozen. The annual rainfall ranges all the way from 8 to 10 ins. in Arizona, California, Colorado, Nevada, and northwest Texas to from 50 to 60 ins. in parts of Florida, Alabama, Georgia, Mississippi, Louisiana, Tennessee, Arkansas and southeast Texas. The rainfall, as much as any other factor, affects the condition of the road and, while good earth and gravel roads often give entire satisfaction where the rainfall is light, a more durable and expensive type of road must be built where the rainfall is heavier. If the rainfall is light, however, and the traffic is heavy as is the case in many of the arid regions of the West, special treatment for laying the dust and preserving the surface with oil and other preparations sometimes becomes necessary.

The condition of the soil also affects the

TABLE II—MILEAGE OF SAND-CLAY ROADS IN THE UNITED STATES IN 1904 AND 1909.

State	[illegible]	[illegible]
Alabama	[illegible]	[illegible]
Arizona		[illegible]
Arkansas		[illegible]
California		[illegible]
Connecticut		[illegible]
Delaware		[illegible]
Florida	[illegible]	[illegible]
Georgia		[illegible]
Idaho		[illegible]
Iowa		
Kansas		[illegible]
Louisiana		[illegible]
Maryland	.....	25
Michigan		[illegible]
Minnesota	.....	1,051.5
Mississippi		
Missouri		[illegible]
Nebraska		[illegible]
New Mexico		[illegible]
North Carolina	[illegible]	[illegible]
Oklahoma		[illegible]
Oregon		[illegible]
Rhode Island		[illegible]
South Carolina		[illegible]
South Dakota		[illegible]
Tennessee		[illegible]
Texas		[illegible]
Utah		[illegible]
Virginia		[illegible]
Washington		[illegible]
West Virginia		[illegible]
Wisconsin		[illegible]
Total	[illegible]	[illegible]
Approximate [illegible]		

TABLE III.—AVERAGE COST PER MILE OF IMPROVED ROADS IN VARIOUS STATES IN [illegible]

State	Sand-clay	Gravel	Macadam	Bituminous
Alabama	$ 680	$1,483	$[illegible]	$[illegible]
Arkansas		940	[illegible]	
California	412	1,375	[illegible]	[illegible]
Colorado	...	1,475		
Connecticut	...	5,412	[2]8,220	
Delaware		[illegible]	6,850	10,120
Florida[5]	829	3,900	[6]3,112	
Georgia	[illegible]	[illegible]	2,275	
Indiana	...	1,887	2,657	
Kansas	785	.....	[illegible]	
Kentucky	...	1,011	2,158	
Louisiana	[illegible]	[illegible]		
Maine	...	3,687	9,022	[illegible]
Maryland	[illegible]	[illegible]	8,192	
Massachusetts			7,451	[illegible]
Michigan		[illegible]	[illegible]	
Minnesota	766	946	3,280	
Mississippi		[illegible]	5,135	
Missouri	...	1,023	[illegible]	
Montana		[illegible]		
Nebraska	[illegible]		[illegible]	[illegible]
New Hampshire	...	2,352	5,016	
New Jersey	...	4,317	8,746	[illegible]
New York	...	5,950	9,496	
North Carolina	506	1,006	4,020	
Ohio	([12])	1,909	4,580	7,766
Oklahoma	[illegible]		3,750	
Oregon	...	1,940	3,491	
Pennsylvania	...	1,575	9,164	[illegible]
Rhode Island	...	.....	[illegible]	[illegible]
South Carolina	415	1,133	3,252	
Tennessee	1,050	1,697	2,727	
Texas[15]	[illegible]	[illegible]	2,160	[16]6,000
Utah	[illegible]	[illegible]	5,000	
Vermont		[illegible]		
Virginia	[illegible]	[illegible]	4,920	
Washington	...	2,600	7,600	
West Virginia	...	.....	5,414	
Wisconsin	[illegible]	[illegible]	2,978	
Average	$ 723	$2,047	$4,989	$10,348

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[1] For 1 section of road only.

[2] Average cost of telford macadam, $11,323.47; telford gravel, $7,659.71 per mile.

[3] $0.15 per sq. yd.

[4] $0.25 per sq. yd.

[5] Average cost of shell roads, $3,186.

[6] Marl and coral, sometimes referred to as coquina.

[7] Average cost of shell roads, $3,000.

[8] Some of these roads are 40 ft. in width.

[9] Average cost of shell roads, $2,984 per mile.

[10] Average cost of 3 sand and oil roads, $4,718.66 per mile.

[11] $0.23 per sq. yd.

[12] Average cost of brick roads, $12,381 per mile.

[13] $0.80 per sq. yd.

[14] $1.25 per sq. yd.

[15] Average cost of shell roads, $3,083 per mile.

[16] Telford gravel roads, $2,500 per mile.

[17] Average cost of brick roads, $14,500 per mile.

cost of road building. For instance, on sandy loams and gravelly soils 4-in. macadam roads are being successfully built and maintained in many parts of the country. In other localities it has been found necessary to macadamize to a depth of from 8 to 10 ins. on certain types [illegible] times the Telford method of construction or the V-shaped drain foundation must be resorted to in order to obtain a solid and durable road. One of the most important factors affecting the cost is that of the traffic. A road which would be satisfactory for light carriage traffic would not always be suitable for heavy wagon traffic and, on the other hand, a road which would be satisfactory for heavy, horse-drawn, steel-tired traffic would not be, as a general rule, suitable for fast automobile traffic. The character and cost of construction is therefore largely determined by the traffic to which the road is subjected.

Table 4 presents a summary of the information secured from the various states in regard to the cost of four of the standard types of construction, i. e., sand-clay, gravel, macadam, and bituminous macadam.

It was impossible to obtain cost data from Illinois and the cost data obtained from Arizona, Idaho, Iowa, Nevada, New Mexico, North Dakota, South Dakota and Wyoming were so meager as to be of little value, and were therefore not included.

It will be seen from the table that the cost of gravel roads is greater in Maine, New Hampshire and Connecticut than in Indiana, Ohio and Minnesota. In the states last named the statute labor tax is still used, and many of the gravel roads are built by farmers in working out their tax, while in the states first named the standard of construction is much higher and all road taxes are paid in cash.

It is believed that the figures given represent approximately the average cost of road building in the respective states, as they are based upon reports received in regard to the actual cost of road building. Some of the county and township reports are based on one section of road only, but most of them are based on the average cost of construction in the county or township from which the report was received.

The cost of large bridges and extraordinary construction, such as retaining walls, etc., is not included, except in a few instances, but the cost of small bridges and all ordinary construction, including surface drainage, is included.

The average cost of the four types of construction referred to in the summary, Table II of the appendix, is as follows: The average cost of sand-clay roads for the 17 states from which reports were received is $723 per mile, the average width of surface treated 17 ft., and the average depth of the material 9 ins.

The average cost of gravel roads for the 31 states from which reports were received is $2,047 per mile. The average width of gravel surface is 13 ft. and the average depth of the material 7 ins.

The average cost of macadam roads for the 34 states from which reports were received is $4,989 per mile. The average width of macadam surface is 13 ft. and the average depth of the material 6 ins.

In view of the fact that the mileage of poorly built macadam, gravel, and sand-clay roads exceeds the mileage of properly constructed roads of the same types, the above figures should not be used as a basis of comparison in communities where the roads are being built according to the latest and most approved methods, for it is safe to say that in such places the cost will considerably exceed the average given above.

The average cost of bituminous-macadam roads for the 10 states from which reports were received is $10,348 per mile for roads surfaced to a width of 15 ft. and to a depth of 6 ins. The information received in regard to bituminous construction, however, is rather meager, and it is believed that it does not represent the average cost of country roads, as do the figures in regard to other methods of construction. The reason for this is that this method of construction is new and to some extent experimental. Furthermore, bituminous macadam roads have, up to the present time, been built only in the neighborhood of the larger cities, where the cost of labor is comparatively high, and where the roads would naturally be surfaced to a greater width than the roads farther out in the country. It is believed, therefore, that the cost is greater than will be the case when this method of construction becomes more general and when this type of road building becomes standardized.

Additional information regarding the cost figures shown in Table III are given below. These notes also contain data on types of construction other than those shown in the table.

[illegible] bama varies from $175 to $300 per mile, and the average for the three counties reporting is $225 per mile. This evidently represents the cost of ordinary surface drainage and shaping, and does not include heavy cuts and fills or rock excavations. The cost of sand-clay roads varies from $400 to $1,350 per mile and the average for the 6 counties reporting is $680 per mile. The width of the sand-clay road surface varies from 16 to 30 ft., with an average of about 23 ft. Gravel roads cost from $500 to $4,950 per mile and the average for the 6 counties reporting is $1,483 per mile. The average width of gravel-road surface is 16 ft. Macadam roads cost from $1,500 to $3,600 per mile with an average for the 4 counties reporting of $2,525 per mile. This is a rather low cost for macadam construction, but the reports indicate that the roads are surfaced to a width of only about 10 ft. Only 1 county, Jefferson, reports on the cost of bituminous construction and the cost for the 1 mile upon which the report is based is $13,250.

Arkansas.—Only 2 counties reported on the cost of earth roads, and the average was $225, which includes only ordinary surfacing and draining. The average cost of gravel roads for the 6 counties reporting is $940 per mile, but it varies from $350 to $3,000 per mile. The average width of graveled surface is about 10 ft. The cost of macadam construction varies from $1,000 to $6,000 per mile in the 4 counties reporting, with an average of $3,250. The average width of the surface is 17 ft. While $6,000 is considered a little high for macadam construction in Arkansas, $1,000 is too low. It is quite evident that only the crudest sort of macadam road can be built in that state for that price, even though materials are plentiful and labor is cheap.

California.—The types of improved roads ordinarily built in California are sand-clay, gravel, macadam, and bituminous macadam. Only 2 counties reported on the cost of sand-clay roads, with an average of $412, while the average width is 17 ft. Twelve counties furnish information in regard to the cost of gravel roads. Six counties report the cost by the mile, five by the square yard, and one, Glenn, by the cubic yard. The average cost of the counties reporting by the mile is $1,375 and that of the counties reporting by the square yard is 69 cts. The cost in Glenn County is given as 89 cts. per cu. yd. The average width of the gravel roads is about 13 ft. Nine counties report on the cost of macadam construction, 4 by the mile and 5 by the square yard. The average cost per mile for the counties reporting is $5,375, while the average cost per sq. yd. is $1.08. The average width of the macadam roads is 17 ft. Sever counties report the cost of bituminous macadam, 3 by the square yard and 4 by the mile. The average cost per sq. yd. is about $1.39 and by the mile $8,575. The width of the bituminous surface is 17 ft.

Colorado.—Only 2 counties report on the cost of earth roads, and the average is $600 per mile. Summit County reports the cost of sand-clay roads to be about $300 per mile. Four conties report on the cost of gravel roads, with a minimum cost of $700 and a maximum cost of $2,000, while the average is $1,475.

Connecticut.—The average cost of gravel roads for the 22 townships reporting was $5,411.77 per mile. The average width of the gravel roads is 14 ft. and the average depth of material 8 ins. The average cost of macadam construction for 50 sections of road is $8,219.60 per mile, while the average width of macadam is 14 ft. and the average depth 7 ins. The average cost of the telford roads for 48 sections is $10,254.87 per mile, the average width 14 ft., and the average depth of material 13 ins. The telford roads are of two kinds—those surfaced with crushed stone and those surfaced with gravel. The average cost of 34 macadam telford roads is $11,322 per mile, while the average cost of the gravel telford construction for 14 sections is $7,659 per mile.

Delaware.—The cost of macadam roads in New Castle County, built of different materials, is as follows: Limestone, 12 ft. wide and 6 ins. deep, $6,150; granite, 13 ft. wide and 7 ins. deep, $6,900; trap rock, 12 ft. wide and 6 ins. deep, $7,500; average for the three types, $6,850. The average cost of bituminous construction in New Castle County is $10,120. The average width of the road is 12 ft. and the average depth 6 ins. Sussex County reports that sand-clay roads are being built for 15 cts. per sq. yd. and that gravel roads are costing about 25 cts. per sq. yd.

Florida.—Seven counties report in regard to the cost of earth roads. The minimum cost given is $300 and the maximum $1,200, while the average is $786. Six counties report the cost of sand-clay roads. The minimum cost is $550 and the maximum $1,000, while the average is $829. The average width of the sand-clay roads is about 15 ft., with a depth of about 8 ins. Three counties report the cost of gravel roads. The minimum cost of this type is $1,700 and the maximum $6,500, with an average of $3,900. The average width of gravel roads is 17 ft. The county reporting the cost of a gravel road as $6,500 per mile is Duval, of which Jacksonville is the county seat. Seven counties report on the cost of shell roads. The minimum cost is $800 and the maximum $6,500, with an average cost for the counties reporting of $3,186, and an average width of about 10 ft. The county reporting the highest cost of shell roads is Duval. Eight counties report the cost of marl rock roads, with a minimum cost of $1,000, a maximum cost of $8,000, and an average of $3,112. Duval County has also constructed some cement roads at a cost of about $10,000 per mile, and in Lake County roads have been improved by spreading pine needles over the sand roads at a cost of about $35 per mile.

Georgia.—Eight counties report on the cost of earth roads. The minimum cost given was $200 and the maximum $1,500, with an average of $700. The average width of these earth roads between ditches is about 28 ft. There are 38 counties in the state which reported on the cost of sand-clay roads. The cost varies from $100 to $1,200 per mile, with an average cost of $387. The average width of the sand-clay roads between ditches is about 27 ft. Nine counties furnished information regarding the cost of gravel roads, which varies from $200 to $3,500, and the average is $1,250. The highest cost of gravel roads is reported for Chatham County, but the material for these roads is shipped from near Augusta by rail. Nine counties report on the cost of macadam construction, and the cost given varies from $1,000 to $5,000, with an average of $2,275. Fulton County reports the average cost of macadam construction to be 33 cts. per sq. yd. This county also reports the average cost of bituminous macadam to be about $1.25 per sq. yd.

Indiana.—The average cost of gravel roads in the 204 townships reporting is $1,887 per mile. The gravel roads are surfaced to a width of from 9 to 15 ft., with an average of 12 ft. for the counties reporting, and an average depth of material of 9 ins. The average cost of macadam roads for the 158 townships reporting is $2,657 per mile. The macadam roads vary in width from 9 to 16 ft., with an average for the townships reporting of 12 ft., while the average depth of material, unrolled, is 9 ins. The low cost of gravel and macadam roads in Indiana may be attributed to the abundance of material and to the fact that in some of the townships the roads are not carefully constructed. Most of the gravel roads are built by farmers in working out their taxes. In many places the gravel or crushed stone is placed on the road without preparation of foundation and is left for the traffic to consolidate. Moreover, a large number of these roads are so narrow as to be only a single track.

Iowa.—The information received from the various townships in Iowa in regard to the cost of gravel and macadam roads is so meager as to render the data of little value. The split-log drag has been used to a considerable extent in Iowa, and some valuable information was obtained from the various townships in regard to the cost of dragging per mile and per annum. The cost of dragging per mile varies from 25 cts. to 50 cts. The average cost for the 126 townships reporting is 45 cts. per mile for each dragging. The average cost of dragging per mile per annum varies from $2 to $5, while the average for the 195 townships reporting is $3.75. At an average cost of 45 cts. for each dragging, this would indicate that the roads are dragged from seven to eight times each year in the townships where this method is practiced.

Kansas.—Sand-clay roads are being built in Kansas for from $300 to $1,600 per mile, while their average cost in the seven counties reporting is $785 per mile. The average width of the sand-clay surface is 14 ft. and the average depth of the material 10 ins. The cost of macadam roads varies from $2,000 to $7,200 per mile, with an average for the eight counties reporting of $4,070 per mile. The average width of these roads is about 15 ft. and the average depth of material 11 ins., unrolled. Franklin County reports that bituminous-macadam roads, 12 ft. in width, are being built in that county for $6,570 per mile, while Neosho County reports that macadam roads, 15 ft. wide and 16 ins. in depth, are being treated with an oil binder at a total cost of $5,035 per mile.

Kentucky.—Gravel roads in Kentucky cost from $320 to $2,000 per mile, with an average for 20 counties of $1,011 per mile. The average width of gravel roads for the counties reporting is 12 ft. For the 43 counties reporting on the cost of macadam roads, the minimum is $1,200 per mile and the maximum $6,400 per mile, with an average of $2,158 per mile. The average width for the counties reporting is 14 ft. and the average depth of material is 9 ins. unrolled. This is a rather low cost for macadam construction, but many of the roads in Kentucky are built by hand in the same way that stone roads were constructed before steam rollers and stone crushers were invented. In many parts of the state the rock is broken by hand and is often spread on the old roadbed and left for the traffic to consolidate. The first cost of roads of this character is less than if the materials were crushed by machinery and rolled with a heavy roller, but the results are less satisfactory.

Louisiana.—Only 2 parishes in Louisiana furnished information showing the cost of earth roads, and the average was about $100 per mile. Sand-clay roads cost all the way from $75 to $2,000 per mile. The average for the 6 parishes reporting is $654 per mile. The average width of roadway treated with sand-clay surface is 18 ft. The average for the 2 parishes reporting on shell roads is $3,000 per mile, and the average for the 2 parishes reporting on gravel roads is $2,100 per mile. The shell roads are about 20 ft. wide and the gravel 15 ft. wide.

Maine.—The average cost of roads of different types is as follows: Earth, $3,891; gravel, $3,687; macadam, $9,022; and bituminous-macadam, $19,681. This includes the cost of grading, drainage, bridges and culverts, where the bridges do not exceed a span of 20 ft. It also includes the cost of constructing V-drain foundations under most of the roads. The earth roads vary in width from 20 to 25 ft., and are usually surfaced with the best available soil and are practically as good as the gravel roads. The width of the gravel roads is from 21 to 25 ft. from ditch to ditch, with a gravel surface about 15 ft. wide. The gravel is placed 8 ins. thick in the center, and 6 ins. thick at the sides. The macadam roads vary in width from 15 to 21 ft., and the average depth is about 7 ins., varying from 8 ins. in the center to 6 ins. at the sides. For the 21-ft. macadam roads the broken stone is laid to a depth of about 3 ins. only at the sides. The bituminous roads vary in width from 14 to 40 ft., which accounts for the high average cost. Where the roads are built to a width of 40 ft., the work is usually done on village or city streets, in order to connect important trunk line roads. The average depth of the bituminous construction is 7 ins. including 5 ins. of No. 1 stone and 2 ins. of bituminous surface, which is placed according to the mixing method. The cost of bituminous roads per sq. yd. varies from 75 cts. to $1.40, with an average of about $1.02 per sq. yd.

Maryland.—Frederick County reports the cost of earth roads in that county to be about $800 per mile. Caroline and Wicomico Counties report on the cost of sand-clay roads, and the average for the 2 counties is $1,775 per mile for an average width of sand-clay surface of 24 ft. Anne Arundel and Charles Counties report the cost of gravel roads at $1,000 per mile, with an average width of 12 ft. The cost of shell roads is reported from 6 counties, and the minimum is $500, while the maximum is $5,400 per mile, with an average of $2,984 for the counties reporting. The average width of the shell roads is 13 ft. and the average depth is 8 ins. The cost of macadam roads varies from $1,500 to $12,800 per mile. The average for the 14 counties reporting is $8,192. The average width of macadam is 13 ft. and the average depth is 7 ins. Baltimore County reports that macadam roads have been treated with 3 gals. of bituminous material to the square yard at a cost of 75 cts. per sq. yd., and that macadam roads are treated with oil at a cost of about 3½ cts. per sq. yd.

Massachusetts.—The average cost of the 24 sections of plain macadam road was $7,451 per mile, exclusive of bridges. The standard macadam road in Massachusetts is surfaced to a width of 15 ft., and the material is spread and consolidated to a depth of 6 ins. in the center and about 4 ins. at the sides. Most of of the roads upon which the above cost data are based were built according to standard specifications. The average cost of the seven bituminous-macadam roads is $9,714 per mile. These roads are built in practically the same manner as plain macadam roads, with the exception that the surface course is bonded with some bituminous preparation and screenings, instead of screenings alone. The work is usually done by what is known as the penetration method. The crown of the bituminous-macadam roads is only ⅜ in. to the foot, whereas on the plain macadam roads the crown is about ¾ in. to the foot. The average cost of three sand-oil roads is $4,718 per mile. These roads were built for experimental purposes, and consist of a combination of asphaltic oils and sand. The work was done by the penetration and mixing methods, with the object of developing a dustless and durable road for sandy regions, which may be built without using crushed stone or gravel.

Michigan.—The cost data was obtained from the annual report of the Michigan State highway department for 1909, and represents the cost of roads built by the counties and townships under the state reward system, which may be described briefly as follows: On roads 18 ft. in width between ditches and having grades of not over 6 per cent, and which are surfaced to a width of not less than 9 ft., the state pays a reward as follows: Sand-clay or gravel-clay roads, $250 per mile; gravel roads, $500 per mile; stone-base and gravel-surface roads, $750 per mile; gravel or slag base with stone surface, $750 per mile; macadam or bituminous-macadam roads, $1,000 per mile; concrete, with or without brick surface, $1,000 per mile. The depth of materials on the gravel roads must be not less than 8 ins. consolidated, and on the stone roads and the stone-gravel roads not less than 7 ins. consolidated, and they must be built according to specifications of the state highway department and be accepted by that department before the reward is given. The cost of gravel roads built under this system in the various townships varies from $461 to $6,422 per mile, with an average of $1,843 per mile for the 75 sections of road. The cost of the macadam roads varies from $1,421 to $12,128 per mile, with an average cost of $4,346 per mile for 65 sections.

Minnesota.—Only 2 counties in Minnesota reported in regard to the cost of earth roads, with an average cost of $275 per mile. Three counties report on the cost of sand-clay roads, with an average of $766 per mile. The average width of the sand-clay roads is 20 ft. Fourteen counties furnish information in regard to the cost of gravel roads at a minimum cost of $150 and a maximum cost of $1,700 per mile. The average for the counties reporting is $946 per mile, while the average width of the gravel surface is 14 ft. One county, Winona, reports the cost of gravel roads as $0.15 per sq. yd. Eight counties furnish information in regard to the cost and width of macadam roads. The minimum cost is given as $1,700 and the maximum as $6,00 per mile, with an average cost of $3,280. The average width is 12 ft. and the average depth 6 ins. Winona County reports the cost of macadam roads as 65 cts. for country roads and $1.20 per sq. yd. for city streets.

Mississippi.—The cost of earth roads in Mississippi varies from $16 to $275 per mile, with an average for the 5 counties reporting of $97. The minimum cost of gravel roads reported is $650 and the maximum $5,000, with an average of $2,058 per mile for the 6 counties reporting. Only 2 counties furnished information in regard to the cost of macadam roads and the average was $5,135. The average width of the macadam roads is 16 ft.

Missouri.—Only 2 counties report the cost of earth roads, with an average cost of $275 per mile for an average width of 28 ft. Scott County reports the cost of sand-clay roads to be $300 per mile. The minimum cost of gravel roads is $250 per mile and the maximum $3,68, with an average cost of $1,023 for the 22 counties reporting. The average width of gravel surface is 14 ft. The cost of the macadam roads varies from $1,000 to $6,700 per mile, and the average cost for the 21 counties reporting is $3,388. The average width of macadam roads is 14 ft. and the average depth, unrolled, 10 ins. St. Charles County reports the cost of Telford macadam roads as $5,000 per mile. These roads have a width of 16 ft. and a depth of 4 ins. Adair County reports the cost of bituminous construction at $2.10 per sq. yd.

Montana.—Dawson County reports the cost of 20-ft. earth roads as $300 per mile. Beaverhead County reports the cost of earth-road construction to be about 21 cts. per cu. yd. Sand-clay roads in Rosebud County are built to a width of about 18 ft., and their cost is about 23 cts. per cu. yd. Dawson County reports the cost of gravel roads at $800 per mile, and Beaverhead County at 62 cts. and Fergus County at 52 cts. per sq. yd. The average width of these roads is 20 ft.

Nebraska.—Three counties furnished information in regard to the cost of sand-clay roads, which varies from $200 to $1,600 per mile, with an average for the counties reporting of $933 per mile. Nemaha County reports that macadam roads cost about $6,000 per mile, while Douglas County reports the cost of bituminous construction as $8,448 per mile for roadways 12 ft. in width and 7 ins. in thickness.

New Hampshire.—Cheshire Township reports the cost of earth roads as $1,750 per mile, with an average width of 19 ft. Orange Township reports that sand-clay roads are being built at an average cost of about $620 per mile. Gravel roads cost from $500 to $4,500 per mile, with an average for the 43 towns reporting of $2,352 per mile. The average width of gravel surface is 18 ft. and the average depth 9 ins. Seven towns report the cost by the square yard instead of by the mile; the minimum cost given is 20 cts. and the maximum 90 cts., with an average of 60 cts. per sq. yd. Macadam roads cost from $2,000 to $7,700 per mile, and the average for the 31 towns reporting is $5,016 per mile. The average width of the macadam is 16 ft. and the average depth 9 ins. For the 3 towns reporting the cost by the square yard the average is 97 cts.

New Jersey.—The cost data were obtained from the annual report of the state commissioner of public roads for 1909 and represent the cost of various roads built in the state of New Jersey under the directions of the state highway department during the years 1907, 1908 and 1909. The average cost of the gravel roads for the 11 counties reporting is $4,317 per mile. The gravel roads vary in width from 14 to 20 ft., but the majority of them are about 20 ft. in width. The gravel is placed to a depth of from 8 to 9 ins. in the center and from 3 to 4 ins. at the sides. The average cost of macadam roads is $8,746 per mile for the 10 counties reporting. All of these roads are surfaced to a width of 14 ft. and vary in depth from 4 to 8 ins., with an average width of these roads is about 14 ft. and the average depth from 6 to 8 ins. Most of this work was done according to the penetration method.

New York.—The cost data for New York were furnished by the state highway department. The cost of macadam roads per mile varies between wide limits, with an average for the year 1909 of approximately $9,496. The average width of macadam is 14 ft. and the average depth about 5 ins. The cost of macadam roads varies considerably with the different materials used, and is, therefore, presented under the following headlines: "Limestone," "Trap rock," "Field stone," and "Miscellaneous." The average cost of limestone macadam roads for the 29 counties reporting is $9,370 per mile. The average width is 15 ft., and the average depth 5 ins. The average cost of the trap-rock macadam roads is $10,183 per mile for the 27 counties reporting. The average width of these roads is 15 ft., and the average depth 3 ins. of trap-rock surface. The foundation of the trap-rock roads is usually composed of local stone. The average cost per mile of macadam roads built of field stone for the 12 counties reporting is about $8,428. The average width of field-stone macadam roads is 14 ft., and the average depth 5 ins. The average cost per mile of roads shown under the head of "Miscellaneous macadam" is as follows:

Material	Cost per mile	Av. width, ft.	Av. depth of foundation, ins.
Local sandstone	$ 9,003	14	5
Syenite	11,678	15	2
Local bluestone	8,112	14	5
Quartz	7,980	14	5
Granite	8,163	14	4
Local stone	10,346	14	6
Gneiss	9,857	16	4
Local shale	4,795	12	5

It will be noticed that the average depth of the roads surfaced with syenite is 2 ins. Roads built of this material are provided with foundations composed of local stone. The average cost of gravel roads for the 5 counties reporting is $5,950 per mile. Their average width is 17 ft., and their average depth 7 ins.

North Carolina.—Only 1 county reports on the cost of earth roads—Johnson County—where the average cost for this type is $800 per mile. Sand-clay roads vary in cost from $250 to $1,200 per mile, with an average for the 13 counties reporting of $506 per mile. The average width of the sand-clay surface is 24 ft. Eight counties report on the cost of gravel roads, with a minimum cost of $300, a maximum cost of $2,500, and an average of $1,006 per mile. The average width of gravel roads is 20 ft., and the average depth 8 ins. The minimum cost of macadam roads is $3,000, and the maximum $6,000, while the average is $4,020 per mile. The average width of macadam roads is 12 ft., and the average depth 8 ins. Durham County reports that where macadam roads are built by convict labor the cost is $5,000 per mile, but where the work is done by contract the cost is about $6,000.

Ohio.—Gallia County reports that the average cost of earth roads is about $1,600 per mile. Gravel roads cost from $500 to $4,000 per mile, with an average for the 16 counties reporting of $1,909 per mile. The average width of gravel roads is 11 ft. and the average depth 6 ins. The cost of macadam roads varies from $2,000 to $9,000 per mile, with an average for the 53 counties of $4,580 per mile. The average width of the macadam roads is about 12 ft. and the average depth of loose material 10 ins. The cost of bituminous-macadam construction for the 3 counties reporting is from $5,000 to $10,300 per mile, with an average of $7,766. The average width of the bituminous-macadam roads is about 16 ft. and the average depth 9 ins. The minimum cost of brick roads for the 6 counties reporting is $10,786 per mile, while the maximum is $14,500, and the average is $12,381. The width of brick roads varies from 12 to 20 ft.

Oklahoma.—The cost of sand-clay roads varies from $72 to $800 per mile, with an average for the 5 counties reporting of $389 per mile. There are only 2 counties which furnished information in regard to the cost of macadam construction, and the average for those 2 was $3,750 per mile.

Oregon.—Gravel roads vary in cost in Oregon from $600 to $3,500 per mile, with an average for the 6 counties reporting of $1,940 per mile. The average width of gravel surface is from 9 to 10 ft. and the average depth of material from 6 to 8 ins. Macadam roads vary in cost from $2,000 to $5,000 per mile, while the average for the 7 counties reporting is $3,491 per mile. The average width of these roads is 10 ft. and the average depth of the material from 5 to 8 ins. The low cost in some of the counties is due to the abundance of road-building material. Trap rock is within easy hauling distance of the main roads in nearly every county in the state. Benton County reports that bituminous roads are being built at a cost of about $2 per sq. yd.

Pennsylvania.—The cost of gravel roads varies from $400 to $3,000 per mile, and the average for the 8 townships reporting is $1,575 per mile. There are only 3 counties in the state which report the cost of gravel roads. The average width of these roads is 14 ft. and the average depth of material 10 ins. The minimum cost of macadam construction is $1,425 and the maximum $16,042 per mile. The average for the 38 townships reporting is $9,164 per mile. The average cost of macadam roads for the 6 townships in Delaware County which report the cost by the square yard is 78 cts. The average width of the macadam surface is 16 ft. and the average depth of material, unrolled, 10 ins. Nether Providence, in Delaware County, reports that bituminous-macadam roads are being built there at a cost of $10,000 per mile. Allegheny, Venango, and Warren Counties report that brick roads are being built within their limits at an average cost of $16,334 per mile. These roads vary in width from 12 to 20 ft., with an average of about 15 ft.

Rhode Island.—The average cost of macadam roads in Rhode Island is about 80 cts. per sq. yd., and the bituminous-macadam roads cost on an average about $1.25 per sq. yd. The cost is about the same in the 4 counties of the state.

South Carolina.—Sand-clay roads cost from $250 to $1,000 per mile, with an average for the 18 counties reporting of $415 per mile. These roads vary in width from 16 to 30 ft., while the average for the counties from which reports were received is 23 ft. The average cost of sand-clay roads in Richland County is $400 per mile. Only 3 counties furnished information in regard to the cost of gravel roads, and the average was $1,133 per mile. Macadam roads vary in cost in the 5 counties reporting from $1,800 to $7,000 per mile, with an average of $3,252 per mile.

Tennessee.—Sand-clay roads are reported as costing from $400 to $1,500 per mile, with an average for the 3 counties reporting of $1,050 per mile. The average width of sand-clay roads is about 14 ft., and the average depth of material from 6 to 8 ins. Gravel roads are reported as costing from $400 to $5,000 per mile, with an average for the 15 counties reporting of $1,697 per mile. Gravel roads have an average width of 14 ft. and an average depth of material of 7 ins. The cost of macadam roads varies from $700 to $5,100 per mile, and the average for the 22 counties reporting is $2,727 per mile. The average width of macadam surface is 13 ft. and the average depth of material, consolidated, 7 ins. The cost of macadam roads in Sumner and Williamson Counties is reported as $700 and $800, respectively. It is quite evident that roads built at that cost, however, are not high-grade macadam roads, but are probably built by simply crushing the rock, piling it on the old roadbed, and leaving it for the traffic to consolidate.

Texas.—The cost of earth roads varies from $60 to $400 per mile. The average for the 5 counties reporting is $168 per mile. The cost of sand-clay roads varies from a minimum of $60 per mile to a maximum of $2,000 per mile. The average for the 41 counties reporting is $593 per mile. The sand-clay roads are surfaced to a width of about 20 ft., and the sand-clay mixture is placed to a depth of from 8 to 12 ins. The average cost of shell roads for the 3 counties reporting is $3,083 per mile, with an average width of 14 ft. and an average depth of material of 10 ins. The average cost of gravel roads for the 27 counties reporting is $1,708; the maximum cost is given as $4,000 and the minimum as $100. Five counties furnish information in regard to the cost of macadam roads; the minimum cost is reported as $1,000, the maximum $3,500, and the average $2,160 per mile. Macadam roads vary in width from 12 to 18 ft. and in depth from 6 to 8 ins. El Paso County reports that bituminous roads are being built at a cost of about $6,000 per mile.

Utah.—Sand-clay roads are being built at a cost of from $160 to $3,000 per mile, while the average for the 6 counties from which reports were received is $718 per mile. Carbon County reports that sand-clay roads are being built at a cost of 20 cts. per cu. yd., and that their width is from 18 to 40 ft. Gravel roads vary in cost from $500 to $5,000 per mile, with an average for the 4 counties reporting of $2,188 per mile, while the width varies from 15 to 25 ft. Beaver County reports that these roads are costing $0.45 per sq. yd. in that county. Salt Lake and Uinta Counties both report the cost of macadam roads as $5,000 per mile, but no information is given in regard to the width and depth.

Vermont.—The state highway department is authority for the statement that the average cost of gravel roads in Vermont is about $1,600 per mile and of telford gravel, $2,500 per mile. The width of gravel and telford gravel roads is about 12 ft., with shoulders about 4 ft. wide on each side, making a total width from ditch to ditch of 20 ft. The gravel roads are surfaced to a depth of about 8 ins. and the gravel telford to a depth of about 15 ins.

Virginia.—Dickenson County reports that earth roads are costing about $500 per mile, with a width of 12 ft. from ditch to ditch, while Halifax County reports the cost of earth roads to be about $700 per mile for a width of 16 ft. Sand-clay roads vary in cost from $400 to $800 per mile, with an average cost for the 7 counties reporting of $607 per mile. The minimum cost of gravel roads is $800 and the maximum cost $5,000, with an average of $2,200 for the 6 counties reporting. The gravel roads are surfaced to a width of from 12 to 16 ft. Macadam roads vary from $1,750 to $7,000 per mile, and the average for the 27 counties reporting is $4,920 per mile. Macadam roads are surfaced to a width of from 12 to 16 ft. and to a depth of from 6 to 8 ins.

Washington.—The average cost of gravel roads for the 7 counties reporting is $2,600 per mile. The gravel roads vary in width from 9 to 12 ft. and in depth from 3 to 9 ins. Douglas County reports that gravel roads are being built at a cost of 30 cts. per cu. yd., while San Juan County reports the cost to be 30 cts. per sq. yd. The average cost of macadam roads for the 3 counties reporting is $7,600 per mile. All of these roads are surfaced to a width of 16 ft. King County reports that macadam roads are costing about 85 cts. per sq. yd., while Walla Walla County reports the cost to be about $1 per sq. yd.

West Virginia.—The average cost of earth-road building for the 3 counties reporting is $742 per mile. Macadam roads vary in cost from $2,400 to $10,000 per mile. The average for the 11 counties reporting is $5,414 per mile. The average width of macadam roads is 12 ft. McDowell County reports that macadam roads built with paid labor cost about $4,000 per mile, but where they are built with convict labor the cost is about $1,300 per mile. The average cost of brick roads in Ohio and Brooke Counties is $14,500 per mile.

Wisconsin.—The average cost of sand-clay roads for the two sections reported $800 per mile. The cost of gravel roads varies from $250 to $2,100 per mile, with an average for the 14 counties and townships reporting of $1,135 per mile. Macadam roads vary in cost from $2,000 to $5,986 per mile and the average cost for the 14 counties and townships reporting is $2,798 per mile.

Some Cost Data on Gravel Road Construction.

During the firscal year ending June 30, 1911, seven object lesson gravel roads were constructed under the direction of engineers of the U. S. Office of Public Roads. These roads were constructed at Pell City and Three Mile Creek, Ala.; at Fort Collins, Colo.; at Kalamazoo, Mich.; at Starkville, Miss.; at Arlington and at Center, Tex. The following data on the gravel work proper of these roads have been taken from the last annual report of Logan Walter Page, director U. S. Office of Public Roads.

Obtaining Gravel and Hauling.—On the Pell City work chest gravel was used for the surfacing. It was donated in the pit and approximately 830 cu. yds were used. The gravel was excavated from the pit at a cost of 7 cts. per cu. yd., and was hauled to the road at a cost of 11.9 cts. per cu. yd, for an average haul of one-half mile.

The Fort Collins work required 1,000 cu. yds. of gravel. This was shipped by rail 12 miles. It cost 30 cts. per ton to load on the cars. The cost of team hauling from the side track to the road was 33.9 cts. per cu. yd.

In the work at Kalamazoo, Mich., the gravel was obtained from a pit 2½ miles from the road. It cost 1 ct. per cu. yd. to strip the pit, 3.9 cts. per cu. yd. to load the gravel into wagons, and 65.6 cts. per cu. yd. for hauling to the road. A total of 3,959 cu. yds. was used.

The work at Starkville, Miss., required 5,577 cu. yds. of chert gravel. This was delivered on railroad siding and was hauled an average of 3,000 ft. to the road at a cost of 27.3 cts. per cu. yd.

In the work at Arlington, Tex., 1,974 cu. yds. of gravel were used, of which amount 212 cu. yds. went into the concrete. The gravel was delivered on a railroad siding. It cost 27.2 cts. per cu. yd. to unload it from the train, and 43.6 cts. per cu. yd. to haul it to the road.

A total of 398 cu. yds. of gravel was delivered on board railroad cars for the work at Center, Tex. One-half of this was unloaded by shovels over the sides of the cars at a cost of 8 cts. per ton, and the other half was dumped from side dump cars at a cost of 1 ct. per ton. About 198 tons of the gravel were screened by hand through dash screens, yielding 50 per cent of screened material, which cost 25 cts. per ton. Loading this into the wagons cost 3 cts. per ton. The average haul for gravel was 800 ft., and the cost was 17½ cts. per ton.

Spreading and Rolling.—In the Pell City work the gravel was spread loose to a depth of 8 ins. It was dumped on boards, spread by hand in one course and dressed with the grader. The cost of spearding and dressing was 2.3 cts. per cu. yd. No roller was used, but travel compacted the gravel to about 7 ins.

At Fort Collins spreading, sprinkling and rolling the gravel cost 12.5 cts. per cu. yd., the rolling being done with a 10-ton steam roller, for which fuel cost $4.50 per ton.

In the work at Kalamazoo, Mich., the gravel was deposited in two courses—the first course 7½ ins. deep at the center and 4 in. deep at the edges. Was compacted by rolling to 6 ins. and 3 ins. respectively; and the second course 3 ins. deep at the center and 2 ins. deep at the edges, compacted to 2 ins. and 1½ ins. respectively. The cost of spreading the gravel on the road was .9 ct. per cu. yd. and the cost of harrowing were also about .9 ct. per cu. yd. The cost of rolling with a horse roller was .56 ct per cu. yd.

At Starkville, Miss., the gravel was deposited in three courses; each course was rolled with a 10-ton steam roller, and the total finished depth was 7 in. The gravel was spread at a cost of 4.3 cts. per cu. yd, and was sprinkled and rolled at a cost of 9.2 cts per cu. yd.

In the work at Arlington, Tex., the gravel was deposited in three courses, 5 in., 3 in. and 8 in. loose, and was compacted by rolling to 4 in., 2 in. and 6 in., respectively, making a total finished surface of 12 in. The gravel was spread at a cost of 9.7 cts. per cu. yd.; patching, dressing and sprinkling cost 2.3 cts. per cu. yd. The cost of rolling was 12.8 cts. per cu. yd.

At Center, Tex., the gravel was deposited in two courses, the first course of unscreened material was 6 in. thick and was compacted by traffic; 4 in. of screened material averaging 1½ in. to ¼ in. in size were then added and the road given a crown of ¾ in. to the foot. The cost of spreading the gravel by hand was 3.6 cts. per ton. For purpose of comparison some of the above costs have been tabulated in Table I.

TABLE I.—COST PER CU. YD. OF SIX GRAVEL ROADS.

	Pell City, Ala. Cts. per cu. yd.	Fort Collins, Colo. Cts. per cu. yd.	Kalamazoo, Mich. Cts. per cu. yd.	Starkville, Miss. Cts. per cu. yd.	Arlington, Tex. Cts. per cu. yd.	Center, Tex. Cts. per cu. yd.
Digging gravel at pit	7	....	4[5]	.....	.	.
Hauling	11.9	33.9[2]	65.6	27.3	43.6	17½[t]
Spreading	2.3[1]	12.5[3]	.9	4.3	9.7	3.6[t]
Dressing	..	....	.9	....	2.3[8]	. .
Rolling	...	.....	.56	9.2	12.8	....
Labor, 10 hr. day	$1.00	$2.00[4]	$0.40[6]	$1.25[7]	$1.50	$1.50

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[1] Spreading and dressing. [2] Teams owned by town with driver. [3] Spreading, sprinkling and rolling. [4] $4 and $4.50. [5] 1 ct. for stripping and 3.9 cts. for loading. [6] County prisoners. [7] $1 and $1.25, teams $3 and $3.50. [8] Patching, dressing and sprinkling. [t] Per ton.

American Road Builders' Association.—The annual meeting of the American Road Builders' Association was held Feb. 2 at the Hotel Astor, New York City. At this meeting reports of the executive committee, the secretary and the treasurer, were presented. Their reports showed a very healthy and substantial growth during the past year, the membership having increased very materially. Prospects for a much larger increase the present year are exceedingly bright. The election of the officers of the association is by letter ballot. At this meeting the ballots were counted and officers were declared elected as follows: President, Nelson P. Lewis, Chief Engineer Board of Estimate and Apportionment, New York City; First Vice-President, Harold Parker, ex-Chairman Massachusetts State Highway Commission, Worcester, Mass.; second Vice-President, J. D. Meriwether, Territorial Road Engineer, Socorro, N. Mex.; third Vice-President, W. A. McLean, Provincial Engineer of Highways of Ontario, Toronto, Ont., Canada; Secretary, E. L. Powers, editor and publisher *Good Roads*, New York City, N. Y.; Treasurer, W. W. Crosby, Chief Engineer State Roads Commission, Baltimore, Md. Directors for three years: A. W. Dean, Chief Engineer Massachusetts Highway Commission, Boston, Mass.; F. D. Lyon, Deputy Commissioner of Highways, Albany, N. Y.; P. L. Hardison, State Highway Commissioner, Augusta, Me.; S. D. Foster, Chief Engineer Highway Dept., Harrisburg, Pa.; W. J. Roberts, State Hignway Commissioner, Olympia, Wash.; Clifford Richardson, Consulting Engineer, New York City, N. Y.

WATER-WORKS AND SEWERS SECTION

Vater Works Extension in Kansas City, Kansas.—Details of Design.

Immediately after the purchase of the water vorks property of the Metropolitan Water Co., f Kansas City, Kansas, by the city, steps vere taken to extend and improve the plant nd distributing system. In September, 1909, Vynkoop Kiersted, of Kansas City, Mo., and ee Riley, of Kansas City, Kans., were emloyed to design and supervise the construction f the water works improvements. The fol- ow information is abstracted from the reort of the engineers issued in January, 1912:

The improved and extended works embrace new pump house, new boiler house, a reinorced concrete settling basin divided by lonitudinal division walls into three compartments of 1,000,000 gals. each, a settling basin ead house, a second settling basin of about ,000,000 gals., capacity, a filter plant consisting of five mechanical filters, additions to istributing system in the city, and the necesary pipe lines and appurtenances at the supply vorks. The general layout at the Quindaro vorks is shown in Fig. 1. The full line drawings indicate present structures, and the dotted ne drawings show structures that will be eeded in the immediate or remote future. he clear water storage basin is a part of the riginal plant. Proposed settling basins 5, 6, nd 7 are intended to duplicate basins 1, 2 and . Filters 6 to 13 inclusive will duplicate lters 1 to 5 inclusive.

The old filter house contains a Jewell ooden tub filter installation of approximately ,000,000 gals. capacity. These filters are conected with two settling tanks each 50 ft. in iameter and about 25 ft. high. It is proposed o continue the use of the old filters for the resent.

Settling basins, 1, 2, and 3 are essentially oughing basins. In these basins it is expected o relieve Missouri River water of the greater portion of its sediment, treat it thoroughly with a coagulent, and thence pass it into settling basin 4 during those periods of each year when the river is excessively muddy and the capacity of the roughing basin is insufficient properly to prepare the water for the filters. This settling basin 4 is an essential part of the present plan and its early construction is recommended.

The wash-water tank is a part of the new filter plant. The drain well near the washwater tank is intended for use at stages of the Missouri river too high to admit of gravity flow from the new settling basins when emptied for washing. At these periods the washwater discharged from the basins will be received in the drain well, elevated by a motor driven vertical centrifugal pump and discharged into the Missouri River.

PUMPING STATION AND BOILER HOUSE.

The top of the basement walls of the new pump house is 3½ ft. above the high water mark of 1903. The structure is of reinforced concrete, 120 ft. long by 60 ft. wide in the clear with a division wall separating it into an upper and a lower basement. The lower basement is laid off for three river-water pumping engines of a capacity of 15,000,000 to 25,000,000 gals. each per 24 hours, while the upper basement is proportioned for two horizontal, cross-compound, high-pressure pumping engines of a capacity of at least 12,000,000 gals. each per 24 hours.

The floor of the lower basement is 21 ft., and the upper basement 11 ft. below the high water level of 1903. The footing of the floor slab extends 4 ft. beyond the exterior of the basement side walls in order to render the structure secure against the uplift of water when the Missouri river is at maximum flood stage. The entire basement is a monolithic concrete box, substantially waterproof and safe in every particular from invasion of flood waters of the Missouri River.

The 1910 cu. yds. of concrete in this basement is reinforced with 241,760 lbs. of corrugated steel bars. The upper basement is surrounded with sheet steel piling 15 ft. long in order to prevent any danger of undermining the foundations in the event of the breaking of the large high-pressure force main on the east side of the building.

Careful attention was given to the design of the floor slabs to insure the transmission of the pressures resulting from the weight of the engines and their foundations to the side walls of the basement, the entire floor-slab acting as a footing for the engine foundations. Future engine bids may be placed directly on the floor slab of either the lower or upper basement.

Openings 4 ft. in diameter were constructed in both the upper and lower basements to admit suction and discharge lines of size sufficient to accommodate all future engine installations. This was done to avoid future cutting of the reinforced concrete walls which would weaken the structure and impair its efficiency as a waterproof structure. Sectional views of the pumping station basement are shown in Fig. 2.

The boiler house foundation is of concrete with basement ash pits opening into a gallery running lengthwise of the building. The house is 50 ft. wide by 108 ft. long, inside, arranged to accommodate three batteries of boilers aggregating 1,800 to 2,000 H. P. The floors of the boiler room are of reinforced concrete over the gallery and the basement openings between the service boiler installations, otherwise of plain concrete. Fig. 3 shows a cross section through the boiler house. The contract cost of the reinforced concrete basement of the pumping station and the boiler house foundation walls was $31,960. The superstructures of the pump house and boiler house are of fireproof construction. A 20-ton traveling crane is installed in the pump

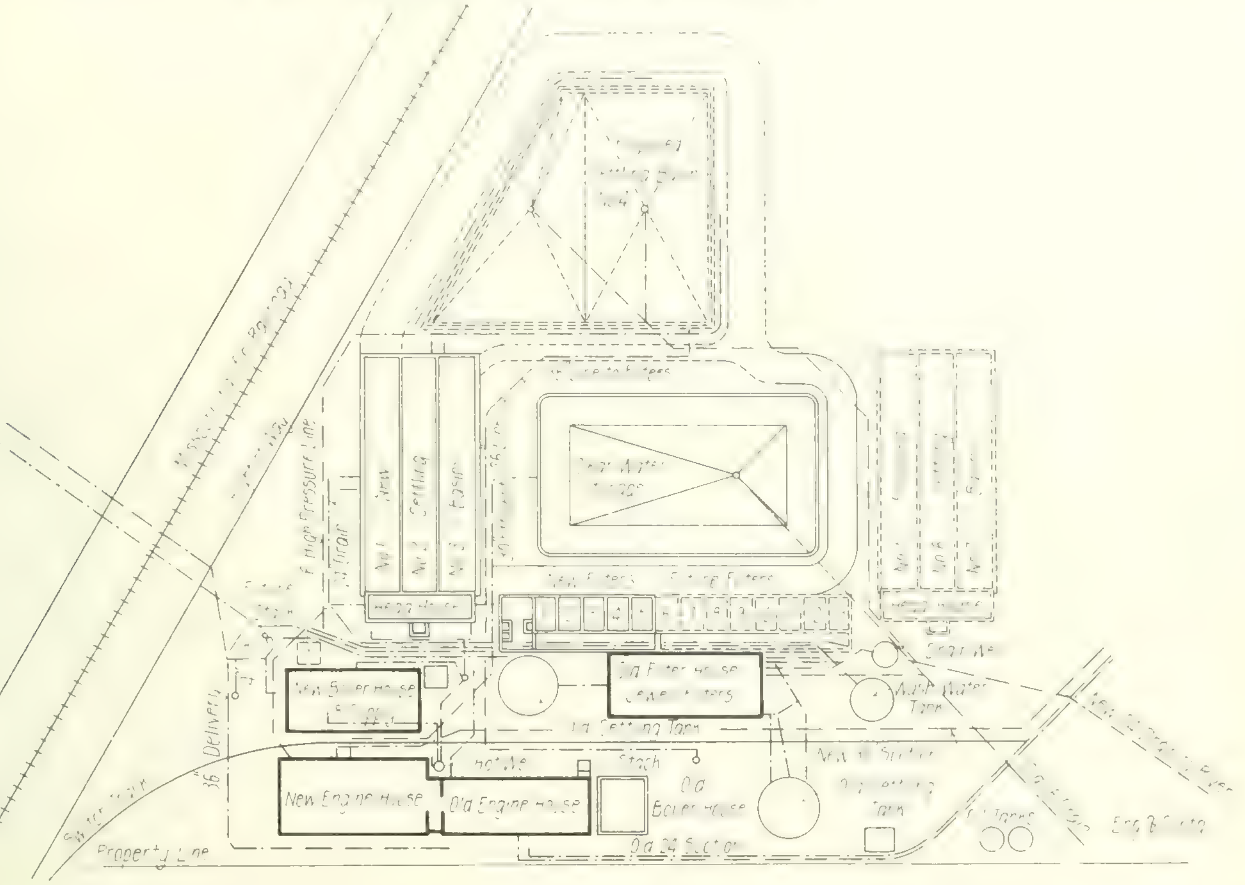


Fig. 1—General Layout of Improved Water Purification Plant at Kansas City, Kansas.

house. The brick superstructures of the pump and boiler houses were erected under one contract at a cost of $48,750.

The new boiler house chimney is a self-supporting steel structure lined with fire brick. The top of the foundation is nearly on a level with the top of the boiler house foundation and about 3½ ft. above high water of the Missouri River. The steel shaft reaches 135 ft. above foundation level. The chimney has a clear circular opening 6 ft. in diameter from top to bottom.

The steel shaft is 7 ft. in diameter at the top, 8 ft. 9 ins. at a level of 105 ft. below the top, from which level it gradually enlarges to a diameter of 15 ft. at the bottom. The bottom 30 ft. is of ⅜ in. steel, the next 30 ft. of 11/32 in. steel and the remaining three sections of 25 ft. each of 5/16 to ¼ in. steel.

The lining of the stack is of Versailes standard fire brick from top to bottom, backed up with the best quality of hard-burned building brick. The foundation is of concrete with a base 20 ft. square and 2½ ft. thick reinforced with steel rods, and a hollow octagonal shaft 8 ft. high, 20 ft. in diameter at the bottom and 18 ft. in diameter at the top. The anchor bolts reach to the center of the foundation footing.

The contract cost of the chimney foundation was $977, and the cost of the chimney was $5,089.

SETTLING BASINS.

The design of the settling basins 1, 2, and 3 embraces four important considerations, namely: Rapid sedimentation through a long, deep, narrow basin; concentration of valves in a head house for the operation of the basins in parallel or in series and the easy separation of any one of the basins from the others for cleaning without interrupting the service; facilities for thorough coagulation of water as it passes through the head house; facilities for rapid washing of any one of the basins with the loss of but little water.

Each basin is 200 ft. long by 30 ft. wide, 25 ft. deep at the middle and 23 ft. deep at the ends, constructed of reinforced concrete. The combined storage capacity of the settling basins is 3,000,000 gals. The estimated operating capacity is 12,000,000 gals. per 24 hours.

These basins were designed as roughing basins in which all of the heavy sediment is deposited and more or less of the fine sediment, and the water thoroughly coagulated before entering basin 4. In basin 4 the water is expected to deposit most of the fine sediment and to become thoroughly prepared for filtration under all conditions of the raw Missouri River water.

The walls of the basin are divided lengthwise into a series of panels 18 ft. long, with a buttress at the extremity of each panel reinforced with steel and acting as a vertical beam, each series of transverse buttresses being securely tied together by heavy transverse reinforced concrete beams at top and bottom. In other words the entire structure is a large concrete box tied together every 18 ft. of its length by heavy steel hoops extending around it, embedded in concrete and acting substantially as the hoops on a barrel. The panels of concrete composing the side walls between buttresses, acting as horizontal beams, transmit the stresses induced by the water or earth pressure into the buttresses, thence into the tie-beams. The bottom of each basin is crowned transversely and sloped longitudinally from either end toward the center, affording both lateral and longitudinal drainage. At the center of each basin is a 24-in. disc valve with an extension stem reaching to a platform on the top of the basin where a valve standard and a bevel gear and crank affords facilities for readily opening the mud valves and draining the basin. A 6-in. rising pipe with 2½-in. hose valves at the top affords facilities for quickly washing the mud from each basin with water taken directly from the pressure main. Sectional views of the settling basin are shown in Fig. 4.

River water is admitted from the pumps into basin 1 through a 30-in. pipe discharging near the west end of the basin. The water returns through the basin to the head house, entering the head house over a weir 20 ft. long. Gates in the head house admit the water from basin 1 to a 36-in. pipe discharging at the west end of basin 2. The water thus discharged returns through basin 2 and enters the head house over a weir and then passing through basin 3 in precisely the same way, discharges over a weir and through gate into a large chamber in the head hous connecting with the filter plant.

As thus described these three basins work i series. The valves and pipes are so arrange however, that basins 1 and 2 may work i parallel, both receiving river water simultaneously at the west end and returning it throug the basins into the head house, then through gate into the east end of basin 3 and discharging the water at the west end of basin through a valve and pipe connecting settlin basin 4, when constructed, with basin 3.

This arrangement admits of the use o basins 1, 2, and 3 only for the preparation o water for the filters whenever the condition of the river water is such as to insure sufficient coagulation and clarification in thes small basins for proper filtration. Howeve at seasons of the year when the capacity c the three small basins is insufficient for th proper preparation of the river water for filtration then basin 4 becomes available for furthe sedimentation.

The 36-in. effluent pipe from basin 4 connects both with the large chamber in the hea house and with the filters directly, to adm of the water returning from basin 4 receivin a little additional coagulation in the hea house when necessary before entering th filters, or to enter the filters directly.

The head house is divided horizontally by reinforced concrete floor. The space belo the floor (except the space taken up by th two downtake shafts affording entrance t basins 2 and 3) has no connection whatev with the settling basin, but is intended f filtered water storage and is connected by 30-in. pipe with the clear-water basins und the filters. The space above this floor is su divided by vertical walls into a series of pas ages which admit of by-passing any bas which is out of service temporarily, and in four coagulant mixing tanks. From these tan the coagulant solution is pumped by centr ugal pumps into a reinforced concrete d tributing tank elevated several feet above flo level. From this distributing tank the coag lant solution flows to a perforated pipe ov each weir discharging the solution in a seri of jets into the water passing over the we into the head house. Provision is made f

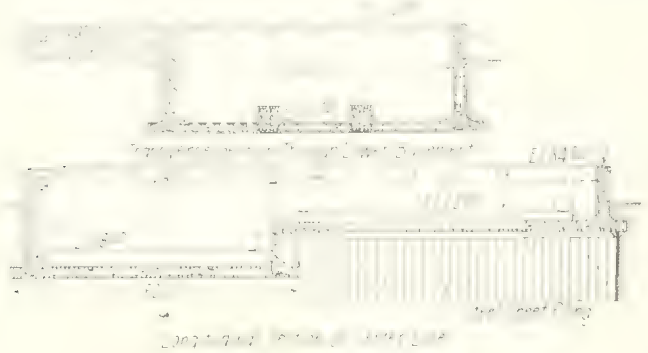


Fig. 2—Sectional Views of Pump House Basement.

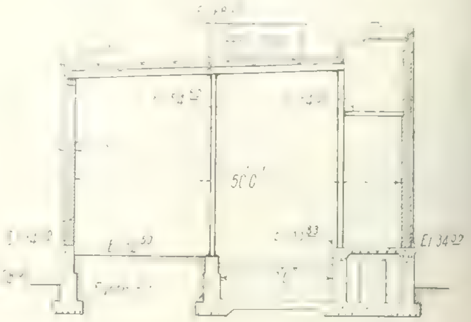


Fig. 3—Sectional View of Boiler House.

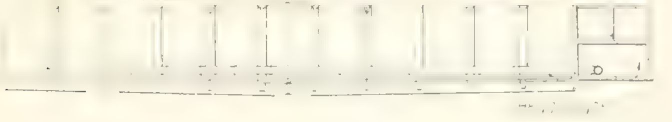


Fig. 4—Transverse and Longitudinal Views of Settling Basin.

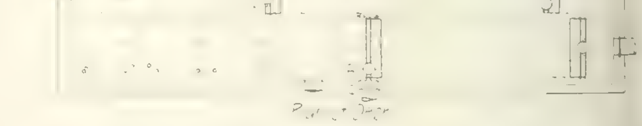


Fig. 5—Section and Plan of Reinforced Concrete Head Hous Showing Valves and Subdivisions.

ree coagulations when necessary, although o coagulations are regarded as generally fficient. The coagulant pipes are of brass, ns. in diameter.

Referring to the section and plan of head use, Fig. 5, valves 3 and 4 control the admis- n of river water into basin 1 and 2 re- ectively. Valves 6 and 7 give admission of ter from basin 1 into 2. Valves 11 and 13 e admission of the water from basin 2 into sin 3. Valve 14 allows the water from sin 3 to pass into a chamber connecting with filters through valve 10. Valve 15 provides the admission into the head house chamber water from settling basin 4. Valves 8 or 5 en opened, admits of by-passing basin 2. lve 9 admits of taking water from basin 2 ectly to the filters. The above description plies to the operation of basins in series. Basins 2 and 3 can be operated in parallel h 1 in series and basins 1 and 2 may be erated in parallel with 3 in series.

Valves 1 and 2 are at the west end of ins 2 and 3 respectively, and are to be used y in connection with the operation of in 4. Valves 16, 17 and 18 are 6-in. valves draining the head house chambers. The y advantage in operating the basins in allel is the decreased loss of head of the ter in circulating through the settling basin, s allowing slightly more filtering head. is increased filtering head may be desirable ing periods of excessive consumption.

The tower at the middle of head house con- is a hydraulic elevator of 2 tons capacity elevating coagulant to the head house floor, ere there is ample room for storage of two three car loads. The concentration of ves and the coagulating apparatus under roof renders the manipulation and oper- on of the basin and the coagulant plant nparatively simple and economical.

Basins 1, 2 and 3 possess a storage capacity about 3,000,000 gals., but an operating acity as roughing basins of about 12,000,000 s. affording 5 to 6 hours' time for the water deposit heavy sediment. The subsidence of fine sediment after coagulation requires litional time and the additional basin No. 4. Settling basins 1, 2 and 3 were built under a tract covering 5,660 cu. yds. of excavation. 0 cu. yds. of concrete, and 625,000 lbs. of el rods, amounting in all to $51,500. The ll pipes and valves were furnished at a t of $10,000. The head house contract was $5,760

COAGULATION.

The coagulating plant is designed for the of sulphate of alumina as a coagulant. e use of the sulphate of alumina requires presence in the treated water of an alkal- base to produce the chemical reaction ich results in the production of hydrate of mina, an insoluble substance which coagu- es fine sediment and accelerates sedimenta- n. The Missouri River water is a hard ter and contains naturally, at all seasons of year, sufficient alkalinity to unite chem- lly with all the sulphate of alumina it is essary to use for coagulation. The design the coagulating works provides for the use of a constant volume of coagulant solution, but of variable strength from day to day to meet the changes of turbidity of the Missouri River water.

In order to follow the changes in the physical characteristics of the river water, daily determinations of the turbidity and alkalinity of the water in the settling basin and the river should be made with suitable apparatus in the room set apart in the filter house as a laboratory. The apparatus for this work is very simple and comparatively inexpensive, but thus far has not been installed. The sediment in the raw river water can generally be determined by comparison or by direct measurement in graduated tubes, but at periods of excessively muddy water the direct method of determination by weighing is the better. In any event the relation between the scale and weight determinations should be approximately established.

No provision whatever is needed for the storage and the use of lime in the settling basin head house for the reason that the use of it in connection with sulphate of alumina is not necessary. Should the city at any future time substitute the spulphate of iron for the sulphate of alumina as a coagulant, then the use of lime would become compulsory because without the lime the sulphate of iron, transformed chemically into a hydrate, is soluble in water containing carbonic acid and in a dissolved condition will be carried into the water supply to collect on the fixtures and furnishings of the toilet room, to clog meters, and to cause more or less annoyance in general in the domestic uses of the water. The usual way to prevent this undesirable condition is to treat the water in advance of the application of an iron coagulant to a dose of hydrated lime to absorb any uncombined carbonic acid.

Aside from the troubles encountered practically in the preparation and application of the hydrate or milk of lime, and the skill required in its application, there is the additional objection that water freed of carbonic acid is unpalatable. Moreover, the labor expense required in the mixing and application of lime and iron is greater than that required in the use of the sulphate of alumina.

The sulphate of alumina leaves the finished Missouri River water perfectly palatable and without a trace of the coagulant solution as introduced originally. Furthermore, the sulphate of alumina does not adhere to the filtering sand to the same extent that sulphate of iron adheres and thereby detracts less from the capacity of the filters. We strongly urge the use of sulphate of alumina as a coagulant and know from past experience that it will prove the best coagulant, the simplest to apply, and the safest from a sanitary standpoint. The high degree of alkalinity in the Missouri River water absolutely prevents any of the undecomposed coagulant entering the city's water supply so long as reasonable attention is given to the handling of the coagulant machinery.

The maximum turbidity for the effluent of basin 3 or 4 must be determined by trial. This maximum turbidity when once determined, will represent the maximum turbidity of the water admitted to the filters, but the turbidity may be as much less as can be conveniently and cheaply obtained in the management of the settling basin. In order to insure an effluent of standard turbidity the settling basins must be kept clean and the amount of coagulant applied in the settling basin must be modified from day to day to meet the changes in the physical condition of the river water and variations in the amount of water consumption. All of this will require close attention and a careful and skillful management of the settling basin, but in no other way can the filters be expected to render a good account of themselves.

MECHANICAL FILTERS.

The filters installed in 1897 consist of ten units of double wooden tub type of a nominal capacity of 500,000 gals. each per 24 hours. In service these filters failed to a greater or less degree when the river water was excessively muddy because of the inadequate settling facilities consisting simply of two tanks each 50 ft. in diameter and about 25 ft. high. In these tanks it was never possible properly to prepare the water for filters and as a result the filters became gorged with mud and completely unable to meet the requirements of the city service in any particular. There is in all probability several years of good service for these filters used in connection with the present and proposed settling basins.

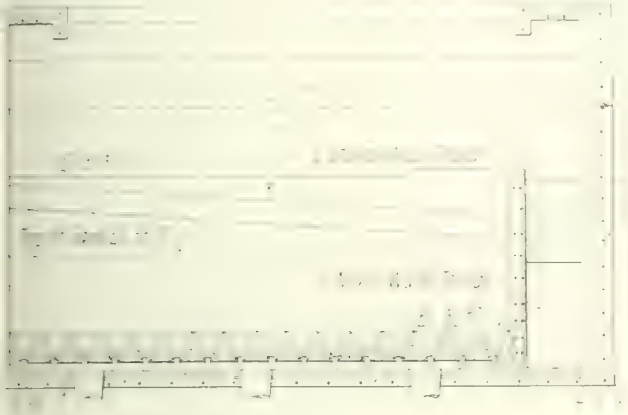


Fig. 6—Typical Transverse Section of Filter.

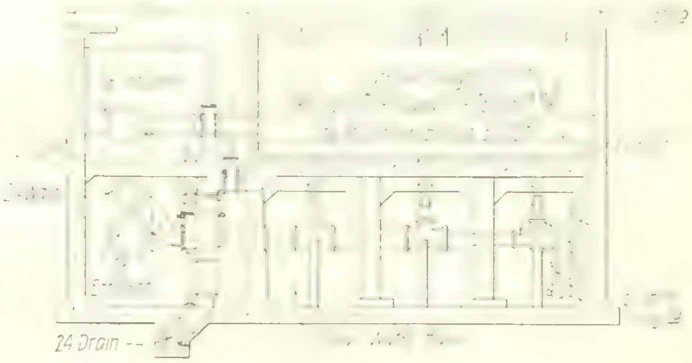


Fig. 7—Typical Longitudinal Section of Filter.

In the new concrete filters connections are provided of such size that additional filters can be added from time to time until the filtering capacity aggregates about 20,000,000 gals. per day. The filters are of reinforced concrete consisting of five tanks 32 ft. long, 12 ft. deep, and 20 ft. 3 ins. wide, out to out measurements, each tank containing a sand area of 480 sq. ft., and possessing a moderate daily filtering capacity of 1,250,000 gals. The capacity of the five filters aggregates 6,225,000 gals. per day, but with water carefully prepared in the settling basin (containing 50 to 60 parts per million of sediment) the combined filtering capacity of these filters should reach 7,000,000 gals. per 24 hours. The Kansas City, Kansas, filters are modeled generally after the Cincinnati, Ohio, plant, except that the filtering units are smaller.

The pipe system connecting the filters is installed in a pipe gallery running north and south between the new filter installation and the old filter installation in such a way as to be accessible to both the new and the old filters. This pipe gallery is 25 ft. deep uncovered and protected by suitable railing.

Immediately under the filters is a clear water basin 13 ft. in depth with a heavily reinforced concrete roof supported upon reinforced concrete columns which in turn are supported upon a thick floor slab extending entirely under the clear water basin and pipe gallery and heavily reinforced with steel rods so as to distribute the pressure uniformly over the ground; the filters and contained water rest directly upon the roof of the clear water basin and the supporting columns and beams.

At the south end of the filters [illegible] forced concrete basement and sub-basement. The sub-basement contains the pipes communicating with the old storage reservoir, with the pumping machinery in the new pumping station, and with the clear water basin under the settling basin head house and various other smaller pipes together with valves and appurtenances necessarily installed therein. A portion of the valves in this sub-basement have extension stems rendering them convenient for manipulation from the basement immediately above.

The upper basement contains an electric motor driven wash water pump for pumping water into the filter wash water tank and a second pump for boosting water from the clear water basin under the filters into the present storage basin, but not necessarily required for constant operation. There is a shaft extending vertically through both basements partially divided by a vertical wall into two compartments. The water is delivered from the filters into one of these compartments, passes over a weir into the other compartment, thence into the clear water basin. By means of this weir the filter effluent passes into the clear water basin at practically a constant level somewhat above the bottom of the filters. A second and similar shaft and division wall connected with the filter influent pipe on one side of the division wall and the drain on the other side, prevents flooding of the building by overflow of filters.

The entire reinforced concrete structure is covered with a brick filter house of simple design containing two apartments, one for use as a laboratory for the superintending chemist and filter attendants, the other for use as a lavatory suitably plumbed and fitted with the necessary conveniences. Typical transverse and longitudinal sections of the mechanical filter are shown in Figs. 6 and 7 respectively.

The bottom of each filter unit is composed of a series of parallel reinforced concrete blocks. At the bottom of the blocks is a series of channels or conduits running lengthwise of the filter for the distribution of water. The concrete channels communicate with three lines of transverse cast-iron conduits, which in turn communicate with nine pipes affording an exit for the filtered water and an inlet for the wash water. The rectangular concrete channels or conduits at the bottom of the filter blocks above described are covered with a perforated semi-circular brass plate held down by brass bolts anchored into the concrete. The "V" shaped openings immediately above the perforated brass plates or strainers are filled with gravel of assorted size up to a level of the top of the concrete strainer blocks. The displacement of this gravel is prevented by a screen of heavy brass wire cloth secured by brass bolts anchored into the strainer blocks and by copper rivets.

About 33 ins. of Kaw River sand is deposited upon the screen. This filter sand was prepared for the filters by passing it through a screen having 8 to 10 meshes to the lineal inch. The undesirable fine particles of sand were removed mechanically from the filter tanks after repeated washings of the sand in place had brought the fine and objectionable particles to the surface and had removed the silt contained in the river sand through the concrete wash water channels in each filter tank and thence into the drain pipe connecting the filter system with the river.

The water as prepared in the settling basin is discharged from a chamber in the settling basin head house through a 36-in. main pipe communicating through 16-in. branch pipes with a series of troughs which serve to distribute the water laterally above the filter sand. The water after slowly percolating through the filter sand and the gravel below the sand passes through the strainers into the small concrete channels communicating through the cast iron transverse conduits and nine outlets with a 16-in. branch effluent pipe connecting in the pipe gallery with a 36-in. effluent main. The effluent main carries the filtered water into the shaft at the south end of the filter house through which it enters the clear water basin immediately under the filters. This clear water basin communicates directly with the suction pipe of the high pressure pumping engines and also with the clear water basin under the settling basin head house.

The sediment removed from the water in the process of filtering downward through the sand is removed by reversing the direction of flow through the filter. In washing, water under pressure is admitted to the filters through the nine pipes entering the bottom of each filter tank, passes upward through the strainers, gravel and sand at a comparatively high velocity and carries the accumulation of mud into the same troughs which in the filtering process admits water from the settling basin but which during the washing process delivers the wash water into the drain pipe system communicating with the river.

The wash water is conveyed from an elevated tank immediately north of the old filter house, holding about 60,000 gals., through a 24-in. pipe and delivered to each filter through a 20-in. branch wash water pipe. This wash water tank is filled with water by an electric motor driven centrifugal pump located in the upper basement or machinery room at the south end of the filter house, or is filled directly from the high pressure main.

The manipulation of the filters is easily accomplished by five valves and as many branch pipes to each filter tank. One of these valves admits settled water into the filter over the filter sand; a second valve is on the branch pipe connecting the system of channels and conduits in the bottom of each filter with the effluent main; a third valve admits water beneath the filters from the wash tank during the process of washing; a fourth valve connects the main trough inside of each filter tank with the main drain pipe leading to the Missouri River, and a fifth valve connects the branch filter effluent pipe with the river drain pipe in order to allow the first water passing through each filter immediately after washing to be wasted.

These five valves, the branch pipe lines in which they are installed and the main effluent and main influent and the wash water and drain pipes are all in the pipe gallery on the east side of the filters. These valves are operated hydraulically from a small operating board over the pipe gallery at each filter, each filter having its own independent operating table. The extension stems on each valve enables the attendant in operating any filter to see the position of each valve. To the extension stem of one of the valves is a clamp and a sort of knuckle joint manipulating a small valve which places the branch effluent pipe of each filter in communication with the atmosphere through the float pipe when the filter is in service, and cuts off this atmospheric communication during the washing process, thus avoiding negative head operation.

On the branch effluent pipe from each filter tank is a Vivian rate controller manufactured by the Norwood Engineering Co. for automatically rating the delivery of water from each of the filters.

Over 30 copies of the filter specifications were sent out asking for bids Sept. 1, 1910, in the list being the large construction companies who were equipped for doing reinforced concrete work and five of the filter construction companies who were equipped for building mechanical filters. Under the specifications calling for bids on the construction of filters, the city agreed to furnish all cast iron pipes, valves, and special castings which entered into the construction of the filter plant.

Three bids were received for furnishing the cast iron water pipe and special castings, four bids for furnishing the necessary valves and but one bid was received for the construction of the filters, the latter bid being $69,000 for a four-filter layout, $81,000 for a five-filter layout, and $93,000 for a six-filter layout. No bids were received for the construction of the filters from any of the mechanical filter companies.

A contract was awarded to the United States Pipe Company for furnishing the pipe and special castings to the Chapman Valve Company for furnishing the filter valves. The single bid for the construction of the filters was rejected and upon the recommendation the engineers the city proceeded to constru the filter plant by force account, employin such men and installing such machinery as w found necessary to carry on the constructio under the direct supervision of the engineer

The work commenced in the fall of 1910, w carried on throughout the winter, and the fi ters were completed in the latter part of Jul 1911. The concrete work was continu throughout the freezing weather, provisio having been made for the heating of all sa and water entering into the manufacture the concrete to an extent which admitted placing concrete in the forms during freezi weather at a temperature of 70 to 80°. T work on which a bid of $81,000 was receiv was completed by day labor under the supe vision of the engineers, W. A. Bott, acting resident engineer, and R. R. Applegate, a pointed by the city as foreman of constru tion, at a cost of $63,592.52, which includes t brick filter house contracted at $5,570. T cost also includes all the material used in t construction of the drain well and the foun tion for the wash water tank, neither of whi items were included in the bid of $81,000.

The cast iron pipe and special castings, co trollers and valves entering into the constru tion of the filter plant cost $15,378.30, the wa water tank $3,400, and the labor expended the construction of foundation for the wa water tank and in the construction of the dr well aggregates $1,706.60. The booster pum installed cost $2,784.25 and the electric wir of the filter house and settling basin he house, together with switch board and pow circuits, cost $3,115. The total cost of complete filters, together with the several traneous but inseparable expenditures of el trical installation and drain well constructi aggregates $87,727.49, which amount wo have been increased to over $105,500 had work been contracted in accordance with received.

GERMICIDE.

As a sanitary safeguard, provision has b made in the filter house for the use of a so tion of hypochlorite of lime.. The hypochlo of lime combines chemically with the carb ates in the natural water producing oxy which is destructive of bacterial life. The c tinuous use of hypochlorite of lime is not c sidered necessary but regarded rather a safeguard when there is occasion for m than ordinary precautions against water- ried disease. Under the ordinary working c ditions of the settling basins, the hypochlo can be applied immediately after the w leaves basin 3 or 4 (when the latter shall been constructed) and before it enters the ters. This will give ample time for the struction of the bacterial life and will in the elimination of any odors or tastes res ing from the use of this germicide.

In the absence of basin 4 and high turbi in basin 3 it may be best to apply the h chlorite solution to the filtered water as water passes over the weir into the clear w basin under the filters rather than into force main delivering water into the distri ing pipes of the city. The amount of h chlorite solution used should not exceed pounds of hypochlorite to each one mi gallons of water.

In order to avoid dependence upon th tendant in the application of the hypochl of lime, a conveniently located orifice should be used which will automatically r late the flow of the solution through it a this way prevent an overdose of the germ so long as the basin pumping engines ar erated at regular speed. In all probabili will be safest to use two orifice boxes, on day use when the rate of pumping is high the other for night use when the rate of p ing is low, and in this way avoid as mu possible hand regulation of the orifice bo an attendant.

On the whole, the use of a germicide sh be undertaken only with the strictest care with the best possible provision for regul the flow of the solution.

Mixing of the hypochlorite of lime sh be done in a well ventilated room where nes can be conducted outside of the building. In all probability the place best adapted this work is in the filter house after having ced a ventilator over the hydrating tank. e hydrated hypo. can then flow into the rage tank in the filter house, diluted with per amount of water, the solution allowed clarify, and then delivered by pump into a tributing tank, thence into the water re- wing treatment.

A Method of Waterproofing Sewers Successfully Employed at South Orange, N. J.

tributed by Bradley C. Cattley, Resident Engineer, with Alexander Potter, Consulting Engineer, New York City.

uring the summer of 1911, the writer was ident engineer in charge of the construc- n of approximately 4.45 miles of lateral vers for the township of South Orange, J. These laterals ranged in size from 8 ins. 12 ins.

he specifications for this work were drawn Alexander Potter, Consulting Engineer, v York City, who acted as supervising ineer of the work. In these specifications . Potter mentioned specifically the use of K. compound as the jointing material. This er unusual clause in a specification of kind needs further explanation.

outh Orange township is one of eleven nicipalities which are using jointly an out- sewer to tide water in New York harbor. st of these municipalities own outright a d proportion of the capacity of the outfall er. South Orange township is one of the nicipalities which recently bought from the ginal members of the joint outlet sewer the it to discharge into the joint trunk sewer a cific number of gallons of sewage daily. the inception of the joint trunk sewer ject South Orange township was the only nicipality embraced within the district cared by this sewer that refused to enter the ject. The capacity that South Orange nship was able to procure by purchase is than half that which was originally set le for them when the project was first un- taken, and which, upon their refusal to er the sewer, was absorbed by the other nicipalities. With half their original al- ed capacity now available, their only means increasing the number of persons that can accommodated within the township is by total elimination of waters of infiltration. use of a jointing material which the pro- tors guarantee will eliminate ground wa- is, therefore, thoroughly warranted, even the expense of this material is slightly ater than that of some other material ch might be offered as a substitute. Mr. ter's idea in calling for a special material to put the contractors on notice in ad- ce as to the cost of the jointing material, so that th [illegible] plying a material which, in his opinion, may have been just as good as the material specified, and upon which he might claim to be able to save money, would not be raised to the possible embarrassment of the work.

Last summer two contracts were let by the township for the construction of lateral sewers; one to James J. Fusco, Newark, N. J., for the construction of 18,568 ft. of 8 in., 10 in. and 12 in. sewers in the Hilton district; the other to Martin & Miller, Garfield, N. J., for the construction of 4,869 ft. of 8 in. and 10 in. sewer in the Pierson and Lackawanna and the Blue Ridge Park tracts. In both of these localities the greater portion of the sewers were laid below the ground water level. Quicksand also was encountered to a very considerable extent. Although labor inexperienced in the use of the G.-K. jointing compound was employed, the men became rapidly proficient in its use and splendid results were obtained.

The custom followed in making the joints was to join two or three lengths of pipe on the bank. The joints on the bank were cast with the pipes in a vertical position without the use of either runner or snake. The G.-K. compound was heated in iron kettles, previous to pouring, to the proper liquid consistency. The compound hardened without shrinkage. The consistency obtained on hardening of the jointing material is such that it permits of considerable flexibility at the joint, and this without detracting from its water tightness. Only one joint in two or three was made in the trench, and then with the use of a runner. No difficulty whatever was experienced in wet trenches, even in those places where the ground-water stood well above the invert of the pipe.

As is customary with other jointing materials, a portion of the socket was filled with a good quality of hempen yarn or jute. The following average amounts of G.-K. compound were used per joint:

Size of pipe. Ins.	Depth of material, ins.	Amount. Lbs. of G.-K.
8	1½	[illegible]
10	1½	[illegible]
12	1½	[illegible]

The theoretical requirements to fill the annular space on the pipe actually used upon the work were 2.25 lbs. on the 8 in., 2:45 on the 10 in. and 3.12 on the 12 in.

These figures are significant because in the pamphlet published by the company which furnishes the material, it is stated that, for a depth of 1½ ins. the 8 in. pipe requires 1.68 lbs., the 10 in., 2.05 lbs. and the 12 in., 2.42 lbs. These amounts may be sufficient for certain makes of pipe with a small socket, but the advantages of a wide socket in sewer pipe laying are so great that wide-socket pipe should be used under all circumstances where water-tightness is to be expected.

The cost of the *material* per joint for the various sizes of pipe at a unit of 6¼ cts. per pound was:

[illegible] Ins.	[illegible] Cts.
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

The cost of the *labor* in making these joints, as near as could be ascertained, was approximately half the cost of the material.

From these figures it will be seen that the cost of laying sewer pipe with this special material is very much greater than the cost of laying pipe with cement joints, but the writer agrees with the statement made many times by Mr. Potter, the supervising engineer, that if the same care is taken in making a cement joint as is required with the G.-K. joint, the difference in cost of the two kinds of joints would not be very great. However, a joint made with G.-K. or any other similar compound has a flexibility which is absent in a properly made cement joint. It is paradoxical that the greater the care taken in making the average cement joint, the greater the liability of rupture of the entire sewer line, unless the foundation upon which the sewer pipe is laid is practically perfect; any uneven settlement due to the weight of the backfilling being likely to cause rupture of the sewer line which will not stop with the pipe that have not sufficient foundation, but is likely to extend for a distance of several hundred feet. The use of a flexible jointing material eliminates, to a very great extent, the danger of breakage of the sewer pipe where unequal settlement takes place.

Tests made for water-tightness on short stretches, both under an internal and an external hydrostatic pressure of 5 ft. showed the sewers to be absolutely water-tight. The ground-water flow over the total completed Hilton section—approximately 3.53 miles of sewers—amounted to 14,100 gals. daily, or approximately 400 gals. per mile per day. This amount is very small, indeed, for a sewerage system, half of which is below the ground water level, and some of which, at the lower end, is subjected to a ground-water head of 3 ft. In the section built by Martin & Miller, the ground-water flow in the finished sewer was measured and the amount of leakage was found not to exceed that in the Hilton section of the system.

It is but fair to state that, while the G.-K. compound was used practically throughout the work, test lengths were made with other flexible mixtures of the same general characteristics as the G.-K., and also with the use of "Pioneer" asphalt. As applied upon the work, the results obtained from the use of these other materials were satisfactory, although it was impossible to determine with the same precision what the actual leakage in these sections was.

STEAM AND ELECTRIC RAILWAY SECTION

st of Concrete Abutments and Pedestals on Track Elevation Work Where Lack of Room Made Construction Difficult.

tributed by Charles G. Huestis, General Manager Essex Construction Co., Buffalo, N. Y.

At the point where the following described rk took place two streets intersect at the ct place crossed by four tracks of the rail- d proposed to be elevated. On one of these eets are two tracks of a very busy street line and team tracks on both streets. account of heavy traffic the railroad com- ny was obliged to use at least two of its cks during construction and at least one of trolley tracks had to be kept in service. m traffic also had to be maintained on at st one side of the street. Overhead along railroad line were twenty or more telegraph and telephone wires and along the streets were electric light wires and trolley wires.

The masonry consisted of a heavy concrete abutment on each side of the street and 23 pedestals in the street. It was impossible to find place in the street for machinery so that all the working room allowed was the space of two tracks and outside the outer track about 20 ft. in width and back as far as required.

The railroad company abandoned two of its tracks, and the stub end on each side of the street was allowed the contractor for construction sidings. A stiff-leg derrick with a 40-ft. boom was set up, with one leg parallel to the face of the abutment and in such a position that the boom would reach pedestals in the center of the street. One track of the street railway company with its trolley wire was taken out of service and by working a low boom the derrick was able to avoid other wires almost entirely. The stiff-leg parallel to the abutment necessarily crossed the siding track but was high enough to allow cars to move under it so that excavated material from the pedestal pits might be loaded by derrick and taken away by the railroad company.

A ½-cu. yd. Smith mixer was set up near the end of the siding and far enough ahead of the derrick to allow the boom to reach the mixer when very high. When the siding was not in use for cars to remove excavated material the cars containing materials for concrete were placed alongside and back of the mixer and derrick. Plank staging was built alongside the cars and to the mixer, so that wheelbarrows might be loaded over the sides of cars and wheeled to the mixer. The excavated material as well as the concrete were handled in 1-cu. yd. dump buckets by the derrick. When several pedestals had been built the excavated material from others was used as backfilling for the ones completed.

The derrick was first erected near the face of the abutment and when the pedestals in the street were completed it was necessary to move the entire rig, derrick and mixer, backward about 40 ft. in order to build the abutment. This was accomplished by drawing the engine on rollers by its own power, and sliding the derrick on plank, still erect, using the engine for power.

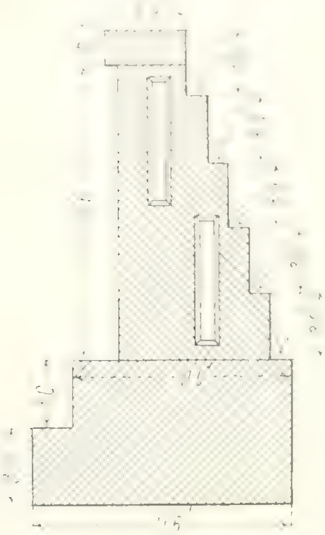


Fig. 1—Section of Concrete Abutment.

the opposite side of the street, two derricks and two mixers being used on the entire work.

Excavation.—The excavation for the abutments was about 16 ft. in depth and for the pedestals from 16 to 22 ft. The material, beside the street paving and sidewalk on top, was about 5 ft. of clay and the remainder gravel, all perfectly dry. Excavation, as covered by the contract, was measured only to the foundation lines of the concrete footings though as a matter of fact much more was necessarily excavated in deep pits. The entire payroll for excavating, sheathing and bracing, backfilling to original ground or loading on cars was the sum of $2,292.58 for 2,832 cu. yds., engineer's measurement. (This gives a unit cost of slightly over 80 cts. per cubic yard. —Editors.)

Concrete.—The concrete materials were crushed stone and gravel taken from cars direct as described above. Water was piped to the mixers from a nearby hydrant, and cement was carried from box cars back of gravel and stone cars. The cost of unloading materials as described and wheeling them to the mixer, together with mixing and placing them and the finishing of the face after the forms were removed, was as follows for a total of 1,598 cu. yds.:

46½ hrs. foreman at 40 cts	$ 18.60
20 hrs. foreman at 37 cts.	7.40
52 hrs. foreman at 38½ cts	20.02
138 hrs. foreman at 32½ cts..	44.85
144 hrs. hoist runner at 30 cts	43.20
[illegible] hrs. carpenter at 27½ cts	[illegible]
54½ hrs. straw boss at 25 cts.	13.63
2,186½ hrs. labor at 20 cts.......	437.30
781 hrs. labor at 17½ cts......	136.67
51 hrs. labor at 15 cts..	7.65
Total	[illegible]

(This total gives a cost per cubic yard of concrete of 45.7 cts., say 46 cts.—Editors.)

Forms.—The concrete forms were extremely easy to build and set. There were no sloping wings and nothing but straight work except that one end of each abutment was turned at an angle of about 30°. The other ends of the abutments were left for future extension. There were three expansion joints in one abutment and two in the other, where a full stop in each case was made and key ways put in for bonding. It took 30,500 ft. B. M. of lumber to form the neat work of abutments and the formed part of pedestals, if all had been formed at once. Two-inch yellow pine boards were used and 4x6-in. yellow pine for uprights. The total payroll for building forms, [illegible]ing with paraffine oil, [illegible] cleaning lumber was as follows:

23½ hrs. foreman at 40 cts.	$ [illegible]
[illegible] hrs. foreman at 38½ cts.	[illegible]
[illegible] hrs. foreman at 37 cts.	[illegible]
18 hrs. foreman at 32½ cts.	5.85
56 hrs. hoist engineer at 30 cts.	16.80
451½ hrs. carpenters at 27½ cts.	124.16
479½ hrs. carpenters at 25 cts.	119.88
69½ hrs. carpenters at 22½ cts.	15.63
463½ hrs. labor at 20 cts.	[illegible]
25½ hrs. labor at 17½ cts.	4.46
4 hrs. labor at 17½ cts.	[illegible]
Total	[illegible]

(On a basis of 1,598 cu. yds. of concrete the cost of forms per cubic yard was 25.9 cts. or say 26 cts. As a matter of fact not all of the concrete work required built forming, so that this unit cost is indicative only.—Editors.)

Rigging.—The total payroll for setting up and taking down, together with moving each plant once as described above, also the building and moving of stagings alongside of cars, for two derricks and two mixers, was as follow:

40 hrs. foreman at 38½ cts.	[illegible]
31 hrs. foreman at 40 cts.	12.40
119 hrs. rigger at 32½ cts.	38.68
57 hrs. hoist engineer at 30 cts.	17.10
45½ hrs. carpenter at 27½ cts.	[illegible]
157½ hrs. carpenter at 25 cts.	39.38
41 hrs. carpenter at 22½ cts.	9.23
3 hrs. carpenter at 23 cts.	.69
479½ hrs. labor at 20 cts.	95.90
149½ hrs. labor at 17½ cts.	26.16
30½ hrs. labor at 15 cts.	4.57
Total	[illegible]

The payroll for setting up one derrick only, unloading and setting one mixer, together with building platform and stagings once only, was as follows:

8 hrs. foreman at 40 cts.	$ 3.20
10 hrs. foreman at 38½ cts.	3.85
30 hrs. rigger at 32½ cts.	9.75
20 hrs. hoist engineer at 30 cts.	6.00
100 hrs. carpenter at 25 cts.	25.00
3 hrs. carpenter at 23 cts.	.69
30 hrs. carpenter at 22½ cts.	6.75
29 hrs. labor at 20 cts.	5.80
35 hrs. labor at 17½ cts.	6.12
Total	$67.16

The other items of payroll not mentioned in the above were as follows:

Building and repairing tool house	$ 28.71
Loading and unloading tools and lumber..	133.87
Night watch, Sunday watch and other general expense	158.97
Repairs to machinery	12.66
Total	$334.21

Total payroll for the work, $4,043.36.

The ledger accounts for this work show other expenses as follows:

Premium on bond	$ 20.00
Liability insurance	98.72
General and sundry expenses	[illegible]
Office and timekeeper	275.00
Materials for repairs	11.29
Small tools	34.49
Lumber for foundations	274.04
Form lumber	267.70
Wire and nails for forms	40.20
Paraffine oil for forms	3.70
Oil, waste, etc.	37.70
47.04 tons of coal	141.13
Water, lump sum	75.00
Paid railroad company for unloading cars of excavated material	76.80
Total ledger accounts	$1,404.42

The coal consumption amounted to about ⅓ ton per day per boiler. Only 20 h.p. upright boilers were used.

Figures 1 and 2 show the character of the masonry. In constructing the abutment 2x2-in. molding was used to bevel top and bottom edges of the coping and to mark expansion joints. There were eleven square pedestals of the dimensions shown; ten pedestals 18 ins. less in height and 9x8 ft. on the bottom, and two pedestals irregular in shape on account of being set close to the sidewalk. These were five courses in height.

Prices Employed in the Physical Valuation of the New York, New Haven & Hartford R. R.

In the valuation of the physical property of the New York, New Haven & Hartford R. R., under the direction of George F. Swain, M. Am. Soc. C. E., the unit prices adopted were based upon the average ruling prices for the [illegible] during the last few and upon prices actually paid by the ra company. From the report on the val we have taken the following prices ad

Grading:	
Clearing, per acre	$
Grubbing, per acre	
Earth excavation, per cu. yd	0.32
Solid rock excavation, per cu. yd	
Solid rock excavation, per cu. yd	1.15
Loose rock excavation, per cu. yd	
[illegible] excavation	0.32
1st class retaining wall, per cu. yd	5.00
2nd class retaining wall, per cu. yd	
3rd class retaining wall, per cu. yd	
Sodding, per sq. yd	
Riprap, per cu. yd	
Piling, per lin. ft	
Timber, per M. ft. B. M	
Tunnels:	
Excavation, per cu. yd	$
2nd class masonry, per cu. yd	
Brick lining, per cu. yd	
Bridges, Trestles and Culverts:	
1st class deck girders, per ton	$ 70.00
2nd class deck girders, per ton	
1st class through girders, per ton	
2nd class through girders, per ton	
1st class trussed bridges, per ton	
Draw and lift bridges, per ton	
Counterweight bridges, per ton	
Viaducts, per ton	
Howe truss bridges, per lin. ft	
Timber trestles, per lin. ft	
Solid floor, per lin. ft	
Stringers, per M. ft. B. M	
I-beam stringers, per ton	
1st class masonry, per cu. yd	
2nd class masonry, per cu. yd	
3rd class masonry, per cu. yd	
Riprap, per cu. yd	
Paving, per sq. yd	
Wet excavation, per cu. yd	
Dry excavation, per cu. yd	
Timber, per M. ft. B. M	
Piling, per lin. ft	
Bolts, per lb	
Cast iron pipe culvert to 24 ins., per lin. ft	
Cast iron pipe culvert over 24 ins., per lin. ft.	
Sewer pipe culvert to 24 ins., per lin. ft	
Sewer pipe culvert over 24 ins., per lin ft.	
Ties:	
Main track, per tie	$ 0.
Sidings, per tie	0
Switches, per M. ft. B. M	
Bridge floor, per lin. ft	
Rails:	
Main track, 100-lb. per mile	$4
Main track, 79-80-lb. per mile	
Main track, 74-78-lb. per mile	3
Main track, 66-72-lb. per mile	
Main track, 50-65-lb. per mile	
Siding, over 75-lb. per mile	
Siding, 65-75-lb. per mile	
Siding, 50-65-lb. per mile	2
Frogs and Switches:	
100-lb. rail turnouts	$
79-80-lb. rail turnouts	96.
74-78-lb. rail turnouts	
66-72-lb. rail turnouts	
56-65-lb. rail turnouts	
100-lb. rail derails	
66-80-lb. rail derails	
50-65-lb. rail derails	
100-lb. rail slip	
74-80-lb. rail slip	
50-72-lb. rail slip	
Track Fastenings, etc.:	

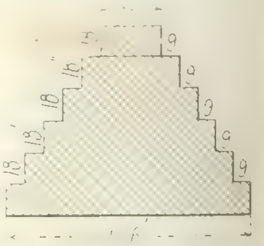


Fig. 2—Section of Concrete Pedest

[illegible]-lb. rail per mile (main track)	$
[illegible]-lb. rail per mile (main track)	
66-72-lb. rail per mile (main track)	
50-65-lb. rail per mile (main track)	
75-lb. rail per mile (sidings)	
[illegible]-lb. rail per mile (sidings)	
[illegible]-lb. rail per mile (sidings)	
Ballast:	
Stone, per mile	$
Gravel, per mile.	
Other ballast, per mile	
Track Laying and Surfacing:	
Main line, per mile	
Sidings, per mile..	
Fencing:	
Wire, per mile	
Tight board, per mile	
Open, per mile	
[illegible], per mile	
Crossings and Signs:	
Cattle guards, per pair	$

Timber, piling, excavation, etc., as previous given.

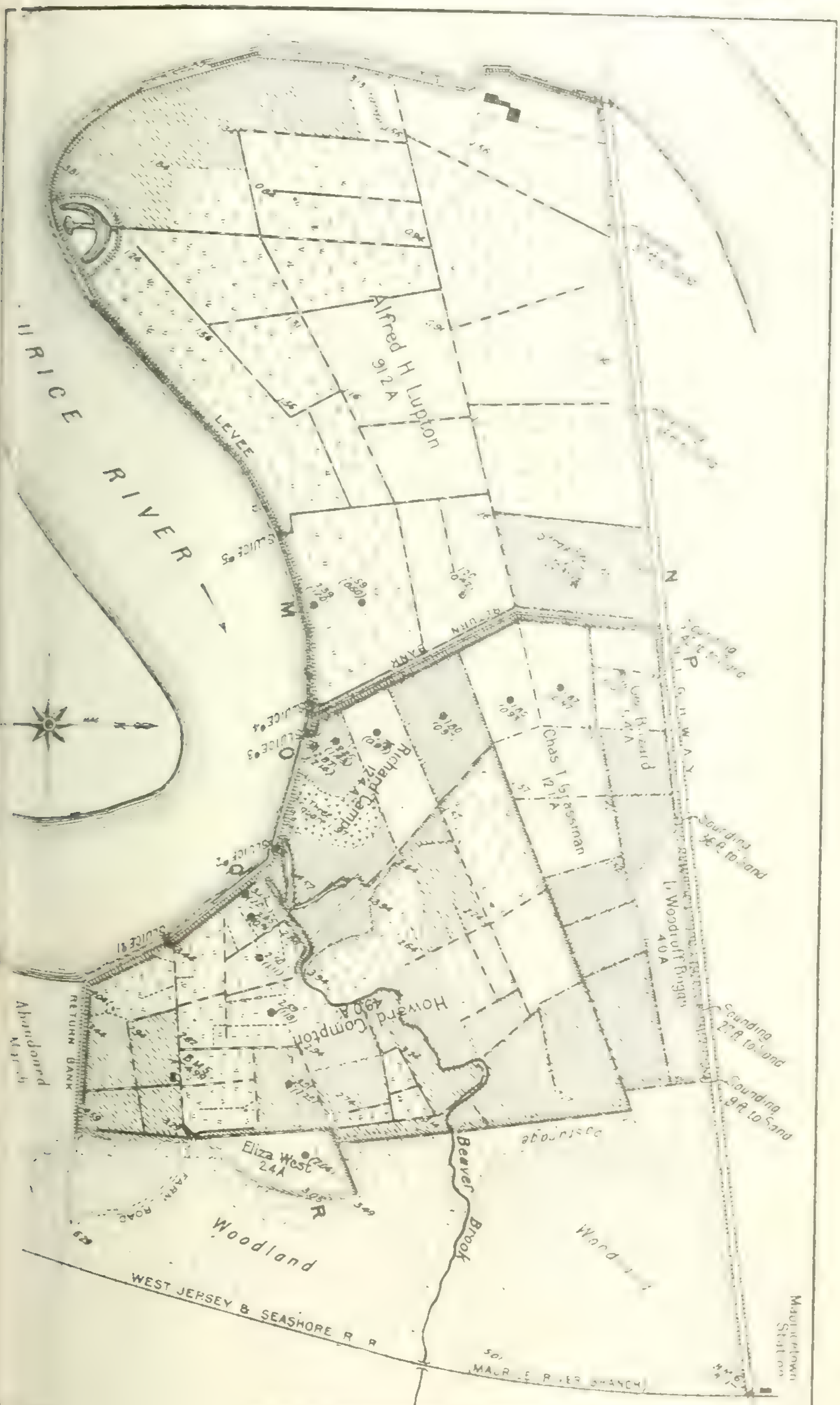
DRAINAGE AND IRRIGATION SECTION

Some Examples of Tidal Marsh Land Reclamation; Structures and Cost.*

IV.

[illegible]

Tidal marsh land reclamation presents certain advantages particularly its own. These [illegible]



—Map of Tidal Marsh Reclamation, Near Dorchester, Cumberland County, New Jersey.

[illegible] exemption from prolonged drought [illegible] proximity to populous communities, and the hygienic improvement, which [illegible]

[illegible] neers. These works are not presented as ideal [illegible] are open to severe criticism, but as studies, the [illegible]

[illegible]

This project has a total drainage area of 2,150 acres with a frontage on the Maurice River of 1.2 miles. Of this area only about 176.5 acres have been ditched and actually reclaimed for farming purposes, the remainder having been left in woodland. The following account relates to the 176.5 acres that have been actually reclaimed. Figure 1 is a map [illegible] levees, etc. The land is divided according to ownership into seven parcels the elevations of which above datum (mean low water) are as follows:

[illegible]

As is usual in tidal marshes, the elevation just back of the levee is higher and gradually drops, proceeding inshore, to the lowest level and from this rises again to the highest level. The mean range of tide is 5.62 ft., with extreme high water probably about 2 ft. higher.

Levees.—The location of the levees is shown by the map. The shore levee is built close to the water and along a greater portion of its water side it is protected against wave action. Fig. 2 is a section of levee protected by two rows of piles between which brush is packed. This protection is generally approved; it is easy to repair and being yielding it resists wave action well. Another type of protection is shown in two forms by Figs. 3 and 4. Sticks of cordwood are piled as shown to form a protective belt. When the brush and cordwood protection has been used there has been very little damage to the levees, but levees protected by plank and pile bulkheads as shown by Fig. 5 have quite commonly washed as indicated. The top elevation of the levee ranges from 8½ to 9¾ ft., and is well above overflow by any tide likely to occur.

Sluices.—The general construction of the sluices is indicated by Figs. 2 to 5 and Table I shows their dimensions and the drainage area tributary to each. In all of these sluices the gates are hinged by means of chains. The construction is as follows: The gates are of single unmatched planking. The hinges are ½ in. chains attached by staples to gate and sluice box. A point to be noted is the arrangement of the chains to play over a timber. These chain hinges are claimed to give a wide opening along the upper edge of the gate when the sluice is operating and to reduce the chances of obstruction. Records were taken of the operation of three of the sluices and the results are given in Table I. The large ratio of leakage to discharge is to be noted.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Hrs.	min.	Cu. ft.		Cu. ft.	Pct
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2........	3	32	74,048	.39	33,580	45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Ditches.—Interior drainage is effected by about 2,423 rods of open ditches, varying in width from 2 to 24 ft. and in depth from 1 ft. to 3.5 ft. On the Compton land the ditches are generally of trapezoidal cross section; the sides are neatly trimmed, and the bottoms and sides are free from obstructing vegetable growths. The main ditch leading to sluice 1, which takes the drainage from some 47 acres of land on the south side of Beaver Brook, is 19 ft. wide at the top, 10 ft. at the bottom, and about 3.5 ft. deep. The bottom is little above the floor of the sluice and would probably average about 0.75 of a foot below datum. The lateral ditches divided the lands into irregular quadrilaterals, averaging about 1⅓ acres each. These ditches average about 5 ft. wide, and their bottoms are from 0.5 ft. below datum in the ditches near the river to 1.2 ft. above mean low water in the ditch next the woodland. There are about 2,000 lin. ft. of underdrains of wooden construction. Beaver Brook, draining 2,014 acres, flows by winding course that between slightly raised banks through the land of Compton and Camp and is discharged by sluice 2 into the river. From the railroad to the river this brook averages about 18 ft. wide and 4 ft. deep at the center. The bed is rough and unclean and from 1 to 3 ft. above the floor of sluice 2. The brook water at the sluice is ordinarily lowered about 2.85 ft. during the period of sluice action. At the railroad culvert, half a mile away, the fall is usually not more than 1 in.

North of Beaver Brook the Compton land is somewhat lower and the ditches are shallower and subdivide the lands into lots of about 2 acres each. The drainage from this land is received into Beaver Brook through a small sluice 12x14 ins., situated about 300 ft. northeasterly from sluice 2.

The ditches on the Camp, Grassman, Blisard and Boggs land are in poor condition. Not only are they badly choked with wild oats and other grasses, but are much too shallow to properly drain the land. Their bottoms would probably average at least 1 ft. above the floor of sluice 3, to which they drain. Their average width is about 4 ft.

The main ditch on the westerly side of Camp's land is about 6 ft. in width and 2 ft. in depth; its storage capacity in the vicinity of the sluice is entirely inadequate, and two artificial barriers greatly diminish its usefulness even as a conducting channel.

The lateral ditches subdivided the Camp lands into three fields of about 4 acres each, Grassman's land into six fields of about 2 acres each, and Blisard's into four fields of about 1⅓ acres each. Bogg's area of 4 acres is undivided.

The Lupton farm is the lowest of the entire tract. It is a self-contained area of about 91 acres, free from all upland drainage and subdivided by ditches into fields, averaging about 5 acres in area each.

The main ditch leading to sluice 5 is from 11 to 24 ft. in width and from 2 to 3 ft. in depth; its bottom is from 1 to 1.5 ft. below datum. In general the bottoms of all the ditches on this farm are from 0.5 ft. to 1 ft. below mean low water and are free from vegetable growths and serious obstructions. The laterals average 8 ft. in width. The ditch water seldom rises more than 5 to 6 ins. above mean low water, though sluices 4 and 5 play but for short periods and very frequently not at all. The difference in elevation of the water in the various ditches is shown by Table II.

The areas of the different marshes, length and storage capacity (between M. L. W. and elevation of lowest part of tract being considered) of ditches, and ratio of superficial area of ditches to marsh, are noted in Table V.

TABLE II.—ORDINARY [illegible] DITCH WATER AT OPENING AND CLOSING OF SLUICES, AND ENTIRE FALL.

No. of sluice.	Owner of land.	Ordinary elevation ditch water When gates open. Feet.	Ordinary elevation ditch water When gates close. Foot.	Fall. Feet.
[illegible]	Compton	[illegible]	[illegible]	[illegible]
[illegible]	Camp	[illegible]	[illegible]	[illegible]
[illegible]	Camp	[illegible]	[illegible]	[illegible]
[illegible]	Lupton	[illegible]	[illegible]	[illegible]

Rainfall and Ground Water.—Seventeen test pits for purposes of observation on the ground water were dug [illegible] shown on the plan Fig. 1. Four were in a north and south line (M-N) near the eastern side of the Lupton farm. Seven were in a nearly parallel line (O-P) on Camp, Grassman, and Blisard lands; and six were southerly of Beaver Brook on lands of Compton and Mrs. West (Q-R). The positions of the ground water on Nov. 8 and 25 are shown in Table III.

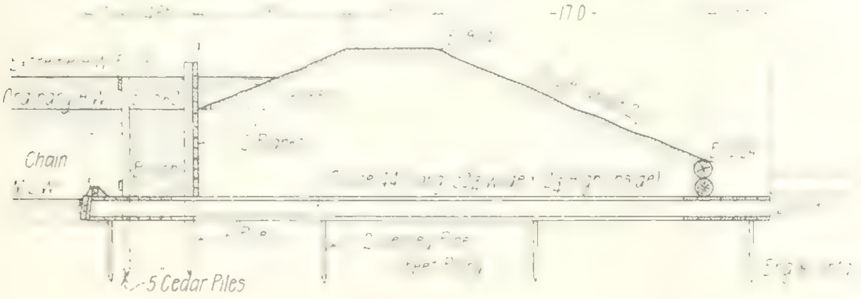


Fig. 2—Section of Levee Having Brush Protection.

TABLE III.—POSITIONS OF GROUND WATER ON NOVEMBER 8 AND 25, THE LOWEST AND HIGHEST OBSERVED.

Profile.	Date. 1909.	Ground Water Approximate elevation (feet above M. L. W.) Feet.	Ground Water Approximate distance below surface of ground Inches.
M-N	Nov. 8	0.12	17
O-P	Nov. 8	.68	13
Q-R	Nov. 8	.82	[illegible]
M-N	Nov. 25	[illegible]	[illegible]
O-P	Nov. 25	1.75	0
Q-R	Nov. 25	[illegible]	[illegible]

The distance from the surface of the marsh to the ground water, taking the average of all gaging made at the several test pits, was as follows:

	Feet.
Upon land of Compton	1.39
Upon land of West	1.22
Upon land of Lupton	1.14
Upon land of Grassman	.88
Upon land of Camp	.82
Upon land of Blisard	.75

From that which has preceded, it is clear:

(1) That the deeper, cleaner character and greater proportional storage capacity of the ditches on Compton's marsh, notwithstanding their interception of considerable ground water near the southeasterly corner of the tract, made possible, at the end of one and one-third months during which about 1.5 ins. of rain fell, an average depth of soil above the water table of 22½ ins.

(2) That the deeper, cleaner character of the ditches on Lupton's marsh, notwithstanding the low elevation of the land and comparatively small storage capacity of the ditches themselves, made possible an average depth of soil above the water table of 17 ins.

(3) That the shallow, choked ditches the marsh of Camp, Grassman, and Blis notwithstanding fair elevation of the tr and slight drainage from the uplands, c not make possible a greater average depth soil above the water table than 13 ins.

The marsh of Mr. Boggs is unimproved the water stood practically at the surface the ground at all times. The single test near the center of Mrs. West's lot showed ground water with very slight variations elevation 1.95. Just east of this test pit the edge of the woods the water table little from 5 ins. below the surface of ground.

It is obvious that a run of low tides duces a corresponding lowering of the w table and that a series of high tides, by creasing the leakage and seepage, produc corresponding rise. In passing from the mer conditions of the tide to the latter, interior ground water very frequently found to be rising near the levee while falling in the remote parts.

At test pits considerably removed from ditches it was found that a rise or fall of ground water might follow the tides w produced the movement by from one to th days. Under the influence of a low run tides and favorable weather the ground w may fall from 1 to 3 inches per day adja to the levee, ¼ to 1 inch near the center of marsh, and from 0 to 1 inch at the more mote parts.

It is very probable from the studies m that in the long run the water table is close to a mean between the surface of ditch water at the opening and at the clo of a sluice.

Cost.—The cost of effecting this reclama is given below in some detail, so that cost of the different classes of work can compared.

Embankment	
River embankment, 6,250 lin. ft., at $0.80	$[illegible]
Return bank (Compton's), 565 lin. ft., at $0.50	[illegible]
Return bank (Lupton's), 1,450 lin. ft., at $0.25	[illegible]
Total	$[illegible]
Shore protection:	
Brush, 2,100 lin. ft., at $0.[illegible]	$[illegible]
Cordwood, 1,300 lin. ft., at $0.90	1,10[illegible]
Plank, 850 lin. ft., at $0.40	30[illegible]
Total	$[illegible]
Ditches, 2,423 lin. rods, at $0.60 per rod	$1,4[illegible]
Sluices:	
No. 1 (actual cost)	$[illegible]
No. 2	1[illegible]
No. 3	[illegible]
No. 4	[illegible]
No. [illegible]	1[illegible]
	$[illegible]
Underdrains, 2,500 lin. ft., at $0.05	$10[illegible]
Contingencies, 5 per cent	44[illegible]
Total	$10,35[illegible]

From this total the cost of reclaiming 7 acres of land was $59 per acre.

Assessments for Benefits From Drainage Systems, for Agricultural an Sanitary Purposes.

Contributed by S. T. Morse of The M Water Engineering Co. of Carlinville, Ill.

Many systems and theories have been, time to time, advanced endeavoring to ou a method of reaching an equitable apportionment of the cost of construction, among several tracts of a drainage district. Alo these possess merit but most of them fa furnish a rule satisfactory in all cases e

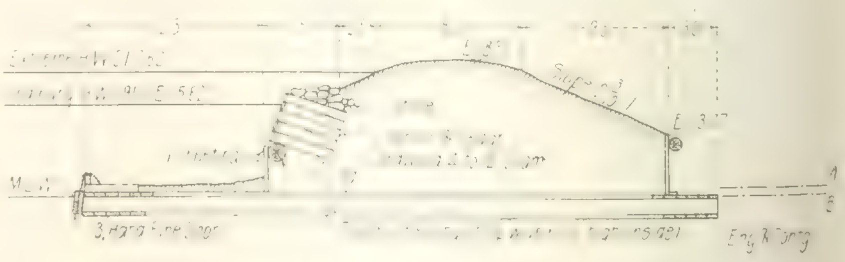


Fig. 3—Section of Levee with Cordwood Protection.

E IV SIZE, LENGTH, GRADE AND TRIB[illegible]
DORCHESTER, N. J.

Sluice.	Clear opening. Sq. ft.	Length. Feet.	Crown. Foot.	Feet	[illegible] Feet	Tributary Acres
	2.57	[illegible]	—0.03	—1.05		46.8
	8.33	[illegible]	.53			
	2.61	32.6	.36			
	4.29	[illegible]	.05		[illegible]	91.2
	5.56	46.2	— .17	1.86		

[illegible] the system [illegible]
presenting the met[illegible]
d that it is almost wholly a matter of
nt. or dependent upon the intelligence
oper training of the commissioners.
[illegible] must be admitted that judgment [illegible]

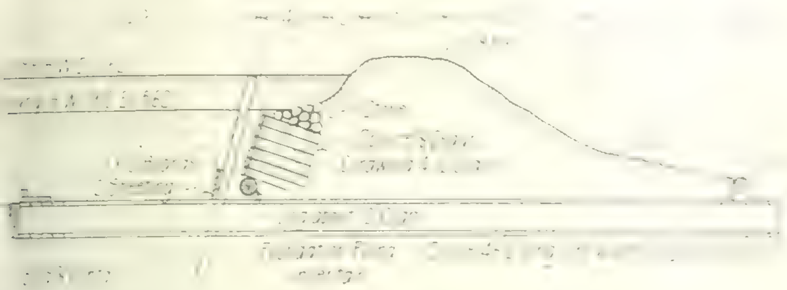


Fig. 4—Section of Levee with Cordwood Protection and Pile Fender.

s mental computation to a large de-
ll not be much in error provided all
; which bear upon the case can proper-
resented to the mind; it is believed
h all the necessary facts which affect
ness of the tracts, known and pre-
n the books and maps of the en-
he is in a position to make combina-
ıd computations which will arrive at a
r measure of the apportionment than
ded untrained judgment of any com-
r. and which will be much more dif-
assail in any court. The formulas
re presented have been so complicated
mpractical and to lead to confusion.
ıccessfully employed a system must be
nd easily used, which is of more im-
than extreme accuracy in cases of
cost distribution, where in any case
ill always exist in the minds of some
e justice done, and where conditions
g the field work and the many factors
the benefits of different tracts unite
ıt best, results which are approximate-
ather than exact.

thstanding these difficulties, the en-
ould be in a position to give a more
ssification than the average commis-
who usually lack many qualifications
vork. They seldom have much previous
ge of drainage work, and have no
f knowing all the facts as to the
height of tracts or the capacity of
sent and future drainage outlets, and
her pertinent factors, except as they
in part by the engineer, and they
ıre usually owners interested in their
l and that of their relatives and po-
iends and are frequently subject to
tside influences.

er that a better understanding may be
all the conditions under which the
erein outlined is successfully used a
t of such conditions will first be made.
em applies under the laws of Illinois
y:

> n as the plans for the work have been
> [illegible] the commissioners shall proceed to
> cial assessments for benefits by classi-
> nds in the district in tracts of 40
> ore or less, according to the legal or
> d subdivisions on a graduated scale,
> mbered according to the benefits to be
> by the contemplated drainage.

ystem also applies for gently rolling
central Illinois, particularly as found
upin county, where the grades of the
ditches or drains may usually be laid
niform; in such cases the difference
uare root of the grades becomes prac-

[illegible] efits [illegible] the per cent of benefits to be conferred by the [illegible]

factors tend to increase or decrease the amount of benefits to be receivd from any drainage system depending for their amount upon its character and design whether tile or ditch, whether complete drainage is derived or a partial and temporary system is installed.

The reason for organization of a drainage district is to benefit the tracts by the removal of water, or by giving additional opportunity for drainage. To give additional opportunity for drainage, the drains must be enlarged and deepened. The opportunity given the land for drainage and the inherent advantages for drainage which it may now possess regulate the benefit it may receive for agricultural and sanitary purposes, from the contemplated drainage. This rule is universal.

Such items as the cost of the improvement, the distance of tracts from the outlet, or their location on branches or mains, and their assumed present state of wetness do not in any way confer benefits on the lands for agricultural and sanitary purposes.

The maximum amount of benefits which it is possible for any drainage system to confer upon any tract of land is to transform it from a state of complete saturation all the time to a state wherein all its surplus or hydrostatic waters are kept removed all of the time, between the extremes of this maximum benefited condition, all percentages of benefit are received. It is this reducing of the wetness of the lands and the giving of the opportunity to further reduce their wetness, which measures the amount of the benefits to be derived from any system. To compute these benefits therefore it is necessary to know the effectiveness of the present drainage of each tract, the size of its present outflow ditches and their elevation or depth and to know the elevation above the district datum plane of all parts of all tracts in the district, as well as their average elevation; and to know the amount of additional drainage which is to be provided and the additional depth of drainage given to each tract, which measures the opportunity given for still more complete work by the owner thereof in ditching and tiling his land. For in the light of modern scientific farming which has demonstrated that most plant roots penetrate for food and water to a depth of at least 4 to 6 ft., and knowing the chemical changes which take place in the soil following a system of deep tile, it is evident that the benefits increase in proportion to the opportunities given for this added depth.

The basic principles to which all benefit assessments upon farm lands must directly or indirectly be referred is the relative elevation of the land in question to its present drains and to the proposed drain. Due credit must be given to natural, inherent advantage, which relieves the owner of land of the necessity of expending large amounts of money for drainage, by reason of sufficient elevation to give natural drainage or cheap artificial drainage. The chief influencing factor of just assessments is the comparative elevation of the tract in its relation to the present and proposed drains. The factor of depth greatly influences the benefits to be derived from both tile drains and ditches and the lowest tracts, or those lying least above their present outlet, which require the greatest depths for outlet purposes, are certainly the most benefited because their relative elevation to their present outlet is least and their capacity to receive benefits is greatest. Conversely, a tract possessing sufficient elevation to render it independent of the proposed drain for a drainage outlet is not subject to assessment. This condition usually occurs in this section when the tract in question possesses a clear and unsubmerged outlet about 6 ft. below its lowest [illegible]

It is therefore submitted that the benefits derived by any assessable tract from the proposed improvement increase directly as the additional depth and size, or efficiency, of the drain increases. For the added depth below present outlet and added size govern the efficiency and measure the additional amount that the wetness of the tract is reduced, and also the added opportunity presented for more complete drainage. It has been demonstrated in practice that usually the new enlargements are in proportion to the added depths. This may be also mathematically determined by considering the usual form of the ditches of drainage improvements. In the case of tile mains it must be assumed that the system is planned of size adequate for all tracts, so that the surplus waters will be removed from all

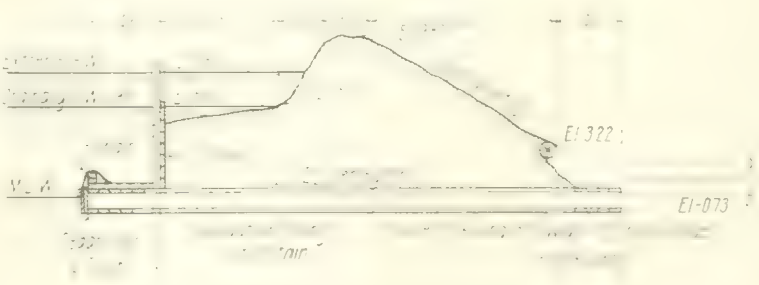


Fig. 5—Section of Levee Having Plank Protection.

TABLE V.—DITCH DATA, ETC., [illegible] NEAR DORCHESTER, N. J.

Owner.	[illegible] marsh.	Length of Ditches: Total. Feet.	Length of Ditches: Per acre. Feet.	Storage Capacity: Total. Cu. ft.	Storage Capacity: Per acre. Cu. ft.	Ratio of ditch and marsh areas.
Compton south of brook	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.5 : 100
Compton north of brook	26.4	[illegible]	[illegible]	26,426	1,001	1.8 : 100
Blisard	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.1 : 100
Grassman	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Camp	[illegible]	[illegible]	[illegible]	16,995	1,371	2.4 : 100
Lupton	[illegible]	[illegible]	[illegible]	108,747	1,192	3.0 : 100

in substantially the same time, or at least opportunity be given to accomplish this result. This leaves the additional depth of drainage given each tract as the variable element affecting the classification.

It is depth that determines the quantity of soil drained and the ultimate amount of water that can be removed by the laterals and main, and that, therefore, measures the benefit received.

It is further submitted that the credit due each tract by reason of advantages in having sufficient elevation to secure cheaply installed drainage increases directly as the vertical distance of its present outlet, or as its depth increases below the tract in question. This distance or depth determines the credit to which the tract is entitled for work previously done artificially, or by nature; it measures the benefits already secured for which no assessment can be made. Stated differently, the benefits vary inversely as the depth of present outlet increases below the tract. It is unfair to measure the depth of the present outlet below the lowest or highest points of the tract but more correctly from a plane of average elevation computed for each assessable unit of 40 acres, more or less, which may be designated as the mean plane.

More readily to explain the above theorems assume two cases: First, assume that the present effective outlets of each tract in the district lie at the same distance below their mean planes, and that the new drains will be deepened below present outlets varying amounts. This being the case, it is manifest that each tract will be benefited directly as its present outlet is lowered a greater or less amount, since this additional depth very closely measures the additional amount of wetness removed in a given time. Second, assume that it is proposed to lower the present effective outlet of each tract the same amount, but that the vertical distance from the mean plane of each tract to its present outlet varies. In this case it is manifest that the benefits to be received will vary inversely, or that the credits to be awarded will vary directly as this vertical distance increases. There is no other available variable which affects the wetness of the lands.

To express mathematically: Let A = classification of one tract E; let A' = classification of another tract F; let B = additional benefits to be received by E; let B' = additional benefits to be received by F; let C = credits to be allowed E; let C' = credits to be allowed F; let X = additional depth given outlet of E; let X' = additional depth given outlet of F; let Y = vertical distance from the base of present outlet to mean plane of E; let Y' = vertical distance from the base of present outlet to mean plane of F.

Then since B varies as X, and C varies as Y,

$$B : C = X : Y,$$

$$B/C = X/Y \text{ and } B'/C' = X'/Y'.$$

As B/C represent the ratio of benefits to credits, the net benefit and the true classification will be proportional to this ratio

$$\therefore A : A' = X/Y : X'/Y'.$$

Considering A the most benefited tract with classification 100 then $A' = 100\ X'Y/Y'X$, which gives a simple formula for the equitable classification of all tracts. After having determined the most benefited tract, which will have the largest ratio X/Y the remaining tracts may be rapidly classified.

Maximum and Minimum Assessments.—Many conflicting plans have been presented for determining the relative portion of cost which should justly be borne by lands tributary to so-called mains and so-called branches. The distance, which a tract lies from the outlet of the district, has also led to much clouded discussion. The following rules have been found very helpful in dealing with these conditions. In all cases, the maximum assessment against any individual or group of individuals or any main or branch, shall not be greater than the minimum cost at which they, acting separately or collectively, can secure equal drainage and equal benefits. To assess more than this would be confiscation and unconstitutional and not contemplated under the drainage laws.

All tracts shall be assessed in accordance with the benefits to be received from the improvement for agricultural and sanitary purposes, provided the amount shall not exceed the maximum amount above stated.

Under these rules and theorems each tract, lying within the district, is placed impartially, upon its merits and inherent advantages, before the commissioners for classification as an unfavored member of a single improvement considered as a whole. It is usually considered that a tract ceases to be benefited when its free and unsubmerged outlet lies at all times from 5 to 6 ft. below its lowest parts; although to such a tract, sanitary benefits may still accrue if it lies in close proximity to a stagnant and disease breeding swamp which is drained.

A direct benefit is received from a tile main by the tracts through which the main is laid. This benefit may readily be computed for each special case. In this locality it is usually customary to assess $1 per rod for each rod of main laid considering that the outlet benefits are included in the classification. Since this feature of benefit is on the same footing as other laterals which may from time to time be laid by the owner, it is not deemed just that it should affect the classification. Full recompense is made for such benefits in the first assessment, which is made to cover this item, in the nature of an extra bill. The entire amount of such benefits in the district are computed and deducted from the total estimate, the remainder is then spread against each tract, as per the classification, and the extras added. Or where it is held proper to be included in the classification, a recomputation may be made to give a classification sufficient to produce the equitable assessment.

Surveys and Maps.—Under this system it becomes important to make the surveys somewhat more extensive and complete than is generally considered necessary. The engineer is, however, compensated by the knowledge that he is working toward the accomplishment of a tangible, definite purpose. The first requirement is to choose or determine a datum plane for the district, and establish a firm bench mark. A survey of all the ditches which it is proposed to improve is next made, establishing accurately their location from section corners and their alignment, and taking levels at top and base of ditches at each station of 100 ft. and at other ruling points. Cross sections of the present ditches are taken perhaps each 500 ft. and at all narrow points, which limit the effectiveness of the ditches. A rapid survey is next made of each 40-acre tract, or other assessable unit, for the purpose of determining the elevation of all parts, and locating all ponds, swamps, ditches and watersheds. Special care is taken to locate properly the elevation and size, or carrying capacity of the present effective outlets at or near the perimeter of each tract. A very satisfactory method for doing this work is to locate the level near the center of each tract, while the rodman gives readings over the land at each 50 paces and at intermediate high and low points and at ditches, calling distances. These notes are sketched and platted on the book in the field as taken, which will then show all elevations and ditches ready for mapping. The number of readings required is governed by the evenness of the surface. About [illegible] acres per day can thus be surveyed and sketched.

From the field notes the maps and profiles are made. The profile will show the old and new elevation of the bottom of ditches and also of the banks, and the location of all roads and bridges; the point at which the ditch enters each tract of land should also be shown. The map should show each assessable unit with the owner's name, description, and number of acres to be assessed. All ditches, lakes, swamps, watersheds and houses should be platted substantially correct, the direction in which the fields are plowed, whether parallel or at right angles to the contours should be noted. The contours will be platted with much care and from these the plane of average elevation for each tract be computed. All elevations taken in the field will be shown on the plat.

Trial Sheet of Classification.—From information obtained as above, a trial sheet of the classification of each unit is made as herein outlined, showing all the pertinent information affecting the classification of all the lands.

When such a trial sheet is completed by the engineer, showing the salient features affecting the reduction of the wetness of the lands, copies are referred to the commissioners who should have previously viewed the lands preferably while the survey was in progress, and who will jointly, with the engineer, consider each tract, giving due weight to all features which will in any way serve to modify the results given by the trial sheet. It is surprising in wet lands to find how many tracts are plowed and furrowed in a direction opposite to that which would produce the best drainage, where this is true, the tract is a wetter tract than the elevations will show, and the benefits will therefore be greater than those given on the trial sheet. The effect is to raise the true elevation of the present outlet. The commissioners may make allowance for this. In ditch work it sometimes occurs that drains are constructed, which by reason of economy or expediency, do not give a tract the full required outlet or drainage. In such a case the system herein outlined tends to give the credits and allowances due. This [illegible] should never occur where a tile system is installed; where it does occur, the classification as here given should be multiplied by the ratio of the tile area given to that [illegible] should be given, which will then give a classification sufficient to collect only for the benefit actually received.

It is customary in this locality to bring the improvement into the lands of each man assessed. Where the party possesses assessable units not so tapped, a future proposed drain should be designed to drain such tracts and the assessment made as for other similar tracts, after deducting the estimated cost of the future drain.

The cost of separately draining all tracts or groups of tracts for which it may be possible to secure cheaper drainage than proposed, should be estimated and tabulated and compared with the assessment for the entire drain, which must be then reduced, where required by the rule for maximum assessments. Owing to the nature of the assumptions herein made as to the effect of extra grade and new enlargements of ditches, the formula here presented is liable in usual cases to be in error by amounts varying up to about 10 per cent. For these reasons, it is doubly proper for the commissioners and engineer to review the classification, using the trial sheet as their guide. After the commissioners have passed upon the features affecting the classification

Land Owner.	Description.	No. of acres assessed.	Elev. of mean plane.	Elev. of present outlet.	Diff. credit factor	Added depth or benefit factor	Ratio of benefits to credits X/Y	Classification $100\ X'Y/Y'X$	Remarks.
H. Jones	S. E. ¼ S. E. ¼ 23-9-9	40	92.5	90.5	2	4	2.00	100	Wet
J. Smith	S. W. ¼ S. E. ¼ 23-9-9	40	94.0	90.0	4		0.75	38	Tract plowed wrong
M. J. Brown	S. W. ¼ S. W. ¼ 24-9-9	40	90.0	88.0	[illegible]	3	1.50	75	New drain inadequat

tract, they will adopt a final classifica- h should be adhered to against the nities of all interested owners. After nates of cost, including incidental and penses, are made up, this classification to obtain the assessment against each

s appears that the assessment of bene- be reduced to a simple, satisfactory itable system, which will automatical- ler and express in one operation from [illegible] and features [illegible] to be derived from any [illegible] tract, and it has [illegible] the final classification, as [illegible] judgment of the commissioners, [illegible] from the trial sheet as computed [illegible] per cent or 15 per cent [illegible]

Some such met[illegible] the approximate [illegible] classification before final compa[illegible] possible. For as an open hearted commissioner remarked to the engineer, "If you do not know what is right in this matter, we certainly do not, we are lost entirely." There has in the past been far too much arbitrary guess work in this matter which poses under the term of judgment. This paper is presented with the hope of giving benefit to some, and with the further hope that other points of interest may be brought to the front by other engineers.

ENERAL ARTICLES AND CLASSIFIED ITEMS

e Adaptability of Types of nodynamic Prime Movers for Electric Power Plants.

general comparisons of the relative ity of the various types of the ther- ic prime movers, for electric power ere recently made in a paper by Prof. tter, of the Kansas State Agricultural before the Kansas Society of En- The comparisons follow.

ernal combustion engine in any form ch higher thermal efficiency than the gine or turbine. Also the best fuel of the internal combustion engine is comparatively small units and is but cted by the size of the engine. With prime mover, the economy depends ze, and the maximum feul consump- ot attained by reciprocating engines ess than 500 h.p., while the limit is r in the case of steam turbines.

et the above advantages, the internal n engine is more costly, its economy nfluenced by the load factor and it suitable for the parallel operation of s, as is the steam prime mover. Also al combustion engine when rated at capacity will stand no overloads, as ium capacity is reached when a full a mixture of the highest possible ombustion and density has been ad- the cylinder.

his it is evident that the greatest pplication for the internal combus- e is in comparatively small sizes. of prime mover is especially ad- s for electric power stations of 500 k.w., where four or more units can carry the load, with the consequent factor of each unit and the in- eliability of service. The internal n engine is also applicable as an for a hydraulic power plant, or as ncy or peak load unit in a steam- wer plant.

units, the internal combustion en- t a competitor of the steam prime less the fuel cost is very great, or plant is located at a place where ially suited for internal combustion n be obtained at a very low price. e to the fact that the steam prime large sizes, has a thermal efficiency inferior to that of the internal com- gine, and offers additional advan- ar as first cost and reliability of concerned.

he relative advantages of steam vers, the various types of steam re very uneconomical when oper- ondensing, and on account of the of rotation, are not suited for the large direct current generators. ocating engine should, therefore, be all cases where the plant must be on-condensing, and in large sizes, nes are to drive direct current gen- he steam turbine is meeting with e success in small units as a motor iving of exciters, pumps and other requiring a high speed of rotation. iving or direct connected alternat- t generators the reciprocating en- the non-releasing type of Corliss s will prove very satisfactory in to 500 h.p. The high speed automatic engine is suited for units under 200 h.p., while engines with some form of drop cut-off gear or gridiron valve will be found most satisfactory in sizes above 500 h.p.

In general the steam turbine does not offer any advantages over the reciprocating types as a power plant unit in sizes under 500 h.p., its field being mainly in large units for driving of alternating current generators. This type of prime mover in large units, while having an economy as good as the very best types of reciprocating engines, costs less per horse power, offers considerable saving in the cost of building and foundations, and produces also a saving in the feed water, in that this type of heat engine requires no internal lubrication, thus facilitating the return of the condensed steam to the boilers without oil filtration. The exhaust steam turbine is capable of producing considerable saving when installed in connection with a reprocating plant. A recent installation of a 1,000 k.w. exhaust steam turbine produced a saving of $14,000 in one year in a plant of 3500 k.w. capacity. Some large plants using reciprocating engines and exhaust steam turbines show a thermal efficiency of nearly 21 per cent.

LETTERS TO THE EDITOR.

Comparative Economy of Government and Contract Work, Upper Mississippi River Improvement.

Sirs: In reading over your interesting journal, Jan. 24 issue, I read the article contributed by Charles W. Durham, Principal Assistant Engineer Upper Mississippi River Improvement, in which he very ably shows, in his open way, how much [illegible] for the government engineers to do [illegible] work on the Mississippi River than it is to do it by contract work. Mr. Durham has the making up of all these figures and [illegible] up a very nice story representing the government engineers' side of the matter, but as most of the statistics on all government work all over the country show that government work can be done cheaper by contract system than it can be done by the direct [illegible] of the government, I do not believe the Mississippi River job is any exception. Mr. Durham in his article acknowledges that the government engineers do their own inspecting and estimating. The [illegible] per cent advantage over the contractors [illegible] way you figure it. The figures he submits on the number of men employed show that some of these contract[illegible] the times [illegible] assertion, that if the work being done on the Mississippi River [illegible] date contract[illegible] deal less expense than by the government engineers, and a profit could be made.

Y[illegible]

[illegible]

S[illegible] Inte[illegible]
Shovel and Dredge Men.
Chicago, Ill., Feb. 5, 1912.

A Problem in Excavation.

Sirs: We at present have a small dredging contract, deepening certain parts of a river which was [illegible] laid up last fall we ran into a bar of ma- [illegible] sand and some fine gravel in parts) which is so hard that our orange peel will not touch it. We cannot even put a hole in it with a crowbar—it is almost like cement. We know that a good dipper dredge would rip this bar up, but its use is out of the question. The [illegible] wide, to be deepened to 8 ft., and as we have gone up the river eight miles and under two steel bridges 14 ft. above the water it would not pay to take a dipper up for this small job. We might say that we tried blasting with 4 per cent dynamite. We jetted the holes and got the powder down deep enough—put in four sticks to shot—but it would only blow a hole about 2 ft. square and did not seem to loosen any more around it. We would like to have the opinions of your readers as to the best way to get this bar out. It is in a river with about 2 ft. of water and we have to deepen [illegible]

Yours sincerely,
CONTRACTOR.
Sault Ste. Marie, Ont., Feb. 8, 1912.

PERSONALS.

Mr. Aaron Johnston has been appointed Principal Assistant Engineer of Maintenance of Way of the Florida East Coast Railway.

Mr. Geo. W. White, a prominent retired contractor of Pulaski, N. Y., died on February 7. He was born at Millard, Otsego County, in 1833.

Mr. Wm. H. O'Brien, Baldwinsville, N. Y., has been appointed Assistant Superintendent of Public Works in charge of the middle divisions of the canals.

Mr. Harold Parker, M. Am. Soc. C. E., on Friday, February 9th, delivered a lecture on "Contracts and Specifications" before the graduate students in Highway Engineering at Columbia University.

Mr. Edward A. Dorn was appointed Second Deputy State Highway Commissioner by the Highway Commission of the State of New York to succeed Mr. Frank D. Lyon of Binghamton.

Mr. L. S. Shaw, formerly Construction Superintendent for J. G. White & Co., Inc., 43 Exchange place, New York, has accepted a position with the Westinghouse Machine Co. of East Pittsburgh, Pa., being connected with the Chicago office of the Westinghouse company.

Mr. Matthew Neilson, Consulting Engineer of Montreal, Quebec, died at his home in Westmount on January 21. He was born at Almonte, Ont., in 1853. For a number of years he was connected with the engineering department of the Canadian Pacific Railway, having charge of the construction work in the Kicking Horse Pass in the Rocky Mountains and in Maine. Later he was Chief Engineer of the Calgary & Edmonton Railway. For some years he was Manager of the St. John Railway, Gas & Electric Co. of St. John, N. B.

Catalogs Worth Having.

Engineers and contractors should have on file the latest catalogs of machines, tools and supplies that they use. In sending for catalogs reviewed or advertised in this paper, you will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING & CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Clam Shell Dredges, paper, 6x9 ins., 66 pp. Theodore Smith & Sons Company, East Essex St., Jersey City, N. J.

These pages are designed to show the form, build, power and efficiency of the dredges and dredging buckets manufactured by this company. The [illegible] and hand [illegible] for [illegible] general railroad and contractors' work. This catalog presents important types of the soft digging clam shell bucket, hard digging clam shell bucket, clam shell dredge, orange peel bucket, dipper dredge bucket and the stone grapple. The book is well illustrated.

Catalog I, a more recent production, contains illustrations of the operation of the cars on different jobs with descriptions of the operations.

Protective Paint—Paper, [illegible] Pyramid Paint Co., 131 No. 22nd St., Philadelphia, Pa.

This booklet describes "Kant-Korod" for steel work. Another booklet of the same size covers the subject of painting cement and concrete surfaces. Sample colors are enclosed.

Cement Colors—Paper, 3½x6 ins., 4 pp. Toch Brothers, 320 Fifth Ave., New York City.

This pamphlet describes the ornamentation of cement and gives sample colors.

Clinton Electrically Welded Wire—Paper, 3½x6¾ ins., 12 pp. Clinton Wire Cloth Company, Clinton, Mass.

This booklet gives complete information regarding the manufacture and use of electrically welded wire for architectural work in reinforced concrete. Tables showing average shearing strength, tensile strength, sizes and description of stock are given.

Power Plant Piping—Cloth, [illegible] ins., 396 pp. Best Manufacturing Co., Pittsburgh, Pa.

The new catalog for 1912 is No. 103 showing piping such as is required in power plants. The catalog is exceptionally well gotten up. The makers have deviated in a number of ways from the usual beaten path of compiling a catalog, which in a great measure simplifies the catalog as a reference book. The method of arrangement is completely set forth in the fore part of the book. All material for any one given standard of pressure is found together in the section devoted to that pressure, irrespective of purpose, service or material from which it is made. These sections are arranged in order and the edges of the pages of the three most used sections are shown by thumb cuts, viz., Standard, Extra Heavy and Dimensions.

Crude Oil Producer—Paper, 3¾x8½ ins., 8 pp. The Wisconsin Engine Company, Corliss, Wis.

This catalog describes a producer consisting of a plain steel shell, lined with fire brick and provided with a fire brick hearth or grate. The producer is designed to convert low grade oils into high grade power gas.

Yellow Pine Manual—Paper, 4⅝x7¼ ins., 96 pp. The Yellow Pine Manufacturers' Association, Wright Bldg., St. Louis, Mo.

This is a manual of standard wood construction. This book gives complete tables and data for engineers, architects and builders, containing formulae for the strength of yellow pine beams, columns, girders, etc., extended rules for grading and diagrams showing standard sizes and shapes.

Road Building—Paper, 6x7 ins., 16 pp. The Huber Manufacturing Co., Marion, Ohio.

This book gives illustrations of the new Huber Roller at work on roads throughout the country, showing the roller with grading and scarifying attachments and giving complete descriptions.

Rib Lath and Rib Studs—Paper, 5¼x7⅝ ins., 36 pp. Trussed Concrete Steel Company, Detroit, Mich.

This edition is the most complete and comprehensive one that the company has yet published on these products. It is an entire revision of previous editions and contains many new illustrations, applications, etc., regarding rib lath and rib studs for plaster and stucco building work.

Five Concrete Machines—Paper, 5x8 ins., 8 pp. Cockburn Company, 126 Liberty St., New York City.

This catalog illustrates and describes the Lockwood Automatic Dump Bucket, The Lockwood Automatic Skip, The Cockburn Cubical Concrete Mixer, the Cockburn Grout Mixer and Ejector, and The Cockburn Block Machine.

High Explosives—Paper, 6x9 ins., 124 pp. E. I. du Pont de Nemours Powder Company, Wilmington, Del.

This is a catalog of instruction on the handling, storage and use of high explosives. The book is exceptionally well written and illustrated, giving valuable information to all users of high explosives. Descriptions of the methods of doing unusual work with dynamite, such as digging ditches, sinking wells, raising buildings, etc., are given in detail.

Cold Weather Concreting—Paper, 6x9 ins., 40 pp. Universal Portland Cement Co., Chicago-Pittsburgh.

This book describes the methods used in the practice of handling concrete during freezing weather, and gives laboratory and field tests as conducted in the Watertown Arsenal which demonstrate the effect of low temperatures upon the strength of cement and cement mortars. The book is illustrated showing various methods in handling work in cold weather.

Cement Gun—Paper, 6x9 ins., 4 pp. General Cement Product Company, 30 Church St., New York City.

This pamphlet, with the several folders accompanying it, describe the work of the Cement Gun on the Field Museum at Chicago, the Culebra Cut, Panama, the Sea Wall at Lynn, Mass., and several other important pieces of work.

Expanded Metal Construction—[illegible] 12 pp. Northwestern Expanded Metal Company, 37 Van Buren St., Chicago, Ill.

This catalog describes the work of building construction by the means of the expanded steel concrete system.

Concrete Machinery—Paper, 6x9 ins., 88 pp. Marsh-Capron Manufacturing Co., Old Colony Bldg., Chicago, Ill.

This catalog is No. 27 and is one of the most complete which we have seen in the concrete machinery line. The book contains chapters devoted to the following: Rail Track Mixer, Tilting Mixer, Mortar Mixer and General. Each of the subjects is covered completely. The descriptions are carefully written and the illustrations are shown in detail. Drawings are also given with tables showing dimensions of various sizes of machines.

Solvay Road Binder—Paper, 6x9 ins., 46 pp. Solvay Process Company, Syracuse, N. Y.

This book gives illustrations and descriptions of roads and their construction with Solvay Granulated Calcium Chloride, which is claimed to be a clean, dustless, economical and practical road binder.

Gas Machine—Paper, 6x9 ins., 32 pp. The Hawkeye Manufacturing Co., Waterloo, Ia.

This catalog gives a description with illustrations of gas plants for individual buildings, or small groups of buildings.

Hercules Rope—Paper, 8x11 ins., 12 pp. A. Leschen & Sons Rope Co., St. Louis, Mo.

This pamphlet contains illustrations and descriptions of the work of the Roosevelt Dam, where Hercules Wire Rope was used.

Alternating Current Switchboard Panels—8x10½ ins., 16 pp. General Electric Co., Schenectady, N. Y.

Bulletin No. 4901 is devoted to alternating current switchboard panels with oil switches attached, and designed for three-phase, three-wire circuits; 240, 480 and 600 volts, 28 to 60 cycles.

Imperial Curb Bar—Paper, 9x12 ins., 1 pp. Edward E. Buhler & Co., 103 Park Ave., New York City.

This circulars describes a curb bar for the protection of concrete curb corners and columns.

Penton's List—Paper, 9x12 ins., 8 pp. The Penton Publishing Co., Cleveland, Ohio.

This is a monthly publication containing lists of new and second-hand machinery.

Railway Motor.—Paper, 8x10½ ins., 16 pp. General Electric Co., Schenectady, N. Y.

Bulletin No. 4920 illustrates and describes a motor of the box frame, commutating pole type, rated at 50 h. p. on 600 volts and 40 h. p. on 500 volts. It is considerably lighter per h. p. than its previous design. Bulletin No. 4900, issued by the General Electric Company, is devoted to apparatus used in Series incandescent street lighting.

Sidewalk Construction.—Paper, 6½x5½ ins., 8 pp. Zeiser Brothers, Berwick, Pa.

This catalog illustrates and describes cement sidewalk construction by the use of Zeiser sidewalk ties and dividing plates, which are of steel, or may be used with wood side rails.

Cement Tests.—Paper, 3½x6 ins., 20 pp. Huron Portland Cement Co., Detroit, Mich.

This booklet contains descriptions and results of laboratory tests on Huron and Wyandotte Portland cements.

Specifications.—Paper, 3½x6 ins., 24 pp. Robt. W. Hunt & Co., 90 West St., New York City.

This booklet contains standard specifications for Portland cement adopted by the American Society for Testing Materials. Other information concerning the business of the Robt. W. Hunt Co. is given.

Hydrocide.—Paper, 3½x6 ins., 8 pp. L. Sonneborn Sons, 262 Pearl St., New York City.

This booklet gives a description of Hydrocide and damp proofing material.

Motor Trucks.—Paper, 3½x6¼ ins., 4 pp. Stegeman Motor Car Co., Milwaukee, Wis.

This pamphlet illustrates and describes briefly trucks of one to six tons capacity.

Saw Mill Machinery.—Paper, 6½x6 ins., 8 pp. American Saw Mill Machinery Co., Hackettstown, N. J.

This booklet gives illustrations, descriptions and dimensions of various contractors' wood working machines. These are adaptable for portable plants with engines or electric motors.

Keystone Cement.—Paper, 3½x6 ins., 4 pp. Integral Waterproofing Co., 50 Church St., New York City.

This pamphlet describes briefly a modern imitation Caen which the company has placed on the market to combine an exact imitation o the celebrated French stone in tone, with the character necessary for a material that could be for decorative purposes. Another booklet tled "Integral Waterproofing" describes methods of waterproofing with the Key compound and gives tests and descriptio structures upon which the compound has used.

Waterproofing.—Paper, 3½x6 ins., 16 pp. [illegible] Company, 1133 Broadway, New

This booklet describes Minwax, a trade for mineral wax, a waterproof coating whic been used in waterproofing repair work dor the last six years on the New York Subwa

Good Roads.—Paper, 6x9 ins., 48 pp. Wyandotte Portland Cement Co., Wyandotte, Mi

This booklet gives some interesting and information regarding the construction of by the use of concrete. Descriptions of are given with cost data, methods of cons tion and illustrations.

Bates Corliss Engines.—Paper, 6x9 ins., pp Bates Machine Co., Joliet, Ill.

This catalog contains illustrations and de tions of Bates Corliss engines, power tran ting machinery, complete motive power and air and gas compressing machinery. letin No. 35, paper, 6x9 ins., 24 pp., issu the Bates Machine Co., illustrates and des heavy duty Corliss engines. Bulletin N paper, 6x9 ins., illustrates and describes th Bates inertia valve gear, a noiseless rel valve gear for Bates Corliss engines.

Cookson Feed Water Heater.—Paper, 6x 80 pp. Bates Machine Co., Joliet, Ill.

This book contains complete descripti this heater with descriptions of installatio lustrations and line drawings.

Olds Engines.—Paper, 6x9 ins., 48 pp. Engine Works, Lansing, Mich.

This catalog gives complete detailed illus descriptions of various types of Olds ga engines from 1½ h. p. to 70 h. p. Engin various purposes are shown, both stat and portable.

Emerson Fans.—Paper, 7x10 ins., 62 pp Emerson Electric Mfg. Co., 2024 Wash Ave., St. Louis, Mo.

Catalog No. 6000, under date of Jan. 19 contains illustrated descriptions and spe tions of fans for alternating and direc rents.

Equipment, New and Second-hand.—Pap x9 ins., 64 pp. M. Mitschkun Co., Detroit,

Contains a price list of railway and tors' equipment and tools.

Office Furniture.—Paper, 6½x9¾ ins., The Weis Mfg. Co., Monroe, Mich.

This catalog contains illustrations, d tions, specifications and price list of offi niture and stationery supplies. This is "D." Catalog "E," issued by the pany, 6½x9¾ ins., 32 pp., contains illust descriptions, dimensions and specificati sectional bookcases and files.

Simplex Concrete Piling.—Boards, [illegible] 96 pp. Cranford Construction Co., Cin Ohio.

This very complete and instructive shows the method of molding and plac Simplex concrete piling and gives illustra typical structures carried by Simplex pil gether with a selection of tests by loadi posure and experience.

Civil Engineering Society Meet

Iowa Engineering Society.—S. M. Wo Iowa City, Sec'y. Annual meeting at Da Feb. 21-23.

Interstate Cement Tile Manufacturers ciation. Chas. E. Sims, Worthingto Sec'y. Annual convention at Chic 21-23.

Western Cement Show.—Coliseum, Feb. 21-28.

National Paving Brick Manufacturers ciation.—Will P. Blair, 826 Engineers Cleveland, O., Sec'y. Annual meeting March 4-6.

Canadian Mining Institute.—Annual Toronto, March 6-8.

International Brick and Clay Product sition.—First annual meeting, Coliseu cago, March 7-12.

National Association of Cement User E. Krauss, Harrison Bldg., Philadelphi Annual convention at Kansas City, Mo. 11-16.

Kansas City Cement Show.—Conventi Kansas City, Mo., March 14-21.

National Railway Appliances Associa V. Crandall, Ellsworth Bldg., Chicago, Annual meeting at Chicago, March 1

American Railway Engineering Assoc E. H. Fritch, 962 Monadnock Blk., Sec'y. Annual meeting at Chicago, Mar

American Society for Testing Materia E. Marburg, Univ. of Penn., Phil Sec'y. Annual meeting at New Yo March 28-29.

CONTRACT NEWS SECTION
of
ENGINEERING & CONTRACTING

Doings the eek.

Few railroad construction contracts of any size appear to have been let the past few days; however, bids on several big jobs are under consideration and it is probable that contracts laced shortly. Among these contracts on double tracking in the Pennsyl- R. in the vicinity of Harrisburg, and aining contracts for the construction Lewisburg & Northern line of the L. nnouncement has been made that it is that work will be started in about on the extension of the New Orleans, & Chicago R. R. from Middleton, o Lexington, Tenn., where a con- an be made with the Nashville, Chat- & St. Louis, thus giving the Frisco into Paducah. Another item of con- interest is a report that the Gilmore urg R. R. would early in March let for the extension of its line from City, Idaho, toward Lewiston. This annot be verified at the present time. levelopments indicate that New Eng- to have much railroad construc- the near future. Announcement has de that the Grand Trunk was to ex- nething like $35,000,000 in this section ountry. The latest work this company [illegible] is the double tracking of 140 the Central Vermont Ry. and the tion of a new line from White River , Vt., to Boston, Mass. This Grand vork is of particular interest, for it 20 years since a new railroad of any been constructed in some of the New states.

g the railway construction contracts ntly are the following: Maney Bros., W. Main St., Oklahoma City, for the construction of a 30- tension of the Clinton, Oklahoma ern Ry., from Butler, Okla., up to Valley, the contract including the 3,000 lin. ft. of bridge work and four ions; P. M. Johnston & Son., 620 Binz Iouston, Tex., for the second section Stone City-Giddings line of the Hous- exas Central R. R, the section extend- n the East Yegua River to Caldwell. nd involving about 275,000 cu. yds. of on; Norton Griffiths Co., Ltd., Lon- g., for the development of the Grand Pacific terminals in Courtnay Bay, St. he work calling for the expenditure t $7,500,000.

way of irrigation work the largest he past few days is the one for work South San Joaquin and Oakdale Dis- California. For work on Section 2 oint main canal north of the Stanislaus the Utah Construction Co., Ogden, t $658,193 was low bidder. Bids on 3, 4 and 5 of the South San Juaquin Canal were also received; T. K. Modesta, Cal., and the Pacific Con- n Co. are understood to be the lowest Bids are now being asked by the n Pacific Ry. for the construction of aqueduct in connection with its Cal- lta., irrigation system. This structure 10,000 ft. long and is to contain 23,400 of concrete.

on one of the largest government g jobs so far this year are now being y the U. S. Engineer at New York The work calls for removing obstruc- channel between North and South Islands, East River, N. Y. The of material to be removed is estimated at 21,000 cu. yds. scow measurement of other material than bowlders and ledge rock; 50 cu. yds. of bowlders ½ to 2 cu. yds. in size, solid measurement, and 14,200 cu. yds. of ledge rock, place measurement, and bowlders over 2 cu. yds. in size, solid measurement. The amount of money available for payment of contractor's estimates is $175,000.

Bids on another contract in connection with the construction of the Calumet-Sag Channel for the Sanitary District of Chicago were opened last week. This work called for Contract Section 3, and included 335,000 cu. yds. glacial drift excavation; 220,000 cu. yds. rock excavation; 182,300 sq. ft. channeling, 13,400 cu. yds. concrete retaining walls and 5,000 sq. yds. riprap slope. S. R. H. Robinson & Son Contracting Co., St. Louis, Mo., was the low bidder.

The largest highway contract of the past few days appears to be the one awarded to the Stokes Constructing Co. by the County Board of Washington County, Tenn. This contract calls for grading and macadamizing 31 miles of the Memphis to Bristol highway.

A good sized filling contract is now being advertised by the Panama Pacific International Co. of San Francisco, Cal. This work calls for approximately 1,000,000 cu. yds. of earth filling between Webster, Ray and Lewis Sts., at San Francisco.

The Port Commissioners of Seattle, Wash., have voted to submit the Harbor Island Terminal bond issues, aggregating $5,000,000, to the voters of Seattle March 5. Two propositions cover the Harbor Island Terminal scheme. The first is an issue of $3,000,000 of bonds to cover the cost of acquiring the necessary land on Harbor Island by condemnation, estimated at $2,000,000, and $1,000,000 additional for construction of the first concrete piers. The second proposition is a resolution providing for the issuance of an additional $2,000,000 bond issue.

Marking the Boundary.

Many and various have been the ways employed in marking out the boundaries for some of the earlier Indian land grants in this country. One of the most interesting of these boundary limits is what is known as the 10 o'clock line, which extends from a point near the mouth of the Miami River northwest through Indiana. According to tradition, when the Indians had agreed to cede a portion of the territory to the whites, a meeting was held to mark out the ground. A surveyor was present and had set up his instrument. The head man of the tribe went up to the instrument, stared steadily at it for a while, grunted in an interested manner, and returned to the circle about the camp fire. Not a word was spoken by any one. Presently another Indian arose, walked cautiously to the instrument, gravely examined it, grunted twice and returned to his place by the fire. After a half dozen other Indians had followed his example, a short consultation was held. The chief then approached the white man. "That what Indian know," he said, drawing a small circle on the ground with a stick; "that what white man know," drawing a larger circle around the first one; "this what nobody know," he added, pointing to what lay without the last circle. "White man know that," indicating the instrument. "Indian not know it. Indian know sun. He never cheat. Him always same. Him throw shadow. Indian give white man land one side." After a long consultation it was decided that a line drawn in the direction in which the sun would cast a shadow from an agreed point at 10 o'clock should be made the boundary, the white men taking the land on one side and the Indians keeping that on the other.

40 Years Afterward.

In 1872 Frank Flanagan, a contractor, built a road for a county in Colorado. Last week the State Court of Colorado held that he should be paid for the work he had done 40 years before. The building of the road was promoted first by the organization of a company, which later sought aid from the county. This was given by vote of the citizens and bonds for $15,000 to cover the expense of construction were issued and taken over by the county. A contract for building the road was given to Flanagan. It was found that the $15,000 was sufficient to complete only a part of the highway. When the road was completed the contractor put in a bill for the money due him. For 40 years this bill has remained unpaid. Judgment was rendered in the district court against the county in favor of Flanagan. The County Board appealed the case and finally it came before the State Court of Appeals, which gave a decision by which litigation in the state courts over the subject is ended. The chief point considered by the court was whether the statute of limitation applied to the case. It was ruled that since a bill had been presented in time by the contractor, and he had made reasonable application for his pay afterwards he was entitled to his money.

Willing to Take a Chance.

A small city in Nebraska has a street railway system whose service sometimes is not exactly satisfactory. Naturally the citizens kick more or less, and in moments of vexation make sarcastic remarks about the street railway. A stranger in the city evidently heard some of these remarks, and believed them, for one of the city officials has received recently the following letter:

> Dear Sir: I was in your city in September and some of the people told me that the city [illegible] and that they would be glad if some one would come and start the cars to running again. I was traveling at that time and could not take up the work. But now I am in a position to take charge of the system, if the city wants the cars to run. I would like to ask it to give me the lines, cars and a building for an office on Main street and the privilege to run lines on other streets, and to sign papers to me to show that I have a right to all the lines in the city, also give me $5,000 in money and I will put my car shops there and the cars will be run without horses. This will be a big improvement to the city. Please let me hear from you.
>
> Yours for business.

Land owners in the Pueblo Municipal Irrigation District met at Pueblo on Feb. 16 to take action on a proposed bond issue of $2,500,000. The preliminary work of reclaiming 50,000 acres immediately west of Pueblo has been completed by the engineers and the bond issue will be the next move. It is proposed to bring water from the western slope through a tunnel in the mountains and carry it to a point 45 miles west of Pueblo in the channel of the Arkansas River.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

⊙Some further details are now available regarding the construction contracts awarded recently for work on the Lewisburg & Northern line of the Louisville & Nashville R. R. and mentioned in our last issue. The Asheville Construction Co., R. M. Ramsey, President, Asheville, N. C., secured a contract at New Castle, Ala., embracing more than 1,000,000 cu. yds. of classified excavation and more than 10,000 cu. yds. of concrete. The Asheville Construction Co. will do all of the steam shovel work in the contract, but will let out part of the other work, and will be on the job the first of March to show any contractors who may desire some of same over the work. The sub-contractors will have 18 months to complete their work. The contract covers a distance of 10 miles. The contract awarded the C. G. Kershaw Contracting Co., Birmingham, Ala., begins at Leesdale and ends 1½ miles north of Hartsell, Ala. None of this work has been sub-let as yet. The contractors will move their office to Hartsell on March 15. This contract includes 200,000 cu. yds. earth excavation, 250,000 cu. yds. rock excavation, 2,800 cu. yds. concrete masonry, and 500 cu. yds. stone masonry. The contract awarded Thrasher & Gunter, Knoxville, Tenn., is located at Blount Springs, Ala. It includes 600,000 cu. yds. of earth excavation, 750,000 cu. yds. rock excavation, a rock tunnel 1,100 ft. long, and a similar tunnel 2,300 ft. long, and about 15,000 cu. yds. of concrete masonry. The contract awarded J. C. Carland & Co., 832 The Spitzir, Toledo, O., is located at Cullman, Ala., and covers 17 miles of road. About three sub-contractors are wanted on this contract. The contract includes a little over 1,000,000 cu. yds. of earth and rock excavation.

The Birmingham & Southeastern Ry., W. M. Blount, President, Union Springs, Ala., is reported to be about ready to commence work on the construction of 20 miles of new line. This road is being built toward Birmingham which will ultimately in the northern terminus. The new section to be constructed is understood to be between Milstead and Eclectic.

Grading work for the new Louisville & Nashville line from Brookwood to Tuscaloosa has been practically completed and as soon as one steel bridge to be placed over Hurricane creek is finished the laying of rails will be commenced. Already 35 car loads of rails have been delivered at North Alabama junction, a mile from Brookwood. The line will be 18 miles long and when finished will give the Louisville & Nashville a direct line from Birmingham to Tuscaloosa over the Mineral line.

The Birmingham Railway Light & Power Co., Birmingham, is considering building a 1-mile extension to Irondale.

Preliminary surveys have been made for a 2-mile electric railway proposed to be built from the terminus of Mobile Light & Ry. Co.'s line at Spring Hill to Pinehurst, a new residence suburb of Mobile. The extension will cost about $10,000 and will be built for C. C. Mechem of Mobile.

Arkansas.

The Cairo, Truman & Southern R. R. Co. has been chartered and proposes to build a logging railroad from Truman, Poinsett county, to Earle, in Crittenden county, a distance of 29 miles. The Truman Cooperage Co. of Truman, which is back of the proposition, already has a road about nine miles long running south from Truman. This road, while used chiefly for logging purposes, is a standard gage railroad, and will be used as a part of the proposed railroad.

The De Queen & Eastern R. R. has completed a survey for an extension from its present terminus at Dierks to Hot Springs, a distance of 60 miles. M. F. Allen, De Queen, Ark., is General Superintendent.

California.

The San Francisco & Northern Ry. Co., incorporated early this month with a capital stock of $2,500,000, for the purpose of building and operating an electric railway from Santa Rosa & San Quentin, a distance of 212 miles, is understood to have completed its preliminary surveys with a view to commencing construction work in the spring. Among those interested are Allen J. and John C. Kittle of Ross; Archibald Borland, president of the American Rubber Co., of Oakland; Frank A. Brush, a director of the Santa Rosa National Bank and Petaluma & Santa Rosa R. R., and William L. P. Jackson, assistant cashier of E. H. Rollins & Sons.

The Northern Electric Ry. Co., A. D. Schindler, General Manager, Alaska Commercial Bldg., San Francisco, has negotiations under way for financing the proposed Marysville-Colusa branch, the construction of which has been under contemplation for some time. This branch will be about 28¼ miles in length.

It looks as though Los Angeles would have two $5,000,000 steam railroad stations instead of a union station. The Santa Fe System is understood to have refused to join with the other railroads in the erection of a common station, and is said to have preliminary plans under way for a building of its own. Plans for the $5,000,000 station to be occupied jointly by the Salt Lake R. R. and the Southern Pacific are about completed. Both stations are to be completed before the Panama Exposition in 1915.

Col. Theodore Pinther, San Francisco, Cal., has submitted with a communication to the Harbor Board, a plan for the construction of a belt railroad line which is to encircle San Francisco. According to the plan outlined, the road is to start from the Ferry depot, extend along the water front, Presidio Military Reservation, Lincoln Park, Richmond district, Golden Gate Park, Sunset, Ocean beach, Ingleside, Ocean View, Mission and the Potrero. The Board referred the matter to the committee of the whole for further consideration.

It has been announced by L. A. Nares, Fresno, Calif., President of the Laton & Western Ry., mentioned in our last issue, that S. Tielman, engineer has completed surveys for the extension from Lanare and the work is ready for grading crews.

Robert Sherer & Co., 650 Pacific Electric Bldg., Los Angeles, Calif., contractors for grading the San Diego & Arizona line in the Imperial Valley, are making good progress and expect to finish the first ten-mile section next month. As fast as the graders finish the roadbed they are followed by the track builders. They are now working a considerable distance west of the new townsite of Dixie on the second contract in the Imperial section. The first contract extended five miles west from Seeley. The second contract will bring the line to a point not far from Coyote Wells, 10 or 12 miles from the San Diego-Imperial county line. Most of the grading in Imperial requires team and wagon work, while that in Mexico requires the employment of heavy machinery. The ten-mile stretch on which the contractors are now working is through solid granite, requiring the blasting out of the roadbed practically every foot of the way.

Board of Public Works, of San Francisco, will call for bids shortly for completing the construction of the road bed of the Geary St. Municipal Electric R. R. Bids will also be taken about April 1 for furnishing the cars, the previous bids for this having been rejected. Of the bonds voted for building the city railroad, amounting to $2,020,000, sales aggregating $1,037,000 have been made, leaving $983,000 to be sold. The sum so far expended is $495,000 and $55,000 more is n due and payable, leaving available in the trea ury $187,000 cash. This sum and the unso bonds furnish a total of $1,470,000 for t completion of the roadbed, construction of t cars, building of the power house and c barn and general equipment. Marsden Ma sion is City Engineer of San Francisco.

Florida.

The St. Johns Light & Power Co., St. Au ustine, operating the electric railway at th place has applied to the County Commissione for permission to extend the line into Ne St. Augustine.

Georgia.

The State Railroad Commission has a proved an issue of $15,000 common stock f the Albany Terminal Co., which is compos of the five railroad companies entering A bany. This stock will be used to acquire t ground necessary for the erection of a joi passenger terminal which is to cost $80,0 Construction work will begin within a fe weeks.

At a meeting of the citizens of McRae, G. it was unanimously decided to build the pr posed railroad from Barrow's Bluff, on t Ocmulgee river, to McRae. Two routes ha been surveyed in part, and the actual wo of staking off the right of way will be beg shortly. The line will traverse the middle the county obliquely, and will cover about miles. Crossing the river it will give us co nection with Douglas on the south, and event ally the extension will reach Dublin on t north.

Idaho.

The Oregon Short Line R. R. has recent had engineering parties at work on the pr jected line down Snake River from Hom stead to Lewiston, making some desirable r visions in the old survey. There has, ho ever, been no contract let for work, nor is t immediate construction of this line being co sidered at this time.

It is reported that the Gilmore & Pittsbu R. R., T. T. Bacon, Chief Engineer, Armstea Mont., will early next month let contracts f the construction of its line from Salmon Ci toward Lewiston. It is stated that co tractors have recently been over the route wi a view to bidding on the work.

Illinois.

The Jacksonville Street Ry. Co. of Jackso ville, has been incorporated with a capit stock of $2,500, and proposes to operate stre railways in and adjacent to the city of Jac sonville. H. E. Chubbuck, Peoria, Ill., Ge eral Manager of the Illinois Traction Syste is one of the incorporators.

The Chicago & Interurban Traction Co. h been incorporated with a capital stock $1,000,000, and proposes to construct an el tric railway from Chicago through the cou ties of Cook, Will and Kankakee to Kankak The capital stock is $1,000,000; the incorp ators and first board of directors are War H. Robinson, Charles R. Moore, Edgar Pank, William W. Crawford and Charles Ireland, all of Chicago.

The Chicago, Peoria & Quincy Traction has been incorporated and proposes to c struct an electric railroad from Quincy Peoria through the counties of Adams, Brow Schuyler, Cass, McDonough, Fulton and P ria. The capital stock is nominally $200,0 and the principal office is to be located Quincy. The incorporators and first board directors are John A. Steinbach, Charles Oe man, August H. Heidbreder, H. E. Knaphei and George J. Jost, all of Quincy.

The Hillsboro Ry. Co., the incorporation which was mentioned in our last issue, p poses to build additional lines and to otherw extend the street railway system at Hillsbo

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Frey, Hillsboro, one of the incorporators, tly acquired control of the present system illsboro.

Indiana.

omotion work is reported well along for lroad to be built from Goshen to Fort ne, with a branch from Columbia City untington to connect with the Cincinnati, ton & Chicago R. R., of which J. C. Cur- Huntington, Ind., is receiver.

e Indianapolis, New Castle & Toledo ion Co., 30 Union Trust Bldg., Indian- s, Ind., is understood to have financed its cted extension from New Castle to Mun- All right of way is stated to have been ed and it is probable that work will be d as soon as the weather conditions will t.

e Baltimore & Ohio R. R. has closed a for a parcel of real estate at Garrett. where the company will build new shops. k on the improvements will begin as soon e ground thaws.

Iowa.

e of the first improvements to be under- this spring by the Des Moines City Ry. of Des Moines will be the double-track- of the 6th Ave. line. The line is now le-tracked as far as Laurel St. and an ional track will be constructed from el St. north.

e Creston, Winterset & Des Moines Ry. has completed surveys for the first 22-mile on of its proposed railroad, the route from Creston to Des Moines via Macks- and Winterset. About 50 per cent of apital for construction has been secured le of common stock locally. Construction act will be let when bonds are sold to r the entire cost of the first 22 miles. R. n, Creston, Ia., is President; C. B. Judd, mwa, Ia., is Chief Engineer, and A. S. , Orient, Ia., is Secretary.

e fact that Chicago, Milwaukee & St. Ry. engineers are running surveys for construction of a cut to eliminate a curve e line between Cambridge, Ia., and Max- gives rise to reports that the entire line een Madrid and Woodward, will be ghtened in the near future.

Kentucky.

tizens of North Middletown and Paris, still hope to secure the construction of an nsion of the Louisville & Nashville to the fields by way of those cities. Mayor L. Hinton, Paris, is reported to have re- d a letter from officials of the company ng that a representative of the road would ent to Paris to show sketches of the pro- d route and to ascertain the sentiment of property owners along the right of way.

Maine.

oard of Trade of Jonesport, Me., is to e an attempt to secure the construction . 15-mile steam or electric line to connect the Washington County Division of the ne Central R. R. D. O. French, Jones- , is Secretary of the Board of Trade.

lans are under consideration for the con- ction of an electric railway from Water- to Skowhegan by way of Fairfield Cen- and North Fairfield. A committee con- ng of W. T. Reynolds of Waterville, mas Dean of Skowhegan, Barker San- of Skowhegan and Lester Holway of field Center have been selected as a mittee to proceed toward a preliminary ey.

Michigan.

he Grand Rapids & Indiana Ry., E. H. nes, Chief Engineer, Grand Rapids, Mich., , it is understood, have work started short- on the construction of a 5-mile spur, start- from Pantlind, a wood station, and run- g west into the timbered lands drained by headwaters of the Cedar River.

he Grand Trunk Ry., H. L. Safford, Chief gineer, Montreal, Que., has completed sur- s for a proposed extension from Bad Axe Cass City, and it is stated that if the neces- y right of way is secured the line will be constructed and placed in operation this year.

Preliminary details have been completed for the organization of a company for the purpose of building a railroad to operate in the eastern upper peninsula. As proposed, the road will operate over a private right of way throughout, and will reach territory surrounding Riverside cemetery, Rosedale, McCarron, the Dunbar Agricultural School, Barbeau, Kelden, Stirlingville, Rockview, Pickford and points lying between the latter and the Snows. The road will be about 58 miles long, and freight traffic will probably be handled by steam and passenger traffic by gasoline electric locomotives. Among those interested are Mayor Charles H. Chapman, Sault Ste. Marie; Frank H. Taylor, Pickford; William D. Hossack, Cedarville; A. S. Riber, Philadelphia, Pa., and A. S. Robinson, an engineer.

Minnesota.

The Mesaba Ry. Co., which proposes the construction of a high speed electric railway on the Mesaba Range between Hibbing and Gilbert is reported to have completed financial arrangements so that construction work can be started in the early spring. The work will be under the supervision of an advisory committee, comprising Robert W. Watson of New York, vice-president of the Great Northern Power Co. of Duluth; Oscar Mitchell, a Duluth attorney, and Chauncey Eldredge of Tucker, Anthony & Co., bankers, Boston, Mass.

It has been announced that the Minneapolis Railway Transfer Co., operating an 11-mile line in the milling district of Minneapolis, Minn., has issued bonds amounting to $2,000,000 to be used by the Minneapolis & St. Louis Railroad, of which the M. R. T. Co., is a subsidiary concern, for the enlargement of the terminals. R. G. Kenley, Minneapolis, Minn., is Chief Engineer of the M. & St. L. Ry.

Mississippi.

The Illinois Central R. R. is reported to have preliminary surveys underway for a new line from Jackson, running up the Pearl River Valley. It is believed that in a general way the line is to follow the valley of the Pearl and go northeastwardly through the counties of Leake, Neshoba and Noxubee to the Alabama line, where it will connect with the line now running into Birmingham.

Engineers of the Louisville & Nashville Railway, according to reports from Jackson, Miss., are busy making a tentative survey for a line extending 25 miles up the east side of the Pearl River, probably to Birmingham.

The Natchez Eastern R. R., projecting a 340 mile line from Meridian to Natchez, Union Church, Baton Rouge and Raleigh to Carthage, has made surveys and has secured the construction capital. The construction contract has already been let. M. P. Finnegan, Meridian, Miss., is Chief Engineer, and William Cornell, Meridian, Miss., is President.

Contracts have been signed between the St. Louis & San Francisco R. R. and the New Orleans & Northeastern, permitting the former to use trackage from Laurel, Miss., on the New Orleans, Mobile & Chicago, to a connection with the New Orleans Terminal, which the Frisco owns jointly with the Southern Ry. This for the first time enables the Frisco over its own rails and with tracks jointly owned with the Louisville & Nashville to handle business between Chicago, St. Louis and New Orleans, Kansas City and New Orleans, as well as from Oklahoma, Kansas, Illinois and Indiana to both New Orleans and Mobile.

Board of Aldermen of Ellisville, Miss., have adopted a resolution to sell the city electric light plant to the Laurel Railway, Light & Power Co. of Laurel, Miss., which is to be given a franchise to build an electric railway to the Agricultural High School at Ellisville.

Missouri.

The Atchison, Topeka & Santa Fe Ry., C. A. Morse, Chief Engineer, Topeka, Kan., has authorized an expenditure of $794,000 to complete the double track work between Sibley and Floyd, Mo.

It is rumored that the Chicago, Rock Island & Pacific Ry. is contemplating extending the new Carlisle-Allerton branch south across the Missouri river at Jefferson City, Mo., thence to a connection with the St. Louis-Kansas City line and eventually to the Gulf.

Steps are being taken for securing the right of way for a proposed system of electric railways to reach the northern end of St. Louis county. As at present proposed, four lines of a total mileage of 82 are under construction. The main road would begin at Baden, follow the Columbia Bottom road to the Missouri River, 13 miles away; go thence along the Missouri River to Fort Bellefontaine, eight miles; thence to Music's Ferry, six miles; thence to St. Charles, four miles. A spur would terminate at Creve Coeur Lake. Three cross-country lines would connect points on the Bluff line. One of 16 miles will originate at Baden, follow the Bellefontaine road to Spanish Lake and go thence eight miles farther to Fort Bellefontaine. From Baden the second line, also 16 miles long, would go to Black Jack, eight miles; thence along the old Jamestown road to the Missouri River at the quarters of the St. Louis Portland Cement Works, eight miles. The third connection of 18.5 miles would extend from the intersection of New and Old Hall's Ferry roads to Cross Keys, seven miles; thence to Florissant, a half mile, and then to Music's Ferry, eleven miles. J. Charles Miller, a contractor of 3500 Herbert St., St. Louis, Mo., is the promoter.

Kansas City, Mo., and Vicinity.

[illegible]

The writer has just returned from a trip to Oklahoma. The observing topic among contractors there—especially in the vicinity of Muskogee—is the new M. O. & G. work about to start. Definite announcement of the route to be followed has not been announced. Several surveys have been made. It is a certainty, however, that about 200 to 300 miles will be constructed and that there will be some very fine team work as well as shovel and car work involved. Contractors with idle outfits should get in touch with the M. O. & G. R. R. Address Bryant Bldg., Kansas City, Mo.

The construction of the new Santa Fe line in western Kansas marks a great era in that section of the country. In this day and age it is hard to believe that there is a spot on the map not in close touch with a railroad. Yet the line referred to actually traverses five counties that have never known a railroad before. The contract calls for completion of the road to a point in southwestern Haskell county by July 1. At this point the road divides, one branch going southwest to Point of Rocks and the northwest through Haskell, Grant and Stanton counties. New towns are springing up all along the line and it looks very much as though this corner, at least of western Kansas, was going to develop very rapidly. Crop prospects in that section never were better than now and everything seems to be combining for a boom.

Mr. E. S. Johnson of Davenport, Ia., was a Kansas City visitor last week. Mr. Johnson is president of the Davenport Locomotive Works as well as being interested in the contracting business. Business is rushing with the locomotive company these days and there seems to be no immediate prospects of a let-up in orders.

Announcement has been made in Kansas City that about 50 miles of Wabash R. R. will be doubled tracked in Missouri, following orders from the receivers in St. Louis. The work will start at the opening of spring and is expected to be completed by the end of the year. Orders have been issued to rush the completion of a number of new engines, passenger, box, hopper and automobile cars. The announcement follows the decision of the receivers and the United States court to spend $750,000 in bettering the road in Missouri. The second track work as outlined by Frederick A. Delano, former president, embraces the following lines: Birmingham to Excelsior Springs Junction, 14 miles, $237,000; Salisbury to Brunswick, 18 miles, $228,000; Huntsville to Moberly, 6 miles, $84,000, and Moberly to Clark, 11.3 miles, $147,000.

Mr. John Bales of Kansas City, Kans., has just placed his order for a crusher plant and expects to start work at once on some nice contracts he has for furnishing rock ballast.

Jas. O'Connor & Son will furnish the ballast for the Kansas City-St. Joseph electric line railway. The quarry will be established near St. Joseph and the ballast will be distributed at the rate of about 2,000 yds. to the mile.

F. M. Jordan was in our office a day or two ago. Mr. Jordan is enjoying a fine business these days in mixers and cement machinery, which all tends to show that we can expect a great year. When lines like the above sell readily in the middle of winter it is only reasonable to expect a rush when work is really started.

Nebraska.

Newspapers are persistent in the report that the Union Pacific Ry. is planning to build within a short time, a line from Omaha to Lincoln, Nebr., with a branch northwest from the latter city to a connection with the Central City line near Stromsburg.

Nevada.

The Verdi Lumber Co., Verdi, Nev., has purchased the timber in Lemon Canyon near Sierraville in the National Forest from the U. S. Government and will build a 20-mile railroad from Loyalton to Sierraville to get out the lumber.

It is rumored that officials of the Oregon Short Line Ry. will take immediate steps looking to the securing of data upon the requirements of the proposed construction of the Rogerson-Contact line. The length of the proposed line will be 35 miles and it will tap one of the richest ore-bearing sections of the country.

New Hampshire.

The Grand Trunk Ry. has taken steps for its proposed new line from White River, Junction, Vt., to Boston, Mass. In order to build the line across the state of New Hampshire, the company has filed articles of association for the Southern New England R. R. The length of the proposed line in New Hampshire will be about 100 miles. The state law requires the charter to name the towns through which it is proposed to survey for a right of way, and these are given as Lebanon, Enfield, Grafton, Grantham, Springfield, Croydon, Sunapee, New London, Bradford, Warner, Henniker, Hopkinton, Weare, Dunbarton, Newbury, New Boston, Goffstown, Bedford, Litchfield, Merrimac, Londonderry, Hudson, Sutton, Webster, Bow, Pembroke, Hookset, and the cities of Concord, Manchester and Nashua. The list of towns allows of several provisional ways of reaching the Masachusetts line and all are not decided upon as a hard and fast proposition. H. R. Safford, Montreal, Que., is Chief Engineer Grand Trunk Ry.

North Carolina.

The Black Mountain R. R., a new branch line of the Carolina,Clinchfield & Ohio R. R., Ward Crosby, Chief Engineer, Johnson City, Tenn., will be opened for traffic on April 1. This branch line runs in a southerly direction from Black Mountain Junction toward Asheville, N. C. It is said that the plan of the management of the C. C. & O. is to extend this branch later into Asheville.

The following officers have been elected by directors of the Durham & Danville Railroad, for which surveys have been started, as mentioned in the Feb. 7 issue. Gilbert C. White, C. E. Durham, N. C., President, and J. F. Wily, Raleigh, N. C., Secretary and Treasurer. The new road will be the most direct route between Durham and Danville and will cut off many miles. The charter for the road calls for operation by steam or electricity.

North Dakota.

All sub-contracts have been let for the work of the furnishing the grading of the 130 mile Soo branch line from Fordville to Drake, for which Foley, Welch & Stewart, St. Paul, Minn., have the general contract. This work consists in finishing an old contract for the Drake-Medford work which was closed down summer before last.

Ohio.

The stockholders of the Mahoning & Shenango Railway & Light Co., Youngstown, O., will vote March 20 on increasing the capital stock from $10,000,000 to $65,000,000. It is understood that $2,500,000 of this sum will be expended for extensions and double-tracking at Youngstown and vicinity, and it is probable that a portion of the remainder will be used for completing the system between Cleveland and Pittsburg.

The budget of the Cincinnati, Hamilton & Dayton Ry., F. H. Alfred, General Superintendent, Cincinnati, O., is understood to call for an appropriation for additional double-track facilities between Cincinnati and Toledo.

Oklahoma.

⊙Maney Bros., 126½ West Main St., Oklahoma City, Okla., have been awarded the contract for the construction of a 30-mile extension of the Clinton, Oklahoma & Western Ry., Guy V. McClure, Chief Engineer, Oklahoma City, from Butler, Okla., up to Washita Valley. The contract includes the grading, 3,000 lin. ft. of bridge work and four new stations.

It has been announced by Jake L. Hamon, Lawton, Okla., that the line of the Lawton-Duncan-Ardmore R. R. Co., which was chartered about a year ago and financed in Philadelphia, Pa., will be completed by June 1, 1913. As proposed the route runs from Lawton through Duncan to Ardmore and ultimately to Denison, Texas.

The Chicago, Rock Island & Pacific Ry., J. B. Berry, Chief Engineer, Chicago, Ill., is reported to be planning to begin work at Ardmore early in June on an extension to Waurika. It is understood that the segregated right of way which the Frisco has across Carter and Jefferson counties has been purchased by the Rock Island, and that the Frisco and the Rock Island will use the tracks of the new road jointly between Ardmore and Waurika and between Waurika and Lawton. The Rock Island can build and operate the line under an old charter granted before statehood and will not be forced to domesticate in order to build the line.

Oregon.

⊙The Utah Construction Co., Ogden, Utah, has awarded a sub-contract to the Banks Bros. Construction Co., Salt Lake City, Utah, for tunneling at Mile Post 56 and grading roadbed at that point on the Oregon Eastern R. R.

A company has been organized by capitalists of Milwaukee, Wis., for the purpose of building an electric railroad from Cottage Grove to the Lorane Valley, 10 miles west. Jesse Darling, Milwaukee, Wis., is the promoter. Interested with him are E. J. Comstock, Milwaukee, and J. M. Comstock of Spokane, Wash.

Fuller & Co., Portland, Ore., who have a sub-contract from Twohy Bros., Portland, for grading about 18 miles of the Willamette Pacific Line of the Southern Pacific, beginning at Eugene, have about 200 men at work clearing the right of way and taking out small cuts with teams. As soon as the weather settles steam shovels will be put at work. The Twohy contract covers the first 23 miles of the line, and these contractors are now working about 200 men at the 2,360-ft. tunnel at Noti Pass.

Pennsylvania.

Contractors have been going over the Sunbury Division of the Pennsylvania R. R., preparatory to submitting bids on double-tracking the line between Sunbury and Honeypot.

The Borough of Bentleyville has granted a franchise through that place to the West Side Electric Street Ry Co. of Charlevoi. The company proposes to begin work shortly on this new 9-mile line.

The Pennsylvania R. R. is going ahead with the preliminary arrangements for increasing its trackage at the Broad St. station in Philadelphia. The company has served notice on tenants of its properties on the north side of Fil bert St. between 15th and 17th to vacate withi 30 days. When these properties have bee razed, space will be provided for an extensio of the railroad's elevated trackage over Fil bert St. to Cuthbert St. This extension wi consist, it is understood, of four additiona tracks which will be built around "island plat forms." While no definite announcement ha been made regarding the company's plans, it i generally believed that those tracks will be th first electrified, and that they will be use mainly for trains in suburban service. Fo some time the Pennsylvania R. R. has bee planning for the electrification of its suburba lines, and to that end it has been constructin new bridges along the Germantown and Chest nut Hill branch.

The Johnston & Altoona Electric Ry. C will probably start work in the early sprin on its projected 34-mile line. Geo. U. C Holman, Suppes Bldg., Johnston, Pa., is Chie Engineer.

Tennessee.

Construction work will be started abo March 15 on the subways under railroa tracks at Main and S. Third Sts., and th I. C. R. R. tracks at Carolina Ave. at Mem phis, Tenn. Work will also be started on th N. C. & St. L. R. R. subway at Carolina Av The drainage work for the N. C. & St. L. sub way will be started March 1. J. H. Weather ford is City Engineer of Memphis.

The Nashville, Chattanooga & St. Louis Ry H. McDonald, Chief Engineer, Nashvill Tenn., has acquired 35 acres of land at Be claire, near the end of Summer Av., at Mem phis, which will be added to its other pro erty there and converted into track yards. Th company has plans made for the new yard They call for roundhouses and machine shop of sufficient size to handle the repair work o this division. About $100,000 will be expende

Texas.

✣Bids will be received until 3 p. m., Marc 6, by State Commission in Lunacy, Capito Albany, N. Y., for electric railway consistin of the construction of the roadbed with a necessary sub-structures, furnishing and plac ing the ballast and track complete, but n including electrical equipment, at Mohansi State Hospital, Yorktown, N. Y. Drawing and specifications may be consulted and blan forms of proposal obtained at the Mohansi State Hospital, Yorktown, N. Y., at the offic of the State Commission in Lunacy, No. Madison Ave., New York City, and at th office of the State Architect. Complete se of plans and specifications will be furnishe to prospective bidders upon reasonable notic to the State Architect, Franklin B. Ware, A bany, N. Y., and upon the payment of a de posit of $25. T. E. McGarr is Secretary c the Commission.

⊙P. M. Johnston & Son, 620 Binz Bldg Houston, Tex., have been awarded the co tract for the second section of the Stone Cit Giddings line of the Houston & Texas Ce tral R. R. This section extends from th East Yegua River to Caldwell, Tex., and i volves about 275,000 cu. yds. of excavation.

The citizens of Weatherford, Tex., have a cepted the proposition of the Gulf, Texas Western Ry., B. B. Cain, General Manage Dallas, for the extension from Jacksboro t Weatherford and have appointed a committe to raise a $150,000 bonus.

The Pecos Valley Southern Ry., L. W. A derson, Chief Engineer, Pecos, Tex., is to p an engineering party in the field shortly t make surveys for an extension from Pecos.

The improvements proposed by the Mi souri, Kansas & Texas Ry. S. B. Fishe Chief Engineer, St. Louis, Mo., for East Wac mentioned in our January 7 issue, will includ the construction of shops, round house, tur tables, water purification plant, etc. Abo $300,000 will be expended; actual constructio work will be started shortly.

Maj. Earl I. Brown, U. S. Engineer, Ga veston, Tex., has been authorized by the Go ernment to have a spur track built fro Downs Station to the site of the lock and da

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ly under construction below Waco. The r will be about three miles long.

The Stephenville, North & South Texas Ry., J. M. Killian, General Manager, Stephenville, Tex., is understood to have completed financial arrangements for its proposed new construction work. It is believed that the new construction will start at Commanche and extend northwest with Sweetwater as the objective point.

The Missouri, Kansas & Texas Ry., A. M. heson, Chief Engineer, Dallas, is reported to have decided to construct a 30-mile line between Austin and San Marcos, to take the place of the stretch of International & Great Northern Ry., which it has been using under a lease contract. This lease contract was terminated recently, but it was understood that negotiations were under way for renewing it.

The Greenville & Whitewright Northern action Co. has been chartered and proposes to construct an electric railway through Hunt, Collin and Grayson counties, the principal points touched being Greenville and Merit, nt County; Blue Ridge and Westminster, Collin County, and Whitewright. The corporation has a capital stock of $210,000, of which one-half has been subscribed and 15 per cent paid in. The incorporators and first year directors are: A. R. Nicholson, J. W. Castle-ry, H. A. Barsun, A. W. Defee, J. E. Mor- and W. H. James of Greenville and S. M. kens of Merit.

The Directors of the St. Louis Southwestern Ry., C. D. Purdon Chief Engineer, Tyler, x., have authorized an issue of $100,000,000 first terminal and unifying 5 per cent bonds. special meeting of stockholders has been led for April 17 to authorize the new bond ue, which will be appropriated for refunding d retirement of certain underlying bonds d equipment obligations and the acquisition valuable terminals at St. Louis, Grays Point d Fort Worth. The initial allotment of this nd issue will be for $7,500,000. Part of the ue will be devoted to the purchase of new uipment, to the construction of branch lines d extensions and other works for permanent provement of the property.

The Texas & Pacific Ry., C. H. Chamberin, Chief Engineer, Dallas, Tex., has plans der consideration for a considerable amount improvement work in the way of extenions and repairs between Marshall and Fort orth in the near future. New steel and bal-t will be laid and in many places the sidings ll be improved and new passing tracks put and the entire line double-tracked between llas and Fort Worth.

Construction work is progressing rapidly on e extension of the San Benito & Rio Grande ilroad from a point on the loop of that ad to Santa Maria, an old Mexican town miles up the Rio Grande Valley. According to an announcement reported to have been ide by Sam T. Robertson, San Benito, Tex., 10 is constructing the line, work will be mpleted early in March and motor cars erated over the road.

A mass meeting of citizens was recently held Weatherford to discuss the proposed exnsion of the Gulf, Texas & Western Railay from Jacksboro, Texas, to a connection th Weatherford. A committee was appinted to raise a bonus of $15,000 and over lf of the amount was subscribed immediely. B. B. Cain, Dallas, Texas, is vice esident and general manager of the railroad.

At a recent meeting with the business men Beeville, Texas., A. L. Matlock, San Antonio, general counsel and vice president of e San Antonio, Rockport & Mexican Ry., ade a tentative offer to build the proposed ne through that city. A committee was appinted to raise the necessary bonus and Mr. atlock assured the citizens that work would started about the first of August. The ute as projected will be from either San ngelo or San Antonio, through Crowther, eeville and Refugio on to Rockport and on Harbor Island.

It has been announced that the Railway ommission of Texas has permitted the ephenville, North & South Texas Railway Co. to issue bonds amounting to $658,000 and that construction work on the proposed extension from Comanche northwest, toward Sweetwater, Texas, will be started at once. J. M. Killian, Stephenville, Texas, is vice president of the company.

Advices from Floydada, Texas, state that a deal has been made at that place for the extension of the Quanah, Acme and Pacific Ry. from Paducah, the present Southwestern terminus, to Floydada, county seat of Floyd County, and that the road will extend from Floydada to the Pecos Valley. Efforts are being made in Pecos to secure the line. This city has offered a large bonus to Sam Lazarus, St. Louis, Mo., president, to bring the road here, where, it is suggested, trackage arrangements could be made with the Texas and Pacific to enter El Paso.

H. G. Palmer, representative of T. L. Butterfield & Co., Chicago, Ill., recently visited Vernon, Texas, to investigate the outlook for the construction of a railroad from that city to Crowell. The proposition was taken up with the Business League.

Utah.

The construction of a street railway from the depot in Provo along Fourth South St. to the mouth of Slate canyon, and the building of a hotel on Maple Flat, on the mountain east of Provo, and the construction of a cog road from the mouth of Slate canyon to the hotel on Maple Flat is under consideration. As a preliminary to this work the Duchesne Construction Co., of Provo, has been incorporated with a capital stock of $25,000, its officers being Samuel H. Wood, President; H. H. Wood, Vice-President, and S. G. Pollock, Secretary.

Vermont.

In connection with its extensive construction program for New England the Grand Trunk Ry. is understood to be planning the double tracking of 140 miles of the Central Vermont Ry. It is probable, however, that this work will not be undertaken for some little time.

Virginia.

The Norfolk & Western Ry., C. S. Churchill, Chief Engineer, Roanoke, Va., is understood to be planning to dispose of $14,000,000 of convertible bonds, the entire proceeds to be used for betterment work. This work will probably include the building of a second track on the east end of the line and the erection of another steel pier and coal docks at Sewells Point, Va. It is proposed to double-track 45 miles of the road on the east end through Virginia this season. The line is now double-tracked between Columbus, O., and Phoebe, Va., a station east of Lynchburg.

The Norfolk & Western Ry., C. S. Churchill, Chief Engineer, Roanoke, Va., has surveys under way east of Lynchburg for the proposed double-tracking of its line between that city and Norfolk. This work will cost something like $4,000,000.

The Norfolk & Western Ry. is to lay the following additional track this year: 3.3 miles, constituting a third track, between Norfolk and Lambert's Point, 16.4 miles of second track between Gilmerton and Suffolk; 11 miles of second track between Nottoway and Burkville, and 13.2 miles of second track between Evergreen and Phoebe. Nearly all of this work will be carried out by the company's forces.

The Richmond & Northern Neck Ry. Co. has completed surveys and has practically secured all right of way for its projected railroad between Doswell, the junction of the Chesapeake & Ohio, and Richmond, Fredericksburg & Potomac Roads, and the mouth of the Wicomico River, in Northumberland County. It is believed that construction work will be started at an early date. Channing M. Ward, Chicago, Ill., is the promoter. Tazewell M. Carrington, President of the Chamber of Commerce of Richmond, Va., is a director.

It is understood that the Carolina, Clinchfield & Ohio Ry., Ward Crosby, Chief Engineer, Johnson City, Tenn., has secured the necessary funds for the completion of its line from the present northern terminus at Dante, W. Va., to Elkhorn City, Va., and the extension of the line from its southern terminus at Spartansburg, S. C., to Charleston, S. C. It is understood that the work on the northern extension of the C., C. & O. will be begun early next spring. The contracts for this work will be let soon. It is a distance of nearly forty miles between Dante and Elkhorn City. According to present plans there will be about twenty different contracts let for this proposed stretch of road. The section traversed by the proposed extension is mountainous. The cost of building will be enormous. The purpose of the plan to let these contracts for two miles each is to expedite the work of construction. It is reported that the contract for the construction of the steel piers and coal docks at Charleston harbor has been let and that work will be begun in the spring. The erection of coal docks and piers at Charleston and the building of the extension from Dante to Elkhorn City are only a part of the construction plans of the C., C. & O. which are to be carried out at once. From Columbia, S. C., to Charleston the C., C. & O. already has a right of way and the grade thrown up ready for the laying of steel. This connecting link will be about 150 miles in length. It is understood steel laying on this stretch of proposed roadway will also be begun in the spring. The construction of this stretch will cost much less, probably, and be more easily accomplished than will the construction of the northern extension from Dante to Elkhorn city. The grading on the road between Columbia and Charleston was completed six months ago. At that time all construction work on the Carolina, Clinchfield & Ohio was discontinued.

The Atlantic Coast Line Railroad, according to advices from Stony Creek, Va., is rapidly completing the double track work. For some time the company has had a double track from Richmond to Petersburg and in the last year the part from Weldon, N. C., south has been completed so that all that remained to be done was the piece from Petersburg to Weldon. The contract for the building the bridges in this place has been let to Davis, Williams & Company, and the work is nearing completion. The bridge at Stony Creek will be about 30 ft. longer than the old one and the bed of the creek widened by this much the object in widening the creek being to prevent overflow by giving more waterway. On account of this increase in the length of the bridge at Stony Creek it is the largest of the undertakings and it is expected that when this is finished that the double-tracking will be completed in a short time.

Washington.

Interests represented by Sanderson & Porter, engineers, New York, who have recently completed the interurban railway system between Raymond and South Bend, have taken over the franchise and property of the South Bend-Raymond Electric Co. The consideration was $100,000, and the affairs of the old company passed into the hands of the Willapa Harbor Ry. Co.

According to advices from Seattle, Wash., grading on the Lake Union Belt Line, contract for the first section of which has been let to the Weymouth Construction Co., is progressing rapidly, and will be completed as far as the first section extends by the middle of April. The work included in the contract extends from Third ave. west and Aetna st., near Ross, to Boren ave. and Valley st., one block east of the Brace-Hergert Mill. The distance is 10,933 ft.—a little more than two miles. The first 1,800 ft. of this distance is over the ground; it is on this part that the grading already is over three-fourths completed. Besides this 1,800 feet of grading there is a 554-section of piling between Ross and Fremont Bridge, which is completed. From the Fremont Bridge to the southern and eastern end of the spur is a distance of 8,579 ft., all of which, save for a block or two between the Brace-Hergert Mill and the end, will be built on piles. In the construction of the supporting [illegible] of piling will be used, each "bent" being composed of five piles, making the total number to be used in that portion of the line, 3,050. Timber to the amount of 2,000,000 feet will be required. From Third ave. north and Etruria st., where the belt line will cross under the Fremont Bridge, it will follow closely along the shore of Lake Union, paralleling the tracks of the Seattle Electric Company on Westlake Ave. Westlake Ave. already is about two-thirds filled, affording room enough for the street car tracks and for the driveway inside, but not sufficient room for the railroad. In the course of time that part of the avenue between the street car tracks and the railroad will be filled, so that the road then will rest upon the same solid foundation as the tracks of the trolley lines. With the filling in of lots now out in the lake will come additional space which may be utilized for sidetracks, coal sheds and warehouses.

Wisconsin.

The Chicago & Lake Superior Ry., B. L Delameter, President, Cambridge, Wis., operating a 3-mile steam line between Cambridge and London, has applied to the State Railroad Commission for a certificate of convenience and necessity to extend its system from Cambridge to Rockdale, a distance of 2½ miles.

City Council of La Crosse, Wis., is considering calling for bids for the construction of a ½ mile spur from the Green Bay & Western R. R. to the site of the new pumping station in Myrich Park. H. W. Mahoney is Secretary of the Water Committee of La Crosse.

The Chicago, St. Paul, Minneapolis & Omaha Ry., C. W. Johnson, Chief Engineer, St. Paul, Minn., has sold the $5,000,000 bond issue mentioned in our last issue, and the proceeds will be used for double-tracking from Eau Claire to Hudson, a distance of 60 miles.

The Chicago & Wisconsin Valley R. R. Co., projecting 276 miles of line between Janesville and Merrill, Wis., has completed surveys for that portion of its line between Madison and Merrill. The Western Indiana Construction Co., Chicago, Ill., has the general contract for constructing the road; sub-contractswill be let during March and April. George S. Foster, Madison, Wis., is Chief Engineer, a Allen T. Russell, 1702 Fisher Bldg., Chicag Ill., is President.

Canada.

⦿The Canadian Government has award the contract for the development of the Gra Trunk Pacific terminals in Courtenay Bay, John, to Norton Griffiths Co., London En land. The contract involves an expenditure $7,500,000 for the construction of the te minals within five years. The late Gover ment called for tenders some time ago. noted in these columns.

Mexico.

The Mexican Government has granted concession to Vicente Mistretta, City of Me ico, for the construction of a railway from t Port of Frontera, along the Rio Seco, throu the state of Tabasco, toward the boundary Chiapas. The preliminary surveys for tl railway have been made, and the location su veys will be commenced within 60 days. T concessionaires have five years' time to co plete the line.

ROADS, STREETS AND PAVEMENTS

Arkansas.

The City Council of Arkansas City, Ark., has ordered the paving of Summit St. and Fifth Ave. with vitrified brick. Summit will be paved from Birch Ave. on the north to the canal on the south and Fifth Ave. from the Santa Fe depot on the east to the canal on the west.

Plans are being prepared by City Engineer Merle H. Reed of Fort Smith, Ark., for the construction of about 33,000 sq. yds. of pavement at an estimated cost of $40,000 to $60,000. The work will require the removal of the old pavement, repairing of the present concrete foundation and straightening of stone curb. The contract will probably be let by April 1. Roy M. Johnston is Secretary of the Improvement Board of Paving District No. 7, in which district the improvement will be made.

California.

✣Bids will be received 11 a. m. until noon, Feb. 26, by Frank R. Thompson, City Clerk, Oakland, Calif., for the construction of a 6-ft. wide cement sidewalk on both sides of 21st Ave. from East 14th St. to East 30th St.

⦿The Board of Trustees of Coronado, Calif., has awarded the contracts for the grading and paving of five streets to H. G. Fenton as follows: Alameda, Glorietta, G and Encino Sts., 30 cts. per cu. yd., for excavation, 30 cts. for embankment, and 10 cts. per sq. yd. for paving; Third St., 30 cts. for excavation, 10 cts. for embankment and 6½ cts. per sq. yd. for paving. The latter street will be paved with gravel, while the other four will be paved under the petrolithic system.

Colorado.

Commissioner Charles A. Lannon of the department of highways, Pueblo, Colo., has estimated that it will cost $18,000 to put through the Grand Ave. extension from its present termination at Union Ave., to Central Main St.

Florida.

✣Bids will be received until 10 a. m., March 15, by C. W. Ellis, Chairman, Board of County Commissioners, Jacksonville, Fla., for paving Lake Shore Blvd., from Orange Park Road to Middleburg Road. Gail L. Barnard is County Engineer.

✣Bids will be received until 10 a. m., March 15, by Board of Duval County Commissioners, Jacksonville, Fla., for grading and paving Davis St. from the city limits to Lem Turner Road. C. W. Ellis is Chairman of the Board. Gail L. Barnard is County Engineer.

Georgia.

⦿The City Council of Barnesville, Ga., has let the contract for the grading and paving of streets, also curbing and laying sidewalks, to the J. B. McCrary Co., of Atlanta, Ga. The work will cost approximately $30,000.

⦿Following contracts have been awarded by the street committee of the City Council, Atlanta, Ga., for street work during the year: Jamison & Hallowell, for tile paving, $0.92 a sq. yd.; for sheet cement paving, $1.10 a sq. yd.; for concrete curb, $0.29 a lin. ft.; for tile sidewalk repairs, $0.99 a sq. yd.; for sheet cement repairs, $1.24 a sq. yd. A. T. Newsome, for granite curb, $0.36¾ a lin. ft. Southern Tile and Stone Co., for brick sidewalks, 62 cts. a sq. yd. R. O. Campbell, for cement, $1.11 a barrel. Rockmart Brick and Slate Co., for brick for repairs $6.60 per thousand, f. o. b. Atlanta. By the Cement Stone and Tile Co., for tile repair, $0.12½ per tile. By the Pine Mountain Granite Co., for stone, $0.73 a ton for one man rubble; No. 1 rubble, $1; No. 2 rubble, $1.15; for run of stone, $1.05.

Illinois.

✣Bids will be received until 1:30 p. m, Feb. 28, by Board of Local Improvements, Monmouth, Ill., for $5,333 sq. yds. of brick pavement on gravel base; 4,181 ft. concrete curb and gutter; also 1,828 cu. yds. of excavation. R. M. Ferguson is City Engineer.

✣Bids will be received by the town of Cicero until 8 p. m., Feb. 26, for furnishing all labor, tools, material, etc. necessary to pave S. 52d Ave. from 12th St. to 16th St. with a brick pavement on a macadam foundation, and constructing a macadam pavement on 52d Ave. from 26th St. to 33d St. Cash or certified check made out to the Board of Local Improvements, Cicero, Ill., must accompany proposal, equal to 10 per cent of total bid. Jno. J. Forrest is secretary of the board.

Petitions have been circulated in Pigeon Grove Township, Iroquois County, Ill., asking the construction of two miles of paved roads leading into Cissna Park, the two main roads leading into the village. Watseka is the county seat.

The Board of Local Improvements of Peoria, Ill., has approved three ordinances for the paving of as many streets, to-wit: Knoxville Ave., from Illinois Ave., to the north city limits; North Monroe St., from Cornhill to Abingdon, and Frye Ave., from Knoxville to Wisconsin. Leonard D. Jeffries, City Engineer, has presented an estimate for the paving of East California Ave., from Ravine Ave., to connect with Frye Ave.

The City Commissioners of Ottawa, Ill., have been petitioned by property owners for the paving of the following streets: Main st., from the lateral canal to Fisher st.; We ster st., from Fillmore st. to Harden st.; Il nois ave., from Fillmore st. to Leland st.; O tawa ave., from Clay st. to Leland st.; Fi more st., from Madison st. to Illinois ave Clay st., from Madison st. to Ottawa ave Benton st., from Webster st. to Illinois ave Buchanan st., from Madison st. to Webst st.; Bissell st., from Madison st. to Main s and from Webster st. to Illinois ave.; Tayl st., from Main st. to Ottowa ave.; Hard st., from Madison st. to Illinois ave.; Lelar st., from Madison st. to Ottawa ave.: Fish st., from Madison st. to Main st.

The Board of Local Improvements Joliet, Ill., Wm. S. Welch, Secy., has adopt the supplementary resolution and estimate the cost of the proposed pavement in Sherma St. The pavement will be of bituminous co crete and will cost approximately $0.90 per s yd. H. A. Stevens is City Engineer.

The Board of Local Improvements of Ste ling, Ill., has adopted resolutions providi for the paving of Second Ave., from Thi St., to the city limits, East Fourth St., fro First Ave., east and around Central Park, tl alleys in Blocks 27 and 28, East Eighth S from Locust to Third Ave., the alleys in Blo 39, Avenue B from Fourth St., and Aven D, from Seventh to 10th St.

Central Township, Bond County, Ill., w submit to the voters at the April election tw propositions for the construction of ha roads. Greenville is the county seat.

The City Council of Decatur, Ill., has aba doned the proposed paving of Orchard S estimated to cost $12,799. R. L. McCalman City Engineer.

Some plans have been completed by Ci Engineer E. F. Harper of East St. Louis, Il for the construction of 259,679 sq. yds. brick pavement in that city, at an estimat cost of $467,500, not including grading a curb. The pavement will be laid on a co crete foundation with cement filler and w have sandstone, granite and limestone curb The contracts will be let between March a July

Following is the low bid submitted to E. McGann, commissioner of public work Chicago, Ill., for furnishing to the Bureau Streets approximately 800,000 paving brick, a cording to specifications: Garden City San Co., 133 W. Washington St., $14.10 per M Bids opened Jan. 25.

Following is the low bid submitted to L. McGann, commissioner of public works, Ch cago, Ill., for furnishing and delivering to th Bureau of Streets approximately 100,000 gal of road oil: Indiana Refining Co., 122 Michigan Ave., 3 cts. per gal., specific gravit

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

2 Baume, 3.1 cts. per [illegible] Baume. s opened Jan. 25.

'ollowing is the low bid submitted to L. E. Gann, commissioner of public works, Chi- o, Ill., for furnishing approximately 5,000 s. of gasoline for use of steam rollers: ndard Oil Co., 72 W. Adams St., 9½ cts. gal. Bids opened Jan. 25.

'ollowing is the low bid submitted to L. E. Gann, commissioner of public works, Chi- o, Ill., for furnisihng and delivering to the eau of Streets at the various ward yards n gravel not over ½ in. in. size: Mc- ghlin Building Material Co., 9 S. La Salle $1.59 per cu. yd. Bids opened Jan. 25th.

ollowing is the low bid submitted to L. E. Gann, commissioner of public works, Chi- o, Ill., for furnishing and delivering to the eau of Streets in tar wagons approximate- 0,000 gals. of paving pitch, the same to be direct result of the distillation of straight coal tar: Barrett Manufacturing Co., 38 Dearborn St., $0.05 per gal.

ollowing is the low bid submitted to L. E. Gann, commissioner of public works, Chi- o, Ill., for furnishing and delivering to Bureau of Streets bank sand as specified: den City Sand Co., 9 S. La Salle St., $0.99 [illegible] Bids opened Jan. [illegible]

Idaho.

ids were received by the Board of Public rks of Bois, Ida., on Feb. 2, for the lay- of pavement in Paving District No. 17, n the following firms: Story Murphy, se, (1); C. P. Madsen, Boise, (2); Bid- , Hayden & Co., Portland, Ore., (3; Con- lated Construction Co., Salt Lake City, h, (4); Inland Hassam Paving Co., Port- , Ore., (5); Strange & Maguire, Salt e City, Utah, (6); Cleveland Trinidad ing Co., Cleveland, O., (7); Rackliff Gib- Construction Co., St. Joseph, Mo., (8); irch & Sons, Fargo, N. Dak., (9); Warren struction Co., Portland, Ore., (10); Gillis struction Co., Salt Lake City, Utah, (11); Green & Co., Chicago, Ill., (12); Giebisch in Co., Portland, Ore., (13); Keasal Con- ction Co., Tacoma, Wash., (14); Slick s. Construction Co., Boise, (15); R. S. ne & Co., Chicago, Ill., (16): Barber As- t Paving Co., Seattle, Wash., (17); Oregon pendent Paving Co., Portland, Ore., (18); . Heman, St. Louis, Mo., (19); P. J. Mc- h, Seattle, Wash., (20), and the Western ing Co., Oklahoma City, Okla., (21). The k will include, besides the pavement, 300 age catch basins, 380,412 lbs. gutter plates, lin. ft. of sidewalks, 11,826 lin ft. of , 70.356 sq. yds., of concrete curb gutters, 10 sq. yds. of street car pavement with- base, and the same amount with con- base. The itemized bids on the different es of pavement follows:

DOLARWAY

(6-in. concrete foundation.)

	(1)
[illegible] cu. yds.	$1.00
ithout guarantee, 240,643 sq. yds.	1.75
th [illegible] sq. yds.	1.85

VITRIFIED BRICK.

(4-in. concrete, 2-in. sand cushion.)

	(4)
[illegible] ....110,543 cu. yds.	$0.70
thout guarantee .. ....310,998 sq. yds.	2.95
th [illegible] ....310,998 sq. yds.	3.25

GRANOCRETE.

(6-in. pavement.)

	(13)	(16)
[illegible] cu. yds.	$0.70	$0.65
thout guarantee.310,998 sq. yds.	1.40	1.69
th guarantee....310,998 sq. yds.	1.48	1.69

HASSAM.

	(5)
vation, 6-in. pavement, 76,333 cu. yds.	$0.65
vation, 5-in. pavement, 68,040 cu. yds.	.65
thick, no guarantee, 310,998 sq. yds..	1.70
[illegible] with guarantee, 310,998 sq. yds.	[illegible]
thick, no guarantee, 310,998 sq. yds..	1.51
thick, with guarantee, 310,998 sq. yds.	1.51½

Indiana.

✣Bids will be received until April 1, it is reported, by Board of County Commissioners, South Bend, for the Edwardsburg road improvements.

✣Bids will be received until 10 a. m., Feb. 28, by Department of Public Works, South Bend, Ind., for paving Portage Ave., from the C. I. & S. Railroad viaduct to first alley north of Kinyon St. A. P. Perley is Clerk.

✣Bids will be received until 10 a. m., March 11, by Board of Marion County Commissioners, Indianapolis, Ind., for the furnishing of 210 car loads of crushed stone for Marion county highways and 40,000 gals. of tarvia binder or equal, machine to be loaned to county to apply same.

✣Bids will be received until 10 a. m., March 4, by Board of Public Works, Indianapolis, Ind., for the improvement of the following streets; Jefferson ave., from the n. property line of Michigan st. to the s. property line of Tenth St., by grading and paving the roadway. Pennsylvania St., from the n. property line of Twenty-eighth St., to n. property line of Twenty-seventh st., by grading and paving the roadway.

✣Bids will be received until 10 a. m., March 1, by Board of Public Works, Indianapolis, Ind., for the improvement for the following streets: Ruckle St., from the n. property line of Thirtieth St., to the n. property line of Third-third St., by grading and paving the roadway; Emmett St., or first alley n. of North St., from w. property line of Alabama St., to e. property line of Hudson St., by grading and paving the roadway; Wallace St., from the n. property line of Washington St., to the s. property line of New York St., by grading and paving the roadway.

✣Bids will be received until 10 a. m., March March 5, by Board of Cass County Commissioners, Logansport, Ind., for the construction of two gravel roads in Miami township, macadamized road in Eel township and gravel road in Clinton township. J. E. Wallace is County Auditor.

✣Bids will be received until 10 a. m., March 7, by Board of Randolph County Commissioners, Winchester, Ind., for the improvement of 12 public highways. Henry F. Wood is County Auditor.

✣Bids will be received until 10 a. m., March 7, by Board of Shelby County Commissioners, Shelbyville, Ind., for the construction of two highways in Noble township. Frank W. Fagel is County Auditor.

✣Bids will be received until 10 a. m., March 7, by Board of Huntington County Commissioners, Huntington, Ind., for the construction of four highways in Warren township. Harold Guthrie is County Auditor.

✣Bids will be received until 10 a. m., March 7, by Board of Gibson County Commissioners, Princeton, Ind., for the construction of a gravel road in Johnson township. William T. Roberts is County Auditor.

✣Bids will be received until noon, March 6, by Board of Lake County Commissioners, Crown Point, Ind., for the construction of four gravel roads in North township. C. A. Johnson is County Auditor.

✣Bids will be received until noon, March 5, by Board of Dearborn County Commissioners, Lawrence, Ind., for the construction of highways in Jackson township. W. S. Fagley is County Auditor.

✣Bids will be received until 10 a. m., March 5, by Board of Grant County Commissioners, Marion, Ind., for the construction of a gravel road in Jefferson township and two macadam roads in Franklin and Center townships. E. H. Kimball is County Auditor.

✣Bids will be received until 2 p. m., March 5, by Board of Monroe County Commissioners, Bloomington, Ind., for the construction of a stone road in Bloomington and Benton townships. Horace Blakely is County Auditor.

✣Bids will be received until 10 a. m., March 5, by Board of Montgomery County Commissioners, Crawfordsville, Ind., for the construction of a highway in Union and Brown townships. Bennett B. Engle is County Auditor.

✣Bids will be received until Noon, March 5, by Board of White County Commissioners, Monticello, Ind., for the construction of a stone road in Jackson township. A. G. Fisher is County Auditor.

✣Bids will be received until 10 a. m., March 11, by Board of Commissioners of Vermillion County, Newport, Ind., for the construction of macadamized roads in Vermillion and Eu-

HASSAMITE.

	(5)
Excavation, [illegible] cu. yds.	$0.65
5-in. concrete base, without guarantee, 240,643 sq. yds.	1.00
5-in. concrete base, with guarantee, 240,643 sq. yds.	1.05
5-in. Hassam base, without guarantee, 240,643 sq. yds.	1.32
5-in. Hassam base, with guarantee, [illegible] sq. yds.	[illegible]

ASPHALT.

(4-in. concrete, 1-in. binder, 1½-in. wearing coat.)

	(4)	(6)	(7)	(8)	(12)	[illegible]	(14)	(17)	(18)	(19)	(20)	(21)
Excavation, 80,480 cu. yds.	$0.70	$0.80	$0.50	$0.60	$0.77	$0.50	$0.55	$0.55	$0.60	$0.34	$0.60	$0.67½
Without guarantee, 240,643 sq. yds.	[illegible]	[illegible]	1.49	[illegible]	1.76	1.70	[illegible]	1.38	1.49	1.47	1.38	1.53
With guarantee, 240,643 sq. yds.	2.25	1.65	1.54	1.43	1.91	[illegible]	1.69	[illegible]	[illegible]	[illegible]	1.40	1.58

ASPHALTIC CONCRETE.

(4-in. broken stone or concrete, 2-in. surface.)

		(4)	(7)	(19)	[illegible]	(21)
Excavation, 76 333 cu. yds.		$0.70	$0.50	$0.34	$0.60	$0.67
Stone base without guarantee	240,643 sq. yds	1.60	1.26	1.37	[illegible]	...
Stone base with guarantee	240,643 sq. yds.	2.25	1.31	1.47	1.00	[illegible]
Concrete base without guarantee	240,643 sq. yds	2.00	1.42	1.54	1.30	1.45
Concrete base with guarantee	240,643 sq. yds.	2.25	1.47	1.64	1.30	1.50

BITULITHIC.

		(6)	(7)	(10)	(17)
Excavation, 6-in. paving	76,333 cu. yds.	$0.80	$0.50	$0.60	$0.55
Excavation, 5 in. paving	68,040 cu. yds.	.80	[illegible]	.60	.55
4-in. stone base, 2-in. top, without guarantee	240,643 sq. yds.	1.90	1.26	1.80	1.71
4-in. stone base, 2-in. top, with guarantee	240,643 sq. yds	2.00	1.31	1.85	1.76
4-in. concrete base, 2-in. top, without guarantee	240,643 sq. yds.	2.10	1.42	[illegible]	1.90
4-in. concrete base, 2-in. top, with guarantee	240,643 sq. yds	2.20	1.47	2.01	1.95
3½-in. stone base, 1½-in. top, [illegible]	[illegible] sq. yds	1.65	1.11	1.53	1.49½
3½-in. stone base, 1½-in. top, with guarantee	240,643 sq. yds.	1.75	1.16	1.58	[illegible]
3½-in. concrete base, 1½-in. top, without guarantee	240,643 sq. yds.	1.81	1.27	1.67	1.64
3½-in. concrete base, 1½-in. top, with guarantee	240,643 sq. yds.	1.91	1.32	1.72	1.69

CONCRETE.

(Cement top.)

		(4)	(5)	(11)	(12)	(13)	(14)	(15)	(19)
Excavation	72,187 cu. yds.	$0.70	$0.65	$0.90	$0.77	$0.50	$0.55	$1.00	$0.34
With cement top without guarantee.	310,998 sq. yds.	1.28	1.21	1.10	1.29	1.22	1.14	1.30	1.10
With cement top with guarantee....	310,998 sq. yds	1.33	1.29	1.25	1.34	1.28	1.30	1.45	1.15

CONCRETE.

(4-in. foundation, 1½-in. sand and cement top.)

	(1)	(2)	(3)	(4)	(5)	[illegible]	[illegible]	[illegible]	(12)	(13)	(14)	(15)	(17)	(19)	(21)
[illegible] . . . 76,333 cu. yds.	$1.00	[illegible]	[illegible]	$0.70	[illegible]	[illegible]	$0.75	$0.90	$0.77	$0.50	$0.55	$1.00	$0.55	$0.34	$0.67½
ithout guarantee . ..310,998 sq. yds.	1.23	1.12½	1.27	.99	1.02	1.03	1.26		[illegible]	1.04	.95	1.15	1.00	.98	1.15
[illegible] .310,998 sq. yds.	1.28	.....	.....	1.04	1.14	1.20	1.31	[illegible]	1.19	1.10		[illegible]	1.10	1.00	1.20

gene townships. H. T. Payne is County Auditor.

✣Bids will be received until 1 p. m., March 5, by Board of Franklin County Commissioners, Brookville, Ind., for the construction of a highway in White Water township. Charles G. Reifel is County Auditor.

✣Bids will be received until 1 p. m., March 4, by Board of Switzerland County Commissioners, Vevay, Ind., for the construction of a highway in Pleasant township. Scott Culbertson is County Auditor.

✣Bids will be received until 10 a. m., March 4, by Board of Martin County Commissioners, Shoals, Ind., for the construction of macadam roads in Perry and Halbert townships. J. T. Morris is County Auditor.

✣Bids will be received until 10 a. m., March 4, by Board of Adams County Commissioners, Decatur, Ind., for the construction of macadamized road in Monroe township. H. S. Michaud is County Auditor.

✣Bids will be received until 1 p. m., March 4, by Board of Warren County Commissioners, Williamsport, Ind., for the construction of a gravel road on line between Pike and Steuben townships. D. H. Moffit is County Auditor.

✣Bids will be received until 2 p. m., March 4, by Board of Crawford County Commissioners, English, Ind., for the construction of a pike road in Ohio township. J. Evan Jones is County Auditor.

✣Bids will be received until 1 p. m., March 4, by Board of Warren County Commissioners, Williamsport, Ind., for the construction of a gravel road in Pike township. David H. Moffit is County Auditor.

⦿The Carrol County Commissioners, Delphi, Ind., have awarded contracts for the construction of roads as follows: Macadam road in Deer Creek Township to James F. Pierce, Delphi, at $13,900; gravel road in Burlington Township to Beal & Bell of Logansport, Ind., at $13,230; gravel road in Jefferson Township to Holoway & Misner, Monticello, Ind., $3,600.

⦿The contract for a stone road in Big Creek Township, White County, Ind., has been awarded by the Board of Commissioners, Monticello, to J. W. Moneyham of Monon, Ind., for $8,938.

⦿Chas. Kain of Medaryville, Ind., has been awarded the contract by the Board of Jackson County Commissioners, Brownstown, Ind., for a macadam road to be constructed in Wheatfield Township. The contract price is $25,999

⦿The Board of Knox County Commissioners, Vincennes, Ind., has awarded contracts as follows for road work: Watts Bond road in Buskron Township to C. F. Wolf for $1,350; Henry Paden road to J. H. Blackwood for $3,333; John E. Page road to Abe Hart for $3,398; J. Brazelton road to D. C. Rogers & Co., for $7,495.

⦿Charles Kain of Medaryville, Ind., has been awarded the contract by the Board of Jasper County Commissioners, Rensselaer, Ind., J. P. Hammond, county auditor, for the macadamizing of a road in Wheatfield township, at $25,999. The road is about 10 miles long. Bids were opened Feb. 6.

⦿Gordon & Sullivan of Summitville, Ind., have been awarded the contract by the County Commissioners of Rush County, Rushville, Ind., Jesse M. Stone, auditor, for the macadamizing of a road in Walker township, for $39,925. Bids were opened Jan. 31.

The City Council of Goshen, Ind., has passed a preliminary resolution for the paving of Pike St., from Fifth St., west to the Elkhart river bridge, for the paving of First St., from Pike St., north to the L. S. & M. S. tracks.

The Blackford County Commissioners, Hartford City, Ind., have accepted the engineer's and viewer's report on the Green road in Harrison Township. The Commissioners have also been petitioned for the following roads: Fleming-Futrell in Washington township; Stroud and Brennan in Harrison Township, and the Blair on the Harrison and Jackson Township line.

Iowa.

✣Bids will be received until March 6 by city clerk, Fairfield, Ia., for approximately 25,000 sq. yds. of pavement, 12,000 lin. ft. curb, 12,000 gutter plates, 600 cu. yds. extra grading. Bids will be received on brick block with asphalt and sand filler, creosoted block, sheet asphalt, asphaltic concrete pavements and on natural stone cement and combined curb and gutter. Material will be selected after bids are received. A certified check for $1,500 must be filed with each bid. Hall & Adams, Centerville, Ia., are engineers.

⦿Dunnegan & Hamilton of Shenandoah, Ia., have been awarded the contract by the City Council of Corning, Ia., for the construction of 14,000 sq. yds. of brick block pavement, 450 sq. yds. of alley paving cement, 11,500 ft. of curb and gutter, for $1.84 per yd. Bids were opened Feb. 13 by William C. Chubb, city clerk.

⦿The City Council of Eldora, Ia., has awarded the contract for 22 blocks of concrete paving to J. S. McLaughlin & Sons of Red Oak, Ia., at $1.23 per yd., and $0.35 per lin. ft., for curbing. The specifications call for a 5-in. base, with a 2-in. topping.

Following low bids were received by the Board of Public Works of Davenport, Ia., for paving work: Myrtle St., between Hamilton and Seventh; Hubbell Construction Co., excavation, $0.38 per cu. yd.; concrete paving, $1 per sq. yd.; cement curb, $0.30 per lin. ft. Myrtle st., between 13th and 15th Sts.; Hubbel Construction Co., excavation, $0.38 per cu. yd.; concrete paving, $1.05 per sq. yd.; cement curb, $0.30 per lin. ft. College Ave., between Fulton Ave., and Valley St.; Hubbell Construction Co., excavation, $0.38 per cu. yd. concrete paving, $1.09 per sq. yd.; cement curb, $0.30 per lin. ft. Rusholme St., between Rock Island and Iowa Sts.; McCarthy Improvement Co., excavation, $0.45 per cu. yd.; asphalt paving, $1.89 per sq. yd.; combined curb and gutter, $0.66 per lin. ft. 15th st., between Warren and Marquette; McCarthy Improvement Co., excavation, $0.45 per cu. yd.; asphalt paving $1.90 per sq. yd.; combined curb and gutter, $0.66 per lin. ft. Oneida Ave., between East River and Fulton Sts; Independent Construction Co.; excavation, $0.75 per cu. yd.; brick paving, $1.67 per sq. yd.; cement curbing, $0.35 per lin. ft. Rusholme St., between Iowa and Farnam St.. Hydraulic Concrete Construction Co., excavation, $0.40 per cu. yd., brick paving, $1.69 per sq. yd.; cement curbing, $0.33 per lin. ft. Ripley St., between 9th and 12th Sts. Independent Construction Co.: Excavation, $0.35 per cu. yd.; brick paving, $1.69 per sq. yd.; cement curb, $0.35 per lin. ft.

The City Council of Carroll, Ia., has received bids from 13 firms for the paving of 12 blocks of streets in that city. M. Ford of Cedar Rapids, submitted the lowest bid on bitulithic pavement; Coon & Bridgen of Boone, Ia., on brick, and the National Roofing Co., of Omaha, Nebr., on creosoted wood blocks. The improvement will cost approximately $60,000.

Kansas.

Plans have been prepared by City Engineer A. D. Stivers, Reporter Bldg., Independence, Kans., for the construction of 15 blocks of brick or brick block pavement in that city at an estimated cost of $57,000. The pavement is to be laid on a 6-in. macadam foundation with asphalt filler and will require 10,000 cu. yds. of excavation and 12,000 ft. of concrete combined curb and gutter. The date for the letting of contract has not been decided upon.

Kentucky.

⦿The Board of Public Works of Louisville, Ky., has let the contract for the construction of vitrified brick paving on Ninth St., from Magnolia to Hill Sts., to G. W. Gosnell for $1.75 per sq. yd., and the contracts for the paving of Oak St., from 18th to 26th Sts., and St. Xavier, from 20th to 21st St., to L. R. Figg & Co., at $1.76 and $1.80 respectively. These contracts amount to approximately $40,000.

The city of Guthrie, Ky., contemplates extensive improvements in the way of concrete sidewalks and the construction fo some three miles of rock roads. A. A. Van Winkle, Guthrie, is Engineer.

Louisiana.

✣Bids will be received until 11 a. m., March 14, by Clerk, Police Jury, Caddo Parish Shreveport, La., for grading, draining anc macadamizing or graveling 25 miles of road J. T. Bullen is Parish Engineer.

✣Bids will be received until noon, March 12, by mayor, Bastrop, La., for the construction of concrete sidewalks at that place. A certified check for $500 must be filed with each bid.

Maryland.

⦿The Board of Awards, Baltimore, Md., ha awarded a contract to A. C. Bedford of Richmond, Va., for supplying the city engineer' department with 100,000 belgian blocks, to b used in repairing the streets of the city befor June. The contract price is $57.50 per 1.000.

A delegation from Baltimore Count brought to Annapolis, Md., a new road loa for that county to replace the one recentl adjudged unconstitutional. It provides for bond issue of $1,500,000 to be divided equall among the 15 districts of the county, $20,00 of each county's portion to be expended eac year. James Rittenhouse, Asa B. Gardine Noah Offutt, John S. Ensor and Thomas B Todd are named as commissioners and Engineer Henry G. Shirley is retained as engineer.

The Paving Commission of Baltimore, Md R. Keith Compton, Chairman, has approve specifications for $368,000 of paving contract in different sections of the city, in additio to those for which bids were opened Feb. 14 Bituminuous concrete is to be placed in competition with sheet asphalt. Bids are also t be asked on streets to be improved with vitrified brick blocks and granite blocks. Street to be improved under these contracts are Lanvale, from Ensor to Broadway; Lafayett Ave., from Aisquith to Broadway; Olive from Ensor to Lamont; Valley, from Hoffma to Chase; Ensor, from Chase to Lamont Eden, from Madison to Lanvale; Collingto Ave., from Ashland Ave. to Orleans; Montford Ave., from Baltimore St. to McElderry Milton Ave., from Baltimore St. to McE derry; McElderry, from Duncan to Milton Pine, from German to Saratoga; Chester, fro Lombard to Baltimore; Lombard, from Che ter to Patterson Park Ave. Bids call for she asphalt on cobblestone or bituminous concret on cobblestones. Following are to be pave with sheet asphalt on cobble or sheet aspha on concrete: Caroline St., from Oliver North Ave.; Caroline, from Hoffman t Chase; Lombard, from Fremont Ave. to Paca Penn, from Pratt to German; Green, fro Lombard to Baltimore. Preston, between Va ley and Gay St., and Hollins St., west of Fr mont Ave., are to be paved with vitrifie blocks on concrete; Sharp St., between Camden and Hill Sts., and Oliver St., betwee Mount Royal Ave. and the alley west of Mar land Ave. are to be paved with granite block on concrete.

Bids were received by the Board Awards of Baltimore, Md., on Feb. 14 from firms for about $400,000 worth of street in provement contracts under plans of the Pa ing Commission. Among the low bidders the different classes of pavement were: Eld Paving & Construction Co., Patrick Flaniga & Sons and the Filbert Paving & Constructi Co. The contracts for the work will probab be awarded Feb. 21. The streets to be pave are: With sheet asphalt, under Contract No —Biddle St., from Jones' Falls to Bond St Aisquith St., from Harford Road to Nor Ave.; Harford Road, from Ensor St. to Ol ver, and Bond st., from Biddle St. to Nor Ave. Total, 57,156 sq. yds. With sheet aspha under Contract No. 7—Eager St., from Broa way to Chester St.; Madison St., from Broa way to Patterson Park Ave.; Jefferson S from Aisquith St. to Broadway; Jefferson S from Wolfe St. to Patterson Park Ave.; Che ter St., from Eager St. to Chase St.; Chase S from Monument St. to Ashland Ave., ar Chester St., from Orleans St. to McElderry S Total. 40,953 sq. yds. With sheet asphalt, under Contract No. 8—Eager St., from Jone lls to Homewood Ave.; Eager, from Ensor Broadway; Madison, from Gay to Broad-y; Harford Ave., from Forrest St. to Ash-id Ave.; Bond, from Madison to Gay; High, om Hillen to Lexington; High, from Fay-e to Baltimore; Front, from Hillen to Gay; nway, from Sharp to Light; Aisquith, from onument to Ashland Ave. Total, 42,059 sq. s. With vitrified block, under Contract No. -Biddle, from Bond to Broadway; Harford e., from Oliver to North Ave. Total, 8,350 yds. With vitrified block, under Contract . 10—Madison, from Greenmount Ave. to ntral Ave.; Ensor, from Gay to Ashland e.; Aisquith, from Orleans to Mon-ent. Total, 16,862 sq. yds. With granite cks, under Contract No. 11—Camden, from nover to Charles; Barre, from Sharp to arles. Total, 4,853 sq. yds. With granite cks, under Contract No. 12—Harford Ave., om Ashland Ave. to Ensor; Ensor, from hland Ave. to Harford Ave.; Chester, from hland Ave. to Eager. Total, 7,075 sq. yds. ith granite blocks, under Contract No. 13—nstitution, from Front to Madison; Bond, om Gay to Biddle. Total, 8,119 sq. yds.

Frederick County Commissioners, Frederick, d., will ask the Legislature to pass a bill pro-ding for a bond issue of $75,000 for good ads in the county.

Michigan.

The City Council of Ann Arbor, Mich., has opted a resolution for the paving of West ain St., and has accepted the estimate of e Engineer for the paving of the street with phaltic concrete to a width of 60 ft.

The Gogebic County Road Commission, Bes-mer, Mich., recently asked the Board of Su-rvisors to approve its plans for the imme-ate construction of the new county trunk ad to Sans Souci, the eastern boundary of e county; to clear the right-of-way, grade e 38 miles between the Marenisco-Lake ogebic road and Sans Souci, construct the idges on the stretch already built between akefield and Marenisco and the proposed w section between Marenisco and the pro-sed new section between Marenisco and ans Souci, and make needed improvements various sections of the trunk road already aded. The Commission estimates the work ill require an outlay of about $150,000.

Plans have been prepared by Engineer E. H. hrist, 7 Norris Bldg., Grand Rapids, Mich., r the construction of 10,000 sq. yds. of brick avement in the city of Lowell, Mich., at an timated cost of $20,000. The pavement will e laid on a concrete foundation and will re-uire 3,500 lin. ft. of cement curb, 3,000 cu. ds. of excavation and cement filler. Con-acts will soon be awarded.

At a meeting of the Board of Supervisors f Gogebic County, Bessemer, Mich., held eb. 13, it was decided to put the proposition f bonding the county for $150,000 for road mprovements up to the people at the April lection. If this bond issue is passed it is the ntention of the Board of County Road Com-missioners to complete the trunk line from the arenisco-Gogebic road to Sans Souci, a dis-ance of 39 miles, with necessary bridges. ontracts will be let early in the spring for he moving of approximately 180,000 cu. yds. f dirt, 55,000 squares of grubbing and 270 cres of clearing, to grade the above road. . A. Harper, Bessemer, is county road engi-eer. G. S. Barber is chairman.

Minnesota.

✣Bids will be received until 8 p. m., March , by Charles Scofield, city clerk, Ortonville, Minn., for the construction of cement side-walks, gutters, curbs and crossings during 912.

Mississippi.

The city of Booneville, Miss., has sold onds to the amount of $15,000 for pavement nd street improvement purposes. About three miles of concrete sidewalks will be laid. Engi-neer C. L. Wood of Columbus, Miss., is mak-ng a survey of the work to be done.

The Board of Supervisors of Carroll County, Miss., has passed an order authorizing a bond issue [illegible] to improve the county roads. Vaiden is the county seat.

Missouri.

The city engineering department of Springfield, Mo., is preparing specifications for sarcolithic pavement and resurfacing and oiling gravel pavement. H. G. Horton is City Engineer. J. H. Langston is City Clerk.

Curtis Hill, State Highway Engineer of Missouri, has received plans and specifications for the building of three and one-half miles of rock road in St. Francois County, along the old Kings Highway route, otherwise known as the St. Louis Arcadia road. The plans specify the paying of $3,000 a mile for the construction of the road. Farmington is the county seat of St. Francois County.

New Jersey.

✣Bids will be received until 8 p. m., March 4, by Charles O. Brown, mayor, Haddonfield, N. J., for furnisihng the necessary labor and material required in the construction of macadam streets and concrete gutters in said borough. This work includes about 108,342 sq. yds. of macadam paving and about 20,841 sq. yds. of concrete gutters. Bids for the whole must be given by unit price on each item and must be accompanied by a certified check for $8,000, made payable to borough treasurer. Plans and specifications are on file with Allen Clymer, borough clerk.

⦿E. M. Mullen & Co., 67 Bayview Ave., Jersey City, N. J., have been awarded the contract by the Board of Street and Water Commissioners of that city for the improvement of Lafayette St., from Van Horne St. to 100 ft. west of Woodward St., at 85 3-10 per cent. The work includes cement curbs, walks and gutters, street brick pavement. Bids were opened Feb. 13.

A bill was recently introduced by Assemblyman Meyer in the New Jersey Legislature providing for a Delaware River drive from Trenton to the New York state line at Port Jervis. The bill provides for an appropriation of [illegible]

New York.

✣Bids will be received until 11 a. m., Feb. 28, by Alfred E. Steers, president borough of Brooklyn, N. Y., for ten street improvement contracts, the largest being No. 5, for repaving with asphalt the roadways of Leonard St., between Greenport Ave. and Broadway, South 9th St., between Berry St. and Broadway, and Jamaica Ave., between Pennsylvania Ave. and borough line, together with all work incidental thereto. The engineer's estimate of the quantities is as follows: 94,700 cu. ft. asphalt wearing surface, delivered and laid, outside railroad area, no maintenance (measured in trucks as received on the work); 5,100 cu. ft. of asphalt wearing surface, delivered and laid, within railroad area, no maintenance (measured in trucks as received on the work); 700 cu. ft. extra binder, delivered and laid (measured in trucks as received on the work); 100 sq. yds. old stone pavement to be relaid; 90 cu. yds. concrete; 290 lin. ft. new curbstone set in concrete; 880 lin. ft. old curbstone reset in concrete; 430 lin. ft. new curbstone set in sand; 2,200 lin. ft. old curbstone reset in sand; 100 lin. ft. new headers; 100 lin. ft. old headers reset; 164 noiseless covers and heads for sewer manholes. The time allowed for the completion of the work and the full performance of the contract will be 90 working days. The amount of security required will be $15,000.

✣Bids will be received until 3 p. m., Feb. 29, by Park Board at the office of the Department of Parks, 5th Ave. and 64th St., New York city, for furnishing and delivering 40,000 gals. emulsifying road sprinkling oil.

On recommendation of State Superintendent Duncan W. Peck the State Highway Commission of New York will let contracts the coming season for nearly 27 miles of state highways in [illegible] Resolutions adopted call for the completion of plans and specifications and the advertisement for pro-[illegible] roads are: Marcellus-Marietta road, 6.46 miles long; the road from Skaneateles to improved highway No. 867, five miles; the road from improved highway No. 672 northeast to Bridgeport, three miles; the Baldwinsville-Euclid road, 5.61 miles; the Euclid-Cicero road, 5.58 miles, and 6,600 ft. of highway in the town of Fabius, which will make connections between four state roads that have been improved.

Under the bill appropriating $2,466,128 for the repair of highways by the State Highway Commission of New York during 1912, now under consideration by the ways and means committee of the Assembly Chamber, Albany County's allotment is $46,285, Rensselaer's $107,000, Schenectady's $40,309, Clinton's $10,891, Columbia's $25,997, Essex's $56,427, Fulton's [illegible], Greene's [illegible], Montgomery's [illegible] $105,442, Otsego's $20,930, Saratoga's $60,834, Schoharie's $1,728, Warren's $199,339 and Washington's $13,300.

Charles S. Mead, W. J. H. Parker and George G. Follett have been appointed a committee by the Village Trustees of Moravia, N. Y., to act with the village trustees and supervisors in looking after the plans for laying a brick pavement in East Cayuga St., through Main and on South Main to the village line. The estimated cost is as follows: Macadam, $5,200; asphalt, $1,900, and brick, $12,000. The road will be either 40 ft., or 45 ft. wide.

Village President William J. Peach of Pulaski, N. Y., has circulated a petition among property owners whose property abut the business section from Canal St., on the south side to the north end of North Park, providing for the paving of that section with brick. It is planned to ask the State Highway Commission to lay a brick pavement 16 ft. wide, provided the village and abutting owners will lay the balance.

Plans will be ready shortly for the construction of 14 miles of state roads in Wayne County, N. Y., and for over 12 miles of county roads, including two miles north from the town of Lyons to the town of Sodus. W. G. [illegible]

North Carolina.

✣Bids will be received until 2 p. m., March 4, by Murphy Township Highway Commission, M. L. Mauney, Secy., Murphy, N. C., for grading the Hanging Dog Road and a short section of Peach Tree St., a distance of approximately 8 miles. The work will consist of approximately 68,000 cu. yds. grading, 1,200 lin. ft. vitrified pipe, 550 cu. yds. rubble masonry, 6,300 lbs. structural steel. Plans, profiles and specifications are on file at the office of G. W. Scott, Engineer, Courthouse Bldg. A certified check for $500 must be filed with each bid.

⦿The Executive Board of Charlotte, N. C., has awarded the contract for grading East Ninth St., extended, to Shuman & Snell, at $2,400, and the contract for the pipe and culvert work to Johnson, Porter & Peck, for $1,327.

The city of Charlotte, N. C., will do a considerable amount of paving work this year, according to Chairman E. W. Thompson of the finance committee of the Board of Aldermen. Order of procedure in the next paving contracts, and cost of same, as estimated by the City Engineer, as follows:

	City's part.	Total cash.
N. Graham—Fifth to Southern Railway	$ 7,357	$ 25,701
W. Trade—Southern Railway to [illegible]	[illegible]	[illegible]
N. College—Phifer ave. to Thirteenth	3,226	12,179
S. Tryon—Morehead to Bland	2,891	13,382
Belmont ave.—Creek to Pegram	6,813	15,759
W. Trade—Woodlawn to Creek	3,094	9,810
Cedar—Trade to Third	3,163	8,243
E. Sixth—Tryon to College	168	1,752
S. Boulevard—Morehead to East Boulevard	21,148	47,723
N. Poplar—Trade to Tenth	4,879	16,729
N. Church—Sixth to Seventh	924	3,224
[illegible] to Avondale	[illegible]	[illegible]
Total	$74,584	$220,113

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Ohio.

⊙The Smithfield-Hopedale Free Turnpike Road Commissioners, at the office of the county auditor, Steubenville, O., have awarded the following contracts for the grading, sewering and macadamizing of the Smithfield and Hopedale free turnpike road, grading 21 ft. wide and macadam 10 ft. wide, for which bids were opened Feb. 15: S. T. Frazier, Bloomingdale, O., section 1, 10,283 ft. long, $9,637; section 2, 9,735 ft. long, $10,340. Wm. Heburn, Mt. Pleasant, O., section 3, 9,984 ft. long, $9,856.

Plans and specifications are being prepared for the construction of from 35 to 40 blocks of macadam pavement in Troy, O., on a concrete base. Estimates have not been completed. The work will be in charge of the Public Improvement Commission of the Council, J. Hays Stewart, chairman. Thos. J. Gibbs is clerk of the Council.

Oregon.

✣Bids will be received until 10 a. m., Feb. 28, by F. S. Fields, Multnomah County Clerk, Portland, Ore., for the furnishing fuel oil and road oil to Multnomah County, for a period of one, two or three years. Deliveries to be made by tank wagon at: Courthouse, Multnomah Hospital, ferry boat "Lionel R. Webster," ferry boat "W. S. Mason," ferry boat "St. Johns." Bidders to state place of delivery for road oil in carload lots. For fuel oil for Kelly Butte, state place where our wagons can call. For Multnomah farm, f.o.b. at farm.

The Oregon Good Roads League was recently organized at Corvallis, Ore., with Victor P. Moses, County Judge of Benton County, Corvallis, President; Prof. E. F. Ayers of Oregon Agricultural College, Corvallis, Secretary, and the following directors: J. R. Edwards of Lincoln County, Toledo; Prof. H. M. Parks of Oregon Agricultural College, and P. B. Cator of Benton County, and others. The purpose of the organization is to foster good roads building in the state and to supply supervisors and others with information that may aid them in the highway improvements under their jurisdiction.

City Engineer Tom Hurlburt of Portland, Ore., has completed plans and specifications for the improvement of two Sellwood streets, and will ask for bids on a new kind of asphalt pavement, as well as other classes. The estimated cost is $1.50 per sq. yd.

Pennsylvania.

The Fayette County Commissioners, Uniontown, Pa., have determined to establish a county highway department for the purpose of constructing permanent roads. The new department will act in conjunction with the branch of the State Highway Department to be located at Uniontown. The Commissioners have levied a one-mill road tax.

Tennessee.

⊙The Stokes Construction Co. has been awarded the contract by the Washington County Board, Jonesboro, Tenn., for the grading and macadamizing of 31 miles of road in Washington County, being part of the Memphis to Bristol highway. Bids were opened Feb. 15.

⊙The Cleveland Trinidad Paving Co., of Cleveland, O., has been awarded the contract by the officials of Johnson City, Tenn., for the construction of pavement in Paving District No. 9, being West Main St., for $12,036. The company is just completing an $87,000 paving contract in the city.

The City Commissioners of Memphis, Tenn., have passed an ordinance for the paving of Fourth St., between Union and Court Aves. According to the estimate of City Engineer J. H. Weatherford, the improvement will cost $11,594. Asphalt will be used.

Texas.

✣Bids will be received until 10 a. m., March 5, by J. G. Sutton, City Secretary, Beaumont, Texas, for all or any portion of the following work: For furnishing all tools, material, labor, etc., necessary for paving approximately 93,000 sq. yds., on concrete foundations, with vitrified brick, asphalt, bitulithic, or creosoted wooden blocks, or any other material, as may be determined by the City Council; and also approximately 37,000 lin. ft. of concrete curb. A certified or cashier's check in the sum of $1,000, made payable to Emmett A. Fletcher, Mayor, on some Beaumont bank, will be required to accompany said bid. For specifications, streets to be paved, or any other information, apply to C. L. Scherer, City Engineer.

⊙Okander Bros., of Waco, Tex., have secured the contract to pave two alleys in the business section of the city of Temple, Tex., with vitrified brick.

The City Council of San Angelo, Tex., has ordered an election to determine whether or not the city is to issue bonds to the amount of $40,000 to carry on additional paving work. Chadbourne and Twohig Sts., are to be paved.

Citizens owning property abutting upon both sides of Webster Ave., between Main and Crawford Sts., have petitioned the City Council of Houston, Tex., to pave that thoroughfare with brick.

It is reported the Robertson County Commissioners' Court, Franklin, Tex., has acted favorably on the proposed issuance of bonds in the sum of $150,000 by the county for the construction of good roads. It is proposed to construct about 50 miles of hard clay roads. G. L. Cade is Assistant County Engineer.

The Chamber of Commerce of San Angelo, Tex., has inaugurated a campaign for good roads in Tom Green County. The County Commissioners have indicated their willingness to call an election for a bond issue. The estimated cost is $150,000.

Washington.

✣Bids will be received until Feb. 27 b Board of King County Commissioners, Seattle, Wash., for the construction of Charle Schafer road near Vason, Wash. The wor will include grading, grubbing and clearing.

✣Bids will be received until March 7 b Board of Whatcom County Commissioner Bellingham, Wash., for the construction of ½ mile of road on the extension of Hannega Road; also for building a mile of road nea Lynden.

✣Bids will be received until March 5 by C R. Bell, town clerk, Castlerock, Wash., fo grading of Improvement District No. 4. Re advertisement of work for which bids wer received Feb. 6.

⊙The King County Commissioners, Seattl Wash., have awarded the contract for the construction of 16,488 ft. of the North Trun Blvd. to J. H. Cullen & Co., 6020 Third St N. W., Seattle, for $13,998. Other bidder were: Frazier & Anderson, $14,179.75; Sloan Bros., $14,720; Yost & Son, $14,950; W. F Manney & Co., $15,000; Geo. Banderet, $17,500 J. L. Stanley, $17,711.88; Geo. C. Detrick Co., $17,982; Pacific Contracting Co., $19,018 A. Peterson & Co., $19,200; MacQuaid Moore, $20,701.25.

All bids received by J. M. Shields, auditor Skagit County, Mt. Vernon, Wash., on Feb. 6 for the construction of 5,728 ft. of the Asplan road, have been rejected.

The City Commission of Hoquiam, Wash. has been petitioned for the paving of K St. from Eighth to 11th Sts., and J St., fro Seventh to 11th Sts. The work will includ about 20,000 sq. yds. of paving.

Wisconsin.

✣Bids will be received until 11 a. m., March 4, by Board of Public Works, Manitowoc, Wis., for the construction of 20,000 sq. yds. of brick and asphalt pavement on concrete foundation with cement filler, including limestone curb. W. Rudolph is city engineer.

The City Council of Manitowoc, Wis., has passed an ordinance adopting the paving specifications and authorized the Board of Public Works to advertise for bids for the paving of five streets. The specifications provide for a 5-in. concrete base and a 3-in. curb.

The City Council of Fond du Lac., Wis., has decided to pave Hoyt St., from Olcott St. to Park Ave.; Third St., from Park Ave. to Everett St., and Algoma St., from East Division to Merrill St.

Canada.

The Ontario Good Roads Association, according to advices from Toronto, Ont., has called upon the Dominion Government to lay their views on highway construction before the Ministers. The association plans the construction of 2,000 miles of Provincial State highways and 5,000 miles of county roads in the next 10 years.

BRIDGES—STEEL AND CONCRETE

Arkansas.

⊙The contract for the construction of 22 steel bridges included in the Drainage District No. 9, Mississippi County, Ark., for which bids were received Jan. 25, has been awarded to the Stites Steel Bridge & Construction Co., St. Louis, Mo., at $14,411.

California.

As the result of a consultation between I. N. Noble, Los Angeles County Surveyor, Los Angeles, Calif., and J. L. Harrington, of Waddel & Harrington, Consulting Engineers, Kansas City, Mo., the plans and specifications for the proposed Arroyo Seco bridge will be changed, at the request of the county authorities, to provide for a 2-arch monolithic structure. Bids for the work will be advertised soon.

Board of Colusa County Supervisors has approved petition of a committee of citizens from Princeton for a bridge over the Sacramento River at that place and it is probable that the structure will be erected during this summer.

Board of County Supervisors, Sacramento, Calif., has instructed the County Surveyor to prepare plans and specifications for the construction of two trestles in connection with the new county bridge over the American River at J St.

Colorado.

It has been recommended that the City Council, Denver, Colo., use the Permanent Improvement Fund of $125,000 toward completing the West Colfax viaduct or the Broadway extension, which will cost about $115,000.

Work has started under supervision of the State Engineer, Denver, Colo., excavating for the abutments of the proposed $50,000 reinforced concrete bridge over the Arkansas River on the Santa Fe trail east of La Junta. Plans and specifications have been submitted to the state authorities, who have agreed to pay one-half the expense and it is hoped that the balance of the necessary amount can be raised in time to proceed with the work.

Idaho.

The Board of Bingham County Commissioners, Blackfoot, Idaho, has awarded the contract for the construction of five steel bridges to Perham & Harris, St. Anthony, Idaho.

Illinois.

✣Bids will be received until 2 p. m., Feb. 23, by T. E. Johnson, Township Clerk, Sangamon township, Piatt county, Ill., for the construc-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ion of one steel highway bridge of two spans f 100 ft. each on concrete abutments and ier. Plans and specifications are on file vith the town clerk at White Heath, Ill.; also t the office of W. J. Day, engineer, Bement, ll.

✣Bids will be received at the Town Clerk's ffice, Collinsville, Ill., up to 1 p. m., Feb. 28, or the construction of three reinforced conrete bridges in Collinsville Township, Madion County. William Grenard, Town Clerk, ollinsville, Ill.: Chris. Andrews, span, 14 ft.; dy., 20 ft.; type, R. C. box; 115 cu. yds.; [illegible] witch. Diedering, span, 12 ft.; Rdy., 16 ft.; ype, R. C. Sub. and Super.; 46 cu. yds.; steel, 092 lbs.; 1½ miles from Maryville. Kalbeisch, span, 14 ft.; Rdy., 20 ft.; type, R. C. ox; 182 cu. yds.; steel, 13,896 lbs.; 1 mile rom Sand Bank switch. All material for the bove bridges will have to be shipped in. Present structures for 1 and 3 are, 5½-ft. steel ubes; No. 1 has a 9-ft. wood bridge. On acount of the condition of the excavation, it [illegible] ne bridge sites be made before bidding on ame. Work to be completed on or before ugust 1, 1912. More detailed information ay be had by an examination of the plans nd specifications prepared by the Illinois ighway Commission, which may be seen at he Town Clerk's office or may be obtained pon application in writing, from the Illinois ighway Commission, Springfield, Ill.

⊙At a meeting of the Committee of Superisors and Highway Commissioners of Cottonood and Union Townships, Greenup, Ill., the ontract for the construction of a bridge over yan Ford was awarded to P. J. Coggin, Arola, Ill., at $8,120.

⊙Following are the low bids submitted o L. E. McGann, Commissioner of Public Vorks, Chicago, Ill., for removing and disosing of present draw span, center pier nd center pier protection of Chicago Ave. ridge, including piles, pile clumps and obtructions: Fitz Simons and Connell Dock Dredging Co., 5 N. La Salle St., $800: redging material, measured in scows quanity assumed 15,000 cu. yds., $4,350, Naional Contracting Co., 189 W. Washington t. Bids opened January 25th. The conract has been awarded.

The city of Waukegan, Ill., contemplates the rection of a reinforced concrete highway viauct at Genesee St., the engineer's estimate or which is $69,891.40. This viaduct will be aid for by special assessment, but the work annot be advertised until after confirmation y the county court, which will probably be arly in March. After confirmation the work vill be advertised two weeks, but as this will ot allow very much time for the preparation f bids, it has been considered proper to allow uch contractors as desire them to obtain rawings and specifications before the bids re advertised for. Plans and specifications ay be obtained of Westcott & Ronneberg, 89 W. Madison St., Chicago, Ill. A deposit f $25 will be required to insure the safe rearn of the plans and specifications. Plans nd specifications may be viewed also at the ffice of ENGINEERING & CONTRACTING, 608 S. earborn St., Chicago, Ill. M. J. Douthitt, Vaukegan, Ill., is assistant superintendent of ublic works and Alvah S. Rogers is secrery of the Board of Local Improvements.

Indiana.

At a recent meeting of the White County ouncil, Monticello, Ind., appropriated $30,000 or the construction of a number of county ridges during the 1912 season.

⊙The Gibson County Commissioners, Princeon, Ind., have awarded the contract for the rection of three bridges and repairing an old tructure, to George Soller, at $2,897. Other idders were Vincennes Bridge Co., $3,298; Villiam Toelle, $4,312; J. G. Berger (three ridges), $3,060. Patoka Township gets one f the new bridges, to be located on the Mt. armel road near the residence of Henry weppy. The other two bridges and the reair job are in Union Township.

Iowa.

✣The Minnehaha County Board of Commissioners, Sioux Falls, Ia., will receive bids March, 8, for the construction of bridges to be constructed in the county during the ensuing year.

⊙The contract for the construction of bridges in Monona County has been awarded by the Board of Supervisors, Onawa, Ia., to the Iowa Bridge Co., Des Moines, Ia. Other bidders for the work were: Continental Bridge Co., Chicago, Ill.; Western Bridge Co., Omaha, Neb.; A. E. Shorthill, Marshalltown, Ia.

⊙The Board of County Supervisors, Cedar Rapids, Ia., has let the contract for the furnishing of three bridges and erecting two of them (excepting the contract for concrete) to the Clinton Bridge Co., Clinton, Ia., at $4,570. D. Jayne, Marion, at $650, got the concrete work. One structure will be erected at Ivanhoe, in Franklin Township, and will consist of 4 71-ft. steel spans. Other bids for furnishing and erecting the bridges complete were as follows: Carmody Foundry and Machine Co., Cedar Rapids, $14,143.95; Leonard Construction Co. of Dubuque, $13,157; J. D. Palmer Co. of Cedar Rapids, $10,047; Ottumwa Construction Co., $9,263; Clinton Bridge Co., $8,-273.

The Fort Dodge, Des Moines & Southern Interurban Railway Co., has had plans prepared for the construction of a steel bridge to replace the present high trestle between Boone, Ia., and Des Moines River. The contract for the work will probably be let in the near future. H. M. Wallace, Boone, Ia., is Vice President and General Manager of the company.

Complying with the request of the committee from the Improvement Association of Cole's Addition, the City Council of Sioux City, Ia., is to take up for consideration the matter of building a bridge over the Floyd River on 11th St., estimated to cost $7,000.

Kentucky.

It is reported that bids for the construction of the railroad bridge over the Ohio River 12 miles below Paducah, Ky., will be opened March 15, and that the contract will be let within 30 days thereafter. The bridge is to be built jointly by the Burlington, which initiated the enterprise; the Illinois Central, the Louisville & Nashville, the Frisco and Big Four railroads. It will cost $3,600,000 and another million will be spent in constructing terminal facilities and shops. The Nashville, Chattanooga & St. Louis will double track to the bridge from Paducah, where a belt line right-of-way already has been secured and will handle the Burlington business south, at least until the Burlington's own lines to gulf ports, rumored to be already in the building link at a time, are connected. It is persistently suggested that the Illinois Central is contemplating the regrading and double-tracking of the division from Carbondale, Ill., to Metropolis, with a view to sending some of the through traffic from Chicago and St. Louis south over the new bridge.

Maryland.

According to an announcement reported to have been made by A. W. Thompson, General Manager of the Baltimore & Ohio R. R., Baltimore, Md., the proposed subway under the Virginia Ave. crossing, Cumberland, Md., will be constructed in the near future.

Michigan.

⊙The Muskegon County Board, Muskegon, Mich., has awarded the contract for replacing the fallen bridge over Crokery Creek at Revenna to the Beach Manufacturing Co., Charlotte, Mich., at $2,250.

E. A. Hunt, City Engineer, Battle Creek, Mich., has started preparing plans for the construction of the proposed bridge over the Kalamazoo River at Carlyle St. The structure will be 150 ft. long and 50 ft. wide and is estimated to cost about $8,000. The construction work will be started, it is believed, about July 1.

Minnesota.

A petition is being circulated at Twig, Minn., asking that the St. Louis County Commissioners, Duluth, Minn., take up the matter of building a bridge over the Cloquet River on the Cloquet River road.

The City Council of Duluth, Minn., has under consideration the construction of a new bridge at 87th St. to replace the structure which was recently partially destroyed by fire. The cost of such an improvement is estimated at about $10,000.

The City Council of Minneapolis, Minn., on the recommendation of the Ways and Means Committee, ordered the issuance of $200,000 of bonds for the construction of new bridges. Andrew Rinker is City Engineer.

Missouri.

⊙Grundy County Highway Engineer M. E. Moonep, Trenton, Mo., has awarded the contract for the construction of a steel bridge over the Grand River at the John I. Craig ford, between Harrison and Grundy Counties, to the Canton Bridge Co., Canton, O., at $1,-474.

A petition is being circulated at Bethany, Mo., asking that a new bridge be constructed across the river at that place.

Advices from Washington, D. C., state that the House of Representatives has passed the bill extending the time within which the city of St. Louis may complete the construction of the free municipal bridge across the Mississippi River. The present statute expires Jan. 7, 1913. As amended, the bill provides for an extension of three years from the date of the approval of the act.

Montana.

✣Bids will be received until March 6 by Warren E. Evans, clerk, Powell County Commissioners, Deer Lodge, Mont., for the construction of a steel bridge over Deer Lodge river at Garrison, Mont.

New Mexico.

⊙Commissioners of Bern Alillo County, Albuquerque, N. Mex., have awarded the contract for the construction of a breakwater at the west end of the Barelas bridge to J. R. Sanchez at $1,350. Bids are also being asked by County Clerk A. E. Walker for a wing dam to be built just above the west end of the bridge.

New York.

A bill has been introduced asking that the state appropriate $100,000 for the construction of a steel bridge at or near Vischer's ferry. Providing the amount is allowed, plans for the structure will be prepared by the State Engineer.

North Carolina.

✣Bids will be received until 8 p. m., Feb. 26. by Bridge Committee, Salisbury, N. C., for building a bridge across South River between Rowan and Davie Counties. Plans and specifications are on file at the office of Register of Deeds in Salisbury, N. C. Bids for grading and abutments will be received at the same time under separate contract. C. M. Miller, Salisbury, is Engineer.

Ohio.

✣Bids will be received until noon, Feb. 26, by Director of Public Service, Cleveland, O., for lumber for the repair of city bridges. Plans and specifications may be obtained of the Chief Engineer. W. J. Springborn is Director and W. H. Kirby is Secretary.

✣Bids will be received until Feb. 26 by the Board of County Commissioners, Millersburg, O., for the construction of two steel girder bridges and one steel truss bridge, being 70, 60 and 56 ft. in length and having 14 ft. roadways. The costs of the structures are estimated at $1,298, $1,338 and $1,291 respectively. W. L. Reidenbach, Millersburg, O., is engineer.

✣Bids will be received until noon, March 5, by S. A. Kinnear, Director of Public Service, Columbus, O., for furnishing the necessary labor and constructing under Contract 17, the masonry and approaches to and the substructure of a viaduct over the tracks of the Hocking Valley Railway on South High St., in Columbus. A certified check for 10 per cent of the amount of bid and payable to Cal. R. Boulton, Clerk, must be filed with each bid. The engineer's estimate of quantities is as follows: Item No. 1, excavation, 18,500 cu. yds.; No. 2, embankment, 20,200 cu. yds.; No. 3, concrete, Class A (parapet wall), 1,540 lin. ft.; No. 4, concrete, Class B (footings), 3,500 cu. yds.; No. 5, masonry, Class A (coping), 1,540 lin. ft.; No. 6, masonry, Class B (concrete, with standstone facing), 7,500 cu. yds.; No. 7, limestone wheel course, 190 lin. ft.; No. 8, twisted steel rods, 30,000 lbs.; No. 9, expanded metal, 5,850 sq. ft.; No. 10, crushed stone for roadway surface, 1,000 cu. yds.

Oklahoma.

⦿The Oklahoma County Board of Commissioners, Oklahoma City, Okla., has awarded the contract for the construction of a steel bridge near Jones to the Kansas City Bridge Co., at $2,993.

The Corporations Commission at Oklahoma City, Okla., has issued instructions to the Santa Fe System to build a viaduct over its tracks in Guthrie, Okla., at either Cleveland, Oklahoma, or Noble Aves. Plans and specifications are to be submitted to the Commission within 60 days.

Oregon.

The Multnomah County Court, Portland, Ore., has adopted the recommendation of Road Supervisor Chapman to construct a new steel bridge with a span of 300 ft. to replace the present wooden structure over the Sandy River at Troutdale. The cost of the work will amount to about $20,000, it is expected. Engineers will be engaged at once to make soundings and draw plans and specifications for the work and the contract will be advertised as soon as the necessary information is available.

It is believed that the Polk County Court, Dallas, Ore., will shortly take active steps toward the construction of a new steel bridge over the slough on the west side of the Willamette River, near Independence, Ore., to replace the old wooden structure at that place.

The Court of Benton County, Corvallis, Ore., will probably appropriate $60,000 for the construction of a bridge over the Willamette River, between Benton and Linn Counties.

City Engineer, Thomas Hurlburt, Portland, Ore., has recommended that the new bridge over the Willamette River south of the Hawthorne bridge, be constructed at Spokane Ave., to replace the Selwood ferry.

Pennsylvania.

Commissioners of Washington and Fayette Counties, Pa., will probably take action shortly in regard to the construction of the proposed bridge over the Monongahela River, between Brownsville, Washington County and South Brownsville, Fayette County. The estimated cost of the structure is about $150,000. Washington, Pa., is county seat of Washington, Pa.

Citizens of Bechtelsville, Pa., have petitioned the Berks County Court, Reading, Pa., to appoint viewers to pass upon the necessity of the erection of a new county bridge over the north branch of Swamp Creek at Main St.

It is reported in Norristown, Pa., that Montgomery County and the Philadelphia & Reading and the Pennsylvania Railroad will jointly construct a concrete bridge over the Schuylkill River connecting with Valley Forge on the west side of the river. The cost of the work is estimated at $250,000.

The Harrisburg Park Commission, V. Grant Forrer, P. O. Box 672, Harrisburg, Pa., Secy., will construct a bridge over Spring Creek providing the City Council appropriates the money within the next two months.

South Carolina.

⦿Board of Chester County Commissioners, Chester, S. C., has awarded the contract for the furnishing of five new bridges to be erected by the county, to Austin Bros., Atlanta, Ga., at $1,000. The structures will be located as follows: 180-ft. span for South Fork Fishing Creek, near the residence of Mr. John O. Darby; 40-ft. span to go across Little Rock Creek, near the residence of Mr. W. O. Guy; 30-ft. span to go across the Rainey Branch, on the York road; one 20-ft. span to be erected across Grassy Run, on the Lancaster road, and the other 20-ft. span to be used across Polly Walker Branch on the Lowryville road.

South Dakota.

⦿Commissioners of Brown County, S. Dak., at Aberdeen, have awarded the contract for the construction of four new bridges and moving and repairing two others to C. E. Gilbert, Aberdeen, S. Dak., at $12,971. Other bidders and their amounts were: The Illinois Steel Bridge Co., $16,885; Marsh Engineering Co., $16,650; Joliet Bridge & Iron Co., Joliet, Ill., $17,270; International Bridge and Iron Co., $14,506; Lepper Construction Co., $17,072; A. Y. Bayne, $16,282.

⦿The following bids were received Feb. 6, by Board of Butte County Commissioners, at the office of D. C. Barr, County Auditor, Bellefourche, S. Dak., for the erection (county furnishes the material) of wooden bridges during 1912 in Butte County, of which Carl C. Adams, Scotney Block, Bellefourche, S. Dak., is engineer. (1) standing for A. T. Moore, Bellefourche, S. Dak.; (2) Lou Knight & Co., Bellefourche, S. Dak.; (3) Jefferies & Roush, Fort Pierre, S. Dak.; (4) Canton Bridge Co., 400 Paxton Block, Omaha, Nebr.; (5) S. B. Standard, Bellefourche, S. Dak. (awarded contract):

Item.	(1)	(2)	(3)	(4)	(5)
Driving oak, cedar or pine piling, up to 16 ft long, per lin. ft. in place	$0.30	$0.35	$0.24	$0.25	$0
Driving oak, cedar or pine piling, 16 to 39 ft. long, per lin. ft. in place	.20	.40	.19	.25	
Placing and securing caps and sway bracing on bents "A" and "D," each	3.00	[illegible]	3.00	1.55	1.
Placing and securing caps and sway bracing on bents "B" and "D," each	3.75	4.00	4.00	1.47	1.2
Superstructure, 14 ft. roadway, per lin. ft.	.85	1.00	1.35	.89	
Superstructure, 16 ft. roadway, per lin. ft.	.85	1.00	1.45	.89	
Placing and securing 2 in. and 3 in. lumber in bulkheads and wing walls, per M	15.00	15.00	5.00	7.00	10.
Loading and unloading bridge material, per ton	1.50	.50	.50	.90	
Hauling, per ton-mile	.35	.50	.25	.36	
Placing earthwork in embankment, per cu. yd.	.333	.40	.30	.22	

Tennessee.

✣Bids will be received until March 11, it is reported, by Bridge Commission, Carter County, Elizabethton, Tenn., for the construction of iron and steel bridge across Doe River at Roan Mountain.

✣Bids are being asked by T. C. Owen, Bridge Superintendent, Shelby County, Memphis, Tenn., for the following material for the county of Shelby, state of Tennessee, bridge department, f.o.b. Memphis, freight to be paid, and amount added to invoice. All material to meet the following specifications: A Portland cement that will meet the specifications of the American Society of Civil Engineers for testing material. Specifications for crushed stone, Mississippi River gravel, screened; also what is locally known as "Mississippi run," and Mississippi River sand, to meet the requirements of the specifications in use by the city of Memphis, 1911. Reinforcing rods to be made of square steel of standard size for ½ to 1-in., and to be a deformed bar of known reputation, twisted bar preferred. Bids to be made by the pound. Lumber for making concrete forms; must be good pine, free from knots and dressed on one side. Lumber for building bridges; must be good, sound, tough white oak, red oak and post oak, delivered, freight prepaid to the following points: Oakville, Germantown, Baileys, Collierville, Cordova, Bartlett, Arlington, Woodstock and Millington, Sawmill men throughout the county are requested to bid on lumber to be furnished on mill yard. All lumber to be furnished as ordered by the bridge superintendent.

As the result of the recent conference with President H. V. Mudge of the Chicago, Rock Island & Pacific Ry., the citizens and business men of Crittenden County, Ark., the construc tion of the proposed new bridge over th Mississippi River at Memphis, Tenn., is prac tically assured.

A preliminary survey has been complete by City Engineer J. H. Weatherford, Mem phis, Tenn., preparatory to running Winches ter St. across the Louisville & Nashville rail road tracks, through private property, and con necting that thoroughfare with the north Park way at Mananssas St. The plan will embrac the building of a 600-ft. viaduct across th tracks. Cost of the whole plan will approxi mate $100,000. The viaduct alone, the Cit Engineer believes, will cost $75,000.

Texas.

Preliminary to the construction of the 30 mile gap between Austin, Texas., and Sa Marcos, to take the place of the stretch o the International & Great Northern track un der lease, the Missouri, Kansas & Texas ha let the contract for the construction of a stee bridge over the Colorado River, estimated t cost about $192,000.

Virginia.

City Engineer V. O. Cassell, Jr., Ports mouth, Va., at a recent meeting of the Stree Committee, was instructed to prepare an es timate of the cost of installing some sort o a culvert in Dinwiddie St. at the point wher the city proposes to extend that thoroughfar to Fifth St., South Portsmouth.

Washington.

⦿The Board of Public Works, Seattl Wash., has awarded the contract for the con struction of a concrete viaduct on Fremon Ave., between Westlake Ave. and Ewing St to Timothy Ryan, at $46,323.

Wisconsin.

M. W. Torgelson, Bridge Engineer of th State Highway Commission, Madison, Wis has recommended that the City Council Cumberland, Wis., take steps to construc steel girder or truss bridge with tubular sup ports and a cement floor, on Elm St. Th structure will be about 50 ft. in length. resolution was passed to employ an enginee to draft plans and specifications for the im provement.

Plans have been approved by City Enginee E. B. Banks, Superior, Wis., for the construc tion of the proposed extension of the Belkna St. viaduct and the engineering department c the Northern Pacific announces that work wi be started immediately.

⦿The contract for the construction of th new bridge over the Apple River at Amer Wis., has been awarded to the Hughitt Bridg Co., at $5,300. The structure will consist c two 70-ft. spans and 200 ft. of fill. The latte part of the contract has been sublet for $2,00

Canada.

✣Bids will be received until 11 a. m., Fe 26, by chairman Board of Control, at th office of M. Peterson, secretary, Winnipe Man., for supply of labor and material fo the erection of fender for Redwood bridg Plans and specifications are at the office of th city engineer, 223 James Ave.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Caliornia.

[illegible] m, Cal., is proposed. Balfour-Guthrie ., Central Bldg., Seattle, Wash., is interested.

Idaho.

he Emmett Irrigation District, Emmett, ho, will replace all wooden structures on system with modern metal flumes, siphons. The W. H. Rosecrans Engineering Co., N. La Salle St., Chicago, Ill., is the con-ing engineer in charge of this work. Plans specifications are now being prepared.

Illinois.

✣Bids will be received until March 9, by L. Lambert, County Clerk, McLeansboro, Ill., excavation of a ditch 13,900 ft. long in Haw [illegible] Special Drainage District. Bids will be eived on two sets of specifications—No. 1 a ditch with a 2-ft. base, 1 to 1 slope, and . deep, requiring removal of 13,600 cu. yds.; cifications No. 2 for a ditch with a 6-ft. e, 1 to 1 slope, and 5-ft. deep, requiring avation of 31,600 cu. yds. Bidders are re-sted to bid on both specifications. Bids No. 1 to be accompanied by certified check $100; bids on No. 2, certified check for 0. Harry Anderson, attorney for the dis-t, McLeansboro, Ill.

✣Bids will be received until 1 p. m., Feb. 24, J. F. Dart, Commissioner of the North, ldon and South Concord Drainage District 1, of Iroquois County, at the office of the nty Clerk, Watseka, Ill., for furnishing tile construction of drains as follows: Branch [illegible] ft. [illegible] 20-in. tile, Branch No. 5, [illegible] 24-in. tile, and 2,400 ft. of 16-in. , Branch No. 6, 1,281 feet of 24-in. tile; bulkheads for Branches 1, 3, 4, 5 and 6. tified checks for 10 per cent.

✣[illegible] will be received until 1 p. m., Feb. 2[illegible] Commissioners of Drainage District No. 2, [illegible] County, Pitman, Ill., for the con-[illegible] of an open ditch estimated to include 68 cu. yds. of excavation, including willows [illegible] trees to be grubbed out and removed; [illegible] 20-ft. steel bridge supported on [illegible] and having 6 ft. wing walls. Plans on file with Edward Pearman, town clerk, [illegible] Ill., or may be seen at the office of [illegible], Engineer, Taylorville, Ill.

[illegible] were opened Feb. 15 by the Trustees [illegible] District of Chicago, Chicago, Ill., for excavation and construction on Contract ction 3 of the Calumet-Sag channel, the bids eived being as follows: (1) Standing for . of S. R. H. Robinson & Son Contracting ., St. Louis, Mo.; (2) bid of T. J. Forsch- Contracting Co., Lemont, Ill.; (3) bid Shnable & Quinn, Chicago, Ill.

	(1)	(2)	(3)
[illegible] glacial drift, [illegible] yds.	[illegible]	[illegible]	[illegible]
cavation, rock, 220,000 u. yds.	.69	.73	.799
anneling, 182,300 sq. t.	.25	.25	.25
ncrete retaining wall, 3,400 cu. yds.	4.95	6.00	5.50
rap slope, 5,000 sq. ds.	1.00	.65	1.50
Totals	$365,855	$380,275	$406,405

Indiana.

The Commissioners of St. Joseph County [illegible] the report of the viewers for [illegible] drain and have ordered the ditch tablished. R. E. Keller, County Surveyor, uth Bend, Ind., has been appointed Super-endent of Construction.

Iowa.

✣Bids will be received until 1 p. m., March 7, Board of Buena Vista County Supervis-s, at the office of W. W. Bennett, County ditor, Storm Lake, Ia., for the construc-n of improvements in connection with the rainage District No. 34 of the county. The rk will be divided as follows: Sec. 1 including 412,000 cu. yds.; Sec. 2, 884,100 cu. [illegible] yds.; Sec. 9, 60,400; Sec. 10, 64,500 cu. yds.; Sec. 11, 61,000 cu. yds.; Sec. 12, about 40 concrete bulkheads for inlet protection. Plans and specifications are on file with the county auditor.

⊙The Gude Excavating Co., Iowa Falls, Ia., has been awarded the contract at $16,641 for constructing the tile portion of Drain No. 93, bids for which were opened Feb. 5 by A. J. Peterson, County Auditor, Webster City, Ia. The drain requires the following quantities of salt-glazed vitrified tile: 1,500 ft. 30-in. tile, 1,800 ft. 26-in. tile, 1,400 ft. 24-in. tile, 2,000 ft. 22-in tile, 1,400 ft. 20-in tile, 1,400 ft. 18-in. tile, 2,250 ft. 16-in. tile, 5,263 ft. 14-in. tile, [illegible] 10-in. tile, 2,200 ft. 8-in. tile. Maximum depth, 11 ft. E. S. Boudinot of Webster City is the Engineer in charge.

⊙Contracts for constructing ditch system for Joint Drainage District No. 6 of Palo Alto and Clay Counties have been awarded as follows: Open work, 176,460 cu. yds.; John McAndrews, Kankakee, Ill., at 8 cts. per cu yd.; tile, 46,510 ft, Graettenger Tile Works, Graettenger, Ia., at $2,744; laying tile, Hammes & Manneash, West Bend, Ia., at $1,690.

Kentucky.

A. A. Van Winkle, C. E., Guthrie, Ky., desires prices on drain tile and ditching machinery.

Louisiana.

✣Bids will be received until noon, Feb. [illegible], by the [illegible] Levee District, [illegible] Secretary, [illegible], La., at the office of the Board of State Engineers, Rooms 213-215, New Orleans Court Building, New Orleans, La., for the following levee work on the Mississippi River, [illegible] Parish, La.: South [illegible] to protection levee, River side enlargement, approximate contents, 25,000 cu. yds.; deposit required, $1[illegible]; bond required, $1,[illegible].

•Bids were received Feb. [illegible] by the Caddo Levee District, [illegible], Secretary, Shreveport, for the construction of 17,[illegible] ft. of new levee in Caddo Parish, the contents being about [illegible] cu. yds. The contract was let to Jno. G. [illegible], Miss., at 15.92 cts. per cu. yd.

Michigan.

✣Contracts will be let on March 22 by Walter R. Carven, Ingam County Drain Commissioner, Mason, Mich., for the construction of the Toll Gate drain. This job very closely resembles a sewer job and consists in the laying of 4,350 ft. of 48-in., 3,330 ft. of 30-in., and [illegible] ft. of 24-in. reinforced concrete pipe; 1,300 ft. of 18-in. sewer pipe, [illegible] ft. of 12-in., and 360 ft. of 8-in. drain tile. It also includes the construction of 33 manholes and 6 catchbasins. The depths will average as follows: 48-in. pipe, 7.82 ft.; 30-in. pipe, 14.83 ft.; 24-in. pipe, 14.26 ft.; 18-in., 12-in. and 8-in. tile, 6.26 ft. Specifications, etc., can be obtained from Mr. Carven.

Surveys have been completed for the Sauger Lake drain in Ingram County. Contracts on this work will not be let until late in the spring. Walter R. Carven, Mason, Mich., is County Drain Commissioner.

Minnesota.

✣Bids will be received until 2 p. m., March 12, by F. D. Stocking, county auditor, Glencoe, Minn., for the construction of tile ditch No. 22, in McLeod County; also for the construction of ditch No. 21. Certified checks for 10 per cent must be filed with each bid.

Mississippi.

According to a report of H. A. Kipp, Drainage Engineer, U. S. Department of Agriculture, Washington, D. C., the cost of reclaiming [illegible] be done under the general drainage law of Mississippi or under a revised special act, the act of 1909 creating the district having been declared unconstitutional.

Missouri.

The Supreme Court of Missouri has confirmed the decisions of the lower courts giving the trustees of the Fabius River Drainage District power to contract levees to reclaim several thousand acres of land. Col. John H. Best, Quincy, Ill., is one of the officials of the district.

Oregon.

The Umatilla Drainage District, F. A. Baker, Secretary, Stanfield, Ore., is calling for bids until Feb. 26, for the purchase of $31,190 of bonds of the district. These bonds were issued for the purpose of building a drainage system.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE.)

⊙The Lamar Heights Land Co. awarded contracts recently for the work of grading, putting in streets and sidewalks, etc., on their new sub-division. This property consists of 38 acres, bounded by Nelson Ave., McLane Ave., Lamar Ave. and Barksdale St., and is considered a very fine piece of property. Several streets are already laid out, and work will progress very rapidly, and same will probably be opened by the end of spring. The contracts for work were awarded as follows: [illegible] grading, [illegible] pavement $5,[illegible] gravel, $4,[illegible]; Memphis Shade Tree Co., setting in trees, $6,000; water pipe, $4,000.

⊙On Feb. 12, the [illegible] Paving Co., of Memphis, were awarded the contract for [illegible] sq. yds. of brick pavement by the city of Helena, Ark., together with approximately 1,500 lin. ft. of sewer work and concrete curb and gutter, the contract totaling $[illegible]. Seldom in this section of the country has a more hotly contested letting been held. There were 1[illegible] street paving firms bidding on the work, the contractors coming from the north, east, south and west. The desire to land this contract was so keen on account of the fact that this, which being the first brick contract awarded in Helena for many years, is but the first of about 200,000 sq. yds. of brick pavement which that town will let during the next year and a half. The material men, too, were present in large numbers, for they were anxious to tie up with the successful bidder and be in line for the future contracts which the little town will soon have to offer.

⊙At a private letting held at R[illegible]ville, Tunica County, Miss., Lowrance Brothers were awarded contract for the drainage of the entire property of the Mary Mac Plantation. This work will cost approximately $50,000, and was rendered necessary, according to one of the owners, by the excessive rainfall in that section. He states that in 1911 there was nearly 6 ft. of water precipitated on this land, which was too heavy for the drainage facilities to take care of, consequently crops were very materially reduced. He states that the [illegible] will be one of the best investments ever made. Lowrance Bros. are just the boys to carry out this project in record time.

Commissioners of Shelby county, it is rumored, are planning a systematic chain of improved turnpikes, arranged so as to reach every point of Shelby county. All pikes now in use will be widened and improved, while, where necessary, others will be built. On the northeast, the leading road will be the new Memphis-to-Bristol highway, which is now in course of construction, while another similar pike will reach toward the southeast, running

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

to the Mississippi boundary line. Northward will stretch the pike running through Lucy and Woodstock. Detailed plans for this work have not yet been made out, but are expected to materialize during the latter part of the present year.

In a recent election of the Builders' Exchange, of Memphis, Mr. Charles R. Miller, of the Miller Paving Co., was elected president, defeating Mr. T. S. Denton, of the Tschudey Lumber Co. Mr. Miller is a prominent figure in the line of Memphis builders, and both gentlemen are well regarded by all.

On Feb. 20 Sumner county, Tennessee, issued $200,000 in county road bonds, bearing 4½ per cent interest and running for 30 years. From this, it looks as if the commissioners propose to do quite a lot of road building in the near future. Those interested may communicate with Mr. G. W. Boddie, chairman of the County Commissioners at Gallatin, Tenn., where further details will be furnished.

Friends of L. C. Dulaney learn with regret that when the contract on which he is now working is completed, L. C. Dulaney will close out his outfit. L. C. is a dirt mover of the old school and knows levee building from muck ditch to crown, and in losing him we are losing one of the foremost contractors in this section. Au revoir, L. C.

Maj. Lee Richardson and others, of Vicksburg, Miss., have sprung a sensation among automobile enthusiasts by introducing plans for the building of two great automobile highways paralleling the Mississippi River from New Orleans to Memphis. It is proposed to obtain the consent of the United States Government for the use of the tops of levees, constructing a gravel roadway along the crown, which they say is amply wide enough. This will serve at once a two-fold purpose. It will make a highway surpassing any road in the United States for beauty of scenery, traversing, as it will, cultivated fields and immense cypress swamps; and will also be a means of keeping the levees in excellent shape, as any break or weak spot will be discovered before reaching serious proportions. This plan is thought of very favorably by automobilists in this section, and Maj. Richardson can count on their support.

The new Memphis bridge is furnishing the means of much discussion here, as it seems almost impossible to decide what class of structure to erect. Citizens of Memphis and Crittendon County have called a mass meeting to be held here on Feb. 27, at the Business Men's Club, to try and secure the building of a combination bridge, with wagonways and street car facilities. They contend that if the Rock Island and other interested roads build a bridge for their exclusive use, it will take entirely too long to properly develop the property adjacent to Memphis, while with a wagonway and street car service, the property across the river will be immediately available for building purposes. It does look as if the wagonway will be secured, as every one here is taking up the matter. Senator Clark expresses in decided terms as being in favor of the wagonway. In fact, states he will not support any movement for any other style of structure. It is understood that he will be in Memphis soon for a personal conference with interested parties, and will aid in a movement for the purpose of securing the bridge desired.

On April 10 the National Drainage Congress will hold its second annual meeting in New Orleans, to lay plans for extended drainage projects during the coming year. This body was organized on December 5, 1911, and held its first meeting in Chicago, from Dec. 5th to the 9th. It is somewhat akin to the National Irrigation Congress, and the National Rivers and Harbors Congress. The Irrigation Congress is for the purpose of rendering the arid lands fit for cultivation, while the National Rivers and Harbors Congress is working for good waterways as an aid to commerce, and the Drainage Congress for the draining of swamp lands all over the country. It is expected that immense projects will be taken under consideration at this next meeting.

Reports coming from the lumber interests at New Orleans and other places show that the outlook for timbermen is very encouraging. Though in 1911 there was a small slump in exports at Gulfport, Mobile and Pensacola, with a small increase at New Orleans, it will not be long before the winter cut will be at the mills, and then things will boom.

Actual construction on the new Illinois Central depot will start about March 1, and plans have been made public. The tracks will be led into the depot about on a level with the second floor, which will be given up to the ticket office, dining rooms and waiting rooms, while the ground floor will be reserved for the use of baggage, express, mail, etc. From Main and Calhoun Sts driveways will lead into the structure, and there will be elevator service to carry passengers to the second floor. All parts of the yard used by passenger trains will be viaducted, while baggage will be handled from the ground and arrangement will be perfected so that mail cars will be given the preference. On the west will be erected a temporary depot, and as each section of the new depot is completed it will be put into service. Work will be rushed to a speedy completion.

It was announced Friday that an arrangement had been perfected whereby the Frisco R. R. would open a Memphis-to-Gulf route, by using the tracks of the New Orleans & Northeastern from a point near Laurel, Miss., to New Orleans. It is their intention to operate a route from Chicago to New Orleans, and when the line of the New Orleans, Mobile & Chicago connects with the N. C. & St. L. at Lexington, Tenn., the Frisco will have a route that will be but 26 miles longer than that of the Illinois Central. It is the intention of the Frisco people to then open into active competition with the I. C.

On March 1 we are promised the use of our new $2,000,000 union depot, which now lacks only a few finishing touches. This structure was designed by J. A. Galvin, and contract was awarded Murch Bros. Co., who have certainly done splendid work. It will be used by the Louisville & Nashville, Nashville, Chattanooga & St. Louis, Southern, St. Louis, Iron Mountain and Southern, and the Cotton Belt.

Mr. B. J. Friffitt has been appointed local manager of A. B. Koenig's Labor Agency here. Mr. Griffitt is a hustler from the word go, and contractors feel that he will be amply able to take care of their labor requirements.

For the first time in many moons the ground is drying up sufficiently for Memphis street contractors to start work again. From sometime before Christmas it has been one long round of rain, freeze, thaw, snow, rain and freeze again until dirt movers were disgusted with life, and then when they would take advantage of a good day to start work it would rain and drown them off before they moved a hatful of dirt. This has been the hardest winter on dirt movers in a long time, and they are praying not to see many more like this.

On Feb. 20, J. Heiskell Weatherford, city engineer, received bids on approximately 20,000 sq. yds. of Dolarway pavement. As this is the first street laid with Dolarway, local contractors will watch the result of this letting with great interest.

Leut.-Col. Charles L. Potter, secretary of the Mississippi River Commission, has just notified Maj. Clarke S. Smith, who has charge of the Memphis District of Engineers for the United States Government, of the appointment of Col. Curtis McD. Townsend of Detroit, Mich., as president of the Commission, to take the place of Col. William T. Russel, who has been acting president.

Texas.

Plans are being prepared for the irrigation of about 28,000 acres of land in the vicinity of Fort Stockton for J. M. Brooks of Boston, Mass.

Washington.

Bids will be received until noon, March 4, by W. H. Kingery, Supervisor, of Shelton, Mason County, Wash., for the construction of 2 miles of ditch, requiring removal of 20,000 cu. yds.

Wyoming.

The Shoshoni Power & Irrigation Co., Douglass, Wyo., will irrigate 20,000 acres by pumping; power to be furnished from Boysen Dam on Big Horn River. The W. H. Rosecrans Engineering Co., 30 No. La Salle St., Chicago, Illinois, is the consulting engineer who will have general charge of this work. Plans and specifications for the pumping station, transmission line and canal system are now being prepared.

Canada.

✣Bids will be received until noon, May 1, by A. S. Dawson, chief engineer, Department of Natural Resources, Canadian Pacific Ry., Calgary, Alta., for Brooks Aqueduct. The structure will be 10,000 ft. long and 54 ft. maximum height and is designed to discharge 910 cu. ft. per second. The work will require about 23,400 cu. yds. of concrete and 3,640,000 lbs. of reinforcing steel and 40,000 cu. yds. of excavation and filling. Official advertisement will be found elsewhere in this issue.

WATER-WORKS

Alabama.

The waterworks plant in operation in the city of Decatur, Ala., has been purchased from a Boston, Mass., syndicate by local men. The valuation of the plant is placed at $500,000. Eugene Fies, John B. Weakley and L. B. Franklin of New York city are interested. L. B. Wyatt is Superintendent of the plant.

Arkansas.

The Water & Light Commission of Gravette, Ark., has engaged expert engineers and will soon decide on bids for installing the proposed $25,000 water system and light extension.

Brewer & Gore of Memphis, Tenn., who have purchased the electric light and water plant at Imboden, Ark., will give the entire works an overhauling. New equipment will be installed.

California.

✣Bids will be received until March 4 by City of Orange, Calif., for the construction of a reinforced concrete reservoir, 90 ft. in diameter and 12½ ft. deep. Mayberry & Parker, Los Angeles, Calif., and Santa Ana, Calif., are engineers. George L. Bates is City Engineer. James Richardson, Orange, Calif., is Superintendent of Water Works.

⊙The Board of Public Works of San Francisco, Calif., it is reported, has awarded the contract for completing the high-pressure pipe laying in the district bounded by Powell and Market Sts., and the water front to Robert A. Storrie & Co., for $181,549.

The San Juan Water Co. of San Juan, Calif., has been incorporated with a capital stock of $10,000. The incorporators are: Ralph R. Landley, J. D. Freeman and Eugene Kean.

The City Council of San Diego, Calif., will issue bonds in the sum of $600,000 to construct extension to the water and sewer systems.

According to advices from Oxnard, Calif., the Citrus Heights Development Co. plans

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

th construction of a 30,000-barrel reinforced co rete reservoir. Plans are being prepared by Architect A. C. Martin of Los Angeles, C f. The reservoir will be 140 ft. in diam er and 8 ft. deep, with twisted bar and w fabric reinforcement. The company re- ce ly had plans prepared for the irrigation pi system. It is understood that bids will ul tiy be asked for this work.

eorge L. Bates, City Engineer of Orange, C f., has completed plans for the new city re rvoir of reinforced concrete construction. It ill be 80x100 ft., 10 ft. deep and will have a apacity of 600,000 gals. It will be built two compartments, with a wall 1 ft. thick ween them.

Colorado.

t a recent meeting of the citizens of [illegible], Colo., it was decided to at once take s to incorporate the town. Plans are al ly being prepared for the construction of a mountain waterworks system, to cost $50,-

Connecticut.

According to an announcement reported to e been made by President Eli Whitney of New Haven Water Co., New Haven, n., it is proposed to construct a new reser- on West River, above Dawson dam, of 000,000-gal. capacity. Preliminary work is to be under way.

lans are being prepared by Engineer J. N. Keonan of Plainville, Conn., for the con- ction of a new standpipe for which the tract will be let early in the spring. Mr. Keonan is Superintendent of the water ks.

Delaware.

he Board of Water Commissioners of lmington, Del., has rejected all bids re- ved for the installation of the new turbine eels and triplex pumps to take care of the ess water at the pumping station. The ef engineer has been instructed to prepare v plans and specifications for less expensive chinery.

Georgia.

The water committee of the City Council of lumbus, Ga., has adopted resolutions mak- recommendations to the aldermanic body, ich asked that an election be called by the y for the purpose of voting on a $350,000 d issue for the installation of a waterworks tem.

Idaho.

An election is to be held in Ilo, Ida., on Feb. to determine the question of issuing bonds the construction of a waterworks.

The City Council of Salmon, Ida., has de- led to construct a concrete-lined reservoir 60,000-gal. capacity; 10-in. wooden pipe will used for the intake leading to the reservoir d also for the main for a distance of about 00 ft. towards town, where the line will ange to 8-in. iron pipe.

The Village Board of Preston, Ida., has de- led to ask for bids at once for the installa- n of a waterworks system and for the sale bonds for that improvement.

Illinois.

✣Bids will be received by the Board of ocal Improvements, Cicero, Ill., until 8 m., Feb. 26, for furnishing tools, labor d material necessary to construct a water pply pipe in W. 22nd St. from 52nd Ave. 54th Ave., according to specifications on e with Jno. J. Forrest, Secretary of the ard. Cash or certified check for ten r cent of bid must accompany proposal.

⊙The following contracts for the im- ovement of the waterworks system have cently been awarded by L. E. McGann, ommissioner of Public Works, Chicago, l.: 100 3-in. valves, $3.20 each; 30 4-in., .60; 20 6-in., $7 each; 10 8-in., $11 each 10-in., $20 each, and 12-in. at $25. Pratt Cody Co., Hartford Conn.

✣Bids will be received by the Board of ocal Improvements, Chicago, Ill., E. J. lackin, Secretary, until 11 a. m., Feb. 28th, r furnishing all labor, materials, tools, etc., necessary to construct cast iron water supply pipes in the following streets, according to plans and specifications on file at the office of the water pipe extension department:

Street.	Length in feet.	Internal diameter.	Hydrants.	Valves.	Valve basins.
Bennett Ave.	1,949	8	7	2	2
Honore St.	2,008	8	6	2	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
39th Pl.	290	8	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Indiana Ave.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Winchester Ave.	632	8	2	1	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The Green Engineering Co., [illegible] E. Jackson Blvd., Chicago, Ill., has submitted the lowest bid, $5,980, for furnishing the Department of Public Works of Chicago with a pneumatic ash removal system and erecting same at the 68th St. pumping station. The plans include a steel pipe conveyor, dust collector and a motor designed for 220-volt direct current service. Bids were opened Feb. 3 by L. E. McGann, Commissioner of Public Works. Following are the low bids received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering water pipe (cast iron) of the following sizes and quantities, 19,757 tons 36-in. 1,430 tons 30-in., 1,090 tons, 24-in., 1,617 tons 20-in., 966 tons 12-in., according to specifications. United States Cast Iron Pipe and Foundry Co., 122 S. Michigan Ave., $24.15 per ton. Total contract approximately $600,000. Bids opened Feb. 6.

A filter plant of 1,000,000-gal. capacity per day is to be constructed at Rock Island Arsenal, Rock Island, Ill., during the coming summer. Plans have practically been completed and bids for the construction of the plant will be asked in the near future. The work will include three filter beds of 500 gals. capacity each, one sedimentation tank and a building covering the filter tanks and pumps used. All of the pumps required for the installation except one of 1,500-gal. per minute, are now on hand. All pumps will be motor driven. The estimated cost is placed between $25,000 and $30,000. The work is in charge of the Commanding Officer, George W. Burr, Rock Island Arsenal.

The Board of Local Improvements of Rankin, Ill., has had estimates revised for the proposed new waterworks system to be constructed in the village. The estimate calls for 6-in. and 4-in. mains at a cost of $16,000, exclusive of the engine house, etc., which will cost about $5,000.

A proposition will be submitted to the voters of Charleston, Ill., at the coming city election authorizing the issue of $35,000 of bonds for the installation of a modern filter and extend the water service.

Charles A. Jennings, chief chemist and superintendent of filtration of the Union Stock Yards & Transit Co., Chicago, Ill., has been employed by the city of Quincy, Ill., to analyze the present water supply.

The city of Rochelle, Ill., has awarded the contract for furnishing the new water mains to be laid by the city this spring, to James B. Clow & Sons, Chicago. The contract calls for 2,400 ft. of 8-in. mains weighing 60 lbs. per ft., and ⅝-in. in thickness at $24 per ton.

Indiana.

✣Bids will be received until 7 p. m., March 7, by I. N. Trout, City Clerk, Hartford City, Ind., for installing two 100-h.p. steam boilers in Hartford City waterworks.

The City Council of Hartford City, Ind., will shortly advertise for bids for the furnishing of two new water tube boilers for the city waterworks, for which plans and specifications were prepared by the city engineer.

An ordinance has been introduced in the City Council of Evansville, Ind., providing for a bond issue of $950,000 to meet city and waterworks bonds which mature July 1, 1912.

The Town Trustees of Waveland, Ind., are considering a plan to buy the water plant now owned by the Mutual Water Co.

The National Water Works Co., of South Bend, Ind., has asked the City Council of Crooksville, O., for a franchise to install a water works system in that city.

Iowa.

The citizens of Keokuk, Ia., at the municipal election on March [illegible] will be asked to vote on the question of municipal ownership of the Keokuk waterworks plant. J. F. Elder is Mayor.

The city of [illegible], Ia., is searching for an improved water supply.

Kansas.

✣Bids will be received until 8 p. m., Feb. 27, by Board of Water & Light Commissioners, Ottawa, Kan., for furnishing water meters to the department, on future delivery contract covering a period of one year. Between 300 and 700 meters will probably be needed. W. O. Myers is Superintendent of the Water and Light Department.

Louisiana.

Plans have been prepared by Consulting Engineer [illegible] of Meridian, Miss., for the installation of a new waterworks system in Morgan City, La., at an estimated cost of $70,000. The contract will probably be let in March. Bonds for the improvement were recently sold by M. E. Norman of Morgan City.

Consulting Engineers Worley & Black of Kansas City, Mo., have filed a report with the City Commissioners of Shreveport, La., giving an estimate of the value of the water works plant and sewerage system of the Shreveport Water Works Co.

Maryland.

Government engineers have practically completed a survey along the Little Patuxent River, in Howard County, Md., with a view to supplying Washington with water. The survey begins at the iron bridge which spans the river leading from the Columbia road to Brown's bridge, which is several miles up stream. It is proposed to straighten the banks and erect a dam about 180 ft. high, so as to form a reservoir from which the water will be conveyed through tubes to Washington. The project when completed will cost between $1,000,000 and $2,000,000. William V. Judson is District Engineer-Commissioner, Washington.

The town authorities of Myersville, Md., have drawn up a bill asking for a bond issue of $8,000, which will be sent to the Legislature. It is proposed to install an electric lighting plant and water system. The proposition will be submitted to voters of the town the first Monday in May.

Plans and specifications are being prepared by Engineers Crum & Davidson, Frederick, Md., for the installation of a waterworks system in Walkersville, Md. The cost is estimated at $50,000.

Massachusetts.

R. L. Dana of Norton, Mass., representing the Norton Water Co., recently appeared before the committee on water supply of the State Legislature, Boston, in behalf of the bill to allow the company to hold additional real estate to the amount of $50,000 and also for authority to increase its capital stock to $100,000. The additional money is needed to carry out the contemplated improvements.

Michigan.

⊙The Board of Public Works of Grand Rapids, Mich., has let to the Fort Wayne Electric Co., Fort Wayne, Ind., a contract for 100 magnetite lamps, at a cost of $2,177.

Minnesota.

✣Bids will be received until 8 p. m., Feb.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

23, by City Clerk, D. P. McIntyre, Eveleth, Minn., for the construction of about 1,350 ft. of 6-in. water main on Harrison St. and 300 ft. of 6-in. water main on Ave. A.

⊙The Chicago Bridge & Iron Works, Chicago, Ill., has been awarded the contract by the Board of Water Commissioners, Stillwater, Minn., for the construction of a steel standpipe, 30 ft. in diameter and 49 ft. 6 ins. high, for $3,638. The contract for the concrete foundation was let to Albert Evlitz of Stillwater for $825. Bids were opened Feb. 15.

Mississippi.

The city of Vicksburg, Miss., has been offered the waterworks system now in operation in that city for a consideration of $375,000. A. M. Paxton is City Clerk.

Missouri.

The city of Marysville, Mo., has not as yet purchased the City Water Co.'s holdings, for which bonds in the sum of $100,000 were recently voted. If purchased, improvements will be made by extending the water mains and laying new ones to the extent of several miles. F. L. Flynt of Marysville is Engineer. S. G. Gillam is Secy. of the Board of Public Works and A. S. Robey is Mayor.

The City Council of Ash Grove, Mo., has called a special election for a bond issue of $14,000 to install a municipal waterworks plant. The election will be held Feb. 27.

The City Council of Hamilton, Mo., contemplates installing a waterworks system and will probably submit a proposition to the voters to vote bonds for the improvement. The Council also is considering purchasing additional fire apparatus. Worley & Black, Kansas City, Mo., are Engineers.

Nebraska.

The City Council of York, Neb., has set aside the petition asking for the calling of a special election to vote on the issuance of bonds in the sum of $125,000 for a municipal waterworks, electric light and heating plant. A. B. Chatterton is City Clerk.

New Hampshire.

A mass meeting of the citizens of Wolfeboro, N. H., will be held in March to decide upon the question of extending the waterworks system at an estimated cost of $12,750, for which plans and specifications are being made by Engineer Charles H. Bartlett. W. J. Britten is Town Clerk.

New Jersey.

The New Jersey State Board of Public Utility Commissioners has approved the issue of $135,000 of stock of the Normandy Water Co.

Plans have been prepared by Engineer A. D. Rogers of Collingswood, N. J., for the installation of a new municipal water plant, including two 1,500,000 cross compound condensing pumping engines, two safety water tube boilers, standpipe, filter plant, 17 miles of street mains, etc. The water supply will be secured from artesian wells. The estimated cost is $125,000. The contracts will be let shortly after the plans have been approved by the State.

The Peninsula Water Co., of Camden, N. J., has been incorporated with a capital stock of $125,000 to operate a waterworks in Ocean County, N. J. The incorporators are: F. C. Goodwin and E. S. Hale of Camden.

New York.

✣Bids will be received until 2 p. m., March 12, by Maj. B. T. Clayton, Quartermaster, West Point, N. Y., for furnishing material and labor required for extension of the water distributing system at West Point, N. Y.

✣Bids will be received until 2 p. m., Feb. 26, by H. S. Thompson, Commissioner, Department of Water Supply, Gas and Electricity, New York City, for furnishing and delivering standard high pressure fire hydrants.

The village of Solvay, N. Y., has contracted with the Syracuse Suburban Water Co., for a supply of Otisco Lake water for five years. The water company agrees to deliver not less than 300,000 gals. nor more than 600,000 gals. per day at the Solvay village pumping house. Edwin M. Hall is Village Clerk.

Ohio.

✣Bids will be received until noon, Feb. 27, by Director of Public Service, Cleveland, O., for water meters for the water department of the city. W. H. Kirby is Secretary of the Department.

Oklahoma.

✣Bids will be received until March 4, by Mayor and City Council, Pawhuska, Okla., at the office of Albert York, City Clerk, for construction, repair and extension of the water works system. A certified check for $500 must be filed with each bid. Plans and specifications may be seen at the office of the Superintendent of Water works and Electric Light system.

⊙The J. S. Terry Construction Co., of Poteau, Okla., has been awarded the contract for the construction of a waterworks plant at Talihina, Okla., for which James W. Beebe is Engineer. Bids were opened Feb. 6.

⊙C. O. Wilson, representative of the Pennsylvania Drilling Co., has been awarded a contract by the Municipal Commission of El Reno, Okla., for digging a well 10,000 ft. deep. The contract price is $13,575. The city will furnish material for the derrick, and also fuel, water and casting. The estimated cost of the well is about $22,000.

The proposed improvements to be made in the waterworks system of Oklahoma City, Okla., from the $100,000 bond issue to be raised, are: Installation of a new 10,000,000-gal. pump, $34,500; discharge pipes and suction lines, $11,500; housing new equipment and installation of oil burners, $16,000; two new boilers, $13,000; compensation of the three engineers to investigate and report on permanent water supply, $10,500; expense of engineers in making necessary examinations, $14,500.

Oregon.

Plans are being prepared by Engineer Sidney Strong of Sutherlin, Ore., for the construction of a new waterworks system for that city, at an estimated cost of $25,000. The work will include a reservoir and about 8 miles of pipe line. The water supply will be secured from the river. It is probable the contract will be let about the latter part of March.

Pennsylvania.

Plans for a sewage disposal plant for Connellsville, Pa., have been completed by Chester & Fleming, Consulting Engineers, Pittsburgh, Pa., and will be presented to the State Department of Health of Pennsylvania for approval. The plant will consist of a pumping station, sprinkling filters and secondary settling basins and will treat all of the sewage of the borough.

Plans have been prepared by Engineer T. Chalkley Hatton of Wilmington, Del. for the making of extensions to the old waterworks of Berwick, Pa., at an estimated cost of $75,000. The work will include a mechanical filter plant of 3,000,000-gal. capacity, pumping machinery and boiler. The Susquehanna River is the source of supply. Contracts will probably be let late in the spring.

On Feb. 3 Alexander Potter, 114 Liberty St., New York City, was engaged to prepare and supervise the construction of an improved system of water supply for the Borough of Coatesville, Pa. In all probability the plan adopted will be that of impounding the water from a mountain stream. .

Plans are being prepared for the digging of artesian wells, the building of a 40,000,000-gal. storage dam, and for the laying of 9 miles of 20-in. pipe for the South Easton Water Co. Frank Huth, Secretary and Treasurer, Nazareth, Pa.

South Carolina.

⊙The American Machine & Mfg. Co., Charlote, N. C., has been awarded the contract by the City Council of Columbia, S. C., for overhauling and repairing the pumping plant for $5,892. The work includes resetting pumps on foundations, reboring water wheels, new shafting, boxes, etc. F. C. Wyse is Engineer. Bids were opened Feb. 14.

South Dakota.

The Monday Noon Club of Yankton, S. Dak., is circulating a petition calling for a vote at the regular spring election for $60,000 to increase the size of the water mains and to erect a new standpipe.

Texas.

✣Bids will be received until March 4, by H. L. McDuffie, Superintendent, Water and Light Department, Sherman, Texas, for the purchase of water mains, valves, fire hydrants, etc.

Supt. Harve McDuffie of the water and light department, city of Sherman, Tex., has drawn up the plans and specifications for a 12-in. water main from Fairview pump station to the city, a distance of slightly more than a mile, and work will be commenced immediately. The new pump station now has a capacity of 50,000 gals. per hour from the four new deep wells.

The Bastrop Water & Light Co., of Bastrop, Tex., has filed amendment changing purpose so as to provide public water, electric light and ice supply, changing name to Bastrop Water, Light & Ice Co., and reducing directorate from seven to five members.

The City Council of Brownwood, Tex., has sold the $15,000 waterworks bonds to the United States Bond & Mortgage Co., of Dallas. The money will be used to build a cement reservoir of the mountain west of town for the storage of water and for the removal of the present standpipe, which is in the center of the business part of town.

The Aldermen of Stephenville, Tex., have let the contract for two deep wells to Barham & Kiker. Bonds to the amount of $18,000 have been voted to install waterworks.

The Madisonville Artesian Well Co., Madisonville, Madison County, Tex., has been incorporated with a capitol stock of $2,500, by J. A. Herring, W. A. Price, O. A. Parton and others.

The City Commission of Terrell, Tex., has ordered 7,000 ft. of new water mains laid. The water system is to be enlarged and otherwise improved.

Virginia.

✣Bids will be received until noon, Feb. 26, by Water Works Committee, N. P. Angle, Chairman, Rocky Mount, Va., for boring a deep well, size 8 in., with standard casing in earth and 6-in. rock, estimated depth 300 to 500 ft.

The Water Commission for the city of Norfolk, Va., has been appointed to examine into and report to the City Council the best available source for an additional water supply for the city. R. E. Steed is City Clerk.

Plans and specifications are being prepared for the extension of the 20-in. feed main across the river and along streets of the southern part of the city of Richmond, Va., at an estimated cost of $70,000. About 3,000 ft. of 20-in. pipe will be submerged along the bottom of the river and across an island. The contract will be let in a month or so. E. E. Davis is Superintendent of Waterworks.

Washington.

Plans have been prepared by City Engineer W. H. Dunbar of Grandview, Wash., for the construction of a new waterworks system at an estimated cost of $18,000. The work will include well, pumping machinery, 30,000-gal. elevated tank, 5-ft. by 20-ft. steel pressure tank, and 19,000 ft. of wood pipe. The contract will be let as soon as the bonds are sold.

Engineer Frank C. Kelsey of Portland, Ore., has just completed the plans and specifications and estimates for a municipal gravity water system, piping water from the north fork of the Newaukum River for the city of Centralia, Wash. An election is to be held shortly to vote on the issuance of bonds for the improvement.

Following bids were recently received by

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Board of Public Works of Seattle, Wash., the construction of the watermain tunnel 12th Ave. South: (1) 42-in. steel pipe tunnel lining "A;" (2) alternate with nel lining "B;" (3) alternate with tunnel ng "C;" (4) 42-in. lock bar steel pipe tunnel lining "A;" (5) alternate with neling lining "B;" (6) alternate with tun-ng lining "C;" George C. Dietrick & Co., ttle: (1) $27,314; (2) $26,636; (3) $26,; (4) $27,314; (5) $26,636; (6) $26,927. ff Construction Co., (1) $43,860; (2) $42,-; (3) $35,535; (4) $42,980; (5) $41,915; $34,655. Swan Peterson, (1) $40,656; (2) 688; (3) $37,752; (4) $40,656; (5) $39,-; (6) $37,752. Haydon & Sons, (1) $30,-; (2) $29,848; (3) $27,864; (4) $29,717; $29,059; (6) $27,075. J. R. Ritchie, (1) 410; (2) $33,378; (3) $32,410; (4) $32,-; (5) $33,500; (6) $32,532. Jahn Con-ting Co., (3) $45,138. Sloane Bros., (1) 087; (2) $28,393; (3) $27,667; (4) $32,-; (5) $30,518; (6) $29,792. The work in-es 1,837 ft. of riveted steel pipe; 1,109 ft. unneling; 2,904 ft. of tunnel lining.

Wisconsin.

Bids will be received until noon, March y City Clerk, Durand, Wis., for installing ipes, specials, valves, hydrants and connec-s for the waterworks system. The work include laying 8,100 ft. 8-in., 8,100 ft. 6-in. and making all connections with 4-in. Plans and specifications for the work on file with S. G. Gilman, Mondovi, Wis., sulting Engineer, and at the offices of INEERING & CONTRACTING, 608 South Dear-St., Chicago, Ill. A certified check for must be filed with each bid. Official ad-isement will be found elsewhere in this e.

The contract for the sinking of the 15 wells onnection with the new well system to be installed in La Crosse, Wis., has been let to Edward Roesler of La Crosse, for $8,779. A. T. Maltby, Great Northern Bldg., Chicago, Ill., is Engineer.

⊙Bids were opened Feb. 10 by the Board of Public Works of Milwaukee, Wis., for the laying of house drains and water service connections in the following streets, for which the contracts were awarded Herman Hohensee: Eighteenth Ave., from South Pierce St. to National Ave., 23rd Ward, house drains $18 each, long water $23.40 each, short water $17.75 each; Twentieth Ave., from Mineral St. to Greenfield Ave., 23rd Ward, house drains $19 each, long water $24.60 each, short water $17.75 each; Twenty-first Ave., from South Pierce St. to Scott St., 23rd Ward, house drains $18.70 each, long water $23.10 each, short water $17.75 each; Thirty-first Ave., from National Ave. to Scott St., 23rd Ward, house drains $18.10 each, long water $21.60 each, short water $17.60 each.

⊙Following bids were opened Feb. 10 by the Department of Public Works of Milwaukee, Wis., for the laying of house drains and water service connections in the following streets, the contracts being awarded to Charles R. Schroeter: Thirty-second Ave., from National Ave. to Scott St., 23rd Ward, house drains $18 each, long water $21.45, short water $18 each. Following were awarded F. A. Goll: Fredericka Pl., from Trowbridge Ave. to Thirty-second Ave., 23rd Ward, house drains $18 each, and long water $20 each.

Plans are being prepared by Engineer A. T. Maltby, Great Northern Bldg., Chicago, Ill., for the rebuilding of the old water plant at La Crosse, Wis., at an estimated cost of $300,000. It is planned to secure the water supply from wells instead of the present river source. The work will include a new pump station and extension of water mains. The contract will be let probably in latter part of March. The work is in charge of the Board of Public Works.

Wyoming.

Bruce & Standevin, Bee Bldg., Omaha, Nebr., have been retained as engineers for waterworks system to cost $21,000, and a sewer system to cost $9,000, for the city of Torrington, Wyo.

Canada.

✣Bids will be received until noon, Feb. 26, by City Commissioners, Moose Jaw, Sask., for supply delivery and erecting and testing of one elevated water tank within the city limits. Specifications and all information may be obtained on application to the City Clerk, Moose Jaw, or at the office of Walter J. Francis & Co., Consulting Engineers, Montreal.

✣Bids will be received until 11 a. m., March 7, by Chairman, Board of Control, at the office of M. Peterson, Secretary, Winnipeg, Man., for supply of 5 36-in. and 3 20-in. gate valves. Specifications are on file at the office of City Engineer, 223 James Ave.

✣Bids will be received until 6 p. m., Feb. 24, by L. B. Browne, Town Commissioner, Castor, Alta, for supplying material and erecting a steel water tank to contain 120,000 gals. on a 75-ft tower; also for boring a 10-in. well 500 ft. deep and casing same and an 8-in. well about 800 ft. deep.

The fire, water, light and power committee of the City Council, Winnipeg, Man., has instructed the city engineer to report at once on the best locations and the probable cost of laying two additional 10-in. water mains crossing the Assiniboine River to supply Fort Rouge.

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

Bids will be received until 11:30 a. m., rch 4, by Grand Secretary, Masonic Tem-Montgomery, Ala., for installing sewage em at the Alabama Masonic Home, 4 miles n Montgomery. B. M. Jacobs is Chairman, ningham, Ala.

he City Council of Bay Minette, Ala., has ded to install a sewerage system through business part of town.

lans have been prepared by Engineer W. Cooper, of Oxford, Ala., for the con-ction of new sewers in that city at an mated cost of $12,000. The mains will 10 ins. in diameter. The contract will be in about 30 days.

Arkansas.

Bids will be received until noon, March y Roy M. Johnston, Secretary, Fort Smith, ., for the construction of certain storm er sewers or underdrainage for Garrison . The cost of the work is estimated at 500. Plans and specifications are on file the City Engineer.

as. W. Beebe, engineer in charge of ver construction for Prescott, Ark., has n engaged to remodel sewage treating nt for Hope, Ark., and Worley & Black Kansas City, Mo., have been retained as nsulting Engineers.

he City Council of Van Buren, Ark., has ed an ordinance creating Sewer Improve-nt District No. 2, for the purpose of con-cting a sanitary sewer; the district com-es an area of 160 acres. W. B. Bell, of n Buren, is engineer.

ity Engineer Merle H. Reed, of Fort ith, Ark., has completed the specifications the Garrison Ave. storm drainage. The imated cost is about $11,500. The plan olves the laying of two separate storm ers; one emptying in the river at the foot of Garrison Ave., and the other into the storm sewer main, probably on North C St.

California.

⊙The Mercer-Fraser Co., at $12,429, has been awarded the contract for the construction of the concrete foundation piers for the Islais Creek incinerator for the city of San Francisco, Calif.

Plans have been prepared by Engineer Frank Lathrop, Hemet, Calif., for the installation of a new sewerage system in that city at an estimated cost of $30,000. The contract will be let about March 15.

The Board of Trustees of Fullerton, Calif., has received reports from engineers Sloan & Robson, of San Francisco, and Vivian G. Barr, of Los Angeles, concerning the proposed construction of municipal waterworks and a sewer system. The estimated cost of the sewer system is $100,000, and of the waterworks $90,000.

Sewer improvements are to be made in San Diego, Calif., this season at an estimated cost of $120,000, as follows: Brooklyn Heights, $70,000; North of Park, $40,000, and extension of the present Mission Hills system, $10,000. Additional work has been outlined which would bring the total estimated cost up to $450,000. Councilman A. F. Dodson is in charge of sewer construction.

Colorado.

The City Council of Ordway, Colo., has retained George T. Prince, representing the George W. Sethman Co., Equitable Bldg., Denver, Colo., as consulting engineer, to prepare plans, maps, survey, profiles and specifications and estimates of the cost of installing a sewerage system.

Delaware.

Plans have been prepared by Consulting Engineer T. Chalkley Hatton, Wilmington, Del., for the making of extensions to the sewage disposal plant of the Anti-Tuberculosis Hospital of Delaware. The contract will be let late in the spring. The estimated cost is $5,000.

Florida.

✣Bids will be received until noon, March 5, by Board of Public Works, Bradentown, Fla., for the construction of a sanitary sewer system in accordance with the plans and specifications on file at the office of the city clerk. A certified check for $500 must be filed with each bid.

Georgia.

Bids received on castings for sewer work for 1912 for Atlantic were as follows, (1) bid of General Pipe & Foundry Dept., (2) Southern Iron & Equipment Co., and (3) Withers Foundry & Machinery Works:

Material.	Amt.	(1)	(2)	(3)
Manhole covers	500	.01¾	.0159	.0170
Catch basin covers	100	.01¾	.0159	.0170
M. H. steps	2,500	.01¾	.0159	.0170
C. B. bars	100	.15	.40	.30
Grates and frames	100	.01¾	.0159	.0170
Sewer Y markers	8,000	.01¾	.0159	.0170
8-in. valves	[illegible]	[illegible]	.218	[illegible]
10-in. valves	[illegible]	4.00	[illegible]	2.25
12-in. valves	2	4.75	.420	2.25

The City Council of Atlanta, Ga., recently passed upon all sewer work to be done in the city during this year, estimated to cost $150,000. The plans for this work are made as the work progresses and the work is done by the McCrary Excavating Co., of that city. R. M. Clayton is Chief Engineer of Construction.

Idaho.

The City Council of Sandpoint, Idaho, has passed an ordinance providing for the creation of a sewer improvement district, which is to be known as Sewer Improvement District No. 2. This district will include the territory between Boyer Ave. on the west, to First Ave. on the east, Larch St. on the north and Lake Pend d'Oreille on the south.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Georgia.

Following bids were received by the city of Atlanta, Ga., for sewer work for the year 1912. R. M. Clayton, Chief Engineer of Construction: (1) Being bid of Meador Construction Co., (2) Sullivan & Mulcahy, (3) McCrary Excavating Co., (4) R. M. Hudson & Co., (5) Dysard Construction Co., and (6) J. R. Cothran:

Amt.	[illegible]	(1)	(2)	(3)	(4)	(5)	(6)
[illegible]	Brick	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	Cu. yds. rubble masonry..................	2.00	3.20	3.00	2.60	2.00	5.00
50	Cu. ft. cut stone.........................	1.70	2.50	2.00	1.82	1.00	1.85
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10,000	F. B. M. lumber...........................	12.00	18.00	17.00	18.00	14.00	17.75
[illegible]	Cu. yds. earth exc., [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25,000	Cu. yds. earth exc., 15 ft................	.62	.60	.50	.60	.55	.70
3,000	Cu. yds. earth exc., 20 ft................	.75	1.00	.70	.90	.70	.87
500	Cu. yds. earth exc., 25 ft................	.90	1.50	.90	1.20	1.25	1.00
2,000	Cu. yds. solid rock exc...................	2.00	3.00	2.50	2.50	1.75	3.50
10,000	Cu. yds. semmidec rock	1.00	.95	.90	.65	.49	1.80
100	Cu. yds. plain concrete...................	2.00	3.00	3.00	4.50	4.00	5.00
120,000	Lin. ft. 6x8-in. vit. pipe, laid..........	.03	.025	.03	.02	.03	.05
15,000	Lin. ft. 10x12-in. vit. pipe, laid........	.04	.05	.04	.03	.04	.05
10,000	Lin. ft. 15x18-in. vit. pipe, laid........	.06	.06	.06	.04	.06	.06
3,000	Lin. ft. 20x22-in. vit. pipe, laid........	.07	.07	.08	.05	.07	.07
2,000	Lin. ft. 24-in. vit. pipe, laid...........	.10	.10	.10	.06	...	.07

Illinois.

✣Bids will be received until 11 a. m., Feb. 28, by Board of Local Improvements, E. J. Glackin, Secretary, Chicago, Ill., for contracts for constructing sewers in 52nd Ave. and other streets; Archer Ave. and other streets, Aberdeen Ave. and other streets.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., March 1, for furnishing and delivering to 12 different jobs and 3 pipe yards special castings between March 15th and August 15th. Contract is made up as follows: Tees, 6 36x24, 2 36x20, 4 36x16, 45 36x8, 1 30x30, 6 24x24, 2 20x16, 2 20x12, 10 20x8, 10 20x6, 1 48x36 Y branch, 6 36x⅛ bends, 52 36x1/16, 8 30x⅛, 8 30x1/16, 21 24x⅛, 10 24x1/16, 8 20x⅛; reducers 2 48 to 36, 3 36 to 30, 2 36 to 24, 2 20 to 16, 20 36x8, M. H. B. O., 2 30x8, M. H. B. O., 15 36x8 B. O., 1 30x8 B. O., 5 24x6 B. O., 8 20x6 B. O., 18 36 sleeve, 12 24 sleeve, 5 20 sleeve. Total castings 299; total weight, 556,206 lbs. To be delivered March 15th, 105,296 lbs., April 15th 128,598 lbs., May 15th 64,452 lbs., June 15th, 151,224 lbs., July 15th 50,199 lbs., August 15th 56,437 lbs.

Bids were opened Feb. 14 by Board of Local Improvements, Chicago, Ill., for constructing sewers in various streets, the low bidders being as follows: California Ave. and other streets, The Ryan Co., Stock Exchange Bldg., Chicago, Ill., $22,479; 75th St., George Pontorelli, 4817 W. Dakin St., $1,243; N. 68th Ct., George Pontorelli, at $1,932; 77th St., George Pontorelli, at $3,359; Bensley Ave., George Pontorelli, at $2,876; E. 76th St., Nick Mancini, 900 W. Taylor St., at $12,159; W. Lake St., Ch. Malone, $3,537.

Consulting Engineer Dabney Maury of Peoria, Ill., has been engaged by the city of Moline, Ill., to assist in the work on the extension of the waterworks and sewer system of the city. Plans are now being prepared for the extension of the east end sewer system, which will be started this spring.

The City Council of Elgin, Ill., intends to advertise for bids on the West Chicago St., and North State St. sewer systems at the same time. The estimated cost of the North State St. improvement is $44,500, while the estimate of the West Chicago system is $78,000. Morgan H. Brightman is engineer in charge.

The W. S. Shields Co., Hartford Bldg., Chicago, Ill., has been retained by the Board of Local Improvements of Sandwich, Ill., to prepare plans and specifications for the installation of a sewerage system. Alderman Henry Hennis is a member of the board.

City Engineer Jos. A. Tremble of Hillsboro, Ill., has outlined the district for the sewerage system and an ordinance for the improvement has been passed by the City Council.

The Board of Local Improvements of Monmouth, Ill., has passed a resolution establishing a new sewer district to be known as District No. 64, and contemplates the construction of a sewer 7,357 ft. long in the northwest part of the city. City Engineer R. M. Ferguson has estimated the cost of the improvement at $9,688.

The Board of Local Improvements of Abingdon, Ill., has decided to construct sewer systems in Sewer Districts No. 1 and No. 2.

City Engineer J. E. Schwaab, of Upper Alton, Ill., has completed preparing three separate petitions to be circulated in Upper Alton among property owners, calling for three sewer districts to be established and the building of three sewers in the old village.

The City Council of Springfield, Ill., has adopted three ordinances for sewers as follows: In Yates Ave., from Walnut to Pool St., thence on Pool St. to the alley north of North Grand Ave.; in 11th St., and in 10½ St., from Laurel St. to South Grand Ave.

The City Commissioners of Aberdeen, S. Dak., have sold an issue of $200,000 of sewer extension bonds to Bolger, Mosser & Willman and Devitt, Tremble & Co., of Chicago, Ill.

The Board of Local Improvements of Rockford, Ill., has approved plans for the construction of a sanitary sewer in 16th Ave., from Seventh to Eighth Sts.

In a recent letter to George M. Wisner, Chief Engineer of the Sanitary District of Chicago, Commissioner of Public Works John H. Moore, of Evanston, Ill., outlined plans for turning the sewage of that city into the canal and for the enlargement of the sewer system. Nine schemes are being considered for adoption, and the estimated cost of each is given as follows:

Scheme.	Sewer and appurtenances.	Pumping station and equipment.	Total.
A	$575,000	$120,000	$695,000
B	560,000	120,000	680,000
C	495,000	120,000	615,000
D	480,000	95,000	575,000
E	470,000	95,000	565,000
F .	500,000	95,000	595,000
G ..	485,000	95,000	580,000
H ...	495,000	95,000	590,000
I .	510,000	95,000	605,000

Indiana.

✣Bids will be received, it is reported, until Feb. 29, by Board of Public Works, Fort Wayne, Ind., for one cement sidewalk contract, three local sewer contracts, one main sewer contract.

⊙The City Council of Kendallville, Ind., has let the sewer contract for the northeast portion of the city to John McGillicudy of Valparaiso, Ind., for $10,912.

The City Council of Jeffersonville, Ind., is considering an ordinance providing for the granting of a franchise to James P. Goodrich and Jesse T. Moorman of Winchester, Ind., for the installation of a sewerage system. The system will cost approximately $165,000.

The Board of Public Works of Gary, Ind., has approved the plans and specifications for the proposed south side sewer system, which will cost approximately $225,000. The new sewer will be five miles in length and will drain the south central portion of the city. Three branches are to be constructed. Bids for this work will be asked shortly. A. P. Melton is City Engineer.

Iowa.

✣Bids will be received until March 4, City Clerk, Knoxville, Ia., for the constr tion of a sanitary sewer as follows: 1, ft. of 10-in. vitrified pipe sewer; 9,828 8-in. vit. pipe sewer; 26 regular manhol 4 flush tanks; 2 combined manholes a flush tanks; one drop manhole; 2 lamphol A certified check for $500 is required. H & Adams, Centerville, Ia., are Enginee

⊙The J. W. Turner Improvement Co., Des Moines, Ia., has been awarded the tract in that city for the construction of sewer system in the Seventh Ward, to c approximately $130,000. The system will 78,400 ft. long and will include a septic ta to be located at East 30th St., south of railroad tracks. Bids were opened Feb. by Horace Susong, City Clerk.

The City Council of Burlington, Ia., is pl ning for extensive work in the building of n sewerage systems. Recommendations ha been received from the City Engineer for construction of sewers in North, Linden a such other streets in that vicinity. It was a considered advisable to have plans and spec cations prepared for a sewer in Mt. Pleas St., from the Hawkeye sewer to the cen of Gertrude and Mt. Pleasant Sts., w branches in Winter, Chalfant, Doemla, Krueger, Caroline and Dehner Sts.; also Silver Leaf and Short Ave., and in the al north of Mt. Pleasant St., between Krue and Caroline Sts.

Consulting Engineers Bruce & Stande Bee Bldg., Omaha, Neb., recently submit plans, specifications, maps, etc., to the C Council of Lamoni, Ia., for sewerage a street and sidewalk grades, and the same ha been adopted. It is planned to begin c struction work early this spring.

Kansas.

The City Council of Chanute, Kans., h adopted an ordinance establishing a new sev district in the north part of the city. An o let is to be provided for the new sewer.

The Kansas City, Kans., Commission have notified the city officials of Kansas C Mo., that they will offer no opposition to plans for diverting Turkey Creek and O. K. Creek sewer into the Kaw River, p vided Kansas City, Mo., would build a pl at the mouth of O. K. Creek sewer for pu fying the sewage.

City Engineer Bert C. Wells, of Wich Kans., has prepared plans for the constr tion of a surface sewer in East Third from Hillside to the canal.

Kentucky.

✣Bids will be received until noon, Feb. by Commissioners of Sewerage, Equita Bldg., Louisville, Ky., for the construction the Barney Ave. sewer under Contract No. The work consists mainly of the construct of 2,043 ft. of 8-in. sewer and 22-in. to 33 storm-water drain; depth of cut, 4.5 ft. 19.5 ft., including about 280 cu. yds. of c crete and 2,043 ft. of 8-in. and 10-in. pipe. ft. of 22-in. pipe and 900 cu. yds. rock. J. F. Breed is Chief Engineer of the Commissi

Plans are being prepared by Engin George Lindsey of Newport, Ky., for the c struction of a trunk sewer connecting 7 o lets of the present sewer system of Belle (P. O. Dayton, Ky.). George M. Geiger Bellevue is in charge of the work.

Maryland.

✣Bids will be received until 11 a. Feb. 28, by Board of Awards, at the off of the City Register, Baltimore, Md., building storm water drains, storm wa contract No. 19. Plans and specificati are on file with Calvin W. Hendrick, Ch Engineer of Sewerage Commission, Ame can Bldg., Baltimore, Md. The bids must accompanied by a certified check for $2. The work will include the following proximate quantities: 3,250 lin. ft. 36-in to 30-inch masonry drains, 10,735 lin. 24-inch to 12-inch terra-cotta pipe drai

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

;0 lin. ft. 18-inch to 12-inch inlet connec-
:s, 90 manholes, 176 inlets.
'ollowing bids were received by the Board
Awards of Baltimore, Md., for Sanitary
ıtracts Nos. 80 and 83, contracts for lateral
'ers at Bay View asylum, Baltimore, and
'zles, deflectors and special castings for
ınkling filter beds No. 3 and 4 at sewage
ıosal plant, Back River: Sanitary Con-
't No. 80—Bond & Bates, Pratt & Presi-
t Sts., Baltimore, $15,918; Edward Perkins,
9 N. Patterson Park Ave., Baltimore, $19,-
; The David M. Andrew Co., Mt. Ver-
Ave. and 26th St., Baltimore, $19,231;
mond H. Williams, 819 Equitable Bldg.,
imore, $19,838; Ryan & Reilly, Baltimore,
658; N. A. Middleton & Co., Continental
g., Baltimore, $22,499; Frank B. Sweeten,
imore, $23,193; Martin J. Beach, 809
erican Bldg., Baltimore, $23,208; Upshur
Rich, 3205 Clifton Ave., Baltimore, $24,498;
iting-Turner Const. Co., Sexton Bldg.,
imore, $26,077; Charles Bevan Clark, Bal-
ıre, $26,921. Sanitary Contract No. 83—
ific Flush Tank Co., Chicago and New
k, $2,509; Merritt & Company, Camden,
J., $2,900.

[artin J. Beach, 815 American Bldg., Bal-
ıre, Md., will probably be awarded the
tract by the Board of Awards of that
for the construction of trunk sewers in
derick Ave., under Contract No. 79. Bids
e opened Febr. 7.

Minnesota.

he City Comptroller of St. Paul, Minn.,
sell bonds Feb. 29 in the sum of $250,000,
proceeds to be used in waterworks and
er construction.

he city of Red Wing, Minn., plans a con-
rable amount of improvement work for
year, included in which will be new sew-
street paving and water mains. A. E.
.me is City Engineer.

The Board of Public Works of St. Paul,
ın., has awarded three contracts for the
struction of new sewers, as follows: In
tin Ave., from Marshall Ave. to Rondo St.,
tinuing on Rondo to Finn Ave., P. J. Ryan,
34,497; in Dunnedin terrace, from Ada to
ıgress St., E. D. Webster, at $1,277, and a
er on Park Ave., between Winter St. and
no Ave., to Christ Johnson, at $226.

he sewer committee of the City Council
Minneapolis, Minn., has begun work on
plans for trunk sewers, including the River-
Park tunnel project. G. V. B. Hill is
ırman of the Committee.

[ayor Keller, of St. Paul, Minn., has ap-
ved the ordinance for a bond issue of
),000 for sewer construction during the
ıing year. The committee has recom-
ıded to the Common Council that the
ount be distributed as follows: Hester
extension, $15,000; Maryland St., $3,000;
Clair and Cretin system, $8,000; Robie St.
ension, $15,000; Ocean St. extension, $45,-
; Jefferson and Hamline Ave. system,
000; St. Albans St. storm water sewer,
,000; Randolph St. extension, $700; Somer-
e St. repairs, $2,500.

Missouri.

✣Bids will be received until noon, Feb. 29,
W. H. Youse, City Clerk, Hannibal, Mo.,
constructing sanitary and storm sewer
trict No. 200. Each bid must be accom-
ied by a certified check for $1,000. Plans
specifications are on file at the office of
Clerk and of the City Engineer.

✣Bids will be received until 7:30 p. m.,
ırch 4, by City Clerk, Union, Mo., for
nishing the necessary labor and material
constructing a sanitary sewer system.
ıns and specifications are on file with
orge H. Vossbrink, Union, Mo., City
rk and at the office of the engineers,
ller Coult Co., Chemical Bldg., St. Louis,
. The work will include the following
proximate quantities: 1,962 ft. of 12-in.
. sewer pipe, 3,856 ft. of 10-in. vit. sewer
ıe, 11,098 ft. of 8-in. vit. sewer pipe, 6,272
of 6-in. vit. sewer pipe, 54 10x6-in. Y
anches, 290 8x6-in. Y branches, 190 6-in.
[illegible] 6 flush tanks, 15 lampholes. Excavation, 7,360 cu. yds. Bond issue, $10,000.

The City Council of Kansas City, Mo., has passed ordinances providing for a joint district sewer in joint sewer districts 320, 324, 325 and 329, in Division 5; also district 369, Division 3; district 368, Division 5; district 370, Division 3, and district 371, Division 3.

Consulting Engineer Alexander Potter, 114 Liberty St., New York City, has completed the plans for the sewer outlet sanitation plants for the city of Springfield, Mo., for which bonds in the sum of $100,000 will shortly be issued, and bids for construction work advertised. H. G. Horton is City Engineer.

Montana.

The city of Roundup, Mont., will vote on March 12 on the proposition of bonding the city for $15,000 for the purpose of constructing a sewer system. E. J. Parkinson is City Engineer.

A special election will shortly be held in Libby, Mont., to give the citizens another chance to vote on the issuance of bonds in the sum of $15,000, for the purpose of constructing a main sewer extending through the city.

Nebraska.

Plans are being prepared by Engineers Bruce & Standevin, Bee Bldg., Omaha, Nebr., for the construction of a sewer system at Fullerton, Nebr., at an estimated cost of [illegible].

Bids will be called for the construction of a sewer system at Scotts Bluff, Nebr., about March 1, according to plans and specifications made by Engineers Bruce & Standevin, 432 Bee Bldg., Omaha, Nebr. The estimated cost is $12,000.

The City Council of Broken Bow, Nebr., is considering the advisability of installing a sewerage system with septic tank. It is estimated that a system can be put in for $12,000 or $15,000. State Architect Bird Miller is preparing estimates.

Bonds in the sum of $13,200 will be voted upon by the citizens of Mitchell, Neb., on Feb. 27 for the outlet system of their sewers and drainage. Districts will also be organized for their lateral system of drainage. Bruce & Standevin, Bee Bldg., Omaha, Neb., are Engineers.

New York.

The Common Council of Oswego, N. Y., has authorized the Sewer Commission to employ Prof. Olin A. Landreth of Union College, Schenectady, N. Y., as consulting engineer to devise, with the commission, new sewer plans to relieve existing conditions in the city. John C. Churchill is Chairman of the Commission.

The special committee of the Board of Estimate, New York City, which has been investigating the question of sewage disposal in Brooklyn and Queens, has come to the conclusion that the 26th Ward Disposal Works, which are on the waterfront of Jamaica Bay, should be remodeled to prevent the pollution of the waters of the bay. The committee recommends an issue of special revenue bonds in the sum of $50,000 for this purpose.

The Local Board of Jamaica New York City, Denis O'Leary, Commissioner of Public Works, is considering a petition providing for the laying of a 48-in. concrete trunk sewer from Fifth Ave., at about 20th St., along 21st St., Malba Drive and low-water mark, to the end of Malba Dock, Whitestone. The cost is estimated at $44,000.

Plans have been prepared by Engineer W. Thos. Wooley of Schenectady, N. Y., for the construction of the proposed Second Ward sewers at an estimated cost of $70,000. Contracts will be let as soon as state permits are received. The city is also considering the installation of a sewage disposal plant.

The plans prepared by Consulting Engineer Charles C. Hopkins, 349 Cutler Bldg., Rochester, N. Y., for the preliminary treatment of the sewage of Avon, N. Y., are now in the hands of the State Department of Health for approval. After approval the matter of the construction will be submitted to the taxpayers for the necessary appropriation. It is expected that bids will be asked for about May 1.

Consulting Engineer Charles C. Hopkins, 349 Cutler Bldg., Rochester, N. Y., has been engaged to prepare sewage treatment works, plans and specifications for the village of Ilion, N. Y. The amount of sewage to be treated will be about 2,000,000 gals. daily.

Assemblyman Cross, according to advices from Albany, N. Y., has introduced an amend- [illegible] mon Council shall provide for the payment of any sewage disposal plant or plants by general tax to be levied immediately, but only one-fifth shall be expended and collected each year for five years.

The village of Mohawk, N. Y., has been notified by the State Health Department that its sewage disposal plant must be erected [illegible]

Mayor D. D. Long, of Oswego, N. Y., has announced the names of the special committee to consider plans for a new sewage system. The commission will be composed of J. C. Churchill, F. A. Emerick, Dr. J. T. Dwyer, Thomas H. Bennett, Thomas Pearson: Plans and specifications for the system were prepared by City Engineer Charles H. Snyder and modified in some respects by Consulting Engineer T. Chalkley Hatton of Wilmington, [illegible]

Mayor Otta Pfaff, of Oneida, N. Y., has instructed Engineer Tibbitts to secure data and figures in regard to the daily sewage flow from the sewers of the city. It is the intention of the city officials to build a sewage reduction plant during the coming spring and summer, and as soon as the report is made, plans and specifications will be asked.

Ohio.

✣Bids will be received until noon, Feb. 23, by Director of Public Service, Hamilton, O., for furnishing the necessary labor and material for constructing a storm water sewer on Walnut St., from 7th to 9th Sts. A. J. Pater is Clerk.

⦿The Van Meter Construction Co. has been awarded the contract by the Board of Public Service of New Philadelphia, O., for the construction of a sanitary sewer and siphon line for 52,410, for which bids were opened Feb. 8. The Board also awarded a contract for the construction of a storm sewer to Henderson Bros., of Coshocton, O., for $27,363.

City Engineer Guy Crayton of Lima, O., is completing plans and specifications for the proposed purification plants, which were ordered by the State Board of Health to be ready by March 1.

City Engineer Carry S. Pratt of Urbana, O., has presented plans and specifications to the State Board of Health for the proposed sewerage system in Urbana.

Councilman John W. Peck has introduced an ordinance in the City Council of Cincinnati, O., for an issue of $25,000 bonds to pay the expenses of the engineering work in connection with the working out of the sewerage plan. The Mayor and Service Director propose to secure an expert engineer to draw up a general plan for a unified sewer system in the city.

Bids were recently received by the Department of Public Service of Canton, O., for the construction of nine miles of pipe sewer in District No. 4, estimated to cost $39,000. The contract will be let within 30 days. The proposed new sewage disposal plant for this city will require a bond issue of $135,000, which will be voted upon shortly. Phil H. Weber is City Engineer.

Experts in the employ of the city of Cleveland, O., are considering the installation of three separate and distinct intercepting sewage outlets in place of a separate disposal plant previously considered. City Engineer Robert Hoffman announces that his department has under consideration the plan of locating a separate sewage disposal plant on the lake front, near the foot of W. 58th St., for the treatment of the sewage borne from the northwest section of the city.

The City Council of Springfield, O., has accepted the recommendation of Chief Engineer M. J. Bahin to carry off the water of the proposed South End Storm sewer from the southern section down the natural ravine, which runs northwesterly and empties into the creek.

A resolution has been introduced in the City Council of Cincinnati, O., providing for the appointment of a sewerage expert to work out a general sewer system for the city.

Oklahoma.

✣[illegible] Feb. 27, by Alex S. Foreman, Town Clerk, Sallisaw, Okla., for the construction of a sanitary sewer system and disposal plant. The work will embrace 49,700 ft. 8 to 18-in. vitrified sewer, average cut from 6 ft. to 8 ft.; 90 manholes; 17 lampholes; 14 flush tanks; 500 cu. yards rock excavation, and disposal plant. Plans and specifications are on file with the Town Clerk and the Engineers. Parties wishing copies of same can obtain them by remitting $5 to the Engineers to pay for the printing of them. Certified check for $2,000. F. W. Ahrens, President, Board of Town Trustees. Winters & Dove, 810 First National Bank Building, Fort Smith, Ark., Engineers.

Oregon.

⊙The City Council of Riddle, Ore., has awarded the contract for the laying of trunk line sewers over the city to J. L. Calvert of Grant's Pass, Ore., for approximately $9,000.

Civil Engineer G. W. Rice of Lakeview, Ore., has been engaged by the City Council of Lakeview to prepare plans and specifications for a sewer system which will cost about $60,000. A bond issue for the necessary amount will be voted upon in the near future and it is the present intention to have the work in shape to let the contract not later than next June.

Pennsylvania.

Pending the completion of the plans for the disposal of the sewage of what is styled by engineers the metropolitan district of Pittsburgh, Pa., State Commissioner of Health Samuel G. Dixon has given permission to the boroughs of Rankin and North Braddock to construct sewers and drains into the Monongahela River.

The Borough Council of Pottstown, Pa., has engaged Charles E. Collins, Consulting Engineer, Philadelphia, Pa., to act as engineer on the proposed new sanitary sewerage system and sewage disposal plant. There will be about 70 miles of sewers, and the disposal plant will probably consist of a pumping station, tanks and filters. Work will be started on the survey at once and it is expected to have the plans completed in time to receive bids for the construction early in the summer. Frank Seasholtz is Chairman of the Sewer Committee.

South Dakota.

A movement has been inaugurated to have Britton, S. Dak., provided with an up-to-date sewerage system.

Tennessee.

Commissioner of Streets John W. Flenniken of Knoxville, Tenn., will present for consideration of the City Commission, the construction of a sewer along the banks of Third Creek in West Knoxville.

Texas.

At a recent mass meeting of the citizens of Midland, Texas, it was decided to form a $50,000 corporation and proceed at once with the installation of a sewerage system in the city. The City Council will pass an ordinance compelling the use of the sewers.

The City Council of Terrell, Tex., has decided to purchase the sewerage system in that city, which is now owned and operated by a private corporation.

The City Council of Nacogdoches, Tex., has set March 12 as the date for holding a special election for the purpose of voting on the issuance of bonds in the sum of $60 000 for sewerage, street paving and street lighting improvements.

A petition has been circulated in Cuero, Texas, for the purpose of calling an election for a sewerage system.

The City Commission of Galveston, Te will advertise for bids after March 1 for t work of rebuilding the 10th St. sewer, fro the manhole at Avenue A to the manhole the alley between Avenues J and K, removi the old sewer. City Engineer A. T. Dickey h estimated the cost of building the new sew at $6,292 and of removing the old sewer $9,779.

Washington.

The sanitary sewer in Broadway, city Bellingham, Wash., is to be enlarged and co verted into a sewer capable of carrying off t storm waters of Broadway, and also of K shan, Halleck, Meridian and other adjace streets, in accordance with the prelimina plans of City Engineer W. H. North. T sewer will cost about $12,250.

Plans and specifications have been submitt to the City Council of Seattle, Wash., by t Board of Public Works for the constructi of sewers in East 45th St., from 20th A N. E., to Ravenna Ave. et al.; estimated cost $7,559, and for sewers in 10th Ave. N. and 11th Ave. N. E., from 52d St. to Raven Blvd., et al.; estimated to cost $22,251.

Wisconsin.

The City Council of Racine, Wis., h voted in favor of the matter of submitting t issuance of $185,000 bonds for the building trunk sewers in the outlying districts to a vo of the people at the coming spring election.

The City Council of New London, Wi has granted a petition calling for a sewer Davidson St., commencing at the Benson Da son corner and running to the river.

Plans have been prepared by City Engine G. H. Randall of Oshkosh, Wis., for the co struction of 320 ft. of 30-in. sewer, 1,340 ft. 24-in. sewer, 830 ft. of 20-in. sewer, 680 of 18-in. sewer, 2,910 ft. of 15-in. sew 3,055 ft. of 12-in. sewer and 650 ft. of 10-i sewer. The contracts for this work will let in about two weeks. W. A. Marden, Os kosh, will have charge of the work.

The Board of Public Works of Neena Wis., has recommended to the City Coun that plans be drawn for a storm sew through the first and second ward, and es mate of the cost of same.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Alabama.

✣Bids will be received until 3 p. m., March 25, by James Knox Taylor, supervising architect, Treasury Department, Washngton, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior fixtures, of the U. S. post office at Tailadega, Ala. The building is one story and basement and has a ground area of approximately 4,600 sq. ft.; fireproof first floor; stone facing; tin roof.

Plans have been completed for warehouses to be erected by the city of Mobile on the municipal wharves, and bids for the work are to be taken at once by the City Commissioners. The warehouses will be constructed of steel on concrete foundations and will cost about $52,000. Plans were prepared by F. E. Golian, New Orleans, La.

Arkansas.

✣Bids will be received untl 3 p. m., March 27, by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduit and wiring and interior lighting fixtures, of a one story and basement building about 3,600 sq. ft., with brick face and stone and terra cotta trimmings, for the U. S. post office at Paragould, Ark.

California.

✣Bids will be received until 10 a. m., Feb. 27, by the Panama-Pacific International Exposition Co., W. H. Crocker, chairman, San Francisco, Cal., for filling approximately 1,000,000 cu. yds. of earth between Webster, Ray and Lewis Sts.

Town Trustees of Martinez, Cal., are considering the expenditure of $35,000 for improving the water front. The improvement will include a canal and a wharf

The Pacific Wharf & Storage Co., J. C. Wickham, Secretary, Los Angeles, has filed an application with the U. S. War Department for permission to reclaim a large section of Government land now covered by shallow water, the expense of which will reach almost $4,000,000. The application specifically asks for permission to build a bulkhead running from the present holding of the company, just inside Deadman's Island, to the Terminal Island shore, a distance of 10,000 ft. It is the purpose to reclaim this area of land, which has nearly two miles of frontage upon the open ocean.

Connecticut.

Board of Police Commissioners, Alvan W. Hyde, President, of the city of Hartford, Conn., is to apply to the City Council for an appropriation of $25,000 to install a new signal system for the police department.

Town of Meriden, Conn., has voted to expend $225,000 for a new high school building. Town School Committee will be in charge of the work.

District of Columbia.

✣Bids will be received until noon, March 6, by N. C. Twining, Chief of Bureau of Or nance, U. S. Navy Department, Washingt D. C., for furnishing target shell as follow viz: 250 14-in., 250 13-in., 2,000 12-in., 5 10-in., 2,000 8-in., 1,500 7-in., 5,000 6-in., 3,0 5-in., 1,000 4-in., 12,000 3-in., 7,500 6-pound and 75,000 1-pounder.

✣Bids will be received until Feb. 23, by M F. C. Boggs, General Purchasing Officer Ist mian Canal Commission, Washington, D. for furnishing under Canal Circular 683- 600,000 pounds pig iron, 500 pounds pig alu num, 200,000 pounds silica sand, 50,000 poun clay, 40,000 pounds silica grit, 1,500 poun foundry nails and 1 gasoline launch.

✣Bids will be received until 10:30 a. m., F 28, by Maj. F. C. Boggs, General Purchasi Officer, Isthmian Canal Commission, Washin ton, D. C., for furnishing under Canal Circul 684, brass tubing, cast iron pipe, stovepi sheet zinc, solder, steel wire, nails, tac screws, cold chisels, hammers, pick handl shovels, ratchet braces, files, paint brush coal barrows, padlocks, water coolers, metal tapes, Manila rope, sash cord, rubber beltin hose, packing, asbestos gaskets, signal fla bunting, shipping tags and chipped soap.

✣Bids will be received until noon, Feb. by Lt. Col. W. C. Langfitt, U. S. Engine 920 17th St., N. W., Washington, D. C., noted in our Feb. 7 issue, for furnishing a placing riprap on the seawall, Anacostia Riv D. C. The work to be done is the extensi of the riprap seawall along the left bulkhe of Anacostia River, between the outfall sew

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

n. Anacostia bridge, a distance of about 0 ft. A trench has been dredged to the eh of 5 or 6 ft. at mean low water, with als affording access thereto at the out sewer and opposite the upper limits of the v Yard. The wall will be built in the ch with bottom width of about 30 ft., and uniform side slopes to the top which will out 3 ft. wide and about 5 ft. above mean water. The total estimated quantity of ap to be delivered and placed to complete work to be done is 25,000 cu. yds.

Bids will be received until noon, Feb. 26, Lt. Col. W. C. Langfitt, U. S. Engineers, 17th St., N. W., Washington, D. C., as d in the last issue, for furnishing and de- ving building stone and Portland cement. stone is to be granite, gneiss or blue e of a dark color, of the grade known as ling stone, and must range from 1½ or more cubic feet in contents. Beds of e must be at least one and one-half times rise, and the rise must not be less than 6 The amount of stone will be about 4,000 rds. About 2,000 bbls. of Portland cement required.

Hawaii.

Bids will be received until 11 a. m., April y H. R. Stanford, Chief of Bureau of ls & Docks, Navy Department, Washing- D. C., for the construction of an ad- stration building at the naval station, Harbor, Hawaii.

Illinois.

Bids will be received by L. E. McGann, nmissioner of Public Works, Chicago, until 11 a. m., March 2, for furnishing delivering to the City of Chicago at ous points f. o. b. cars approximately 00 cu. yds. crushed limestone. All stone e of the following sizes: Coarse, 4 ins. ins.; medium, 2½ ins. to 1 in.; screen- ; ¾ in. to powder. All stone to be the of its kind, dry, clean, uniform in lity and as near a cube in form as pos- e.

Bids will be received by L. E. McGann, nmissioner of Public Works, Chicago, until 11 a. m., March 1, for furnishing delivering to the City of Chicago, at Chicago Railways shops, 40th Ave. and e St., from 4 to 6 steel dump cars com- e and according to specifications. Cash certified check for $600 must accompany posal.

xtensive factory additions are being med by The Western Clock Mfg. Co. of Saile, Ill. These additions comprise three tooth roof, single-story buildings of the owing sizes: 1st bldg., 435 ft. x 140 ft.; bldg., 178 ft. x 140 ft.; 3rd bldg., 70 ft 08 ft. These buildings will be of brick steel columns, roof trusses, purlins and ers. Plans and specifications will be com- ed in a few days.

he Committee on Harbors, Wharves and dges of the City Council of Chicago has en favorable action for the construction of ks to cost $4,400,000. The work decided n consists of the construction of two piers be built north of the mouth of the river south of Chicago avenue. A 3,000-ft. pier o be constructed for passenger business and 300-ft. pier for freight. The piers will be he foot of Illinois and Ohio Sts., and ade- te facilities for carrying persons to and m the docks have been provided for in the ns, which include the possible use of a mov- sidewalk at some future date. The cost the work is to be distributed as follows: ck construction, $1,339,000; earth filling, ers, paving and railroad tracks, $649,500; lding, foundations, floor and lighting, 399,600; engineering supervision, $120,000; identals, $301,000. The council already has propriated $5,000,000 for the construction of bors contingent on bond issues. Bonds being prepared for presentation to the ncil at an early meeting and then to the ple for their approval at the April election. is stated that preparations for contracts can made immediately following the approval these bonds. John Ericson, City Engineer, is Chairman of the [illegible] in charge of the work.

Iowa.

✣Bids will be received until 3 p. m., March 14, by James Knox Taylor, supervising architect, Treasury Department, [illegible] for the [illegible] post office at Des Moines, Ia.

Louisiana.

✣Bids [illegible] Capt. T. H. Jackson, U. S. Engineer, Dallas, Tex., as noted in our Feb. 7 issue, for constructing a dam at the foot of Caddo Lake, Louisiana. This work is about three miles below Mooringsport, on the Missouri, Kansas & Texas R. R. It consists in the construction of a dam consisting of a concrete cap filled with earth, resting on a pile foundation. The estimated quantities [illegible]

	Quantities.
Quantities that apply to both principal and alternate bids	
Clearing, acres	5
Grubbing, acres	½
Riprap on mattress, tons	1,800
Riprap paving, tons	[illegible]
Mattress, cords	380
Excavation for Section B-C Type A dam, cu. yds.	233
Fill for Section B-C Type A dam, cu. yds.	[illegible]
Lumber for Section B-C Type A dam, ft. B. M.	8,000
Tie rods, nuts and washers for Section B-C Type A dam, lbs.	8,246
Reinforcing rods for Section B-C Type A dam, lbs.	[illegible]
Reinforced concrete for Section B-C Type A dam, cu. yds.	[illegible]
Timber sheet piles for Section B-C Type A dam, lin. ft.	32,000
Round piles, lin. ft.	12,800
Quantities that apply to principal bid only	
Excavation for Sections A-B and C-D type B dam, cu. yds.	3,250
Fill for Sections A-B and C-B Type B dam, cu. yds.	2,240
Lumber for Sections A-B and C-D Type B dam, ft. B. M.	31,200
Tie rods and nuts and washers and bolts for Sections A-B and C-D Type B dam, lbs.	18,469
Reinforcing rods for Sections A-B and C-D Type B dam, lbs.	77,000
Reinforced concrete for Sections A-B and C-D Type B dam, cu. yds.	703
Timber sheet piles for Sections A-B and C-D Type B dam, lin. ft.	68,560
Quantities that apply to alternate bid only—	
Excavations for Sections A-B and C-D Type C dam, cu. yds.	3,033
Fill for Sections A-B and C-D Type C dam, cu. yds.	2,135
Lumber for Sections A-B and C-D Type C dam, ft. B. M.	15,600
Tie rods and nuts and washers for Sections A-B and C-D Type C dam, lbs.	10,769
Reinforcing rods for Sections A-B and C-D Type C dam, lbs.	65,000
Reinforced concrete for Sections A-B and C-D Type C dam, cu. yds.	290
Concrete sheet piles for Sections A-B and C-D Type C dam, lin. ft.	45,702

Maryland.

Bill is before the State Legislature for a bond issue for $800,000 to be expended by the State Lunacy Commission in providing additional accommodations for the weak and feeble-minded. It is proposed to use the fund as follows: $175,000 for the erection of additional buildings at Springfield, $100,000 for the erection of additional buildings at Spring Grove; $175,000 for the erection of buildings at the Crownsville State Hospital for Colored Insane, $150,000 for the erection of buildings and the purchase of additional land at the Maryland School for the Feeble Minded, $200,000 for the purchase of land and the construction of buildings for a hospital on the Eastern Shore for the insane from that part of the state. Dr. A. P. Herring, 330 N. Charles St., Baltimore, Md., is Secretary of the Commission.

A bill is before the State Legislature for a bond issue for $600,000 for the erection of a new normal school near the city of Baltimore. M. Bates Stephen, Annapolis, Md., is Secretary of the State Board of Education.

The Harbor Board of Baltimore, Md., has commissioned Robert G. Ullrich, Architect, Gunther Bldg., Baltimore, to prepare plans for the new recreation pier to be erected at the foot of Broadway and Ann St. It will be a two-story concrete structure, 150x500 ft., and will cost about $740,000. Most of the property needed for the site has been acquired by the city, and it is planned to go right ahead with the [illegible] as soon as the weather permits.

Massachusetts.

✣Bids will be received until 1 p. m., March [illegible] enlarging and remodeling the town hall building. F. A. Dexter, chairman, Orange, Mass. H. M. [illegible] Main St., Fitchburg, Mass., are architects.

Michigan.

✣Bids will be received until 3 p. m., March 12, by Col. C. McD. Townsend, U. S. Engineer, 337 Federal Bldg., Detroit, Mich., for furnishing and delivering at Sault Ste Marie, Mich., about 600 tons steel, etc.

Minnesota.

A 47-acre tract of land has been purchased at West Duluth on which the Berwind White Coal Mining Co., 122 S. Michigan Ave., Chicago, Ill., will erect a coal dock to have a storage capacity of 1,000,000 tons. It is expected that work on the dock will be started next winter.

New Jersey.

✣Bids will be received until noon, March 21, by Col. William T. Rossell, U. S. Engineer, 802 Army Bldg., Whitehall St., New York City, for dredging in Matawan Creek, Raritan and South Rivers, Shoal Harbor and Compton Creek and Shrewsbury River, N. J.

⊙Charles Turner, Sr., Atlantic City, N. J., has been awarded the contract at $4,030 for constructing a jetty at Winchester Ave. for the city of Ventnor, N. J.

New York.

✣Bids will be received until 11 a. m., March 23 by D. A. H. Allen, Lieut. Commander, U. S. Navy, Inspector Light House Service, Tenth District, Federal Bldg., Buffalo, N. Y., for rebuilding the Buffalo breakwater, north end light station, New York. New construction will be composed of concrete base, reinforced with structural steel, built upon the existing timber crib and a granite trimmed brick building, with tower surmounted by a third-order metal lantern.

✣Bids will be received until 3 p. m., March 1, by C. D. Stearns, Commander, U. S. N., Inspector, Lighthouse Service, Third District, Tompkinsville, N. Y., for furnishing two belt driven air compressors.

✣Bids will be received until 3 p. m., March 4, by Board of Contract & Supply, Albany, N. Y., for the construction and completion of a new High School building on property located on Western Ave., North Lake Ave. and Washington Ave. Bids will be received in two ways, viz; Bid No. 1, for the entire work, or separate bids as follows: Bid No. 2A, for the entire work exclusive of work specified under "Plumbing, Gas-fitting and Vacuum Cleaning Equipment." Bid No. 2C, for all work specified under "Heating and Ventilating;" Bid No. 2D, for all work specified under "Electric Wiring and Electric Equipment." After a computation of the lowest estimates received for each of the separate bids Nos. 2A, 2B, 2C and 2D, the contract or contracts will be awarded to the lowest bidder or bidders by either method. Bidders submitting a proposal for Bid No. 1 must properly fill in all blanks under Bid No. 2A, Bid No. 2B, Bid No. 2C and Bid No. 2D. Isidore Wachsman is Secretary of the board.

✣Bids will be received until noon, March 11, by Col. W. M. Black, U. S. Engineer, 39 Whitehall St., New York, for removing obstructions in channel between North and South Brother Islands, East River, N. Y. The work to be done consists in making a channel 300 ft. bottom width by removing all material therefrom to a depth of 26 ft. below mean low water. The amount of material to be removed to secure a channel of the above prescribed width and depth is estimated at 21,000 cu. yds., scow measurement of other material than bowlders and ledge rock; 50 cu. yds. of bowlders, ½ to 2 cu. yds. in size, solid measurement, and 11,200 cu. yds. of ledge rock, place measurement, and bowlders over 2 cu. yds. in size, solid measurement; about 184,000 sq. ft. of these areas are supposed to be of greater depth than 26 ft. at mean low water, and the rocky obstructions in 193,000 sq. ft. of area in "Area A" range in depth of cut from zero to about 6 ft., averaging about 2.0 ft. The amount of money available for payment of contractor's estimates is $175,000.

✣Bids will be received until 2 p. m., March 5, by Chief Quartermaster, Governors Island, N. Y. H., for constructing blacksmith shop and wagon shed.

✣Bids will be received until March 12, by C. D. Stearns, U. S. Navy Inspector, Third Light House District, Tompkinsville, N. Y., for furnishing under circular letter, Tompkinsville, N. Y., gas accumulator flashers, burners and other fittings, 500 steel taper pins and 4 packages, iron jack chain.

✣Bids will be received until noon, Feb. 29, by Southfield Point Co., 165 Broadway, New York City, for making a hydraulic fill on the property of the company on the west shore of stamford, Conn., harbor.

⊙The Inland Waterways Co., Ashtabula, O., has been awarded the contract by the U. S. Government for the construction of a breakwater pier in the St. Lawrence River opposite Cape Vincent, N. Y. This pier will consist of timber cribs sunk on a rubble mound foundation and capped with a concrete superstructure. Cast iron mooring posts will be placed in the concrete at regular intervals for the use of vessels making fast to the pier. The company's derrick scow Yamba and lighter Red Raven will probably be sent up on this work during the spring, together with a concrete plant and other equipment

⊙Department of Docks and Ferries of New York City on Feb. 8 awarded dredging contracts as follows: Class 1, 250,000 cu. yds. on North River 12¾cts. per cu. yd.; Henry DuBois' Sons Co., 17 State St., Manhattan; Class 2, 75,000 cu. yds., East and Harlem Rivers 24 9/10 cts. per cu. yd., P. Sanford Ross, Inc., Jersey City, N. J.; Class 3, 15,000 cu. yds., 44 cts. per cu. yd., R. G. Packard & Company, 130 Pearl St., Manhattan; Class 4, 25,000 cu. yds., 19 9/10 cts. per cu. yd., Henry DuBois' Sons Co., 17 State St., Manhattan.

North Carolina.

⊙The Brette Construction Co., Wilson, N. C., has been awarded the contract at $35,000 for the construction of drainage canals for the Mosely Creek Drainage District, of which G. V. Richardson, Dover, N. C., is chairman. The work calls for about 14 miles of canal requiring 415,000 cu. yds. of excavaton. Bids were opened Feb. 16.

Ohio.

✣Bids will be received until 3 p. m., March 29, by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., for the construction of the post office building at Massillon, O. The building is one story and basement, approximately 62 by 79 ft. in size, of fireproof construction throughout. The exterior walls are faced with stone and the roof is covered with asphalt felt and tile.

⊙The Inland Waterways Co., Ashtabula, has been awarded the contract for the construction of a trestle 650 ft. long on dock No. 6 of the Lake Shore & Michigan Southern R. R. Co. for the use of the Gillen Dock, Dredge & Construction Co. in transferring stone from cars to dump scows. The trestle will be equipped with chutes, so that when the drop bottom cars are dumped upon the trestle the stone will slide by gravity into the scows. The material for this work has been ordered and the greater part of it shipped, and as soon as the weather moderates work will be immediately begun by the Inland Waterways Co. The new trestle will be used in connection with the new breakwater work.

The city of Cleveland may toward the end of March offer for sale part of the $2,000,000 bond issue voted for a municipal light plant. It is expected that the City Council will shortly pass the ordinance authorizing the bond issue, so that contracts for the machinery and cables can be let this spring. Robert Hoffmann is City Engineer of Cleveland.

Oklahoma.

✣Bids will be received until 10 a. m., March 8, by D. L. Stone, Constructing Quartermaster, Fort Sill, Okla., for constructing, plumbing, heating and electric wiring ward wing addition and passage to hospital at old Fort Sill and constructing, plumbing, heating and electric lighting dispensary at new Fort Sill.

Oregon.

✣Bids will be received until 5 p. m., Feb. 29, by R. H. Thomas, School Clerk, 402 Tilford Bldg., Portland, Ore., for equipment of Washington High School gymnasium.

City Council of Hillsboro will call an election to vote on issuing $130,000 of bonds for constructing a municipal light and power plant.

Pennsylvania.

✣Bids will be received until noon, Feb. 23, by Department of Public Safety, at the office of George D. Porter, Director, 215 City Hall, Philadelphia, Pa., for the following: Construction of Police, Fire and Patrol Stations and Stable, to be built upon city lot, southwest corner 55th and Pine streets, 46th Ward; specifications to be had at the office of the City Architect, room 825, City Hall; specifications may be viewed at the Master Builders' Exchange, one high pressure fire automobile tool truck, to be used in connection with and made part of the equipment of the high pressure fire service system in the mill district; specifications to be had at room 215, City Hall. For repairs (labor and materials) to and accessories, tires, etc., for department automobiles, including automobile police patrol wagons, motorcycles, bicycles, fire apparatus, etc., during the year 1912, the same covering the entire equipment of cars; specifications to be had at Room 215, City Hall. For 15,000 ft., more or less, 25 twisted pair (50 conductor) double paper insulated cable; for certain miscellaneous electrical materials required in connection with the wiring of Truck House, Belgrade and Huntingdon sts.; for combination gas and electric fixtures for Truck House, Belegrade and Huntingdon sts.; for repairs to Elevator Pumps Nos. 1 and 2, Power Plant, City Hall; for furnishing and installing new crank shaft for Engine No. 3, Power Plant, City Hall; specifications for all the latter to be had at the Electrical Bureau, Room 618, City Hall.

⊙Irwin & Leighton, Philadelphia, Pa., have been awarded the contract at about $750,000 for erecting a new clubhouse at Broad and Walnut Sts., Philadelphia, for the Manufacturers' Club. The building will be 11 stories in height, and will be built throughout of Green River limestone. Simon & Bassett, 1112 Chestnut St., Philadelphia, are the architects.

Rhode Island.

✣Bids will be received until 2 p. m., March 5, by Frederick V. Abbot, Col., U. S. Engineer, Newport, R. I., for repairs to the breakwater at Point Judith, R. I.

✣Bids will be received until 11 a. m., March 2, by Bureau of Yards & Docks, Navy Department, Washington, D. C., for fire station for hook and ladder and hose reels at the naval torpedo station, Newport, R. I. W. M. Smith is Chief Clerk in charge.

South Carolina.

✣Bids will be received until 3 p. m., March 30, by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures, of the U. S. post office at Darlington, S. C. The building is one story and basement and has a ground area of approximately 4,600 sq. ft., nonfireproof construction, stone facing and tin roof.

Texas.

✣Bids will be received until 10 a. m., Ma 8, Walton Peteet, President, Board of Dire ors, Hotel Galvez, Galveston, Texas, for f nishing the necessary labor and material the erection of a mess hall for the A. & College.

✣Bids will be received until 3 p. m., Ma 20, by James Knox Taylor, Supervising Arc tect, Treasury Department, Washington, C., for the construction complete, includ plumbing, gas piping, heating apparatus, el tric conduits and wiring and interior light fixtures of the U. S. Post office and cou house at Del Rio, Tex. The structure v be three stories, basement, and unfinished tic. It has a ground area of approximat 5,300 sq. ft.; non-fireproof construct throughout, stone, terra cotta, and stu facing, wood cornice and copper gutters; and tin roof.

Virginia.

✣Bids will be received until noon, March, by J. F. Benson, Civil Engineer, 701 Paul-Ga Greenwood Bldg., Norfolk, Va., for constru ing a bulkhead around and filling certain pr erty of the River Front Realty Corporation, Norfolk county, Virginia, according to pla drawings and specifications made by J. F. B son.

Washington.

⊙Dieter & Wenzel, Wichita, Kan., h been awarded the contract at $119,144, erecting a public building at Walla Wa Wash.

Wisconsin.

✣Bids will be received until noon, Ma 5, by Lieut. J. N. Hodges, U. S. Engine Duluth, Minn., for building rubble mound Ashland, Wis. Official advertisement of t work will be found elsewhere in this issue

✣Bids will be received until 3 p. m., Ma 30, by James Knox Taylor, supervising arc tect, Treasury Department, Washington, D. for an electric push button mail lift in t U. S. post office and court house at Madis Wis.

Canada.

✣Bids will be received until noon, March by city commissioners, Saskatoon, Sask., f furnishing the following electrical equipme 5 500 B. H. P. water tube boilers; 5 sets automatic stokers, induced draft plant a duplicate fans for same economizers for 2, H. P. capacity; 2 feed pumps, all necessa equipment for the above; 1 2,000 K. W. hi pressure steam turbine, with condensers, pumps, and necessary equipment; 2 75 K. turbine exciters; 1 generator panel; 2 excit panels with all necessary cables and apparat from turbine to switchboard.

✣Bids will be received until noon, March by William Wallace Blair, Architect, 400 T Nation Bldg., Winnipeg, Man., for the erecti of an office building in the city of Edmont Alta., for the Canadian Pacific Ry. Co. T structure will be 6 stories and basement a of steel construction with partitions and arch and of brick and crushed stone.

✣Bids will be received until 11 a. March 1, by Chairman, Board of Contr Winnipeg, Man., for supply and delivery f. b., Winnipeg, Man., of the following equi ment: One 44-ton or 45-ton steam shov equipped with a dipper of at least 1¼ ya capacity, with a clear lift from rail to b tom of dipper door, when open, of not le than 16 ft. One Locomotive of regular stan ard gauge to have a hauling capacity of least 350 tons on a 1 per cent grade, a equipped, both back and front, with attac ment for coupling to standard 80,000 lbs. ra way cars. Full specifications and drawin must accompany each proposal. M. Peters is Secretary of the Board.

✣Bids will be received until 11 a. March 25, by Board of Control, M. Peterso Secretary, Winnipeg, Man., for the manufa ture and delivery f. o. b., Winnipeg, of Ir pregnated Paper lead covered cables to used in connection with the city's fire a police telegraph system.

PROPOSALS

FURNISHING AND LAYING SEWAGE OUTLET PIPE.

Rochester, N. Y.

Sealed proposals will be received at the office of the Secretary of the Board of Contract and Supply, No. 37, City Hall, until 11 o'clock a. m., March 13, 1912, for the construction of Contract No. 4, including Division No. 8 and part of No. 7 of the Sewage Disposal System.

The work will consist of furnishing and laying about 9,300 feet of 66-in. pipe for the discharge of the effluent from the Disposal Works, into deep water in Lake Ontario. About 2,300 feet will be laid in open trench, and the remainder will be submerged and laid in a dredged trench terminating in a timber crib located about 7,000 feet from the shore and in about 50 feet of water.

Separate proposals will be received for pipe made of steel, ingot iron and cast iron.

A certified check for $20,000.00 must accompany the proposal as an earnest of good faith. The amount of the certified check deposited by the successful bidder will become the property of the City of Rochester if such bidder shall fail to execute and deliver the contract and execute the required bonds for the work within ten (10) days after the contract is awarded to him.

The successful bidder will be required to execute to the city a surety company bond in the sum of $100,000.00 for the faithful performance of the contract and the payment of all laborers' wages, which bond shall be approved by the Comptroller of said city.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Board that he is reasonably familiar with submarine work, and is fully prepared with the necessary capital, materials and machinery to conduct the work to be contracted for to the satisfaction of the City Engineer, and to begin it promptly on award.

All bids must be made upon the bidding sheets furnished by the City Engineer, and be indorsed with the title of the work to which they relate, the name of the bidder and his residence. Information relative to the work may be procured at the office of E. A. Fisher, City Engineer, where plans, specifications and bidding sheets may be obtained after February 17th.

The Board reserves the right to reject all bids.

F. X. PIPER, Secretary.

DEPARTMENT OF THE INTERIOR, United States Reclamation Service. Washington, D. C., Jan. 25, 1912.—Sealed proposals will be received at the office of the United States Reclamation Service, Boise, Idaho, until 2 o'clock p. m., March 1, 1912, for furnishing a rock crusher, ball mills, tube mills, a rotary dryer and a mixing and weighing machine for a sand-cement plant on the Boise Project, Idaho. For particulars address the U. S. Reclamation Service, Boise, Idaho, or Washington, D. C. F. H. NEWELL, Director.

U. S. ENGINEER OFFICE, Duluth, Minn., Feb. 5, 1912. Sealed proposals for building rubble mound at Ashland, Wis., will be received here until noon, March 5, 1912, and then publicly opened. Information on application. JOHN N. HODGES, Lt., Engrs.

PROPOSALS FOR FURNISHING METAL AND ERECTING LOCK GATES.—U. S. Engineer Office, Vicksburg, Miss., Feb. 12, 1912. Sealed proposals for furnishing and delivering about 384,500 pounds of structural metal for Lock and Dam No. 6, Ouachita River, near Felsenthal, Ark., and for erecting lock gates at that work will be received at this office until 12 m., March 14, 1912, and then publicly opened. Information on application. J. A. WOODRUFF, Capt., Engrs. 7-4t

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MASONRY DAM.

Baltimore, Md.

Sealed proposals for the construction for the City of Baltimore of a solid masonry dam with a spillway elevation of approximately 186.0 feet A. M. T., with appurtenances, to be built according to the plans and specifications to be obtained at the office of the Water Engineer, will be received at the office of the City Register, City Hall, Baltimore, Md., until 11 a. m., Wednesday, March 6, 1912.

Proposals must be enclosed in sealed envelopes, must be endorsed "Proposals for the Construction of the New Loch Raven Dam," and addressed to the Board of Awards of Baltimore City.

Plans and specifications, proposal forms, etc., may be obtained on and after February 12, 1912, at the office of the Water Engineer, City Hall, Baltimore, Md., on the payment of ten dollars ($10.00), which will be refunded on the return of same in good condition.

As an evidence of good faith each proposal must be accompanied by a certified check for twenty thousand dollars ($20,000.00) drawn on a Clearing House Bank to the order of the Mayor and City Council of Baltimore. These checks will be returned to the unsuccessful bidders on the awarding of the contract, and to the successful bidder when the contract shall have been signed.

The successful bidder will be required to give bond equal in amount to the contract price, for the faithful performance of the contract.

The Board of Awards reserves the right to reject any or all bids.

The estimated quantities of the principal items for the dam are as follows:

Cofferdam.

Earth and rock excavation foundation, 35,000 cu. yds.

Rock excavation cut-off trench, 4,600 cu. yds.

Concrete and rubble concrete, 38,000 cu. yds.

Steel reinforcing bars, 21,000 lbs.

Steel bridge, 70,000 lbs.

Approved Feb. 7, 1912.

EZRA B. WHITMAN,
Water Engineer.

JAMES H. PRESTON,
President Board of Awards.

WATER WORKS PIPE LINE.

Sealed bids will be received by Jacob E. Bauer, City Clerk of Durand, Wis., at his office in said city, at any time prior to March 1, 1912, at 12 o'clock m. of that day, for installing the pipe line of the Durand water works system, of which plans and specifications are on file in his office and also in the office of S. G. Gilman, Engineer, at Mondovi, Wis. The contract for doing said work will be let to the lowest responsible bidder, at the Council Room in the City Hall in said City of Durand, at 1 o'clock p. m. of that day.

The Water Works Committee reserves the right to reject any and all bids.

Dated Feb. 12, 1912.

A. C. SMITH,
Chairman of Water Works Committee.

U. S. ENGINEER OFFICE.—Kansas City, Mo., Feb. 3, 1912. Sealed proposals for constructing standard revetment on Missouri River 94 miles below Kansas City and 2 miles below Waverly, Mo., will be received here until noon, March 4, 1912, and then publicly opened. Information on application. EDWARD H. SCHULZ, Major, Engrs.

U. S. ENGINEER OFFICE—Little Rock, Ark., Jan. 31, 1912. Sealed proposals for constructing the two (2) steel hull, 24-inch pump dredges H. S. Taber and Robert McGregor will be received here until 12 o'clock noon, April 9, 1912, and then publicly opened. Information on application CLARKE S. SMITH, Major, Engrs.

PAVING.

Sealed bids will be received by the City Council of the City of Beaumont, Tex., [illegible] work:

For furnishing all tools, material, labor, etc., necessary for paving approximately 93,000 sq. yds., on concrete foundations, with vitrified brick, asphalt, bitulithic or creosoted wooden blocks, or any other material, as may be determined by the City Council; and also approximately 37,000 lineal feet of concrete curb.

A certified or cashier's check in the sum of $1,000.00 made payable to Emmett A. Fletcher, Mayor, on some Beaumont bank will be required to accompany said bid.

For specifications, streets to be paved, or any other information apply to C. L. Scherer, City Engineer.

Bids, to be considered, must be filed with me on or before Tuesday, March 5, 1912, at 10 o'clock a. m., said bid to be addressed to J. G. Sutton, City Secretary, and marked "Bid for City Paving."

The city reserves the right to accept or reject any or all bids.

J. G. SUTTON,
City Secretary,
Beaumont, Tex.

REINFORCED CONCRETE VIADUCT.

Waukegan, Ill., Feb. 17, 1912.

The City of Waukegan contemplates the construction of a reinforced concrete highway viaduct at Genesee Street, the engineer's estimate of which is $69,891.40. This viaduct will be paid for by special assessment, but the work cannot be advertised until after confirmation by the County Court, which will probably be some time early in March. After confirmation, the work will be advertised two weeks, but as this will not allow very much time for the preparation of bids, it has been considered proper to allow such contractors as desire them to obtain the drawings and specifications before we advertise for bids.

Plans and specifications may be obtained from Westcott & Ronneberg, 189 W. Madison St., Chicago. A deposit of $25.00 will be required to insure the safe return of the plans and specifications.

M. J. DOUTHITT,
Ass't Supt. of Public Works.

ALVAH S. ROGERS,
Secretary of the Board of Local Improvements.

DEPARTMENT OF THE INTERIOR—UNITED STATES RECLAMATION SERVICE.—Washington, D. C., Jan. 15, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Neb., until 2 o'clock p. m., Feb. 28, 1912, for the construction of an earth dam and auxiliary works, on the North Platte Project, about nine miles north of Minatare, Scottsbluff County, Neb. The work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earthfill, 157,000 cu. yds. gravelly material, 14,000 cu. yds. unscreened gravel, 11,500 cu. yds. screened gravel, 14,000 cu. yds. concrete, and 12,000 cu. yds. brule clay excavation, besides 45 acres of sod stripping, 600 feet of wells and casing, 3,200 lin. ft. of drains, and the handling and placing of 250,000 lbs. of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Neb.; 519 Commonwealth Bldg., Denver, Col., or Washington, D. C. F. H. NEWELL, Director.

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1 Lambert Hoisting Engine, 7x10, with boiler, D. C., D. D.
1 Lidgerwood Hoisting Engine, 7x10, 3 drum, double cylinder with slowing gear.
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2 Lidgerwood Hoisting Engines, 8¼x10, D. C., D. D., skeleton.
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1 No. O Thew Steam Shovel, ⅝ yd. dipper, traction, just rebuilt.
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1 Model 40 Marion Shovel, 1½ yd. dipper, shop No. 2270.
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1 Marion Shovel, Model 91, 5 yd. dipper, shop No. 1165.
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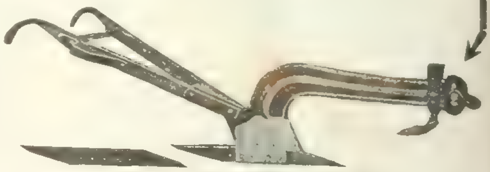
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e Failure of Certain Expensive Oil—Macadam Roads in Los Angeles County, California.

[illegible] examination of California roads, e of the editors of ENGINEERING & CONTRACT-G visited the extensive road work that has en done in Los Angeles County. The edi- had previously seen most of the now com-ted roads during their construction, and s not unprepared to find that many of the ads built under the old Los Angeles County ghway Commission had failed and are now ng resurfaced by the engineers of the new ighway Commission. In the design and nstruction of oil-macadam roads, built un-r the former Highway Commission, several rious mistakes were made, the most im-rtant of which were:

[illegible] rolling of the macadam.
Excess of oil used in binding.
Excess of broken stone.
Much work done by day labor instead by contract.
5. No adequate cost keeping system.

When the public learned that the $3,500.- that had been appropriated for building out 300 miles of roads in Los Angeles unty was certain to be insufficient for the rpose, due to costs much higher than the timates, and when it was also found that e much vaunted "permanent roads" (oil acadam) were being rolled into waves and t into ruts by automobile and wagon wheels, clamor was raised that resulted finally in e appointment of a new Highway Commis-on. The new commission made Mr. F. H. yner its chief engineer. Mr. Joyner had en long engaged in road construction in e employ of the Massachusetts Highway mmission. Much new road work remains r Mr. Joyner to do in Los Angeles County, t it is of the old work done by his prede-ssors that we shall now speak.

Inadequate rolling has been the cause of uch poor construction of water-bound mac-lam. That insufficient rolling may be equally tal in oil-macadam construction is plain to seen by the failure of many stretches of ad near Los Angeles. The writer noted me years ago, in Los Angeles County, that was a not uncommon practice to permit ntractors to compact several hundred tons broken stone with one ten-ton roller in an ght-hour day. It may safely be said that hen such a roller is permitted to compact uch more than 100 tons per day, it should only because an unusual abundance of water is used in puddling or because a soft rock is being rolled.

Perhaps the most serious single mistake made in the design of the work in question was the use of too much of the asphaltic oil. To begin with, it is questionable whether any oil should be used at all in the lower, or foundation, course of an oil-macadam road. Mr. Joyner is of the opinion that the lower course should be made of water-bound macadam, and in this we concur. It is more expensive to use oil as a binder for macadam than to use screenings and water. Furthermore, a few inches below the surface the oil does not dry out or harden for a long time; and, prior to its hardening, it permits the stones to slide upon one another when subject to the pressure due to passing vehicles. In digging up sections of oil-macadam that had been in place several years and had cut up into ruts, it was found that much of the oil was still in a very plastic condition; and, due to insufficient rolling of the stone before its application, the plastic oil was often found in masses of greater size than a walnut.

Typical View of a Los Angeles County Oil-Macadam Road That Has Failed.

The accompanying view is a typical illustration of a Los Angeles County oil-macadam that has failed badly, due apparently to an excessive quantity of oil and insufficient rolling.

According to estimates made in 1908, it was planned to build 307 miles of oil-macadam averaging about 6 ins. thick and 16 ft. wide, at a cost of $3,519,579 or $11,560 per mile. When the old Highway Commission retired, July 12, 1911, it was found that they had completed 97 miles and had partly completed a great deal more. The actual cost of the 97 miles that had been completed was found to be $14,800 per mile, distributed as follows:

Grading	$ 2,110
Bridges, culverts and miscellaneous	1,275
Macadam	10,260
Total	$13,645
Engineering and supervision	1,155
Total	$14,800

The actual cost of these 97 miles had exceeded the estimated cost by nearly 30 per cent. It will be noted that engineering and supervision cost nearly 8 per cent of the total cost.

On these 97 miles of oil-macadam about 600 bbls. (42 gals. per bbl.) of oil had been used per mile. The oil-macadam averaged about 16 ft. wide with a 7-ft. earth shoulder on each side. The shoulders received 1 gal. of oil per square yard and were covered with screenings.

On 82 miles of these completed roads it was possible to ascertain the number of tons of broken stone originally estimated and the number actually used, as follows:

Tons of stone actually used per mile......	3,430
Tons of stone estimated per mile	[illegible]
Excess of actual over estimate.......	560

From this it appears that 20 per cent more stone was actually used than was originally estimated, resulting in a macadam that averaged about 7¼ ins. thick instead of about 6 ins. shown in the original plans. This overrun appears to have been due to various causes, among which was the desire of contractors to put as much stone as possible into the roads, since they were usually paid by the ton of stone. There is no doubt that an excessive amount of stone was used, and this alone accounts for a very large part of the increased cost of the work over the estimated cost.

In addition to the costs above given there were claims made by contractors for damages arising from delays in the delivery of broken stone. The old Highway Commission purchased broken stone from several quarries, and it also crushed a considerable quantity by day labor. The amount of stone furnished was often inadequate to keep the contractors' plants busy, which resulted in damage claims aggregating very considerable sums.

Finding that the contract work was costing more than the estimated cost, the old Highway Commission undertook to build about 11 miles of road by day labor, with results that were even more disastrous, for the actual cost was about 10 per cent higher by day labor than it would have been had the work been done by contract at the bidding prices that were rejected as being too high. Probably the bidding prices were too high, but the old Commission appears itself to have been to blame in this as in other matters. Contractors who had heard of, or had themselves experienced, the delays in securing broken stone through the Commission, were obviously forced to bid high in self protection.

Just before the term of the old Highway Commission expired, it signed as many new road contracts as possible, thus crowning an already bad economic record with a worse performance. The new Los Angeles County Highway Commission found itself confronted not only with the problem of resurfacing much of the oil-macadam recently built, but also with the problem of reducing the unit cost of the work remaining to be done, and with an appropriation that had been largely exhausted. The new Commission has been at work less than a year, but what it has already accomplished forms an excellent contrast with what had preceded its existence.

The Desirability of Office Training for the Inspector on Public Works.

It is a well-known condition, in our cities, that Commissioners of Public Works, City Engineers, Water Works Superintendents and other city officials of similar titles and duties, are not always free to make their own choice of men to serve as inspectors on the various construction jobs built under their general supervision. For various reasons, political and other, the inspector often is employed without any regard to his special fitness for the positon. The city official to whom the inspectors report must do the best he can in such cases with the men supplied him.

Very often the inspectors so appointed are anxious to do good work. However, as a rule they are not familar with engineers' plans and specifications, and they have only the knowledge of the average citizen relating to the materials and methods of construction. The conscientious inspector of this type is very likely to cling too closely to the literal interpretation of specifications and this course on his part almost invariably involves him in difficulties with the contractor. The quality of the work executed under such conditions always is impaired.

In another part of this issue we publish an article which gives an experienced inspector's views of the requisite qualifications of the inspector. He must be industrious, honest, and not too convivial. He should know how to interpret a set of engineers' plans and specifications.

It is strongly recommended that all the inspectors, at least the inexperienced ones, should be given a thorough schooling in the duties of their position, in a week so spent at the beginning of the construction season. Each inspector should be taught the proper use of a set of specifications, and should know when it is permissible to deviate from their strictly literal interpretation.

Training of the kind and in the manner suggested has produced good results in many cases. Public works officials will do well to keep a school of this kind, particularly where inspectors are chosen for the official and not by him.

A Type of Construction Article Containing Well-Kept Cost Data.

We wish to direct the attention of our readers to the article in the Waterworks and Sewers Section of the present issue which treats of costs of excavating sewer trenches by machine at Moundsville, W. Va. The costs may interest only those who are engaged in sewer work, but the form and scope of the article and its presentation of cost data, are the special features to which the attention of the general reader is directed. Readers who would contribute articles to this journal if they felt sure they knew what would be acceptable to the editor, will find a guide to their judgment as to the availability of matter and its presentation, in the article to which we refer. The editors invite the readers to contribute short articles, relating to construction, giving the methods employed in overcoming the various difficulties encountered in the course of the work described, either with or without the corresponding costs. If costs are available they should be presented, where possible, in a form somewhat analagous to the example here cited. Naturally all units and quantities cannot be handled in the same manner, but the degree of detail here introduced is very desirable and should be kept clearly in mind by readers who are collecting material to serve as a basis for future contributions to this journal. It will be noted that the data are complete for the work described. Detailed and specific data on a representative portion of a job are preferable to general discussions supplemented by a few general and scattering bits of data.

The conditions which influenced the cos of this work are stated in detail. The reader should have no trouble in interpreting these data, to fit the scale of wages, hours, etc., in force in his locality, for use in estimating the cost of work done under similar physical con ditions. The constructor also has here a cri terion by which to judge the efficiency of his plant, foremen, and men.

A Series of Interesting Articles on Con crete Inspection.

Contractors, engineers and owners ar equally concerned in the proper inspection o concrete, and any efforts toward insurin competent and efficient inspection merits thei support. Such an effort is made in the notabl series of articles of which we publish th fourth in this issue. There will be perhaps a many opinions as there are persons on wha is the proper scope and character of a manua of concrete inspection. The writer of thi series of articles which we are publishin conceives that such a mannal should be mor than a code of rules. He makes it a manua of construction practice. By doing this th interest in the articles is broadened to includ engineers and contractors and particularl owners. We wish that every man who con templates a concrete building could read thes articles; he would be less likely to turn th construction work over to designers an building contractors with confidence that i was within the ability of anyone of the trad to handle

A stadium capable of seating 60,000 peopl is one of the features of a proposed new ath letic field for Yale University. The plan call for the purchase of 100 acres of land opposit the present field at New Haven, Conn

CONCRETE AND REINFORCED CONCRETE SECTION

An English Proposed System of Forms for Building Construction.*

The design of centering—or "forms" as better called—for reinforced concrete is a very important branch in the execution of the work, for not only is its erection a matter of the greatest importance as regards the cost of the work, but it materially affects the stability and appearance of the structure. Various attempts have been made to devise methods of centering which shall possess features of economy and efficiency. It seems to be accepted by many contractors, however, that it is hopeless to attempt to devise a standard centering, specially in the conditions of English practice, where many buildings are situated upon awkwardly-shaped and restricted sites, which result in beams and panels being of very variable dimensions.

Where a building is regular in disposition and, both by reason of the purpose it is to serve and regularity of size, the floors are designed with equal-sized floor panels and beams, it is possible often to design centering applicable for that job which can be used over and over again, and in such cases the timber is made to serve many times over, some attempt being made to design a centering which shall be easily removable, and that can be easily re-erected. In such cases the work becomes more economical and efficient.

But, as has been stated, the conditions of the majority of English buildings are against maximum economy being obtained in this way. Therefore, when floors have all differently-sized beams and floor panels, reinforced concrete is placed at a material disadvantage because of the greatly increased cost of the centering which is so important to the wor The cost of the centering may vary fro say, 10 to 70 per cent of the total cost of tl reinforced concrete work, and, even und fairly good conditions, frequently comes o at 30 per cent of the work. Reinforced co crete design is economical with regard to tl concrete and steel required, though the lab is generally more than with ordinary stru tural steel and concrete floors. However, it were not for the centering in almost cases reinforced concrete would be four more economical than ordinary standard ste sections and concrete filled between, a could be carried out with as much speed.

If, therefore, it were possible to devise method of centering which could be e ployed in the majority of cases in Engla and for almost any job, and which offered, not an ideal standardized system, some fe tures of economy, it would lead to the great reased use of reinforced concrete, because wn the reinforced concrete contractors are s anxious to prove the superior economy of th r material over ordinary steelwork con-st ction, there is a tendency to cut the cen-te ng too much and risk bad workmanship. T problem is, consequently, one which may w exercise the attention of contractors and o rs. Most contractors work with one or t specialist designers, and a standard cen- ing could be devised and worked to by h the designer and the contractor.

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*Abstract of a paper by H. Kempton Dyson in "Concrete and Constructional Engineering" for February, 1912.

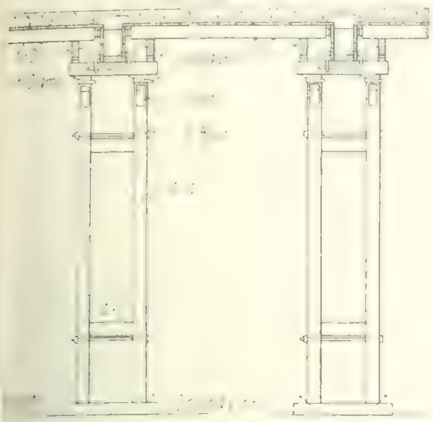

Fig. 1—Standard Form for Secondary Beams and for Floor Slabs.

The suggestion here put forward is not med to be above reproach: it is only ught out as a record of some ideas which y possibly be developed and improved in ctice, or, perhaps, if not considered suit-le for adoption in any respect, may lead something really serviceable being devised. e conditions which it is attempted in this posal to fill are (1) to have a number parts in centering which can be kept in ck by general builders or by specialist con-ctors for reinforced concrete work, these rts being such as will work in frequently r jobs of very varied character, so that e cost will be spread over a great amount of rk; and (2) that where timbers have to be t to length they shall be kept in as long ngths as possible, and not cut short so that ey cannot be used again except for such [illegible]

One finds in the majority of cases that ter each job contractors have a great deal timber in short lengths, which is never orked in again, and is ultimately made use for firewood, a small amount, perhaps, be-g used for such purposes as filling boards, d so on, where short lengths are usable. only the timber could be kept in fairly ng lengths, though it had to be cut about mewhat, it would be usable many more mes than when the framing of the beams d floor panels is, as is often seen, cut into ort lengths to merely fill in between, giving appearance of patchwork. Not only does e see this in beams and floor slabs, but ften in column forms and in uprights or rops.

In attempts at producing a sort of stand-rd design of centering a feature has often een the tendency to economize props. Now, nsidering that the props are the most usable ieces of timber, and undergo only a com-aratively small amount of wastage, this is o particular advantage, although it is urged or the policy that it leaves an unencumbered space in the floor area below. One can, however, obtain a sufficiently unencumbered space below even when a large number of props are used. These props are, of course, of heavy timber, but that timber, if it can be used over and over again, does not add much to the cost of any one job.

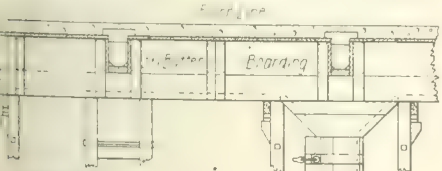

Fig. 3—Main Beam Form.

These preliminary remarks will enable us to describe the design here put forward, and call attention to the manner in which the above-named *desiderata* are to be met.

Figure 1 shows the manner of framing the forms for supporting the floor panels and secondary [illegible] through the secondary beams. Firstly, it will be noted that the centering is arranged for a secondary beam measuring as a maximum 6 ins. in width by 10 ins. in depth, this being reducible in depth by the aid of blocking pieces. If a designer chooses to make the width of his beams 5 in. say, which is about the minimum which they could be made, or prefers not to go below 7 ins. or 8 ins. the modification is easily made; but 6 ins. for the width of a secondary beam is probably the best as a standard width, and the depth is the dimension in which the variation will probably arise.

The sides of these beam boxes are framed of 1-in. stuff for cheapness and convenience in handling. The bottom of the beam box, however, is made of 2-in. stuff, because it has to carry weight over some distance without sagging. The beam boxes are sustained on double uprights bolted together, which extend up on either side of the beam boxes, adjusted in height by folding wedges at the tops, driven in between clamps (which latter are screwed to the uprights) and the cross-bearers under the bottoms of the beams. These cleats can easily be attached at any height if such alteration be necessary, and the only material damage by such alteration would be in the destruction of an odd piece of timber such as the cleat would be made of. A different size of base-plate at the bottoms of the uprights may also be employed to vary the height. The sides of the beam boxes are clamped together at the bottom by iron clamps. By reason of the inclined hole in the shorter loose end, these clamps wedge themselves in place, and are easily removable by just tapping the short end. The cross-bearers in the bottoms of the beams sustain 5x2-in. joists, which again carry 4x2-in. joists, these in turn sustaining 1-in. boarding, which receives the slab concrete. These do not extend completely between the beam boxes by more than 2 ins. and therefore a variation in length is not material, so that the bulk of such timber kept in stock would work in again without cutting.

The tops of the beam boxes are kept in position by wedges in between these 4x2-in. joists, and the 5x2-in. joists are wedged in to the correct height off the cross-bearers, which in turn are wedged from the cleats on the uprights. The beam boxes are kept open by a 4x2-in. blocking piece as shown, these being taken out when the concrete is filled in the beam and, by its own weight, serves the purpose of keeping the boards tight against the external wedges. Now, it is easy to see that such a form of upright is preferable, as they are not underneath the beams, which would require them to be of one height, and would necessitate frequent cutting in buildings with floors of different heights.

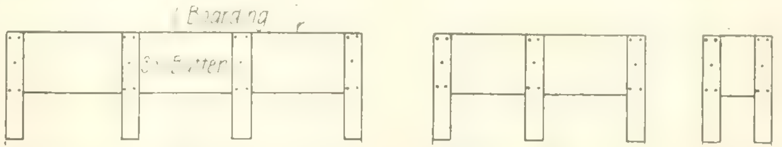

Fig. 4—Filling Boards for Beam Forms.

The boarding to sustain the slab concrete, it should be noticed, is made to run parallel with the beam boxes; this means that the boarding is not cut into short lengths to frame between the beams, but can be used in fairly long lengths, an economy which has been referred to above. The end boards, which may overhang the 4x2-in. joists, bear upon the tops of the side boards of the beam boxing, and are the only fillers, and a few narrower boards may even then be used to avoid cutting. The boarding, being 1-in. stuff, is cheap and readily handled, and is therefore very economical, but the supports have to be placed fairly close together to prevent any sagging, a point which wants careful watching, because where such light boarding is used one often finds the work very uneven, and this unevenness often necessitates rendering, which adds so greatly to the cost of the work.

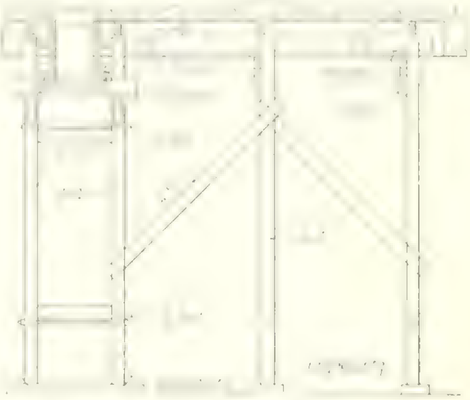

Fig. 2—Standard Form for Main Beams.

This design fulfils another requirement, which it is worth while endeavoring to meet, and that is that every part should be able to be removed independent of the other, and allow the wedges to be removed, firstly, so as to observe if the work is defective, as in some cases it is only possible to see that the work is satisfactory by removing the uprights of the centering, which risks the sudden collapse of the whole structure. Thus, in this particular portion of the work, it is possible to firstly remove the sides of the beams, which should be done in two or three days, so as to allow the air to dry the concrete and harden it. It is then possible to remove the wedges from under the 5x2-in. joists and turn over on either side the 4x2-in. joists, so stopping the boards from tumbling down and injuring the men removing the centering. These boards can then be taken away, still leaving the 4x8-in. joists in place. A few days later, if this be the method adopted, the wedges in between the cleats and cross-bearers of the beams can be eased, when the whole of the weight will begin to bear on the beams, and one can observe the deflection, and see whether the work is good; should there be any failure evidenced, the slabs would be caught by the 4x2-in. joists, which have been turned over on the flat, and by the bottom boards of the beam boxes.

Such a design, therefore, as suggested, fulfils all requirements; the parts can be removed separately with safety, the work is not damaged in the removal, the timbers can be used again without much cutting, and the labor of removal and re-erection is small.

The 4x2-in. blocking pieces at the tops of the beams are also serviceable to suspend the steel the right distance above the bottom of the beams. The depth of the beams is accurately gaged by nailing the triangular fillets the right height above the bottom, and then wedging up the 2-in. bottom boards to stop against them.

The standards are placed convenient distances along the secondary beams, as shown in *Fig.* 2, and are cross-braced diagonally to give stiffness, these cross-braces being 4x4-in. boards, tacked by nails. These nails, as all others, it should be noted, should be left with their heads projecting, so that they can be easily withdrawn.

The sides of the secondary beams are formed of long lengths of boards, and, working to the standard size suggested—namely, 12 ins.—one can form the sides of the beam boxes of two 6-in. boards. These boards need to be cut to length, but they are of sufficient length, as a rule, to enable them to be worked in again, or, even should they be eventually cut into short lengths, it is possible to use them for filling boards, as will be detailed later. The ends of the secondary beam boxes, of course, have eventually to meet or enter the main beam boxes. The advisability of using the 12-in. boards as the sides of the beam is again apparent, because the size is best to work in with the framing of the main beam boxes. The size, however, of the work can be varied by the use of different size boards, and yet the same method of framing would be advisable—that is to say, supposing one wished to have 14 ins. as the minimum depth of the secondary beam, two 7-in. boards might be used to give this depth. Thus, the main beams would be framed up with three 7-in. boards.

The same principle of adopting a maximum size for the secondary beams is adopted in connection with the main beams. In *Fig.* 2, the main beam is shown as being 12x18 ins. internal dimensions; by putting in a different width of bottom board, and putting a blocking piece over the cross-bearers which rest on the uprights, this is reducible to a beam of 6 ins. width, and 15 ins. more or less in depth. The main beams vary not only in height, but in width, whereas secondary beams do not vary, say, in width. It, therefore, means that the bottom boards have to be made up to the width, and in the scheme here proposed, it will be seen, from *Fig.* 2 and *Fig.* 3 that both the bottom boards and the lower side boards are in long lengths, and therefore entail little cutting to waste. The special feature of the upper portion of the beam boxes is the use of filling boards, framed together in standard lengths. Details of these filling boards are given in *Fig.* 4, which shows three standard lengths. The sizes which it is suggested should be kept in stock are as follows:

STANDARD LENGTHS

Feet.	Inches.	Feet.	Inches.
1	0	2	0
1	1	2	6
1	2	3	0
1	3	3	6
1	4	4	0
1	5	4	6
1	6	5	0

The boards are framed up about 12 ins. deep, as suggested above, for the reason cited, made up of two 6-in. boards, cleated together by 1x3-in. battens, as shown, cleated projecting ends. Such stuff would be taken from stock, and a builder could easily keep a number of these in stock, instead of making firewood of such material; much economy would come by using his short pieces for these filling pieces. *Fig.* 3 shows how, in between the secondary beam boxing, the spacing for which happens to work out that way, two different lengths of filling pieces are placed. By arranging the different standard sizes, one can make up any width with exactitude. The secondary beam framing, it will be seen, is sustained quite independent of the main beam boxing. Along the side of the beam boxes, to bear against the battens that cleat the filling pieces, it is suggested that 3x1½-in. runners should be placed to take wedges. Where the runners occur, but between the uprights, iron clamps similar to those above described are used to clamp the bottom of the boxes. Other details are very similar to the secondary beam centering, and the sides of the beams are removable earlier, to provide for the drying and hardening in the greater thickness of the beams before striking the other part of the centering, the advisability of which has already been referred to.

The upright shown for sustaining the main beam boxes is slightly higher than that for the secondary beams, but it is just to point out that the length of the standard could vary, though they might have all been of the same height. The uprights generally are framed out of 4x4-in, timbers, with distance pieces of 4x2 ins. just let into mortises, the uprights being tightened against them by ½-in. bolts, as shown in *Fig.* 2. The 4x4-in. stuff is thought to be preferable to the use of round scaffold poles—or, rather, short lengths of same—which are often used by contractors in rough centering. They could be adapted, but it is thought that the 4x4-in. stuff is as cheap, and has sufficient superior advantage in its squareness to warrant its use, and, of course, some contractors would find an insufficient supply of round timbers by the inevitable wastage of scaffold poles. Often, 9x3-in. deals are used for the purpose, and, indeed, any handy stuff is made to serve, but they would not do for a standard design.

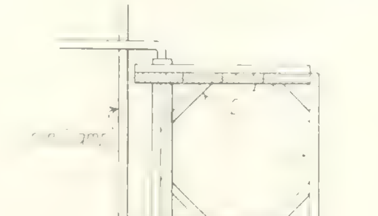

Fig. 5—Standard Column Forms.

The 9x3-in. base-plates to the uprights are employed for the purpose of distributing the load over the ground or floor over which they are strutted. There have been several mishaps through the settling of supports in soft ground and the concentration of a load on a small area of an insufficiently hardened floor below. This should emphasize the necessity of always providing such base plates. The uprights are secured against any possibility of slipping by means of the nails driven crosswise into the base plates.

The uprights for the main beams would obviously have to be wider apart than the uprights for the secondary beams. Such uprights would be placed as close together as found necessary, by reason of the load to be sustained. The supports, too, would be placed all round a column, so as to permit the column boxing to stand quite independent, and allow it to be removed before striking the centering of beam or floor slabs, it being desirable to remove the column boxes (the same as the sides of beam boxes) in order to allow the greater thickness of concrete to harden by the drying out of moisture by the circulation of air, which would otherwise be prevented if the boxing remained in place.

Fig. 5 shows details of a suggested standard form of column boxing, the sides of which are held together by the clamps. In both it will be seen that three of the sides are framed up firstly with 2-in. boards placed vertically, and the fourth side is brought up bit by bit by nailing 1-in. boards horizontally across. When several boards are required to make up the width of the sides, battens are nailed across to keep the boards together. Triangular fillets are easily tacked into the corners of the columns to enable the centering to draw away without damaging the corners. The beams are splayed down to the columns and such splaying is susu provided for, as shown in *Fig.* 5.

On some jobs in America a box-like form has been framed up, in which the whole of each panel and the sides of the beams, are framed up to form a sort of box, which is constructed with a hinged joint in the center, so as to come away easily. On striking, the whole box is dropped and lifted up by a crane, cleaned, and put into a new position. As, however, with such a type of centering the several floors need to be exactly alike, it is not likely to generally fulfil English requirements, and it is thought that the design here put forward is superior in many ways. Of course, if the job is a large one, and the planning is very regular, and the sides of the beams and floor very uniform, then it would be easily possible to devise a form of centering for that one job which would be more economical than the design here put forward; but it is not claimed that this design is the best for all conditions; it is only a suggestion of a form of centering which might be adopted for average conditions with some advantage over the ordinary unsystematic methods of centering in vogue, the wastage under which seriously retards the development of reinforced concrete in many directions.

The Effect of High Pressure Steam Curing on the Crushing Strength of Concrete.*

It is a well known fact that the hardening of Portland cement is accelerated by exposure to heat after hydration, but the value of this acceleration and the possibilities of its application to commercial purposes have not been extensively investigated.

In the manufacture of cement products, such as building blocks, architectural stone, drain tile, sewer tile, fence posts, etc., it is highly desirable to produce a material of uniform and known quality. Under present methods of manufacture the product is not of uniform quality. Even under laboratory conditions of manufacturing, storing, and curing a variation of 50 per cent in strength may be obtained between maximum and minimum values for similar concrete, mixed and molded under apparently the same conditions.

At the present time many manufacturing plants find it to be economical and highly desirable to cure their products by exposing them to heat in the form of steam at atmospheric pressure. By this means it is found that the concrete becomes sufficiently hard in the course of several days to permit handling and shipment. The heat accelerates the setting and also aids in the production of a more uniform quality of material.

The purpose of the investigations reported in this paper was to determine what acceleration in hardening could be obtained by using steam under pressure, with corresponding higher temperatures.

Outline of Tests.—There were [illegible] of investigations: (1) To determine the effect of different steam pressures on the hardening of Portland cement mortars.)

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*Abstract of Technologic Paper No. 5, Bu of Standards, by Rudolph J. Wig

T(letermine the effect of duration of steam ex)sure on the hardening of Portland cem|t mortars.

|asmuch as mortar mixtures are extensi|y used in the manufacture of cement pr:ucts, and since it was thought they would gi' relatively similar results to those which ·ld be obtained with concrete mixtures, mortar mixture exclusively was tested. s mortar was composed of 1 part by vol- ·t Portland cement to 4 parts by volume well-graded sand. Two percentages of :er were used in mixing, corresponding to se employed in molding cement products. e has been termed a damp consistency, the :ture containing only sufficient water to mit of molding a ball in the hands and ding between the thumb and finger. Water ıld not be drawn to the surface by trowel- . The other, designated a "quaking" con- :ency, contained all the water it would d and permit of making a ball in the hands l holding between the thumb and finger. ıter could easily be drawn to the surface the pressure of a trowel.

The materials were mixed in a cubical ch mixer. They were mixed dry for five nutes when the water was weighed, added, l materials mixed another five minutes. e test piece was cylindrical in shape, 8 ins. diameter by 16 ins. in length. The cast- n mold in which these test pieces were ·med was in three sections, held together brass eye-screws and iron wedges. The ıer surfaces were machined true.

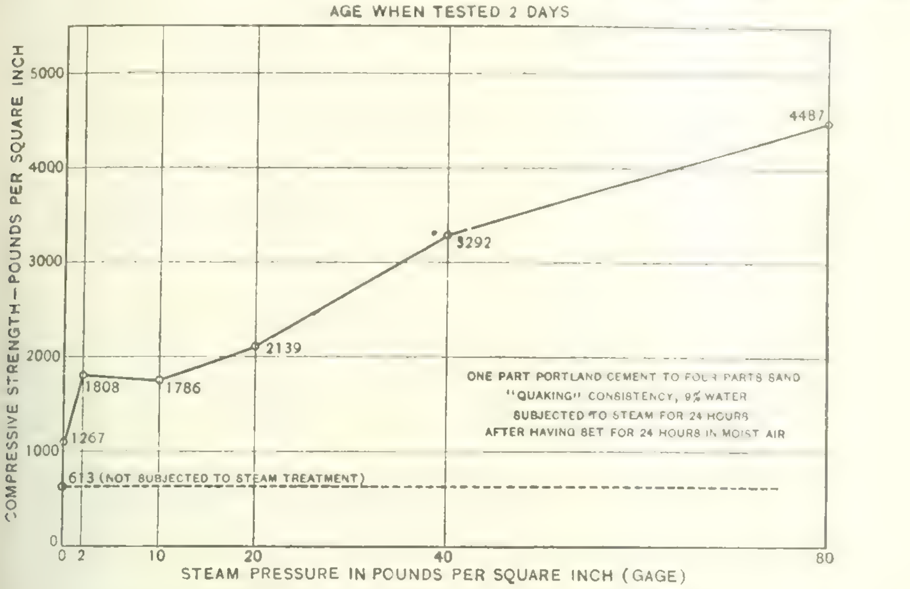
The mold was filled one-fourth full and nd tamped systematically with a 13-lb. peen- ıped tamper, care being taken to cover the tire surface. This operation was repeated til the mold was filled, when it was leveled with a plasterer's trowel.

The molds were placed in the moist room mediately after filling, and the following y they were removed from the test pieces. ter steam treatment all test pieces were ored in the moist room (with a few ex- ptions) until they were tested. The test eces which were not steam treated were not moved from the moist room until the day ey were due to be tested. All test pieces the moist room were sprinkled three times ch 24 hours.

The steam-curing equipment consisted of curing tank 36 ins. in diameter by 10 ft. in ngth, with one head removable; three steel t cars 24 ins. wide by 30 ins. long, track, eam-pressure regulating valve, steam trap, eam gage, and necessary piping. The steam as obtained from the power plant of the boratory.

The method of subjecting the test pieces to eam was as follows: Twenty-four hours ter the test pieces were molded, the molds were removed [illegible] placed on the flat [illegible] the tank, the section of the track at the entrance of the tank was removed and the head of the [illegible] on a rail [illegible] and bolted. It [illegible] utes to exhaust the air from the tank and bring the steam up to the desired pressure. When the pressure was removed, the head of the tank was unbolted and removed. The cars were drawn from the tank, the test pieces removed, and either tested immediately for compressive strength or stored in the moist room until they were due to be tested.

Results of Tests.—All test pieces were calipered and weighed previous to testing. The weight per cubic foot of the concrete or mortar was computed by dividing the weight by the volume computed from actual measurements of each test piece. The ultimate strength in pounds per square inch was obtained by dividing the total breaking load by the sectional area computed from the actual measured diameter.



ıg. 1—Effect of Various Steam Pressures on the Compressive Strength of Portland Cement Mortars.

Examining Figs. 1 and 2 in which the pressure and temperature, respectively, have been plotted with the ultimate compressive strength, it is observed that the acceleration in strength is very marked with the increase in the steam pressure and temperature. The gain in strength of the mortar exposed for 24 hours to steam at 80 lbs. per square inch over the untreated mortar is 632 per cent. Lower steam pressures give a corresponding increase in strength over the untreated mortar, and from the slope of the curves it would appear that the increase in strength would be correspondingly higher for higher steam pressures and temperatures.

In Fig. 3 the age of the mortar when tested is plotted with the ultimate compressive strength for various steam pressures. It will be observed that there is no retrogression in strength with age in any case. The untreated mortar does not equal in strength the steam-cured mortar at any period, and at the age of 180 days it has less than 50 per cent of the strength of the mortar steam-cured under 80 pounds pressure for 24 hours.

Fig. 4 shows how the length of time of exposure to steam affects the compressive strength, the steam pressure being maintained constant. All mortar exposed to steam under 80 pounds pressure for from 12 to 48 hours resulted in an increase in compressive strength over the untreated mortar. The increase in strength is from approximately 400 per cent at the age of two days to 100 per cent at the age of 28 days. None of the steam-cured mortar showed retrogression in strength between 2 and 28 days. The steam treatment of only three hours' duration apparently had an injurious effect upon the hardening of the mortar, as that mortar developed only 60 per cent of the strength of the untreated mortar at the age of 28 days. Comparing the 24-hour curve of Fig. 4 with the 24-hour curve of Fig. 3, it will be observed that the former lies below the latter for all periods, though, if the mortar were of the same quality in both cases, they should have developed equal strength. As previously explained, eight months elapsed between the making of the test pieces of these two series, and the cement had become slightly lumpy during this interval.

Considering all of the above tests, it is apparent that steam under pressure will greatly accelerate the hardening. In order to determine the effect of steam on a lean mixture, one set of cylinders was molded of one part Portland cement and eight parts of sand, using 12½ per cent of water. They were permitted to obtain an initial set in moist air for 24 hours, when they were exposed to steam under 80 pounds pressure for 24 hours. They were tested immediately after

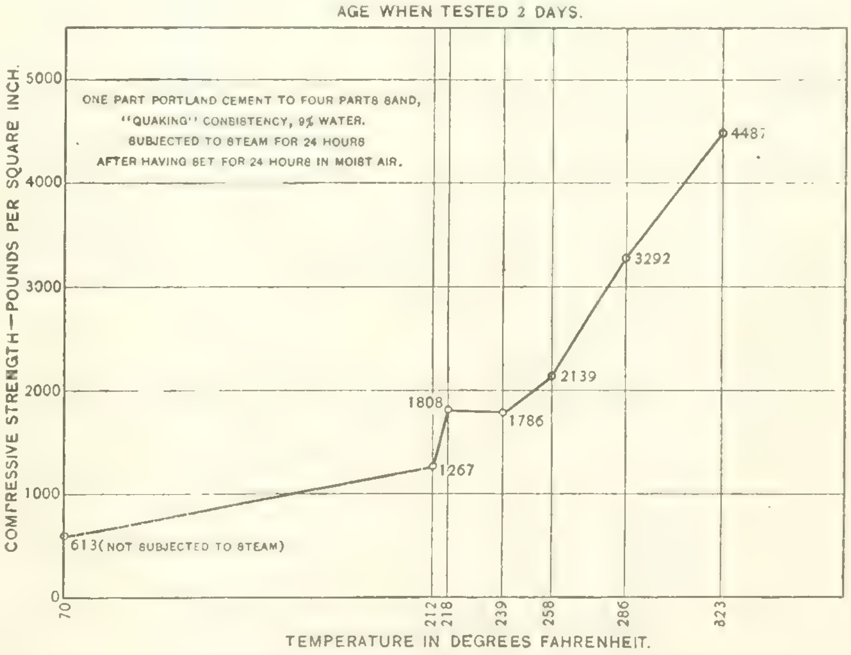


Fig. 2—Effect of Steam of Various Temperatures on the Compressive Strength of Portland Cement Mortar.

removing from the steam, being two days old, with the following ultimate strength in compression (lbs. per sq. in.):

2038; 2307; 2040: Average, 2128.

From these tests it would appear that the strength of a steam-cured mortar is directly proportional to the cement content, but of course too much dependence should not be placed on a few results. One set of limestone concrete cylinders made in the proportion of one part of Portland cement, three parts sand, and six parts limestone was made and tested. They were placed in moist air for the first 24 hours, obtaining an initial set, after which they were exposed to steam at 80 lbs. pressure for 24 hours. They were tested directly after taking from the steam, being two days old, with the following ultimate strength in compression (lbs. per sq. in.):

2429; 2615; 2320: Average, 2455.

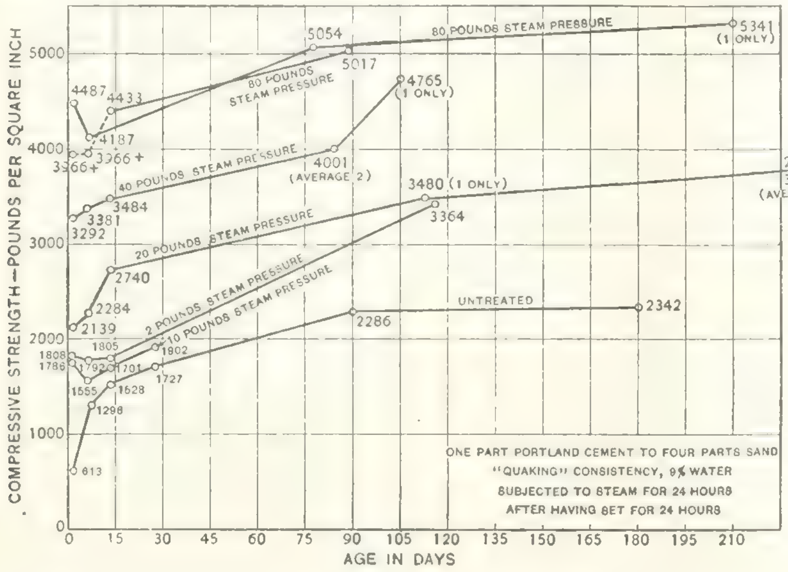


Fig. 3—Effect of Various Steam Pressures on the Compressive Strength of Portland Cement Mortar.

Several sets of cylinders, both mortars and concretes, were exposed to steam immediately after molding without permitting the material to obtain an initial set. In every case the test pieces were cracked longitudinally by the steam, but the concrete or mortar was hard and the test pieces developed about half of the strength of those which were permitted to obtain an initial set before exposure to steam. It was found that if the concrete was mixed to a creamy consistency, although it was permitted to set in the air for four days previous to exposing to steam, the test pieces would be cracked longitudinally by the action of the steam.

Several sets of cylinders were made in which hydrated lime was substituted for part of the cement, but the strength was reduced almost proportionally with the reduction in the cement content, the lime acting apparently as so much inert material.

Summary.—The conclusions drawn on tests of this character must be understood as only directly applicable to materials similar to those tested and they must be limited by the limitations of the investigation. However, the test piece was of good size, and considering the large number made and tested, the reliability and accuracy of the results may be accepted.

(1) Steam up to 80 lbs. per square inch gage pressure has an accelerating action on the hardening of Portland cement mortar and concrete.

(2) The compressive strength increases as the steam pressure is increased.

(3) The compressive strength increases with the increase in the time of exposure to steam.

(4) A compressive strength considerably (in some cases over 100 per cent) in excess of that obtained normally after aging for six months may be obtained in two days by using steam under pressure for curing the mortar.

(5) Steam under pressure, if of sufficient duration, permanently accelerates the hardening of the mortar, giving subsequent constant increase in compressive strength with age.

(6) The steam-cured mortar or concrete is of much more uniform appearance and much lighter in color than normally aged mortar or concrete made from the same materials.

(7) The mortar or concrete should obtain an initial set before it is exposed to the steam treatment.

(8) For steam curing a "quaking" or medium consistency is preferable to a very dry or a very wet consistency.

(9) The initial modulus of elasticity and the yield point of the mortar increase directly with the duration of steam treatment.

(10) The initial modulus of elasticity and the yield point of the mortar increase directly with the steam pressure.

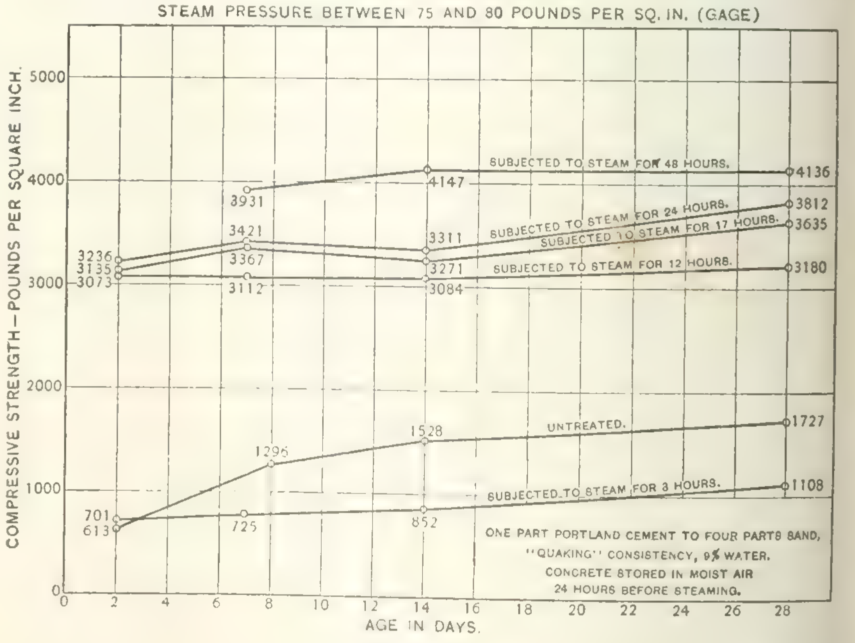


Fig. 4—Effect of Duration of Steam on theCompressive Strength of Portland Cemen Mortar.

(11) The initial modulus of elasticity does not increase in direct proportion to the increase in the ultimate compressive strength of the steam-cured mortar.

(12) Results indicate that the compressive strength obtained by steam curing is directly proportional to the cement content of the mortar.

Inspection of Steel Reinforcemen

d by Jerome Cochran, C. E., For
signing Engineer, Trussed Concret
Steel Co., Detroit, Mich.

The series of articles on the inspectio concrete work, of which this is the fo has been planned in opposition to the eral assumption on the part of writers standards or methods of construction been long ago established and have bec common knowledge. The first article on "Di tions and Suggestions for the Inspectio Concrete Materials" appeared in this jou for Jan. 31, 1912; the second article on " portioning and Mixing Concrete" appeare Feb. 7, 1912, and the third article on "Ins tion of Forms and Centering" appeared Feb. 21, 1912. The following article rel to the inspection of steel reinforcement. It will be followed by articles on transpor and placing of concrete, finishing conc surfaces and waterproofing concrete work

The imbedding of iron in concrete is alr as old as concrete itself. According to Von Emperger:*

> " . . . The writer knows of a case w iron rods were found perfectly rust-free, ing been embedded in concrete below w level for 400 years. . . . . For the pr tion of iron, concrete is better than paint."

Pieces of iron taken out of the founda of the obelisk (2,300 yrs. old) which brought from Egypt and set up in Cer Park, New York City, were not rusted at

The first use of steel reinforced conc in a scientific manner was made by W. Ward in erecting a building in Port Ches N. Y., in 1875. The entire building was structed of reinforced concrete, inclu walls, cornices, beams and roof. There been a very rapid development in the use reinforcement for concrete in structures this country within the past ten years. fact, very little, if any reinforcement used prior to this time. It is not the pose of this article to give a history of development of reinforcement for var structures, nor to give methods of calcula or design, but simply to give such gen and specific instructions as are necessary insure the proper placing of the steel r forcement in the structure after the work been started. In other words, the article c sists of a series of rules and directions to lved in inspecting steel reinforcement brief explanations of their reasons and ir importance.

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*Trans. Am. Soc. C. E., vol. xxxi, p. 453.

DELIVERY AND STORAGE OF STEEL.

al Requirements.—The steel should be red in such quantities and at such times y be required by the work. It should ted, bundled and labeled when delivered. einforcing steel for a concrete building erally delivered at the site in the fol- manner: All loose bars for floor etc., are bundled and tagged, showing respective sizes and lengths. All bars eams, girders, etc., whether loose or up, are delivered in a similar manner. lumn bars are bundled and tagged sep- for each section of column. All hoop- r columns is tagged with column num- nd section. All wire mesh reinforcing oped flat and cut to the required widths ngths.

ding of Steel.—It is generally preferable ve the bars bent before they are deliv- but in case this is not done, the con- r is required to provide such facilities abor as may be necessary to bend the n the field.

of Delivery.—All steel should be from heavy rust or scale.

and Assorting Steel.—As soon as eel is received at the site, it should be assorted and stored in such a man- hat it can be inspected. If the steel is arked, or is improperly marked, a letter effect should be sent to the company hing the reinforcing material, specifving nature and extent of the failure rly to mark the bars.

rage of Steel.—Steel on arrival at te should not be laid on the ground but l in suitable racks under cover in such nner as to protect it from injury. Roof- ver the steel racks not only protects eel from rain and snow, but also enables en to work dry-shod in stormy weather. of each size and length should be stored emselves. They should also be so stored hose portions needed first may be reached ut handling other material or bars.

of Steel.—The steel should be ted from rust, dirt, oil, paint, etc. That say, reinforcing material should be pro- from the weather, but must not be or painted.

PLACING STEEL REINFORCEMENT.

e careful placing of bars is one of the important features of reinforced con- work, and one which is too often ne- because of the expense of doing it

ndling Reinforcement.—All metal which een bent or otherwise injured in han- or in transit should be carefully re- d by the contractor before being used. forcing bars must be straight and free flaws in any degree calculated to im- their strength.

placing Broken Bars.—Should any bar be n it must be laid aside and another bar e same length and cross-section procured ut delay.

anliness of Steel.—The steel reinforce- , before being placed in forms, should oroughly cleaned from loose, scaly rust, oil, paint, or coating that may be detri- al to the positive adhesion of the con- to the steel, and care should be taken to it in this condition and thoroughly pro- d from moisture until the concrete is d. A thin film of rust, which facilitates orming of a hard film or a coat of ferro- te, and increases the adhesion of the rete, should not cause the rejection of r, but any bar on which rust scales have n to form should be immediately rejected, ss such scales are thoroughly removed wire brushes or by other means. Con- which has lodged on the steel reinforce- t and hardened during previous work ld be entirely removed before the re- rcement is finally concreted in.

inting or Oiling Bars.—No steel reinforcement should be painted or oiled, as either will lessen the adhesion of the concrete.

Meth [illegible] All heavy rust and mill scales may be removed from the reinforcing metal by hammering, steel scrapers or brushes, pickling in a weak solution of hydrochloric acid, or by some other equ [illegible] metal, before being covered by the concrete.

Use of Pickling Bath.—If the steel bars have more than a thin film of rust upon the surface, they may be cleaned by pickling in a bath consisting of one part commercial sulphuric acid to six parts water, or other proportions depending upon the amount of rust on the bars. Bars must be washed thoroughly in clean water after the bath and before placing in the concrete. In other words, where the bars are pickled in acid they should be thoroughly washed afterwards so as to remove the acid before depositing the concrete.

Cleaning Forms.—No steel should be placed until the forms have been thoroughly cleaned and inspected. Forms must be cleaned of all dirt and shavings and care must be taken to prevent new dirt and shavings from coming into the forms.

Assembling of Reinforcement.—The steel reinforcement should be so assembled that the exact number, size, form, spacing and location of bars, stirrups, ties, spacers, etc., called for by the engineer's plans is adhered to in every member. Should any discrepancy be noted in regard to the reinforcement of similar members, it should be brought to the immediate attention of the engineer in charge of the work.

Inspection of Reinforcement.—All steel reinforcement should be as per plans and details and should be placed and inspected by the engineer before any concrete is put in place, and to admit of this inspection, steel for a day's work should be placed in advance of the concrete.

Carelessness in Placing Reinforcement.—Steel should be set accurately in place in accordance with the detailed drawings for that purpose. It is the inspector's duty to insist upon the reinforcement being accurately placed, and any carelessness on the part of the contractor in this should be sufficient grounds for the engineer to require the removal of the work, and the replacing of it correctly. The displacing of the reinforcement, either by accident or design to facilitate the placing of the concrete, may cause the failure of the structure.

Spacing of Bars.—Bars should be spaced the proper distance apart and away from the face of the form work and should be securely held in that position so as not to be disturbed by the placing of concrete.

Embedment of Reinforcement.—Steel reinforcement should be embedded to a depth of at least 1 in. from any surface, unless otherwise shown on the detailed drawings or stated in the specifications. Care must be taken to keep all bars at such distance as the engineer directs from the nearest exposed face.

Thickness of Concrete Covering.—The minimum exposed concrete covering of all faces for steel reinforcement used in building construction is generally as follows: ¾ in. for slabs; 1¼ ins. for beams and girders; 1½ ins. for columns and walls, and 2 ins. for foundations.

Distance Between Reinforcing Bars.—The clear spacing between parallel reinforcement in beams and girders should not be less than 1¼ ins. No reinforcing bars should be closer together than 2¾ diameters, center to center.

Placing Reinforcement in Proper Position.—The contractor should be required to follow closely the plans or the instructions of the engineer in the placing of the reinforcing material, both as to size, spacing and placing relatively to the surfaces; and where no measurements are given on the drawings the contractor should be required to follow the instructions given by the engineer. The steel reinforcement must be placed the proper distance from the bottom and sides of forms and in the position required in the finished structure, and each piece or member so firmly fixed as to positively prevent any subsequent displacement when concrete is being poured. It is absolutely essential that the steel be placed in proper position so that line and level of all bars and of the reinforcement as a whole are accurate. If either the number, size or spacing of the reinforcement is varied from, the strength of the concrete member will not be what it was designed to be and injury results. In other words, the inspector *shall* insist that the reinforcing steel be so fixed and held in place in the forms that it will not be displaced from its proper position and spacing during the placing and compacting of the concrete.

Headers.—In all work built between forms, in which the horizontal bars run further than the lengths of the forms for that particular section of work, the headers against which work ends should be perforated at the proper places and the bars should project through the same for a minimum distance equal to the least lap allowed for the size of the bar, and all of different lengths, so that no place will laps occur nearer to each other than 2 ft. in adjoining bars in the same plane.

"Loose-Bar" Method.—In the "loose-bar" method or system, as generally practiced, the reinforcement is designed out of separate bars or rods to be shipped as individual pieces to the job and there bent to the proper shape and wired together in place in the forms. Particular attention must, therefore, be given to loose bar reinforcement to insure that it is accurately and properly supported in position, so that all parts shall remain in true relation and alinement until locked in the setting concrete. This is easier said than done. Owing to the inability of inspectors and superintendents to be everywhere at one time, and very often to the incapacity of these men, reinforcing rods are in many cases incorrectly placed or left out altogether. It is not hard to understand what such oversights mean to the safety of the structure. Such device or devices must, therefore, be used as will absolutely prevent the bars from approaching the forms beyond the limits specified for protection, and at the same time maintain a uniform and accurate spacing of the bars throughout the length of the members. The most imperative duty of the inspector is to see that no detail of the engineer's design of reinforcement is varied from in placing the reinforcement in the structure.

"Assembled Unit" System.—In the assembled unit systems the reinforcement for each member is carefully manufactured either in a shop or on ground adjacent to the building and put into the forms as a unit. In some of the systems these unit frames are provided with connections so that the adjacent reinforcement may be joined firmly together, thus providing the necessary continuity of the structure. The use of these unit frames will greatly facilitate not only the placing of steel but also its inspection. However, most of the general instructions given in this article apply with equal force to either system of reinforcement.

Spacing "Chairs."—Spacing "chairs" and clips for bar reinforcement should be made of a heavy weight and a good quality of sheet steel. They should have ample strength against crushing down under such loads as are likely to come on the reinforcement. The bottom edges of the chair should be bent to form flat feet and prevent cutting into the form boards when used to support floor reinforcement. For wall and column reinforcement, the bending of the bottom edge of the chair to form feet may be omitted, and for spiral hooping the slots for the spiral rods may be cut to pitch so that the chairs set straight with the vertical bars. The chief objection to metal spacers and separators is that they form a straight joint in the fireproofing and also to conduct heat to the bars.

Support of Metal Separators.—All metal separators used to keep the reinforcement at the right distance from the forms should rest [illegible] spot will show on the under surface.

[illegible] be furnished to prevent sagging of the reinforcement.

[illegible] not be used unless absolutely necessary for the reason that, remaining in the concrete, as they are liable to do, a weak spot will be developed.

[illegible] be bent before they are placed in position. The bending of all bars should be done in such a manner that they will not break or crack at the end. The bending force should be applied gradually and not with a jerk. In other words, bending must be done with great care, so that no appreciable strength is lost thereby. Bending must be done with absolute accuracy in accordance with the dimensions and forms shown on the detail sheets for the various portions of the structure. The bends should be accurate in line and plane. All ordinary bending should preferably be done cold. It is very important, especially in bending large bars, that the bending force be applied gradually and evenly and not with a jerk. If the bars are heated and blacksmith work is done, care must be exercised that the steel is not burned in the operation, otherwise it should be condemned. Warming up to a low cherry red should be the highest heat permitted.

Bar Benders.—Bending machines should be required to bend any kind of a steel bar up to 1¼ ins. in diameter to any angle required. A simple cast iron block for bending bars may be made of a block of metal with a longitudinal groove cut in it. The block is attached rigidly in a horizontal position to a work bench, the bar to be bent is dropped in the slot, a piece of extra heavy pipe is then slipped over the end of the bar, and a couple of men can bend it to the required angle. A bending block may also be made of an iron plate with two angles riveted to it back to back to form a slot. Stirrups when bent by hand may be bent on such a plate, the angles, of course, being small and only far enough apart to admit of the size used for stirrups.

Splicing of Bars.—The splicing of bars should be done exactly according to the engineer's plans. No splices whatever should be permitted except at points shown on plans. Various forms of splices are in use and if not definitely instructed by the plans and specifications the inspector should learn from the engineer what form or forms will be acceptable. The length of lap required for splicing of reinforcing bars in tension should be determined on the basis of the safe bond stress and the stress in the bar at the point of splice; or a connection should be made between the bars of sufficient strength to carry the stress. Splices at point of maximum stress should be avoided.

Welding of Bars.—No welding of reinforcement except in column hoops should be permitted without special permission from the engineer. Welding should, however, be avoided if possible.

Protruding Ends of Bars.—The ends of bars which are left protruding for splicing should be, if they are likely not to be connected up for some little time, painted with cement paint to diminish rusting and guarded against being bent or loosened. Throughout the work care must be exercised to prevent disturbing bars, portions of which are embedded in fresh concrete.

Fastening Reinforcement.—All reinforcement should be securely fastened to preserve spacing, location, alinement, etc. In other words, the reinforcing material should be so supported during construction as to insure that it will occupy its designed position in the completed structure. Braces, blocks, suspenders, spacers, ties, etc., should be used in ample number to make certain of this feature. All temporary fastenings should be removed as fast as the concreting reaches them, in order to prevent any unsightly, dangerous or deteriorating matter remaining in the concrete. Whenever practicable all the reinforcing metal should be put in place in the forms and securely fastened in correct positions by wiring or otherwise before the placing of the concrete is begun.

All wiring, straps, braces and templates required for the proper holding of the reinforcement in place should be furnished by the contractor in a manner entirely satisfactory to the engineer.

Wiring Reinforcement.—The wiring of reinforcement at intersections should be done carefully and strongly, using No. 16 or No 1 B. & S. gage soft black wire, such as stove pipe wire. The wire should be cut into lengths of about 8 ins. and preferably two pieces used at intersections.

Tagging Reinforcing Bars.—When the bars are cut and bent to proper shape, each individual bar in every beam and girder; or group of bars in columns, slabs, walls, footings, etc., should be tagged with a cloth tag and wired securely to the bars (for beams and girders), or each bundle of bars, and marked with the proper number of the structural member, and the tags should be left on after the bars are placed in proper position in the forms. The engineer or his inspector should carefully examine the bars after they have been placed, personally remove the tags, after which the concrete may be placed.

Placing Concrete.—The contractor should be required to take the greatest care in the erection of the reinforcement, keeping a constant eye on it at the point where the concrete is being placed, to see that all the bars are in the proper location. Concrete should not be deposited in any portion of the work until all the reinforcement for that section of work is in a position and has been checked over to see that it agrees with the drawings. It is cheaper to delay the work than to cut out work already done. See that the bars are clean when installed in place, ready for concrete. The steel work must be kept sufficiently ahead of the concrete work to give ample time for inspection.

Protection of Reinforcement.—After placing steel reinforcement in position, if concreting be interrupted for any considerable length of time, the steel should be protected with canvas or tarred paper or other satisfactory covering. Ends of metal that are to be left projecting for a considerable time should be painted a heavy coat of neat cement wash for grout to protect them from corrosion.

Concrete Spacing Blocks.—Notched concrete spacing blocks composed of the best concrete may be used for beam, girder and slab reinforcement. The notches should be properly spaced so as to separate the bars from each other and from the sides of the forms, and the bars should be of the proper thickness to hold the bars at the required height above the bottoms of the beams, girders and slabs. The use of spacers and separators are not only necessary from a construction standpoint, but also for prevention of damage by fire and rust. If separators are not used the bars will surely be more or less displaced by the dumping of the concrete carts and during ramming.

Spacing Chairs.—Spacing chairs or heavy wire supports may be substituted for the concrete spacing blocks mentioned above.

N Shaped Saddles.—Saddles made of No. 20 gage metal strips ¾ in. wide may be bent N shape and nailed to forms and then the slab rods laid on saddle and wired thereto.

Washers for Supporting Slab Bars.—Washers may be threaded over the system of bars lying next to the forms so as to hold them off the forms, giving a space for the fireproofing of bars.

Bending Beam Reinforcement.—In bending the girder and beam bars, care must be taken that the depth of the bent bars is not greater than given in the drawings, as otherwise the bars might project above the concrete floor.

Beam Stirrups.—Sufficient stirrups should be provided in beams and girders to take with the bent bars all the diagonal shearin strains. Stirrups should never be spaced fa ther apart than the effective depth (prefer bly three-fourths of the depth) of the stru tural member and must always pass und main tension bars. Care must be taken pro erly to space stirrups and to keep them place. The placing of loose stirrups will r quire very careful supervision on the pa of the inspector.

Fastening U-Bars or Stirrups.—U-ba should be accurately bent, with (say) 6-i wing resting on the form work. Under eac wing should be placed one ¼-in. or 3/16-i rod to which each U-bar should be wir and to assist in holding up bent-up floor ste and to which floor steel should be wir Where no floor slab occurs on one side two sides of a beam, bend wing of the U bars into the beam, fastened to side of bea with staples.

Tagging Beam and Girder Bars.—When th bars are cut and bent to proper shape, eac individual bar in every beam and gird should be tagged with a cloth tag, wired s curely to the bars and marked with the nun ber of beam and girder, and the tags shoul be left on until after the bars have been inspected in the forms and permission given remove them.

Marking Centering.—When the forms ar ready for the steel, the contractor should g over the floors with the blueprints and a piec of crayon or keel, and letter the beams an girders to correspond with the plans, in larg figures on the decking beside the beams an should specify the bars required, i. e.:

Beam B14.

Two—⅞-in. Rounds, Bent.
Two— 1-in. Rounds, Straight.

Placing Beam Reinforcement.—Especial car must be taken in placing steel in beams an girders so to distribute and arrange the bar that each individual part may be incorporate within an individual part of the concrete. Th stirrups should first be placed in all beam an girder forms as shown on drawings (and fas ened as described above), then the straigh bars, and afterwards the bent bars. The bar should be placed symmetrical with the axis o the beam, the bars should be held the require height above the bottom of the beam (ger erally 1½ ins.), and the proper space shoul be maintained between the reinforcement an the sides of the beam. Care must be take to see that beam and girder reinforcement i so placed that the bottom bars lie well abov the bottom board of the form. Concrete spacing blocks may be used to good advantage fo this purpose. Bars should overlap equally a both ends. The required connections shoul also be made at the ends of beam or girde with the column bars or the reinforcemen of abutting beams or walls. All planes an lines should be true and parts of the reinforcement tied with No. 14 wire or otherwis held firmly in position. It cannot be to strongly insisted that proper inspection b made to see that the end connections an bearings of beam and girder frames are connected up and have the bearings called fo by the plans.

Extra Beam or Girder Bars (Continuit Bars).—Perhaps the most important reinforcing detail in respect to proper placing is to reinforcement or continuity bars over girder columns and walls. The continuity bars ove the beams or girders may be placed immediately after the slab is concreted over th beams, and pressed into the concrete. It i absolutely essential that these top bars b placed accurately and not disturbed thereafter This is much easier said than done. These continuity bars may be very easily affecte by the future operations, especially where th free ends project in case of a break at th joints in the progress of the work. These free ends if jarred will many times break the bond of the half bar extending into th work. This precaution regarding the projection of loose continuity bars applies wit equal force to those formed by bending th reinforcement and carrying it into the [illegible]

[illegible] red in bundles and properly tagged; the [illegible] the ends after being placed in the forms then removed after the bars have been ected and permission given.

lacing Slab Reinforcement.—The slab bars uld be placed after the beam and girder and should be wired at two points to their place. Bars should be placed in exact position during the wiring, how- a variation of 1 in. may be permitted if ding concreting the bars are shifted. The tractor should supply his men with a suf- [illegible] ve the floor during concreting. The chief ion to manipulating slab bars by means ook as just stated is that there is no e to determine the final position of the forcement and if the concrete flows un- the reinforcement in too large a quan- it is almost impossible to replace the re- rcement without rebuilding the entire rk. Automatic spacers and devices for the urate placing of slab steel are readily ob- able and should be used in preference to method of raising bars by hooks and al- g the concrete to flow underneath. Con- attention should be given to the rein- cement to see that the slab bars are in ir proper location over the beams, and are fectly straight throughout their length. b steel should be securely wired together as to form a strong network. If the slab nforcement is secured in place by staples ven into the forms, the ends of the sta- s should be clipped off, after the forms removed. Make particularly certain that floor slab reinforcement of sheet metal, eared, punched or expanded in order to tribute the steel through the mass or cold ven wire similar to fencing materiai, lies rfectly smooth.

Placing Steel in Flat Slabs.—Special at- tion should be given to placing the bars belts in flat slab systems and fairly uni- rm spacing should govern, though this is less importance than keeping to the gen- al distribution throughout the full width the belts of reinforcement. In placing the or slab bars, those running from column column directly in one direction should eferably be placed, then those running at ght angles and following up latter with the agonal belts of bars.

Bars should be wired together to hold them position as shown on the plans. It is de- rable to use No. 18 soft annealed wire, king a piece (say) a yard long and fasten- g an intersection, then carry the wire diag- ally to the next intersection, taking a half tch and proceed until this piece is used up d making the end fast. Then start with a w piece and proceed as before. Two lines ties, crossing and normal to the intersect- g belts at the center will hold these bars in sition very nicely. A similar tie across the arallel belts and a suitable number of fast- nings around the head of the column are quired to hold the bars in position.

[illegible] Reinforcement [illegible] Layer of Con- rete.—The practice of first depositing (say) ins. of concrete in the bottom of beam rms and then placing the steel upon the ncrete should be avoided, owing to the lia- ility of the concrete in the bottom of the rms setting before a succeeding layer is dded. A comparatively dry concrete, also required, which is more expensive to lay nd does not give as good adhesion to the eel as a wet mixture.

Provision for Shafting Hangers.—Provi- ons for shafting hangers should be made be- re the concrete is poured. Hangers should xtend well above the lower reinforcement beams, girders and slabs.

[illegible] Reinforcement.—Should reinforc- g metal be exposed on the bottom of floor onstruction that section of the floor should removed and replaced as the plastering ver same with cement mortar should not permitted.

Assembling Column Bars.—All reinforcing bars for columns should be assembled together before being placed in the forms. Hooping should be securely tied to each of the upright bars. No free end of hoops should be bent out of line of the hoops, and the hoops should be tight and regularly spaced. All hoops should preferably have both ends turned and clinched around the vertical steel. Wire ties or hoops holding the vertical bars should be taut, and they should fit exactly. The vertical spacing of the hoops should be exact and according to the engineer's plans. Hoops and verticals must be fastened together as shown on drawings. Hoops for columns may be welded to develop the full strength of the section.

Fabricating Column Spirals.—Spiral reinforcement for columns should preferably be shop fabricated on machines designed especially for that purpose. In making spirals two processes are involved: First, bending the steel, which is usually in the form of wire, to the required diameter; second, spacing the coils to the required pitch, and fastening them so rigidly to small longitudinal bars that this pitch will not be disturbed in handling. The first process is accomplished more economically by machine, the second usually by hand. For fabricating spirals on the job, a simple wooden reel may be employed, the requisites of this reel being that it should be rigid, adjustable for different diameters, and collapsible to allow the finished spiral to be easily slipped off. Particular care should be taken in forming the spirals for columns and in properly fastening them to the longitudinal spacing bars so that the pitch of the spiral will be accurately maintained. Spirals should be bent to a true curve. No splices should be allowed in the spirals, except at floor levels.

Placing Spiral Reinforcement.—The spiral hooping should be wired to each vertical bar at frequent intervals so that the two sets of reinforcement form a strong network. In other words, the column bars should be rigidly wired to the coils, so that they retain their desired spacing in handling and concreting. After placing the column spirals and properly tying the longitudinal bars into their proper positions, no more reinforcement should be erected until the column forms have been filled with concrete.

Spacing Column Bars.—Templates should be used at bottom and top of column to insure accurate spacing of bars. This is necessary to insure that the bars of successive columns will fit when spliced. Where bars are bent at top to form connections with column above, another template should be used to be sure that the connections will fit.

Splicing Column Bars.—Splices are the critical parts of column reinforcement. Column bars may be spliced as follows:

(a) In a butt joint the ends should be square, the bearing uniform, and the joint held to line by sleeves or splice bars.

(b) If lap joints are allowed, the wire wrappings, cable splices, etc., should be made taut and secure.

Large bars should be properly butted and spliced. Small bars may be lap jointed.

Butt Joints for Column Bars.—Column bars should have full perfect bearing at each joint, and such joints should occur at floors or other points of lateral support and a tight fitting pipe sleeve or wired splice bars should be provided at all joints of column bars. Column bars which do not fall exactly under those of the story above should be heated and carefully bent before being hooped together, so as to be perfectly in line vertically.

Lap Joints for Column Bars.—Lower column bars should be carried into the upper column sufficiently to develop the full strength of the upper bars and should be wired to the latter with three No. 10 wire hoops having 1-in. pitch.

Structural Shapes.—Where structural shapes of more than 2-in. width are used, they should be wired (hooped) with No. 10 annealed wire, 2-in. pitch.

Bearing Plates.—At foundations, steel bearing plates should be provided for large bars or structural shapes. No reinforcement should be put into the column forms until the bearing plates at the bottom are properly grouted in place. These plates are generally placed about ¾ in. below the top of footings.

Placing Column Reinforcement.—The reinforcing frame for the column should be placed plumb, concentric with that of the column below and braced in two directions. No part of the steel should touch the walls of the form and the space between the steel and form should be uniform. Column bars should be held in a sufficiently rigid manner to maintain their accurate positions.

Bending Column Bars.—Before placing column reinforcement, the contractor should make sure that all bends required in same, at points where they extend into smaller columns on floors above, are made.

Column Footings.—In case of column footings, a 2-in., or sometimes 4-in., layer of concrete should be spread on the ground before the footing bars are placed. Each bar should be tied at two points by No. 16 wire. Dowels must not be overlooked.

Placing Wall Reinforcement.—The reinforcement should be placed the required distance from the faces of the wall and in exact planes laid down in the engineer's plans. The stipulated spacing of the bars must be accurately followed and the bars should be straight and true to line. Wall reinforcement may be attached to the outer forms, wherever possible, with galvanized staples if necessary. Horizontal wall bars should be wired to vertical bars at least every three feet, and proper provision must be made to keep them in the proper distance from the face of the wall. It is sometimes specified that bars shall be strongly wired at not less than one-half of the intersections. Wiring should be done before the forms are erected to the point that they will interfere by preventing full access to the bars. Wires used to tie reinforcement may serve the further purpose of holding the sides of the forms from spreading.

Removal of Fastenings.—Staples or wire ties used to hold the reinforcement in place and left embedded in the concrete should be cut off deep enough to keep rust spots from showing on the face of the wall.

Headers.—In all walls in which the work is laid up in sections the full height of the wall, finishing against headers to form tongued and grooved joints, the horizontal bars should be carried through the joint continuously without break, and no lap should be permitted at such places.

Wall Footings.—In case of wall footings, a 2-in., or sometimes 4-in., layer of concrete should be spread on the ground before the bars are placed. Bars in wall footings do not need to be wired.

Circular Tank Reinforcement.—Spacing of bars should be accurate and in exact accordance with the plans. The reinforcement should be concentric with the vertical axis and all splices should be made with particular care and as directed by the engineer.

Conduit Reinforcement.—Spacing of bars for conduit reinforcement should be in exact accordance with the plans. The planes of the circumferential bars should be perpendicular to the axis of the conduit and the alinement of the longitudinal bars should be parallel to the axis of the conduit. The reinforcement should be concentric with the axis of the conduit and conform exactly to the required circumferential curve.

The U. S. Civil Service Commission announces examinations in the prinicpal cities of the United States to be held March 20, 1912, for the position of mechanical and electrical engineers in the quartermaster's department at large, New London, Conn. The position pays from $1,800 to $2,000 annually. Examination will also be held for the position of laboratory assistant in physics in the Bureau of Standards, the position to pay $900 to $1,200 per annum.

EARTH AND ROCK SECTION

Some Unusual Construction Methods and Plants Employed on a Large Contract.

(Staff Article.)

The plant and methods described here were employed in the work of building a large additon to the power plant of the Indiana-Michigan Electric Co. of South Bend, Ind. Included in this work were the erection of twelve 400-h.p. Wickes' boilers; the construction of a 36-in. discharge and a 42-in. intake of concrete pipe, one above the other in one trench, and the construction of two reinforced concrete stacks. The three items of work named are the only ones considered here, the descriptions having been compiled from information furnished by Mr. M. F. Marshall, who had charge of the construction.

Stack Construction.—The excavation for each stack foundation was 36 ft. square and was carried down 30 ft. The pit was tight shuted with 2x12-in. plank, double lapped. The material encountered in the excavation consisted of sand and gravel to a depth of about 10 ft., and then of clay to 5 ft. in depth; from this point down there was blue clay, with occasional pockets of quicksand. The sheeting was driven by hand as the excavation progressed by two men who were employed at this work continuously.

The material was excavated by hand and shoveled into the body of a ¾-cu.-yd. car. This car body was V-shaped and was fitted with legs so that it would stand upright on the ground or could be used on the car. A three-way chain was made for the derrick and rings were placed on the car body to receive the hooks of the three-way chains. This arrangement may be seen by reference to Fig. 2, which shows also the method of dumping the material into wagons for hauling it away. In the pit there were employed from four to six men to each bucket, and each man averaged about 3 cu. yds. of material per day. There were four or five buckets used in each pit.

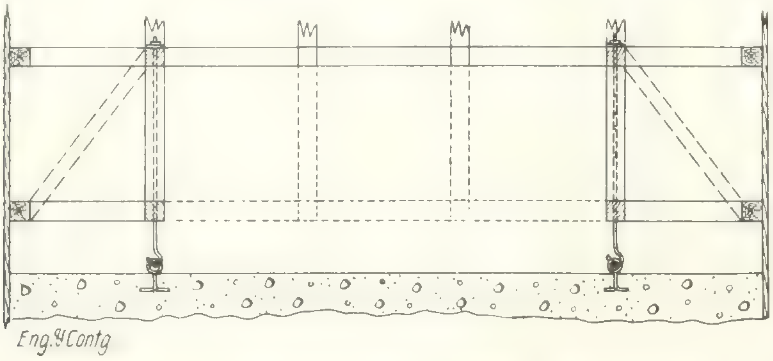


Fig. 1—Sketch Showing Method of Holding Sheeting With Part of the Cross Bracing Removed.

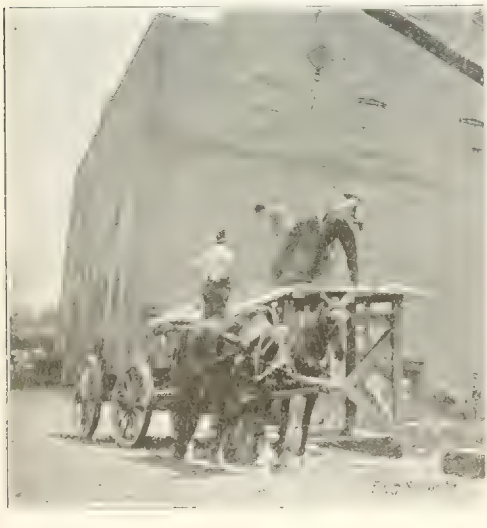


Fig. 2—Method of Loading Excavated Material Into Wagons.

After the excavation was completed the concrete base for the stack was laid. This was heavily reinforced and was laid over the entire area of the excavation for a depth of 6 ft. At this point the circular stack, 19 ft. in outside diameter, was started. In order to allow space for the stack to come up through the timber bracing some of the timber had to be taken out. This was accomplished as follows: The bracing was built in tiers 6 ft. apart vertically. The center portion of the bottom tier was taken out to allow the stack to be built up through it to the second tier of bracing. Diagonal timbers were then run from the bracing in the second tier to the walling timbers of the bottom tier and 16 heavy bolts (one for each diagonal brace) were placed vertically from the complete tier of bracing down to the concrete base, where an anchorage was secured. The procedure is illustrated by Fig. 1. When the stack was carried up 5 ft. another tier of bracing was removed and the method of holding the sheeting was repeated.

The two stacks were each 225 ft. high, and about 18 ft. in diameter at the base and 12 ft. in diameter at the top. They were designed and built by the General Concrete Construction Co., of Chicago. The shell at the top was 4 ins. thick and increased in thickness downward ¼ in. for each 5 ft. The concrete was mixed wet in the proportion of 1:2½:3 and was puddled to insure a dense concrete and a good bond with the reinforcement.

The forms used for the construction of the chimney were designed by Mr. Carl Staeler of the General Concrete Construction Co., and are patented. They consist of inside and outside steel plates 5 ft. high. As shown by Fig. 3, the plates are encircled at the upper and lower edges by steel rings made of angles or channels and having a diameter greater than that of the stack. Screw bolts are run through this steel circle and are screwed in or out to hold the steel plates to the desired diameter. The plates are made to lap to a certain extent and as the chimney proceeds upward the bolts are screwed in to reduce the sectional area of the concrete and also the diameter of the stack. The weight of the forms is carried on a scaffolding within the chimney, which is carried a few feet above the forms. The scaffolding supports radial beams cantilevered out over the circular wall, and blocks and tackle are suspended to the beams as a means of raising the forms. On the scaffolding there is also placed several light pieces of boards projecting out to the vertical reinforcing bars and holding these bars in place. In these stacks there were 108 vertical bars.

The concrete was mixed in a Chicago Improved Cube Mixer and was dumped directly into a chute which carried it into a bucket in the base of the stack. This bucket was raised by a steel cable passing up through the stack and down to a drum which is shown in Fig. 3. One section of stack 5 ft. high was built each working day.

Condenser Intake and Discharge.—The trench carrying the intake and discharge pipes was excavated 30 ft. deep and 8 ft. wide at the top, the materials encountered being the same as those in the foundation pits for the stacks. Sheeting plank 2 ins. thick and ft. long were used and were driven by hand with mauls. Three lengths of this plank were used. The earth and clay were excavated by hand and thrown into car bodies of ¾ cu. yds. capacity and of the same type as was described in connection with the excavation for the stack foundations. These car bodies were hoisted by a derrick and placed on the regular car trucks to which they belonged and run back for back-filling the trench.

The derrick is shown by Fig. 4. It was a stiff leg arrangement which was set on a frame straddling the trench and supported on track upon which it could be run back and forth over the work. The portable frame was built high enough to allow the ¾-yd cars to pass under it. The track for these small cars was laid on stringers supported by the trench bracing. Only one car truck was used, but three or four car bodies were kept in operation.

The 42-in. concrete pipe made by the Reinforced Concrete Pipe Co., of Jackson, Mich., was placed in the bottom of the trench and earth was tamped in around it nearly up to the center point in order to give it a firm and even bearing. This pipe was laid immediately following the excavation and the excavated material was deposited upon it to a depth of about 5 ft. The derrick lowered all the pipe into the trench and often lowered enough pipe during the first hour in the day to keep the pipe men busy for the day. The 36-in. pipe was laid 5 ft. above the 42-in. pipe and was backfilled in the same manner, the backfilling over both pipes being carried

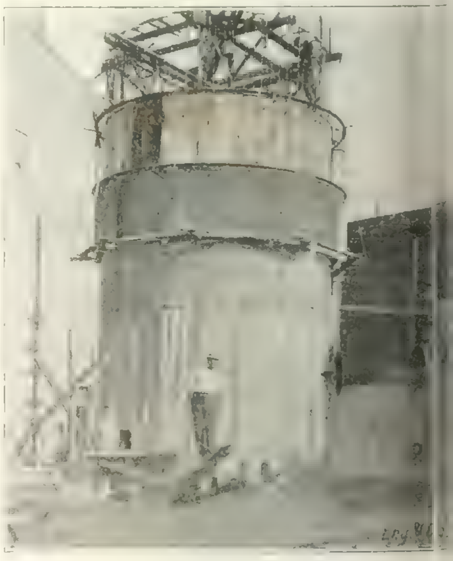


Fig. 3—View of Concrete Stack Under Construction Showing Forms.

ward at the same time with the 42-in. pipe t ahead of the other.

he trench carrying these pipe was 1,000 long and at one point where it branched m the street line to the power companies' perty there was an angle of about 30°. is made the operation of the derrick und the bend difficult so the track was tinued straight away on a tangent and boom was then able to reach a portion the trench and deposit the spoil on the ik. As this was the first point excavated material could not at once be backfilled. e backfilling at this point was done by ans of an ordinary drag scraper. The aper was filled by a line running from a gerhead on the drum of the derrick en- e to a deadman placed on the opposite side the trench from the pile to be backfilled. e line passed through a tackle block fast- d to the deadman and ran from there to bale of the scraper. Another line was ilarly operated in the opposite direction pulling the empty scraper back up to the of the pile. About 25 ft. of pipe trench s built in a 10-hour day with a gang of 30

recting Boilers.—The twelve Wickes 400- tubular boilers were erected by the gal- 's frame shown in Fig. 5. The legs were de of steel tubing and were capped by a vy I-beam. Double blocks were rigged to s beam and from them the line ran ough single blocks at the bases of the s of the frame and to the engine.

A permanent exposition of railway supplies recently been established in the Karpen ilding, 900 South Michigan Blvd., Chicago. is exposition, which covers the entire fourth or of the building, is intended to be a per- nent show place for machinery, equipment d supplies of every character used by the odern railway system. There are assembly d committee rooms in connection with the xposition. These have been placed at the sposal of the various railway organizations r meeting and convention purposes. The as- embly room is capable of seating 400 people. he exhibits are being installed at present and e exposition will be opened March 16.

g. 5—View Showing Steel Tube Gallows Frame for Erecting Boilers.

Unit Costs of Work in The Panama Canal for the Fourth Quarter of 1911.

The unit [illegible] Panama Canal for the three months ending Dec. 31, 1911, have just [illegible] public and are given herewith. Previous articles giving similar costs of canal work have appeared in the issues of Dec. 7, 14 and 21, 1910, and Feb. 22, March 1, May 24, and Sept. 13, 1911.

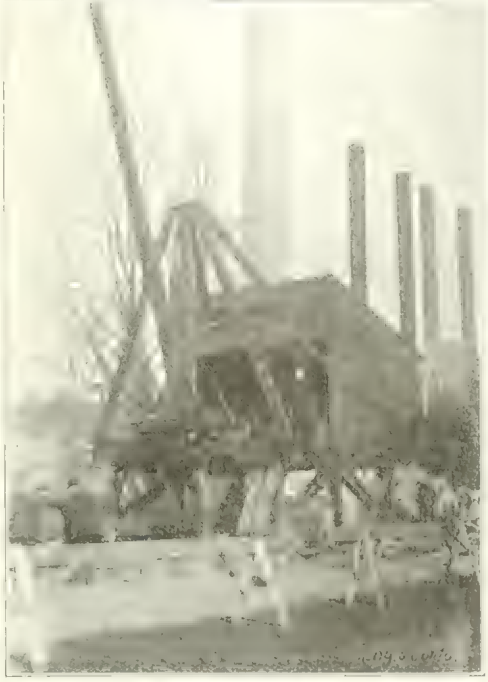


Fig. 4—View of Derrick Straddling Trench at Height Sufficient for Small Cars to 'Run Beneath.

Gatun Dam.—This building of the dam was started in August, 1907, with the placing of the material for the toes and the hydraulic fill was commenced Dec. 24, 1907. In the east wing 4,181,496 cu. yds. of wet material were placed and the dry fill for the south toe of this wing is completed to full height for a thousand feet from the spillway toward the locks. The top, which is at 104 ft. above sea level, will not be brought higher. The west half of the dam where hydraulic fill still continues is now about 20 ft. lower than the east half.

The dry fill is brought, for the most part, on trains from Culebra Cut, consisting of 35 cars of 10 yds. each, or 27 cars of 17 cu. yds. capacity. The material is also furnished from borrow pits in which, up to the present date, two shovels have been working. After Feb. 15, 1912, the trains from Culebra have been discontinued and the number of shovels in the borrow pits near the dam is increased from two to six, and will later be increased to eight. The track from Culebra is being removed to allow the water to fill the lake to the 50-ft. level. The borrow pits are entered at a rising grade from the dam so that as the dam rises the level of the borrow pits also rise, thus effecting a saving in time and expense over the former method, which should be noticed in the work for the first quarter of 1912. The cost of the work at Gatun Dam for the past quarter is as follows:

Dry fill, cu. yds.	[illegible]
Clearing site	[illegible]
Excavation	[illegible]
Tracks	[illegible]
Trestles	[illegible]
Transportation	[illegible]
Filling	[illegible]
Maintenance of equipment	[illegible]
Plant arbitrary	[illegible]
Division expense	[illegible]
Total division cost	[illegible]
Administration and general expense	[illegible]
Total cost	$0.5729

Hydraulic fill, cu. yd.	[illegible]
Clearing site	[illegible]
Clearing for dredge	[illegible]
Dredging	[illegible]
Relay pumps	[illegible]
Pipe lines	[illegible]
Wood flumes	[illegible]
Power	[illegible]
Small boat	[illegible]
Maintenance of equipment	[illegible]
Plant arbitrary	[illegible]
Division expense	[illegible]
Total division cost	$0.4735
Administration and general expense	[illegible]
Total cost	[illegible]

Lock Masonry.—Over 88 per cent of the concrete for the three twin locks at Gatun was in place Dec. 31, the amount being 1,765,483 cu. yds. out of a total of 2,000,000. The yardage per week is now running close to 8,000 yards.

The concrete work in the spillway of the Gatun Dam is about 74 per cent completed, 166,713 cu. yds. having been placed out of a total of 225,000 yds. Work progresses at present at about 800 cu. yds. per week.

At the Pedro Miguel Lock the concrete work is over 94 per cent completed, 790,537 cu. yds. having been placed out of a total of 837,400. The work here is progressing at about 3,000 cu. yds. a week.

At Miraflores where twin locks are being built about 44 per cent of the concrete is in place, the total amount placed being 594,116 cu. yds. out of 1,362,000 cu. yds. Work is very rapidly progressing here, more than 10,000 yds. having been placed each week since Jan. 1st, 1912.

The costs for the last quarter of 1911 follow

	Gatun Spillway	Gatun Locks	Pedro Miguel Lock.	Miraflores Locks.
Masonry—				
Concrete, cu. yds.	[illegible]	120,298	60,420	149,969
Cement	[illegible]	[illegible]	$1.7104	[illegible]
Stone	[illegible]	[illegible]	.7399	[illegible]
Sand	[illegible]	[illegible]	[illegible]	[illegible]
Mixing	.3846	.1727	.2168	.2566
Total cost	$4.6618	$4.8150	$3.0525	$3.2279

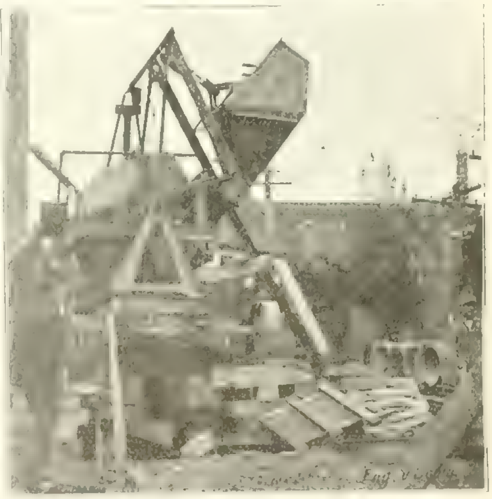


Fig. 6—View of Cube Mixer Set Up for Discharging Into Cars.

Large rock, cu. yds.		2,746		
Cost		[illegible]		
Masonry, cu. yds.	8,582	123,044	60,420	149,969
Concrete	[illegible]	$4.7076	$3.0525	$3.2279
Large rock		.0583		
Wood forms	1.2773	.4303	.4923	.4867
Steel forms		.1895	.0105	[illegible]
Placing	.7896	.1855	.1629	.2002
Reinforcements	[illegible]	.0172		
Pumps	[illegible]	[illegible]	[illegible]	.0231
Power		[illegible]	.0238	.0273
Cofferdam	.1216			

Maintenance of equipment	[illegible]	.2330	.1388	.1919
Plant arbitrary	[illegible]	[illegible]	.5300	.5300
Division expense	.1413	[illegible]	[illegible]	[illegible]
Total division cost	[illegible]	[illegible]	$4.5016	$4.7867
Admin. and general exp.	[illegible]	.2603	[illegible]	.2452
Total cost	$8.6027	$7.5633	$4.7085	$5.0310
Masonry, reinforced, cu. yds.	[illegible]	18,989	8,343	1,402
Cement	$1.7465	$2.2017	[illegible]	$2.7614
Stone	[illegible]	2.0619	.7226	[illegible]
Sand	[illegible]	1.1984	.3685	[illegible]
Mixing	[illegible]	.5526	.2609	1.9752
Wood forms	[illegible]	2.6130	1.4796	3.0641
Steel forms	......	.1672	......	3.3700
Power		.0185	.0260	[illegible]
Placing	[illegible]	.4963	[illegible]	1.7422
Reinforcements	2.1612	1.0328	1.7208	2.6793
Pumps			.0412	.2006
Maintenance of equipment	.4786	.1689	[illegible]	.2017
Plant arbitrary	.3960	[illegible]	1.0219	.5300
Division expense	.3438	.2208	[illegible]	.6835
Total division cost	$13.7365	$11.6121	$9.1439	$18.6743
Admin. and general exp.	[illegible]	.7219	[illegible]	[illegible]
Total cost	$14.9677	$12.3340	$9.7177	$20.2641
Total masonry, cu. yds.	9,118	[illegible]	[illegible]	[illegible]
Total cost	$8.9768	$8.1748	$6.4429	$5.1729

A comparison of the costs of the plain concrete work for the four quarters of 1911 is as follows:

	1st quarter.	2nd quarter.	3rd quarter.	4th quarter.
Gatun Spillway	$6.51	$6.78	$7.21	$8.60
Gatun Locks	6.59	6.63	6.93	7.56
Pedro MiguelLock	5.21	5.65	6.12	4.71
Miraflores Locks	4.89	4.76	4.76	5.03

Colon Breakwater.—The costs of work on the construction of the Colon breakwater from Toro Point, 2 miles into the sea, are as follows:

Toro Point Fill—	
Excavation, cu. yds.	85,655
Surveys	$0.0006
Clearing	....
Drilling	.0063
Blasting	.0273
Loading by power	.0875.
Tracks	[illegible]
Transportation	.0794
Maintenance of equipment	.0472
Total	$0.2842
Filling, cu. yds.	85,655
Trestles	$0.7371
Dumping	[illegible]
Maintenance of equipment	.0317
Total	$0.7839
Plant arbitrary	$0.3100
Division expense	.0302
Tug service	.1042
Total division cost	$1.5125
Administrative and general expense	.1551
Total cost filling	$1.6676

This cost is considerably less than for the previous quarter owing to the fact that the work is nearing completion.

Culebra Cut.—As the Culebra Cut work includes more than 90 per cent of the "dry excavation" on the canal we give only the costs for that work. Some 3,867,551 cu. yds. have been excavated during the past quarter as against 4,120,000 cu. yds. noted for the previous quarter. As the work is approaching completion and the work at the ends of the cut is cleaned up, less space is available for working steam shovels. It is probable therefore that the 16,596,891 cu. yds. which were excavated during the year 1911 will remain as the record annual yardage for the Culebra Division.

Dry excavation, cu. yds.	3,867,551
Clearing	$0.0001
Drilling	.0618
Blasting	.0654
Loading	.0487
Tracks	.1070
Transportation	.0818
Dumps	.0547
Pumps	.0041
Maintenance of equipment	[illegible]
Plant arbitrary	.0500
Division expense	.0136
Total division cost	$0.5818
Administrative and general expense	.0394
Total cost	$0.6212
Dry excavation—Prism, by contract—cu. yds.	[illegible]
Contract cost	$0.3045
Plant arbitrary	[illegible]
Total cost	[illegible]
Total dry excavation, cu. yds.	3,902,824
Unit cost	$0.6188

The yardage and costs for the four quarters of 1911 in the Culebra Cut excavation are as follows:

	Cu. yds.	Cents.
First quarter	5,216,978	57.62
Second quarter	4,278,626	62.94
Third quarter	4,185,856	58.39
Fourth quarter	3,867,551	61.88

Dredging.—The costs of dredging in the Atlantic and Pacific entrances to the canal is shown in the two column table below.

A comparison of the unit costs for the four quarters of 1911 is as follows:

	1st quarter.	2nd quarter.	3rd quarter.	4th quarter.
Atlantic Div.	$0.24	$0.24	$0.26	$0.20
Pacific Div.	[illegible]	0.18	0.17	[illegible]

Quarrying and Crushing.—The cost of quarrying and crushing and transporting rock to storage is given as follows:

	Porto Bello Quarry.	Ancon Quarry.
Quarrying, cu. yds.	129,078	190,977
Stripping	$0.0051	$0.0121
Drilling	.0486	.0543
Blasting	.1759	.0421
Loading	.0753	.0356
Transportation	.0696	.0470
Tracks	.0400	.0412
Power	[illegible]	
Maintenance of equipment	.0838	.0420
Plant arbitrary	.4170	.2400
Total	$0.9523	$0.5143
Crushing, cu. yds.	129,078	190,977
Operation, crushers	$0.0255	$0.0166
Stone bins and conveyors	.0136	.0038
Power	.0476	.0188
Maintenance of equipment	.0683	.0264
Plant arbitrary	.2150	.0749
Total	[illegible]	$0.1405
Total cost of production	$1.3223	[illegible]
Towing, cu. yds.	[illegible]	
Operation, tugs and barges	$0.1663	....
Maintenance of equipment	[illegible]	
Plant arbitrary	[illegible]	
Total	[illegible]	
Unloading, cu. yds.	129,078	....
Oper'n, cableways and cranes	[illegible]	
Power	.0196	
Maintenance of equipment	.0656	....
Plant arbitrary	[illegible]	...
Total	[illegible]	
Rail transportation to storage, cu. yds.	45,938	190,977
Operation of trains	$0.1462	$0.0364
Repairs to tracks	.0423	....
Dumping in storage	......	.0113
Maintenance of equipment	.1010	.0228
Plant arbitrary	......	.0700
Total	$0.2859	$0.1407
Division expense	$0.0249	$0.0152
Total cost in storage	$2.3981	$0.8105

Sand Production.—The cost of dredging and transportation of sand follows:

Items.	Nombre de Dios.	Ch
Dredging, cu. yds.	59,392	123,
Operation, dredges	$0.1609	[illegible]
Maintenance of equipment	.3064	[illegible]
Total	[illegible]	[illegible]
Plant arbitrary	$0.7890	[illegible]
Total cost of production	$1.2563	[illegible]
Towing, cu. yds.	[illegible]	[illegible]
Operation, tugs and barges	$0.2202	[illegible]
Maintenance of equipment	.6976	
Plant arbitrary	[illegible]	[illegible]
Total	[illegible]	[illegible]
Unloading, cu. yds.	59,392	[illegible]
Oper'n, cableways and cranes	$0.0949	[illegible]
Power	[illegible]	
Maintenance of equipment	*.0566	
Plant arbitrary	.2170	
Total	[illegible]	[illegible]
Rail transportation in storage, cu. yds.	23,766	123,
Operation of trains	$0.0954	$0.0
Repairs to tracks	.0151	.01
Dumping in storage	......	.0
Maintenance of equipment	.0632	.0
Plant arbitrary	......	.0
Total	$0.1737	$0
Division expense	$0.0083	$0.0
Total cost in storage	$2.5013	$0.8

*Indicates credit.

†There was a charge to Sand Production $15,623.55 in the month of December. As sand was produced that month the cost for quarter shows an increase.

Hydraulicking.—The excavation with hydraulic monitors in the Pacific Division is proceeding southward in the Pacific entrance channel. The costs follow:

Items.	
Cubic yards	164,
Clearing	$0
Drilling	
Blasting	[illegible]
Pumping station	.1
Pipe lines and monitors	.0
Dredging pumps	
Relay pumps	
Pipes	[illegible]
Maintenance of equipment	.1
Power	[illegible]
Plant arbitrary	.1
Division expense	
Total division cost	$0.6
Administrative and general expense	.0
Total cost	$0

*Indicates credit.

Concrete Piles.—Over 60,000 lin. ft. of concrete piles were manufactured on the Isthmus during the last quarter of the year at a cost of $1.19 per lin. ft. as itemized below. During the previous quarter 12,000 lin. ft. was manufactured at a cost of $1.35 per lin. ft.

Items	
Quantities, lin. ft.	[illegible]
Cement	$
Stone	.0
Sand	.0
Mixing	[illegible]
Placing	[illegible]
Reinforcements	.7

Items.	Atlantic Division — Cu. yds.	Unit cost.	— Pacific Division — Cu. yds.	Unit co
Clearing	1,746,051	$0.0006	....	
Operation, seagoing suction dredge	714,310	.0334	429,272	[illegible]
Repairs, seagoing suction dredge	714,310	.0310	429,272	[illegible]
Operation, ladder dredges	322,921	.0629	133,671	[illegible]
Repairs, ladder dredges	322,921	.0370	133,671	[illegible]
Operation, dipper dredges	191,300	.0980	92,716	.1
Repairs, dipper dredges	191,300	.1003	92,716	[illegible]
Operation, pipe line dredges	517,520	.0447	....	..
Repairs, pipe line dredges	517,520	.0349	....	..
Pipe lines	517,520	.0029	....	..
Poles	517,520	.0037	....	
Operation, tugs, clapets and scow	514,221	.0685	226,387	[illegible]
Repairs, tugs, clapets and scow	514,221	.0541	226,387	
Drilling	126,112	.0714	108,714	
Blasting	126,112	.1187	108,714	
Operation, drill barges	...	.	108,714	[illegible]
Operation, rock breakers			108,714	[illegible]
Small boats	1,746,051	.0018	655,659	[illegible]
Repairs, miscellaneous equipment	1,746,051	.0008	655,659	[illegible]
Plant arbitrary	1,746,051	.0450	655,659	..
Division expense	1,746,051	.0050	655,659	[illegible]
Total division cost	1,746,051	$10.1951.	655,659	$0
Administration and general expense	1,746,051	.0137	655,659	.0
Total cost	1,746,051	$0.2088	655,659	$0
Earth excavation—per cent.	1,619,939	92.78	546,945	[illegible]
Rock excavation—per cent.	126,112	7.22	108,714	[illegible]

*Denotes credit.

[illegible]

ndicates credit.

thod of Repairing a Break in a Cofferdam.

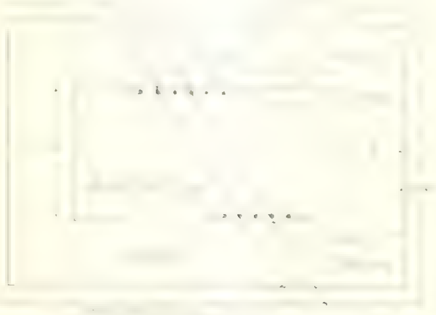
(STAFF ARTICLE.)

[illegible] for a 120-ft. bascule span on the Sea- rd Air Line Ry., at Savannah, Ga. At the [illegible] future dredging of the channel to accommo- [illegible] nd the pier 15 ft. deeper or 40 ft. below an tide level. At this level piles were to [illegible]

o construct the cofferdam a row of 3x12- by 40 ft. Wakefield sheeting was driven en- [illegible] accompanying sketch. Outside of the [illegible] ular space was filled with puddle. Inside fferdam there came two bents of a pile located approximately as shown by the ch. The bents each had six piles and the end piles of each bent were driven on a ter is indicated.

pon completion the cofferdam was pumped and excavation was begun at one end on rip 6 ft. wide across the dam. When this had been carried down about 6 ft. water ke through the Wakefield sheeting at one [illegible] sheeting during driving; the piece had tly begun to split as soon as it entered river bottom and the rift had increased driving progressed. When excavation re- ved the earth inside the broken sheet pile pile was forced in, making a large open- [illegible] s later begun by the contractor to secure mpensation for the extra work caused by break, it was claimed that the damage the sheeting was due to the presence of trestle piles. This fact was never de- mined, the suit being compromised.

Attempts were made to unwater the flood- cofferdam by pumping but after seven months' work these attempts and the work was abandoned by the sub-contractor. The general contractor then took over the work and called in an engineer to advise him in carrying it out. This engineer first located the leak carefully by observing the surface drift which collected at one spot adjacent to [illegible]



Sketch Showing Method of Repairing a Leak in a Cofferdam.

tered to the opposite side of the dam when the water rose in flood tide. The leak having been located the engineer advised that the Wakefield sheeting adjacent to the break should be pulled and replaced with new sheeting. He estimated that the work would cost some $500. The general contractor doubted the efficiency of this plan and decided to enclose the whole cofferdam with a row of steel sheet piling. A row of 40-ft. sheet piles was driven as indicated by the sketch. This sheeting leaked badly. The contractor then decided to puddle between the steel sheeting and the original cofferdam opposite the original break and some 250 car loads of clay were placed. The load distorted the steel sheeting, and after 12 hours the clay fill, which had stood above water, had gradually sunk below the surface. It was found that it had followed a sort of drift or tunnel which the water had opened through the original cofferdam as indicated in the sketch plan and had flowed into and filled the excavation made just before the original break. The next resort adopted was to build a wall of sheeting inside the dam long enough to "cover" the break, and to fill the space between this wall and the original Wakefield sheeting with sacks of earth. This closed the leak completely and the excavation, pile driving and masonry proceeded without further unusual trouble.

The concrete pier measured 13x32 ft. at the bottom and 9x24 ft. at the top and was 47 ft. high. The steel sheet piles were twisted so badly out of shape by the puddling that an enormous amount of work was required to pull them. Special equipment in the way of triple blocks and heavy hooks were required and these, when rigged to give 32 times the pull, exerted by a 30 h.p. engine, sometimes ripped the sheet piling from the hole up to the top.

In the suit for damages against the railway, it was found that the sub-contractor had spent some $15,000 in extra labor. Although he had sued for a larger amount a compromise was finally effected whereby the subcontractor was allowed $10,000 for the extra work done.

Wood Block Pavement With Clay Expansion Joint.—The city of Wellington, New Zealand, according to a recent consular report, constructs its wood block pavements in the following manner: The roadway is excavated to a depth of 11¾ ins. below the finished-surface level of pavement. Six inches of concrete (composed of six parts of ballast to one part of Portland cement) are laid over the whole width of the roadway and floated to a smooth surface. Jarrah blocks, 5 ins. deep, cut from planks measuring 6x3, 7x3, or 8x3 ins., are dipped in hot tar and then laid in courses 3 ins. wide across the street, the blocks in each course and the several courses being placed as close together as possible. Expansion joints 1 in. wide of well-worked clay are laid alongside each curb. The whole surface is coated with boiled tar, well brushed in, and then sprinkled with coarse sand. This tarring and sanding are repeated as found necessary. The sand used is taken from the sea beach, the particles being about the size of rice. The above report states that the city has four miles of wood block pavement constructed in the above way eight years ago which show no signs of wear, this being attributed largely to the coating of tar and sand which is spread over the surface every year or two. The wood block pavement in Wellington cost about $4.38 per sq. yd.

ROADS AND STREETS SECTION

ethod and Cost of Constructing a Concrete Street Pavement.

ntributed by Howard Egleston, C. E., M. Am. Soc. Eng. Contrs.

The following record of laying concrete vement in a street and constructing cement dewalks will give some interesting data with gard to the cost of work executed under tremely difficult conditions of weather and litical influences. Most contractors have doubtedly had similar experience in their es, and some allowance should be made in l estimates for such contingencies as arose in is case.

The work was estimated on in March, 1910, d it was fully expected that construction ould begin within 60 days from that time, t political combinations interfered with the propriation of money until in the fall, and e work was not authorized to begin until e latter part of September. Further delays account of failure of contractors to deliver anite curbing put off the beginning of the ork until late in October, which carried al- ost all of it into bad winter weather. As is was the first piece of concrete paving nstructed in the city, the specifications were ther indefinite as to the finish required, and fter some experimenting the finish put on e pavement was quite different from that in- icated by the first specifications. These facts will account in some measure for the high cost of the work as shown in the figures given hereafter.

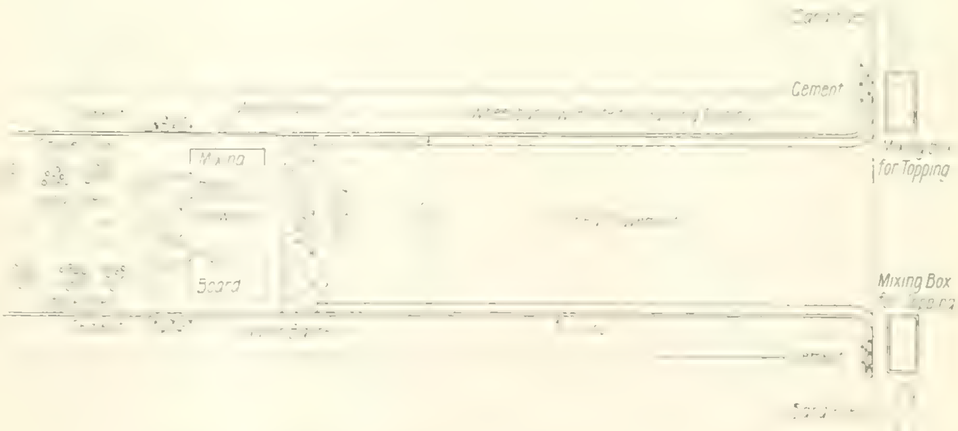


Fig. 1—Sketch Plan Showing Arrangement of Materials for Paving With Concrete

The plan for laying this pavement was substantially as follows: The sand and stone were placed in such manner as to bring two loads of stone opposite one load of sand down the street, the sand being in the middle and the stone on each side near the curb. Two concrete mixing boards were used, 12x8 ft., which were placed on each side of the street, about 2 ft. from the curb line. The barrels

TABLE I.—COST OF CONCRETE STREET PAVING ON WEST FIFTH STREET, CHATTANOOGA, TENN.

5 ins.; 1:3:6 Base with 2-in. 1:1½ Wearing Surface.

Date.	Temperature.			Hours worked on street pavement at—					Total	Sq. yds.	—Cost of labor, sq. yd.—			Cost of labor and material:
	Max.	Min.	Mean.	$[illegible]	$[illegible].50	$1.75	$1.50	$1.35	labor.	pavm't.	Base.	Top.	Total.	Sq. yd.
Bet. Broad and Chestnut:														
1911.														
January 17	[illegible]	[illegible]	44	20		.	32	168	$ [illegible]	210	$0.071	$0.088	$0.1593	$1.07
January 18	[illegible]	[illegible]	[illegible]	[illegible]			36	171	[illegible]	[illegible]	.068	.063	.131	1.04
January 31.......	60	36	48	10			47	64	18.70	[illegible]	.077	.12	.197	1.11
February 1.......	65	49	57	[illegible]			[illegible]½	180½	40.65	[illegible]	.0785	.097	.1755	1.09
February 2	74	[illegible]	[illegible]	[illegible]		3	10[illegible]½	69	28.10	[illegible]	.159	.2062	.3652	1.28
Totals and averages for block....									$155.40	[illegible]	$0.0907	$0.1149	$0.2056	$1.09
Chestnut and Pine:														
1910.														
December [illegible]	[illegible]	[illegible]	[illegible]	.			4[illegible]	60	$ 15.30	50	$[illegible]	$0.132	$0.306	$1.24
December [illegible]	[illegible]	[illegible]	[illegible]	20	10	10	30	153	35.40	200	.08	.0973	.1773	1.11
1911.														
January [illegible]	[illegible]	34	4[illegible]	20		.	40	217	41.30	233½	.08	.0969	.1769	1.11
January 10.......	52	29	40	20			[illegible]	[illegible]	42.30	[illegible]	.072	.09	.162	1.09
January 16.......	46	33	40	1[illegible]½			35	60	18.[illegible]	[illegible]	.06	.0759	.1359	1.07
Totals and averages for block....									$152.60	[illegible]	$0.09	$0.1016	$0.1916	$1.10
Pine and Poplar:														
January [illegible]	[illegible]	31	4[illegible]	20			4[illegible]	[illegible]	$ [illegible]	288¾	$0.071	$0.0874	$0.1584	$0.99
January [illegible]	[illegible]	34	42	21			40	244	45.25	268¼	.0783	.09	.1683	1.00
January 27.......	62	52	57	9		.	38	139	27.15	198½	.063	.0738	.1368	.97
January 28	6[illegible]	[illegible]	[illegible]	[illegible]		.	11	76	14.00	62	.10	.1259	.2259	1.05
Totals and averages for block....									$132.15	817½	$0.08	$0.0924	$0.1724	$0.99
Market and Broad:														
1910.														
December 10.....	50	30	40	13	10	.	40	80	$ [illegible]	100¼	$0.10	$0.1313	$0.2313	$1.17
December 12.....	43	25	34	16	10	10	70	153	[illegible]	299½	.0743	.06	.1343	1.07
December 14.....	49	21	35	[illegible]	5	5	15	91	18.[illegible]	[illegible]	.123	.15	.273	1.21
December 15.....	54	32	43	12	10	10	40	200	[illegible]	261¼	.07[illegible]	.0773	.1563	1.10
Totals and averages for block....									$122.45	727½	$0.09	$0.1087	$0.1987	$1.12
Intersection at Pine St.:														
1911.														
February 4	[illegible]	41	53	12		11	105	84½	$ 32.65	90	$0.10	$0.1169	$0.2169	$1.08
Average cost for whole contract..											$0.0965	$0.11	$0.2065	$1.08

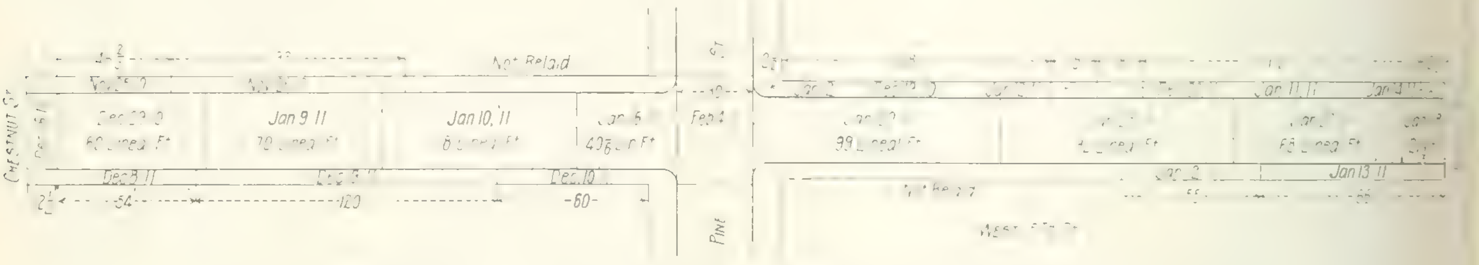


Fig. 2—Progress Sheets for Concrete Paving on West Fifth St., from Chestnut to Poplar.

for water were placed on the sidewalk near the curb. The concrete gang was divided as follows: Four men to turn concrete, three of whom were paid $1.50 a day, and one, called the captain, rated at $1.75; three men with wheelbarrows measuring sand and stone and placing it on the boards, were paid $1.35 a day; two men to shovel off the concrete when mixed and clean the board; one man to attend to the water and cement and two men to level the concrete and tamp it when placed by the "shovel off" men. This gang of twelve men handled the 5-in. concrete base. For the top or wearing surface, 2 ins. thick, there was a gang of three men mixing at the box and five wheelbarrow men whose duties were not only to carry the cement and stone screenings to the mixing box, but also to carry the finish coat to the street, where it was deposited for the finishers. We also had two men for striking off the finishing coat, and two finishers. There was very little opportunity for continuous work, which would have made possible a good showing for economical handling of the work, but on two or three days when the weather permitted a full day's work, and with fairly organized gangs, good figures were made. For instance, at one time 263½ sq. yds. of pavement was laid at a total cost of $34.50, or 13 cts. per square yard. On some other days when the city engineer required that work be stopped early in the afternoon on account of cold weather, and from frequent change of men, which was brought about by the lack of steady work, the cost of this work went up to about 36½ cts. per square yard. The total average cost of the entire street work was 20 4-5 cts. per square yard for the labor of mixing and placing concrete base and concrete top. The grading for this pavement was very costly, averaging as much as 19 cts. per square yard, though some portion of it was done for 9 cts., 11 cts. and 13½ cts. Very heavy rains which necessitated the regrading of certain blocks, increased the cost so materially as to bring the cost of these blocks up to the amount named above.

The experience of the best day's work demonstrated quite clearly that on moderate sized pieces of work, mixing by hand was very nearly as economical as by machine. When thoroughly organized, the handling of a 5-in. base of concrete was done for 13 cts. a square yard. The division of labor in having four men do all the turning for two boards and nothing else, forced the entire gang to work hard to keep up, and made the output very satisfactory. All the men were forced to work hard to clear off the board in time for the mixing gang to start work when they finished their last batch on the other board. Five turns were given to every batch, and the wheelbarrow men and "shovelers off" were kept very busy in keeping out of the way of the mixers. It was the rule to place the sand on the board over night so that the first thing to be done when work began was to place the cement on the sand and turn it over until the mixture was of an even color. While this was being done, wheelbarrows were filled with stone, and at a signal three men brought each a wheelbarrow of stone to the board, the first going back after a fourth wheelbarrow. While water was being placed on this and the mixing was completed, the wheelbarrow men were filling two wheelbarrows of sand and the "shovel off" men were busy clearing the board on which the last mixture had been made and on which the two wheelbarrows of sand was to be placed by the wheelbarrow men immediately. This process was followed on the two boards throughout the day, and on ten hours' work the output was from 30 to 40 batches a day. Had we continued the mixing of concrete for a full ten hours, the average day's work would have been 40 half yard batches, but on account of the low temperature, we were unable to mix more than 30 to 36 batches a day, usually stopping the mixing at 3 p. m. in order that the work might be finished by daylight.

Owing to the low temperature that prevail during a greater part of the time, we we much delayed by the very slow setting of t concrete, which for hours remained almo exactly in the same condition as when first d posited. Often we found in the morning th concrete finished the night before was ve slightly more solid than when we left it. Th slow setting kept the finishers back so th they were frequently obliged to work late the evening, whereas in warmer weather th could easily have finished within an hour the time when the last batch of a finish co was placed.

When freezing weather was indicated t concrete was covered with tar paper, and some exceptionally severe cases about 6 i of mill shavings were spread over the tar p per. With this protection we had no troub from frozen concrete, though the temperatu went down in one case as low as 21° and in number of instances was below freezing.

The relation of temperature to cost of wo is shown in Table I, though there were s many other causes that influenced cost th the influence of low temperature is not clear as I could wish. The higher unit cost finishing up a small portion of the street shown in work done on Jan. 28, where the was only 62 sq. yds. of pavement to lay a the labor cost per square yard was 50 per ce higher than for the balance of the block, a again on Feb. 2, when 77 sq. yds. cost twice much per yard as the balance of the bloc Considering the weather conditions, whic frequently caused a stoppage of the work f one to three or four days at a time, and days when work was attempted, often caus a delay in beginning work, and made nece sary stopping at 3 o'clock in the afternoon, consider the cost of the work not unsatisfa tory. In warm and settled weather we shou have done the work for 20 to 25 per cent les

In Table No. II will be found the record

I.—COST OF CONCRETE SIDEWALK WORK ON WEST [illegible] CHATTANOOGA, TENNN.

Made up of 1-in. cinder, 4-in. 1:3:6 base, 1½ [illegible]

	Temperature Max.	Min	Mean.	Hours worked on sidewalk at— $3.00	$1.50	$1.35	Total labor cost.	Sq. ft. of sidewalk laid.	Cost of labor per sq. ft.	Cost of labor and material per sq. ft.
Market and Broad:										
	49	34	42	5½	11	18	$ 5.70	*	*	*
	48	32	40	10	20	52	13.05	*	*	*
	52	35	44	11	[illegible]	51	13.20	*	*	*
	53	40	46	10	[illegible]	[illegible]	12.45	*	*	*
	61	33	47	11	63½	3½	13.35	[illegible]	$0.0264	$0.0860
	66	36	51	11	60	..	12.30	592	.0208	.0800
	66	40	53	11	34	..	8.40	358	.0234	.0830
	65	51	58	2	5	..	1.35	[illegible]	.028	.0880
and avgs. for block..				...	.	....	$79.80	3,205	[illegible]	$0.08507
Broad and Chestnut:										
	49	21	[illegible]	4	16	..	$ 3.60	[illegible]	$[illegible]	$0.0926
	[illegible]4	32	43	9	[illegible]	.	10.95	[illegible]	.02	.0876
	45	30	38	12	60	.	12.60	540	.0233	.0909
	45	24	34	14	[illegible]	20	11.25	[illegible]	.0625	.1301
and avgs. for block...							$38.40	1,1[illegible]4	$[illegible]	$0.0949
Chestnut and Pine:										
	64	44	54	11	37	..	$ 8.85	280	$0.0491	$0.1121
	58	37	48	11	66	..	13.20	558	.0236	.0866
	48	24	36	12	28		7.80	324	.0247	.0877
	52	30	41	15	[illegible]½	35	13.50	720	.019	.0770
	50	30	40	7	36		7.50	360	.02	.0830
and avgs. for block...							$50.85	2,242	$0.0227	$0.0857
Pine and Poplar:										
	47	36	42	10	40	30	$13.05	648	$0.02	$0.0759
	44	24	34	5	8	..	2.70	108	.025	.0809
	63	46	54	20	40	90	24.15	[illegible]	.0355	.0914
	64	59	62	20	36	90	23.55	821	.0286	.0845
	70	59	64	11	39	[illegible]	12.15	406	.0299	[illegible]
	66	54	60	13	21	10	8.40	129	.065	.1225
and avgs. for block..							$84.00	2,793	$[illegible]	$0.0859
cost of whole job....									$0.02616	$[illegible]

t recorded.

s laid on the same street and under e weather conditions. When freezing threatened, the finished work was with tar paper laid flat on the cement nd though the temperature on one day wn to 21° we had no damaged work in one case where the engineer di- ne inspector to test several blocks with et, and, as the cement had not set, he up the surface so badly that we had it up and relay it. I preserved some f the concrete we took up and it has nto as fine a sample of concrete as I er seen.

his sidewalk work we tried a steel ut it did not seem at all superior to -in. forms I have been using. I have a le in the top of these scantlings with a ery 4 ft., my steel division plates are thick by 4 ins. wide, and in each end plates I have a notch cut so that the ill fit over and into the wood scant- inging the top of the wood and steel In this way my wood forms are held the right distance apart, the steels can ly lifted out of the sawed groove, and ntling picked up and carried forward. that iron pins made from ⅜ in. round

III.—COST DATA ON WEST FIFTH STREET PAVING CONTRACT.

Street Construction, Per Sq. Yd.

ion.	Labor mixing and placing concrete.	Grading and removing dirt, etc.
arket to Broad..	$0.1987	$0.135
road to Chestnut	.2056	.1116
hestnut to Pine..	.1916	.0945
ine to Poplar....	.1724	.3168
tion at Pine.....	.2169	.2925
rage cost........	$0.2065	$0.1901

IV COST OF SIDEWALK CONSTRUCTION PER SQUARE YARD.

ion.	Labor mixing and placing concrete.	Grading and removing dirt, etc.
arket to Broad..	$0.2241	......
road to Chestnut	.2457	$0.2475
hestnut to Pine..	.2133	.1638
ine to Poplar....	.27	.2151
rage cost	$0.2383	$0.2088

V.—COST OF MATERIALS ON JOB, NE SQUARE YARD OF CONCRETE WALK, BETWEEN MARKET AND AD STREETS.

	$0.036
	.135
	.1172
	.2646
of materials	$0.5528
concreting	.2383
grading, etc. (approximate)	.2088
al cost of sidewalk, sq. yd	$0.9999

iron, sharpened at one end, are much handier than wooden stakes, and last longer.

The condensed Table III shows a fairly even labor cost. The lost cost in block between Pine and Poplar is due to a week of warm weather, while the higher cost of the intersection at Pine St. is due to the extra work of laying the pavement to meet the crowning of the two streets. The grading is very irregular; the blocks between Broad and Chestnut and Chestnut and Pine were in fairly good shape, requiring the handling of not over 6 ins. of material on the average. That between Market and Broad had a street railroad track in the center and required the removal of 8 to 10 ins. of material. The block between Pine and Poplar is very steep and not only required the removal of more material than any other, but all the teaming had to be worked down hill, and owing to heavy storms, the grading had to be gone over three times, many loads of material, after being washed down the hill, having to be hauled up again and distributed.

From an examination of Table IV, I think we may see the folly of expecting a contractor to do grading and furnish material of best quality and in specified quantities for standard sidewalk construction for 90 cts. a yard, and yet contracts are let every day that involve quite as much grading and removal of material as here shown, for 10 cts. per square foot and even less. On large contracts with very careful management a contractor can make a fair profit at 10 cts. a square foot, if paid extra for grading, but a living profit cannot be made when work is taken for less than this sum if materials are honestly measured and work honestly done, and I doubt very much if an engineer is justified in letting a contract for this class of work for less than this figure. He will probably serve his clients best by selecting the contractor who bids 12 or 12½ cts. per square foot.

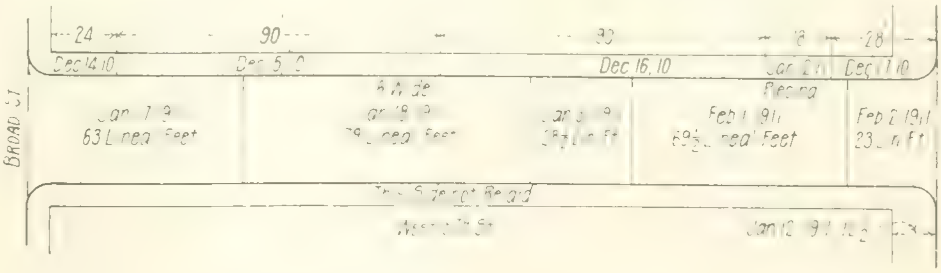


Fig. 3—Progress Sheet for Concrete Pav ing on W. 5th St. from Broad to Chestnut

Tar-Surfaced Concrete Pavement at Portland, Me.

During the season of 1911 a considerable amount of tarred concrete pavement was constructed at Portland, Me. Two sections, totaling 3,635 sq. yds., were built out of the city appropriation, and an additional amount of 11,238 sq. yds. was built on the 4th section of the state highway in Portland. This state highway work was located on Cumberland Ave. and extended from Elm St. to Washington Ave., a distance of 2,460 ft. The construction of this last section was under the supervision of Edwin L. Lynch, Assistant Engineer, Department of Public Works of Portland. We give the following description of the work as taken from a paper by Mr. Lynch, presented at the recent meeting of Maine Society of Civil Engineers:

The street was excavated to a depth of 6 ins. below grade and thoroughly rolled with a 10-ton tandem roller. The bed was found to be of a good quality of gravel. On the foundation, thus obtained, was laid 6 ins. of concrete in the proportions, 1 part Portland cement, 2½ parts clean sharp sand, and 5 parts local crushed stone. The cement used was Vulvanite and Dragon.

This concrete was mixed in an Austin traction cube concrete mixer. This mixer was fitted with a swinging crane with a ½-yd. bucket attached, which placed the concrete where needed and it was then spread out into shape. Any dry spots in the concrete as it was spread out were wet with grout and the concrete was then rolled with a 500-lb. hand roller until the grout flushed to the surface. The surface was then broomed as smooth as possible with Hvass push brooms and left to dry and set. About ten days were necessary for this.

An expansion joint of 1 in. in width and 6 ins. in depth was left next each curb and was filled with No. 1 pitch.

When thoroughly dry, the concrete was carefully swept and refined local coal tar was squeegeed onto the surface; about one-half gallon of tar per sq. yd. being used. The temperature of the tar on application averaged 210° F.

Hot sand was then spread onto the surface and immediately rolled with a 10-ton tandem roller. During this rolling more sand was added as needed. After being thoroughly rolled, the road was opened to travel and occasionally more sand was added as bleeding spots showed up.

The final surface averaged ⅜ in. thick; in no case being over ½ in.

Owing to the fact that the cross-section of the road was constantly changing, the concrete was shaped by means of center and quarter-grade stakes and the curb facing. Whenever the cross-section is constant, it is much better to use a templet which is dragged over the surface, giving a more uniform surface.

The work was done by the Shawmut Contracting Co. of Boston, whose bid for grading was 67 cts. per lin. ft. and for concrete surfaced with bitumen was $1.14 per sq. yd. This figures $1.29 per sq. yd. for the finished pavement.

It is Mr. Lynch's opinion that these figures can be materially reduced as the demand for this type of road increases and the contractor becomes more familiar with his work. Also a pavement 6 ins. thick is not necessary in all cases and 5 ins. is ample, generally speaking. This reduction in depth will, of course, reduce the cost.

Street Asphalt Paving Mixtures.

During the last few years chemists and engineers throughout the country have made a great deal of progress in the chemistry and testing of bituminous materials used for paving purposes, but the same progress has not been made by contractors in their methods of handling materials at the asphalt plants and on the streets, and this is most essential for producing a good mixture. It is probably true that there are a great many more failures of asphalt streets due to poor handling of materials at the plant and on the street than can be laid to the raw materials themselves. Some excellent suggestions for contractors in the proper handling of asphalt mixtures were given by Mr. H. B. Pullar, Chief Chemist, American Asphaltum & Rubber Co., Chicago, Ill., in a paper presented before Section D, of the American Association for the Advancement of Science, and from this paper we have taken the matter in this article.

One of the most important features at the paving plant are the temperatures. These vary according to the asphaltic cement used, and the climatic conditions. There are a number of asphaltic cements on the market which are very easily injured by overheating and require different handling at the plant, and it would be well for the contractor and engineers, before starting work, to make a thorough investigation as to the method of handling the bituminous material which they propose to use, and especially in regard to the temperatures which it will stand without injury.

In sheet asphalt, sand is the principal ingredient and naturally should be most seriously considered. It should be clean and moderately sharp, the grains varying in size from ⅛ in. in diameter to those passing a 200-mesh screen. While it is advisable to follow some definite grading which has given successful results, it is not impossible to make a good pavement out of a poorly graded sand. However, in using a poorly graded sand, care must be taken to experiment with it in order to determine the proper amount of asphaltic cement and dust which must be added to give a satisfactory mixture. The engineer should be careful in preparing specification for sheet asphalt pavement to specify a grading of sand which is procurable in the city in which the pavement is to be laid. After a suitable sand has been obtained, it is necessary to test the grading two or three times each day to see that it is running uniform, and should there be any noticeable difference, the per cent of asphaltic cement should be increased or decreased to meet change in grading.

Besides the sand and asphaltic cement, dust, Portland cement or other fine inorganic material is the other ingredient used in sheet asphalt pavement mixtures. It is necessary before determining upon a mixture that a study be made of the traffic conditions of the street. The dust is used to stiffen up the mixture and the per cent used depends upon the above conditions and the sand grading. For instance, for a heavy traffic street, it is advisable to use from 10 to 15 per cent of Portland cement or dust, while on light traffic streets this may be reduced to 6 or 8 per cent with very satisfactory results.

Providing the necessary raw materials are satisfactory, the next important requirement is that they are properly mixed. The sand should be uniformly heated to a temperature of approximately 350° F., at which temperature it should be combined with the proper amount of cold dust and the two mixed for a period of about 15 seconds. The asphaltic cement should be heated to a temperature of from 250° F. to 350° F., depending upon the kind used, and then added in the proper proportions and the mixing continued at least 45 seconds longer. As this mixing is probably the most important feature, it is necessary to have a first-class mixing man in charge, and it is owing to a lack of capable men in this capacity which has been the principal cause for a large number of failures in sheet asphalt pavements. It is very easy for a mixing man, if he is at all careless, to put in a few pounds too much or too little of asphaltic cement or to dump a box before it is properly mixed, which when it gets to the street mixed with other boxes, is unnoticeable, but which in time will cause serious trouble.

Provided that materials have been satisfactorily and properly handled at the plant, there is still a chance for improper handling on the street, and there have been a number of failures due to this cause. It is both economical and good judgment for the contractor to employ only first-class street foremen, rakers and rollermen, for the employment of these men insures him of first-class street work, which is most essential, and which to the average person is the only important part of the pavement. The mixture should be protected while in transit from the plant to the street and dumped some distance from the spot on which it is to be spread. All of the materials should be turned over before raking and any lumps should be broken up. The raking should be so thorough and so true to grade that it would be unnecessary after rolling to go back and retouch the low and high places. As soon as the material has cooled sufficiently to allow the surfacing roller, it should be used, and especially in cold weather should this roller be employed as soon as possible. This gives the initial compression and, if properly done, is of great assistance for the final rolling. The final rolling should be continued until the surface is thoroughly compacted, smooth and showing no signs of roller marks. It is too often the case that a fair amount of rolling is considered sufficient, and engineers, inspectors and officials should insist upon the proper amount of rolling.

An Experiment with Road Construction by Convict Labor in Onondaga County, New York.

During the season of 1911 the Committee on Prison Employment of the Board of Supervisors of Onondaga County, New York, in co-operation with Mr. Frank E. Bogardus, County Superintendent of Highways, and Mr. John S. Markell, superintendent of the penitentiary, undertook the construction with convict labor of a portion of the road leading from Amboy to Warners, N. Y. The object of this work was to determine whether road construction by prison labor could be made profitable to the county and towns and at the same time could show earnings for the penitentiary. Work on the road was started on Aug. 24, 1911, and continued until Nov. 24, 1911. In this period there was a total of 73 working days, and during this time practically a mile of road was constructed.

The road selected for improvement was chosen with the idea that the construction would show to the Board of Supervisors the maximum cost of construction by prison labor and with stone shipped from the penitentiary. The reasons which it was thought would give a maximum cost were:

(1). All stone used was shipped from the penitentiary and practically the highest freight rate in the county of Onondaga prevails between Janesville and Amboy, it being over both the D. L. & W. and West Shore railroads, at a commodity charge of 55 cents a ton.

(2). There were no supplies or materials on the ground to assist in the construction of the road, not even sand, which had to be purchased and drawn a distance of over two miles, nor was there gravel to use in the concrete work.

(3). It was an expensive place to get supplies of all kinds, because they had to be carted or shipped there, and such bills were heavy.

(4). The road itself was one of the very worst in the county to construct, requiring much grading in the first mile; in ma places there being quicksand and other staple foundations which required a sub-b or foundation first to be built before the r could be laid.

Because of it being so far from penitentiary it required that the prisoners kept in the locality and all goods and suppl shipped there to them.

In its report to the Board of Supervisc from which these notes are taken, the co mittee states that it would be almost imp sible for all of the above conditions to found in any other part of the country.

On Aug. 23 thirty prisoners were mov from the penitentiary at Jamestown to site of the work. The prisoners were hou in an old farm building, arrangements be made whereby the county was to pay rental for the house other than to put it repair. Work was started the next day a continued until Nov. 24. At the beginn of the work there were no tools whate for use except those borrowed from town of Camillus and others; and owing the fact that the keepers and prisoners w totally unaccustomed to the work and manner of doing it, and owing to the furt fact that the facilities were very inadequ very little effective progress was made dur the first two weeks. Weather conditions a were bad during the latter part of the wo In October alone there were 11 rainy da During the last month of the work, owing the lateness of the season and the inclemency the weather, little progress was made, a this at a much greater than normal exper

The net cost of the construction of the m of road, as given in the report, was s follow:

[illegible]	[illegible]
Freight on stone at [illegible] cts per ton and [illegible]	14
Water used by prisoners and for puddling on road	[illegible]
Rent of roller at $10 per day	[illegible]
Blacksmithing and repairs	9
Tools, net cost	[illegible]
Rental of prisoners' house, etc.	[illegible]
Transporting prisoners	[illegible]
Net cost of supplies for prisoners not including food and clothing, etc.	[illegible]
Net cost of supplies on road	[illegible]
Cost of stock used on road, including cement, sand, metal and lumber for sluices, etc.	25
Salaries of extra keepers employed by penitentiary on account of extra work caused by road	1
Board of all keepers used on road	63
Total	[illegible]

In the five contracts heretofore let by county the average cost per mile w $6,122.87. In only one of these contracts w it contemplated to ship in the stone. In t one contract the cost is $6,833.55, but stone would require only one freight, about one-half the rate paid for the st shipped in for the convict labor road. There fore in order to make a fair compari between the contract cost of roads and convict labor roads the committee points that the freight paid in this instance sho be deducted; and if only one-half of freight charge, or $732.71, is deducted, net cost would be $5,168.56.

While not much showing was made in way of saving to the county on this pie of road, the committee believes that the c of this piece of road, being the maxim cost, shows that road work can be done this manner after the forces are fully org ized, equipped and experienced, cheaper, at least as cheaply as by contract work, at the same time credit to the Penitentiar fair amount for the labor of the prisoners.

It should be borne in mind that the org ization expense is as great for one mile road as for three miles; therefore, the c at the end of the first mile is always m in proportion than at the end of any ad tional mile.

Another condition which has increased cost of this work has been due to the f that the law regarding the number of ho prisoners may be employed is uncertain, therefore the Superintendent of the Penit tiary thought best not to work them o eight hours a day, whereas under the contr system the men are employed ten hours [illegible] increased the number of days required complete the road 20 per cent, and, conse- ntly, added just that 20 per cent to the ount of the cost of the keepers' salaries their board, beside also increasing the t of teams five cents per hour, for teams be hired for ten hours each day at $4.50, in order to get teams for only eight rs each day, it was necessary to pay $4 day, or 50 cents an hour. It also natu- y increased the maintenance of the pris- rs that amount and also increased the er hire expense, for it was necessary to the same rate per day for eight hours it would have been for ten hours.

he work took 73 days of eight hours each, had it been possible to have worked the n ten hours each day with the same ount of efficiency, the same work could e been accomplished in 59 days, or at a ing of two weeks, with the consequent ing of two weeks' board of the prisoners keepers, cost of teams and salaries of pers and expense of roller and engineer. saving in the keepers' salaries would e amounted to about $200, the board of keepers about $100, and a result in the ing of team hire of about $175, making otal saving from these items, by lessening work of two weeks, of about $475, with saving on the roller not figured.

t was originally intended to build three es of road so if the house be used for all of work, then only one-third should be rged to the contract mile and there ld be a credit of $63.15 from this rce. The Penitentiary would have to rd the regular keepers at the Peni- tiary if they were not on this con- ct: therefore, if only the board of the ra keepers hired on account of this work s charged, there would be a saving in this nner of $130.25, making a total saving m these items of $193.40.

f these deductions were made from the cost of $5,168.56, the committee states, then s road would be on a fair basis of compari- with these other contracts, and it would ve the actual cost to the county $4,975.16.

If to this sum should be added 50 cents a y for each day of labor performed on the d by the prisoners, viz.: 73 days, with an erage of 34.67 men per day, or a total of 31½ days of ten hours each, at 50 cents day, would equal $1,012.60. If the stone s also charged up at 25 cents a ton, viz.: 01 tons at 25 cents a ton, would equal 25.25, making a total of $1,637.85 credited the Penitentiary by reason of stone and or of the prisoners. The gross cost of mile of road under conditions equaling se prevailing in the other contracts would en amount to $6,613.01.

If the law could be amended, allowing the isoners to work ten hours daily, from this uld be deducted the further saving which uld be made by working the prisoners ten urs a day, the sum of $475 . This would ke the road cost the county, under all or- nary and equal conditions with the other [illegible] freight was necessary, as [illegible] the lowest of the [illegible] could be deducted and the cost then would be $5,405.70, as compared with the contract cost of $5,365.17.

It can be seen by the above figures, states the report, that putting this present operation upon the same footing with other county contracts, that some saving can be made to the county of Onondaga in the cost of the road and at the same time crediting to the Penitentiary the sum of $1,637.85, as earnings [illegible]

As is shown by the above, that if 34.67 men per day for three months' time, or 73 actual working days, earned for the county $1,637.85, [illegible] 400 men at the Penitentiary could be employed at as profitable work for six months of the year, the Penitentiary would receive a credit from such source of $28,000.

The committee is of the opinion, and recommends that only such expenditures as it authorized should be a charge upon road building, and if this was done in this instance and the Penitentiary furnished the labor on the same basis as if it was furnishing it to a contractor for so much per day per man, and the Penitentiary carry their own maintenance, the result would then show the following: Total expenditures by committee, including $1,470.53 for freight and tools purchased by Mr. Markell, $3,928.49. If the committee should pay each prisoner $1 per day for each day for ten hours employed, or $2,025.20, and pay for stone at 25 cents per ton, $625.25, it would make this road cost per mile $6,578.94. If from this should be deducted one-half of freight, or $732.15 (to put it on same basis as contract), which would make the cost of the road on that basis, $5,846.79.

At the same time the Penitentiary is credited $2,650.45 for labor and stone as the result of 34.67 men per day for 73 days' work, or a total term of three months, and upon this basis, it would seem to the committee that the Penitentiary could stand the expense of maintenance of keepers, if no more keepers were employed than absolutely required and leave a nice profit for the Penitentiary.

On this basis 300 men of the Penitentiary for six months would earn $42,406, from which would have to be deducted the board and salary of the keepers.

The committee was very much pleased with the experiment from the standpoint of the prisoners themselves, for in the course of the work it is safe to say that there were at least 100 different men at work on the job and not one escaped, or attempt to escape was made, and no difficulty of any importance was experienced.

The prisoners themselves enjoyed the work and much preferred it to confinement at the penitentiary, many of them expressing the wish that the work might continue all winter. The committee is satisfied that much good has been done the men themselves; that their health has been benefited to a great extent, and that when they are discharged they have been in a condition to and have found employment and are in better condition to hold such employment regularly.

The committee is also strongly of the opinion, from the experiment, that in working 50 men on the road that but five guards or keepers are needed instead of seven, as was used in this case, namely, three for day and two for night watchers, and if this was done it would result in the saving of $160 a month for their board and salaries.

The prisoners were found to work faithfully and showed more of a willingness to work than was predicted, but the committee believes that much more efficient work could be secured from the men if the law was changed so that for each month of faithful service on the road a prisoner could receive a deduction of five days from his sentence; such faithfulness to be determined by the Superintendent of Highways and the Superintendent of the Penitentiary, and the committee recommends that if this work is continued, that the Board endeavor to get such legislation.

One difficulty and handicap in this experiment has been the inexperience of the keepers, and in some cases the unwillingness of the keepers to make the best effort, and, of course, it is necessary in the success of this work that the keepers act as foremen. It is therefore also recommended by the committee, that if this work is continued, such keepers be required to act as foremen, and if found competent and faithful, that they be paid an additional 50 cents a day while employed on construction work.

The committee has found from this experiment that at least 50 prisoners should be kept on the road at all times, in order to work to the best advantage and greatest efficiency, and as this was not the case during this work, the committee recommends that if this work is continued, at least 50 prisoners be furnished for work on the road at all times.

It is also further recommended by the committee, that if road building is continued, that sectional quarters be built for both men and keepers which can be handily moved from place to place, so that such quarters can be kept in the immediate vicinity of the construction work, thus making it more convenient to handle the men at work; and if quarters were made for the keepers, the lodging of the keepers could be saved to the county and also their board by having their cooking done in such camp.

The committee believe that if they could have prosecuted this work to the completion of the three miles of road with favorable seasons, with the experience already acquired, they could build each succeeding mile for at least $500 less, since the worst part of the three miles is completed.

The committee believes that road building by the convicts, if it receives co-operation of the officials and men in charge, can be made profitable to the county and town, and at the same time show earnings for the Penitentiary greater than heretofore shown.

WATER-WORKS AND SEWERS SECTION

ost of Trenching with Sewer Excavator in Moundsville, W. Va.

[illegible] by A. W. Peters, Resident Engineer.

Vork was begun on the Moundsville sewer tem in May, 1911. Labor troubles devel- ed a few weeks later. The contract time s one year. The cuts called for were as lows: 3½ miles of trench from 0 to 6 ft.; ½ miles, from 6 to 8 ft. deep; 3 miles, from to 10 ft. deep; and 3 miles of trench in ich the cut was greater than 10 ft.

The contractor, finding the soil suitable for chine work, purchased a No. 00 Chicago wer Excavator, steam driven. The excava- was fitted with buckets 22 ins. wide, and a separate set of buckets 27 ins. wide was secured. The length of arm was 8 ft., with an extra 2 ft. extension for use in cutting trenches 10 ft. deep. The contractor was then in shape to handle 23 out of 26 miles of his trench work, regardless of labor conditions.

The topography of Moundsville was favorable to machine work; the grades, within the corporate limits, being very light. The soil was excellent for machine work, being mostly fine sand mixed with loam and unstratified yellow clay, moist enough to stand well with only occasional vertical braces. Where the sand and loam predominated in the mixture, the machine made big daily runs; when the clay predominated, the going was much harder and slower. At places soil was encountered which was as stiff as a glacial drift hardpan, but which contained no boulders, or even small stones.

As the light cuttings handled by this machine were situated between the two trunk sewers, and therefore pretty well bunched, not much time was lost in shifting the machine from one street to another. When an occasional long shift was necessary the machine traveled under its own power at the rate of 1½ miles per hour. Table I gives the operating cost of the excavator. A little explanation is due some of the items:

Superintendence.—Four gangs working, therefore one-quarter of superintendent's time is charged to the excavator.

TABLE II.—QUANTITIES AND COSTS OF MACHINE EXCAVATION ON SEWER WO

Run No.	Lin. ft. trench excavated.	Aver. depth. Ft.	Excav. Cu. yds.	Hours actual run. Time.	Cu. yds. per actual run. Time.	Cost per cu. yd actual run. Time.	Cu. yds. per day.	Cost per yd. on day basis.	Remarks.
1	390	6.6	264	10	26.4	$0.082	264	$0.082	
2	565	7.7	286	10	28.6	0.075	286	0.075	
3	638	6.5	281	10	28.1	0.076	281	0.076	
4	530	8.6	308	9	34.2	0.063	308	0.070	
5	547	6.7	218	[illegible]	[illegible]	0.067			
5	180	6.0	73	2.5	[illegible]	0.074	321	0.067	
6	125	7.2	150	[illegible]	21.4	0.101			
6	100	6.0	30	2	15.0	0.143	180	0.119	
7	180	[illegible]	64	4	16.0	0.135			
7	[illegible]	6.9	127	4	31.8	0.068	191	0.113	
8	340	6.9	159	7.5	21.2	0.102			
8	130	4.3	38	2	19.0	0.113	197	0.109	
9	106	4.3	30	2	15.0	0.143			
9	162	6.8	75	3.5	21.4	0.101	105	0.204	
10	160	6.8	46	3	15.3	0.140	46	0.468	Broken chain
11	565	7.8	298	10	29.8	0.072	298	0.072	
12	200	6.4	87	10	8.7	0.248	87	0.248	Bad banks
13	283	6.4	123	5	24.6	0.088			
13	200	6.9	93	5	18.6	0.115	216	0.100	
14	100	5.5	37	4	9.2	0.234	37	0.582	Long shift
15	400	5.0	135	10	13.5	0.159	135	0.159	
16	109	5.0	37	5	7.4	0.290			
16	348	5.5	130	5	26.0	0.083	167	0.129	Wet
17	450	5.5	168	10	16.8	0.128	168	0.128	
18	248	6.0	114	8.5	13.4	0.160	114	0.189	
19	447	6.3	191	10	19.1	0.112	191	0.112	
20	200	6.0	82	10	8.2	0.262	82	0.262	Bad banks
21	316	5.8	124	10	12.4	0.173	124	0.173	
22	400	7.0	190	9.5	20.0	0.108	190	0.113	
23	400	4.0	108	6.5	16.6	0.129	108	0.200	Long shift.
Totals			4,096	203					

$\frac{23 \times \$21.55}{4096}$ = aver. cost per cu. yd. = \$0.121 on 10-hour day basis.

$\frac{203 \times 2.155}{4096}$ = aver. cost per cu. yd. = \$0.107 on actual running time basis.

Sheeting.—Although this item has been figured into the daily cost, yet there were times when no bracing was necessary, the banks standing up well during the backfilling and flushing. For those cases where vertical bracing is not necessary our excavation cost is slightly high, or on the safe side.

Coal.—A steam driven machine was selected by the contractor, because there are three bituminous coal mines within a mile of the city which supply coal, run of mine, at 5 cts. a bushel, 7 cts. delivered.

Depreciation.—In this particular case, no serious breakages have occurred to date, most of the smaller delays being due to the breakage of links in the bucket chain, the defective links being easily replaced. Still a time must come when the breakages, figured not in dollars and cents necessary to replace defective parts, but in delays to the general progress of the work, must convince the contractor that the efficiency of his machine is low enough to allow of its being discarded. It may be that five years is a conservative estimate; if so, then the costs deduced from this depreciation are on the safe side—a good place for them to be.

Table II shows the work done by this machine in a run of 23 consecutive working two ways. First, on actual running time, or hourly basis; second, the work done per day is placed against the total daily operating cost.

Table II shows this excavator during a run of 23 consecutive working days, with time lost in making shifts from street to street and delays due to waiting for the pipe layers in wet ditches, handled an average 178 cu. yds. per day, at an average cost of 12 cts. per cubic yard. The maximum yardage per day was 308.

The table also shows that during actual running time the machine excavated on an average of 20.2 cu. yds. per hour at a cost of $0.107 per cubic yard.

In the column of costs based on actual running time, we find results ranging from $0.063 to $0.290. It is well to note that the low figure of 0.063 was made in a run of 530 ft. in 9 hours with an average trench depth of 8.6 ft. This is significantly the maximum depth quoted in this record. Partly in explanation of this low cost it may be stated that in shallow trench work the upper 6 or 8 ins. of road metal or even solid compacted surface, which in comparison to the rest of the ditch is hard to excavate, forms a considerable percentage of the total material excavated.

COST OF BACKFILLING THE TRENCH.

The backfill is divided into two parts: first, the foot of earth covering, which is thrown in and tamped by hand, which serves as a protection for the pipe and the cement joints during the 24 hours in which the ditch is left open for the joints to set up before flushing can commence; and, second, the remainder of the backfill which is put in with team and scraper and flushed and settled with water.

Part 1.—Part 1 may be estimated at 16 cts. per cubic yard, although the variation from this average cost was great in some instances. It is readily seen that in estimating the cost of backfill per lineal foot on ditches of various depths, the proportion of this expensive form of backfill varies inversely as the depth. It has also been noted that in shallow trenches the cost per cubic yard of excavation runs higher than the same unit cost in ditches whose depth approximates the maximum reach of the digging arm.

Part 2.—The trench above the 1 ft. covering was filled with a Sydney scraper and team. Water was run into the ditches during this fill, from the hydrants, with a meter on the line. Two men followed behind the scraper, cleaning out the gutter and rounding off the top of backfilled trench.

The daily cost of this part of the backfill is shown in Table III.

The operating cost per day for the scraper outfit was as follows:

Team and driver	$ 4.50
Helper on scraper	1.75
Helper on hose, etc	1.75
Cleaning up gutter, 2 men at $1.75	3.50
Water, 5,000 gals., at 10 cts. per M	.50
Per day of ten hours	$12.00
Per hour	$ 1.20

On this work B. F. Sweeten & Son of Camden, N. J., were the contractors. Chas. E. Collins of Philadelphia, Pa., was consulting engineer, and the writer was resident engineer, in charge of construction.

LE I DAILY OPERATING COST
CHICAGO SEWER EXCAVATION AT
MOUNDSVILLE, W. VA.

Operation:	
Superintendence	$ 1.
Engineer and helper	4.
Watchman	1.
Coal, 15 bu. at 7 cts	1
Water, 1 single team	2
Plumber, service pipes, average	1
Total	$12
Sheeting: Uprights and jacks; no rangers.	
2 men at $1.75	$ 3
Lumber, used repeatedly, neglected.	
Maintenance:	
Replacing dull spuds on buckets	$ 0
Engineer's time Sunday cleaning up, $3.00 ÷ 6	0
Miscellaneous	0
Total	$ 1
Depreciation:	
Life of machine figured at 5 years, 9 months to the year, 25 days to the month	$ 4
Daily total	$21.
Hourly total	$ 2.

Accounting in Waterworks Depa. ments of Small Cities.*

Because a waterworks plant is small is adequate reason for laxity in its system records and accounting. Indeed, all greater should be the necessity for accur convenient, systematic and comprehens records. Good bookkeeping and well-k records are absolutely necessities to the s cessful conduct of any enterprise, no mat how small or large it may be. Even in smallest waterworks plant such a syst should be employed as will disclose at time the actual working conditions of business. Moreover, it should be in such fo that comparisons may readily be made w any corresponding period in the history the enterprise. To the alert and wide-aw manager such comparisons are fraught w many enlightening suggestions which he find to be valuable aids in the prosecution his work. For instance, in the purchase coal, a comparison of the results obtai from the different grades will disclose wh is best and most economical to use. A co- parison from day to day of pumpage ords, laboratory test records, coal consu- tion records, recording pressure gauge ords and watchmen's clock-dial records, all be found to be abundantly worth wh. Likewise, a comparison from month month of cash receipts and disburseme when properly classified, will tend to emp- size conditions needing correction, and so pointing out the way to the right sort mangement as the business develops grows, will make failure improbable.

The office records should show comple of what the physical plant consists. Ev water main should be definitelv shown as location, connection and size. Every va fire hydrant, curb stop-box and service should be correctly mapped, and each ser record be made to indicate fully every fix and purpose for which it is to be used by consumer. These really important mat too many of our smaller cities entirely dis- gard.

Good accounting will not permit the ital investment account to be charged replacements and repairs, nor will it atte

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*Abstract of paper by E. L. Loomis, St. Valparaiso Home Water Company, Valpara Ind., before the Indiana Sanitary and W Supply Association, Indianapolis, Feb. 16,

TABLE III.—COST PER CUBIC YARD OF SCRAPER BACKFILL

Length trench. Ft.	Depth trench. Ft.	Backfill. Cu yds.	Actual time. Hours.	Cu. yds. per hr.	Cost per cu. yd. actual time.	Cu. yds. per day.	Cost per cu. yd. day basis.	Remarks. Depths taken to p of pipe cove
150	6.5	65	3	22	$0.055			
550	4.0	117	7	21	.057	212	$0.057	
800	4.0	213	6.5	33	.036			
280	5.0	93	3.5	27	.045	306	.039	
600	3.0	120	5	24	.050	(240)	.050	½ day.
565	5.0	188	5	38	.032	(376)	.032	½ day.
145	5.0	148	5	29	.041	(296)	.041	½ day.
		974	35				(.044)*	

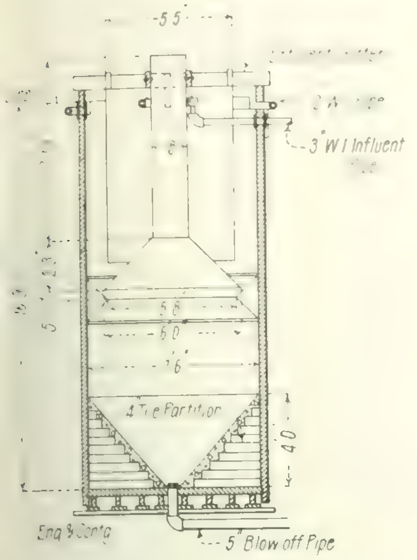
$\frac{974}{35}$ 28 = average backfill in cubic yards per hour.

*$0.011 = average cost per cubic yard.

ceive by overlooking and failing to take consideration the very important item of eciation.

cussion of Engineering Problems onnected With Biological Sewage Disposal.*

abstract of T. Aird Murray's paper the recent meeting of the Canadian Health Association was published in NEERING & CONTRACTING of January 31.



1—Sectional Elevation of Experimental Emscher Tank of Sanitary District of Chicago.

The discussion of the paper, by Mr. se and Mr. Murray, is interesting and is here to supplement the abstract fory published:

Langdon Pearse.—I have been interested eading the paper of Mr. T. Aird Murray, am glad to furnish some discussion thereon. ne light of the experimental work which I conducting for the Sanitary District of ago, as well as our engineering investiga-

less very greatly mistaken, Great Britain a Royal Sewage Commission as early as Later, in 1888, the Lawrence experiment on was established by the Massachusetts Board of Health, serving as a pioneer in experimental field in the United States n Lawrence came many ideas, adopted ad as well as in the U. S. In later years rimental stations have been operated at mbus, O.; Gloversville, N. Y.; Waterbury, ; the Massachusetts Institute of Techgy; Philadelphia, Pa., and Chicago, Ill. In nany and France much has been done litions abroad, however, differ radically those in the United States. From these rimental stations much definite data have accumulated.

SEPTIC TANKS.

om the available data, I agree with Mr. ray that it has been abundantly proven that early claims of the promoters of the septic were greatly exaggerated. In general I ve, however, that as regards the amount of ge found in a septic tank, less will be found in a settling tank, and more than in an cher tank. The accompanying table, Table iving some of the results at 39th St. is n from a report made by me to our Chief ineer, Mr. Wisner. The difficulty with the ic tank is the control of the unloading of sludge by violent action. Our septic tank at times, over a period of two days, deliv five times as much suspended matter as in influent, eventually blowing out all the sludge [illegible] posal facilities of a small town near Chicago, I recently found a septic tank eight years old which had never been cleaned. Half the tank was full of peaty scum. The sludge was being unloaded into a ditch, making a nuisance for a mile or more below the tank.

Mr. Watson, in Birmingham, has sensed this trouble [illegible] settling basins and then scrubbing filters between the septic tanks and the sprinkling filters. I [illegible] that in any sprinkling filter scheme a screen or scrubbing filter between the tanks and the filters is [illegible] of maintenance.

I do not believe, however, that separate sludge digestion in itself is a complete solution of the problem. A double deck tank of the Emscher type [illegible] settling matter always entering the digestion chamber [illegible] testing station, in the sludge digestion tank (into which [illegible] blown at frequent intervals) was the only nuisance on the grounds.

EMSCHER TANKS.

We have been operating an Emscher tank at the experiment station for over 18 months with very satisfactory results. The tank was recently remodeled, and is shown in its present form by Fig. 1. The sludge dries readily, is practically odorless, and is thoroughly digested in about six months. The principle seems excellent. Recently a second tank of slightly different design, Fig. 2, was put in operation to handle the effluent of the coarser sprinkling filters. In the Emscher tank, it seems immaterial whether the flow be radial or straight away, as in the diagram in Mr. Murray's paper. We are using a radial flow type on the grit chamber sewage with a flow of 20,000 gals. per 24 hours, with success. Depth, however, is essential, I believe, for a compact sludge, full of gas, to facilitate drying. This is a point which Mr. Murray has overlooked.

In the abstract of Mr. Murray's paper published Jan. 31, we omitted the portion of the paper which compared the Emscher and Lethbridge tanks. A full understanding of Mr. Pearse's discussion now requires that we publish that portion of the original paper. The comparison follows: The essential difference between the "Lethbridge" tank and the "Emscher" lies in the basis of design. The former is designed to suit the rectangular shape, and the latter, the circular.

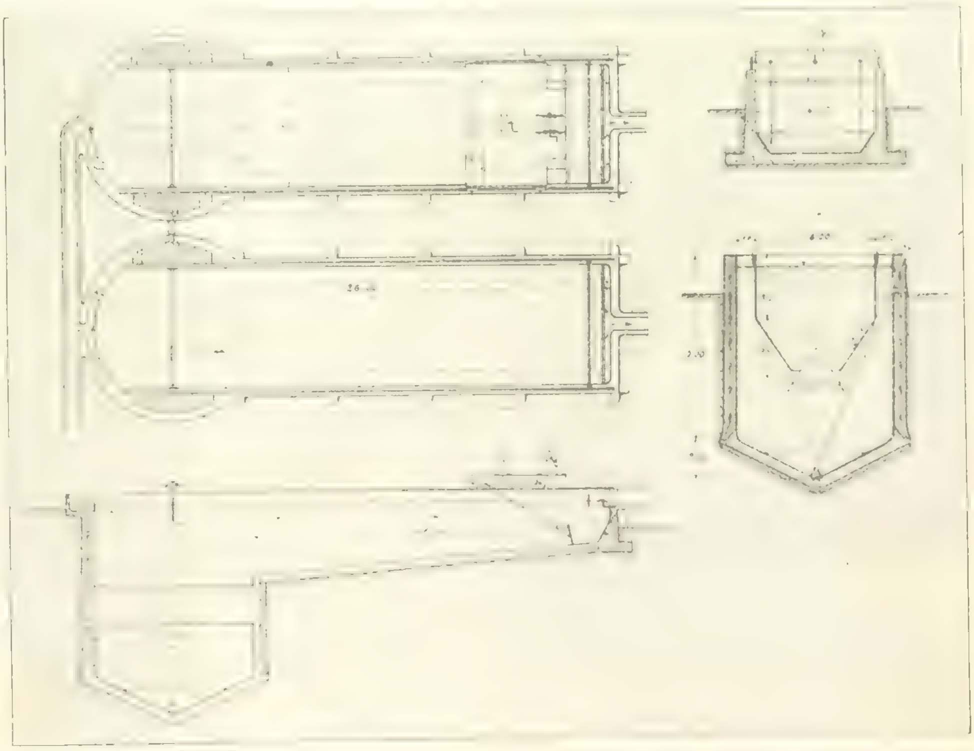


Fig. 3—Design for Emscher Tank on Special Sewages. Dimensions in Meters.

In adopting the rectangular shape the following factors were taken into consideration:

It is generally concluded that more efficient sedimentation, even velocity of flow, and avoidance of eddies can be obtained by the rectangular form than by the circular.

Circular tanks have been adopted more generally for the removal of grosser solids and such heavy matters as humus given off from biological filters.

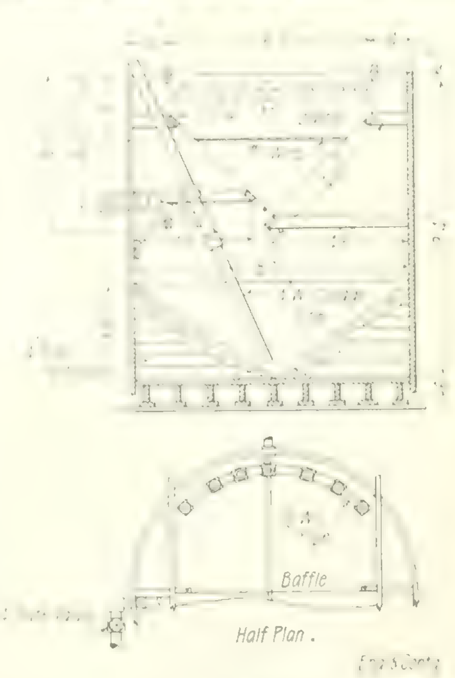


Fig. 2—Half Plan and Sectional Elevation of Experimental Emscher Settling Basin, Sanitary District of Chicago.

Rectangular tanks are generally less expensive than circular in construction, are more simple in operation, and require less depth of excavation.

Reliable data exist as to the possible of

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*Discussion by Langdon Pearse, of Chicago, T. Aird Murray, of Toronto, of Mr. Murs paper before the Canadian Public Health ociation; Dec., 1911.

T[illegible] SLUDGE ACC[illegible]MULAT[illegible] [illegible] TH[illegible]NTH STREET TESTING ST[illegible]

	Velocity min. per second.	Period in hours.	per million	Specific [illegible]	Per cent moisture.	Calculated to Dry Weight Nitrogen.	Volatile matter.	Fixed matter.	Ether so
Period October 15, 1909, to October 31, 1910.									
[illegible]		0.13		1.07	84.5	1.5	47	[illegible]	6.1
[illegible]			0.33	1.07	85.2	1.9	54	46	6.8
[illegible]	[illegible]	0.13		1.01	86.3	1.6		[illegible]	
[illegible]			0.026	1.35	[illegible]	[illegible]	21	79	
[illegible]			2.1	1.01	[illegible]	2.0	[illegible]	[illegible]	
			2.4	1.02	[illegible]	1.9	[illegible]	16	
			2.6	1.04	[illegible]	1.6	[illegible]	53	
[illegible]			2.1						
			0.9*	1.04	[illegible]	1.7	40		
		[illegible]	Max	from June 1, [illegible]					
[illegible]		1 to	Max 2.						
			[illegible]	1.04	88	1.6	[illegible]	61	4.4

During the present year there has been less sludge retained in the Sedimentation tanks.

*This represents amount actually cleaned out after 10 months. It does not, however, repre- [illegible] excluded by the tank previously.

†This represents the average accumulation over a period of 5 months and is the residue of [illegible] this tank [illegible]

[illegible] be removed in order to obviate chokage of the filter media; and, therefore, there does not appear to be any good reason for departing from this particular form of design.

The remainder of Mr. Pearse's discussion [illegible]

LETHBRIDGE TANK.

I have examined the design of the "Lethbridge" tank with much interest, inasmuch as Dr. Imhoff apparently designed a similar tank over three years ago, as shown by a drawing given me by him, dated 1907, see Fig. 3. The dimensions are in meters. There are several points in Mr. Murray's design which are open to criticism which do not apply to Dr. Imhoff's design. The use of glass for the cover of the sludge well and floor seems unnecessary, as I believe that the sludge would slide equally well on concrete after operating a few weeks. As a method of construction to reduce the cost of forms, the use of glass (or concrete slabs, cast outside) is worth investigation, particularly for the cover of the sludge digestion chamber. The slope of the floor is too flat, I believe, for successful operation without means for scraping the sludge into the digestion chamber. Dr. Imhoff has provided such a scraper, to be used several times a day preferably.

In Mr. Murray's design, only small gas outlets are shown. From the writer's experience with various forms of tanks, these vents are too small and would rapidly choke with the "swimming" sludge or scum. A larger area for gas vents would seem necessary. No dimensions are given on Mr. Murray's sketch. The sludge storage well, however, appears too shallow in depth to obtain the density of sludge which Mr. Murray claims. In the experimental tank at 39th St., with a depth of over 16 ft., the moisture content of the sludge is rarely below 88 per cent water. Depth is required to obtain a dense sludge. That is why Dr. Imhoff advocates depths of 30 to 40 ft.

So far as I can see, the principles involved in the Lethbridge tank are identical with the Emscher, and if the matter of depth be included, as it should, the factor laid down by Mr. Murray of saving in depth of excavations becomes of no consequence.

SEDIMENTATION PROCESS.

The sedimentation problem depends on velocities of flow, either forward or upward, and not on the shape of the tanks, as such. With a knowledge of the critical velocities at which the desired size of particle is to be deposited, a designer should be able to build a tank equally effective, in either a rectangular straight flow, or circular upward flow form, so far as mere removal of settling suspended matter is concerned. For the purpose of ease in cleaning in purely sedimentation tanks, the writer has advised the trial of the Dortmund type, with hopper bottoms, to settle a very heavy industrial sewage in the stockyards. The comparative cost of the several types of tanks is well illustrated in the table prepared by me for the report of our Chief Engineer, Mr. Wisner. (See Eng. & Cont'g for Nov. 29, 1911.)

Despite the greater cost of the Emscher tank, we have recommended its use for improving the condition of the domestic sewage in Chicago, because we believe it is the best type today for removing the settling suspended matter, with [illegible] and [illegible] of producing the minimum amount of sludge, thoroughly digested and easy to dry.

SPRINKLING FILTERS.

I have been much interested in Mr. Murray's remarks on distribution. At our experimental station we have been operating five open filters, one of which has rubble sides and one covered filter, through two winters. During the second winter the covered filter gave consistently better results both in stability and nitrification. The crude sewage (from an area of 22 square miles) was never below 43° F., and the maximum loss of temperature (through the rubble sided filter) was 16°. Under the winter conditions at Chicago we believe open filters can be operated with success. Owing to the restricted localities for sites, light covers may eventually be necessary to prevent aerial nuisance.

Our distribution has been made extremely uniform by the use of a Taylor nozzle, fed by a dosing tank, the outlet of which is controlled by a butterfly valve actuated by a revolving cam cut to give uniform distribution. The writer has been interested in the revolving distributors but has felt that no definite data have ever been presented to determine whether the claims are substantiated. Exact data on plants of two types working side by side are required to settle the question. The writer understands that at the experimental testing station of the Massachusetts Institute of Technology, in Boston, the traveling distributor of the Ham Baker type (tipping buckets) has not been found to give as good satisfaction as the fixed spray distributors working under variable heads. On practical grounds alone, the conclusion is borne out, since in the writer's opinion it is desirable to dose the beds uniformly and as continually as possible in order to keep the rate of application as close as possible to the average yield. With a traveling distributor giving a large dose once only in 5 to 10 minutes the effect certainly cannot be obtained. Where land is valuable the circular beds cause a loss of space.

SIZE OF FILTER MATERIAL.

The size and depth of the filter material is all important. Undoubtedly the better results can be obtained with material as uniform in size as possible. The most favorable size for higher rates of treatment is 1¼ to 2 ins. With the dilute domestic sewage at the 39th St. testing station yields of 2,500,000 to 3,000,000 gals. (U. S.) per acre can be obtained. With a depth of 6 ft. steady results are obtained. The indications are that graded material of fine surfaces are not economical.

FILTER DESIGN.

The usual design for sprinkling filters in the United States is to have the drainage from the outer to the inner portion of the bed. This permits thorough inspection of the underdrains and flushing if required, since in the more recent designs the tile underdrains open into a gallery through the walls.

DISCHARGE OF SEWAGE INTO WATER SUPPLY.

The writer is firmly of the opinion that wherever circumstances demand that sewage should be turned into a water supply, the problem should be considered as a whole. Purification of the water by filtration and sterilization insures a water practically free from all bacteria. This is usually much cheaper than the purification of sewage to the same degree of bacteria' [illegible] and far more certain as a prot[illegible] [illegible] In such cases the sewage [illegible] must be considered, too, first to relieve the nuisance on bathing beaches, and later [illegible] lieve the load of pollution on the water [illegible] cation. Lakes and rivers furnish an exc[illegible] means of oxidation for amounts of sewage [illegible] in their oxidation capacity. Too great co[illegible] [illegible] treatment [illegible] Where a water supply is pol[illegible] however, the writer firmly believes in obt[illegible] a pure water, which today can readily b[illegible] tained by filtration, either in mechanical [illegible] [illegible] on slow sand filter[illegible] cording to circumstances. A small amou[illegible] [illegible] of calcium makes an ex[illegible] sterilizing agent to finish the work of the [illegible]

Mr. Murray's remarks in closing th[illegible] cussion, as published in The Canadian [illegible] [illegible] Dec. 28, 1911, follow:

In the first instance I wish to thank [illegible] Pearse for the valuable discussion he has [illegible] tributed with reference to my paper. [illegible] reference to his remarks that conditions [illegible] differ radically from those in the United [illegible] I would here add that conditions in Ca[illegible] especially in parts, would prove to differ [illegible] conditions both abroad and in the United [illegible] In Canada it is very probable that the [illegible] genic features of sewage disposal will re[illegible] more attention than elsewhere, for the [illegible] reason that Canadian waters have not [illegible] become altogether unfit for water supply [illegible] in their raw state. Under most conditi[illegible] populated areas, it appears reasonable [illegible] will prove cheaper to disinfect surface [illegible] supplies than sewage effluents. On the [illegible] hand it appears reasonable that the [illegible] producer should do something more in con[illegible] tion with sewage disposal than merely [illegible] a chemical nuisance. In order to prote[illegible] individual or isolated water consumer, [illegible] districts and small urban centers, which [illegible] not be able to afford the cost of effective [illegible] purification, in connection with most [illegible] disposal works now under construction or [illegible] constructed in Western Canada, hypoc[illegible] disinfection of sewage effluents is being [illegible] to the standard methods for removal of [illegible] and putrescibility.

The sketch attached to my paper is m[illegible] sketch and, unfortunately, does not [illegible] many of the essential features of the [illegible] bridge Tank," which can only be sho[illegible] further drawings. The sketch is given [illegible] sole reason of illustrating the apron met[illegible] isolating a sludge storage area in a rec[illegible] lar tank. Further drawings are being p[illegible] and will probably be illustrated in The [illegible] dian Engineer. Mr. Pearse will be int[illegible] to know that it has already been conclud[illegible] the fore base is too flat and steps are [illegible] taken to remedy this fault.

I am very gratified to know that Mr. [illegible] agrees [illegible] in the main principle [illegible] removal of solids from the supernatant li[illegible] sedimentation tanks and that this p[illegible] will prove a great advance upon the [illegible] "septic tank" where the settled sludge [illegible] loaded back into the liquid sewage.

With reference to the question of d[illegible] do not consider that it is necessary to [illegible] great depths for sludge concentration [illegible] British Royal Commission, in their 5th [illegible] lay stress more upon the time allowed [illegible] solidation and decomposition of the [illegible] matter. The ordinary flat septic tank [illegible] given sludge with as low a water con[illegible] 80 per cent.

I cannot agree that a concrete surfa[illegible] prove as efficient as a glass surface. T[illegible] sons in favor of a glass surface appear [illegible] obvious. All tests in this connection sh[illegible] clusively the higher efficiency of a glass [illegible] [illegible] minimum friction and [illegible] bacterial growth.

[illegible] have been submitted to [illegible] [illegible] of Boston, Mass., by L[illegible] Rourke, Commissioner of Public [illegible] regarding the proposed filling of So[illegible] [illegible] installation of a new sewer [illegible] [illegible] end. The figures sh[illegible] [illegible] cost about $9,000 [illegible]

nsjction and Cost Data in Relation to City Improvements.*

[illegible] rapparent each year. The closest atten- [illegible] to get the best results from the iended in public improvements. The [illegible] l, at all times and under all circum- He should know the proper thing [illegible]

spection does not mean, necessarily, spector should "split hairs" with a on questionable points. Few plans ications are drawn that will cover ions encountered during the prog- e construction of any improvement uence. Hence it is of first impor- the inspector in charge of any im- t should know when, how, and why from the plans and specifications nade. Furthermore, close attention part of the inspector commands the of the contractor, and reflects credit engineering department. The general tion of the contractor for doing honest should not operate to lessen the vigi- f the inspector.

uestion of the appointment of in- s one of the troublesome questions gineering Department. Unless the nt in question requires an inspector than ordinary ability, the engineer often inclined to listen to public senti- and name some interested property some deserving citizen that needs connected with the position, or pay cal debt with the appointment. The o selected has about as much con- f his duties as the average black- [illegible] uld be favored, but many improve- been badly neglected and injured se adherence to this policy.

[illegible] st to enable them to read and interpret f improvement plans. However, many fulfilling this requirement are too l inexperienced to cope with the ities of the position, and fall an [illegible]

ally, in the appointment of inspectors, say, first of all, pick honest, sober rious men. If they have had some [illegible] are property owners and tax payers in on they should have some preference. d their appointment pay some political or add to the popularity of the admin- on it harms no one, and sometimes les- the trouble of the engineer; but under rcumstances let party prejudice or public nent cheapen the standard of inspection. inspector should not be placed in e of an improvement until he has been ughly schooled in the duties of his posi- [illegible]

are sent out [illegible] in the spring will [illegible] son's work. This preliminary training for an inspector not only [illegible] him for his work, but also enables the engineer to get a good line on the inspector as to his ability and general fitness for the position. The young and inexperienced inspector needs the advice and instructions of the engineer.

Weekly or semi-weekly meetings of inspectors and engineer, where problems pertaining to the work in progress can be discussed are very profitable and have been found fruitful of good results.

The authority of an inspector should never be called in question. He should be made fully to understand before he assumes the duties of his office just what authority he has, and just as fully made to understand that he must not abuse that authority. If he is in doubt as to any question arising over the work on which he is in charge, he should consult the engineer and be positive as to his answer before he renders a decision. A decision should always be rendered through the inspector in charge. There should be at all times perfect confidence between the inspector in charge of the work and the engineer. If this confidence is maintained there will seldom arise an occasion for the inspector's authority to be questioned. It is bad policy for the engineer or chief inspector to issue orders or question any part of the work except through the inspector in charge unless called upon to do so by the inspector. It is always better to have the contractor or foreman in charge of the work understand that the inspector is in authority.

Each inspector should be required to keep a daily report of the progress of his work, showing not only the amount of material used but also the labor required; the cost of labor for finished work, total cost of finished work including labor and material, weather conditions, general progress, etc., and in addition, anything unusual causing delays, extra cost, etc., should always be reported.

Some regular form for daily reports should be adopted by the engineer's office, and each inspector should be supplied with these forms and required to file one daily with the office. He should retain a copy of the report. Such report blanks easily can be arranged so as to cover every item entering into city improvement work.

The inspector should be made to understand fully the importance of these daily reports. Unless they are carefully and accurately kept their value is entirely lost. If the inspector is careful to report daily the quantities of material used and the amount of work completed, together with the labor required, the engineer or chief inspector can very readily ascertain the progress of the work and render safe judgment as to its merits.

COST DATA.

The importance of cost data in the city engineer's office is too often lost sight of In the rush to get the work completed and to keep the expenses of the engineering department at a minimum it is often sadly neglected. The only way to keep accurate cost data on any improvement is to start the inspector on the work at the very beginning If it is street improvement let him begin with the grading. Teach him to be as careful and keep as accurate account of the labor as though employed as a time-keeper on the job. If he proves proficient in his work let him stay on the job until it is completed. By so doing he becomes not only familiar with the men and manner of the work, but is fully prepared to tabulate the cost of the work when it is completed.

If the inspector is well trained in keeping his daily reports and is careful to charge his labor accounts to each particular part of the work as it progresses, it will be but little trouble to figure out the cost of the improvement at any stage and almost the exact cost of each item.

It will be found not only convenient but of great advantage to the engineer and all concerned to keep the tabulation of bids for the entire season's work on one sheet.

If daily reports are kept in perfect order, so that the cost data is reliable, they will be of great help in making final estimates. Any question as to material used and labor performed can easily be settled by reference to the daily reports of the dates in question. This is not only a protection to the contractor but provides a sure protection to the city. After the contractor realizes that the inspector on his work is as careful and accurate as his own foreman or time-keeper, he will seldom question the report of the engineer's office as to final estimates. Well kept cost data records are also of valuable assistance to the engineer's office in making estimates of cost of proposed improvements

The past few years experience on inspection work in a city that has expended from $550,000 to $1,000,000 annually on city improvements, has convinced me that a uniform system of inspection will practically eliminate all effort on the part of contractors to attempt to give short measurements on materials.

When the contractor knows that daily reports are kept of the amount of material used and labor performed and that the engineer's office is in daily touch with his work, it insures higher class workmanship, and means less trouble and more satisfactory results to the engineering department.

No employe of the city holds a more responsible position than the inspector.' On his honesty depends the protection of the property owner and tax-payer.

In progressive cities where much public work is being done, the engineering department is by far the most important department in the municipality. Nothing adds more credit to the department than first-class improvements, honestly awarded and faithfully built

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stract of paper by F. O. Hodson, Chief ctor, Gary, Ind., before recent annual ng of the Indiana Engineering Society.

DRAINAGE AND IRRIGATION SECTION

iods of Preparing Land and Applying Water for Irrigation.

(STAFF ARTICLE.)

e preceding article discussed the com- methods of clearing and grading land for tion and gave general costs of such After arid land has been cleared and ed, important and in the aggregate some- expensive work has to be done contour- nd diking the fields for the application ater to the soil. There are various ods in use of applying irrigation water. In this article we describe the check method and its modification the border method.

CHECK METHOD.

The check method of applying water to crops consists in dividing the land by low dikes or embankments into a number of areas each having a comparatively level floor. A bordering supply ditch delivers water to each area through a sluice in the embankment. Figure 1 is a conventional sketch of a check system of irrigation. The check method is very old, and practice at one time and another shows examples of checks ranging in area from a few hundred square feet to 30 acres. American opinion has become somewhat settled on check areas of from ¾ acre to 1½ acres.

Laying Out Checks.—There are two systems of laying out checks and they may best be explained by means of diagrams. Let the rectangle Fig. 2 represent an area of land upon which 3-in. contours have been located as shown by the dotted lines. The area between any two adjacent contours is substantially level. Obviously if dikes are built along the contour lines and occasional cross dikes are built at suitable points the area will be divided into a number of compartments or checks, the floor of each of which is very nearly level. Figure 3 shows the area divided as described, the black lines showing the dikes and the double lines showing the supply ditches. This method of checking land is called contour checking. Taking the same area it may by suitable placing of dikes be divided into a number of rectangular compartments; such an arrangement is shown by Fig. 4, in which as in Fig. 3, the single lines indicate dikes and the double lines indicate supply ditches. This method of checking land is called rectangular checking.

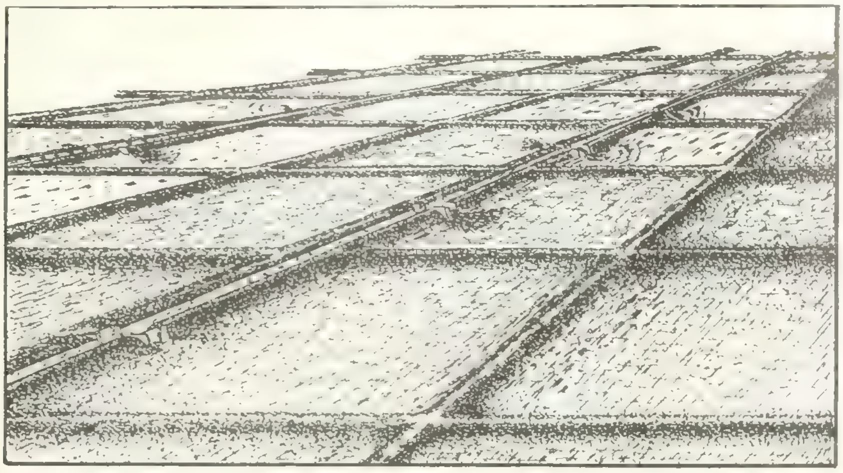
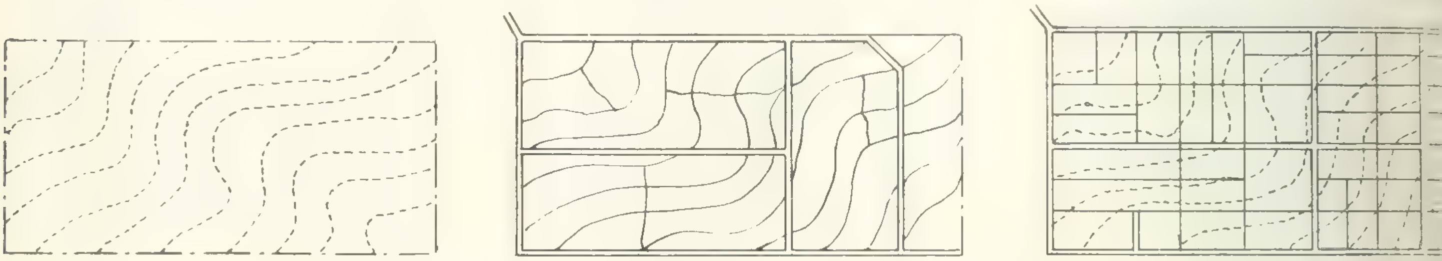


Fig. 1—Conventional Sketch of Check Method of Applying Irrigating Water.

Locating Contours.—The manner of locating dikes and contours so as to secure checks with level floors is a very simple problem in surveying. Ordinarily no more elaborate methods are adopted than the following: Setting up his level the surveyor takes from half a dozen to a score of scattered readings to locate high points and obtain an idea of the general lay of the land. He then starts contouring by driving a stake flush with the ground at the higher corner of the upper end of the area. A reading is taken on this stake and, assuming that 3-in. contours are to be run, the rod target is raised 3 ins. The rodman then moves down one of the margins until the level line from the instrument intersects the middle of the target and there a stake is driven. The rodman then walks infield say 30 paces and by shifting his rod from place to place locates a second "level" point which is marked. A third and other points are similarly located until the contour "runs out" of the opposite margin. A second and other contours are located similarly. To mark the contours visibly on the ground a man with a wheeled plow whose elevated seat gives a clear view ahead runs a furrow, using the stakes set by the rodman as range marks.



Figs. 2, 3 and 4—Diagrams Showing Methods of Dividing Land Into Checks.

Dike Construction.—The dikes or levees separating checks are merely low broad ridges of earth; a typical cross-section would be one 9 ins. high and 72 ins. wide at the base. This cross-section permits for many crops the cultivation of the dike as well as the floor of the enclosed basin or check. Dikes are constructed usually with scrapers, using the soil obtained by cutting down high points within the check.

Sluice Boxes.—As indicated by Figs. 1, 3 and 4 the supply ditches are so located that a ditch runs alongside or to each check. To admit water into each check from the ditch a sluice box is built through the embankment or dike. This sluice box is ordinarily a simple wooden structure—merely a short wooden flume provided with a vertically sliding board gate to open or close it. The width of the flume will vary with the size of the check to be flooded from 1 ft. to 10 ft.; it is somewhat shorter than the thickness of the dike so that its ends will be back out of the way of harrows or other devices employed in cultivating and harvesting.

Cost of Checking Land.—As will be seen from the preceding description of the constructions required, the work of checking land calls for only simple appliances and moderate construction ability. Ordinarily the work is done by the land owners themselves, with perhaps the services of a surveyor to locate the contour checks. Contract prices for checking land range from $5 to $20 an acre. The following are prices furnished by a contractor, a 20-acre tract being considered:

Item.	Cost.
4 horses 48 days scraping at $1	$192.00
2 horses 7½ days plowing at $3	22.50
3 days surveyor locating contours at $4	12.00
1,666 ft. B. M. lumber for sluice boxes at $24	40.00
Labor and hardware for sluice boxes	25.00
Total	$29[illegible]
Cost per acre	$ 9.60

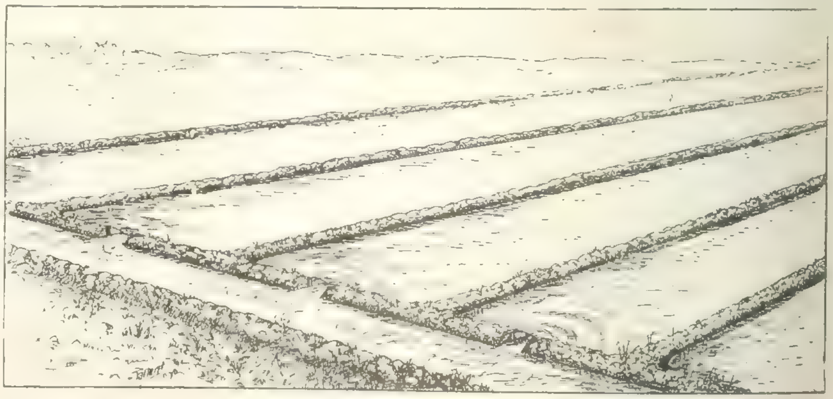


Fig. 5—Conventional Sketch of Border Method of Applying Irrigating Water

The following is the actual cost of checking 160 acres into ¾-acre checks about 190

Item.	Cost
Survey	[illegible]
Labor at $1.15 per day and board	5.33
Teams at 50 cts. per day per span	[illegible]
Provisions, feed, etc	[illegible]
Lumber for head gates	[illegible]
Repairs on tools	[illegible]
Total	[illegible]

This total gives a cost per acre of about $6 not including sluice boxes.

BORDER METHOD.

The border method of applying wate is a modification of the check method. Instead of being divided into approximately equal sided checks, the division is into long narrow strips as indicated conventionally by Fig. 5. The basins range from 60 to 100 ft. wide and from one-eighth to a quarter of a mile long. The supply ditches are built along the narrow ends of the basins and are considerably larger than are required for flooding ordinary checks. Dike and sluice box construction is simir to that described for the ordinary check method of irrigation.

Land Reclamation by Flood Protection; a Typical Problem and I Solution.

(STAFF ARTICLE.)

There are in Kansas and Nebrask in Oklahoma, in South Dakota and in the Mississippi valley states large areas of land subject to perodical inundation. The reclamation of these areas generally is less a problem in drainage than a problem in flood protection. At ordinary stages of wate the bottoms offer no difficulties in the w. o ground water that the farmers cannot overcome by ordinary small drainage works. Commonly under-drainage is all that is called for. The streams, however, are subject to floods and when floods arise the bottoms are inundated, crops are destroyed and propert and structures are washed away. As examples of such conditions, choosing only those that have been recently studied there may be mentioned the Black River and Cary Creek bottoms in Independence County, Kansas 14,000 acres; the Little Caney River bottoms in Montgomery and Chautauqua Counties, Kansas, 8,500 acres; the Nematin River bottoms in Johnson County, Nebraska, 13,000 acres; the Deep Fork of Canadian River bottoms in Lincoln and Okmulgee counties, Oklahoma, 38,000 acres; the Big Sioux River bottoms in and South Dakota, 11,700 acres, and osho River bottoms in Kansas, 161, es. In all of these areas cultivation ardous; the soil is rich and the land is tillable, but the owners dare not put s because of the danger of floods. The bl, it will be seen, is reclamation by d ontrol.

s specific example of the conditions en red and of the works required to meet e take the case of the Neosho River Kisas. A very complete study of this alley was made in 1908 by J. O. Wright, Engineer Figure 1 is a map of r and its tributaries, which are very

ous. The watershed is quite wide at nd, 30 to 50 miles; it narrows to 15 at about midlength, and then widens out to 30 miles. The soil is a porous loam nderlying clay, shale or limestone. The s mostly cleared and cultivated and has ocally drained. The richest lands are the river valleys and form a level 1 to 5 miles wide. It is this bottom hat is most in danger from inundation; eat is this danger in fact that many s will not take the risk of putting in

The flood of 1904 is the most e of all those recorded, by reason of idespread injury to property which re- The water spread over the bottom throughout the entire valley, destroying e acreage of crops. Fences and buildwere washed away and private roads ridges were destroyed. Much live stock lrowned, meadows and pastures were etely ruined, and in places the land itself njured by the erosion of the current. ighways crossing the valley were ren impassable and much damage was done bridges and culverts, and in some places e grade of the road. Parts of many and villages along the river were y damaged. Railroads suffered from es to their roadbeds, buildings and ds; trains could not run for several and travel was entirely suspended in alley except by boat. Some of the oil nies were driven from their field of ions, and their property suffered more s injury from the overflow; the levees the river in Neosho County were sly damaged.

s difficult to compute the damage done operty along the Neosho River and its aries by the floods of 1904, but a conive estimate places it at $1,200,000.

ere are, in addition, various indirect ful results which follow overflows. The grass is killed and the seeds of noxious are widely disseminated. The overd ground is rendered difficult to cultiby the standing of the water upon it. stagnant water remaining after the subce of the flood is a menace to the health- [illegible] far-reaching [illegible] lies in the discouraging effect [illegible] overflow has upon the further [illegible] land for agriculture. Destructive floods have occurred so frequently during the past decade that many residents of the valley are disheartened and fear to plant a crop lest it be destroyed.

Although the bottom land is the most fertile in that region, farmers who cultivate it feel that they take great risk of losing both seed and labor. The danger of the loss of a crop introduces an element of uncertainty most [illegible] tenant with small capital prefers the upland, although it is less productive, because he can not afford to run the risk of loss; and those who own and cultivate the land in the bottom do it in only a half-hearted way.

Fortunately, most of the tributaries of the Neosho are short and drain comparatively small areas, while several of the longer ones, as Labette, Cherry and Lightning creeks, empty into the river near the state line, so that in case of a heavy rain their water is usually discharged before that from the upper part of the valley reaches this portion of the stream; but frequently, when the parent stream is about full, a heavy rain on the country drained by these lower tributaries throws them out of their banks because they have no outlet. So long as these creeks can empty into the river without hindrance there is little damage done by their overflow, as the flood water runs off the land very rapidly. Although disastrous floods do not occur throughout the valley every year, there are many places where the land is so low that it rarely escapes some damage each season.

Condition of River Channel.—The Neosho River is extremely crooked, but has a well-defined permanent bed which gradually increases in width from its source to its mouth, where it is 500 ft. wide and 20 ft. deep. The entire stretch of river from the state line to Emporia is more or less filled with snags, brush, and with gravel bars resulting from these obstructions. In the lower portion of the river there is a wider channel, rather deeper water, and the snags are not so noticeable. As one goes up the river, the current is more restricted to a narrow channel, indicating the presence of numerous snags under the surface, and this fact is supported by the changing of the current from side to side in comparatively short distances and without the interference of bends or change in bank conditions. Above Erie, gravel bars are more frequently encountered than below this point in the stream, and the current is confined to a few feet in width by accumulation of trees stumps and brush. Some points are almost impassable for a rowboat, either from the great number of snags or their distribution over the entire width of the channel. There are riffles on the upper part of the river from Leroy to Iola that are not the result of a natural fall. Soundings show that in some cases the water is rather deep from one riffle to the next and has but little current. This indicates that the riffles are formed by the snags and trees in the stream.

All stages of this riffle and bar formation are apparent in an examination of the stream. No attempt is made at present to prevent the

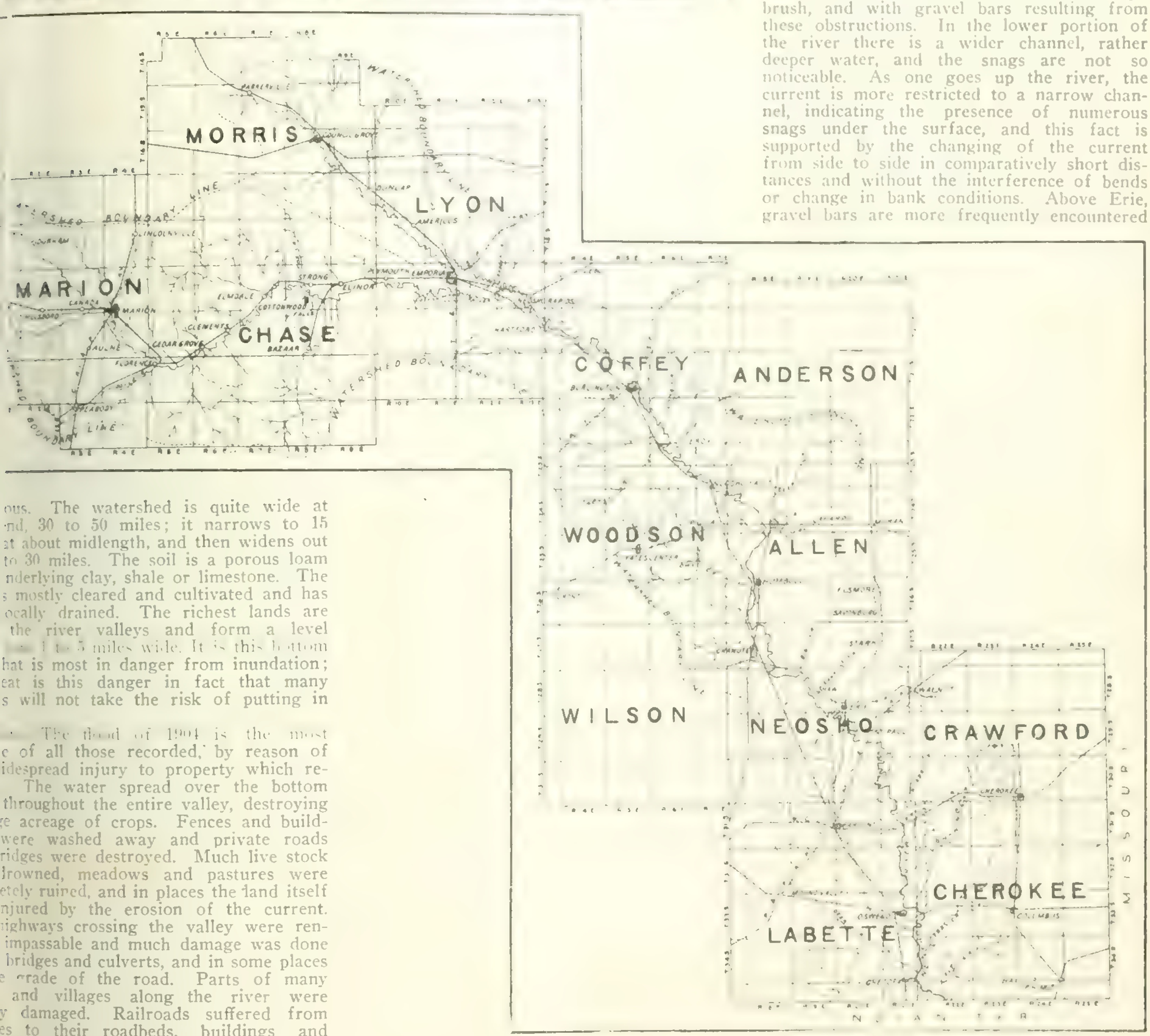


Fig. 1—Map of Neosho River Drainage Area in Kansas.

timber growing along the channel from going into the river with caving banks, nor is the brush cleared from the timber or banks. Furthermore, when a farmer clears a piece of land he usually hauls the stumps into the timber left standing on the bank, and the first high water deposits them on a brush pile in the channel. In cutting wood the trimmings are left scattered among the trees and rarely burned. When a big tree falls into the river it is carried into the deepest water and lodges there. In time it secures a firm hold, and gravel washes down and lodges around it, piling up, collecting drift, limbs of trees, and some of the stumps that were hauled to the bank of the river. In a year or two, the time depending upon the water conditions, floods, etc., this tree, with its accumulation of drift, forms a large gravel bar, often entirely covering the original obstruction. Here the channel has of necessity been changed to the other side of the river. Within a short time a riffle forms where there should be an open deep channel.

The landowners along the river have noticed these facts and seem to realize the effect they have upon the discharge of the water, but because their nighbors do not attempt to prevent the trash and trees from getting into the channel each one feels free to be equally negligent. The land owners were questioned on this matter, particularly where the snags were most abundant. Almost without exception they agreed as to the damage caused by snags, and many suggested the advisability of some legislation such as is in force in other states compelling the clearing of banks, the burning or removal of brush and stumps, and other means of preventing drift material from entering the channel. They are willing to do this work, but assert that it would not be done unless there were some uniformity of cleaning up and some legislation providing for doing the work and for taxing the cost up against the property fronting the river, in case the property owner failed to do the work himself. If such laws were in effect, nearly every farmer would do his share without compulsion and thus avoid the extra tax. It is evident to one going over the ground that the channel of the river is greatly filled and that an immense amount of good would be accomplished by clearing out the snags, removing the bars, and cutting the timber on each side.

The natural features of the tributary streams are similar to those of the main river. The larger ones have their sources near the edge of the watershed and flow obliquely toward the river. They are crooked and have about the same amount of fall as the river, except near their sources, where the slope is much greater. They have well-defined flood plains, often of considerable area. Their banks are usually wooded, and the stream beds in many places are filled by drift and fallen trees.

Possible Improvements to a Channel.—The carrying capacity of a channel may be increased in two ways: First, by enlarging the cross section of the channel, either by the removal of obstructions from its banks and bed or by the actual excavation of an enlarged channel; second, by cutting the bends of the channel so as to shorten it and hence increase the slope and therefore the velocity of the moving water. Moreover, removing obstructions from the banks of a channel also increases the velocity by lessening the retarding influences opposing the current. The formula given previously shows that the velocity is proportional to the square root of the slope. Hence, if it were possible by cutting bends to reduce the length of a given channel to exactly half its original length, the slope of the channel would thereby be exactly doubled, and since the square root of 2 is 1.41, the velocity would be increased by 41 per cent.

Similarly, if the slope could be increased to 4 times its original amount, the velocity and discharge would be doubled. On the other hand, if the area of the cross section of the channel could be increased to 4 times its original amount, preserving the same shape, the carrying capacity would be 5.6 times its original volume, on account of the increase of velocity due to the larger channel, combined with the greater area of cross section.

The course of the Neosho is very crooked, the channel being about twice as long as a straight line between its source and its mouth. In some places it loops back and forth across the valley in a series of sharp bends, increasing its length as much as five times that of a direct course between the same points. There is an opinion throughout the valley that if these bends were cut through and the channel straightened the stream would not overflow its banks. It is even claimed by the advocates of this plan that a channel much smaller than the cross section of the river would accomplish this object. But the great expense of such excavation, as compared with any benefits that may be expected to result from it, shows that but little can be recommended along the line of cutting bends in the river. This method of increasing the capacity of a stream has two important limitations which should always be taken into account. If the channel in the bend is smaller than that below, into which the cut-off, if made, would discharge, such an improvement would add to the carrying value of the channel. If, however, the channel for its entire length is nearly uniform in section, the straightening process should be systematically followed throughout, otherwise a congestion of water and overflow will take place at points where such conditions were unknown previous to the changes made in the course of the channel. However, by cutting off bends where practicable, by clearing out driftwood and snags, removing gravel bars, chopping down overhanging trees, and removing any other obstructions, the carrying capacity of the present channel may be increased about 10 per cent, and is an improvement that should under no consideration be neglected.

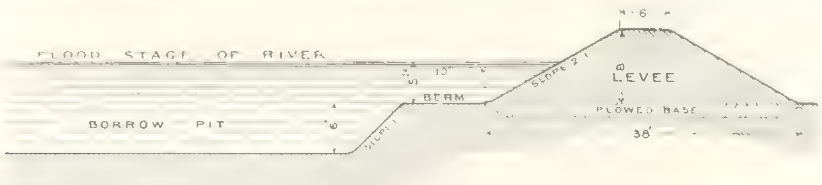


Fig. 2—Cross-Section of Proposed Levees for the Neosho River.

However, after all feasible improvements of this character have been executed, further measures will be necessary if the valuable bottom lands are to be protected from overflow at times of highest water in the river. To accomplish this object, levees will be needed, such as have already been tried on a small but usually inadequate scale in Neosho County.

The Plan Recommended.—It is recommended that all the bottom land along both sides of the river between the state line and Emporia the value of which will justify the expense be protected by levees on the opposite sides of the river at least 900 ft. apart at all points, leaving a clear channel of that width between them. The levees should be 8 ft. high, 6 ft. wide on top, and have side slopes of 2 horizontal to 1 vertical making a base 38 ft. wide as shown by Fig. 2.

Other Necessary Improvements.—In addition to the construction of the levee system it is of the utmost importance that cer n portions of the river channel, as indicate on the accompanying maps, should be strahtened and the channel further improved by removing the logs, stumps, trees, and bru which now clog it and impede the flow of t water.

The space between the levees and e river bank should be cleared absolutely. T get the maximum discharge the full area f the cross section must be free from obs ctions. From one end of the river to the er the banks are lined with oak, cottonwo, sycamore, with now and then walnut, pe n, elm and maple. Some of these trees are aluable for lumber and the rest will ma good cordwood or mine props. In places here is much worthless underbrush, but as a timber will nearly, if not entirely, cost of the clearing.

estimate the carrying capac channel between levees, let it be that the water rises above the top of river banks between the levees to a h 5 ft. The water will not only be flo ing in the main channel with a high velocity ut will also be flowing with a considerable el over the broad flat banks between th on each side of the main channel. the conditions are so different in channel from what they are in the h stretches along the sides that the am water flowing in the two places must e culated separately. So the channel ill considered as made of two parts, the portion 240 ft. wide and 30 ft. other part made of the two together, 650 ft. wide and 5 ft. dee both portions the slope is the same, For the main channel, the area is 6,20 sq the wetted perimeter, 265 ft., the h radius 23.4 ft., and the coefficient C taken at 97. This gives a calculated of 7 ft. per second and a dis 45,000 cu. ft. per second. The other has a width of 650 ft. and a depth 5 ft. Its hydraulic radius may be assumed its area is 3,250 sq. ft., and the C as 70. Its calculated velocity is, th ft. per second and its discharge 8,00 cu per second. This added to the amou ing in the main channel gives a to charge of 53,000 cu. ft. per second. the completion of the channel impro m recommended this discharge will be m increased.

If all the channel improvements pr iously recommended are carefully carried the levees will afford protection to the la s that are now overflowed, the improvement ill be permanent in its character, and the nnual cost of maintenance after the surfac is set in grass will be small. The failures th have occurred throughout this valley ha dis-couraged some of the people and cr ted distrust of levees as a means of p These failures, however, have been e the manner in which the work was d subsequently cared for, rather than t kind of improvement adopted.

Cost of Improvements.—A levee dimensions recommended, 8 ft. high 6 wide on top, and with side slopes of will contain about 34,400 cu. yds. per ile

The cost of such earthwork will vary ightly in different parts of the valley, bu taken in large quantities so that the most im oved machinery may be employed, it should t exceed 8 cts. per cubic yard. At this ice mile of average levee will cost approx at $2,800. The cost for the right of w for these levees and the construction of eturn levees on some of the tributaries, the acing of sluice gates, and the digging of d n ditches in certain places must be added cost of the work. In order to estim cost of protecting these lands by leve to determine whether or not it will pay s an economic proposition, the positions the levees have been platted. From these the lengths of the levees have been est a and also the amount and cost of oth improvements needed, and these results ar compared with the amount of land which ll benefited.

In the discussion which follows it

[illegible] that all the lands [illegible] ho River will be organized into drain- districts under the drainage law enacted [illegible] in 1905. If this is done [illegible] several districts co-operate and the [illegible]nt is put under one head, economy [illegible]dministration will be effected and the [illegible] can be maintained in good condition at inimum cost per annum. Another ad- [illegible] nization of large drainage districts [illegible] will draw the attention of the best con- ng firms in the country, equipped with most modern machinery, who will be to submit a low price for doing the work. ving will be effected also in the admin- ive expenses and better results secured could be expected if the work were let all quantities to numerous contractors. an improvement of this kind the right v will be acquired by the drainage dis- [illegible] the title to the land occupied by s and to the strips between them and [illegible] r. The board of directors, however, d have such jurisdiction over this land av be necessary to properly control and ll drainage works. In the subse- [illegible] deration, but the damages which will to the owners of the land by reason te construction of the proposed improve- [illegible] nted on all the land occupied by the s and lying between the levees and the channel.

provide for the interior drainage, open es must be dug to collect the water, and es must be provided to discharge it [illegible] considered in the estimate of the [illegible] the liberal allowance of $1 per acre ll the land protected by the levees has made for their construction. As many hese drainage ditches will be of special fit to the land through which they pass, owners thereof should contribute a large of the cost of their construction. No amount has been estimated for [illegible] een the levees, as the value of the posts, cordwood, and mine props which be thus secured will pay a large portion his expense. The ideal condition would have all logs, brush, and overhanging removed from the land between the s and to have all branches hanging below [illegible] trees. This will increase the carry- ity of the river and is a necessary [illegible]

further improve the channel certain s, bars, and fallen trees should be re- ed. To do this a snag boat must be em- ed. From an inspection of the stream it ed that such a boat would make an rogress of 500 ft. per day at a cost for operating expenses. This is to a rate of 4 cents a foot or 0 a mile, and on this basis an item ncluded in the detailed estimate of cost each section of the river.

the estimates of cost nothing is allowed expenses of administration and organiza- legal expenses, or engineering expenses. amounts which will be necessary for e purposes are uncertain and will depend ely upon the procedure to be followed in ying out the work.

he total length of new levees recommend- is approximately 398 miles, costing about [illegible] It is proposed to enlarge some 35 old levees at a cost of about $63,000. roximately 15,800 acres will be required the right of way for the levees and for [illegible]

The cost of clearing obstructions from miles of river channel is estimated at ,000. The amount of land to be protected m floods by these proposed improvements 161,800 acres, for which $1 per acre is al- [illegible]

The cost [illegible] recommended to [illegible] included in the estimate [illegible] course it will [illegible] levees with whatever value they may have in [illegible] of work; such credits will go to reduce the assessments which their owners would otherwise be expected to pay for the construction of the work. Hence, to arrive at a fair esti- [illegible] work per acre of land benefited, it is necessary to make a new estimate of what the work would cost if the whole length of levees were to be entirely new construction. Under such a condition the total estimated cost would be $1,703,000, or $10.52 per acre.

[illegible] discussion of the several problems which have presented themselves in the course of the critical examination of the Neosho River, made for the purpose of devising a plan for the protection and reclamation of its bottom land, indicates that the project is one of more than usual magnitude and importance. The data secured and the various physical conditions observed during the field investigations have been given due weight in formulating the plan recommended. A review of the entire subject under consideration will now be useful in pointing out the relation of engineering, agricultural, industrial, and economic features of the proposition, all of which merit critical inspection before any plan of extensive improvement be adopted.

It is seen that 161,800 acres of land will be directly affected by the plans proposed, which if carried out will cost in round numbers $1,703,000, or an average of $10.52 an acre if the entire cost is assessed against the land. The plan upon which this estimate is made consists of:

(1) The removal of obstructions of all [illegible] channels.

(2) Substantial levees on each side of the channel of the river 900 ft. apart on the lower section, and return levees on each side of the channels of the larger tributaries.

(3) The removal of all brush and trees from land lying between levees.

(4) Interior drainage by means of ditches with outlets through the levees into the channels by means of sluice gates.

(5) Cutting a few bends, where found practicable, in the upper section of the river.

The data required for determining the height of levees and the width of waterway between them are unsatisfactory in many respects. The run off of the Neosho River after the banks are full has not been determined with any degree of accuracy. The specifications for these two important factors of the flood channel have been made after ascertaining the amount discharged by other streams whose flood flow has been measured quite accurately, and whose watershed is similar to that of the Neosho Basin. The ratio of the run-off of the two basins has then been taken as proportional to the rainfall which produces the floods of the respective districts. In dealing with problems dependent upon rainfall and climatic changes, a liberal margin should be allowed to meet conditions which can not be foreseen. The channel provided will discharge 9,000 cu. ft. per second more than has been deduced by this method of computation. It should be observed in this connection that an improved channel will, in some degree, prevent the congestion of water and lengthen the time during which a given volume must be discharged by starting the flow sooner than would be the case were the channel unimproved. These well-recognized facts of any improvement of water courses furnish an additional factor of safety from the overtopping of the levees.

The benefits accruing to land from adequate protection from overflow are not limited to its use for agriculture. All property beneficially affected by the improvements is subject to special assessment for a portion of the cost, be it highways, railroads, or other property, provided a specific benefit is conferred. With reference to public highways, it should be observed that certain changes in construction will be required if the proposed levee system is built. The plans require than an unobstructed channel be maintained between the levees. The approaches to all highway bridges crossing the streams must be made of trestlework extending the entire distance between the bridge and the levees on either side, and should have as few bents as practicable. Railroad bridges and their approaches will be subject to the same requirement. With this exception, highways crossing the valley may be built and maintained with less expense than under the present arrangement, and will be greatly benefited by the reclamation.

The portion of the cost of the work chargeable to properties other than agricultural lands can not be estimated closely until an examination with reference to this matter has been made in greater detail, but it may be safe to estimate this at 10 per cent of the entire cost of the improvements recommended. Since much the larger part of the cost of drainage will fall upon the land it benefits for agricultural use, the effect upon such property should be quite fully investigated. Lands subject to overflow are valued at about $15 an acre. Could these lands be guaranteed against occasional overflows, and the losses occasioned by them, it is stated that their market value would easily be $60 an acre, based upon their ability to produce a good yield of staple crops each year. This has been given as a conservative estimate by owners of the land in the valley, and if correct shows a possible increase of $45 per acre in value which will result from drainage. In considering this question it will be only business prudence to also take into account the fact that land values fluctuate from various causes. There may be a drop in prices of agricultural products or the crops grown may, on account of climatic or other reasons, be light in yield or poor in quality. Financial depressions may prevail at times, causing a depreciation of all classes of property. All of these affect farm values of even the most productive land, as shown by statistics covering the subject in this country and also in Europe. It is possible that land now worth $60 an acre may depreciate to $40 within ten years. Yet restricting the margin of profit in this way, there seems to be little chance of loss in reclaiming the land should it cost even $20 an acre. The estimated damage to property in 1903 and 1904 was greatly in excess of the estimated cost of the proposed system of protection and drainage.

The plans proposed do not hold out the hope of cheap drainage, but of profitable drainage. It is quite possible that the cost to landowners will be greater than the estimate, rather than less, since the history of reclamation projects of this character and magnitude shows that various contingencies not provided for in the estimates will arise which may increase the final cost.

The fact that the construction of the entire work by one management is recommended does not preclude the prosecution of the work as individual units by districts under special organizations if such a method should commend itself to the landowners. The carrying out of the first part of the plan recommended, namely, cleaning out all obstructions from the bottom and sides of the channel of the river, will abundantly pay the cost of the work by diminishing the frequency and height of the floods. Should no more than this be done it would be a wise step toward the execution of the entire plan. The history of such improvements emphasizes the wisdom of starting the work correctly and persistently prosecuting it along right lines until it is completed in a thorough and permanent manner.

GENERAL ARTICLES AND CLASSIFIED ITEMS

Standard Designs in Concrete Track Structures, Baltimore and Ohio Railway.

The Baltimore & Ohio R. R. Co. does not use reinforced concrete for arches, abutments or culverts, but it does use reinforcing in concrete work of this character to prevent temperature cracks, sufficient concrete being placed in all cases to withstand the load strain which may come upon it. Illustrated herewith are standard plans for concrete metal bridges, concrete abutments, concrete headwalls for iron pipe culverts, rail top culverts and for a 30-ft. arch.

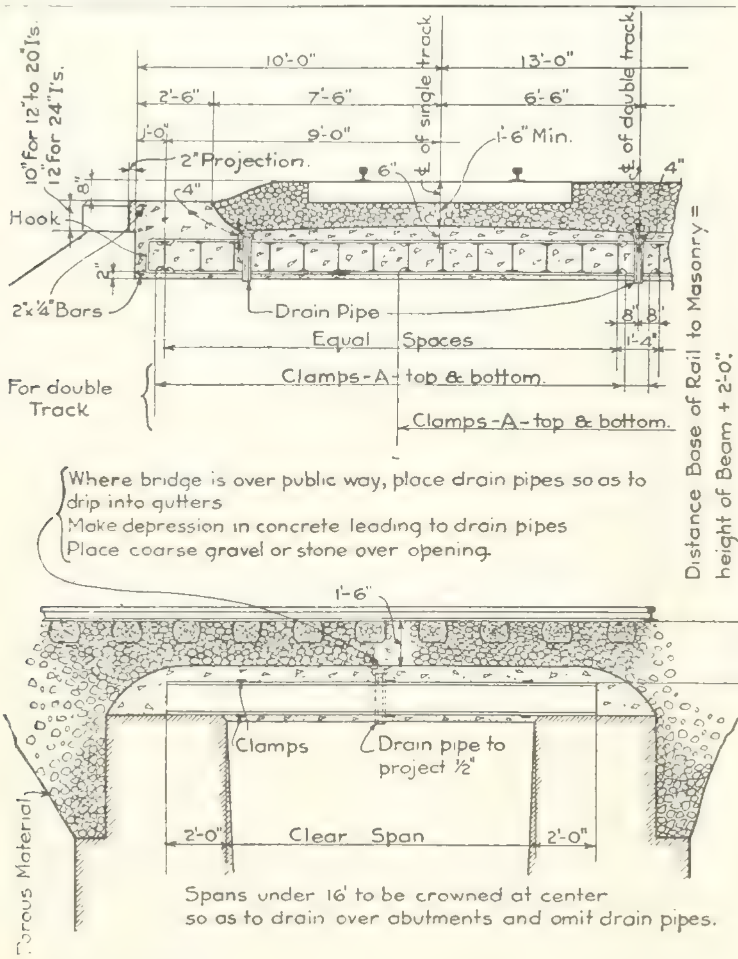


Fig. 1—Standard Concrete Metal Bridges, B. & O. R. R.

The concrete metal bridge is designed for spans of 10 ft. to 26 ft. It consists of a series of I-beams laid longitudinally between abutments and encased in concrete 2 ins. below and 6 ins. above the steel. The top surface of the concrete is rounded for drainage toward the sides and depressions are made at the sides leading to the drain pipes which consist of 3-in. terra cotta pipe. The top surface of the concrete is waterproofed with an improved compound. Following are tables I and II giving quantities. The costs are estimated as follows: I-beams, 2 cts. per pound; concrete, $6.50 per cubic yard; erection, $30; ballast and ties, 80 cts. per foot of track.

Figure 2 shows the plans for standard concrete abutments. When rock can be used for supporting the structure it is leveled or is excavated into until a good foundation is secured. Where the rock foundation is not continuous or uniform in character concrete of proper thickness and area is used.

The standard design for concrete headwalls for iron pipe culverts is shown in Fig. 3. Table III gives the dimensions to correspond with the letters on the drawing. The dimensions vary with the diameter of the pipe, which is from 12 to 60 ins.

TABLE I.—MATERIAL FOR SINGLE TRAC BRIDGES SHOWN IN FIG. 1.

	I-Beams				Quantities		
Max. clear span. Ins.	No.	Size. Ins.	Weight per ft.	Length Ft.	Lin. ft. of iron for h'ks and cl'p's.	Metal. Lbs.	Concrete.
10	15	12	31.5	14	18 bars 16'	7,100	
12	17	12	31.5	16	20 bars 16'	9,100	
16	17	15	42	20	21 bars 16'	14,850	
20	17	18	55	24	23 bars 16'	23,050	
22	16	20	65	26	24 bars 16'	27,700	
26	15	24	80	30	26 bars 16'	36,700	

TABLE II.—ADDITIONAL QUANTITIES FO EACH ADDITIONAL TRACK.

	I-Beams				Quantities		
Max. clear span Ins.	No.	Size. Ins.	Weight per ft.	Length. Ft	Lin. ft. of iron for h'ks and cl'p's.	Metal. Lbs	Concrete
10	9	12	31.5	14	6 bars 16'	4,150	
12	11	12	31.5	16	6 bars 16'	5,800	
16	11	15	42	20	6 bars 16'	9,400	
20	11	18	55	24	6 bars 16'	14,700	
22	10	20	65	26	6 bars 16'	17,100	
26	9	24	80	30	6 bars 16'	21,800	

TABLE III.—DIMENSIONS OF HEADWALLS.

A	B		C		D		E		F		G		H		J	K		L	M	N
Inside diameter of pipe.	Length of headwall under coping.		Length of coping over all.		Length of foundation.		Height of wall under coping.		Width of wall under coping.		Width of wall at neat line.		Width of foundation.		Thickness of coping	Depth of foundation.		Contents of headwall in cu. ft.	Contents of headwall and coping in cu. ft.	Contents of foundation in cu. ft.
ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ft.	ins.	ins.	ft.	ins.			
12	6	3	6	9	7	3	2	3	2	6	3	4	4	4	12	2	0	38.12	54.99	62.
18	8	3	8	9	9	3	2	9	2	6	3	6	4	6	12	2	0	61.73	83.60	83.
24	10	3	10	9	11	3	3	3	2	6	3	8	4	8	12	2	0	92.35	119.22	105.
30	12	3	12	9	13	3	3	9	2	6	3	10	4	10	12	2	0	127.75	159.62	128.
36	14	3	14	9	15	3	4	3	2	6	4	0	5	0	12	2	0	170.45	207.32	[illegible]
40	15	3	16	1	16	7	4	7	2	6	4	1	5	1	12	2	0	201.71	241.92	168.
42	16	3	16	9	17	3	4	9	2	6	4	2	5	2	12	2	0	220.76	262.63	178.
48	18	3	18	9	19	3	5	3	2	6	4	4	5	4	12	2	6	277.38	324.25	256.
54	20	3	20	9	21	3	6	3	2	6	4	6	5	6	12	3	0	378.77	430.64	350.
60	22	3	22	9	23	3	7	0	2	6	4	8	6	0	12	3	0	476.98	533.85	418.

The rail top culvert is illustrated by Fig. 4. Rails of 60, 70 or 80 lbs. per yard are used and the spans of the culverts are from 5 to 10 ft. The rails are cut about 3 ft. longer than the span and distributed over the abutments as shown. The rails used are usually old ones without further defect than wear. In erecting the bridge where traffic must be maintained the bridge is erected complete on the outside of the track and allowed to stand for 30 days until thoroughly hardened and is then slid into place on the abutments and grouted to secure an even bearing. The abutments for these culverts are taken from the standard plans for abutments. In calculating the costs of the rail top culverts the following figures are used: Rails f. o. b., 1½ cts. per pound; cutting and placing, ½ ct. per pound; concrete materials, $4.00 per cubic yard; cor crete labor, $2.50 per cubic yard; roadbed ma terials, 60 cts., and roadbed labor, 20 cts. pe foot of track; erection, $30 per track. Tabl IV shows the number of rails required fo different spans.

TABLE IV.—NUMBER OF RAILS REQUIREI

Clear span.	60 lbs. per yd.		70 lbs. per yd.		80 lbs. per yd.	
	Total		Total		Total	
Ft	S.T.	D.T	S.T.	D.T.	S.T.	D.
5	30	50	24	40	22	
6	34	56	28	46	24	
7	..	..	32	54	26	
8	..	..	38	64	32	
9	..	..	..	..	38	
10	..	..	..	..	44	

The standard plans of structures of the B & O. R. R. Co. are reduced in zinc etchings t fit a page 8x10 ins. and are bound in a book The cost of making a large number of suc books is also less than for blueprints.

Methods of Increasing the Econom of Operation in Small Pumping and Power Plants.*

Economy in the production of power i small and medium sized plants is not give the same thought as in the larger plants. Th is not always due to the fact that the equip ment is not high grade, but is often due t numerous losses which can be attributed mair ly to inattention or lack of knowledge of th all details which, considered as a whole, are portant.

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*Abstract of paper by Chas. Brossman, Cor sulting Engineer, Indianapolis, Ind., before th Indiana Engineering Society.

n only a very small percentage of pump- and power plants is there any reliable eck on what they are producing and the cost reof. Coal is purchased from the lowest der and perhaps some rough check is made to the amount of water pumped, but in few nts is it known with any certainty whether not the component parts of the plant are ch doing their share in an efficient manner. one visits a plant five or ten years after its tallation he often will find that the original cient operation has not been maintained ough operating conditions apparently are same.

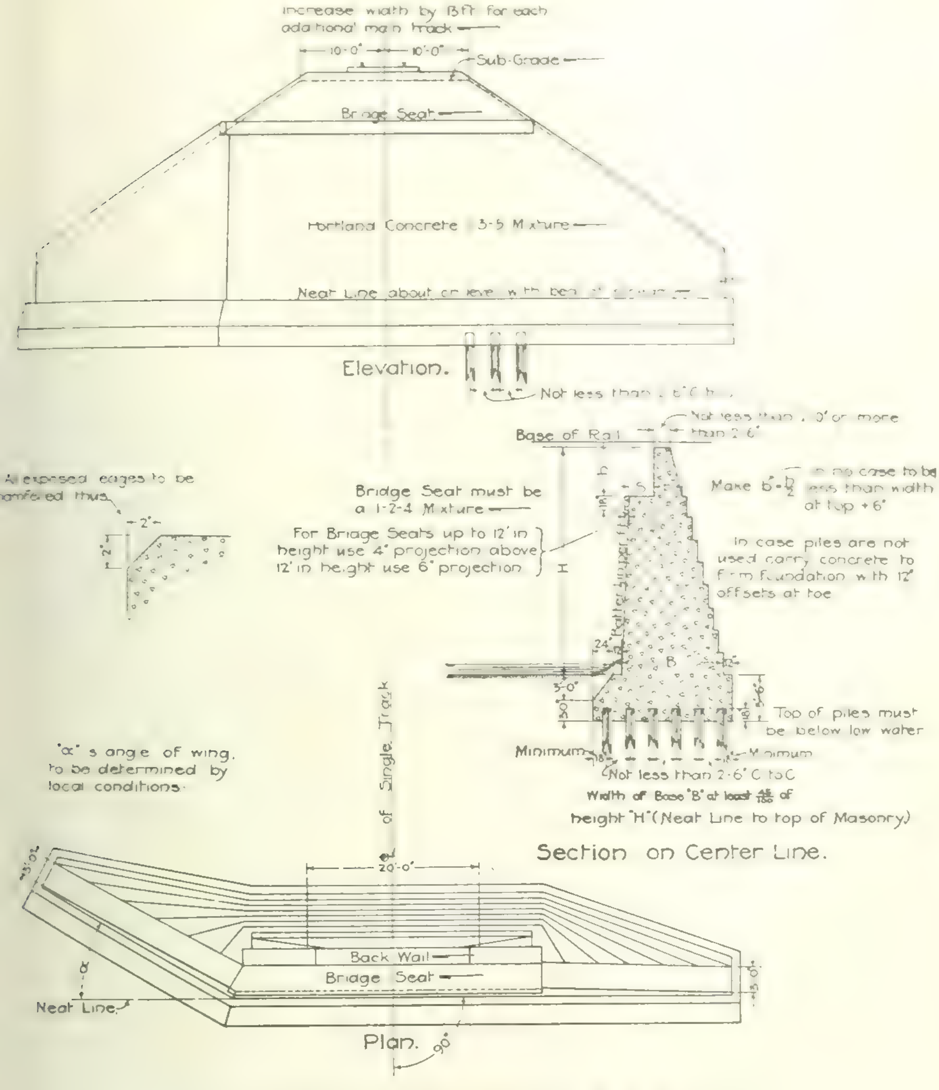
Increase width by 13 Ft for each additional main track
10'-0"
10'-0"
Sub-Grade
Bridge Seat
Portland Concrete 3-5 Mixture
Neat Line about on level with bed of stream
Elevation.
Not less than 2'-6" C to C
Not less than 2'-0" or more than 2'-6"
Base of Rail
All exposed edges to be chamfered thus
2"
2"
Bridge Seat must be a 1-2-4 Mixture
For Bridge Seats up to 12' in height use 4" projection above 12' in height use 6" projection
h
S
18"
Batter 1 in 12
H
Make b = h/2 in no case to be less than width at top + 6"
In case piles are not used carry concrete to firm foundation with 12" offsets at toe
24"
B
12"
3'-0"
30"
18"
5'-6"
Top of piles must be below low water
Minimum
18"
Minimum
Not less than 2'-6" C to C
Width of Base "B" at least 45/100 of height "H" (Neat Line to top of Masonry)
Section on Center Line.
"α" is angle of wing, to be determined by local conditions.
of Single Track
20'-0"
3'-0"
Back Wall
Bridge Seat
3'-0"
α
Neat Line
Plan.
90°

Fig. 2—Standard Concrete Abutment, B. & O. R. R.

Considering the boiler room first, a definite mber of pounds of water should be evapoted per pound of coal for the grade of coal ed under the existing conditions. Both the al and water should be measured or weighed curately. It is best to weigh the coal been the bins and the boilers, as with the ales so placed the amount of coal can always be found without referring to the ount in the bin.

The device for measuring the water should installed between the feed pump and boiler order that all water entering the boiler can accounted for. If open feed water heaters used the device should be of such type d be so installed that it can be placed been the heater and boilers, otherwise the ndensed exhaust will not be accounted for.

With means provided for weighing water d coal the evaporation of a certain coal ll be known under proper conditions of opation such as clean boilers and flues, proper aft, etc. Should the evaporation drop from lbs. of water per pound of coal to 7 lbs., r example, with the same grade of fuel, trouble is indicated—either the coal is not up to standard, the boilers are scaled, the tubes sooted up, or some other trouble is indicated which can be found. The great loss in small plants is that such troubles do develop but remain unknown, and steps are not taken to find and remove the cause of the trouble. If the coal bills increase from 10 to 25 per cent as the plant grows older the increase usually is attributed to increased consumption of water or power. However, the increase often is due to some trouble easily remedied.

Many boilers are not set properly and in a few years they are full of cracks and fissures through which the air is drawn and the draft reduced. Many are not operated with the minimum amount of scale. In other boilers the tubes are not kept clean. The accumulation of scale ⅛ in. thick will make a difference of from 15 to 18 per cent in the cost of evaporation. The accumulation of soot and the drop in draft add still more to the fuel cost.

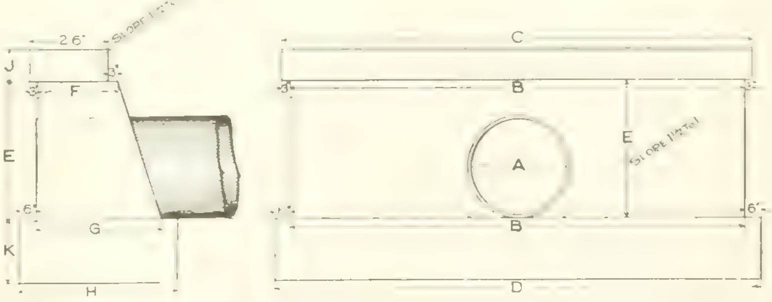

Fig. 3—Standard Concrete Headwalls for Iron Pipe Culverts, B. & O. R. R.

The draught of the boiler often is sadly neglected and is of great importance as a factor in economical steam production. In any case the draught should be sufficient for the finest coal and the thickest fire that is likely to be used. There is considerable loss in many plants due to the settings of boilers being cracked, due to the settlement of foundations or through deterioration. All cracks admitting air should be repointed and small hair cracks should be given a coat of thin paint or whitewash. All cracks around iron work and in the breeching should be stopped up. The writer has seen cracks in boiler settings into which the fingers of one hand easily could be inserted, and before which a lighted match would be snuffed out, doors in breeching with ½ in. openings, and cast iron clean-out doors in settings with large pieces cracked out. Such cracks after being properly stopped have made a marked difference in operation.

Advantage is usually although not always taken of utilizing the waste heat of the steam from the main engine or auxiliary units in heating the feed water. In a noncondensing plant the main exhaust usually can be connected to the heater. When a condensing plant is installed the steam from the air and feed pumps or other auxiliaries may be diverted to the feed water heater. With an open heater about ⅙ of the exhaust steam from the main engine will heat all the water from about 50° to a temperature near the boiling point. Where condensers are used it often is advisable to place a closed heater in the exhaust line between engine and condenser discharging the feed water through this into an open heater into which the auxiliaries exhaust.

The feed water heater whether of closed or open type should be attended properly and cleaned at proper intervals. The writer has seen closed heaters so clogged in the water space that nothing but a thin stream could trickle through. When closed heaters are installed in connection with vacuum systems they should be arranged with a by-pass.

It is surprising that more advantage is not taken of the use of superheated steam in pumping plants where the long stroke and slow speed make it especially suited to increased economy. Superheated steam will give a greater amount of work than that due to the extra cost of coal required to produce it. It approaches more closely the law of a perfect gas than does saturated steam, and the extra degrees of superheat are given up in the steam line, cylinders, and other condensing surfaces, delivering steam to the pump or engine in a dryer and more effective condition.

In ordinary engine apparatus the total heat of the steam can be up to approximately 500° which if steam pressure of 150 lbs. is used would mean about 135° of superheat. As higher temperatures are used, care must be observed regarding materials of construction in engines, valves, etc. In practice dry steam can be given to the point of cut-off, doing away with the initial condensation, and this by using only a moderate amount of superheat.

On steam pumps of long and slow strokes the saving will be more marked owing to the greater condensation occurring. Ordinarily the efficiency of pumps can be increased from 5 per cent to 25 per cent by the use of super-

[illegible] with large high duty triple expansion engines a saving of 12 per cent in steam has been recorded. For purposes of comparison it may be stated that the saving by using superheated over saturated steam will be approximately as follows for 100° superheat: For simple engine about 15 per cent and above; for compound engine about 14 per cent; for triple expansion engine about 12 per cent; for steam turbine engine about 10 per cent.

It is not the intent of the writer to make the statement that all the faults herein enumerated are to be found in most plants, but from personal observation of a large number of municipal and private plants it is found that advantage is not taken of the various means of producing power cheaply. The poor economy, to a large measure, may be attributed to the lack of a proper checking and accounting system of reports, and the proper utilization of available accessories which contribute to efficient operation.

No man conducting a business would hand over large sums of money to his cashier without knowing how the money was expended. He would insist on knowing what was paid for rent, for labor, for merchandise of this kind and that, and what his profit was on this material and that material. Now consider the average plant of medium size. Usually the cost of operation in round figures is all that is known. Often not even a check is made in a pumping plant as to revolutions of pump. How many pumping or power plants know each day the amount of water pumped, the pounds of coal consumed, the cost to evaporate 1,000 gals. of water in the boiler plant, or whether or not the coal is doing the same or only one-half the work it did in the preceding month? Contracts are entered into for coal for thousands of dollars per year and yet no effort is made to determine whether or not 25 per cent of the material is worthless as fuel as compared to the sample car received. Again the coal may be all right but the plant may have reached such a condition that 25 per cent more fuel is required to operate it than at the outset. Such losses usually can be avoided either by a close inspection and the necessary tests at suitable intervals, or by a system of daily records showing just what is being done each day, and then by the proper interpretation of such records. In this the personal factor is an important element. The attention to the innumerable details of the plant which require intelligent and constant attention cannot be slighted if the plant is to be operated satisfactorily. The superintendent cannot do all this but the operating engineer directly in charge should be held directly responsible for his part. He should take and turn in records of operation and keep the plant in proper condition, and should be held directly responsible after proper instruction.

The writer has seen condensers which have not been touched for six or eight years; plants in otherwise good shape but without a vestige of any steam pipe covering or high pressure steam lines; crank and fly-wheel machines, in pumping plants, and engines that are not indicated once in three or four years. In one plant the writer was called in and found a large Corliss engine where the steam was blowing through the exhaust. The load could not be carried at all. The engine was indicated and it was found that the valve had been repaired in a local shop and placed wrong.

Any plant, however good at the start, cannot be operated economically without constant and intelligent supervision, and in many plants this lesson is being learned. In plants of public institutions this could be accomplished by employing a competent supervising engineer to pass on both design and methods of operation. County and state institutions should have a permanent or available consultant to advise on such questions. Large cities having a number of city plants could well afford to do this. The state could save thousands of dollars each year, not only by installing equipment that was especially suited to conditions, but in buying supplies and getting what was best suited, and in keeping plants in proper condition after installation.

The boiler end of the plant is not usually considered important in small and medium-sized plants; hence many losses are found at this end. The smoke question touches very largely the question of economy in boiler plants. In the small town or the isolated plant the aesthetic side of this question need not be considered, but in the large cities it is of importance. However, as smoke and dollars usually are close companions the subject is here touched upon.

Legislation may minimize the smoke but the results ultimately to be desired can never be attained without looking at the question as one of dollars and cents. The problem is not easy, especially when the industries of a locality are so much dependent on soft coal as a fuel. In the first place there is no such thing as a commercial smoke consumer, despite the fact of inventions and statements to that effect. Smoke cannot be commercially consumed although it may be disguised or treated in such a manner that it has a less formidable appearance to the aesthetic eye.

The only way to consume smoke commercially is not to make it, and engineers who have studied the problem recognize this as the first commandment in the smoke question. No doubt smokeless combustion will come about but it will not be general until the plant owner recognizes that he is wasting money when he is producing smoke.

The common method of purchasing a boiler, building a brick wall under it, and placing a low smoke stack above it, all without regard to the ordinary principles of combustion, is the cause of great annual loss. The principles of combustion are not mysterious, hence neither is the prevention of smoke.

To secure perfect combustion it is necessary that all the products of combustion be consumed before touching the cold surfaces of the boiler. To do this requires good draft which means a high stack if natural draft is used. It means a properly designed furnace that is not too cramped to allow perfect combustion of the gases before the comparatively cold boiler surfaces are reached with proper handling of fuel whether mechanical devices or by hand. It means the boiler be properly set up so that in year's time the settings are not full of cra or crevices which admit air. Air so admi kills the draft and contributes to the in ciency of the furnace both as regards sm prevention and economy of combustion. W these essentials are carried out the sm problem is solved.

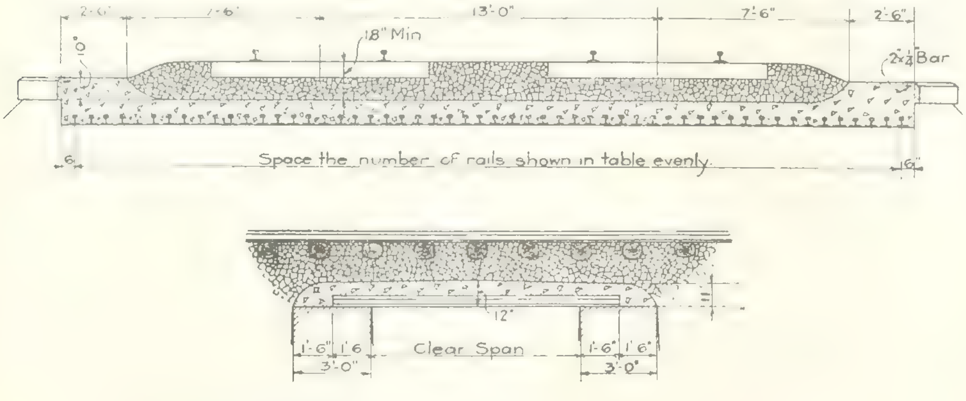

Fig. 4—Standard Rail Top Culverts, B. & O. R. R.

Civil Engineering Society Meeting

Western Cement Show.—Coliseum, Chica Feb. 21-28.

National Paving Brick Manufacturers' As ciation.—Will P. Blair, 826 Engineers' B Cleveland, O., Sec'y. Annual meeting Chic March 5.

Illinois Water Supply Association.—Edw Bartow, Urbana, Sec'y. Annual meeting at bana, March 5-6.

Canadian Mining Institute.—Annual meet Toronto, March 6-8.

National Brick Manufacturers' Associatio– T. A. Randall, Indianapolis, Ind., Sec'y. Ann convention at Chicago, March 6-5.

International Brick and Clay Products Ex sition. First annual meeting, Coliseum, cago, March 7-12.

National Association of Cement Users.—E E. Krause, Harrison Bldg., Philadelphia, Se Annual convention at Kansas City, Mo., Ma 11-16.

Kansas City Cement Show.—Convention H Kansas City, Mo., March 14-21.

National Railway Appliances Association.– A. Crandall, Ellsworth Bldg., Chicago, Se Annual meeting at Chicago, March 18-23.

American Railway Engineering Associatio E. H. Fritch, 962 Monadnock Blk., Chica Sec'y. Annual meeting at Chicago, March 19

American Society for Testing Materials.— Edgar Marburg, Univ. of Penn., Philadelp Sec'y. Annual meeting at New York C March 28-29.

National Drainage Congress. Annual meet at New Orleans, La., April 10-13.

PERSONALS.

Mr. Griggs Car has been appointed Super tendent of Streets of Phoenix, Ariz.

Mr. James W. Barrett has been appoin Superintendent of Waterworks at Portsmou N. H.

Mr. Lewis Kingsman, Office Engineer of tional Railways of Mexico, at Mexico City, di on February 27.

Mr. C. L. James of Mattoon, Ill., has b appointed City Engineer of Oakland, Ill., by City Council of that place.

Mr. Guy Stone of Visalia, Cal., has secured appointment with the engineeing crews of State Highway Commission.

Mr. W. B. Gatewood has been appointed vision Engineer of the Chicago Division of Chesapeake & Ohio Ry. at Peru, Ind.

Mr. James E. Parker, formerly City Engin of Portsmouth, N. H., has resigned to eng in engineering and contracting in Boston.

Mr. Geo. H. Herrold, who has been enga in private practice in St. Paul, Minn., has appointed Assistant City Engineer of that

Mr. Watson C. Mobley, an engineer who fo number of years was engaged in railroad w in the neighborhood of Pittsburg, died on F ruary 1.

Mr. George Ridgeway has been appoin County Highway Engineer of Boone Coun Mo. He was formerly connected with the M souri Pacific Ry.

Mr. Nelson P. Lewis, M. Am. Soc. C. E., Cl Engineer, Board of Estimate and Apporti ment, New York City, on February 19th del ered a lecture on "Design of Highways and S tems of Highways" before the Graduate S dents in Highway Engineering at Columbia U versity.

Mr. Charles W. Reinhardt, for twenty-t years Chief Draftsman for Engineering Ne has severed his connection with that publi tion and has opened a general drafting office 150 Liberty street, New York City. Mr. Re hardt will do general tracing, map work a free hand sketching, making a specialty of lettering and the preparation of drawings photo-engraving. He will also supervise engravers' work as well as prepare illustrati for trade catalogs, books and general publi tions.

Mr. John Herron, Consulting Mining En neer of San Francisco, was accidentally kil by falling timbers while coming up the sh of the Tom Boy Mine at Telluride, Colo., Feb. Mr. Herron was formerly engaged railway work and in 1887 was under Mr. Jo F. Wallace on the Illinois Central. He went the Tom Boy properties about 1888, but the past seven or eight years has been acti only in an advisory capacity for the Engl syndicate owning these properties. He is su vived by his wife, two daughters and a son.

CONTRACT NEWS SECTION

of

ENGINEERING & CONTRACTING

Doings of the Week.

[illegible] railroad construction con[illegible] the near future. One piece construction of much interest is the Grand nk Ry.'s new line from Palmer, Mass., to [illegible] re opened yesterday. This marks the be ning of the extensive plans for new con[illegible] for New England. Another piece of work interest is the completion of double track- of the Erie R. R. It is believed that bids this work will be taken soon. Of the new cks, 120 miles will be laid on the Chicago Erie division, which extends from Marion, to a point near Hammond, Ind., and 120 es will be laid elsewhere.

mong the railroad construction contracts recently are the following: Morey-Faul er Construction Co., Chemical Bldg., St. uis, Mo., for building a 5-mile extension of Houston & Texas Central R. R., from ldwell, Tex.; Westinghouse, Church, Kerr Co., Pittsburg, Pa., for building additional ps for the Canadian Pacific Ry. Co. at Cal- y, Alberta, to cost $2,750,000; J. G. Har- ive & Co., Ltd., Winnipeg, Man., for ex- ation and embankment for the new branch [illegible] Canadian Pacific Ry. from Suffield, erta; Foley, Welch & Stewart, St. Paul, nn., for the construction of 100 miles of Weyburn-Wellbridge extension of the nadian Pacific Ry.; the Callahan Construc- n Co., Empire Bldg., Knoxville, Tenn., for miles of work for the Lewisburg & North- line of the Louisville & Nashville R. R., work being located near the state line of maba and extending north into Tennessee; L. Tribble, Spokane, Wash., for construct- a 6-mile extension of the Yakima Valley ansportation Co.'s line from North Yakima, ish., the contract amounting to about $300,- and including a steel bridge on concrete ndations; Scott & Sons, Times Bldg., St. uis, Mo., for constructing a 10-mile spur m the Illinois Central R. R., from Bloom- ton, Ind., into the Bloomington stone belt r Harrodsburg; Nelson Bennet, Tacoma, ish., sub-contract from Porter Bros., Port- d, Ore., for constructing a 4,500 ft. tunnel the new Point Defiance line of the North- Pacific; the following secured sub-con- cts on the 30-mile extension of the Clinton, lahoma & Western extension from Butler, which Maney Bros., 126½ West Main st., lahoma City, have the general contract: klin Bros., Frank L. Adams, Matt Cunyon, L. Hale, Ben Sweeney and Pat Gleason, all Oklahoma City.

he chief item of interest of the past few s in the way of irrigation work is the rding of several contracts for the South Joaquin Irrigation District in California. Utah Construction Co., Ogden, Utah, se- ed contracts amounting to $658,128 and in- ding about 2¾ miles of extremely heavy -hill rock excavation in the Stanislaus er canyon and two 1,000 ft. tunnels; also ew 2,940 ft. tunnel, with about 2,000 ft. of roaches. T K. Beard, Modesta, Cal., se- ed two contracts aggregating about $507,- and C. F. McCarthy of the Pacific Con- ction Co., San Francisco, secured one con-

he Government River and Harbor bill for current fiscal year has been completed in congressional committee. It carries a gen- [illegible] of $[illegible] [illegible] of $5,950,000 is carried in the bill for the Mississippi River. Of this amount the stretch of the river between St. Louis and Cairo is allotted $1,000,000. For the upper Mississippi River permanent improvements the bill provides $1,250,000. For the general improvement of the Mississippi below Cairo the committee has allowed $3,500,000. In addition to the $800,000 carried in the bill for the Missouri below Kansas City the committee provides $150,000 for the upper stretches.

In the way of drainage work the two largest contracts which appear to have been advertised recently are the ones for the Dead Timber Drainage District No. 13 of Osceola, Ark., and for the Commissioners of Drainage of Sunflower County, Miss. The latter work calls for digging about 22 miles of open ditches, requiring about 800,000 cu. yds. of excavation. The Dead Timber drainage work calls for 1,665,000 cu. yds. of excavation and eight bridges.

Bids are now being asked by the city of Pasadena, Cal., for a large reinforced concrete bridge. This bridge will be 1,460 ft. long, with a 28 ft. roadway and two 5 ft. sidewalks and is estimated to cost $185,000.

Surveys for the State Barge Canal terminal at Albany, N. Y., have been completed and plans are now being prepared. It is possible that these plans will be approved by the Canal Board in March, after which bids for construction work will be asked. John A. O'Connor, Albany, N. Y., is Engineer in charge of the Barge Canal terminal work.

Highway Construction Prospects.

Last year there were more [illegible] highways constructed throughout the country than in any previous year; the work for the current year promises to far exceed the record of 1911 The state of California, which last year voted $18,000,000 of bonds for improved roads, has been busy with the preliminary work, and is now about ready to begin actual construction. Pennsylvania intends to construct 300 miles of road this year; in addition the citizens of the state will probably vote on a plan for giving the highway department $50,000,000 for good roads purposes. The present plans call for linking the county seats, the building of 40 miles in Pike County, the construction of roads through the northern tier of counties and work in Susquehanna County. The $50,000,000 figure seems to be popular with good roads advocates. The Ohio Constitutional convention on Feb. 20 adopted an amendment to the state constitution which permits the legislature to issue bonds in the sum of $50,000,000 for state aid in the construction of inter county roads. In New York state a plan is on foot for another $50,000,000 loan for highway purposes. This state some years ago voted $50,000,000 of bonds for road work, and a large part of this has been expended already. Quite a bit of it remains, however, and a considerable amount of work will be let this spring. Texas, the state of "magnificent distances," is constructing its improved highways by the county system. In many cases the counties are as large as ordinary states and consequently are split up into road districts, each of which votes on bond issue for road construction in the district. In 1911 a total of $8,915,000 of bonds was voted by 49 counties in the state. Of this total $4,550,000 was voted by 10 counties, Tarrant County leading with $1,-[illegible] next with $500,000 each. The amount of the bond issues voted last year was twice as great as that of the previous year. In Massachusetts, Governor Foss has recommended to the state legislature that a special appropriation of $5,000,000 be voted for new highways. In this connection it is interesting to note that the governor in his message recommending the appropriation urges that a revised schedule of motor car fees be considered at once, at an average of not less than 80 cts. nor more than $1 per horse power and that the fees be utilized in full to meet the expense of maintaining highways. The present fees assessed on automobile owners in Massachusetts are at the average rate of 30 cts. per horse power. As there are 40,000 automobiles in the state aggregating about 1,000,000 H. P. at $1 per horse power, the sum realized would be $1,000,000 which is stated to be about the cost of maintaining the present state highways and parkways. Six states only have been mentioned, but in all the other states every indication points to greatly increased expenditures for the present year for highway work.

Civil Service and Politics.

The civil service method of selecting municipal employes is all right in theory, but sometime when it goes [illegible] gets a swift kick in the slats. Here is an example. The Civil Service Commission of a certain large eastern city held a civil service examination for a position in the street department. Among the papers turned in was the following:

"Question No. [illegible] [illegible] in the department's specifications and regulations?

[illegible] the concrete base or asphalt paving?

"b. As to what materials should enter into a concrete base, and their proportions?

"c. What when the concrete base is being laid?

Answer, verbatim:

"2 I wood [illegible] that the Contractor Following out is Specifications and Regulations See that theair is no Soft Spots ore spugey Places on the Base if so have them taking out and Fild in With gravel 6 barrow of stone 3 barrow of Sand one Bag of Cement."

"Question No. 6. Give in detail the method to be observed in laying granite blocks, after the base has been laid."

Answer, verbatim:

"6. Laying granite Blocks a Crosse the Street From Curbet to Curbet in Strate Rose ther Ram with a 55 Pound Rammer 3 times."

"Question No. 4. Street Cleaning Specifications—Mention nine classes of wrok which are under the direction of the Street Cleaning Division of the Bureau of Highways and Street Cleaning? What are they?"

Answer, verbatim:

"4. ice, Snow ases Papers inlet st Cleaned up See that the Drivers takes up the ases Clean that the Drivers take up the Street Dird Clean See that the Drivers Dont Spill any ases on the street."

If one is to judge from the answers to the above questions, it would be concluded that the position to be filled was that of laborer. Instead it was a position carrying a salary of $2,500 per year, and the man, from whose paper the above excerpts are given, secured the place 'He was very active in politics."

RAILWAYS, STEAM AND ELECTRIC

Alabama.

⊙The Callahan Construction Co., Empire Bldg., Knoxville, Tenn., has been awarded a contract for 15 miles of work for the Lewisburg & Northern line of the Louisville & Nashville R. R. The work is located near the State line of Alabama running north into Tennessee. These same contractors were also awarded a 6-mile section near Warrior, Ala., as was noted in our Feb. 14 issue. The work will embrace something like 1,500,000 yds. of material, and comprises some very fine team borrow, cart and car work, together with some highly classified steam shovel work, and about 12,500 yds. of concrete masonry. The work is all very accessible to the railroad. The Callahan Construction Co. is in position to sublet a large amount of this work, and contractors that are interested can address the company at home office at Knoxville, Tenn. Free transportation to outfits over the L. & N. can be obtained.

The second survey for the projected line of the Eufaula & Chattahooche Valley R. R. has been completed and it is believed that bids for the construction of the line to Pittsview will be taken shortly. D. B. McKenzie, Eufaula, Ala., is Engineer.

Bids are reported to have been asked by W. M. Blount, Union Springs, Ala., President of the Birmingham & Southeastern R. R., for the construction of a 20-mile extension.

The Lipsey Valley R. R. Co. has completed surveys and has secured the capital for the construction of a 15-mile railroad southerly from Fayette, Ala. J. P. Daniel, Fayette, Ala., has the construction contract. Lee Baskett, Henderson, Ky., is President and Woodson Hopkins, Henderson, Ky., is Chief Engineer.

Officials of the Queen & Crescent Route are understood to be considering double tracking the Alabama Great Southern R. R. between Birmingham and Meridian.

Alaska.

A bill has been introduced in Congress providing for the creation of an Alaska railroad commission of three members. The commission would be directed to visit Alaska to investigate railroad routes from the seaboard to various coal fields and interior navigable water ways.

Arizona.

The following minor improvements are planned by the Santa Fe system for the state of Arizona: Construction of new freight house, at Seligman, estimated cost $53,000; concrete protection and widening embankment at bridge A 588, Arizona division; extension of passing track at Flagstaff to cost $8,600.

Arkansas.

R. E. Lee Wilson, Memphis, Tenn., President of the Jonesboro, Lake City & Eastern R. R., is reported to have negotiations under way for the purchase of the Blytheville, Leachville & Arkansas Southern R. R. It is stated that this road will be extended from Truman, Ark., to Earl, a distance of 29 miles, to a connection with the Crittenden R. R., which is also to become a part of the Wilson system. The Cairo, Truman & Southern R. R., the incorporation of which was noted in our last issue, is understood to have been formed for the purpose of building this extension. In connection with the extension of the road from Truman, a logging line owned by the Truman Cooperage Co., extending south for 9 miles, will be taken over and practically reconstructed.

California.

Van Sant & Houghton, Hooker & Lent Bldg., San Francisco, have started work on the Santa Fe roundhouse at Riverbank. This is a reinforced concrete structure built according to patented "Unit-Bilt" methods of the Unit Construction Co., St. Louis, for whom Van Sant-Houghton Co. are Pacific Coast representatives.

City Trustees of Glendale have granted a franchise to E. D. Goode for an electric railway line from 4th St. and Brand Blvd. west on 4th St. to Pacific Ave., south on Pacific Ave. to Vine St., west on Vine St. to the westerly city limits of Glendale, near the Glassell winery on San Fernando Road, from which point a private right of way will be secured westerly to Griffith Park, where connection will be made with the proposed municipal railway of Los Angeles.

The Tidewater & Southern Transit Co., which filed its articles of incorporation on Feb. 15, was organized for the purpose of building extensions for the Tidewater & Southern R. R., which were not permissible under the articles of the latter company. It is understood that the two companies will be merged. The Tidewater & Southern is now under construction and the new company proposes to build 172 miles of railroad extending from Turlock to Fresno and touching with branch lines various points in San Joaquin, Stanislaus, Merced and Fresno counties. Of the total amount of capital stock the sum of $189,200 has been subscribed. Stockton is the principal place of business of the incorporation and the following are the stockholders: Karl C. Brueck, J. A. Coley, Byron A. Bearce, J. L. Craig, George S. Schuler, Ward B. Minturn and T. J. Wisecarver, all of Stockton.

The California Air Line R. R. Co. has been incorporated with a capital stock of $20,000,000, of which $450,400 have been subscribed, and proposes to build a railroad to connect Los Angeles and San Francisco. The incorporators are C. Elliott Craig, Glen Behymer and V. L. Gelffrion, Los Angeles attorneys; Ralph S. Twombly, a Pasadena capitalist, and Mrs. Leonora M. Thompson. Press reports quote one of the attorneys as stating that European capital and bankers were supplying the money anl that the line would be built to accommodate the travel which would come to California in the year of the opening of the Panama Canal and the holding of the expositions at San Francisco and San Diego.

The Santa Fe system plans on the following improvements for the state of California: Automatic signals, Needles to Goff, estimated cost $70,000; construction of a 25-stall roundhouse at Barstow to cost $133,000; extension of house track at Wasco to cost $3,000; work on the 1st, 2nd and 3rd districts of Los Angeles division at a cost of $32,000; minor improvements at Minkler, Piedra, Oakhurst and Sheepcamp to cost $19,500.

N. P. Hultberg, Turlock, Cal., a member of the Good Roads Committee, has recommended that the county build a railroad to tap gravel deposits, 55 miles in the Sierras, northeast of Turlock, in order that gravel may be obtained for improvement of highways. The cost of such a railroad would be, it is estimated, about $1,000,000.

Advices from Falls River Mills, Shasta County, Cal., state that surveyors setting grade stakes are moving north toward Klamath Falls, Ore., over a former survey to meet the survey of the Natron cut-off, which is now under construction. It is now reported that the Natron cut-off will be extended from Klamath Falls south through Modoc and Shasta Counties to Anderson on the California and Oregon branch of the Southern Pacific.

Colorado.

Negotiations are understood to have been completed for readjusting the finances of the Denver, Laramie & Norhtwestern R. R., whereby means will be provided for continuing the construction of the railroad from Greeley to Scott this year. W. D. Hodge, Railway Exchange Bldg., Denver, Colo Chief Engineer.

Advices from Manitou, Colo., state Clough & Son, contractors for the new Mountain Incline Ry., are pushing gra work with all possible speed and expec have track laying completed by April 1.

The Colorado-Kansas R. R., which has construction work under way on a mile line from Pueblo northwest will the work completed by April 1 next. struction work was started Dec. 1, 1911, is being done by J. R. Greenlees, F Kelley and C. W. Crews, syndicate mana for the underwriters. Edward F. R Pueblo, Colo., is Chief Engineer and E Wilson, Pekin, Ill., is President.

In order to facilitate traffic in Pueblo Santa Fe system is to rebuild the line o old Denver & Gulf R. R. from Overto First St., Pueblo.

Advices from Meeker state that the field Coal Co. has awarded a contract fo construction of a railroad from Rifle to vey Gap to tap the coal fields at that pla

It is expected that some definite annou ment will be made shortly regarding the tensive betterment work projected for Denver & Rio Grande R. R. J. G. G Chief Engineer, Denver, Colo. It is estin by President Bush that it will require 000,000 in the next three years to plac road in first class condition both as to and equipment. Of this between $5,00 and $7,000,000 will be needed in the cu year to be applied to the double tracking minal, grade reduction and equipment n Between Denver and Salt Lake City co erable double track will be laid, althoug mileage the second track work will cov not yet been determined. Attention w paid to reducing grade, and particularl Soldier Summit, the backbone of the Ro and the chief obstacle to heavy train loa When improvements now in contempl are completed the Rio Grande will have structed a new route around the sum which will lengthen the line about seven but which will give a maximum grade per cent of the western slope and 1% cent of the eastern slope. Improvemen Soldier Summit, which is near Tenn Pass, will cost in the neighborhood of $1 800,000. Standardizing of narrow gage also will come in for attention.

Georgia.

The Rome Railway & Light Co., Ga., has plans under way for an extensi East Rome.

The Seaboard Air Line Ry., W. L. Se Chief Engineer, Portsmouth, Va., is h details prepared for additional terminal ties on Hutchins Island near Savannah, will cost about $100,000.

The Waycross & Western R. R. Co ha been chartered with a capital stock of 50 000 and proposes to build a 72-mile line Waycross to Adel, Ga., where a conn will be made with the Georgia Southe Florida Ry. The incorporators include H. Sessions and E. T. King of Waycros Ga

It is reported that the town of Camilla has completed negotiations with officia the Valdosta, Fort Gaines & Montgome R. for the construction of a line to that The citizens have guaranteed right of wa terminal sites. It is probable that work be started about April 1. Frank Roberts, Valdosta, Ga., is President of the railroad.

Idaho.

A project is under consideration fo construction of an electric railroad Blackfoot to St. Anthony. R, Rounds, Idaho, is interested.

No construction work has been auth for the extension of the Pacific &

✣ indicates work now open for bids.. ⊙ indicates a contract let recently.

ern Ry., from Meadows to Riggins, and not expected that the work will be taken is year. As noted in our Feb. 14 issue n map for the right of way has been with the Government Land Office at

Illinois.

city council of Charleston, Ill., has ed a 50-year light franchise to the Cen- llinois Public Service Co. of Mattoon, n return for which the company is to spur of its city railway to the Coles y Fair Grounds. The council also ex- d the time for completing the electric rom Charleston to Paris until 1914.

Indiana Harbor Belt R. R., O. Gers- Engineer Maintenance of Way, Gibson, County, Ind., has taken title to about res of land at 48th and Aberdeen Sts., go, Ill., and will enlarge its yards.

appropriation of $201,000 has been made Santa Fe system to cover cost of re- g switches, frogs, guard rails, etc., in ction with laying the new 90 lb. steel Valley division.

Chicago & Alton R. R., R. A. Cook, eer in Charge of Track Elevation, Ill., has plans and estimates under way e elevation of its tracks from 22nd St., go. It is probable that the work on this vement will be started some time during ear so that it may be completed soon the other elevation work in Chicago and The latter work is progressing to the action of the officials. The ten blocks vation mentioned above is the last con- g link in the system of elevated tracks gh Chicago and Joliet and marks the eriod of the improvement.

Indiana.

cott & Sons, Times Bldg., St. Louis, Mo., been awarded the contract for the con- ion of a 10-mile spur from the Illinois al road from Bloomington, Ind., into the nington stone belt, near Harrodsburg. It derstood that the contract price was $35,000 a mile. The contract is to be by the general contractors in order that oad may be completed at an early date.

Iowa.

ckholders of the Waterloo, Cedar Falls rthern Ry. Co., Waterloo, Ia., have au- ed an increase of capital stock to the nt of $50,000, making a total of $2,500,- The increase is for the building of an rban extension to LaPorte City, a dis- of 15 miles, this spring.

icles of incorporation have been filed at tic, Ia., by J. J. Hess, attorney for the Shortline Railroad Co., of Delaware. company is capitalized at $5,000,000 and tgage or trust deed for that amount has filed in favor of the First Guarantee & Co., Philadelphia, Pa. The headquar- of the new corporation, which recently over the Iowa & Omaha Short Line, are iladelphia. It is understood that August mmrow of Treynor will be chosen presi- of the reorganized company. Thomas G. er of Philadelphia is Second Vice Presi- and Andrew Luffbarry of Omaha, the eer of the road, is Secretary. Colonel ge W. Adams and J. J. Hess are now ers of the Board of Directors and will bly continue in that capacity.

Kansas.

lt & Son, who have been awarded the act for the construction of the 10th sec- of the Santa Fe Railway's Colmar cut- Ransom & Cook, Ottawa, Kan., general actors, have started work 10 miles south- of Dodge City, Kan.

vices from Hutchinson, Kan., state that minary steps are being taken toward the ization of a railway company in cen- Kansas, to build a steam railway through d, Ottawa, Saline, McPherson, Harvey, , Sedgwick and Sumner Counties. The sed railroad would extend from Arkan- City or Wellington direct to Hutchinson, gh a section of country now without rail- [illegible] through eastern McPherson County, through Moundridge, [illegible] Roxbury, Salina and [illegible] tween the Burlington, Union Pacific, Frisco, Midland Valley and Orient roads in central Kansas. Hutchinson and Wellington capitalists are interested in the project.

Property owners of Centropolis and Appanoose Townships have filed a petition with the County Commissioners, Ottawa, Kan., asking that a special election be held to vote on the issuance of the necessary bonds to secure the construction of the Salina, Winnipeg & Gulf R. R. through Franklin County

The Hutchinson & Western Interurban Ry. Co., a corporation organized under the laws of the state of Kansas with an authorized capital of $1,000,000 for the purpose of building and operating an interurban railroad from Hutchinson to Hudson, a distance of approximately 44 miles, with probable extensions to Larned and Great Bend, Kans., has been organized at Hutchinson with the following officers and directors: A. Bradbridge, Hutchinson, Kans., president; C. F Bunte, Hutchinson, Kans., vice president; W. A. Knorr, Hutchinson, Kans., secretary-treasurer; F. P. Roehr, Hutchinson, Kans., general manager; B. E. Giles, Hutchinson, Kans.; T. Blakemore, Hutchinson, Kans.; A. C. Wheeler, Garden City.

Kentucky.

Preliminary surveys and commercial reports have been completed for the projected line of the Kentucky Southwestern Electric Railway, Light & Power Co. Final location surveys will be started on March 1 and it is expected to ask bids for construction June 1 or possibly before that date. The projected line of this company is being designed more especially for standard gage freight than passenger service. The northern terminal will possibly be at Henderson, Ky., the county seat of Henderson County, from which point the line is run to the south, passing through the following counties: Union, Crittendon, Livingston, McCracken, Ballard, Carlisle, Graves, Calloway, Hickman and Fulton Counties. The capital has been partially secured. H. C. Rhodes, Paducah, Ky., is president. No chief engineer has been appointed. W. A. Calhoun, 609 City National Bank Bldg., Paducah, Ky., is the consulting engineer, and will be in charge of the entire work, with a principal assistant to be denominated later, who will act as chief engineer during construction.

The Kentucky-Tennessee Traction Co. incorporated two weeks ago with a capital stock of $1,000,000, proposes the construction of an interurban line from Hopkinsville to Guthrie, and ultimately to Evansville, Ind., and Nashville, Tenn. A street car system at Hopkinsville is also proposed. The Hopkinsville-Guthrie line, 28 miles long, is to be built first. The officers of the company are: President, Nat Gathers, president of the Bank of Hopkinsville; vice president, J. W. Cross, cashier of the Farmers and Mechanics' Bank of Pembroke; secretary, H. A. Keach, president of the Keach Furniture Co. of Hopkinsville; treasurer, A. H. Eckles, cashier of the Planters' Bank & Trust Co.

Louisiana.

A street railroad company is being organized at Baton Rouge, La., backed by local capitalists, for the building of a street car line from South Baton Rouge to the Standard Oil plant. The proposed capital stock will be $250,000.

Citizens of Clinton are taking steps to form [illegible] direction to a point on the Louisiana Railway & Navigation road in Ascension Parish. Isidor Mayer, president of the Bank of Clinton, is interested.

Maine.

The Maine Central R. R., T. L. Dunn, Chief Engineer, Portland, Me., is reported to have surveys underway for the Woolastook extension, which was chartered to the Somerset Ry. by the legislature of 1907. The charter was acquired by the Maine Central at the time of its absorption of the Somerset Ry.

According to the report of the engineers filed with the State Railroad Commission, the projected 10.73 mile line of the Rangeley Lakes & Megantic R. R., mentioned in our Feb. 7 issue, will cost $23,000 per mile. This line is to be built from the outlet of the Rangeley Lakes, near Oquossoc, to the Kennebago River, about half a mile from the outlet of Kennebago Lake. It is also proposed to rehabilitate and use the northerly end of the former Rumford Falls & Rangeley Lakes R. R. from the outlet of Rangeley Lake to a point just above the Toothaker farm, a distance of 2.34 miles. The location is practically all in the valley of the Kennebago River. It is understood that grading will be started in the spring. This road is a subsidiary of the Maine Central, of which T. L. Dunn, Portland, Me., is chief engineer.

Maryland.

The State Public Service Commission has authorized the Washington, Potomac & Chesapeake Ry., W. W. Early, General Manager, Brandywine, Md., to increase its capital stock from $500,000 to $2,000,000 and to issue $2,000,000 5 per cent bonds. It is understood that arrangements have been made for the sale of these securities and that the proceeds will be used for the construction of a new line in southern Maryland.

Massachusetts.

The city of Lynn and the Boston & Maine R. R., B. T. Wheeler, Engineer of Construction, Boston, Mass., are reported to have reached an agreement regarding the track elevation work in that city. The railroad is stated to have acquired over $800,000 worth of property in Lynn on which it will construct its additional tracks without any expense to the city or the state.

Bids were opened yesterday (Feb. 27) by E. H. Fitzhugh, vice president Grand Trunk Ry., Montreal, Que., for constructing the first portion of the new Southern New England Ry. This road is to extend from Palmer, Mass., to Providence, R. I., and the portion on which bids have been taken extends from the former place to the Rhode Island state line at Woonsocket, a distance of about 58 miles. The estimated cost of the Massachusetts action is $3,500,000, of which $1,163,287 is for grading and $1,047,200 for bridging. The work on which bids have just been taken is divided into six districts. A. S. Going, Montreal, Que., is Construction Engineer of the Grand Trunk

Michigan.

The Michigan United Rys. is to extend its line from Owosso to Flint. The work will be in charge of the Northern Construction Co., Owosso, Mich.

Handy Bros., Bay City, Mich., recently submitted a proposition to the town of Sandusky, Mich., offering to build the Detroit, Bay City & Western R. R. through that city providing a bonus of $10,000 is raised and right of way and depot yards furnished.

The Grand Rapids & Indiana Ry., E. H. Barnes, Chief Engineer, Grand Rapids, Mich., will this spring build a side track from Pantland to reach some timber. The work will be done with company forces. This track will probably be about two miles long instead of five miles as previously noted.

Plans are being prepared by Roberts & Schaefer Co., Consulting Engineers, 37 W. Van Buren St., Chicago, for coal docks to be erected at Saginaw, Mich., for the Pere Marquette [illegible] construction work is to be started shortly.

Minnesota.

Engineering work under the direction of C. E. French, Construction Engineer, is now under way for the projected electric line of the Mesaba Ry. Co., mentioned in our last issue, and it is expected that construction work will be started in the early spring. The route of the road is as follows: Beginning at Gilbert, the line will run to Eveleth, thence to Virginia, entering on Mesaba Ave., turning a block west on Ash St. and then north on Wyoming Ave. through the city north of Virginia Lake, thence west to Fifth Ave. and north to the Mountain Iron road to that village, then Lucknow, Buhl, Chisholm and Hibbing in order.

We are advised that there is nothing to the reports that the Minneapolis & St. Louis R. R. will enlarge the terminals at Minneapolis or that $2,000,000 worth of bonds has been issued for this purpose.

Directors of the Chicago, Milwaukee & St. Paul are reported to have voted funds for the construciton of an extension from Crystal Falls to the Iron River-Stambaugh district. The proposed extension will be about 24 miles in length and passes through a hard wood country, touching several mining properties.

Business Men of Bear River and Baudette, Minn., are promoting the construction of a railroad between those points. A committee was recently appointed to investigate the feasibility of the project and the report has been favorable. It is believed that at the next meeting the Duluth, Bear River & Baudette Ry. will be organized to do the work. The line as proposed will make connections with the Canadian Northern, the Duluth, Missabe & Northern and the Great Northern Railroads.

Missouri.

Plans are being prepared for a new passenger station to be erected at Springfield, Mo., for the Frisco system. The station will cost about $250,000. Jarvis Hunt, Chicago, Ill., is the contractor.

The St. Louis, Lakewood & Grant Park Electric Ry. Co., 418 Rialto Bldg., St. Louis, Mo., now operating 10 miles of line, is planning to build an extension from the southern end of its Cherokee line to Sunset Inn. Right of way has been secured and it is believed that construction work will be completed before the beginning of the summer season. About $200,000 is to be expended for rails and additional equipment, it is said.

At the meeting of the Board of Directors of the St. Louis Southwestern (Cotton Belt) R. R., Feb. 13, action was taken authorizing an issue of $100,000,000 face value of the first terminal and unifying bonds secured by mortgage to the Guarantee Trust Co. of New York as trustee. The bonds are dated Jan. 1, 1912, and mature Jan. 1, 1952, and bear interest at the rate of 5 per cent per annum. The initial issue of the bonds will be for $7,500,000, which will provide for the terminal facilities at St. Louis and at other points, the retirement of approximately $2,100,000 face value equipment obligations, betterments and other improvements now in contemplation.

St. Louis Items.

By [illegible]

⊙The Morey-Faulhaber Construction Co., Chemical Bldg., St. Louis, Mo., were awarded the contract for building a 5 mile extension of the Houston & Texas Central R. R. out of Caldwell, Tex. They have opened a branch office at Caldwell, Tex., and are ready to sublet this work in quantities to suit outfits.

⊙The Commonwealth Trust Co. has completed negotiations with the Metropolitan Life Insurance Co., of which Nathan Frank is the St. Louis financial representative, for a loan of $1,500,000 for the erection of the 21-story office building to occupy nearly a half a block at the northeast corner of Broadway and Olive St. Contracts for the construction of the building have been let to the James Stewart Construction Co. The building will be erected by a subsidiary of the Commonwealth Trust Co., which virtually will control it. The structure will replace the present Commonwealth Trust Building, a 10-story office building and the four-story former home of the Third National Bank on the north side of Olive St. and the adjoining structure on the east side of Broadway extending north to the building [illegible] Street Consol. Furniture [illegible] the site, the assembling of which has taken more than five years, the improvement will represent an investment of approximately $3,500,000.

S. Dolman of S. Dolman & Son made us glad with a short visit the other day. It has been more than ten years since his last visit. They have 28,000 yds. of nice team and machine work, building false berms for the Santa Fe R. R. to let. Topeka, Kans., will catch them.

Ordinances providing for street construction were drafted Feb. 23 by the Board of Public Improvements, which will attempt to have contractors bid on the work in the hope that the supreme court will reverse the lower court decision, holding that deeds of trust on property take precedence over tax liens. Members of the board expect a favorable decision. The ordinances drafted are for wood, bitulithic, asphalt and brick, as follows: Wood—Reconstruct 9th St. from Market St. to Washington Ave., $11,291; bitulithic—improve Cora Ave. betwen Page Blvd. and Easton Ave., $8,558; Green Lea Pl. between Fair Ave. and Harris Ave., $5,327; Alice Ave. between Florissant Ave. and Carter Ave., $7,962; asphalt—improve Labadie Ave. between Union Blvd. and Abner Pl., $5,633; Virginia Ave. between Chippewa St. and Winnebago St., $9,203; brick—improve Koeln Ave. between Vermont Ave. and Eugene Ave., $25,298, Obear Ave. between Penrose St. and Carter Ave., $5,327, Tholozan Ave. between Grand Ave. and Spring Ave., $7,609, Salena Ave. between Chippewa St. and Broadway, $13,891, Rosedale Ave. between Washington Ave. and Delmar Blvd., $3,114, Fair Ave. between Labadie Ave. and Ashland Ave., $6,340, reconstruct 9th St. from Pestalozzi St. to Sidney St., $9,788, 9th St. from Wyoming St. running east of 9th St. to Arsenal St., $3,722.

Sten Lund was snow bound here a couple of days on his way back to Kansas City from Canada. Lund reports two new steam-shovel jobs on the Grand Trunk Pacific in British Columbia. He is shipping his outfit onto this work and will begin work just as soon as his outfit arrives there. He is also going to open an office in Winnipeg and another one in St. Paul.

The joint committee, consisting of the East St. Louis Commercial Club and other citizens, appointed by Mayor Charles S. Lambert to look into the depot situation in East St. Louis, met last week with a committee representing the railroads passing through East St. Louis. The meeting was at the Noonday Club. Those present said no definite result was accomplished and the railroads were merely trying to find out, in a general way, what the demands of East St. Louis before the State Railroad and Warehouse Commission for improved terminal facilities would be. The railroads were represented by John Fitzgerald of the Louisville and Nashville; Benjamin McKeen of the Vandalia, Henry Miller of the Wabash and George W. Parker of the Illinois Central. All admitted conditions at the Relay Depot, the Union Station of East St. Louis, were bad, and left the impression they were willing to meet any reasonable demands made by East St. Louis.

Mike Conroy returned from Hot Springs, Ark., looking like a two-year-old. Mike says the water cart that he was driving while there done him a world of good. In fact he felt so good that he took Koenig over and cracked a couple of bottles with him. He expects to resume on his levee work at Granite City, Ill., just as soon as the last bit of frost is out of the ground.

An attempt to obtain control of all the important electric light plants in Southern Illinois is seen in the action of the Marissa Light & Water Co. in taking options on practically every private light plant between Cairo and Coulterville, and from Duquoin to Harrisburg. The Marissa company recently was organized by J. A. Hamilton of Marissa, who is president, and who was instrumental in obtaining the options, all of which terminate May 1. The electric light plant at Sparta is one of these on which options have been taken, the municipal plants at Marissa, Freeb New Athens and Red Bud are not on the It has been rumored that the Illinois Trac System is contemplating taking over the h ings of the Marissa company should it c the options it now holds.

Springfield and the entire mining distric Joplin, including the electric lighting pl and street car systems of the two cities, i be supplied with the current from the 15,000 H. P. hydro-electric power plant of Ozark Power & Water Co. by April 1, under the plans of this company, which is ceiving financial support in St. Louis. power is to be obtained from White R across which stream a dam will be buil miles south of Springfield. The Ozark pany is capitalized at $3,000,000 and is financed by Henry L. Doherty & Co., of York. The company proposes to operate der a federal grant, similar to that of Mississippi River Power Co., which has structed a dam across the Mississippi at kuk and will furnish electric current to Union Electric Light & Power Co. and United Railways Co. of this city. The O company has let the contract for building dam and power house to the Ambursen draulic Construction Co. of Boston, el machinery to the General Electric Co. an hydraulic machinery to S. Morgan Smi New York. The dam is to be 50 ft. high will overflow several hundred acres of all of which has been obtained through demnation proceedings. The current wi available for mining and will be carrie means of steel towers and overhead from the dam site through Springfield a Joplin, a distance of 123 miles. The power plant and transmission lines is mated at $1,500,000. The cost of the struction of the dam, power plant and tr mission lines is estimated at $1,500,000.

"Father" E. L. House, the hustling builder, was in town the other day. H about finished his contract with the Mountain R. R. in Arkansas.

Chas. W. Grant has finished his wor Frankfort, Ind., and is in the market some team work. His address is 453 Ave., Frankfort, Ind.

A 16-in. snowfall here on Feb. 21 c quite a run on the labor market. Rai companies were forced to pay from 22½ cts. per hour and even at these figures was not enough labor here to go around of the trains arriving in St. Louis wer 3 to 36 hours late. The railroad comp in this part of the country are not pre to take care of snow the way they ar north, for it is only once in a lifetime we have snow over 12 ins. deep in this ritory. A couple of warm days and a after this snow made it all disappear as as it came and railroad officials are all ing and hoping that there will be no snow this winter.

The Salina, Winnipeg & Gulf R. R. selected a site for a $40,000 depot in Sa Kans. A proposition to obtain the sho this road will be made to the citizen Salina, Kans., in a few days.

J. W. Skinner has resumed his pile dr work near Venice, Ill.

Tom McGregor, Route No. 1, Box 8, St. Louis, Ill., has five teams idle.

The National Light & Power Co. o Louis will shortly make application t cities of Fort Smith, Ark., and Musk Okla., for franchises to furnish electric and power from a hydro-electric power to be built near the juncture of the Ill Grand and Arkansas rivers in Oklahoma 3,000 acres of land have been obtained b demnation proceedings in the vicinity o proposed dam site, which will be cover the reservoir and which is expected to vide enough power to tide the company during the dry seasons. Work on the struction of the dam will begin withi days, it is announced. The National Li Power Co. is capitalized at $500,000. [illegible] is president. The pr re plant will [illegible] H. P. Transmission lines [illegible] from the power plant into Muskogee ugh Oklahoma to the Arkansas line t Smith. The company is operating federal charter granted to the Oklaower Co. prior to the admission of into the Union. The construction of and the installation of the necessary y will represent an outlay of $1,250,- [illegible] and power houses will be built t. Louis corporation, which is adverr bids for the machinery and trans-

Vare Construction Co., Houser Bldg., Mo. [illegible] rk to let on the St. Louis, Columbia loo electric line near Columbia, Ill.

nit to lay T-rails on Jefferson Ave. ed the United Railways Co. by the f Public Improvements because the under which the Jefferson Ave. line d expired Feb. 6. The board granted or laying T-rails on other lines. The requested permits to put down T-Lamp Ave. from Utah St. to Wyom-Etzel Ave. from Belt to Clara Ave. gan St. from Grand to Vandeventer he permit was requested a week or re the franchise expired. The coms not asked the city to renew the Granite blacks are to be specially t under the T-rails, as the ordinary cks will not fit.

Montana.

orthern Pacific has secured the final way for the extension of its branch Mott to Terry.

orthern Pacific will make extensive in its yard facilities at Missoula, is spring. It is said the yards will be xtended and arranged in a manner switching and handling of trains The work will include the construcsubway at Waverly St., passing untracks.

eat Northern Ry. Co. will start work ring, according to information from ont., on the construction of two stae at Helena and the other at Butte. the structures have been completed cost is estimated at about $175.000 . H. Hogeland, St. Paul, Minn., is gineer.

Nebraska.

s of incorporation have been filed Secretary of State, Lincoln, Nebr., posed new steam or electric railroad projected to run from Springview Paha County to Spalding, Greeley passing through the counties of Greeld, Wheeler, Holt, Rock and Keya e capital stock of the company is fixed 0, with authorization for a bonded he same amount. The incorporators les F. Lear, John F. Carr. C. A. Rip- Cassady, Jr., and C. E. Coon. Omaha,

New York.

wenty-eighth & Twenty-ninth Streets n R. R. Co., of New York City, now 5.7 miles of horse car lines, has rganized and incorporated under the the Mid-Crosstown Railway Co. of k City, with capital of $500,000. The include John W. Henner, Horace Charles E. Loxley and A. Merritt f Philadelphia and Gilbert and Cor- Wright of New York City.

udson Valley Ry. Co. (electric), Glen Y., has applied for a franchise to oadway in Saratoga Springs. The plans to build from the Putnam St. along Congress St. and across y to connect with its present termi-

inary surveys have been made and al is now being secured for the con- of a 3-mile electric railway to the lion, N. Y. The Board of Trade of which J. H. Harrison is secretary, is l in the proposition.

North Carolina.

The Yadkin [illegible] has been in- [illegible] and proposes to [illegible] mile line from [illegible] G. M. Grandin [illegible], Pa., and J. T [illegible]

W [illegible] folk & Southern R. R., following a conference with [illegible] N. C., is reported to have made an announcement to the effect that work will be started in [illegible] division. The first work of this sort will be the building of a connection between the Norfolk Southern in Raleigh, and the Raleigh and Southport, which the Norfolk Southern has [illegible] Charlotte and Southern extension.

North Dakota.

Right-of-Way Agent H. J. Tavis, Mandan, N. Dak., of the Northern Pacific, has been quite successful in purchasing right of way along Knife River, Spring Creek and Goodman Creek for the proposed branch from Stanton, N. Dak., on the Missouri River road, running northwest to the old townsite of Mercer, thence along Knife River to its junction with Spring Creek, following the latter to Goodman Creek and along the Goodman Flat to Dunn County.

⦿C. J. Jamison, Stillwater, Minn., who has a grading contract on the new line of the Minneapolis, St. Paul & Sault Ste. Marie R. R. connecting the main line at Drake, N. Dak., with the Thief River Falls branch, has started work north of Esmond, N. Dak., with a large crew of men and teams.

Ohio.

The Erie R. R., W. J. Harahan, Vice President, New York, is now understood to be making financial arrangements for the completion of the double tracking of its main line between New York and Chicago. About 170 miles of work on the Chicago and Erie Division and 120 miles elsewhere will complete this work.

The Lake Shore Electric Ry. Co., Cleveland, O., is acquiring private right of way between Huron and Rye Beach for a cutoff which will shorten its track between Toledo and Cleveland. At the present time the line of the Lake Shore Electric curves to the north after entering Huron on the east, and then passes through the northern part of the village along Lake Erie shore, which it follows to a point near Rye Beach. Upon the completion of a bridge now going up over the Huron River, right to the use of which has already been secured, the tracks will extend through the southern part of the village and thence in comparatively a straight line to Rye Beach.

Oklahoma.

⦿The Clinton & Oklahoma Western Ry. Co. is in the market for 100,000 ties and bridge timber. This company, as noted in our last issue, has just awarded a contract to Maney Bros., 126½ West Main St., Oklahoma City, for a 30-mile extension from Butler, Okla., northwest to the new town of Strong. T. J. Nave, Clinton, Okla., is President and Guy V. McClure, Oklahoma City, Okla., is Chief Engineer.

⦿The following have been awarded subcontracts on the 30-mile extension of the Clinton, Oklahoma & Western extension from Butler, for which Maney Bros., 126½ West Main St., Oklahoma City, have the general contract: Acklin Bros., Frank L. Adams, Matt Cunyon, E. L. Hale, Ben Sweeney, and Pat Gleason, all of Oklahoma City. All grade work will be effected through sub-contractors, while Maney Bros. themselves will have charge of the track laying. Steel laying will begin the middle of May and will be rushed as rapidly as possible.

The Quapaw-Lincolnville Ry. Co., the incorporation of which was noted in our Feb. 14 issue, has completed surveys for its projected 2-mile line from Quapaw to Lincolnville, Okla. Contracts for track materials will be let in 20 or 30 days J. D. McIntyre, Miami, Okla., is vice President; Geo. J. Stein, Miami, Okla., is Chief Engineer.

The Santa Fe system plans to construct a water tank at Pauls Valley, estimated cost $5,000.

The Fort Smith & Western R. R. is reported to be considering building a line from Okemah or Dustin, north through Henryetta and Wagoner, Okla., to St. Joseph, Mo. From Okemah or Dustin it is about 100 miles to the Kansas State line, and from there to St. Joseph would be a direct line across the eastern part of the State.

Election is to be held at Sulphur on April 2 to vote on granting a franchise to the Rapid Transit Interurban Co., which proposes to build an interurban from Shawnee and Tecumseh to Sulphur, and a city system of lines in Sulphur. A bonus of $10,000, half in realty and half in cash, has been tendered the interurban company by Sulphur. It is stated that the company will begin the construction of the 50 miles of line within a year, and agrees to have the entire system completed and in operation within three years. J. W. Saxon, of Tecumseh, is president of the company.

The Shawnee Interurban Ry. Co. is reported to be planning to begin construction work in April on its projected 40-mile line from Shawnee to Oklahoma City. Enough eastern capital is reported to have been interested to assure the completion of the road. C. T. Edwards, Herskowitz Bldg., Shawnee, is the promoter.

Oregon.

Advices from Vale, Ore., state that 8 additional carloads of railroad construction equipment have arrived at that place for the Utah Construction Co., which, as recently mentioned in ENGINEERING & CONTRACTING, is building the Oregon Eastern across the state of Oregon. The shipment consists of stationary engines and air drills for tunnel work, dump cars, scrapers and other material to be used on railroad grading. The outfit will be taken out to Mile Post No. 40 in the Malheur canyon, where the company has a large force of men at work on a 2,600-ft. tunnel, the longest on the entire trans-Oregon line. A camp has been located on the eastern end of this tunnel for over a month and has just completed the approach to the western end of the tunnel as well as a wagon road around the big rocky cliff to the western entrance, where a camp has been located.

Pennsylvania.

The Pennsylvania R. R., J. P. Charlton, Division Engineer, Reading, Pa., is reported to be planning to build a new line from Douglassville to Shanesville, Berks County, where extensive iron ore mines will be operated in the near future. The new line will be 12 miles long and will be for the carrying of ore from the mines to the Schuylkill division line.

It is reported at Reading, Pa., that the Philadelphia & Reading Ry. is preparing plans for double tracking the Shamokin division, from Snydertown to Williamsport, Pa. The work will include the double tracking of the bridge over the Susquehanna River at Sunbury. Part of the proposed work will be done this summer, and it is expected to have all completed within two years. William Hunter, Philadelphia, Pa., is Chief Engineer.

South Carolina.

The Spartanburg & Glenn Springs R. R. Co. has been chartered with an authorized capital stock of $250,000 and proposes to build an electric railway from Spartanburg to Glen Springs, 14 miles. The incorporators are J. B. Lee, Jr., N. F. Walker, J. T. Harris, J. Wright Nash and W. H. Herring.

South Dakota.

The Chicago, Milwaukee & St. Paul R. R., it is believed, will start work shortly double tracking the line between Aberdeen and Summit, S. Dak., a distance of 75 miles. The work will be in charge of [illegible] Assistant Engineer of the construction department. It is said that the entire line between Aberdeen and Minneapolis will be double tracked later.

Texas.

⊙P. G. Burns, Houston, Texas, who was formerly Construction Engineer of the Trinity & Brazos R. R., has the contract for the Victoria-Bloomington extension of the Browrsville R. R. About 50 teams have been placed at work on the Victoria end and work is progressing nicely.

The San Antonio & Aransas Pass Ry., Hans Helland, Superintendent Maintenance of Way, Yoakum, Tex., is to relay about 45 miles of 50-lb. rail with 70-lb. rail. The company will do the work with its own forces.

Surveys are to be started shortly, it is said, for a projected railroad to run from San Angelo, Tex., southeast to a connection with the San Antonia & Aransas Pass at Waring. As projected the line will be about 175 miles long and will pass through Brady, Llamo and Fredericksburg. J. J. Lanin, New Hampton, Ia., is the promoter.

Surveys are now under way and it is believed that by April 1 construction work will be started on terminals to be built at Yoakums Bend, near San Antonio, for the Missouri, Kansas & Texas R. R. and the San Antonio & Aransas Pass R. R. It is understood that the contract between the Katy and the Sunset for the use of the terminals of the latter at San Antonio will not be renewed, for which reason the former road is to construct terminals of its own.

It now looks as though grading work for the 35 mile extension of the Orange & Northwestern R. R. (a Frisco line) would be started at an early date and the road completed this spring. The extension is being built for the primary purpose of tapping a timber belt, but ultimately it will be extended to Hemphill.

It is believed that the Missouri, Kansas & Texas Ry. will shortly take up the matter of constructing a 30-mile line between San Marcos and Austin. No definite information on the proposition is available as yet. A. D. Bethard, Dallas, Texas, is General Manager of the lines in Texas.

Regarding the report that the International & Great Northern Ry. had surveys underway for an extension from Laredo toward Rio Grande City, we are advised that this probably originated from the fact that surveys were being made to some onion fields just south of Laredo.

The Palacios, San Antonio & Pecos Valley Ry. Co. is understood to have completed negotiations with eastern capitalists for floating the bonds for its projected line, and it is probable that contracts will be let and construction work begun at Palacios and Yoakum within the next two months. H. L. Montandon, Palacios, Tex., is Chief Engineer.

The Santa Fe system plans on making the following minor improvements in Texas: Construction of reinforced concrete viaduct at El Paso over the tracks of the Rio Grande & El Paso Ry., estimated cost $13,700; construction of autogenous welding plant at Clebourne to cost $3,200; construction of a 1,000,000 gal. storage tank at Galveston for creosote oil, estimated cost $9,500.

O. R. Mounsey, San Antonio, Chairman of the European Contract Syndicate, Ltd., London, England, which proposes the construction of the San Antonio, Rockport & Mexican Ry., is reported to have instructed W. Pattinson & Sons, of London and Liverpool, contractors, to leave for San Antonio, Texas, at once. Preliminaries for the construction will be started and it is hoped to have work begin not later than April 1. These contractors will be in charge of 307 miles of line, but the work will probably be done by sub-contractors.

Construction work is well along on the branch line of the Brownsville (Frisco line) from Bloomington to Victoria, and it is likely that when the latter place is reached contracts will be let for still further extensions with Yoakum as the northern terminus.

Utah.

Officials of the Denver & Rio Grande Railroad recently held a meeting to discuss the proposed terminal improvements at Ogden, Utah.

The Salt Lake & Utah Valley Ry. Co. is to apply to the City Commission of Salt Lake City for a franchise for the entrance of its proposed line into that place. This company is planning an interurban line from Nephi to Salt Lake, and has already secured most of the necessary franchises and right of way. Preliminary surveys have been completed from Lehi Junction to Nephi. A. J. Evans, Lehi, and J. S. McBeth, Payson, are interested.

Virginia.

The Norfolk & Western Ry., C. S. Churchill, Chief Engineer, Roanoke, Va., has plans for extensive improvement work at its terminals at Norfolk, Va. These are understood to include the enlargement of the shop facilities, the reconstruction and enlargement of the yards and the erection of another steel pier at Lambert's Point. The Norfolk & Western, it is said, has requested the city council of Norfolk to order certain streets closed between this city and Lambert's Point. It is said the company proposes to remove the old shop buildings and construct new buildings. The request for the closing of streets is necessary in order that the railroad company may carry out its plans with reference to the removal of the old and the construction of new shop buildings. It is said the company proposes to begin the wrecking of the old and the construction of the new shop buildings just as soon as these streets have been ordered closed. It is understood that a third track of the N. & W. will be laid from Brambleton Ave. to Lambert's Point yard, upon the company's right of way. A new roundhouse, power house, machine shop and car shed will be constructed on the company's property, which lies south of the present yard limit.

The Norfolk & Western Ry., Charles S. Churchill, Chief Engineer, Roanoke, Va., has arranged to double track the following sections of our road on the Norfolk division, state of Virginia: Gilmerton to Suffold, 16.4 miles; Nottoway to Burekville, 11 miles; Evergreen to Phoebe, 13.2 miles. Work on two of these sections is now in progress with company forces. It is expected to get started on the third section in March.

Washington.

⊙Yakima Valley Transportation Co. (electric), North Yakima, has awarded a contract to W. L. Tribble of Spokane for constructing 6 miles of the extension line into the Selah Valley.

⊙Nelson Bennet, Tacoma, Wash., has been awarded the contract for constructing the tunnel for the new Point Defiance line of the Northern Pacific. The tunnel will be about 4,500 ft. long, 27 ft. high and 28 ft. wide in the clear. This line is to be 45 miles long and Porter Bros., Portland, Ore., as previously noted in these columns, have the general contract for the clearing, grading, filling and bridging. Winston & McDougall have the contract for laying the track. Associated with Porter Bros. on this work are Grant Smith & Co., Henry Bldg., Seattle, Wash.

The Milwaukee Terminal Railway Co. has started condemnation proceedings to acquire a block of water front at Bremerton, Wash., and surveyors are establishing grades for tracks and it is generally believed that the city will be the terminal for the lines on the Kitsap and Olympic peninsulas.

Wisconsin.

Citizens of the village of Melrose, Wis., are about to take steps to secure the construction of a railroad branch to that place and a mass meeting will be held shortly to discuss the matter.

Canada.

⊙The Canadian Pacific Ry. has begun
ing contracts for the 700 miles of new
to be built this year. Foley, Welch & St
St. Paul, Minn., have been awarded th
tract for the construction of 100 miles
Weyburn-Wellbridge extension and J. G
grave & Co., Ltd., secured the contra
earthwork and embankments on the
branch from Suffield, Alberta.

⊙The Westinghouse, Church, Kerr
Pittsburgh, Pa., has been awarded th
tract for constructing additional railway
at Calgary, Alberta, for the Canadian
Ry. The work will cost about $2,750,0
includes the design and construction o
motives, machine, boiler, blacksmith, p
coach and freight car repair and paint
foundry, planing mill, power house, dr
scrap docks, material bins, store roo
office buildings. In general the const
will be of concrete, steel, brick or holl

A bill is before the Canadian Parl
to incorporate the High River & Huds
Ry. The company proposes to build
some point in Alberta to Saskatoon,
the Pas Mission.

The Canadian Parliament has passed
to incorporate the Northern Territori
Co. The promoters propose to build
from Churchill or Nelson to Port Es
and from the Athabasca River
southward to Edmonton.

The Grand Trunk Pacific Ry. is pl
to start survey work shortly on its tw
from Weyburn, Sask., with a view to
the grading this year. The two lines w
as follows: One from Cedoux, a p
the Regina-Griffin branch due north of
burn, to Weyburn, thence to the Intern
boundary. The other from Weyburn
westerly, paralleling the boundary and
Lethbridge.

The Berlin & Bridgeport Street R
Berlin, Ont., is considering extending i
to Elora through Bloomingdale, West
rose and Winterburne.

The Dominion Government has been
for a subsidy for the construction
Brantford & Lake Erie electric line
Dover. The route for the road has
been laid out, and in construction the li
follow the New York, New Haven &
ford R. R.

The Grand Trunk Railway Co., accor
advices from Toronto, Ont., intends t
lish a freight yard on the Russell prop
the north side of Queen St., east of
Ove., to Toronto, to cost about $100,0
R. Safford, Montreal, Que., is Chief En

The Village Council of Rockwood,
making efforts to induce Mackenzie &
to touch Rockwood with the C. N. R.,
it is said will reach Guelph, Ont., this su

Announcement of the policy of the
government of British Columbia
railroad extensions has been made,
lows: Aid will be extended for the co
tion of the Kettle Valley Ry. from Col
Junction to Hope, a distance of 50 mil
down the Coquahalla River. The
E. Ry. is to have running rights
road satisfactory to the Great Norther
Canadian Northern Pacific will build
from Kamloops to Kelowna via Grand
and Vernon, and will also have a bran
to Lumby, a distance of 145 miles.
cific & Great Eastern Ry. will be
construction from Fort George to Nort
couver, and on by way of the second
bridge into Vancouver and New West
This line will be the first link in the
to tap the Peace River country. It
vided that a ferry service will be mai
between the mainland and Victoria
Canadian Northern Pacific will receive
for 150 miles on Vancouver Island
Campbell River to Hardy Bay. The
ance to be given by the government
various enterprises will be briefly as
The Kettle Valley line will get a cas
of $10,000 per mile, approximately half
lion dollars in all. The Province is

00 for the construction of a bridge Fraser River to Hope. This will nection between the Kettle Valley he Canadian Pacific Ry., and will short line between Vancouver and nays. The Canadian Northern Pa- eceive a guarantee to the extent of r mile for the construction of its ncouver Island. This line will fur- ntrance to Strathcona Park. The Pacific on Vancouver Island will Parksville to Comox. The lease & N. to the Canadian Pacific is so that the road may be used as the Vancouver Island lines of the C. P. R. The Canadian Pacific will take over the Kaslo & Slocum Ry., and for this will receive $100,000 from the Province. It will cost the C. P. R. $400,000 to take this line over from the Great Northern. The Kaslo & Slocan line is to be standardized. The line from Fort George to North Vancouver will be built by Foley, Welch & Stewart of St. Paul, Minn., who will be given the same guarantee of bonds [illegible] Northern in the construction of its main line in British Columbia.

Mexico.

Announcement has been made that the Durango & Llano Grande R. R., which will soon be completed from Durango to Llano Grande, about 63 miles, will be extended to the port of Mazatlan on the Pacific Coast. This line will form a part of the system of the National Railways of Mexico, of which James L. Reid, City of Mexico, is Chief Engineer.

The Cananea Consolidated Copper Co. has made surveys for a 6-mile narrow gage line from the Sonora-Bonanza copper property to Imuris. V. R. Walling, Cananea, Sonora, Mexico, is Superintendent of the copper company's railroad.

OADS, STREETS AND PAVEMENTS

Alabama.

vill be received until 4 p. m., March ty Commissioners, Court, Washing- y, Chatom, Ala., for grading, drain- rfacing with sand-clay approximate- of State Aid road. A certified check must be filed with each bid. W. S. State Highway Engineer.

will be received until 1 p. m., by Wilcox County Commission- , Camden, Ala., for grading, drain- urfacing with gravel approximate- s of State Aid road. A certified $400 must be filed with each bid. yd, Montgomery, Ala., is Assistant ghway Engineer.

ling to advices from Bessemer, Ala., act for a new macadam road from ation to Rutledge Springs has been ight & Crowder. The road will be long, and will be brought to a grade cent.

s received on Feb. 21 by the Com- rs of Randolph County, Roanoke, grading, draining and surfacing d clay approximately 5 miles of be built with State aid, have been The work will be re-advertised ne in April. W. S. Keller, Mont- is State Highway Engineer.

izens of Hale County, Ala., recently issuance of bonds in the sum of for road improvements. Greenboro inty seat.

oard of Trade of Tuscaloosa, Ala., inted a committee to confer with owners to secure their co-operation atter of paving the business section ty.

Arkansas.

Roach-Manigan Paving Co., of Mem- n., has been awarded the contract y of Helena, Ark., for the laying of yds. of brick pavement for $54,000. ipal streets of the city will be paved.

ard of Commissioners of Paving No. 28, which includes all of the th Ave., from Main St. west to the elt tracks, was organized at a recent in Pine Bluff, Ark. Judge C. M. vas elected Chairman, M. E. Bloom and Treasurer, and Maj. W. J. Pine Bluff, Engineer.

California.

gation from Taft, Cal., recently ap- efore the County Supervisors, Bakers- ., and asked that a road district be o cover the Maricopa-Taft-Fellows- ck road, a distance of 30 miles. It is to use gravel and oil in large quan- ring a permanent road. The cost is between $55,000 and $60,000.

or Arthur L. Logan and assistant, e, of Miranda, Cal., recently went to ce to survey the proposed Lord-Ellis he road will run from Larkins' ranch, e Lake, to Green Point. This is one ew roads the Humboldt County Su- are planning on building. An election will soon be called to vote on the issuance of $300,000 in bonds for road work. Eureka is the county seat.

Colorado.

✣Bids will be received until 11 a. m., March 5, by Board of Public Works, Denver, Colo., for furnishing the necessary labor and material for the construction and reconstruction of sidewalks otherwise than in districts. A certified check for $500 payable to the City and County Treasurer must be filed with each bid. Henry Read is President of the Board.

Petitions have been circulated in Weld County, Colo., to secure the necessary 5,000 signatures to put into operation the Madden bill. It provides for the maintenance of highways after they have been constructed by the county. Road districts are to be formed. Greeley is the county seat.

Florida.

• All bids received Feb. 17 by the Board of Walton County Commissioners, De Funiak Springs, Fla., for the construction of approximately 60 miles of public highway of sand and clay were rejected. Bids on this work were also rejected on Jan. 15. The work will again be re-advertised. Charles V. Gordon is Clerk.

Idaho.

It is reported the residents of Blaine and Crichton, Ida., on Feb. 17 voted to organize a highway district.

The City Council of Moscow, Ida., has granted a petition presented by the Chamber of Commerce, providing for the passage of an ordinance creating a certain paving district.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., March 2, for furnishing and delivering approximately 5,000 cu. yds. of crushed granite to various public team tracks for use of the street department.

⊙The Board of Local Improvements of Mendota, Ill., has awarded the contract for the paving of Eighth St. and part of Fourth Ave., East Side, to Henry Zolder & Sons of that city, for $16,988. Other bidders were: Keyes & McNamara, La Salle, Ill., $17,331; Pogger & Fletcher, Blue Island, Ill., $17,531; Graham & Co., Freeport, Ill., $17,743.

⊙John F. Bretz of Springfield, Ill., has been awarded the contract by the Board of Local Improvements of Lincoln, Ill., for the paving of four streets, about 2 miles in length. The work includes grading, concrete curb and gutter and paving with vitrified brick on a concrete base. Brazil block will [illegible] Feb. 16.

⊙P. Trenkenschuh of Rock Island, Ill., has been awarded the contract by the Board of Local Improvements of that city for the paving of Sixth Ave., from 34th to 35th Aves., with brick at $1.83 per sq. yd. Bids were opened Feb. 17.

⊙Following bids were received at the letting of the contract for the Trenton road in Helvetia Township, Madison County, Ill., on Feb. 15: (1) standing for price per sq. yd. for bituminous macadam, (2) price per sq. yd. for water-bound macadam: O. T. Dunlop, Edwardsville, Ill., (1) Standard Oil "C," $1.03, Pioneer $1.09, Tarvia, $1.12, Sarco, $1.11, (2) $.89; St. Clair Engineering Contracting Co., East St. Louis, Ill. (awarded contract), (1) Pioneer, $.98⅛, Arbito, $1.05⅛, Tarvia, $1.00⅛, (2) $.74⅛; Highland Marble Works, Highland, Ill., (1) Standard "C" or other meeting specifications, $1.06, (2) $.91⅔. The contract includes 11,200 sq. yds. using 2 gals. per sq. yd., of Pioneer asphalt. Work to be done under State Highway Commission.

C. L. James of Mattoon, Ill., has been elected City Engineer of Oakland, Ill. The City Council contemplates a considerable amount of street paving, for which plans will be made by Mr. James.

Bids for furnishing the City of Chicago with cedar block were opened by L. E. McGann, Commissioner of Public Works Wm. B. Crane was the low bidder at 56 cts. per sq. yd. The contract has not been awarded.

The City Council of East St. Louis, Ill., has passed an ordinance providing for the construction of a mile of sidewalk on both sides of Ninth St., from St. Clair Ave. to the city limits.

The Board of Local Improvements of Rock Island, Ill., has decided to pave Second Ave., from 14th to 20th Sts., with asphalt. Wallace Treichler is City Engineer.

The city of Pana, Ill., will let contracts not later than March 5 for the paving of eight streets, estimated to cost several thousand dollars.

The Village Board of Glencoe, Ill., has adopted a resolution providing for the paving of Grove St., from Jefferson to Drexel, at an estimated cost of $13,419. A public hearing will be held Feb. 20.

The Board of City Commissioners of Waukegan, Ill., has abandoned the proposed improvement of County St., between Madison and Franklin Sts., estimated to cost $10,000. J. J. Dietmeyer is in charge of paving work.

The city of Sterling, Ill., is passing ordinances providing for the construction of a considerable amount of pavement, estimated to cost between $50,000 and $60,000. An election will shortly be held to vote on the proposition. J. D. Arey, Sterling, is Engineer. M. E. Wilger is in charge of the work.

Indiana.

⊙D. H. Fatout has been awarded the contract by the County Commissioners, Covington, Ind., for the construction of the gravel road in Shawnee Township, known as the Chas. Hoagland road, for $3,998. Other bidders were S. S. Martin, $4,190 and E. E. McKee, $4,182.

Petitions for the purchase of the toll road of the New Albany & Vincennes Plank Road

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Co., which runs through New Albany, Lafayette and Greenville Townships to the Harrison County line, for a distance of about 12 miles, have been filed with the Board of Com[illegible] John H. Shine, chairman of the city development committee of the New Albany Commercial Club, is interested.

The Board of Public Works of Richmond, Ind., has adopted a resolution provding for the improvement of South Eighth St., from A St. to H St., with brick paving.

The Town Board of Bourbon, Ind., is taking preliminary steps for continuing the paving on the two main business streets to the city limits in either direction; also the paving of several blocks of another business street.

The Board of Public Works of Evansville, Ind., proposes to pave Locust St., from Water to Eighth, with wood block, and Michigan St., from Oakley to Main Sts. The streets to be improved as outlined by the Board and for which the City Engineer has prepared estimates are as follows. East Iowa, from Edgar to Garvin; Louisiana, from First Ave. to Main; Tennessee, from First Ave. to Fulton; Illinois, from Ninth Ave. to St. Joseph; Walnut, from Morris Ave. to Kentucky; Lincoln Ave., from Tenth St. to Kentucky; Heidelbach Ave., from Walnut St. to Louisiana; Linwood Ave., from Monroe to Green River road; Evans Ave., from Lincoln Ave. to Washington; Powell, from Bayard Park to Kentucky; Morris Ave., from Division to Walnut; Baker Ave., from Franklin to Illinois; Chestnut St., from Fourth to Eighth. Aug. Pfefflin is City Engineer.

The City Council of Shelbyville, Ind., has voted in favor of paving some of the principal streets under the three-mile road law. It is proposed to pave the streets lying to the south of the main streets of the business sections with brick, to be done by general taxation in Addison Township.

Iowa.

✣Bids will be received until 1 p. m., March 4, by Board of Trustees of Green Bay Township, at the office of A. J. Huebner, Clerk, Wever, Ia., for the construction of road work in that township.

✣Bids will be received until March 1, by Herman Miller, Noble Township Clerk, Noble, Ia., for superintending the dragging of the roads and doing all the road work.

⦿The Cedar Rapids Construction Co. of Cedar Rapids, Ia., has been awarded the contract by the City Council of Carroll, Ia., J. A. Dougherty, City Clerk, for the improvement of several streets with creosoted wood block, brick and bitulithic pavements, including 24,000 sq. yds. of pavement. The contract price is $52,327. Bids were opened Feb. 20.

Resolutions were considered by the City Council of Cedar Falls, Ia., providing for the construction of 80,000 sq. yds. of pavement. C. H. Streeter of Cedar Falls is Engineer.

The City Council of Creston, Ia., has passed a resolution of necessity for nearly five miles of new paving this season. The City Engineer has prepared specifications for the work.

The City Council of New Hampton, Ia., has voted to lay seven blocks of cement paving, 40 ft. wide.

The Common Council of Marshalltown, Ia., has been asked to consider the paving of the following streets: Second St., Church to Lincoln; Third St., Main to Church; Fourth St., Main to Church; Fifth St., Church to State; Seventh St., Church to Jerome; Eighth St., Main to Church; 13th St., Main to Summit; Church St., Fifth to Seventh Aves.; Seventh Ave., Church to Main; Sixth Ave., Main to Linn.; Linn St., Sixth Ave. to First St.; First St., Church to Linn St.; North St., Center to Second Ave.

The City Council of Iowa Falls, Ia., has taken the preliminary steps towards paving 16 blocks this year. Five blocks will be from College Ave., east on Washington Ave., to Talbott St.; also 10 blocks on Main St. north from Washington Ave., to North St., and one block on Stevens St., between Washington Ave and Estes St. The resolution adopted calls for concrete paving.

Kansas.

✣Bids will be received until 2 p. m., Feb. 29. Board of Commissioners, Topeka, Kan., for grading, curbing and paving with brick various streets, avenues and alleys in the city of Topeka. A certified check for $7,000 must be filed with each bid. C. B. Burge is City Clerk.

⦿F. R. Dellone & Co. of Independence, Kans., have been awarded the contract by that city for grading and paving the alley in Block 56, including the following approximate quantities, for $1,247: Brick paving, 665 cu. yds.; curb, 630 lin. ft.; earth excavation, 163 cu. yds.; rock excavation, 54 cu. yds. Bids were opened Feb. 15.

⦿The Board of County Commissioners, Iola, Kans., has let contracts for building six miles of rock roads in Allen County, as follows: Concrete Construction Co., four miles north of Iola, $15,348, and Ransom & Cook of Ottawa, Kans., two miles at, Humboldt $6,022.

Kentucky.

⦿L. W. Hancock Co. of Louisville, Ky., on Feb. 26, secured the contract from the city of Mt. Sterling, Ky., for the construction of 12,000 sq. yds. of brick pavement on a concrete foundation with combined curb and gutter. Bids were opened Feb. 14.

Louisiana.

✣Bids will be received until noon, March 11, by Highway Department of the Board of State Engineers of Louisiana, 104 New Orleans Court Bldg., New Orleans, La., for the construction of a main public highway extending from New Iberia to Jeanerette, Iberia Parish, La., a distance of 9½ miles. Information as to location, character of work, amount, extent and class of material, terms of payment, regulations governing manner of submitting proposals and executing contract may be obtained at the office of the Highway Department. Frank M. Kerr, Chief State Engineer, is President of the Board of State Engineers. Gervais Lombard is Acting State Highway Engineer.

The City Council of Crowley, La., has ordered the City Attorney to draw up a paving ordinance providing for the covering of Parkerson Ave., a distance of 7 blocks, with first-class paving material, to be selected. J. D. White is City Engineer

Maryland.

⦿Five bids for paving, aggregating approximately $140,000, were approved by the Paving Commission of Baltimore, Md., on Feb. 19, as follows: David Andrews Co., for laying vitrified brick on Biddle St., between Bond St. and Broadway, and on Harford Ave., between Oliver St. and North Ave., $1.93 per sq. yd., on a 4-in. base and $2.14 on a 6-in. base. The work will cost about $20,617; also for the laying of vitrified brick on Madison St., between Greenmount and Central Aves.; on Ensor St., between Gay St. and Ashland Ave., and on Aisquith St., between Orleans and Monument Sts., at $2.08 a sq. yd. on a 6-in. base, total $47,389. N. A. Middleton & Co., contract for laying granite block of Camden St., from Hanover to Sharp, and on Barre St., from Sharp to Charles, at $3.09 a sq. yd.; cost about $17,328; for granite blocks on Harford Ave., from Ashland Ave. to Ensor St.; on Ensor St., from Ashland Ave. to Harford Ave., and on Chester St., from Ashland Ave. to Eager St., at $2.97 a sq. yd.; cost will approximate $25,000. Cunningham Paving & Construction Co., Philadelphia, for granite blocks on Constitution St., between Front and Madison Sts., and on Bond Sts., between Gay and Biddle Sts., at $2.98 a sq. yd. on a 4-in. base and $3.17 on a 6-in. base; cost will be about $28,746 Where there were alternate bids for different bases, it is believed that the 6-in. base will be laid.

Michigan.

✣Bids will be received until noon, M
by Board of Houghton County Road C
sioners, Houghton, Mich., for the c
[illegible] of the following roads: On
Road, beginning at Houghton and run
Atlantic, about 2½ miles of bitumin
[illegible] Hancock-Calumet road, 1½
bituminous macadam; Baraga Road, be
at the Snake River and running to the
line, a distance of 4½ miles. This wi
[illegible] 24 ft. between ditches.
and specifications may be seen at th
of the Board of County Road Comm
ers, Shelden-Dee Bldg., Houghton, M
Martin, Engineer.

Public Works Commissioner Haarer
troit, Mich., has presented to the City
a list of the streets he has in mind f
ing under the forced paving clause th
Twelve streets will be paved in this w
total estimated cost being $190,647, whi
will be paved by petition, at a cost of

The Common Council of Howell, M
engaged Consulting Engineers Riggs
man, The Nasby, Toledo, O., to make
veys and prepare complete plans,
tions, form of contract, estimates of
for the paving of Grand River St.,
Court and Walnut Sts.

Minnesota.

✣Bids will be received until 10
March 2, by James Gorman, City
East Grand Forks, Minn., for pav
Mers Ave., from Water St. to the N
Pacific right of way.

✣Bids will be received until March
said, by the County Commissioners, S
Minn., for road improvements. Oth
were recently rejected. T. H. Arms
County Surveyor. George Ries is
Auditor.

Mississippi.

✣Bids will be received until Mar
J. L. Young, City Clerk, West Poi
for grading and graveling a portion
Main St. The improvement will inclu
1,137 cu. yds. of grading, about 91,55
of novaculite macadam, 7 ins. thick;
concrete culverts, 2 ft. by 3 ft. 5 in
ft., and 400 lin. ft. of 18-in. terra c
pipe. D. Cottrell is Mayor, G. L.
Engineer, Columbia, Miss.

Missouri.

✣Bids will be received until 5 p. m
7, by H. E. Moody, City Clerk, Ca
Mo., for the construction of combi
crete curb and gutter on both sides
St., from Allen St. to Hatcher Av
and specifications are on file with Ci
F. B. Newton is City Engineer.

At a recent mass meeting of Dad
business men and farmers, held at G
Mo., enough money was pledged to
miles of rock roads radiating from th
seat. The first road to be macadami
be that between Greenfield and South
field, a distance of 3 miles; then
between Greenfield and Arcola, and
from Greenfield to Lockwood.

The Board of Public Works of
seph, Mo., has recommended ordina
the City Council providing for the pa
Moss St., 12th to 13th, with mineral
asphalt, and Monterey St., 28th to
with concrete, and to lay artificial sto
walks on Renick St., 20th to 27th.

Montana.

✣Bids will be received until 1
March 4, by Dawson County Audit
dive, Mont., for grading work on t
dive-Mondak road.

New Jersey.

⦿Van Kewren & Son have been
the contract by the Committee on
and Sewers of Jersey City, N.
Prout, Chairman, for the improve
Woodlawn Ave., from Ocean Ave.
son Blvd., at 89 per cent; also for
provement of Fleet St., from Conc

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

win Ave., to Edward P. O'Neill at [illegible] Bids were opened Feb. 19.

New York.

will be received until 11 a. m. by Maurice E. Connolly, Pres the Borough of Queens, for 10 street ment contracts, the largest being follows: For regulating, grading, and laying sidewalks, together work incidental thereto, in Good from Ditmars Ave. to Flushing Ward. The time allowed for completing above work will be 75 days. The amount of security re ill be $12,000. The Engineer's esti th quantities is as follows: 4,000 of earth excavation; 50 cu. yds. of cavation; 43,000 cu. yds. of embank excess of excavation); 100 lin. ft. urb, redressed and reset; 100 lin. ft. oncrete curb reset 6,200 lin. ft. of curb, one year maintenance; 32,000 new flagstone sidewalk; 100 sq. ft. [illegible] sidewalk trimmed [illegible]

will be received until 11 a. m., by Alfred E. Steers, President of ough of Brooklyn, N. Y., for 10 nprovement contracts, the largest o. 5, for repaving with asphalt the s of Leonard St., between Green ve. and Broadway, South 9th St., Berry St. and Broadway, and Ja Ave., between Pennsylvania Ave. ough Line, together with all work l thereto. The Engineer's esti the quantities is as follows: 94,700 sphalt wearing surface, delivered , outside railroad area, no main (measured in trucks as received on [illegible] asphalt wearing delivered and laid, within railroad maintenance (measured in trucks ved on the work); 700 cu. ft. extra lelivered and laid (measured in s received on the work); 100 sq. stone pavement to be relaid; 90 cu. icrete: 290 lin. ft. new curbstone oncrete; 880 lin. ft. old curbstone concrete; 430 lin. ft. new curbstone and; 2,200 lin. ft. old curbstone re and; 100 lin. ft. new headers; 100 ld headers reset; 164 noiseless cov heads for sewer manholes. The lowed for the completion of the d the full performance of the con l be 90 working days. The amount ity required will be $15,000.

will be received until 2 p. m., 5, by George McAneny, President Borough of Manhattan, New York r 22 street improvement contracts. the larger being No. 9, for regu nd repaving with improved granite avement on a concrete foundation, lway of First Ave., from south side to south side 70th St., and from ide 71st St. to south side 85th St. r's estimate of the amount of work [illegible] 32,000 sq. yds. of improved block pavement, with paving ce nts, except the railroad area. 3,000 of improved granite block pavement, ving cement joints, within the rail a (no guarantee). 6,420 cu. yds. of cement concrete. 12,030 lin. ft. of ich bluestone, medina sandstone, or curbstone, furnished and set. 1,250 f old bluestone curbstone, to be pur nd removed by contractor. 1,390 lin eaderstone, furnished and laid. 1,770 of old stone blocks to be purchased noved by contractor. The time al or doing and completing the above ll be ninety (90) working days. The of security required will be thirty [illegible] dollars ($30,000).

amin F. Mulderry, of Albany, N. Y., n awarded the contract by the Board ract & Supply of that city for the im nt of McKinley St., between Manning nd Lincoln Ave., including grading, and paving the carriageway with re pressed [illegible]

[illegible] service, etc.

[illegible]

The Board of Trustees of Penn Yan, N. Y., has been petitioned by property owners requesting the board to have submitted to the [illegible] of Elm St., from Keuka St. to the village limits.

The Board of Public Works of Fulton, N. Y., will hold a meeting March 4 to hear objections to the paving of West First St., for a distance of three miles. The state will pave the street to a width of 16 ft., and, the city will pave the balance. Brick and bituminous macadam will be used.

[illegible] Lowville, N. Y., a committee was named to select material for the paving of State St. next summer in connection with the proposed trunk line State road through the village. L. Charles Davenport is Village Clerk.

Village President Fred. B. Fuller of Gouverneur, N. Y., is engaged in securing data as to the cost of constructing the proposed Main St. pavement. Brick and various kinds of bituminous macadam are being considered for the work.

City Engineer Henry C. Allen of Syracuse, N. Y., has submitted estimates on the cost [illegible] ferson St. to Onondaga St., to the Common Council, as follows: Sandstone block, creosoted wood block or Hassam pavement, with granite, new top, $51,500; vitrified brick or block, new, $32,900; asphalt sheet, bitulithic, bituminous macadam or Hassam cement macadam, surface, $18,400; macadam, surface, $13,000; asphalt sheet surface on sides, new sandstone block in railroad strip, $26,900; asphalt sheet surface on sides, vitrified brick or block in railroad strip, new, $22,600. Estimates on the resurfacing of East Onondaga St., from South Salina St. to South State St., were given as follows: Sandstone block, creosoted wood block or Hassam pavement, with granite, new top, $36,000; vitrified brick or block, $14,000; asphalt sheet, bitulithic, bituminous macadam or Hassam pavement, macadam, surface, $13,500; macadam, surface, $10,300; asphalt sheet surface on sides, new sandstone block in railroad strip, $18,000; asphalt sheet surface on sides, vitrified brick or block in railroad strip, new, $16,000.

North Dakota.

✣Bids will be received until 5 p. m., March 11, by City of Fargo, N. Dak., for paving in fourth and fifth wards.

Plans have been prepared by City Engineer Frank L. Anders of Fargo, N. Dak., for the construction of 120,000 sq. yds. of pavement, estimated to cost from $1.50 to $3 per sq. yd. The pavement will be laid on a concrete foundation and will include 60,000 lin. ft., of concrete curb. Bids will be asked about March 6 on 9 different kinds of material.

Ohio.

✣Bids will be received until noon, March 15, by the Village Council, Caldwell, O., Harry A. Smith Clerk, for the improvement of a section of the Combs road by grading, paving and curbing.

✣Bids will be received until noon, March 25, by Fred H. Shoaff, Clerk of the Village of Euclid, O., for furnishing the material and labor necessary for the improvement of Euclid road from 818.5 ft. westerly from the center line of Chardon road to Upson road, by constructing a 10-in. water main on either side of Euclid road, from 818.5 ft. westerly from the center line of Chardon road to the east line of Chardon road, and a 10-in. water main on the northerly side of Euclid road, from the easterly line of Chardon road to the Up [illegible] cations on file at the office of Clerk at the Town Hall, and at the office of the F. A. Pease Engineering Co., at No. 931 Williamson Bldg., Cleveland, Ohio.

⊙F. M. Gephart, of Dayton, O., has been awarded the contract by that city for the paving of N. Main St., with brick for $29,327. The work includes cement curb and gutter.

[illegible]

Plans have been prepared by Engineer A. A. Kotte, of Alliance, O., for the construction of 2,500 sq. yds. of brick block paving, estimated to cost $4,500. Stone curb will be used. J. F. Hogan is in charge of the work.

Oregon.

Following bids were received Feb. 14 by the City Council of Portland, Ore., for the paving of Kearney St., from 15th to 28th Sts., with hard-surface pavement, including wood blocks, asphalt, bitulithic and Hassam: Oregon Independent Paving Co., asphalt, $1.70 per sq. yd., total $26,278; Oregon Hassam Co., for Hassam, $1.75, total $26,937; Barber Asphalt Co., for asphalt, $1.75, total $27,911; Warren Construction Co., for bitulithic, $1.37, total $22,377; Giebisch & Joplin, for asphalt, $1.65, total $25,901; for wood block $1.85, total $40,141; Carbolineum Wood Preserving Co., $1.74, total $37,098.

Following bids were received Feb. 18 by the City Council of Portland, Ore., for street work; Bowdoin St., from Portsmouth to Haven, grading and concrete curbs and walks—John Keating, $4,704; Carter Bros., $6,429; P. H. Flynn, $7,734; Peninsula Feed & Fuel Co., $6,883; Bechill Bros., $6,813; W. W. Mason, $6,533; Oregon Independent Paving Co., $6,625; Kibbe-Welton Co., $6,446. Wygant St., from Vernon Ave. to East 24th, grading and concrete curbs and Walks—P. H. Flynn, $5,239; Giebisch & Joplin, $4,718; Miller & Bauer, $4,381; Scott & McDougall, $4,748; Bechill Bros., $4,659; Crawford & Co., $4,321; Kibbe-Welton Co., $4,324; M. Hanson, $4,851. East 37th St., from Prescott to Humboldt, grading and concrete curbs and walks—Bechill Bros., $2,327; P. H. Flynn, $2,537; Giebisch & Joplin, $2,471; Crawford & Co., $2,444; Miller & Bauer, $2,583; Oregon Independent Paving Co., $2,444; Kibbe-Welton Co., $2,261. East 41st St., from Prescott to Humboldt, grading and concrete curbs and walks—Kibbe-Welton Co., $1,903; Oregon Independent Paving Co., $2,110; O'Neill & Co., $1,969; Bechill Bros., $2,104; Crawford & Co., $2,102; Giebisch & Joplin, $1,968; Miller & Bauer, $1,961; J. Keating, $2,157. East 25th St., from Albina to Going, grading and concrete curbs and walks—Kibbe-Welton Co., $2,197; O'Neill & Co., $2,745; Crawford & Co., $2,711; Giebisch & Joplin, $2,423; Bechill Bros., $2,639; Miller & Bauer, $2,584; Scott & McDougall, $2,430. Fremont St., from Vancouver to Commercial, bitulithic pavement—Pacific Bridge Co., $8,770; Warren Construction Co., $8,789. East 20th St., from Alberta to Prescott, grading and concrete curbs and walks—Crawford & Co., $2,749; J. Keating, $2,934; Giebisch & Joplin, $2,719; M. Hanson, $2,835; Miller & Bauer, $2,712; Kibbe-Welton Co., $2,576; Scott & McDougall, $2,680. East 67th St. district, grading and concrete curbs and walks—Joplin & Meeks, $6,972; Giebisch & Joplin, $5,575; Cochran, Nutting & Co., $6,142; Scott & McDougall, $6,538; Bechill Bros., $6,442; Manning & Co., $5,224. Broadway approach fill—North Coast Construction Co., $3,475; Pacific Bridge Co., $4,297; Crawford & Co., $3,547; H. Howard, $5,923.

The Alberta Improvement Club, F. Beies, President, Portland, Ore., is working for the widening of Alberta Ave., between Union and Vernon Sts., from 50 to 60 ft. The club has projected a hard-surface paving district between Going St. and Killingsworth ave., Union and Vernon Aves. This district is 10 blocks wide and 10 blocks long, and the total length of streets to be hard-surfaced is nearly 5,000 ft. This district includes Alberta St., between Union and Vernon Aves., and the cost of the district improvement will be about $100,000, including the sidewalks and grading.

Pennsylvania.

⊙The McNichol Paving & Construction Co. of Philadelphia, Pa., has been awarded the contract by the Department of Public Service of that city for the repaving of Arch St., between Front and 21st, with wood blocks, at $2.87 per sq. yd. The contract will amount to $119,487.

South Dakota.

The Black Hills-Yellowstone Park Interstate Highway Association was recently formed at the good roads convention in Deadwood, S. Dak., to promote the construction of an interstate road through South Dakota and Wyoming, connecting in the east with established roads from St. Paul, Minneapolis and Chicago. A. L. Kinkead of Huron is President, and I. A. Herrick of Deadwood is Secretary-Treasurer.

Texas.

⊙Hanson Sons, Inc., Galveston, Tex., have been awarded the contract by the County Commissioners, Galveston, John M. Murch, County Auditor, for grading, shelling, bulkheading, etc., of the Avenue S road down the island from Seventh to 13th mile post for $27,510. Bids were opened Feb. 5. Contract let Feb. 12.

It is understood the officials of Ellis County, Waxahachie, Tex., county seat, are planning to macadamize all roads to the amount of $550,000.

The Grayson County Commissioners' Court, Sherman, Tex., has entered an order for the issuance of bonds in the sum of $400,000 voted Dec. 9, for the purpose of building good roads in the Sherman District.

The City Council of Taylor, Tex., has passed a resolution calling an election of taxpayers for March 19, to submit to the people of Taylor the proposition of issuing bonds of $25,000 for street paving in the business section of the city.

Washington.

✣Bids will be received until March 7, it is reported, by Board of County Commissioners, Bellingham, Wash., for the construction of about ½-mile extension of the Hannegan road and also for the construction of about a mile of road near Lynden, to be a part of the Blaine-Sumas road, in Whatcom County.

✣Bids will be received until 1 p. m., March 5, by Board of County Commiss [illegible] Mitchell, Chairman, Mt. Vernon, Wash., for the construction of the Asplund road. Bids for this work were rejected recently.

✣Bids will be received until March 4, by Board of Mason County Commissioners, A. W. Hurst, Chairman, Shelton, Wash., for the construction of 1 mile of permanent road No. 1.

⊙The City Council of Pasco, Wash., L. H. Koontz, City Clerk, has awarded a contract to the Pacific Paving Co., of Seattle, Wash., for the paving of Fourth St., and Maple St., from Columbia St., to the Northern Pacific depot. The contract price is $30,721. Bids were opened Feb. 13.

⊙The Pacific Paving Co. has been awarded the contract by the city of Pasco, Wash., for paving 9 more blocks of streets with bitulithic, at $2.39 per sq. yd. The work includes about 18,300 sq. yds.

A bill has been introduced in the House of Representatives at Washington, D. C., appropriating $20,000 to construct a military road on Fort Canby military reservation, Pacific County, Washington; also a bill authorizing the sale of ripe timber on this reservation, the proceeds to be applied to construction of a road from Ilwaco to the life-saving station.

Plans are being prepared by City Engineer J. M. Crom of Cashmere, Wash., for the construction of about 16,000 lin. ft. of concrete sidewalks, estimated to cost $19,000. The contract will be let about March 25.

The City Council of Toppenish, Wash., proposes to pave practically the entire business district of the city. The Council also passed a resolution providing for the grading of eight streets in the original townsite of Toppenish and the improvement of sidewalks throughout that district.

The Whatcom County Commissioners, Bellingham, Wash., has recommended to the State Highway Commission that the $42,000 state aid fund now available be used o Northwest and Northeast Diagonal road the Sumas-Nooksack road. A total o miles are to be improved. Bids will be for probably in March. Charles Lin is County Engineer.

It is reported the City Council of Oly Wash., has adopted a resolution providi the continuation of street paving on F St., from Jefferson St., east to Eastsid also for sidewalks and sewerage.

Wisconsin.

At the coming spring election the to Gibraltar, Door County, Wis., will vote appropriating money for road improv The road along the state park bounda tween Fish Creek and Ephriam will b proved.

The Ashland County Board, Ashland, has authorized the issuance of $50,000 in for 10 years, for macadam road buildin ing the coming summer. In addition t amount the Board has appropriated $ for the work.

The City Council of Appleton, Wis ordered parts of seven streets and two paved and two streets ordered to be red with gravel and oiled. North St., from to Green Bay Sts. is to be redressed, and curb and gutters put in; State St. College Ave. to Second St. is to be red and oiled. The city engineer has be structed to draw up plans and specific for the pavement of the following s Eighth St., from North Elm to Hig North Elm from Lawrence to Seventh; ty from Seventh to Sixth; South Elm Sixth to Prospect; Seventh from Cou Cherry; Fifth from Walnut to Pr Dillon from State to Walnut. The al Blocks 52 to 53 on the south side of to Cherry. The alley in the block of t armory from Durkee to Drew St.

Canada.

✣Bids will be received until noon, 11, by City Clerk, Westmount, Que., construction of pavement on Wester Archibald Currie is City Surveyor.

BRIDGES—STEEL AND CONCRET

Alabama.

The Lauderdale County Court, Florence, Ala., has ordered the construction of a steel bridge over Anderson Creek at Goadsville Road. The structure, as proposed, will be 75 ft. long and is estimated to cost about $2,250.

Arizona.

The new concrete bridge at Tempe, Ariz., is being built under the direction of the Territorial engineer and the supervision of the Board of Control. No contracts will be let for the work. G. A. Mauk, Phoenix, Ariz., is Territorial Auditor.

California.

✣Bids will be received until 11 a. m., April 8, by Board of San Bernardino County Supervisors, Calif., for the construction of a 250-ft. steel highway petit truss highway bridge with concrete abutments. The cost of the structure is estimated at about $12,000. J. Bright, Jr., is County Surveyor.

✣Bids will be received until 10 a. m., March 26, by Heman Dyer, City Clerk, Pasadena, Calif., for the construction of a reinforced concrete arch bridge, 1,460 ft. long, with 28-ft. roadway and two 5-ft. sidewalks. The cost of the structure is estimated at $185,000. Plans and specifications may be obtained of Waddell & Harrington, Kansas City, Mo., or City Engineer of Pasadena, Calif. Official advertisement will be found elsewhere in this issue.

⊙The Glenn County Supervisors, Willows, Calif., have awarded the contract for the erection of the Glenn bridge over the Irrigation canal to Graham & Jensen at $1,475. The contract for the construction of the Vess Crouch bridge near Butte City, was awarded to Jenkins & Wells, at $7,339.

A meeting will be held at Colusa, Calif., March 8, by Boards of Supervisors of Glenn and Colusa Counties to discuss the necessity of building a bridge over the Sacramento River at Princeton, Calif., as mentioned in our last issue.

Colorado.

Commissioners of Adams County, Brighton, Colo., have ordered the preparation of plans and specifications for the construction of a steel and concrete bridge over Sand Creek on Dayton St., Aurora.

Florida.

✣Bids will be received until March 29, by Duval County Commissioners, Jacksonville, Fla., for the erection of a bridge on the Pensacola Road in Cracker swamp. As planned the structure will be of steel 510 ft. long and 16 ft. wide with a concrete floor; also for two wooden bridges on Fernandina Road at Inconstanto River. C. W. Ellis is Chairman of the Board and Gail Barnard is County Engineer.

Georgia.

⊙Board of Cobb County Commissioners, Marietta, Ga., has awarded the contract for the material to construct a new bridge over Power Creek at Powder Springs to the Virginia Bridge & Iron Co., Atlanta, Ga. The structure will have a 60-ft. span and will have a 16-ft. concrete roadway.

Idaho.

A movement is on foot for the const of a wagon and foot bridge across wood Creek and it is expected that the County Commissioners, Grangeville, will act favorably on the proposition.

Illinois.

✣Bids will be received until 8 p. m., 6, by Pleasure Driveway & Park Distr City Hall, Peoria, Ill., for the const of an 80-ft. riveted steel truss bridg reinforced concrete floor and concret ments, erected complete over Dry F Laura Bradley Park.

✣Bids will be received at the County office in Virginia, Ill., up to 1 p. m., 19, for the construction of one rei concrete bridge in Road District No. County. L. O. Skiles, County Clerk ginia, Ill. Baxter bridge—Span, 50 ft. deck girder bridge; 16 ft. roadway. D from finished roadway to bottom of f 23 ft.; wings, 16 ft. long. Estimated of concrete in structure, 238 cu. yds. forcing steel, 28,292 lbs. Nearest r station is Chandlerville, on the C. P. L. railroad, 4½ miles. Material will be shipped in. Sand might be haule the Sangamon River, 2 miles. Existing is a 40-ft., steel leg structure. Excavati average 16 ft. in a soft sandy materia will probably be necessary. Average f stream, 3 ft. deep and 20 ft. wide. C sioners will provide temporary crossing to be completed on or before August More detailed information may be had

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ation of the plans and specifications d by the Illinois Highway Commisich may be seen at the Town Clerk's may be obtained upon application in from the Illinois Highway Commisoringfield, Ill.

s will be received at the State Bank, Ills., up until 2 p. m., March 1, for struction of one reinforced concrete n Houston Township, Adams County. T. Pearce, Town Clerk, Bowen, Ill. Bridge.—Span, 16 ft.; roadway, 16 ft. of wings, 12 ft. Estimated amount of in structure, 53.3 cu. yds.; reinfo c- l, 4,360 lbs. All material will have to ed in. Nearest railroad station, Golthe Wabash and C. B. & Q. rail¾ miles. Roads, fair. Average lo l ,500 lbs. Existing structure, 18 ft., ridge. Average flow of stream, 3 ins. d 4 ft. wide. Excavation will average n sandy loam to probably clay. The on the work will be held until the meeting of the County Board. Work ompleted on or before June 1, 1912. letailed information may be had by nination of the plans and specifications d by the Illinois Highway Commisich may be seen at the Town Clerk's r may be obtained upon application ng. from the Illinois Highway Com- Springfield, Ill.

s will be received up to noon, March e Court House, Ottawa, Ill., for one ed concrete bridge to be built across lian Creek in Serena Township, Laounty. A. E. Bach, County Clerk, Otl. West Serena Bridge.—Two spans, ft. in the clear; roadway, 18 ft.; e to be placed on one new abutment old stone abutment. Total estimate rete, 286.7 cu. yds.; reinforcing steel, . Foundation to be carried about 2½ w stream bed to rock. It is reported avel may be obtained from the stream hin ½ mile from bridge site. Present is a King arch, 95 ft. span. One old butment to be entirely removed. Orflow of stream, 2 ft. deep; ordinary ater, 12 ft.; extreme high water, 17 ft. railroad station, Serena, on the C. B. miles. Certified check required equal er cent of the bid. Work to be comon or before Aug. 1, 1912. More denformation may be had by an examinathe plans and specifications prepared Illinois Highway Commission which seen at the Town Clerk's office or may ined upon application in writing, from nois Highway Commission, Springl.

ls will be received until 1 p. m., March ridge Committee of the Board of Superand the Highway Commissioners of od township at the Court House in e, Ill., for the construction of one 150- l span bridge with reinforced concrete esting on concrete abutments, over the ork of the Vermilion River at Cheney n Oakwood township. Plans and specis are on file at the office of Swallow llow, Attorneys, First National Bank Danville, Ill. John F. Fisher, Engineer, Harrison St., Danville, Ill.; S. C. Sailor, ay Commissioner, Oakwood, Ill. Bids e mailed to Swallow & Swallow.

ls will be received by L. E. McGann, ssioner of Public Works, Chicago, Ill., l a. m., March 5, for the construction ection of a temporary drawbridge and ches over the Calumet River near 92nd emized bids must accompany proposals ows: (A) Transferring and re-erecting esent drawspan and turntable at 92nd its new substructure, complete, includnforcements, for removing all obstrucfor doing all grading excavation, etc.; or 3 or 4-in. planks furnished and built e and to be used for the roadway floor approaches and drawspan, including all ngs, quantity approximately 72,000 ft. (C) for yellow pine timber furnished ilt in place and not covered in item A, including [illegible] assumed 19,000 [illegible] in previous [illegible] fastenings, quantity [illegible] way pine [illegible] er acceptable kind, delivered at [illegible] quantity assumed 24,000 lin. ft.; (F) [illegible] piles, quantity assumed 23,000 lin. ft. [illegible] cut-off line; (G) [illegible] or more test piles; (H) for each cu. yd. of reprop in place, used in center pier and abutment piers, quantity assumed 1,200 cu. yds.; [illegible] lbs.; (K) for structural steel for repair work, if needed, quantity assumed 10,000 lbs.; for cast iron for repair work, quantity assumed 3,000 lbs.; (M) for cast steel for repair work, quantity assumed 1,000 lbs.; (N) for machinery, steel and iron, quantity assumed 2,000 lbs.

⊙[illegible] tee, Carl J. Lager, Chairman, Geneseo, Ill., for the construction of two bridges in Henry County as follows: 130 ft. structure with 16-ft. reinforced concrete roadway to be known as Potters Bridge, to H. S. Wetherell, Morgan Park, Chicago, Ill., at $5,600; 150-ft. structure with 16 ft. reinforced concrete roadway, to be known as Green River Bridge, to Joliet Bridge & Iron Co., Joliet, Ill., at $5,800. Bids for the work were opened Feb. 15. Both structures will be riveted truss type.

⊙The Joliet Bridge & Iron Co., Joliet, Ill., has been awarded the contract for the construction of the Northampton bridge in Hallock township at $1,921. The structure will be of steel and concrete construction and will be 75 ft. in length.

Elections will be held soon at East Oakland, Morgan and Ashmore, Ill., to vote on the location of the proposed bridge over the Embarrass River.

Commissioners of the Illinois & Michigan Canal recently conferred with the city officials of Ottawa, Ill., in regard to the construction of a new bridge over the lateral canal at West Main St. A stationary bridge will probably be erected as the old waterway has not been used for a number of years.

The City of Lacon, Ill., contemplates the construction of a 150-ft. single-leaf bascule bridge with 16 ft. concrete roadway resting on concrete substructure, over the Illinois River. Final plans will be completed as soon as the test borings have been made. The estimated cost of the structure with creosote fenders is $80,000 and without creosote fenders $78,200. A. N. Johnson, Springfield, Ill., is State Engineer. Frank Taylor, Lacon, Ill., is Chairman of the Bridge Committee.

Petitions have been filed with the clerks of Middleport and Concord townships, Ill., asking that a proposition to issue bonds for the construction of a new bridge at Old Texas be submitted to the voters in the Spring. It is proposed to construction a three-span concrete bridge across the Iroquois River on the line between the two townships. The estimated cost is $7,500. The proposition must carry in both townships in order to build the bridge.

The Santa Fe System has planned on the following bridge work for the near future: Renewal of bridge No. C 479, Northern Division, estimated cost $7,300; bridges No. 1135, 1136, 1137 between Middle River and Onwood, Valley Division, to be renewed, estimated cost $259,000; rebuilding the piers with concrete and repairs due to washout at bridge 200 D, Southern Kansas Division, $10,500 has been apportioned; to cover cost of changing line and constructing bridges between milepost 60 and 68, Albuquerque Division, $285,000 has been appropriated; to cover cost of extending pipe line, building a berm on south side of track near bridge at Cardy, Mo., an appropriation of $3,600 has been made. The Santa Fe System has appropriated $2,000,000 to cover cost of constructing a bridge for double trackage over the Missouri River at Sibley, Mo., and grade reduction between mile post 427 and 429. A. F. Robinson, Chicago, is Bridge Engineer.

Indiana.

⊙[illegible] steel bridges in Jasper County has been awarded to Henry Cripe, Goshen, Ind., at the fol[illegible] bridge in the county was awarded to the Attica Bridge Co., at Attica, Ind., at $742. J. P. Hammond, Rensselaer, Ind., is County Auditor. Bids were opened Feb. 5.

Iowa.

Officers of the South Sioux City Commercial Club are making efforts to promote the construction of a new high bridge over the Missouri River between South Sioux City and Sioux City, Ia. C. D. Smiley is President of the Club.

Kansas.

✣Bids will be received until March 18, by Board of County Commissioners, Wichita, Kan., it is reported, for the construction of 8 small culverts to be let as one contract and for five bridges as follows: 54-ft. standard pile bridge between sections 17 and 18, Waco township; a 60-ft. standard pile bridge, between sections 30 and 31, Payne township; and a 60-ft. standard pile bridge between sections 12 and 13, Lincoln township. These bridges are to be reinforced concrete or steel I-beam construction. Tops are ordered on three other bridges, one between sections 8 and 7, Ohio township; one between sections 17 and 20, Greeley township, and one between sections 22 and 23, Illinois township. Two small concrete bridges are also to be built on the Lawrence Ave. road.

A petition is being circulated among the property owners of Hutchinson, Kan., asking for the construction of a reinforced concrete bridge over Cow Creek at Ave. A west.

Louisiana.

The Police Jury of Winn Parish, Winnfield, La., has decided to appropriate $2,000 for the construction of a bridge at Strong's Ferry on Saline Bayou near St. Maurice.

Maryland.

A bill will probably be introduced into the State Senate by Senator Sproesser, according to advices from Annapolis, Md., providing for an appropriation of $250,000 for the Light St. bridge, which will connect Baltimore with both Anne Arundel and Baltimore counties. This sum is to come out of the road loan that the Legislature will probably create. It is the present purpose of those who have the matter in hand to create a loan of $2,800,000. Of this $2,000,000 will be to continue the work of the Road Commission in the counties, $300,000 for Calvert, Charles and St. Mary's Counties and $500,000 for Baltimore City, to be used on the streets. If the city wishes to devote $250,000 of this sum to the Light St. bridge it will probably be at liberty to do so.

Massachusetts.

⊙The Public Works Department, Boston, Mass., has awarded the Contract No. 1, Chelsea Bridge, North, to George T. Rendle, 28 School St., Boston, Mass., at $178,004. The work will include temporary pile bridge with steel draw span for same, masonry, center pier for permanent draw, new pile fender piers, etc., and rebuilding portions of existing pile bridge. Other bids for the work were as follows: W. H. Ellis, Boston, Mass., $190,875; William J. Lawler, Boston, Mass., $199,522; William L. Miller, Boston, Mass., $224,102; W. H. Keyes & Co., Boston, Mass., $237,086. Frederic H. Fay is Division Engineer. Bids were opened Feb. 20.

Michigan.

State Railroad Commissioners Lawton T. Heemans and George W. Dickinson and representatives of the Saginaw Southern Interurban and Pere Marquette Railroads recently met at Saginaw, Mich., to look over the proposed site of the viaduct at Tuscola St. and 14th St. Plans for the interurban tunnel un-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] over.

A recent inspection of the bridge over the Black River at Military St., Fort Huron, Mich., revealed that the structure is in pretty dangerous condition and the city council will probably take steps toward building a new bridge.

Minnesota.

✣Bids will be received until 10 a. m., March 4, by P. A. Hoffman, County Auditor, Hastings, Minn., for the construction of a steel bridge across the Vermilion River in Section 31, town of Vermilion. Plans and specifications are on file at the office of the State Engineer, St. Paul, Minn.

Plans are being prepared by G. C. Warner, Engineer, Grand Rapids, Minn., for the construction of a 475-ft. steel and concrete bridge for the township of Grand Rapids and County of Itasca, Minn. The structure will have an 18-ft. roadway floored with planks and concrete. The contract for the structure will probably be let during March. The total amount available for the work is $19,500. Hugh McEwan, Grand Rapids, Minn., is official in charge of the work.

The Crow Wing County Commissioners, Brainerd, Minn., have called a special election for March 12 to submit to the voters the proposition of issuing $35,000 of bonds for the construction of a bridge over the Mississippi River in northeast Brainerd to replace the old structure which was recently condemned by George W. Cooley, State Highway Engineer, St. Paul, Minn.

Missouri.

✣Bids will be received until March 5, it is reported, by Board of Public Works, Kansas City, Mo., for the construction of a reinforced concrete bridge to replace the structure over Brush Creek at 48th and Main St. According to the plans prepared by Waddell & Harrington, Consulting Engineers, Kansas City, Mo., the structure will be 136 ft. long and 40 ft. wide, having 3 arches.

The Board of Public Works, Kansas City, Mo., has instructed Waddell & Harrington, Kansas City, to proceed at once with plans for the construction of the West 12th St. viaduct.

Montana.

A petition is to be presented to the Commissioners of Yellowstone County, Billings, Mont., asking for the construction of a bridge over the Big Horn River east of Hardin. As proposed the structure will be erected a short distance below the Burlington R. R. bridge.

Nebraska.

◉The Buffalo County Board of Supervisors, Kearney, Nebr., has awarded the contract for the construction of county bridges during 1912 to the Omaha Structural Steel Works, Omaha, Nebr.

◉The Elkhorn Construction Co., Fremont, Nebr., has been awarded the contract for the construction of all steel concrete and wooden bridges and repairing old structures in Colfax County. Ed F. Vrzak, Schuyler, Nebr., is County Clerk.

◉H. T. Ward Construction Co., Tecumseh, Nebr., has been awarded the contract for the construction of all wooden and steel bridges in Otoe County, of which Nebraska City is county seat, for the year of 1912. The prices were as follows: Steel structures from 10 to 100 ft. long from $6 to $11.50 per lin. ft.; wooden bridges from 30 ft. to 80 ft. long, $2.45 per lin. ft.; I-beam bridges, 16 to 32 ft. long, from $0.83 to $7.80 per lin. ft. The Kimballton Construction Co., Atlantic, Ia., was awarded the construction of one concrete bridge at $974. Louis Statt is County Clerk, Nebraska City, Nebr.

New Mexico.

Advices from Farmington, N. Mex., state that a meeting was recently held at that place to take up the matter of rebuilding the bridge across the San Juan River.

New York.

Plans are being prepared at the [illegible] the American Bridge Co., New York [illegible] for the construction of 14 steel bridges [illegible] the Delaware & Hudson R. R. Co., [illegible] Burgess, Albany, N. Y., Chief Engineer, [illegible] build this year between Oneonta and [illegible] Point. The bridges are to take the place of structures built from 15 to 20 years ago and now declared to be too light for the heavy equipment that is used on the railroads. With the completion of the bridges it will be possible to run some heavy locomotives north [illegible] which now do not [illegible] direction. The bridges range in length from 95 ft. to 180 ft. each and will be for the most part of the through riveted span type. Work is going on upon a new bridge for the Delaware and Hudson over the Mohawk at Schenectady. Operations were begun last August and to date two abutments and two piers have been completed; one pier is nearly done, and the fourth will be finished in about a week. Concrete is the material used for this work. The abutments and piers will support a double track 508 ft. in length.

Ohio.

✣Bids will be received until noon, March 11, by W. H. Bodurtha, Delaware County Auditor, Delaware, O., for the superstructure of the Worline bridge over the east fork of the Olentangy River in Oxford township. Plans and specifications are on file with County Auditor. A certified check for $200 must be filed with each bid.

✣Bids will be received until 10 a. m., March 6, by Board of Coshocton County Commissioners, Coshocton, O., for the construction of three new bridges and repairing two old structures.

✣Bids will be received until 1 p. m., March 5, by Board of Van Wert County Commissioners, Van Wert, O., for the construction of five new bridges and repairing of three other structures. Carl Simon is County Surveyor.

◉Commissioners of Ross County, Chillicothe, O., have awarded the contract for the construction of the Downs bridge to Hurff & Son, Chillicothe, O. They will use the old Hopetown bridge and put a concrete top over it.

Director of Public Service, Cleveland, O., is considering plans for the construction of a bridge over the upper Cuyahoga River connecting Clark Ave. S. E. and Clark Ave. S. W. As proposed the structure will be of bascule type and will be erected jointly by the city and Corrigan, McKinney & Co.

T. D. Paul, Summit County Engineer Akron, O., has recommended that the commissioners take action toward constructing a 3-span bridge at Boston. Nothing definite has, as yet, been decided.

Plans are being prepared by Robert L. J. Wager, City Engineer, Sandusky, O., for the construction of a bridge over the Lake Shore & Michigan Southern R. R. at Hayes Ave.

In a recent message to the City Council Mayor F. A. Hartenstein, Youngstown, O., states that among the most important propositions to be acted upon immediately is the construction of a new bridge on East Federal St. and Himrod Ave., which was recently condemned by Service Director Heasley and City Engineer F. M. Lillie.

Oklahoma.

◉The contract for the construction of the Oklahoma & Western R. R. from Butler, Okla., up the Washita Valley, which was recently awarded to Maney Bros., Oklahoma City, as mentioned in our last issue, includes 3,000 lin. ft. of bridge work.

Oregon.

Plans and sketches for the proposed bridge over the Columbia River between Portland, Ore., and Vancouver, Wash., have been submitted to J. P. Stapleton, Chairman of the Bridge Committee by Ralph Modjeski, Consulting Engineer, Monadnock Bldg., Chicago Ill. The [illegible] estimated at $1,930,000. The drawing shows a bridge of [illegible] spans, 375 ft. each center to center piers [illegible] bascule span 285 ft., center to center o [illegible] total length of steel structure in the mai [illegible] being 1,360 ft. The estimate is base [illegible] 24-ft. roadway between curbs. A trestl [illegible] included in the estimate, from the west sid [illegible] main channel at Hayden's Island acros [illegible] Columbia Slough and across the flats to Port

Panama.

✣Bids will be received until 10:30 a. m., Feb 29 (postponement of date from Feb. 15), b Maj. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D C., for the necessary lifting trusses, liftin mechanism, electrical equipment, signals, etc for the complete construction and erection o a single-track, single-leaf bascule, same to b installed by the commission on the 103½-ft steel girders now on hand at bridge 140, re located line, Panama railroad.

Pennsylvania.

✣Bids will be received until noon, Marc 12, by County Commissioners, Norristown Montgomery County, Pa., for the removal o an old covered bridge and a stone pier use to support the same, also for the furnishin and erection of a new steel girder highwa bridge with a reinforced concrete floor, pier to receive the girders, said bridge to spa the Schuylkill River at Pawlings, Cheste County, Pa. Plans and specifications may b secured from either the Montgomery or Ches ter County Commissioners upon the paymen of $10, same to be refunded upon return o plans. A certified check of $1,000 must ac company each bid.

Plans and specifications are under way b the City Engineer, for the construction of new bridge to replace the present structure a Seventh St., Altoona, Pa., and it is hoped t have things in shape in order that bids fo the work may be advertised in about 30 days

A proposition is under consideration a Du Boistown, Pa., to construct a bridge con necting with Newberry on the south side the river.

South Carolina.

City Council of Columbia, S. C., have bee advised that representatives of the Souther Ry. will make arrangements for the constru tion of a steel bridge to replace the prese wooden structure at the foot of West Elm wood Ave.

A petition has been circulated in the vicinit of Ravenna, a suburb of Gaffney, S. C., ask ing that the Commissioners of [illegible] County, at Gaffney, erect a bridge [illegible] Goucher Creek.

South Dakota.

✣Bids will be received until noon, Feb. [illegible] by Board of Fall River County Commissio ers, Hot Springs, S. Dak., for all steel bridg required by the county for the year of 191 J. P. Tiernan is County Auditor.

✣Bids will be received until 10 a. m., Mar 12, by Hutchinson County Auditor, P. Hofer, Olivet, S. Dak., for the constructi of the county bridges during 1912. Bids mu be per lin. ft. of spans and foundations specified by law.

Tennessee.

Plans have been made by the Engineeri Department of the Illinois Central R. R. the construction of a viaduct over Beale A to Pontotoc Ave., connecting up one of t railroad tracks on river front with those n building between Main and South Front S Memphis, Tenn.

Texas.

◉The contract for the construction of t reinforced concrete bridges at Nacogdoch Texas, has been awarded to the Missouri V ley Bridge & Iron Co., as follows: Main bridge, at $2,297; Fredonia St. bridge, at $ 498. Bids were opened by the city coun Feb. 13. Hess & Skinner, P. O. Box 6 Dallas, Texas, are agents for the bridge co pany.

Property owners of the North Side ha

✣ indicates work now open for bids. ◉ indicates a contract let recently.

etition to the City Commission- Worth, Texas, asking for the repair over Marine Creek on North other improvements on the of the bridge to the city limits.

to information from Pearland, rangements are now being made for on of a bridge over Clear Creek on-Chocolate road and across the just above the Santa Fe Ry. new Pearland-Houston road.

Utah.

will probably be held in Grand mit to the voters the proposi- [illegible] ruction of a bridge over Grand ey, 20 miles above Moab, Utah, it

Virginia.

improvements permission for rfolk & Western R. R. Co. re- the City Council, Norfolk, nstruction of a concrete and [illegible]

Washington.

for the construction of a pile n the Elliot Bay Iron Works nds, Wash., has been award- ett Construction Co., Everett, 58. Bids were opened Feb. 13.

The International Contract Co., 501 Central Bldg., Seattle, Wash., $65,396, was the lowest bidder for the construction of the proposed reinforced concrete bridge 500 ft. long on East 21st St., between Pacific Ave. and Multnomah St. in Portland, Ore., to be known as the Sullivan Gulch bridge. Other bids received Feb. 16, by the City Council were as follows: Lunstenman & Sanderberg, Portland, $68,758; Mr. Morris, Portland, $69,389; Mr. Wiles, Portland, $71,305; Pacific Bridge Co., Portland, $71,483; Graff Construction Co., Seattle, $71,881; Jahn Construction Co., Seattle, $73,869; Pearson Construction Co., Seattle, $74,887; Hayden & Bidwell, Portland, $76,451; Gieburtz & Joplin, Portland, $78,997; Portland Concrete Pile Co., $79,789. A. L. Barbur is City Auditor.

⊙The contract for the construction of the substructure of a bridge over the North Fork of the Lewis River, near Woodland, Wash., plans for which were prepared by Bowerman & McCloy, Central Bldg., Seattle, Wash., has been awarded by William J. Roberts, State Highway Commissioner, Olympia, Wash., to the Jahn Contracting Co., 114 Railroad Ave., So., Seattle, Wash., at $16,565. The following bids were opened for the work Jan. 30.—(1) Jahn Contracting Co.; (2) C. L. Creelman, Tacoma, Wash.; (3) Bidwell, Hayden & Co., Portland, Ore.; (4) Robert Z. Drake, Portland, Ore.; (5) Pearson Construction Co., Seattle, Wash.; (6) International Contract Co., Seattle, Wash.:

	(1)	(2)	[illegible]	[illegible]	[illegible]	[illegible]
l placing 1,000 lin. ft. natural bark protection that may be ordered, per	$ 0.16	$ [illegible]	$ [illegible]	$ [illegible]	$ 0.16	$ [illegible]
d placing 1,000 lin. ft. peeled piles that may be ordered, per lin. ft...	.17	.17	.40	.21	.17	.20
d placing 10 M. ft. B. M. timber ection that may be ordered, per M.	[illegible]	[illegible]	[illegible]	[illegible]	25.00	[illegible]
four concrete piers, furnishing all aterial, forms and excavating for xcepting piling.						
ls. concrete above elevation 5.0, per	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ls. concrete below elevation 5.8, per	[illegible]	[illegible]	[illegible]	[illegible]	14.85	17.90
concrete pedestals, furnishing all aterials, forms and excavating for ding						
. of concrete, per cu. yd.............	10.30	8.25	7.10	11.25	[illegible]	[illegible]
d placing 6,100 lin. ft. natural bark concrete piers, per lin. ft............	.19	.20	.40	.35	.28	.29
d placing 6,100 lin. ft. peeled piles ete piers, per lin. ft.................	.20	.21	.40	.36	.29	[illegible]
nd placing 100 cords live fir brush around piers as may be directed by r, per cord..........................	5.70	5.00	5.00	3.50	4.00	4.00
d placing 100 cu. yds. good sound e on mattress around piers as may by engineer, per cu. yd..............	1.80	4.00	2.50	2.50	4.00	2.50
tting piles, per lin. ft................	.48	.20	.20	.25	.10	.15
d placing shoes on piles.						
cast iron, per lb......................	.06	.04	.06	.04	.06	[illegible]
forged, per lb.........................	.11	.04	.10	.08	[illegible]	.07
steel, per lb..........................	.11	.04	.....		.07	
d using, as directed by engineer, any nt that may be ordered, 100 bbls., ...	2.60	3.00	2.75	2.75	2.50	2.15
s, including 850 cu. yds., haul from 000 ft., per cu. yd....................	.36	.07	.55	.35	.25	[illegible]
excavation, including 3,300 cu. yds., exceed 300 ft., per cu. yd............	.35	.32	.55	.25	.24	.30
re, per acre...........................	100.00	250.00	75.00	70.00	155.00	[illegible]
f grubbing, per sq. rod................	.60	1.50	1.70	.90	1.50	.35
of road excavation hauled more than cu. yd. per each 100 ft. additional....	.015	.01	.02	.05	.01	.02
f unscreened gravel in place on road, ...	1.75	1.50	1.25	.95	1.50	1.25
t prices.						
agon and driver, per day............	6.00	6.00	4.00	5.00	6.60	5.50
labor, per day......................	2.75	2.75	2.50	3.00	3.00	2.30
man, per day........................	6.00	4.50	4.50	6.00	6.00	5.50
d upon bark piles and cast iron shoes	$16,565	$17,009	$17,184	$18,410	$20,695	$20,735

Wisconsin.

⊙Wixon & Forbes, Rhinelander, Wis., have been awarded the contract for the construction of the proposed bridge at Big Lake to cost $1,976.

⊙Contracts have been let for construction of the bridge over the Fox River at Eggleston, 6 miles east of Endeavor. The construction of the concrete abutments has been let to Kutzke Bros., Portage, Wis., and the steel superstructure to Ward & Allen, Milwaukee, Wis. The cost of the structure will be about $6,500.

At a meeting of the Outagamie County Board, Appleton, Wis., March 9, the matter of appropriating an additional $1,320 will be decided upon, and if the amount is allowed a contract will be signed with the Modern Steel Structural Co., Waukesha, Wis., for a Scherzer rolling lift or bascule bridge. This company at $27,640 was the lowest of 11 bidders for the work.

Canada.

✣Bids will be received until 2 p. m., March 4, by S. K. Ewart, Chesley P. O., Ont., for the erection of steel bridge of one span 70 ft. long with 16-ft. roadway over the North branch of the Saugeen River about 1½ miles north of Chesley; also for the erection of two concrete abutments for same including about 400 cu. yds. Plans and specifications may be seen with James Warren, A. L. S., Walkerton, Ont.

✣Bids will be received until noon, March 7, by Chairman Board of Control, Toronto, Can., for grading and constructing the concrete abutments and wing walls for Coxwell Ave. subway. Specifications and plans may be seen and forms of tender obtained at the Department of Railways and Bridges, City Engineer's office, Toronto.

✣Bids will be received until noon, April 15, by A. S. Dawson, Chief Engineer, Department of Resources, Canadian Pacific Ry., Calgary, Alta., for design, manufacture and erection complete of the following steel highway Bridges: Two 125-ft. bridges; 4 100-ft bridges; 14 75-ft. bridges and 9 60-ft. bridges. Official advertisement will be found in ENGINEERING & CONTRACTING.

⊙The contract for extending piers and abutments of the Red River bridge at Winnipeg, Man., has been awarded by the Canadian Pacific Ry. to the Foundation Co., Ltd., of Montreal and Winnipeg, Can. Bids were opened by Frank Lee, Division Engineer, Winnipeg, Man., Feb. 14.

⊙The contract for furnishing the necessary labor and material for the construction of two bridges over the Boyne River at Carman, Man., has been awarded by A. Malcolmson, Secretary-Treasurer, to S. McClain, Carman, at $2,630. Bids were opened Feb. 20.

The Canadian Northern Ry. Co. has filed with the Railroad Commission plans for the construction of a second viaduct over the end of Main St., close to Norwood bridge and between the new viaduct at the foot of Bell Ave. and the bridge, at Winnipeg, Man.

The Works Committee of the City Council, Toronto, Ont., has passed the city engineer's estimate of $200,000 for the construction of a new bridge at Gerrard St.

RIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

ll be received until March 7, by Attorney, Dead Timber Drain- No. 13, Osceola, Ark., for 1,665,- of excavation and 8 bridges. Fur- ation may be obtained of the at- Willis E. Ayres, Civil Engineer, dg., Memphis, Tenn.

California.

re opened Feb. 8 by the South Irrigation District, of which Edwin Duryea, Jr., San Francisco, is Chief Engineer, on Contract-Divisions 2a, 2b, 3, 4 and 5 and on February 10th a contract for Divisions 2a and 2b was awarded to the Utah Construction Co., Ogden, Utah, at an estimated total cost of $658,138. On Feb. 13th contracts for Divisions 3 and 5 were awarded to T. K. Beard of Modesto, Cal., at estimated total amounts of $272,765 for Division 3 and $234,600 for Division 5. Also, on Feb. 13th, the contract for the wooden flume, constituting Contract-Division 4, was awarded to C. F. McCarthy of the Pacific Construction Co., San Francisco. The only remaining portions of the main canal between the head-works and the east edge of the South San Joaquin Irrigation District were awarded to T. K. Beard last August, as noted in these columns at that time. These portions are the diversion dam and head-works, Contract-Division 1, estimated total cost about $147,000, and Contract-Division 6, 6½ miles of unlined earth canal next to the district, with some structures, estimated total cost $132,000. The work on Contract-Division 2a consists of about 2¾ miles of extremely heavy side-hill rock excavation in the Stanislaus River canyon and includes two 1,000-ft. tunnels. All this portion of the work is the enlargement of an existing smaller ditch. Contract 2b consists of a new 2,940-ft. tunnel, with about 2,000 ft. of approaches. The material throughout these two contracts is generally hard slate and the capacity of the canal and tunnels will be 1,370 cu. ft. sec. ultimately and 1,110 in the beginning, 260 cu. ft. sec. of which will be water belonging to the Oakdale Irrigation District. Contract No. 3 consists of about 3 miles of canal along a ridge in hard pan with four short tunnels aggregating 960 ft. in length. The cuts are heavy and both the tunnels and open canal will be lined with concrete. The capacity of Contract 3 will be 1,110 cu. ft. sec. ultimately and 860 in the beginning. Contract 4 consists of a wooden flume 2,000 ft. long and about 80 ft. maximum height, built for an ultimate capacity of 1,110 cu. ft. sec. This flume crosses a saddle or break in the country. Contract 5 consists of about 5 miles of partially side-hill and partially crest canal with one tunnel 780 ft. in length. The canal is generally unlined and with an ultimate capacity of 1,110 cu. ft. sec. and a present capacity of 860. Contract-Division 1, the dam and head-works, has already been constructed across the river span to a height of 12 ft. above low-water and the north span of the arch dam is now being built. About 2½ miles of the canal in Contract-Division 6 is already constructed.

The directors of the Turlock Irrigation District, Turlock, have begun condemnation proceedings for a right of way for proposed lateral No. 5½ and for the extension of the Ceres main canal.

Bids have been received by the directors of the Turlock Irrigation District, Turlock, for the work necessary to extend lateral No. 2½ for a distance of about four miles through the Sayler colony, formerly the Tomlinson ranch. The bidders were J. D. Ninan, Hoskins Bros., Clyde Wood, Bradley & McKinnon, all of Turlock; Popp & Schwab and Ernest Green, Modesto; and Gilmer & McMillen, Wasco, Kern County. The work will cost about $8,000.

Georgia.

The Western Drainage Corporation of Atlanta, Ga., recently incorporated with a capital stock of $2,000,000, has acquired 75,000 acres of land in Ware County, which it proposes to drain for agricultural purposes. Frederick Fleming and J. P. McKinney, Dallas, Tex., are the incorporators.

Idaho.

⊙Conway & Wilhite, Boise, Idaho, have been awarded the contract for completing the construction of the laterals for the Downey-Marsh Valley Irrigation Co.'s project near Downey.

Illinois.

✣Bids are being received by the Western Brick Co., Danville, Ill., for moving about 35,000 cu. yds. of dirt. Steam shovel and dump wagon outfit preferred.

Indiana.

✣Bids will be received until 1:30 p. m., Feb. 28, by Elmer C. Williams, Construction Commissioner in the Circuit Court Room, Court House, Winamac, Ind., for the construction of Tony L. Ketman, et al. ditch, main drain being 148,200 ft. long and including 2,661,454 cu. yds. excavation.

Iowa.

✣Bids will be received until 3 p. m., March 6, by the Boards of Supervisors of Buena Vista and Sac Counties, Ia., at the office of J. Wilbur Neal, Sac County Auditor, Sac County, Ia., for improvements contemplated in the establishment of Drainage District Nos. 36-38 of said counties. Bids will be received as follows: First, for the furnishing of the tile delivered along the line of ditch, which bids must include the tile and sewer pipe for the catch basins, each of which requires one 24-in. sewer pipe 30 ins. long, one 6-in. 90-degree sewer pipe elbow, and 12 ft. of 6-in. tile; second, for the doing of all construction work and the furnishing of all material except tile necessary for the completion of the tile drains; third, for the construction of the open ditches. All bids must be submitted, received and acted upon separately as to the main drain and each of the laterals. Complete plans and specifications showing all necessary details may be seen at the offices of the county auditors.

✣Bids will be received until 10 a. m., March 7, by Board of Supervisors, Buena Vista County, Ia., at the office of W. W. Bennett, County Auditor, Storm Lake, Ia., for the improvements contemplated in the establishment of Drainage District No. 35. First, for the furnishing of the tile delivered along the line of drain, which bids must include the tile and sewer pipe for the catch basins, each of which requires one 24-in. sewer pipe 30 ins. long, one 6-in. 90-degree sewer pipe elbow and 12 ft. of 6-in. tile; second, for the doing of all construction work, and the furnishing of all material, except tile, necessary for the completion of the tile drains. All bid must be submitted, received, and acted upon separately, as to the main drain, and each of the laterals. Complete plans and specifications showing all necessary details may be seen at the office of the county auditor.

⊙Bids were opened Feb. 16 by J. C. Devine, County Auditor, Dakota City, Ia., for the construction of Drainage District No. 3, contracts being awarded as follows: Open work, Interstate Drainage & Investment Co., Britt, Ia., at 9 cts. per cu. yd.; tile work, John Dunkel, Webster City, Ia., for Sec. 4; Frank Forbes, Northwood, Ia., Secs. 2, 5, 6, 7 and Koob & Lock, Dakota City, Ia., Sec. 8.

⊙Contracts for work in Drainage District No. 2, bids for which were opened Feb. 16 by J. C. Devine, County Auditor, Dakota City, Ia., have been let as follows: Open work, Geo. Conn, Royal Center, Ia., at 9 cts. per cu. yd.; tile work, W. L. Stewart, Fort Dodge, Ia., at $34,018.

Kansas.

✣Bids will be received until 10 a. m., March 9, by Directors of the Kaw Valley Drainage District, Wyandotte County, Kansas City, Kan., for furnishing and installing all material, labor, appliances and equipment and operating for test, two direct connected 18-in. side suction steam centrifugal pumps and two 100-h.p. locomotive type boilers; also two motor driven 18-in. centrifugal pumps, near the mouth of what is known as the Santa Fe ditch or sewer, Argentine, Kansas City, Kan. W. H. Daniels is President. Official advertisement will be found elsewhere in this issue.

Michigan.

✣Bids will be received, as mentioned in our last issue, until March 22, by Walter R. Carven, Ingam County Drain Commissioner, Mason, Mich., for the construction of the Toll Gate drain. Specifications, etc., are on file at the office of ENGINEERING & CONTRACTING, 608 S. Dearborn St., Chicago, Ill.

North Carolina.

⊙Bids were opened Feb. 16, by Moseley Creek Drainage District, R. R. Eagle, Engineer, New Bern, N. C., for drainage work, the contract being awarded to the Brett Engineering & Contracting Co., Wilson, N. C., at $35,000.

Minnesota.

✣Bids will be received until 1 p. m., March 12, by H. P. Edwards, Martin County Auditor, Fairmont, Minn., for the construction of Judicial ditch No. 20, including 692 cu. yds. of earth at outlet and one retaining wall and the following tiling: 6,460 ft. of 6-in. tile, av. depth 4.38 ft., max. depth 6.08 ft.; 9,500 ft. of 8-in. tile, av. depth 4.85 ft., max. depth 7.23 ft.; 8,700 of 10-in. tile, av. depth 6.06 ft.: max. depth 11.58 ft.; 4,200 ft. of 12-in. tile, av. depth 7.4 ft., max. depth 10.12 ft.; 3,700 ft. of 15-in. tile, av. depth 8.81 ft., max. depth 10.85 ft.; 2,900 ft. of 1
tile, av. depth 7.12 ft.; max. depth 8.5
1,600 ft. of 18-in. tile, av. depth 6.9 ft.;
depth 8.63 ft.; 8,600 ft. of 20-in. tile,
depth 6.89 ft., max. depth 9.78 ft.; 6,750 f
22-in. tile, av. depth 7.89 ft., max. depth
ft. Soil is mostly black loam with clay
soil. Average haul is about 11 miles. Ne
railroad station, Fairmont. Best quality
tile to be used. Bids to be accompanie
certified check for 10 per cent of the am
of bid.

✣Bids will be received until 11 a. m., M
12, by H. P. Edwards, County Auditor, F
mont, Minn., for constructing County D
No. 26, including the following approxi
quantities: 7,800 ft. of 22-in. tile, av. d
8.15 ft., max. depth 12.40 ft.; 2,300 ft. of
in. tile, av. depth 9 ft., max. depth 12.05
1,600 ft. of 18-in. tile, av. depth 6.3 ft.
depth 6.55 ft.; 1,600 ft. of 16-in. tile, av. d
6.6 ft.; max. depth 7.15 ft.; 1,500 ft. of 1
tile, av. depth 5.73 ft., max. depth 6.65
3,800 ft. of 12-in. tile, av. depth 4.84 ft.,
depth 7.25 ft.; 5,325 ft. of 10-in. tile, av. d
4.75 ft., max. depth 9.34 ft.; 4,800 ft. of
tile, av. depth 4.75 ft., max. depth 6.5
2,250 ft. of 7-in. tile, av depth 3.62 ft.,
depth 4.15 ft. Soil is black loam with
subsoil. Average haul is about two
part of ditch being within limits of Vi
of Ceylon on C. & N. W. R. R.

✣Bids will be received until 10 a. m., M
27, by John Kelley, County Auditor, Lu
Minn., for the construction of Judicial I
No. 2 in Rock County. A certified check
10 per cent of the amount bid must be
with each proposal.

✣Bids will be received until 10 a. m.,
4, by L. H. Slocum, County Auditor, I
national Falls, Minn., for the constructio
Judicial Ditch No. 9, Koochiching County
surveyed the ditch is about 28 miles long
the estimated number of yards of dirt t
excavated is about 169,042: total estim
cost of the construction of said ditch
about $34,377.94. Bids will be received
the work as one job or for one or more
tions of said work. Each bid must be ac
panied by a certified check on a national
or trust company for not less than ten
cent of the bid.

Mississippi.

✣Bids will be received until March
Commissioners of Drainage, Sunflower C
ty, Miss., for digging about 22 miles of
ditches, involving the excavation of a
800,000 cu. yds. of dirt. A certified check
$3,500 must be filed with each bid. Fu
information may be obtained of D. M. Qu
Indianola, Miss.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE.)

The Memphis Street Railway Co. will sl
ly construct a reinforced concrete culve
carry their tracks, on Rayburn Blvd.,
Carolina St. Plans were recently furni
the Street Railway Co. by City Engi
Weatherford, and work will start immedi
and be rushed to a speedy completion.

Stout & Dennison, of Perryville, Tenn
nounce the early opening of their gravel
at that place. They state they have lots of
cellent gravel, are located near the railr
and are prepared to take orders for gr
and make prompt shipments.

T. J. Wallace, of Crystal Springs, Miss.,
in our city Feb. 20 and 21 inspecting our str
paving. He expresses himself as being
much pleased with the asphalt streets, and s
that he considers them as good as any in
country. According to Mr. Wallace, Cry
Springs is contemplating doing some pav
work soon and the officials are trying to m
a decision as to what character of pave
to use.

It is announced that the Chicago, Mobi
New Orleans R. R. will make a junction
Lexington, Tenn., with the Nashville, Ch
tanooga & St. Louis Ry. This is a link in
contemplated Air line from the Gulf of M
ico to Chicago, which will be put in by

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

sland system. There now lacks but a gap between Mid[illegible], [illegible] Hardeman ounty, on the Southern, and a point not yet l upon on the N. C., and the construc- a bridge at Paducah to complete this

C. Aderholdt, of Rina Lara, Miss., is in the arket for grader work. Charlie has been ar ng all last year, but can't keep out of the game. He is an old hand at the business. ny work he starts will be finished on

G. Beanland, secretary of the Delta Pub- and Improvement Association, announces prospects in that section for 1912 are fine. He states that a bill providing for rainage of the Delta is now in the Mis- ssippi legislature, having been already passed e lower house. This bill provides for the provement of 4,500,000 acres of the finest land, and is pushed by northern capital.

Feb. 27 bids were opened for the im- ment of Mulberry St., from Beale to Cal- This improvement is to take care of [illegible] on South Main St., as it will be [illegible] sted when the new depot is opened. Bids received on wood block, bitulithic, vitri- rick and asphalt, and will include about cu. yds. of excavation, and the removal eat quantities of old pavement. It is said tler Ave., in this section, will also be l soon.

sentative McKeller is pushing an at- have something done to prevent the g of banks at Riverside Park in Mem- The heavy current of the Mississippi at this point is constantly carrying away nse quantities of earth from the banks, n the past year has eaten in something 00 ft. This is due to the park being sit- in a bend of the river, where the cur- strikes it full. Representative McKeller that unless something be done soon, the park will be carried away.

spite the protests of numerous factory rs, the Memphis smoke ordinance was d on Feb. 21, and now all manufacturing s must install smoke consumers. Some e owners interested advanced the argu- e that such a law would deter other in- ies from locating here, but Mayor Crump a different opinion, and to back up his nent quoted the fact that there are numer- arge cities in the United States that have benefited by such an ordinance. John . Sheean, engineer at the Tennessee Trust . was appointed smoke inspector and will his duties about March 1.

E. Carlyle, president of the paving brick any of Portsmouth, O., which bears his . was a visitor to Memphis last week and n foot a deal with the street railway any of this place whereby they will prob- purchase in the neighborhood of a million . While here, Mr. Carlyle closed a con- with the Roach-Manigan Paving Co. for se of his pavers on the Helena contract tly secured by the latter firm.

b Leonard has established an office in the phis Trust Bldg., where he will be glad all his contractor friends. Bob has been successful in the last few years and now that his business has assumed propor- large enough to warrant his keeping an

esback Bros. have taken a good sized con- in the eastern part of Memphis and have f their crack outfits hard at work. The made pretty good money on their levee near Wilson, Ark., last season and have n together a bunch of excellent mules.

As announced in these columns recently, R. E. Lee Wilson, the millionaire Memphis cotton and lumber man, is after control of a number of the small logging roads in eastern Arkansas with a view of combining them into a system of standard gage railroads. It is now reported on good authority that Mr. Wilson has gained control of the Blytheville, Leach & Southern R. R. and that it is his intention of extending this line to Earle, Ark., a distance of about 32 miles, to connect with the Crittenden branch of his Jonesboro, Lake City & Eastern R. R. This will give Mr. Wilson a chain of roads which tap some of the richest country in Arkansas and when he has completed the proposed improvements on several of his lines he will be amply prepared to take care of the new business which will be created by the drainage of many acres of swamp lands across the river from Memphis. Mr. Wilson is one of the biggest men financially in eastern Arkansas and much of the new drainage being carried on in that section of his state is due to the broad ideas and untiring efforts which he has put forth in that direction. The local railroad builders are watching with interest the movement of Mr. Wilson, for they hope that within the very near future he will have several good sized contracts to offer.

Lewis Friedman, chairman, D. J. Young and Jas. Grier, of Ft. Smith, Ark., were in Memphis last week inspecting the excellent streets which the latter town has, with a view to adopting the best suited pavement to use in Ft. Smith. It is the intention of the citizens of the latter town to soon begin extensive street improvements and to the above gentlemen will fall the task of saying what sort of pavement will be laid. The gentlemen while in Memphis were the guests of Mike Roach, a past master in the art of street building.

Ed. Scott, of St. Louis, one of the largest railroad contractors in the United States, was a visitor to Memphis last week in the interest of his paving concern, the Roach-Manigan Paving Co. Ed. is looking well and speaks glowingly of the work he has under way in New York City and in the far west.

H. W. Brennan and O. K. Robertson, both of Memphis, are just about to begin a new sand business in this city, anticipating the immense amount of street work and building which will be carried on during the year 1912. For many years there has been but one sand and gravel company in Memphis, which company has enjoyed a beautiful business. Now the contractors are congratulating themselves that there is a prospect of cheaper sand and gravel. The barges of the new concern have been secured and they are on a deal for a huge dredge boat which will lift the sand and gravel from the bed of the Mississippi river. H. W. Brennan was for many years a noted street contractor of this city and has a host of friends among the boys who are at present engaged in that line.

A prominent official of the Cotton Belt and one who is in position to know whereof he speaks has just announced that his road will build a line from Memphis to Brinkley, Ark., a distance of about 69 miles, and that contracts will be awarded within the near future, in order that his road may enter Memphis over its own tracks. An arrangement has just been made for using the Rock Island line from Brinkley to Memphis and the announcement above has come as somewhat of a surprise to railroad officials here and elsewhere. Some time ago such a move on the part of the Cotton Belt would not have been wondered at and would have created no surprise but after the working arrangement with th Rock Island had been perfected, it was though that all idea of entering Memphis over its ow rails had been abandoned by the Cotton Bel However, the news is gleefully received b some of the large local railroad contractor who hope to have an opportunity of biddin on the work which is expected to start thi spring. The grading will be quite heavy, bu will be excellent team and steam shovel work

President Owen of the New Orleans, Mobile & Chicago road has announced that hi company will soon begin work on the exten sion of its line from Middleton to Lexingto Tenn., to connect with the N. C. & St. L. som time this spring or summer. When this branc is built and after the Frisco will begin run ning trains from Memphis to New Orlean by way of the M. & O. and N. O. M. & C this will give Memphis practically anothe road and will mean much to the shippers i this territory who have had only the I. C. t rely upon for New Orleans freight. It is no known at this writing what the yardage wi be in the new extension, but announcemen of the final plans is expected within the nea future.

Vice President Park of the Illinois Centra passed through Memphis last week en route t Chicago after an inspection of the Souther lines of his road. Mr. Park, while here, state that it was the intention of his company t start the work of grading for the new I. C station at this point about March 15, addin that engineers were now hard at work preparing blue prints and plans for the new proposition.

Texas.

⊙Cory, Harrison & Bryant, San Antoni Tex., have been awarded the contract for th construction of a canal in connection with th irrigation project of Fowler Bros., in the Fri Valley. The canal will necessitate about 25,000 cu. yds. of excavation and the construction of a small dam.

⊙Vogalsang & Hardy, Bay City, Tex., hav been awarded the contract at 12.24 cts. pe cu. yd. for the construction of drainag ditches in Matagorda County Drainage District No. 3, bids for which were opened Fe 15 by C. A. Marshall, Secretary, Blessin Tex. The work calls for about 29 miles o ditches involving about 158,000 cu. yds. o excavation.

Washington.

The stockholders of the Selah & Moxe Canal Co., according to advices from Yakim Wash., have reached an agreement with th Central Washington Investment & Power C whereby the latter company will take over th canals and expend $85,000 in improvement and extensions.

Wisconsin.

✣Bids will be received until 8 p. m., Marc 15, by Jacob Jackson, Village Clerk, Independence, Wis., for furnishing the necessary labo and material for the following work: Approximately 1,200 ft. of 8-in. cast iron pipe in trench 7 to 16 ft. deep in sandy soil; fou driven wells with header about 60 ft. dee through sand, and having screens packed i gravel inside 12 ins. temporary casing. All furnishing of materials and doing said work mus [illegible] according to the plans and specifications [illegible] file in the office of the Village Clerk, at Independence, Wis., and also at the office of W. E Miller, Madison, Wis., Engineer, who prepare the plans and specifications.

WATER-WORKS

Alabama.

e Decatur Water Supply Co. has been rporated in Alabama with a capital stock 25,000. The officers of the company are: ene Fies, president; J. B. Franklin and J. B. Weakley, vice presidents; W. C. Hamilton, secretary and treasurer. Mr. Franklin is from New York City, while all the others are from Birmingham, Ala.

An election will be held in Stevenson, Ala., on March 4 for the purpose of deciding whether or not bonds to the amount of $14,500 shal be issued to construct a system of water works. J. K. Shofner is Mayor.

California.

⊙Chas. C. Moore & Co. have been awarde

the contract by the board [illegible] of San Francisco, Cal., for furnishing and installing mechanical equipment [illegible] building to be located [illegible] reservation for the Auxiliary Water Supply System for fire protection. The contract price is $140,000. Bids were [illegible] the contract awarded Feb. 19.

Consulting Engineers Olmstead & Gillelen, Wright & Callender Bldg., Los Angeles, Cal., have reported a plan for constructing a municipal water system with a mission style pumping station, and new pipe lines for Oxnard, Cal.

Georgia.

An election will be held in Americus, Ga., on March 20, for the purpose of voting on the question of issuing bonds to the amount of $60,000 for the establishment of a municipal electric light plant and the installation of water meters throughout the city.

The Board of Water Commissioners of Macon, Ga., W. H. Fetner, Chairman, has postponed the opening of bids for a new pumping station for the city, for which bids were to have been opened Feb. 21.

Illinois.

✣Bids will be received until March 5, by City of Savanna, Ill., for rebuilding the entire water works plant. The work will include furnishing pumps, boilers, cast iron pipe, etc., as follows: 375 ft. of 10-in., 75 ft. of 8-in., 4,925 ft. of 6-in. cast iron class B.; B. & S. pipe, one 8", seven 6" and one 4" double water gate valves. A. T. Maltby, 803 Great Northern Bldg., Chicago, Ill., is Engineer.

✣Bids will be received until 11 a. m., March 5, for furnishing tug service to the City of Chicago, by L. E. McGann, Commissioner of Pubic Works. The service required is to transport men and supplies to and from city cribs in Lake Michigan, transporting materials for repairs, furnishing the cribs with steam when necessary, etc. Accompanying proposal must be the name of tug, keel length, beam, draught, date built, construction, engine, etc.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., March 5, for furnishing and delivering on various streets 35 36-in. 18 24-in., 5 20-in. and 3 16-in. gate valves. The valves are to be of standard design with hub ends, with iron body and bronze mountings; single stem inside screw with nut for opening and closing and shall be parallel seat valves with loose discs.

✣Bids will be received until 10 a. m., March 4, by Board of Local Improvements, W. S. Welch, Clerk, Joliet, Ill., for the construction of a water main in Chicago St. Plans and specifications are on file with the City Engineer, H. A. Stevens.

✣Bids will be received until March 5, by John Jares, City Clerk, Berwyn, Ill., for the construction of a 16-in. artesian well to be put down at the waterworks.

⊙McGregor & Lederer have been awarded the contract by the Board of Local Improvements of Bloomington, Ill., for the laying of a water main on Mulberry St., from Western Ave. to Hinshaw Ave., for $1,180.

⊙The Chicago Bridge & Iron Works, Chicago, Ill., has been awarded the contract by the city of Anna, Ill., for the construction of a steel water tank and tower at $3,950. Bids were opened Feb. 19.

Following bids were received Feb. 10 by the Board of Public Works of Chicago, Ill., for furnishing temporary turbine-driven centrifugal pumps at the Lake View pumping station; (1) standing for name of pump, (2) for name of turbine, (3) for duty, (4) for time of completion, and (5) for prize: Wm. A. Pope, (1) Platt Iron Works, (2) Kerr Turbine Co., (3) 80.3, (4) 110, (5) $30,980; (1) Allis Chalmers Co., (2) Kerr Turbine Co., (3) 82.0, (4) 110, (5) $29,500; Dravo-Doyle Co., (1) De Laval Steam Turbine Co., (2) De Laval Steam Turbine Co., (3) 95.0, (4) 135, (5) $50,000; Allis Chalmers Co., (1) Allis Chalmers Co., (2) Allis Chalmers Co., (3) 78.0, (4) 125, (5) $25,106, (2) Kerr Turbine Co., (3) 78.0, (4) 110, (5) $23,946; Camden Iron Works, (1) R. D. Wood & Co., (2) Kerr Turbine Co., (3) 70.0, (4) 100, (5) $25,100, (2) Terry Turbine Co., (3) 68.0, (4) 100, (5) $25,600, (2) Terry Turbine Co., (3) 55.0, (4) 100, (5) $25,900, (2) Westinghouse Electric & Mfg. Co., (3) 64.0, (4) 100, (5) $25,900; Henry R. Worthington, (1) H. R. Worthington, (2) General Electric Co., (3) 82.0, (4) 150, (5) $37,500; (1) Jeanesville Iron Works Co., (2) Terry Turbine Co., (3) 65.0, (4) 150, (5) $30,500; Alberger Pump Co., (1) Alberger Pump Co., (2) General Electric Co., (3) 75.0, (4) 150, (5) $34,550.

The citizens of Tampico, Ill., at a recent election voted in favor of the issuance of bonds in the sum of $11,800 for the installation of a waterworks. Plans were prepared by Consulting Engineer Arthur M. Morgan, 160 W. Jackson Blvd., Chicago, Ill.

The citizens of Seaton, Ill., have voted the issuance of bonds in the sum of $7,400 for the installation of a system of waterworks. Contracts were awarded some time ago.

The citizens of Havana, Ill., will decide at the spring election whether the city shall spend $15,000 to lay 20 blocks of new water mains, and $5,000 for a new auto fire fighting apparatus.

The Village Board of Piper City, Ill., will probably submit the proposition of installing a waterworks system in the village to the citizens at the spring election. Engineer R. E. Pickens of Kankakee, Ill., estimates the cost of the pumping station and well at $4,200, and the cost of mains not to exceed $25 per 50-ft. lot.

Plans have been prepared by Engineer R. E. Pickens of Kankakee, Ill., for the sinking of a well, constructing building, and for the laying of 4-in. and 6-in. water mains in the city of Rankin, Ill., at an estimated cost of $25,000. The Board of Local Improvements is in charge of the work.

Indiana.

✣Bids will be received until 7 p. m., March 7, by J. T. Trant, City Clerk, Hartford City, Ind., for furnishing and installing two 100-h.p. steam boilers, including the work of removing the present old boilers, placing the new boilers in position and for connecting the boilers with pumps of the waterworks.

Bids received Feb. 19 by the City Council of New Castle, Ind., for furnishing approximately 350 tons of cast-iron pipe, 10,000 lbs. of specials, 10,000 lbs. of lead, 400 lbs. of hemp; also for furnishing and erecting one 3,000,000-gal. pumping engine and accessories, are still under consideration. Charles Brossmann, Union Trust Bldg., Indianapolis, Ind., is Engineer. L. M. Johnson is City Clerk.

Iowa.

The city of Marshalltown, Ia., contemplates sinking 10 or more wells in the Iowa River Valley water field where the city water comes from, during the summer. It is estimated each well will cost about $150.

Kansas.

The Wichita Water Co., Wichita, Kans., has been reorganized for the purpose of borrowing more money for the making of improvements to the water system. The new company is incorporated with a capital stock of $2,000,000. The incorporators are: G. E. Hoffmaster, Pittsburgh, Pa.; H. V. Davis, Wilmington, Del.; O. B. Thornburg, Clifton, Pa.; R. M. Wilson, Ashinwall, Pa.; A. A. Adams of Pittsburg, Pa.

Michigan.

The officials of Brighton, Mich., contemplate installing a village waterworks at an estimated cost of $20,000. The proposition will be submitted to the citizens at an election.

Following bids were received by Wm. F. Jahnke, Clerk, Board of Water Commissioners, Saginaw, Mich., for installing two new pumps in the eastern district pumping station: Alert Pipe & Supply Co., advance pump (duplex), $2,475; condenser pump, $530; Laidlaw-Dun-Gordon Co., crank and fly wheel pump, $9,750 for two; condenser pump, $24
Henry R. Worthington, duplex pump, $5,97
for two; condenser pump, $590 for two; Fai
banks, Morse & Co., duplex pump, $2,22
condenser pump, $441; condenser pump, $36

The Board of Water Commissioners
Saginaw, Mich., Wm. F. Jahnke, Clerk, ha
passed a resolution ordering the laying of
6-in. water main in Stone St., between Co
gress Ave. and Union Ave., together with th
necessary hydrants, valves and specials.

The electors of Grand Haven, Mich., hav
voted the issuance of bonds in the sum of $60
000 for making extensions and improving t
waterworks system of the city. The wat
will be secured from wells sunk along t
beach of Lake Michigan.

Minnesota.

✣Bids will be received until 8 p. m., Mar
7, by City Council, Hill City, Minn., for t
construction of a complete city water wor
system. Separate contracts will be award
for the following: (1) Tower and tank.
Engine and pump. (3) Well. (4) Engi
house and foundations for the tank, etc.
Pipe and fittings. (6) Trenching of
blocks or more. D. V. Case & Broomha
Duluth, Minn., are engineers.

Plans have been prepared by D. V. Case
Broomhall of Duluth, Minn., for the install
tion of a municipal waterworks system in H
City, Minn., at an estimated cost of $15,00
The work will include the laying of ei
blocks of mains and the erection of a 50,00
gal. steel water tank. Bids will be asked i
mediately.

The Village Council of Kerkhoven, Min
is having plans and estimates prepared for
proposed system of waterworks. A propo
tion to bond the village for the improveme
will probably be submitted to the voters
the March election.

Missouri.

✣Bids will be received until 9 a. m., Mar
4, by Board of Managers State Hospital, N
vada, Mo., for the erection of a steel wat
tower with a capacity of 100,000 gals. Pla
and specifications are on file with J. J. Alfor
Secretary of the Board.

Nebraska.

A petition has been circulated in Sidne
Neb., providing for an election to vote on t
issuance of bonds in the sum of $10,000 to e
tend the water mains.

New York.

⊙The Snow Steam Pump Works of Buffal
N. Y., has been awarded the contract for t
furnishing and installing a 3,500,000-g
pumping engine for the city of Sioux City, I
at $11,895. Bids were opened Feb. 10.

The officials of Watervliet, N. Y., conte
plate installing a waterworks system.

Comptroller Edward S. Osborne of Roche
ter, N. Y., has sold city waterworks impro
ment bonds to the amount of $230,000 to G.
Bassett of Buffalo, N. Y.

The city of Little Falls, N. Y., O. J. Dem
ster, City Engineer, will construct a pipe li
across Hanson Island about June. Plans a
estimates have not been prepared.

Engineer C. C. Hopkins of Rochester,
Y., is preparing plans for the construction
a new waterworks for the village of Wolc
N. Y., to cost between $35,000 and $40,0
The water supply will be secured from sprin
The work will be in charge of the Vill
Council.

North Carolina.

The Wake Water Co., of Raleigh, N.
which plans the construction of a stora
reservoir, has not had plans perfected for t
improvement. E. B. Bain is official in char

Ohio.

An extensive report has been submitted
the city officials of Alliance, O., by Consulti
Engineers Chester & Fleming, Pittsburgh, P
covering a complete investigation of the wat
supply with recommendations involving t
construction of several storage reservoirs a
other improvements.

Oklahoma.

a recent mass meeting of citizens of Pur- Okla., a movement was started looking [illegible] ectric light plant. A committee has been nted to co-operate with the City Commis-

Oregon.

wn of Cornelius, Ore., will vote on a on to bond the town for $27,000 for llation of a water system. It is pro- to install a gravity system and take the from Roderick Creek, west of town.

Pennsylvania.

chitect Thomas H. Scott of Pittsburgh, has completed plans for the new pumping n to be built by the city at the Aspin- ation plant, which will be used to sup- North Side with pure water. The for the plant, which will be 121x180 ft. ze, call for a building of concrete, brick, nd terra cotta, to cost about $200,000 r C. O. Daughhaday, 529 Oliver Pittsburg, Pa., has completed 90 per the plans for the construction of a 00-gal. reservoir for the North Side sburg, estimated to cost $1,000,000. rk will include excavating, embank- l fill, concrete, and a 60-in. steel pipe. tracts will be let about April 1.

South Carolina.

he City Council of Columbia, S. C., has contract to the American Machinery Co., harlotte, to repair the power pumping on at the city waterworks for $5,892.

South Dakota.

The city of Yankton, S. Dak., plans making extensions to the present water system at an estimated cost of $[illegible]000. The work will include relaying old mains with cast iron pipes, construction of a standpipe, sinking of wells, etc. A bond election will be held. Hugh C. Leibec is City Engineer.

Texas.

The City Council of Huntsville, Tex., has decided to abandon the project of pumping the water from Rocky Creek to town to be used for domestic purposes. Another well will be sunk to furnish additional supply of water.

The Commercial Club of Pecos, Tex., is carrying on investigations looking to the securing of a large supply of soft water. Twenty-five analysis have been made and a supply 16 miles from the city has about been agreed upon. The cost, it is estimated, will be between $65,000 and $80,000.

The Water Commission of Waco, Tex., has passed resolutions calling on the City Commission to call an election to pass on the issuance of $400,000 for enlargement of the water plant to meet the rapid growth of the city.

Utah.

⊙The Utah Engineering & Machinery Co., Salt Lake City, Utah, has been awarded the contract by the city of Manhattan, Mont., for furnishing a Multistage centrifugal underwriters' fire pump with a capacity of 750 gals. per minute and a working pressure of 100 lbs. per sq. in., with pipe connections; also a motor. The contract price is $1,997. Bids were opened Feb. 19.

Washington.

✣Bids will be received until 7:30 p. m March 11, by Town Council, Rockford, Wash for supplying 1,000 ft. of 6-in. iron wate mains and 2,000 ft. of 4-in. iron mains an necessary connections or for less quantiti according to specifications on file with Ca W. McDowell, City Clerk.

Wisconsin.

• The Massillon Iron & Steel Co., The Rook ery, Chicago, Ill., has been awarded the con tract by the Village Board of Owen, Wi Geo. D. Richards, Clerk, for furnishing 8,0 ft. of cast-iron pipe and 4,800 lbs. of specia at $25.40 and $.02¾ per lb., respectively. Th Chicago Bridge & Iron Co., Chicago, secure the contract for constructing the 90-ft. ste tower and tank at $2,700. W. G. Kirchoffe Madison, Wis., is Engineer. Bids we opened Feb. 20.

Wyoming.

✣Bids will be received until 8 p. m., Mar 4, by W. J. Sisk, Town Clerk, Thermopol Wyo., for the construction and extension the water works system.

Canada.

The fire, water, light and power committ of the City Council, Winnipeg, Man., has i structed the City Engineer to submit pla and estimates of the cost of extending t water system to Poplar Springs. The cost the work, it is thought, will exceed $1,100,00

The City Council of Wadena, Sask., w proceed at once to develop a complete syste of waterworks, sewage disposal and electr light, at a cost of $110,000.

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

Sullivan, Long & Hagerty of Bessemer, ve been awarded the contract by the f Revenue, Jefferson County, Birm- Ala., for the construction of the city sanitary sewer at Boyles, Ala., for 3250. The work includes 24-in. terra cotta, n. cast iron, 20-in. terra cotta, 18-in. terra a, 15-in. terra cotta, 12-in. terra cotta, 12- cast iron and 10-in. terra cotta pipe, 36 holes, 100 cu. yds. of concrete, about three s of sewer. Bids were opened Feb. 15. I. Salter is Sanitary Engineer.

Arkansas.

E. Hale, of Pine Bluff, Ark., has been rded the contract by the Commissioners Sewer District No. 15, for the construc- of a sanitary sewer system for $7,282. J. Parkes, 203 Citizens Bank Bldg., is ineer. Bids were opened Feb. 17.

ngineers Dickinson & Watkins, State Nat. k Bldg., Little Rock, Ark., have been rded the engineering for the new sewer em to be installed by the city of DeQueen. The system will cost approximately 000 and the contract for construction will [illegible] as soon as the plans are ready.

California.

⊙Bids were received Feb. 19 by the City of Oakland, Cal., Perry F. Brown, City Engineer, for constructing a sewer in 36th and 35 Ave., the contract being awarded to John Heafey. The bids received were as follows:

	2,669 ft. [illegible] S. P. [illegible] ft.	4,235 ft. 16 in. S. P. 6 ft.	15 4 ft. M. H. 6.5 ft.	1 [illegible] L. H. [illegible]	16 5x16 Y's 6.5 ft.	15 [illegible] Y's. 6.5 ft.	Totals.
Cross	[illegible].69	$1.[illegible]	$30.00	$10.00	$3.00	[illegible]	[illegible]
n Construction Co.	1.66	1.30	44.00	6.00	1.50	2.10	10,858
son Con. Co.....	1.65	1.45	33.00	8.00	2.50	3.00	11,122
& Ellery ...	1.65	1.27	55.00	20.00	1.50	2.00	10,681
rland	[illegible]	1.12	40.00	12.00	1.50	1.75	9,222
Bros. & Ayer..	1.4[illegible]	1.25	55.00	10.00	.50	.60	9,936
ra Costa Const. Co.	1.98	1.72	35.00	8.00	2.50	3.00	13,187
Vincent....	1.55	1.31	40.00	15.00	1.25	1.65	10,345
Heafey...	1.28	1.04	40.00	10.00	3.00	4.00	[illegible]
an & Co. ..	[illegible]	1.33	60.00	15.00	1.38	1.95	10,868
W. Bigger	1.76	1.55	37.20	9.00	3.37	4.00	11,949
Page ..	[illegible]	1.60	40.00	7.50	2.00	3.00	12,632
He[illegible]	1.40	1.11	35.00	15.00	1.15	1.75	9,022
el Heath	1.50	1.20	45.00	10.00	[illegible]	3.00	10,279
Grady	1.51	1.20	35.00	10.00	2.00	2.00	9,702
es Stanley, Sr......	1.39	1.09	30.00	12.00	2.50	2.80	8,870

The Board of Public Works of San Francisco, Calif., has requested the Supervisors to set aside $60,000 out of the proceeds of the sale of sewer bonds of 1904 for the construction of a sewer in Pierce St., from Bay St., to Lewis.

The Board of Supervisors of Orange County, Santa Ana, Calif., has granted a petition of Geo. McPhee, chairman of the sewer committee of the City Council, Santa Ana, for a right of way for the sewer line along the county roads to the ocean. It is proposed to construct an outfall sewer.

Georgia.

The Board of Health of Atlanta, Ga., has accepted the specifications for a new crematory or incinerating plant which have been prepared by Chief Engineer of Construction R. M. Clayton. Bids will be advertised for at once. The specifications for the new incinerator provides for a building made of red brick and lined with fire brick with a dimension of about [illegible] about 150 ft. in height. The plant is to destroy 250 tons of garbage and refuse eve 24 hours under a high pressure of an avera of 150 degrees in the combustion chamber. complete plant is to generate 1,500 boil horse-power which will be sufficient to eith pump the city water or furnish a lighting sy tem. The estimated cost is between $300,0 and $400,000.

Idaho.

The City Council of Pocatello, Ida., h created five lateral sewer districts, take in 24½ blocks in the West Si extending from Harrison Ave., west Hayes Ave., and from Hayden St., south Lewis St.; also about 51 blocks in the Ea Side. Bonds will be issued to pay for t construction of the sewers.

Illinois.

✣Bids will be received by the Board Local Improvements, Chicago, Ill., E. Glaskin, Secretary, until 11 a. m., March 6, f furnishing the materials, labor, etc., necessa to construct brick and tile pipe sewers in t following streets: Euclid Ave., W. 43rd S Iowa St., W. 114th St., Walden Parkwa Bennett Ave., S. Center Ave., N. 44th Av Melrose St., School St., Roscoe St., W. 63 St., W. 67th St., W. 69th St., W. 71st St., Claremont Ave., S. Oakley Ave., S. Irvi Ave.

✣Bids will be received until 10 a. m., Mar 4, by Board of Local Improvements, W. Welch, Clerk, Joliet, Ill., for the improveme of Mississippi Ave. and Grant Ave. by t construction of sewers, etc. Plans and spe ifications are on file with H. A. Stevens, Ci Engineer.

✣Bids will be received until 9 a. m., Fe 29, by Board of Local Improvements, Gale burg, Ill., for the construction of a sewer Henderson St., and other streets; also f the construction of a sewer on North Bro St. and Main St. requiring the following a proximate quantities: 967 lin. ft. of 24-i pipe, 3,424 lin. ft. of 19-in. pipe, 1,902 lin.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

of 15 in. pipe, 292 lin ft of 12-in. pipe, [illegible] manholes, 12 catchbasins. F. M. Connelly is City Engineer.

The Board of Local Improvements of Bloomington, Ill., has rejected all bids received for the laying of the Oak St. sewer pipe and the Woodland Ave. and Jackson St. pipe sewer.

Indiana.

The Town Council of Walkerton, Ind., is again agitating the installation of a sewer system. It is planned to commence construction work in the spring.

Iowa.

✣Bids will be received until March 13, by City Council, Des Moines, Ia., it is said, for the construction of the proposed Greenwood Park system with a septic tank at 44th and Grand Ave. J. W. Budd is City Engineer.

⊙Bids were opened Feb. 20 by the City of Tipton, Ia., for constructing a sanitary sewer system for which the Iowa Engineering Co., Clinton, Ia., is the Consulting Engineer, contracts being let as follows: City sewer, J. W. Smith & Son, Oklahoma City, Okla., $53,979; outlet at septic tank and dosing chamber, M. Tschirgi & Sons, Dubuque, Ia., at $563 and $3,521; filter beds, Grant Baker, Tipton, Ia., at $2,822. The bids received on the construction of the city sewers were as follows: (1) standing for bid of J. W. Smith & Son, Oklahoma City, Okla.; (2) for bid of C. B. McNamara, Dubuque, Ia.; (3) F. C. Robinson, Manitowoc, Wis.; (4) Garberich & Anderson, Sheldon, Ia.; (5) Lana Construction Co., Harlan, Ia.:

		(1)	(2)	(3)	(4)	(5)
15-in vitrified pipe laid	3,420 ft	$ 1.90	$ 2.40	$ 1.94½	$ 3.25	$ 3.50
12-in. vitrified pipe laid	4,500 ft	1.78	2.00	1.84	3.00	2.50
10-in. vitrified pipe laid	10,550 ft.	1.06	1.20	1.20	1.92	2.00
8-in. vitrified pipe laid	34,500 ft	.63	.64	82½	.60	.85
12-in. c. i. pipe laid	48 ft.	2.00	2.50	1.60	3.25	2.00
10-in. c. i. pipe laid	132 ft.	1.50	2.00	1.50	3.00	2.00
8-in. c. i. pipe laid	48 ft	1.50	2.00	1.25	2.80	2.00
Manholes	85	36.00	50.00	60.00	49.00	70.00
Flush tanks	53	59.00	60.00	60.00	95.00	80.00
Totals		$53,979	$59,858	$64,669	$75,457	$82,581

City Engineer C. H. Young of Muscatine Ia., has presented plans to the City Council for the establishment of a sewer system in the flat grounds in South Muscatine. The plans provide for a pumping house, to include a pump, gasoline engine and a smaller engine, to cost $2,000.

Kansas.

⊙E. M. Eby, of Wellington, Kans., has been awarded the contract by the city of Sedalia, Mo., for the construction of vitrified pipe sewers in District No. 22 for about $12,000. Bids were opened Feb. 19.

Louisiana.

The Sewerage and Water Board of New Orleans, La., will shortly ask for bids for the lining and other work to be done on the lower Claiborne Canal, from Elysian Fields to Lafayette Ave., estimated to cost $50,000.

Maryland.

⊙Gallagher, Boyle & Muller, 120 Law Bldg., Baltimore, Md., have been awarded the contract by the Sewerage Commission of that city for house connections across footways, for $24,712. Bids were opened Feb. 14.

Plans and specifications are being prepared by City Engineers Crum & Davidson, Frederick, Md., for approximately 3,600 ft. of 6-in. to 24-in. vitrified pipe storm water sewers; 4,500 sq. yds. of vitrified brick paving, and 1,800 lin. ft. of concrete or granite curb. Work will be advertised in March.

A joint meeting of the Commissioners of the State Board of Health of Maryland, of Prince George's County, Montgomery County and the officials of the District of Columbia, was held Feb. 24 in Washington, D. C., to consider a plan for a metropolitan sewerage system that will allow the sewers of the contiguous Maryland communities to connect with the Washington system.

Following bids were received by the Board of Awards of Baltimore, Md., on Sanitary Contracts Nos. 79, 81, 84 and 85, Sanitary Sewers in Frederick Road, High Level Interceptor, Section No. 5, Lateral Sewers in Light and Gay Sts., and house connections across footways: Sanitary Contract 79—Martin J. Beach, 809 American Bldg., Baltimore, Md., $35,527; James Ferry & Sons, Crafton Station, Pittsburgh, Pa., $37,639; David M. Andrew Co., Baltimore, Md., $38,351; B. F. Sweeten & Co., Baltimore, Md., $33,678; Gallagher-Bayle & Muller, Baltimore, Md., $40,054; The Whiting-Turner Construction Co., Baltimore, Md., $40,565; Ryan & Reilley, 2300 W. Lexington St., Baltimore, Md., $46,885. Section No. 81.—Ryan & Reilley, 2300 W. Lexington St., Baltimore, Md., $171,368; Whiting-Turner Const. Co., Baltimore, Md., $177,911; J. Connelly Const. Co., 427 Schofield Bldg., Cleveland, Ohio, $178,329; B. F. Sweeten & Son, Baltimore, Md., $180,542; C. B. Clark & Co., 1808 Greenmount Ave., Baltimore, Md., $187,369. Sanitary Contract No. 84.—Ryan & Reilley, 2300 W. Lexington St., Baltimore, Md., $12,832; The Whiting-Turner Construction Co., Sexton Bldg., Baltimore, Md., $15,057; B. F. Sweeten & Son, Baltimore, Md., $17,460; N. A. Middleton & Co., Baltimore, Md., $18,139; M. J. Beach, 809 American Bldg., Baltimore, $20,757. Sanitary Contract No. 85.—Gallagher, Boyle & Muller, Baltimore, Md., $24,712; B. F. Sweeten & Son, Baltimore, Md., $27,727; Ryan & Reilly Co., 2300 W. Lexington St., Baltimore, Md., $27,768; George C. Souder, Lancaster, Pa., $36,600; Middleton Co., Baltimore, Md., $39,003.

Massachusetts.

The Harbor Board of Lynn, Mass., William E. Dorman, Chairman, has recommended to that city radical changes in the method of Lynn's sewage disposal, which will cost the city many thousands.

Commissioner of Public Works Louis K. Rourke of Boston, Mass., has submitted figures to the mayor for the proposed filling of South bay and installation of a new sewerage system for the South End, totaling nearly $9,000,000. Of the amount it is estimated that $4,000,675 will be required for the sewer system.

Minnesota.

✣Bids will be received until 3 p. m., March 18, by City Council, Willmar, Minn., for the construction and installation of a sanitary sewer system, storm or surface water sewer and septic tank, sludge beds, etc. The total length is approximately 46,000 ft. including the drain tile for the outlet. Plans and specifications are on file at the office of the Builders' Exchange, Fargo, N. Dak., and with the City Clerk, Hans Gunderson, Willmar, Minn.

⊙The city of Minneapolis, Minn., on Feb. 9 awarded the contract for supplying the sewer pipe for the year 1912 to the Streator Clay Mfg. Co., of Streator, Ill.

Engineer Lang has submitted plans to the City Council of Chisholm, Minn., for the sewer disposal tank to be constructed, for which the sum of $25,000 has been set aside by the council. The plans will be submitted to the State Board of Health for approval.

Missouri.

⊙H. F. Heman, 1106 Chemical Bldg., St. Louis, Mo., has been awarded the contract by the Board of Public Improvements, C. A. Moreno, Secy., St. Louis, for the construction of sewers in Harlem Creek Sewer District No. 4, for $11,688. Bids were opened Feb. 16.

City Clerk J. H. Langston of Springfiel Mo., will sell bonds March 5 in the sum $100,000 for sewer work.

Montana.

The City Council of Lewiston, Mont., h adopted the preliminary plans of the city e gineer for the east side sewer project. Th system will cost approximately $50,000. Bi will be asked shortly.

Nebraska.

The City Council of Hastings, Neb., h authorized the sewer committee to proce with preparations for the provision of add tional settling basins, for the disposal of se age at the sewer farm. The work will nece sitate the installation of a centrifugal pu with gasoline engine equipment.

New Jersey.

The Town Council of Guttenberg, Huds County, N. J., has adopted a resolution d claring its intention to order the constru tion of a 12-in. vitrified pipe sewer in Adam St., from its north end to 26th St. Em Nothacker is Town Clerk.

New York.

⊙Goldsmith & Stephens, of Albany, N. Y have been awarded the contract by the Boar of Contract & Supply of that city, for t construction of the Osborne St. sewer. Bi were opened Feb. 19.

The city of Binghamton, N. Y., will l contracts about April 15 for the constructi of 18,579 lin. ft. of new sewers, estimated cost $33,325. The work includes sanitary a storm water sewers from 8-in. to 30-in. i diameter. Plans were prepared by City E gineer John A. Giles.

North Carolina.

Plans have been prepared by Engineer N. Ambler of Winston-Salem, N. C., for th construction of the East Winston and Pete Creek sewer line at an estimated cost of b tween $40,000 and $50,000. Mayor R. I. Da ton is in charge of the work.

Ohio.

✣Bids will be received until noon, Marc 1, by Board of Public Service of Mario Ohio, for the construction of sewers in Par St. and Summit St. The work will include manholes and iron covers and necessary and 6-in. pipe. E. A. Scott, Marion, O., Engineer.

⊙Wm. McDowell & Son, of Cleveland, O have been awarded the contract by the Department of Public Service of that city fo the construction of sewers in the followin streets, avenues and thoroughfares: Madiso Ave., and West 112th St., at $21,105. Wn Lehman, of Cleveland, secured the contra for constructing a sewer in Davenport Av Bids were opened Feb. 21.

⊙The Department of Public Service of Salem, O., has awarded the contract for the construction of a sewage disposal plant to W H. Rallston of Mt. Vernon, O., for $48,39 divided as follows: Grading, $5,900; concrete and masonry, $5,123; filter material, $37 375. Preliminary estimates have placed th cost of the iron construction work at $1,00 and the railroad siding at $1,500. Other bidders were J. C. Devine, Alliance, O., $55,057 Martin P. Connelly & Sons of Youngstow O., $59,705 and the C. M. Neeld Construction Co., of Pittsburg, Pa., $65,206.

⊙The Board of Control of Columbus, O has awarded the following contracts for th construction of sewers: In Grace St., fro Harris to Hague Aves., Ames Bros., Columbus; sewer in Long St., from Franklin Par to the alley west of Woodland Ave., Ame Bros.; sewer in the alley west of Wiscons Ave., to J. F. Ryerson, Columbus; sewer i Cole St., to R. D. Fulton, Columbus; sewe in the alley west of Parsons Ave., fro Beck St., to the alley north, B. F. Belem Columbus.

A resolution has been introduced in th City Council of Cincinnati, O., providing fo the establishment of a municipal garbage re

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

plant at the expiration of the present ar contract.

State Board of Engineers has ap- the plans and specifications as pre- by City Engineer Carey Pratt of Ur- O., for the construction of a sanitary system in Urbana. A. Elliott Kimberly, bus Savings & Trust Bldg., of Colum- has been retained as Consulting En-

City Council of Troy, O., has decided e a survey made to ascertain whether ld be possible to connect with the trunk on Canal St., by constructing a system care of the territory bounded by Ra- larket and Grant Sts.

sulting Engineer Walter J. Sherman of & Sherman, The Nasby, Toledo, O., at it meeting of the Toledo Civic Federa- ecommended the construction of a ation plant near the mouth of Ten-Mile The engineer estimates the cost of an pting sewer along the north bank of Creek at $195,000, and of an inter- sewer along the south bank of Ten- reek at $286,652, or $428,745, depend- on the location.

have been prepared by City Engineer tte of Alliance, O., for the construc- 1000 ft of 15 in., 1,600 ft. of 12 in., of 10-in., and 500 ft. of 8-in. vitrified wers, including 12 manholes. The es- cost is $5.000. J. F. Hogan is Direc- Public Service.

Oregon.

wing bids were received by the City il of Portland, Ore., for the construc- of the Olmstead district sewer: W. $8,270; J Kennedy Construction Co., F. W. Riner, $7,258; Consolidated Co., $6,623; Johnson-Anderson Co., J. Currigan, $7,496; E. Sandeberg, and Jeffery & Bufton, $7,163.

Pennsylvania.

city of York, Pa., contemplates having which were prepared about five years evised, with the idea of securing a more n system of sewage disposal and the installing the same. Providing new re made a bond issue will be held to on the proposition. George A. Warner y Engineer.

ns have been prepared by Consulting eer Clyde Potts, 30 Church St., New City, for the construction of about 2½ miles of new [illegible] disposal plant at Nazareth, Pa. Work will probably be started as soon as spring opens up. A. R. Williams and Palmer J. Young, of Nazareth, are in charge of the work.

The City Engineer of Newcastle, Pa., has completed plans of the sewers which will have to be constructed in order to connect the sewer system with the proposed sewage disposal plant on Shaw's Island. Two sewers will be built at an estimated cost of $22,000.

Dr. Samuel G. Dixon of the State Board of Health has approved the plans prepared by Borough Engineer R. E. Neumeyer of South Bethlehem, Pa., for the construction of a sewage disposal plant.

State Health Commissioner Samuel G. Dixon has approved plans for the installation of a sewer system in the borough of [illegible] town, Pa.

The Borough of Port Allegheny, Pa., will shortly have plans prepared for the installation of a sewerage system.

The Borough of Coudersport, Pa., contemplates having plans prepared for the construction of a sewer system.

South Carolina.

An election will probably be held in Anderson, S. C., during March to determine whether or not the city shall issue $25,000 of bonds for sewerage extension.

South Dakota.

Plans have been prepared by Engineer S. B. Howe of Sioux Falls, S. Dak., for the installation of a new sewerage system for that city, estimated to cost $195,000. The contract will probably be let in March. Commissioner H. N. Gates is official in charge.

Tennessee.

✣Bids will be received until March 19, by Water Works and Sewerage Commission, Jellico, Tenn., for furnishing necessary labor and material for the construction of complete system of house sewers, comprising 4.8 miles of 8 to 12-in. clay pipe sewers with all manholes and accessories without pumping or purification. Plans and specifications are on file with A. B. Mahan, Secretary, Jellico, Tenn., or with Walter G. Kirkpatrick, Jackson, Miss., Engineer.

Texas.

The city of San Benito, Tex., will vote March 9 on the issuance of bonds for the construction of 20 miles of street improvement and $3,000 for sewerage. Estimates on this work should be taken up with the San Benito Commercial Club.

The City Council of Calvert, Tex., has entered into a contract with the Fountain-Shaw Engineering Co. of Dallas, Tex., for the making of all necessary estimates incident to the construction of a modern sewer system. Bonds will be voted upon for the improvement.

Vermont.

City Engineer H. M. McIntosh of Burlington, Vt., in his annual report to the City Council suggests the construction of a sewage purification plant.

Washington.

The city of Bellingham, Wash., will probably enlarge the existing sanitary sewer on Broadway St., from Holly to Broadway Park addition, to make it a combined storm and sanitary trunk sewer. The estimated cost of the work is $12,250. A hearing on the proposed improvement will be held March 11. W. H. North is City Engineer.

The City Council of Kennewick, Wash., has approved the plans prepared by Engineers Hanford & Blackwell, Hoge Bldg., Seattle, Wash., for the installation of a sewer system.

Plans are being prepared by City Engineer J. M. Crom of Cashmere, Wash., for the construction of new sewers at an estimated cost of $16,000. Contract will be let about March 25.

Wisconsin.

✣Bids will be received until 2 p. m., Feb. 28, by Board of Public Works, Oshkosh, Wis., for the construction of sewers in a number of city streets.

The City Council of Lake Geneva, Wis., has ordered plans and specifications to be drawn for a sewer system in that city. The W. S. Shields Co., Hartford Bldg., Chicago, Ill., is Engineer.

The City Council of Merrill, Wis., is considering the proposed construction of the sewer in the Seventh Ward and the outlet extending from Second St. to the Wisconsin River on Mill St.; also the construction of a sewer to the Second Ward school.

Canada.

✣Bids will be received until noon, March 11, by City Clerk, Westmount, Que., for the construction of an intercepting sewer in Western Ave., and for paving Western Ave. Archibald Currie is City Surveyor.

UILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

City Council of Oakland has adopted and specifications for the construction two-section apron wharf in the Key basin to lie parallel to the rock fill and in the first section and the Southern c mole in the second. The plans in- a partial reorganization of the water plans and provide wharf space for deep hipping, a belt line railway, space for ouses and like facilities. An expenditure proximately $355,000 is involved in the vement. This sum is available under issues. The following details are in- d in the proposed work: Apron wharf, levee in Key Route basin, reached by ach from 7th St., facing on deep water, sions 2,000 by 65 ft., cost estimated at 00; dredging 1,000,000 cu. yds. from in of quay wall along First St. on estuary front, estimated cost $120,000; street adjoining First St. estuary quay wall to docks available for use, estimated cost 0; belt line railway to be used by all ers on quay wall and First St., estimated $10,000. Harry Anderson is Commis- of Public Works of Oakland.

Connecticut.

The Yale University Alumni Advisory Board Committee, David Daggett, Secretary, New Haven, Conn., has recommended the expenditure of $700,000 for athletic improvements. The plan includes the purchase of a tract of land of 100 acres or more on Derby Ave. across from the present Yale field on which to build a stadium to seat at least 60,000 persons. It is proposed also to build there a large club house which will contain a grill, baths, etc., with squash courts adjoining. The remainder of the territory will be laid out for football fields, baseball diamonds and tennis courts.

Delaware.

✣Bids will be received until 11 a. m., March 18, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for furnishing propelling machinery and electric installation for repair of the U. S. inspection boat Gannet.

District of Columbia.

✣Bids will be received until March 5, by Capt. R. J. Burt, Disbursing Officer, Signal Corps, U. S. Army, Washington, D. C., for furnishing wireless station equipment.

✣Bids will be received until 10:30 a. m., March 7, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 686, material for steel cylinders, rivets, wrought iron and steel pipe, pipe fittings, valves, grease cups, hose, twine and lard oil, brake rod connection pins, coupler knuckle pins and steel [illegible] keys.

✣Bids will be received until 2 p. m., March 7, by Commissioners of District of Columbia, Washington, D. C., for furnishing and installing the District pumping station, a water softening plant. Specifications may be obtained of the Purchasing Officer.

✣Bids will be received until 11 a. m., April 6, by H. R. Stanford, Chief of Bureau of Yards & Docks, Navy Department, Washington, D. C., for about 22,575 sq. yds. of oiled macadam paving at the U. S. Naval Station, Pearl Harbor, Hawaii. Plans and specifications may be had of the Commandant of the Naval Station, Honolulu.

Florida.

✣Bids will be received until 3 p. m., March 29, by State Building Commissioner at the office of the Governor, Tallahassee, Fla., for the construction of a Supreme Court building to be erected at Tallahassee. Building 75x125

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

ft., three stories in height, reinforced concrete construction, exterior of brick and terra cotta. steam heated. Drawings and specifications may be seen at office of the Governor, Tallahassee, Fla., and at office of P. Thornton Marye. Architect, Candler Bldg., Atlanta, Ga.

Idaho.

A 10,000 H. P. hydro-electric plant will be built on the Payette River, near Boise, Idaho, for C. L. Tallmadge, 37 Wall St., New York City. Plans and specifications are now being prepared by the W. H. Rosecrans Engineering Co., 30 N. La Salle St., Chicago, Ill., the Consulting Engineers, for the work. Bids will be received in about 30 days.

Indiana.

✣Bids will be received until 11 a. m., March 30, by Capt. E. S. Stayer, Quartermaster, Fort Benjamin Harrison, Ind., for furnishing and delivering 6 gage cocks, 1 penberthy injector, 12 brass plugs, 2 indicator springs and 1 hot water thermometer.

Minnesota.

⊙Contracts for a new $1,000,000 coal dock to be constructed at West Duluth, Minn., for the Island Creek Coal Co. have been let as follows: Dredging, Zenith Dredging Co., Duluth, superstructure, Whitnev Bros., Superior, Wis.; machinery, Heyl-Patterson Co., Pittsburg

Missouri.

✣Bids will be received until noon, March 20, by Lieut. Col. Charles L. Potter, U. S. Engineer, Liggett Bldg., St. Louis, Mo., for the construction and delivery of a sternwheel steamboat 114 ft. long, 21 ft. wide.

Montana.

✣Bids will be received until 2 p. m., March 21, by Commissioner of Indian Affairs, Washington, D. C., for furnishing the necessary labor and materials for the erection of a brick quarters at the Crow Indian School, Mont.

Nebraska.

✣Bids will be received until March 4, by J. E. Baxter, Deputy Quartermaster, Omaha, Nebr., for furnishing under Schedule No. 31, miscellaneous quantity of anvils, tools, hardware, boiler compound, toe calks, hose, padlocks, cotton waste, carriage whip and wheelbarrows.

New Jersey.

✣Bids will be received until 11 a. m., March 8, by Maj. R. R. Raymond, U. S. Engineer, 6th and King Sts., Wilmington, Del., for dredging at Cold Springs Inlet on the coast of New Jersey about 3 miles east of Cape May City and 16 miles from the Delaware Breakwater. Stone jetties 850 ft. apart have been constructed from the shore seaward to deep water. The work to be done is the dredging of a channel between the jetties to a depth of 15 ft. at mean low water, and a width of 400 ft. over a length of about 5,300 ft. The quantity of material to be removed is about 850,000 cu. yds. of sea sand and marsh mud.

✣Bids will be received until noon, March 21, by Col. Wm. T. Rossell, U. S. Engineer, 39 Whitehall St., New York City, as noted in our last issue, for the following dredging work: In Matawan Creek, amount available. $2,500; in Raritan River, $18,000 available; in South River, $5,500 available; in Shoal Harbor and Compton Creek, $5,000 available; in Shrewsbury River, $9,000 available.

✣Bids will be received from [illegible] p. m., March 11, by Committee on Public Buildings, Common Council, Newark, N. J., for furnishing necessary labor and material for the erection of the new almshouse at Ivy Hill, South Orange Township, N. J., in accordance with plans and specifications drawn by J. O'Rourke & Sons, Architect, Essex Bldg., Clinton, N. J., and George W. Knight, Engineer. Frederick J. Fischer is Chairman of the Committee.

Bids will be received until 11 a. m., March 8, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging [illegible] Springs Inlet, N. J.

New Mexico.

✣Bids will be received until 2 p. m., March 19, by Commissioner of Indian Affairs, Washington, D. C., for the erection of a brick dormitory building at the Albuquerque Indian School, New Mexico.

New York.

✣Bids will be received until noon, March 16, by Col. W. M. Black, U. S. Engineer, 39 Whitehall St., New York City, for dredging and rock removal in Westchester Creek, N. Y. The work consists in making a channel 8 ft. deep at mean low water, and 100 ft. bottom width and length of about 2,000 ft. from the East River across the estuary; thence 80 ft. bottom width and length of about 3,200 ft. to about 1,000 ft. above Seriven's wharf; thence 60 ft. bottom width and length of about 9,000 ft. to the head of navigation just below the fixed bridge at Main St. in the town of Westchester. The total length of the proposed channel is about 2⅝ miles. The amount of material to be removed is estimated at 119,000 cu. yds., place measurement of other material than ledge rock, and broken rock and bowlders ½ cu. yd. in size, or larger, solid measurement; 920 cu. yds. of ledge rock, place measurement; 25 cu. yds. of broken rock or bowlders ½ up to 2 cu. yds. in size, solid measurement; and 15 cu. yds. of bowlders exceeding 2 cu. yds. in size, solid measurement.

✣Bids will be received until 11 a. m., March 4, by the State Tuberculosis Commission, State Capitol Bldg., Albany, N. Y., for the construction of administration building and infirmary and two duplicate buildings for incipient cases at Norwich, New London County. The contractors are to submit bids for all work included in the specifications and in accordance with drawings and specifications of Smith & Bassette, Architects, 36 Pearl St., Hartford, Conn.

✣Bids will be received until 1 p. m., March 2, by Charles H. Strong, President of the Board of Managers of the New York State Training School for Girls, Hudson, N. Y., for cottages Nos. 11 and 12, and branch conduit, including construction, heating, plumbing and electrical work at the New York State Training School for Girls, Hudson, N. Y.

✣Bids will be received until 10 a. m., March 4, by Commanding Officer, Torpedo Depot, Fort Totten, N. Y., for furnishing under proposal 568, 211 cast iron automatic submarine mine anchors, complete.

✣Bids wil lbe received until 10 a. m., March 12, by Capt. W. D. Davis, Quartermaster, Plattsburg Barracks, N. Y., for the construction of an addition to stable plan 139-H at Plattsburg Barracks, N. Y., including plumbing.

✣Bids will be received until 11 a. m., March 25, by Lieut. Col. J. G. Warren, U. S. Engineer, Buffalo, N. Y., for the construction of timber crib, concrete wing walls, Black Rock Shiplock, Buffalo, N. Y.

✣Bids will be received until noon, March 18, by Secretary, Trustees of Public Buildings, Executive Chamber, Albany, N. Y., for certain items of work in connection with the reconstruction of the State Capitol, Albany. A separate and distirct proposal is required for each of the following items of work: (a) Heating and ventilation; (b) plumbing and drainage; (e) metal window frames, sash and glazing; (d) electric elevators and elevator fronts; (e) metal window frames, sash and glazing. Each proposal shall be accompanied by a certified check or cash deposit for the amount indicated below for the several sections of the work: (a) Heating and ventilation, $3,000; (b) plumbing and drainage, $2,000; (c) electric light and power wiring, $2,500; (d) electric elevators and elevator fronts, $2,000; (e) metal window frames, sash and glazing, $1,500. And the contractors to whom the awards are made will be required to furnish surety bonds for each division of the work in amounts as follows: (a) Heating and ventilation, $30,000; (b) plumbing and drainage, $20,000; (c) electric light and pow wiring, $25,000; (d) electric elevators and e vator fronts, $20,000; (e) metal wind frames, sash and glazing, $15,000, within days from date of notice of award of co tract. Failure to furnish bond within the ti specified will cancel the notice of award contract and cause forfeiture of certif check or cash deposited with bid. Franklin Ware is State Architect.

North Dakota.

✣Bids will be received until 2 p. m., Ap 4, by Board of Pembina County Commissi ers, Joseph Morrison, Chairman, at the off of W. W. Felson, County Auditor, Cavali N. Dak., for the erection of courthouse a jail for the county, according to plans a specifications prepared by Buechner & Or Architects, St. Paul, Minn.

Ohio.

✣Bids will be received until noon, March by W. J. Springborn, Director of Public Se ice, Cleveland, O., for dredging Cuyah River. W. H. Kirby is Secretary of the I partment. Specifications may be obtained the Chief Engineer. Official advertisem will be found elsewhere in this issue.

City Auditor Coughlin of Cleveland, O., w receive bids on April 8 for the purchase $145,000 park bonds issued for the erection two park bath houses.

Pennsylvania.

✣Bids will be received until noon, March by George W. Norris, Director, Departm of Wharves, Docks & Ferries, 555 Bou Bldg., Philadelphia, Pa., for Contract No. for the mill and shop inspection and testi of all structural steel required for the pi at the foot of Dock and Spruce Sts., on t Delaware River; Contract No. 82, for roofi city properties in the 40th Ward; Contr No. 83, for supplying cast-iron water pi special casting and joint material required f fire service line at the House of Correcti wharf.

⊙The Owego Bridge Co., Owego, N. Y., reported to have been awarded the contr for reconstructing the dam at Austin, P formerly owned by the Bayless Pulp & Pa Co., which was destroyed by flood last fall

The city officials of Chester, Pa., have plied to the Commissioners of Navigation a permit to erect a 529-ft. long, single de concrete pier at Reaney St. in that city.

Tennessee.

✣Bids will be received until noon, Ma 12, by Maj. Clarke S. Smith, U. S. Engine Memphis, Tenn., for furnishing about 637, lbs. of wire, silicon bronze wire, wire stra wire cables, staples and clips and 140 coils manila rope.

Texas.

✣Bids will be received until March 12, Wilbarger County Commissioners' Court, V non, Texas, for the erection of a 2-st brick jail. Plans and specifications may obtained of J. A. White, Vernon, Texas. the same time they will let the contract f four new toolproof cells, the moving and stallation in the new jail of the four old ce in the old jail and all other structural ir work for the said new jail as per specific tions; also on file with said Clerk.

Bids were opened Feb. 5 by the City Cou cil of Houston for the construction of t new Rusk School, the low bidder for t work being C. E. Wengel, Houston, at $7 306, this bid including heating and plum ing

Construction work will be started this spri on two buildings for the Southern Method University at Dallas, Tex. One of them w be a dormitory building to cost about $125,0 and the other will be the main administrati hall. Shepley, Routan & Coolidge, 134 S. Salle St., Chicago, Ill., are the architects.

Board of Education of Dallas, Tex., h decided to ask for the submission at the Ap election of a bond issue of $600,000 for sch improvements. Some of the proposed i

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ments are: New High School in South s, $150,000; school building in Cotton district, eight rooms, $33,000; eight-room l on lot recently purchased on Reiger East Dallas, $33,000; new school of rooms for West Oak Cliff, $33,000; fire es for all non-fireproof buildings now $20,000; steam heating for buildings built and using stoves, $60,000; negro buildings, $70,000.

Washington.

ns will be ready for bids about March a 2-story and base concrete high school ing to be erected for the city of Van- r, Wash., at a cost of $100,000. Stephen phen, New York Block, Seattle, Wash., e contractors.

Port Commissioners of Seattle have to submit the Harbor Island Terminal issues, aggregating $5,000,000, to the of Seattle March 5. Two propositions the Harbor Island Terminal scheme. irst is an issue of $3,000,000 of bonds er the cost of acquiring the necessary on Harbor Island by condemnation, esti- at $2,000,000, and $1,000,000, additional onstruction of the first concrete piers. second proposition is a resolution pro- for the issuance of an additional ,000 bond issue. The land purchased e city is to be leased to a New York ate known as the Pacific Terminal Co., binds itself to build terminal ware- s of the style of the Bush Terminal Co., lyn. R. F. Ayers, ex-vice-president of ush Terminal Company, is president of ndicate. Paul Starrett, president of the ton Construction Co., is also interested.

Canada.

ids will be received until 6 p. m., March Charles Hall, Esq., for the trades re- for the completion of the superstruc- f the Y. M. C. A. building at Saskatoon, Plans and specifications are on file at ffice of D. W. F. Nichols, Winnipeg. of Thompson, Daniel & Colthurst, Sas- , Sask.

ids will be received until 6 p. m., March A. E. Nicholson, Architect, 46 Queen . Catherines, Ont., for the erection and etion of the Holy Trinity Church, Wel- Ont.

he Norton-Griffiths Co., Vancouver, B. as been awarded a contract for con- ing a concrete bulkhead at North Van- r. The whole scheme of which the ead is a part will call for the expendi- of about $1,000,000. Dredging work is underway.

J. Lund, 201 Empire Bldg., Vancouver, , has been awarded the contract for ucting a convent for the Madames of acred Heart at Point Grey, B. C. The ure will cost about $300,000. C. G. ey, White Bldg., Seattle, Wash., is the ect.

ns and specifications will be received by Moher, Secretary, North Battleford School District No. 12, until March 1, e erection of a Collegiate Institute in the of North Battleford, Sask. The build- be erected is to cost from $50,000 to complete.

ns are now ready for a structural steel ng shop, 78x228 ft., with concrete and lery floors and roof, also a fire proof ning and impregnating building for the lian Crocker-Wheeler Co. at St. Cath- , Ont. E. D. Pitt, 405 Victoria Ave., Falls, Ont., is the engineer and archi-

Mexico.

. Manuel Urquidi, sub-secretary of the tment of Communications and Public s, City of Mexico, is to make an in- on of ports on the Pacific Coast of o, where the department expects to un- ke some improvements soon. The port ogreso will be left for the present with- the great improvements which were ed for it. When due investigations were it was learned that the works proposed for it would cost $32,000,000, and the government did not feel like making such an outlay at the present time.

TRADE NOTES.

[illegible] St., New York City.

[illegible] the concrete piles and foundations for the iron and steel warehouse to be erected at Pittsburgh for the Frick & Lindsay Co., W. G. Wilkins Co., contractors and engineers.

Mr. [illegible] general manager of the Best Manufacturing Co., Pittsburgh, Pa. He will supervise the sales, order and engineering departments. Mr. Evans was formerly connected with the Crane Company of Chicago, in a similar capacity.

The Berkshire Motors Co., Pittsfield, Mass., will remove in the near future from its present quarters in Pittsfield, Mass., to its new reinforced concrete manufacturing building in Cambridge, Mass., designed by Monks & Johnson, architects and engineers, 7 Water St., Boston, Mass.

The Canton Manufacturing Co., Canton, O., manufacturers of the Cann patented ventilator, fireproof windows and doors, special sheet metal work, etc., has begun active work on doubling the capacity of its plant. This company has also recently begun the manufacture of multoplex filing cabinets.

The Metropolitan Coal Co. of Boston, Mass., is to abandon its present yard in Chelsea, Mass., and will occupy new and larger quarters on Broadway of the same city. This new coal handling plant, which with its equipment will cost in the neighborhood of $100,000, is being designed by Monks & Johnson, architects and engineers, 7 Water St., Boston, Mass.

The Wheeler Condenser & Engineering Co. of Cartaret, N. J., manufacturers of surface and jet condensers, pumps, cooling towers, etc., announce it has moved its Cincinnati office from 111 Ingalls building to offices in the Mercantile Library building of the same city. The new office will be in charge of Mr. Richard L. Strobridge, who was formerly connected with the Boston office of the Wheeler Condenser & Engineering Co.

At the annual meeting of the stockholders of the Federal Terra Cotta Co. of New York city, held Jan. 29, 1912, the following were elected directors for the ensuing year: John E. Berwind, Alfred H. Bond, Wm. B. Dinsmore, Stuyvesant Fish, DeForest Grant, Madison Grant, Wm. Manice, Lewis R. Morris, Schuyler Schieffelin, Dwight W. Taylor, Edwin Thorne, and at a subsequent meeting of the directors, the following officers were elected: DeForest Grant, president; Edwin Thorne, first vice president; Wm. Manice, second vice president; Wm. B. Dinsmore, treasurer; Dwight W. Taylor, secretary and assistant treasurer.

Announcement is made of the reorganization of the Watson-Stillman Co., manufacturer of hydraulic machinery, with a plant at Aldens, N. Y., and general offices at 50 Church St., New York. It is stated that the increasing use of hydraulic presses and the steady growth of the business necessitates an immediate extension of the company's manufacturing facilities. To take care of business increase it was considered advisable to reorganize the board of directors. The new officers elected are: Francis H. Stillman, president (re-elected); E. A. Stillman, vice president; J. P. Bird, treasurer; A. F. Stillman, secretary and works manager; and Carl Wigtel, chief engineer.

The Contractors' Supply & Equipment Co., of Denver, has lately reorganized. Messrs. H. E Owen & Sons, contractors, compose the officers of this concern. Mr. H. E. Owen is well known in contracting circles, being one of the oldest contractors in the field. The business is under the management of Mr. Chandler Owen, who is familiar with contractors' equipment from a practical standpoint. The company has secured the agencies of the following companies: Austin Manufacturing Co., Chicago, Ill.; Austin-Western Co., Chicago, Ill.; Buckeye Traction Ditcher Co., Findlay, Ohio; Polygon Concrete Machinery, Waterloo, Iowa; Disc Grader & Plow Co., Minneapolis, Minn., and carry a stock of goods manufactured by the above concerns, in Denver.

The Vulcan Engineering Sales Co. has been organized and incorporated with offices in the Fisher building, Chicago, and 30 Church street, New York. The company controls the entire product and will handle all sales of the Hanna Engineering Works of Chicago, Mumford Molding Machine Co. of Plainfield, N. J., and O. M. S. Co. of New York. Further factory arrangements are under way and the Vulcan Co. will own and manufacture [illegible] of railway special tools and equipment for shop and maintenance departments. The officers are: F. K. Gilbert, president, formerly vice-president of the Buda Co., and P. W. Gates, secretary and treasurer, now president of Hanna Engineering Works, formerly president of Gates Iron Works E. H. Mumford, now vice-president and genera manager of Mumford Molding Machine Co., will continue in the same position and duties as heretofore, and William L. Laib, vice-president and secretary of the Hanna Engineering Works, will continue in his present position with that company.

Mr. J. G. Fairbanks, after having been for several years President and General Manager of the Fairbanks Steam Shovel Co., has retired. Mr. C. W. Fisher, of Bucyrus, is made the new president of the concern, and Mr. J. E. Marbaugh, of Monterey, Ind., is named general manager. At a meeting of the stockholders of the company, Messrs. A. G. Stoltz, O. P. Lennox, R. M. Imbody, G. W. Hill, C. W. Park Fisher, W. E. Scofield and J. G. Fairbanks were [illegible] directors as the president and Mr. A. G. Stoltz, also of Bucyrus, was named as vice-president. No treasurer was chosen by the directors, but it is probable that Mr. R. C. McCullon, the present treasurer, will be named to succeed himself.

The H. W. Johns-Manville Co., already well known in the lighting field by reason of its J-M Linolite system of illumination, has acquired the sole selling agency for the entire products of I. P. Frink. "Frink" reflectors and fixtures need no introduction to the lighting trade and consumers throughout the country, and this arrangement means that the H. W. Johns-Manville Co. will be in position to design and sell lighting systems for every known form of artificial illumination. An engineering department will be maintained along very extensive lines. This department will maintain a corps of engineers throughout the United States and Canada and be equipped to place data and recommendations in the hands of all interested in any sub- [illegible]

PROPOSALS

SEWER CONSTRUCTION.

On March 22, 1912, I will let the contracts for the construction of the Toll Gate Drain, at the City Hall, in the City of Lansing, Mich. This job very closely resembles a sewer job and consists in the laying of 4,350 feet of 48-inch, 3,330 feet of 30-inch, and 3,430 feet of 24-inch reinforced concrete pipe, 1,300 ft. of 18-inch [illegible] feet of 8-inch drain tile. It also includes the construction of 33 manholes and 6 catch basins. The depths will average as follows: 48-inch pipe, 7.82 ft.; 30-inch pipe, 14.83 ft.; 24-inch pipe, 14.26 ft.; 18, 12 and 8-inch tile, 6.26 ft. All pipe, tile castings and other appurtenances will be furnished the contractor on the ground by the Drain Commissioner. The improvement to be paid for with orders drawn upon the County Treasurer and secured by a tax upon the district drained by the drain. Certified check or certificate of deposit upon a bank of this county or a draft in the sum of $1,000.00 required from all prospective bidders as evidence of good faith. Specifications, blue prints, etc., and further information may be had by application to the undersigned.

WALTER R. CARVEN,
Drain Commissioner of Ingham County.
Mason, Mich.

PAVING.

City of Fargo, N. Dak.

Bids will be received until 8 o'clock p. m. on the 11th day of March, 1912, at the office of the City Auditor, for approximately 82,000 sq. yds. of paving in said city, in two contracts, with either creosote block, vitrified brick, bitulithic, Blome concrete, bituminous concrete, cement concrete, sheet asphalt, Dolarway or Westrumite, all in accordance with the several resolutions regularly adopted by the City Council of the City of Fargo.

Formal advertisements for bids appears in the official paper of the City of Fargo, The Fargo Forum.

Plans and specifications on file with the undersigned.

E. R. ORCHARD,
City Auditor.

U. S. ENGINEER OFFICE, Duluth, Minn., Feb. 5, 1912. Sealed proposals for building rubble mound at Ashland, Wis., will be received here until noon, March 5, 1912, and then publicly opened. Information on application. JOHN N. HODGES, Lt., Engrs.

PROPOSALS

FURNISHING AND LAYING SEWAGE OUTLET PIPE.

Rochester, N. Y.

Sealed proposals will be received at the office of the Secretary of the Board of Contract and Supply, No. 37, City Hall, until 11 o'clock a. m., March 13, 1912, for the construction of Contract No. 4, including Division No. 8 and part of No. 7 of the Sewage Disposal System.

The work will consist of furnishing and laying about 9,300 feet of 66-in. pipe for the discharge of the effluent from the Disposal Works, into deep water in Lake Ontario. About 2,300 feet will be laid in open trench, and the remainder will be submerged and laid in a dredged trench terminating in a timber crib located about 7,000 feet from the shore and in about 50 feet of water.

Separate proposals will be received for pipe made of steel, ingot iron and cast iron.

A certified check for $20,000.00 must accompany the proposal as an earnest of good faith. The amount of the certified check deposited by the successful bidder will become the property of the City of Rochester if such bidder shall fail to execute and deliver the contract and execute the required bonds for the work within ten (10) days after the contract is awarded to him.

The successful bidder will be required to execute to the city a surety company bond in the sum of $100,000.00 for the faithful performance of the contract and the payment of all laborers' wages, which bond shall be approved by the Comptroller of said city.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Board that he is reasonably familiar with submarine work, and is fully prepared with the necessary capital, materials and machinery to conduct the work to be contracted for to the satisfaction of the City Engineer, and to begin it promptly on award.

All bids must be made upon the bidding sheets furnished by the City Engineer, and be indorsed with the title of the work to which they relate, the name of the bidder and his residence. Information relative to the work may be procured at the office of E. A. Fisher, City Engineer, where plans, specifications and bidding sheets may be obtained after February 17th.

The Board reserves the right to reject all bids.

F. X. PIPER, Secretary.

NOTICE TO CONTRACTORS.

HALLOCK AND MEDINA DRAINAGE DISTRICT.

Sealed bids will be received by Hallock and Medina Drainage District of Peoria County, Illinois, at the office of Wm. S. Kellogg, Attorney, in Peoria, Illinois, on March 18, 1911, for the following described work: New channel for Hallock Hollow Creek, 7,800 cu. yds. cleaning present channel of Hallock Hollow Creek and changing outlet of Crow Creek, 3,000 cu. yds. Additional information may be secured from

HARMAN ENGINEERING CO.,
Peoria, Ill.

MISSISSIPPI RIVER COMMISSION. 1st and 2d Districts, U. S. Engineer Office, Memphis, Tenn., Feb. 20, 1912. Sealed proposals for furnishing about 637,000 lbs. wire, silicon bronze wire, wire strand, wire cables, staples and clips, and 140 coils of manila rope, will be received at this office until noon of Mar. 19, 1912, and then publicly opened. Information on application. CLARKE S. SMITH, Maj. Engrs.

MASONRY DAM.

City of Baltimore, Md.

Sealed proposals for the construction for the City of Baltimore of a solid masonry dam with a spillway elevation of approximately 186.0 feet A. M. T., with appurtenances, to be built according to the plans and specifications to be obtained at the office of the Water Engineer, will be received at the office of the City Register, City Hall, Baltimore, Md., until 11 a. m., Wednesday, March 6, 1912.

Proposals must be enclosed in sealed envelopes, must be endorsed "Proposals for the Construction of the New Loch Raven Dam," and addressed to the Board of Awards of Baltimore City.

Plans and specifications, proposal forms, etc., may be obtained on and after February 12, 1912, at the office of the Water Engineer, City Hall, Baltimore, Md., on the payment of ten dollars ($10.00), which will be refunded on the return of same in good condition.

As an evidence of good faith each proposal must be accompanied by a certified check for twenty thousand dollars ($20,000.00) drawn on a Clearing House Bank to the order of the Mayor and City Council of Baltimore. These checks will be returned to the unsuccessful bidders on the awarding of the contract, and to the successful bidder when the contract shall have been signed.

The successful bidder will be required to give bond equal in amount to the contract price, for the faithful performance of the contract.

The Board of Awards reserves the right to reject any or all bids.

The estimated quantities of the principal items for the dam are as follows:

Cofferdam.

Earth and rock excavation foundation, 35,000 cu. yds.

Rock excavation cut-off trench, 4,600 cu. yds.

Concrete and rubble concrete, 38,000 cu. yds.

Steel reinforcing bars, 21,000 lbs.

Steel bridge, 70,000 lbs.

Approved Feb. 7, 1912.

EZRA B. WHITMAN,
Water Engineer.
JAMES H. PRESTON,
President Board of Awards.

THE KAW VALLEY DRAINAGE DISTRICT, WYANDOTTE COUNTY, KANSAS.

OFFICE OF DIRECTORS.

Kansas City, Kans., Feb. 23, 1912.

Sealed proposals in duplicate will be received until 10 o'clock a. m., March 9, 1912, and then publicly opened for furnishing and installing all material, labor, appliances and equipment and operating for test, two direct connected 18-in. side suction steam centrifugal pumps and two 100 horsepower locomotive type boilers, also two motor-driven 18-in. centrifugal pumps, near the mouth of what is known as the Santa Fe Ditch or Sewer, Argentine, Kansas City, Kans. Information on application.

W. H. DANIELS, President.

U. S. ENGINEER OFFICE.—Kansas City, Mo., Feb. 3, 1912. Sealed proposals for constructing standard revetment on Missouri River 94 miles below Kansas City and 2 miles below Waverly, Mo., will be received here until noon, March 4, 1912, and then publicly opened. Information on application. EDWARD H. SCHULZ, Major, Engrs.

U. S. ENGINEER OFFICE—Little Rock, Ark., Jan. 31, 1912. Sealed proposals for constructing the two (2) steel hull, 24-inch pump dredges H. S. Taber and Robert McGregor will be received here until 12 o'clock noon, April 9, 1912, and then publicly opened. Information on application CLARKE S. SMITH, Major, Engrs.

PAVING.

Sealed bids will be received by the City Council of the City of Beaumont, Tex., for all or any portion of the following work:

For furnishing all tools, material, labor, etc., necessary for paving approximately 93,000 sq. yds., on concrete foundations, with vitrified brick, asphalt, bitulithic or creosoted wooden blocks, or any other material, as may be determined by the City Council; and also approximately 37,000 lineal feet of concrete curb.

A certified or cashier's check in the sum of $1,000.00 made payable to Emmett A. Fletcher, Mayor, on some Beaumont bank will be required to accompany said bid.

For specifications, streets to be paved, or any other information apply to C. L. Scherer, City Engineer.

Bids, to be considered, must be filed with me on or before Tuesday, March 5, 1912, at 10 o'clock a. m., said bid to be addressed to J. G. Sutton, City Secretary, and marked "Bid for City Paving."

The city reserves the right to accept or reject any or all bids.

J. G. SUTTON,
City Secretary,
Beaumont, Tex.

TENDERS AND DESIGNS FOR AN AQUEDUCT, CANADIAN PACIFIC RAILWAY COMPANY, DEPARTMENT OF NATURAL RESOURCES, IRRIGATION BRANCH.

Sealed tenders, addressed to the undersigned and endorsed "Proposals for Brooks Aqueduct," will be received up to noon of May 1, 1912.

The site of the work is about four miles southeast of Brooks, Alberta, a station on the main line of the Canadian Pacific Railway 125 miles east of Calgary. The aqueduct is about 10,000 feet long and 54 feet maximum height, and is designed to discharge 910 cubic feet per second.

Tenders will be received based either on the design prepared by the company's engineer or on designs to be submitted by the bidder. The engineer's design involves the furnishing and placing of about 23,400 cubic yards of concrete and 3,640,000 pounds of reinforcing steel, together with excavation and filling to the amount of 40,000 cubic yards.

All labor and materials required will be at the expense of the contractor.

Bidders will be required, either personally or by representative, to visit and inspect the site and satisfy themselves as to local conditions, supply of material, etc.

Plans, specifications and full information may be obtained on application to A. S. Dawson, Chief Engineer, Calgary.

A deposit of $300.00 will be required before plans or specifications will be given out, which will be returned on receipt of the same in good condition.

All proposals must be accompanied by a certified check payable to A. S. Dawson for 5 per cent of the amount of the tender, to be forfeited as liquidated damages in case the bidder neglects or refuses to enter into a contract should the work be awarded to him.

Proposals will not be considered unless made out on the form provided. Interlineations, alterations or qualification of prices, except as therein provided for, may invalidate proposals.

The company reserves the right to reject any or all tenders and to waive defects.

A. S. DAWSON,
Chief Engineer, Dept. of Natural Resources, Canadian Pacific Railway.
Calgary, Alberta, March 1, 1912.

Engineering & Contracting

Devoted to the Economics of Civil Engineering Design and to Methods [illegible] of Construction

Published every Wednesday by The Myron C. Clark Publishing Company, 608 S. Dearborn St., Chicago, Ill.

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[illegible]

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cial Costs" That Frequently Are Underestimated.

[illegible] engineer's estimate of the [illegible] contains an adequate allow- what may be called "financial costs." even the most self-evident of these l costs," interest during construction, omitted from cost estimates. Some- ich omissions are purposely made by s, especially when it is known that ners or promoters will themselves estimate of the "financial costs." We , however, whether it is ever wise for neer to omit any element of cost that pable of making, unless he is spe- instructed to return an estimate of sical property only.

h are the "financial costs" of a project? ay be classified as follows:

rganization cost; i. e., legal and ad- [illegible] than engineering erintendence), general office expen-

axes during the construction period.

okerage fee or discount involved in ng securities.

nterest on the capital tied up during struction period.

evelopment cost (being the sequel to during construction) or the accumu- ficit below a "fair return" on the in- tal up to the time that a "fair re- s to be earned.

t element of "financial cost" is one existence has always been recognized rienced promoters, but one that, until cently, has never appeared in any en- estimate that we have seen. *Yet fail- provide capital with which to meet the ment cost of a project has been the [illegible] receiverships*

ng the past year we have published articles discussing the development r "going value," of public utilities, railways; and the method of deducing elopment cost by the aid of the ledgers ompany has been illustrated by several es. It may be added that the writer praised the property of about a dozen utility companies within the last year, as deduced the development cost in ase. It is rare that the development as been less than 25 per cent of the f the physical plant.

ur issue of Feb. 14, Mr. Norman E. r, Jr., discusses "Methods of Finan- rrigation Developments." Mr. Web- ves estimates of the "financial costs" of on projects, expressed as percentages of the cost [illegible] The following is a summary of his estimate of these cost items:

	Per Cent
Organization [illegible]	[illegible]
General [illegible]	[illegible]
Interest [illegible]	[illegible]
Total, exclusive of bond discount	41 to 50

Mr. Webster [illegible] development cost, but classes it under interest lost on the investment up to the time that the property begins to make sufficient net earnings to meet the interest charges. He estimates 6 per cent per annum on the entire cost of the plant for a period of 3½ to 5 years, making a total of 21 to 30 per cent to cover the interest lost on the investment. He also points out that all the bonds must usually be sold in advance of the first construction work, which results in a long nonremunerative period. For the comparative purposes the following percentages used by the writer in recent estimates of electric railway properties may be of interest.

	[illegible]
Engineering and supt. (5%) and business administration [illegible]	[illegible]
Legal, taxes and other general expenses..	1½
Interest during construction	[illegible]
Brokerage [illegible]	[illegible]
Development cost	[illegible]

Calling the cost of the physical plant unity (1), we have the following:

	[illegible]
Physical plant (incl. 5% for contingencies)	1.000
Add eng., supt. and adm. (11½%)........	0.115
Total	1.115
Add 5% of 1.115 for interest..............	0.056
Total	1.1[illegible]
Add 5% of 1.171 for brokerage...........	0.059
Total	[illegible]
Add 30% of 1.23 for development cost....	0.369
Grand total	[illegible]

It is difficult for some people to look upon the development cost—the accumulated deficit below a fair return on the investment—as being a real cost. They argue that a deficit can not be a source of value, but is the reverse. Yet, curiously enough, they concede that interest during construction is an element of the cost of a property. When it is pointed out that the development cost is merely a sequel to interest during construction, it becomes more apparent that the development cost is an essential element of the cost of the going concern.

Can a deficit be a cause of value? Yes, if it is not a deficit that connotes a *permanent* loss. A deficit arising from a fire or a burglary can not be an asset in the absence of insurance. But a deficit arsing from a nec- [illegible] plant or to create the business of a going concern, is a wholly different sort of deficit. Such a deficit is, in fact, an investment, which, in all probability, will ultimately yield an adequate return if the project is one that is well managed and is not begun too far ahead of the times. Perhaps no better example can be found to illustrate the confusion that a word can cause than is to be found in this word deficit. Since deficit often denotes a permanent loss, it impresses the mind that there is an incongruity in the argument that any deficit can be the measure of an asset. The word deficit is merely a symbol to denote an outlay of cash. If the outlay is irrecoverable—as in the case of loss of uninsured property by fire—the deficit decreases the assets. But if the outlay is recoverable—as in the case of money reasonably spent for advertising an article or promoting an irrigation project—the deficit increases the assets.

Honest promoters never incur temporary deficits in fair return upon their investments without belief in the ultimate recovery of the deficits. But many an honest promoter is too sanguine as to the short duration of the deficit period—the development period. It is clearly the function of the modern engineer to study the development cost of all sorts of projects of an engineering nature, with a view to estimating development costs with some degree of accuracy. Protection of his clients, and of the public whom his clients seek to interest in a project, should be the prime consideration of every engineer who is called upon to design a plant and estimate the cost. Full protection can only be given by a correct and full estimate of cost up to the time that the project will begin to yield an adequate return on the invested capital.

The Investigation of the Chicago Water Works System.

In an editorial, published April 5, 1911, we summed up the findings of the Chicago Commission on City Expenditures, commonly called the Merriam Commission, which had been published before that date. The commission prepared and presented twenty-one special reports of which the first seventeen were published in pamphlet form. The remaining four reports were presented to the Council but were not published. The Chicago Bureau of Public Efficiency has undertaken to print and distribute the four reports mentioned, and the first of the four, relating to the Water Works System, has just been issued.

In another part of this [illegible] abstract of the portion of the report relating to conditions in the pumping stations, as found at the beginning of the investigation.

Some of the suggestions made by the investigator have been taken up and have been made the subject of special reports by city officials to the City Council. It is only fair to the engineering department of the city to state that attention repeatedly had been called to some of the conditions, pointed out by the special investigator, in annual reports of the City Engineer.

The condition of the Chicago Water Works System, as found at the beginning of the investigation, is of general interest since it is an illustration of the inefficient method of managing city business in American cities. Conditions similar to those found in Chicago may exist, and doubtless do exist, in many other cities in this country. The conditions disclosed by the report of the special investigator are here briefly summarized.

It was found that the operation of the pumping stations was by no means as economical as it was thought to be, either in cost of labor or cost of fuel; this, too, in spite of unusually favorable physical conditions, such as unlimited supply, low suction lift, low pressure pumped against, large quantity pumped, pumping units of large capacity and of highly economical type, and unusually uniform load.

Comparisons of operating costs were made between the eight major pumping stations in Chicago, a municipality operated plant in Milwaukee and one in Cleveland, the water company's plant in Peoria, Ill., and eight privately managed plants in Chicago. The statistics collected show that the average hourly rate of pay in the eight private plants investigated in Chicago is 26 cts.; in the Kirtland Street Pumping Station at Cleveland, municipally operated, 31 cts.; in North Point Pumping Station, Milwaukee, municipally operated, 30 cts.; and in the pumping station of the Peoria Water Works Company, 25 cts.; while the average hourly rate paid at the eight major pumping stations in Chicago is 42 cts. A similar comparison shows that in the private plants in Chicago one oiler per watch looks after engine units equivalent to 2.35 average City pumping engines; whereas, in the eight Chicago City pumping stations, one oiler looks after only 0.95 average City pumping engines. In other words, one oiler in the privately managed plants looks after nearly two and one-half times as much machinery as does one oiler in the city pumping stations.

It was observed by the investigators that the chief engineers of most of the pumping stations frequently were absent from the stations during the hours when they were supposed to be on duty. The investigators were unable to find anything which had been done by the Chief Mechanical Engineer in charge of all the pumping stations, towards reducing the cost of coal or labor at the stations. It was recommended that some method be devised for offering to the Chief Engineers at the pumping stations more incentive than now exists to increase the efficiency of the plants under their charge.

It was learned that the average station duty is below 79,000,000 ft. lbs. per 1,000 lbs. of steam, notwithstanding the fact that with but few exceptions the engines installed are all of types that should give test duties running from 100,000,000 to 180,000,000 ft. lbs. per 1,000 lbs. of steam.

The pressures are much too low everywhere. In the outlying districts, many persons living on the lower floors of buildings frequently are deprived of the use of water. Nowhere in the city can the owner of a six-story building count on water service to his upper floors. This means an enormous annual expenditure on the part of property owners for separate
[illegible] pumping plants. The aggre
[illegible] accurately be estimated, but
tainly not less than two or three millio
per year, and may be much more.

The extra insurance premiums paid
cago on account of water-works de
were estimated for the investigator by
neer employed by the insurance com
report on the fire-protection features
works plants in cities in this sectio
United States at $1,250,000 for the y

At the beginning of the investig
the work on the distribution system
considered evident that there was a l
in the labor cost on construction, rep
maintenance, and an effort was made
mine where the losses were and to
tent they occurred. An investigator de
the time-efficiency of such work, a
the men credit for full time as long
were on the work and made any pre
working. Deductions were made onl
men were off the job or plainly loa
several instances the time-efficiency
improve as soon as the foremen wer
that they were under observation, in
rising from 57 to 90 per cent.

There is an enormous waste of w
tually pumped. The waste amounts, a
to the report of the investigator,
two-thirds of the entire amount pum
half the amount wasted is due t
fixtures and careless use on private
and one-half is due to leaking mains

In concluding their letter transmit
special report to the City Council, t
man of the commission said: "The
sion is of the opinion that the wast
inefficient operation of the water wor
for a long series of years has impos
heavy burden on the consumers and
sulted in a type of service far bel
might have been rendered."

CONCRETE AND REINFORCED CONCRETE SECTIO

The Economics of Silo Construction of Permanent Materials (Concrete and Clay Tile); Construction Methods and Costs.

Contributed by M. L. King, Department of Agricultural Engineering, Iowa State College, Ames, Iowa.

I.

THE CONTRACTING PROBLEM

For rural buildings contractors of small means or for mechanics who wish to get into work that will pay more directly in proportion to push, ingenuity and industry there is no work so promising as silo contracting. The number of these to be built in the next ten years is simply unbelievable. When the middle west, the corn belt in particular, has an average of one silo for every quarter section of land the demand will probably be at its height. Until then the demand will increase.

The township which has at present more silos than any other township in the state is the one in which there will be the greatest number of silos built next year. The thicker silos are the more thoroughly the people are impressed with the ultimate necessity of using them. Five years ago the writer had occasion to visit personally a large percentage of the silos in Iowa. The total number then amounted to about 200. Twice that number were built the following year, and since then it is conservative to say that the number built each year was twice that of the preceding year. This means at least 4,000 silos in Iowa today. One silo on each quarter section means 2,000 silos in each county and 200,000 in Iowa. Now these silos mean an average saving of $200 apiece per year to the average owner. The average farmer believes this, as it is being demonstrated right under his nose in every part of the state. If we were not so accustomed to seeing large figures in print it might be worth while to multiply this out and find the average saving in the state.

It may be predicted that the larger percentage of these silos will be built of wood and will last on an average of from 10 to 15 years. These cost today for labor and material more than a good masonry silo, which will last 50 or 100 years, and will probably be as good at the end of that time as at the beginning. Why then will they be built of wood? Because the wood silo is factory made and requires the services of four men not over two days to set up, while the masonry silo takes four men, one of whom must be a good mason, a week to ten days of good weather to build.

One mason working at silos and filling in unavoidable delays with other work will average not over a dozen silos in a year and it is impossible for the supply of mechanics to keep pace with the demand. During August of last year there were more than a hundred masonry silos given up in Iowa alone on account of scarcity of experienced mechanics to construct them.

The chief competition which contractors for masonry silos have to meet is that of the factory made stave silo. It is important that the contractor should know the character of this competitor—know what claims are real and what are false. The wood silo really has some advantages and many advantages are claimed for it which it does not have. The principal advantage is: That it is quickly and easily erected by comparatively unskilled workmen. A great many people postpone the matter of purchasing or planning for a silo until too late to secure the services of a good mechanic for the erection of a masonry silo. Another advantage is that there are already more wood silos than any
other kind in existence; that is, they a
known. On the other hand they have
failings. A very large percentage
blow down every summer. Guying
vent a great deal of this, but, the
remains, that no reputable insuranc
pany will insure a stave silo built ou
a barn, against a wind loss. [illegible]
juices, etc., present conditions cond
very rapid decay. The average life
stave silo is 10 to 15 years. Yellow p
only last a very short time.

Those interested in the sale
silos are very thoroughly and [illegible]
organized. There are perhaps [illegible]
local agents in every county in th
west. These are all interested in
of wooden silos. Most of them k
or nothing concerning the comparati
of wood and masonry. They, of cou
informed by the head of the selling o
tion, that the wooden silo is the onl
and they are furnished with pictur
ing poorly constructed masonry sil
have failed. It is claimed that
freezes more inside than do stave sil
is untrue with solid masonry walls a
low masonry walls are even better tha
in this respect. Also it is told that [illegible]
will not keep against the walls, that m
silos crack, and that the acid from
silage quickly disintegrates [illegible]
walls. Likewise, it is claimed that th
acid which ruins permanent materia
vents the decay of lumber. This see
ridiculous to even consider but it h
told until it is very generally beli
reality this acid is so weak that it
effect upon either masonry or wood.
gard to cracking, it will be seen fr
cussions in later articles that masonr
correctly reinforced, have never crack
fact, the perfectly built masonry silo is
ly successful in preserving silage; is p

nt, and is, in practically every case, better investment than a wooden silo. ply up to the contractor and builder silos to do his work well and the public will finally be supplied with ent investment in which [illegible] e required and which will pay on an much more than 50 per cent on the nt. In addition to this, the mason-

-Typical Monolithic Concrete Silo.

an be made to serve as a water tower ould cost practically as much as the is, serving as a means of furnishing nce and sanitation in rural homes the most immediate requirement for rovement of country life.

ccount of existing patents on the factory made wood silo the price t 30 to 40 per cent higher than it e would be. The principal patent is years old now which points toward inuance of these conditions five years This is fortunate for the masonry its merits are not always conceded at and within five years the permanent will be more thoroughly understood difference in price which will prob- en exist will be paid readily. In- ly it might be mentioned that the oes not in any way interfere with the of any kind of a silo.

SILO ESSENTIALS.

valls must be nonporous as moisture prevented from passing out of the also the air must be kept out. The ust be strong enough to resist the of the ensilage. This acts outward irections as the ensilage settles. The of the silage against the wall, and the of the wall produce a crushing action s great near the bottom of the silo. when empty should withstand heavy The walls should be smooth inside to have the silage settle freely. If re any shoulders or offsets on the vall, air pockets will be formed which se a considerable loss of ensilage. The ould above all things be durable. It ould be a building requiring a mini- mount of care and expense to keep it ir.

y a silo should have a good appear- Any mechanic taking pride in his work careful about appearance, but there ndency to hurry work and get away [illegible] the farmer [illegible] beauty for which [illegible] finishes his [illegible] shape will be able [illegible] neat work will [illegible] furnish satisfaction, but will do away with the expense of moving [illegible]

The principal masonry silos of the future will be concrete or cement block and clay [illegible] materials is absolutely permanent. The quality of silo made of either of these materials is so similar that a choice between the two will depend almost entirely upon the ultimate cost. This will of course depend upon local conditions; local prices of either material or labor may be a deciding factor.

The details of construction of perhaps the cheapest and a very good type of clay product silo known as the Iowa silo will be described in a later article. This silo was originally designed to meet the demand for a masonry silo in localities where gravel and therefore concrete were expensive. In choosing which of these silos to build a contractor should study the conditions in the territory in which he will operate, also decide how much he wishes to invest in equipment. A sum of $125 wil equip the contractor with a hoisting engine, gin pole, adjustable scaffold, and what few forms are necessary in building either the cement block or Iowa silo. Apparatus for economical building of monolithic concrete silos will cost considerable more money. The scaffolding will be practically the same in either case. Both a hoisting engine and a mixer will be required. The same engine may be used for the hoist and the mixer, and the same gin pole will serve for each. The patented forms will cost from $100 to $300.

General Conclusions Based on Results of Tests on Reinforced Concrete Columns.

The results of tests on reinforced concrete columns made in the laboratory for testing materials of the University of Wisconsin during the years 1909 and 1910 are given in a bulletin by Prof. M. O. Withey, published by the University of Wisconsin. These tests are a continuation of a branch of the work reported in a previous bulletin. Briefly, the purpose of these experiments was to make a further study of the strength and elastic properties of columns reinforced with spirals and longitudinal rods. More specifically, the tests were made to obtain some data relating to (1) the effect of varying the percentage of spiral reinforcement; (2) the effect of varying the percentage of longitudinal reinforcement; (3) the effect of varying the richness of the mixture; (4) the effect of a small number of repeated loadings; (5) the effect of maintaining a constant load for different time intervals; (6) the behavior of columns eccentrically loaded; (7) the relative value of plain and deformed bars for longitudinal reinforcement; (8) the effects of differences in end conditions. All told, 66 columns of commercial size were made and tested.

It is customary in good practice to encase all column reinforcement in a shell of concrete about 2 ins. thick. This shell is provided to protect the reinforcement against fire and rusting. Since this coating is likely to be injured or destroyed in various ways its strength should not be considered in structural design. Consequently, the core, or portion of the column inside the spiral, should be proportioned to carry the entire load. It, therefore, seemed desirable to make the protective shell on these columns as thin as possible in order that the properties of the core might readily be more observed.

From tests made to determine the effects of varying the percentage of longitudinal and lateral reinforcement, in reinforced concrete columns, the following conclusions may [illegible] built of similar concrete:

(1) Closely spaced spiral reinforcement will greatly increase the toughness and will considerably increase the ultimate strength of a concrete column, but will not materially affect the yield point. The ultimate strength under dead load will doubtless be somewhat less than the value obtained from a testing machine. Since spiral reinforcement should be employed principally as a factor of safety against sudden collapse, more than 1 per cent does not appear to be necessary. On account of lack of stiffness in columns made from this grade of concrete and reinforced with spirals only, it seems necessary to use some longitudinal steel.

(2) Longitudinal steel in combination with such spiral reinforcement raises the yield point and ultimate strength of a column and increases its stiffness. Columns reinforced with longitudinal steel only are brittle and fail suddenly when the yield point of the steel is reached; but they are considerably stronger than plain concrete columns made from the same grade of concrete.

(3) From behavior under test of the columns reinforced with spirals and vertical steel and the results computed, it would seem that a static load equal to 30 to 40 per cent of the yield point would be a safe working load. As the ultimate strength of the concrete and the yield point of the steel are generally known or can be assumed with fair accuracy, formula (B), see below, can be readily used in determining the working load.

In order to derive strength formulas which would apply to the results of these tests, values of the yield point and ultimate strength were grouped in accordance with the percentage of spiral reinforcement in the respective columns and plotted as ordinates against the corresponding percentage of longitudinal reinforcement as abscissas. From the results tabulated it is evident that spiral reinforcement does not increase the strength at yield point, but does raise the ultimate strength.

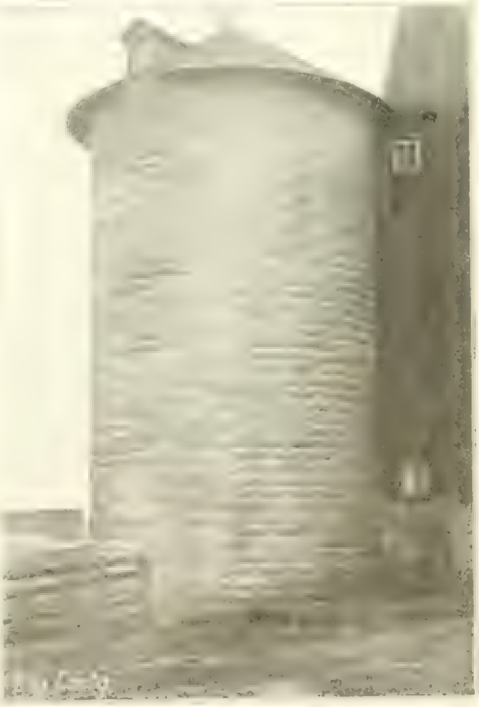


Fig. 2—Typical Cement Block Silo.

Hence, the general equation used for unit stress at the yield point and ultimate, respectively, are

$$\frac{P}{A} = [illegible]$$

$$[illegible] \qquad (B)$$

In these formulas P = maximum load,

[illegible] f_c = ultimate compressive strength of concrete, f_s = yield point of longitudinal steel, f'_s = yield point of lateral steel, and k = [illegible]

In considering the conclusions presented, it must be borne in mind that the specimens were very carefully made. Great care was taken in pouring thoroughly to puddle the concrete with a rod as fast as it was poured into the columns. It was by this means that [illegible] full cross-section obtained throughout the length of the column. Puddling is a very effective method of securing uniformity in fabrication. When it is impossible to use this method the size of the largest particles composing the aggregate must be much smaller than the pitch of the spiral and a very wet mixture must be used. Assuming as hypotheses that a well balanced design will be made, that careful inspection will be given to the selection and testing of all materials and to the details of fabrication, it seems practicable to secure similar results in actual construction. The following general conclusions may be drawn from the results of these tests:

(1) If materials can be obtained at average unit prices, rich mixtures are more economical than lean ones. Considering materials similar to those employed herein, the more economical mixtures will be produced if the proportion of cement to aggregate, by weight, lies between 0.2 and 0.7.

(2) Although the yield point of a reinforced concrete column is practically independent of the percentage of spiral reinforcement, the ultimate strength and the toughness are directly affected by it. On account of the excessive deformations accompanying loads beyond the yield point, on account of the probability that both yield point and ultimate strength are less in repeated or long time load tests than in the progressive load tests ordinarily made in the testing machine, and on account of the uncertainties which always surround the hypotheses adopted in designing, good practice demands that only a portion of the stress producing disintegration of the outside shell be used as a working stress. Consequently, only enough lateral reinforcement is needed to prevent the longitudinal rods from bulging outward, and to provide an additional factor of safety against an overload by increasing the toughness and raising the ultimate strength somewhat above the yield point. From these tests 1 per cent of a closely spaced spiral of high carbon steel seems to be sufficient for this purpose.

(3) By the addition of longitudinal steel the yield point, ultimate strength, and stiffness of a spirally reinforced column can be considerably increased. If maximum economy in floor space is desired, if a column is so long or is so eccentrically loaded that tension exists on a portion of the cross-section, or if a large dead load must be sustained by the column while the concrete is green, a high percentage of longitudinal reinforcement may often be advantageously employed. Such reinforcement is also a valuable safeguard against failure due to flaws in the concrete. If the cost of cement is extremely high, it may be economical to use a leaner mixture than suggested in (1) and considerable longitudinal steel to increase the stiffness and strength. In general, however, cement is a more economical reinforcement than steel. Therefore, for ordinary constructions it does not seem advantageous to use in combination with a rich concrete more than 2 or 3 per cent of longitudinal steel.

(4) The amount of data presented on tests of columns subjected to repeated or time loadings is far too small to warrant drawing definite conclusions as to the limiting stress for repeated loadings which will hold true for all kinds of columns and for an infinite number of repetitions, or for a prolonged loading. However, it does appear from the results presented that there is practically no increase in set or deformation after a few repetitions of loads equal to 40 to 50 per cent of the yield points of the colum[illegible] The results of the repeated load tests [illegible] plainly indicate that there is considerable additional strength and toughness afforded by the spiral after the yield point of the longitudinal steel has been passed.

(5) The close agreement between theoretical values and values derived from test data [illegible] A [illegible] monly used in designing short homogeneous columns eccentrically loaded, may be applied to reinforced concrete columns, provided suitable allowance be made for the steel.

(6) The strength of a column resting upon a footing will be about as great as when bedded on a metal plate, provided considerable lengths of the longitudinal reinforcing bars are bent outward into the slab or footing. The results given show that the use of metal base plates and longitudinal steel milled to the required length leads to greater uniformity in strength.

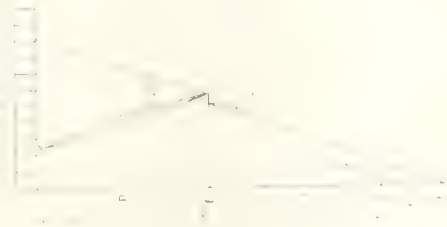


Fig. 1—Diagram for Use With Table 1 for Laying Out Tower and Chuting System for Concrete.

A = Extreme or total length from tower to be reached. B = Boom. C = Free end of pipe [illegible] ft., maximum 40 ft. D = Chute, 10 to 20 ft. [illegible] Z [illegible] 4 ft. swivel. x = C tan [illegible] Z = 4 ft. H = [illegible] ft.

(7) Although only a few test pieces were reinforced with corrugated bars of high carbon steel, the results were so uniform and the strengths so high that attention should be called to this type of reinforcement. It is quite evident that, with certain ratios of unit prices, the use of deformed bars with high elastic limits will be more economical than the use of plain round bars of mild steel.

(8) Briefly summarizing the foregoing, it seems economical to use for reinforced concrete columns a very rich mixture, and advantageous to employ about 1 per cent of closely spaced high carbon steel lateral reinforcement combined with 2 or 3 per cent of longitudinal reinforcement. From the test data presented it seems apparent that such columns, centrally loaded, may be subjected to a state working stress equal to one-third of the stress at yield point.

Some Data for Use in Laying Out Towers and Chutes for Depositing Concrete by Gravity.

The following data are based on studies made by the Concrete Appliances Co., Los Angeles, Cal., to determine, in depositing concrete by chuting, the maximum and minimum angles of flow, the maximum and minimum reach of boom and free end, the relative values of different trough shapes and of closed, etc.:

Concrete has successfully been run at angles from 7° to 45°, and dropped vertically 120 ft. into a hopper and redistributed. The best angle is, however, that of 18° with the horizontal.

Different shapes of trough have been experimented with, from the flat wide trough to V-shaped trough, and pipe from 4 to 10 ins. in diameter. The result is that 7 or 8-in. pipe has been found to be large enough for all capacities and is light enough to be easily handled. The latest equipment is an 8-in. trough having open trough swivels and an open trough free end. This allows the novice to handle it without injury to the plant.

It was found by the experiments of Me rs. [illegible]alen and Turner, engineers of the Wh ington Power Co., Spokane, Wash., at through a 7-in. pipe emptying into an in. trough, at an inclination of 18° with the ri- zontally mixed concrete of proper consistcy flowed at the rate of 132 cu. yds. per hr [illegible] consistency is meant a mi re which will flow like a thick gravy. Tal I [illegible] accompanying sketch have en worked up for the use of engineers in lang out towers and chutes.

TABLE I.

	E	B	C	D	a	x	
[illegible]	60	½E	½E	..	4	23′ 0″	[illegible]
[illegible]	[illegible]	40	30	..	4	25′ 2″	[illegible]
[illegible]	70	50	30	.	4	28′ 1″	[illegible]
[illegible]	[illegible]	60	30	.	4	31′ 4″	[illegible]
[illegible]	[illegible]	60	40	..	4	34′ 0″	[illegible]
[illegible]	100	70	40	..	1	37′ 2″	[illegible]
120	110	80	40		4	40′ 5″	[illegible]
[illegible]	115	90	40	.	4	43′ 7″	[illegible]
[illegible]	125	100	40	..	4	46′ 9″	[illegible]
[illegible]	130	100	40	10	4	46′ 9″	[illegible]
[illegible]	[illegible]	100	40	20	4	46′ 9″	[illegible]

[illegible] dimensions are given in feet and in.

A short method of approximately determ ing the necessary height of tower to de er concrete to any given distance is to mu ly the horizontal distance by one-third.

Inspection of Concreting.

Contributed by Jerome Cochran, C. E., For
Designing Engineer, Trussed Concret
Steel Co., Detroit, Mich.

The series of articles on the inspectio concrete work, of which this is the first of the fifth, has been planned in oppos to the general assumption on the par writers that standards or methods of struction have been long ago established have become common knowledge. The st article on "Directions and Suggestions or the Inspection of Concrete Materials" p peared in this journal for Jan. 31, 1912 second article on 'Proportioning and M Concrete' appeared on Feb. 7, 1912; the article on "Inspection of Forms and Ce ing" appeared on Feb. 21, 1912; and the f article on "Inspection of Steel Reinf ment" appeared on Feb. 28, 1912. Th lowing article relates to the inspecti concreting. It will be followed by articl finishing concrete surfaces and waterpro concrete work.

With the actual handling or transp of the concrete, the inspector has little his duties being restricted to seeing tha quality of the work is maintained rather the means used by the contractor to on the work. However, as the inspect interested in the progress of the work t that it is completed in the time agreed u the method of handling the materials a become of vital importance. The writer therefore, discuss the subject very briefl

TRANSPORTING CONCRETE.

Provision should be made by means suitable hoists and other tools and in ments for the rapid transportation of fresh concrete to the forms in such a ma as not to separate in any degree the ponent parts. The arrangement for han the concrete should be such that it will under perfect control at all times.

Conveyors.—Concrete may be conv from mixer to place with buckets, carts, wh barrows or cars running on a track. C may be used with the approval of the gineer only if they can be so arranged a deliver the concrete in a thoroughly m condition. The inspector, of course, wil governed by the engineer's decision in matter. Other forms of continuous con ors should not be used without the exp permission of the engineer.

Concrete cars should be of simple struction, easily cleaned, dumping at ends as desired, and without moving p which will become clogged with concrete. size of car or bucket to be used will de somewhat on the character of the work.

The selection to be made from among t common conveyors is dependent on econ as in handling other materials, the only quirements being that the concrete shal conveyed to place quickly, and that the ill not be allowed to separate as a any of the manipulation.

rting Concrete.—No concrete should d over 150 ft. from mixer to point is to be deposited, unless absolutely Too long a trip for a wheel- ust be avoided, unless proper pre- are taken, because the liquid sep- om the mass, and, if in a leaky ow, is lost, or if in a tight iron ow or in carts, the workman often e "slush," which is mostly cement, than where it ought to go. In han- transporting concrete, it is essen- event the separation of the stones mortar. If long trips are unavoid- concrete should be dumped on a form, preferably of sheet iron, and y turning over several times, and eled to its proper place. No wheel- l be allowed on the centering or rete. Running wheelbarrows direct- reinforcing rods must not be al- he wheelbarrows must not be filled to permit mortar to slop out.

nd Hoisting Machinery.—The loca- e apparatus used for mixing and he concrete should be such as to depositing the material and leaving out being walked or traveled over, same time not interfere with the of other work, especially when the of the work is such that several ts of a work must proceed unin- after the construction has reached stage. All hoisting machinery must ted independently of the forms, so concrete will not be subjected to The mixer should be placed high ngredients raised to it, so that the vill not have to be lifted after it is from the mixer.

ction and Arrangement of Runways. nways for wheelbarrows or carts provided to convey the concrete to out displacing forms or reinforce- nways should preferably be built idth or in double sets. Proper uld be provided underneath the hold them together. Runways for should be so constructed as to avoid y jolting of the concrete in tran- ring will tend to separate the stone mortar. The runways for wheeling te should be smooth and ends of rming them must butt together in avoid jarring of wheelbarrows or nways should be at least 36 ins. two-wheel carts.

s should be so arranged that work- l out by one route and return by All runways must be supported in- ly of the forms, so that the con- not be subjected to vibrations. They upported by horses or trestles that per clearance of the steel and con-

s must be kept free from dirt and ondition.

ions to pe Taken Before Concret- re placing the concrete, the in- ould see that the forms are sub- nd thoroughly oiled or otherwise insure smooth surfaces and the e occupied by the concrete is free ris and the reinforcing steel has erly placed and firmly secured by other methods to prevent displace- ncrete should not be started under nstances until everything is in readi- roceed without interruption. It is to have the forms finished far advance of the placing of the con- insure continuity of the concreting.

g Forms.—Before starting to place it is very important to see that the clean. All dirt, shavings, sawdust, wood and other rubbish of this t be removed from the forms just cing concrete, and whenever neces- ns should be cleaned out by a steam ually effective means. Especial care taken to prevent shavings and saw- n lodging in the beam and column oo much care cannot be given the s it is of far-reaching importance, and failure to [illegible] after this cleaning, [illegible] hard to rectify. [illegible] should be done just [illegible] fore closing the door at the foot of the column box [illegible] through the box and see that no chips, blocks of wood or refuse of any kind has fallen into the box and become lodged in the reinforcing steel. It is very easy for blocks of book to become lodged among the reinforcing rods of walls or columns. These must be removed, as they do not make good reinforcement.

All forms having been previously used should be thoroughly cleaned and prepared before being used again.

[illegible] to pour concrete, the reinforcement for the entire floor should be directly at hand with that for the columns below all in place. Special care must be used to see that each piece of reinforcement is in its proper position before pouring, and is not moved in placing the concrete. It cannot be too strongly insisted that each piece of steel be securely fastened in position while concreting is being done, this fastening in no case being of wood. All reinforcement should by all means be given a final inspection just previous to pouring the concrete, this is particularly essential where the reinforcement is placed sometime in advance of the concreting. The writer would suggest that the inspector remain with the gangs doing the work and be very diligent in watching to see if all the reinforcement (especially with the loose bar system) is placed according to the detail drawings.

Wetting of Forms.—Special care must be taken to prevent wooden forms or other absorbent materials (such as brick, porous tiles, etc.) which will come in contact with the fresh concrete from absorbing its water, by insuring that the surfaces of such materials exposed to the concrete have been rendered non-absorbent by being thoroughly wetted, just before the placing of concrete. In other words, when concrete is placed in contact with brick, porous tile, etc., these should be thoroughly saturated so as to improve the bond and to prevent the absorption, by the porous substances, of the water in the concrete.

The cleaning and wetting of forms has been discussed by the writer in his previous article on "Inspection of Forms and Centers" in this journal, page 205, Feb. 21, 1912.

Engineer's Approval.—When the forms are ready to be filled with the concrete, the engineer in charge of his authorized representative should be notified and no concrete should be allowed to be deposited in the forms until he has inspected the arrangement of the steel and the various fastenings of the reinforcement, and given his approval of the work. The engineer will then give due notice to proceed with the concrete. To avoid delays, the engineer should be notified one day in advance when the steel and forms will be ready for inspection.

Fastenings, Etc.—Before commencing to pour concrete in floors or walls, the contractor should ascertain whether proper provision has been made for location of hangers for shafting, sprinklers, lights, and the passage of wires, pipes, shafting, etc., through floors and walls. It is cheaper to delay the work until proper provisions have been made than to cut out work already done. In other words, the contractor should inform himself in advance of what is needed in every piece of work, and have the same on hand in advance of beginning of thec oncrete work.

Removing Lumps [illegible]—No lumps of concrete should be permitted to lie in any of the cars, hoppers, troughs, wheelbarrows, or other receptacles which are used for conveying it from the mixed to the forms. Each receptacle should be cleaned at the cessation of work. If a tank or hopper is used for receiving the mixed concrete care must be taken to see that the hopper discharges uniformly and that mixed concrete does not accumulate and lie in the tank or hopper until it has set. In hot weather this needs special attention.

Any concrete which may be spilled on the forms or reinforcement and is set and dry in advance of completed work, must be swept up and removed, and forms and reinforcing steel must be washed clean before concrete is deposited. Concrete spilled along runways should not be deposited in the structure without permission.

Resumal of Work.—Before depositing any concrete after work has been discontinued for over one hour, the forms should be cleaned of any concrete adhering to them, and all fins or broken pieces on the top of the concrete removed, and the forms and upper surfaces of the concrete thoroughly wetted.

[illegible] —All unfinished and unsafe panels or sections should be removed before starting a new one, and any batches or remnants of materials, containing cement, not used on the first set, should be condemned and removed whether in the wall or floor, or in the vicinity of the work.

Inspecting Concrete Before Placing in Forms.—No concrete should be laid except in the presence of an inspector. The inspector should carefully note the uniformity of the mixture delivered to the forms and should make it his duty to see that it contains no foreign substances, such as wooden blocks, shavings, chips, etc. He should carefully note whether the color apparently indicates the proper mixture and in case of doubt should verify from the mixer the proportions of the batch.

A competent should should also be in constant attendance at the mixer to give his approval of every batch that leaves the machine or the mixing platform as the case may be. It is of great importance that every precaution and vigilance be exercised continuously so as to be sure, beyond any doubt, that not less than the specified proportion of cement goes into the mixer. The man in charge of the mixer should also observe the dry batch and see that the cement has not been overlooked.

[illegible] No concrete should be placed until it is definitely determined that the forms are correct and properly braced. If the forms stand any considerable time between erection and time of depositing the concrete, the alignment should be carefully checked just before placing the concrete. The alignment should also be checked after storms and high winds. The alignment should be maintained during the placing of the concrete. Before the pouring of concrete there should be workmen assigned to keep watch of all forms and correct any displacement or looseness of forms. It will be too late to attempt to correct poor alignment after the concreting has started, and the buckled forms must remain in their warped position, unless trueness of face is of sufficient importance to warrant tearing down the concrete and replacing it.

Excess Water in Forms.—Excess water in forms should be drawn off by boring holes with an auger before placing concrete. By thus drawing the water off the top before closing a day's work and taking care that no water accumulates, laitance may be avoided to a great extent.. If the water is allowed to stand and to evaporate, very fine impurities, finer than pass a 200 mesh, will be deposited on the surface. In order to discharge the surplus water, small holes about ⅜ of an inch in diameter may be made in the planks when and wherever required.

..*Rock Surfaces.*—Rock surfaces should be cleaned and washed with wire brooms, roughened if required, and covered with a thick neat grout before placing the concrete or the surfaces thoroughly wetted. Steel bars may be used to anchor concrete to rock, if required. Special care must be taken in placing concrete against a rock surface where a bond is desired. All loose or broken chips of rock and dust must be carefully removed before concrete is placed either on or against the rock.

Earth Surfaces.—Earth surfaces should be wetted and compacted by ramming immediately before depositing concrete thereon.

Dry Weather.—In dry weather, the forms [illegible] fore placing the concrete within them. In hot weather, the sand and gravel, or broken [illegible] the time of initial set of the concrete to as near the normal as possible. If necessary, the sand, broken stone or gravel piles should be protected from the sun. Sufficient canvas, timber or wet sand should be provided in advance to protect freshly laid work from the direct rays of the sun and wind.

Wet Weather.—Concrete should not be made when rain is falling on it.

Freezing Weather.—In freezing weather steam must be used in place of water to drench the forms, immediately before placing the concrete. No concrete should be laid in freezing weather unless proper precautions are taken to prevent injury to the concrete. Special precautions must be taken to avoid the use of materials containing frost or covered with ice crystals during freezing weather.

The subject of concreting in freezing weather will be discussed more fully at the close of this article. The subject is such an important one that this entire article could very easily be devoted to it.

Bonding Old and New Concrete.—Every precaution should be taken to secure good bond when joining fresh concrete to concrete that has already set. Bonding new to old concrete will be discussed very fully at the close of this article.

Remixing.—When the concrete has to be transported a long distance in wheelbarrows or carts, and the water has separated from the solid matter, the concrete should be remixed before being placed in the forms. That is to say, when the water arises to the surface in wheeling concrete from the place where mixed to the place of deposit, the concrete should be turned over in the wheelbarrow or cart with a shovel before it is deposited in the forms. If, however, delay occurs in the placing of the concrete that results in leaving a batch mixed but not placed before the end of half an hour (the maximum time usually allowed), generally the mixed concrete should be rejected. There are times, however, if the concrete is thoroughly remixed, adding a little water, if necessary, it may be made quite good for the purpose. The writer has found that retempered concrete was almost as good as freshly mixed concrete, when the second mixing was well done. For walls and heavy work, retempered concrete ought not to be objectionable, when used in limited quantities. In other words, the uniformity of the work should not be disturbed by using an occasional batch of concrete that has received a different treatment from the rest of the work. The inspector, of course, will be governed by the engineer's instructions as regards the use of re-tempered concrete. The writer would recommend that in reinforced concrete construction that its use be entirely avoided.

Concreting at Night.—It is sometimes necessary to continue concreting into the night when work of importance must not be stopped or broken off. In such cases extra precautions should be taken to see that the material, and especially the cement is properly supplied to the mixer. During the progress of night work, it is necessary to be extremely careful that the work is carried on in exact accordance with the specifications, and the inspector cannot be any too careful in this respect. No night work should be permitted unless suitable arrangements are made for the lighting of the work. Night work should be carried on with as small a gang as will insure the placing of fresh concrete pefore that beneath it has set.

[illegible] REQUIREMENTS.

Handling Concrete.—Concrete, after the addition of water to the mix, should be handled rapidly, and in as small masses as is practicable. The amount of concrete that should be placed at once depends upon the kind of construction and the kind of concrete. Comparatively dry mixtures, which, in general, should [illegible] be used in massive, unreinforced work, may be carried in half cubic yard or cubic yard buckets, handled with a derrick. If large quantities of concrete are placed at a time or in one place in reinforced concrete work, it may cause spreading of the forms, or it may bend or displace the reinforcing bars or any rods that are used to brace the forms.

When concrete is properly made the whole mass becomes one stone when it has set, and it is very important that the placing of concrete should be continuous. The contractor may at times be required to complete the section of work then going on without stopping, even if working overtime is resorted to. It is sometimes of great importance that no stop be made in placing the concrete in any portion of the work until the depth or thickness called for is in place. This is particularly true of reinforced work. In continuous work the inspector should see that the placing is conducted in such order as will prevent the concrete first placed from becoming set before the remainder is placed.

After concrete is taken from the mixer or the mixing platform it should be placed as soon as possible in the forms, as any disturbance of the mass, after the cement has begun to set, detracts from the ultimate strength. As a rule the sooner it is placed the better. Rapidity of execution where quick-setting cement is used, is a point which must be carefully attended to. A slow setting cement should be used when a long time is likely to occur between mixing and final placing. Concrete should be kept in motion until deposited in place.

Concrete may be handled and placed in any way, best suited to the nature of the work, provided the materials do not separate in placing. Excess of water causing materials to separate must be avoided.

Dumping Concrete. — Concrete may be dumped from wheelbarrows or carts, or shoveled directly into place. In depositing of concrete in place, care must be taken not to undo the work of mixing. The concrete should be dumped as nearly as possible in the place it is to occupy in the work. Concrete must either be dumped slowly or shoveled out, and must not be dropped from too great a height or thrown from too great a distance when being placed upon the work. The method formerly advocated of dumping concrete from a height of three or four yards is now discountenanced, for the reason that the larger stones in falling become separated from the mortar and smaller stones, and the concrete is not therefore homogeneous and uniform. It should not be dropped further than 6 ft. The contractor should be required to furnish suitable appliances when necessary to deposit concrete without allowing it an excessive free fall. It should be so deposited as not to injure the forms nor the concrete already placed. In narrow forms only small quantities should be dumped at a time.

Great care must be used in dropping the concrete. If the concrete is allowed to fall freely a distance of several feet or to slide down an inclined plane, it will be likely to fall in a cone-shaped pile and separate the stone from the mortar, which will pile up, the result being a layer of broken stone followed by a layer of mortar. The broken stone or gravel will roll down the outside of the cone-shaped pile. This action is especially bad in concrete that is mixed rather dry. The inspector must insist upon the concrete being deposited in such a manner that there will be no separation of coarse from fine material. If this separation cannot be avoided by some other method of dumping, then care must be taken to remix the concrete.

There is one method by which the concrete may be deposited by gravity without causing a separation of its component parts. This consists in allowing the concrete to slide down a metal tube or enclosed trough, but the tube must be kept continuously full, the concrete being allowed to run out at the bottom only as fast as it is filled in at the top. This method, however, is only applicable where the mixing is continuous, as in the case of machine mixers.

If buckets are used for conveying con
they should just clear the work when
charged, for if the concrete is allowe
drop, it is liable to jar the forms an
place the reinforcement and at the same
produce separation of the stone fron
mortar. Buckets should not leak and
concrete over the work.

Wheelbarrows must not strike the flo
dumping.

If a receptacle is used to convey the
crete, it should be taken out of the rece
in the order in which it is put in. This
avoidable, however, when drop-bottom
ets are used for depositing concrete
water. It would be preferable to tur
bucket over and dump out its contents.

Time of Placing Concrete.—The time
ing between mixing and pouring the
crete must be well within the time set
cement. As a rule the elapsed time shoul
exceed 30 to 60 minutes between wettin
cement and the undisturbed concrete in
place. Generally concrete should be pla
less than one-half hour after mixing.
specifications restrict it to 10 minutes.
inspector, however, should be guided by
in establishing a limit beyond which any
crete once mixed shall not be used i
work. Concrete mixed for over one
shall not be allowed in the work.

Re-Handling Concrete.—Concrete sho
so placed as to avoid any unnecessary re
dling within the forms, if possible to d

*Preventing Concrete from Setting
Rapidly.*—Care should be taken not to
the first concrete placed to appreciably s
or set before the remaining concre
placed. The remedy for this is to occ
ally or as often as is necessary, add a
more concrete to that already placed ov
exposed surfaces.

Depositing Concrete Under Water.—No
crete should be laid in water except
the instructions of the engineer in char
the work and with special permissio
each case. Depositing concrete under
will be discussed more fully at the clo
this article.

Order of Placing Concrete.—C
should be placed in the positions as di
by the engineer, and the order of p
must in all cases be as directed by the
gineer.

Work Divided Into Sections.—The
should be carried up in sections of conve
height and length, and the sections
pleted without intermission as far as
ticable. In no case should work on a s
stop within eighteen inches of the top, o
face.

Pouring Wet Concrete.—Wet or liqui
crete must be deposited so that it w
flow along the forms or sweep the rei
ment out of place. Concrete should be
in the most approved manner. That
say, wet or liquid concrete should be
posited as to maintain a nearly level to
face and so avoid flowing along the f
Concrete should be poured at several
over the area to be filled so as to r
flowing and spreading to a minimum.

Manipulation of Concrete (Compacti
The concrete should be deposited in
a manner as will permit the most tho
compacting, such as can be obtained by
ing with a straight shovel or slicing tool
moving up and down until all the ingre
have settled in their proper place by g
and the surplus water has been forced t
surface by ramming or otherwise comp
so as to make a dense and compact mass.
manner and extent of the compacting s
be satisfactory to the engineer. All co
should be either tamped or puddled whe
practicable. For dry and medium mi
thorough tamping is necessary in ord
obtain a solid mass, and even with ver
mixtures pockets or voids may occur
the mass is puddled.

When placing the concrete there mu
ways be one man detailed, or more if t
gineer so orders, whose duty it will be
tamping or puddling exclusively, foll
up the shovelers or dumpers as they pla
concrete. In general, the methods shou

[illegible] give a compact, dense and [illegible] concrete.

[illegible] in Layers.—Excepting in [illegible]rk, concrete should be deposited in [illegible] layers of uniform thickness. Lay[illegible] concrete must not be tapered off in [illegible]haped solids, but should be built with [illegible] ends, temporary planking being placed [illegible] partial layers, so that none will run [illegible] thin edge. In order to avoid horizon[illegible], it is necessary that each layer [illegible] deposited before the "initial" set of [illegible]ously deposited layer and should be [illegible]what rough to insure bonding with [illegible] layer above, and should be of [illegible]ckness that it can be incorporated [illegible] one previously laid. The surface of [illegible] layers should be leveled with a [illegible] edge, or in other suitable manner. [illegible] words, the layers should be kept, in [illegible] as nearly horizontal as may be dur[illegible] process of placing, one layer being [illegible] before another is started, and lay[illegible]ncrete must not be run out to a thin

[illegible]

[illegible] be tapered off, but be built with [illegible]nds, and when, from any cause, it be[illegible] impracticable to complete a layer, a [illegible] convenient width should be secured [illegible]rm against which the concrete should [illegible]ed, thus making a vertical joint. [illegible] become necessary to start a second [illegible] once, it should stop short of the first [illegible] least 12 ins., when a second plank [illegible]e secured in the same manner as the [illegible] the concrete rammed against it, the [illegible]ing carried up full thickness to the [illegible]nd left rough. No loose stones or [illegible]laces should be left on the surface of [illegible]r, but such places must be filled with [illegible] and the ramming repeated until wet [illegible] flushes to the surface. The ends, [illegible] full layer cannot be laid at the time, [illegible]e squared off in every case by ver[illegible]porary planking.

[illegible] Layers.—The thickness [illegible] [illegible]ill depend upon the character of the [illegible] hand. Opinions differ as to the [illegible] of layers in which concrete should [illegible]sited. Some advocate thick layers, [illegible]n ones. The inspector, of course, will [illegible]rned by the specifications or by the [illegible]'s decision in the matter.

[illegible]xture which does not quake in the [illegible]row should be deposited in layers [illegible] 6 ins. and thoroughly tamped. [illegible] has been rammed in 3 in. layers, [illegible], very seldom, because whatever care [illegible] taken, the joints between the layers [illegible]ays a source of weakness. Layers [illegible] than 6 ins. for dry concrete should [illegible] attempted unless a large number of [illegible] employed in mixing the concrete, as [illegible] the depositing and ramming a [illegible] thickness may take so long that the [illegible]portion may have begun to set before [illegible] can finish the upper part, and this [illegible] a disturbance of the setting, and [illegible]ent weakness. The reason for com[illegible]ly thin layers in rammed work is so [illegible] ramming will be effective. In spe[illegible]es where the concrete must be placed [illegible] slopes, a dry mixture in 4-in. layers [illegible] be used.

[illegible]aking mixture may be deposited in [illegible] to 12 ins. thick, and should be pud[illegible]ith a square-pointed spade. Even [illegible] layers of wet concrete may be placed [illegible] in mass work, if it can be done with[illegible]ing air pockets.

[illegible] Churning Wet Concrete.—Pud[illegible] should be thoroughly done so as to [illegible]ut air bubbles and pockets and bring [illegible]crete into close contact with the rein[illegible] steel at every point. In reinforced [illegible]e, where wet concretes must be em[illegible] it is important that the concrete be [illegible] in such way and in such amounts as [illegible] cause air pockets to form. The same [illegible] of any concrete that is to be imper[illegible] Ramming is not essential in such [illegible]es, as puddling is quite as effective as [illegible]g, if properly done. In fact, if the [illegible]e is of such consistency that it can be rammed, it is [illegible] reinforced concrete work. [illegible]te should be thoroughly churned after it has been deposited in the forms. [illegible] or other suitable instruments should be used for this purpose. These implements should be small enough to enter well into the spaces between and around the reinforcing steel and make the concrete flow into the corners and along all faces of the walls. Care must be taken to avoid displacing the reinforcing steel. Bars should be lightly tapped to assist the settlement of concrete under and around them and must be entirely incased in concrete, care being taken to insure the coating of the reinforcing metal with mortar and the thorough compacting of the concrete around the bars. Jarring of bars must be carefully avoided when the concrete begins to set.

The inspector should insist upon the concrete being well spaded, for only by thorough spading can air bubbles be worked out. The stones should be carefully but judiciously spaded away from the face; too much and unskillful spading will permit an upward flow which will wash the cement from the concrete at the face. In other words, excessive puddling or churning is injurious, it dries the stones together and forces the sand and cement to the surface. Puddling of wet concrete should be performed to only a moderate extent, just sufficient to expel the air. With very wet concrete poured in mass work it is not usual to tamp or puddle it, except at the face that is to be exposed for the purpose of forcing some fine material to that face so that it will present a smooth surface when the forms are removed.

Obtaining Smooth Face for Exposed Surfaces by Spading.—Faces exposed to view may be made smooth by thrusting a spade or fork through the concrete close to the form to force back the large stones and prevent stone "pockets." Care must be taken in removing the large stones from the face to prevent an upward flow which will wash the cement from the concrete at the face. The finer mixture must be flushed against the forms. It is sometimes customary to specify that no separate facing, and no plastering will be allowed, and when the forms are removed, a smooth surface, free from voids, will be required, and pointing of holes in the face must be reduced to a minimum by the above method.

In the case of a dry mixture, "spading" must be done with greatest care by experienced hands to get uniform results. Such special rammers and folks should be used near the surface as may be required to give the desired finish.

Obtaining Smooth Surfaces With Rich Mortar.—Smooth surfaces may be obtained by spreading a thin layer of rich mortar (1 cement to 2 or 3 sand), about 1 in. thick, over a section of the area to be concreted ahead of the regular mixture. The thickness of mortar facings should not exceed 1½ ins., nor be less than ¾ in. Care must be taken to remove from the form the dried mortar which splatters against them, in order to secure a perfect face.

Placing Mortar Facing and Backing Simultaneously.—It is sometimes customary to place the mortar facing and backing simultaneously in the same horizontal layers. In order to gauge the thickness of the mortar facing accurately, a light board or diaphragm of thin metal with convenient handles should be set on edge parallel to and (1 or 1½ ins.) from the front wall of the forms. The facing material is deposited in the space between this board and the form. The concrete of the backing should then be deposited and spread against the back of this board, which may then be withdrawn and the whole mass thoroughly rammed so as to bond the mortar facing and backing by destroying the surface demarcation between them, but no stone must be forced nearer to the front wall of the form than ¾ in. Necessary deviations from this method may be adopted on the approval of the engineer. Care must be taken to remove from the forms the dried mortar which spatters against them, in order to secure a perfect face.

By using the metal diaphragm or light board in the manner above described, the face of each layer may be made exactly the right amount of mortar, and the proper amount of the layer may be accurately determined. The intention is that the facing and the backing should be rammed and set together. In no case is one to be put in in advance of the other, so that either may set before the other. The facing should show a smooth dense surface without pits or irregularities. This is most likely to be secured by thorough and systematic ramming. The facing mortar should be of the same composition as the mortar used in the concrete back of same.

In places where the above method cannot be used, as the under surface of arches, the same end should be attained by methods satisfactory to the engineer.

Refinishing Mortar Facing.—In no case should any work be finished by plastering mortar or concrete which has set, but should it become necessary at any time to refinish a surface which has set, it should be picked off so that at least 3 ins. of mortar can be added, and the surface of the old concrete should be roughened and thoroughly wet before new material is added, such new material being mortar as specified for facing.

Ramming (Sometimes Called Punning) of Concrete.—For some unaccountable reason most of the older specifications specify that the concrete shall not be rammed or tamped after being put in place, and in order that it may be, to a certain extent, solidified, it was specified that it should be dumped in place from a certain height. Nothing could have been more erroneous than such ideas. The concrete should not by any means be allowed to fall a considerable height. Such a fall tends to separate the larger pieces from the smaller, and thus results in a lack of uniformity in the concrete. The concrete should be put in place with care, and not allowed to fall more than 6 ft., if possible.

In placing dry concrete in layers, see that the layers are of the required thickness, evenly spread, and properly rammed. Each layer must be thoroughly rammed and consolidated so that no void spaces are left. The advantage of suitable ramming is obvious. It compresses the concrete, rendering it more solid and free from voids, and squeezes out all superfluous water. The inspector must insist upon the thorough ramming and compacting of all dry concrete, as the value of the work largely depends upon the completeness with which this highly important part of the work is done. Too much ramming, however, is dangerous, as it may be continued until the cement has begun to set, and in this case a loss of strength is entailed. For this reason, concrete made with a quick-setting cement should be rammed very little, if at all. The ramming must be completed as the work progresses. In no case should concrete be permitted to remain in the work if it has begun to set before the ramming is completed. The ramming should be done quickly in order to avoid the possibility of layers setting before completing them, but the tamping must be done thoroughly and not slighted. If the concrete in tamping should quake this will indicate that it is too wet.

The bottoms of tamping tools should be kept clear of hardened mortar so as to pack the concrete with flat surfaces. No mortar that has been prepared for the purpose of forming a new batch of concrete should be taken to plaster any rough or improperly tamped places that may appear in the work, as ramming or tamping should be the only means employed to obtain a smooth and regular surface.

Cinder concrete should be rammed or tamped very lightly if at all, as heavy ramming or tamping will break the cinders. A wet mixture is most suitable for concrete made with cinders.

Concrete should be laid and rammed in layers, as far as practicable, normal to the direction of the pressure it carries.

Care should be taken in the ramming not to displace any braces, ties, forms, pipes, or other embedded fixtures.

Any portion of any layer of concrete which has been left long enough to have any appearance of setting should be taken up and relaid before the next layer is put on or may be treated as follows: When a fresh layer is to be put on one which has set or partially set, the entire surface must be thoroughly swept with metal brooms or brushes. The skin or film usually forming on the surface of the concrete must be completely scrubbed or steamed away. All surfaces and pockets must be cleaned of all sawdust, shavings or other matter, and when completely cleaned, it should be thoroughly wetted before the new layer of concrete is placed.

Force of Rammers and Shovelers.—For distributing and ramming the concrete in place after delivery, a sufficient force of rammers and shovelers should be maintained for each mixer in operation to handle the concrete rapidly and ram or tamp it thoroughly before another batch is dumped within the forms, and when this labor is specially severe, the inspector should require the changing of men so employed in order that this part of the work may be thoroughly performed. The labor necessary to spread and compact the concrete must be other than that required to mix it.

[illegible]

The length of time ramming or tamping should be continued and the vigor with which it should be done depend largely on the degree of plasticity of the concrete. Too much tamping is to be avoided, as it separates the mortar from the stone, bringing the former to the surface. The ramming should be stopped when the water flushes to the surface. In other words, a flushing of water to the surface should always serve as an indication when to cease tamping.

Tools for Ramming or Tamping Concrete.—Tampers or rammers may be made of an oak stick 18 ins. long, 4x4 ins. at the top and 3x3 ins. at the bottom fixed to a handle at the top. Square wooden rammers measuring from 6 to 8 ins. on a side, or round ones from 8 to 12 ins. in diameter and weighing between 10 and 20 lbs., are quite often used.

Rammers are frequently made of wood, but those of iron are believed to be better. A convenient rammer is made of an iron casting, 6 ins. square, having a handle of 1-in. round iron, or 1½-in. pipe, about 5 ft. or 5½ ft. in length, which should weigh in all about 20 lbs. Twelve-pound metal rammers are also used, especially where only light tamping is required. The weight of a tamper is limited by the capacity for work of the man who wields it. Tampers have been made up to forty and even to fifty pounds in weight.

In all cases, tampers should be of such form and material as the engineer may approve. The tamping tools should be at least 6 ins. square at the bottom and should not exceed 20 ins. square. Rammers of special shape or pneumatic machines may be required by the engineer to secure thorough work in different places. Special shaped tampers will be required for places where ordinary tampers would not be effective. Bevel rammers are necessary for the backs of arches. Railroad tampers for heavy mass work. Short-handled rammers in confined places and long-handled rammers in columns.

Concrete to be Free from Voids.—The concrete must be so thoroughly compact that there will be no pores or open spaces between the stones of which it consists that are not thoroughly filled with mortar and every effort should be made to secure the greatest possible density of the mass.

Tapping Forms to Produce Smooth Surfaces.—In addition to tamping or puddling, the forms of all concrete work, i. e., beams, girders, etc., should be lightly and continuously tapped with a suitable maul, in order to provide smooth and perfect surfaces. The outside of the forms should be pounded with wooden mauls or mallets immediately after receiving the concrete, to assist in shaking down and consolidating the concrete.

Removal of Defective Concrete.—Any concrete work indicating that it has not been thoroughly mixed in the required proportion should be dug out and replaced as directed by the engineer. The inspector, of course, will be governed by the engineer's decision in the matter.

Wetting Concrete.—When a deficiency of moisture is indicated after ramming is completed, it should be supplied by sprinkling with a fine spray of water. After ramming, surface of concrete should be kept moist until it fully sets by sprinkling at short intervals. For this purpose not less than one large watering pot for each mixer should be kept in constant service, and as many more as may be required.

No Walking on Fresh Layers.—When in place, all wheeling, working or walking on the concrete must be prevented, until at least twelve hours after being deposited or until it has set for a sufficient length of time. Protection of concrete after placing will be discussed more fully elsewhere.

Excess of Water in Concrete.—An excess of water is detrimental to the concrete, as it brings a layer of cement which has already set to the surface, forming a point of weakness in the finished work, unless it is well scraped off before the next layer is deposited. If one or more batches are too wet, a comparatively dry batch or more should be mixed to take up the surplus water.

Rubble Concrete.—In massive work, as in foundations, retaining walls, harborworks and the like, the embedding of stones of "one-man size," or larger, in the concrete is a practice that has long been in vogue. In heavy engineering works, some of the stones thus inserted contain a cubic foot or more, but in buildings smaller pieces must be used according to the thickness of the wall or foundation. The objection is sometimes made that the incorporation of large stones into concrete interferes with the homogeneity of the wall and that variations in expansion may result in injury to the work. This danger, however, is more theoretical than real, especially in large massive work. Sometimes the "packing" amounts to as much as 25 per cent or more of the total bulk of the work.

The stones thus embedded should be perfectly clean, hard and sound, and should not lie nearer one to another than 4 ins. nor should they lie nearer than this to the face of the wall. Such stones must be thoroughly scrubbed clean before being placed in the work and should be wetted immediately before setting in position. The concrete should be mixed rather wet and should contain a proportionate excess of mortar in order that the stones may be properly united with the rest of the mass. Care must be taken that each stone is completely surrounded by a compact mass of concrete. The stones should be settled into the concrete already laid far enough to assure their having a full bed of mortar. Large stones should not exceed 20 per cent in volume of the masonry containing them. No rotten or soft stones or rock should be used, nor those which are partly rotten or soft.

Stones used in the manner described above are sometimes called "plumbs," "one-man stone," "nigger heads," "boulders," or "packing."

The inspection must be thorough in order to insure watertight work by a thorough compacting of the rubble concrete. It can not be too strongly emphasized that the difficulties of inspection are much increased when rubble concrete is specified, as there can be little check on the quantity of large stones which a contractor can put into a wall. For this reason it is sometimes better, in contract work, where the constant supervision of an inspector is not available, to forbid all the incorporation into the concrete of large stones and to use a well-broken aggregate, irregular in shape and size and containing, therefore, as small a quantity of voids as possible. In this way, the cement will bind a larger quantity of aggregate, and the cost entailed by forbidding the use of large stones will be to some extent, reduced.

Record of Concreting.—The concrete foreman should be required to mark in ink upon the plans the date and hour when each part of the work is concreted. This must be [illegible] to every time concreting is done, [illegible] must not be put off until some conve[illegible] me and then filled in from memory. [illegible]ous.

[illegible] Blocks of Concrete.—A sa[illegible] block of concrete should be made from [illegible] day's work. This sample should be po[illegible] into a box, say 6x6x6 ins. and the box sh[illegible] be dated, and kept so as to obtain the s[illegible] climatic conditions as the original. Tha[illegible] to say, the sample block must be expose[illegible] the same weather conditions as the concre[illegible] which it represents. This will serve a[illegible] guide to determine the condition of the [illegible]crete before centering is removed. The w[illegible] would suggest that signs be placed over [illegible] box, warning all workmen against mo[illegible] these boxes or tampering with the cont[illegible], otherwise workmen are likely to pay [illegible] attention to this and constant watching [illegible] the part of the inspector is necessary to g[illegible] against their removal.

Introduction of Cells in Mass Conc[illegible] Work.—Where weight is not desirable, [illegible] may be introduced in the mass, formed ei[illegible] by cheap hemlock boxes, which can be le[illegible] the work, or by collapsible boxes which [illegible] be withdrawn and used over again. W[illegible] weight is desirable, large stones may be [illegible]med in the heart of the mass, as descr[illegible] above for rubble concrete.

[illegible] IN EXCAVATIONS AND FOUNDATIONS.

Concrete should be placed in excavation [illegible] means of chutes or other appliances to [illegible]vent an excessive free fall. The contra[illegible] should be expressly prohibited from u[illegible] methods that will cause separation of the [illegible]gregate and matrix unless with special [illegible]mission of the engineer, and in such cases [illegible] concrete should be thoroughly remixed be[illegible] being placed.

When used for foundations concrete sh[illegible] when practicable, be deposited and ram[illegible] against the sides of the excavation.

[illegible] Water [illegible].—W[illegible] concrete is to be put into a foundation [illegible] water level, all water should as far as [illegible]ble be removed from the excavation. If [illegible] impossible by means of the ordinary pum[illegible] facilities to control the flow of water, [illegible] excavation may be taken out in sections, [illegible] the concrete may be placed in the founda[illegible] section by section. Special care must be [illegible] to ram thoroughly the bottom layer of [illegible]crete, and to remove all mud and clay [illegible] the vertical face of each section of con[illegible] as additional sections are excavated and [illegible]pared for additional concrete work.

Where the foundation is soft, as for [illegible]ample, where piles are used, either fin[illegible] coarse broken stone may be spread over [illegible] bottom of the excavation and thorou[illegible] rammed into the earth before putting in [illegible] concrete.

In no case should a dry mixture of s[illegible] cement and broken stone or gravel be [illegible] into a foundation. The cement may be mi[illegible] with a less proportion of water, but must [illegible] be placed in the foundation without thoro[illegible] mixing.

Where strata of gravel and sand pe[illegible] the entrance of water into the founda[illegible] with such freedom that small sections of [illegible] same cannot be excavated and pumped [illegible] for concreting, a grout of pure cement o[illegible] a mixture of cement and one or two part[illegible] sand may be injected through a pipe into [illegible] loose gravel and sand in the bottom of [illegible] foundation; this work being done while [illegible] excavation is filled with water. The [illegible] through which this grout is passed shoul[illegible] pushed a few inches below the surface of [illegible] gravel, and a bucketful or more of g[illegible] should be poured down through the pipe, [illegible] pipe being then moved 1 or 2 ft., and [illegible] operation repeated, distributing the grout [illegible] the whole area of the bottom to be thus [illegible]mented, and the work then should be [illegible]lowed to stand for 24 to 36 hours. It [illegible] generally be found that the sand and gr[illegible] will be converted into a water tight conc[illegible] permitting the pumping of the excavatio[illegible]

Foundation Concrete.—Foundation conc[illegible] hout into excavations without the use or , provided the sides of the excava- a reasonably true and the material is cie y firm, so that the concrete may be ne thoroughly without yielding of the ce earth. Foundation concrete, if put e vations which are not protected by s. eed not have any special attention the finish of the concrete against the und it.

he it is necessary to use forms in the tion of foundation work, the finer [illegible] iter portion of the mass against the s, as to insure the filling with mortar res or open spaces between the con- ne. Where a cheaper kind of con- used for foundation work, the top ame should be finished smooth and corners and edges being thoroughly and compacted, and the whole sur- full of mortar. It will not be sat- leave a honeycombed surface or ich loose concrete stone is left out. If necessary, the inspector ave the contractor make batches of onsisting of one part of cement to ts of sand, the same being thoroughly should cover the whole surface of on concrete with enough of this flush full all such open, porous

Concrete in Trenches.—Concrete wered into trenches (over 6 ft. xes or buckets, and not allowed to y shovels from the surface. The y require, instead of buckets, that rete be dumped in inclined chutes, of the incline to be determined by e inspector, of course, will be gov- the engineer's decision in the matter.

Trenches.—Before the first layer is put into the trench, the bot- he trench must be thoroughly sprin- water from a hose, so that the the concrete may not be absorbed.

s.—Footings should be cast at one where practicable, and the concrete in layers not exceeding 9 ins., and r thoroughly rammed.

[illegible]E IN COLUMNS AND WALLS

g Columns.—Columns should be ell ahead of the beams or girders, being preferable. This is important. regular column mixture is poured, be at least 2 or 3 ins. of mortar s 1 to 1, placed in the bottom of ns. Some specifications require ver 1 ft. of each column shall be h a concrete containing more sand stone than the regular mix, under uctions of the engineer, in order to y "honeycombing" at this point, the f the column being filled with con- ed in the proportions specified. Other ions require that before beginning e forms of columns, the bottom or urface must each time be thorough- d with a neat cement grout. The . of course, will be governed by the s instructions in the matter.

ng columns the concrete should be small batches, preferably by dump- wheelbarrows on the floor, and shov- concrete into the column. The should preferably be continuous base to the underside of supported girder, but if stopped short of com- the unfinished surface must be left is the practice with some contractors our the entire column at one opera- to allow a height of about 4 ft. to hree or four hours before the second When laying concrete in columns, ous spading should be kept up dur- peration so that it will make a smooth hen the column forms are removed. olutely necessary to expel bubbles of onstantly puddling or joggling the with a rod heavy enough to sink into rete with ease. The outside of col- ms should also be hammered with during the process of pouring so as de air bubbles and make a smooth [illegible] the process of [illegible] by means of a [illegible] ins.), or with [illegible] that will go in and around the reinforcing steel at all four sides simultaneously. [illegible] must be taken that the column bars [illegible] their place while concreting the columns, and for this purpose the tops of the bars should be steadied by wires or boards. Special care is needed in puddling the concrete in columns to make it flow around the reinforcing rods. During the operation, the concrete in the column should be constantly churned in order to prevent arching in the interior of the column, by being freed from air bubbles. Ramming on top will not accomplish this result. Long slender poles with flat steel ends may be used advantageously for puddling the concrete in columns. At least two of these rammers should be constantly used in large columns during the pouring of the concrete.

Columns Over 12 Feet in Height.—Columns more than 12 ft. high should be poured from a point half way up and at the top, [illegible] the concrete will not have so far to d[illegible] so that puddling of the concrete around the reinforcement can better be effected. Concrete in long columns may also be deposited continuously through tremies, in order that the stone and the mortar will not be separated. Openings left in the sides of column forms, to facilitate pouring should, of course, be closed when the concrete reaches that point, and the remainder of the column then poured. Constant puddling is equally necessary in long columns.

Minimum Time for Filling Long Columns.—Where columns are of an unsupported length of more than twelve times the least diameter, the filling should be done gradually and to every foot of height there should not be less than ten minutes' time used to insure minimum amount of contraction, due to the setting of the mixt[illegible]

Spiral Columns.—In columns having spiral or circumferential reinforcement the concrete should preferably be introduced by means of a tremie or tube, in order to prevent the ingredients from sorting in layers.

Pouring Flat Slab Columns.—In pouring, the column and cap or head should be filled first completely, then proceed to pour the concrete in the slab.

Excess of Water in Columns and Walls.—Particular care must be given to the filling of columns and walls not to have an excess of water, the whole must be uniform from bottom to top. If water accumulates on the concrete, churning or working should cease until additional dryer concrete is placed to prevent the washing out of cement.

Pouring Walls.—Walls should be blocked off into convenient lengths and the whole work brought up uniformly along this section to prevent long, wedge-shaped layers of concrete. Upon stopping, the concrete should be brought up to a uniform level. A panel should be of a size that can be completed in a day's work.

It is well to keep in mind that the thinner the wall the stronger and denser should be the concrete.

Soupy concrete should be used for thin walls, but not so wet that the mortar is watery. Don't dump large quantities of concrete into narrow forms. The concrete should be puddled rather than rammed, the object being to prevent stones from collecting in any one place, and causing noticeable voids on the surface. Puddling is quite as effective as ramming, if properly done.

No rods used to hold the forms apart should be allowed to pass through the wall, except with permission of the engineer.

Concrete should be laid in layers not exceeding 6 ins. in depth when deposited dry; if thicker than this, it is apt to lose a part of the benefit of the labor of tamping—the effect of the blows not penetrating to the bottom of the layer. Wet concrete may be deposited in layers of 10 to 12 ins., and thoroughly puddled.

Pouring Slabs.—In making slabs, the full thickness must be poured in one continuous operation. Stakes should be placed from place to place showing the thickness of the floor in order to insure a level floor. If possible slab and beam must be made monolithic. The units of construction as indicated on the drawings should be rigidly observed, and each unit completed at one time. The floor slabs may be made in sections, provided that the ends of all sections coincide with the center of beams.

During the pouring of floors there should be at least two workmen assigned to giving their undivided attention to this work. Care must be taken to raise slab reinforcement the proper distance above centering as concreting progresses or better still, use some automatic spacers for the accurate placing of the steel. The method of pouring a slab and allowing the material to slope down over the beams and girders and then beginning the next day gives a slip slab joint which should not be allowed.

After the floor slabs have begun to set they should not be walked on or wheeled over until hard, as otherwise their strength is seriously injured. If traffic over them is unavoidable, boards should be provided for the purpose of distributing the weights.

Any preliminary shrinkage cracks which occur on the surface of the slab due to too rapid drying should be immediately filled with liquid cement grout.

Hollow Tile Construction.—In hollow tile floor construction, the concrete on top of the tile must be poured at the same time as the concrete in the joists. Unless this is done the floor will be greatly weakened, and might have to be removed at great expense.

Where hollow tile is used with the floor system, it should be of the best quality, vitrified clay, with walls and webs not less than ¾-in. thick. The exterior surface of tiles should be scored to give greater adhesion. The bottom of the tile should in no case be broken, but a slight break in the upper part is not objectionable, provided that the concrete is allowed to flow into the same.

The tile must be placed regularly at equal distances apart, and absolutely straight and true for the reception of sleepers, etc., and at such distances as shown on drawings. The tile is generally spaced 4 or 5 ins. apart. A wooden strip of the proper width should be laid between the lines of tile when a new line is being laid, to serve as a spacer, and also to get the proper alignment. When the line of tile has been spaced, the spacer can be removed and used on the adjacent line. Under no condition must the joist between two rows of tile be made crooked or with non-parallel sides. It is advisable, in placing the tile, that the long lengths be placed in the center of the span and the joints be made to alternate in the adjoining rows.

Care must be taken in placing the concrete between the tile, so that at least a full inch is filled in over the entire bottom before the steel is placed in position. Especial care must be taken to form T-shaped beams by stopping the rows of tile back from the edge of the beams as shown on drawings, and covering the ends of tile with tin to prevent the concrete from flowing into same. Even where concrete is not specified to go on top of the tile, allow enough concrete in the joist to flow over the whole top surface of the tile for a thickness of about ¼ in.

The tile must be thoroughly wet before placing the concrete, especially in warm weather.

Pouring Beams and Girders.—Beams are sometimes poured in one continuous operation from bottom to top. This method of pouring beams or girders up to the bottom of the slab and then afterwards placing the slab is not desirable. If possible, beam and slab should be poured in one continuous operation, the concrete being worked closely around the reinforcement by puddling, and the stone worked back from the sides by spading. Churning and spading the sides of beams and girders is necessary to obtain neat appearing surfaces. At least one man, but generally two men, will be required to tamp each beam, during the process of concreting, by means of special spades. Care must be taken that the stirrups remain in their places and are held up tight against the underside of beam tension bars while concrete is being placed, and that neither is disturbed or shifted by the process of ramming.

Beams and girders are sometimes filled in two operations, the concrete being first carried up to the tops of the bottom bars, and immediately after being thoroughly tamped or churned by striking the bars with the tamping tools, the beams and girders are completely filled and carried over the slab in one operation.

When beam and slab are designed to act together as a T-beam, both should be poured in one operation. No portion of the work must be started unless it can be pushed to completion, except by special permission of the engineer.

No stops should be allowed on extra long beam or girder spans and special arrangements should be made to do the entire work in one operation.

Shoring Floor Forms.—During the process of concreting, the inspector should see that a careful workman is stationed underneath slabs, beams, girders, etc., to watch for any deflection in the forms and do any necessary wedging up. A workman should be employed at all times watching centering while concreting is being done. This watchman to stretch wires from column to column to guard against deflection, and to see to immediate strengthening of centering where necessary.

PLACING CONCRETE IN ARCHES

In concreting arches, the arch ring should be divided into sections of such size that the pouring of each can be made a continuous operation. Transverse and longitudinal arch blocks should be cast continuously and the contractor should not be allowed to start such work unless provided with sufficient plant and material to insure the finish of such a section continuously. No work should be started on arch rings until piers and abutments have been examined and permission given by the engineer.

Concreting in Longitudinal [illegible] longitudinal sections, the concrete should be begun simultaneously at both skewbacks and continued uniformily and continuously to the crown. That is to say, the construction of the arch ring must proceed continuously and without interrupion from the time it is started until completed, work being begun at both abutments simultaneously, and carried at a uniform rate of progress therefrom until joined in completion at the crown of the arch.

Concreting in Transverse Sections.—Where the sections are transverse or across the arch, the better practice is to concrete the crown section first and work towards both skewbacks a pair of sections, one each side, at a time.

Placing Layers of Concrete.—The thickness of the layers and the degree of ramming should be such as specified for other concrete work mentioned above, but the layers should be placed as near radially as practicable, and the ramming done in a direction as nearly at right angles thereto as possible. This is difficult to do without setting up temporary forms normal to the arch ring and tamping beside these. This is an argument for the use of wet concrete in arches, as it is not important to have the layers of wet concrete normal to the line of thrust except at quittiqng time.

In the abutments of arches the layers should be sloped as nearly as possible normal to the direction of the line of thrust of the arch.

Rising of Centering at Crown.—While the arches and spandrel walls are being concreted, the centering should be watched closely, and if it shows any tendency to rise at the crown, it should be loaded with concrete materials until such tendency is overcome.

Division of Arch Into Parallel Rings.—Should the size of the arch be such as to make it impracticable to construct the entire ring in one day it may be divided vertically into a series of parallel rings of such width that one ring can be constructed contin ly. The width of such ring should, how in no case be less than 5 ft. One si this sub-ring should be formed agains ring previously constructed, and the side against a substantial vertical par which must be removed immediately b commencing the next ring. This cou removed in a day or two, when the co would still be green enough for the nex to adhere pretty well. In order to fo substantial bond between the adjacent allel rings, cleats should be fastened t partitions in such locations and of such and dimensions as may be directed by th gineer. Sections of the arch along the are to be limited to such length as to of the concrete being deposited continu between springing lines.

In constructing new rings against old the vertical surface of the old ring first be thoroughly cleaned and scrubbed coarse brushes and water and then fl with cement grout immediately before p of the new concrete. The arch ring also be connected by steel clamps or ri nections built into the concrete.

Spandrel or Face Walls.—The spand face walls may be carried up at the time as the arch ring, or may be con with it later by leaving short lengths o projecting radially from the concrete arch. Some specifications require tha centering shall be lowered sufficiently t the arch-ring to assume its permane before parapet walls are placed.

Layer of Granolithic for Tunnels, Where concrete is placed on top of she as in the roofs of tunnels, culverts, etc., a layer of granolithic should fi placed, in order to insure a smooth fi the interior, and the concrete above then be thoroughly tamped into it.

Groined Arches.—Vaulted roofs sho laid in alternate squares, the lines of d being through the crown of the g arches.

(To be continued.)

EARTH AND ROCK SECTION

Doubletrees for Heavy Slip and Fresno Scraper Work.

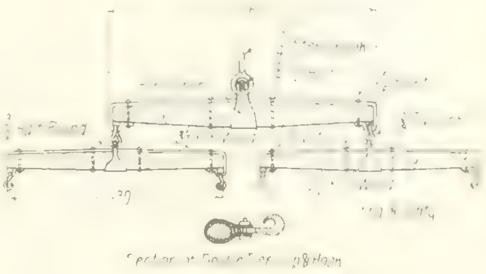
Contributed by R. E. Post, Assistant Engineer U. S. Reclamation Service, Ellensburg, Wash.

In moving dirt with slips or fresnoes and the accompanying work of pulling roots, dragging large rocks, etc., one of the most annoying delays is caused by the use of weak or clumsy doubletree sets.

One of the worst details is the singletree hook which pulls from the back of the singletree and which, whenever the doubletrees are used off of a tongue, cause the singletree to turn half over. Usually at the first hard pull the cast eye of the singletree ferrule breaks, or the center clip spreads. Then there is the clevice and bolt method of fastening the doubletree set to the slip. This is a good rig (although necessitating heavy doubletrees), so long as the team is on a slip, but when needed elsewhere some time is wasted unfastening and fastening the clevice. Moreover, the clevice is a poor device to which to fasten a chain or rope quickly and when a doubletree set is not in use someone usually takes the clevice and forgets to return it. The above annoyances are likely to occur many times a day where such doubletree sets are used and they provoke foremen and teamsters as well as cause considerable delay.

The factory made doubletree sets sold under the name of lead bars are light and handy, but will not stand use on a plow, stump pulling, or other heavy work without much breakage. Further the center clip, fastening the hook to the doubletree, soon becomes loose and pulls to one end. Home-made doubletree sets made of the best woods with factory made center clips, end straps, and hooks, are a great improvement over the lead bars, but the largest oval woods obtainable for the doubletrees will not stand all kinds of work without considerable breakage and the center step fastening the hook to the doubletree behaves the same as in the factory made lead bars.

The accompanying drawing shows a set of doubletrees that will stand the jerks of the heaviest teams, that is not too heavy, that is reasonable in cost, and that will not ordinarily be in the repair shop until worn out. The doubletree center clip in particular is a trouble saver, as whenever the wood shrinks and the clip becomes loose it can be readily tightened with the bolt. Another advantage is in being able to replace a broken hook without a weld. In case considerable work involving pulling on a chain is to be done a special grab hook may easily be inserted or, better yet, one or two sets can be with grab hooks and kept for this wo



Detail Drawings for Slip Doubletrees.

The following is the itemized cost of these doubletree sets:

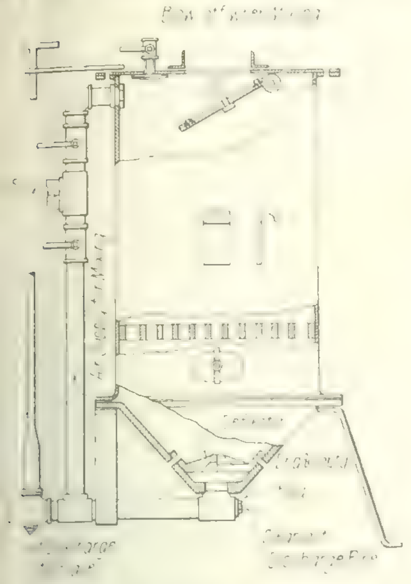
Items.
4 ft. 1-in. half round iron
7 ft. ¾-in. half round iron
1 3½x36 in. wood
2 2½x36 in. wood
1 ft. ¾-in. tool steel
4 singletree hooks
16 ins. ½x1½ in. iron
2 center clips
12 rivets
1 bolt ⅝x2 ins.
2½ hrs. labor at 45 cts.
Total

Civil Service Examinations.—The Civil Service Commission of New Yo nounces examinations to be held at A March 23, 1912, for the following pos Junior Bridge Draughtsman, $900 to Bridge Draughtsman, $1,200 to $1,500; mer of Municipal Accounts, Comptr Department, $5 to $15 per day. County tions for which examinations will be gi the same date, and for which three m residence in the county is required, follows: Rodman, Onondaga Count to $100 per month; Leveler, Onondaga ty Service, $100 to $115 per month.

An investigation in regard to the corr of iron and steel in cinder concrete is made by the Aberthaw Construction concrete engineers and contractors, 8 B St., Boston. They will be pleased to from anyone who has had practical e ence or possesses information on this su

Compressed Air Grouting Machine or Grouting Tunnel Lining.

uting machine in which the grout is and also injected by compressed air illustrated by the accompanying drawing, Fig 2 shows a battery of these ma-



—Section Showing Construction of Ransome-Canniff Grout Mixer Used on Catskill Aqueduct.

work grouting the concrete lining Wallkill Tunnel, which is one of the ssure tunnels in the Catskill aqueduct be-ilt to supply water to New York City. ecifications for these tunnels provide larger voids behind the concrete lining shall be dry packed and that minor voids evices shall be filled with grout either

2—View Showing Arrangement of uting Machines in Walkill Tunnel.

h pipes built into the lining wherever of them can be foretold, or through drilled after the lining is placed. The tions of the grout mixture is to be determined by the engineer, but the character of the [illegible] sand of such fineness that 100 per cent will pass a [illegible] inch and [illegible] 1,600 openings per square inch.

The plan, Fig. 1, shows the general construction and operation of the grouting machine quite clearly. There is a cylindrical steel tank with a conical hopper bottom and a flat [illegible] charge of cement, sand and water is placed in the tank and the compressed air is directed through the bottom, running upward through the material and mixing it by agitation. When the batch has been sufficiently mixed the air pressure is diverted into the top of the mixer and passes the grout out through the discharge pipes, whence it is delivered by hose to the cavity being grouted.

Fig. 2 is a view showing the arrangement for grouting in the Wallkill pressure tunnel. Here a special outfit of mixers was installed by the Degnon Co., contractors. This particular outfit conists of four Ransome-Canniff grout mixers and an air compressor set up on a heavy platform on wheels. The mixer nearest the compressor is used exclusively as an air receiver. The other three mixers are connected up in a battery, but the end one is so connected that it can be shut off from the other two mixers and used separately. By this arrangement the three mixers can work together under any pressure up to 300 lbs., and if necessary the end mixer can be cut off from the other two and worked separately under 300 lbs. pressure, while the other two mixers continue to eject under 75 and 100 lbs. pressure. This has resulted in a large saving of time and expense. It should be added that the rear end of the platform is used to pile bags of cement upon and from this point the cement is emptied into the three hopper-like affairs above each mixer. With these grout mixers the contractors are grouting 24 hours a day divided into three 8-hour shifts, and an average of [illegible] lineal feet of tunnel has been grouted per [illegible]

On the Rondout pressure tunnel grouting is also in progress, using the same type of grout mixers; a battery of three mounted on a car is [illegible] air compressors. The compressors are used to raise the pressure to 350 lbs., when necessary, the normal direct-line pressure being only 100 lbs. An air reservoir made of a piece of 12-in. wrought iron pipe 5 ft. long is used between the compressor and the tanks. The grout used was generally a 1 to 1 mix with sufficient water to lift it into place.

The grout mixer described is known as the Ransome-Canniff mixer and is manufactured by the Ransome Concrete Machinery Co., Dunellin, N. J.

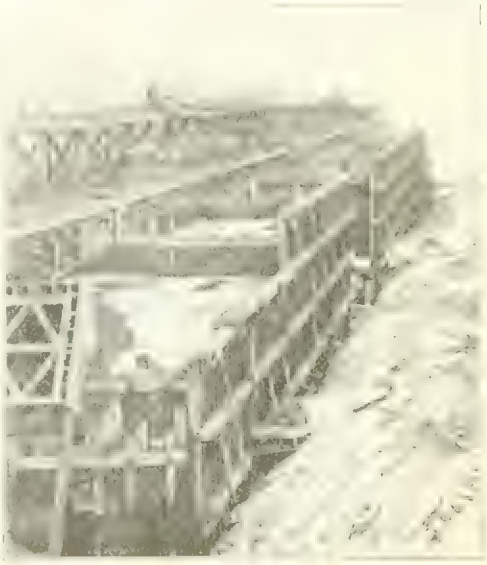


Fig. 1—View Showing Belt Conveyor, Tripper Car and Portable Chute on Lock 6, New York Barge Canal.

The Borough of Carlisle, Cumberland County, Pa., a town of about 10,000 inhabitants, is open for applications for the position of Borough Engineer. Applications directed to the Secretary should give education, experience and salary expected. The salary of former engineers has been $1,000 per annum.

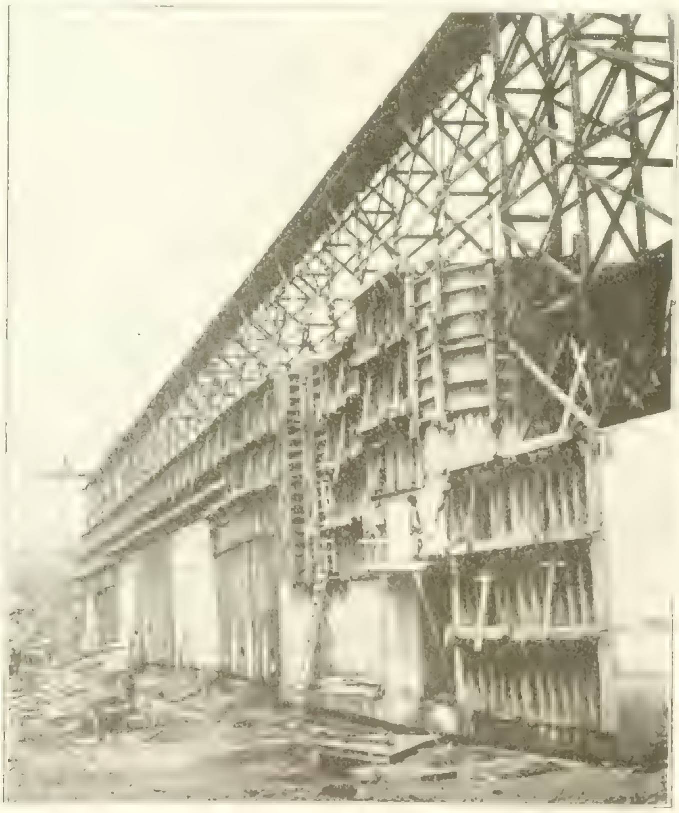


Fig. 2—View Showing Later Arrangement for Carrying Concrete Conveyor on Trestle of 2 in. Pipe, Lock 6, New York Barge Canal.

Methods and Cost of Constructing Lock No. 6 and Guard Gate, New York State Barge Canal.*

[illegible]
in Charge of Contract Eleven, New York State Barge Canal.

The construction of Lock 6 on Contract [illegible] plant and freight yard were located between

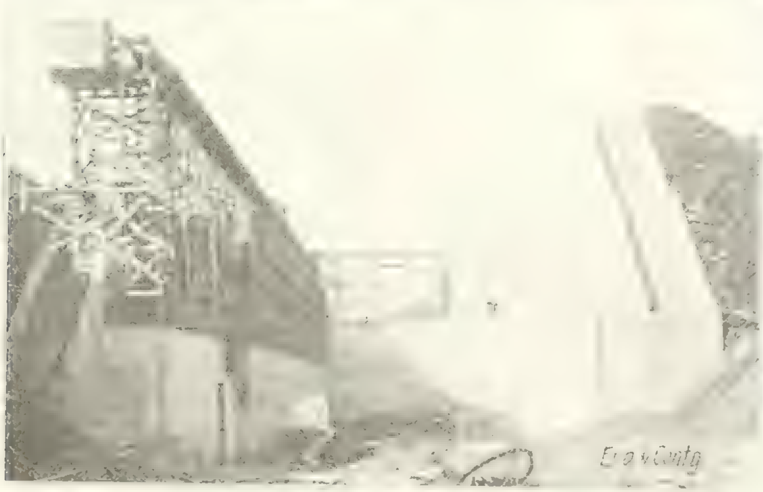


Fig 3—General View of Lock 6 Showing Concrete Conveyors

One over south wall and the other at right angles [illegible] concrete from the cars.

the last named locks and the ground surface was comparatively level, thereby facilitating the handling of concrete and other materials used in the work. The problem at Lock 6 was how to get the concrete from the mixer to the lock, a distance of about 2,300 ft. This distance was considered too great for belt conveyors and yet it was necessary, or at least desirable, to use a belt conveyor for handling the concrete at the lock as there was nothing else available on the work for that purpose. It was not considered feasible to construct a mixing plant at Lock 6 as it was impossible to get the materials without rehandling them, any further than Lock 5, because of a very abrupt rise in the ground at this point. However, it was finally decided to haul the concrete from the mixer between Locks 4 and 5 in 4-yd. 36-in. gage side-dump cars, such as are used for handling earth or rock excavation, the cars being lined with sheet iron and made as tight as possible. A narrow gage track was laid from the mixer, up the north side of the valley, following a highway that had been previously constructed, to a point opposite the head walls of Lock 6, the track at this point being about the same elevation as the top of the lock.

The excavation for the north wall of the lock was completed about Nov. 1, 1909, and preparations made for placing concrete.

A hopper was located at a point on the narrow gage track opposite the lower end of the lock, and from it, a belt conveyor trestle about 100 ft. long extended across the valley to the lower end of the lock. From this point, a second trestle was built on the bank, parallel to the lock and just outside the line of excavation. The principal reasons for locating the trestle on the bank, instead of over the lock wall, were, that it could be built much cheaper, the bank being about 20 ft. above the foundation, it could be made entirely of wood, and drippings from the belt would not fall off on the concrete. The disadvantages of this location of the trestle will be seen later. The tripper car used on Lock 4 was placed on the trestle, an iron chute about 20 ft. long was attached to it and extended over the wall at a slope of about [illegible] was supported [illegible] about 7 ft. from the ends by a frame [illegible] a single rail, spiked on top a 6x6-in. timber which was held in place by 2-in. pipe, embedded in concrete and spaced about [illegible] ft. apart. The car supporting the chute was moved at the same time as the tripper car. [illegible] were made in the bottom of the chute, so that by opening and closing them, the concrete could be fairly well distributed across the wall. Foot boards were built on the sides of the chute and men stood on those to keep the concrete moving down the chute; four men usually being kept busy

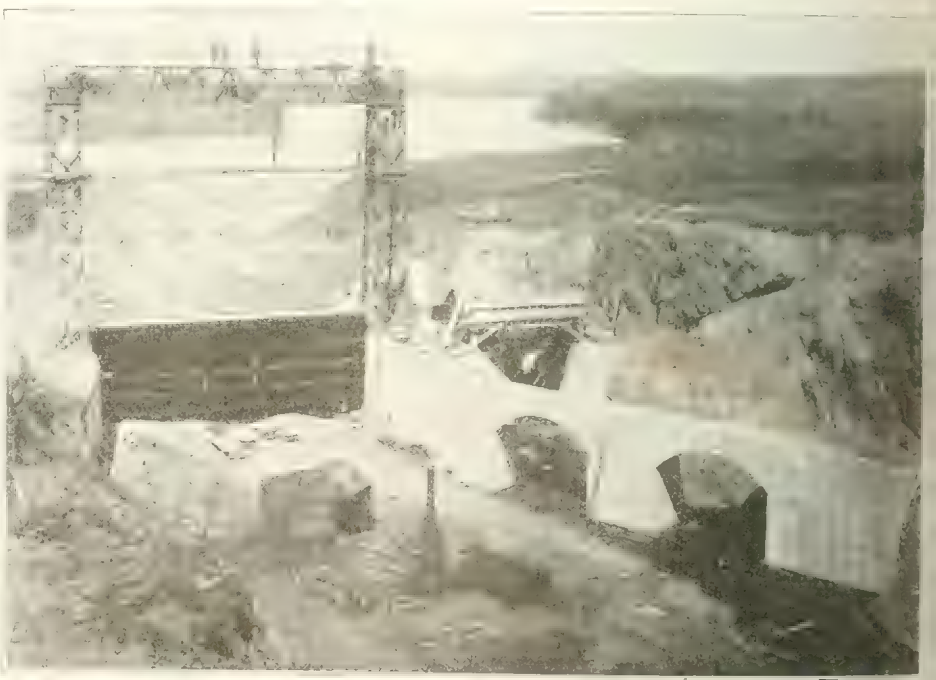


Fig. 4—View Showing Guard Gate, Sluice Gate and Masonry between Lock and e Mohawk River, New York Barge Canal.

in this way, and even then the chute would very often clog, necessitating stopping the belts until it could be cleared. Moreover, when the concrete was dumped from the cars into the hopper to be fed on the belt conveyor, it fell in with so much force that the concrete was compacted into a solid mass. To get this concrete broken up, so that it would feed evenly on the belt conveyor, took considerable time, energy and oratorical effort on the part of the foremen

The north wall of Lock 6 was built t [illegible] 25 ft. with the above [illegible] bed plant, after which the entire tre was torn down and a hopper built along [illegible] gage track opposite the upper end the lock. A trestle was built from this hop- across the valley to the head walls of lock and was located just east of the c wall foundation, which crosses the valley this place. A second trestle, built of 2 pipe, similar to the one used in Lock 4, constructed at right angles to the first was located directly over the unfinished p tion of the north wall. With this trestle upper part of the north wall was comple with much less difficulty than the bott portion. The pipe trestle and system of br ing are quite clearly shown in Fig. 2.

In order to build the south wall, the tre from the hopper was extended across [illegible] and a pipe trestle built [illegible] the south wall, to per erecting the wall to about half its h after which the trestle was raised and wall completed to the top.

The head walls and breast-wall were b by placing the tripper car on the trestle ning at right angles to the lock and as trestle was directly above them, there but little difficulty experienced in their c struction. This trestle can be plainly seen Fig. 3, also the north wall complete and south wall under construction. The no core-wall was constructed by placing the per car on the trestle that ran along the core wall and using open chutes. As lock is located on the south side of the v where the rock rises abruptly to the top the lock wall, no south core-wall was nec- [illegible] Concrete for the floor was [illegible] directly into the lock and dumped on p forms, from which it was shoveled into pl

The following table gives the labor cost f mixing and placing concrete in Lock 6, incl- ing cost of erecting trestles and plant, cident to placing the concrete, but does include the cost of lumber or other mater depreciation, etc.

TABLE I.

No. of cu. yds. placed	29,700
General expenses	$ 3,848.00
Mixing	7,661.55
Placing	9,064.49
Forms	10,896.00
Finishing	2,236.80
Erection of plant	4,239.88
Total	$37,946.72

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*This is the fourth article by Mr. Becker describing the methods of carrying on the work under Contract 11. The other articles appeared in our issues of Oct. 18 and Nov. 1, 1911, and Feb. 21, 1912.

GUARD GATE.

o. 6 is the last or upper one of the locks between the Hudson and Rivers. The surface of the ground comparatively level for about 500 ch point there is an abrupt rise of ft. above the grade of the canal. prism is cut through this hill for a f about 3,000 ft., where it enters the the Mohawk River. A guard gate ned to be located at the west end t. During the seasons of 1908 and Crescent dam was constructed e Mohawk River, about 1,000 ft. point where the canal enters the e top of the dam is at El. 184.00 or ove the grade of the prism above 6. Five 30 ft. openings are left in o take the normal flow of the river. ime, the excavation in the cut had l to such an extent that, in case of re was danger of the waters rising gh to come down through the cut alley, into the village of Waterford, would have caused considerable As it was impossible to make the in the fall of 1909, in time to build a gate, it was thought advisable to const[illegible] across the ca[illegible] se had just been completed, wh[illegible], 1910, one of the highest [illegible] levels [illegible] damage was done.

The [illegible] the rock on either side of the canal prism; and a central pier, from either end of which wing wa[illegible] [illegible] There is a sluice gate located between the north abutment and the center pier, and the guard gate [illegible] and the center pier. The masonry, with guard and sluice gates in place, is shown in Fig. [illegible]

Th[illegible] guard gate was completed about Sept. 1, 1910. A Ransome mixer was then set up, just east of it on a berm, about 9 ft. above grade and about 30 ft. wide, that had been left by the steam shovel on the south side of the canal prism and a trestle built from the mixer to the top of the north abutment of the guard gate, which is about 18 ft. above the foundation. The concrete was carried in wheelbarrows over this trestle, from which it was dumped into the form. As soon as the abutment was completed, the trestle was extended to the ring walls and center pier. The mixer had been running only a short time when the engine broke down and considerable time was wasted trying to make repairs. As all efforts in this direction failed, it was decided to haul the concrete with dinkeys and dump cars from the Haines mixer between Locks 4 and 5 (a distance of about 5,300 ft.) and dump it on a platform at the end of the trestle, from which it was handled with wheelbarrows. This method proved successful and the guard gate was completed Dec. 1, 1910.

The following table gives the labor cost of building the guard gate, but it does not include cost of lumber or other materials.

TABLE [illegible]

		Cost per cu. yd.
[illegible]	[illegible]	
[illegible]	$ [illegible]	[illegible]
[illegible]	[illegible] 71	[illegible]
[illegible]	[illegible]	.968
[illegible]	[illegible]	1.090
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.023
[illegible]	$ [illegible]	$2.719

ROADS AND STREETS SECTION

of Locating a New Highway Florida Mountain in the osac Range in Western Massachusetts.

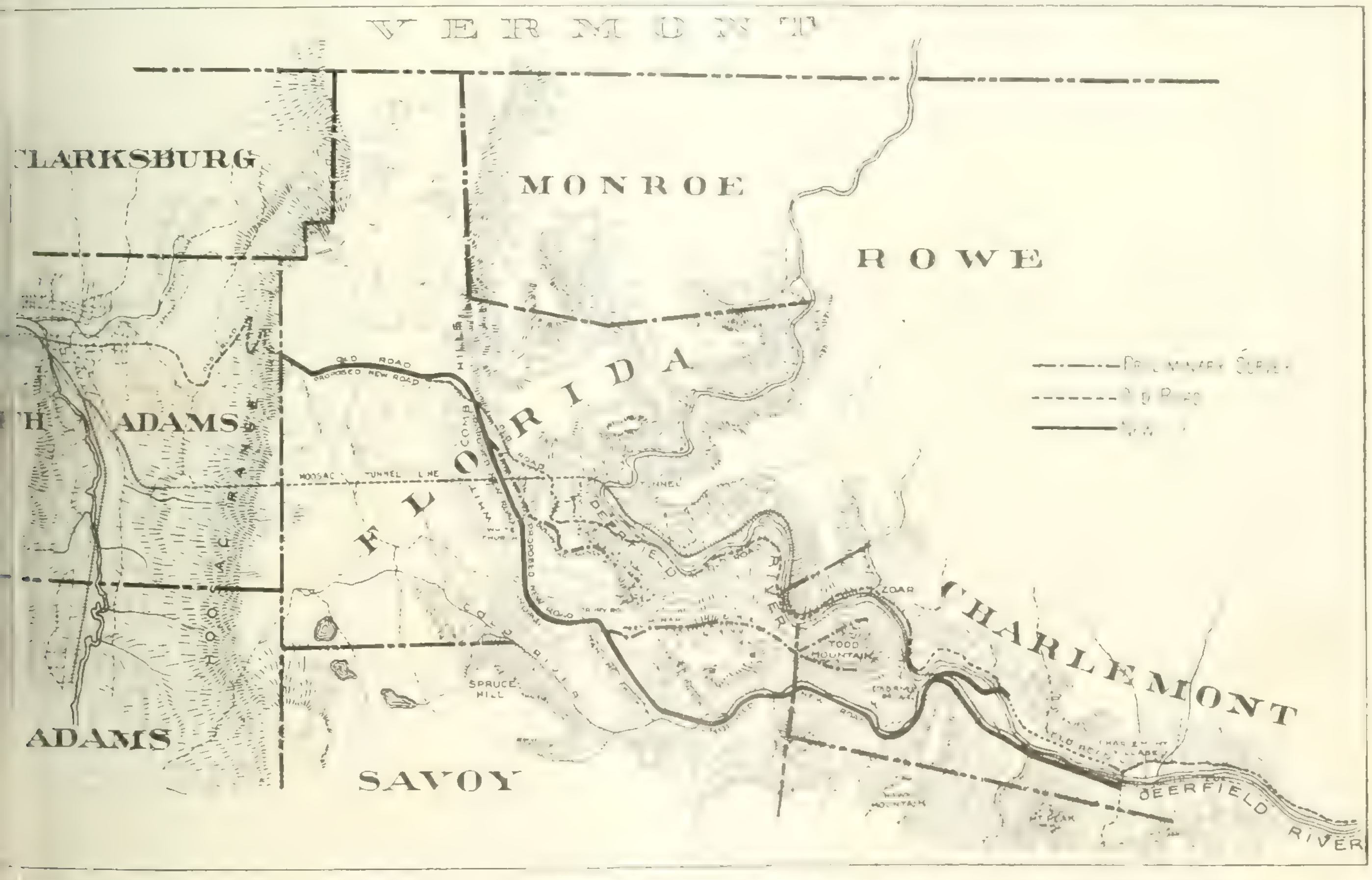
By ANDREW M. LOVIS *

r 15 years the Massachusetts High- mission has been developing systems ghfares radiating in different directions n centers represented by the larger outes thus formed extend across the state from the New York boundary line and converge towards the Metropolitan District of Boston.

In the process of this development short sections of State roads have been constructed on the primary thoroughfares until at the present time there is a nearly continuous first-class highway through the southern and central portion of the State, from the New York State line through the cities of Pittsfield, Springfield and Worcester to Boston. This route passes over the Hoosac Mountains, and reaches its summit, an elevation of 1,750 ft. above the sea, in the town of Becket. Here a new location of the highway has been made to avoid the steep section of the old road known as "Jacob's Ladder."

A northerly route across the State is also being developed. A good State highway runs east from the beautiful town of Greenfield in the Connecticut Valley, passes through the city of Fitchburg, and extends almost continuously to Boston. On this route, to the west of Greenfield, portions of the road have been constructed in the towns of Shelburne, Buckland and Charlemont, but the greater part of this western route is yet to be constructed.

To improve a highway between Greenfield



ketch Showing Proposed Improved Highway Over Florida Mountain n the Hoosac Range in Western Massachusetts.

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rs Assistant Engineer Massachusetts va Commission.

on the east and North Adams, on the west of the mountains, a distance of 37 miles, is the immediate problem, and the task given to the engineers of the Commission, by a special act [illegible] the highway over the Hoosac Mountain, between the city of North Adams and the Valley of the Deerfield River, for which $75,000 was appropriated.

The section of country covered by the act of the Legislature includes the roughest and most mountainous part of the State, as will be remembered by those who have passed through the Hoosac Tunnel under the mountain over which a new highway must be constructed. The existing road between North Adams and the town of Charlemont, a distance of 18 miles, is one of steep grades, a circuitous alignment, and of a width only sufficient to provide for one vehicle at a time.

The Hoosac range of mountains extends across the State in a general northerly and southerly direction, from Vermont to Connecticut, and is rugged towards the north. The "Florida Mountain," which is the local name for the range in this section, is a rough, irregular plateau on the top, for a width of about two miles, and descends abruptly to the valleys below. The summits on either side have an elevation of about 2,200 ft. above the sea.

and in making the surveys for a new highway [illegible] was adopted. This new location was extended for a distance of 2½ miles, to an existing road in the locality of the "White Church," shown on the plan, Fig. 1. About 6,000 ft. of this was on a 7 per cent grade, and the balance of the grade was at a lighter rate.

It was found that the existing road from this locality could be utilized, as it runs in the general direction of the objective point, and the grades are not heavy. The survey, therefore, followed the road to the locality known as "Drury Post Office." From this place a new road has been located which follows the course of Manning Brook, one of the tributaries of Cold River, to the mouth of the brook, and thence along Cold River, crossing to the southerly side of the river, and connecting on that side with an old logging road, a distance of 2¼ miles. At the lower part of Manning Brook and along Cold River to the proposed crossing the engineers met with more difficulty in location than in any other part of the whole road, for the mountain side is exceedingly steep, in some instances standing at an angle of 45°, and in no instance being less than 25°. The slope is covered with a thin layer of soil over a solid ledge base, and is

is about three miles. The road, how
crosses the tracks of the Boston & Maine R
at grade and at three places, and to reach
village of Charlemont a bridge across
Deerfield directly opposite the village mus

The route of one survey follows on
southerly side of the railroad tracks, and
require a new location for about one mile
for the balance of the distance the pr
road may be improved. This will avoid
grade crossings of the tracks. The b
across the river at Charlemont is in poor
dition, and it will need to be rebuilt be
many years, and when this is done the b
should be elevated to allow for a bridge
the railroad tracks. Such construction w
expensive. Another route was surveyed, w
crossed the railroad tracks by an overa
bridge, and continues by a new location a
the Deerfield River to the existing roa
the northerly side. A bridge of two spa
105 ft. each will be required across the
and a design for a reinforced concrete
bridge has been made. This line connects
the highway on the northerly side, abou
miles westerly from the village of Charle
and the highway from this point to Ch
mont Village is a very good one.

Some items of interest concerning dist

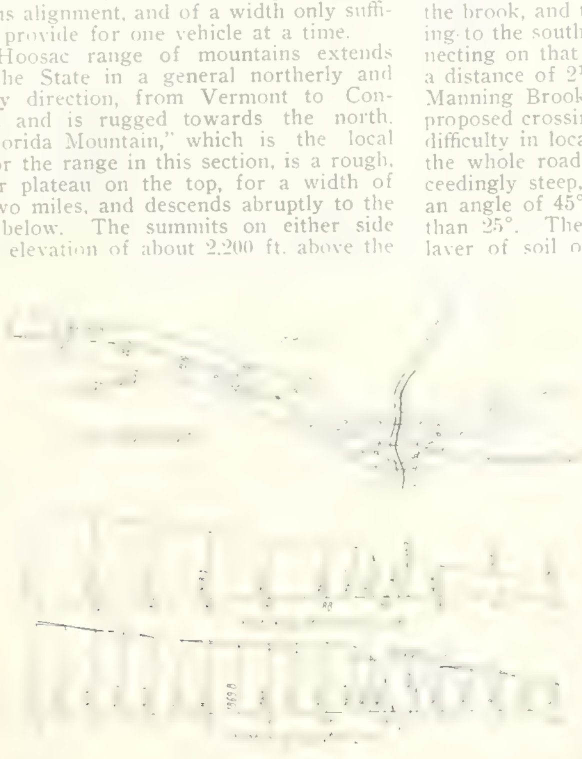

Fig. 2—Sketch Showing Preliminary and Location Lines in Whitcomb Hill Road.

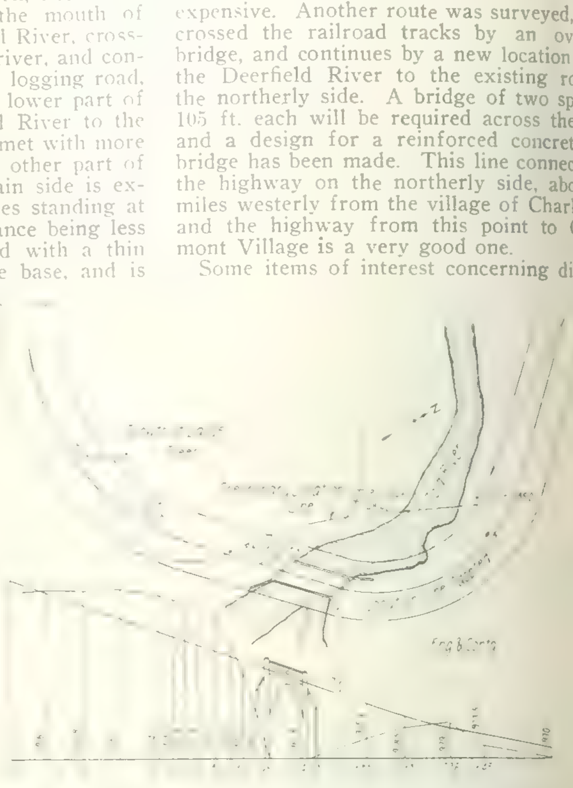

Fig. 3—Sketch Showing Preliminary and Location Lines Crossing of Cold River.

The surveys for the work for this season extended from the line which divides the city of North Adams from the town of Florida on the mountain to the village of Charlemont, on the easterly side, a distance of 14 miles, measured along the present highway.

The North Adams-Florida division line is near the westerly side of the plateau, and for nearly two miles the existing road may be improved before coming to the easterly summit known as "Whitcomb Hill." From this point the problem is to reach the Deerfield Valley by an improved highway.

Before proceeding to a description of the surveys, reference may be made to the character of the existing road from this point easterly. The road starts from the summit with an elevation of 2,200 ft. above the sea, falling at an average rate of 600 ft. per mile. The road follows a zigzag route with grades of 17 and 18 ft. per 100 ft. As on most mountain roads, there are "water bars" constructed at short intervals. This means that in lifting over them, a vehicle must overcome a grade of 30 ft. per 100 ft., or more. From the foot of the steep grade, at the east end of the Hoosac Tunnel, to the village of Charlemont, the road follows the course of the Deerfield River. As the tracks of the Fitchburg Division of the Boston & Maine R. R. also follow closely the course of the river, there are places where the highway is decidedly cramped for room, between the tracks on one side and the mountain on the other, and the cost for improving this section of road would be excessive.

Starting from the easterly summit at Whitcomb Hill, the present road descends steeply, heavily timbered. The cost for construction on this part of the road will be comparatively large. It was also the most arduous part of the route in making the surveys, especially as the men were obliged to travel a considerable distance over this rough ground in getting from and to their boarding place. In the short days which they had at the time the surveys were made, the party were obliged to leave work early in the afternoon in order to reach home before dark, making progress slow in running these lines.

The old logging road follows the course of Cold River to its mouth for a distance of four miles. The course of the river meanders to such an extent that at least a mile is added over a distance by straight line between these points.

If the road is built as proposed along Cold River and up Manning Brook, this section of over six miles will be recognized as one of the most beautiful of roads. The stream has a good fall, and tumbles over a rocky foundation, and varies in width from 50 to 100 ft. The mountains rise directly from the river on the opposite side, and reach a height of 1,500 ft. above the river. The sides of the mountain are covered with a heavy growth of spruce and hemlock.

It may be said, in regard to the location of the highway easterly from the junction of Cold River with the Deerfield to its terminus, that the best route has not been definitely determined. Surveys have been made for connecting with the village of Charlemont by two routes. There is a fair road along the river to Charlemont, and the distance by this road

and grades on the proposed road are sho
Table I.

The engineers began survey work o
mountain in August, and there were o
miles of preliminary lines run. Some of
lines are shown on the accompanying
Fig. 1. An attempt was made to get a
line around "Todd" Mountain, as
peared to be a possibility and had the
tage of being the most direct route.
per cent grade lines were run on b
northerly and southerly sides of the m
and were finally abandoned when perp
lar clifts were encountered, making it
sible to proceed or to find ground which
by any possibility be practicable for a
way.

The engineers succeeded in finding co
able accommodations at the old "Pars
at "Drury Post Office." The hou
wholly at their disposal, and they g
meals at the next house. This proved
central location. Mr. E. N. Colburn
mediate charge of the survey work
field. Most of the time two parties
employed, Mr. Colburn having charge
and Mr. F. H. Cunningham of the othe
mountains are covered with heavy timb
in places with underbrush, and on th
which were run for new locations, it
matter of cutting the way. The slopes
mountain sides are as steep as 45° in
places, making the progress slow, and t
ditions were really dangerous unless gre
was taken. The work was in fact dela
account of injuries sustained by some
engineers.

TABLE I.

distance from North Adams boundary lin		
location, along the railroad		
distance from North Adams boundary line to [illegible]		
d via route which crosses the river and [illegible]		
y on the northerly side thereof about 1½ [illegible]		
ttlemont Village		[illegible] ft (12.5 m.)
distance from the North Adams boundary line [illegible]		
mouth of Cold River		
length of new locations between North Adams		
the mouth of Cold River—		
Manning Brook section	11,[illegible] ft	
Whitcomb Hill section	12,300 ft	
length of existing road utilized between North Adams boundary		
and the mouth of Cold River—		
Between North Adams line and Whitcomb Hill	8,800 ft	
Between White Church and Drury P. O.	7,600 ft.	
Rough road down Cold River	19,100 ft	
	35,500 ft.	35,500 ft. (6.72 m.)
length of maximum (7 per cent) grade		
Manning Brook section	8,300 ft	
Whitcomb Hill section		
Present road, westerly of Whitcomb Hill	900 ft	

urveys were made with a mountain aving a vertical arc. The line of the n grade was obtained by setting the t 4° for a falling grade of 7 per cent ary lines were run, finding the ground is angle, and levels on this base line ken, and following closely after the staked out. By this means the pre- line followed the ground and grade curately, and a profile was obtained, e minimum amount of earthwork on le. The country, although steep and is not very irregular from a trans- int of view. There are, of course, s ravines to be crossed and some nds to be eliminated, resulting in avy cuts and fills, but on the new loca- r most of the survey the excavation side-hill work. The notes of the pre- surveys were plotted in the main Boston, the plan on a scale of 40 ft. ich, and the profile on a scale of 40 ft. nch, horizontal, and 8 ft. to the inch. On the plan a line for the proposed was laid down and the line in the n out practically as taken from the he location line was afterwards cross- l at intervals of 50 ft. and extra sec- ken where necessary.

ketch, Fig. 2, showing a section on the nb Hill line, and sketch Fig. 3, show- crossing of Cold River, illustrate the of placing the location line.

old River sketch shows two crossings l. The one adopted is marked on and gives the best location for the The mountain slope on the westerly very steep, and a roadway on this side equire heavy retaining walls, or a rock tending into the river, and although ance is somewhat longer the location directly to the easterly side is prefer-

e preliminary line down Cold River, levels were taken on the base line and cross-sections were taken from this th a hand level. These notes were tisfactory in enabling the engineer to n a location line along the river. This survey will be made in the spring. d appropriation for the highway is l to be 70 ft. in width for most of the

arties consisted of four men each. The party also took the levels. It did not to be wise to keep a special party on ling in these surveys as the difficulties ion were such that the progress of the party was slow and much time was cutting out the line.

interesting to know that the line pro- or crossing the Deerfield is in the rhood of the ford used by the Indians early days, which was part of the "Mohawk Trail," which went over the in from the Deerfield Valley on the what is now the city of North Adams town of Williamstown on the westerly

time is near when an improved high- er Florida Mountain must be construct- neet the needs of the traveling public. The increasing amount of travel by automobile demands new and better roads. If the highway which has been located is constructed it will solve the problem of a first-class highway on the easterly side of the mountain and a road will be ready for use by the traveler which will be practically the same length as the present road and which will have for a maximum 2.88 miles of 7 per cent grade, in place of the three miles of steep grade having a maximum of from 17 to 18 per cent, which exists on the present road. It is not too much to say that 1½ hours in time will be saved by autoists in going from Greenfield to North Adams, a distance of less than 40 miles, and an automobile need have no trouble in making 15 miles an hour over the steepest part of the new road. The road will be exceedingly attractive on account of the beauty and grandeur of the scenery.

Methods of Survey Work of the Wisconsin Highway Commission.*

The first problem is, of course, the surveying of roads to be improved. The Commission decided that probably it was best fitted at the present time to do this work and has offered, as far as its means allow, to have made under its direction all surveys during the first year or two of the operation of the State Aid Law of 1911. In fact, about 125 miles of 1912 work have already been surveyed. The value of surveys and plans in road work has been little appreciated in the past in rural communities and it has been found practically impossible to get them to pay the cost of work of this class, no matter how badly the situation might demand it. In view of this fact the commission will make surveys for a year or two until the communities of the State have been aroused to a realization of their value; but it hopes at some day not very far in the future to have this work assumed by the county and simply approve the plans prepared by the County Commissioner or County Surveyor. It is not expected, with the small force available, to make such surveys that the work can be let on the unit basis.

In making road surveys our system is to run a transit line where it can be most conveniently measured and distances are taken to the present fences and the tops of fills and the bottoms of cuts, so that the new center line can be placed with a due knowledge of what is there now. The stakes are placed 100 ft. apart at the side of the road well out of the way of construction and at the time the profile is run a level is taken on the top of those stakes and at the bottom. The distance from a stake to the transit line is recorded and the distance from the stake to the new center line is computed in the office. When taking the profile elevations are taken at the center of the present traveled road and also in the ditches where the country is flat and drainage doubtful and a cross section of the cut or fill is taken at such places as may seem necessary. Along those parts of the road where the center cut or fill will be a true indication of the earthwork no cross section is taken. We have found that one man who acts as chief of party and instrument man with a party of two or three local men (new on each survey) can usually complete about one mile of survey per day, including location and levels, where the work is on a road already in use. Of course, where relocations have to be made or new roads laid out progress is very much slower than this. On the other hand, where conditions are extraordinarily favorable nearly two miles of road have been finished in one day. It is not claimed that the methods of surveying above outlined are by any means complete, but we have found that plans can be gotten up from such surveys that adequately take care of ordinary road construction and the aim has been to do sufficiently accurate work and cut out any unnecessary refinements.

The work of getting out plans in the office is about double the work in the field. Under good conditions one man can complete about one mile of such plans in two days. The cost of surveys is kept down by making those close together on the same trip, and it has been found that the field and office work in preparing the road plans will cost the commission about $20 per mile on the average, not including the overhead office expense.

Plans are drawn in pencil directly on Plate A tracing paper, usually on a scale of 1 in. equals 80 ft. horizontal, and 1 in. equals 8 ft. vertical. About ½ mile of road is placed on each sheet and the 10 in. paper is used except for very hilly roads where the 20 in. width is used. The completed plan shows in ink the edge of the traveled way, the fences, culverts, bridges and the center line of the new road. The profile gives the center profile of the present road and also the profile of the center of the new road, the finished center in the case of dirt roads and the center subgrade in the case of macadam roads. Both plan and profile are drawn on the same sheet, the profile below the plan. At the end of each sheet is placed the grade sheet, which gives first the stake number, second the distance from the new stake to the new center, third the distance of the new center above or below the top of the stake, and fourth, the actual cut or fill at the station. With this grade sheet and a carpenter's level and metallic tape, it is possible to stake out a road and get good results. No center line stakes or slope stakes are set, the stake on the side of the road being placed out of the way of construction and used for building, so that outside of the original survey of the road no additional engineering work is needed in the field. The writer has used this method on many miles of work in Maryland and Wisconsin with good success and it is expected to continue these methods on the State Aid work.

Notes on Road and Street Work.

Maintenance Cost of Bituminous Macadam at Portland, Me.—The Department of Public Works of Portland, Me., has built or supervised the construction of three sections of state highway at a total cost of $38,787. These sections total 7,040 ft. in length and an area of 23,861.16 sq. yds. of bituminous macadam. The first section was built by the penetration method and the second and third sections by the hand-mixed method. In a paper presented recently before the Maine Society of Civil Engineers Mr. Edwin P. Lynch, Assistant Engineer, Department of Public Works of Portland, states that the maintenance on these three sections to date amounts to $2,397, and more repairs will have to be made next year. A detailed statement of the maintenance on these three sections is as follows:

Section 1.

1909	Maintenance	$0.0104*	per sq. yd.
1910	Maintenance	.0691	per sq. yd.
1911	Maintenance	.0363	per sq. yd.

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*From [illegible] State Highway Engineer, presented at the 1912 meeting of the Engineering Society of Wisconsin.

Section 2.

1910 Maintenance............$0.0378* per sq. yd.
1911 Maintenance....... [illegible] per sq. yd.

Section 3.

1911 Maintenance ..... [illegible]* per sq. yd.

*First year after building.

Asphalt Slag Road.—This road was constructed at Robinson Station, Ala., the work being done under the direction of an engineer of the U. S. Office of Public Roads. Work was started on Feb. 13, 1911, and was completed 8 days later. About 325 ft. of the Telegraph road was surfaced to a width of 16 ft. The material used was an asphalt slag donated by a local asphalt company. The slag contained considerable bitumen and was broken by hand in sizes varying from 3 ins. to dust. It was black, exceedingly tough, and possessed a rather weak binding quality, which probably could have been improved by crushing fine and heating. The first course of material, varying in size from 3 ins. to ¾ in., was spread to a depth of 5½ ins. and rolled. A second course, 2 ins. deep, varying in size from ¾ in. to dust, was then applied. The road was given a crown of ½ in. to the foot. A 3-ton horse roller was used for the rolling. The work comprised 578 sq. yds. and the total labor cost of the work was $125.88, or 21.8 cts. per sq. yd. Labor cost $1.50 per day and team with driver $4 per working day of eight hours.

Cost of an Oiled-Gravel Road.—The following data relates to the construction of an oiled-gravel road on the campus driveway at the New Mexico College of Agriculture, Las Cruces, N. Mex. The work was done in 1910 under the direction of an engineer of the U. S. Office of Public Roads. The road is 3,410 ft. long and is graded for a width of 30 ft. The surrounding country is rolling and the roadbed is sandy. The excavation was done with plows, slip scrapers and road machines, and cost $90.50. The foundation course, 16 ft. wide, was an adobe clay, applied 4 ins. deep. About 700 cu. yds. of this material was used and hauled for a distance of 1,500 ft. The cost of the work was as follows:

	Per cu. yd. Cts.
Loading	9
Hauling	20
Spreading	2

After the clay had been spread, the roadbed was wet thoroughly by irrigation at a cost of $15. As soon as the ground had dried sufficiently, the subgrade was rolled with a 10-ton steam roller. Fairly good gravel was obtained at a pit 3,000 ft. from the road, but it was necessary to screen this gravel, since it contained 40 per cent of fine sand and dirt. The screening was done by hand, and cost, with the loading, 45 cts. per cu. yd.; hauling from the pit amounted to 26 cts. per cu. yd.; spreading, 5.3 cts. per cu. yd.; and sprinkling and rolling, 6 cts. per sq. yd. The gravel was applied as follows: A first course, varying in size from 3 ins. to ½ in., was spread to a depth of 7 ins. and rolled into place. A second course, varying in size from 1 in. to ¼ in., was next applied, and the road was sprinkled and rolled until firm and smooth. Hot asphaltic oil was then applied at the rate of 1 gal. to the sq. yd., and was followed by a layer of screened gravel, varying in size from 1 in. to ¼ in., which was spread uniformly over the entire surface. The road was then rolled with a 10-ton roller and a second application of hot asphaltic oil was made at the rate of ½ gal. per sq. yd. The surface was now dusted over with carefully selected fine gravel ranging from 1 in. to dust, and the road was then rolled until firm and smooth. This treatment was given for a length of 2,400 ft. The remaining 1,010 ft. were finished without the use of asphaltic oil. The cost of the California asphaltic oil treatment was as follows: 75 cts. per 42-gal. barrel at the wells and $1 per barrel for freight. Heating, hauling and spreading amounted to a total of $90.80, making a total cost of 8 cts. per sq. yd. for the oil treatment. Other cost items of this work were: Shaping the subgrade, $48; labor on the cross drains, $3; and repairs, $13.70. The total cost of this road to the community was $2,411.30. From this may be derived the following unit costs: Oiled-gravel section, 42.1 cts. per sq. yd., or $3,963 per mile; and water-bound gravel section, 34.1 cts. per sq. yd., or $3,209 per mile. These costs were based on a labor charge of $1.50 for nine hours and $4 per day for teams; 7½ tons of fuel were used, at a cost of $6.85 per ton. The work comprised 4,266 sq. yds. in the oiled-gravel section and 1,795 sq. yds. in the water-bound gravel section.

Some Costs of Road Grading.—The accompanying tabulation shows the cost of grading work in connection with the construction of a number of gravel and sand-clay object-lesson roads. Most of these roads were constructed during 1910-11, the work being done under the supervison of engineers of the U. S. Office of Public Roads.

Experience with Surface Treatment with Tar at Madison, Wis.—In a paper read at the 1912 meeting of the Engineering Society of Wisconsin, Mr. John F. Icke, City Engineer of Madison, Wis., gave the following information regarding his experience on the surface treatment of macadam streets with tar. The work was done in 1908, the material used being Tarvia A, a prepared tar made by the Barrett Mfg. Co.: The street in question was one built of crushed limestone in 1897. The surface was in ideal condition, with very few depressions or irregularities. The preliminary treatment of the road before applying the tar consisted in thoroughly sweeping the street surface to r as much of the dust as possible. The sistency of the tar was such as to m necessary to heat it before it could plied. Application was by means of s ling cans with broadened nozzles. Ap mately ½ gal. of tar was applied per yard of surface. The surface of th was covered with a thin layer of coarse [illegible] screenings approximately ¼ diameter from which practically all dust had been removed. The street rolled with a 15-ton roller and was open to traffic as soon as possible ther After a short time and after the exce screenings had been worn away the resembled in many respects a sheet pavement. After the lapse of two y second treatment was given similar respects to the first, except that the q of tar per square yard was about This second treatment was given pri to cover the individual stones which jected above the general surface of the ment and were thus not thoroughly c by the first treatment. Several exca made in the street since the last tre show that the tar penetrated the surf the road from ¾ in. to 1 in. and tho found the surface. How soon it w necessary to again apply the tar it is sible to tell; however, it is safe to say not be necessary to apply another tre for at least three years, and possibly n five or six. The above mentioned tr has practically eliminated the formati dust caused by the breaking down stone under traffic. The street is, ho not dustless as more or less dust is b upon it from traffic and other outside s and it has been found advisable to gi street more or less sprinkling with wa keep down the small amount of dust does accumulate on the street fro sources mentioned above. The street s is so well bound that any ordinary ra free the surface from dust as though an asphalt pavement. One objection above mentioned treatment is that it the street slippery at those times whe to weather conditions, other pavement asphalt are also slippery. The cost first treatment was 7 cts. per square In this cost is included all the items should enter, namely, the cost of clean street, the cost of the tar, of heatin applying it, the cost of the screening applying them, and the cost of rolling. second treatment cost 4 cts. per square as the quantity of tar applied per yard was less

COST OF GRADING IN CONNECTION WITH THE CONSTRUCTION OF GRAVEL AND SAND-CLAY ROADS.

Place.	Length gr'd'd. Ft.	Width gr'd'd. Ft	Old max gr'de. %	New max gr'de. %	Soil.	Cu. yds. moved.	Cost per cu. yd. Cts.	Haul. Ft.	Tools used for grading.	Labor. Per 10-hr. day.
Pell City, Ala. (G.) ..	2,800	22	14.4	6	...	1,300	15.3	400	Plow, slips, graders..........	$1.00[1]
Mobile, Ala. (S.C.) ..	2,450	18	6	4	Hard sandy.	[illegible]	38.8	200	....	1.50[1]
Fort Collins, Col. (G.).	2,330	24	[illegible]	4.8	Por. clay loam, clay subsoil.	1,522	24.8		....	2.00
Vernon, Fla. (S.C.)....	5,280	30	6	2.5	Sand top underlaid by clay.....	2,400	15	200	Plow, picks; drag and wheel scrapers	1.50
Chalybeate Spgs., Ga. (S.C.)	2,300		10	7.14	Red and mica clay	1,752	8.8	350	Plow wheel scraper, road machine	.70[3]
Eastman, Ga. (S.C.)...	6,200	30	10	4	Sand and clay	[illegible]	9.3	500	Plow, small tools[4]..............	.36[3]
Lumber City, Ga.(S.C.)	5,280	[illegible]	[illegible]	4	Sandy	1,[illegible]	11.1		Road grader	1.25[5]
Mullinville, Kan. (S.C.)	4,460	24	11	6	Sandy	3,635	11.2	223	....	1.80[1]
Wichita Kan. (S.C.)..	[illegible],610	30	[illegible]	[illegible]	Sandy loam	[illegible]	[illegible]	100	Road grader, scrapers..........	2.00[2]
Coffeeville, Miss, (S.C.)	5,280	24	11	7.8	Sand and clay.............	3,410	[illegible]	200	Road machine, 8 drag scrapers.	1.00
Starkville, Miss. (G.)..	7,000	[illegible]	6	4	.....	14,416	21.9	...	....	1.25
Elizabeth City, N. C. (S.C.)	5,280	30	[illegible]	1	Loamy sand and fine sand	1,208	21.6		Grader, wagons	.60[3]
Williamston, N. C. (S.C.)	4,000				Soft, sandy subsoil	3,471	23.1		Grader, 5 drag slips.....	1.00
Wilson, N. C. (S.C.)...	4,300	34	[illegible]	[illegible]	Clay	1,38[illegible]	[illegible]	310[9]	Two-horse grader..........	.60[3]
Carnegie, Okla. (S.C.).	9,800	[illegible]	8	5	Subsoil, sand loam, clay and mixture	3,352	[illegible]	200	Road grader, 9 wheel scrapers, 8 slips	1.60[7]
Allendale, S. C. (S.C.).	3,070	22	[illegible]	1	Sandy	350	[illegible]	1,000	Grader, scraper	.50[3]
Waterloo, S. C. (S.C.).	5,280	[illegible]	[illegible]	2.86	Sand and clay.	3,654	6.06		Road machine, slip scrapers, 5 dump wagons.	.50[3]
Arlington, Tex. (G.)...	6,928	28	4	3.7	Black waxy prairie subsoil.....	6,407	38.1		Plows, graders	1.50
Center, Tex. (G.)......	1,000	36	4	3	Sand and clay.................	229	20		Two farm plows, 4 No. 2 slip scrapers	1.50
Center, Tex. (S.C.)....	2,300	30	4	3	Sand and clay.................	1,[illegible]	[illegible]	100	....	1.50
Livingston, Tex. (S.C.)	2,200	24	[illegible]	[illegible]	Sand clay	184	20	1,000	Six road plows, 4 No. 2 slip scrapers, wagons	1.50

(G.) = Gravel road. (S.C.) = Sand-clay.

[1] 9-hr. day. [2] $4 and $4.50. [3] Convicts, mule teams. [4] Hauled in slat bottom wagons. [5] $1.25 for free labor; 60 cts. for convicts. [6] Prison ca teams. [7] Per 8-hr. day. [8] $4 and $4.50 per 8-hr. day. [9] 420 cu. yds. hauled average distance of 310 ft. [10] 1-horse teams owned by county, 60 cts.; horse teams, $4; 4-horse teams, $8.

VATER-WORKS AND SEWERS SECTION

he Condition of an Intermittent Sand Fi er for Sewage After Twenty-three Years' Operation.

Ex imental Filter No. 1 at the Lawrence, ss. sewage experiment station had been op ation for nearly twenty-three years at e of the year 1910. It is constructed sa of an effective size of 0.48 millimeter. e th of the sand in the filter is 60 ins. s 200 of an acre in area, and was first ir operation on Jan. 10, 1888. Since 1893 er has been operated without removal sa from its surface. The report of the Board of Health for 1910 states that fi r produced a satisfactory effluent dur-). There was no appreciable increase ging due to stored organic matter.

h eport contains an interesting discussion h ermanence of intermittent sand filters n hich the following matter is taken: h has been of late years considerable on in regard to the permanence of tent sand filters by those who believe ch filters are simply "retention beds" rge part of the organic matter applied . There is no doubt, as has been n previous reports of the station, that ters may become clogged by over- hat is, by the application of a greater of sewage than can be cared for. h eview of the Lawrence work given in ort for 1908 many tables were given the relative amounts of applied or- natter of different kinds that were l, stored or unaccounted for on account pe into the air in gaseous forms. In ussion it was brought out clearly that e purifying work of a filter was meas- gely by analyses of the different com- s of nitrogen in the sewage applied he effluent, still the nitrogenous organic formed but a small part of the organic in sewage, and hence its change in the rmed but a small part of the work ilter, this being especially true of sand r other filters of fine material. With filters of material too coarse to act ainer, a speedy oxidation of the nitrog- rganic matter is the main requirement. not true of sand filters in which car- us matters in large amounts are re- Sand Filter No. 1 has received during ty-three years' operation, to Dec. 1, 395,532 gals. of sewage. This sewage tained about 30 lbs. of organic matter 12,000 gals., or a total weight of about s. of organic matter applied to this lter, and of this, about 3,400 lbs. have ganic matter in suspension. Of this ganic matter, Filter No. 1 has retained red only 3.5 per cent of the applied and about 13 per cent of the total matter. In other words, the filter has ully cared for, without retention, 96.5 t of the applied nitrogen and 87 per the total applied organic matter. Rela- peaking, a very minute portion of this matter has appeared unoxidized in the fluent. These statements are true of er sand filters, in operation now for ears. Analyses of the sand at various n Filter No. 1, in July, 1910, showed amount of stored nitrogen was not ng

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ort has been submitted to the Board of of Toronto, Ont., relative to the of the city's water supply from Scar- eights, at an estimated cost of $6,000,- he work would include an extension of ke pipe, the duplication of the filtra- nt, a tunnel at Scarboro Bluffs, a large r on the top of the bluffs and a pump- ion there.

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are now 4,200 miles of railroad under ction in Canada west of Lake Superior.

Some Operating Costs of Power Plants and Pumping Stations.

A [illegible] one of twenty one special reports to the com- [illegible] Bureau of Public Efficiency printed Mr. Maury's report in December, 1911, so that it would not remain unknown in the files of the city and its value remain entirely lost.

The report on the water system is handled under two main heads, namely, the pumping stations, and distribution system. Articles have been published in this journal within the past year, showing the progress made in water waste and electrolysis surveys, so the portion of Mr. Maury's report relating to the distribution system is not touched upon in the present article. Useful statistics on the cost and efficiency of power plants and pumping plants are given under the portion of the report relating to pumping stations, and they are given here. These statistics relate to the various city pumping stations in Chicago, all municipally owned and operated, to several privately owned and operated power plants in Chicago, to a municipal pumping plant in Milwaukee and one in Cleveland, and to the pumping plant of the Peoria, Illinois, Water Company. The relative efficiencies of the various plants are clearly shown by the data given.

[illegible]

With a view to determining the proper labor cost a number of privately managed plants in Chicago were visited, and data were secured from them for the purpose of comparison with similar data from the eight major pumping stations in Chicago. These data are given below. Similar data were secured from the municipal pumping stations at Cleveland and Milwaukee, and they are also given.

These data give a brief description of the equipment at each power station and pumping plant, with rated and actual horse powers and load factors of engines and boilers; complete data with regard to number and class of employes, hours of labor and rates of pay; number of boilers per fireman per watch; pounds of coal fired per fireman per hour; number of average city pumping engines which would be equivalent to the engines actually in use in each plant; number of such equivalent engines per engineer and per oiler per watch; ratio of cost of coal to cost of labor; average pay per man per day and per hour; and actual engine horse power developed per dollar of daily payroll.

In making these comparisons the actual coal consumed in 1909 for operating the Chicago pumping stations and the prices actually paid for the same were taken as a basis. The coal used for baths, shops, etc., was not included. The labor costs at the Chicago pumping stations were based on the 1910 appropriation, and included only the regular employes at the stations, with no allowance for such extra men as may be from time to time obtained by requisition or otherwise for special work. The comparisons and estimates contained in the report are based on the conditions as they were found when the investigation was begun.

The most significant items, in so far as the comparisons of the labor statistics are concerned, are (a) average hourly rate of pay per man; (b) number of equivalent pumping engines per oiler per watch; (c) ratio of cost of coal to cost of labor; (d) actual output in horse power per dollar of daily payroll.

The statistics show that the average hourly rate of pay in the eight private plans investigated in Chicago is 26 cts.; in the Kirtland Street Pumping Station at Cleveland, municipally operated, 31 cts.; in North Point Pumping Station, Milwaukee, municipally operated, 30 cts.; and in the pumping station of the Peoria Water Works Company, 25 cts.; while the average hourly rate paid at the eight major pumping stations in Chicago is 42 cts. A similar comparison shows that in the private plants in Chicago one oiler per watch looks after engine units equivalent to 2.35 average City pumping engines; whereas, in the eight Chicago City pumping stations, one oiler looks after only .95 average city pumping engines. In other words, one oiler in the privately managed plants looks after nearly two and one-half times as much machinery as does one oiler in the city pumping stations.

The ratio of cost of coal to cost of labor and the actual output in horse power per dollar of daily payroll will naturally vary with the horse power of the plants under consideration. Accordingly, Figs. 1 and 2 were prepared from the data given and show graphically on the upper curve on each sheet the conditions in the private plants in Chicago, and, on the lower curve, similar conditions in the Chicago city pumping stations. These curves represent the average conditions obtaining in each set of plants, and enable them to be compared on the basis of equal horse powers.

For the sake of further comparisons, points representing the conditions in the pumping stations in Cleveland, Milwaukee and Peoria have also been platted on these diagrams. In platting Fig. 1, allowance was made for difference in price and quality of coal used in Chicago and Peoria.

A comparison of the two curves in Fig. 1 will show that for plants of equal horse power the ratio of cost of coal to cost of labor for the private power plants in Chicago averages three times as high as for the eight major Chicago city pumping stations.

The municipally operated plants at Cleveland and Milwaukee show ratios almost identical with those in the Chicago city pumping stations, Cleveland being very slightly below the curve representing the average ratio for these stations, and Milwaukee a little above it. The ratio at the privately operated water works at Peoria is almost on the line of the curve showing the average ratios in the private power plants in Chicago, being, like these, about three times as high as the average for the Chicago stations, compared on the basis of equal horse powers.

Similarly, the two curves in Fig. 2 will show that for plants of equal horse power the actual output in horse power per dollar of daily payroll is nearly three times as great for private plants as for the city pumping stations.

The city water works plants at Cleveland and Milwaukee, and especially the latter, show in this respect much better results than the Chicago city pumping stations, while the privately owned Peoria station is well above the average for the private power plants investigated in Chicago, and about four times as high as the Chicago city pumping stations, all comparisons being made, as before, on the basis of equal horse power.

The conclusion is inevitable that Chicago is spending too much money for salaries at the pumping stations. The excessive number of oilers is especially noticeable. Practically all of the pumping engines are equipped with either automatic lubricating devices or grease cups, but the payrolls show 98 oilers for 32.6 pumping engines in average service, or one oiler per engine per watch. At the Sixty eighth Street pumping station there are seven comparatively small horizontal engines, all on one floor and in one engine room, and there are 21 oilers, at $90 per month each, on the regular payroll.

After careful study of all data available in connection with the question of labor at the pumping stations a table for each station was prepared analogous to Table I here given. Table I refers to the Sixty-eighth Street pumping station and is taken as an example of the eight [illegible] the table shows the regular payroll as per the 1910 budget. The second part of the table, entitled Plan No. 1, shows what the payroll for the regular men would be, without allowing for vacations, if this plan were adopted.

Plan No. 1, with the proper allowance for men to fill the places of the regular men while the latter are taking the vacations prescribed by city ordinances, was the plan recommended by Mr. Maury. Plan No. 2 shows what the payroll would be if the station were operated by a private company.

The cost for salaries of the regular employes at the eight major pumping stations, as per the 1910 budget, is $397,862.20. The annual [illegible] Maury, after allowing liberally for absence on vacations and due to sickness, would be $75,760. The annual saving by Plan No. 2, which shows what the payrolls would be under private management, would $171,242.20.

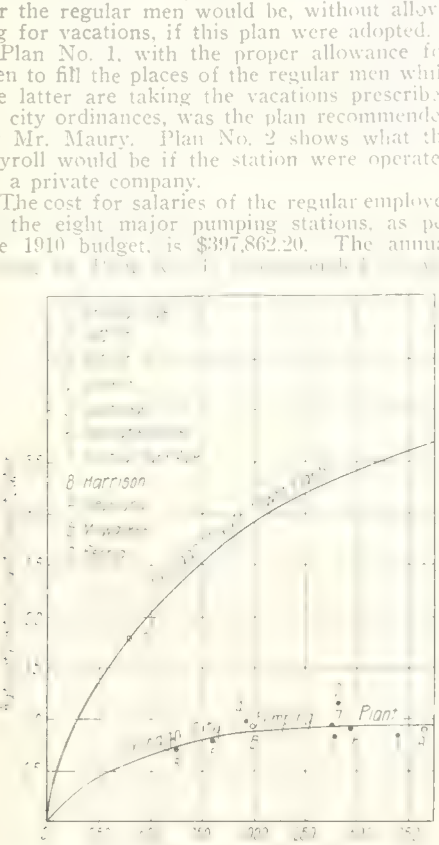

Fig. 1—Comparison of Chicago Private and Municipal Power Plants and Pumping Stations, Showing Ratio of Cost of Coal to Cost of Labor.

FUEL.

Mr. Maury confined his work in connection with the fuel used at the pumping stations to a brief study of the economy with which it is consumed.

All of the pumping engines at the eight major stations are either compound condensing or triple condensing engines, and over two-thirds of them have direct connected air pumps and circulating pumps. With a few exceptions, they are all of types that should give test duties running from 100,000,000 to over 180,000,000 ft. lbs. of work per 1,000 pounds of steam. The average test duties of the engines actually in service would probably be close to 135,000,000 ft. lbs. The average station duty, based upon the reported coal consumption and the city's evaporation tests, is below 79,000,000 ft. lbs. per 1,000 lbs. of steam. While it is not to be expected that station duties will ever equal test duties, yet it is apparent that in the Chicago city stations there is far too wide a margin between the station duties and the test duties of the various engines. The two stations which make the worst showing in this respect are the new ones at Central Park avenue and Springfield avenue. The reported test duties of the engines at those stations ranged from 156,600,000 ft. lbs. to 174,700,000 ft. lbs. for the three 20,000,000 gallon engines at each station, while the test duty of the 40,000,000 gallon engine at Springfield avenue was about 175,000,000 ft. lbs., the similar large engine at Central Park avenue not having been tested. The station duties at these two stations are considerably below 50 per cent of these test duties.

The station duty in regular service on a week's run of the two new engines at Mil[illegible] within less than 3 pe[illegible] their test duty. The Kirtland Street station in Cleveland reports a regular station duty within from 10.76 per cent to 20.2 per cent of the respective test duties of the four engines at that station. Other similar records could [illegible]

The fact that the Chicago engines fall so far below what might be expected of them is probably due, in part, to some or all of the following causes: (a) Steam and water pressures are, in most instances, lower than those for which the engines were designed. These low pressures are in large measure due to the excessive leakage and waste of water throughout the city. (b) The test duties as reported may be too high, in which case the bonuses paid by the city for excess duties were not fully earned. (c) The weight of coal reported to have been consumed may be too high. (d) The evaporation tests of the coal may have been erroneous. (e) Departmental methods, which offer to the engineers and crews at the stations practically no incentive to increased efficiency.

The cost of the coal used in 1909 for the operation of the eight major stations, exclusive of the coal used for baths, shops, etc., was $343,154. If the average station duty had been 100,000,000 ft. lbs. instead of 79,000,000 ft. lbs., the cost of coal used would have been only $271,092, and there would have been a saving of $72,062.

The matter of station duty is one which deserves serious attention, and some method should be devised for offering to the chief engineer at the pumping stations more incentive than now exists to increase the efficiency of the plants under their charge.

RECOMMENDED CHANGES IN EQUIPMENT.

Limitations of time and money did not permit the investigator to make anything like a thorough study of the conditions and requirements at the stations, and the recommendations made covered only the most evident and salient needs.

A study of the equipment at the major stations showed that in many instances the boiler plants and stacks were far from being such as would be dictated by the best recent practice. There seems to have been a preference for hand-fired Hawley Down Draft furnaces and Scotch Marine boilers, when, in the opinion of the investigator, the conditions at the station were such as would have seemed to indicate that the installation of water tube boilers and gravity-fed automatic stokers would have been better.

In plants where the load is uniform, and where a material saving in labor can be effected by their use, the best modern boiler practice tends to the installation of water tube boilers with automatic stokers, gravity-fed from overhead bins, which are filled by conveyors. It is now recognized as good practice to run such boilers far above their commercial rating, thus saving in first cost without loss of efficiency.

In order that this may be done it is necessary that there be sufficient chimney draught, and with the exception of two of Chicago's stations the stacks are too low to provide the necessary draught. The conditions of almost uniform load at the stations are decidedly advantageous to automatic stokers. The saving in labor by their use would be large, as one fireman on a watch could easily handle all the boilers in use in the station. There would be a considerable saving in coal, by reason of the fact that screenings could be burned smokelessly at all stations; whereas, with the Hawley Down Draft, the larger and more costly grades of coal are required in order to prevent smoke. A still further saving would be effected by reason of the decreased maintenance charges, which the city's report shows to be very high on the Hawley Down Draft equipments.

Table II gives data with regard to the present boiler and stack equipment at the city pumping stations, and an estimate of the cost of the reconstruction or improvements recommended at seven of those stations, together with an estimate of the resulting annual savings in fuel, labor and maintenance. total estimated cost of the improvemen $270,150, and the total annual saving in labor and maintenance is estimated t [illegible]

In estimating the costs of the chang equipment, every effort was made to mak prices liberal ones, and it is believed that are. For example, the cost of the water boilers, installed with stokers, complet estimated at $29 per horse power, which s be more than enough to cover the cost o very best modern equipment. Similarly cost of stacks, 200 ft. x 8 ft., is put at $ Reinforced concrete stacks of this size a the best modern design and constructio be built, under Chicago labor conditions $4,800. A good brick stack of the same could be built for $6,000. The extra a ance of $4,200 over the cost of the reinf concrete stack should be far more enough, on the average, to cover any tectural features that might be requir harmonize the stacks with the existing sta

The cost of boilers and stacks of equa may, of course, vary for the different tions; but the figures given above are int not for any particular case, but as safe fi applicable on the average to all cases.

In estimating the saving in labor, th duced payroll under Plan No. 1 was tak a basis of comparison with what the pa would be if the changes recommended equipment were made. In estimating th ing in coal, the highest price paid in 19 Illinois screenings at Sixty-eighth stree taken as a basis, and an allowance was for cost of hauling to all stations at whi delivery is now by wagon, with the exc of the Twenty-second Street station this station the cost of a railroad side was included in the estimates of cost changes in equipment.

The figures for the total cost of th provements include no credit for th value of the existing boiler plants, sh be necessary to remove them. The firs

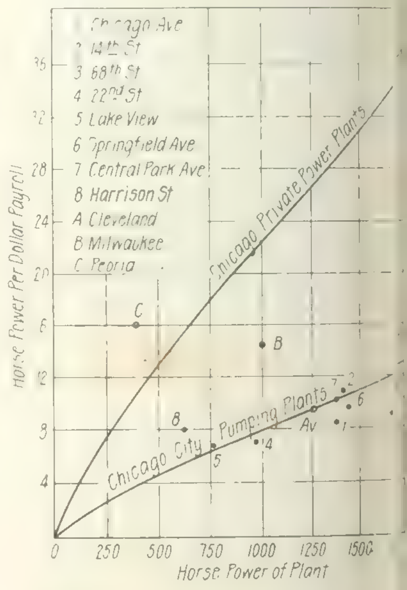

Fig. 2—Horse Power Developed for of Daily Payroll in Municipal and P Power Plants and Pumping Statio Chicago.

of these boiler plants and appurtenanc given in the appraisal of the City Works, published in the annual report Commissioner of Public Works for th 1908, aggregates $748,000, and the val January 1, 1909, after deducting deprec is given as $400,000. Assuming only cent of the first cost as the value of this ment, its selling price would amount 800. This would reduce the first cost proposed changes to $195,350. Interest amount at 4 per cent would make a ge , $7,814. Deducting this charge from 764 he net annual saving resulting from ording changes would be $115,950.

If the valves in suction and discharge of pumps are set with valve stems ver- is is dangerous, as the leaves of set sometimes drop off their sup- fall, suddenly closing the valve. occur while the pump is running, either of the main or of the pump, [illegible] be broken.

cef engineers in charge of the major tations are, generally speaking, com- n, who, under a system which would them to do their best, ought to give count of themselves and of the ma- nder their care. They apparently ttention, however, to economy of n they do to keeping their plants l in neat condition.

[illegible]

ant No. 1.—The boiler equipment is as follows: 4-350 h.p. Babcock x Boilers, Extension Front, Hawley aught, Gravity fed, and 2-350 h.p. Boilers, Flush Front, Hawley D. D., ed. The total rated boiler horse 2,100, the average horse power on is 1,400, and the load factor is 67

e equipment is as follows: 2-65 p., and 1-140 h.p. simple horizon- Two 110 h.p. simple vertical en- h.p. simple 2-cylinder vertical en- h.p. 25 k.w. electric light engine, h.p. 10 in. and 6 in. and 10 in. x 16 in. mp. The total rated engine horse 83, the average horse power on 00, and the load factor 28 per

payroll for this plant, for 12-hr. s follows:

[illegible]	$ 6.[illegible]
[illegible] at $2.68	10.72
[illegible] at $2.[illegible]	[illegible]
[illegible] room	$17.[illegible]
[illegible] at $[illegible]	6.[illegible]
[illegible] at $2.68	[illegible]
[illegible]	4.[illegible]
[illegible] at $2.[illegible]	[illegible]
[illegible] at $[illegible]	[illegible]
[illegible]	.1[illegible]
	$17.42
[illegible] at $[illegible]	1.20
ist (added) at $3.00	1.50
	$20.12
[illegible] deducted)	2.6[illegible]
[illegible]	$17.[illegible]

aximum number of boilers per fire- watch is 1⅓, and the maximum ver per fireman per watch is 467. By ng 2,000 lbs. of Pocahontas coal is hour per fireman on the average on watch, and 1,800 lbs. of Illinois slack

mber of city pumping engines equiv- average number of units in service is erage equivalent number of pumping er engineer per watch, as corrected, d per oiler per watch is 2. The ratio f coal to cost of labor, as corrected, he actual daily payroll is $57.72, and rted $23.64. The average pay per man is $2.62 and per hour is $0.33. The gine horse power per dollar of daily s corrected, is 16.9.

ine room and machinery are not well f time for one janitor and half time machinist are added. But as the engine horse power is only 28 per average boiler horse power, the bal- ng used for other purposes, and as neers and others have other duties he care of the machinery, the total for the purpose of figuring the cor- ns is taken at $17.[illegible] plus $6.20

Plant No. 2.—The boiler equipment lant is as follows: 5-375 h.p. Stirling be boilers with Greene chain grates, d. The rated boiler horse power is e average horse power on the day 960, and the load factor is 51 per

The [illegible] h.p. vertical [illegible] condensing engine generators, [illegible] 3 cylinder, horizontal [illegible] pump, 2-200 h.p. [illegible] horizontal compound, [illegible] h.p. 10 in. and 18 in. [illegible] horizontal vacuum pumps, [illegible] house pump, 1 25 h.p. horizontal simple, duplex [illegible] elevator return pumps. The rated horse power of the total engine and motor units is 2,180, [illegible] and the load factor 55 per cent.

The daily payroll for this plant, for an 8 hr. shift, is as follows:

[illegible]	[illegible]
[illegible]	[illegible]
Total [illegible]	[illegible]
½ chief [illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
1 janitor at $2.00	2.00
1 [illegible]	[illegible]
	$36.60
2 oilers (added) at $2.00	4.00
Total	$40.60

The maximum number of boilers per fireman per watch is 1, and the maximum horse power of boilers per fireman per watch is 465. On an average 2,000 lbs. of coal is fired by hand per hour per fireman on the day watch.

The number of city pumping engines equivalent to average number of units in service is 3, the average equivalent number of pumping engines per engineer per watch is 2¼, the average equivalent number of pumping engines per oiler per watch is 1½, as corrected. The ratio of cost of coal to cost of labor is 2.96, as corrected. The actual daily payroll is $57.72, and, as corrected, is $61.72. The average pay per man per day is $2.62, and per hour is 22 cts. The actual engine horse power per dollar of daily payroll is 19.6, as corrected.

Part of this plant does not run at night. In order to figure the corrected items above, two oilers were added, who would be the only extra men needed for full 24-hr. service.

Private Plant No. 3.—The boiler, engine, and motor equipment of this plant is as follows: 4-400 h.p. Heine water-tube boilers with Murphy stokers, gravity fed. The rated boiler horse power is 1,600, the average horse power on day watch is 880, and the load factor 55 per cent.

There are 2-470 h.p. simple horizontal, non-condensing engine generators, 1-335 h.p. simple horizontal, non-condensing engine generators, and 2-10 h.p. motor-driven air compressors. The rated horse power of the total engine and motor units is 1,295, the average horse power on day watch 1,050, and the load factor 81 per cent.

The daily payroll for this plant, for an 8-hr. shift, is as follows:

3 firemen at $2.1[illegible]	$[illegible]
3 coal passers at $1.[illegible]	[illegible]
3 ash wheelers at $1.67	5.00
½ boiler washer at [illegible]	1.[illegible]
1 helper at $1.83	1.[illegible]
Total for boiler room	$19.58
½ chief engineer at $4.67	2.33
1½ asst. engineer at $2.92	4.38
3 oilers at $1.9[illegible]	[illegible]
1 janitor at $1.67	1.67
1 laborer at $1.67	1.67
1 machinist at $[illegible]	[illegible]
	$18.85
½ chief engineer (added) at $[illegible]	[illegible]
½ asst. engineer (added) at $2.92	1.46
1 laborer (added) at $1.67	1.67
Total	[illegible]

The maximum number of boilers per fireman per watch is 1½, and the maximum horse power per fireman per watch is 440. There are 5,000 lbs. of coal, gravity fed, per hour per fireman on the average during the day watch.

The number of city pumping engines equivalent to the average number of units in service is 1.4; the average equivalent number of pumping engines per engineer per watch is 2.1, as corrected; the average equivalent number of pumping engines per oiler per watch is 1.4, as corrected. The ratio of cost of coal to cost of labor is 3.33, as corrected. The actual daily payroll is $38.43, and as corrected is $43.89. The average pay per man per day is $2.08, and per hour is 26 cts. The actual engine horse power per dollar of daily payroll is 17.1, as corrected.

Private plants Nos. 3 and 4 are near each other and are operated by the same management, some of the men dividing their time between the two plants. Neither runs full 24 hrs. For the purpose of figuring the corrected items given under plants 3 and 4, enough men were added to the payroll of each plant to run the plants independently of each other, and also to provide for full 24-hr. service.

Private Plant No. 4.—There are 4 450 h.p. Stirling water tube boilers, with chain grates, gravity fed. Their rated horse power is 1,800, the average horse power on day watch is 990, and the load factor is 55 per cent. There is 1 140 h.p. horizontal compound pump, handling 2,000,000 gals. against 150 lbs., used occasionally for elevator service.

The engine and pump equivalent is as follows: 2 140 h.p. vertical compound pumps, each handling 2,000,000 gals. against 150 lbs.; 1 670 h.p. 500 k.w. vertical compound engine generator, 2 430 h.p. 320 k.w. vertical compound engine generators; 2 268 h.p., 200 k.w., vertical compound engine generators; 2 131 h.p., 100 k.w. vertical compound engine generators; 1 40 h.p. house pump; 1 50 h.p. house pump, and 3 10 h.p. elevator return pumps.

The total rated horse power of the engine and pump units is 2,874, the average horse power on day watch is 1,186, and load factor is 41 per cent.

The daily payroll, for 8-hr. shift, is as follows:

3 firemen at $2.17	$ 6.50
[illegible]	[illegible]
3 ash wheelers at $1.67	5.00
½ boiler washer at $2.50	1.25
1 helper at $1.83	1.83
Total for boiler room	$19.58
[illegible]	[illegible]
[illegible]	[illegible]
3 oilers at $1.93	5.80
1 janitor at $1.67	1.67
[illegible]	[illegible]
1 machinist at $3.00	3.00
	$18.85
[illegible]	[illegible]
½ asst. engineer (added) at $2.92	1.46
1 laborer (added) at $1.67	1.67
Total	$[illegible]

The maximum number of boilers per fireman per watch is 1½, and the maximum horse power per fireman per watch is 495. During the day watch 5,610 lbs. of coal are gravity fed per hour per fireman.

The number of city pumping engines equivalent to the average number of units in service is 2.5; the average equivalent number of pumping engines per engineer per watch, as corrected, is 3.8; the average equivalent number of pumping engines per oiler per watch, as corrected, is 2.5. The ratio of cost of coal to cost of labor, as corrected, is 3.84. The actual daily payroll is $38.43, and, as corrected, is $43.89. The average pay per man per day is $2.08 and per hour is 26 cts. The actual engine horse power per dollar of daily payroll, as corrected, is 26.9.

Private Plant No. 5.—The boiler equipment is as follows: 8 500 h.p. Aultman-Taylor water tube boilers, with chain grates, gravity fed. The total rated boiler horse power is 4,000, the average horse power on the day watch is 3,000, and the load factor is 75 per cent.

The generating units are as follows: 3-1,200 h.p. horizontal compound condensing engines; 1 800 h. p. horizontal compound condensing engines; 1 100 h.p. horizontal simple engine; 1 50 h.p. horizontal simple engine; 1 60 h.p. 2-stage compound air compressor; 1 80 h.p. 2-stage compound air compressor; 2 90 h.p. horizontal compound duplex steam pumps; 1 300 h.p. horizontal triple Corliss steam pump; 1 300 h.p. compound elevator pump; 1 75 h.p. horizontal compound elevator pump; 3 90 h.p. horizontal duplex fire pumps; 1 40 h.p. 30-ton ice machine; 2 30 h.p. 10 in. and 18 in. x 20 in. vacuum pumps; and 1 50 h.p. motor-driven duplex pump (not counted). The rated horse power of the total generating units is

TABLE I.—PRESENT AND SUGGESTED PAYROLLS AT SIXTY-EIGHTH STREET STATION

Payroll for Regular Men [illegible]

1 chief engineer	[illegible]
[illegible] assistant engineers	[illegible]
[illegible] crane engineer	[illegible]
1 [illegible] engineer	[illegible]
10 firemen	[illegible]
21 oilers	[illegible]
1 boiler washer	1,260.00
8 coal passers	8,000.00
1 janitor	900.00
1 well tender	1,000.00
[illegible] laborers	[illegible]
1 steamfitter	1,716.00
1 steamfitter's helper	1,092.00
2 machinists	[illegible]
1 machinist's helper	1,000.00
58	$67,275.20

$184.32 per day.

Average pay per day	[illegible]
Average pay per hour	[illegible]
H. P. per dollar of daily payroll:	
Rated	11.2
Actual	9.2

Ratio Coal to Labor:

$$\frac{55,062}{67,275} = [illegible]$$

Payroll Plan No. 1, Without Allowance for Vacations

1 chief engineer	$ 2,500.00
3 assistant engineers	[illegible]
1 crane engineer	1,747.20
1 rigger engineer	900.00
[illegible] firemen	7,560.00
12 oilers	12,960.00
1 boiler washer	1,260.00
5 coal passers	5,000.00
1 janitor	900.00
3 laborers	2,700.00
1 steamfitter	1,716.00
1 steamfitter's helper	1,092.00
1 machinist	1,560.00
1 machinist's helper	1,000.00
[illegible]	$46,895.20

$128.48 per day.

Average pay per day	[illegible]
Average pay per hour	[illegible]
H. P. per dollar of daily payroll:	
Rated	[illegible]
Actual	13.2

Ratio Coal to Labor:

$$\frac{55,062}{46,895} = 1.17$$

Saving, $20,380.00 per year.

Payroll Plan No. 2.

1 chief engineer	$ 1,200.00
2 assistant engineers	3,000.00
1 crane engineer	1,200.00
1 rigger engineer	900.00
9 oilers	7,560.00
[illegible] firemen	[illegible]
1 boiler washer	960.00
5 coal passers	4,200.00
1 janitor	900.00
2 laborers	1,680.00
1 steamfitter	1,320.00
1 steamfitter's helper	900.00
1 machinist	1,200.00
1 machinist's helper	1,000.00
34	$32,860.00

$90.03 per day.

Average pay per day	$ 2.65
Average pay per hour	.33
H. P. per dollar of daily payroll:	
Rated	22.9
Actual	18.9

Ratio Coal to Labor:

$$\frac{55,062}{32,860} = 1.68$$

Saving, $34,415.20 per year.

5,915, the average horse power on the day watch is 2,900, and the load factor is 48 per cent.

The daily payroll follows, firemen and assistant engineers working 8 hours, all others 10 hours:

3 firemen at $2.14	$ 6.42
1 coal unloader at $2.20	2.20
3 asst. unloaders at $2.00	6.00
1 boiler washer at $2.70	2.70
2 asst. boiler washers at $2.00	4.00
Total in boiler room	$21.32
1 chief engineer at $5.00	5.00
3 asst. engineers at $3.00	9.00
5 oilers at $2.00	10.00
2 janitors at $2.00	4.00
1 machinist at $3.00	3.00
1 machinist helper at $2.00	2.00
Total	$33.00

The maximum number of boilers per firemen per watch is 6, and the maximum horse power of boilers per fireman per watch is 3,000. On the day watch 15,833 lbs. of coal are gravity fed per hour per fireman.

The number of City pumping engines equivalent to the average number of units in service is 5, the average equivalent number of pumping engines per engineer per watch is 3.7, the average equivalent number of pumping engines per oiler per watch is 3. The ratio of cost of coal to cost of labor is 3. The actual daily payroll is $37.32, the corrected $54.32. The average pay per man per day is $2.49, per hour, 27 cts. The actual engine horsepower per dollar of daily payroll is 53.4.

Plant No. 5 does not run 24 hours repair force is not sufficient to keep machinery in order. Three oilers, two ant coal unloaders and one assistant washer, amounting to $12 per day, were to give 24 hour service; and one m and one helper, amounting to $5 per da added to keep up repairs to machiner

Private Plant No. 6.—The boiler eq [illegible] follows: 10 500 h.p. Aultman- water tube boilers with chain grates, [illegible] and equipped with fuel econ Total rated boiler horse power 5,000, horse power on day watch, 4,000, and lo tor of 80 per cent.

The engine, motor, pump and com units are as follows: 1 400 h.p. 3 horizontal, compound, condensing 1 670 h.p. 500 k.w. horizontal, compoun densing engine; 1 1,340 h.p. 1,000 k. tical compound condensing engine; h.p. 1,200 k.w. vertical comuound con engine; 1 670 h.p. 500 k.w. turbine ge (not counter); 1 165 h.p. compoun densing air compressor; 2 30 h.p. ho vacuum pumps; 1 40 h.p. horizontal pump 1 40 h.p. horizontal circulating 1 20 h.p., 16-ton ice machine; 5 motor compressors or pumps (not counted) condensing sets. Total voted horse p engine, motor pump and compressor 4,545, average horse power on dail 5,400, and load factor 119 per cent.

The daily payroll follows:

3 firemen at $2.00........................
3 asst. firemen, 8 hrs., at $1.92.........
2 water tenders, 10 hrs., at $2.80.......
2 ash shovelers, 10 hrs., at $2.40.......

For boiler room..................
1 chief engineer, 10 hrs., at $6.00..
3 asst. engineers, 8 hrs., at $3.29...
6 oilers, 8 hrs., at $2.00..............
2 janitors, 10 hrs., at $2.00........
1 machinist, 9 hrs., at $3.00..........
1 helper, 9 hrs., at $2.00..........

Total ....

The maximum number of boilers p man per watch is 5, the maximum power of boiler per fireman per w 2,000. On the day watch 8,600 lbs. are gravity fed per fireman, on the a

The number of City pumping equivalent to the average number in service is 8; the average equivalen ber of pumping engines per engin watch is 6; and the average equivalen ber of pumping engines per oiler per is 4. The actual daily pay roll is $45 corrected $59.03. The average pay p per day $2.52, per hour 23 cts. The

TABLE II.—APPROXIMATE ESTIMATE OF COST OF CONSTRUCTION OR IMPROVEMENTS RECOMMENDED FOR BOILER PLAN SEVEN CHICAGO CITY PUMPING STATIONS, WITH ESTIMATE OF RESULTING ANNUAL SAVING IN FUEL, LABOR AND MAINTENANCE.[7]

Station.	14th Street.	68th Street.	22nd Street.	Chicago Avenue.	Springfield Avenue	Central Pk. Avenue.	Lake View
B. H. P. installed	2,100	2,276	1,788	1,500	1,700	1,700	1,840
Average B. H. P. in use	1,000	1,196	1,100	1,000	900	1,100	750‡
B. H. P. required under economic overload	1,200	None	1,200	1,260	1,200	1,200	1,200
Size of present stack	1[illegible]0'x7'	90'x5'0"[1] 100'x6'0"[2] 100'x6'0"[3]	116'x5'0" 6'0" dia. at bot.	.....	175'x9'0" 14' dia. at bot.	175'x9'0" 14' at bot.	125'x6'0"
H. P. of stack required	1,700	2,000	1,700	1,700	1,700	1,700	1,700
Size of stack required	200'x8'0"	200'x9'0"	200'x8'0"	200'x8'0"	(6)	(6)	200'x8'0"
Cost of new boilers, including chain grates, auto stokers and superheat	$34,800.00	None	$34,800.00	$34,800.00	$34,800.00	$34,800.00	$34,800.00
Cost of hoppers, bins, conveyors and crushers	None	$ 3,000.00	*6,000.00	750.00	1,000.00	None	5,000.00
Cost of new stack (brick)	9,000.00	9,600.00	9,000.00	9,000.00	.....	....	9,000.00
Cost of coal per ton burned in 1909	2.64	1.86	2.63	2.71	2.27	2.27	3.01
Average No. B. T. U. per lb. coal burned in 1909	11,512	10,7[illegible][4] 10,20[illegible][5]	10,856	11,180	10,747	10,893	11,357
Total tons of coal burned in 1909	20,108	29,087	18,977	18,086	20,841	20,215	10,842‡
Cost of coal for 1909	53,001.00	54,018.00	50,000.00	48,976.00	47,309.00	45,904.00	32,634.00‡
Cost of coal per ton under new conditions	2.19	1.86	1.86	2.29	1.86	1.86	2.49
Average number of B. T. U. per lb. of coal under new conditions	10,500	10,500	10,500	10,500	10,500	10,500	10,500
Total tons of coal per year under new conditions	22,050	29,087	19,620	19,260	21,330	20,970	11,720
Cost of coal per year under new conditions	48,290.00	54,018.00	36,493.00	44,105.00	39,674.00	39,004.00	29,183.00
Saving in cost of coal per year	4,711.00	None	13,507.00	4,871.00	7,635.00	6,900.00	3,451.00
Cost of labor in boiler room as per Plan No. 1	13,980.00	15,567.00	19,220.00	13,980.00	14,980.00	14,980.00	13,980.00
Cost of labor under new conditions	7,500.00	7,500.00	7,500.00	7,500.00	7,500.00	7,500.00	7,500.00
Saving in labor	6,480.00	8,067.00	11,720.00	6,480.00	7,480.00	7,480.00	6,480.00
Maintenance in 1909†	4,814.00	4,062.00	4,303.00	9,552.00	4,531.00	5,900.00	2,760.00
Depreciation in 1909[8]			....	....	....	....	....
Maintenance under new conditions	1,060.00	1,060.00	1,060.00	1,060.00	1,060.00	1,060.00	1,060.00
Depreciation under new conditions	....	....	....	....	....	....	....
Saving in maintenance	3,754.00	3,002.00	3,243.00	8,4[illegible].00	3,471.00	4,840.00	1,700.00
Total saving	14,945.00	11,069.00	28,470.00	19,843.00	18,586.00	19,220.00	11,631.00
Total cost of new construction	43,800.00	12,600.00	49,800.00	44,550 00	35,800.00	34,800.00	48,800.00
Sale value of present equipment	...			.....	.....	....	.....
Net first cost of new equipment				.....	.....	....	.....
Interest at 4 per cent				..	..	......	......
Net annual saving	......	......	......	.....	.....	......	....

*This includes 100 ft. of switch track. †One half of piping repairs charged against boilers. ‡These figures based on log sheets of Januar
[1]North. [2]Middle. [3]South. [4]Lump. [5]Screen. [6]Present stack large enough. [7]The Harrison Street plant is now modern. [8]No charge made, b
no charge is made by the city in the statement of its operating expensesat stations. Depreciation charge in improved plants would be less
aggregate than on the plants as they now exist.

horse power per dollar of daily payroll

t No. 6 does not run 24 hours. One assistant shoveler, two janitors and two are added to give 24 hour service.

ate Plant No. 7.—The boiler equipment ses 12 420 h.p. Babcock & Wilcox water oilers, with Murphy stokers, gravity The total rated horse power is 5,040, e average horse power on the day watch 0, the load factor being 100 per cent.

engines are as follows: 3 2,400 h.p., k.w. horizontal, compound, condensing s, 1 2,133 h.p., 1,600 k.w. horizontal und, condensing engines; 1 1,200 h.p. v. horizontal, compound, condensing en- and 1 20 h. p. horizontal house pump. ated horse power of the engine and units is 10,553, the average on the day is the same, and the load factor is 100 t

daily payroll follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
boiler room	$31.69
[illegible] 10 hrs	[illegible]
[illegible] 12 hrs	[illegible]
[illegible] 10 hrs	[illegible]
[illegible] at $2.17, 12 hrs	[illegible]
men at $2.17, 12 hrs	4.34
[illegible] hrs	[illegible]
[illegible] hrs	[illegible]
[illegible]	[illegible]

maximum number of boilers per fire- er watch is 3, and the corresponding um horse power is 1,260. On the day 7,261 lbs. of coal are fired per hour per n, on the average. The number of City ng engines equivalent to the average r of units in service is 12; the average lent number of pumping engines per er per watch is 8; the average equiva- mber of pumping engines per oiler per is 2.4. The ratio of the cost of coal t of labor is 1. The actual payroll is per day. The average pay per man per $2.44, and per hour is 22 cts. The engine horse power per dollar of daily 127.

ate Plant No. 8.—The boiler equipment follows: 12 400 h.p. B. & W. water oilers, chain grates, gravity fed; and h.p. B. & W. water tube boilers, chain gravity fed.

total rated horse power of the boiler s 9,800, the average horse power on the atch is the same, and the load factor per cent.

engine equipment is as follows: 2 2,000 500 k.w., vertical, compound condensing s; 3 1,340 h.p. 1,000 k.w. horizontal com- condensing engines; 4 1,070 h.p. 800 horizontal compound condensing en- The total rated horse power of the s is 12,300. The load factor is 100 per

force employed is as follows: 6 fire- 1 boiler washer, 1 asst. boiler washer, i engineer, 2 asst. engineers, 2 janitors, mfitters, 2 dynamo men, and 16 oilers ers being added to the actual number). otal of the daily payroll is $79.72.

maximum number of boilers per fire- er watch is 7.3, and the maximum cor- ding horse power is 3,300. On the day under average conditions, 8,333 lbs. of re gravity fed per hour per fireman.

number of City pumping engines lent to average number of units in is 16; the average equivalent num- pumping engines per engineer per watch 7; the average equivalent number of ng engines per oiler per watch is 2. The e pay per man per day is $2.28 and ur is 20.7 cts. The actual engine horse per dollar of daily payroll is 154.3.

nd Street Station, Cleveland, Ohio. al Plant.—There are 8-272.5 h.p. B. water tube boilers, with superheaters ain grates, gravity fed. The total rated horsepower is 2,180, the average horse on the day watch is 1,140, and the load is 52 per cent.

There are [illegible],000,000 gal. vertical triplex [illegible] horizontal [illegible]. The total rated horse power of the [illegible] units is 3,505, the average horse power on the day watch is 1,820 and the [illegible] is 52 per cent. One of [illegible] engine room in which the other four units are located.

The work is done in 8-hour shifts, the watchmen working 12 hours. The daily payroll follows:

1 [illegible]	[illegible]
6 [illegible]	[illegible]
1 boiler [illegible]	[illegible]
1 boiler [illegible]	[illegible]
1 [illegible]	[illegible]
Total [illegible]	$3[illegible]
1 chief engineer at $6.03	[illegible]
1 [illegible]	[illegible]
1 operating [illegible]	[illegible]
6 operating [illegible]	[illegible]
2 [illegible]	[illegible]
1 [illegible]	[illegible]
1 [illegible]	[illegible]
1 [illegible]	[illegible]
1 [illegible]	[illegible]
5 janitors at $1.76	[illegible]
1 pipe [illegible]	[illegible]
1 pipe fitter [illegible]	[illegible]
1 machinist at [illegible]	[illegible]
1 second machinist at $3.01	[illegible]
1 blacksmith [illegible]	[illegible]
2 blacksmith [illegible]	[illegible]
1 watchman at [illegible]	[illegible]
	[illegible]

The maximum number of boilers per fireman per watch is 2, and the maximum horse power corresponding is 500. On the day watch there are 1,400 lbs. of coal gravity fired per hour per fireman.

The total number of engine units is 5. The number of City pumping engines equivalent to the average number of units in service is 7; the average equivalent number of pumping engines per engineer per watch is 2.1; the average equivalent number of pumping engines per oiler per watch is 3.5. The ratio of the cost of coal to cost of labor is 0.90. The daily payroll is $119.42. The average pay per man per day is $2.49, per hour is 31 cts. The actual engine horse power per dollar of daily payroll is 15.2.

North Point Station, Milwaukee, Wis., Municipal Plant.—There are 6 125 h.p. horizontal tubular boilers with Hawley down draught furnaces, flush front, hand fired, and 3 150 h.p. horizontal tubular boilers, with Hawley down draft furnaces, extension front, hand fired. The total rated boiler horse power is 1,200, the average boiler horse power on the day watch is 470, and the load factor is 39.1 per cent.

The engine units are as follows: 2 218 h.p. 8,000,000 gal., vertical compound, condensing beam engines; 1 327 h.p. 12,000,000 gal. Vertical Steeple compound, condensing engine, 1 490 h.p., 18,000,000 gal. vertical triplex condensing engine; 2 545 h.p., 20,000,000 gal. vertical triplex condensing engine, and 1 561 h.p., 12,000,000 gal. vertical triplex condensing engine. The rated horse power of the total of the engine units is 2,904, the average horse power on the day watch is 994, and the load factor is 34.2 per cent. There are two separate boiler rooms, one on each side of the engine room.

The work is done in 8-hour shifts. The daily payroll follows:

6 firemen at $2.[illegible]	$1[illegible]
3 coal passers at $2.00	6.00
½ coal weigher at $1.[illegible]	.92
½ coal trimmer at $1.[illegible]	[illegible]
	$21.75
1 engineer in charge at $4.17	4.17
3 asst. engineers at [illegible]	10.50
6 oilers at $[illegible]	[illegible]
½ machinist at $2.78	1.39
½ blacksmith at $2.50	1.25
½ blacksmith helper at $2.00	1.00
½ carpenter at $[illegible]	1.67
2 janitors at $2.00	4.00
5 helpers, etc., at $2.00	10.00
	$47.98

The maximum number of boilers per fireman per watch is 3, and the maximum horse power corresponding is 300. On the day watch there are 855 lbs. of coal hand fired per hour per fireman.

The total number of engine units is 7. The number of city pumping engines equivalent to the average number of units in service is 4; the average equivalent number of pumping engines per engineer per month is 3; the average equivalent number of pumping engines per oiler per watch is 2. The ratio of the cost of coal to cost of labor is 0.96. The daily pay roll is $69.73. The average pay per man per day is $2.40, per hour is 30 cts. The actual engine horse power per dollar of daily pay roll is 14.3.

Peoria, Illinois, Pumping Station. Private Plant.—There are six 150 h.p. Heine water tube boilers, with plain grates, hand fired, and three 400 h. p., 7,000,000 gal., vertical compound condensing pumping engines. The total rated horse power of the boilers is 900 and of the engines 1,200. The average horse power on the day watch is 300 for the boilers and 400 for the engines, the load factor being 33 per cent for both.

The firemen work 9 hours and the assistant firemen 8½ hours; all others work 10 hours.

3 firemen at $2.00	$ 6.00
1 asst. fireman (who washes boilers, cleans filters, wheels ashes, etc.) at $1.83	1.83
[illegible]	[illegible]
	[illegible]
1 chief engineer at $3.89	3.89
[illegible]	[illegible]
1 machinist at $2.50	2.50
[illegible]	[illegible]
[illegible]	[illegible]
	$14.97

The maximum number of boilers per fireman per watch is 2 and the maximum horse power corresponding is 300. On the day watch there are 1,833 lbs. of coal hand fired per hour per fireman.

The number of city pumping engines equivalent to the average number of units in service is 1⅓; the average equivalent number of pumping engines per engineer per watch is 1⅓; the average equivalent number of pumping engines per oiler per watch is 4. The ratio of the cost of coal to cost of labor is 1.08. The daily pay roll is $24.55. The average pay per man per day is $2.23, per hour is 25 cts. The actual engine horse power per dollar of daily pay roll is 16.3.

[illegible] CITY PUMPING STATION

Statistics of the eight major pumping stations of Chicago are given below. In all cases the men at the stations work 8 hours a day.

Chicago Avenue Pumping Station.—There are 6 250 h.p. Scotch marine boilers, with Hawley down draught furnaces, gravity fed, erected 1900 to 1904. There are 2 235 h.p., 12,000,000 gals., horizontal compound, Gaskill engines, piston speed 116 ft., 17.3 R. P. M., erected 1887; and 3 498 h.p., 25,000,000 gals., vertical triple, Allis engines, speed of piston 488 ft., 61 R. P. M., erected 1904 to 1906. The total rated boiler horse power is 1,500, and the engine horse power 1,964. The average boiler horse power under service is 1,000 and the engine horse power 1,380. The boiler load factor is 67 per cent, and the engine load factor 70 per cent.

The daily pay roll follows:

11 firemen at $2.96	$ 32.56
[illegible] coal passers at $2.[illegible]	13.70
1 boiler washer at $3.42	3.42
1 conveyor engineer at $3.29	3.29
	$ 52.97
1 chief engineer at $6.85	6.85
6 asst. engineers at $5.48	32.88
12 oilers at $2.96	35.52
1 janitor at $2.47	2.47
1 well tender at $2.74	2.74
5 laborers at $2.50	12.50
6/7 steamfitter at $5.[illegible]	4.70
6/7 steamfitter helper at $3.50	3.00
12/7 machinist at $5.00	8.55
	$109.21

The maximum number of boilers per fireman per watch is 1.1 and the maximum horse power corresponding is 273. On the day watch there are 1,130 lbs. of coal gravity fired per hour per fireman.

The total number of engine units is 5. The number of city pumping engines equivalent to the average number of units in service is 3.6; the average equivalent number of pumping engines per engineer per watch is 1.5; the average equivalent number of pumping engines per oiler per watch is 0.9. The ratio of the cost of coal to cost of labor is 0.83. The daily pay roll is $162.18. The average pay per man per day is $3.40, per hour is 42½ cts. The actual engine horse power per dollar of daily pay roll is 8.5.

[illegible] are 6 250 h.p. Scotch marine boilers, with Hawley down draught furnaces, gravity fed, erected in 1904, and 3 200 h.p. B. & W. water tube boilers, with Roney stokers, erected in 1898, but not now in use.

There are 3 296 h.p., 15,000,000 gal. vertical, triple, Allis engines, 159 ft. piston speed, 15.9 R. P. M., erected in 1891-92, and 1 592 h.p., 30,000,000 gal., vertical, triple, Lake Erie engine, 123 ft. piston speed, 19.3 R. P. M., erected in 1898. The total rated horse power of the boilers is 1,500 and of the engines is 1,480. The average horse power developed by the boilers is 1,000 and by the engines is 1,406, the load factors being 67 per cent for the boilers and 95 per cent for the engines.

The daily pay roll is as follows:

4 coal passers at [illegible]	[illegible]
[illegible]	[illegible]
1 boiler washer at [illegible]	[illegible]
[illegible]	[illegible]
	[illegible]
1 chief engineer at [illegible]	[illegible]
[illegible] asst. engineers at [illegible]	[illegible]
[illegible] oilers at [illegible]	[illegible]
[illegible] janitor at [illegible]	[illegible]
[illegible] laborers at [illegible]	[illegible]
[illegible] steamfitter at [illegible]	[illegible]
6/7 steamfitter helper at $3.50	3.00
6/7 machinist at $5.00	4.28
	$81.22

The maximum number of boilers per fireman per watch is 1.2, and the maximum horse power corresponding is 300. On the day watch there are 1,370 lbs. of coal gravity fired per hour per fireman.

The total number of engine units is 4. The number of city pumping engines equivalent to the average number of units in service is 4.4; the average equivalent number of pumping engines per engineer per watch is 3.3; the average equivalent number of pumping engines per oiler per watch is 1.0. The ratio of the cost of coal to cost of labor is 1.15. The daily pay roll is $128.49. The average pay per man per day is $3.36, per hour is 42 cts. The actual engine horse power per dollar of daily pay roll is 10.9.

Sixty-eighth Street Pumping Station.—There are 4 100 h.p. and 4 129 h.p. horizontal, tubular boilers with common grates, hand fired, the former erected in 1898 and the latter in 1890; and 4 340 h.p. B. & W. water tube boilers with chain grates, gravity fed, erected in 1906.

There are 4 263 h.p., 12,000,000 gal. horizontal, compound, Gaskill engines, 108 ft. piston speed, 16.2 R. P. M., erected 1886 to 1898, and 1 263 h.p., 12,000,000 gal. horizontal, compound, Worthington engine, 96 ft. piston speed, 12 R. P. M., erected 1890, and 1 308 h.p., 14,000,000 gal., horizontal, compound, Holly engine, 120 ft. piston speed, 18 R. P. M., erected 1898, and 1 438 h.p., 20,000,000 gal., horizontal, compound, Snow engine, 305 ft. piston speed, 43.5 R. P. M.., erected 1906. The total rated horse power of the boilers is 2,276 and of the engines is 2,061. The average horse power developed by the boilers is 1,196 and by the engines is 1,700, the load factor being 53 and 82 per cent respectively.

The daily pay roll is as follows:

10 firemen at [illegible]	[illegible]
8 coal passers at $2.74	21.92
1 boiler washer at $3.42	3.42
6/7 [illegible] engineer at [illegible]	[illegible]
	$ 59.74
1 chief engineer at [illegible]	6.85
3 asst. engineers at [illegible]	16.44
21 oilers at [illegible]	62.16
1 janitor at $2.47	2.47
1 weigh tender at $2.74	2.74
5 laborers at [illegible]	12.50
1 [illegible] at [illegible]	2.63
6/7 steamfitter at [illegible]	4.70
6/7 steamfitter helper at $3.50	3.00
12/7 machinists at $5.00	8.55
6/7 machinist helper at $3.20	2.74
	$124.78

The maximum number of boilers per fireman per watch is 1.8 and the maximum horse [illegible] watch there are 590 lbs. of coal hand fired and 6,650 lbs. gravity fed per hour per fireman.

The total number of units is 7. The number [illegible] average number of units in service is 5.6; the average equivalent number of pumping engines per engineer per watch is 4.2; the average equivalent number of pumping engines per oiler per watch is 0.6. The ratio of the cost of coal to cost of labor is 0.82. The daily pay roll is $184.52. The average pay per man per day is $3.23, per hour is 40.4 cts. The actual engine horse power per dollar of daily pay roll is 9.2.

Twenty-second Street Pumping Station.—There are 6 161 h.p., horizontal, tubular boilers with Hawley down draught furnaces, hand fired, erected 1884, and 6 137 h.p., horizontal, tubular boilers with Hawley down draft furnaces, hand fired, erected 1894.

There are 2 267 h.p., 15,000,000 gal., vertical, compound, Beam Quintard, Corliss engines, 196 ft. piston speed, 9.8 R. P. M., erected 1876, and 2 267 h.p., 15,000,000 gal., vertical, compound, Beam Quintard, Corliss engines, 187 ft. piston speed, 9.4 R. P. M., erected 1884. The total rated horse power of the boilers is 1,788 and of the engines is 1,068. The average horse power developed by the boilers is 1,100 and by the engines is 965, the load factor being 62 per cent for the boilers and 90 per cent for the engines.

The daily pay roll is as follows:

15 firemen at $2.96	$44.40
8 coal passers at $2.74	21.92
1 boiler washer at $3.42	3.42
	$69.74
1 chief engineer at $6.85	6.85
3 asst. engineers at $5.48	16.44
9 oilers at $2.96	26.64
1 janitor at $2.47	2.47
1 laborer at $2.50	2.50
6/7 steamfitter at $5.50	4.70
6/7 steamfitter helper at $3.50	3.00
6/7 machinist at $5.00	4.28
	$66.88

The maximum number of boilers per fireman per watch is 1.2 and the maximum horse power corresponding is 220. On the day watch there are 870 lbs. of coal hand fired per hour per fireman.

The total number of engine units is 4. The number of city pumping engines equivalent to the average number of units in service is 3.5; the average equivalent number of pumping engines per engineer per watch is 2.6; the average equivalent number of pumping engines per oiler per watch is 0.9. The ratio of the cost of coal to cost of labor is 1.04. The daily pay roll is $136.62. The average pay per man per day is $3.28, per hour is 41 cts. The actual engine horse power per dollar of daily pay roll is 7.1.

Lake View Pumping Station.—There are 2 210 h.p. Scotch marine boilers erected in 1897, but not now in use, and 4 250 h.p. Scotch marine boilers, with Hawley down draught furnaces, hand fired, erected in 1906

There is 1 90 h.p., 5,000,000 gal., horizontal, compound, Worthington engine, 89.4 ft. piston speed, 14.9 R. P. M., erected in 1885, and 1 215 h.p., 12,000,000 gal., horizontal, compound, Gaskill engine, 105 ft. piston speed, 17.3 R. P. M., erected in 1888, and 1 234 h.p., 13,000,000 gal., horizontal, compound, Gaskill engine, 105 ft. piston speed, 17.3 R. P. M., erected 1891, and 1 251 h.p., 14,000,000 gal. horizontal, compound, Holly engine, 119 ft. piston speed, 17.8 R. P. M., erected 1898, and 1 450 h.p., 25,000,000 gal., vertical, triple, Allis engine, 170 ft. piston speed, 25 R. P. M., erected 1909.

The total rated horse power of the boilers is 1,000 and of the engines is 1,240. The average horse power developed by the boilers is 750 and by the engines is 790, the load factors being 75 per cent and 64 per cent respectively.

The daily pay roll is as follows:

9 firemen at $2.96	$26.64
[illegible] coal passers at [illegible]	[illegible]
1 boiler washer at [illegible]	[illegible]
	$38.28
1 chief engineer at $6.85	6.85
3 asst. engineers at $5.48	16.44
12 oilers at $2.96	35.52
1 janitor at $2.47	2.47

[illegible] tender at $2.7[illegible]
[illegible] at $2.50
[illegible] steamfitter at $5.50
6/7 machinist at $5.00
[illegible] machinist helper at $3.20

The maximum number of boilers per fireman per watch is 1 and the maximum horse power corresponding is 250. On the day watch there are 1,140 lbs. of coal hand fired per hour per fireman.

The total number of engine units is 5. The number of city pumping engines equivalent to the average number of units in service is [illegible]; the average equivalent number of pumping engines per engineer per watch is 2.1; the average equivalent number of pumping engines per oiler per watch is 0.7. The ratio of the cost of coal to cost of labor is [illegible]. The daily pay roll is $116.52. The average pay per man per day is $3.37, per hour is 42 [illegible]. The actual engine horse power per dollar of daily pay roll is 6.8.

Springfield Avenue Pumping Station.—There are 6 200 h.p. Scotch marine boilers, with Hawley down draught furnaces, hand fired, erected in 1900, and 2 250 h.p. Scotch marine boilers, with Hawley down draught furnaces, hand fired, erected in 1907

There are 3 420 h.p., 20,000,000 gal., vertical, triple, direct acting, Worthington engines, 144 ft. piston speed, 17.6 R. P. M., erected in 1900, and 1 840 h.p., 40,000,000 gal., vertical, triple, direct acting, Worthington engine, [illegible] ft. piston speed, 16.7 R. P. M., erected in 1906.

The total rated horse power of the boilers is 1,700 and of the engines is 2,100. The average horse power developed by the boilers is 900 and by the engines is 1,442, the load factors being 53 and 69 per cent respectively.

The daily pay roll is as follows:

12 firemen at $2.96
7 coal passers at $2.74
1 boiler washer at $3.42
6/7 hoist engineer at $5.60

1 chief engineer at $6.85
3 asst. engineers at $5.48
13 oilers at $2.96
1 janitor at $2.47
3 laborers at $2.50
6/7 steamfitter at $5.50
6/7 steamfitter helper at $3.50
6/7 machinist at $5.00

The maximum number of boilers per firemen per watch is 1 and the maximum horse power corresponding is 225. On the day watch there are 1,190 lbs. of coal hand fired per hour per fireman.

The total number of engine units is 4. The number of city pumping engines equivalent to the average number of units in service is [illegible]; the average equivalent number of pumping engines per engineer per watch is 3.9; the average equivalent number of pumping engines per oiler per watch is 1.2. The ratio of the cost of coal to cost of labor is 0.9. The daily pay roll is $146.64. The average pay per man per day is $3.30, per hour is 41 cts. The actual engine horse power per dollar of daily pay roll is 9.8.

Central Park Avenue Pumping Station.—There are 6 200 h.p. and 2 250 h.p. Scotch marine boilers, with Hawley down draught furnaces, hand fired, the former erected in 1899 and the latter in 1907.

There are 3 405 h.p., 20,000,000 gal., vertical, triple, direct acting, Worthington engines, [illegible] ft. piston speed, 17.6 R. P. M., erected in 1900-01, and 1 810 h.p., 40,000,000 gal., vertical, triple, direct acting, Worthington engine, [illegible] ft. piston speed, 16.7 R. P. M., erected in [illegible]

The total rated horse power of the boilers is 1,700 and of the engines is 2,025. The average horse power developed by the boilers is 1,100 and by the engines 1,380, the load factors being 65 and 68 per cent respectively.

The daily pay roll is as follows:

13 firemen at $2.96
4 coal passers at $2.74
1 boiler washer at $3.42
1 conveyor engineer at $3.29

1 chief engineer at $6.85
3 assistant engineers at $5.48
12 oilers at $2.96
1 janitor at $2.47
3 laborers at $2.50

[illegible]

ximum number of boilers per fire-
watch is 1.2, and the maximum horse
rresponding is 254. On the day
the are 1,062 lbs. of coal hand fired
[illegible]
[illegible]
[illegible]
ege number of units in service is 5.2;
[illegible]
[illegible]
[illegible]
oiler per watch is 1.3. The ratio of
[illegible]
[illegible]
[illegible]
engine horse power per dollar of
[illegible]

[illegible] water tube boilers, with chain grates [illegible] to hopper, erected in 1900, [illegible] p., 15,000,000 gal., vertical, triple, [illegible] speed, 15.9 R. P. M., [illegible] in 1889.

[illegible] ing 50 and 111 per cent respectively.

[illegible]

[illegible]	$ 6.87
[illegible]	16.41
[illegible]	2.47
[illegible]	2.71

The maximum number of boilers per fireman per watch is 1 and the maximum horse power corresponding is 340. On the day watch there are 2,160 lbs. of coal gravity fired per hour per fireman.

The total number of engine units is 2. The number of city pumping engines equivalent to the average number of units in service is 2.3; the average equivalent number of pumping engines per engineer per watch is 1.7; the average equivalent number of pumping engines per oiler per watch is 1.15. The ratio of the cost of coal to cost of labor is 0.73. The daily pay roll is $78.76. The average pay per man per day is $3.65, per hour is 46 cts. The actual engine horse power per dollar of daily pay roll is 8.

'EAM AND ELECTRIC RAILWAY SECTION

of Making Culvert Extensions dening Roadbed, New York ral & Hudson River R. R.

[illegible] Engineer.

[illegible]
Hudson River R. R. carried out four
erations for a distance of twelve
en Staatsburg and Rhinecliff on
Division. During the course of
a number of bridges and culverts
to accommodate the additional
The extensions in general were
[illegible]
ft. being reinforced with I-
drawing, Fig. 1, shows a typical
tension of the rail floor type.
ng on the river side was done by
iver with a hammer weighing 2,600
for extensions on the shore side
by a land driver resting on three
These pontoons were built of 3x
w pine on a frame of 6x6-in. tim-
ts being tarred and calked with
ch pontoon was built 28 ft. long,
and 5 ft. wide. The object of the
was to have a support for the driver
be moved from place to place
fficulty and they were made in
ns in order to be small enough
through the openings of the cul-
h in some cases did not exceed 6
hree pontoons were placed side by
bound together by 8x8-in. timbers
oss them. On these were placed an
of 6x6-in. timbers which supported
for the driver.
s on account of shallow water or
ructions it was impossible to get
close enough to the desired spot to
piles. In cases of this kind an
was used. This made it possible
bout 11 ft. in front of the driver.
gger consisted of a frame con-
that it could be hung on the front
s and the hammer raised and low-
front of the frame. The outrigger
8x10-in. yellow pine with 4x6
shown by Fig. 2. The frame was
and 20 ft. high, and wide enough
ront of the leads and carry the
At the front of the outrigger
r side of the timbers forming the
placed guide strips for the ham-
these timbers acted as leads. The
e was run from the top of the
he front of the outrigger, raising
ing the hammer between the fram-
outrigger which took the place of
t. in front of the pile driver. At
and lower side of the outrigger on
xt the pile driver the top cross tim-
allowed to project several inches
e frame. These projecting blocks
een the leads at the top and bottom
trigger and prevented it from slipping sideways. The frame was supported by a block and fall fixed part way up the leads. Upon commencing to drive, the outrigger could be raised high enough to accommodate the pile and as the driving proceeded it could be lowered and kept in the proper position with reference to the pile. With this outrigger a 2,600-lb. hammer was used.

In driving sheathing a longer outrigger was used. This was feasible for the reason that a 1,500-lb. hammer was used to drive sheathing and the stress on the frame was not so great. The outrigger used in driving sheathing was 18 ft. long and 14 ft. high and was built with a diagonal tension member from the top at the front of the frame at an angle of about 45° upward to the end of the frame at the pile driver. This formed a truss to support the weight caused by the additional length of the frame. This diagonal timber was braced with right angle and diagonal braces running between it and the rear member as shown by Fig. 3.

The cofferdams were of 6x10-in. yellow pine grooved sheathing with fillets fitting into the grooves. Driving was done by the same drivers, an outrigger being used where necessary to reach otherwise inaccessible sheathing. One double row of whaling was placed at about high water mark and in deeper foundations another row about 4 ft. lower. The driving of sheathing was carried about 3 ft. below bottoms of foundations. Where spans were long enough to permit, a separate cofferdam was constructed for each abutment, and in a few cases one cofferdam enclosed both abutments. The work was carried on during a dry season, otherwise a method of taking care of the flow from inland streams would have been necessary, where both abutments were enclosed.

Pumping was accomplished by means of a 4-in. centrifugal pump and pulsometer, furnished with power by a 50 h.p. upright boiler. In the case of extensions on the land side the boiler was unloaded beside the bridge by a locomotive crane and set up alongside the track. On the river side the power was fur[illegible] [illegible]. The pumps were set up [illegible] platforms on top of the cofferdams.

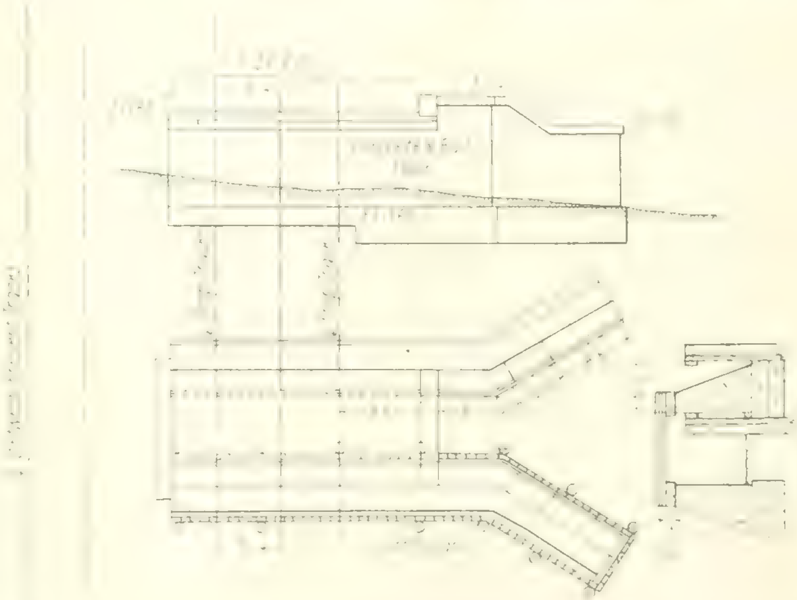

Fig. 1—Typical Plans for Extending Culverts in Widening Track, New York Central & Hudson River R. R.

Leaks in the cofferdams were of several varieties. The most difficult leaks to stop were those caused by openings in the old masonry which formed one end of the cofferdam and to which it was intended to join the new concrete. In excavating below low water it was found that the old stone masonry of the bridges to be extended was in some cases loosely bonded and the water poured into the cofferdams through the seams.

It was possible by pumping to control the water sufficiently for excavation, but the stream of water was too large to permit concreting.

Excavating was done by hand, the material [illegible] and from there out of the cofferdam by other [illegible] When [illegible] tom of the foundation at the old masonry end of the cofferdam preparations were made to commence concreting. A bulkhead was built against the nearest bearing piles and on the side of the piles nearest the old masonry. This bulkhead was pierced by short pieces of rail in order to form a bond between the main body of the masonry and the patch. The object of placing the bulkhead on the old masonry side of the piles was to give the main foundation the advantage of the bearing power of the piles. This left a space of about 18 ins. between the bulkhead and the stonework. The bulkhead was carried above the leaks which brought it usually to about low water mark. The cofferdam was allowed to fill and concrete of a 1:2:4 mix was poured through a closed chute or tremie into the space between the bulkhead and the old foundation, care being taken to keep the bottom of the tremie buried a foot or so in the previously deposited concrete, allowing no water to get into the tremie. Upon commencing the operation a rather dry batch of concrete was used. This acted as a plug and drove the water out of the chute. On top of this and during the remainder of the operation a very wet mix was used. The tremie was at all times kept partly filled with concrete and raised slightly to allow a portion of each batch to run out. After depositing, the concrete was allowed to set for 24 hours before pumping out the cofferdam. This method formed a slab against the old foundation which effectually prevented the water from entering the cofferdam through the old masonry. Leaks in the cofferdam which could not be stopped by calking with oakum were boxed in with bulkheads and sealed under water through the tremie in a similar manner.

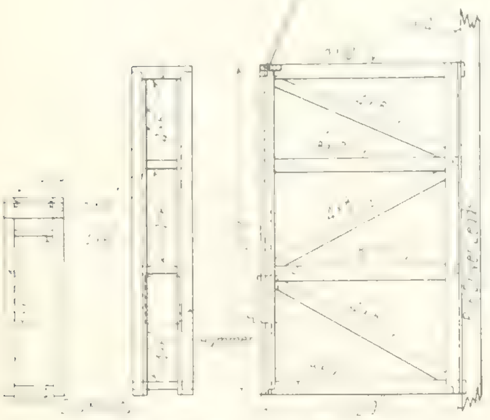

Fig. 2—Outrigger for Driving Piling Beyond Reach of Pile Driver Leads.

Concreting on the shore side was done by hand, but could probably have been done [illegible] platform was built on stringers laid on top of the cofferdams. The concrete was mixed on the platform and deposited through a chute. On the river side the concrete outfit consisted of a scow which carried a derrick, and a ½-cu. yd. Ransome mixer operated [illegible] stone, etc., arrived on scows or small boats and was loaded, from time to time, onto the concrete scow. The extra scows in the mean time remained moored beside the concrete scow. The concrete was mixed on the scow and the mixer, being on the edge of the scow, the concrete could be deposited either directly into the forms through a chute or by means of the derrick and bucket into more remote parts of the forms.

The forms were built of 2x10-in. matched yellow pine tongue and grooved stuff with studs spaced about 3 ft. center to center. All exposed edges were rounded by a 1 in. quarter round concave fillet or moulding. Cracks were filled with soap or clay as were also nail holes and other similar defects. Date plates were made of cast iron and were screwed onto the face of the forms. Screw holes and cracks around the edges were filled with clay and the plate oiled to prevent the concrete from sticking.

After removing the forms the concrete was moistened with water in which a small amount of cement had been mixed, and was then rubbed with a carborundum brick. In moistening the surface before rubbing care was taken not to use too much cement, about three or four handfuls being enough in a pail of water. Too much cement in the water tends to give a bluish color to the concrete and it must also be remembered that the object is not to cover the blemishes with a paste (which would inevitably crack off) but merely to have enough cement to liven up the small amount of sand and dead cement which is rubbed loose. After the surface had been rubbed comparatively smooth it was gone over again with the brush only slightly moistened to remove marks of rubbing. This treatment gives a very smooth finish and one that will not crack off.

Some Considerations Affecting the Choice of Type of Bridge Truss with Notes on Secondary Stresses and the Design of Connections.

Conditions which determine the choosing of pin-constructed or vertical trusses for railway bridges are discussed by Mr. Albert Reichmann in a paper presented to the Western Society of Engineers on Nov. 8, 1911. The requirements of the ideal span are stated and the relative degrees to which these requirements are met by the four available types of construction are considered. The requirements of lateral bracing for compression chords are specified. The use of nickel steel in conjunction with carbon steel is pointed out as objectionable. The importance of eliminating secondary stresses is urged and methods of minimizing such stresses are indicated. The paper follows in abstract:

By an economic design is meant a design wherein the cost of material and labor entering into the construction, will be a minimum. A well designed structure is one which will most efficiently perform its function with a minimum outlay of capital and the lowest annual maintenance charge.

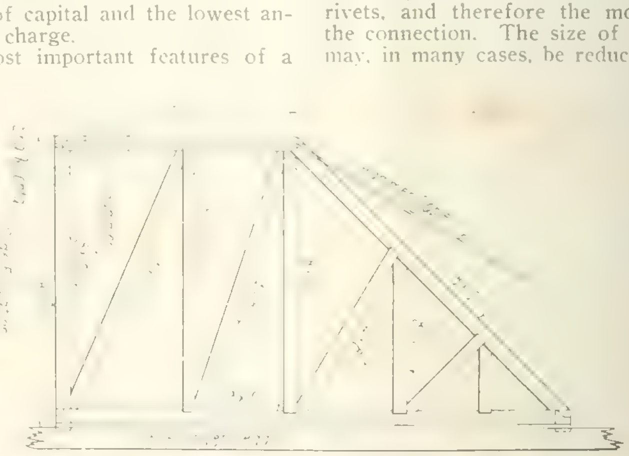

Fig. 3—Outrigger for Driving Sheet Piling Beyond Reach of Pile Driver Lea

One of the most important features of a material to be used in construction work, consists in the ease and simplicity, together with the safety and reliability, with which one member can be attached to another. In structural steel, owing to its homogeneous nature and uniformity of strength, it is possible to determine mathematically the value of connections of one member to another with reasonable margins of safety and secure a perfectly safe structure. Owing to the importance of securing reliable connections of one member
to another, it is perfectly natural th
type of connections used in steel str
should be one of the most important s
to be considered in structural steel des

If we analyze why we departed fr
old-time practice of building pin-co
bridges and substituted the use of the
bridges, we find that in the first place
time pin-connected span was used
consideration of span length. The
pin-connected spans, owing to their e
lightness, the small moment of inertia c
tension members, poor lateral bracin
generally inferior details, vibrated exce
under traffic. The fact that these sma
spans were used out of the sphere
naturally belonged to them, led a great
engineers to abandon the pin-connecte
almost entirely and of recent years w
adopted more extensively the use of t
riveted span for our longer span bridg
has occurred to the writer, however, t
many cases we have substituted riveted
for our long span bridges where a p
nected structure would have been pr

The ideal span to build would be o
is free from vibrations and without sec
stresses, but as this is impossible, the p
then is to select that type of design
has the minimum number of objecti
features. For an ordinary simple tru
there are four types of construction
considered:

First, the truss with built up chor
diagonals and riveted connections thro
or what is ordinarily called a riveted
In this type of construction the span
be made as deep as good designing w
mit. The dimension of the chords an
members should be made as narrow
plane of the truss as permissible. By
ing the depth of the trusses the com
of the diagonals to the chords become s
the deformation of the truss under l
comes smaller and consequently the sec
stresses become smaller.

The problem of selecting the proper
sions of the various members forming
requires a great deal of skill and jud
In the first place the various members
be slender, so as to be as flexible as
in order to reduce the secondary stre
to the bending of the member. On th
hand, with slender members it is exce
difficult to concentrate the rivets in th
nections. This calls for the rivets t
far out into the members; hence the
large gusset plates. The longer the con
becomes, the more uncertain the action
rivets, and therefore the more objec
the connection. The size of the gusset
may, in many cases, be reduced by co
the main member to both sides of th
plate by means of an auxiliary co
plate. By this means the rivets co
the main member to the gusset plat
double shear and thus the number of
can be reduced in proportion.

The slenderness of members calls f
pression members with small moments
ertia, and therefore they are not so eco
as a column as one with a greater mon
inertia. In the case of tension mem

cker material and, therefore, more to deductions on account of rivet [illegible]

are [illegible] with the [illegible] members having large [illegible] s-section in the plane of the truss, possibility of their connections being [illegible] thereof, of having large secondary [illegible] Or, on the other hand, selecting a [illegible] turn calls for small moments of that is to say, the members are not compression members, nor are they [illegible] too concentrated. The great problem ore, to know just where to draw the e selection of the various members.

[illegible] econdary stresses in riveted-truss ne of our specifications call for their mination by lengthening and short- various truss members, amounting pective distortions due to dead load half the live load, and reaming of splices, while the chords are assem- straight line, and then forcing them roper position before the connections agonals to the chords are drilled or This is all right as far as it goes in but when the structure is actually cted it is an altogether different n. If the chords were first riveted and then put on their camber block- [illegible] se results might in a measure be [illegible]

a long fixed span can be swung ssary to rivet all the tension splices ords, so that it is very probable that art of the refinement that was put work in the shop is lost in the field. the truss with built-up continuous nd built-up diagonals, pin-connected ut. The vertical posts and diagonals cted to the chord by means of pins, the case of a continuous chord be- y small, owing to the fact that the ely transmit the increment of the the chords. It is sometimes found to rivet such posts and diagonals. case of reversal of stresses in these in order to avoid the wear in the s. In such cases the stresses to be ed to the chords are very small, in- nsequently the connections are small re, secondary stresses are also This type of construction can be making the chords sufficiently order to make the same flexible liagonals sufficiently wide in the plane ss, so that they are sufficiently strong on the pin and overcome the pin n the structure deflects. It is t this type of construction has mount of secondary stresses.

bjection to this type of span is ghs more than a span with eye- as tension members, and that the [illegible] spliced in the [illegible] he span can be safely swung, which ses is very objectionable as in most ridges it is desirable to make the the least time possible.

e truss with the chords built up shallow in order to be flexible; -bars, pin-connected.

e truss with bottom chords and made of eye-bars. While this type tion is pin-connected throughout tically articulated, the joints are e or less rigid, due to the friction ring of the eye-bars on the pins. reduce to a minimum, the second- sses due to pin friction, it is desirable the bars as wide as permissible and exceed the allowable bearing value ye-bars upon the pins.

extremely difficult to determine the [illegible] secondary stresses [illegible] dge, due to the weight of the bridge asmuch as it is impossible to deter- e frictional resistance upon the pins e various members encounter in righting themselves, while the camber blocking is [illegible]

[illegible] is not perfect [illegible], that bars have [illegible] something about which [illegible] knowledge is rea- [illegible] however, that it is the [illegible] practice of engineers either not to use eye-bars at all or else to use them rigidly, to the limit of their capacity as determined by full size tests. They seldom figure out what amount of econ- [illegible] with a somewhat lower unit stress on the same [illegible] the case of a built up tension member, there is a large amount of material which is wasted, [illegible] part of the primary stress; namely, such ma- [illegible] tions from the section, necessary on account of rivet holes, and material added for lattice-bars, batten plates, etc. If they realized that they could add considerable material to their [illegible] reduce the normal stress in the eye-bars to such an extent that the secondary stresses could be entirely ignored.

The vibration of pin-connected spans may be reduced in several ways. *First*, by making all of the members built up, with, comparatively speaking, large moments of inertia in the plane of the truss; *second*, by making the eye-bars sufficiently wide so that their deflection, due to their own weight, will not be too great; *third*, by weighing down the bridge by means of a ballasted floor. The writer cannot help but feel that when we come to our longer span bridges, the pin connected type bridge is the proper one to build. The main advantages of a pin-connected span with eye-bar tension members, are that it weighs less than other types of construction and can be built in the shop with extreme accuracy so that there is little possibility of encountering trouble in erection through faulty workmanship. Erection can proceed with greater rapidity than with the riveted span, and the writer believes that less skill is required in designing a pin-connected span than a riveted span.

There is a feature in our long span bridges which should be considered very thoroughly, and that is the question of lateral bracing for the compression chords. In the shorter span bridges the loads allowed for wind bracing are ample to provide sufficient material to take care of the actual wind stresses, and also to hold in alignment the compression chords. However, in very long span bridges, the question of providing sufficient lateral bracing for the compression chords to hold them in proper alignment, so that the compression chords will act in unison throughout their entire length and in reality form one compression member when considered in a horizontal plane, should be carefully considered. In this respect the lateral bracing, in addition to performing the function of wind bracing, also performs the same function that the lattice bars do to the individual compression members. However, in the case of an ordinary member the lattice bars connect continuous members, whereas, the lateral bracing must hold in alignment members which are not thoroughly spliced, and are, therefore, more liable to be out of true alignment on account of imperfect workmanship.

It is not an easy matter to determine the amount of lateral bracing which it is necessary to provide to hold the compression chords in proper alignment, owing to the fact that we have not made sufficient tests of large size compression members to determine just how much material is required to hold in proper alignment the main sections of a compression member.

This same question of uncertainty applies to the proper bracing of the top flange of our through plate girder bridges. The writer is well satisfied that a large number of our designers do not have the same margin of safety in the compression flange of their through plate girder bridges as they have in the tension flange. Some recent tests of plate girders show that the ultimate strength of the top flange is about the elastic limit of the material. In order to make the top flange of a through plate girder bridge the same strength as the bottom flange, we should have some formula to guide us in the proper proportioning of the top flange. A formula for this purpose can be developed only by a series of experiments. However, in the meantime it seems to the writer that we should apply our column formula to these flanges. Of course, the value of intermediate supports should be given proper consideration.

Another feature in our plate girder designs, which the writer is inclined to believe will cause our engineers some regret, is that they have not as a rule increased the thickness of their web plates in the same ratio that they have increased their flange areas. This is especially true of the long plate girder spans. When the large web plates are rolled at the mills the edges of the plate cool first which causes the plate to become "dished." In order to eliminate this dishing or buckles in the web, it is necessary to put these web plates in the bending rolls until the buckles are eliminated. After this the plates are straightened for use. There can be no question but what there are heavy secondary stresses in all these large web plates. In addition to this the web plates are more exposed to corrosion than any other part of the structure and if there is any deterioration in this structure, the web plates will show the greatest portion of this deterioration.

In many cases stringers and the shorter span plate girders could be built not only better, but also cheaper, by omitting stiffeners altogether, except at end connections or bearing points and in cases where necessary on account of other connections, and putting a like amount of material in the web, thereby obtaining a much stronger web and adding some to the strength of the flanges.

It frequently happens that heavy portal or sway bracing is attached to the upper part of bents, leaving the lower portion unbraced, and due consideration is not given to the bending which this portal or sway bracing might induce into the columns; the columns are merely provided with ordinary lattice bars below the portal or sway bracing instead of being provided with proper web plates or cover plates to transmit the shear to its proper destination.

Lattice-bars should be eliminated where it is practicable, inasmuch as their function consists merely in holding members together, and they do not assist materially in transmitting the main stresses, whereas, if a solid plate were used it would form a part of the member as well as take care of any local shear that might be manifest.

In order to get accurate workmanship in large compression members, they should be so designed that they can be completely assembled in the shop before riveting. This practically means that even some of the smaller compression members should have lacing bars with at least two rivets at each end, in order to keep in proper alignment the members while they are being riveted in the shop. The larger members should have sufficient diaphragms to insure the proper amount of rigidity.

There is a tendency among engineers to over-rivet their compression and tension members to make the material act as a unit, and it often happens that the material is weakened by this means. Material should be used as it comes from the mills with as little labor on it as possible.

In many cases the specifications call for symmetrical sections, but do not mention the fact that the connections should be symmetrical or at least an equal number of rivets on each side of the center line of the member.

Some engineers are inclined to lay down rules to others which they themselves are not following—for instance, in trough floor construction used extensively for track elevation purposes. These troughs are filled with con-

[illegible] inspection. The writer believes that much better results might be obtained by using I-beams and reinforced concrete decking on top of the I-beams with ballasted floor on top of the concrete. In this way the structural material is always accessible for painting and inspection.

In the designing of our mill buildings, especially where high speed traveling cranes are used, special attention should be paid to the proper distribution of the lateral forces induced by the traveling cranes throughout the building. In cases of this kind, the bottom chords of the roof trusses should be provided with a good lateral system extending the full length of the building, so that the lateral forces will be thoroughly absorbed throughout the structure.

NICKEL STEEL.

[illegible] have been advocating the use of nickel steel and other steels of high ultimate strength. Inasmuch as the modulus of elasticity of nickel steel is the same as that of carbon steel, the structures designed with these steels of high ultimate strength, where the unit stresses are from two and one-half to three times those used for ordinary carbon steel, the deformation and deflections will be from two and one-half to three times those of structures built of ordinary carbon steel. As the deformation of the structure increases, the secondary stress also increases in proportion. What is more, even if the secondary strains have been rectified for the dead load, the deflections due to the live load will be much greater in proportion in structures of nickel steel than in those of carbon steel, for the reason that the weight of the live load in this case is much greater in proportion to the weight of the dead load than is the case where ordinary steel is used. In addition, the deflections caused by the passing of the live load over the structure are much greater owing to the increased unit stress employed.

For the above mentioned reasons, structures built of steel of high ultimate strength should be designed with the minimum secondary stresses. One of the worst features in connection with the use of nickel steel has been that some of our engineers have used carbon steel in conjunction with nickel steel. Take the case of a simple truss span, where the chords are made of nickel steel and the lateral bracing is made of carbon steel. The two chords are tied together by the lateral bracing forming one compression member, and any deformation which takes place in the chords due to the compression of the same must be borne proportionately by the laterals. This means that the lateral bracing may be stressed up to its elastic limit, while the chords themselves are not stressed beyond their usual requirements.

In stating that nickel steel and carbon steel should not be used together, is meant in such parts of the span that act in unison. For instance, there can be no objection to the use of carbon steel in a nickel steel structure for floor beams and stringers, or such members as act independent of the main structure, provided ample provision is made for the stringer connections to expand. These are points, however, which can be taken care of in the design of the structure.

[illegible]

The future development of our bridges depends upon the careful consideration and elimination, as far as possible, of the secondary stresses. It will be observed that in none of the various types of spans considered is it possible to eliminate entirely the secondary stresses in the chords. The secondary stresses may be reduced by the selection of the proper section for the diagonals and their attachments to the chords. Secondary stresses are developed in trusses through the connections of the lateral bracing and the floor system. In a through bridge the elongation of bottom chord produces an elongation in the bottom laterals, resulting in heavy secondary stresses in both the floor beams and laterals when they are attached to the stringers and intermediate points. In a deck bridge chord being in compression is red length, while the bottom flange of th ers is elongated more or less, for whic the stringers should be provided wit sion joints at the floor beams in avoid excessive secondary stresses.

To minimize the effect of secondary in a truss, it is well to omit knee and sway frames at intermediate pane

The main posts of a truss should the full depth of the truss wherever in other words, bracing to increase ciency of posts and the use of sub-str terially increases the secondary stresse beams should be made deep and connected to the posts. In order t chord stresses to be transmitted to their end connections should be made This can be done by using a wide the outstanding leg of the angle co the stringer to the floor beam.

When a truss with subdivided panel the unit stress of the floor beam should be very low so as to keep d elongation in same, as the elongatio hanger produces heavy secondary st the chords to which it connects.

Aside from the make-up of the members of a truss span and their con a great deal depends upon the type itself. Secondary stresses are very m increased or decreased according to of the truss, whether it is a single inte a multiple intersection or a multipl section with vertical posts or without posts.

Another source of secondary stres truss is due to the fact that the bottom are, as a rule, attached to the botton post quite a distance below the botto so that the chord stresses in the lat tem must travel through bending in into the bottom chord. Besides thi laterals are not generally run in centr the chord, thereby inducing uneven tion of chord stresses.

GENERAL ARTICLES AND CLASSIFIED ITEM

Average Construction Costs of Steam Turbo-Electric Power Plants.

The average range of costs of constructing steam turbo-electric plants is given in a discussion before the Engineers Society of Western Pennsylvania by O. S. Lyford, Jr., and R. W. Stoval of Westinghouse, Church, Kerr & Co. The plants are assumed to have no other equipment than that required efficiently to produce alternating currents. Bituminous coal is the fuel assumed to be used. The costs are shown in the accompanying table, and the authors explain the several items as follows:

Some of the group costs in this table do not have any very specific relation to the kilowatt capacity installed in the plant and the probable range in such costs is a matter of experience with previous cases. This refers to such groups as "Preparing Site," "Yard Work," "Electrical Switching Equipment" and "Service Equipment." For instance, the main item of cost coming under the "Yard" group is generally that of condensing water flumes exterior to the building and it will be readily understood that this cost is affected much more by the relative location of the building to the water supply and by the character of work required than by the actual size of the plant.

Similarly the electrical switching equipment costs depend much more on the extent and the scope of the electrical distributing system than upon the actual capacity of the plant. Again the largest item of the "Service Equipment" costs, namely that of coal handling depends upon the existing physical conditions much more than upon the capacity.

Some of these [illegible] groups, however, be reduced to other units than that of the kilowatt, and this permits a clearer understanding of their range.

The foundation costs, for instance, will run from $1.25 to $4 per square foot of building plan area, depending on the character of the soil; the lower cost covering simple concrete footings on thoroughly good bearing soil, while the necessity for piling, waterproofing, excessive rock excavation, etc., will run this cost toward the higher limit. Then the plan area will vary from 0.8 to 1.5 sq. ft. for each kilowatt of capacity installed, depending upon the size of the units and upon their arrangement; the combined effect of these two cost ranges giving the range in price per kilowatt shown on the table.

The building cost will vary from 8 cts. to 12 cts. per cu. ft. of overall building volume, according to the size of the building, and the character of construction and the local price of building materials and labor. Depending again upon the size of the units and upon the efficiency used in arranging them, there will be required from 50 to 100 cu. ft. of volume per kilowatt of capacity. The combined effect is to make the building costs range from $4 to $12 per kilowatt as shown.

In boiler room equipment the cost of materials and labor will generally be between $30 and $40 per nominal boiler horse power, and generally there will be installed between 0.4 and 0.6 boiler horse power per kilowatt of capacity, resulting in the cost range shown on the table.

From this table it is seen that the cost of such stations under normal conditions may range in price from $40 to $85 per kilowatt of maximum continuous generator capacity. So far known to the writers, no stations have as yet been built for the lower fig this minimum is possible only with tremely fortunate combination of stances, such as natural advantages tion combined with most favorable si arrangement of apparatus.

It is apparent from this table th may be a very large difference in costs of two stations of the same s that this may be the case, even tho two stations have been designed a with equal ability and economy.

TABLE SHOWING COST OF STEAM
ELECTRIC GENERATING STATI
From say 2,000 to 20,000 K. W. Capacit
on Maximum Continuous Capacity
Generators at 50° Rise.

	Dollars I K Hig
PREPARING SITE — Dismantling and removing structures from site, making construction roads, tracks, etc.	$ 0.5
YARD WORK—Intake and discharge flumes for condensing water, railway siding, grading, fencing, sidewalks, etc.	2.5
FOUNDATIONS — Including foundations for building, stacks and machinery, together with excavation, piling, waterproofing, etc.	6.
BUILDING—Including frame, walls, floors, roofs, windows and doors, coal bunker, etc., but exclusive of foundations, heating, plumbing and lighting	12.0
BOILER ROOM EQUIPMENT—Including boilers, stokers, flues, stacks, feed-pumps, feed-water heater, economizers, mechanical draft and all piping and pipe covering for entire station except condenser water piping	24.0
TURBINE ROOM EQUIPMENT—Including steam turbines and generators, condensers with condenser auxiliaries and condensing water piping, oiling system, etc.	22.0

AL SWITCHING [illegible] MENT—Including exciters [illegible] kinds, masonry switch [illegible] with all switchboards, [illegible] instruments, etc., and [illegible] except for building [illegible] 5.00

EQUIPMENT Such as [illegible] lighting, heating, plumb[illegible] protection, compressed [illegible] niture, permanent tools, [illegible] handling machin[illegible] etc. 2.50

[illegible] UP Labor, fuel and [illegible] getting plant ready to [illegible] load 0.50

L CHARGES Such as [illegible] ering, Purchasing, Super[illegible] Clerical Work, Construc[illegible] and Supplies, Watch[illegible] eaning up, etc., etc....... 6.00

[illegible]

[illegible]TERS TO THE EDITOR.

[illegible] with Water Jets for Removing the Drill Cuttings.

[illegible] has been in use over 20 years; the [illegible] at work sinking [illegible] ft. deep. This well was drilled in 6½ [illegible] have floated the cuttings out over the [illegible] drill hole 300 ft. deep [illegible] through a 1-in. pipe [illegible] of the [illegible] ment Co., near Mitchell, Ind., in [illegible] was used for boring heavy blast [illegible] were the first [illegible] drilled there. The drilling cost [illegible] included wages for drill[illegible] gasoline for the engine, lubricating [illegible] dressing. In the Rock Leick quarry [illegible] bore from 5 to 8 ft. an hour, but we [illegible] a good day's run because the drillers [illegible] their work on account of [illegible] impossible to keep [illegible] count. I have given the cost as shown [illegible] feet drilled and the mone[illegible]

[illegible] ill tool may be seen in the illustration [illegible] against the truck frame. It is made of [illegible] quality of tool steel, forged out of the [illegible] cutting edge like a cold chisel, [illegible] the side cutters both on one side. [illegible] cutters are sharpened to a gage [illegible] as the point, and both cutting edge [illegible] cutters are carefully tempered. In [illegible] of drill-bit the water flows through [illegible] shown in the cut, and down the groove [illegible] cutting edge, thoroughly lubricating the [illegible] washing out the cuttings, giving the [illegible] unobstructed drop all the time.

[illegible] mon double action pump with a vari[illegible] ke is used, so as to feed the right [illegible] of water through a pipe to the top of [illegible], with a return elbow at top of pipe. [illegible] in. hose on the elbow, hanging in the [illegible] of drill shaft while drilling. In forcing [illegible] own deep holes or where the muck is [illegible] y to float easily, a reversible valve is [illegible] ler the top point of the drill shaft. [illegible] kes the hydraulic connections from the [illegible], the top pipe of the drill shaft un[illegible] y, and does the work better.

[illegible] holes I use 2½-in. extra and double [illegible] long pipe, with hydraulic couplings for [illegible] shaft, and screw the pipe together [illegible] ends of the pipe are tight. When [illegible] erse valve is used it fits in the coupling, [illegible] the two upper sections of pipe.

Respectfully yours,

CHAS. E. WYMAN

[illegible], Ind., Feb. 8, 1912.

[illegible] ions for Solving a Problem in Excavating.

The situation mentioned by "Con[illegible] in your issue of Feb. 21 has occasion[illegible] en in a large drain which I have just [illegible] ompleted. My custom has been to take [illegible] by the horns and throw it an earth [illegible] ad of the machine. If the grade is not [illegible] ough to dry the cut below the dredge [illegible] a small mud bank will keep out

[illegible] drilling from the [illegible] sledges, and [illegible] to have a good lifting [illegible]. I never have had much satisfactory [illegible] hardpan from the top. The drill bars should have enlarged [illegible]

The obstruction should be taken out for $2,000 or so if the hardpan is not too hard. The annoying feature in "Contractor's" case [illegible] up while the cut is being taken out. Perhaps he can jump the bar in the spring flood; or perhaps, as the course of the work is up[illegible]

If "Contractor" is engaged in a drainage ditch, he will probably be able to get an in[illegible] tered into the contract. Yours truly,

G[illegible]

[illegible] sufficient for his dredge to operate, "Contractor" might improvise a "Liebnitz" rock crusher by replacing his orange peel bucket with a heavy chisel-shaped bar of iron. He could probably crush the hardpan with the bar for the required distance and depth, then excavate with the bucket.

Very truly yours,

[illegible]

[illegible]

The First Use of Reinforced Concrete.

Sirs: I have been greatly interested in the very valuable and instructive articles on concrete inspection appearing in the pages of Engineering & Contracting. Mr. Cochran is handling the subject in a practical manner and every young engineer should preserve this series.

One error, however, was noticed on page 232 of the issue of Feb. 28, which should be corrected. He says "The first use of steel reinforced concrete in a scientific manner was made by W. E. Ward in erecting a building in Port Chester, N. Y., in 1875. * * * There has been a very rapid development in the use of reinforcement for concrete in structures in this country within the past ten years. In fact, very little, if any, reinforcement was used prior to this time."

In the first place the residence of Mr. Ward was the first built in the United States. In 1830 the roofs of pig sheds and poultry sheds were reinforced on some English farms. In 1840 the Vaux system and the Thuasne system of reinforced fireproof floors were in use in France, the mortar, however, having in it plaster-of-paris instead of hydraulic cement. In 1854 an English patent on reinforced concrete was taken out by Mr. W. B. Wilkinson, a plastering contractor. In 1855 Francois Coignet took out a French patent. In 1861 joint patents were taken out in France by MM. Coignet & Monier. Patents were granted in Great Britain in the following years: C. C. Dennett, 1857; Matthew Allen, 1862; Frederick Ransome, 1865; H. Y. D. Scott, 1867; Philip Brannon, 1870; Monier, 1867-1873. In the United States Thaddeus Hyatt commenced experimenting in 1873 and in 1877 were performed for him a series of experiments, now classic, in London. In that year patents were granted him in Great Britain and the United States. At the date of the erection of the house of Mr. Ward in 1875 in the United States more than a hundred reinforced concrete structures had been erected in Europe and Mr. Ward obtained his ideas from buildings inspected while on a European trip.

Referring to the statement that little, if any, reinforcement was used prior to ten years ago, I have shown how far the use of reinforced concrete had progressed in Europe more than ten years ago. [illegible] San Francisco [illegible] of the Hyatt patents on the Pacific Coast in 1879, his first reinforced concrete sidewalk being put in early in 1880, although I was told by an old workman that he knew of a warehouse floor made of reinforced concrete after the Monier [illegible] San Francisco. This I was never able to verify. Mr. Ransome was engaged in concrete work in San Francisco when Mr. Jackson was licensed under the Hyatt [illegible] bars, his patent being granted in 1883 for the use of twisted bars for reinforcing concrete. I received my engineering education in San Francisco, graduating in 1887, and the use of reinforced concrete was so common for sidewalks and warehouse floors that none of the engineering students were aware that it was a particularly new form of construction. Mr. Ransome was an indefatigable advertiser and Mr. Jackson was not one whit behind him. I was employed for a time in 1887 in the offices of Percy & Hamilton, a prominent firm of engineers and architects, and the men who did much of the early theoretical investigation for Mr. Ransome, my first work being the figuring out and drawing plans for some reinforced con[illegible] "Reinforced Concrete Construction," by Turneaure & Maurer (2nd ed.), appears the following: "But the Pacific Coast saw the actual early development of this form of construction. H. P. Jackson, G. W. Percy and E. L. Ransome were the pioneer workers. Jackson has been credited with reinforced concrete constructions dating as far back as 1877, but Ransome executed the most notable early examples. Among these are a warehouse (1884-5), a factory building a few years later, the building of the California Academy of Sciences (1888 or '89), and the museum building of the Leland Stanford Junior University (1892)." The foregoing extract bears me out in some of the above statements.

My reason for writing this letter is to prevent your readers from being led astray by the statements of Mr. Cochrane made without due consideration. Engineers have been charged with being less interested in the historical side of the profession than are the men engaged in any other profession. It is the duty, therefore, of all engineers to correct immediately any lack of accuracy they may observe in statements regarding engineering processes or materials.

Yours truly,

ERNEST McCULLOUGH

Chicago, Ill., Feb. 29, 1912.

PERSONALS.

Mr. Ovington E. Weller of Arlington, Md., has been appointed Chairman of the State Roads Commission to succeed Mr. John M. Tucker, whose resignation will take effect March 1.

Mr. F. W. Welsch has been appointed Assistant Division Engineer of the Lehigh Valley R. R., with headquarters at Buffalo, N. Y. He was formerly Assistant Engineer at Sayre, Pa.

Mr. L. Beauman, Division Engineer of the Southern Pacific Co. at Stockton, Cal., has been appointed Assistant Superintendent of the Salt Lake Division. His headquarters are at Ogden, Utah.

Mr. J. R. Wemlinger, President of the Wemlinger Steel Piling Company, 11 Broadway, New York, has been re-elected Secretary of the American Society of Engineering Contractors, with headquarters at 13-21 Park Row, New York.

Mr. Clifford Richardson, M. Am. Soc. C. E., Consulting Engineer, New York City, delivered a lecture on Feb. 16 on "Trinidad and Bermudez Asphalts and Their Use in Highway Construction" before the graduate students in Highway Engineering at Columbia University.

Mr. Henry S. Hayward was recently appointed Consulting Engineer of Floating Equipment for the Pennsylvania R. R. He was born Sept. 19, 1845, at Brooklyn, N. Y. He entered the service of the Pennsylvania April 1, 1873, as a machinist and later became a draftsman and civil engineer. His headquarters are in Jersey City, N. J.

Mr. Francis H. Stillman, President of the Watson-Stillman Company, died suddenly Feb. 18 at his residence, 105 Rodney street, Brooklyn, in his 62d year. The day before his death he was at his office as usual and apparently in the best of health. Mr. Stillman was born in New York on Feb. 20, 1850, was graduated from Yale in the class of 1874 with the degree of B. S. He is survived by his widow and two sons. Mr. Stillman was a member of the Brooklyn Engineers' Club, the American Society of Mechanical Engineers and treasurer and director of the National Association of Manufacturers.

Catalogs Worth Having.

[illegible] file the latest catalogs of machines, tools and supplies that they use. In sending for cata- [illegible] will confer a favor on us if you will write directly to the advertisers and state that you saw the catalog mentioned in ENGINEERING & CONTRACTING. If you are in the market for tools, machinery or supplies, tell us and we will notify promptly the leading manufacturers.

Corrugated Products [illegible]

[illegible] controlled by the company include corrugated bars, corr-bar units, corr-mesh, corr-bar-o waterproofing, corr-tile and corr-plate floors. Complete specifications, illustrations, designing [illegible] are given.

Another catalog entitled Corr-Tile, or Two-Way Floor Construction, paper, 6x9 ins., 52 pp., gives complete information regarding this system with illustrations and diagrams.

Another book, paper, 6x9 ins., 48 pp., gives [illegible] etc., regarding corr-mesh and shows examples of installations.

[illegible] forced concrete and contains an advanced re- [illegible] versity by Frank J. Trelease.

Converse Rotary Screen.—Paper, $7\frac{1}{2}$x$10\frac{3}{4}$ ins., [illegible]

This circular illustrates and describes rotary screens and gives a list of prices and dimensions of different sizes of screens.

Cranes. [illegible] Bay City, Mich.

This is catalog No. 104 on railroad and commercial cranes embracing wrecking, locomotive construction, pillar and hand power cranes. Also pile drivers, transfer tables, portable rail sawing machines and clam shell buckets. The catalog is well illustrated and the illustrations show details of the mechanical design and also views of various machines under operating conditions.

Ornamental Street Lighting. [illegible] ins., 32 pp. MacBeth-Evans Glass Co., Pittsburgh, Pa.

This book describes methods of ornamental street lighting in connection with Alba Globes and gives average cost of erecting and maintaining the ornamental street lighting systems of representative cities. Charts showing illumination curves on a line between posts, and other data of interest and use are given. The book is well illustrated.

Sprague Electric Fans.—Paper, 8x10 ins., 40 pp. General Electric Company, 527 W. 34th St., New York City.

This catalog gives complete illustrations and data regarding all classes of electric fans.

Hess Flumes.—Paper, 10½x7½ ins., 18 pp. The Hess Flume Co., 635 First Natl. Bank Bldg., Denver, Colo.

This attractive catalog gives illustrated descriptions and data as to sizes, dimensions and construction with line drawings, etc., of the Hess Galvanized Flumes made with a smooth interior and built of Toncan metal.

Vanadium.—Paper, 8x10½ ins., 7 pp. American Vanadium Co., Frick Bldg., Pittsburgh, Pa.

This is a monthly bulletin containing illustrated articles descriptive of the uses to which vanadium is put.

Crushing Machinery. [illegible] pp. Indiana Road Machine Co., Fort Wayne, Ind.

This catalog contains descriptions, illustrations, tables of sizes, dimensions, specifications, etc., of road building and rock crushing machinery.

Supplies.—Paper, 7x9 ins., 88 pp. Harrison Supply Co., 5 Dorchester Ave. Extension, Boston, Mass.

This catalog covers chilled steel shot, granite and marble polishing machinery and supplies of every description. The catalog contains illustrations, tables of dimensions, prices, etc.

Design of Dams. Paper, $6\frac{3}{4}$x$9\frac{3}{4}$ ins., 40 pp. Ambursen Hydraulic Construction Co., 88 Pearl St., Boston, Mass.

[illegible] the design of dams.

[illegible] study of cement and costs and show the company's system by illustrations of cost sheets of an actual job.

Coal Plants. Paper, 6x9 ins., 24 pp. Allen & Garcia Co., McCormick Bldg., Chicago, Ill.

This catalog illustrates and describes various coal washeries, coal tipples, factory buildings and steel bridges which this company has designed [illegible]

Blaw Publications.—Paper, 6x9 ins., 24 pp. Blaw Collapsible Steel Centering Co., Pittsburgh, Pa.

Bulletin No. 49 contains a reprint of an article describing work on the Fourth Ave. subway, New York, with reference to Blaw forms used in that construction.

Bulletin No. 48 contains illustrations and letters from users of Blaw steel forms for concrete wall construction.

Bulletin No. 50 contains line drawings and descriptions of steel forms for walls, columns, girders, beams and floors.

Bulletin No. 51 contains line drawings and half-tone illustrations, together with descriptive data on steel forms for concrete fire proofing of steel frame buildings.

Bulletin No. 52 is devoted to steel forms for circular tanks, grain elevators, etc.

Hassam Pavement.—Paper, $8\frac{1}{2}$x$4\frac{3}{4}$ ins., 28 pp. Hassam Paving Co., Slater Bldg., Worcester, Mass.

This catalog contains a description of the methods of construction of this pavement with illustrations showing installations. Letters from city officials, etc., are given.

Surveying Instruments. [illegible] tion, Boston, Mass.

This catalog shows illustrations of surveying instruments, giving specifications and prices [illegible]

Expanded Metal. Paper, 6x9 ins., 12 pp. [illegible] Buren St., Chicago, Ill.

This is the March issue of the company's bulletin describing expanded metal construction and showing tests made on various classes of work. The booklets of the company containing designing data, tables and specifications for the use of expanded metal and expanded metal lath are as follows:

Designing Data No. 1 containing full information regarding the use of expanded metal for reinforcing forms and sidewalks; No. 2 for bridges, sewers, tanks and walls; Silo Booklet for construction of silos without the use of forms; Overcoated Houses; Kno-Burn Lath Catalog for plastering lath; 20th Century Lath, containing full information regarding 20th Century acid resisting expanded metal plastering lath

H-P Spreader.—Paper, 6x9 ins., 8 pp. A. Burlingame Co., Worcester, Mass.

This contains an illustrated description of the H-P spreader for bituminous road material. The design of the machine is described and shown by illustrations and line drawings.

Spraying Machine.—Paper, 6x9 ins., 4 pp. Standard Manufacturing Co., 186 Union St., Worcester, Mass.

This contains an illustrated description of the Johnson Oil and Tar Spraying Machine for road work.

Tunaloid.—Paper, 6x9 ins., 44 pp. Flintkote Mfg. Co., 88 Pearl St., Boston, Mass.

This catalog is entitled "The Waterproofing of Structures" and deals with the subject with special reference to sublevel construction, the envelope method and the use of Tunaloid. Illustrations of construction are given in connection with descriptions.

Universal Cement.—Paper, 6x9 ins., 40 pp. Universal Portland Cement Co., Pittsburgh, Pa.

This is the February bulletin describing work in which concrete is used.

Concrete Chimneys.—Paper, 5x8 ins., 24 pp. General Concrete Construction Co., Manhattan Bldg., Dearborn St., Chicago, Ill.

This booklet contains an illustrated description of the design and construction of tapering chimneys with letters from companies for which chimneys have been built.

Concrex Waterproofing.—Paper, 5x7 ins., 24 pp. Flintkote Mfg. Co., 88 Pearl St., Boston, Mass.

This booklet describes the waterproofing of concrete roofs with Concrex and shows illustrations of applications of this material to various structures.

Surveying Instruments.—Paper, $5\frac{1}{4}$x$6\frac{3}{4}$ ins., 116 pp. L. Beckman Co., Toledo, Ohio.

This booklet contains specifications, dimensions, prices and illustrations of levels, transits compasses and accessories.

Steam Tables for Condenser Work.—Paper, 4x7 ins., 32 pp. Wheeler Condenser & Engineering Co., Carteret, N. J.

This booklet contains tables which have not been published before and which were calculated especially for this book, which should be of practical service to engineers having to do with engineering and condenser work. The booklet is a handbook of steam tables, with pressures below atmosphere expressed in inches of mercury referred to a 30-in. barometer; also includes a discussion of the use of the mercury column, the errors in such measurements and constants for their correction.

Reliance Hoisting Engines.—Card, 8x3¾ ins [illegible] St. Louis, Mo.

This mailing card contains illustrations of Reliance 3 Drum Hoisting Engines with boiler, the Owen Portable Steel Crane and Bucket, the [illegible] Patent Accelerated Valve Mo

[illegible]ing Recording Instruments.—Paper ins. The Uehling Instrument Co., Passaic

Bulletin No. 102 describes a line of instruments for pressures up to 30 square inch.

[illegible] Trucks. Paper, 6x9 ins., 4 pp. Commercial Car Co., Ottumwa, Ia.

This pamphlet describes the mechanic tures of the Dain Car and gives specifications for a 1-ton car.

Motor Trucks.—Paper, 7x10½ ins., 12 pp. Mogul Motor Truck Co., Chicago, Ill.

This catalog describes and illustrates t gul truck of two to six tons capacity.

Sampson Motor Trucks.—Paper, 6½x10 ins. 16 pp. U. S. Motor Company, 8 W. 62d St. New [illegible]

This catalog gives illustrations, description and specifications of Sampson trucks (1,000 pounds to 5 tons' capacity.

Speedwell Trucks.—Paper, 11¾x7¾ ins Speedwell Motor Car Co., Dayton, Ohio.

This catalog contains a detailed descri motor trucks of 4 and 6-ton capacities sions and line drawings are given.

Water Power.—$8\frac{1}{4}$x10½ ins., 16 pp. Ge Henry, Jr., Hydraulic and Mechanical De and Constructing Engineer, Rialto Bld Francisco, Calif.

This catalog gives a brief outline of th acter of the apparatus which Mr. Henry pared to design and build to suit the pa necessities of each installation. The shows illustrations of installations and of the construction of tangential wheels cis turbines, pipe lines, etc.

Steam Acetylene Generators.—Paper, ins., 8 pp. The Alexander Milburn Co., Lombard St., Baltimore, Md.

This catalog illustrates and describ steam generator used for acetylene light locomotive headlights, railroad coaches, yachts, etc.

Diamond T Trucks.—[illegible] Diamond T Truck Car Co., 512 W. Hu Chicago, Ill.

This pamphlet gives illustrations and cations for a 5-ton truck.

Mack Trucks.—Paper, 4x9 ins., 12 pp. national Motor Co., Broadway and 57th St York City.

This catalog gives illustrations and sp tions of Mack trucks of 1 to 7-ton capaci

Premier Trucks.—[illegible] mier Motor Mfg. Co., Indianapolis, Ind.

This pamphlet gives an illustration Premier chassis with specifications for a [illegible]

Ferro Engines.—Paper, 9x12 ins., 48 pp. Machine & Foundry Co., Hubbard Ave. 66th St., Cleveland, Ohio.

[illegible] equipment with a practical treatise on [illegible] illustrated and written. Specifications, [illegible] marine engines are given. Prices are also

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Civil Engineering Society Meetis.

National Paving Brick Manufacturers [illegible] March 4-6.

Illinois Water Supply Association.— Bartow, Urbana, Sec'y. Annual meeting bana, March 5-6.

Canadian Mining Institute.—Annual [illegible]

National Brick Manufacturers' Associa T. A. Randall, Indianapolis, Ind., Sec'y. convention at Chicago, March 6-9.

International Brick and Clay Products Exposition.—First annual meeting, Coliseum, Chicago, March 7-12.

National Association of Cement Users. E. Krauss, Harrison Bldg., Philadelphia Annual convention at Kansas City, Mo., 11-16.

Missouri Highway Engineers' Associat M. Cloch, County Highway Engineer, County, Sec'y. Annual meeting at Kansa Mo., March 13-14.

Kansas City Cement Show.—Conventio Kansas City, Mo., March 14-21.

National Railway Appliances Associatic V. Crandall, Ellsworth Bldg., Chicago Annual meeting at Chicago, March 18-23.

American Railway Engineering Associa E. H. Fritch, 962 Monadnock Blk., C Sec'y. Annual meeting at Chicago, March

American Society for Testing Materials gar Marburg, Unit. of Penn., Philad Sec'y. Annual meeting at New York March 28-29.

National Drainage Congress.—Annual m at New Orleans, La., April 10-13.

CONTRACT NEWS SECTION

of

ENGINEERING & CONTRACTING

e 'oings f e Veek.

[illegible] prospects continue to grow [illegible] establish a top notch record [illegible] t i double track work which it has in ıe Chicago & Northwestern Ry. has [illegible] i y that the contracts will be let this he time for opening bids on the unk Ry. work, calling for the con- the first section of the Southern [illegible] some extensive railroad work in l and quite a number of middle [illegible] the Louisville & Nashville R. R.— e & Maxfield, Miamisburg, O., to [illegible] River in Tennessee. Luck Con- Roanoke, Va., to build 23 miles nning at Brentwood, Tenn., and ithward. The Ryan Co., Ports- . to build 13 miles of road extending n Athens, Tenn. W. J. Sparks Con- [illegible] l near Lewisburg, Tenn. T. L. Marion, N. C., to build 3 miles of nding north from Brentwood, Tenn. n. Falls Mills, Va., to build 6 miles north of Brentwood, and a tunnel 15 idth near Nashville. Asheville Con- . Asheville., N. C., contract for steam shovel work near Athens. ims & Sullivan, 215 South Fifth St., . to build 14 miles of road near prings, Ala. A & C. Wright, Ash- to build 8 miles of road near Del- Charles Sigler, Houston, Tex., for railroad spur from Downs Station, the U. S. Government. Northwest ng & Construction Co., 804 Germania .. St. Paul, Minn., for the 8-mile sec- e Ontario & Northern Ry. from Wil- ntario, Wis.; W. A. Dutton, Winni- .. for constructing 85 miles of grade tension of the Canadian Pacific line [illegible] anadian Pacific between Regina [illegible] Edmonton, Alberta, for building 25 line for the Canadian Pacific from Canada. McMenamin & Sims, Ar- . Philadelphia, Pa., for double track- he Pennsylvania R. R. from Honey scopeck on the Sunbury Division. M. Davis, Quebec, Que., for construct- iles of branch line for the Govern- va Scotia Ry. from Dartmouth east Settlement. John Runquist, Duluth, r constructing the 34 miles of the lectric R. R. in Minnesota.

incipal drainage contract of the past ears to be the one awarded to Englert onterey, Ind., for work in Indiana. ract amounts to about $164,000 and bout 3,000,000 cu. yds. of excavation. ve re-paving work is planned for the of Manhattan, New York City. Late rom that city state that at least $3,- ill be available for the work, and racts will be advertised in the near vering a large portion of this work, which will include sheet asphalt, granite, and wood block pavements, all laid on concrete foundation, together with certain other varieties in smaller quantities.

[illegible] City has awarded a large contract to J. F. Cogan Co., 280 Broadway, New York City. This work covers Contract No. 72 in connection with the Catskill aqueduct and includes clearing and grubbing Ashokan reservoir in towns of Olive, Marbletown, Hurley, Woodstock and Kingston, Ulster County. The contract price was $451,000.

Bids on two subway contracts are now being asked. The Boston Transit Commission, Boston, Mass., is calling for bids for building section 1 of the Boylston St subway, open incline and two-track subway extending from Kenmore St. to Massachusetts Ave., a distance of about 1,900 lin. ft., and the Public Service Commission of New York City is readvertising for bids for the construction of section 2-A of the Lexington Ave. subway.

The City Council of Winnipeg, Man., on Feb. 29, decided to authorize a bond issue for $4,800,000. The by-law provides for the fol- [illegible] extensions, $72,000 for conduit enlargement, $215,639 balance of amount expended on waterworks in 1911, $200,000 balance for erecting and equipping the isolation hospital, $60,000 balance on power works, $20,000 for unissued debentures on conduits, $125,000 balance for erecting and equipping the tuberculosis hospital, $200,000 balance for grant for reconstruction of Osborne St. bridge, $200,000 for extension of electrical works system in 1912, $600,000 for school districts, $1,694,361 for local improvements. It is intended to obtain water from the Poplar spring district, which, it is estimated, will supply 20,000,000 gals. of water daily.

An Engineer Commissioner.

The experiment of Staunton, Va., in placing the entire management of the financial affairs of the city in the hands of one man has proved such a success that it seems likely that other municipalities will try a similar plan. In fact a special committee, composed of members of the city council and citizens have reported to the City Council of Fredericksburg, Va., an ordinance providing that on July 1 there shall be elected a commissioner who shall have charge of the city affairs. The ordinance provides that the commissioner shall attend to all contracts and to the buying of all supplies for the city. Much of the success of the experiment at Staunton is ascribed to the fact that the man selected to manage the financial affairs of the city was a civil engineer. The citizens of Fredericksburg evidently realized this for in the ordinance for the new form of government for that city, it is provided that the commissioner shall be an engineer.

Versatility.

Most of us are one-handed men. When the Lord turns out a two-handed man he usually becomes a champion. Take [illegible] punch in either paw. But two-handed men are not all exponents of the manly art. There is F. Hopkinson Smith, for example. He is one of the best water color artists in this country; as an author his books are always among the six best sellers; as a lecturer his services are in constant demand; as an engineer he accomplished many important works, and as a contractor he built some of the largest and most important lighthouses on the Atlantic coast. Out in Iowa there is a ditching contractor who runs a close second for versatility. In addition to handling some of the largest drainage contracts in the state, he is also a capable engineer, a skillful attorney, and quite frequently acts as a minister of the gospel.

Economy.

The commissioners of a county in a middle west state in asking for re-election point to the economies effected during their term of office. "In 1908," they state, "the former commissioners paid the county surveyor $1,500 per year; in the succeeding year they paid him $1,200. When we came into office we reduced this salary to $1,000, and last year we succeeded in securing a very able and capable engineer for $700 per year. If re-elected we shall endeavor to secure still further economies in this direction." Aristophanes tells a sad story of a farmer who tried to reduce living ex- [illegible] Just when the plan seemed likely to be a success the donkey died. In repeating this ancient bit of pleasantry it is not intended to suggest that the county commissioners are lineal descendants of the farmer, nor that the county surveyor is the donkey. However, the attempts at economy of this tiller of the soil and the men in charge of the country's business bear a marked resemblance.

A Short Order.

The sayings of governors of states often become famous. There is one noteworthy utterance of the chief executive of a commonwealth which, though entirely unknown to engineers and contractors, is yet the motto of all tried and true members of the Prohibition party. The epigrammatic saying runs: "Said the Governor of North Carolina to the Governor of South Carolina, it is a long time between drinks." Now comes the Governor of Arkansas with a saying which has worked its way into a service order of the U. S. Reclamation Service, one of the project engineers having issued the following:

[illegible] with."

[illegible]

Massachusetts Highway Engineers.

A deserved tribute to the men who have made possible the excellent system of highways of Massachusetts was paid by William D. Sohier of the Massachusetts Highway Commission in an address before the New Hampshire Good Roads Congress. In the course of his remarks Col. Sohier said:

> If we have been able to do anything in Mas- [illegible] nology boys to make up our field parties in [illegible] can pay them well.

RAILWAYS, STEAM AND ELECTRI

Alabama.

⦿The Louisville & Nashville Railroad Co. has let, in addition to the contracts recently noted in [illegible] the following [illegible] the Lewisburg & [illegible] & Maxfield, Miamisburg, O., to build 3 miles of road from Maplewood to Cumberland River in Tennessee. Luck Construction Co., Roanoke, Va., to build 23 miles of road, beginning at Brentwood, Tenn.; and extending southward. The Ryan Co., Portsmouth, O., to build 13 miles of road extending north from Athens, Tenn. W. J. Sparks Contracting Co., Mt. Vernon, Ky., to build 13 miles of road near Lewisburg, Tenn. T. L. McCurry, Marion, N. C., to build three miles of road, extending north from Brentwood, Tenn. S. Walton, Falls Mills, Va., to build 6 miles of road, north of Brentwood, and a tunnel 15 feet in width near Nashville. Ashville Construction Co., Asheville, N. C., contract for 8 miles of steam shovel work near Athens, Ala. Adams & Sullivan, 215 South Fifth St., Louisville, to build 14 miles of road near Blount Springs, Ala. A. & C. Wright, Ashland, Va., to build 8 miles of road near Delrose, Ala.

⦿The Ryan Co., Athens, Ala., as noted above, has been awarded the contract for constructing 13 miles of double track for the Louisville & Nashville R. R. The contract includes 400,000 cu. yds. of earth excavation and 10,000 cu. yds. of concrete masonry. About 75,000 cu. yds. of the earthwork will be sublet. The contract is located near Athens, and lies close to the main line of the Louisville & Nashville.

Work is progressing rapidly on the extension of the Peninsula Railway Co., north through Woodland place to Redwood City. The work is being done on a permanent basis and will include the construction of a bridge over the San Francisquito Creek.

Business men of Decatur and Huntsville have started a movement for the construction of a trolley line between those two places. It is estimated that it will cost about $1,500 to make the survey and it is understood that the business men of Huntsville are willing to pay $1,000 of this expense.

Arizona.

An election is to be held at Tempe, Ariz., on April 2, to vote on granting the Salt River Valley Electric Ry. Co. a franchise for a line through the town.

Arkansas.

Business men of Pine Bluff, Ark., have appointed a committee to draw up a contract with W. J. Miller, Lamar, Mo., President of the Pine Bluff & Northern R. R. Co., for the extension of that road into Pine Bluff from the Rock Island road in Lonoke County. The Pine Bluff & Northern will be a part of the Pine Bluff & Southern R. R., recently incorporated by Little Rock capitalists. Already more than $50,000 is stated to have been subscribed by local business men as a bonus for the northern division of the road.

The Batesville & Northeastern Ry. Co. has been organized at Batesville, Ark., and proposes to obtain a new charter of the old Earnhart survey, and to build the railroad from Batesville to either Hoxie, Black Rock or Pocahontas to connect with the Frisco. The officers of the company are: President, Col. V. Y. Cook; First Vice President, Nathan Adler; Treasurer, William Ramsey; Secretary, Sam Deener.

The Arkansas, Louisiana & Gulf R. R., J. M. Parker, General Manager, Monroe, La., is understood to have about completed all preliminary arrangements for the extension of the road north from Hamburg to Pine Bluff.

California.

As mentioned in our last issue the Tidewater & Southern Transit Co., has been incorporated in California with a capital stock of $4,000,000. Further information is available concerning the construction of extensions throughout Stanislaus, San Joaquin and other counties in the San Joaquin valley. The proposed mileage and routes are as follows: From Turlock, Stanislaus County, to Fresno, Fresno County, 97 miles; from Hatch to Newman and thence to North Danos, Merced County, 35 miles; from Ceres through Patterson, 15 miles; from Modesto to Wood's Colony, 10 miles; from Stewart's Station to Riverbank and thence to Oakdale, 10 miles; from Salmon Station, San Joaquin County, to Manteca, 5 miles. The incorporators are: C. C. Bruech, J. A. Coley, B. Bearce, J. L. Craig, George F. Schuler, all of Stockton and W. B. Minturn, Fresno, and T. J. Wisecarver, Modesto.

The Santa Barbara & Suburban Ry. Co. has been incorporated with a capital stock of $750,000, the incorporators being A. A. Maxwell of Los Angeles, L. J. Lee of Pasadena and William Dieterle, E. A. Morphy and Herbert F. Keenan. The Edison Electric Co. of Los Angeles is reported to be interested in the new company.

The [illegible] Electric Ry. Co. has [illegible] pleted surveys and has secured the capital for the construction of a [illegible] Yuba City to Colusa, Cal., via Meridian. Construction contracts are to be let at once. A. D. Schindler, Alaska, Commercial Bldg., San Francisco, Cal., is Chief Engineer.

Colorado.

It is reported that the Garfield Coal Co., E. E. Whitney, Denver, Colo., has work under way on the construction of a new railroad from Rifle to Harvey Gap, tapping the coal beds at that place. It has been announced by S. E. Becket, one of the stockholders of the railroad company, that the road is financed entirely by Eastern capital and that it is entirely independent of all other railroads.

In connection with the irrigation of some 100,000 acres of land in San Miguel and Montrose Counties, Colorado, it is proposed to build at least 50 miles of narrow gage railroad. Robert McF. Doble, Placerville, Colo., is Chief Engineer for the project, additional information on which is given in the Irrigation, Drainage, Levees and Canals section in this issue.

The Denver & Rio Grande R. R. and the Santa Fe System are reported to have reached an agreement for interchange of tracks between Denver and Pueblo. It is stated that the Santa Fe track will be used for the joint traffic of the two roads one way and the Rio Grande track for the same purpose the other way. At the crest of the divide cross tracks will be constructed so that the traffic may be interchanged from that point to take advantage of the grades.

Georgia.

The Ocilla Southern R. R., J. A. J. Henderson, President, Ocilla, Ga., has made a proposition to the Chamber of Commerce of Macon for the extension of the line to Macon via Fitzgerald, Unadilla and Perry.

Illinois.

Preliminary work is under way for the proposed electric railway from Galena to Freeport by way of Elizabeth and Stockton. H. G. Palmer & Co., Consulting Engineers, Yorkville, Ill., are understood to be interested.

The Chicago City & Connecting Rys. Co. which recently purchased the Chicago & Southern Traction Co., is understood to be planning to develop a traction system covering the entire steel belt from Gary to Joliet. The Hammond, Whiting & East Chicago Electric Ry. Co. is a subsidiary organization of the Chicago City & Connecting Rys., and the lines already in service on the two consolidated lines and those proposed there will be a total of 118 miles of line. Besides linking the entire steel belt from Joliet to Gary and connecting them with Chicago, the p lines will embrace the manufacturing centering at South Chicago, Burnham wisch, Blue Island, Chicago Heights, mond, Whiting, East Chicago & India bor. An extension from Hammond vey will be put through next summer 20 miles of line will be built, it is sai new company, the Eastern Illinois Co. The Chicago City Ry. Co., First Bank Bldg., Chicago, Ill., is reporte behind the project.

The Chicago, Peoria & Quincy Tract incorporated recently, as noted in our issue, proposes the construction of a line through Adams, Brown, Schuyl Donough, Fulton, Cass and Peoria Surveys have not been made nor has ital for construction been secured as y A. Steinbach, Quincy, Ill., is Preside C. A. VanNess, Quincy, Ill., is Secret

Indiana.

⦿Jack Bennett has been awarded a to build 1¼ miles of switch near Bl ton, Ind.,. There is 30,000 yds. of r dirt in this contract. It connects the [illegible] R. R.

⦿Rogers & McCormick, contractors been given a subcontract on the Bloom Southern R. R., near Bloomington, Ind & Sons, St. Louis, Mo., are the gener tractors.

⦿Walter Smith, contractor, has been ed 20,000 yds. excavation near Blooming the Bloomington Southern R. R.

The Chesapeake & Ohio R. R. has w der way on the road between Cincinn and Richmond, Ind. The railroad ya Boston, Ind., are nearing completion.

The Northwestern Elevated R. R Merchants' Loan & Trust Bldg., Chica proposes to extend its line this spring its present terminus at Central Ave. in ton, north about a mile to Linden and Aves. in Wilmette.

Iowa.

An effort is to be made in Colesburg, raise the necessary $40,000 bonus to sec construction of the proposed line of th ley & Iowa Northern R. R. through that

The Federal Construction Co., Mus has applied to the City Council of Mus Ia., for a franchise for a street railwa tem, and for the privilege of erecting a plant in Mad Creek bottom, near Mon

Kansas.

⦿Sub-contracts for work on the new City & Cimarron Valley R. R. (Sa line), running southwest from Dodge Kan., have been let by Ransom & Coo tawa, Kan., the general contractors, a lows:

Miles [illegible] and 3 let to J. C. Allen, 10 team
Miles 4 and 5 let to G. W. Galegor [illegible]
Also will work some hired teams
Miles [illegible] and 8 are being done by Ransom
with two of their own 16-team outfits
Mile 7 let to Thompson & Sons, 10 teams
Miles 9 and 35, J. L. Keller, 10 teams.
Miles 10, 11, 16, 17, 18, 36 and 37, Colt &
35 teams.
Mile 13, J. N. Athey, 5 teams.
Mile 14, Clarence Milbern, 5 teams.
Mile 15, F. N. Hanson, 6 teams.
Miles 19, 20 and 21, W. B. Ross, 12 teams
Mile 22, Goddard Brothers, 6 teams.
Miles 23 and 24, N. L. Shultz, 8 teams
Miles [illegible], 26 and 27, J. B. Fields, [illegible]
Miles 28 and 29, Sam McLain, 7 teams.
Miles 30 and 31, Shaw & Johnson, [illegible]
Mile 32, Edward Lee, 20 teams.
Mile 33, Parker & Jarvis, 22 teams.
Miles [illegible] and 54, S. H. Fields [illegible]
Miles 55, 56, 57, 58 and 59, Pat Gleason, 8
Contract for hauling material let to C. L
& Sons, 20 teams.
Contract for the bridge work has been
the Blodgett Construction Co.

Very little work has been done on thi [illegible] the ground until Feb. 20th, [illegible]

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] All [illegible] Mar [illegible] the ground [illegible] The material [illegible] ce and is all good fresno work. [illegible] It may be decided to give it to the line, but this has not been at the present time.

of the Missouri Pacific Ry. have that the company will build a switch freight distributing station and improvements at Arma, Kan.

chinson & Western Interurban R. rently incorporated as noted in our has submitted a proposition to the [illegible] be built west from Hutchinson lson, with probable extension to [illegible] d road to be equipped with other [illegible] k in Hutchinson and territory [illegible] company. Road to be built son to Hudson in three sections ach. Stock subscribers to pay hen the right of way is secured ctually commenced, and 25 per de of the first 15 miles is ready The first 50 per cent to be lding the first 15-mile stretch, and ing 50 per cent in constructing the les section. The balance needed e road to be secured by a con- or bond issue. The incorpora- ll preliminary expenses, taking [illegible] the construction is actually begun. [illegible] nts and see that funds are properly P. Roehr, Hutchinson, Kan., is

Kentucky.

tucky-Tennessee Traction Co., the on of which was mentioned in our proposes the construction of a 28- from Hopkinsville to Guthrie. Sur- been made, but the construction ave not been let as yet. Nat Gaither, le, Ky., is President.

Louisiana.

ncil of St. Martinville, La., through of the taxpayers has ordered an be held on April 1 for a 5 mills tax ears in favor of the New Iberia, & Northwestern R. R. F. M. Welch r of the road.

w Iberia, Lafayette & Northwestern A. Genung, Chief Engineer, New ., is now having preliminary surveys a line from Eunice, La., to New ., 53 miles.

& Southeastern R. R. [illegible] der way for its projected line from Ark., to Lake Providence. At last e surveyors were working in the f Oak Grove, La. E. S. Price, St. ., is Chief Engineer.

tion has been made to the Progres- ue of Monroe, La., looking to the on of a railroad from that place River, a distance of 20 miles. The be built primarily to open up timber the company building it will erect ll at Monroe.

Maryland.

estern Maryland Ry. is acquiring val- perty in Cumberland, Md., for the on of a new passenger depot, freight ards and two new bridges. No of- rmation has as yet been available. ratt, Baltimore, Md., is chief en-

s of the Western Maryland Ry., H. Chief Engineer, Baltimore, Md., are for the improvements contemplated on the Maryland [illegible] ese include ad- [illegible] Cumberland, with [illegible] rminals at the last-named point. [illegible] will be rushed, so as to have the imp[illegible]s ready for the increased trade which will [illegible] me to the road when the Connellsville [illegible] is opened.

Massachusetts.

✣ [illegible] 12, by the Boston Transit Commission, B. Leighton Beal, Secretary, 15 Beacon St., Bos- [illegible] ton St. subway, open incline and two track subway extending from Kenmore St. to Mas- [illegible] ft. Specifications and forms of contract can [illegible]

Michigan.

Right of way is being secured for the construction of the proposed extension of the Michigan Central R. R. from Owendale to Pineberg by way of Elkton, Mich. G. H. Webb, Detroit, Mich., is chief engineer.

Surveys are reported under way for an extension from Crystal Falls to Iron River for the Chicago, Milwaukee & St. Paul Ry. It is said that John Marsch, Chicago, Ill., has the construction contract.

At a recent mass meeting of the citizens at Croswell, Mich., the proposition of the Port Huron & Northern Ry. Co. to build a gasoline road into the Thumb section of Michigan was endorsed. The citizens' organization entered into an agreement with the Port Huron & Northern Railway Co., which is composed of Detroit and Port Huron capitalists, that the city would give the new company a bonus of $10,000, sites for depot and yards and a right-of-way through the city. In return the gasoline railroad promoters guaranteed to the association that they would have their line in operation from Port Huron to Croswell by Dec. 1, 1912, unless prevented by causes beyond their control, or they would forfeit their bonus money, which, according to the notes issued, is not payable until the road is in working order.

The Le Saut-Les Cheneaux Ry. Co. is projecting a 36 to 41-mile line from Sault to Cederville and Hazel, or what is known as Les Cheneaux Islands, and thence by ferry to Cheboygan, Mich. Preliminary surveys have been made. The company has not been incorporated as yet, and none of the capital for construction has been secured. A. S. Robinson, Sault Ste. Marie, Mich., is Chief Engineer.

Minnesota.

The Northern Pacific, according to information from St. Paul, Minn., is planning to complete the double track from Philbrook, Minn., to Rices, giving the company a double track system from St. Paul to Dilworth.

Plans are being prepared by Charles S. Frost, Chicago, Ill., architect, for the construction of the proposed Great Northern depot at Minneapolis, Minn. The cost of the work is estimated at $2,000,000.

Duluth and the Ranges.

[illegible]

⦿John Runquist, Duluth, Minn., the railroad contractor who was awarded the contract for the construction of the Mesaba Electric R. R. for a distance of 34 miles, will start his work immediately. He has let the bridging and timber work to Edward Gallagher. This proposition was financed by Tucker, Anthony & Co., of Boston, and their C. E. Thomas is Chief Engineer of this work. The work is to be completed by Oct. 1.

⦿P. C. Pastoret of the Pastoret-Lawrence Co., was a caller this week and reported that they had been awarded a small sewer contract by the city of Eveleth, amounting to about $5,000.

⦿The Roberts-Kingston Co., Duluth contractors, were awarded a very nice contract by the Republic Iron & Steel Co. a few days ago. It is a steam shovel job and consists of loading 2,000,000 tons of ore. They will start on this work March 15 to April 1.

E. P. Kimball of Kimball Brothers, contractors, was a caller at this office a short while ago. They are engaged at the present time in doing some drainage work in Northwestern Canada. Mr. Kimball states they have been very successful in this contract, and have about one and one-half year's more work to finish up.

Robert W. Knox, superintendent for A. Guthrie & Co., in charge of some of their work, was in to see us. He said that their work in Canada was progressing very nicely.

H. T. Hazen, Chief Engineer of the Duluth, Winnipeg & Pacific R. R., and who is in charge of one district on the construction of the Canadian Northern east of Port Arthur, embracing 285 miles, was a visitor in Duluth a few days ago. Asked if the Canadian Northern R. R. is going to build any grain elevators or coal docks in Duluth, he said: "Yes, I think it will, but just when, I am unable to say. Water front property has been acquired suitable for those improvements. There is nothing definite as yet." Mr. Hazen says that the work of construction on the Canadian Northern, eastward from Port Arthur, is progressing as favorably as could be expected. There are 2,500 men engaged at the work in his district. The Canadian Northern is being constructed through a sparsely-settled region, north of Lake Superior. There are places where it is necessary to carry supplies 60 miles or more. This is a territory which many think will yield mineral. The road will open up at least one known iron ore district.

E. T. Foley, of Foley Brothers, railroad contractors in St. Paul, spent a couple of days in this city recently. Their firm is very busy at the present time, as they have a great many contracts under construction in different sections of the country.

Greer Thompson, General Superintendent for the Drake & Stratton Co., stripping contractors on the iron range near Duluth, and who is spending the winter in the South for his health, is quite ill at the present time. The last reports were that he was being taken under a doctor's care to Los Angeles. All of his friends in this territory, and there are many, sincerely hope that Mr. Thompson will recover rapidly, and we will expect to see him back here on the job very soon.

W. M. Barnard, the contractor, has already started on his 25 miles of railroad work that he has in the northern part of this state, and has sublet some of it to Contractor Elwell, who has already started to build his camps.

H. A. Johann and H. R. Cope of the Taylor Iron & Steel Co., spent a couple of days in the city recently. They seem to be well pleased with the result of their trip, and, I believe, in the future will pay very close attention to this territory.

W. F. King of W. F. King & Co., general contractors, was a caller at this office, and stated he had four or five small concrete jobs that he is working on at the present time.

J. W. Magill, assistant manager of the Dupont Powder Co. at Kansas City, Mo., was in to see us recently. He stated that business in general, especially in the contracting line, looked very good to him, and he thought the contractors should enjoy a very successful season.

The situation at Duluth is improving right along. There are quite a few contracts in sight, and the season of 1912 should be a very busy one for contractors in this vicinity. There is a lot of work to be done up here, and a lot more being talked about. Men are not very plentiful, and there will have to be a lot of laborers coming into this territory or there will be quite a shortage when the work starts up.

Mississippi.

Citizens of Meridian, Miss., have voted a $50,000 bond issue for the Meridian & Memphis R. R., which it is proposed to build from Meridian to Union, Newton County, to a

[illegible]
[illegible] ton States and Burkwalter Lumber Railroads have been secured and that heavier rails will [illegible] of only about 15 miles to complete the line [illegible] San Francisco R. R. is believed to be behind the new road.

The Illinois Central and the Yazoo & Mississippi Valley R. R. are believed to be con- [illegible] to Redwood, a station on the main line of the [illegible] Vicksburg. Such a line would be about 40 miles long and could be used for heavy freight traffic between Jackson and Memphis, especially when traffic is interrupted on the Jackson-Clarkedale line by high water, or other causes.

Missouri.

⦿The contract for constructing two street car tunnels under the tracks which enter the Kansas City, Mo., union depot, has been let by the Kansas City Terminal Co. to C. F. Betz, Sioux City, Ia., at $56,000. The job in- [illegible] men and 35 teams will be used.

The Kansas City, Ozark & Southern Ry. is considering the construction of three new lines out of Ava, one to run to Rockbridge, the second to Hammond and the third to Bradleyville. Preliminary surveys only have been made, and the matter of securing the construction capital has not been settled. J. B. Quigley, Ava., Mo., is Vice President and Chief Engineer.

E. S. McCarty, New Madrid, Mo., president of the St. Louis & Missouri Southern, is reported to have announced that the line has been completed from Marston, Mo., to Madrid, Mo., a distance of 10 miles, and that work will be pushed this summer on an extension north to Thebes bridge, giving the line a total length of 40 miles.

Kansas City, Mo., and Vicinity.

(REGULAR CORRESPONDENCE.)

⦿Sten Lund came in from the Canadian wilds the other day. Mr. Lund has taken a large contract on the Grand Trunk R. R. in that country and is busy these days getting equipment assembled with which to do the work. Besides having the above work to do, Mr. Lund states he has another proposition or two in view that look good.

C. W. Marshall is in the city from his work in Arizona. The Santa Fe contract on which Mr. Marshall is engaged is rapidly nearing completion. It has been done rapidly and no doubt has been a highly satisfactory piece of work to all concerned.

There seems to be but very little, if any question, but that the Chicago, Milwaukee & St. Paul will do a large amount of double-track work in Iowa this season. No definite word has been given out, but it has been stated unofficially that the letting of this important contract will take place about the [illegible]

W. M. Spencer made a flying trip to St. Louis this week. Work on Mr. Spencer's Excelsior Springs work is in full blast and moving along in fine shape.

[illegible] the new depot here is of little value to many of our friends, still it is of such importance to Kansas City that we wish to say that during the past ten days the steel work has been rapidly going forward. It will not be long until the skeleton form will be in place and the outline of the new station will be seen. Grading, however, will continue for some time to come. Some of the more important contracts involving the removal of thousands of yards of earth and rock have not yet been touched. Approaches must be prepared and the heavy grades within the city limits will soon be no more. Not only is Kansas City proud of this gigantic project, but every one in the county who knows Kansas City and its splendid spirit joins in this feeling of sincere satisfaction.

T. Fitzpatrick has just received his new revolving shovel and it will be on city work inside of the next ten days.

Mr. Wm. List of List & Gifford has been on the sick list for the past few days. He is, however, much improved at this writing.

Kansas City was fortunate enough to escape the severe storm that gripped the greater portion of the country last week, and consequently plans for grading have not been interfered with. Much of the work laid out has not been even let to contract as yet, and none of it started, but it is now only a question of [illegible] time.

New Mexico.

[illegible] Mountain & Pacific R. R. O. H. B. Turner, Chief Engineer, Raton, N. Mex. from Ute Park to Taos.

New Jersey.

Frank Battles, Sydnew L. Wright and Redman Wright, all of Philadelphia, Pa., who recently purchased the New Jersey & Pennsylvania Traction Co.; of Trenton, are understood to be planning to rebuild the entire system. The company has been operating 40 miles of line, connecting Princeton, Lawrenceville, Trenton, Newton, Morrisville, Yardley, Newton, Taylorsville and New Hope, Pa., [illegible]

New York.

✣Bids are asked until noon, March 22 (re-advertisement), by the Public Service Commission, Travis H. Whitney, Secretary, 154 Nassau St., New York City, for the construction of Section No. 2-A of the Lexington Ave. Rapid Transit R. R., including the underlying portion of the Canal St. Rapid Transit R. R. or Route No. 20. The points within the city between which the said part is to run and the route or routes to be followed are briefly as follows: Section No. 2-A: Beginning at a point under Broadway, about 90 ft. north of the center line of Walker St. and extending thence northerly under Broadway for 530 ft. to a point about 50 ft. north of the center line of Howard St., including the underlying portion of the Canal St. Rapid Transit R. R., or Route No. 20, extending under Canal St. and Broadway and under and across the portion of the Lexington Ave. route above described a distance of about 157 ft. The general plan of construction calls for a subsurface railroad having four tracks for such portion of the Lexington Ave. route and two tracks for such underlying portion of the Canal St. route; all of which are more particularly indicated on the contract drawings. The method of construction will be by trench excavation under cover, unless otherwise permitted by the commission.

A report from New York City states that the Erie R. R. is contemplating electrifying 208 miles of its suburban lines. It is stated that the company will spend $12,000,000 as a starter and the work will require three years. Under the plan, the Hudson & Manhattan Terminal Co. will build two more tubes under the Hudson River to the Church St., New York, terminal, when the Erie completes its electrification.

The 145th St. Crosstown R. R. Co. of New York City has been incorporated and proposes to operate a street surface railroad. The incorporators are H. M. Fisher, Plainfield, N. J., E. F. J. Gaynor and G. Keegan, New York City.

The Elmira, Corning & Waverly R. R. (electric), Waverly, N. Y., is taking steps for extending to Owego and Corning.

The Lehigh Valley R. R., E. B. Ashley, Chief Engineer, New York City, is contemplating starting work in the spring on a new line to Auburn. The road will be an extension from Geneva to Cayuga village, at the foot of Cayuga Lake, and will connect with the old Cayuga Lake R. R., part of the Lehigh system. It will shorten the route to Auburn by 60 or 70 miles and will be used for freight exclusively. The new line will parallel the Central tracks across the [illegible] distance of a little over a mile, and [illegible] the bridge built by the New York

North Carolina.

It is reported that J. M. Turner, Aug Ga., who recently resigned his position as eral manager of the Georgia & Florida road, is preparing to build a new railro North Carolina.

North Dakota.

Surveyors have gone over a portion o proposed right of way for the Great Nort R. R. Co.'s contemplated extension from dan, N. Dak., to the Sidney branch in tana, tapping a rich agricultural section.

Ohio.

Bids are reported to have been receive [illegible], Pittsburgh, Pa., Chief neer of the Pittsburgh & Lake Erie R. for the grading work for a portion o line of the new Lake Erie & Eastern R. is understood that the section on which were asked extends from a point bet Louisville and Struthers to Maumee Youngstown.

The Northern Ohio Traction & Light [illegible] is reported to be plan double track a portion of the line bet Canton and Akron. It is said that the d tracking in Canton will extend from Junction to Reedurban, and the other tion of the double tracking will be laid Massillon.

As the result of an inspection of the crossing at the entrance of Garfield Cleveland, O., by officials of the Pennsyl and Wheeling & Lake Erie Railroads Cuyahoga County, definite steps will prol be taken toward its elimination.

Regarding the report that the Cinci Hamilton & Dayton Ry. was planning some double-track work between Cinci and Toledo, we are advised that there is ing contemplated along this line for the ing season.

It is now understood that the Erie R double-track work in Ohio will be started month. On Feb. 28 the directors of this authorized the issuance of $10,000,000 cent 3-year notes to complete the d tracking of the line to Chicago.

Oklahoma.

The election held at Oklahoma City, to vote on the question of issuing bond secure the construction of the Oklahoma & Northwestern R. R. to connect Wood and Oklahoma City resulted in the passag the bonds.

A proposition has been submitted to Commercial Club of McAlester, Okla build a railroad 25 miles to the southwe Ashland for $200,000, the McAlester p to take over the Sallisaw, McAleste Southern, seven miles of which is graded gether with the right of way, which has secured. A committee has been appo to secure this road, which is now owne McAlester people. It is later proposed to tend to Lehigh to connect with the Miss Oklahoma and Gulf or the Oklahoma tral.

Oregon.

The Portland, Eugene & Eastern Ry. tric), Jas. L. Lambirth, Chief Engineer, gene, has asked for additional franchises its street railway system at Eugene. company is also planning on building a 6- line through the truck gardening regio Ward Junction.

The Southern Pacific Ry., D. W. Camp General Superintendent, Portland, Ore., authorized the expenditure of $100,000 fo construction of a freight house on the side of Portland. It will be 200x50 ft. brick and concrete.

Pennsylvania.

⦿McMenamin & Sims, Arcade Bldg., adelphia, Pa., have been awarded the tract for double tracking for the Pennsyl

[illegible]

estern Maryland Ry., H. R. Pratt, Engineer, Baltimore, Md., is consider- ing its freight yard at York. Plans [illegible] understood that the improvements ade at a comparatively early date.

est Side Electric Street Ry. Co. oix, Pa., has completed surveys for ruction work under a franchise re- [illegible] e, and it is expected that actual be started in the near future

South Carolina.

[illegible] ville, Spartanburg & Anderson Ry. rson, S. C., has been started and it at the line will be open for oper- [illegible]

Tennessee.

of Martin Mill Pike and Vestel, xville, have organized the Ves- [illegible] President, with the object of se- street car line for this portion of oxville. The Knoxville Railway & will be petitioned to extend its line [illegible]

Texas.

[illegible] er, Galveston, for constructing a from Downs Station to the sites [illegible] t 2.8 mile long; the contract price [illegible]

ments are stated to have been com the proposed interurban line from [illegible] d will touch Ennis, Waxahachie, Italy. J. F. Strickland, Dallas, of the Texas Traction Co., is at the he new project.

[illegible]

sville Street & Interurban Ry. nsville, which will operate street in lines within and near that its charter. The capital stock [illegible] contractor, of San Benito; S. nan of Brownsville, and H. L. Bor- louston. They are also first-year di- [illegible]

on the Mexico, San Antonio & Gulf ormerly Crystal City & Uvalde R. R.) [illegible] rs expect to start laying rails at the n with the International & Great within a short time. There is now employed on the work and the road- a distance of several miles is being The new line will give San Antonio connection with the Gulf. A. R. vice-president and general manager of any, Crystal City, Texas, is in charge [illegible]

ements have been made by the Cole- ified Brick Co., with the Gulf, Colo- Santa Fe Ry. for the construction of rom the main line of the Santa Fe to plant, at Coleman, Tex.

is under consideration for the con- of an interurban line from Bellville range. It is proposed to raise $1,000 preliminary arrangements, making and securing right of way. C. J. Ro- La Grange, Tex., is President of the y citizens' organization.

McSweeney Construction Co., Hous- has begun grading work for a spur [illegible] orthern to the new coal mine which opened by the Southwestern Fuel Co., iles north of Calvert. There will be [illegible]

[illegible]

Utah.

[illegible] Ophir. It is probable [illegible] the Utah Construction Co., Ogden, [illegible] as it finishes its work on the [illegible], will remove its outfit to the new branch at Ophir.

The charter of the Central Pacific Ry. Co., a subsidiary of the Southern Pacific, has been [illegible] chase, own, hold or extend the Central California R. R., Chicago & Northern R. R., [illegible] Southern R. R., Modoc Northern R. R. and [illegible]

Virginia.

[illegible] Southern Ry. Co.'s, of which J. C. Campbell, Marion, Va., is president and general manager, are planning the construction of a new line. The extension, covering a distance of from 10 to 12 miles, will connect Fairwood, Va., with Konnarock, Va. Surveys will begin early in March and the route to be taken is up Fox Creek from Fairwood to its head, thence west of Mt. Roger to Konnarock, where it will connect with the Virginia-Carolina railroad. A grade of 3 per cent will be attained with little effort. Lumber, the chief export of Konnarock, will be more readily transported to the northern markets by this [illegible]

Washington.

The Seattle & Eastern Electric Ry. Co., R. S. Terhune, President, Seattle, has about completed plans for its proposed line from Factoria to Issaquah, and it is possible that work will be started April 1. The company plans to build a standard gage electric line from [illegible] quah, with freight terminals at Factoria and passenger terminals at Bellevue or Medina. A ferry system from the passenger terminal on the east side of the lake will be [illegible]

West Virginia.

The Clarksburg & Philippi Traction Co., incorporated recently, is projecting a 50-mile line, the route of which runs from Clarksburg via Philippi to Billington, W. Va., and thence from Craigmore to Buckhannon. Surveys have not been made as yet. Dr. Thomas L. Nutter, Clarksburg, W. Va., is President and C. E. Corder, Philippi, W. Va., is Chief Engineer.

Wisconsin.

⊙The Ontario & Northern Ry., projecting a 35-mile line from Tomah to Lafarge, Wis., has awarded the contract for the 8-mile section from Wilton to Ontario to the Northwest Engineering & Construction Co., 814 Germania Life Bldg., St. Paul, Minn., and construction work will be started at once. Ed. Stackman, Ontario, Wis., is President of the railway and A. E. Rau, 814 Germania Life Bldg., St. Paul, Minn., is Chief Engineer.

Ordinance is before the City Council of Kenosha, Wis., to grant the Kenosha Electric Ry. Co., now operating 4.2 miles of line, the privilege of laying double tracks.

The Chicago & Northwestern Ry. is reported to be planning the construction of second track between Fond du Lac, Wis., to Green Bay, this spring. All bridges installed last year provide for double tracks. W. H. Finley, Chicago, Ill., is assistant chief engineer of the company

The city of Milwaukee, Wis., has received a tentative order of the State Railroad Commissioner, requiring the elevation of the tracks of the Chicago, Milwaukee & St. Paul Ry. Co. south of the Menominee River. It is believed that actual construction work will be commenced by May 1 and that it will be completed within two years. The total cost of track elevation is estimated at $3,000,000. The share of the city under the tentative order will be $200,000. Under the order of the commission the city will save the railroad companies from damage suits resulting from grade changes, but it is believed by the city engineering and legal forces that the damages will not amount to a great sum because the railroad companies are the principal abuttors and can not claim damages for grade changes and for street and alley vacations. The city will pay for lowering water mains, sewers, house drains and water connections and for repaving work that can not be charged against the street railway company or the railroad companies. The actual cost of elevating the tracks, including the building of retaining walls, will be borne solely by the railroad companies. The cost of the subways, sewers, connections in the subways and repaving in the subways also will have to be paid by those corporations. Each subway will have four drains connected with the city sewer system. The street railways company will have to pay the cost of adjusting its tracks to the subways. The Wisconsin Telephone Co. must pay for moving its poles and the Milwaukee Gas Light Co. must pay the cost of lowering its gas mains where charges are necessary. L. J. Klug, superintendent of bridges and public buildings for the city of Milwaukee, has charge of track elevation plans.

Canada.

✣Bids will be received until noon, March 20, at the office of A. J. McGee, Secretary, Temiskaming & Northern Ontario Ry. Commission, 25 Toronto St., Toronto, Ont., for the works (other than steel bridges) necessary to the complete construction of the roadbed, ready for the ties and rails, upon that section of the Temiskaming & Northern Ontario R. R. Commission's R. R., extending from Earlton to Elk Lake. S. B. Clement, North Bay, Ont., is Chief Engineer.

✣Bids will be received until noon, March 19, by Mayor G. R. Geary, Chairman of the Board of Control, City Hall, Toronto, Ont., for the supply of the following: 250 tons 45-lb. "T" rail, A.S.C.E. section, 100 kegs 5-in. x 9/16 in. spikes, 1,400 pair angle bars for 45-lb. "T" rail, 24 kegs ¾ in. x 3-in. bolts, 810 tons 80-lb. "T" rail, similar to Lorain Section 335; 972 tons 90-lb. girder rail, similar to Lorain Section 392; 1,100 pair splice bars for Lorain Section 335, 1,250 pair slice bars for Lorain Section 392, 60 kegs 1-in. x 3⅝-in. track bolts and nuts (200 lbs. per keg); 5,500 pair of ⅞ in. x 5 ft. 3¾-in. steel tie rods; 6,000 steel tires and necessary rail fastenings, 4,000 wood ties 5-in. x 6-in. x (6 ft., 7 ft., 8 ft. long). Official advertisement will be found elsewhere in this issue.

⊙Josh. W. Hargrave of the J. G. Hargrave & Co., Ltd., Winnipeg, Man., advises us that his company has been awarded a contract for the construction of 30 miles of roadbed for the Canadian Pacific Ry. from Suffield to a point 30 miles southwesterly. The completion of this line will necessitate the handling of approximately 700,000 cu. yds. of earth. There will be a large force required for this work. Mr. Hargrave intends to sub-let a portion of the grading. The material will be free to handle, and there will be no heavy machinery required in this work, as it is prairie fill. A portion of the grade runs along about 3 ft. above the level, and makes good side work. The balance is good machine work. This construction will commence as soon as the weather conditions will permit. The Hargrave Co., Ltd., has some construction work to complete from Bassano north, and when through there will move their entire construction crew to Suffield. Their head office is at Winnipeg.

⊙Foley Bros., Welch & Stewart, St. Paul, Minn., have sublet the work of constructing the Weyburn-Wellbridge extension of the Canadian Pacific Ry., noted in our last issue, to Ed. Peterson Co., Omaha, Neb. This work covers about 100 miles of line.

⊙W. A. Dutton, Winnipeg, Man., has been awarded the contract by the Canadian Pacific Ry. for constructing 85 miles of grade for [illegible] Swift Current, Sask. Mr. Dutton has also been awarded the contract for double-tracking the main line of the Canadian Pacific between Regina and Chaplin, a distance of 70 miles.

◉John Timothy, Edmonton, Alberta, has been awarded a contract for building 25 miles of line for the Canadian Pacific from Sterling at the west end of the Weyburn extension.

◉M. P. and J. T. Davis, Quebec, Que., are reported to have been awarded a contract to build 70 miles of branch for the Government Nova Scotia Ry., from Dartmault east to Doan's Settlement. Cavichi & Paganno, Halifax, N. S., have been awarded a sub-contract [illegible] this [illegible].

The City Council of Brantford, Ont., has passed a resolution urging the Dominion Government to grant the usual subsidy to the proposed traction line between Brantford and Port Dover and Brantford, Paris, Ayr, and Galt. It is claimed that such a line would be essential to the agricultural, manufacturing, and mercantile interests of Brant, Norfolk and Waterloo Counties.

The Toronto & Suburban Street Ry. Co., Toronto, Ont., is to apply to the Legislature this session for an amendment to its charter, which will authorize it to build an extension from a point on its proposed Toronto-Hamilton line in Toronto Township, Peel County, to Brampton, and thence easterly to Davenport Station, Toronto.

Application is to be made to the Legislature by the Niagara Falls, Welland, and Dunnville Electric Ry. Co. asking for authority to increase its capital to $500,000, and its bonding power to $30,000 a mile.

Officials of the Canadian Northern Ry. have been in conference with the city officials of Montreal, Que., regarding the tunnel plans of the railroad for that city. Detailed plans have been prepared by the Canadian Northern and it is hoped to settle all legal preliminaries so that work can be started in March. In connection with the tunnel scheme the Canadian Northern has started surveys to locate a route for a line between St. Eustache and St. Jerome, from which latter point the C. N. has a line running through the Laurentians past Sixteen Island Lake to Huberdeau.

The Great Northern Railroad Company will start work in April, it is reported, on the terminal work at Vancouver, B. C. The work, which must be completed within 5 years, includes a passenger station, estimated to cost $500,000, a roundhouse and other buildings to cost $25,000. About $5,000,000 will be spent for the entire improvement of the terminals. A. Stewart, Seattle, Wash., is assistant chief engineer of the road.

Officials of the Canadian Northern, upon the request of Mayor Douglas, Taber, Alta., have promised to run a survey for a line into that district.

The Government of British Columbia has invited competitive plans for the general scheme and design for the proposed new university to be erected at Point Grey, near Vancouver, together with more detailed plans for the buildings to be erected first at an estimated cost of $1,500,000. Prizes of $10,000 will be given for the most successful designs submitted. Particulars of the competition and plan of site may be obtained on request from the Minister of Education, Parliament Bldgs., Victoria, B. C. The designs are to be sent in by July 31st, 1912.

Announcement has been made that the Canadian Government is to grant the Province of Ontario a strip of land 5 miles wide, for the continuance of its railway to a port on Hudson Bay, and a 10-mile water front along the mouth of the Nelson.

The Canadian Northern Ry. is understood to have definitely decided to extend the Niagara, St. Catharines & Toronto Ry. system—a Mackenzie & Mann corporation—from St. Catharines to Niagara-on-the-Lake on the one hand and Jordan on the other, connection being made at the latter point with the main Canadian Northern line. The extension of the electric road will be completed in little over a year.

The Prince Edwards & Hasting R. R. Co. is applying for an act of incorporation giving it the privilege to build the following lines: From Trenton, Ont., to Gardenville, thence easterly through or near Albury, Rednersville and Rossmore, thence northwesterly to Frankfort and back to Trenton; from a point between Albany and Rednersville to Wellington, thence easterly through or near Bloomfield to Picton; from a point near Picton northerly to Demorestville, thence easterly through Northport and Solmesville to Ferry Point; from Bloomfield southwesterly to West Point; from Picton southwesterly to West Point; from Picton southwesterly to Black River, and from Picton easterly through Waupoos to Indian Point. Pringle & Guthrie, Ottawa, Ont., are the solicitors for the company.

The Canadian Pacific Ry. has purchased a site of 1,800 acres in East Kildon, a suburb of Winnipeg, for approximately $1,500,000, the property to be used for the new yards of the company.

Advices from Edmonton, Alberta, state that the French syndicate, incorporated under the name of the Pacific & Peace River Railway Development Syndicate, is completing the organization of a railway company capitalized at $5,000,000, this capital being subscribed exclusively in France. The purpose of the company is to build a railway from Dunvegan to Bella Coola, B. C., the route followed being the shortest from Peace River to the Pacific. A federal charter was granted last year to the syndicate by the Dominion Government and gives power to the Pacific & Peace River R. R. Co. to construct and operate a railway from Bella Coola
Channel, B. C., to a point at or
vegan, touching at Fort Fraser, St
Fort St. James, Fort McLeod, a
through the Pine Pass, the total d
ing in all about 480 miles.

The following is an outline of the
railway work in Saskatchewan for
Government will give guarantees.
Central Northern Saskatchewan
the guarantees are for four of the
tioned in the charter, township 26
southerly and southwesterly, 35 m
a point on the Rossburn branch t
45 miles, from the Prince Alber
branch at Shellbrook, a distance o
to connect with the Jack Fish li
man, on the Maryfield extension, n
the Brandon-Regina branch, 45 n
an extension of any of these line
lines designated, 50 miles. For the
Northern R. R. the guarantees
are: Extension to Maryfield line,
township 13, range 5, toward New
35 miles; further extension of the
Jack Fish line, 30 miles; further ex
the Thunderer Hill extension w
miles; also extension of any of the
tioned and others that may be desi
miles. In connection with the Gra
Pacific Branch Lines Co. it is pro
guarantee the bonds for an exten
further 50 miles on the Biggar-Ca
for which guarantees have [illegible]
granted for a distance of 50 miles,
distance of 40 miles on any lin
province the company is authorize
struct or may be designated by th
ant-governor-in-council. Guarantees
posed for four of the lines includ
proposed charter of the Grand Tru
Saskatchewan R. R. Co.: Saskatoo
tleford, 95 miles; Watrous, throu
Current to the international bou
miles; township 9 or 10, range
through Weyburn, southwesterly an
to the boundary, 50 miles; Melvill
rous, 75 miles; also for an extens
miles on any of these lines or oth
nated.

Mexico.

The Mexican Pacific R. R. proj
ported to have been financed by E
French capitalists who have under
$25,000,000 bond issue for the new
new road will give the City of Mex
ditional outlet on the Pacific at
From that port to the interior the
Pacific Co. has projected a line 118
The new land concession will give
ican Pacific a line of railroad stand
and modern in every respect 450
The road will join the Mexican N
R. at Balsas Bridge, 135 miles from
of Mexico. Moritz Thomsen, Seatt
is interested.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received until noon, March 11, by Board of Revenue, Mobile County, Mobile, Ala., for 100,000 cu. yds. of road surfacing material, chert, clay gravel, sand gravel, screened gravel and oyster shells. For specifications apply to C. L. Strange, County Highway Engineer, Room 11, Bank of Mobile Bldg., or P. O. Box 631.

The Franklin County Commissioners' Court, Russellville, Ala., has appropriated $15,000 for the construction of the Russellville and Newberg and Russellville and Rockwood roads, providing the individuals of Red Bay would allow their subscriptions to stand, amounting to $4,700.

The Pickens County Commissioners' Court, Carrollton, Ala., has donated $4,000 to conform with the requirements of the State to obtain a like amount for the building of a model road from Pickensville to Carrollton, a distance of 11 miles.

The Court of Revenue of Lawrence County, Ala., has called an election for March 18, for the purpose of voting on the proposition to issue bonds in the sum of $123,000 for the building of permanent system of roads. Moulton is the county seat.

Arizona.

The Paving Commission of Phoenix, Ariz., Eugene Hackett, chairman, has passed a resolution recommending the pavement of the following streets and alleys, that is to say: All streets and alleys between Fourth St. and Fourth Ave., and Monroe and Jackson Sts., in accordance with plans and specifications on file with the city recorder.

Arkansas

✣Bids will be received until 2 p.
20, by Board of Street Improvemen
No. 186, Little Rock, Ark., for gradi
ing and paving with vitrified brick
asphaltic concrete, creosoted blocks
lithic pavement on concrete foundati
said district. The work will include
mately 14 blocks. Plans and spe
may be obtained of S. W. Reyburn,
Union Trust Bldg., Little Rock, Ark
advertisement will be found elsewhe
issue.

California.

✣Bids will be received in the near
City of Vallejo, Calif., for the co
of approximately 600,000 sq. ft. of
and asphalt pavement. A. P. Noye
Engineer.

✣ indicates work now open for bids. ◉ indicates a contract let recently.

cording to advices from Redlands, Calif., in Supervisor S. V. Horton is planning [illegible] will ask for bids at once for the pav- Huntington Blvd. The contract will a roadway of asphalt concrete, extend- sides of the Pacific Electric tracks nbra road on the south city limits Ave., the east city limits. The is call for a sub-grade of 5-ins., ndation grading to be rolled by a 10- ller. On this broken granite or lime ill be dumped and bound with asphalt [illegible] Storm drains, inlets, catch basins cul- [illegible]

Bedford, in charge of Division No. 2 state highway, with headquarters at Calif. has started surveys for the [illegible] s work will be completed from dding on the east, and a branch Red Bluff to Orland, on the west After surveys are completed estimates made and bids asked to construct the contract to cover 20 miles of road.

nt convention in El Centro, Calif., Imperial valley towns were repre- olutions were adopted to recom- [illegible] Devil's Canyon and San Diego for unty's portion of a state highway El Centro with other points.

l. chief of party No. 1 of division e California Highway Commission, eadquarters at Madera while doing f surveying for the proposed state Surveys will be made north from mits and continue to Merced or neet another surveying party which south from that city. This work he command of Engineer J. B. n charge of Division No. 6, Fresno.

[illegible] Brown of Oakland, Calif., for the of 28,553 sq. ft. of asphalt pave- oncrete foundation with 1,280 lin. The work will incude 31,129 sq. ace grading. The estimated cost is r ft. Contracts will be let about one [illegible]

and surveys have been made for ction of 8½ miles of asphalt ma- similar pavement in Hillsborough, onsulting Engineer P. A. Haviland, mmercial Bldg., San Francisco. is work will cost approximately A bond election will be held March the issuance of bonds for the im- [illegible]

Colorado.

[illegible] again been petitioned for the paving No. 1 in North Denver. The pav- asphalt with a 5-in. concrete base, ot exceed $3.40 per front ft.

Georgia.

City Council of Dalton, Ga., has ap- d a committee to investigate the cost ding all sidewalks within the city limits.

Hawaii.

eys are being made in the County of Makawao, Hawaii, by Chief Engineer E. Harvey, Makawao, for the construc- 35 miles of new road, work on which egin the latter part of this year. The ently issued bonds in the sum of r the construction of roads, bridges [illegible]

Idaho.

e contract for the construction of ap- mately 328,200 sq. yds. of pavement in y of Boise, Ida., for which bids were d by the Board of Public Works on is not to be awarded. Bids were [illegible]

[illegible]

Illinois.

✣[illegible] City of Ottawa, Ill. [illegible] construction of brick pavement [illegible] foundation on various streets. The cost [illegible] work is esti- [illegible]

✣Bids will be received until 1 P. M., March [illegible] Pana, Ill., for the construction of brick pave [illegible] ter as follows: W. Second St. from the I. C. R. R. to the W. Corporation Line, 8 blocks, 8,780 sq. yds.; W. Third St. from the I. C. R. R. to the E. Line of Grant St., 7 blocks, and S. Chestnut St., 1 block, 8,233 sq. yds.; S. Cedar St. from the N. Line of W. Second St. to the B. & O. S. W. R. R., 2 blocks, 2,270 sq. yds.; S. Locust St. from the S. Line of E. Sixth St. to the N. Line of E. Ninth St., 3 blocks, 3,681.5 sq. yds.; E. Main St. from the W. Line of N. Poplar St. to the E. Line of the I. C. R. R. right of way, 2 blocks, 2,387 sq. yds.; S. Oak St. from the N. Line of E. Third St. to the S. Line of E. Main St., 2 blks., 2,605.2 sq. yds.; Commercial Alley from N. Line of E. Third St. to S. Line of E. First St., 2 blocks, 2,591 sq. yds.; Congress Alley from the N. Line of E. Third St. to the C. C. C. & St. L. Freight Patform. 2 blocks, 2,739.2 sq. yds. Totals, 29 blocks, 33,286.9 sq. yds. Estimated cost, $79,308.46. Plans and specifications are on file in the offices of the City Clerk and City Engineer. A. C. Stanfield is City Engr.

◉City Engineer Wallace Treichler of Rock Island, Ill., has estimated the cost of paving Fourth Ave., with brick from 16th to 20th Sts., at $13,500. The old foundation and curb will be used. The improvement of Second Ave., from 14th to 20th Sts., with asphalt, will cost about $26,928. H. M. Schriver is mayor.

◉The Board of Local Improvements of East Moline, Ill., has awarded the contract for paving Seventh St., with brick to the Abrahams-Porter Construction Co., of that city, at $20,250. The pavement will extend from High St., in Radden's addition, north across the railroad tracks to Keokuk Ave.

The Board of Local Improvements of Joliet, Ill., Wm. S. Welch, Secy., has awarded William Tunny of that city the contract for the construction of creosoted wood block paving in Scott St., from Washington to Cass Sts., at $19,266. The work will include 6,070 sq. yds. of pavement on a concrete foundation at $2.68 per sq. yd.; 350 lin. ft. of curbing at $0.50 per lin. ft.; 735 cu. yds. of excavation at $0.54 per cu. yd.; 1,625 lin. ft. of old curb reset at $0.18 per lin. ft.; 750 sq. yds. of repaving with brick, including new concrete foundation at $1.08 per sq. yd.; 370 lin. ft. of 10-in. pipe sewer at $0.32 per lin. ft.; 312 lin. ft. of 8-in. pipe sewer at $0.22 per lin. ft.; 682 lin. ft. of trench excavating and backfilling, exclusive of rock excavation, $0.24; 800 ft. of rock trench excavation at $0.30 per lin. ft.; 17 catchbasins at $30 each and 8 manholes at $28 each. Bids were opened Febr. 19.

A petition has been circulated in Hindsboro, Ill., providing for the proposition of hard surface roads to be voted upon at the coming spring election. The petition calls for about 25 miles of road.

Petitions have been received by the City Council of Galesburg, Ill., providing for the laying of a considerable amount of paving during the year, estimated to cost about $250,000. The new pavements are planned for the following streets: Main St., from the square to the Burlington tracks, this is to be a 70-ft. pavement; Ferris St., from Seminary to Academy; Water St., from Seminary to Broad; North St., from Lincoln to Kellogg; Beecher Ave., from Losey to Fremont; Henderson St., from Main to North; Losey St., from Seminary to Pleasant Ave., this being a total length of one and one-half miles; Lincoln St., from Blaine to Farnham; all of Matthew St.; Pine St., from Main to street below the Peoria branch of the Burlington; and, Mulberry St., from Seminary to Chambers, and then on east after the subway question is definitely settled.

The Board of Local Improvements of Decatur, Ill., and property owners have voted in favor of paving East North St., from Morgan St. east to Jasper St., and Morgan St., from William St. to North St. City Engineer R. L. McCalman has estimated the cost of the work at $18,039.

Plans and profiles for the proposed pavement in St. Charles St. Elgin, Ill., have been completed by Morgan H. Brightman, engineer in charge. The estimated cost of the proposed brick pavement is from $1.75 to $1.80 per sq. yd. The city engineer's department is also preparing plans and profiles for the improvement of Villa St., from National to Chicago Sts. Asphalt will probably be used for this work.

City Engineer Hepner of Freeport, Ill., has completed the estimate of the approximate cost of the improvement if Taylor Ave., and Henderson St., which will cost about $34,000. The work will include a storm sewer over the improvement cement curb and the pavement to be laid on a concrete foundation.

A petition has been presented to the Jackson County Commissioners, Murphysboro, Ill., for the construction of hard roads in Murphysboro Township.

The citizens of East Marion Township, Williamson County, Marion, Ill., at a recent election, voted in favor of constructing six miles of hard road.

Engineer W. A. Fuller of the Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., and assistant, E. W. O'Brien, have started preliminary surveys for the 20 blocks of brick roadway in Lewiston, Ill.

Indiana.

✣Bids will be received until 7:30 p. m., March 12, by H. G. Bollinger, Engineer, Columbia City, Ind., for 17,000 sq. yds. of pavement, brick or concrete wearing surface on gravel or concrete foundation and stone curb.

✣Bids will be received until March 11, by Board of Posey County Commissioners, Mt. Vernon, Ind., for the construction of three gravel roads in Smith township. J. R. Haines is county auditor.

✣Bids will be received until March 11, by Board of Vermilion County Commissioners, Newport, Ind., for macadamized roads in Vermilion and Eugene townships. H. T. Bayne is county auditor.

✣Bids will be received until 10 a. m., March 27, by G. S. Bingham, Assistant Quartermaster, Jeffersonville, Ind., for repairs to roadway and guttering at Fort Donelson National Cemetery, Dover, Tenn.

◉David P. Drook, of Mier, Ind., has been awarded the contract by the Board of Grant and Wabash Counties' Commissioners, Marion, Ind., for the construction of a highway on the line between Waltz and Liberty Townships in Wabash County and Richland and Pleasant Townships in Grant County. The contract price is $6,773. Bids were opened February 29.

A petition has been circulated in Crawfordsville, Ind., by James S. Kelly for the paving of Market St., from the Monon tracks to Pine St.

Iowa.

✣Bids will be received until 7:30 p. m., March 15, by City Council, Cedar Falls, Ia., at the office of the city clerk, for furnishing tools, labor and materials for paving, curbing and guttering portions of a number of streets. Bids will be received on sheet asphalt, on concrete foundation and on concrete pavement. The total amount of pavement will be approximately 76,000 sq. yds. W. H. Merner is Mayor.

The City Council of Marshalltown, Ia., has fixed March 11 as the date of hearing objections to the proposed paving of 41 blocks with concrete pavement.

The City Council of Harlan, Ia., has ordered

✣ indicates work now open for bids. ◉ indicates a contract let recently.

[illegible] blocks of new paving [illegible] residence district. [illegible] expects [illegible] pavement this year [illegible] estimated [illegible] following kinds of paving: Sheet asphalt, creosoted wood block, vitrified brick block, concrete, asphaltic concrete and Warren's bitulithic. W. S. Beattie is city engineer.

Kansas.

✣The city of Emporia, Kans., will let con[illegible] for the construction of [illegible] of new pavement, estimated to cost $[illegible] Matthew Brown, 211 South State St., Emporia, is city engineer.

◉The Capital City Vitrified Brick & Paving Co., Topeka, Kans., has been awarded the contract by that city, A. R. Young, City Engineer, for the laying of 60,606 sq. yds. of vitrified block pavement on a 4-in. concrete base with grout filler and 9,474 sq. yds. of vitrified block pavement on a 4-in. concrete base with asphalt filler at $1.55 and $1.40 per sq. yd., respectively. The total amount of [illegible] is $11[illegible]. Bids were opened February 29. Contract awarded March 1.

Louisiana.

The Police Jury of Rapides Parish, La., has decided to submit the question of voting on the proposition of a 5-mill tax for five years for the purpose of acquiring, building and maintaining public roads and bridges to the people. Alexandria is the parish seat.

The citizens of Caddo Parish, Shreveport, La., on Febr. 27 voted a five-mill tax for five years to build good roads, amount to $115,000 annually. The parish has other funds available for this work amounting to $25,000 or more annually. J. T. Bulen is Parish Engineer.

Maryland.

[illegible] Board of Awards of Baltimore, Md. [illegible] open bids [illegible] March [illegible] for about $368,000 worth of paving, including sheet asphalt, bituminous concrete, granite-vitrified and wood block. Specifications covering these contracts, which will be from 14 to 18, inclusive, will not be ready for distribution, however, until March 7th or 8th. R. Keith Compton is Chairman of the Paving Commission.

◉The following contracts were awarded by the Board of Awards of Baltimore, Md., on Febr. 28, upon the recommendation of the Paving Commission, R. Keith Compton, Chairman, the working being on sheet asphalt: No. 6—Elder Paving & Contracting Co., Law Bldg., Baltimore, $119,427; No. 7—P. Flanigan & Sons, 120 E. Lexington St., Baltimore, $[illegible]; No. 8—Filbert Paving & Construction Co., Charles & Lexington Sts., Baltimore, $[illegible].

Massachusetts.

✣Bids will be received until 7:30 p. m., March 8, by Board of Public Works, William Walker, Everett, Mass., for furnishing sand, gravel, cement, edgestone and granite paving blocks.

Michigan.

✣Bids will be received until March 11, by John J. Campbell, Clerk of the township of Winsor, Pigeon, Mich., for the construction of 15 miles of macadamized road of Class E. specifications of Michigan State Highway Department.

The City Council of Muskegon, Mich., has adopted a resolution calling for the city engi[illegible] prepare estimate of cost and plans for the improvement of Spring St., with a pavement from Muskegon Ave. to Wood Ave. H. N. Beck is city engineer.

All bids received Jan. 30 by J. A. Hagman, Village Clerk, Howell, Mich., for paving with concrete Grand River, between Walnut and Court Sts.

Minnesota.

✣Bids will be received until 8 p. m., March 12, by A. M. Childs, City Clerk, Crookston, Minn., for the construction of cement sidewalks during the season of 1912.

The Paving Committee of the City Council, Minneapolis, Minn., has adopted tentative plans for the laying of about $650,000 worth of pavement during the year. The requests and apportionments are as follows:

[illegible]	Allowed	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	100,000	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Sixth	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	15,000	[illegible]
Eleventh	[illegible]	26,251.75
Twelfth	78,000	88,272.70
Totals	[illegible]	[illegible]

Mississippi.

The Mayor and Board of Aldermen [illegible] Lucedale, Miss., have passed a resolution [illegible]quiring the building of cement sidewalks both sides of Main St., from the depot [illegible] Winter St.

Missouri.

Contracts will shortly be awarded for the building of about 30 miles of macadam roads in the Fulton 8-Mile Road District, just outside of the city limits of Fulton, Mo. W. R. Heagler, Fulton, is engineer. The citizens in this district on Dec. 29 voted the issuance of $100,000 in bonds for the work.

◉The Acme Paving & Construction Co. has been awarded the contract by the Park Board of Kansas City, Mo., for the paving of Swope parkway from Indiana to 67th St., for $53,000.

Montana.

✣Bids will be received until [illegible] 11, by Town Clerk, Chinook, Mont., for constructing concrete sidewalks, [illegible] curbs, gutters, furnishing and setting electroliers, wiring and conduits.

New Jersey.

The Rose Paving Co., 147 N. Warren St., Trenton, N. J., has been incorporated with a capital stock of $100,000, to pave streets, construct bridges, viaducts, etc. The incorporators are: Alfred A. Rose, James C. Tattersall, H. Arthur Smith; all of Trenton.

New York.

The preliminary survey of the state road from Margaretville to Oneonta, N. Y., has been completed under the direction of J. E. Snyder, of Binghamton. The survey is in charge of Robert B. Hoadley of Binghamton.

The Board of Public Works of North Tonawanda, N. Y., has directed City Engineer A. T. Smith to confer with Resident Engineer William B. Perkins at Niagara Falls, with reference to date, which he desires in making plans and specifications for the pavements which the state is to construct on several streets in North Tonawanda this summer as continuation of state roads from the city line to paved streets in the city.

The taxpayers of Little Valley, N. Y., at a recent special election voted to pave Rock City and Fair Oakes Sts., with brick.

The Board of Public Works, of Niagara Falls, N. Y., has rejected all bids received recently for the paving of Whirlpool Ave. and Third Sts. Frederick S. Parkhurst is city engineer.

North Carolina.

◉The Board of Aldermen of Durham, N. C., has awarded T. D. Scruggs the contract for excavating Oakwood Ave., Markham St., and Jackson St. The work will require the excavation of about 14,000 cu. yds. of dirt. The price ranges from $0.25 to $0.35 per cu. yd.

Ohio.

✣Bids will be received until 1 p. m., March 18, by Board of County Commissioners, Elyria, O., for the grading of East 31st St. in Sheffield township.

✣Bids will be received until noon, March 7, by Henry Reifel, Village Clerk, West Unity, O., for paving a number of streets.

✣Bids will be received until 10 a. m., March 20, by Board of Stark County Commissioners, Canton, O., for the construction of 1 of improved road on what is know [illegible]sillon Millersburg Road in Tu Township, by grading, curbing, pav drainage in accordance with the pla [illegible] specifications, etc., now on file office of J. H. McConnell, Auditor County, Ohio. Following are the e quantities: 12,766 cu. yds. excavation [illegible] approaches; 10,334 sq. yds. bri ing, including filler and sand cushion sq. yds. 4-in. concrete foundation; 12 ft. 14-in. Standard concrete curb laid lin. ft. 4-in. by 15-in. Stone curb set ft. Standard Concrete Marginal cu 4,000 lin. ft. 4-in. curb drain tile (if needed); 12 lin. ft. 15-in. stor pipe furnished and laid; 10 lin. f storm sewer pipe furnished and laid ft. 30-in. storm sewer pipe furnish laid; 16 lin. ft. 8-in. storm sewer pipe 154 lin. ft. 12-in. storm sewer pipe Standard catchbasin furnished and bu plete; 7 trees to be removed and de The above items of sewer pipe and are optional with the Commissioners a veyor as to whether they will be used Each proposal must be accompanied b tified check on a Stark County Bank [illegible] $500, payable to the Star Commissioners.

✣Bids will be received until noon, M by Commissioners of Hamilton Coun [illegible]innati, O., for the following con Under Specification No. 298—For ment of Round Bottom road along Norfolk and Western Railway, near t mont County line, in Anderson T The work to be done according to t and specifications now on file in the the Board of County Commissioners. must be accompanied by a bond in of $1,000. Albert Reinhardt is Clerk.

◉The Hamilton County Commis Cincinnati, O., have awarded James L baugh of Cincinnati the contract for provement of Cornell Ave., from Leba to Montgomery pike for $14,283. Bi opened Febr. 22.

◉The Cuyahoga County Comm Cleveland, O., have awarded a $34,000 to the Wilson & Harper Construction Zanesville, O., for the paving of Un from Kinsman St. to the city limits o land. Work is to start at once.

◉James Ra[illegible] has been [illegible] by the Board of Hamilton Commissioners, Cincinnati, O., for provement under specification No. Cornell Ave., from Lebanon pike to gomery pike, in Sycamore and Symmes [illegible]ships. The contract price is $14,2 were opened Febr. 23.

The Ohio constitutional conventi adopted the second amendment to the tution permitting the state legislature bonds to the amount of $50,000,000 support and maintenance of county roads. The state legislature will have [illegible] the issuance of bonds, after w proposition will probably be submitted citizens of the state for a vote.

The township trustees of seven to in Erie County, O., have filed with the of County Commissioners, Sandusky, for road improvements that will cost aggregate about $25,000. The impro asked for are: One-half mile on the Ridge road in Oxford township; one- on the state road in Florence townsh mile on the Columbus pike in Perkin [illegible] one-half mile in Berlin [illegible] mile along the Lake Shore Huron township; one mile on the Cast Bellevue road in Groton township, mile on the Milan road in Milan tow

The Village Council of Cuyahoga F s, is considering the proposed paving of St., from Front to Second; Second Broad to Portage, and Portage, from to Front.

Plans have been prepared by City E Howard M. Yost of Massillon, O., construction of 8,185 sq. yds. of vitrifie

✣ indicates work now open for bids ◉ indicates a contract let recently.

[illegible] Main and Erie Sts. [illegible] for 6,975 sq. yds. [illegible] on Tremont and S. Erie Sts., which [illegible] $29,787. Bids for the [illegible] W [illegible] Works.

Oregon.

[illegible] Council of Portland, Ore., for street [illegible]ments: Kearney St., from 15th to [illegible] ulithic redress, Warren Construction [illegible] $377; East 16th St., from Halsey to [illegible] asphalt pavement, Oregon Independ[illegible]ing Co., $1,022; Monroe St., from [illegible] ve. to East Seventh St., asphalt pave[illegible]egon Independent Paving Co., $5,442; [illegible]enth St., from East Main to East [illegible] asphalt pavement, Oregon Indepen[illegible]ing Co., $1,540; East 63d St., from [illegible] Gilsan, grading [illegible] walks, [illegible] East 11th St., from Killingsworth to [illegible] Ave., grading and concrete curbs [illegible] from Holgate to Schiller, grading [illegible]rete curbs and walks, Oregon Inde[illegible] Paving Co., $1,399; East 37th St., [illegible]te to Schiller, grading and con[illegible] and walks, Oregon Independent [illegible]o., $1,367; East 43d St., from Bel[illegible] East Stark, grading and concrete [illegible] walks, M. Hansen, $1,808; East 25th [illegible], grading and concrete curbs and [illegible]plin & Meeks, $9,025; East 13th St., [illegible]llingsworth Ave. to Holman, grading [illegible]rete curbs and walks, Giebisch & Jop[illegible]

[illegible]gton County, Ore., will expend ap[illegible]ely $100,000 on rock roads this year. [illegible] is the county seat.

[illegible]ouncil and Commercial Club com[illegible] of Pendleton, Ore., have recom[illegible] to the Council the construction of ap[illegible]ely 65 blocks of pavement, 42 blocks [illegible] hard surface and 23 blocks to be [illegible]

Pennsylvania.

[illegible] will be received until 6 p. m., March [illegible]ell Township Board of Supervisors, [illegible] the construction [illegible] a brick [illegible]

[illegible] be received until March 25, by [illegible]enzie, City Controller, Oil City, Pa., [illegible] for paving, curbing and grading [illegible] that city.

South Carolina.

[illegible] City Council of Orangeburg, S. C., [illegible]rded the contract for the construction [illegible] pavement from where the present [illegible]t stops at Lowman St., down Russell [illegible] the Southern depot to Berghaus & [illegible]f Orangeburg. The work will cost [illegible]ately $16,000. Fingal C. Black is [illegible]

Texas.

[illegible] will be received until 10 a. m., March [illegible] T. Lockwood, McLennan County [illegible] Waco, Texas, for road graders, mules, [illegible] widening em[illegible] Brazos Rive[illegible] [illegible]

[illegible] Cantu; for grading [illegible]s-Spraul road, Gideon Meier [illegible]

[illegible] closed a contract with the County Commissioners of Upshur County, Tex., for the building of county roads. Three outfits are [illegible]

The Frio County Commissioners' Court, Pearsall, Tex., has ordered the construction of a cement walk about the court house, the grading of the Frio town road, and set aside $1,000 [illegible] fined entirely within the city limits. The Court also set aside $1,500 for the building of a road to the Keystone property, and a further sum of $2,000 toward the building of a road running parallel with the International & Great Northern tracks to the northern boundary of the county.

Consulting Engineer J. Gibbons Browne, Houston, Tex., is preparing plans for the construction of sand-clay roads in Leon County, Tex., for which $84,000 have been appropriated. W. D. Lacey, County Judge, Centerville, is in charge of the work.

The Commissioners' Court of Palo Pinto County, Palo Pinto, Tex., has announced its acceptance of the good roads' petition in Precinct No. 1, and will set a day for the election. The election will decide the question of $100,000 bonds in this precinct, each road receiving its legal pro rata of expenditure.

The Walker County Commissioners' Court, Huntsville, Tex., has accepted the report of Engineer Brown on the survey of the Walker county roads and the cost of building 79 miles of good highway in the county. The report gives in detail the cost of each separate mile, every bridge, grading, grubbing, etc. The cost of the work complete with five steel bridges and several creosote wooden bridges, will be $175,000.

Virginia.

The Tazewell County Board of Supervisors, Tazewell, Va., rejected all bids received Febr. 13 for grading, draining and macadamizing about 113 miles of road in Clear Fork, Jeffersonville and Maiden Spring district. D. B. Daniel is chairman of the supervisors. This work will be done under the direction of the State Highway Commission, P. St. J. Wilson, Richmond, Commissioner.

Washington.

⊙The Board of Pierce County Commissioners, Tacoma, Wash., W. A. Stewart, County Auditor, has awarded the contract for the construction of the Brown-Dash Point Blvd., 5.56 miles long, to Keasal-McDowell Logging Co., of Tacoma, for $10,849. Other bidders were: A. P. Stoll, $14,735; Frank McHugh, $18,645; The Sunset Construction Co., $20,275; W [illegible] $[illegible]; [illegible] Huntington, $17,615; Tweeden & Jones, $16,[illegible] [illegible] Bros., 16,258.

Following bids were received by the Board of Public Works of Seattle, Wash., for the [illegible] Asphalt Paving Co., $94,884; P. J. McHugh, Third Ave., W. & Mercer St., Seattle, $85,989, and Sloan Bros., $90,170.

West Virginia.

The city of Bethany, W. Va., will let contracts about April 1 for the sewering of all streets of the town and for paving Main St., and repaving all other streets. The estimated [illegible]

Wisconsin.

The Marathon Board of County Commissioners, Wausau, Wis., has appropriated money for the purchase of road rollers, graders and a complete stone crusher outfit. R. H. Brown of Unity, is Commissioner.

The Wood County Commissioners, Grand Rapids, Wis., have appropriated money for the purchase of road rollers, graders and a complete stone crusher outfit. Ed. McCamely of City Point is Commissioner.

Canada.

✣Bids will be received until 5 p. m., March 11, by Frank Chappel, Town Engineer, Oshawa, Ont., for the construction of a brick or asphalt block pavement, on a concrete base, together with a cement concrete curb and gutter, approximately 25,000 sq. yds. The pavement will include that portion of the road occupied by the track of the Oshawa Street Railway. Plans may be seen and specifications obtained at the Town Engineer's office, Town Hall, Oshawa, Ont.

✣Bids will be received until March 24, by L. W. Atkinson, Herid, Sask., R. M. of Milton, No. 292, Secretary and Treasurer, for the following: 1 road grader; 6 wheel scrapers; 12 slush scrapers.

✣Bids will be received until noon, March 18, by George R. Boyd, Town Clerk, Welland, Ont., for the construction of approximately 37,000 sq. yds. of pavement, in vitrified brick, bitulithic, asphalt block or granitoid. Plans and specifications are on file at the office of the town engineer.

Plans for the following street work have been ordered by the City Council of Vancouver, B. C.: Paving, asphalt—1st Ave., Yew to Cypress, $25,237; Keefer St., Main to Campbell, $91,359; Keefer, Vernon to Victoria Dr., $88,205; Jackson Ave., Hastings to Powell, $11,986; Jackson Ave., Harris to Union, $26,194; 12th Ave., Pr. Edw. to Victoria, $115,887. Brick paving—Alexander St., Main to Hawkes, $91,344. Bitulithic paving—Cornwall St., Cypress to Trafalgar, $67,176; Alberta St., Broadway to Union, $5,956. Creosoted wood block—Dunlevy Ave., Harris to Union, $5,956.

The estimated cost of the paving of East Main and Muir Sts., city of Welland, Ont., from the Grand Trunk Railroad to the Michigan Central Railroad depot, which is to be done this year, will cost $100,000. The town engineer's staff has been engaged for some time in taking levels and surveys, and tenders for the work will be called for in a short time.

RIDGES—STEEL AND CONCRETE

Alabama.

[illegible]usiness men of the city of Decatur, [illegible]ve a plan on foot looking to the con[illegible] of a bridge across the Tennessee [illegible] that place.

Arizona.

[illegible] has been introduced by Ralph H. [illegible] delegate, providing for an appropri[illegible] $100,000 for the construction of a steel bridge over the Colorado River at Yuma, Ariz.

California.

⊙Board of County Supervisiors, San Luis Obispo, Calif., has awarded the contract for the construction of a steel highway bridge over Santa Maria River near the town of Guadalupa on the Arroyo Grande-Guadalupe Road in Santa Barbara and San Luis Obispo counties, to the Midland Bridge Co., Kansas City, Mo., at $46,000. F. J. Rodrigues is county clerk. Bids were opened Feb. 5.

Colorado.

It is urged that the city officials of Denver, Colo. take action towards constructing a viaduct at the Union Stock Yards. As proposed, the structure will start at 39th and Walnut Sts., and will end at Wewatta and 49th Sts., a distance of 2,100 ft.

✣ indicates work new open for bids. ⊙ indicates a contract let recently

Illinois.

✣Bids will be received until 1 p. m., March 11 (no bids received Feb. 26 on account of storm) at the Town Clerk's office, LaMoille, Ill., for the construction of two reinforced concrete bridges in LaMoille, Bureau County. J. H. Showalter, Town Clerk, LaMoille, Ill. Midwood Bridge:—Span, 50 ft.; roadway, 16 ft.; distance from finished roadway to bottom of footings, 16½ ft.; length of wings, 16 ft. Estimated concrete in structure, 182.8 cu. yds.; reinforcing steel, 24,289 lbs. LaMoille, 2 miles; roads, fair. Average load, 3,000 lbs. Local gravel pit, one mile from bridge site; gravel 50 cts. per cubic yard at the pit, same will probably require washing and proportioning. Existing bridge is a 50-ft. wood pile structure. Excavation full depth of abutments. Average flow of stream, 3 ft. deep and 27 ft. wide. Flowers Bridge:—Two 50-ft. deck girder spans; 16-ft. roadway; reinforced concrete abutments and plain concrete piers· distance from finished roadway to bottom of footings, 19½ ft.; length of wings, 16 ft. Estimated concrete in the structure, 309 cu. yds.; reinforcing steel, 37,453 lbs. LaMoille, 4¼ miles; VanOrin, 3¼ miles. Gravel same as for above bridge; ½ mile from bridge site. Existing bridge is a 50-ft. steel on tubes with two 15-ft. wood approaches. Average flow of stream, 3 ft. deep and 50 ft. wide. Excavation will be full depth of abutments in sandy loam and gravel. Clay will probably be found from 3 to 4 feet below bed of stream. Work to be completed on or before September 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission which may be seen at the Town Clerk's office or may be obtained upon application in writing from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received at the Town Hall, Coal Valley, Ill., up to 2 p. m., March 14, for the construction of 2 reinforced concrete bridges in Rural Township, Rock Island County. J. W. Caughey, Town Clerk, O ion, Ill. Willhouse Bridge:—Span, 16 ft.; roadway, 16 ft.; distance from finished roadway to bottom of footings, 14 ft.; wings, 14 ft. long. Estimated concrete in structure, 68.6 cu. yds.; reinforcing steel, 5,685 lbs. Nearest railroad station, Milan, on the C., R. I. & P., 5 miles. Roads fair; average load, 3,000 lbs. Existing structure is a 14-ft. wood bridge. Average flow of stream, 6 ins. deep and 2 ft. wide. Excavation will average full depth of abutments in loam to clay. Cook Bridge:—Span, 18 ft.; roadway, 16 ft.; distance from finished roadway to bottom of footings, 10½ ft.; wings, 10 ft. long. Estimated concrete in structures, 50 cu. yds.; reinforcing steel, 4,835 lbs. Nearest railroad station, Sherrard, on the Rock Island, 4 miles. Condition of roads, existing structure, flow of stream and character of foundation same as above bridge. Work to be completed on or before July 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission which may be seen at the Town Clerk's office, or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received until 11 a. m., March 12, by L. E. McGann, Commissioner of Public Works, of Chicago, Ill., for labor, material., etc., for constructing superstructure of the bridge over the Chicago River at Indiana St., the work being similar to that to be done at the 35th St. bridge, noted elsewhere in this column. Official advertisement will be found elsewhere in this issue.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Mar. 12, for furnishing and delivering material, labor, etc., necessary to erect the superstructure of the highway bridge over the Chicago River at W. 35th St. The official advertisement will be found elsewhere in this issue. The work includes the superstructure complete, including machinery, locks, electrical equipment, operators' house, watchman's house, automatic and other bridge gates, temporary telephone service during the erection of the superstructure, for keeping the tailpit dry, etc., and all other labor or materials called for by the plans or specifications or necessary to complete and operate the bridge.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Mar. 12, for furnishing labor, materials, etc., necessary to construct the substructure of a highway bridge over the Chicago River at Indiana St. Following are principal items of bidding sheet: Removing the old bridge abutments, docks and approaches as far as needed, at 35th St.; building, maintaining, protecting and removing the cofferdams. For miscellaneous work as follows: For making preliminary borings, for testing tailpit, for pumping out and keeping tailpit dry during construction of the substructure, etc. Dredging 6,000 cu. yds.; excavation, 3,000 cu. yds.; excavation requiring blasting, 1,500 cu. yds; oak timbers in place, 15,000 ft., B. M.; pine lumber in place, 13,000 ft., B. M.; white or burr oak piles, 1,200 lin. ft.; Norway pine piles, 1,400 lin. ft.; driving piles, 2,400 lin. ft.; concrete in piers, abutments, etc., 3,300 cu. yds.; cement mortar for facing, 250 cu. yds.; handling and erecting abutment steel, 45,000 lbs.; reinforcing brass and rods, 80,000 lbs. The official advertisement will be found elsewhere in this issue.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., Mar. 12, for furnishing material, labor, etc., necessary to construct the substructure of a highway bridge to be erected over the Chicago River at Indiana St. Following are the principal items of bidding sheet: Removing the shore piers, the east abutment and approach spans of the old bridge, also the pier under the viaduct bent on the west side, also the dock and east approach; building, maintaining, protecting and removing the cofferdams; making preliminary borings, for testing tailpits, for pumping out and keeping tailpits dry during construction of the substructure, etc.; excavation at site of piers, etc., 9,000 cu. yds.; dredging, 6,000 cu. yds.; oak timbers in place, 15,000 ft., B. M.; pine timbers in place, 8,000 ft., B. M.; white or burr oak piles, 8,000 lin. ft.; Norway pine piles, 34,000 lin. ft.; driving piles, 32,000 lin. ft.; concrete in piers, etc., 3,850 cu. yds.; cement mortar for facing, etc., 350 cu. yds.; rubble masonry, 100 cu. yds.; cedar block pavement, 100 sq. ft.; reinforcing steel bars, 60,000 lbs.; handling and erecting structural steel, 65,000 lbs. The official advertisement will be found elsewhere in this issue.

⊙The contract for the construction of a reinforced concrete bridge, known as the Dry Lake Bridge, has been awarded by D. M. Fullmer, Town Clerk, New Athens, Ill., to The Stites Steel Bridge & Concrete Co., St. Louis, Mo., at $1,512. The structure will have a 35-ft. span with a 16-ft. roadway. Bids were opened Feb. 23.

⊙The contract for the construction of a reinforced concrete bridge between Earl and Paw Paw townships in LaSalle and DeKalb counties, Ill., has been awarded to I. L. Woodward, Ottawa, Ill., at $2,320. The structure will be known as the Alexander bridge and will have a 50-ft. span with 16-ft. roadway. Bids for the work were opened Feb. 20 by C. R. Moore, Town Clerk, Earlville, Ill.

Plans have been prepared by Westcott & Ronneberg, 189 West Madison St., Chicago, Ill., for the construction of a bridge over the Des Plaines River at Forest Park, Ill. Fred Samuel is Town Clerk.

The Chicago, Rock Island & Pacific Ry. has under consideration the construction of considerable bridge work. It is planned to strengthen all structures on the Iowa Division from Davenport to Council Bluffs and on the Missouri Division from Davenport, Ia. to St. Joseph, Mo., to accommodate the new Mikado Engines. It is also proposed to take out and reconstruct, making it a double track instead of gauntlet as at present, the bridge at Mosco, Mo., at a cost of $200,000. A bridge over the Salt Fork of the Arkansas ver at an estimated cost of $160,000, will probably be constructed. I. L. Simmons, Chicago, Ill., is bridge engineer.

The Chicago & Alton Railroad Co. W. Reid, Bridge Engineer, Chicago, Ill., is reported, rebuild the bridge over th Kankakee River at Wilmington, Ill. The ture is 539 ft. long and the cost of the struction is estimated at about $20,000. W. will probably be started in the spring.

Indiana.

✣Bids will be received until March it is reported, by Commissioners of Wayne ounty, Richmond, Ind., for the construction of three culverts and five reinforced concrete dges.

Business men of Hazleton, Ind., ha employed engineers to draw preliminar plans and specifications for the construction f the proposed bridge over the White River that place.

Iowa.

Dakota County business men are so advocating the construction of a ne h bridge over the Missouri River at Sio C Ia. It is proposed that the counties sh bonds for the improvement.

Kansas.

The City Commission has instruct City Attorney to investigate the city's ig to construct a viaduct over the Santa yards at Washington St., Hutchinson K It is proposed to construct the viaduc fr Second Ave. to Fourth Ave. It would across the Santa Fe freight warehouse, across the railroad tracks, an over the loading docks at the Unde Viles and Hutchinson Produce Co. a coming back to the ground at Fourth S proposed viaduct would be built of ste struction and would have a roadway o City Engineer G. L. McLane is now f out what necessary grade would be re

An election will be held in April, at ita, Kan., for the purpose of voting proposition of issuing $20,000 of bonds construction of a new reinforced c bridge over the Little Arkansas R 11th St. William Sense is City Clerk.

Maryland.

It has been announced by Mayor P Baltimore, Md., that the Commission o City Plan has approved a bill authorizing the city to bond for $2,000,000 for making improvements in South Baltimore. The bill wil probably be sent to the Legislature shortl and will be submitted to the voters at the e next fall. Under the plans proposed a th following improvements: The V- bridge across Spring Gardens, to tal place of the present Long Bridge; ext si of the Harbor Board's water-front st t, water-front park at Ferry Bar and the qu sition of the lowlands on the Anne And County side of the river for factory ite

Massachusetts.

W. C. Tannatt, Town Engineer, East m ton, Mass., and E. E. Davis, Engineer th Northampton Street Railway Co., North m ton, Mass., have examined the Cotta S bridge and embankment and have repor the Board of Survey that they are in d ge ous condition. The estimated cost of str gt ening and widening the bridge and em m ment is $25,000.

Michigan.

At a recent meeting of the City Comm io Port Huron, Mich. (not Fort Huron, as co rectly stated in our last issue), a resotic was passed providing for the engagement f engineer to prepare plans for the constr tic of a new bridge over Black River at M a St.

Minnesota.

✣Bids will be received until 2 p. m., 18, by County Board of Waseca County, ca, Minn., for the repair or constructi bridges listed below: Construction of I

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] clear span and 16 ft. roadway [illegible] abutments in sw. [illegible] of section 13, [illegible] 106, range No. 24, Freedom town[illegible] State Bridge No. 425, construction of [illegible] concrete or steel bridge, 16 ft. roadway, [illegible]crete abutments on N. side of section 2, [illegible] 105, range No. 22, township of New [illegible]dal; State Bridge No. 426; placing new [illegible] joists and new plank floor on 110 ft. of [illegible]gend approaches, roadway 16 ft.; bridge [illegible] rods east of se. corner section 32, [illegible] 107, range No. 23, township of St. [illegible] State Bridge No. 435; placing new steel [illegible] new plank floor on 48 ft. bridge [illegible] and repair of abutments [illegible] rods north of [illegible] corner of section [illegible] 105, range No. 24, [illegible] over [illegible] River; State Bridge [illegible] repair [illegible] section 24, township 106, [illegible] State Bridge No. 437; [illegible] 40 ft. I-beam bridge [illegible] rods [illegible] township 107, range 24, [illegible] State Bridge No. 438. Theodore [illegible] Auditor of Waseca County, Minn.

[illegible] Hennepin County Commissioners, Minneapolis, Minn., has awarded the [illegible] the construction of bridges at [illegible], Deephaven and Norenberg to the [illegible] bidders, respectively: Minneapolis [illegible] Machinery Co., Minneapolis, Minn., [illegible]48; J. J. Mergens, at $4.482; Illinois [illegible]idge Co., at $8.142. All bids received [illegible] structures are as follows: Norenberg: [illegible] Illinois Steel & Bridge Co., $8,142; [illegible] Bridge Co., $12,386; Marsh Engin[illegible] $8,700; Warden-Allen, $12,485; [illegible] & Machinery Co., $8,848; Modern [illegible]ructure Co., $8,560; J. R. Johnson, $8,-[illegible]iet Bridge & Iron Co., $13,400; Conti[illegible] Bridge Co., $8,990, and Massillon [illegible] $11,330. Crystal Bay Bridge:— [illegible] Steel & Bridge Co., $42,290; Mars[illegible]ring Co., $46,500; J. R. Johnson, $48,-[illegible]iet Iron & Bridge Co., $54,900; Conti[illegible] Bridge Co., $46,000; Massillon Bridge [illegible],912; Minneapolis Steel & Machinery [illegible]1,948; J. N. Turner Improvement [illegible]4,803; Modern Steel Structure Co., [illegible] Midland Bridge Co., $55,637, and [illegible] $43,385. Deephaven Bridge: [illegible] Steel and Bridge Co., $4,498.50; Oscar [illegible] $5,794; Barber and Werring, $5,146; [illegible]polis Steel & Machinery Co., $5,598; [illegible]ntal Bridge Co., $5,900; George Trun[illegible],000; J. J. Mergens, $4,482; J. R. John[illegible]060, and Hase & Chabot, $4,852.

[illegible] Commissioners of Marshall and Bel[illegible]ounties recently let the contract for the [illegible]ction of 12 steel I-beam bridges rang[illegible] 28 to 48 ft. in length over the Mar[illegible] and branches 1 and 200 of Judicial [illegible]No. 11, to the Continental Bridge Co., [illegible], Ill. Bids were opened Feb. 2 at [illegible], Minn.

[illegible]agreement with the City Council of [illegible]lis, Minn., the Great Northern Rail[illegible] build a traffic bridge over the tracks [illegible] Ave. N. As planned, the structure [illegible] as wide as the street, and will extend [illegible]r sufficient distance on either side to [illegible]earance and permit street traffic to [illegible]er the tracks.

[illegible] Virginia & Rainy Lake Railroad Co., [illegible]ng to advices from Tower, Minn., is [illegible]g the construction of a bridge over the [illegible]hon River, near Six-Mile Creek, in [illegible]on with a proposed extension of the [illegible]

Mississippi.

[illegible] understood at Meridian, Miss., that [illegible]thern Railroad officials have appointed [illegible]mittee to take some definite step toward [illegible]ly construction of a viaduct or subway [illegible]nect the parts of the town north and [illegible]of the tracks.

Missouri.

[illegible]ds will be received until 2 p. m., March [illegible]Board of Jasper County Commissioners, [illegible]ge, Mo., for the construction of three [illegible]

•[illegible] the new bridge across [illegible] Creek at $1,900 by the Board of Commissioners of the Hollister-Kirbyville road district, Hollister, Mo.

Montana.

⊙The State Board of Examiners, Helena, Mont., has awarded the contract for the construction of the bridge across the Boulder [illegible]

Nebraska.

✣[illegible] the county clerk of Lancaster County, Neb., [illegible] rel; also, for each foot increase or decrease in [illegible] forced concrete in wings per cu. ft.

⊙John L. Mullen, 645 South 18th St., Lincoln, Nebr., [illegible] the [illegible] in Morrill County over the North Platte River at Bayard and Bridgeport, at his bid of $41,-500. Both structures will be approximately 800 ft. in length, including 33 ft. concrete girder span and 38,000 cu. yds. of fills and 1,400 cu. yds. of surfacing. Other bids received for the structures are as follows: (a) Standing [illegible] girder bridges: Bartlett & King, Cedar Rapids, Ia. (a) $39,200 and (b) $48,400; C. R. Inman, Cheyenne, Wyo., (a) $30,000 and (b) $30,000; Midland Bridge Co., Kansas City, Mo., (a) $57,310 and (b) $64,320; Pueblo Bridge Co., Pueblo, Colo., (a) $39,985 and (b) $41,650; Ward & Weighton, Audubon, Ia., (a) $30,000; Collier Construction Co., [illegible], Nebr., (a) $38,739 and (b) $39,990; Herrington & Anderson, Fort Collins, (a) $39,099 and (b) $39,168; Lincoln Construction Co., Lincoln, Nebr., (a) $35,400; Western Bridge Construction Co., Omaha, Nebr., (a) $47,400 and (b) $55,200; Charles G. Sheely, Denver, Colo., (a) $38,000 and (b) $45,000; J. W. Turner Improvement Co., Des Moines, Ia., (a) $46,500 and (b) $49,080; Liggett & Welton, Fort Morgan, Colo., (a) $46,042 and (b) $44,500. D. D. Price, Lincoln, Nebr., is state engineer.

⊙The Cuming County Board, Westpoint, Nebr., has awarded the contract for the construction of all bridges necessary during 1912 to the Standard Bridge Co., Omaha, Nebr.

•Custer County Board of Supervisors, Broken Bow, Nebr., has awarded the contract for the construction of all bridges necessary during 1912 to the Omaha Structural Steel Works, Omaha, Nebr.

The Dawes County Commissioners have rejected all bids received Feb. 20, for the construction of bridges during 1912. Charles Naylon, Chadron, Nebr., is county clerk.

New Hampshire.

✣Bids will be received until 8 p. m., Mar. 21, by City Council, Berlin, N. H., for furnishing and erecting superstructure of two 116-ft. single span steel highway bridges to replace old iron bridges over the Androscoggin River at Mason St. Plans and specifications are on file with L. J. Wertheim, City Engineer.

New Jersey.

It is reported that the Union County Engineer, Elizabeth, N. J., is preparing plans for the construction of the proposed new South Ave. bridge to be built this spring at Cranford, N. J. The new structure will carry two trolley tracks and will eliminate the present curves and double track.

New York.

•The Board of Public Works, Fulton, N. Y., and the [illegible] Committee of the [illegible] County Board of Supervisors have awarded the contract for the construction of the proposed reinforced concrete bridge at Broadway, Fulton, N. Y., to Lew B. Cleveland, Watertown, N. Y., at $125,785. Bids for the work were opened Dec. 18. By terms of the contract the work must be started by March 15 and be completed by December 31, 1912.

North Dakota.

•The County Commissioners of [illegible] County, [illegible], N. Dak., received bids [illegible] for the construction of county bridges during the year of 1912. The contract for the work was let to the [illegible] Bridge & Iron Co., [illegible], on the following bid:

Superstructure, Steel.	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
32 ft. to 35 ft. low truss, per ft.	21.00
36 ft. to 40 ft. low truss, per ft.	21.25
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
96 ft. to 102 ft. high truss, per ft.	[illegible]
Superstructure, Reinforced Concrete.	
[illegible]	[illegible]
[illegible]	[illegible]
Substructure, Steel.	
42 ins. dia. set of 4 steel tubes 8 ft. long.	$435.00
36 ins. dia. set of 4 steel tubes 8 ft. long.	410.00
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
30 ins. dia. extra per ft. in height 4 tuber.	32.00
Substructure, Concrete.	
Concrete, per cu. yd.	$ 12.00
Reinforced concrete, per cu. yd.	[illegible]
Substructure, Reinforced Concrete, with Steel Piling.	
1—A price per rising ft., including cap	$ 6.00
2—B price per rising ft., including cap	7.00
3—C price per rising ft., including cap	7.00
4—D price per rising ft., including cap	[illegible]
[illegible] price per rising ft., including cap	[illegible]
Concrete, including reinforced bars, per cu. yd. in place	18.00
Steel piling in place in wings, per lin. ft. 7-in. I's	.95
Steel piling in place in wings, per lin. ft. 8-in. I's	1.05
Substructure, Piling.	
5 ft. fill or less, price per rising ft.	$ 4.70
6 ft. or more, price per rising ft.	4.60
Piling, Extra, Ft.	
Tamarac, under abutments, per ft. in place	[illegible]
Western cedar, under abutments, per ft. in place	.65
Tamerac, wing or retaining, per ft. in place	.45
Western cedar, wing or retaining, per ft. in place	.65
Per 1,000 ft. in place of new 3-in. plank backing	42.00
Per 1,000 ft. in place of old 3-in. plank backing	20.00

Ohio.

✣Bids will be received until 10:30 a. m., March 11, by Board of Huron County Commissioners, Norwalk, O., for the construction of the superstructure of a riveted steel truss bridge 33 ft. in length, located in Bronson township.

✣Bids will be received until 1 p. m., April 15, by Board of Columbiana County Commissioners, Lisbon, O., for the construction of a steel bridge in Middleton township.

✣Bids will be received until 1 p. m., April 1, by Board of Ashtabula County Commissioners, Jefferson, O., for making the fills of the approaches to a bridge on Pine St., Jefferson. Plans and specifications are on file with the county surveyor, J. S. Matson. A. V. Hillyer is clerk of the board.

⊙The Commissioners of Ross County, Chillicothe, O., awarded the contract for the construction of the Lattaville bridge to O. M. Junk at his bid of $1,065. Other bids received for the work were as follows: W. P. Maddux, $1,097.35; S. M. Darby, $1,144; George and Albert Tweed, $1,250; John Alexander, $1,280; L. E. Wiley, $1,174; E. Hurff & Son, $1,060. All bids for the repair of the Bridge St. bridge at Chillicothe were rejected.

⊙The contract for the construction of a 230-ft. concrete bridge on Dunlap Creek road has been let by the Board of Hamilton County Commissioners, Cincinnati, O., to M. Hanlon, Cleves, O., at $5,172. Bids for the work were opened Feb. 16.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] pleted, according to reports, by County Surveyor, F. R. Lander, Cleveland, O., for the construction of the new high level bridge, and it is expected that bids will be advertised shortly for building the two river piers costing about $100,000 each. The cost of the entire structure is estimated at about $3,000,000.

The County Commissioners recently held a conference with the city officials of Youngstown, O., in regard to the reconstruction of the East End Viaduct, and it is believed that definite steps will be taken shortly for the improvement. Ett S. Smith is county engi-[illegible]

The City Council of Columbus, O., has adopted a resolution providing for a special election May 21 to submit to the voters the proposition of issuing $425,000 of bonds for purchasing land incident to the proposal to open Third St and construct a viaduct.

All bids received Feb. 26 by Board of Holmes County Commissioners, Millersburg, O., for the three county bridges have been rejected. W. L. Reidenbach is county surveyor.

Oregon.

⦿The Portland Bridge & Iron Co., Portland, Ore., has been awarded the contract for the construction of two additional bridges in Douglass County, one at Riddle and the other at Glendale. The contract price of the two bridges [illegible]

Pennsylvania.

⦿[illegible] County Commissioners, Wellsboro, Pa., has awarded the contract for the construction of four bridges to the Groton Bridge Co., Groton, N. Y., at $7,014. The structures will be located at Liberty, Hamilton, Blossburg and Mansfield.

The Commissioners of Lycoming County, Williamsport, Pa., have decided to postpone for some time the construction of Du Boistown-Newberry and Montgomery bridges.

Commissioners of Lawrence County, New Castle, Pa., are having plans prepared for the construction of a number of bridges during the coming summer. The largest bridge proposed is that which will connect Hazel Dell and Ellwood City. There is now some controversy over the location of this bridge and it will likely be somewhat delayed. In addition to the two proposed bridges over the Neshannock in New Castle, Pa., one on Mill and the other near the end of North St., there are a large number of small bridges to be erected. The location of these bridges will be as follows: Wampum run on the Wampum and New Galilee road; McCready's run where it crosses the New Bedford and West Middlesex road; Deer Creek, near New Bedford; Coffee Run, near New Bedford; Big Run, [illegible] Potter Run, near Volant; Jameson's Run, [illegible]

[illegible] of the Grand Juries recommending the con-[illegible] Fifth St., Chester, Pa., the Delaware County Commissioners at Media, Pa., will secure plans for the improvement.

Plans have been prepared by the engineers of the Lehigh Valley Transit Co. and presented to the City Council of Allentown, Pa., for the construction of the proposed concrete bridge over the ravine between Allentown and South Allentown. The structure, according to the plans, will be about 1,940 ft. long and 127 ft. high, and will cost about $500,000. W. W. Wysor, Allentown, Pa., is chief engineer of the Transit Co.

South Dakota.

⦿[illegible] Aberdeen, S. Dak., have awarded the contract for the constructiin of four new bridges and the repairing of two other structures to the Gilbert Improved Corrugated Culvert Co., Aberdeen, S. Dak., at $12,971.

⦿The Board of Minnehaha County Commissioners, Sioux Falls, S. Dak., has awarded the contract for the construction of all bridges necessary during the year of 1912 to the following contractors: Standard Bridge Co., Omaha, Nebr., for steel structures; Watertown Cement Product Co., for reinforced concrete structures.

⦿The Lawrence County Commissioners, Deadwood, S. Dak., have awarded the contract for the construction of all bridges during 1912 to the Standard Bridge Co., Omaha, Nebr. Bids for the work were opened Feb. 20.

The State Engineering Department, Pierre, S. Dak., has received plans for the construction of the proposed bridge across Cheyenne River near Wasta. As proposed, the structure will be 600 ft. in length, with four spans of 150 ft. each, and practically all the approach on either side to be of earth fill. It is estimated that the cost of the structure will be about $20,000.

State Engineer Lea, Pierre, S. Dak., recently conferred with residents of Wasta in regard to the construction of the proposed bridge over the Cheyenne River to cost $25,000.

Texas.

F. H. Allsbury & Co., Houston, Texas, has been awarded the contract for the construction of five iron bridges in Gonzales County, at a cost of about $2,300.

Virginia.

✣[illegible] will be received until [illegible]
13, by P. St. J. Wilson, State Highwa
missioner, Richmond, Va., for the cons
of a 160-ft. reinforced concrete brid
Mattaponi River, near Milford. Th
will include both sub and superstruct

Washington.

[illegible] Board of Lewis County [illegible]
[illegible] Wash., rejected all [illegible] re-
ceived for the construction of the brid
the Cowlitz River at Randle and for
a new bridge over the Tilton River at
A. L. Preston is county superinte
bridges.

The Board of Public Works, Seattle,
received the following bids for the o
foot bridge at Pike St.: A. S. Peters,
653.45; J. A. McEachern Co., $7,946.95
[illegible] R[illegible], $7,531.65; John [illegible]
[illegible] Elmer Johnson, $7,[illegible]
[illegible] $8,437.50; M. C. Home
E. Galer St., $7,064.90; Weymouth C
tion Co., $7.193.40.

Wisconsin.

Mayor Crumpton, Superior, Wis., is
to have vetoed the resolution of th
Council authorizing the calling for bids
construction of the bridge over Bluff
between Itasca and Allouez.

Canada.

✣Bids will be received until noon,
18, by William Purves, Township Cle
lumbus, Ont., for the construction
forced concrete bridges in the town
East Whitby. Bowman & Connor, To
Ont., are engineers. Plans and specifi
are on file with H. Gifford, Reeve, Ce
Ont.

⦿The following bids were received
substructure of the 23d St. subway in
toon, Sask., of which George T. Clark
engineer: Robinson & Foster, S
Wash., $50,027; Wilson, Townsend &
ers, Moosejaw, Sask., $52,534; Hoy
St. Paul, Minn., $63,150, providing
sewer is laid first; Nelson & Foster, W
Man., $64,731.

A petition has been signed asking t
Department of Public Works take up t
ter of constructing a bridge over Battle
16 miles south of Hardisty, Alta.

Bylaws have been passed at Toronto
authorizing the construction [illegible]
bridge on Albertus Ave. The cost
structure is estimated at about $2,500.

IRRIGATION, DRAINAGE, LEVEES AND CANAL

Colorado.

At a special election held in the Greeley-Poudre irrigation district at Nunn, Pierce and Camfield land holders in the district voted to ratify the contract recently made between the directors of the district and the Poudre Valley Ditch Co. By the contract the district becomes the owner of the Poudre Valley ditch, Cobb Lake and secures 100,000,000 cu. ft. of storage in Douglas reservoir. Former stockholders in the ditch reserve the right to carry water in the Poudre Valley ditch and to fill Douglas reservoir to a capacity of 275,000,000 cu. ft., their share of storage in the reservoir. The debts of the Poudre Valley ditch are cared for by the contract. The contract has been pending for more than a year and its conclusion ends all litigation for the Greeley-Poudre irrigation district.

Idaho.

The Mountainhome Irrigation & Development Co., which filed its articles of incorporation recently, proposes to complete the irrigation systems in the vicinity of Mountainhome, Idaho. The company has opened offices at that place. Former Governor James H.Brady is at the head of this enterprise. D. W. Standrod, Pocatello, Idaho, is also interested.

Illinois.

✣Bids will be received until March 18 by Hallock & Medina Drainage District of Peoria, Ill., at the office of W. S. Kellogg, Attorney, Peoria, Ill., for the following described work: New channel for Hallock Hollow Creek, 7,800 cu. yds.; Cleaning present channel of Hallock Hollow Creek and changing outlet of Crow Creek, 3,000 cu. yds. Additional information may be secured from Harman Engineering Co., Peoria, Ill.

✣Bids will be received until 2 p. m., March 23, by Commissioners, Deer Creek Drainage District No. 3 at the office of Ferris E. Gaines, Crete, Ill., for cleaning and straightening one mile of dry bank open ditch, 5 ft. base, average depth, 5.5 ft., estimated yardage, 7,000 cu. yds. Also for 1,300 ft. of 20-in. No. 1 shale tile; 1,300 ft. 18-in. No. 1 shale tile; two 20x10-in. wyes; one 18x10-in. wye; one
wye. Also for hauling, laying and c
above tile. Separate bids will be recei
excavating of open ditch; for tile; for
tile; for laying tile; for covering tile;
may be entered embracing entire c

⦿J. M. Powell, Brooklyn, Ind., ha
awarded the contract, at $6,196, for co
ing tile drains in the North Sheldon and
Concord Drainage District of Iroquois

Indiana.

⦿Englert Bros., Monterey, Ind., hav
[illegible] the contract at about $[illegible]
drainage work, bids for which were
Feb. 28 by Elmer C. Williams, Const
Commissioner, Court House, Winama
The work includes the following: Ma
main Drain—Length, 148,200 ft.; cu. y
cavation, 2,661,454. Branch No. 1, or
Branch—Length, 9,262 ft.; cu. yds.
[illegible] 69,503. Branch No. 2, or L
[illegible]—Length, 10,500 ft.; cu. yds.
[illegible] 23,771. Branch No. 3, or B
Branch—Length, 5,557 ft.; cu. yds.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Branch No. 4, or Zed Branch [illegible] cu. yds. excavation [illegible] or Little Monon Length [illegible] yds. excavation [illegible] Thompson Length 3,[illegible] vation, 90,009. Bran[illegible] ch Length, 5,770 ft. [illegible] 7,580 Branch No. 8 [illegible] gth 6,080 ft., cu. yds. [illegible] Branch No. 9, or Bl[illegible] 5,300 ft., cu. yds. excavation, 5,7[illegible] Franks Branch [illegible] yds. excavation 1,750.

Iowa.

[illegible] received until [illegible] Board of Fort Dodge [illegible] ors, Fort Dodge, Ia., for constructing [illegible] Drain 69. J. L. Ham[illegible] [illegible] county audit[illegible] [illegible] opened Feb. [illegible] Adel, Iowa [illegible] The work includes [illegible] yds. excavation in open ditch [illegible] side slope 1 to 1; 3,100 ft. [illegible] tile; 1,000 ft. of 18-in. [illegible] tile; 4,000 ft. of 14-in. [illegible] tile; 2,900 ft. [illegible] 1,100 ft. [illegible]

Michigan.

[illegible] Federal Bldg., Detroit, Mich., for [illegible] excavate the new navigation channel [illegible] east end of St. Marys Falls Canal, [illegible] remove the cofferdam at west end [illegible], and furnish all the labor, plant [illegible] during navigation season, and by [illegible] ter. The contractor will be permitted to occupy such portion of the unoccupied [illegible] designated [illegible] contracting officer for storing machinery, [illegible] only. These quantities will be [illegible]

[illegible] cu. yds. .150,000

[illegible]

[illegible] and placing, timber, cu. ft. [illegible]

[illegible] (exclusive of cement), cu. yds. .. 16,000

[illegible] U. S. Engineer [illegible] Detroit and Sault Ste. Marie, Mich., [illegible] be ordered from the Multi-Color [illegible] Detroit, Mich. [illegible]

Minnesota.

[illegible] A. Anderson, Sheldon [illegible] contract at $7.25 [illegible] laying about 36,000 of 5-in. to 16- [illegible] County Ditch No. 10. Bids on this [illegible] opened Feb. 26 by [illegible] Auditor, Marshall, Minn.

Mississippi.

[illegible] A. G. McWilliams, [illegible] have been awarded the [illegible] constructing 15 miles of [illegible] 7-ft. deep canal for the Hayes Creek [illegible] and Drainage District. Bids for the [illegible] opened Feb. 26 [illegible]

New Mexico.

Bids will be received until 2 p. m., March [illegible] Orchard Irrigation District, First National Bank Bldg., Farmington, N. Mex., it is [illegible] for the construction of about [illegible] of ditch work including a diversion dam and headgate in the river near Cedar Hill. A [illegible] District

Ohio.

✣ [illegible]

Oregon.

[illegible] of the west extension of Umatilla irrigation [illegible] report recently submitted by the special board [illegible] adopted and arrangements will probably be made for beginning work on the project, which will reclaim 30,500 acres at a cost of [illegible] Hermiston, Ore., is Project Engineer.

Memphis, Tenn., and Vicinity.

⦿The Pouney Paving Co., of Memphis, has been awarded the contract for laying brick alleys and courts in and around the new $1,000,000 municipal building just being completed by the city of Memphis. The contract involves about 10,000 sq. yds. of pavement, and the contractor proposes to use Egyptian Block in the work. The brick will be laid on a 6-inch concrete foundation and in accord with the regular specifications adopted by City Engineer Weatherford. The Pouney Co. has already begun the work.

⦿Mr. Adkins is contemplating the erection of a concrete plant at Jonesboro, Ark., for the manufacture of concrete building block. Mr. Adkins has purchased a factory site, and will shortly construct his plant.

Phil Linz, the popular office man of the Larkin Construction Co., this city, has just been appointed local representative of the Koehring Machine Co. of Milwaukee. Phil has a host of friends among the contractors and is a hustler of the best kind; the Koehring people could not have made a better selection in their representative.

J. A. Cordeal, the Western and Southern manager of the Western Wheeled Scraper Co., was in Memphis last week in the interest of his firm. Joe is looking well and it did the contractors, whom he met in Memphis, good to hear him speak so optimistically of the vast amount of railroad work which will come up within the very near future. Joe Cordeal is a man of keen discernment and does not make a statement unless he knows whereof he speaks; therefore when he states that he is sure of a busy railroad year, the boys bank on his words. Joe has a great many opportunities to get advance information. He numbers among his friends the chief engineers of some of the biggest roads in the country, and traveling over the South as he does, he picks up a great deal of information that is of an advance nature. From Memphis, Joe went to Birmingham and intends to go over the new L. & N. work about 30 miles north of the latter place which was recently awarded. He will traverse the entire 200 miles and meet all the boys on the line before returning to his St. Louis headquarters.

E. A. Kingsley, ex-city engineer of Little Rock, and now in charge of the pavin[illegible] to be done by the City of Helena, Ark., was in Memphis last week and dropped in on all his old friends. He conferred with City Engineer Weatherford on various kinds of pavements and praised the Memphis engineer on the good streets which he found in this city. E. A. said there was not a city in America the size of Memphis which had such an extensive system of excellent roads and was surprised to learn that it is the intention of the city to spend $[illegible] the coming year. According to Mr. Kingsley, Helena, too, will spend a great deal of money this season on good streets and he expects to be able to make some announcements within the very near future.

Willis E. Ayers, Engineer for Drainage District No. 13 of Arkansas, will receive bids until March 7, at Oceola, for the construction of about 38 miles of drain ditches. This work will amount to approximately 1,550,000 cu. [illegible] per yard, or something like $40,000. There will also be eight wooden bridges, and a lot of miscellaneous work done. The work will be let in six sections, and bids will be received on [illegible] Mr. Ayers, this will open up more than 25,000 acres of fine land for cultivation.

It is rumored that Frank N. Fisher, Superintendent of the Louisville & Nashville R. R., will be appointed chairman of the Board of Control of the New Union Station. This Board will be elected at the next Directors meeting, which will be held some time in March. Frank will be a good man for the position, familiar as he is with all phases of rail- [illegible]

Ed Mosely is in the city, recovering from the effects of a premature explosion of dynamite. Ed was superintending the placing of a blast on his Alpine, Texas, work, and was quite painfully injured when the blast exploded. Ed says he will hang around Memphis for a week or two, and then go back to Texas. Incidentally he says he is making all kinds of money on his contract there.

Report comes from Dan Jacks, one of the many Memphis contractors who went West in the past few years, that his large contract near Alpine, Texas, is progressing rapidly, and profitably. Dan says he expects to buy him an automobile in the near future, to better cover his work.

The School Commissioners of Jonesboro, Ark., are figuring on the early erection of a new high school building at that place, to cost about $40,000. Plans for this building have been drawn up by Memphis architects, and bids will be received on March 27 by Henry H. Haughton, Secretary of the Jonesboro School Board. The Board is now floating a bond issue of $40,000 to pay for the cost of building.

It is rumored that the railroad shops of the Jonesboro, Lake City & Eastern at Paragould will be removed to Nettleton in the near future. Officials have been making tests, and have declared that Nettleton has more facilities to offer.

Although service on the new Cross Town Line of the Memphis Street Ry. was promised on Feb. 27, it will not be completed until about March 15, owing to the unusual run of bad weather in this section for the past two months. Officials now state that the work is well in hand, and they hope to be running cars in less than two weeks. This line will relieve the up-town section of a great deal of traffic, and it is said will entirely do away with the congestion in the business district.

The Iron Mountain R. R. and the Rock Island will shortly erect another station at Augusta, Ark., in place of the building recently destroyed by fire. This should be known as the "Hoodoo Station," inasmuch as three buildings have been burned there in the past two years.

Overton County, Tenn., has voted $150,000 in County Turnpike Bonds, and contemplates the building of several new pikes. It is stated that as soon as this bond issue is confirmed and sold, work will be started on roads in this county.

President H. U. Mudge, of the Rock Island, was in the city last week, for the purpose of conferring with a committee regarding the proposed bridge here, and now makes the announcement that unless the original bill is passed that there will be no bridge. He states that the Rock Island will accept no changes, and does not consider that his road should be compelled to maintain approaches and wagonways. The citizens of Memphis also stand firm in their demands for facilities, and the outcome can only be guessed.

Wyoming.

M. T. Christensen of the Routt County Development Co., of Steamboat Springs, Colo., has started a surveying crew on the proposed project, between Dixon and Savery, Wyo., to [illegible] on an enlarged scale [illegible] water for about 2,000 acres on the mesa [illegible]

Canada.

✣Bids will be received until noon, March 23, by H. Grills, Secy.-Treas., Macdonald, Man., for the removal of 20,000 yds. of earth from bottom and sides of ditches on the lowances in Township 8, R. 23, E. P specifications are on file with C. A 428 Main St., Winnipeg, Man

WATER-WORKS

Alabama.

The City Commission of Birmingham, Ala., has adopted a resolution requiring the Birmingham Waterworks Co. to lay an 8-in. main along 77th St., from the East Lake Blvd., to Fourth Ave.; along Fourth Ave. to 80th St.; along 80th St. to Fifth Ave., and along Fifth Ave. to 84th St.

Arkansas.

Plans have partially been completed for the installation of a waterworks and electric light system in Gravett, Ark., estimated to cost $25,800. The work is in charge of the Water & Light Commission.

California.

⊙The Judson Mfg. Co. has been awarded the contract by the Board of Public Works of San Francisco, Calif., for the structural steel and iron work of Class A building located in Fort Mason Military reservation for pumping station No. 2. The contract price is $9,145. Bids were opened Feb. 21.

The Bear Valley Extension Water & Pipe Line Co., of Redlands, Cal., has ordered an issue of bonds in the sum of $25,000 for an extension of the water system. Plans have been completed.

Colorado.

The City Council of La Junta, Colo., has purchased six acres on the north side of the river as a source of a new and better water supply. Wells will be sunk and if the supply proves sufficient the old water plant on the south side will be abandoned and a large pumping plant installed at the new point.

Georgia.

The Commissioners of Cartersville, Ga., are planning to submit at an early date a bond issue for the purpose of enlarging and extending the waterworks system and electric light plant, putting in a day current of electricity, and the erection of a city hall. The issue will probably approximate $60,000.

The citizens of Pavo, Ga., will vote March 11 on the proposition to issue bonds in the sum of $10,000, $6,000 of which will be used for rebuilding a school, the remainder for completing the equipment of the waterworks plant.

Idaho.

The Boise Natural Hot Water Heating Co., First Nat. Bank Bldg., Boise, Ida., has sold bonds in the sum of $300,000, and will begin work at once in enlarging its wells near the Kelly Hot Springs, the source of the hot water supply. Alonzo Fisher, engineer of the company, estimates the cost of laying pipe lines to the city at $150,000. A. W. Berr is president and State Treasurer O. V. Allen is secretary and treasurer of the company.

Illinois.

✣Bids will be received until April 17, by City of Fairbury, Ill., for the erection of a steel water tank. Plans and specifications are on file with T. D. Karnes, City Clerk.

⊙James B. Clow & Sons of Chicago, Ill., have been awarded the contract by the city of Dayton, O., for furnishing the waterworks with 665 tons of cast iron water pipe the coming year, at $22.70 per ton for all sizes and $50 per ton for specials.

⊙The City Council of East Moline, Ill., has awarded the contract to the Chicago Bridge & Iron Works of Chicago, Ill., for the construction of a new 500,000-gal. water tank. Bonds were recently issued in the sum of $25,000 for this work, a new pump and an air compressor.

The citizens of Galena, Ill., will probably be asked to vote at the city election on April 16 on the proposition of purchasing the waterworks property operating at present in the city.

The city engineer of Normal, Ill., has presented plans to the City Council for the new improvements at the waterworks. The plans call for a new 12-in. well equipped with a 500-gal. deep well turbine pump, which will deliver the water into the new reservoir to be built north of the new building and immediately east of the present structure. The reservoir will be 26 ft. wide by 74 ft. long by 11 ft. deep and will have a capacity of 150,000 gals. It will be concrete. The new building will be of brick. The plans also call for two new contrifugal single stage high pressure pumps. Bids will shortly be asked on the work.

Bids opened Jan. 23 at Chicago: 8,950 gals. of engine oil according to prices in Engineering & Contracting, Jan. 31st, Magie Bros., 155 N. Canal St., Chicago; 32,000 lbs. white cotton waste, Harris & Co.; 10,000 lbs. plumbers' refined solder, Gardiner Metal Co., 1364 W. Lake St., 19.36 cts. per lb. Bids opened Jan. 20th: Cast iron pipe, 5,000 tons of 6-in., 8-in. and 12-in. pipe, $23.40 per ton, United States Cast Iron Pipe and Foundry Co., 122 S. Michigan Ave. Bids opened Jan. 18th: 100 tons of pig lead, The Gardner Metal Co., $4.57 per 100 lbs. Bids opened Jan. 20th: Sewer pipe, 15,000 pieces 4-in., 3⅕ cts. per ft.; 800 pieces 6-in., 5 cts. per ft.; 600 pieces 9-in., 10 cts. per ft. Wm. E. Dee & Co., 30 N. La Salle St., bids opened Jan. 23rd.

Indiana.

✣Bids will be received until 7:30 p. m., March 18, by City Council, New Castle, Ind., for laying approximately 10,000 ft. of 8, 10 and 12-in. cast iron water mains and accessories. Specifications are on file with Charles Brossman, Consulting Engineer, Union Trust Bldg., Indianapolis, Ind. L. M. Johnson is City Clerk. Official advertisement will be found elsewhere in this issue.

The Board of Public Works of South Bend, Ind., has retained Consulting Engineers Burns and McDonnell, Scarritt Bldg., Kansas City, Mo., to prepare plans and specifications for the making of improvements to the waterworks system. Among the improvements contemplated are: Erection of a new powerhouse at a cost of $23,000, the installation of two 5,000,000-gal. pumps, storage reservoir costing $55,000 and the purchase of several other pumps. The total cost of the work is estimated at $200,000. Bids will be asked immediately upon the completion of plans.

Iowa.

⊙The Board of Water Trustees of Dubuque, Ia., has awarded the contracts for the sinking of the well at the Eagle Point pumping station, at a cost of $14,000, as follows: Sinking well, Schoh & Coleman of Peoria, Ill.; installing machinery, Key City Iron Works of Dubuque; construction of brick building about the well, 18 ft. by 14 ft. 6 in., Henry Meuller of Dubuque; steel casing for well, Springfield Boiler Works.

The water company of Centerville, Ia., contemplates making improvements to its plant at an estimated cost of $50,000. H. M. Crawford is interested.

The City Council of Griswold, Ia., has decided to place the proposition to extend the water mains of the town before the people at the coming city election.

The citizens of Alden, Ia., have been asked to vote March 25 on the proposition of utting in water mains.

Kansas.

Consulting Engineer J. W. Mavity Lyndon, Kans., is preparing preliminary pl s and estimates for water supply and sewers r the city of Lyndon. An election will be ld in the near future to vote bonds for e improvement.

Louisiana.

⊙The General Contract Co., of New La., has been awarded the contract b A. J. Macnab, Jr., Consulting Quarte 416 Hibernia Bank Bldg., New Orlea, constructing roof over settling tanks connections to quarters and earth fill elevated water main at Fort St. Philip, $2,323. The roofs will cost $1,923, sew and fill $175. Bids were opened Feb.

Massachusetts.

✣Bids will be received until 10 a. m., 9, by Department of Public Works, Ge W. Servis, Engineer, Melrose, Mass., f nishing the following kinds of stock: stones and flagging, standard Akron pipe, standard cast iron water pipe.

✣Bids will be received until 7:30 March 8, by Board of Public Works, Walker, Chairman, Everett, Mass., f nishing 300 water meters.

⊙The Coffin Valve Co., of Boston, has been awarded the contract by the of Water Supply, 165 Broadway, New City, for Contract No. 114, Catskill Aq for furnishing and delivering 43 pressu ulating valves, varying in size from 12 ins., for installation in connection with t tunnel and the City pipe lines of Catskil duct. The contract price is $13,405. Bid opened Feb. 23. J. P. Morrissey is Se of the Board.

Michigan.

Plans are being prepared for the ma extensions to the waterworks system of Haven, Mich., estimated to cost $60,0 which bonds were voted. The work clude the laying of suction line and the ing of the wells in the beach of Lake gan. Contracts will be let within the month. William H. Loutit is Chairm the Water Commission.

Minnesota.

✣Bids will be received until noon, 11, by John Caulfield, Secretary, Water St. Paul, Minn., for furnishing and ins a 1,500,000 gal. pump in the West Side ing station at Page and State Sts.

⊙Wanless & King of Duluth, Minn., have been awarded the contract for relayin and extending the intake pipe at the Negaune erworks plant, Negaunee, Mich., for $3,2

⊙Pastoret-Lawrence Co., Mutual Auto Duluth, Minn., has been awarded the co by the City Council of Eveleth, Minn. McIntyre, city clerk, for the constructi about 1,350 ft. of 6-in. water main on Ha St., and 700 ft. of 8-in. sewer for $4,200. were opened Feb. 23.

Missouri.

✣Bids will be received until 5 p. m., 18, by City Council, Cape Girardeau, Mo furnishing detailed plans, specifications estimates of the cost of construction ar stallation of a water works and electric ing system for the city. George E. Ch is City Clerk.

New Jersey.

✣Bids will be received from 3:15 to 3 m., March 7, by Board of Street and

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] M. R. Sheri[illegible] N. J., for the [illegible] wing streets [illegible] r St., frim Leslie St., to the city line; m St., from Pacific St. to Jefferson St.; ma Ave., from South Orange Ave. to [illegible] Plymouth St. [illegible] ashington Ave. to Chester Ave.; Ridge fro Park Ave. to Sixth Ave., the width [illegible] lis; Vermont Ave., from South Orange t 135 ft. south of Laurel Pl.; Voorhees fro Leslie St. to the city line; Wain- [illegible] Haw[illegible]

New York.

her M. Harper, Inc., Newburgh, N. Y., en awarded the contract by the Board r Commissioners, E. B. Talbot, clerk, l-on-Hudson, N. Y., for the con- i a storage reservoir for the village; The following is an approximate [illegible] 15,000 cu. yds. of earth excavation; yds. of rubble masonry; 125 cu. yds. ncte; 10 acres of clearing and grubbing; ds. of clay puddle; 81 sq. rds. of soil- r seeding; 2,700 sq. yds. of stone pav- f nishing and laying 120 lin. ft. of 16-in. in water pipe weighing 110 lbs. to the ot, with one 16-in. iron body bronze t gate valve, also cover for gate well th hasp and lock. The contract price [illegible]

[illegible] Water District, Manhasset, L. I., N. awarded the contract for the con- ti of a waterworks to W. G. Fritz of r N. J., at $114,189. Bids were received firms. Bids were opened Feb. 15 and t was awarded Feb. 29. Johnson Nassau St., New York City, are ng Engineers.

Cogan Co., 280 Broadway, New York s been awarded the contract by the f Water Supply of New York City, for No. 72, of the Catskill aqueduct, for The work includes clearing and grub- Ashokan reservoir in towns of Olive, Hurley, Woodstock and Kings- ounty. Bids were opened Feb. 20 P. Morriesssey, secretary of the

North Carolina.

e Board of Water Commissioners of N. C., has ordered the laying of a North Caldwell St., a distance of [illegible]

Ohio.

B will be received until noon, March les W. Stage, Director of Public eland, O., for furnishing approx- 26,836 ft. of underground lead cables First Department. H. F. Stillman is

De Vore-McGormley Co., of Toledo, been retained by that city to do the g engineering work on the high pres- mping station. The City Council has ated $12,000 for the work.

Girard Water Co., Girard, O., will ex- lines this summer. Jerome Gray of , O., has been appointed new sup-

Oregon.

is & Christinsen have been award- [illegible] e., for furnishing materials and con- cast iron water mains which will in replacing the existing wooden or ter mains on First, Third and Fifth m "A" St. to "I" St., and on "B," "D," " Sts., from First to Fifth Sts., at e work will require approximately [illegible] of 14-in. pipe, 2,520 ft. of 8-in. pipe, of 6-in. pipe, together with necessary special, gates, hydrants, etc. A. M. s chairman of the Water Committee. opened Feb. 19.

Hydraulic [illegible] and estima[illegible]

South Carolina.

✣[illegible]

✣Bids will be received until March 9, by Sewer and Water Department, Columbia, S. [illegible] class "A" water pipe, 6,000 pounds 6 and 8-in. specials, 17 6 and 8-in. gate valves, 6,000 pounds of pig lead, 8 4½-in. three-way fire hydrants, 2,000 ft. 10-in. and 400 ft. 8-in. vitrified sewer pipe, 10-6-in. and 8x6-in. vitrified sewer pipe specials, 10 standard manhole castings and 3,000 pounds waterproof sewer joint com- [illegible]

Tennessee.

[illegible] chased an acre of ground on Main St., for the erection of electric light plant and waterworks.

Texas.

The City Council of Moody, Texas, contemplates putting in a system of waterworks, paving streets and building concrete sidewalks.

The Trustees of Seguin, Tex., have ordered a standpipe of 275,000 gals. capacity and 200 tons of water mains for the waterworks system. The standpipe will be placed in North Seguin to supplement one of the same capacity now located in South Seguin.

⦿The Commissioners' Court, Columbus, Tex., has contracted with the Des Moines Bridge & Iron Works, Des Moines, Ia., for the erection of a new steel water tower and reservoir for Columbus. The reservoir is to have a funnel-shaped bottom upon a 3-ft. standpipe extended down to the ground, and is to be supported upon steel frame construction 60 ft. high. It is to have a capacity of 75,000 gals. above the 53-ft. line from the ground. The contract price is $3,800.

Virginia.

⦿Stothoff Bros., of Flemington, N. J., have been awarded the contract by the Waterworks Committee, N. P. Angle, chairman, Rocky Mount, Va., for boring a deep well, size 8-in., with standard casing to a depth necessary to get 100 gals. per minute. The work is estimated to cost $3,000. Bids were opened Feb. 6.

The Altavista Light & Water Corporation, Altavista, Va., has been incorporated with a capital stock of from $15,000 to $30,000, to construct and operate light and water plants. The incorporators are: J. E. Lane, president, Esmont, Va.; A. G. Ball, secretary and treasurer, Altavista, Va.; Thomas S. Martin, Charlottesville, Va.

Washington.

Following bids were received Feb. 23, by the Board of Public Works of Seattle, Wash., for the construction of a water main in North 41st St. et al.: C. J. Johnson & Co., $81,842; Jahn Cont. Co., $76,028; Wrad & Scherer, $84,464; Ferguson-Colt Co., $79,618; Geo. C. Dietrich & Co., $76,761; Hayden & Sons, $80,717; Sparger Concrete Co., $81,878; Sound Const. & Engr. Co., $88,825; Krogh & Jessen, $85,085; J. L. Ritchie, 1241 18th Ave. N., $74,298; Northwest Const. Co., $96,377; Cummings & Kiehl, $80,000; Graff Const. Co., $79,768.

R. H. Thompson of Seattle, Wash., has submitted his report to the City Council of Victoria, B. C., on the Smith's Hill reservoir. It recommends a reconstruction of the reservoir. The estimated cost of rebuilding the walls of the reservoir is $40,000.

The Town Council of Grandview Wash., A. E. Fish, town clerk, will sell bonds March 11 in the sum of $18,000 for waterworks.

Civil Engineer Frank C. Kelsey of Portland, Ore., has filed his report with the City Commission of Centralia, Wash., on the preliminary plans prepared for the installation of a gravity water system whose source of supply will be the North Fork of the Newaukum River, 19 miles east of the city. The pipe line will be 14 miles in length, and the cost of a 16-in. pipe, sufficient to deliver 3,000,000 gals. of water a day, will be $112,115. The cost of an 18-in. pipe, to deliver 4,000,000 gals. will be $134,115. The citizens will shortly be asked to vote on the proposition. Stanley Macomber is city engineer.

Wisconsin.

✣Bids will be received until 8 p. m., March 15, by Jacob Jackson, Village Clerk, Independence, Wis., for furnishing the necessary labor and materials for approximately 1,200 ft. of 8-in. cast iron pipe in trench seven to sixteen ft. deep in sandy soil. Specifications are on file with W. E. Miller, Madison, Wis.

⦿F. O. Robinson & Co., of Manitowoc, Wis., have been awarded the contract by the city of Durand, Wis., Jacob E. Bauer, City Clerk, for installing all pipes, specials, valves, hydrants and connections for the waterworks system. The work will include laying 8,100 ft. of 8-in., 8,100 ft. of 6-in. pipe and making all connections with 4-in. pipe. The work was let at the following prices: $.31 per ft., for 8-in. pipe, $.32 for 6-in. pipe, $.29 for 4-in. pipe and $2.70 per cu. yd., for rock excavation. S. G. Gilman, Mondovi, Wis., is Consulting Engineer. Bids were opened March 1.

The village of Wauzeka, Wis., has secured plans for a water and sewerage system.

Wyoming.

The town of Sundance, Wyo., will vote March 12 on the proposition of bonding the place for $18,000 for the purpose of raising money to construct waterworks.

Canada.

✣Bids will be received until noon, March 8, by City Commissioners, Prince Albert, Sask., for supplying cast iron water pipe required by the city during the year of 1912. Pipe to conform to requirements of Canadian Society of Civil Engineers specifications Class "B." Tenders to state price per ton for each size delivered in carload lots f. o. b. cars in Prince Albert, freight and duty paid. Subject to inspection and approval on delivery. The following approximate quantities will be required: 2,122 lin. ft. 10-in. cast iron pipe; 7,982 lin. ft. 8-in. cast iron pipe; 16,570 lin. ft. 6-in. cast iron pipe. Thirty per cent of the above quantity must be delivered on or before the 30th days of April, 1912, and the remainder on or before the 31st day of May, 1912. C. O. Davidson, is secretary-treasurer.

✣Bids will be received until 6 p. m., March 11, by J. McTeigue, city clerk, Port Arthur, Can., for the supply and delivering f. o. b. city warehouse of the water works and Board of Works material, including sewer pipe, etc.

✣Bids will be received until noon, March 18, by T. W. Brooke, chairman, Water Commissioners, Windsor, Ont., for pumping engine. Proposal No. 1—For the building and installing of one horizontal cross compound, high duty crank and flywheel condensing pumping engine, having a capacity of five million imperial gallons in 24 hours against a domestic pressure of 50 lbs. per square inch, or a fire pressure of 110 lbs. per sq. inch, with 100 lbs. steam at throttle. Proposal No. 2—For the building and erection of a pump, having a capacity of eight million imperial gallons in 24 hours, under similar conditions and specifications as contained in Proposal No. 1. Each tenderer will furnish his own plans and specifications.

✣Bids will be received until noon, March 18, by City Commissioners, Moose Jaw, Sask., for work in connection with the laying and fitting up of an 18-in. steel pipe line from Moose Jaw to Sandy Creek west of Caron, Sask., a distance of approximately 100,000 lin. ft. Specifications and full particulars may be obtained on application to the city clerk, Moose Jaw, or Walter J. Francis & Co., consulting engineers, Montreal. A plan and profile of the [illegible] City Commissioners, Moose Jaw, or at the office of Walter J. Francis & Co., consulting engineers, 232 St. James St., Montreal.

✣[illegible] 18, by E. B. Bonnell, city clerk, Moose Jaw, Sask., for supplying various valves and fittings for waterworks installation. Specifications and information may be obtained of Walter J. Francis & Co., Montreal, Que., consulting engineers.

✣Bids will be received until noon, March 18, by E. B. Bonnell, city clerk, Moose Jaw, Sask., for supplying and erecting a reinforce[illegible] [illegible] 2,000,000 gals. Plans and specifications are on file with W. J. Franciso & Co., consulting engineers, Montreal, Que.

The city of London, Ont., contemplates issuing debentures for $61,000 for additions to the pumping plant, and for $66,000 for addition to the lighting plant.

Water experts of the city of Toronto, Ont., have submitted a report to the Board of Control relative to the bringing of the city's water supply from Scarboro Heights at an esti[illegible]ted cost of $6,000,000. The work [illegible] extension of the intake [illegible] duplication of the filtration plant, a t[illegible] Bluffs, a large reservoir on [illegible] bluffs, and a pumping statio[illegible] Willis Chipman of Toronto is secretar[illegible] of Experts.

[illegible] received Feb. 26 by the Cit[illegible] missioners of Moose Jaw, Sask., for [illegible] ing delivery and erecting and testing [illegible] elevated water tank within the city lim[illegible] been referred to Consulting Enginee[illegible] ter J. Francis & Co., Montreal, Que.

SEWERAGE AND GARBAGE DISPOSA

Arkansas.

⦿The Commissoioners of Sewer District No. 69, Little Rock, Ark., have awarded the contract for the construction of a sewer to serve the Eighth ward to M. D. L. Cook of that city for $35,500. The commissioners are: Charles Heckler, L. J. Wright and H. S. Turner.

The City Council of Russellville, Ark., has passed an ordinance forming practically the entire city limits into an improvement district for the purpose of building a municipal sewer system. R. C. Brown, G. C. Nugent and H. W. Patrick are commissioners. An engineer will be engaged to make the necessary surveys and advertise for bids at once.

California.

⦿Bids were received by the city of Oakland, Cal., Perry F. Brown, city engineer, on Feb. 19, for the construction of sewers in 7th and 71st Aves. The following are some of the details: Concrete pipe 6-in. shell, 1-6 mix, soil good picking, all dry work, cement $3 per bbl., sand $2 per cu. yd., lumber $20 per M, brick $12 per M, labor $3 per day, masons $7, castings $8.25 delivered. Bidders on the work were: (a) J. R. Sorenson, (b) Consolidated Construction Co., (c) Dakin Construction Co., (d) Bates Borland & Co., (e) Hutchinson Co., (f) Contra Costa Construction Co., (g) C. D. Vincent, (h) John Heafy, (i) Wm. Heafy, awarded contract (j) Arthur W. Bigger.

[illegible]	[illegible] Con	[illegible] Con	[illegible] S. P.	[illegible] S. P.	1,220' 18" S. P.	[illegible] M. H. 4'	[illegible] Y	21 Y's.	[illegible] Y	[illegible] Slant
(a)	[illegible]	[illegible]	[illegible]	[illegible]	$1 70	[illegible]	[illegible]	$4.20	[illegible]	[illegible]
(b)	[illegible]	[illegible]	[illegible]	[illegible]	1.90	40.00	5.00	[illegible]	2.00	[illegible]
(c)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.50	2.75	2.10	[illegible]
(d)	[illegible]	[illegible]	[illegible]	[illegible]	1.59	55.00	[illegible]	[illegible]	.60	2.00
(e)	[illegible]	[illegible]	[illegible]	[illegible]	2.62	[illegible]	5.00	4.00	3.00	[illegible]
(f)	[illegible]	[illegible]	[illegible]	[illegible]	2.40	35.00	6.00	5.00	[illegible]	1.50
(g)	[illegible]	2.37	2.41	2.08	1.74	41.00	3.15	2.50	[illegible]	[illegible]
(h)	[illegible]	[illegible]	[illegible]	[illegible]	1.73	40.00	4.50	[illegible]	[illegible]	[illegible]
(i)	2.80	2.12	2.21	1.91	1.53	40.00	[illegible]	[illegible]	[illegible]	[illegible]
(j)	4.12	2.77	2.40	2.44	1.67	37.20	[illegible]	[illegible]	4.07	[illegible]

⦿Bids were received Feb. 19 by the city of Oakland, Cal., Perry F. Brown, city engineer, for the construction of a sewer on Seminary Ave., to 66th Ave. The contract was awarded to Wm. Heafy at $14,487. Some details of the work are as follows: 2,392 ft. 36-in. pipe; 2,443 ft. 21-in. concrete pipe; 1,643 ft. 18-in. concrete pipe; 13-4-in. manholes, 68-5-in. wyes, 20-5-in. wyes; concrete sewer pipe 6-in. shell, 1-6 mix, good soil, dry work, cement $3 per bbl., sand $2 per cu. yd., lumber $20 per M, brick $12 per M, labor $3, masons $7, castings $8.25 delivered. Eleven bids were received on the work.

Plans have been completed for the construction of outlet sewers in District No. 4, city of Oakland, Cal., to cost approximately $40,000. Bids on this work will be asked shortly. Perry F. Brown is city engineer.

The town of Colfax, Cal., is about to take steps to make its sewer system more modern to prevent the polution of streams. W. A. Newman is city clerk.

The City Council of Oakland, Cal., has adopted plans and specifications for extensive sewer improvements in the following streets: West St. and Market St., between Fifth and Seventh [illegible] Aves. [illegible] East 14th St., Rusdale St., Hamilton St., Snell St., [illegible] Brookdale Ave.

Florida.

Engineer G. W. Bullock expects to submit maps, specifications and plans for the construction of a sewerage system to the City Council of Orlando, Fla., on March 7. A bond election for the improvement will be held in about 30 days. The improvement will cost approximately $100,000.

Georgia.

The sewer committee of Macon, Ga., is ascertaining the number of miles, etc., needed for the extension of the sanitary sewers to portions unprovided. Bids will shortly be asked on this work. C. C. Anderson is city engineer.

Illinois.

⦿The Board of Local Improvements of Springfield, Ill., has awarded H. Nelch & Son of that city the contracts for the construction of two sewers, as follows: Miller St., from Seventh to 12th St., 18-in. diameter, $0.56, inlets, $0.32 and manholes, $22; Yates Ave. and Bond St., 12-in. sewer, $0.37, manholes, $22.

City Engineer J. D. Arey of Sterling, Ill., is preparing plans for the purpose of giving relief to the Avenue B sewer system. It is probable that it will be necessary to either construct an outlet at the foot of Second Ave. or build an outlet from Avenue G along the present system as far as the corner of Locust St. and Fifth St. Such an outlet would cost approximately $20,000.

Indiana.

✣Bids will be received until 7:30 p. m., March 12, by Bonneville, Ind., W. Schafer, clerk, for the construction of main sewers and branches in the South Side.

Resolutions have been passed by the Board of Public Works of Evansville, Ind., for the construction of sewers, as follows: In an alley from Seventh to Eighth Sts., between Cherry and Oak Sts., from a sewer in block 41, Eastern Enlargement, in an alley in the rear of lots 6 to 11, block 2, Forest Park, from a sewer in the alley of block 3, Forest Park; along Fifth St., from a sewer in Division St., north to Ingle St.; along Columbia St. from a sewer in Twelfth Ave. west to an alley in the rear of lots 1 to 10, of blocks 14 and 39, Lamasco; in Columbia St., from a sewer in 12th Ave., west to alley in rear of lots 1 to 10, of blocks 14 and 19, Lamasco, thence through alleys to Iowa St. with branches in alleys east and west in blocks 14 and 39, Lamasco; in an alley in block 8, Archer's Addition, [illegible] sewer in Garfield Ave., east 140 ft. to [illegible] thence north in an alley 210 ft.; in a[illegible] block 2, Shanklin's Enlargement, from [illegible] in Michigan St.

Iowa.

⦿Following bids were received by t[illegible] Council of Tipton, Ia., for the cons[illegible] of a sewer system, including the outle[illegible] tank and filter bed: Construction of [illegible] manholes, etc.—J. W. Smith & Son, [illegible] homa City, Okla., $53,979 (awarded co[illegible] C. B. McNamara & Co., Dubuque, Ia., [illegible] F. C. Robinson & Co., Manitowoc, Wi[illegible] 668; Lana Construction Co., Harlan, I[illegible] 581; Garberick & Anderson, Sheldon, I[illegible] 457. Outlet, septic tank and filter bed [illegible] Smith & Son, $610, $3,362 and $3,787, [illegible] tively; McNamara & Co., $697, $3,[illegible] $3,388; Cook Construction Co., Des [illegible] Ia., $806, $3,862 and $3,891; Tschirgi [illegible] Dubuque, Ia., $563, $3,521 (awarded co[illegible] and $3,359; Geo. D. Inman, Kansas Ci[illegible] $853, $3,315 and $3,834; Hoar & Par[illegible] Iowa City, Ia., $796, $3,740 and $3,807 [illegible] Yager, Cedar Rapids, Ia., $858, $3,[illegible] $4,223; Grant Baker, Tipton, $2,813 f[illegible] bed (awarded contract).

⦿[illegible] & Scanlon, of Sioux City, [illegible] been awarded the contract by the City [illegible] [illegible] miles of the Leeds sewer at $.48 per [illegible] [illegible] Blackhawk Construction Co., of Water[illegible] secured the contract for two sections, [illegible] as the Springfield St. section and the J[illegible] St. section, at $.48 and $.44, respective[illegible]

The Board of Local Improvements [illegible] enport, Ia., has recommended the laying [illegible] Second ward sewer, including the t[illegible] bounded by 11th to 8th Sts., and 11th [illegible] Aves. The estimated cost is $29,240. [illegible] ward sewer from 38th to 41st Sts., a[illegible] to 18th Aves., was also recommende[illegible] The estimated cost is $7,500.

The Board of Local Improvements [illegible] Dav enport, Ia., has decided to provide pl[illegible] a sewer to include the territory bound[illegible] 41st to 46th Sts., and 11th to 18th Ave[illegible]

Kentucky.

Resolutions urging the Kentucky [illegible] Assembly to enact, at once, a law auth[illegible] a bond issue of $2,000,000, to complete [illegible] tem of lateral sewers in Louisville, ha[illegible] adopted by the special legislation comm[illegible] that city.

Louisiana.

✣Bids will be received until noon, A[illegible] by F. S. Shields, secretary, at the office [illegible] Board of Sewerage and Water, New [illegible] La., for the construction of a concret[illegible] and covered canal on Claiborne St., fr[illegible] sian Fields to Lafayette Aves. The mai[illegible] of the work will consist of approxi[illegible] 9,000 cu. yds. of excavation, 1,740 cu. [illegible] concrete and masonry, 7,310 lin. ft. o[illegible] cotta pipe lines from 36-in. to 6-in. [illegible] meter, and other work incident thereto, [illegible] as Contract "42-D." A certified check [illegible] New Orleans bank in the sum of $1,[illegible] posited in accordance with the terms [illegible] specifications will be required of each [illegible] [illegible] with blank forms of [illegible]

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible]

Maryland.

[illegible]

Massachusetts.

[illegible]

Michigan.

[illegible]

Minnesota.

[illegible]

Nebraska.

[illegible] William Grant [illegible] has submitted his report to the Village of [illegible], Nebr., for [illegible] sewerage system for [illegible] sum of $22,000 will be voted upon. [illegible]

MAINS	
12-in. vit. pipe sewer, at 75	[illegible]
[illegible]	[illegible]
[illegible] ts.	[illegible]
ft. 10-in. c. i. pipe sewer, at 2.00	20[illegible]
ft. 8-in. vit. pipe sewer, at 55 ts.	391
nholes, at $40	880
	$ 5,[illegible]
LATERALS.	
ft. 8-in. vit. pipe sewer, at 55 ts.	$ 8,587
ft. 8-in. c. i. pipe sewer, at $1.75	88
nholes, at $40	1,360
sh tanks at $75	900
[illegible]	[illegible]
DISPOSAL PLANT	
[illegible]	[illegible]
omplete	[illegible]
ound plant	100
[illegible]	[illegible]
Total	$ 6,840
Total	$23,480
ng and legal expense, 7½ per ent	$ 1,760
[illegible] total	[illegible]

New Jersey.

Council of Longport, N. J., has [illegible] Municipal Engineers Pugh and Hub[illegible] Philadelphia, Pa., to prepare plans [illegible] of a new sewerage [illegible]

[illegible] being prepared for the [illegible] new trunk line sewer for the city [illegible]ford, Nebr., estimated to cost $12,-[illegible]; work will require excavation, mate[illegible] complete construction of sewer. Bids advertised on March 2 and will run [illegible] ays. Page T. Francis of Crawford [illegible]er. C. J. Hornsly is Clerk.

New York.

[illegible] will be received until 11 a. m., March [illegible] partment of Public Works, Francis [illegible], Commissioner, Buffalo, N. Y., for [illegible] wing work: A separate proposal must [illegible] for the work and supplies included [illegible] ing: For constructing a 15-in. sewer [illegible]

Lake. [illegible]

[illegible] items.

[illegible] at two points below the Freeman's bridge, and the work of [illegible] lower Van Vranken Ave. will shortly be started. [illegible]

The contracts for the construction of the [illegible] the charter election which will be held March [illegible]

Prof. Olin A. Landreth of Union College, Schenectady, N. Y., has [illegible] Council has approved a bill which will be introduced in the legislature authorizing a bond issue for the construction of sanitary trunk sewers and sewage disposal plant on both sides [illegible] of $325,000. Charles H. Snyder is city engineer. John C. Churchill is chairman of the commission.

The village of Rockville Center, L. I., N. Y., is contemplating the installation of the first [illegible]

Ohio.

✣[illegible] March 7, by Director of Public Service, Youngstown, O., for [illegible] terial for constructing Oak St. sewer from Truesdale Ave. to Bond St. and Himrod Ave. from Truesdale Ave. to outlot 719.

✣Bids will be received until noon, March 7, [illegible] O., for furnishing the necessary labor and materials for sewering Court St., from Walnut St. to Harrison St., Harrison St., from Court St. to Adams St. and Williard St., from Harrison to Watt St. W. H. McMillin is [illegible]

⊙Hugh O'Neill has been awarded the contract [illegible] Lakewood, O., for furnishing all necessary labor and material for making collection of garbage and dead animals in the city, for a period of two years, commencing March 1, 1912, at $274 per month. Bids were opened Febr. 26.

City Engineer R. S. Blinn of Mt. Vernon, O., has prepared plans for the construction of two miles of sanitary sewers, estimated to cost $32,000. The work will include 4 sanitary sewers and one storm sewer. Contracts will be let about June 1.

The City Council of Hamilton, O., has decided to issue bonds in the sum of $25,000 for the construction of storm sewers.

[illegible] the outlet. [illegible]

Oklahoma.

[illegible] sanitary sewers in Stonebreaker Heights, owing to the fact that a mistake [illegible] in printing the call for bids.

Oregon.

✣[illegible] Department of Public Works, Portland, Ore., for the construction of East Stark St. sewer [illegible] City Engineer.

The City Council of Enterprise, Ore., con[illegible]

Pennsylvania

⊙Director of Public Works C. V. Terwilliger of Scranton, Pa., has awarded sewer contracts aggregating in the neighborhood of $100,000, as follows: Jones & Markwick, sew[illegible] from Prescott Ave. and Mulberry St., to the Roaring Brook, $8.40 per lin. ft., to cost about $22,000. Mathias Stipp & Co., section K, 17th district sanitary sewer, $3.28 per lin. ft., estimated to cost $51,000; Kearney & Co., relief [illegible]

South Dakota.

✣[illegible] 26, by Board of Commissioners, Sioux Falls, S. Dak., for the [illegible] of sewerage in accordance with plans and specifications on file with S. B. Howe, City Engineer, Sioux Falls, So. Dak., and L. P. Wolff, Consulting Engineer, St. Paul, Minn.; [illegible] Engineering & Contracting, 608 S. Dearborn St., Chicago, Ill. Official advertisement will be found elsewhere in this issue.

The City Council of Bridgewater, S. Dak., has passed a resolution favoring the construction [illegible] blocks. Work will begin in the spring.

Texas.

✣Bids will be received until 10 a. m., March 19, by J. G. Sutton, city secretary, Beaumont, Tex., for the construction of sewers, as follows: 1,600 ft. of concrete or brick, 7½x5 ins. on Long Ave.; 1,800 ft. on Wall St., to be not less than 27-in. vitrified pipe; 1,125 ft. of 18-in. vitrified pipe on Mariposa St.; 400 ft. of 15-in. vitrified pipe on Bismarck St.; 1,700 ft. of 12-in. vitrified pipe on Orange St., including all manholes, catch basins and "wye" branches. For specifications, profiles and plans, address C. L. Scherer, City Engineer.

The City Council of Cuero, Tex., has ordered a bond election to take place at the

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

same time as the regular city election. The bond calls for $25,000, [illegible] clusively for the purpose of installing a sewerage system.

The City Commission of Terrell, Tex., is planning to purchase the sewerage system of the city from the present private corporation, under an arbitration plan.

Washington.

The following bids were received by the Board of Public Works of Seattle, Wash., on Feb. 23, for the construction of sewers in West 61st St.: Dicken & Rightmire, $6,224; McGuire & Moon, $5,123.55; Becker & Walker, $5,723.55; J. A. Bailey, $5,403.40; J. M. Johnson & Co., $5,548.75; Young & Uhrich, $5,378; C. Michael, $5,318; Frasca & Caluccio, $5,351.25; Dahlstrom & Rodal, $6,788; Erickson Bros., $5,599.55; J. Ruthe, $4,985.90; T. I. Peterson, $5,304.50; Will Kopta, 1422 27th Ave., Seattle, $4,594.

Following bids were received by the Board of Public Works of Seattle, Wash., for the construction of the 25th Ave., N. W., et al., sewers: G. N. Johnson & Co., $18,354; McGuire & Moon, $17,080; Becker & Walker, $19,183; Frasca & Coluccio, $18,671; Chas. Michael, $16,899; Krogh & Jessen, $17,668; Young & Uhrich, $17,583; Dahlstrom & Rodal, $16,783; J. Ruthe, 418 Highland Drive, Seattle, $14,978; T. I. Peterson, $17,987; Dicken & Rightmire, $18,876.

Wisconsin.

✣[illegible] received until 4 p. m. [illegible] 19, by H. B. Anderson, Clerk, Colfax, Wis., for constructing a sanitary sewer about 1,400 ft. long including 10 to 15-in. pipe. A. T. Thompson, Menominee, Wis., is Engineer.

The City Council of Milwaukee, Wis., will shortly pass an ordinance providing for the issuance of bonds to the amount of $265,000, to commence construction work on the Menomonee River flushing tunnel. The tunnel will have a capacity of pumping 200,000,000 gals. of water from Lake Michigan into the Menomonee River each day. A tunnel, 11 ft. in diameter will extend 1,000 ft. into Lake Michigan from the foot of Huron St. and will be built to connect with the pumping station at St. Paul Ave. and 13th St. From there an 11-ft. tunnel will run to connect with the North Menomonee River, a 7-ft. tunnel will pour water into the river at 27th St., while an 8-ft. main will provide flushing facilities for the South Menomonee and Burnham slips. With these facilities it is expected to keep the river fairly free from odors and unnecessary contamination. The entire cost will be $1,200,000, but it will take from four to five years to complete the entire undertaking, according to the city engineer. The $250,000 expenditure this year will relieve conditions on a small scale.

Canada.

✣Bids will be received until noon, March 15, by City Commissioners, Prince Albert Sask., for supplying sewer pipe required by the city during 1912. Material to be first [illegible] in every respect, and subject to inspection [illegible] approval on delivery. A sample of the material proposed to be furnished shall [illegible] mitted with the tender. Price to be f. o. b. cars, Prince Albert, freight, duty and [illegible] included. The following approximate quantities will be required:

	Standard length straight pipe.	Y junctions.	Bends.
24-in.	[illegible] lin. ft.	137	[illegible]
18-in.	1,770 lin. ft.	[illegible]	
15-in.	5,812 lin. ft.	[illegible]	
[illegible]	3,121 lin. ft.	[illegible]	
[illegible]	6,108 lin. ft.	171	
8-in.	21,327 lin. ft.	[illegible]	[illegible]
6-in.	3,000 lin. ft.	[illegible]	[illegible]
[illegible]	6,000 lin. ft.		[illegible]

Twenty per cent of the above quantit[illegible] be delivered on or before the 30th [illegible] April, 1912, and the remainder on or [illegible] the 3d day of May, 1912. C. O. Davi[illegible] secretary and treasurer.

Municipal Engineer D. R. Baribault [illegible] Vital, Man., has submitted his report [illegible] City Council relative to the installation [illegible] water and sewer system to cost [illegible] $500,000. The water purification pla[illegible] necessitate an expenditure of nearly $[illegible]

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC

Alabama.

✣Bids will be received until noon, March 25, by Board of Commissioners, Mobile, Ala., for construction of foundations under proposed steel sheds, 1,000 to 1,240 ft. long, such foundations consisting of piling and concrete piers. Plans and specifications are on file with Wright Smith, City Engineer.

✣Bids will be received until noon, March 25, by Board of Commissioners, Mobile, Ala., for the construction of steel shed approximately 1,000 by 100 ft. and also alternately on shed 1,240 by 100 ft., on the river front. Wright Smith is City Engineer.

Arkansas.

✣Bids will be received until noon, March 12, by C. L. Moore, Jr., Osceola, Ark., for the construction of a power plant and for installing machinery, dynamo and other equipment for an electric light plant at Osceola, Ark. W. N. Gladson, Fayetteville, Ark., is Engineer.

California.

Bids were received Feb. 20 by Lt. Col. Thomas H. Rees, U. S. Engineer, 401 Custom House, San Francisco, Cal., for dredging 152,259 cu. yds. of material in Suisun Channel, Cal. N. R. Harris, 23 California St., San Francisco, Cal., at 4.49 cts. per cu. yd. were the low bidder.

Connecticut.

✣Bids will be received until 3 p. m., March 28, by Capt. A. E. Waldron, U. S. Engineer, New London, Conn., for completing Kelsey Point Breakwater, Harbor of Refuge, Duck Island, Conn.

District of Columbia.

✣Bids will be received until March 12, by J. R. Burt, Capt., Signal Corps, U. S. Army Disbursing Officer, Washington, D. C., for furnishing 2 switchboards, local battery, unit type, capacity 100 lines, 4 switchboards local battery, unit type 50 lines.

✣Bids will be received until 10:30 a. m., March 28, by Maj. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for the furnishing under Canal Circular 687, structural steel, cold-rolled steel, steel bolts, wrought iron pipe, pipe wrenches, push cars, hose, level rods, salt-water soap and lumber.

✣Bids will be received until 10:00 a. m., March 15, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C. (date postponed from March 1), for furnishing under Canal Circular 679, general control apparatus for the lock machinery, including starting panels for all motors, which are to be controlled from a remote point; limit switches, commutating switches used in the miter-gate control, auxiliary, cut-out switches for miter-gate strut, handrail controllers, miscellaneous remote indicators and indicator controllers, control switchboards for all locks and spillways and control and indicating apparatus for the chain fenders.

Bids as follows were received Feb. 26 at the U. S. Engineer Office, Washington, D. C., for furnishing and placing 25,000 yds. of riprap on the seawall, Anacostia River, D. C.: Washington Stone Co., Washington, D. C., $1.19; Columbia Granite & Dredging Co., Washington, D. C., $1.27.

Florida.

Bids were opened Feb. 23 by Lt. Col. G. D. Fitch, U. S. Engineer, Montgomery, Ala., for about 80,000 cu. yds. of dredging in Carrabelle Harbor, Fla. The Home Dredging Co., Mobile, Ala., at 17½ cts. per cu. yd., is the probable contractor.

Illinois.

✣Bids will be received until 3 p. m., April 2, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures [illegible] United States Post Office at Mattoon, I[illegible] The building has a ground area of approx[illegible] 6,000 sq. ft.; one story, basement and m[illegible] zanine; fireproof construction, except [illegible] the exterior is faced with granite and [illegible] and roof is of tile and tin.

⊙The State Board of Administratio[illegible] awarded the contract for the constructio[illegible] the tunnel system at the Peoria State [illegible] pital to Ross Caterbury, a resident of [illegible] Ill., at $17,084.

Michigan.

The city of Three Rivers, Mich., [illegible] tained Cox-Norton & Co., Engineers, Coldwater, Mich., in the development [illegible] water power on the Rocky River, [illegible] purchased of Lewis Emery. The wor[illegible] also include the design of a municipa[illegible] for lighting and waterworks pumping.

New York.

Bids were received Feb. 15 by Lt. Col. [illegible] G. Warren, U. S. Engineer, Buffalo, N. [illegible] for removing sheet pile cofferdam and purc[illegible] steel sheet piling at Black Rock Harb[illegible] lock, the Great Lakes Dredge & Dock Co., Chicago, Ill., being the probable successful contractor. The itemized bids received [illegible] this work were as follows: (1) Being bid of [illegible] Chapman & Co., Buffalo, N. Y.; (2) [illegible] of Great Lakes Dredge & Dock Co., Chicago, Ill.; (3) bid of Arthur H. Vogel, Milwaukee, Wis.; (4) of Buffalo Dredging Co., Buffalo, N. Y.; (5) bid of Empire Engineering Corporation, New York; (6) bid of [illegible] W. Adolf, Buffalo, N. Y.; (7) bid of Michael Bock, Buffalo, N. Y.; (8) bid of Julius Ull[illegible] man, Buffalo, N. Y.

	(1)	[illegible]	(3)	(4)	(5)	(6)	(7)
Excavating, depositing and removing clay filling, per cu. yd. place measurement, 25,000 cu. yds.	[illegible]	[illegible]	[illegible]		$[illegible]		
Extracting and removing steel channels, per channel, 115 channels	[illegible]	12.50	10.00		[illegible] 00		
Extracting and removing steel sheet piles, per sheet pile, 6,414 piles	20.00	[illegible]	10.00		[illegible]		
Excavating and removing stone embankment, per cu. yd. scow measurement, 1,650 cu. yds.	[illegible]	1.00	[illegible]		[illegible]		
Excavating and removing material from channel, per cu. yd. scow measurement, 17,000 cu. yds.	.30	[illegible]	.22		19½		
Total for removing cofferdam	[illegible]	$[illegible]	[illegible]	$91,000	$76,529		—
Purchasing the piling, all channels, from U. S. Government, 6,659 tons, per ton		$12.00			$[illegible]	$6.0[illegible]	$[illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Minnesota.

[illegible] will be received [illegible] [illegible] mptr ller, George H. Hayes [illegible] Minnesota, Minneapolis, Minn., [illegible] p. water tube boilers to be [illegible] heating plant on the University cam-

New York.

[illegible] will be received until [illegible] April [illegible] Knox Taylor, Supervising Ar[illegible] easury Department, Washington, D. C., [illegible] mechanical system of mail handling [illegible] us in the United States Post Office [illegible] New York. [illegible] New York, [illegible] he Wallabout Canal for the city of [illegible] ork.

Ohio.

[illegible] received until [illegible] Maj. H. Jervey, U. S. Engineer, Cin [illegible] a O., for hire of two towboats to serve [illegible] Ohio River [illegible] Ohio [illegible]

[illegible] s will be received until noon, March 25, [illegible] Board of Education, City Hall, Cin- [illegible] for furnishing all materials and [illegible] Hyde Park [illegible] northwest [illegible] Ave. and Edwards [illegible] innati, Ohio, in accordance with [illegible] 511 West Court St., Cincinnati. The [illegible] labor and materials must be stated [illegible] ly, and bidders may submit proposals [illegible] the following [illegible] dding and planting, plumbing, ce- [illegible] driveways, [illegible] m, business manager.

[illegible] s will be received until noon, March 14, [illegible] ctor of Public Service, Cleveland, O., [illegible] nishing two light delivery automobiles, [illegible] quipped in accordance with specifica- [illegible] the Director W. H. K[illegible]

[illegible] received until noon, March [illegible] Director of Public Service, Cleveland, [illegible] transformers for the Municipal Elec- [illegible] ght Plant of the city of Cleveland. [illegible] ations are on file with Superintendent [illegible] Department W. H. [illegible]

[illegible] ates will be received shortly on the [illegible] Mvey-Ferguson Co.'s [illegible] Oakley, O., the dimensions of which [illegible] 37x70 ft., construction of steel frame [illegible] lls of stucco. During the summer the [illegible] to build an extension [illegible] stories and a basement [illegible] will be turned over for the con- [illegible] f the employes, containing a dining [illegible] itchen and recreation halls. The build- [illegible] l be of fireproof construction. The [illegible] scheme of architecture of the present [illegible] he exterior being of stucco, will be [illegible] out in this building. The Allyn En- [illegible] g Co., Cincinnati, O., are the Engi- [illegible] r the work.

[illegible] of Hospital Commissioners of Cin- [illegible] have selected Tietig & Lee, Archi- [illegible] incinnati, to draw up the plans for [illegible] tuberculosis sanitarium to be built [illegible] ick Run site. The board decided that [illegible] nate of cost for the new buildings ex- [illegible] the heating and ventilating system [illegible] not exceed $250,000.

Oregon.

[illegible] s will be received until 2 p. m., April [illegible] Lighthouse Inspector, Portland, Ore., [illegible] nishing the necessary labor and mate- [illegible] r the construction of Alki Point light [illegible] Washington.

Pennsylvania.

[illegible] s will be received until 3 p. m., April [illegible] mes Knox Taylor, Supervising Archi- [illegible] Treasury Department, Washington, [illegible] for the construction, including plumb- [illegible] piping, heating apparatus, elec[illegible]

[illegible] tin roof. [illegible]

[illegible]	29
Alternate	[illegible]

will be 8,800 ft. long; at Artificial Island, 1,200 ft.; Chester Island, 1,800 ft.; Old Man's Point, 1,700 ft.; and the topping off at the Reedy Island dike will extend for 6,000 ft. Bids [illegible]

Rhode Island.

✣Bids will be received until 3 p. m., April 8, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures of the U. S. Post Office at Westerly, R. I. The building is to be approximately 4,400 sq. ft. in ground area, one story and basement with granite facing to first floor and marble facing above, tile and copper roof; the building is to be fireproof throughout except the roof.

Tennessee.

✣Bids will be received until noon, March 26, by Maj. Clarke S. Smith, U. S. Engineer, Memphis, Tenn., for furnishing turbines, pumping sets, boilers and electric light plant.

Texas.

✣Bids will be received until noon, March 9, by Edgar Odell Lovett, 1110-1112 Scanlan Bldg., Houston, Texas, for the heating, plumbing and electric work in the north and south wings of the residential hall for men of William M. Rice Institute, at the site of the institute on Main St. in Houston, Texas.

✣Bids will be received until 11 a. m., March 18, by P. W. Guiney, Constructing Quartermaster, Fort Sam Houston, Texas, for furnishing and installing screens in four buildings at Fort Sam Houston, Texas.

Washington.

✣Bids will be received until noon, March 12, by Maj. J. B. Cavanaugh, U. S. Engineers, Burke Bldg., Seattle, Wash., for the construction of the motor survey launch Orcas.

Bids as follows were received Feb. 16, by Paul W. Hauser, Secretary Duwanish Waterway No. 2, Renton, Wash., for dredging about 300,000 cu. yds.: J. D. Blackwell, 35 cts. per cu. yd.; Puget Sound Bridge & Dredging Co., 29 cts. per cu. yd.; Chamberlain Construction Co., 25.4 cts. per cu. yd.; Tweeden, Jones & Barker, 21⅝ cts. per cu. yd. All bids were rejected and the matter of purchasing a dredge is under consideration. Bids on a [illegible]

Wisconsin.

✣Bids will be received until 10:30 a. m., March 11, by Department of Public Works, H. E. Briggs, Commissioner, Milwaukee, Wis., for dredging the several rivers and canals in the city of Milwaukee during the season ending Dec. 1, 1912. A certified check for $3,750 must be filed with each bid.

[illegible] E. [illegible] Cavanaugh, U. S. Engineer, Seattle, for three sections of the work of constructing the Lake Washington Canal. The work calls for a canal prism 75 ft. wide at the bottom and 25 deep at mean low water. The bids received were as follows: (1) standing for bid of Stillwell Bros., Inc., Seattle; (2) Holt & Jeffry, Seattle; (3) Puget Sound Bridge & Dredging Co., Seattle; (4) International Contract Co., Seattle; (5) Andrew Peterson, Seattle; (6) Geo. C. Dietrick & Co., Seattle; (7) Graff Construction Co., Seattle; (8) Erickson Const. Co., Seattle; (9) Standard American Dredging Co., San Francisco; (10) Duluth Superior Dredging Co., Duluth, Minn.

		30	1.245
.39	.33		

Canada.

✣Bids will be received until 10 a. m., March 30, by City Commissioners, Moose Jaw, Sask., for the following: Contract "A"—One 1,500 K. W. A. C. Steam Turbo-Generating Set. Contract "B"—One 500 K. W. A. C. Generator, direct connection to Diesel O. Engine. Full particulars and specifications can be obtained on application to J. D. Peters, Electrical Superintendent.

✣Bids will be received until noon, by E. B. Bonnell, City Clerk, Moose Jaw, Sask., for supplying and erecting four centrifugal pumps, two motors, wiring, switchboard and accessories. Specifications are on file with Walter J. Francis & Co., Consulting Engineers, Montreal, Que.

✣Bids will be received until noon, March 15, by City Commissioners, Saskatoon, Sask., for supplying about 5,000 barrels of Portland cement. Further information may be obtained of George T. Clark, City Engineer, Saskatoon, Sask.

✣Bids will be received until noon, March 13, by A. W. Chapman, County Clerk, Belleville, Ont., for furnishing the corporation of the county of Hastings, one concrete mixer. Same to be of the batch type, mounted on trucks, operated by gasoline engine, self-charging automatic water supply and capable of handling not less than 8½ to 9 cu. ft. of unmixed material per batch.

✣Bids will be received until March 18, by City Clerk, Vancouver, B. C., according to reports, for an' auto fire engine.

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CALLS FOR BIDS

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SUBSTRUCTURE, INDIANA STREET BRIDGE.

DEPARTMENT OF PUBLIC WORKS.
Chicago, Feb. [illegible], 1912.

Sealed proposals will be received by the City of Chicago until 11 a. m. Tuesday, March 12, 1912, at room 406 City Hall, to furnish all materials, tools, labor and appliances and to perform all operations necessary for the complete construction and erection of the substructure for a bascule bridge over the south fork of the south branch of the Chicago river at Indiana St., including the approaches thereto, as well as the removal of the old bridge, abutments and approaches and the diversion of the sewers on both sides of the river, according to plans and specifications on file in the office of the Department of Public Works of said city, room 406 City Hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Substructure, Indiana St. Bridge," and be accompanied with Three Thousand Dollars in money or a certified check for the same amount on some responsible bank located and doing business in the City of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

Bidders are invited to submit alternate bids on plans prepared according to their own designs, which designs must conform to rules and requirements, which can be obtained at the office of the Commissioner of Public Works.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

L. E. McGANN
Commissioner of Public Works.

LAYING WATER MAINS.

NEW CASTLE, IND.
New Castle, Ind.

Sealed proposals will be received by the City Council of the City of New Castle, Ind., at the Council Chamber until 7:30 p. m., March 18, 1912, and will be publicly opened at that hour for laying approximately 10,000 feet of 8", 10" and 12" cast-iron water mains and accessories. All the above, according to plans and specifications on file at the office of City Clerk. Each bid must be accompanied by a certified check of 10 per cent of amount of bid made payable to the City Clerk.

Instructions to bidders, specifications and blank proposals may be obtained from the City Clerk or from Chas. Brossmann, Consulting Engineer, Union Trust Bldg., Indianapolis. The right is reserved to reject any or all bids or accept such bids as are to the best interest of the City of New Castle.

GEO. M. BARNARD, Mayor.
L. M. JOHNSON, City Clerk.

GRADING, DRAINING AND PAVING.

Sealed bids will be received by the Board of Street Improvement, District No. 186, Little Rock, Ark., until 2 o'clock p. m., Wednesday, March 20, 1912, for grading, draining and paving with vitrified brick, asphalt, asphaltic concrete, creosoted blocks or bitulithic pavement on concrete foundation within said district. Extent of proposed work is approximately the paving of fourteen blocks on concrete base.

Plans and specifications may be obtained from Sam W. Reyburn, Chairman, District No. 186, care Union Trust Co., Little Rock, Ark., to whom all bids should be addressed. Bids must be accompanied by certified check for $500. The right is reserved to reject any and all bids.

SAM W. REYBURN, Chairman.
R. W. RIGHTSELL, Secretary.

SUPERSTRUCTURE 35TH STREET BRIDGE.

DEPARTMENT OF PUBLIC WORKS.
Chicago, Feb. 26, 1912.

Sealed proposals will be received by the City of Chicago until 11 a. m. Tuesday, March 12, 1912, at room 406 City Hall, to furnish all materials, tools, labor and appliances and to perform all operations necessary for the complete construction and erection of the superstructure for a bascule bridge over the south fork of the south branch of the Chicago river at 35th St., including the approaches thereto as well as the removal of the old bridge, abutments and approaches and the diversion of the sewers on both sides of the river, according to plans and specifications on file in the office of the Department of Public Works of said city, room 406 City Hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Superstructure, 35th St. Bridge," and be accompanied with Three Thousand Dollars in money or a certified check for the same amount on some responsible bank located and doing business in the City of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

Bidders are invited to submit alternate bids on plans prepared according to their own designs, which designs must conform to rules and requirements, which can be obtained at the office of the Commissioner of Public Works.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

L. E. McGANN
Commissioner of Public Works.

TENDERS AND DESIGNS FOR AN AQUEDUCT, CANADIAN PACIFIC RAILWAY COMPANY DEPARTMENT OF NATURAL RESOURCES, IRRIGATION BRANCH.

Sealed tenders, addressed to the undersigned and endorsed "Proposals for Brooks Aqueduct," will be received up to noon of May 1, 1912.

The site of the work is about four miles southeast of Brooks, Alberta, a station on the main line of the Canadian Pacific Railway 125 miles east of Calgary. The aqueduct is about 10,000 feet long and 54 feet maximum height, and is designed to discharge 910 cubic feet per second.

Tenders will be received based either on the design prepared by the company's engineer or on designs to be submitted by the bidder. The engineer's design involves the furnishing and placing of about 23,400 cubic yards of concrete and 3,640,000 pounds of reinforcing steel, together with excavation and filling to the amount of 40,000 cubic yards.

All labor and materials required will be at the expense of the contractor.

Bidders will be required, either personally or by representative, to visit and inspect the site and satisfy themselves as to local conditions, supply of material, etc.

Plans, specifications and full information may be obtained on application to A. S. Dawson, Chief Engineer, Calgary.

A deposit of $300.00 will be required before plans or specifications will be given out, which will be returned on receipt of the same in good condition.

All proposals must be accompanied by a certified check payable to A. S. Dawson for 5 per cent of the amount of the tender, to be forfeited as liquidated damages in case the bidder neglects or refuses to enter into a contract should the work be awarded to him.

Proposals will not be considered unless made out on the form provided. Interlineations, alterations or qualification of prices, except as therein provided for, may invalidate proposals.

The company reserves the right to reject any or all tenders and to waive defects.

A. S. DAWSON,
Chief Engineer, Dept. of Natural Resources, Canadian Pacific Railway.
Calgary, Alberta, March 1, 1912.

SEWER.

The Board of Public Works of the City of Owosso, Mich., will receive sealed bids until 10 o'clock a. m., March 11, 1912, for the construction of a sewer on Shiawassee St. as follows: 335½ ft. 10 in. sewer, 100 ft. 10 in. cast-iron pipe, 6 Y branches, 1 manhole, all in accordance with plans and specifications on file in the office of the clerk. Bids must be accompanied by certified check approximately in the amount of 5 per cent of the bid, made payable to the Treasurer of the City of Owosso. The city reserves the right to reject any or all bids, to waive defects and to accept any bid.

ARTHUR H. DUMOND, City Clerk.

CALLS FOR BIDS

Rate, $2 40 an inch, single column. **Copy received until Monday noon.**

SEWER CONSTRUCTION.

[illegible] March [illegible] 1912, I will [illegible] contracts for the construction of the [illegible] Gate Drain, at the City Hall, in the City of Lansing, Mich. [illegible] resembles a sewer job and consists in the laying of 4,350 feet of 48-inch, 3,330 feet of 30-inch, and 3,430 feet of 24-inch reinforced concrete pipe, 1,300 ft. of 18-inch [illegible] feet of 8-inch drain tile. It also includes [illegible] catch basins. The depths will average as follows: 48-inch pipe, 7.82 ft.; 30-inch pipe, 14.83 ft.; 24-inch pipe, 14.26 ft.; 18, 12 and 8-inch tile, 6.26 ft. All pipe, tile castings and other appurtenances will be furnished the contractor on the ground by the Drain Commissioner. The improvement to be paid for with orders drawn upon the County Treasurer and secured by a tax upon the district drained by the drain. Certified check or certificate of deposit upon a bank of this county or a draft in the sum of $1,000.00 required from all prospective bidders as evidence of good faith. Specifications, blue prints, etc., and further information may be had on application to the undersigned.

WALTER R. CARVEN,
Drain Commissioner of Ingham County.
Mason, Mich.

SEWER SYSTEM.

Notice is hereby given that sealed proposals will be received by the Board of Commissioners of Sioux Falls, S. D., until 11 o'clock a. m. on the 26th day of March, 1912, for the construction af a System of Sewerage for said City, in accordance [illegible] marked "Plan C," on file in the office of the City Auditor of said City.

The work will be divided into six divisions [illegible] of said divisions.

All bids must be [illegible] cash payment for the work and must be [illegible] forms furnished [illegible] pose and each bid must be accompanied by a bond running to said City in a penal [illegible] of the bid in accordance with Section 1343 of the South Dakota Political Code for [illegible] duly certified check for a sum equal to [illegible] made payable unconditionally to the order of the City Treasurer of the City of Sioux Falls, S. D. [illegible] the bidder will enter into a contract and [illegible] award to him of the work contained in his proposal.

[illegible] basis of using vitrified pipe, reinforced concrete pipe or stone for all single sewers 24" or more in diameter and also for using either of these materials or plain concrete for the storm water section of all double sewers in which the storm water section is more than 20" in diameter, and the right is reserved by the Board of Commissioners to designate which class of material shall be used in each division after the bids have been opened, and to award the contract for such classes as they may deem for the best interests of the City.

[illegible] S. D., and L. P. Wolff, Consulting Engi- [illegible]

WALTER C. LEYSE, City Auditor.

FURNISHING AND LAYING SEWAGE OUTLET PIPE.

Rochester, N. Y.

Sealed proposals will be received at the office of the Secretary of the Board of Contract and Supply, No. 37, City Hall, until 11 o'clock a. m., March 13, 1912, for the construction of Contract No. 4, including Division No. 8 and part of No. 7 of the Sewage Disposal System.

The work will consist of furnishing and laying about 9,300 feet of 66-in. pipe for the discharge of the effluent from the Disposal Works, into deep water in Lake Ontario. About 2,300 feet will be laid in open trench, and the remainder will be submerged and laid in a dredged trench terminating in a timber crib located about 7,000 feet from the shore and in about 50 feet of water.

Separate proposals will be received for pipe made of steel, ingot iron and cast iron.

A certified check for $20,000.00 must accompany the proposal as an earnest of good faith. The amount of the certified check deposited by the successful bidder will become the property of the City of Rochester if such bidder shall fail to execute and deliver the contract and execute the required bonds for the work within ten (10) days after the contract is awarded to him.

The successful bidder will be required to execute to the city a surety company bond in the sum of $100,000.00 for the faithful performance of the contract and the payment of all laborers' wages, which bond shall be approved by the Comptroller of said city.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Board that he is reasonably familiar with submarine work, and is fully prepared with the necessary capital, materials and machinery to conduct the work to be contracted for to the satisfaction of the City Engineer, and to begin it promptly on award.

All bids must be made upon the bidding sheets furnished by the City Engineer, and be indorsed with the title of the work to which they relate, the name of the bidder and his residence. Information relative to the work may be procured at the office of E. A. Fisher, City Engineer, where plans, specifications and bidding sheets may be obtained after February 17th.

The Board reserves the right to reject all bids.

F. X. PIPER, Secretary.

CITY OF TORONTO.

[illegible]

Separate tenders on prescribed forms will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Can., up to noon on Tuesday, March 19, 1912, for the supply of the following:

1. 270 tons 45-lb. "T" rail, A. S. C. E. section.

[illegible]

3. 1,400 pair angle bars for 45-lb. "T" rail.

[illegible]

5. 810 tons 80-lb. "T" rail similar to [illegible]

[illegible] to Lorain Section 392.

7. 1,100 pair splice bars for Lorain [illegible]

8. 1,250 pair splice bars for Lorain [illegible]

9. 60 kegs 1"x3⅝" track bolts and [illegible]

10. 5,300 pair of ⅞"x5' 3¾" steel tie rods.

11. 6,000 steel ties and necessary rail fastenings.

12. 4,000 wood ties, 5"x6"x(6', 7', 8' long).

Specifications and form of tender may be obtained on application to the Department of Railways & Bridges, City Engineer's Office, Toronto.

Envelopes containing tenders must be plainly marked as to contents.

Prospective tenderers will please only ask for the specifications coving those items on which they propose to tender.

Quick delivery will be required on Items No. 1, 2, 3, 4 and 12.

The tenderers shall submit with their tenders the names of two sureties (approved of by the City Treasurer, not Members of the City Council or Officers of the Corporation of the City of Toronto) or in lieu of said sureties, the bond of a guarantee company approved of as [illegible]

The lowest or any tender not necessarily accepted.

[illegible]
Chairman of the Board of Control,
City Hall, Toronto.

DREDGING.

Sealed proposals will be received at the office of the Director of Public Service, Room 104, City Hall, Cleveland, O., until 12 o'clock m., March 7, 1912, for dredging Cuyahoga River.

Each bid must be in accordance with the specifications furnished by the Chief Engineer, Room 305, City Hall, Cleveland, Ohio.

No proposal will be entertained unless made on the blanks furnished by the Chief Engineer and delivered at the office of the Director of Public Service previous to 12 o'clock m. on the day specified.

The city reserves the right to reject any or all bids.

W. J. SPRINGBORN,
Director of Public Service.

W. H. KIRBY,
Secretary Department Public Service.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SUPERSTRUCTURE INDIANA STREET BRIDGE.

DEPARTMENT OF PUBLIC WORKS,
Chicago, Feb. 26, 1912.

Sealed proposals will be received by the City of Chicago until 11 a. m. Tuesday, March 12, 1912, at room 406 City Hall, to furnish all materials, tools, labor and appliances and to perform all operations necessary for the complete construction and erection of the superstructure for a bascule bridge over the south fork of the south branch of the Chicago river at Indiana St., including the approaches thereto, abutments and approaches and the diversion of the sewers on both sides of the river, according to plans and specifications on file in the office of the Department of Public Works of said city, room 406 City Hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Superstructure, Indiana St. Bridge," and be accompanied with Three Thousand Dollars in money or a certified check for the same amount on some responsible bank located and doing business in the City of Chicago, and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

Bidders are invited to submit alternate bids on plans prepared according to their own designs, which designs must conform to rules and requirements which can be obtained at the office of the Commissioner of Public Works.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

L. E. McGANN,
Commissioner of Public Works.

BRIDGE.

Pasadena, Cal.

Sealed bids will be received until 10 a. m., March 26, for the construction of a reinforced concrete arch bridge, 1,460 ft. in length, 28-foot roadway and two 5-foot sidewalks. Estimated cost, $185,000. Plans and specifications can be obtained from Waddell & Harrington, Kansas City, or the City Engineer, Pasadena, upon a deposit of $20.00. The city reserves the right to reject any and all bids. Each bid must be accompanied with a certified check, draft or cashier's check equal to 10 per cent of bid. Further particulars in regard to bids and bidding blanks must be obtained from Heman Dyer, City Clerk.

MISSISSIPPI RIVER COMMISSION. 1st and 2d Districts, U. S. Engineer Office, Memphis, Tenn., Feb. 20, 1912. Sealed proposals for furnishing about 637,000 lbs. wire, silicon bronze wire, wire strand, wire cables, staples and clips, and 140 coils of manila rope, will be received at this office until noon of Mar. 19, 1912, and then publicly opened. Information on application. CLARKE S. SMITH, Maj. Engrs.

DITCHING.

Sealed proposals will be received until noon on March 9, 1912, by the Board of Commissioners for Ditching District Number Two, Independence County, Ark., at the Court House in Batesville, Independence Co., Ark., for the construction of about 4¾ miles of open ditches, ranging from 6 to 25 feet in width at the bottom and from 1 to 6 feet in depth with one to one side slopes, containing approximately 62,000 cubic yards of excavation and 33 acres clearing and grubbing. Also about 23½ acres additional clearing in the creek and below the mouth of the ditch. All situated in Township 12 N., R 4 and 5 W., Independence Co., Ark.

Plans and specifications may be seen in the office of the County Clerk, Batesville, Ark., or in the offices of the Miller Engineering Co. in the Southern Trust Bldg., Little Rock, Ark.

Each proposal must be accompanied by a certified check for $500 as a guaranty of good faith and security for giving good and satisfactory bond.

The Board of Commissioners reserve the right to reject any or all bids.

R. R. RATTON, Newark, Ark.,
Secretary of District.
Miller Engineering Company,
Engineers of District,
Little Rock, Ark.

THE KAW VALLEY DRAINAGE DISTRICT, WYANDOTTE COUNTY, KANSAS.

OFFICE OF DIRECTORS.
Kansas City, Kans., Feb. 23, 1912.

Sealed proposals in duplicate will be received until 10 o'clock a. m., March 9, 1912, and then publicly opened for furnishing and installing all material, labor, appliances and equipment and operating for test, two direct connected 18-in. side suction steam centrifugal pumps and two 100 horsepower locomotive type boilers, also two motor-driven 18-in. centrifugal pumps, near the mouth of what is known as the Santa Fe Ditch or Sewer, Argentine, Kansas City, Kans. Information on application.

W. H. DANIELS, President.

HALLOCK AND MEDINA DRAINAGE DISTRICT.

Sealed bids will be received by Hallock and Medina Drainage District of Peoria County, Illinois, at the office of Wm. S. Kellogg, Attorney, in Peoria, Illinois, on March 18, 1911, for the following described work: New channel for Hallock Hollow Creek 7,800 cu. yds. cleaning present channel of Hallock Hollow Creek and changing outlet of Crow Creek, 3,000 cu. yds. Additional information may be secured from

HARMAN ENGINEERING CO.,
Peoria, Ill.

PROPOSALS FOR FURNISHING METAL AND ERECTING LOCK GATES.—U. S. Engineer Office, Vicksburg, Miss., Feb. 12, 1912. Sealed proposals for furnishing and delivering about 384,500 pounds of structural metal for Lock and Dam No. 6, Ouachita River, near Felsenthal, Ark., and for erecting lock gates at that work will be received at this office until 12 m., March 14, 1912, and then publicly opened. Information on application. J. A. WOODRUFF, Capt., Engrs. 7-4t

SUBSTRUCTURE 35TH STREET BRIDGE.

DEPARTMENT OF PUBLIC WORKS,
Chicago, Feb. 26, 1912.

Sealed proposals will be received by the City of Chicago until 11 a. m. Tuesday, March 12, 1912, at room 406 City Hall, to furnish all materials, tools, labor and appliances and to perform all operations necessary for the complete construction and erection of the substructure for a bascule bridge over the south fork of the south branch of the Chicago river at 35th St., including the approaches thereto, as well as the removal of the old bridge, abutments and approaches and the diversion of the sewers on both sides of the river, according to plans and specifications on file in the office of the Department of Public Works of said city, room 406 City Hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Substructure, 35th St. Bridge," and be accompanied with Three Thousand Dollars in money or a certified check for the same amount on some responsible bank located and doing business in the City of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

Bidders are invited to submit alternate bids on plans prepared according to their own designs, which designs must conform to rules and requirements, which can be obtained at the office of the Commissioner of Public Works.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

L. E. McGANN,
Commissioner of Public Works.

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n Erroneous Estimates of the Cost of Pavement Maintenance.

have had occasion repeatedly to bewail ct that data on the life of pavements sts of annual maintenance are so meager lose estimates of annual maintenance an not be made in America. A recent by a pavement commission to the city nbridge, Mass., serves again to emphae necessity of securing more cost data ement maintenance. We can not agree he conclusions of the commission as to nance costs, and we doubt whether the ssion itself would undertake to defend n conclusions were it required to subnerican maintenance data to sustain its

Cambridge commission, as we shall call es no attempt to rate the life of a paven terms of the traffic to be carried, yet is, of course, one of the chief factors considered in such a problem. The life tain classes of pavement is limited by al and physical changes that are indet of traffic conditions, but even in those the traffic is an important factor. As slowly become brittle upon exposure. hemical change, however, may be so that the strength of an asphalt paveis sufficient to withstand a very heavy for 10 years, or a light traffic for 25 or more. So that even in the case of nous pavements we must know the apnate density of traffic before we can t the life with any considerable degree [illegible]

best modern practice in pavement des to lay the pavement in two courses a nd a top or wearing coat. The latter ordinarily be readily separable from the r for repair purposes. A concrete or a bound macadam base should be pracindestructible, and therefore its life be everlasting, provided only that the g coat or top be properly maintained. is a fact that many engineers overlook signing pavements, and it is not to be ered that engineers often err in estimataintenance costs because they fail to guish between the life of the base and fe of the top of a pavement.

Cambridge commission did not make rror in considering the life of pavements g a concrete base, but it did err in conng the life of macadam and bituminous lam, as will be seen from the following tion of their estimated life of different ents.

	Years
(1) [illegible]	[illegible]
(2) Brick, top (4 ins.).........................	15
(3) Wood block, top [illegible]	[illegible]
(4) Bitulithic, top (2 ins.).........................	10
(5) Bituminous [illegible]	[illegible]
(6) Macadam, top and base (8 ins.)..........	10

As above stated, there is no reason why the life of a concrete base should be limited, unless for reasons other than its own ability to perform the required service. Concrete between the cross-ties of a street railway is usually dug up when the ties are renewed; hence a concrete pavement base between street car rails may not have a life of more than 20 years. If a street must be regraded, of course a concrete base will be destroyed, but this is a prospective loss of life that can rarely be estimated at all. Why, then, should not the life of a concrete base be called infinity, for the purposes of estimates of this character?

Were it not that a water-bound macadam base is frequently torn up when a new type of wearing top is laid, the same reasoning that holds as to a concrete base would hold as to a macadam base. And in ordinary road maintenance, a macadam base is seldom destroyed except where grades are to be changed. Hence it is erroneous to assign a life of only 10 years to the full thickness of macadam, particularly when the estimate provides for a current maintenance of the top at an expense of 5.4 cts. per square yard per annum, as is provided in the estimates of the Cambridge commission.

The same criticism applies to the commission's estimate of a 10-year life for the full thickness of bituminous macadam. The best practice now consists in laying a thin bituminous macadam top on a water-bound macadam base. Certainly the base need not be renewed in 10 years—probably never.

Now let us consider the life assigned to brick, wood block and bitulithic by the Cambridge commission. In the absence of statistics as to traffic we can not call these estimates absolutely wrong, but, judging by the size of Cambridge, we believe that the commission has badly underestimated the life of these pavements. In fact it seems probable that a life nearly double that estimated by the commission would occur in such a city.

Why, for example, should bitulithic pavement not last as long as sheet asphalt? In Washington, D. C., and in Buffalo, sheet asphalt pavements are resurfaced at an age that averages about 20 years. For data on asphalt repairs [illegible] Engineering & Contracting [illegible] 1910. There are asphalt pavements in Buffalo still in service after nearly 30 years of use.

Other articles on asphalt life and cost of annual repairs will be found in the following issues of this journal: Sept. 19, 1906; Mar. 3, 1909; Oct. 13, 1909; Mar. 16, 1910; Aug. 10, 1910, and Aug. 2, 1911.

It is worthy of note that European data as to the life of asphalt pavements point to an average life about half that attained in America. This is unquestionably due, in large measure, to the much greater density of traffic in the European cities. Omnibus traffic in London and Paris, for example, is enormous, because trolley cars are almost non-existent. In fact in all European cities the street traffic is much denser than in American cities of the same size.

Creosoted wood block pavements have not been long enough in use in America to enable us to estimate the life accurately. Furthermore, such pavements have usually been laid only where the traffic is very dense, which adds to the difficulty of forecasting the life under other conditions. Apparently the Cambridge commission based its estimate of 15 years life for wood blocks on European data. Hence the same danger of extreme error exists in this case as in the use of European data on the life of asphalt pavements. In our issue of Sept. 15, 1909, we gave costs of maintaining treated wood block pavements in England, maintenance costs were given also in our issue of June 29, 1910. Instances of such pavement 20 years old, under heavy traffic, and still in service, were given. We do not doubt that under light traffic creosoted blocks will last 25 or 30 years.

The Cambridge commission estimates a 15-year life for brick. On one of the main streets of Seattle, Wash., there is still in service a brick pavement 15 years old that is in fair condition. There are scores of American cities where the age of existing brick pavements exceeds 20 years. Since brick is not subject to chemical change, its life in a pavement is a function of the traffic density and the quality of the brick. Hence a first class brick pavement under light traffic is unquestionably good for 30 years or more. We hope to present some interesting facts on this subject in the near future.

The Cambridge commission gives estimates of the annual cost of pavements of different kinds. The annual cost consists of three items: (1) Interest on investment at 4 per cent; (2) sinking fund to redeem the investment at the end of the life of the pavement, the fund bearing 3½ per cent interest; (3) ordinary or current repairs.

In several of the sinking fund calculations the commission has apparently erred, but we give the results as recorded in the report. The total first cost and cost of resurfacing at the end of the life are estimated to be as follows per square yard:

	First cost	Resurfacing cost
Brick pavement............	$3.00	$2.10
[illegible] pavement	[illegible]	[illegible]
Wood block	[illegible]	[illegible]
Bituminous macadam	[illegible]	[illegible]
Macadam	1.00	[illegible]

The annual costs are estimated to be as follows in cents per square yard:

	Interest [illegible]	Ordinary repairs	Total
[illegible]	[illegible]	1.0	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Wood	[illegible]	[illegible]	[illegible]
[illegible] macadam	[illegible]	[illegible]	[illegible]
Macadam	[illegible]	[illegible]	[illegible]

Macadam and bituminous macadam are assumed to be subject only to "light local traffic," while the other types of pavement are to carry heavier traffic. The item of "ordinary repairs" relates to patching only, for the sinking fund provides for the entire resurfacing. We believe the commission has greatly overestimated the cost of "ordinary repairs," and we have already stated that we believe they have overestimated the annual cost of resurfacing because they have assigned too short a life to the top or wearing coat.

The commission's estimates as to macadam and bituminous macadam are far too high, as will appear most clearly when reduced to costs per mile per annum. Let us consider these somewhat more in detail.

The commission's estimate of the annual cost of 8-in. macadam may be rearranged and stated thus:

	Cts. per sq. yd.
Interest, 4 per cent on $1.00..............	4.0
Sinking fund to replace $1.00 in 10 yrs....	8.5
Ordinary repairs	5.4
Total	17.9

Since the total annual maintenance is the sum of 8.5 and 5.4, or 13.9 cts. per square yard we should have to expend $1,300 per mile of 16 ft. macadam road per annum. This is several times what the best available American records indicate that macadam maintenance costs have averaged under "light local traffic." The reader is referred to the following issues of Engineering & Contracting for annual maintenance costs of macadam: May 23, 1906; Feb. 17, 1909; May 11, 1910; July 20, 1910; July 27, 1910; June 21, 1911, and Dec. 6, 1911.

The commission estimates the annual cost of bituminous macadam to be as follows:

	Cts. per sq. yd.
Interest, 4 per cent on $1.25	5.0
Sinking fund to replace $1.25 in 10 yrs....	10.6
Resurfacing once during the 10 yrs.......	5.0
Interest on resurfacing, 4 per cent of $0.50 for 5 yrs..............................	1.0
Ordinary repairs	8.0
Total	29.6

This would make the maintenance alone cost nearly $2,300 per annum per mile of bituminous macadam 16 ft. wide. This is grossly excessive. The error arises in large part from failure to consider that the base of such a pavement would not be renewed at all. The "sinking fund" provides for the renewal of the entire pavement—both top and base—every 10 years, which would not occur. The same sort of error occurs in the commission's estimate of water-bound macadam maintenance above given. Should it be contended that the "sinking fund" is not a depreciation fund, but merely a fund to redeem a bond issue, then the reply is that an annuity for a bond sinking fund has no place in estimates of this sort for any one can make the estimate what he pleases merely by changing the life of the bonds without any regard to the life of the pavement. We shall discuss this phase of the subject of estimates of annual costs in a subsequent issue, and shall there outline a correct method of estimating the total annual cost of a pavement.

The Ethics of Consulting Engineering and Standard Fees for Consulting Service.

A code of ethics and a schedule of fees to govern their services were adopted last June by the American Institute of Consulting Engineers. These rules and figures were the result of careful consideration in committee and by the society as a body. Recently the Pacific Association of Consulting Engineers was organized and according to announcements just received has an initial membership of 22 engineers. The association has also formulated a code of ethics and a schedule of fees, both of which are based upon the corresponding documents of the American Institute of Consulting Engineers, but both of which are original in many particulars. These two codes and schedules are of interest as indicating what leading engineers consider to be good ethical procedure and fair compensation for engineering services of expert character.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS.

Code of Ethics.—It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of The American Institute of Consulting Engineers

(1) To act for his clients in professional matters otherwise than in a strictly fiduciary manner or to accept any other remuneration than his direct charges for services rendered his clients, except as provided in Clause 4.

(2) To accept any trade commissions, discounts, allowances, or any indirect profit or consideration in connection with any work which he is engaged to design or to superintend, or in connection with any professional business which may be entrusted to him.

(3) To neglect informing his clients of any business connections, interests or circumstances which may be deemed as influencing his judgment or the quality of his services to his clients.

(4) To receive, directly or indirectly, any royalty, gratuity or commission on any patented or protected article or process used in work upon which he is retained by his clients, unless and until receipt of such royalty, gratuity or commission has been authorized in writing by his clients.

(5) To offer commissions or otherwise improperly solicit professional work either directly or by an agent.

(6) To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of a fellow engineer.

(7) To accept employment by a client while the claim for compensation or damages, or both, of a fellow engineer previously employed by the same client and whose employment has been terminated, remains unsatisfied or until such claim has been referred to arbitration or issue has been joined at law or unless the engineer previously employed has neglected to press his claim legally.

(8) To attempt to supplant a fellow engineer after definite steps have been taken towards his employment.

(9) To compete with a fellow engineer for employment on the basis of professional charges by reducing his usual charges and attempting to underbid after being informed of the charges named by his competitor.

(10) To accept any engagement to review the work of a fellow engineer for the same client, except with the knowledge or consent of such engineer or unless the connection of such engineer with the work has been terminated.

Schedule of Fees.—As a general guide in determining fees for professional services, The American Institute of Consulting Engineers recognizes the propriety of charging: A per diem rate; a fixed sum; or a percentage on the cost of work; as follows:

Per Diem Rate: (1) Charges for consultations, reports and opinions should vary according to the character, magnitude and importance of the work or subject involved and according to the experience and reputation of the individual engineer, from $100 per day to a higher figure, and in addition where expert testimony is required or where otherwise conditions warrant so doing, a retainer varying from $250 to $1,000 and upwards. An additional charge should be made for all actual expenses such as traveling and general office expenses and field assistants and materials, with a suitable allowance for indeterminate items. In such cases six hours of actual work should be considered one day, except that while absent from the home city each day of 24 hours or part thereof should be considered one day, irrespective of the actual hours of time devoted to the case.

Fixed Sum: (2) A fixed total sum for above mentioned services may be agreed on in lieu of per diem charges. A fixed sum may also be charged for a portion or all of the items of preliminary surveys, studies, examinations, reports, detail plans, specifications and supervision, including all of the expenses above recited under per diem rate.

Percentages on the Cost of Work: (3) For preliminary surveys, studies and report on original project, or for examinations and report on project prepared by another engineer, including in both cases all expenses of every nature except those that may be specifically omitted by agreement—from 1½ to 3 per cent on the estimated cost of the work.

(4) For the preliminary stage (3) and in addition thereto detail plans and specifications for construction, including all expenses of every nature except those that may be specifically omitted by agreement—from 2½ to 5 per cent on the estimated cost of the work.

(5) For the preliminary and middle stages (3) and (4) and in addition thereto general supervision during construction, including all expenses of every nature except those that may be specifically omitted by agreement—[illegible] cent, but more for work costing comparatively small amounts, and from 4 to 5 per cent where the amount involved is considerable.

(6) For full professional services (3), (4) and (5) and management, including the awarding of contracts, and including all expenses of every nature except those that may be specifically omitted by agreement, 10 per cent, but more for work costing comparatively small amounts, and 6 to 10 per cent where the amount involved is considerable.

(7) When desired, the percentage basis may be adopted for one or more stages, supplemented by a daily or monthly charge or fixed sum for the remaining stage or stages.

General Provisions: (8) The period of time should be designated during which the given percentages and daily or monthly charges or fixed sum shall apply and beyond which period an additional charge shall be made.

(9) The percentages are to be computed on the entire cost of the completed work or upon the estimated cost, pending execution or completion.

(10) Payments shall be made to the engineer from time to time in proportion to the amount of work done.

(11) When alterations or additions are made to contracts, drawings or specifications, or when services are required in connection with negotiations, legal proceedings, failure of contractors, franchises or right-of-way, a charge based upon the time and trouble involved shall be made in addition to the percentage fee agreed upon.

PACIFIC ASSOCIATION OF CONSULTING ENGINEERS.

Code of Ethics.—It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the Pacific Association of Consulting Engineers:

(a) To act for his clients in professional matters otherwise than in a strictly fiduciary manner, or to accept any other remuneration than his direct charges for services rendered his clients, except as provided in Clause (d).

(b) To accept any trade commissions, discounts, allowances or any indirect profit or consideration in connection with any work which he is engaged to design or to superintend, or in connection with any professional business which may be entrusted to him save with the knowledge and consent of his client.

(c) To neglect informing his clients of any business connections, interests or circumstances which may be deemed as influencing his the quality of his services to his

o receive directly or indirectly any gratuity or commission on any pat- protected article or process used in on which he is retained by his clients, lor to the use of the same he shall have is clients that he is entitled to such gratuity or commission.

o offer commissions or otherwise im- solicit professional work either directly agent.

attempt to injure falsely or maliciously or indirectly, the professional repu- rospects or business of a fellow engi-

accept employment by a client while for compensation or damages, or fellow member previously employed ame client and whose employment has minated, remains unsatisfied, or until m has been referred to arbitration, or s been joined at law, or unless the previously employed has neglected to s claim legally, excepting with the consent of the fellow member.

attempt to supplant a fellow engi- definite steps have been taken to- employment

compete with a fellow engineer for ent on the basis of professional reducing his usual charges and at- to underbid after being informed of ges named by his competitor.

accept any engagement to review the a fellow member for the same client, with the knowledge of such member, e connection of such member with the been terminated.

or the purpose of improving present oceedings in its relation to engineering and for the purpose of increasing the of the engineering profession as an he settlement of questions in contro- his association believes it desirable to such engagements as soon as practi- the following conditions:

s a witness when appointed by and ated through the agency of the court.

s court commissioner, referee or other r, preferably sitting with an attorney, evidence involving engineering ques-

s arbitrator appointed by either party to th [illegible]

[illegible]

This association [illegible] the early adop- [illegible] procedure.

[illegible] time to receive from the Board of Governors an interpretation of this code of ethics in appliction to difficult and unusual cases.

[illegible] termining fees for professional services, the Pacific Association of Consulting Engineers recognizes the propriety of charging: (a) A per diem rate; (b) A fixed sum; (c) A percentage on the cost of work.

A—P[illegible] reports and opinions should vary according to the character, magnitude and importance of the work or subject involved, and according to the experience and reputation of the individual en- [illegible] in addition, where conditions warrant, a suitable retainer. An additional charge is to be made for all actual expenses such as surveys, traveling and general office expenses.

B—Fixed Sum.—A fixed total sum for the above mentioned services may be agreed on in lieu of per diem charges.

C—Percentages on Cost of Work.—(1) For making preliminary studies, working drawings, specifications and contracts and for the general direction and supervision of the work, in lieu of a per diem or a fixed sum the minimum charge shall be five (5) per cent upon the entire cost of the work, exclusive of legal and administration costs.

(2) For work costing less than $20,000 or of unusual complicity of design, it is proper to charge a special fee in excess of the above.

(3) Consultation fees for professional advice are to be the subject of special agreement.

(4) Payments to the engineer are due as his work progresses; upon completion of the preliminary design of an original project or for the examination and report upon a project prepared by another engineer, one-fifth (1/5) of the entire fee; upon complettion of working drawings and specifications, two-fifths (2/5); the remaining two-fifths (2/5) being due from time to time in proportion to the work done at the office or at the site.

General Provisions.—(1) Until the actual cost of work is determined, the charges shall be based upon the estimated cost.

(2) Necessary traveling expenses shall be [illegible]

[illegible] dered by the owner shall be paid for by the owner; the additional fee to be based upon the amount of the cost involved in the change

[illegible] tests, examination of sites, etc., are to be paid for by the owner.

(5) In case of abandonment or suspension of the work at any time, an adjustment of the fee shall be made on the same basis as that of the partial payments hereinbefore stated.

(6) If any material or work used in the construction of the project be already upon the ground or come into the owner's possession without expense to him, its value shall be included in making up the total amount upon which the fee is determined.

(7) It is recognized that in any work undertaken by an engineer there may be problems requiring the services of a specialist. The cost of such special assistance shall be paid by the owner.

(8) Contract forms shall, when requested, be prepared by the engineer; but all legal services connected therewith, together with all services, legal or otherwise, incidental to purchase of rights of way, failure of contractors, disputed contracts and work of such order shall be paid for by the owner The engineer shall render all necessary assistance in the way of explanation of his work

(9) It is recognized that engineers may with propriety undertake all the work in connection with a project including business, legal and other matters, in which case the fee shall be the subject of special agreement.

The distinguishing feature of the Pacific Association's code of ethics compared with the older code on which it is based, is the provisions embodied to establish better procedure in the service of engineers as expert witnesses before the courts. Briefly, it is proposed that the engineer shall in no case act as expert witness under pay by one of the contestants. He may serve as advisor to a contestant or as expert witness or commissioner appointed by the court or as arbitrator appointed by contestants or court and compensated by both contestants conjointly.

ARTH AND ROCK SECTION

al Methods of Difficult Cofferdam struction at Koochiching Falls Power Development, Minnesota.

construction and arrangement of a of cribwork cofferdams to lay dry a edge for constructing a masonry dam wer houses is described in a paper be- e Minnesota Surveyors and Engineers by Mr. H. C. Ash, M. Am. Soc. C. E., Minn. Several novel methods are ed including the use of a cableway to cribs and from which to make sound- n the crest of the falls and the sheath- one operation of an 80-ft. space in a cofferdam. The paper somewhat ed follows:

International Falls hydraulic develop- lies on a sharp granite upheaval be- the towns of Fort Frances, Ont., and ational Falls, Minn. This rock ridge the natural dam over which Rainy flowed, producing the picturesque Koo- g Falls. The ridge lies due east and extends north and south about 500 pping abruptly at both upper and lower to unknown depths. The river is a r of a mile wide, from 30 ft. to 70 ft. and carries the water from a drainage f 16,000 square miles. The location for purposes is in many ways ideal. The ratively flat drainage basin, with its thousands of small lakes and connecting streams, its larger lakes and unnumbered islands, forbids any violent fluctuations in river stages. Rainy Lake, with 250 square miles of area and its outlet two miles above the dam, forms a most excellent reservoir. So steady is the flow, it has been said that one could tell the day and month by reading the stage board. However, I will not vouch for the accuracy of this.

In the winter, the water comes warm from under the ice sheet at the outlet of Rainy Lake and rarely freezes except in the most extreme weather, till it has reached a point a mile beyond the wheels. Anchor ice is unknown. A peculiarity of the runoff is that, instead of having low stage in February and a peak in June, with a secondary peak in the fall, as most of our rivers have, the low stage comes in April and from that time on it continues to climb in a fairly smooth and uniform curve till November and then follows a gradual subsidence to the low point in April.

Before the development of the Falls was undertaken the water did not pour over the rocks in an unbroken sheet. The rock barrier was doubly and trebly folded so that although the river broke over in several places, the main current had to use the scheme adopted by our proverbial friend from Minneapolis and attempt it in two jumps. Influenced by submerged rocks and a small island the main current above the falls deflected sharply from the American shore, struck the Canadian shore, then rebounded as sharply to the American side before it took the plunge into the falls. The natural drop from the upper to the lower river was 22 ft. This was increased by the dam to 35 ft.

The dam was not built directly across the stream but in the form of a parabola with its vertex up stream near the upper edge of the rock. The two power houses extend from either end of the dam to the Canadian and American shores, forming an angle between the face of the dam and the power house in each case of 135° (see Fig. 1).

The power houses are of concrete with brick superstructures. The dam is rubble-faced cyclopean concrete of the overfall type with ogee crest. No forms were used on the dam proper except in moulding the crest.

The shell of the dam was built of selected granite blocks, of which there were great quantities within reach of the derricks. As the outer shell was built the interior was filled with concrete in which were carefully bedded granite chunks varying in weight from a quarter of a ton to several tons. This work was done rapidly and cheaply.

In the several years occupied in this development there was much that would interest an engineer. Base lines, triangulation, location and cross-section, each played its important part. In addition to these there were river and foundation soundings, stage readings, gaging station work, construction with

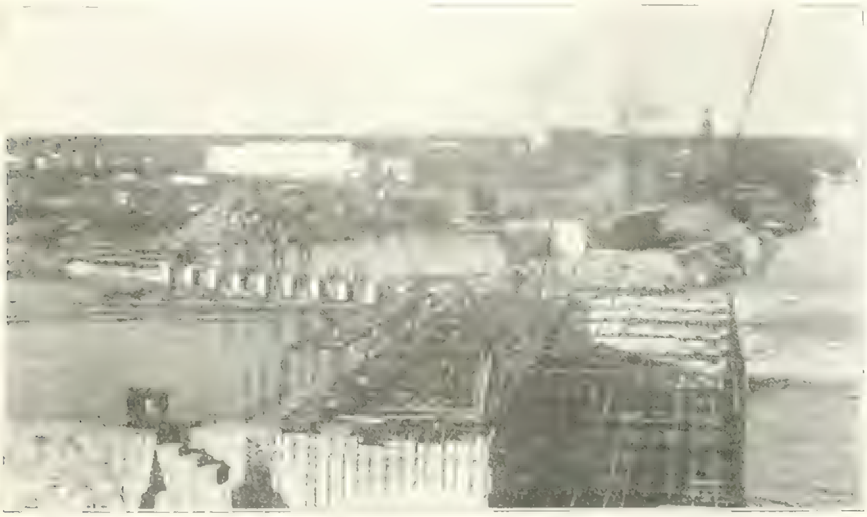

Fig. 1—General View of Dam and Power Houses, Koochiching Falls, Minnesota.

all its [illegible] and the [illegible] in field and office that had no name. To go into detail would carry me far beyond the limits of my paper. It is, I think, sufficient to say that, aside from foundation work and river control, there was nothing essentially difficult. It is of these that I wish to speak more particularly.

The general location of the dam and power houses was made before the river was brought under control and the actual sites examined. The proposed locations were, of course, contingent on subsequent discoveries when the water should be turned. Fourteen cofferdams were built, varying in length from 100 ft. to 600 ft. and in depth from 20 ft. to 50 ft. These coffers were known by letter and their sub-divisions by numbered section and check. These cribs were built chiefly of round logs, drift-bolted together, loaded with rock and sunk to place. They were then faced in various ways, depending on depth and location.

It was evident from the location and direction of the main currents that the first point of attack would best be on the Canadian side. It was stated above that the main current left the Canadian shore and crossed nearly to the American side before dropping into the falls. By building a coffer parallel to this stream from near the Canadian shore to the middle of the river and as close to the upper edge of the rock ridge as the slope of the ledge and the strong current would permit the site of the Canadian forebay was left comparatively dry. This was known as coffer *A*. Coffer *B* joined the Canadian end of *A* on the outside and ran upstream into very deep water where it joined coffer *C* which extended to the Fort Frances shore. Coffers *B* and *C* enclosed the head of what is known as the McKenzie and Mann canal. This canal was cut through from the lower to the upper river, about 40 years ago, at the expense of nearly a million dollars. It was intended for navigation purposes, but the necessary lock was never completed. Across the head of this canal, inside coffers *B* and *C*, six 10x12 ft. waste gates were built which were later used in stream control. It was now possible to examine the proposed site of the Canadian power house. Much of it was bare granite, swept clean by the water, but at the northeast corner there was a triangle lying out of the current. This was covered with saw dust and mill refuse from an abandoned mill. The power house was to be 225 ft. long and this as it turned out included every inch of available space between the McKenzie and Mann canal and the unknown depths at the foot of the main falls. It was possible to move the building up or down stream to almost any extent inside the 500 ft. li[illegible] to move it upstream would involve [illegible] mense amount of rock excavation [illegible] tail-races and would furthermore cut [illegible] space proposed for waste gates in the Canadian wing of the dam and necessary in the scheme of stream control. It was decided to build as close to the lower edge of the [illegible] as possible and after careful drill soundings for solid rock at every point not visible on surface the building was so located.

Fig. 2—View Showing Removal of Cribwork Cofferdam by Blasting.

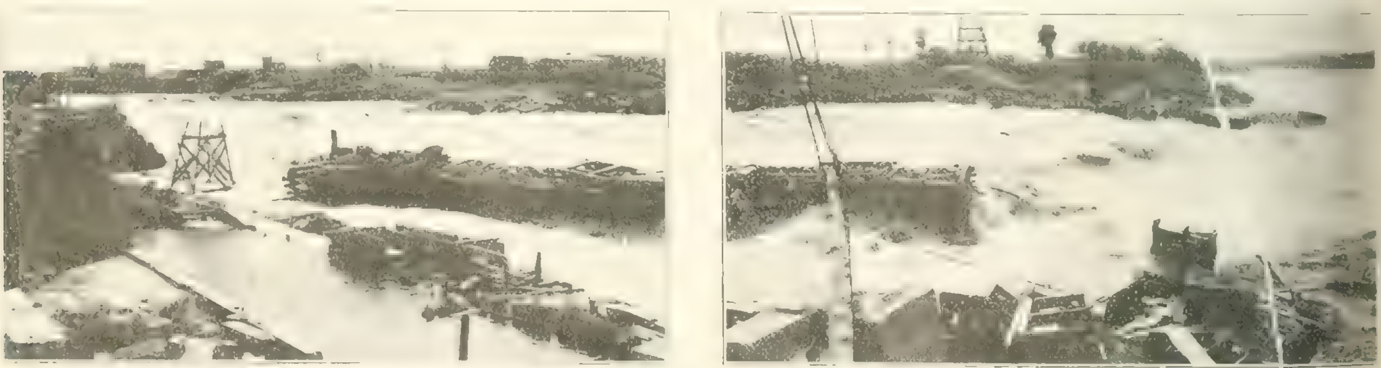

Fig. 3—View from Canadian Shore Showing Falls and Part of Cofferdam D.

By building two more coffers of no very great depth it was possibly to shear the water from the westerly edge of the falls sufficient to start excavation on the American power house site. This building location was similar to the Canadian. Rock excavation was also started on the Canadian power house site and the Canadian forebay. Up to this time the dam itself had not been located. There were certain things wanted. The longest possible spillway, and ample waste gates, [illegible] to carry the river during construction [illegible] should be turned from the American side, at any future flood-time, and with these requirements, the smallest possible [illegible] yardage consistent with safety. That there was great depth on the line directly between the two power houses there could be little doubt. The rock at the upper edge of the falls stood much higher. In this case, as some others, the longest way round [illegible] to be the shortest distance between two points. We had the added advantage of making room for ten waste gates of the same dimensions as the six at the head of the canal. [illegible] also expected that this location would [illegible] advantage in withstanding ice pressures which were expected to develop in the quiet water above the dam. As I have indicated [illegible] in my paper, this precaution proved [illegible] special value for that purpose as practically no ice formed at any time.

Although coffer *A* had been built [illegible] the center of the river along the upper edge of the falls, the water still poured in [illegible] volume over the whole dam site, and [illegible] this for operations, a shear dam, [illegible] was planned to join the outer end of *A* and extend down on the Canadian side [illegible] center of the falls about 250 ft. It was impossible, on account of the force of the water to build a crib dam here in the usual way, so another plan was adopted.

At this time a cableway stretched across the site of the development with a [illegible] ft. pivot tower on the Canadian side and [illegible] ft. tower on trucks on the American side. The latter tower was movable through an arc of 1,000 ft. By means of this, men in a skip were lowered over the falls and, [illegible] use of a graduated steel rod located and [illegible] by instrument on shore, careful soundings over the very irregular surface were taken and platted and cribs were built to fit the ground. These cribs were planked on the outside partly loaded and carried to place by the cableway where the loading was completed.

By beginning at the upper end where the coffer joined *A* the water was gradually shoved out, each section acting as part protection for the next. Considering the [illegible] was remarkable how closely these tted the work. It was of course, y to build a coffer inside of this but , a comparatively simple matter.

anadian half of the dam-site was posed and the base prepared in the ay. Loose and fractured rock was re- cracks were cleaned out and grouted, surface was thoroughly scrubbed with l fiber brushes, using strong lye where

g these operations excavations for the 1 wheel pits had been progressing. dust and refuse at the northeast cor- e power house had been removed and made plain that the sounding drills , stopped by large boulders instead of ck. The ledge at that point dipped toward the northeast. A double cof- built surrounding the spot and exca- arried down. Only a small force rk in the limited space and that space aller as they went down. A number were spent in a vain search for in- At every foot of depth the danger of n the soft material became more ap- The water and mud pressures be- re and more difficult to handle. Both on and pumping were carried on con- day and night. At a depth of 60 y the water surface and 50 ft. below race floor, excavation was stopped, re put to work and a level shelf was out. On this was built a concrete and cantilever grillage which now sup- e corner of the power house. No [illegible] ier loped.

cavating for the American power othing of unusual interest occurred. rk was progressing on these struc- other cofferdam was built in the loop by the main current above the falls nding from the American shore to a [illegible] outer end of coffer A nearly to it and about 150 ft. above. Before E were sheathed which was done lanks, grooved and splined, coffers surrounding the head of the Mc- and Mann canal was removed and the as allowed to relieve the flow to a con- [illegible]

anadian wing of the dam with its ten waste gates being completed and the cavation of the Canadian forebay up ne of coffer A, it only remained for a pectacular blast Fig. 2 to throw the the obstruction into deep water and river into the gates of the Canadian use and through the gates of the [illegible]

this greatly relieved the flow of wa- the falls there was still a stream 125 and 30 ft. deep, flowing between the the dam and coffer E that made the [illegible] hum like a tuning fork g of this gap by a coffer known as last of the coffer series, and it plished as follows. Simultaneous- he apex of the dam and from cof- s were started pointing upstream this particular case, was toward the es shore. Their lines produced an angle with each other of 90°. s were extended until the gap be- [illegible] about 80 ft. They were sloping faces which were carefully ith 3-in. plank. The outer ends of hing cribs were also sheathed with plank. These ends formed the bear- the 80-ft. section similar to the bear- r the keystone of an arch. No ac- dings of the gap could be made. ly be guessed at and approximated, eful horizontal measurements were etween the ends of the cribs.

shelter of the outer end of E and a d, cribs were built, joined together loaded. These were hinged at one outer end of one of the projecting s, and when completed were shoved o the stream which swung them to ontrolled during the operation by f cables. The loading was next com- d the cribs settled to the bottom. ked the flow to such an extent that soundings could be taken. It remained now to sheath this gap, and it was thought desirable [illegible] stability to the cribs. To accomplish this a slightly flexible but heavy timber frame work was built, balanced on top of the cribs and over-hanging the upstream side, the balance being maintained by means of wire rope. This framework was carefully planked and when completed formed a trap door that in shape resembled a gigantic piece of pie. When all was ready the cables that held it in balance were simultaneously released and as it tilted it was caught by the current and carried by the force of the water to its place. Ten minutes later, one could walk anywhere on the site of the falls.

From this time on, work on the dam and power houses was carried forward without special incident.

A few words in reference to some methods used in sheathing these coffers might be of interest. A diver was found to be a necessary adjunct to the coffer building force. There were many bad leaks to be stopped where the cribs were on bare rock. In spiking the planking to the cribs he was also a necessity in setting spikes and guiding the hammers. Spike driving below water was done from a raft by means of an iron pipe which was slipped over the spike. This acted as guide to an iron rod rammer. The Wakefield sheet piles were not found so satisfactory as [illegible] grooved for 1x2-in. hardwood splines. The latter made a much tighter joint, cost less and were more easily put down. An attempt to make a Wakefield sheathing water-tight was made with heavy oiled canvas. This was a complete failure in a very short time, although working perfectly at first. The action of the water quickly rotted the canvas so that it would almost fall apart on being lifted.

Leaks at the toe of sheet piling on rock were closed with concrete in gunny sacks. Blows in soft mud under sheathing were stopped with evergreen mats ballasted with gravel. Twenty feet of water and 10 ft. or more of fluid mud constituted a real menace in the case of coffer E. This coffer slid downstream nearly 4 ft. in three days. No amount of loading would hold it and it was only by laying a track and dumping carloads of rock below it that disaster was averted. This coffer was originally built on a straight line on account of current and depth of water. If it could have been built in a crescent, trouble of a sliding nature would probably have been avoided.

Methods of Restoring Soil on Dredged Areas and Costs of Gold Dredging in Australia.

Large areas in Australia are worked for gold and often other metals by dredging. The gold bearing alluvium is broken down, passed through sluices to recover the metals sought and then redeposited. Thus when an area has been dredged over the original volume of earth is restored but of course not in its original arrangement. For example, if the area dredged had originally a top soil bearing vegetation overlying auriferous gravel, the dredges will have redeposited practically all of the original volume excavated, but the top soil and gravel will have been mixed and often the restored soil will be almost worthless for growing crops or vegetation of any useful sort. Consequently the mining laws made by the Australian government stipulate:

> That [illegible] sion in water, and [illegible] grade on top of the coarse and fine material dumped from the boxes, and unless otherwise directed the newly [illegible] must be sown with approved [illegible] and that where the soil and other earthly over burden are [illegible] greatest possible quantity of fine material from the excava- [illegible] distributed [illegible] spread and [illegible] on the surface of the tailings dump with a flat grade, and [illegible] shall be sown with approved grass seeds until they take root.

Full success in restoring the top soil on dredged areas has not been obtained largely because of the opposition of the dredge miners to performing this, as they consider, unnecessary work, and because many of the older dredging plants are not constructed so as readily to enable the separate deposition of the top soil and the underlying gravel, etc.

The type of dredge commonly used is the [illegible] of one of these dredges working at Bonnie Doon and equipped to restore top soil is given in the report on dredge mining for 1910 by the Victoria government engineers. This description is condensed as follows:

> [illegible] soil is a shoot made of sheet iron ½ in. thick. [illegible] breadth 46 ins. across the top, and its depth 18 [illegible] tom, and when being utilized lies inside of and along the whole length of the ordinary timber sluice box. With the full length of the shoot in use it delivers the earthy material 27 ft. beyond the end of the wooden gold-saving sluice box. The shoot is made in four sections, the upper one 20 ft. in length being removable, and this length is hung up clear of the sluice box when dredging of gravelly wash is in progress. The next length or section is hinged at its lower end, so as to admit of its upper end being raised out of the way when not required for resoiling. The next length is a fixture, and the last piece, 8 ft. in length, is on a hinge at its upper end, thus allowing it to be turned up when not in use, and lowered again into place when required to carry the soil to the furthest possible distance from the face. The upper section of 20 ft. in length, when in position for resoiling, has a pitch of 3 ins. to 1 ft., and is so placed that the top end nearly touches the lips of the buckets as they revolve. The balance of the shoot has a grade of 1¾ in. to the foot. When dealing with soil or overburden only, the pitch is sufficient to carry the material deposited from the buckets along the shoot with the help of a little water. When, however, there is an appreciable proportion of gravel deposited with the earthy matter, the mixture heaps up and requires a push to start it along the shoot. The additional water required to gravitate the overburden to the top of the dumped gravel at stern of the dredge besides that which comes up in the buckets, is admitted to the shoot through a 3-in. pipe, but this pipe does not run full. At date of inspection the discharge was about 10 cu. ft. per minute, whilst the volume of solid material being moved along the shoot was about 30 cu. ft. per minute. Occasionally the 3-in. pipe becomes blocked by clay, etc., deposited in the shoot by the buckets, and at such times the services of a man are required, for a few minutes, to shove the material and start it along towards the tailings dump. Sometimes a whole shift is run without the assistance of this man. It is estimated that this extra work costs about 10s. [illegible] per week. Between the end of June and [illegible] August [illegible] about 1½ acre had been done, on which ½ an acre had been neatly levelled off [illegible] the dredge men with shovels, working occasionally, and the cost of the work was estimated at about 10s. ($2.50) per week, or [illegible] per acre. When levelled off, the surface of the redeposited material is about 12 ins. above the adjacent natural surface and the depth of soil and earthly matter so replaced and levelled off averages from 2 ft. 6 ins. to 3 ft. In the working face on Aug. 5, 1910, the overburden was 4 ft. 6 ins. in thickness, consisting of dark-colored soil, sandy loam, and clay, overlying coarse gravelly wash. The water level in the operating pond was from 12 ins. to 4 ft. 6 ins. below the surface of the ground. The center of the lower tumbler shaft was 3 ins. out of the water, and the cut made extended back 6 ft. from the face. The drop from the center of the top tumbler shaft to the bed of the soil shoot is 3 ft. 6 ins., of which

2 ft. is occupied by the buckets, leaving 18 ins. of a clear fall. Some of the buckets do not empty freely, then most of the contents fall into the well hole. Occasionally buckets come up with some water, but no dirt. On Aug. 5, 1910, the material deposited in the shoot was mostly large clods of soil and clay, ranging in size from 12x6x4 ins. to 18x9x5 ins., also some stones were noticed up to 5x5x4 ins. The pitch of 3 ins. to 1 ft. at the upper end enables the deposited material to get away readily and reach the tailings dump, after a few short stoppages in the flatter portion of the trough, without much delay. The depth of the material sliding along the shoot was usually from 12 ins. to 15 ins. The dredge master stated that with sandy loamy soil, the discharge from the 3-in. pipe had to be cut off, such material did not need so much water to move it along as did the mixed material. The advance-stripping of this dredge occupied about four hours per day. From the upper tumbler shaft to the deck measures 19 ft. 6 ins., and to water level 22 ft. 6 ins. The cost of providing and installing the resoiling appliance on this dredge was less than £100. To obviate the occasional attendance of a man at the head of the shoot, it is intended to provide an appliance so arranged as to work automatically from the main shafting. The cost of the arrangement will be moderate.

The above plant is typical of a number which, however, all differ in detail. Another type of plant for resoiling dredged land is described as follows:

An interesting development has taken place in the matter of advance-stripping top soil and earthy overburden, and again depositing same in a useful condition on top of the wash and other coarse material which has passed through the sluice-box. The Briseis Company's bucket dredge, known as the Red Bluff No. 2 Plant, is provided with a belt conveyor, and is the first gold mining dredge constructed in this State on which the use of an effective appliance to deal satisfactorily with overburden has been made a special feature. The plant may be simply described as an ordinary bucket dredge, with sluice-box and belt conveyor. During the course of an inspection it was ascertained that the buckets, having each a capacity of 4 cu. ft., were traveling at the rate of 12½ per minute. Most of the buckets came up full of earth, but those in which the soil was well pressed did not discharge their contents wholly into the drop shoot, from which the conveyor is fed. In such cases about one-half of the material dropped into the shoot, and the balance slipped down the well hole into the operating pond. The material from the buckets may, by means of the drop shoot, be diverted into sluice-box or to conveyor. When overburden is being dealt with, the material from the drop shoot passes on to a shaking table operated by springs and eccentric rods, thence on to a travelling belt or conveyor, which may be adjusted to any desired angle. By this appliance it is carried along and dumped well clear of the stern of the dredge on to the top of gravel, etc., previously run through the sluice-box. The belt of india rubber is 125 ft. in length, 2 ft. in width, ½ in. to ⅝ in. thick, and travels over iron rollers on a steel framed elevator at a speed of about 160 ft. per minute. At date of inspection, the buckets were operating on a face of overburden extending from a depth of 8 ft. below water level to a height of from 3 ft. to 6 ft. above same, whilst the depth of soil deposited on the gravel, etc., behind the dredge ranged from 3 ft. to 6 ft. Probably about one-third of the alluvium was conveyed by the belt and dumped in a dry and useful condition, one-third went by way of the well hole into the operating pond, and one-third was scooped up with the auriferous gravel by the buckets, and after passing through the sluice-box was discharged in the form of sludgy water at the stern of the dredge. With such improvements in the plant as will provide for the full discharge of the solid contents of the buckets into the drop shoot, probably two-thirds of the overburden treated could be transferred from the working face of the paddock to the dump at the rear of the dredge in a practically dry and uninjured condition. Since the foregoing was written, revolving tynes have been provided to empty the buckets, and, if necessary, these latter might be altered in shape so as to let the stu out more readily.

A third plant which resembles the p t Bonnie Doon except that a screw co eyor operates in the top soil trough is used the Myrtle Queen plant operating near Myr ford on the Owens River.

Shortly described, the contrivance cons s of an ordinary shoot or flume of sheet ir say 2 ft. or 2 ft. 6 ins. wide, with semic ular bottom and vertical sides, and long eno h to extend from the upper tumbler shaft t some distance beyond the stern of the pontoo In-side of this shoot and along the whole le h of same, a spiral mechanical appliance w re-volve, by means of which the earthy over rden delivered by the buckets at the upper d of this trough will be shifted forward and pos-ited on top of the dredged-gravelly wash the stern of the dredge, in almost a dry cor tion It is really a screw conveyor in an open ugh

In addition to the information on re lir the reports mentioned give costs of dr gir for gold during 1909 and 1910. The ror for 1909 cover 54 plants of all sizes d various degrees of efficiency. Summariz th give the following figures:

Number of plants	54
Number of weeks worked	2,1
Cubic yards excavated	11
Cubic yards per week	74
Depth of ground, feet	
Number of men worked	6
First cost of plant	$1,15
Maintenance and repairs	$ 3,7
Fuel and water	$
Wages	$
Total last three items	$ 5,1
Cost per cu. yd., etc., say	cts

The corresponding summary for th ye 1910 is as follows:

Number of plants	
Number of weeks worked	2,0
Cubic yards excavated	15,0
Cubic yards per week	5,5
Depth of ground, feet	17
First cost of plant	$1,3,7
Maintenance and repairs	$ 5,9
Fuel and water	$
Wages	$
Total last three items	$ 1,5
Cost per cu. yd. etc	3 c

ROADS AND STREETS SECTIO

Some Consideration Affecting the Choice of a Pavement.

The growing demand for municipal efficiency calls for a much-needed reform in the selection of pavements. As it is now in many cities the choice of a pavement for some particular street is frequently left to chance or prejudice. Every taxpayer, thinking only of his own convenience and his taxes, considers himself an expert when it comes to deciding on this question. And too often his views overweight those of the engineer. An interesting paper on this choice of a pavement was presented to the recent meeting of the Engineering Society of Wisconsin by Leonard S. Smith, Associate Professor of Topographical and Geodetic Engineering in the University of Wisconsin. An abstract of Prof. Smith's paper follows:

It cannot be too emphatically stated that in each case the best structure for a pavement depends upon the particular service required of it and also, too, upon the widely varying local conditions. These modifying factors naturally divide themselves into two general classes. The first of these govern the conditions to which the pavement will be subjected. Chief among these factors are the quality, nature and even the direction of the traffic, the character of the district served by the pavement, the grade of the street and the presence of car tracks.

On the other hand, the second class of factors which may determine the selection have reference to the character of the pavement itself, such as durability, smoothness, noiselessness, slipperiness, cost, etc.

The best pavement for some particular street, then, would be the one which would give the greatest and most needed service, using the word service in a broad way. For example, if the street had a steep grade, all such considerations as smoothness, noiselessness, cost, etc., must needs give way to the single governing quality of non-slipperiness. Again, if the street in question were on a moderate grade in a high-class residence district or in the office building district of a large city, the factors of smoothness and noiselessness might properly determine the final selection. Such a selection, while involving a very expensive pavement, has repeatedly been shown to fully justify itself by the added value and earning capacity of the property. As a third example, considering the choice of a pavement in a wholesale district, subject to concentrated heavy traffic the qualities of durability and non-slipperiness would here naturally receive the greatest consideration.

But while there is great economic need that the best fitted pavement for each particular street should be thoughtfully and carefully chosen, it is at least of equal importance that all such paving improvements should proceed in accordance with some well considered plan—some comprehensive system for future improvement of the entire city, ward or region. For example, pavement improvements should be so planned as to provide several parallel routes for through traffic. If this be not done, the single route becomes congested and the pavement is prematurely worn out. Again, pavements should be continuous, both for the convenience of traffic and for ease of maintenance.

In the case of country highways, it is necessary to construct disconnected str ches of pavement, but even here it is of prin im-portance that such construction shoul pro-ceed in accordance with a systematic pl , so that disconnected stretches may eventua b come a part of such system. For ex pl in our own state it would be easy to s ct few trunk roads leading from the m trop s the state to the adjoining cities, an still others connecting the largest city or unty seat of each county, as being certain at-tract the heaviest traffic. Portio s of ucn trunk roads should be improved with fer-ence to sustaining heavy traffic and als with a view of becoming a part of an intr tate system.

Unhappily, the city paving program too often determined by the ward politician the opposition or favor of short-sighted re es-tate owners. A few cities which have ried this plan of adopting a paving progra e tending over ten years will soon occu enviable position. Our cities cannot do tter in this respect than to follow the exam of the most successful railroad companies.

It is worthy of restatement that che ness does not necessarily mean a cheap pri of the pavement when laid; indeed, such a ve-ment may likely prove the most expens in the end. The other governing elements ich determine the actual cost of a paveme are the annual cost of repairs and the to life of the pavement. Permanent pav ent may properly be paid for out of the pr e of bond issues payable during the life the pavement. In such cases, the public eventually have to pay for the fol items: Interest on the bonds, cost of re and annual sums for a sinking fund, the ime the pavement is worn out will of he bonds. Such a plan may be shown the ollowing formula:

$+ \frac{R}{L} =$ annual cost, where

yearly amount put in the sinking fund

= st cost of the pavement

= e rate of interest

= e life of the pavement in years

= e total cost of repairs.

Obviously, the cheapest pavement is the involving the least annual cost. If, for mp a macadam pavement be chosen for tre having a heavy traffic, the last term

wo l be so large as to make such a pave-

most expensive type that could be er This fact is an added illustration of importance of a wise selection of a pave- t the traffic conditions.

ls and Costs of Constructing a e-Gravel Road on a Sand Sub Grade in Menominee County, Michigan.

[illegible] by K. I. Sawyer, County Road Engineer.

fall of 1910 Menominee County extension of about 17 miles to its 7, known locally as the Bay Shore The northerly 10 miles of this exten- back from Green Bay (an arm of ichigan) and on a good bottom. The equirements are light and there are deposits of good gravel along the en- ch either on or near the right of way. lecided to build this stretch gradually all crews.

the southerly seven miles lies near h of the bay and on a sand bank aries in width from 400 ft. to a quarter in depth from 3 to 12 ft. The nat- tom is clay. This sand bank was pre- the off-shore bar in one of the early f the great lakes (the last Nipissing The sand varies in consistency, but en miles are easily divided into two as to road bottom. The north three as sand which shows water action but still retains a slight cohesion. The the south four miles has been rounded educed by water action that when wet s or sucks similar to quicksand. This ams back the water shoreward and an apparent swamp belt immediately the road. As you go westward there eral more repetitions of exactly similar phy before you strike the glacial dis- t altered by water action. This land is hence impervious, and carries a layer which holds the water like a sponge. ater seeps under the road and this con- ecessitated a complete system of drain- usual in sand, so as to acquire what the sand has through its weight.

southerly seven miles is through a con- e settlement. In the summer time it is ed mainly to a pleasure traffic, but in it must stand heavy and continuous A load of 60 packages of fish on a n 3½ in. tire wagon is not unusual; uld weigh about 5 tons.

[illegible] AND INSTALLING CONCRETE TILE.

	Making Tile.				Installing Tile.		
	Cement.	Cost.	No.	Rate, cts.	Cost.	No. tile.	No. culverts.
May							
June					....		
July	[illegible]	[illegible]	[illegible]	75 3/10	$ 37.00	22	2
August	97.86	189.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September	29.38	74.93	[illegible]	[illegible]	119.62	[illegible]	[illegible]
October					106.62	[illegible]	
November							
Total	$170.50	$380 26	[illegible]	*90 1/10	$331.56	[illegible]	[illegible]

*Average.

It was decided to put in all culverts [illegible] build the [illegible] the job and by force account. An organization as illustrated in Fig. 1 was adopted for handling the work and all culverts and the south four miles were put under construction in 1911.

For the culverts three sizes of concrete culverts were adopted for use on this road, standard sizes being used in batteries when necessary capacity required. The sizes adopted were 24 in. round tile and 48 and 96 in. diameter full arch culverts.

The so-styled culvert crew put in all the 4 and 8 ft. arches on this road and two arches on No. 1 road this season. The crew was equipped with Blaw collapsible steel centering, lumber and miscellanous tools. The crew lived in tents, taking its own cook with it, and moved from creek to creek. All culverts are designed for 25 ton engine, live load; they are of monolithic pattern and without reinforcement. This latter requirement was not to the satisfaction of the engineer, but was necessary on account of local sentiment. The crew was inexperienced when started and the engineer lived practically on the job for the rst two structures. Better success was had, however, than a year previous, when a culvert was installed by a crew of experienced sidewalk and street concrete workers.

Costs and data on culverts are given in Table I. The schedule of wages of this culvert crew was:

Foreman, 30 cts. per hour.
[illegible]
Laborers, [illegible] per hour.

The main construction crew was equipped with a No. 3 Austin gyratory crusher and appurtenances, two 75 h. p. Case traction engines for hauling, one 60 h. p. Case engine for pulley work, one 15 and one 10 ton Kelly Springfield roller, 10 Port Huron 6-yd. spreader wagons, six 2-yd. Austin spreader wagons, one set Miracle tile molds, portable blacksmith outfit, K. & J. scrapers, road machine, sprinklers, tanks, wagons and miscellaneous small machinery and tools. This crew camped in tents at a permanent camp for the season. The feeding of the crew was done on contract and was directly under the supervision of the engineer.

Fig. 1—Sketch Showing Plant Lay-Out.

There was only one source for obtaining road metal on this portion of the road. This source was a gravel pit which the preliminary investigations showed to contain about 11,000 yds. of gravel which had a 53 per cent stone content. The filler was not uniform but was mainly a clay loam containing sand pockets. The season's run showed the pit to be better than the indicated quality.

A synopsis of the specifications under which the road was built is as follows: Road ditched 24 or 30 ft. between ditches, depending on depth of ditches and of sand; subgrade of native sand; 3-in. layer of crusher screenings (clay loam and pebbles) laid on sub-grade worked into sand clay bed and rolled when dry with 15 ton roller; 5 ins. by 12 ft. clear crushed stone slightly bound and rolled; then 4 ins. by 18 ft. clear crushed stone bound with little excess of screenings rolled dry in puddle and then dry repeat as necessary. This past season

TABLE I MASS CONCRETE CULVERTS NO REINFORCEMENT

of Creek—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
tion	Clay	Clay.	Clay.	Hard sand	Sand.	Sand.	Clay.	Ledge.	Ledge.
pan, ft.	16	8	8	8	8		8		16
hes	2	1	1	1	1	1	1	3	[illegible]
concrete	[illegible]	60.3	38	46	[illegible]	[illegible]	[illegible]	108	56
st culvert	$505	$469	$387	$37[illegible]	[illegible]	[illegible]	[illegible]	$929	[illegible]
ost concrete	358	266	200	227	230	62	205	489	345
it Cost Concrete.									
mix and place	1.70	1.44	1.64	1.38	1.54	1.35	1.22	1.55	1.66
	2.85	1.88	2.16	2.04	1.89	1.42	1.78	1.91	2.16
ate	1.41	1.10	1.46	1.51	1.25	1.36	1.77	1.07	2.13
al per cu. yd.	$5.96	$4.42	$5.26	$4.93	$4.68	$4.13	[illegible]	$4.53	[illegible]

TABLE III.—CRUSHING.

	Labor.	Coal, oil, etc.	Cost.	Yds.	No. 1.	No. 2.	Rate 1 yd.
June	[illegible]	[illegible]	[illegible]	1,401	702	699	29 1-10
July	[illegible]	[illegible]	[illegible]	2,994	1,426	1,568	[illegible]
August	[illegible]	[illegible]	[illegible]	4,234	2,004	[illegible]	25 7-10
September	[illegible]	[illegible]	[illegible]	2,144	940	1,204	[illegible]
October	[illegible]	[illegible]	[illegible]	2,474	1,154	1,320	31 7-10
November	[illegible]	[illegible]	262.16	842	340	502	31 2-10
Totals	[illegible]	[illegible]	[illegible]	14,089	6,566	[illegible]	[illegible]

*Average.

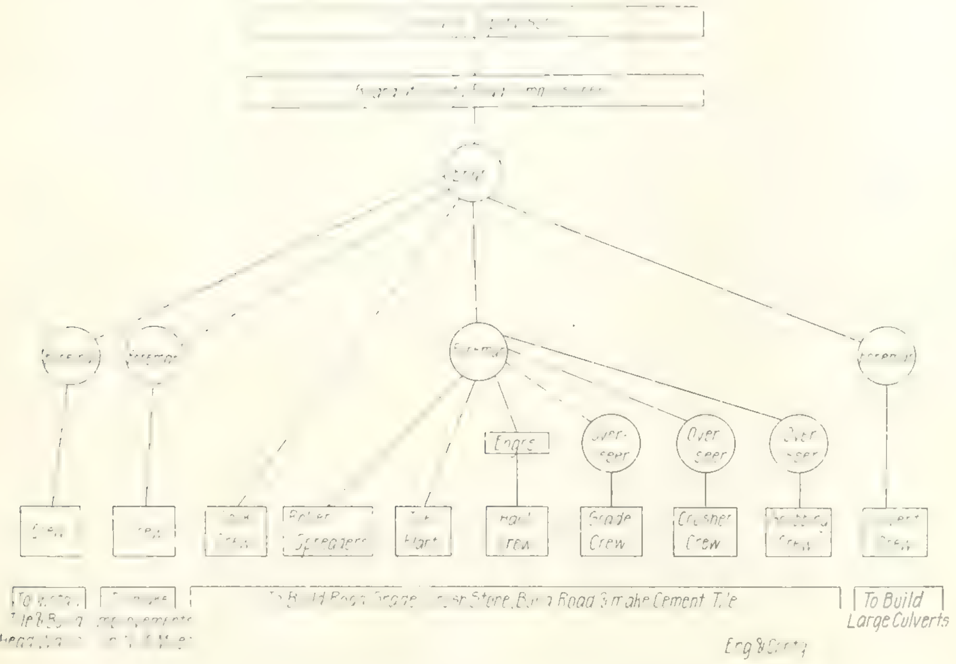

Fig. 2—Chart Showing Organiaztion forHandling Work.

TABLE IV.—COST OF HAULING WITH TRACTOR AND TEAMS.

	Steam Haul.								Team Haul			
	Labor.	Coal, oil, etc.	Cost.	Av. haul. Ft.	Max. haul. Ft.	Yds.	Av. cost 1 yd. Cts.	Rate 1 yd. mi. Cts.	Cost.	Mean haul. Ft.	Yds	Av. cost 1 yd. Cts.
May	$ 16.62	$ 9.16	$ 25.78	Instructing crews.								
June	[illegible]	110.04	173.69	2,300	4,600	1,359	12 7-10	34 2-10	$ 12.00	1,300	42	28 3-5
July	185.25	139.20	324.51	6,500	10,200	2,826	11 5-10	9 4-10	63.88	2,000	168	37 9-10
August	257.26	234.30	491.56	13,000	16,100	3,524	13 9-10	5 7-10	162.85	2,300	710	22 9-10
September	182.14	171.10	353.24	17,800	19,500	1,816	19	5 6-10	67.30	2,300	328	20 5-10
October	199.22	123.40	242.62	12,000	19,500	1,860	13	5 8-10	99.75	1,200	614	16¼
November	36.65	26.88	63.53	2,500	5,100	792	8 7-10	18½	48.48	5,700	50	97
				9,700	19,500	12,177	14½	*8 6-10				
Totals	$940.87	$814.08	$1,754.95						[illegible]	2,300	1,912	23 2-10

*Average

it was mostly puddle though, as it rained continuously. All excess screenings were used as shoulders and to make bottom in some low spots to be put under construction next season.

The lay-out of the plant is shown by Fig. 2. The plant site was wooded when work was started and this increased installation costs considerably. The gravel from the bank was plowed loose then teamed in wheel scrapers to the crusher, the teams driving over the crusher on the feeding platform and dumping the gravel directly into the crusher. Most of the season but two grades were taken by the screen on the bin but all dirt was removed from the stone by a ⅜-in. dust screen mounted outside the stone screen. The bins are so built that the engines and cars run under them to receive the contents of two compartments and receive the third from the end. All ports in the bins are on the bottoms which is built horizontal. It took about 3 to 4 minutes to load a 6-yd. wagon from the bin. The engines handled two to four wagons to a train according to climatic conditions. The usual practice, however, was to haul three wagons (18 yds.) which seemed to be enough as an extra wagon more puts too great a tractive effort on the engine for the good of

Owing to the fact that the stea were a new part of the county pla season a comparison was worked ou the advantage of using this equipm comparison was taken directly from ule of actual costs of the road. In 12,177 cu. yds. of stone were handl engines and 1,912 cu. yds. by team. was under identical conditions an good basis of comparison. The team was 53 cts. per yard-mile. This wou sidered high under normal conditio was good under existing conditions. ditions under which the hauling were very stern as is shown by the it was possible to load only about a load for teams at the start, and eve was necessary to double the teams siderable of the road now built. teams weighing 2,900 lbs. to 3,400 were used. Further details regarding ing are given in Table II. The fol a comparison of the cost of the en and team haul:

Engine Haul.

Engines hauled 12,177 cu. yds., a me haul of 9,700 ft. at a cost of..........
20% interest and depreciation on $6,
plant ....
Water tower expenses ....
Cleaning and repairs on haul equipme
Material placed in engine track in exce of amount required by specificatio 1,703 cu. yds. at 47 cts...............

Total ....

Team Haul.

Team haul cost at 53 cts. per mile giv average cost for mean haul of 9,700

$$\text{of 53 cts.}\times\frac{9{,}700}{5{,}280}=96\text{ cts. per}$$

hauled 9,700 ft. by team as mean ha
12,177 cu. yds. at 96 cts...............
Economy by use of engine..............

Fig. 3—View Showing Rock Crusher and Other Equipment.

Two rollers were kept at work cont one on the dump and one most of on completed work rolling the shou prevent movement of the subgrade. and subgrade work was handled by t crew under the grade overseer. Th portion of the work of the sprea passing the excess screenings out shoulders and shaping them, as after practice the spreader wagons drop metal practically in place.

The 24-in concrete tile were made crew and some of same installed on w Two men worked at the tile molds, th gate being taken from the sand gravel

TABLE V.—COST OF SPREADING AND ROLLING.

		Spreading			Rolling			
	Per cent good work days.	Cost	Yds	Rate, cts. per cu. yd.	Labor.	Coal, oil, etc.	Cost.	Rate, cts. per cu. yd.
May	[illegible]							
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5 1/20
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September	51	67.20	1,816	3 7/10	83.28	78.00	161.28	5 6/10
October	32	80.35	1,860	4 3/10	129.50	120.62	250.12	[illegible]
November	29	26.80	792	3 4/10	36.50	34.20	70.70	[illegible]
Total		$409.08	12,177	*3 4/10	$442.16	$414.62	$856.78	*7 1/40

*Average.

. A 1:3½ mix was used, the tile n. walls, lap joints, and being reinth steel car wire so spaced as to 5 ins. c to c when the tile are in he labor cost on the tile was about

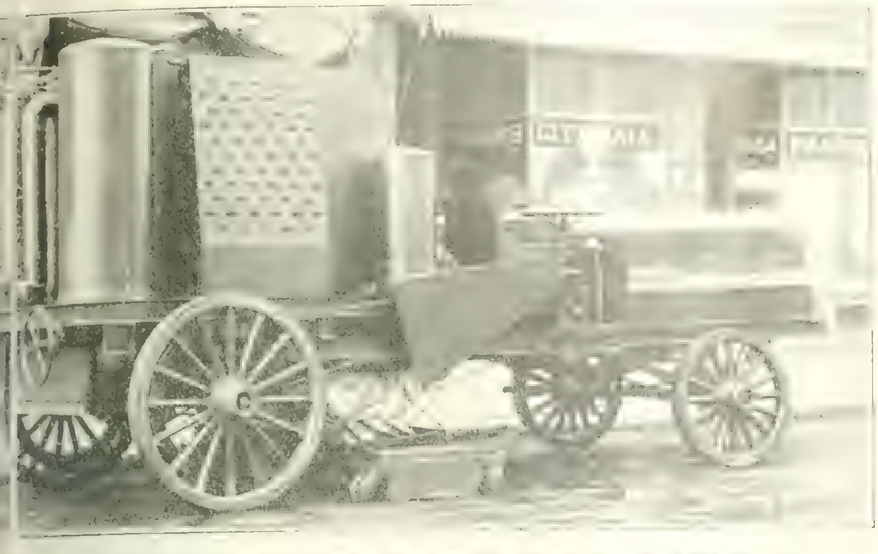

Fig. 1—General View of Furnas Pneumatic Street Cleaning Machine

ch or 22½ cts. per foot. Some data ork of the tile crew are given in

of wages of this main construc-
[illegible]
[illegible] cts. per hour.
, 25 and 27½ cts. per hour
, 20 to 2[illegible] cts. per hour
n, 20 cts. per hour.
cts. per hour.
and 20 cts. per hour.
at 17 cts. each.
at $1.50 f. o. b. scow at camp.

and data on the work of the main ion crew are given in Tables III, IV view (Fig. 3) taken in front of the looking towards the crusher gives a a of the plant installation. The costs expenditures only, no interest and depreciation being included. Two noteworthy s effected over former methods are the cement tile which cost 45 cts. per the job as compared to $1.76 per foot paid formerly for pipe of the same e tile stood up under the engines with exception and the former installations five instances.

work of the minor crews shown mainly in culvert installation, and in concrete head walls.

reports were made by all overseers rs to the foreman, these were an- a daily report from the foreman to These reports are on standard rms which show the costs and ac- ment for the day. These reports are with time books and supply accounts and the tables above given are com- them

mment on the crushed gravel of this probably in order. The community now opening up to general settlement, minous roads would be too heavy a for roads of the character of this ex- also it is a question whether traffic s that type. Observation of roads con- under specifications similar to the nd which have been in use three years that the roads built from stone ex- from gravel and bound with their earth stand the combined auto and affic they receive better than field stone m. In the main, the stone is a very nestone which stands abrasion compara- well. Most of the local gravel pits have -clay hard-pan filler and the capillary of the clay seems to make it consid- of a dust retainer. Furthermore this f construction permits of economical by unskilled labor. In one instance a of 3 miles which had become slightly was honed while the frost was coming out in t[illegible] was added [illegible] to reshape [illegible] it a week [illegible] to a [illegible]

A Pneumatic Street Cleaning Machine.

Dustless street cleaning and resulting dustless streets are the great desideratums of all municipal officials. Many machines have been designed for the purpose of producing these desired results. It is only in recent years, however, that engineers have turned their attention to producing a street cleaning machine which should act on the vacuum cleaning principle. One of these machines which has been perfected lately is the Furnas pneumatic street cleaning machine. This was described by Mr. C. A. Tripp, consulting engineer, Indianapolis, Ind., in a paper presented at a recent meeting of the Indiana Engineering Society and from his paper we have taken the matter that follows:

The illustration, Fig. 1, shows a general view of the machine, which is of the automobile type, propelled by a gasoline engine. The sweeping hood is shown resting on the street. This is preceded by a set of coarse brushes or rather scratchers, which loosen any dirt which may be stuck to the street surface. The dirt is taken up and deposited in the dirt box, the bottom of which consists of two doors which can be dropped for depositing the load. The small boiler shown furnishes a supply of steam which dampens the dirt, aiding in its separation from the air, and also forms it into a dustless mat or cake in the box, so that no dust is made when dumping or when loading into wagons.

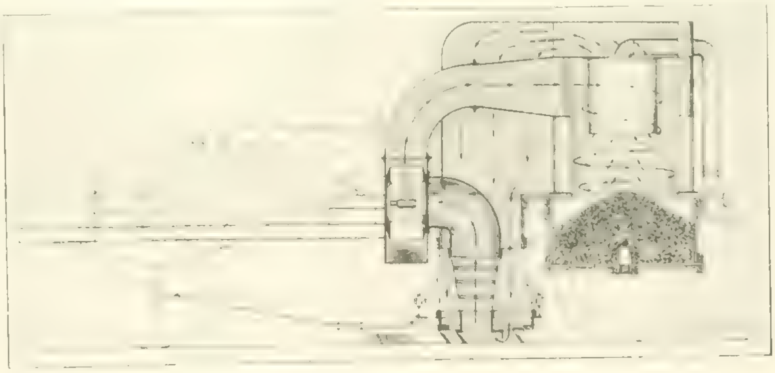

Fig. 2—Sectional View of Machine.

The sectional view, Fig. 2, shows the air circulating system, which is the interesting and all important part of the machine. The general plan is that the air used for sweeping is recirculated, being used over and over again, with the exception of a small amount which is taken out to provide for leakage, as will be explained later.

The sweeping hood consists of an inner and an outer portion. The outer portion is inclosed by short curtains or lines, made of canvas, to which small plates of iron are riveted. These plates serve to weight down the canvas and also to take the wear due to dragging on the street. They are sufficiently light, however, to pass over the dirt and not act as a brush or scraper. The inner portion is separated from the outer portion on the front side by a similar line, but on the rear side by a metal strip which runs at a distance of about ½ in. from the street surface. This is the real sweeping point. The air comes down in [illegible] comparatively low velocity and at substantially atmospheric pressure. The inner portion is under the full suction of the fan. The air rushing through this narrow opening at high velocity and in a direction practically parallel with the street picks up the dirt, which is then carried up through the opening in the center of the inner portion.

As shown this opening is connected directly to the fan suction. From the fan the air and dirt enter the centrifugal separator, which is directly above the dirt box. Here a small amount of steam is blown in, as previously described. After the air has deposited the dirt picked up from the street it leaves by the center tube and returns directly to the outer portion of the hod. Within the center tube by which the air leaves the separator is a small pipe, which is open at the lower end. A small amount of the air leaves by this pipe, which leads to the ash pit of the boiler. The amount of air taken out through this pipe is equal to the inward leakage to the outer portion of the hood.

The pressure in the separator, and hence the amount of air leaving by the small pipe, is controlled by the damper shown in the passage between the separator and the hood. Indirectly this determines the pressure in the outer portion of the hood, which is maintained at or slightly below that of the atmosphere, so that any leakage is inward, thus preventing dust.

The small steam boiler serves a double purpose. Steam added to the dirt and air as it enters the separator, increases the weight of the dust particles and thus aids in the separation. It also dampens the mass of dirt so that dust is prevented when dumping. The air returning to the hood, and therefore the air leaving the separator by the small offtake pipe, carries a fine dust which it is very difficult to separate. The fire in the boiler serves as an effective filter for removing this from the small volume of air which must be discharged, while the air acts to produce draft for the fire.

The power equipment consists of a 6x6 4-cylinder engine, located at the forward end of the machine. The sweeping fan is driven from the rear end of the engine shaft through a cone clutch and spur gears running in oil The power for propulsion is taken from the front end of the shaft and transmitted through a friction drive and differential jack shaft to the rear wheels. The maximum spread of travel is 5½ miles per hour, which may be reduced by the friction transmission, as required by the condition of the street being swept.

The machine is operated by two men. The driver controls the steering, and propulsion and fan speeds. The operator controls the pressures in the air system, raises and lowers the hood as required by means of the two levers shown, fires the boiler and dumps the dirt.

For average conditions this machine will sweep 15 to 18 great squares of 10,000 sq. ft. per hour.

The Utility of Coke Oven Tars as Road Materials.*

The rapidly increasing use in this country of refined coal tar in the treatment and construction of roads and the fact that an immense quantity of coal tar will ultimately become available for this purpose through the installation of by-product coke ovens make it highly desirable to obtain accurate information as to the properties of coke-oven tars which are being produced at present.

While, in the manufacture of coal gas, the production of tar is absolutely unavoidable, this is not true of the manufacture of coke for metallurgical purposes. There are two general types of coke ovens in use at present, in one of which no attempt is made to recover the volatile products of the coal. This is the oldest form of oven, known as the "beehive," and is extensively used in this country today. Coke ovens in which the by-products are saved are now used to some extent in this country, and sooner or later will undoubtedly replace the old-style oven entirely, and thus increase our output of tar enormously. With the development of the road-tar industry, which promises to consume vast quantities of tar, and the necessity for refining such tars before use, the general adoption of by-product ovens is only a matter of time. What this will mean in the increase in tar production can be imagined from the fact that in 1908, out of a total of over 26,000,000 tons of coke produced in coke ovens, only a little over 4,000,000 tons were obtained from by-product ovens. About 22,000,000 tons of coke were, therefore, produced without recovery of the tar. As the average yield of coke per ton of coal was 66 per cent, this would represent the consumption of over 33,000,000 tons of coal. Upon the basis of a yield of 10 gals. of tar per ton of coal, it may be seen that over 330,000,000 gals. of tar were lost in 1908 which might have been saved. As the actual production of coal tar both from coke ovens and gas houses amounted to about 101,000,000 gals., it is evident that over three-fourths of our possible production of tar as a by-product was lost during that year. At a valuation of 2½ cts. per gallon, this means a loss of over $8,000,000. At a conservative estimate, the tar lost each year from nonrecovery coke ovens is sufficient to build 9,000 miles of tar macadam road 15 ft. wide.

In order to determine the character of coke-oven tars at present being produced in the United States, it was first necessary to obtain samples from all of the known plants.

From a total of 31 manufacturers to whom questions were submitted 30 replies were received, but 4 of these reported their plants as not in operation. The remaining 26 furnished samples of their crude tar for examination and answered the questions in so far as they were able. Upon receipt of each sample the entire contents of the package were thoroughly mixed and a representative sample taken for analysis.

The statements relative to the maximum temperature to which the coal is brought during distillation indicate that two of the plants run below 970° C., that a total of 22 run not over 1,150° C., that 9 run from 950° C. to 1,150° C., and that only 5 run above 1,150° C. The maximum temperature of firing the retorts is, however, reported in most cases as being higher than the maximum temperature to which the coal is brought.

The maximum percentage of free carbon reported is from 16 to 24 per cent, but 17 manufacturers reported the maximum percentage of free carbon as being 12 per cent or under, and only 4 as 16 per cent or over.

Analyses of the samples received were made, the work consisting in determining the specific gravity, free carbon, or organic matter insoluble in c. p. carbon disulphide upon a 15-minute digestion at room temperature, material soluble in carbon disulphide, percentage of ash, and percentage of different fractions obtained by distilling a 250 c. c. sample in a 750 c. c. tubulated glass retort with the thermometer so placed that the top of the bulb was level with the bottom of the juncture of the stem and body of the retort.

The gravities of the samples examined range from 1.133 to 1.214 and that the great majority are lower than 1.200. This in itself indicates low percentages of free carbon. The minimum percentage of free carbon was 2.73, the maximum 16.80, and the average for the 26 samples 8.38. Eighteen samples contained less than 10 per cent of free carbon and 8 more than 10 per cent. About two-thirds of these products might, therefore, be considered as low-carbon tars and the other third as medium-carbon tars. The amount of ash in no case exceeded 0.16 per cent, and in most cases it was practically nil. This is, of course, also true of practically all gas-house coal tars. The percentage of water present varied from a trace to 10.1 per cent by volume, but in only 3 instances did it exceed 5 per cent. It is of interest to note that 14 of the pitch residues, remaining after distillation had been carried to 315° C., were either soft or plastic—a condition which has seldom been noticed by the author in the distillation of gas-house coal tars. The amount of solids which crystalized or precipitated out of the different fractions was found to vary greatly.

Results were also calculated upon a water-free basis—i. e., the percentages are expressed in terms of the actual tar exclusive of water. Considering these products according to type, the tar produced by the Koppers ovens contained the lowest percentage of free carbon, the Semet-Solvay tars the next lowest, the United Otto next, the Otto Hoffman next, and the mixed tar from the United Otto and Rothberg ovens contained the highest percentage of free carbon. For the sake of comparison the minimum, maximum, and average percentages of free carbon for each of these types are shown in Table I.

TABLE I.—PERCENTAGE OF FREE CARBON IN COKE-OVEN TARS.

(Water-free basis.)

	Percentage of free carbon.		
Type of oven	Minimum	Maximum	Average
Koppers	2.81	3.97	[illegible]
Semet Solvay	4.04	9.00	6.74
United Otto	5.26	12.55	9.00
Otto Hoffman	8.62	14.69	12.16
Otto Hoffman and United Otto (mixed)	11.51	13.52	12.51
United Otto and Rothberg (mixed)	17.17	17.17	17.17

The percentages of various fractions for the different types of tars overlap to such an extent that no detailed comparison will be made. The maximum, minimum, and average total distillates to 315° C. for the different types are, however, given in Table II.

TABLE II.—PERCENTAGE BY VOLUME OF TOTAL DISTILLATE TO 315° C. IN COKE-OVEN TARS.

(Water-free basis.)

	Percentage by volume.		
Type of oven	Minimum	Maximum	Average
Koppers	30.5	36.0	33.3
Semet-Solvay	22.6	40.8	29.9
United Otto	25.6	38.5	32.6
Otto Hoffman	[illegible]	[illegible]	[illegible]
Otto Hoffman and United Otto (mixed)	19.9	32.1	26.0
United Otto and Rothberg (mixed)	26.9	26.9	26.9

From this table it is evident that wide variations exist in the relation of total distillate to pitch residue in the coke-o produced in this country, and this true of different tars produced by t type of oven.

Straight coal-tar road binders or coal tars are usually manufactured jecting the crude material to a pr distillation with or without steam or tation. Distillation is carried to the which the residuum remaining in the obtained the desired consistency at temperatures, and this involves the of certain of the more volatile oils in the crude material. For use in c tion work a soft and almost flui often produced, and the consistency pitch is controlled by means of a point or float test. When the crude abnormally high in free carbon, it i times mixed with crude water-gas ta distillation. Water-gas tar contains low percentage of free carbon, and by ly proportioning the two products tained, upon distillation, which does n more than the maximum limit of fre set by manufacturers. What the m limit should be is a much mooted among those who have given though matter. The governing consideratio (1` What is the most economical lin the standpoint of manufacture? and (is the proper limit with regard to the tion of the product as a road materi a number of reasons, which it is unne to mention in this circular, an ex high-carbon tar is difficult to distill and, with other things equal, the lo percentage of carbon the easier and the distilling process. From this sta therefore, by-product coke-oven tars adapted to the manufacture of road Moreover, because of their low perce free carbon, they may be employed in ner similar to water-gas tars, when i sired to utilize a crude high-carbon the production of a medium-carbon binder.

In an ordinary road tar for use struction work where free carbon is to the extent of about 20 per cent, t portion of total distillate, below 315 pitch residue is approximately 1 to 4. this relation exists the pitch residue and brittle. A residue which is soft ties is to be preferred, as it woul longer life during service, and where residue is present the proportion of would naturally be lower for a giv sistency, as the distillates may be co as fluxes for the residues.

In conclusion it may be said that tions point strongly to the fact that uct coke ovens will eventually play important part in the road-material i The future demand for economi minous road binders in the United St undoubtedly exceed the supply, and i spite of the natural increase in petrole asphalt road binders. If such is the c present loss of enormous quantities o say nothing of gas and ammonia, of the use of beehive ovens, is worthy of the utmost consideration part of all who are interested in servation of our resources.

Chief Irrigation Engineer.—Th isting a vacancy in the position of Chi neer, Indian Irrigation Service, at $4 annum. The government is endea find the best available man for this w has no particular individual in vie qualifications and fitness of applicants determined by a board of experien neers. Qualified persons interested quested to communicate with the Civil Commission at Washington. It is de fill the vacancy as soon as possible.

Civil Service Examinations.—The Civil Service Commission announce tions April 3 to fill the positions of assistant in ceramics, and junior elect gineer at salaries ranging from $900 t per annum.

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*Abstracted from a circular prepared by Prevost Hubbard, Chemist, U. S. Office of Public Roads, and issued by that office.

VATER SUPPLY, SEWERAGE AND SANITATION SECTION

Review of the Methods of Disposal of Municipal Refuse— Progress of e Art—Data of Operation of Cleveland and Buffalo Plants.

t of the refuse disposal problems of [illegible] recently was made by and Gregory, consulting engineers, of rk City. A full statement of the recommendations to the city will be sue of March 27. The report a review of the methods of refuse which have been applied to conditions untry, with special reference to gar- e, rubbish and ashes. The progress of the he and in Europe, is traced and summed fic data relating to the operation of nd reduction plant and to the Buf- nerating plant are given. The matter h given is abstracted from the report.

LLECTION OF REFUSE

age should be collected in water-tight prevent the dripping of the liquids streets and pavements, and the uld be covered in order that the ay be transported in as inoffensive as possible. The wagons should be washed each day, inside and out- ep them in a clean condition. With llections and clean covered wagons n be transported through the streets ffense. The only remaining objec- the separate collection of garbage is ptacle in which the garbage is kept removal. These receptacles should ght and covered, not only to keep erial from sight, but to confine possible and to prevent the breeding of flies. ble receptacles and reasonable care t of the householder offensive con- d not exist, but it is safe to say garbage, rubbish and ashes are col- ther, as is generally done in Europe, nditions are less likely to occur.

nd also ashes, especially the latter, collected in wagons also provided kind of covering, to prevent the d light material from being blown in- streets, as it is this material, especially separate collection, which may cause a e. While it is almost impossible to ome dust from arising when dumping al into the wagons, especially on s, still, with suitable wagons, and care in dumping, this should lly eliminated.

lative merits of a separate or com- ction of the garbage, rubbish and far as the collection alone is con- e advantages are in favor of the collection, but a decision as to which should be adopted depends upon the as to the final disposal of the ma-

DISPOSAL OF GARBAGE.

[illegible] The feeding of garbage, resh, to swine was one of the first f disposal ever used. It is still in r less, and is the common method l in many of the small and medium- unities in the New England States. method of disposal the garbage sh, must be collected and delivered must be kept free from rubbish and refuse which would injure its food Where it can properly be carried out eems to be, according to Dr. Chapin ny other health authorities, no serious to this method of disposal, either ygienic or commercial standpoint. ble revenue may be derived from f garbage for feeding and under ditions the revenue may be greater om all other methods of disposal. This however, is only applicable where the s are such that the sanitary quality [illegible] odors, can safely be guarded and maintained, and which conditions exclude it from adoption in large cities, except in the case of restaurants and hotels, where a restricted private collection can be secured.

Dumping as Filling.—The dumping of garbage to fill up land is objectionable and especially so if the amount of garbage thus disposed of is large. The material putrefies rapidly, emits offensive odors and produces a nuisance. When mixed with other refuse, especially ashes, the results are not so bad. If the proportion of ashes is quite large and the dumping ground remotely located, it is even possible to thus dispose of the material without offense or objection. In large cities favorable conditions for the disposal of garbage by this method, especially in summer, are seldom met with. Filled ground made with material containing garbage cannot be used for permanent improvements until, after many years, the material has gradually and firmly settled. Structures cannot be built upon it, and even when streets or roads are built over it, unsatisfactory results are obtained, as the pavements settle unevenly and constant repair work is required.

Trench Burial.—Garbage is sometimes disposed of by burial in the ground. Trenches of convenient width and a foot or more in depth are first dug, the garbage is then dumped into them and covered with the dirt which was removed from them. If the work is done carefully and the garbage covered quickly it is possible to thus dispose of it without producing a nuisance. The garbage gradually decays below the ground and after some years the ground may be used again for the same purpose. The city of Berlin and many small towns in the United States use this method. Owing to the fact that generally a large area of land is required and the cost of haul to such area is excessive, as land for this purpose generally cannot be obtained within a short distance, it rarely is found that this method of disposal can be used advantageously in the case of large cities.

Ploughing the Soil.—Under certain conditions, garbage may be ploughed into certain kinds of soil with satisfactory results, and the fertility of the ground more or less increased. Large areas of land are needed and careful management required. It is rare that this method of disposal is applicable for large cities.

Dumping Into Large Volumes of Water.—It is sometimes possible to dispose of garbage by dumping it into large volumes of water. If this can be accomplished at a sufficient distance from shore in a large volume of water, and if the water is of sufficient depth to prevent the material which will sink from accumulating to such an extent as to interfere with navigation or produce foul deposits, and if the currents and winds are such that the floating material will not drift or be blown back to the shore, garbage may be thus disposed of without offense. It is seldom, however, that conditions are such that this method of disposal can be used and give satisfactory results.

Incineration.—Until the middle of the last century cities disposed of their general refuse simply by dumping and filling up low land. Garbage, when fresh, was used chiefly for feeding, and, when stale, was mixed with other refuse and dumped. About 50 years ago England began to improve on this method by introducing incinerators. It was found that domestic refuse consisting of garbage, rubbish and ashes, when mixed in the pits of "middens," contained a sufficient amount of combustible matter to burn without the addition of fuel.

The Fryer furnace at Nottingham, built in 1875, was the first successful city refuse incinerator. It consisted of a series of cells, each being about 5 ft. square, having a grate sloping toward the front and fed through a hopper at the rear. The success of this furnace was sufficient to cause in England a rapid growth of refuse incineration. Today it is the only method of refuse incineration practised in that country. Many improvements in the details of construction and operation have since been made. About 14 years ago the burning of refuse was introduced into Germany and Belgium; some years later it was introduced into Paris, and it is now favored quite generally in Europe and wherever city refuse is to be destroyed.

In America the best of the early methods practised were feeding garbage to swine ,and dumping the other refuse. Due to the fairly good condition of our soil, city refuse has not been much used for fertilizing purposes. When it became apparent that only fresh garbage could safely be fed to animals, and that in large cities it was difficult to collect and dispose of garbage so rapidly that it could be fed in a fresh state, other methods of disposal were sought. On account of the nuisance caused by the early putrefaction of garbage, efforts were made, chiefly in the large cities, to find some other way of disposing of this part of the city's refuse properly, and no attention was given to the other parts, which were usually dumped anywhere at the least possible cost.

The first of these methods of garbage disposal was incineration, and the Engle furnace, built in Milwaukee, was the first one to be introduced in America. Due to the large amount of moisture contained in garbage, if not mixed with rubbish and ashes, which permits much of the moisture to evaporate, it was found necessary to add fuel, such as coal, and the Engle furnace as well as almost all of the subsequent variations of it, used coal in greater or less quantities to assist combustion.

It will be evident that the addition of coal represents in some cases, a large expense. It is, therefore, somewhat strange, that, for many years, no furnace was designed on well known principles which would burn the garbage in a way so that the amount of coal would be reduced to a minimum or made entirely superfluous. It is not necessary to mention here the many types of furnaces that have been suggested and erected in America and which have been operated for a while. Almost none of the earlier ones have stood the test of time and efficiency, and none, until a very few years ago, demonstrated their capacity to permanently maintain a satisfactory disposal at low cost.

A modern refuse incinerator consists of one or more furnaces in which the refuse is burned, together with other devices for insuring satisfactory results. The furnaces are built of brickwork and fitted with one or more grates, the refuse being charged into the furnaces either from above or from the front or back, depending on local conditions and the type of furnace adopted. An artificial draft is produced either by steam blast or by a forced draft of hot air, in order to ensure a high temperature and the destruction of offensive odors. From the furnace the hot gases pass through a large combustion chamber, in which also the dust is allowed to settle out. If power is to be produced at the incinerator the hot gases from the combustion chamber first pass through a boiler and then through a regenerator and on to the chimney and atmosphere. The air used in the forced draft first passes through the regenerator where it is heated by the hot waste gases on their way to the chimney.

In most refuse incinerators, especially in Europe, the steam generated in the boilers is utilized to produce power, which latter, besides operating the works themselves, is frequently used either for operating sewage pumping machinery or for generating electric current for lighting purposes. The exact amount of water which can be evaporated into

TABLE I. ANNUAL COST OF OPERATION OF AND INCOME FROM THE GARBAGE REDUCTION WORKS AT CLEVELAND, OHIO, 1905-1910.

Year	1905	1906	1907.	1908.	1909	1910
Population	[illegible]	[illegible]	506,000	[illegible]	[illegible]	[illegible]
Garbage collected, tons	30,382	34,891	37,606	41,247	44,590	44,747
Total cost of works [illegible]	$ [illegible]	$ [illegible]	$190,820	$223,782	$225,[illegible]	$232,10[illegible]
COST OF OPERATION:						
Operation of reduction works	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Freight on raw garbage*	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Unclassified	[illegible]	[illegible]	171	713	[illegible]	[illegible]
Total expenses, [illegible] interest and depreciation	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]
Interest at 4 per cent on cost of works	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]
Depreciation charged off	[illegible]	[illegible]	9,902	[illegible]	[illegible]	[illegible]
Total cost of operation	$ 68,142	$ 96,075	$108,824	$123,073	$120,608	$117,629
INCOME:						
From sale of product	$ [illegible]	$ [illegible]	$116,[illegible]	$143,711	$[illegible]	$ [illegible]
From [illegible]	[illegible]	[illegible]	11,979	2,582	[illegible]	[illegible]
Total income from product	$ 62,899	$105,045	$128,303	$146,293	$160,097	$190,161
Total net annual income	†$ 5,243	$ 8,970	$ 19,479	$ 23,220	$ 39,489	$ 72,532

*From Cleveland to reduction works at Willow. †Deficit.

steam depends on the character of the refuse burned, and, without attempting to set exact limits, it may be said to vary approximately, where conditions are not unusual, from 0.5 to 1.25 lbs., per pound of refuse burned.

Where the clinker removed from the furnaces is hard, it is often the practice to pass it through a clinker mill, in which it is crushed and then to screen it. Clinker thus produced is suitable for use in certain classes of concrete work and its sale may yield a considerable revenue. Where the clinker is not hard, or if there is no market for crushed and screened clinker, it is used for filling.

The first furnace on this side of the Atlantic Ocean which has not only given complete satisfaction, both from a sanitary and economical point of view, but has utilized the heat created by the burning, is the one which was created in 1906 and has since been operated at Westmount, a suburb of Montreal, Canada, see Engineering & Contracting, Sept. 28, 1910. It is situated not very far from residences, burns all kinds of refuse and supplies heat for generating electricity which assists in lighting the town. As first built the incinerator had only one furnace, having a capacity of burning fifty tons of refuse per day; the operation of this furnace was so satisfactory that a second furnace has since been added. The cost of incineration at Westmount, including fixed charges, for the three years, 1907, 1908 and 1909, averaged 88 cts. per ton of refuse. The heat value for the same period was 36 cts. per ton, making the net cost of incineration 52 cts. per ton of refuse.

Since then a number of other projects have been successfully carried out in Canada and the United States among which may be mentioned those at Vancouver, 1907, Seattle, 1908, West New Brighton (New York City), 1908, and Milwaukee, 1910, the dates referring to the years in which the incinerators went into operation. The incinerator erected in West New Brighton, in the Borough of Richmond, New York City, was designed on principles determined by the Borough Department, and calculated to consume general refuse and utilize the heat for power. This furnace has given satisfactory results and in January of this year (1911) bids were received for a second incinerator.

The largest refuse incinerator in America is in the city of Milwaukee and has been in operation about a year and one-half. The incinerator has a capacity for burning a total of 300 tons of mixed refuse per 24 hours, and consists of four furnaces, each capable of burning 75 tons per 24 hours. With three furnaces in operation the net rated capacity of the works is 225 tons per 24 hours. The total cost of the works, exclusive of land, was $212,007. A careful investigation of the operation of the incinerator for the first three months of 1911 was made by the Milwaukee Bureau of Economy and Efficiency, and during this period it was found that the actual total cost of operation, including interest, depreciation, etc., was $1.65 per ton of refuse. With modifications in the method of operation of the furnaces along the present general design, the report further states that this cost can be reduced to $1.30 per ton. No funds were provided for the necessary equipment to produce power from the steam generated at the incinerator or to crush the clinker, but it is the intention to add the necessary equipment and produce electric current and also to install a clinker mill in order to derive a corresponding revenue.

The latest refuse incinerator built along still more favorable lines is in the city of Montgomery, Alabama, and has been operated since last July. It consists of one 60-ton furnace of four grates with hydraulically operated top-feed doors. The refuse is mixed, consisting of garbage, rubbish and ashes, and is dumped from the collecting carts directly into storage hoppers immediately above the containers which top-feed into the furnace. The clinkering is done by hand. The clinker falls into a car which is removed and automatically dumped by a hoisting engine and then returned. The labor has been reduced below that required at Milwaukee, because of the machine feeding and clinker removal. It is fair to estimate that, with improvements similar to those at Montgomery, the labor cost can be reduced below that at Milwaukee to the extent of about 20 cts. per ton.

Both in Europe (Hamburg, Barmen and Zurich) and in the incinerators to be built in San Francisco, further reductions in operating cost are either being secured or are expected.

Regarding the income to be derived from incinerators, figures from England, from the aforementioned continental cities, as well as from Westmount, Vancouver and Seattle, all show a tendency to increase.

With a careful analysis of the materials contained in refuse and of its physical conditions, it is not a difficult engineering problem to foretell the results that must follow. There are precedents under conditions similar to those of the cities mentioned, all of which allow such a forecast to be made with no question as to the final result.

Reduction. While in Europe the incineration of city refuse has been practically the only method which has proved successful and economical, there has been developed in the United States another method which has advantages which cannot be secured in Europe. The character of the garbage in the United States, due to the wastefulness in the use of food matter, particularly of animal food, is such that there is a large percentage of grease contained in the garbage, the amount varying from 2 to 4 per cent of the whole mass. This grease may advantageously be used in the manufacture of candles, soaps and other products and, therefore, sells for a good price.

The process by which the grease is extracted from the garbage is called the reduction process and may briefly be described as follows: The garbage, which for this process must be collected separately from the rubbish and ashes, is placed in closed tanks, called digesters and cooked for several hours under steam pressure. The cooked material is then withdrawn from the digesters and pressed to remove as much as possible of the liquids. These liquids, which carry roughly about two-thirds of the total amount of grease in the garbage, then flow to separating tanks [illegible] which the grease rises to the surface and [illegible] withdrawn. The remaining liquids, in many of the reduction works, are then allowed [illegible] go to waste, but in other works they are still further treated to recover valuable ingredients which are in solution. The pressed material, called tankage, which still contains [illegible] considerable amount of moisture, is dried [illegible] remove as much of this moisture as possible and then screened. Dry tankage, [illegible] duced, is a marketable product and [illegible] as a base in the manufacture of fertilizers.

Tankage which has simply been pressed and dried contains a considerable amount [illegible] grease, as it is impossible to remove all the grease [illegible] simply pressing. The grease contained in the dry tankage can, however, be nearly all recovered by the use of the naphtha process. This process consists of placing the dry tankage in closed vessels called percolators and then allowing naphtha to percolate through the mass, the naphtha acting as a solvent. [illegible] naphtha and dissolved grease are [illegible] and flow to a treating tank in which [illegible] heated to vaporize the naphtha and [illegible] grease. The naphtha is recovered by [illegible] ing it in a separate vessel.

Where it is desired to extract valuable ingredients in the liquids removed [illegible] separating tanks, mentioned heretofore, from which the grease has been separated, the liquids are carried to evaporators [illegible] a large amount of the liquid is evaporated, leaving a syrup. This syrup is then drawn and mixed with the tankage, which [illegible] or may not have been treated by the naphtha process, after which the tankage is dried [illegible] remove the moisture added by the syrup. Tankage, thus produced, is of a better quality and commands a higher price.

The disposal of garbage by reduction and the recovery of the by-products has been [illegible] ticed for many years and is the chief [illegible] of disposal in the larger cities of the [illegible] States, where it has been found that the [illegible] bage is sufficiently rich in grease to [illegible] its extraction. Among those cities [illegible] mentioned Boston, New York, Phila[illegible] Baltimore, Washington, Buffalo, Indiana[illegible] Cleveland, Columbus, Ohio, Chicago and [illegible] ers. In all of these cities except Cleveland and Columbus, Ohio, the reduction works [illegible] owned and operated by private parties and solely for profit.

Until within a few years but little knowledge could be obtained as to the profit [illegible] would accrue from the reduction of garbage and the sale of the products obtained therefrom. On January 1st, 1905, the [illegible] Cleveland, Ohio, purchased the reduction works from the private company owning them. From this time on, they have [illegible] erated by the city and figures are now available which show what return can be obtained from the production and sale of grease and tankage. The annual cost of operation of and income from the reduction works at Cleveland, for a period of six years, is given [illegible] Table I, and an examination of this table will show what profit accrues to the city from the operation of these works.

The amount of grease which can be extracted from garbage, of course, varies, and depends on the character of the garbage and [illegible] the details of the process carried out at the works. The amount of grease produced at the reduction works at Cleveland for a period of six years, is given in Table II, and from the table it will be seen that the grease varied from 2.63 per cent in 1905 to 3.75 per cent [illegible] 1910. The increase in the percentage [illegible] grease recovered is due to the introduction [illegible] improved methods and machinery a[illegible] cially to the introduction of the naphtha process.

The prices received for grease and tankage have varied from time to time depending

TABLE II. GREASE PRODUCED AT THE CLEVELAND GARBAGE REDUCTION [illegible] 1905-1910.

	Weight of Material				
Year	1905	1906	1907.	1908.	1909
Garbage, in tons	30,382	34,891	37,606	41,247	44,59
Grease, in tons	799	1,070	1,183	1,420	1,67
Percentage of grease, by weight, of garbage	2.63	3.07	3.14	3.44	3.7

HE PRICES RECEIVED FOR GREASE [illegible] DRY TANKAGE AT THE CLEVE- ND, OHIO, GARBAGE REDUCTION WORKS, 1905-1911.

iod.	Grease per pound	Dry tankage per ton.
1905, to June 30, 1905.	[illegible]	$7.0[illegible]
1905, to Dec. 31, 1905...	2.91	7.02
1906, to June 30, 1906.	[illegible]	[illegible]
1906, to Dec. 31, 1906	[illegible]	8.49
1907, to June 30, 1907.	[illegible]	[illegible]
1907, to Dec. 31, 1907	[illegible]	[illegible]
1908, to June 30, 1908.	4.35	[illegible]
1908, to Dec. 31, 1908.	[illegible]	5.89
1909, to June [illegible] 1909..	3.46	[illegible]
1909, to Dec. 31, 1909..	3.95	6.81
1910, to June [illegible], 1910..	[illegible]	[illegible]
1910, to Dec. 31, 1910..	[illegible]	6.12
ge	$3.80	$7.19

ket conditions. The prices received for [illegible] dry tankage at the reduction works veland for a period of six years are in Table III. The average price re- grease was 3.80 cents per pound r dry tankage $7.19 per ton.

only other city in the United States wns and operates a municipal garbage works is the City of Columbus. These works, built by the city, have a pacity of handling 160 tons of garbage y. They were completed in 1910, have peration somewhat over a year and een satisfactory, as they are run in a sanitary manner and give no offense. present time the naphtha process is not but it is to be installed, the work being ell under way. The total cost of con- n of the reduction works, exclusive of engineering, was $189,542. Adding the cost of land, loading station, rail- ding and engineering, $46,028, the total iture was $235,560.

results of operation of the Columbus for the first six months of 1911 have y become available, see Engineering ntracting, Sept. 27, 1911. The amount ase actually recovered, without the use naphtha process, was 2.57 per cent, and ount of tankage 16.8 per cent, of the of garbage reduced. Careful analyses ade of the dry tankage during this pe- hich indicated that the dry tankage still ed approximately 10 per cent of grease. this tankage 8 per cent of grease is rable, and to recover which the naphtha is being installed. With the naphtha it is expected that the amount of recovered will be about 3.9 per cent, e dry tankage 15.5 per cent, of the of garbage reduced.

average price received for grease at bus during the first six months of 1911, 19 cts. per pound and the average price y tank $9.14 per ton. The higher price d from the tankage is due to the fact e tankage produced at these works had rup from the evaporators mixed with had, therefore, a greater percentage of le ingredients and was of a better grade hat ordinarily produced in reduction

total net receipts at the Columbus works the sale of the by-products recovered the first six months of 1911 year were . The expenditures for the same pe- ncluding freight on the garbage, were , which, with an interest and sinking harge of 5.78 per cent per annum on 0 or $6,808, would make the total cost ration $24,140. It will be seen, there- that the net profit for this period was or at the rate of $10,952 per year. As works at present are operating at much an their rated capacity, the net profits an increased amount of garbage would respondingly increased.

he operation of most of the reduction in the past, serious nuisances have due to the emission of offensive odors ced. With the exception of the two just mentioned, they have all been by private parties and have been op- solely for profit and, except under com- n, generally without much regard to do- e work in an inoffensive way. The re- n process in itself is a strictly sanitary [illegible] ection to the r[illegible] process is the possibility [illegible] reason the works have generally been located [illegible] perature of about 600° F., or thereabout. By [illegible] odors can largely be eliminated. By subjecting them to temperatures of at least 1,300° F., such as are obtained in well operated incinerators, the offensive odors can be entirely eliminated. In the reduction works most recently built, substantial progress has been made in their design, construction and operation, whereby not only has the cost been reduced, but also the escape of objectionable odors can be prevented.

Rubbish is most frequently disposed of by dumping, generally where low land is to be filled up, and either with or without an ad[illegible] conditions this may possibly be a satisfactory method of disposal, provided the materials will not cause future trouble and if sufficient land is available, but in general a rubbish dump is liable to be more or less of a nuisance. Fires frequently are started and the odors thus produced frequently are quite offensive. Further, a rubbish dump affords a good breeding place for vermin, and in windy weather a good opportunity for scattering disease germs that may have been contained in sweepings and discarded matters from sick rooms. Land made by dumping rubbish, as is the case with land made by dumping garbage, is unsatisfactory for permanent improvements except after the lapse of many years. When rubbish is not used for filling it is disposed of by burning in an incinerator, either alone or with an admixture of garbage and ashes.

Rubbish, while consisting mainly of material which has been discarded, contains a considerable amount of material which is saleable, such as paper, rags, bottles, tin cans, scrap iron, etc. Some years ago it was appreciated that, if the rubbish was collected separately and the salable material picked out, there would be a considerable return from the sale of such material and the systematic sorting of rubbish was undertaken in the city of London, in Boston, New York and Buffalo.

A brief description of the method as carried out in Buffalo will serve to illustrate what can be done towards utilizing the salable material in rubbish. The rubbish is de[illegible] after having been dumped from the wagons is raked over onto a conveyor. The conveyor transports and lifts the rubbish to a sorting room. Stationed on each side of the conveyor are six assorters and as the rubbish is conveyed past them they pick out the materials which are saleable. In Buffalo mainly women are employed for this work of sorting, but the bottles and certain other miscellaneous materials are picked out by boys or men. The materials are then thrown into different bins, each girl assorter picking out only one class of material. Situated beneath these bins are machines in which the various classes of paper and rags are pressed and baled ready for shipment.

The remainder of the rubbish which is not saleable passes to another part of the building and is burned in a rubbish incinerator, the heat being utilized to produce steam which operates the conveyor and the remainder is sold to the sewage pumping station connected with the incinerator.

The annual cost of operation of and income from the rubbish incinerator at Buffalo, where the saleable portions of the rubbish are utilized, for a period of four years, 1907 to 1911, is given in Table IV. Briefly stated the total cost of operation, and including a small amount of new construction, for the four years was $148,042, and the total income from the sale of material picked out and from the sale of steam to the sewage pumping station was $147,375. It will be seen, therefore, that rubbish incinerator was practically self-sustaining, or in other words, that the rubbish, after having been collected, was disposed of with practically no cost to the city.

The desirability of picking over rubbish has been questioned from a sanitary standpoint, it being claimed that there is a liability to the spread of disease, as rubbish may contain mattresses or old clothing or other material which may have been in contact with people suffering from some type of contagious disease. Careful inquiry, however, which has been made at Buffalo, has failed to show that there has been any apparent spread of disease caused by the sorting over of the rubbish. No evidence of causing disease has been reported in the other cities where picking has been practiced. In London it was abandoned because it was considered impossible to guarantee such immunity.

TABLE IV.—ANNUAL COST OF OPERATION OF AND INCOME FROM THE RUBBISH INCINERATOR AT BUFFALO, N. Y., 1907-1911.

	1907-1908. [illegible]	1908-1909.	1909-1910.	1910-1911.	Total of 4 years.
OPERATION:					
Pay roll	$[illegible]	$22,940	$26,839	$31,615	$[illegible]
Maintenance and repairs	5,853	6,045	[illegible]	5,507	23,491
Interest on bonds	2,000	[illegible]	2,000	[illegible]	[illegible]
Hauling ashes from plant.	4,395	1,453			5,848
New construction			3,60[illegible]	1,500	[illegible]
Total	$[illegible]531	$32,438	$38,531	$41,542	$148,042
INCOME:					
Newspaper	$10,104	$ 9,008	$[illegible]	$11,485	$ 40,617
Mixed paper	15,382	17,375	20,187	18,812	[illegible]
Manila paper	320		[illegible]	3,062	[illegible]
Rags	1,245	1,128	1,122	1,12[illegible]	4,623
Flour bags	68	[illegible]	581	[illegible]	[illegible]
Charcoal bags	156	[illegible]	160	[illegible]	[illegible]
Magazines	[illegible]	1			51
Beer bottles	173	[illegible]	1[illegible]	333	1,[illegible]
Mixed bottles	450	[illegible]	531	716	2,037
½ gal. bottles	[illegible]	[illegible]	[illegible]		[illegible]
Ammonia bottles	24	[illegible]			70
Tin cans	[illegible]	[illegible]	[illegible]	1,049	2,611
Scrap iron	[illegible]	303	[illegible]		[illegible]
Old rubbers, etc.	...		65		65
Broken glass			[illegible]	......	20
Old shoes			28	84	112
Sundries					[illegible]
	$[illegible]	$29,384	$36,395	$37,162	$[illegible]
Deductions for moisture	1,164	[illegible]			1,934
TOTAL NET INCOME, EXCLUSIVE OF SALE OF STEAM	$[illegible]	$28,636	$[illegible]	$37,162	$134,479
Steam furnished sewage pumping station.	3,553	2,629	2,803	3,909	12,894
TOTAL RECEIPTS	$[illegible]	$31,265	$[illegible]	$41,071	$147,373
Population	......	[illegible]	423,715	[illegible]	
*Weight of material sold, tons	4,247	4,412	5,110	5,396	19,165
*Weight of rubbish burned, tons	8,493	[illegible]	10,220	10,794	38,335
*Total weight rubbish handled, tons	12,740	13,240	15,330	16,190	[illegible]
Net income per ton of rubbish handled exclusive of sale of steam	$[illegible]	$[illegible]16	$[illegible]	$ 2.30	$ 2.34

*It is assumed that two-thirds of total weight of rubbish is burned and one-third sorted out.

DISPOSAL OF ASHES

Ashes are most frequently disposed of by dumping and filling up low land. Where care is used in dumping to prevent the fine ash and dust from blowing into the atmosphere, this method of disposal is satisfactory. Land, which would otherwise be of little value, can be reclaimed by filling it with ashes, provided the ashes are kept free from garbage and rubbish.

Nearly all ashes contain some unburnt coal. In England, in New York and in Milwaukee the amount is about 25 per cent, which is sufficient to warrant burning them in an incinerator, when mixed with garbage and rubbish, in order that the unburnt coal will provide fuel for the incineration of the moist garbage.

The Curtailment of Water Waste in Decatur, Illinois, Following the Installation of Water Meters.

The experience of a typical Illinois town with the water waste problem were stated concisely in a paper by H. Ruthrauff, Commissioner of Public Property at Decatur, before the recent convention of the Illinois Water Supply Association. Mr. Ruthrauff stated the facts as he has found them during 22 years service in the water department of Decatur. The following matter is based on his paper.

The question with me from the beginning of my experience was, "How can the water waste be stopped?" I first was employed as a laborer in this department, later on as foreman, and finally in the year 1894 was appointed water inspector; therefore, I knew of the great waste of water upon entering the duties of my office.

The first five years I served as water inspector I worked faithfully in an effort to stop the waste, which was enormous, due to carelessness on the part of consumers and to defective plumbing. I used every honorable means along this line, always looking after this work personally. In 1896 I employed four assistants with the avowed intention of stopping all leaks, thereby preventing waste in the city. I again went over the city in 1898 with four assistants, looking after this waste, intervening myself.

I had citizens by the score brought into our Police Courts and prosecuted for willful waste. After about five years labor along this line, I began to get discouraged. I found that a great many of our citizens believed we had an inexhaustible supply of water, therefore, could not see any good reason why I should be so extremely anxious about this matter. Consequently, I began to look for some other plan as I believed if this waste was allowed to continue, taking into consideration our rapid increase in population, we would in a short time find our supply short, or else be put to the unnecessary expense of installing additional machinery and mains, and enlarging our reservoir and filter-plant merely to provide water to be wasted.

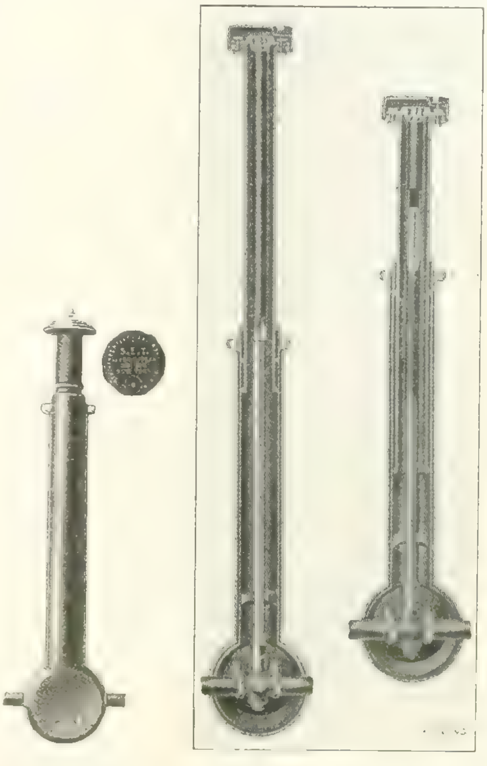
In 1901 I recommended to the Council the adoption of the water meter on all services. The recommendation was filed, but no action taken. Again in 1902, I urgently recommended the same plan and was then ordered to have all livery stables, hotels and laundries install meters. I was then able, by comparison, to prove the water meter would be beneficial both to the city and the consumer, and each year thereafter I strongly recommended the placing of meters on all services. Finally, in the spring of 1908, the Council ordered all services metered by July 1st, 1908. The results are as follows:

[illegible] 30th, 1904, the end of our fiscal year, we had 2,112 services recorded. Five consumers for each service gave us 10,560 consumers; 987 of these services were metered. I wish to say here that there was no record kept of water pumped prior to the year 1903. However, with 10,560 consumers, 4,935 of them metered, there was pumped for this year 1,023,463,180 gals., which gave us a daily per capita consumption of 266 gals.

For the fiscal year ending April 30th, 1911, we had 4,939 services in use, 4,933 being metered. I will say the six services unmetered are large consumers. This gives us, on a basis of five consumers to the service, 24,695 consumers. There was pumped during this year, 1,124,212,338 gals., which is 100,749,158 gals. in excess of that for the year ending April 30th, 1904. With an addition of 14,135 consumers, we now have a per capita consumption of less than 125 gals. It is my belief that if the six consumers previously mentioned were metered, our per capita consumption would be less than 100 gals. This may yet seem excessive to some, but we have some very large consumers for a city of our size, having six consumers using annually about 300,000,000 gals.

We have accomplished by the enforced use of meters at least a 30 per cent reduction in the average householder's bill. Under the old flat rate system, the water tax on a 7-room modern house would be $17 per year. Under our present system, the yearly bill should not exceed $12.

We have also cut the daily per capita consumption from 265 gals. to 125 gals., thereby saving, at the present time, an unnecessary pumpage of 1,270,928,175 gals. each year. Therefore, the benefit derived from a complete metering of any city is very clear to me.



Exterior View of "Perfect" Curb Box and Sectional Views of Style 1 Partly and Fully Extended.

An Improved Form of Curb Box for Water and Gas Service Pipes.

A new style of service box has been put on the market by the S. E. T. Valve & Hydrant Co., of 50 Church St., New York. The new curb box, called the "Perfect," is the result of some years' study of actual operating conditions. The structural features of the box, as shown in the accompanying cut, prevent the entrance of mud and sand at the bottom. If the cover is carelessly left off, the box cannot be choked by dirt entering at the top. The box cannot be slid away from the valve.

The curb box is telescopic and is built in two styles, the same in external appearance. Style 1 has a telescoping valve rod while Style 2 is provided with a solid long wrench. The lower section of the box is made in two parts, so constructed that when placed together one part fits into a recess in the other, making a tight joint. The lower secti the service pipe and encases the va completely closes the lower end of The lower section is provided with which maintains the original align tween the box and valve.

The top section telescopes the low clamped by it in any desired po means of the two bolts shown in the top section has a double cover, the being secured by a special nut pl recess in the top of the cover. Th operated by means of a key. The in is provided with a recess similar t in the outer cover, in which is the nut on the valve rod. This is op means of the same key that re cover. The box cannot be opened the proper key.

Style 1 is provided with a telescop rod which adjusts itself to corresp adjusted length of the box. It fits of valve. This valve rod eliminates solid wrench and renders removal outside cover unnecessary. Style actly the same as Style 1 except for rod. A special inside cover is furn Style 2 that is locked in position or by a quarter turn of the key, the being used for both covers. When t cover is removed the wrench may be to the valve. A division plate is pl mediately above the valve, so tha wrench is dropped it will not strike The plate is provided with an oper responding to the opening of the insi and to the shape of the head of the Style 2 curb box can be changed to by inserting the telescoping rod.

Some Properties of Anchor I Discussion of Ice Terminol Methods of Removing Anchor Ice.

The trouble caused by anchor ice intakes during the recent severe wi again led to a discussion of its p and to a study of methods of rem Some of the problems arising from mation of anchor ice were stated Trow, Superintendent of the Lake Fo Water Co., in a paper recently rea the Illinois Water Supply Associat his introductory remarks Mr. Trov that after several years experience chor ice he would rather ask, "Wha chor ice?" than deliver a paper on the

The severe winters in the region Great Lakes have always affected th supply to so great an extent that it come a custom to couple the ice quest problems relating to an adequate wa ply. Of course, a shut down of one is an unpardonable occurrence in the the consumer, and with this point i consider the effect of a five-hour sh and a shortage of water at breakfast

ICE TERMINOLOGY.

In different countries ice which c stoppage in the intake is known by names. In Scotland it is called gro and lappered ice; the French Canadi it moutonne from its resemblance, a cumulation, to the wool on the bac sheep, others call it spicular ice, but t of frazil, given by Mr. Murphy in hi to the Royal Society of Canada, is most generally used along the norther Anchor ice is the common expression United States and although it is in misnamed, it is such a handy phrase will probably remain.

Those who have made a thorough s ice formation, divide the ice into three first, sheet ice formed upon the surfa ond anchor ice, formed upon the bott frazil or ice formed below the surfa above the bottom. Anchor ice and fr both formed only when there is oper above. Along the west shore of Lake gan there are a few other features wh always stable; the wind must be in a ly direction and the thermometer must eezing. Frazil or anchor ice are never l when the sun is shining or when there cloudy sky at night, and the rising sun heralds the fact that the accumulation has ceased. The very slightest rise ter temperature relieves the situation e ice will loosen its grip if the water med to the thousandth part of one de- n the positive side of freezing.

nor ice is formed upon the bottom of or bodies of water where the water motion; the growth of frazil is in the itself and the necessity of some object present for it to attach itself to is elim- as the floating particles will adher another. The growth of frazil must companied by surface cooling through rapid agitation and by radiation.

questioning men of practical experien ery interesting to note the different the- ich each one advances as to the cause which closes an intake. The theory man will possibly be an absurdity in f the next man as compared with One engineer advanced the follow- s a law of nature that warm water also a law of nature that objects than water must rise, hence it stands that water at the bottom of the the coldest and that is the point where is formed and from there, having be- [illegible] float [illegible] some disturbance in the water such as an intake, whose suction causes the ice to adhere to the screen in the form of minute crystals until the screen is so thoroughly covered as to stop the passage of water.' This theory is only handicapped by the fact that the rapid circulation of water ceases when the ther- [illegible]

Another is this: "In 1836, Gay-Lusac, observed that water, when placed in a vessel and covered with oil, may be cooled to 10° F., without freezing, but if the vessel is shaken, solidification ensues at once. During a west wind the water at the surface is always warmer than the water at the bottom, and this warm water upon any surface may act as a blanket in some such manner as the oil and the water beneath may reach a point below freezing until disturbed by coming in contact with the intake."

In one city north of Chicago, I found a 42-in. intake with 13 openings some pointing up, some pointing down, and others pointing at different angles; for there is a theory that the way which the opening looks makes considerable difference. Some of the openings are covered with iron screens and some with wooden screens, but in spite of all these precautions this city's intake was closed by ice this winter to such an extent that it was necessary for them to send a diver down to make an opening. Some one connected with the city conceived the novel idea of placing a fan over an opening in the intake to be propelled by compressed air, which would keep away the ice. This worked well for a few nights, but one night the water ceased to come. The diver was hurried to the scene and lowered to the bottom to discover what had gone wrong with the fan, and there, over the intake, he found it churning away completely housed for the winter in a dome of ice.

The usual method of procedure at the Lake Forest works, when anchor ice blocks the intake, is to close the valves in the well and thereby throw any pressure which may be left in the mains upon the intake through the by-pass. At times a pressure of 75 lbs. has been maintained upon the intake for 15 or 20 minutes before there would be any noticeable release. About one out of five times, this method when tried before sunrise, has proved satisfactory, the other four times, more water was lost back flushing than came back before the ice again closed the opening. The pumps usually get a full supply of water with the aid of nature's remedy, the heat of the sun, about as soon as the plant that labors with back flushing and other contrivances.

)RAINAGE AND IRRIGATION SECTION

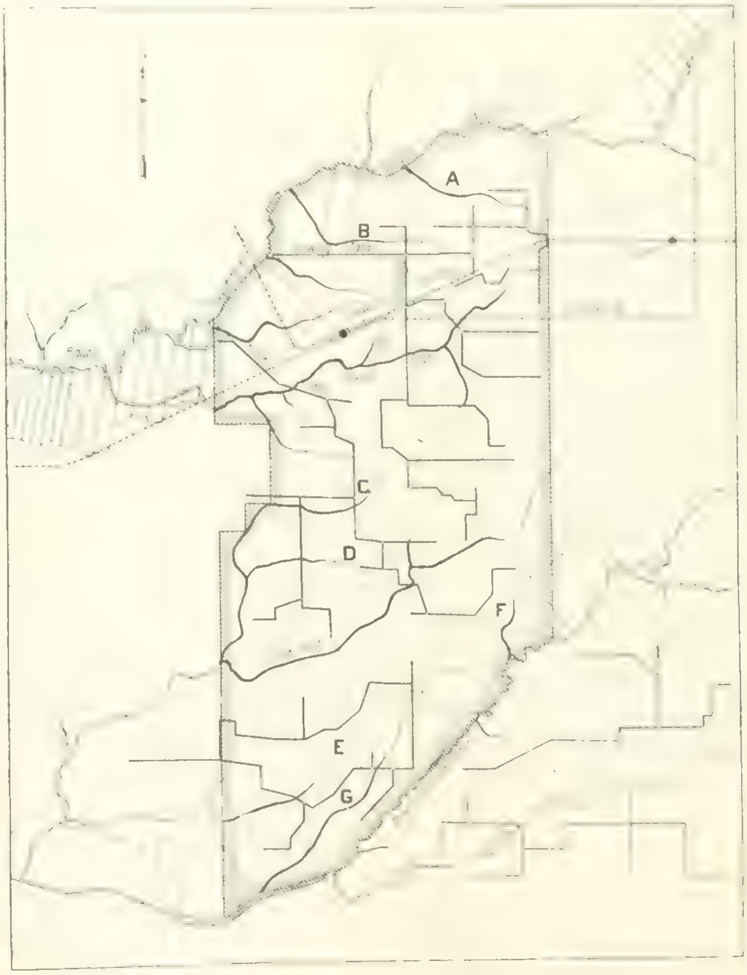
Sixth Ward and Crowley Drainage District, Louisiana.

d by W. S. White, Engineer in Charge.

accompanying map shows the drain- an for an area of 41,000 acres of wet ated near Crowley, La. This work some 38 miles of ditch requiring 653,400 cu. yds. of excavation. In the estimated items of work are as in Table I. The following are the cations for clearing and excavation:

ring under these specifications shall be tood and agreed to be the cutting within nes of the required Drainage Channel, to the surface of the ground, or to a depth ss than that of the prescribed grade of a of channel, and the cutting to within ss than 2 ft. of the surface of the ground ich width on each side of said channel ghout its entire length, as is required in specifications, of all trees, stumps, logs, s, brush, weeds, etc., and removing the ial so cut down, and all other like ma- from the surface of the ground and from ater in the channel, and depositing same e of and beyond the limits of the width aring as described in the foregoing "De- ion of Work and Special Specifications," eyond the usual natural bank lines of the it channels, as may be directed by the er in charge; or else in destroying the by burning. Payments for "Clearing" e made for the number of miles in length annel line thus cleared to the prescribed , and reduced to acres, and as estimated e engineer in charge. No payments will lowed for clearing outside the prescribed of width, nor for any parts of the work , in the judgment of the engineer in e, no clearing is required.

avation under these specifications shall be stood and agreed to be the removal, by es or otherwise, of all earth and like ma- , and of all trees, stumps, logs, brush, s, or other like materials included in the , from the Drainage Channel prescribed; the deepening of the materials so removed e places and in the manner required by specifications, as may be directed by the eer in charge. Payments for "Excava- will be made for the number of cu. yds. rth within the prescribed lines, grades and nsions, as estimated by the engineer in ge. No payment will be allowed for exca- n of material made outside of such pre- ed lines, grades and dimensions. Excavated material must [illegible] obstruct natural drains or drainage into the drainage channel; and for this purpose such openings as may be [illegible] by the engineer in charge, must be left [illegible] through the spoil banks. Passage through public highways crossed with bridges or through irrigation canals must be expedited so as to cause as little delay and inconvenience as possible to the public and the irrigation companies. All bridges connecting highways over natural drains are to be removed and rebuilt by the police jury of the parish, the municipality, or irrigation companies, as the case may be. At least thirty days' notice should be given to the police jury, municipality, or irrigation companies to remove the said obstruc-



Map of Sixth Ward and Crowley Drainage District, Louisiana.

TABLE I—ESTIMATED QUANTITIES [illegible] CLEARING, SIXTH WARD [illegible] CROWLEY DRAINAGE DISTRICT, LOUISIANA.

Name of Ditch	Length in miles.	[illegible]	[illegible] feet.	Total fall in feet.	Excavating. cu. yds.	Clearing. acres.
[illegible]	2.0		[illegible]	13.0	15,000	2.0
[illegible]		[illegible]	16.0	14.0	94,000	12.0
[illegible]		5.0	16.0	5.0	68,700	2.0
[illegible]		3.0	12.0	8.0	16,500	2.0
Ditch "F"		3.0	12.0	12.0	22,300	
[illegible]	[illegible]	4.0	16.0	6.0	17,500	
Ditch [illegible]		5.0	16.0	14.0	52,500	22.0
[illegible]		5.0	16.0	5.0	28,500	....
[illegible]		[illegible]	16.0	9.0	32,000	4.0
[illegible]		5.0	20 & 30	18.0	148,200	30.0
[illegible]		5.0	[illegible]	10.5	148,200	18.0
[illegible]						
Total	[illegible]				653,400	[illegible]

[illegible] must be [illegible] with as much precision as experience makes possible.

As will be seen from the maps the engineering features are reduced to a minimum, [illegible] opening up the natural drainage ways (flats and coulees) throughout this district.

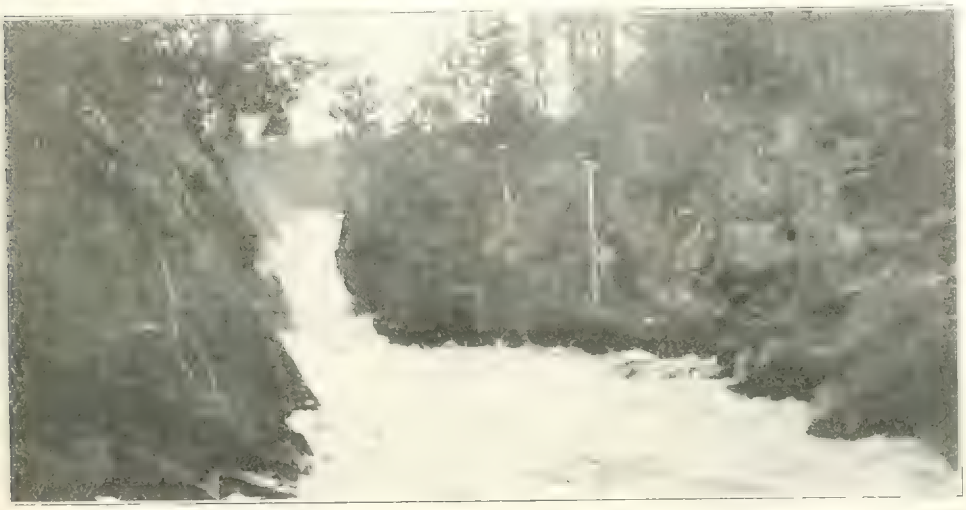


Fig. 1—A 70-ft. Fall in Half a Mile on the Kawishiwi River.

Since the Eastern side of the district is practically on the divide, only the water shed confined to the lines of the district has to be contended with. The natural slope is from 1½ to 2 ft. to the mile and the points of discharge are practically at mean gulf level—on the south into Bayou Que de Tortue, and on the west into Bayou Plaquemine Brulee (which the U. S. Government has dredged and made navigable up to a point about 2 miles west of its confluence with Bayou Blanc, the last named being one of the mains across the district).

The ditches designated as "Bayou Blanc" and "Lions Point" are the principal mains. Floating dredges, of the Marion type, are being installed in the Eastern ends of these two mains, and Mr. D. B. Gore, the contractor, hopes to do the greater portion of the work with these two floating machines, but he will probably be forced to handle some "free dirt" to accomplish this. The smaller drains will be made with a small land machine, teams, or by other means. Should there be a system of lateral ditches determined upon, a small land machine could be used to good advantage.

Since the funds derived from our present bond issue are somewhat limited, a perfect system of laterals, leads, etc., cannot be out—when the present work is well under way funds will be forthcoming to put entire district under perfect drainage as near as is practicable.

The present district comprises about 41,000 acres, all of which is under cultivation except a few acres of wood lands lying along and adjacent to the bayous, and on account of fuel these wood lands are a valuable asset to the owners. The entire area is well covered with irrigation canals, and when drainage is perfected, as it will be during the present year, the practical farmer who diversifies and rotates his crops will not need to fear for the results of his investment or labors. The State Experimental Station Farm, which is located just to the west of Crowley and also a number of the more thorough farmers, have demonstrated conclusively that splendid [illegible] of corn, potatoes, oats, [illegible] rice, sugar cane, broom corn, kaffir corn, sorghum, peanuts, all kinds of truck and many varieties of fruit can be grown on this soil, and in many cases several crops on the same land during the year. One farmer just north of Crowley realized $250 on one-fourth of an acre of Satsuma oranges, while the possibilities of truck, sweet potatoes, and valuable forage crops are limited only by the care and intelligence bestowed upon them.

The Water Resources of Minnesota; Storage Developments Planned and Under Way.

Extensive storage developments to prevent floods and to conserve for power and irrigation the waters of Minnesota rivers are being worked out by the States and Federal government. These are described and other interesting features of the river system of the state are noted in a paper read before the Minnesota Surveyors' and Engineers' Society by Geo. A. Ralph, State Drainage Engineer. The paper follows:

Minnesota lies in three Great Continental [illegible] From her surface the wate flows [illegible] by Red River of the No [illegible] River [illegible] Lake Winnipeg, an on to Hudson's Bay, eastward by St. Louis River into the Great Lakes and through e St. Lawrence to the Gulf of St. Lawren, and southward through the Mississippi o the Gulf of Mexico. The Mississippi rise at an altitude of 1,472 ft. and leaves the S te at an altitude of 615 ft. The Red River f the North rises at an altitude of 1,500 [illegible] crosses the International Boundary Lin [illegible] altitude of 748 ft. The St. Louis rise at ltitude of 1,700 ft. and flows into La [illegible] perior at an altitude of 602 ft.

Each of these water sheets within th State has widely different physical feature The watershed of the St. Louis is rough an hilly. The banks of the streams are general high and steep, and in many places are rock rge [illegible] The landscape in its natural conditi [illegible] heavily wooded, with here and there pa [illegible] or open muskeg. The [illegible] have, as a general thing, swift curre, [illegible] rarely overflow their banks. The wa s of the Rainy River is similar in many sp to that of the St. Louis, but with more xt sive swamp areas, which are generally ar ly timbered.

The watershed of the Red River f the North consists largely of prairie lan [illegible] of which is nearly level, the upper po [illegible] about one-fourth of it being timbere [illegible] banks of Red River are generally low [illegible] ing from 20 to 50 ft. above ordinary l [illegible] ter. The current in the lower reaches f river, or below Breckenridge, is sluggi [illegible] average fall per mile of stream bei ess than 0.4 ft.

The watershed of the Mississippi is composite of the St. Louis and the Red R [illegible] the North, the upper portion and the [illegible] slope being generally rolling with a [illegible] forest cover. In places the banks [illegible] streams are steep and rocky.

The streams, with few exception have swift currents and seldom overflow their banks farther down the watershed an [illegible] such as the Crow, the Minnesota and [illegible] utaries, the Canno, the Zumbro, and th [illegible] rivers. The watershed is similar in m [illegible] spects to that of the Red River of the [illegible] and consists largely of open prairie la [illegible] streams in many places have low ban, tortuous courses, and sluggish currents. As a consequence, many of these streams [illegible] their banks in time of high water.

Few, if any, of the states of the Un [illegible] can compare with Minnesota in the num [illegible] grandeur of the lakes within their bor [illegible] is estimated that there are 10,000 lakes [illegible] or partly within the state, 7,500 of wh [illegible] meandered lakes and known as public [illegible]

Minnesota's many beautiful waterfa [illegible] never been properly described or fully [illegible] ciated. No history or geography of th S [illegible] gives more than a cursory descriptio of a few of the most important waterfa [illegible]

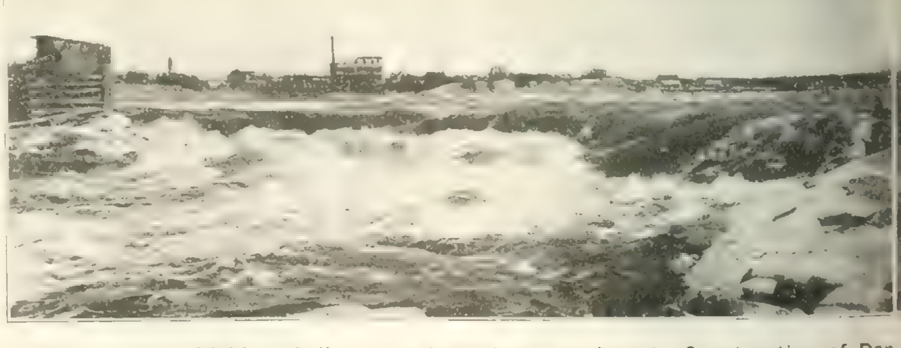


Fig. 2—Koochiching Falls on Rainy River Previous to Construction of Dan

almost every stream flowing into La [illegible] perior in Northeastern Minnesota are [illegible] waterfalls, the grandeur of which is [illegible] passed.

The Pigeon River falls 600 ft. in a [illegible] of 20 miles. In one place there is a [illegible]

of 30 ft., in another 83 ft., in another 52
[illegible] This stream [illegible]
[illegible] 15 miles [illegible]
nto Lake Superior; in places the
s are 250 ft. high and almost per-
The Brule River has a fall of
a distance of 6 miles before empty-
Lake Superior. The Cascade River
ft. in a distance of six miles; the
20 ft. in three miles; the Temper-
ft. in three miles; the Cass, 850 ft.
miles; the Baptism, 710 ft. in nine
Beaver 290 ft. in one mile, and
six miles, and the Gooseberry, 230
miles.

the above named streams has many
waterfalls. On some, the falls are
those on Pigeon River, on others
series of rapids and small perpen-
[illegible]

s of the Kawishiwi and Vermillion,
of Rainy River, are fully as pic-
s those of the north shore stream.
has a fall of 70 ft. in a distance of
The Vermillion falls 85 ft. in a
¼ mile at one place; 52 ft. in a
3 miles at another place, and 88
stance of 2½ miles in another. At
g Falls on Rainy River, under nat-
tions, 16,000 cu. ft. of water per
over a granite ledge and down
rocky gorge, falling 30 ft. in less
mile. Big Fork River at Big Falls,
s 35 ft. in ¼ mile.

Louis in its natural state had many
waterfalls and rapids, the grandest
was the Great Falls at Carleton.
St. Louis tumbles down a rocky
ng 375 ft. in a distance of 3 miles.
il River falls 200 ft. in a distance
s. The Red Lake River, 270 ft. in
The Minnesota River falls 50 ft.
Falls in a distance of 1 mile. The
River falls 63 ft. at St. Croix Falls.
hony Falls, the Mississippi descends
short distance.

he falls on the larger streams of
here are many beautiful falls on the
ms of which Minnehaha Falls, Ket-
alls, Minneopa Falls are most wide-
Many beautiful Falls are found on
streams and rivulets flowing into
rior.

ams of Minnesota are naturally fa-
r cheap power development. The
power which may be developed will
quite a large extent, upon the util-
all available storage sites for the
flood waters. The following sum-
developed and undeveloped water-
the State of Minnesota is contained
rt of the State Drainage Commis-
the years 1909 and 1910:

	Theoretical	[illegible]	Undeveloped
[illegible]		[illegible]	173,700
[illegible]		2,400	7,100
[illegible]		4,500	23,500
[illegible]		1,200	
sippi Trib., above Minnesota River..............	26,300	2,000	24,300
[illegible]		5,100	23,700
[illegible]			29,300
[illegible]		12,000	
[illegible]			61,800
[illegible]			20,700
[illegible]			28,700
		113,100	

summary places the total available
the streams of the state at 553,700
figures are based on the ordinary
ter flow, under natural conditions. By
g all available storage, it is quite prob-
at this estimate would be increased at
3 per cent for ordinary years, or years
1909. This would bring the available
wer of the streams of the state up
hp. The years 1910 and 1911 have
xtraordinary dry years. The total an-
recipitation in the year 1910 was less
alf the average mean annual precipi-
in the state for a period of 25 years
o 1910. Consequently, estimates based
flow of streams under conditions that

[illegible] less.

[illegible]

are from 300 to 400 miles a[illegible] the principal developed waterpowers in the Mississippi, and also to the fact that there is so much uncertainty and irregularity as to the rainfall in the drainage basin of these reservoirs, it is not practicable to get the results that could be secured were they located within easy reach of where the water is required for power purposes.

The State Drainage Commission, in co-operation with the United States eGological Survey, has for the past three years been making a water resources investigation of the state. These investigations and surveys are nearly completed. A complete report of these investigations will be ready for distribution by Jan. 1, 1913. This report will show that it is entirely feasible to store up for use, when needed, the flood waters of many of the streams of the state, in addition to the storage reservoirs now in operation. By a judicious use of these reservoirs, the flood waters of the streams upon which they are located can be controlled, and danger of damages from overflows largely decreased.

Forty-two billion cubic feet can be stored in Red Lake, several billion feet in Ottertail Lake and a few billion feet on head water of Wild Rice River. With these storage sites utilized to their fullest capacity, a considerable amount of the flood waters of these streams could be stored up for use in times of low water instead of being allowed to swell the volume of the Red River of the North above the danger point. Storage reservoirs are also feasible to a limited extent, on the Minnesota River. The Federal Government has just completed the plans and estimates for a large storage reservoir at Lac Qui Parle. This proposed reservoir will have a storage capacity of 39,000,000,000 cu. ft. Its construction would go far towards preventing the overflow of this stream, which has caused millions of dollars in damagees during the past ten years.

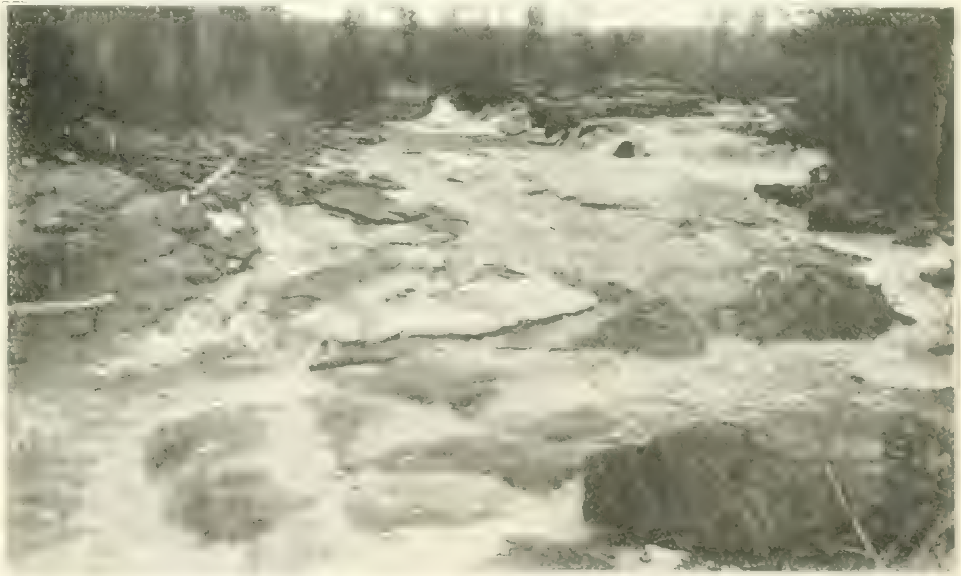


Fig. 3—Vermillion River Rapids Having a Fall of 85 ft. in One-fourth Mile.

A head of 2 ft. on Rainy Lake would hold back twenty billion cubic feet of water, this storage would solve the problem of securing a nearly uniform flow at International Falls. Small storage reservoirs are feasible on some of the streams flowing into Lake Superior. Here a little water gives a lot of power with a head of 375 ft., such as we find at the Great Northern Power Plant at Thomson; a cubic foot of water per second will develop 34.1 hp.

Cost of Dredge Construction.—The cost of constructing a dredge will, of course, vary according to the quality of workmanship and material used; the facilities in the way of well equipped shops, and the geographical location. In California, according to Mr. Robert E. Cranston in a paper published in the Journal of the American Society of Mechanical Engineers for February, 1912, an average of many cost records gives the following:

For all the machinery, including motors, pumps, wire rope, electrical supplies, etc., 12½ cts. per lb. delivered on the ground; for installing, 4½ cts. per lb., or a total of 17 cts. per lb. for the machinery installed. The lumber costs about $30 per 1,000 ft. at Portland, and this, together with freight, bolts, nails, hog rods, steel plates, oakum, paint, etc., will make the hull material cost about $50 per 1,000 ft. of lumber used; labor of building costs about $40 per 1,000 ft., giving $90 per 1,000 ft. as a total cost of the completed hull. In addition the direct costs chargeable to hull or machinery, insurance, traveling, superintendence, camp equipment, temporary buildings, shop, derrick, office expense, design, etc., amount to between $10,000 and $25,000, depending on whether new designs have to be gotten out, what construction tools and equipment are on hand, the size of the dredge, and situation of the ground on which it is to be built. For a complete dredge, $180 per ton, on a basis of its displacement, it is a fair average.

The Nepton tunnel, now being driven in the Pachuca, Mexico, district, will be over six miles long when completed. It lies at a depth of about 1,400 feet below the city of Pueblo. It was started 18 years ago, but only about two miles has been completed. It will drain the Pachuca mining districtt and afford an outlet for the different mines.

BRIDGES AND BUILDINGS SECTION

Inspection of Concreting.

Contributed by Jerome Cochran, C. E., Former Designing Engineer, Trussed Concrete Steel Co., Detroit, Mich.

(Concluded from p. 264.)

The series of articles on the inspection of concrete work, of which this is the second half of the fifth, has been planned in opposition to the general assumption on the part of writers that standards or methods of construction have been long ago established and have become common knowledge. The first article on "Directions and Suggestions for the Inspection of Concrete Materials" appeared in this journal for Jan. 31, 1912; the second article on "Proportioning and Mixing Concrete" appeared on Feb. 7, 1912; the third article on "Inspection of Forms and Centering" appeared on Feb. 21, 1912; the fourth article on "Inspection of Steel Reinforcement" appeared on Feb. 28, 1912; and the first half of the present article appeared on March 6, 1912. It will be followed by articles on finishing concrete surfaces and waterproofing.

Joints Due to Stopping of Work.

All concrete work must be constructed along proper structural lines and when a section or panel of reinforced concrete or any trussed concrete member is started, it should be finished in its entirety before shutting down, but when this is not possible, the resulting joint should be formed where it will least impair the strength and appearance of the structure. To effect this the finishing surface should be normal to the line of thrust and it should not be where there is any considerable shear. In other words, care should be taken in the location of and in the manner of constructing the connecting joints as the work progresses. Joints must be made only at such points as may be approved by the engineer. If the appearance of the finished face is of importance, special care must also be exercised in joining at this joint.

Joints Between Day's Work.—The writer has observed in bridge piers and retaining walls that where one day's work joined that of another, lines could be noticed, and in many cases these lines were inclined, sloping at about the angle of repose of the wet concrete. By inserting temporary partitions in the forms, these lines would have been vertical. Joints between day's work should be at some feature line, or be made truly straight and level. The methods employed to stop a day's work and leave the joint so as to make a satisfactory union with the engineer's directions must be carefully followed as to the location of and methods of constructing joints between day's work.

Horizontal and Vertical Joints.—Layers of concrete should be kept truly horizontal, and if, for any reason, it is necessary to stop work for an indefinite period, it should be the duty of the inspector and of the contractor to see that the top surface of the concrete is properly finished, so that nothing but a horizontal line will show on the face of the concrete, as the joint between portions of the work constructed before and after such period of delay. It cannot be too strongly insisted that the line limiting the height of the concrete at the face should be made perfectly horizontal, for a slight crack, or at least a noticeable line, may be expected at this point, and if not straight it will be the more unsightly. If for any reason it is impossible to complete an entire layer, the end of the layer should be made square and true by the use of a temporary plank partition. In the construction of arches, culverts and sewers, such stop plank should be set normal to the surface of the intrados, instead of vertical. In case more than one layer is left incomplete, they should be stepped back, making an offset for each layer of at least one or two feet. No irregular wavy or sloping lines should be permitted to show on the face of the work at different periods, and none but horizontal or vertical lines should be permitted in such cases. The top layers of concrete at the end of a day's work should be left roughened up or grooved out along their center line in order to form a positive and water-tight bond with subsequent work.

Every time a day's work is finished and a horizontal joint is thereby required, the concrete should either stop 6 ins. below a wale, wiring or rodding, or 6 ins. above. If stopped 6 ins. below, the wires of rods can be tightened and the face boards made to hug the previous day's work, thus avoiding an unsightly lip and saggy contact which will deform an otherwise good surface. If stopped 6 ins. above the wires or rods, the weight of the concrete will tighten the wire and draw the wale close to the studs and thus bring the boards tight to face. Should the above precautions be neglected, it will necessitate shimming the boards away from the studs with shims, and just driving them out with a hammer. Unless the boards are shimmed, the wet concrete will force them back against the studs and the result will be an ugly finish.

Joints in Footings.—Footings should be cast to their full depth at one operation. Where it is necessary to make joints between different portions of the same footing, the surfaces should be roughened after tamping so as to provide a suitable clinch for adjoining concrete to be placed later and should be scrubbed with cement grout with a broom before placing other concrete.

Joints in Columns.—Joints should be made in the columns flush with the lower side of the beams or girders, and should be at right angles to their surfaces. It is preferable to pour the columns some six or eight hours before the beams and girders so as to allow time for settlement and shrinkage. The pouring of concrete for a column should be a continuous operation to the line where beams join in.

Joints in Slabs.—It is better to pour an entire floor at home, but if stops must be made in slabs, the concrete should be stopped in a vertical plane at right angles to the span, either (a) at midspan, or (b) over the center of the supporting beam or girder. No horizontal joints should be allowed in slabs. Panels having girders supporting but one beam should have no stops parallel to beams. For such panels all stops should be parallel to girders and preferably at the center of beams.

Joints in Tile Floor Slabs.—The concrete for a tile floor slab with concrete over the top of the tile must all be poured at the same time.

Joints in Beams and Girders.—Girders or beams must never be constructed over freshly formed columns without allowing a period of at least two hours to elapse to permit settlement in the columns, preferably six or eight hours. Before resuming work the top of the column should be cleansed of foreign matter and laitance.

In beams or girders, the concrete should be stopped in a vertical plane at right angles to the length of the beam, either (a) at midspan, or (b) over the center of the supporting column. Any concrete which may run past the bulkheads must be cleaned up before the concreting of the next section is started. In no event should work be terminated in beams or girders where future shearing action becomes great, as at their ends or directly under a heavy concentrated load. Where brackets are used, the brackets should be considered as part of the beam or girder. Where a beam and slab have been figured as a T beam, both should invariably be poured at the same time. As a rule, deep beams should be constructed some in advance of the slab, but no concrete should be placed in the beam and allowed to become so dry as not to properly bond with the balance of the work. Where the beam has been figured as rectangular, it is not so important that both be placed at once; however, it is preferable to do so, as the full depth of beam includes part of the slab. A notch may be left f the support of the slab, and thus arly t entire beam would be placed at one time.

Beams and girders are sometime split two in the middle longitudinally, mea of a temporary vertical bulkhead, when it necessary to stop work in their neighborhood The writer does not recommend is pra tice by any means, but would mu rath leave a step or notch the depth of he sla an inch or two wide, at the top of e bea or girder. This step will act as suppo for the slab, and if the beam is figured as rectangular beam, as it should be, and n as a T beam, it can depend to a considera extent upon the other slab for wha m lacking in bond at the step. There is erally always an excess of compres in beams designed to carry slabs. I s more economical and just as good p ct rely upon this excess compression a adjoining slab than to go to the trouble expense of placing a bulkhead along he ce ter plane of a beam or girder, with added difficulties this method enta narrowing up the space to work ble displacing of the steel, differen of shrinkage contraction, additional quired, etc.

Joints in Flat Slab System.—In st all cases, the column and column he should be cast and the splice or joint ad against a vertical plank in the cer panel, the splice or joint being in v plane.

Joints in Walls.—When the concre is s ject to vertical forces only, as in fo tions for buildings and masonry su horizontal joints are less objectionable th vertical joints. But in the construction concrete abutments, retaining walls, and t like, vertical joints are desirable to c the cracks to predetermined planes. I building of such structures, the wo s be divided into sections of such le dimensions as may be thought best, and ea section completed as a monolith. There a several advantages in placing walls n sh lengths at a time. Vertical joints do ot sh up as badly as horizontal ones, especially wh these are made by the use of a bulkhead a are true to line as mentioned abo . T contraction of the concrete due to settl will be somewhat equalized as the ll pr gresses, and these vertical joints vl oft be sufficient to take up expansion and contra tion due to change in temperatur

Walls should be stopped at horizontal vertical bead or groove, so that th line the junction of two days' work will t sh It is preferable to stop the wall in verti planes across the wall, and, if practible, t stoppage should occur at an expansion joi This will sometimes require the continuo prosecution of work for 24 or hou Whether this method, involving work nig which is always more expensive an usua less thorough, is justified by the en soug depends, of course, upon the charact of t structure. When the day's work rst st elsewhere than at an expansion join it mu be essentially on a vertical line wi a k or other positive form of bond pro led i the connection of the subsequent wo . Th vertical stop-line must be stepped back least one foot for other and subsequent da work.

Grooves for Joining Future Wor. the placing of the concrete is suspended, necessary grooves for joining futu wo must be made before the concrete has ad tin to set. This may be accomplished bedding pieces of plank in the to horizontal and vertical layers of concrete be removed after the concrete has se leav depressions. Beveling the edges planks will facilitate their removal. joints special care must be taken ncrete thoroughly, in order that it may ense and compact as at other places.

Bonding New to Old Concrete.

ll the continuous laying of concrete be upted for any reason, care must be e to see that the finishing surface is left t the conditions of continuous work are mated as near as possible. Satisfac eans must be taken to clean and rough concrete which has set and to secure d and efficient bond between the older ete and the fresh concrete placed above on it. In other words, the bonding of old concrete must be made as good as nditions will permit. It is better, in gen o leave the surface rough than smooth. oining new work to that which is partly ch precautions of cleaning, wetting and g should be observed as the engineer

ring *Surface.*—When a course of concrete is to be laid on a surface of e which has been exposed for several r longer, the surface should be thor cleaned of all foreign material and e or scum, and drenched with water erably under pressure), so as to make a ond between the two layers. It is very ant that the surface be clean. Also rms should be cleaned of any concrete s been spattered on them. If necessary, rface of the set concrete should be ghly rubbed with stiff wire or willow , removing any loose stones at the sur at appears to be loose. The surface so be roughened with a pick, although operation is not always as benefi generally imagined.

ial care must be taken to remove all nert or foreign material from the old e before any attempt at bonding the ork is made. If laitance has collected, it e carefully and completely removed be e new material is added, in order to better bond. The surface of the hard crete may be treated with an acid such as "Ransomite." The acid must roughly removed by washing with pure

Joints.—The bond may be strength spreading a bed of mortar (say) lf inch thick on the prepared surface efore laying the fresh concrete. The should not be leaner than one part nd cement to two parts sand.

nt Grout.—A grout of neat cement is substituted for mortar, but grout what uncertain in its action. In join w and old layers together, too much annot be taken to have them well grout refilling proceeds; too much grout. er, should not be used, or the bedding t be so good. The cement grout should ughly brushed and tamped in with inary broom, after which the new con y be placed. Neat cement is some ted on the previously moistened sur the writer does not recommend this Grout is more satisfactory.

of Concrete to Bond or Set.—Any te that fails to show proper bond, or ls to set after it has been allowed suf me, should be taken up and replaced w concrete of proper quality.

ges of Mortar.—Thin edges of mor have run out over the centering or f forms should be broken up into es and allowed to become embedded work.

Bond.—When two or more sections d on different days join, a [illegible] other bond approved by the engi be used between adjacent sections.

f Broken Stone.—The surface of the which is to be bonded to other con y be left in a rough condition by g a layer of broken stone or gravel same, running half the depth of the the green concrete and leaving the lf of the stone protruding. Large eighing a hundred pounds or more equently imbedded one-half their depth last layer of a day's work to form a with the following layer.

Rail Ends.—If for any reason the work [illegible] ends set vertically and partly embedded in the [illegible] provide a grip for the succeeding layers. This should not be permitted, however, near the top of the work.

Hollows or Grooves.—The surface of the concrete which is to be bonded to other concrete may be left in a rough condition by setting in strips of wood, which when removed will form a groove and assist in making a good bond.

[illegible] occur the faces of the old concrete, after being cleaned dry, should be given a heavy coat of crude oil, which should have at least one day's drying before fresh concrete is laid against it.

[illegible] must be taken to especially and vigorously ram the first new layer of concrete and the ramming continued so that a dense concrete will result with perfect bonding between the several layers. These layers must be made with great care and in a manner satisfactory to the engineer.

Protection of Concrete After Placing.

Concrete should not be disturbed more than absolutely necessary after being put in place. It is useless to make good concrete, unless care is taken to protect it until it is hard enough to take care of itself. Until sufficient hardening of the concrete has occurred, the structural parts must be protected against the effect of freezing and premature drying, as well as against vibrations and loads. Concrete should not be exposed to the action of water until thoroughly set. Freshly deposited concrete should be protected from the direct rays of the sun and wind by boards or tarpaulins. When work is delayed for any reason the upper exposed surface should be protected by a canvas cover until the work proceeds.

Concrete Deposited in Wet Places.—Concrete required to be deposited in wet places should be thoroughly protected so that the cement will not be washed out. Depositing concrete under water will be discussed more fully at the close of this article.

Jarring of Concrete.—After the concrete is placed it must be left undisturbed until it has received a hard set. To this end care must be taken in placing concrete beside other concrete that is partially set, so as not to undo previous work. Jarring the projecting ends of steel reinforcement with buckets, wheelbarrows or carts in placing fresh concrete will impair the bond of work that is partially set. Jarring the forms by the buckets or carts in which the concrete is handled will have the same results. The jar of a hoisting engine and concrete mixer or other moving machinery should not be allowed to reach the setting concrete.

In placing the concrete, the work should be so laid out that partly set concrete will not be subjected to shocks from men wheeling or handling material over it. This may be avoided to some extent by planning the work so that concrete farthest from the mixer will be deposited first. Walking over newly-laid concrete should be avoided as much as possible. If walked on or wheeled over during the time of setting, the set will be incomplete or may be entirely destroyed. Concrete should be allowed to set for 24 hours, or more if so directed, before any work shall be laid upon it or any walking allowed upon it. Walking across a concrete floor, before the hardening is sufficiently advanced, if not permanent in places in the concrete, if not permanent injury. Workmen are likely to pay little attention to this and constant watching on the part of the inspector is necessary to guard against it. Workmen who persist in walking on green concrete should be discharged.

Keeping Concrete Moist.—After concrete has been placed, a very important detail is to keep it constantly wet until it is covered over with whatever material is to come on it. To enable the concrete to set properly, it must be kept moist. This is an item which too often is neglected. All exposed surfaces of finished and unfinished concrete should be kept constantly moist by sprinkling with clean water at short intervals, unless otherwise directed during cold weather, or by covering with moistened burlap, or by such other means as may be approved. This moistening should continue until the permanent covering is in place or until the concrete has sufficiently hardened. Wetting should commence as soon as the surface of the concrete has set.

The surfaces of concrete exposed to premature drying should be kept wet for a period of at least seven days. This may be done by a covering of wet sand or sawdust, burlap, or by continuous sprinkling, or by some other method equally effective. An excellent practice is to cover the surface with burlaps which may be kept saturated, as this not only furnishes the necessary moisture, but protects the work from the direct rays of the sun. The interior of a large mass of concrete work will probably take care of itself by keping the burlap wetted down by means of a hose, but the precaution has sometimes been taken of leaving vertical holes or wells in the mass, which are kept filled with water for some weeks and are then filled with concrete.

Concrete laid in warm weather should be drenched with water twice daily, Sunday included, during the first week after being put in place. The aggregate should be thoroughly wetted, more water used in the mixing, and, if necessary, the work should be covered with planks or tarpaulins. Throughout the work, care must be taken to prevent the rapid drying of the concrete by the sun. Some specifications require that concrete be well sprinkled in hot weather every two hours of the first day and at longer intervals during the several succeeding days. The inspector will, of course, be governed by the engineer's directions in this regard.

[illegible] and [illegible] of Forms.—No work should be done upon forms nor should they be moved in any way after the concrete is in place, except to correct or secure them before the concrete has set.

Protection From Blasting.—Sufficient canvas or timber covering must be provided to protect freshly-laid work from blasting.

Protection From Traffic.—Where traffic is unavoidable over green concrete, the surface should be covered with at least three inches of sand for protection, or suitable boards should be provided for the purpose of distributing the weights.

Protection From Frost.—When considered advisable, fresh concrete should be covered to protect it from danger of injury by frost. This will be thoroughly discussed below.

Time to Set (Heavy Loads).—After cement has begun to set, it should not be disturbed until it has hardened sufficiently to bear easily any weight that may be put upon it. Time must be given for concrete to become firm before masonry foundation or other mass work is commenced upon it, usually as much as 24 hours, as heavy pressure tends to retard the setting. In the case of quick-setting natural cements, however, 12 hours may be sufficient. No water should be allowed to stand on, or to flow over, fresh concrete work, until the work has had time to set.

Concreting in Freezing Weather.

GENERAL REQUIREMENTS.

Engineer's Permission.—In case it becomes necessary to do work in the winter months, no concrete should be mixed, nor placed, nor any other operations performed, likely to be interfered with by cold during any of the months of December, January, February and March and thereafter until the frost is out of the ground, unless permission be obtained from the engineer in charge of the work. If, however, the engineer is of the opinion that any operation can be satisfactorily perfromed during the above months, he may give the contractor a special written permit, defining the work and the conditions under which such work may be done, and such conditions must be faithfully followed. The inspector, of course, will be governed by the engineer's decision in the matter. As a matter of fact, however, satisfactory results can be obtained in all classes of [illegible] precautions are observed and prejudice against concreting in freezing weather is gradually disappearing.

Suspension of Work.—The engineer may, however, prohibit the laying of concrete at any time when, in his judgment, the conditions are unsuitable or the proper precautions are not being taken, whatever the weather may be, in any season. The practice of mixing, placing and protecting concrete in freezing weather in the same manner as in warm weather, is most certainly to be condemned.

[illegible] Weather.—After prolonged freezing weather the work should not be taken up again with the warmer weather until the approval of the engineer has been obtained.

[illegible]

Special precautions must be taken in placing concrete in cold or freezing weather. Concrete in the cold and damp autumn and winter months set much more slowly than during the summer. Below a temperature of 50 degrees F. concrete sets slowly, and below 40 degrees is very inactive. At 32 degrees concrete freezes before setting. Concrete work can be carried on when the temperature is as low as 20 degrees (seldom lower) if the following precautions are taken:

Concrete Materials.—When it is necessary to make concrete in freezing weather only Portland cement should be used. Natural cements should not be used, as they will not stand freezing. In fact, most natural cements are seriously injured by frost, especially by alternate freezing and thawing. Precautions must be taken to avoid the use of materials containing frost or covered with ice crystals during freezing weather. The inspector should examine all the materials carefully and if they are frosty or frozen he should insist upon the materials being heated.

Careful Inspection Needed.—Particular care should be used by the inspector to see that the forms are properly braced, the bottom of beam and column boxes are clean before pouring concrete; that the steel is accurately placed, concrete thoroughly mixed and the workmanship in general, the best possible. Special vigilance is required of the inspector during cold weather, as workmen are apt to become careless during cold weather. Workmen have a tendency to shirk their duty, especially when it exposes them to the cold.

Cleaning Forms.—Trouble is likely to be experienced from the tendency of frost to make the concrete adhere to the forms. Boiling water may be used with good results in thawing this out. Snow and ice may also be removed from forms by steam from a hose connected to the steam boiler on the job; in this way any particles of ice are melted and the chill taken off the forms.

Warming Steel Forms.—Concrete should never be placed in steel forms until they are warmed, if the temperature is below 32° F.

Methods of Preventing Injury to Concrete.—The precautions which will assist in preventing injury to concrete during freezing weather are as follows:

(1) Lowering the freezing-point of the mixing water.

(2) Heating the sand, broken stone or gravel, and mixing-water.

(3) Covering the newly-laid concrete with some non-conductive material which will retain the heat.

(4) Enclosing or housing the work under construction.

(5) Artificial heating of the enclosed space.

One or more of the above methods should be employed to prevent concrete from freezing. The particular method or methods to be used will depend largely upon the character of the work, large plain mass work, such as retaining walls and abutments, not requiring the same care and protection as thin walls, columns, beams and floor slabs.

In addition to the precautions stated above, the contractor should be required to take such other precautions as may be found necessary to secure first-class work in every respect, including the character of the finish of all exposed faces.

USE OF CHEMICALS.

Lowering the freezing point of the concrete is the simplest and cheapest, but probably not the best method of concreting in freezing weather.

Adding Substances to Mixing Water.—The addition of some chemical to the mixing water is more frequently resorted to than heating the materials as described below, principally, no doubt, because of the simplicity of the process. Only those substances that have no effect on the strength and durability of the concrete should be used to reduce its freezing point. Where such materials as glycerine, alcohol and sugar are proposed for the purpose of lowering the freezing point of water, they should be used with caution, owing to a tendency to lower the strength of the mortar. If any other substance than sodium chloride (common salt) or calcium chloride is proposed for the purpose, the approval of the engineer should be obtained before their use is permitted.

Salt in Mixing Water.—Salt dissolved in the water used in mixing the concrete helps to prevent freezing by lowering the freezing point and is the ingredient most commonly used, the addition of which lowers the freezing point about 1° F. for each per cent added. The excessive use of salt for this purpose should not be permitted. Salt has the effect of slightly reducing the early strength of cement, but does not affect the ultimate strength when used in proper quantities. Salt also delays the setting of cement, but there is no mechanical action from freezing, and the results of its use are usually satisfactory.

If salt is added to the water, great care should be taken to see that it is thoroughly dissolved and that the solution is not overdosed, which is very likely to be the case. If the effect is not bad on the strength of the concrete, it is on the looks of it. Too much salt, or salt in lumps, will eventually work its way to the surface, thus showing in blisters and unsightly stains. Salt should not be added in lumps directly to the mixing water, but in the form of brine. Even when salt is used, it is important that the aggregates be free from lumps of frozen material, as it is impossible to properly mix such materials.

Salt should be used only in plain concrete work, as its effect on reinforcing metal has not been established. It is claimed by some experimenters that salt will corrode steel bars embedded in concrete.

When sodium chloride (common salt) is added to prevent freezing, the amount should not exceed ten (10) per cent of the weight of the water. Some authorities place the safe percentage at a considerable higher figure. A 5 per cent solution of common salt is ordinarily used and is not detrimental to the strength of the concrete where so used. The salt must be thoroughly dissolved in the water before mixing the concrete—approximately one pound of salt to over 18 gals. of water when the thermometer is at 32° F., and one additional ounce of salt for every further degree below 32.

Salt is sometimes added in sufficient quantity to "float an egg" or to "float a potato." Such determinations are untrustworthy—it takes about 15 per cent of salt to the weight of the water to "float a potato" and about 11 per cent to "float an egg." The salt addition should be determined by actual weight and not guessed at. No more than 10 per cent should be permitted under any circumstances and this amount will not be considered effective for temperatures lower than 22° F.

Concrete to which salt has been added dries out more slowly and hence retains its dark color longer than that containing no salt; but both are likely finally to have the same color.

Calcium Chloride in Mixing Water.—Experiments indicate that calcium chloride (chloride of lime) added in quantities not exceeding 2 per cent of the weight of the cement is an effective agent for lowering the freezing point of the concrete. It is also a well-known fact that additions of calcium chloride will often render unsound cement sound. Mr. Richard K. Meade added 2 per cent calcium chloride to several samples of unsound cement and in each case the resulting mixture pasd the steam and boiling tests perfectly. (Ei Rec., Apr. 20, '07, p. 502.)

Calcium chloride may be used in ncre- blocks which are made in the wint ti adding to their strength and impermbii without causing discoloration of, or flores- cence on, the blocks.

Calcium chloride has an advantag over common salt in that it reduces the freing to a lower point. Chloride of barium i small quantities has the same effect as chlde of calcium in hastening the setting of ceent.

Calcium chloride should not be aed in quantities exceeding 2 per cent of the weight of the cement when used as an agent f low- ering the freezing point of the concret This is substantially a 15 to 20 per cent sution, the freezing point of which is fr 14° F. to —2° F. In other words, dissolvin water needed to properly mix the nc two pounds of calcium chloride for eh of cement used. To determine the amn calcium chloride per barrel or tankful f ter, the quantity of water used per bag c ent must be carefully noted and from is amount can be readily figured. The se chloride of calcium in concrete should i by special arrangement and under thu vision of the engineer. If a larger ar than stated above is used, it is likel to hasten the set as to make the concre cult to handle.

Corrosion of Steel Rods in Reinforc C crete.—Tests were made during 1908-0 b Knowles and Clifton P. Mayfield, Pla pia, to determine the relative effects of ir percentages of sodium chloride and lc chloride or reinforcing steel embedded crete.*

From a study of the observations an ta lated weights of the reinforcing bars, es Knowles and Mayfield reached the fo conclusions:

(1) The presence of sodium chlo le calcium chloride in the aggregate cae corrosive action of metal.

(2) This action is greatest on the under side of the bar.

(3 This action is greater in conc e dry consistency than in one of a w c sistency.

(4) The denser the aggregate is opor- tioned the less the action.

(5) The corrosion increases with i in- crease of percentage of the salt in the ggre- gate.

(6) The action caused by calcium coride is greater than that caused by commonalt.

Experiments should be carried fur r to ascertain whether the action noted b would continue until the effective strenh the steel would be dangerously impair.

The writer would suggest that concre inforced with steel should not be prec from freezing by the use of salt, owing results of the above experiments. I is well-established fact that salt and air r steel quickly and concrete placed in the ir is liable to be somewhat porous and et in and if there be any steel embedded rein, corrosion will follow.

HEATING THE MATERIALS.

The best method of concreting in fezing weather is to heat the materials, and p tect the work until it has obtained sc strength to withstand the action of r Either the water, the sand and water, sand, broken stone or gravel and water io be heated. The cement is usaully not al The simple precaution of waking cement by the use of warm water in tl causes it to deport itself more nearl as does in the summer season. Heating t terials accelerates the rate of har lengthens the time before the material b cold enough to freeze, and in tempe but little below freezing, will insure th ening of the concrete before it can b aged by frost.

The necessity of heating the aggreg obvious, since, when boiling water is into the mixer, it has such speed of op ot enough time elapses to thaw frozen and get them properly distributed be- e mixing process is complete.

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*Eng News, vol 67, page 258, Feb. 8.

y *Mass Work.*—For heavy mass work, alls, abutments, etc., it is not necessary the broken stone or gravel except in lly cold weather, but sand and water be heated. If the concrete goes into nchilled it will harden rapidly, as mass etains its heat for a long time and ad- l heat is generated during the process [illegible]

[illegible] e work it is necessary to heat all the ls but the cement; and the concrete be hot when placed in the forms. The cing steel should also be heated to the egree as the concrete, or a steam hose used to take all frost out of the steel [illegible] ible to obtain sand and broken stone vel that is dry and free from frost, aterials will not be required to be heat- t if not, they must be heated. The is not heated, as its setting is hastened great an extent.

unt of Heat Required.—The amount of quired depends upon the temperature air and the rapidity with which the [illegible] The hould be warmed, but not boiled, the ther aggregates should be heated, enough to blister the skin of the If the concrete be deposited in mass warm, it will retain the heat for sev- urs, giving the cement time to take its and final set. In each period there is ger of injury from freezing. Some tions require that all sand, broken gravel and water used in mixing the e in freezing weather, shall be heated mperature of not less than 150° F., and crete placed while yet steaming. There danger in killing the cement with such hot water. The temperature of the should not exceed 130° F. at the most, bly to 120° F. Ordinarily the heat can- so great as to injure the material itself, may kill the cement by hastening its set h an extent as to cause trouble or to out the broken stone that it will ab- gh water to rob the cement of neces- sture in dry mixtures. In other the broken stone must not be over- but must be moist enough not to dry mortar when mixed with it. In heat- materials, too high a temperature will sand to turn red, while stone and gravel t to soften or crack.

f Boiling Water.—When the tempera- low freezing and above 20° F., the g may be carried on by using boil- ter for mixing (tests should, however, de to determine whether the hot water injure that particular brand of regard to strength), and by pouring ter on the forms, and especially the ment, so that not a particle of ice remains. No concreting in cool er should be commenced unless all ations for boiling water are made. When ered necessary, in addition to using hot a pint of salt per bag of cement may led to the mixture. The use of hot cannot always be depended upon to t frozen, lumpy sand or stone, when oncrete. All hard lumps should be ut before they reach the mixer.

ds to Be Adopted for Heating Ma- -The method to be adopted for heating materials will depend largely upon the ter of the work and the arrangement of xing plant. Extremely crude methods sed successfully where the importance work doesn't warrant any considerable r apparatus.

ry Heating of Aggregates.—A small ilt roughly of sheet iron will serve ery small job of concreting. Two of stove pipe, laid flat, with a fire so that the gases go through the sand vel placed in a pile over the pipe is fficient when mixing is done by hand small job. For larger jobs, lengths of culvert pipe closed at one end and [illegible] stone may also be heated by means of an ordinary sand heater, such as is used for heating gravel used in street paving work.

For weather not too severe and the amount [illegible] yards per day, the materials may be heated [illegible] that is, both sand and gravel or broken stone. If a wood fire be kept burning over night on top of the piles of sand and stone a considerable quantity can be heated. The fire can be kept going during the day and moved back on the pile as the heated material is used. This new method of heating aggregates requires a quantity of fuel which in most cases is prohibitive and is not sufficient to supply a power mixer

Steam Coils.—Aggregates may be heated by means of a steam coil placed near the cars that are being unloaded by simply throwing the material on the steam coil and allowing the sand and gravel or broken stone to remain a sufficient length of time to absorb the necessary amount of heat. In many cases, however, material which has already been unloaded must be heated. The expense of putting steam pipes under it is considerable. To avoid this one or more steam jets may be used, the end of the jet pipe being pushed several feet into the pile of material. If the jets are connected up with steam hose they are easily moved from place to place. It is difficult to heat stone by means of a steam jet placed in the manner just described, except in moderate weather, owing to the fact that broken stone requires much more heat than sand or sand and gravel mixed, because of the greater volume of air spaces. If the material so steamed is not used at once it will give more water, therefore more ice to contend with in the material pile.

Steam Boxes.—A very convenient method of heating large quantities of aggregate is to build a long wooden box (say) 8 to 10 ins. square, with numerous holes bored in its sides. This box is then placed on the ground. connected with a steam pipe and covered with sand, broken stone or gravel. The steam thus escaping through the holes in the box will generally heat over night, a pile of sand or sand and gravel, 8 or 10 ft. high. Perforated pipes can be substituted for boxes, though usually more expensive. Material can be heated more rapidly if the steam be allowed to escape in the pile than if it is confined in pipes which are not perforated.

Salamanders.—Another method of heating the sand, broken stone and gravel is by means of a large salamander. This may be accomplished by providing a double bottom of sheet metal to a supply hopper of sufficient capacity to store at least a day's run. The heat from the salamander is thus led into the air space directly under the aggregates and the necessary draft is supplied by chimneys passing through the aggregates. This method will generally be found very effective in extremely cold weather. It will frequently be found more economical to build heaters of brick laid up dry, with large end joints, than to buy salamanders.

Heating the Water.—For heating water the common practice of relying upon a steam pipe placed in an ordinary barrel should not be permitted, as the water is generally used too fast to permit of its being properly heated by this method. A suitable tank should ge provided, and the water heated by means of a coil supplied with steam from the boiler supplying the mixer engine or when this is inadequate one should be erected for this purpose. The size of the tank will be governed by the amount of water needed and the time required for heating it. Close inspection wil' be necessary to insure that the water is not used more rapidly than it is heated.

The most practical water heater for concrete mixed by hand and in small quantities is an iron kettle with a roughly built up brick or concrete block setting. Water for mixing concrete may also be heated by passing through pipes coiled in a salamander.

The practice of mixing and placing concrete in freezing weather in the same manner as in warm weather is to be condemned. It is absolutely imperative to mix and place con- [illegible] hardening during the first few days. Freezing will not damage concrete that has had a chance to harden under favorable conditions, but alternate freezing and thawing is very apt to damage green concrete.

Frozen Aggregates.—Care must be taken that the sand and stone are not frozen or in lumps. The use of frozen, lumpy sand, or stone depending on hot water used in mixing to thaw it out should not be permitted. The use of hot mixing water cannot be depended upon always to thaw such lumps, and they may form a considerable pocket of uncemented material in the finished work. In a small column this might be disastrous. All hard lumps must be thrown out.

[illegible] er should be enclosed in a frame housing, covered with tar paper. The mixer should also be kept warm by means of steam coils outside and jets inside. The exhaust steam from the mixer engine may be turned into the drum of the mixer. This is accomplished by conducting the exhaust pipe to a point in front of the discharging opening of the drum, so that the drum when tilted for discharging will just clear the end of the pipe. The force of the exhaust will then carry the steam into the revolving drum, where complete mixture with the dropping particles of concrete utilize practically all of the heat remaining in the steam.

Mixing Concrete.—In general, less water should be used for mixing in cold than in warm weather, as the less water used the quicker will be the setting. Since the injury due to frost is caused by the expansion of the water used in gaging, concrete mixed wet will suffer most. Concrete, therefore, should not be mixed too wet for use in low temperatures. If the aggregate is porous, it should be well soaked in water before coming in contact with the cement; otherwise it will absorb the water necessary for mixing and for developing the full activity and strength of the cement. Boiling hot water should never be brought in direct contact with the cement, but first mingled with the aggregate, which will sufficiently distribute the heat and lower the average temperature to a safe working degree.

Handling Concrete.—Placing of concrete in freezing weather should be carried on continuously to insure a perfect monolithic mass. The greatest care must be exercised in using reinforced concrete during winter months. The concrete should be placed in the work at a temperature of at least 60° F., regardless of the- temperature of the surrounding atmosphere. See that each batch of concrete is placed in the work immediately after mixing.

Minimum Temperature for Concreting.—In freezing weather concreting should be stopped at the temperature required by the specifications or as may be required by the engineer. In general, no concrete should be made or placed when the weather is or is predicted to be by the United States Weather Bureau within 12 hours, as low as twenty (20) degrees F. The forecast of the Weather Bureau will generally be found of great assistance in determining whether or not it would be advisable to concrete. The minimum temperatures predicted by the Weather Bureau are very accurate indeed.

Concreting Thin Walls.—On thin walls, the time of concreting should be limited to a 28° F. on a rising thermometer and 32° F. on a falling thermometer.

Diminishing Area of Concreting.—In the winter time, the area of concrete work should be cut down by the use of bulkheads, so as to decrease the time of exposure of a single layer, which will result in running the work up to a greater height for a day's work.

Accumulation of Surplus Water on Concrete.—In no case should a surplus of water be allowed to accumulate and freeze on top of a layer of concrete and then be covered up with more concrete before thawing out. If too much water is used in the concrete, the expansion of the water in freezing may disintegrate the concrete by the mechanical action of the ice in forming, causing a crumbling of its outer surfaces.

Bonding New to Old Concrete.—Where the new concrete joins the old the edges should be thoroughly steamed.

Removal of Defective Work.—Whenever any cement work freezes before it has become thoroughly set the entire mass should be removed, since the bond of the concrete which has been frozen will not be as hard to the unfrozen layers as if it had not been frozen. A slight frost extending only ¼ in. into the concrete is not detrimental to strength. It is even claimed that concrete can be frozen, thawed out, and will then reset. This may be so in some cases, but it is always best to remove any concrete in which the freezing has extended throughout the mass. The freezing of a layer of concrete is apt to prevent a good bond with another place on top. Layers of concrete which have frozen should invariably be removed before laying fresh concrete upon them. No sudden removal of frost and ice on the surface by using hot water or steam should be permitted, but should be removed by the use of cold water. The use of fires for the removal of frozen concrete surfaces should be prohibited.

Suspension of Work.—The engineer may, when he deems it best, stop all concreting when the weather is at or below the freezing point. Care should be taken that each day's work is finished off to a horizontal or level line, so that the work may, if necessary, be left in the proper shape for an indefinite period.

PROTECTION OF CONCRETE.

When once hard no hydraulic material is less affected by extreme cold than Portland cement concrete, but in the early process of set and hardening it should be protected from freezing, though some cases are cited* where solid freezing in this stage showed no damaging results. It may be true that frozen concrete will reset under certain conditions, but it is not advisable to depend upon such an uncertainty. The safest plan is to entirely avoid freezing, especially in surface work.

Covering Concrete.—Any concrete liable to be exposed to sleet, frost or snow, before it has attained its permanent set, should be protected from the cold so that it will not freeze. Even the concrete materials are heated (as described above), the heated concrete should invariably be protected by suitable covering to insure the concrete setting before it has cooled to a freezing temperature. The concrete work must be covered before stopping work at night, even though it is warm during the day time, as the nights are often below freezing temperature. A covering of sufficient thickness should be used. No concreting in cool weather should be commenced unless suitable coverings in ample quantities are at the site.

There are innumerable coverings for the top surface of concrete to prevent freezing. Boards, canvas, tar paper, sacking, cement bags, saw-dust, shavings, manure, straw and sand are all used for the purpose.

Use of Boards and Canvas.—Protection of setting concrete may be afforded by a layer of boards, leaving an air space of several inches, and laying canvas over the boards. An air space beneath the canvas is valuable. The edges of the canvas should be brought down to enclose the air space. Two layers of canvas, separated by boards, will give very material protection. If only a single layer is used, it should not be allowed to touch the concrete, but should be kept out by boards. Hay, shavings, or some other material in which quiet air may be entrained, should preferably be placed on top of the canvas.

Use of Tar Paper.—Tar paper should be well lapped and used as suggested for canvas. In temperatures only a few degrees below freezing, it is sufficient to nail building paper on the outside of the forms. A single thickness of tarred paper, well tacked and so put on as to prevent a free circulation of air, has raised the temperature of the air under it 15° F.

Use of Cement Bags.—Cement bags used for protection should be in layers and well lapped; if this is not done the concrete will be frozen between consecutive bags.

Use of Sawdust.—Sawdust when available will probably supply the best protection with little danger of injuring the concrete.

Use of Manure.—The use of manure should not be allowed for the covering of concrete, as it causes disintegration, unless the concrete is well and sufficiently covered so as to be waterproof against the drainage therefrom. Manure must be used with care for protecting concrete in cold weather. If stable manure can be kept in place in sufficient quantities to keep its fermentation it is the most efficient material for covering, as it is a heat generator, but it discolors the concrete (this is seldom of import). In no case should fresh manure be placed over very green concrete to protect it from freezing, as it will spoil the surface of the concrete. When possible the concrete should first be covered with boards or tar paper and the manure placed upon them. This will keep the manure from soiling the concrete and prevent any action of gases generated by the decaying materials. Considerable care should be taken, however, to protect the manure from becoming wet during rain storms. If possible, it should be covered with tarpaulins, or with planks arranged in such a manner as to exclude the water. This is a practical and yet a very inexpensive way to protect concrete in the open where a low, flat surface is presented. A thickness of 12 ins. of manure laid on tar paper or canvas and kept dry will protect the work from freezing for days at a temperature as low as 10°F. It is probable that only green concrete is injured by manure, as it has been used widely for stable floors, manure bins, etc., without any evidence of failure.

Use of Straw or Hay.—A covering of straw or hay may be allowed on certain conditions. Straw should be used at least 12 ins. deep, and, in extreme weather, deeper. In conjunction with the tar paper and canvas, it works very well.

Protection of Concrete by Artificial Heat.—Concrete may be protected from freezing by the use of artificial heat. This may be accomplished by inclosing the entire work under cover, and keeping it warm by heating the air within the enclosure. This is rather an expensive method, and is seldom employed except in building construction. The inclosing framework is lightly constructed of wood, covered with canvas or other material.

Forms may also be so constructed as to protect all parts of the concrete from injury by frost, radiators or live steam being used within the form sufficient to keep the temperature above 35° F. during, and for at least two days after, the placing of concrete.

In reinforced concrete construction during winter it is generally necessary to provide some heating system to prevent the work from freezing. Steam pipes, stoves or open charcoal fires may be used for this purpose. Any method for heating concrete work that does not provide moisture as well as heat should not be considered. It is absolutely essential that concrete be not forced to take its set quickly.

Use of Steam Pipes.—Concrete may be protected by covering with canvas and running a jet of steam under it. If canvas is not available, boards and straw or manure will answer the purpose. The inspector must see that these pipe-lines are well covered with some non-conductive material which will retain the heat. If heat is kept on for 36 hours after completion, this is sufficient, except in unusually cold weather. If the forms are tight and made of heavy material it will only be necessary to protect the top or exposed surface of the work with canvas and apply a jet of steam to the boxed area.

Reinforced Concrete Buildings.—In building construction, the reinforced concrete must be kept from freezing and maintained at a fairly high temperature to permit proper hardening. This will necessitate enclosing the windows and other openings with sheets or canvas. The interior should, in all cases, be kept heated by using stoves, open charcoal fires, etc., so that the enclosed space does not vary in temperature more than a few degrees. Keep the building at a uniform temperature of about 60° F. This heating should be continued for several days and the concrete should then be examined. If found to be in good condition, properly set, and with no evidence of having been frosted, the stoves or salamanders may be removed, but the covering should be left in place for, at least, another week.

Care must be taken to see that the concrete and the forms are not allowed to dry out when salamanders or other artificial heaters are used to keep the work warm. A moist temperature is absolutely essential, and to obtain this, either steam or water must be applied to the centering to avoid a dry heat and too rapid setting of the concrete. In other words, moisture is very essential to the proper setting of concrete, and the loss due to evaporation from concrete and forms by the heat must be replaced by sprinkling or other means.

The protection of floor slabs must be carefully observed. In addition to placing salamanders or other artificial heaters under the floor being concreted, the slabs should be covered with a layer of about 12 ins. of straw or hay. In very severe weather, the writer would suggest that a number of air holes be provided through the slab and an air space left over the slab to give the heated air a chance to pass above the floor and distribute itself over the entire top surface. The slab should be covered over with a layer of boards leaving an air space of at least 4 ins.; over the boards lay tar paper or canvas, and bring the edges down to enclose the air space. On top of this covering use hay or straw or [illegible]. Straw is sometimes sprinkled with salt.

A system of heating by means of live steam jets has been found to be very satisfactory in reinforced concrete building construction and no bad effects were experienced from frost.

Surface Finish for Important Structures.—For a spaded or mortar finish, extreme care should be taken to protect the work, preferably by covering the outside of the forms with a layer of tar paper so as to leave an air space between it and the face lagging. Tests have shown a difference in temperature of 5° F. between the air in the air space and the outside atmosphere. Care should be taken to tack this paper on securely. Structures in which the surface finish is important must not be permitted to freeze until the concrete is well set. Mortar facing which has been frozen is usually permanently injured, due no doubt to the expansion which takes place during freezing. Blocks of the lagging (say 4x12 ins., at different points of the most exposed sides of the work, may be cut out, in order to note whether or not the mortar facing is being affected by frost.

Protection of North and West Sides of Structure.—Special pains should be taken to protect the north and west side of the structure. Canvas curtains may be hung on the north and west sides of the building to keep out the wind. The side from which the wind blows is more liable to be frozen than the sides that are protected from the wind.

Protection Against Heavy Loads.—Work to be placed upon concrete laid in freezing weather should be delayed until the setting of the cement makes the mass sufficiently strong to carry the weight, as heavy pressure tends to retard the setting. Usually as much as 48 hours or more should be required before masonry or other heavy weights are laid upon the concrete. Careful inspection of the concrete should be made before loads are applied.

Duration of Perfection.—All reinforced concrete should be kept at a temperature above freezing for at least 48 hours after being in place. Concrete, if properly cured, should be immune from damage by frost within 48 hours.

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*Eng. News, Feb. 6, 1896, page 92.

REMOVAL OF FORMS.

[illegible] most important precaution, and one [illegible] importance cannot be over estimated, [illegible] *in the removal of the forms* [illegible]

[illegible] Inspection Needed.—Careful inspec[illegible] winter work should be made before re[illegible] the forms, owing to the close resem[illegible] between frozen and thoroughly hard[illegible] concrete in appearance. Frozen con[illegible] requently shows a fracture through the [illegible] ate and will ring when struck with a [illegible] r. Sometimes two weeks or more after [illegible], it is possible to drive a nail into the [illegible] te, which indicates how serious the set[illegible] cement is delayed.

[illegible] Forms.—All forms under con[illegible] placed in freezing weather should re[illegible] ntil the season has advanced beyond the [illegible] ility of a frost. If earlier removal of [illegible] is permitted, they should remain until [illegible] dences of frost are absent from the [illegible] te and the natural hardening of the con[illegible] has proceeded to the point of safety. [illegible] for such work should be kept in place [illegible] two weeks longer than customary. [illegible] are must be used in removing center[illegible] the concreting has been done in [illegible] ther.

[illegible] ork must never be removed while the [illegible] s frozen. If necessary, artificial heat [illegible] nployed to thaw the whole mass and [illegible] and hardness determined before re[illegible] lsework. In other words, don't re[illegible] forms until absolutely certain that [illegible] crete is thoroughly hardened and that [illegible] tion is either soft or frozen. The only [illegible] ay of knowing when the cement is fully [illegible] the concrete properly hardened, is to [illegible] test it with a hammer for hardness. [illegible] this, it is necessary to remove small por[illegible] of the formwork in each section of the [illegible] re to be certain that there are no soft

[illegible] ING AND REPAIRING SURFACES.

[illegible] shing.—Pointing up or finishing outside [illegible] es during cold weather should never be [illegible] ted. Even when the weather during the [illegible] favorable, it is objectionable to do [illegible] g, as the frost at night will do injury [illegible] work attempted. In all cases this work [illegible] left until the temperature is high [illegible] so that this work will have time to [illegible] rd before freezing.

[illegible] iring Frost-Damaged Surfaces.—Con[illegible] urfaces damaged by the action of frost [illegible] ccasionally be repaired by moistening [illegible] rface thoroughly and then applying to [illegible] sort of rough-cast a mortar of one part [illegible] tland cement and two parts of sand.

[illegible] ositing Concrete Through Chutes.

GENERAL REQUIREMENTS.

[illegible] crete may be deposited in place by [illegible] through movable pipes, troughs or [illegible] provided with elevator, hoists, etc., as [illegible] required. They are also provided with [illegible] le frames so that they can be easily [illegible] from place to place as the work de-

[illegible] egation.—Segregation — separating the [illegible] from the finer material—must be avoided [illegible] positing concrete through chutes. On [illegible] t of the velocity with which the larger [illegible] attain in passing down the chute, they [illegible] lly fall some distance in front of its [illegible], whereas the mortar, sliding gently [illegible] drops vertically from the mouth, thus [illegible] racting to a great extent the labor be[illegible] in carefully mixing the ingredients. [illegible] will necessitate remixing the concrete im[illegible] ely after it reaches the bottom of the [illegible] but no time must be lost either in the [illegible] al mixing or in the depositing if this [illegible] mixing is to do any good.

[illegible] sistency of Mixture.—In chuting con[illegible] a mixture should be used which is just [illegible] as it can be and at the same time hold [illegible] er. A rich mixture will flow better than [illegible] mixture, and a mixture which has been [illegible] ughly worked in the mixer flows better [illegible] ne which has not. The inspector should [illegible] mine the wetness of mixture to be em[illegible] by making a few trials with mixtures of [illegible] nt consistencies.

[illegible] ning Chutes.—Cleaning of chutes is es[illegible] sent [illegible] gi [illegible] drench [illegible] avoid [illegible] of concrete.

[illegible]

Wh [illegible] chutes, the inspector has little to do, his duties being restricted to seeing that the quality of the work is [illegible] by the contractor to carry on the work. However, as the inspector is interested in the progress of the work to see that it is completed in the time agreed upon, the method of handling the materials may become of vital importance. The writer will, therefore, discuss the construction of chutes very briefly.

Sagging.—Chutes must have ample strength against bending or sagging between supports. If the supports are far apart the chute should be stiffened by truss rods or some similar means.

Slope of Chutes.—A slope of 1 to 8 is about as flat as concrete will flow without help, even when the travel is short. The inside of chutes, particularly if its slope is flat, must be as smooth as practicable. A wet concrete will flow quite readily on a slope of 1 to 4.

Elbow Connections.—If the chute changes direction, say, from a 45° slope to a vertical drop into the forms, the elbow connection should be firmly anchored against the shock of the flowing mass due to its change of direction.

Canvas Sleeve.—If the chute has a long steep straight run, some arrangement should be made to prevent scattering when the stream discharges. A canvas sleeve extending from the chute or a short vertical elbow will ordinarily accomplish the result.

Steel Lining.—The wear from fast moving batches of concrete is considerable and where a chute will have long use, provision should be made for wear. A removal steel lining may be used to take the wear.

Platforms.—Chutes should be built on substantial platforms, high enough in the air to give proper fall to remotest chutes.

Prevention of Separation of Aggregates.—It is necessary that some precaution be taken to avoid separation of the aggregate. This may be accomplished in several ways—either by chains loosely stretched at intervals across the chute or by shelves extending part way across the chute at an incline, so as to deposit on a corresponding shelf on the opposite side, so alternating for the length of the chute. Either of these methods is a direct benefit, as it more thoroughly mixes the concrete.

Depositing Concrete Under Water.

Concrete may be deposited in still water and will harden there almost as soon as in the air. It should not, however, be placed under water, unless unavoidable. It will not do merely to dump the concrete into a deep pool and trust in Providence for the rest. Where concrete must be placed under water, the structure should be encased with a cofferdam or unusual care must be taken to prevent the cement from being floated away. This usually can be accomplished in still water by placing the concrete through a large pipe or tremie, and in large work by means of a bucket provided with a bottom dump. Where the concrete must be deposited in running water, it may be done by placing the concrete in bags and depositing the bags in place. Instead of bags for placing concrete, substantial forms may be used, so built as to prevent currents of water flowing through them when using tremies or buckets.

Instructions for Concreting Under Water.—In every case, where concrete is to be placed under water, special directions regarding its composition and method of placing should first be obtained from the engineer in charge of the work. The inspector, of course, will be governed by the engineer's instructions.

Depositing and Spreading Concrete Under Water.—Dry concrete, i. e., a mixture of aggregates and cement without water should not be employed in laying concrete under water.

Placing concrete through water should be carried on continuously to insure a perfect monolithic mass. Concrete should be placed in as large batches as possible. It is well to use about 10 per cent extra cement for the concrete that is to be placed under water to allow for loss.

The concrete should not be dropped from any height over six inches, but should be deposited and spread gently without ramming, so as to prevent the separation of the ingredients and thus secure a homogeneous mass. Under no circumstances should it be permitted to deposit concrete by dropping it freely into water, and allowing it to settle to the bottom. Dropping concrete through a depth of water will not only wash out some of the cement but will tend to separate the ingredients, even a drop of a few feet causes the material to rearrange itself and settle with the heaviest part, such as the gravel or broken stone, at the bottom.

Care must be taken to keep the surface of the concrete approximately level by means of a rake or other suitable tool immediately after being deposited. The inspector should insist upon the concrete being deposited in the allotted place in a compact mass and in a good and workmanlike manner. The concrete must not be rammed under water, as the stirring of the water will carry away cement. It should be wet concrete, so as to require no ramming.

Concrete should be mixed long. Concrete that is mixed and allowed to stand several hours and then remixed again is said to be preferable to freshly mixed concrete for placing under water, as the cement is partially set and is less liable to be washed out.

Great care must be taken not to disturb the water in which the concrete is being placed nor to touch the concrete before it has set.

When concrete is deposited in water a pulpy, gelatinous fluid is washed from the cement and rises to the surface. The French engineers apply the term *laitance* to this substance. Care must be taken to prevent the formation of laitance, which hardens very slowly and forms a poor surface on which to deposit fresh concrete. Laitance is formed in both still and running water, and should be removed before placing fresh concrete.

Concrete should not be deposited in foul or polluted water, as that containing sewage or discharge from pulp or paper mill, tanneries, etc., or refuse from any other washing process. Such water coming in contact with fresh concrete will destroy it by attaching the setting cement.

V Shaped Box.—In lowering concrete through water, a V shaped box of wood or plate iron is often used; this apparatus is so built that by a lever or rope arrangement one side of the box will swing loose and allow the concrete to fall out. The box is then raised and refilled.

Tremie.—An iron funnel with a stem 12 or 14 ins. in diameter and long enough to reach to the bottom may be used to deposit concrete under water. Such a tube is called a tremie. The method of operating is to fill the tube with concrete and then lower it into the water, removing the bottom by means of a mechanical arrangement, and thus allowing the concrete to gradually run out, while at the same time a new supply is shoveled into the top of the tube. The concrete should be mixed plastic, but neither dry nor wet—the former is liable to clog in the tube, and the latter flows out at the lower end too easily. Care must be taken that the concrete has no fall through the water, but oozes out so as to cause a minimum disturbance of the material.

Where necessary in passing under and around certain objects, curved adjustable lengths should be provided at the bottom of the tremie for depositing the concrete in place that would be otherwise inaccessible.

Paper and Cloth Bags.—Concrete may be deposited under water by enclosing it in paper bags and lowering or sliding them down an incline into place. The bags get wet and the pressure of the concrete soon bursts them, thus allowing the concrete to unite into a single mass. The paper bags should be placed in the desired position under water in such a manner that the bag or envelope is not ruptured until after or at the time it is in place.

Concrete is also [illegible] enclosing it in open-[illegible] bags [illegible] oozing through the meshes sufficiently to unite the whole into a single mass. Porous cloth bags should be lowered rapidly through the water into place to reduce the time of wash. No delay should occur in the process of depositing which will permit concrete in place to become set before succeeding bagfuls are deposited. The delay between mixing the concrete and filling and depositing the bags should not be long enough to permit the concrete to have set.

Buckets.—There are numerous devices in the shape of buckets that are used. The essential features of all of these buckets for depositing concrete are that the form be such that when the bucket is opened, all of the contents may fall out and also that the device for opening shall be such that it can be worked from above. Care must be taken to keep the deposited concrete as nearly horizontal as possible over the area to be covered. The placing of isolated piles of concrete must not be permitted.

Contraction Joints.

Temperature changes and shrinkage during setting necessitates joints at frequent intervals or else effective reinforcement, depending upon the range in temperature and the design of the structure. Expansion joints should be provided at all points where temperature changes would otherwise cause unsightly cracks. In all cases, joints should be at right angles to their surfaces, and should be constructed exactly according to the engineer's plans.

Massive Concrete Walls, Etc.—In massive work, such as retaining walls, abutments, etc., built without reinforcement, joints should be provided approximately every 30 feet throughout the length of the structure. To provide against the structure being thrown out of line by unequal settlement, each section of the wall may be tongued-and-grooved into the adjoining section. Each section should be finished from the footing course to the top before the adjoining section is started, and no attempt should be made to make the sections adhere to each other, so that when cold contracts the structure it will open up slightly in these vertical joints, and not in an irregular crack. A dowel contraction joint may be used instead of a tongue and groove joint.

Reinforced Concrete Walls.—In reinforced concrete walls the expansion joints should be spaced about fifty (50) feet apart unless otherwise called for or shown by the plans.

Forming Ordinary Joints.—In ordinary short walls the joint may be made by setting up a temporary vertical form or partition of plank and completing the section behind as though it were the end of the structure. When the concrete is set, the partition is removed and the new concrete is placed against the old without any attempt to secure a bond between the new and the old, thus leaving a vertical plane of cleavage between the adjacent sections. In order to cover up the ragged appearance of the joint, the writer would suggest that a triangular strip be nailed to the form where the partition joins the face of the form in such a manner as to leave a vertical triangular groove in the face of the wall with the plane of the contraction joint passing through the apex. A heavy coat of asphalt or coal tar pitch, applied hot to the surface of the section of concrete which was first placed, may be used to prevent a possible adhesion of the new to the old concrete. A sheet of tarred paper may also be used.

Forming Tongue-and-Groove Joints.—There should be spiked vertically to the face of the temporary partition or bulkhead a triangular or rectangular or U-shaped timber against which the concrete is to be rammed, so that a depression will be formed in the end of the section, giving the effect of tongue-and-groove joints in the finished wall. The advantage of the tongue-and-groove joint over the ordinary joint as mentioned above is to strengthen the wall against a lateral thrust applied near the joint.

Forming Dowel Joints.—A dowel contraction joint is made by inserting a short piece of railroad rail in the end of a section of a retaining wall and allowing the rail to project a short distance. Care must be taken to see that the projecting ends of the rails are well wrapped with paper or coated with soap or axle-grease in order to prevent the adhesion of concrete when the adjoining section is placed. Otherwise the concrete laid in the last section will not be free to slip on the rails with temperature changes.

Pointing and Making Good Defects in Concrete.

After the forms are removed, no patching or plastering should be done until all surfaces have been inspected and permission given by the engineer.

Defective Work.—Should voids be discovered when the forms are taken down, the defective work should be removed and the space refilled with one to one cement mortar. In other words, the defective work must be cut out and the space refilled with suitable material in a proper manner. If bolts are used for securing the forms and the ends of which are removed, leaving small holes, all such holes should be neatly pointed or stopped with mortar in the above proportions.

Repairing Broken Corners.—Broken corners should be carefuly repaired by thoroughly cleaning the surface, wetting the patch down well, then if possible driving 20d nails or railroad spikes into the concrete, putting up a form and grouting the broken place.

Frozen Concrete.—Any concrete which has been frozen or frost bitten should be promptly removed and repaired as directed by the engineer.

* * *

The Erie Railroad during the past few years has replaced 384 bridges with steel structures for heavy traffic so that there is not a single wooden bridge on the main line between New York and Chicago.

The Economies of Silo Construc on of Permanent Materials (Conc ete and Clay Tile); Constructi Methods and Costs.

II.

Contributed by M. L. King, Departm Agricultural Engineering, Iowa St College, Ames, Iowa.

CLAY BLOCK SILOS.

The absence of suitable aggregate f con-crete work in many localities caused an rgent demand for a substitute for concret silos. The hollow clay building block burn to a point at which it would permanentl with-stand weather action seemed to be the gical material, because of its cheapness, re kable strength, and the ease with which it an l laid up. Its light weight reduces the c of shipping and hauling. This demand the Experimental Station at Ames, Io develop a reinforced clay block silo,

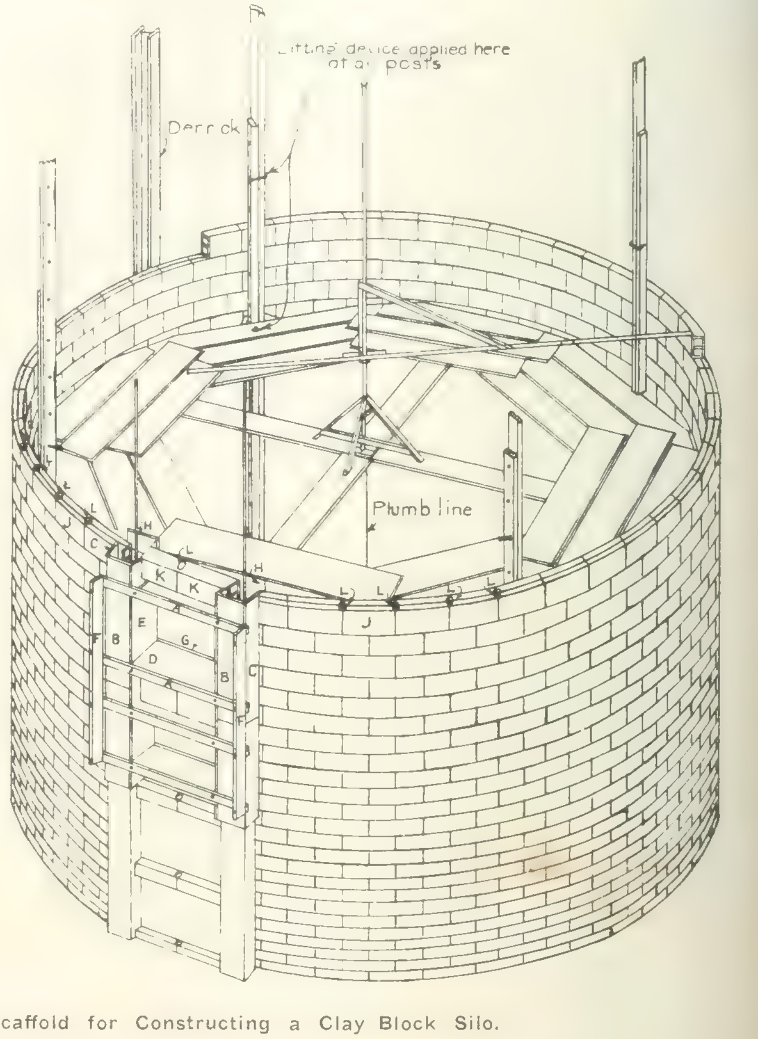

Fig. 1—Scaffold for Constructing a Clay Block Silo.

on account of the place of origin as th silo. In a broader sense, however, thi was the design and development of forcing system, convenient doors, and ticable collapsible scaffold for block si struction.

It was endeavored to use the standa block if possible. The mutual benefit to the manufacturer and the farmer vious. Then methods of automatic of a 4x8x12-in. and a 5x8x12-in. block developed, and today a large percentage clay product concerns in the state have on the market a clay product for si poses. The use of clay products f building is not new. In fact it date considerably beyond the use of concrete principal innovation is the use of pra standard hollow ware, and the intro of the particular reinforcing systems f con-crete door frames. Tile is backed up i y the past use and success [illegible] id for similar purposes. It simply has the tage over common brick in economy, in material and in labor in laying up. T air space adds a little to the warmth e building still leaving the walls abun- n. strong. As in any other building, all ial should be of a character suited to onditions under which it is to be used. ould be recognized at all times that the ions imposed upon material for silo con- ion will probably be the worst that can und. Foundations are apt not to be ly drained. The filling in around the ng and the carrying away of the surface t by proper slope of the ground is not e to be attended to, causing the blocks the grade lines to be exposed to the possible conditions of moisture and filth. atment demands an [illegible] material. Only hard burned vitrified cts should be used.

Its safest to specify a material having an ge absorption of not over 5 per cent weight when absolutely dry, due to tion. No blocks should be used absorb- er 8 per cent. In case it is impossible ain these materials a poorer grade may ed, but should always be protected with t plaster or concrete. However, if good of material is used throughout, put er in a good workmanlike way there e no question concerning the absolute nence of the clay product silo.

relative appearance of this silo is largely ter of taste. A careful selection of the ial will always improve the appearance clay block silo. It makes no difference high a quality of material is secured is always room for selection. Here important advantage in the use of clay instead of concrete for floor and roof. ged or poor blocks may be used in the or roof without interfering in any way the concrete or the job. Of course, it ential to appearance and general utility the wall be smooth, round and plumb, d up neatly outside and air tight on the si.

material for foundation or footing may ner blocks or concrete, depending entirely the relative prices of these two materials. ete may be used for footing without any , as it is only necessary to dig a circular the required depth just below frost, lig a trench directly under the wall, filling ith concrete. In case the foundation is ocks, there should be two 8-in. blocks atwise side by side, extending and facing d the circle. On top of this the blocks be laid crosswise to the former course, ng the two together and forming a header e. Upon this a 4-in. wall may be started. either case the clay block wall should rted directly upon the footing, and the ng for an ordinary silo should be 16 ins. This allows for a soil pressure of not 1,000 lbs. per square foot, which is ultra- rvative practice. There will probably s be some question as to the proper ness of walls. It is common belief among urchasers, who are not acquainted with rength of hollow clay tile, that they are trong enough for thin walls. Naturally, men shy at this material and insist upon ll heavier than 4 ins., but the Experi- al Station has found this thickness to be satisfactory.

ere is considerable discussion concerning elative strength in different thicknesses all. In the ordinary 8-in. wall construc- he air spaces are separate, but, of course, eat to get away must be conducted twice r as would be the case if the walls were 4 ins. thick. The warmth of a silo, how- depends more upon the closing of the when the silo is not in use and upon uilding of a good, warm chute, keeping ors closed as much as possible. Also, as ed out briefly, it is of great importance ve a tight permanent roof upon the silo. regard to the 4-in. wall: The required nt of reinforcing may be readily placed 4-in. wall. It is abundantlv strong to ort almost any weight which may be im- [illegible] upon a standard silo [illegible] in diameter and 40 ft. high. In order to provide the proper [illegible] and sound. In order to secure good tight joints inside for the exclusion of air it is [illegible] while the mortar is still green. This is not for the protection of the clay blocks, but is done to make the vertical joints tight.

There are two types of doorway either of which may be used to advantage. Perhaps the most convenient to use and certainly the most convenient to build is the continuous doorway. The door jambs are of concrete, reinforced vertically, tied together by steel encased in clay blocks filled with concrete. The cross ties are from 4 to 6 ft. apart and should contain 50 per cent more steel than is found in the wall itself, thus making up for the absence of masonry in the openings. The steel should stick far enough into the wall to secure hold upon them. The other type of doorway is the individual doorway. It is simply openings in the wall surrounded by concrete frames, separated generally by three courses of clay blocks.

The only logical roof for such a silo is masonry. Concrete is usually adopted for this purpose. In some cases, as already pointed out, it may be advantageous to use clay blocks plastering them on top with cement.

Masonry floors are ordinarily used in silos. Clay blocks may be used instead of concrete if more convenient. One of the great advantages of clay block silos over concrete silos is the small amount of equipment necessary. No forms are necessary except those for the door frame. The same or even a lighter scaffold than is used in the building of other masonry silos will serve the purpose very nicely.

The light gin pole made of 1x6-in. and 2x6-in. stuff serves every purpose. The 2x6-in. piece may be used the same as a web of an I-beam, while the 1x6-in. piece will serve as a flange. In using 16 ft. stuff, joints should be broken 5 ft. 4 ins. The hoisting may be done with a horse, but if a man is going into the business it is better to rig up a little hoist. A little 2 h.p. gas engine will be abundant for this.

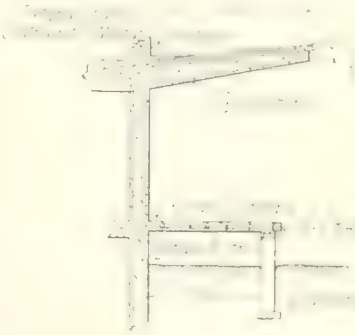

Fig. 1—Details of Reinforced Concrete Canopy Roof.

A very convenient scaffold has been developed for this purpose. This is shown by Fig. 1, and consists of a platform, supported by vertical parts of 2x6-in. pieces doubled. These 2x6-in. pieces break joints in the middle, are secured together by large screws, and are fastened to the wall by means of wires extending into the wall. Blocks are driven securely between the upright and the wall. Holes are bored every 18 ins. in the uprights, and clevices with short chains are used for support. The clevices are fastened to the posts. A light triple block is fastened on the upright and affords a convenient means of raising the scaffold. The plumb and circular shape of the silo is preserved by means of a light arm hinged at the outer end for convenience, which swings about a straight piece of gas pipe 6 or 8 ft. long, located at the center of the scaffold. This is supported by means of a small stand [illegible] slightly to allow for the scaffold not occupying the same relative position to the silo wall each time it is moved. The proper position of this guide is determined by means of a plumb-bob suspended from the stand directly beneath the center of the gas pipe. This plumb line hangs through a 2½ or 3-in. hole, which allows for the adjustment just mentioned. This plumb-bob is made to swing directly over a nail in a stick located in the center of the silo. Thus it will be seen that there is no occasion for not having the silo reasonably round and smooth. An arch stick cut to the inside of the silo wall is often found quite convenient in smoothing up the wall.

In the roof construction either cement or clay blocks may be used for the cornice, giving a good, neat projection. The concrete roof is supported temporarily with rafters having ¼ to ⅓ pitch. Between the rafters are curved headers covered with barn boards ripped cornerwise. The thickness of the roof varies from 3 ins. at the bottom to 2½ ins. at the top. This should all be reinforced with woven fence wire, and to prevent spreading ½-in. bars should extend around the roof in the concrete directly over the wall.

The method of construction is shown and discussed in detail in Bulletin No. 117 of the Iowa Experiment Station, which is free to any one. This booklet is thoroughly illustrated and so definite that the average builder by studying it carefully may proceed with the building with little or no delay.

In regard to the cost, considerable number of data have been collected, but they represent such a large range of practice and conditions that they can scarcely be depended upon as definite bases for estimating. However, we will include a few prices quoted by one of the most extensive contractors of this type of silo, also a bill of material to which the average builder can tack prevailing prices, which will enable him to figure definitely and intelligently.

The price of a 14x36-ft. silo, with concrete roof, is $300 to $325, depending upon the local conditions. The farmer in all cases furnishes board for the men, and sand and gravel for building, and does all of the hauling. The cost of a 16x40-ft. silo, with concrete roof, under same conditions, varies from $420 to $450. The bill of material for the latter size is as follows: Blocks, 3,000; No. 3 wire, 500 lbs.; steel bars, 200 lbs.; cement, 75 sacks; sand and gravel, 10 cu. yds.; 4 men 6 to 10 days. This makes a neat profit for the contractor, at the same time [illegible] a very moderate price to the farmer.

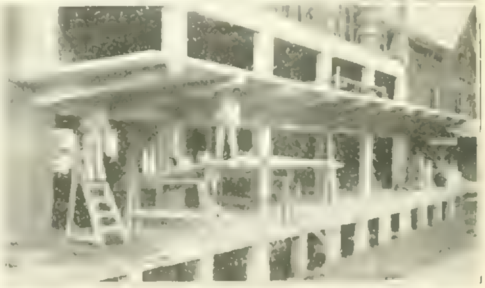

Fig. 2—View of Reinforced Concrete Cantilever Canopy for a Loading Platform.

A Reinforced Concrete Cantilever Canopy Roof for a Loading Platform.

[illegible]

A reinforced concrete cantilever canopy which covers the loading platform on the east side is a feature of the William T. Reynolds Building in Poughkeepsie, N. Y. This building is a warehouse of concrete and hollow tile, built for the firm of Wm. T. Reynolds & Co., as an extension of their plant. The building itself is about 50x80 ft., and is finished on the exterior in panels showing the pebble aggregate. The platform is adjacent to a siding of the New York Central & Hudson River R. R. and from it the cars are loaded for shipment. The platform is supported on one side by the walls of the building and on the other by piers spaced 8 ft. center to center, the span between these two supports being 7 ft. The platform consists of a 6 in. slab reinforced longitudinally by two [illegible] crossed at right angles by ½-in. bars placed 8 ins. center to center. The edge of the slab farthest from the building forms a continuous girder 1 ft. deep, below the top of the slab and 10 ins. wide, supported by the piers placed 8 ft. center to center. The overhanging canopy is a 4-in. slab resting on cantilever arms. The slab is reinforced with rib metal and the supporting beams with three continuous ¾-in. rib bars starting about 3 ft. back in the floor of the building and following the top of the cantilever beam to its end where they bend downward and return along the under side of the beam to the building. At the building the cantilever beams are 21 ins. deep from the bottom of slab, and they are 6 ins. deep at the outer end.

The canopy extends 10 ft. from the building and rises from the wall at a pitch of 1 in 10. In order to take care of the water which falls on the canopy and to carry it to the leader, a sloping back of compacted cinders was placed at the lowside of the canopy and coated with 1 in. of cement mortar. This bank decreases from a width of 2 ft. at a point midway between the leaders to nothing at the leaders, thus affording a slope which carries the water to the leaders and prevents [illegible] the wall of the building.

In [illegible] the [illegible] proportions of 1 2 4 concrete was used. On the forms for the under side of the beams were placed small cement blocks to support the reinforcing rods. These blocks had circular depressions in their tops to receive the rods and were left in place when the concrete was poured.

The building was designed by Dubois Carpenter, Architect of Poughkeepsie, N. Y., and was built by the Poughkeepsie Engineering & Contracting Co.

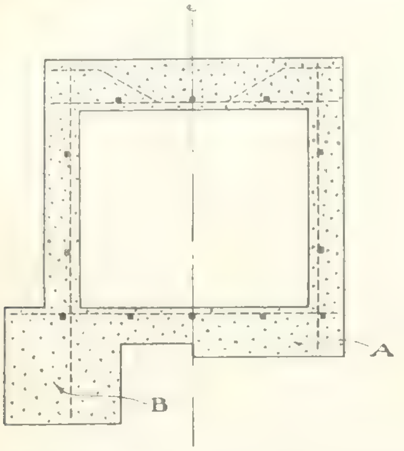

Fig. 1—Reinforced Concrete Box Culvert.

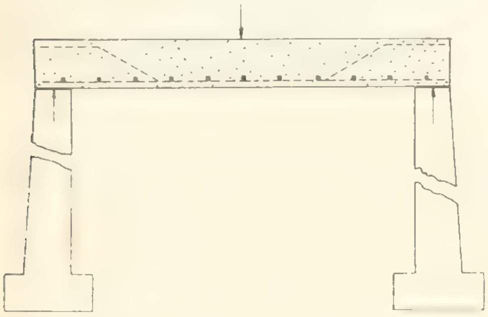

Fig 2—Reinforced Concrete Stub Bridge.

Standard Practice in Reinforced Concrete Highway Bridges and Culverts in Iowa.

The first concrete bridge or culvert in Iowa of which there is record, was a bridge of the Milan type built near Rock Rapids in 1893. About ten years later the engineers of the Iowa State Highway Commission, led by the increased interest in the possibilities of concrete highway structures, began to prepare and distribute plans for concrete bridges, culverts, etc. This work has continued and now various types of standard structures have been somewhat closely adopted. These types are described by Mr. T. H. Macdonald and Mr. C. B. McCullough of the Highway Commission in a recent paper before the Iowa Association of Cement Users. The types described include box culverts, slab and beam bridges and retaining walls. An abstract of the paper follows:

The various types of concrete bridges adapt themselves to the following classifications: (1) Circular and box culverts; (2) slab bridges, and (3) girder bridges and arches. The girder bridges may be subdivided into deck and through girders. There is also another class, the steel truss with concrete floor.

Taking these types up in the order named, Fig. 1 is a box culvert showing a cross section through the barrel of the culvert. The top, sides and floor of this culvert act as beams under the vertical loads, the horizontal earth pressure, and the upward foundation pressure, respectively. Since in each case, the load acts from the outside inward, the reinforcing is placed in each case on the inside of the wall or slab. Since there are no expansion joints, no cantilever action can take place and there is no need for reinforcing on the outside of the walls. The top slab is reinforced with bent up bars as shown to provide for the diagonal tension as outlined above. Two types of footings are used in these culverts. The one marked A, known as a float footing, consists of a heavy floor extending clear across the slab and depending for its stability on the wide distribution of the load. In the type marked B, the footings directly underneath the walls are carried down to a considerable depth and are connected by a thin floor slab built just strong enough to take the bending due to frost action.

The second type as the name implies, consists of a slab or beam of concrete (Fig. 2) as wide as is required for the roadway, resting on two abutments. The reinforcing is for simple bending and diagonal tension. Since at each bridge seat there is an expansion joint, the abutments (Fig. 3) are reinforced near both back and front surface with rods running vertically and horizontally. The horizontal rods form a frame work for the reinforcing, bond the wings to the abutment proper and prevent cracking due to temperature changes in the concrete. The rods in the back face take all the ordinary stress. The front reinforcement is called into action only in case of the failure of the expansion joint to act properly, on this account the vertical reinforcing system in the back is much heavier. Steel bars placed both longitudinally and transversely in the footing as shown help to distribute the footing load and anchor the main reinforcing members.

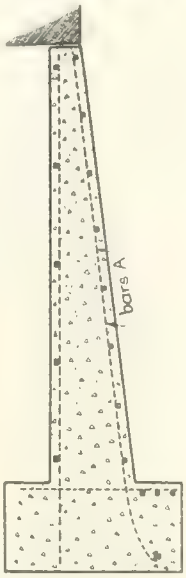

Fig. 4—Reinforced Concrete Retaining Wall.

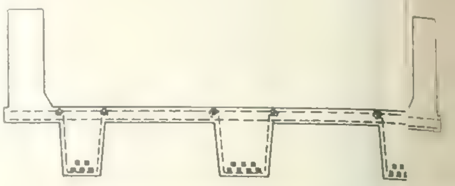

Fig. 3—Reinforced Concrete Deck [illegible] Bridge.

Figure 4 is a cross section of a deck girder bridge. The girders are nearly rectangular section having a slight draw towards the bottom to admit of easy removal of the forms. These girders are thoroughly bonded by means of stirrup rods to the floor slab which rests on top of them, the latter acting both as the floor and as a top flange for the girders. The load is carried by the floor to girders and by the girders directly to the abutments. The rectangular sections at the sides of the roadway serve simply as hand rails and do not help to transmit the load.

Due to the diagonal tension, there is always a tendency for the bent up reinforcing members to fail by a pulling out or breaking of the bond near the end. For this reason a positive connection or fastening of the main reinforcing members at the end of the girder is very desirable. A system of this kind employed with success by the Commission during the last year is substantially as follows. The reinforcing bars are bent in the shop and fitted with a hook on the end. An end plate is also made in the shops and fitted with notches or slits from both top and bottom of sufficient width to admit the reinforcing bars. These notches are so spaced that when the reinforcing bars are dropped in they occupy the position as computed in the stress [illegible]. After the bars are dropped in these notches two small plates about ⅜ in. thick are [illegible] one to each side of the plate both top and bottom, thus completely enclosing and rigidly fastening the reinforcing members.

The other type of a girder, the through [illegible] Fig. 5, differs from the type just described in that the girders, two in number, are placed above and at the side of the roadway. The reinforcing in these girders differs very little in principle from that employed on deck girders. The girders now occupy the [illegible] occupied by the hand rail in the deck type and the floor system is hung between the two girders and reinforced transversely in the same manner as an ordinary slab.

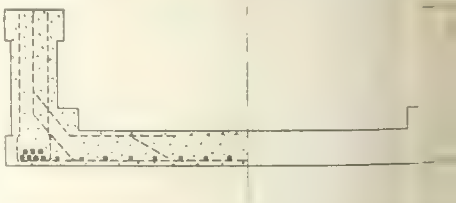

Fig. 5—Reinforced Concrete Through Girder Bridge.

TYPE OF BRIDGE USED FOR DIFFERENT CLASSES OF WATERWAYS.

There is a distinct difference in the [illegible] and size of the drainage lines in Iowa, [illegible] lying within each distinct glacial area [illegible] peculiar to that area and the types of waterways built should be selected with reference to the topography. For illustration: in th at, monotonous stretches of the Wis- glacial region which lies in the north part of the state, the drainage areas the most part, flat and not well de- the channels quickly fill to overflowing arge percentage of the waterway must ned by raising the road grade above level. For such openings, the slab ough girder bridges offer the greatest of waterway with the least rise and n the construction of bridges in this e possibility of the ditch being incor- in a drainage district must always be against in planning a bridge. An is brought to mind of a practically ncrete bridge in Buena Vista county to be destroyed because the founda- ere not carried sufficiently deep when ted to provide against the deepening channel as part of a drainage district. e more rolling areas along the rivers east and west boundaries of the state, the streams have deep, sharply de- annels. During times of heavy storms ter rushes through the openings in the torrents that quickly scour under ndations unless they are protected by otings and floors. For these deeper the box culvert with ample floors and the slab or deck girder or arch with high rise are all applicable. In an drift area which covers a large f the southern part of the state, the t drainage channels generally exist and pes are all applicable to this section. pans up to about sixteen feet it prob- akes very little difference in the amount terial either of steel or concrete, re- to build a culvert of rather the above provided the depth of foundation and f waterway is the same. For spans feet and above, the character of the tion will have much to do with the de- ation of the economical structure. Yel- blue clay is about the best foundation s piling is used) that can be found in rity of the counties of the state and these can be reached at a depth of r four feet below the stream bed. On oundations, the form of construction s the slab or girder bridge, or for the spans, steel bridges with concrete seems to be desirable as the expan- int at each abutment will take care of pansion and contraction of the struc- s well as any settlement of the founda- thout causing material cracks.

of a Reinforced Concrete Flat Slab Building Floor to Determine Actual Stresses.

eries of tests to determine the actual [illegible] n a reinforced concrete building was ed by Prof. Arthur R. Lord in Engi- g & Contracting for Dec. 28, 1910. tests were, we believe, the first to been made in an actual building to de- ne stresses with something of the ac- of common laboratory methods. Re- a second series of similar tests has been made public and these tests are sum- [illegible] Engineering Society." The essential parts of this paper follow:

In brief the panels were loaded with pig iron in increments, and the accompanying deformations were measured in the steel and in the concrete at all critical points, with a view to fixing a safe limit of loading and to understanding the mechanical action of the structure.

[illegible]

ten-story and basement warehouse constructed by the Leonard Construction Co. for Mr. A. J. Franks. The building is used by the printing and paper trades, Dwight Bros. Paper Co. tenants. The type of construction used was the cantilever flat slab system, the reinforced concrete drawings and shop details being made by the Concrete Steel Products Co., Engineers, of Chicago. The architects of the building were Richard E. Schmidt, Garden and Martin. The design load on the floors was taken at 250 lbs. per square foot. The panel dimensions were 19 ft. 4 ins. x 20 ft. 3 ins. The four panels under observation were in the interior of the building and on the tenth floor where the columns were of minimum size. As the effective clear span between capital and the eccentric action on the columns were the greatest, the location was such as to insure the most severe test possible.

The diagonal reinforcement was 18½-in. round bars, 40 ft. long, spaced 5⅝ ins. on centers. The cross bands were composed of 16½-in. round bars, 44 ft. 6 ins. long, spaced 6⅜ ins. on centers. The slab thickness was 9¼ ins., and was increased to 13¼ ins. near the columns. The concrete mix was 1:2:4 in the floors and 1:1:2 in the columns.

Observer and Methods of Observation.—The observations were made by experienced observers as follows: Professor H. H. Scofield, of Purdue University; Professor W. A. Slater, of the University of Illinois Experiment Station; Mr. W. E. Ensign, of the University of Illinois Engineering Experiment Station, with the assistance of Professor L. W. Weeks, of Purdue University.

The deformations were determined by the use of extensometers of the type devised by Professor H. C. Berry, of the University of Pennsylvania, and a former pupil of the writer at Purdue University. On the steel a gage length of 10 ins. was used, which, with the multiplying lever in the instrument, gave direct readings of unit deformations of .00002 in. per inch, corresponding to stresses of 600 lbs. per square inch in the steel, and it was possible to estimate clearly fractions of this amount. On the concrete readings the gage length was 6 ins. and the direct reading of unit deformations was .000033 in., corresponding to a stress of 133 lbs. per square inch, and it was possible to estimate fractions of this amount with accuracy.

Errors in operating the instrument were reduced to a minimum by taking every reading at least five times, and by calibrating on a standard bar at frequent intervals. Four standard bars were used throughout the test, all of these being embedded in the concrete and subject to the same temperature changes as the rods in the test floor but free from any stress due to applied load. By reading on these bars between sets of five or six test readings the observations on the materials under test were freed from temperature differences and systematic errors.

The deflections were measured to .0001 in. by use of the deflectometer described in a previous test (Eng. & Contg., Dec. 28, 1910) for actual stresses.

Tensile deformations were measured throughout the test over 42 gage lengths on the steel reinforcing rods; compressive deformations in the concrete were measured over 26 gage lengths; deflections were observed at 24 points, and 27 other readings of deformations were taken throughout the test to study such phenomena as the arch and slab action, the distribution of stress, and the eccentric loading on the columns at the edges of the loaded area.

The obseravtions were arranged in groups, each designed to cover adequately some particular feature, and symmetrically located observations were obtained as a check in every case where possible, in order to cover variations in the quality of the concrete at different points.

It should be remarked that the results from the use of the Berry extensometer are reliable only after the observer has had considerable preliminary practice with this instrument. The holes in the steel bars must be carefully reamed, the instrument protected from the heat of the hands, and the contact points must be seated under uniform pressure. Observance of these requirements with multiplied observations, and frequent reference to the standard calibration bar are the conditions of success.

The conditions were exceptionally favorable to a satisfactory test. The building was practically completed at the time of test and the variation in temperature was very slight, being about 74° at the start of the test, dropping gradually and uniformly to 70°, and rising again at the end to 74°. The slab was poured on June 23, 1911, and was 64 days old when the maximum load of 624 lbs. per square foot of panel area was placed upon it.

Loading.—The amount of loading was determined by the weight of the pig iron as recorded on the weigh bills delivered by the teamsters, and was checked by weighing a number of piles of pig iron from the test load on a platform scales. The pig iron was piled on the floor in separate piers, each placed within a 2-ft. square, so that no arch action existed in the load itself to relieve the panel from moment. It was necessary to leave several of these squares vacant about columns and to leave an aisle between the columns to allow space for observations. The pig iron belonging on these vacant squares was distributed over the remaining squares of the same panel. It will be apparent that under this procedure the real load intensity, as affecting bending stresses and deflections, is the intensity of loading over the loaded area

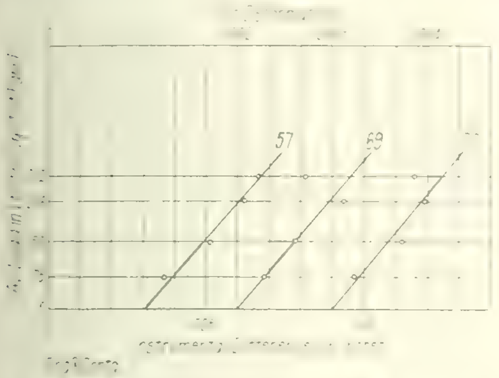

Fig. 1—Typical Curves Showing Relation Between Load and Deformation in Compression in Concrete.

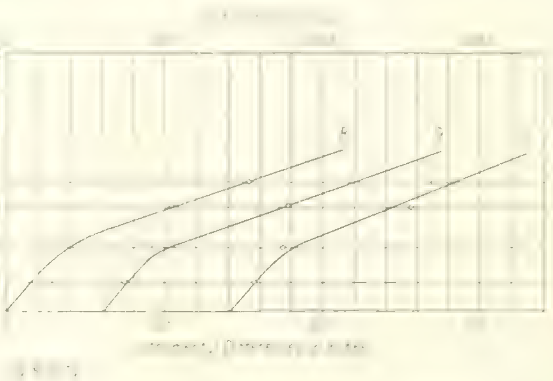

Fig. 2—Typical Curves Showing Relation Between Load and Deformation in Tension in Steel.

TABLE I.—CONDENSED SUMMARY OF ACTUAL STRESSES OBSERVED IN TEST OF A. J. FRANKS BUILDING.

(All stresses are [illegible] [illegible] [illegible] dead and live load, and are given in pounds per square inch.)

Average of Observation Nos.	Description	Live load, Lbs. per sq. ft. 256	312	624
	Stresses in Slab Rods.			
[illegible]	Center of span, diagonal band	1,071	1,320	[illegible]
8, 9, 10, 11, 12, 13.	Center of span, cross band	4,539	6,140	10,095
31, 32, 33, 34, 35, 37.	Over capital at center column, diagonal band	3,440	4,350	9,280
[illegible]	Over capital at center column, cross band	1,775	4,846	[illegible]
[illegible]	Over capital at corner column, diagonal band	1,920	[illegible]	[illegible]
24, 25, 26, 41, 42, 43.	Over capital at side column, cross band	2,690	3,138	5,315
	Compressive Stresses in Concrete.			
[illegible]	On panel at center column	[illegible]	[illegible]	[illegible]
61, 62, 65, 66.	On drop at center column	677	778	1,685
[illegible]	On drop at corner column	318	[illegible]	[illegible]
[illegible]	On slab at corner column	[illegible]	[illegible]	[illegible]
[illegible]	On slab at side columns	[illegible]	[illegible]	[illegible]
	Maximum Stresses in Columns Due to Eccentric Load			
104	Compression in concrete, corner column	680	840	1,660
109	Compression in concrete, side column	416	512	1,000
84	Tension in steel, corner column	4,980	6,000	11,620
99	Tension in steel, side column	2,220	2,640	5,880
	Deflection in Inches.			
121, 124.	Center of panel—at 6 hours	.123	.156	.475
	Center of panel—at 24 hours	....	....	.500
	After standing unloaded 6 hours	.142	....	....
	After standing unloaded 2½ days	.091	....	....

Note:—The loading of 256 and 312 pounds per square foot were on four adjacent panels. The loading of 624 pounds per square foot was on two panels adjoining diagonally.

(about 90 per cent of panel area), rather than the nominal or average load over the entire panel area.

All gage lengths were measured and checked throughout before loading was started. When the loading reached certain amounts, distributed evenly over four panels, it was discontinued and allowed to stand for six hours before the observations were made and the loading resumed. The increments of load at which measurements were made were as follows: 75 lbs., 150 lbs., 256 lbs. (the design load), 312 lbs. (tensity, 359), and 624 lbs. (intensity, 717) per square foot, the latter load being applied to two panels only adjoining diagonally. Readings were also taken with 256 lbs. on two diagonal panels and 312 lbs. on the other two panels, and with 468 lbs. on two diagonal panels and 156 lbs. on the others, but without waiting for the six-hour interval to elapse before taking readings. The total number of complete observations over single gage lengths was over 2,000 and the total individual readings over 10,000. The test occupied one week's time.

Stresses.—The stresses were determined from the observed deformations by using a modulus of elasticity of 30,000,000 lbs. per square inch for the steel, and 4,000,000 lbs. per square inch for the concrete. The latter value was determined from tests of three concrete prisms poured from the concrete in the test slab and tested at Purdue University at an age of 77 days.

Table I gives a summary of the corrected values of the total dead and live load stresses observed in the various groups of observations. The detailed summary of individual stresses at the various observation points are omitted in this report. After the observations had been corrected for temperature and observational errors, by use of the standard bar calibrations, load deformation curves were plotted for each observation point, the known nature of the load deformation curve under flexure being used as a basis. The dead load stress has been taken from these curves as equal to the stress caused by an equal live load. Typical load-deformation curves are shown in Figs. 1 and 2.

Comments on the Results.—The undersigned is not prepared at the present time to state the significance of the results obtained with respect to the mechanics of this form of construction. Such statements would be somewhat speculative, and should be separated from the report of test which is one of measured facts.

As compared with the design requirements of the Chicago Building Code, it is interesting to note that at design load the highest average stress in the steel is 5,078 lbs. per square inch (average of Obs. nos. 11, 12, 13), while the highest average compressive stress in the concrete is 677 lbs. per square inch. On the basis of safe working stress in the steel of 16,000 lbs. per square inch, and in the concrete of 35 per cent of the ultimate strength (which averaged over 3,250 lbs. by tests of prisms) or 1,100 lbs. per square inch, it appears that the steel is stressed to 31 per cent of its safe load, while the concrete is stressed to 62 per cent of its safe load. It appears, therefore, that the design is overbalanced with an excess of steel. At the highest applied load of 717 lbs. per square foot the ratio of the steel and concrete stresses remains practically unchanged.

The eccentric action of the test load was most marked on the corner columns of the loaded area, and was sufficient to produce a tension in the steel of 4,980 lbs. per square inch.

With respect to the strength of the structure, it may be said that a nominal load of 624 lbs. per square foot of panel, actually 717 lbs. per square foot of loaded surface, was applied without producing any permanent damage to the building. At this load the highest observed average total dead and live load stresses were less than 12,000 lbs. per square inch in the steel and less than 1,700 lbs. per square inch on the concrete.

Efficiency of Asiatic Labor.—The following table which is taken from the *Mining and Scientific Press* is based on the experience of H. F. Cole in the Philippines and the East. The rate of pay is given in U. S. currency and the efficiency is figured on the basis of the American mines taken as 100 per cent.

	Efficiency %	Rate of pay.
Russians	100	75c to $1
Koreans	[illegible]	[illegible]
Northern Chinese	70	10c to 20c
Southern Chinese	60	10c to 20c
Japanese	[illegible]	[illegible]
Javanese	[illegible]	[illegible]
Filipinos	40	50c to 75c

These figures are based on trained men in their own countries under average conditions. In the Federated Malay States the southern Chinese working for whites get from 25 to 40 cts (gold) per day, and in Sumatra the southern Chinese get the same as the Javanese. Much depends on the personality of the white foreman, in any case; and the advantage of the white laborer is that he uses his head, while, with the exception of the Korean, the others do not, except in some cases when they are contracting. This applies to underground work. There are good men among all of them, and if you have the time and patience, a good crew can be beaten out of most any material, but it is certainly wearing on the nerves of the white man, and not many of them can do it successfully.

In rock crushing machinery there is always danger of breakage by some object, st... hammer head or drill bit getting in th... feed. In jaw crushers the shaft is ... most liable to be deformed in this kind of an accident. This is sometimes prevented by making the bearing caps of light c... which readily break or else strip the threads of the bolts holding them in place. At the Talisman mine, at Tarangahake, N. Z., says the *Engineering & Mining Journal*, ... shear toggle plates are used in the m... Blake crushers. These plates are held tog... er by six 1-in. rivets. When an unusu... st... comes on the toggle the rivets will be ...e before any other part of the cr... strained to a degree that approaches ... of strength. An extra set of toggles ... kept at hand to replace those that are ... The sheared rivets can readily be bod... and the two pieces riveted together ag... making the toggle as good as new.

A useful aid in running a stoping dr... the *Engineering & Mining Journal,* is ... of steel three or four inches long, tap... at both ends. When it is desired to ... hole a few inches deeper than can ... with the longest bit, this is put in the ... the machine, thus adding its length ... effective length of the drill. After us... device a machine runner would not ... try to get along without it. At th... where this device was originated the ... few holes drilled where it is not us... cost is nothing except a few minutes time of the blacksmith.

The total amount of material excav... the Culebra Cut section of the centr... sion of the Panama Canal during the ... of January, 1912, was 1,416.35 cu. yds ... was the greatest record in that sect... the month of January, the next highe... for the corresponding month of 1911 ... 1,356,395 cu. yds. were removed. The ... mains to be excavated from this secti... per cent.

The Mississippi State Senate has passed the Walker bill creating a State Highway Department and establishing a State Highway C... mission, for the purpose of constru... system of good roads. The bill also ... the office of State Highway Engineer, ... thorizes state aid and creates a fu... makes an appropriation for carrying ... into effect.

A method of thawing frozen water ... to pack them with unslacked lime an... in old rags or carpet. Water is then ... over the pipe covered in this way a... heat generated in slacking the lime w... the ice in the pipes.

An oxy-acetylene plant was used ... overhauling of the dredge Caribbean at Pa... ma. The cost of the entire plant wa... during the one overhauling.

Drilling Under Water.—The performance of the drill barge "Teredo," operated throughout the year ending June 30, 1911, at Panama is given in the accompanying table:

Months.	Drilling Linear feet	Hours	Feet per hour.	Blasting Number of holes blasted.	Dynamite used. Pounds.
1910.					
July	[illegible]	[illegible]	[illegible]	129	2,408
August	[illegible]	[illegible]	6.6	264	[illegible]
September	3,953	664	[illegible]	261	4,771
October	[illegible]	[illegible]	[illegible]	297	5,534
November	[illegible]	[illegible]	[illegible]	[illegible]	6,634
December	4,395	592	7.4	311	5,874
1911.					
January	[illegible]	[illegible]	13.3	[illegible]	13,684
February	[illegible]	[illegible]	15.8	[illegible]	11,289
March	[illegible]	[illegible]	18.9	1,562	46,418
April	[illegible]	[illegible]	[illegible]	1,448	40,812
May	[illegible]	[illegible]	16.9	1,265	44,263
June	20,983	1,150	18.2	[illegible]	41,740
Total	[illegible]	[illegible]	12.1	8,238	[illegible]

NEWS SECTION

ditorial Comment — Personals — Society Meetings — Trade Notes — Catalog Reviews — Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

Comment — The Doings of the [illegible]
Something Doing — Drainage [illegible]
[illegible]

t Doings f the /eek. Developments of the past few days indicate that the railroads are beginning to get busy on their construction program for this year. In addition to the four good sized contracts noted re on this page, on which bids have been received, there are also a num- smaller pieces of work for which pro- have been asked. In Alabama the Chattahoochee Valley Ry. has ids on 21 miles of new line from w to Eufaula, Ala., and in Washing- Great Northern has taken bids for the 60 miles of new line from Wenat- [illegible] northeast to Pateros.

ng the railroad construction contracts ntly are the following: McGregor Rumford, Me., for building between vi, Me., and Kennebago for the Range- es & Megantic R. R., the work cover- niles of line; Clifton, Applegate & Co., la, Mont., and 507 Huton Bldg., Vash., for the grading work for the own extension of the Butte, Anaconda ic R. R., the contract covering 17 miles between the present western terminal road at Brown's spur, six miles west conda, and the Southern Cross mine at [illegible] H. O. & R. L. Culbertson, eller Bldg., Cleveland, O., for grading t Youngstown on the Lake Erie & R. R. (Pittsburg & Lake Erie R. R. he work covering 350,000 cu. yds. of ion and about 5,000 cu. yds. of con- he Cleary-White Construction Co., 17 alle St., Chicago, Ill., for all of the work for the St. Louis, Peoria & stern R. R., the new Chicago & rn line which is to tap the coal lying between Peoria and St. Louis; V. Flickwir, Roanoke, Va., for second ork from Evergreen, Va., to Phoebus, 2 miles, for the Norfolk & Western

siderable amount of river improvement y municipalities is now coming up. Y., is calling for bids for work 2 of the Buffalo River and Cazeno- improvement, the contract calling 1,500,000 cu. yds. of earth excava- me pile protection. In Dayton lation has been made to the City at immediate action be taken to nds for the work of straightening Miami River below Washington St. ted cost of the work is $450,000, of 4,100 would be for changing the d building levees, this work re- handling of 1,210,000 cu. yds. of

sized bridge job has been adver- our last issue. This work calls for [illegible] of the foundations and [illegible] the Bronx Viaduct, about 4,000 ft. nding from the crossing over the & Harlem R. R. to Bronx Kills, City. Bids will be received until arch 23, by Samuel Rea, President New York Connecting R. R., Penn- R. R. Station, New York City.

on a large revetment contract for the Government have been received at the U. S. Engineer's office at Kansas City, Mo. This work called for the construction of 13,000 lin. ft. of standard revetment at Waverly Bend, the low bidders being DeWitt & Shobe, Glasgow, Mo., at about $111,700.

Bids are now being taken for a good sized private grading job at St. Louis, Mo. The work calls for grading 60 acres of land west of Forest Park and south of Washington University, the excavation amounting to about 350,000 cu. yds. Bids will be opened at 2 p. m., March 15, by Julius Pitzman, 615 Chestnut St., St. Louis, Mo., the engineer in charge.

Louis Coste, Dominion Government Engineer, Ottawa, Ont., has reported favorably on the plan for the construction of a 3,000-ft. breakwater at Victoria, B. C., at a cost of $1,250,000 in preparation for the increased business expected on the completion of the Panama Canal.

Something Doing. [illegible] of contractors and supply men that 1912, despite the fact that it is a presidential year, will be an excellent one for railroad construction work. The happenings of the past two weeks indicate that this belief is not unfounded. In this time bids on four railroad contracts, calling for the expenditure of something like $20,000,000, have been taken. The largest of these is the one for the new cut-off line for the Delaware, Lackawanna & Western R. R. in Pennsylvania. The cut-off will call for the expenditure of $12,000,000 to 15,000,000. In California bids have been taken by the Southern Pacific for the construction of the Fernley & Lassen R. R., a new 150-mile line, extending from Fernley, Nevada, to a point in Lassen County, California, and costing $4,000,000 or $5,000,000. Another good contract, on which bids were opened March 4, was the one for the construction of the Chicago & Northwestern Ry. line which will tap the coal fields between Peoria and St. Louis. Some idea of this work can be had from the statement that it covers about 71 miles of line and includes 4,500,000 cu. yds. of excavation. A definite step toward the actual beginning of extensive construction work planned for New England by the Grand Trunk Ry. has been taken. Bids on the construction of the first 60 miles of the new line from Palmer, Mass., to Providence, R. I., were opened on March 7. The estimated cost of this first section is $1,500,000, of which $1,225,000 is for excavation and $1,200,000 for bridging. This new Grand Trunk line is the first large piece of railroad construction undertaken in New England for some years, and it marks the commencement of a new era in steam transportation development in that territory. In addition to the Palmer-Providence line, the Grand Trunk is planning to build from White River Junction, Vt., across the state of New Hampshire and down through Massachusetts to Boston. The Grand Trunk probably will also have work started shortly on a somewhat expensive 40 or 50-mile line from Windsor, Vt., to Brattleboro, Vt., paralleling the Boston & Maine R. R., and doing away with the necessity of using the tracks of the latter road between the points named. In return, the Boston & Maine, which uses the Grand Trunk tracks from South Vernon to Brattleboro, Vt., and from Windsor to White River Junction, has announced its intention of at once beginning work on the construction of lines of its own between these points.

Drainage Bond Decision. [illegible] portance with regard to the reclamation of land in Louisiana by drainage has been rendered by the Supreme Court of that state in the case of Manuel Cokuenheim vs. the Avoca Drainage District, which was designed to test the validity of bonds issued by the defendant for drainage purposes. At the session of the legislature in 1910 an act was passed proposing a constitutional amendment to confer upon drainage commissioners the power of levying taxes for the purposes of drainage without submitting the question to an election held by the people. This amendment was duly ratified and thereafter the legislature passed an act carrying out the purposes of the amendment. This act provided that whenever it was deemed advisable by the commissioners of a drainage district to drain certain lands by the construction of levees and pumping them that they could order the levy of a special tax for this purpose upon the petition by a majority of the land owners in number of acres who are taxpayers. It was provided that the commissioners should have the power to levy this tax for a period not exceeding forty years, and the levy was to be made annually, but was not to exceed $3.50 a year per acre. The plaintiff in the suit attacked the bonds issued by the drainage commissioners on the ground that the tax levied to pay them was unconstitutional because it conflicted with article 281 of the Constitution, but the court held that the amendment had changed this article, and while the legislature could not have conferred power upon the drainage commissioners to levy a tax under the Constitution as it formerly stood, under the amendment, which gave greater latitude to the commission, it could and therefore held that the board had the right to levy the tax without having the matter passed upon by the people at an election called for that purpose. The power of the board was attacked on the ground that the act was unconstitutional, as it did not properly express the purpose of the act, but the court brushed aside this objection, as well as the objection that the act took away from the property holders their property without due process of law. The court also held that the amendment to the Constitution was self-operative and that an act was not necessary to put it into execution and that the power of the board to levy such taxes was full and complete and that the bonds issued by them were valid bonds and secured by the taxes to be levied on the property in the drainage district. The commissioners had issued $300,000 of bonds and these will be sold in the open market at par and will furnish the needed funds for the work of reclaiming the wet lands in the Avoca Drainage District, which takes in a part of St. Mary Parish.

PERSONALS, TRADE NOTES AND TRADE CATALOGS

Personals.

Mr. Frank D. Kemp, Springfield, Mass., has reorganized the engineering department of the Massachusetts Highway Commission. The position of division engineer in the three western counties, including Berkshire, is to be abolished. This position was filled by Frank H. Joyner for many years until he went to Los Angeles. Since his departure S. A. Parsons has filled his position. These three divisions are to be divided into subdistricts with a resident engineer in each and will report to the Springfield office, with J. A. Johnson, Division Engineer, in charge. Mr. Johnson will in turn report to the Boston office. The two eastern divisions will remain as at present. Mr. Parsons will return to his former work in Boston. G. R. Brown, Assistant Division Engineer in Pittsfield, has resigned to take a position with the California State Highway, where he will go about April 1.

Mr. A. F. Blaisdell presided at the fifth annual banquet of the General Electric Plant Foremen's Association, which was held at the Wendell Hotel recently.

Mr. Jos. T. Richards, Jr., of Colera, has been appointed Road Engineer for Cecil county.

Mr. Vicente Saucedo, C. E., has resigned as Chief Engineer of the Monterey Water Works and Sewer Co. and of the Monterey Railway, Light & Power Co., and announces that he has opened offices for the general practice of engineering and will pay special attention to hydraulic work in irrigation, power development and land reclamation and to water supply and sewer systems. His offices are in the Banco Mercantile Bldg., Monterey, Calif.

Mr. Albert M. Brosius, who has been Principal Assistant Engineer for the new sewerage system of the city of Baltimore, has accepted a position as Chief Engineer of Sewerage and Paving in Havana, Cuba, on which work $14,000,000 is being spent. The position was offered him by President Gomez of Cuba. Mr. Brosius was formerly with the New York subway system and went with the Sewerage Commission of Baltimore in 1906. Before going to New York he was Assistant City Engineer of Baltimore and in charge of sewers during the administration of the late Mayor Malster. At the close of the Malster administration Mr. Brosius went to Houston, Texas, as an engineer on the sewerage work in that city. While in Houston he accepted a position in the New York subway system. Mr. Thos. D. Pitts has been appointed as his successor. Mr. Pitts has been a Division Engineer in charge of the office for nearly four years.

Mr. Wm. C. Williams resigned as Assistant Engineer with the Baltimore Sewerage Commission, where he was connected with the storm water drainage system. He has accepted a position as engineer on the New York Barge Canal at Rome, N. Y.

Mr. Paul D. Sargent, M. Am. Soc. C. E., Assistant Director, U. S. Office of Public Roads, on March 4 delivered a lecture on "Sand-Clay Roads and Oil-Cement-Concrete Pavements," before the graduate students in Highway Engineering at Columbia University.

Mr. F. E. Guy has been appointed Assistant Eastern Traffic Manager for the Universal Portland Cement Co., with an office at the Frick Bldg., Pittsburgh, Pa.

Trade Notes.

The Sandusky Portland Cement Co., Sandusky, Ohio, has received recently the following orders: 100,000 lbs. of Medusa waterproofing for use in the New York Dock Co.'s job at Atlantic Basin, Brooklyn; 5,000 bbls. Medusa waterproofed white portland cement for use in the Woolworth Building, New York City; 2,500 bbls. of Medusa gray cement for use in the Central High School building, Minneapolis, and 3,000 bbls. of Medusa white portland cement for use in the same building.

The Ruggles-Coles Engineering Co., 50 Church St., New York City, and McCormick Building, Chicago, has appointed the London Concrete Machinery Co., London, Ont., as its agents for the sale of the Ruggles-Coles portable dryer and heater for road work.

Mr. Frederick Maley, formerly with the Baldwin Locomotive Works, also the American Oxygen Co., has been appointed Superintendent of the Oxy-Acetylene Department of the Alexander Milburn Co. and will develop that firm's line of high and low pressure Oxy-Acetylene Welding and Cutting Apparatus. Mr. Maley is prepared to estimate on jobbing work in any part of the country.

The Alexander Milburn Co. of Baltimore, Md., has recently equipped several locomotive cranes of the Maryland Steel Co. at Sparrows Point, Md., with its new steam acetylene generator, which utilizes the waste steam from the boiler, supplying a number of search lights, and allowing night work to be carried on. The C. N. O. & T. P. Ry. have also equipped one of their industrial wrecking cranes with the same system.

The MacArthur Concrete Pile & Foundation Co., of 11 Pine St., New York City, has recently secured a contract for the foundations of immigration sheds at Quebec, Canada, for the Canadian Government. The foundation will consist of about 1,000 30-ft. piles of the pedestal concrete type. C. E. Deakin is the general contractor, and the architect is D. Ewart, Chief Architect, Public Works of Canada. The MacArthur Co. also announces that it recently secured the contract for the foundations of the Toledo Factories Building, Toledo, O. About 700 pedestal concrete piles will be used for this work. Schenck & Williams, of Dayton, Ohio, are the architects, and the T. A. Bentley & Sons Co. are the general contractors. Another contract recently secured by the company in Toledo is for the concrete pile foundations of the Toledo Plate & Window Glass Co. George S. Mills is the architect for this building.

Catalogs Worth Having.

Dam Construction.—Paper, 7x9 ins., 20 pp. Stone & Webster Engineering Corporation, Boston, Mass.

This artistic booklet gives an illustrated account of the construction of the Hauser-lake Dam.

Universal Cement.—Paper, 6x9 ins., 8 pp. The Universal Portland Cement Co., 72 W. Adams St., Chicago, Ill.

This booklet is published monthly in the interest of cement dealers and is entitled "The Universal Dealer."

Concrete Poles.—Paper, 3½x6 ins., 20 pp. Standard Cement Pole Company of America, 25 Broad St., New York City.

This booklet illustrates and describes the Rubello Santi System Cement Pole which is being used by the New York Central R. R.

Lea Turbine Pumps.—Paper, 6x9 ins., 16 pp. Lea Equipment Co., Wayne Junction, Philadelphia.

Bulletin K describes and illustrates Lea High Duty Turbine Pumps for all classes of service. Descriptions of parts are given with complete information as to details; a chart showing efficiency curves is also given.

Sectional Conduit.—Paper, 6x9 ins., 44 pp. The H. W. Johns Manville Company, New York City.

This catalog illustrates and describes J-M Sectional Conduit, a complete underground pipe covering system. A discussion of the saving made through t the material on hot pipes is ma construction of the material is and its method of application. R tests are given, including a comp saving effected by three types of underground steam system. Line showing installations occupy a n pages. Tables of dimensions, pri are given

The Clay Products Exposition.

The first annual International Brick and Clay Products' Exposition was held at the Coliseum, Chicago, March 7 to 12. The exhibits were of special interest to engineers, architects, contractors and builders.

One exhibit which attracted much comment was the one in which the r of several manufacturers were assebl form a complete sanitary house-drai tem. A modern bathroom equipped with fixtures was at the upper end of the ex The 6-in. vitrified pipe house connection, with a running trap, and jointed wit ite," was shown discharging into a sewer in the street. A Miller flush tank was installed and properly connected size manholes and catch-basins formed a part of the exhibit. These tenances were laid up with mortar, field, and were complete in every cluding castings.

A sewer in process of construction was shown. An Austin Trench excavator was placed at the end of the trench, which was sheeted by means of Wemlinger steel sheet piling. The piling was held to prop of trench by means of Kalamazoo braces. A small centrifugal pump, direct connected to an electric motor, pumped a actuate the flush tank. The discha the flush tank passed through a se line to the reservoir from which the pump was supplied.

There were several exhibits of full size sections of brick pavements, including Dunn's Wire-Cut-Lug brick pavement, vitrified pipe culverts with brick wing-walls, vitrified sewer pipe in all sizes of straight pipe and specials. The pipe testing machine of the Clay Products Publicity Bureau, capable of exerting an internal pressure of 100 lbs. p s was erected and on exhibition. The also two types of segmental vitrified block sewers built up in sections of 6 eter. Full size reinforced vitrified block si were on exhibition.

Among the things of interest to architects and builders may be mentioned the v ing display of terra cotta, pressed br colors, roofing tile, face brick, brick panels and faience.

A very popular feature of the exhibition was the brick bungalow which was erected on the concrete floor of the Coliseum. The building was built of the usual standard cor in every detail. A 4-ft. brick wall was built around the "lot" on which the stood. A coupon was given out to each person, paying admission, good for one chance on the bungalow. The building will be erected on some Chicago lot, and turned over some one, ready to occupy or to sell

An interesting feature in the annex was group of pictures of vitrified clay pe and conduits of great age. Everything in the of clay art products was shown. The Harvey collection of pottery, made by th dians in New Mexico, was on exhibiti collection is owned by the Santa Fe Every form of vase and flower pot beautiful designs and of all ages was Students from the Chicago Art Institute gave an exhibition of clay modeling.

The exposition was a success and it is to be hoped that a similar display of clay products will hereafter be made each year.

AILWAYS, STEAM AND ELECTRIC

Alabama.

ouisville & Nashville R. R. is re-
o have engineers in the field look-
prospective right of way for a line
Gadsden, Ala., and Chattanooga par-
the Alabama Great Southern, and
hrough DeKalb and Jackson counties,
, and Dade county, Georgia.
aid that the Atlanta & St. Andrews
R. is planning the construction of a
extension southeast from Dothan,
is reported that a portion of the
right of way has already been se-
B. W. Steele, Dothan, Ala., is Gen-
ager of the company.
oard of Trade of Tuscaloosa, Ala.,
inted a committee to receive subscrip-
stock for the surveys for the proposed
Northwestern R. R. This company
build a line from Tuscaloosa to a
n with the Georgia Pacific Ry.
ation has been made to the City
of Gadsden, Ala., for a franchise for
ic railroad from Gadsden to the Bell-
tel, on the top of Lookout Mountain.
is stated to have been financed. Louis
dsden, Ala., is the promoter.

Arizona.

been announced that work on the
s-Tucson line of the El Paso &
tern, general contract for which was
McArthur Bros. of Chicago and New
progressing very nicely. About 65
of the grading has been completed
greater part of the concrete work
ridges and culverts has already been
l. Quite a number of the concrete
rs have already finished their work
now getting ready to move their
other fields. Morris Ryan, who
f the largest concrete con-
en Fairbank and Mescal, has
pleted his contract work and
move his camp. Bloom
Myser, who also had a contract
se places, have completed their
vicinity of Contention and most
at Fairbank with the exception of
r the bridge at the San Pedro
ch they are working on night and
Beweitz Construction Co., which
grading contract from the point
e new grade leaves the old to the San
r. have completed all of that work
exception of the approach to the
while waiting for that took a new
the Moore cut-off, between the
and Fairbank, and have already
portion of that. The Moore Con-
., which had the contract for the
the new route between Lewis
Fairbanks, are progressing rapid-
work. The largest portion of the
work has been completed and the
owing up the easy pieces of grade
oing on for the past few weeks,
hes of a mile or more of this class
ng already completed.
Paso & Southwestern System, H.
, General Manager, El Paso, Tex.,
nary surveys under way north
n, Ariz. The route as outlined
gh Oracle, Monmouth, Dudleyville
kelman, thence up the Dripping
lley to the summit near Bellevue,
th of Miami. From Miami, it is
he line will be continued to Globe,
lbrook and Durango.
Council of Bisbee, Ariz., has
franchise to the Warren-Bisbee Ry.,
riz., for an extension of its street
Main St.

Arkansas.

een announced in Rogers, Ark., that
rk Land & Timber Co., recently or-
with a capital stock of $500,000, and George D. Locke, Rogers, Ark., President, will begin work shortly on a new railroad which will be built to open a tract of 13,000 acres of virgin timber in Benton, Washington and Madison Counties. A camp has already been established at the terminal at Monte Ne, where the new line will connect with the Kansas City & Memphis. The new road will necessitate a bridge over the White River, a difficult engineering feat. The tract of timber to be opened by this road is a rich one, and the company proposes putting in large lumber mills as soon as the railroad crosses the river.

City Council of Van Buren, Ark., has granted a 45-year franchise to the Fort Smith Light & Traction Co., Fort Smith, to extend its car lines from Fort Smith to that city. The company has already secured a franchise to use the Fort Smith and Van Buren new steel bridge to enter the Clay county city.

California.

The Southern Pacific Co., W. Hood, Chief Engineer, San Francisco, Cal., has taken bids for the construction of the Fernley & Lassen R. R., a 124-mile line, which is to extend from Fernley in Nevada, to a point in Lassen County, California. This line will cost from $4,500,000 to $5,000,000. This Fernley branch is part of the extensive system that has been planned for northeastern California. A total of 746 miles of new road is projected, at a total estimated cost of $30,000,000. These branches are the California Northeastern, from Weed, on the Shasta Route, to Klamath Falls, which has already been constructed; the Oregon Eastern, building from Klamath Falls to Natron, on the Shasta Route in Oregon; the Modoc Northern, the Goose Lake & Southern, and the Chico & Northern.

City Engineer Homer Hamlin of Los Angeles has submitted estimates to the council of that city covering the cost of constructing a double-track three-rail railway municipal system on San Pedro St., from Fifth to Aliso St. and a double track narrow gage system from Aliso St. to the Piaza, when that portion of San Pedro St. shall have been opened and widened. The estimates place the cost of these proposed lines at about $150,700.

It is reported that the new railroad connecting the big lime quarries at Cool, El Dorado County, with the Southern Pacific Ry. at Auburn, Calif., is nearing completion.

The Trustees of the Chamber of Commerce, Stockton, Calif., have passed a resolution favoring the construction of a municipally-owned railroad along the water front.

R. W. Morgan, Hanford, Calif., who has the grading contract on the H. & S. L. R. R., has completed the work through the swamps on the Burrel tract and is working on another 8-mile section, which will complete the grading on the Riverdale-Jameson extension.

The Mallon-Yohe Co., Inc., Princeton, Calif., contractors for the construction of the Colusa & Hamilton R. R. of the Southern Pacific, are rushing the grading between Princeton and Colusa, Calif. There are now five camps located between the two cities. One is near Colusa. There are three more crews of men at work between Princeton and Hamilton City, making eight in all. A number of steam shovels are being used in the work, and a large amount of earth is being moved each day. Hundreds of head of horses are used in the work. So far as can be learned little work has been done on the south end of the road between Grimes and Harrington

It has been announced by W. R. Alberger Oakland, Calif., Supt. of the Key Route, that surveys are under way and right of way is being secured for the construction of an extension to the line from Berkeley, Calif., to Richmond.

The California Terminal Co. has filed with the Marin County Clerk, San Rafael, Calif., condemnation proceedings to secure a portion of the necessary right of way of the proposed road extending from Point San Pedro to Sacramento, Calif., a distance of 118 miles.

The San Diego & Southeastern Ry. Co. has filed articles of incorporation with a subscribed capital stock of $5,000,000. The incorporators are John D. Spreckles, San Francisco, Calif.; Adolph Spreckles, San Francisco, Calif., and R. C. Gillis, Los Angeles, Calif. The new company announces the acquisition of the San Diego Southern Ry. Co. and the San Diego & Cuyamaca R. R. Co., which are to be merged. The articles announce that it is the purpose of the new company to extend its lines as far as Los Angeles on the north, and Ensenada, Lower California, on the south, to be operated by electricity, or any other lawful power. The San Diego Southern R. R. now operates a line to Tia Juana, 18 miles, and the Coronado Belt Line, 25 miles in length. The line of the San Diego & Cuyamaca Ry. Co. extends from San Diego to Foster, a distance of 26 miles.

Colorado.

A meeting will be held in the offices of the Rock Island R. R. in Chicago on March 22 of the engineers of the various railroads interested in the Denver Union Depot Co. for the adoption of a new terminal plan. It is expected that at the meeting the problem of improved trackage facilities will be definitely solved. Since the last meeting of the engineers three additional plans have been drawn by C. C. Post of Omaha, in which the suggestions of the engineers at that gathering have been incorporated. It is likely that the terminal rearrangement will involve the expenditure of about $1,000,000 regardless of what plan is adopted.

The Denver, Laramie & Northwestern R. R., Wm. D. Hodge, Chief Engineer, Denver, Colo., has completed arrangements with parties to furnish money to go ahead with its extension work. The work will probably not be started before April.

It is announced that the city of Lamar, Colo., has 20 acres of land for city terminals and right of way between Two Butts, Colo., and Lamar, besides a reasonable bonus to offer any railroad building to that place.

Idaho.

There is good reason to believe that construction work will be started in the next two months on the extension of the Gilmore & Pittsburg R. R. T. H. Bacon, Chief Engineer, Armstead, Mont., west of Salmon City, Idaho, toward Lewiston.

The Oregon Short Line R. R. is reported to have taken up the option which it has been holding for some time past on what is known as the Idaho Southern Ry. This line operates now between Gooding and Jerome on the north side of the Snake River and between Milner and Oakley on the south side. The original survey of this line extends through to a point in Nevada on the Western Pacific, and another takes it further east to connect with the Eccles line between Salt Lake City and Ogden, Utah. It was the original intention of the promoters to make it an electric line throughout, and later to extend it further north and west.

The Idaho Falls Electric Ry. Co. has completed surveys for its projected 40-mile line, the route of which is from Idaho Falls south to Goshen and north to Heise. The construction contract has not been let, nor has any date been set for receiving bids. J. L. Milner, Idaho Falls, Idaho, is President and J. W. Springer, Idaho Falls, is Chief Engineer. H. S. Sewell, Idaho Falls, is Secretary.

Illinois.

⊙The Cleary-White Construction Co., 17 N. La Salle St., Chicago, Ill., has been awarded the contract for all of the masonry work

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

for the St. Louis [illegible] Western R. R., the new Chicago & Northwestern line which is to tap the coal regions lying between Peoria and St. Louis. Bids on this work, as well as on the grading, were opened on March 4

⦿The J. A. Flack Construction Co., Deshler, O., has been awarded the contract for grading for the line of Kankakee & Urbana Traction Co., from Urbana to Rantoul, 14 miles. The work includes 31,105 cu. yds. of excavtion, 58,920 cu. yds. embankment, 30,245 cu. yds. barrow and 63,670 cu. yds. over haul, hauled 100 ft.

⦿Winston Bros., Globe Bldg., Minneapolis, Minn., have been awarded the contract for the grading for the new Chicago & Northwestern line which will tap the coal field between Peoria and St. Louis. The work calls for about 4,500,000 cu. yds. of grading.

⦿Frank A. Hawley, Urbana, Ill., has been awarded the contract at $2,250 for the concrete abutments for the first section of the line of the Kankakee & Urbana Traction Co., of which George K. Linton, Flat Iron Bldg., Urbana, is Secretary.

Articles of incorporation have been filed by the Elgin Terminal Railway Co., Elgin, Ill., with a capital stock of $2,500. The new corporation proposes the construction of a railroad from a point in Will County through Kendall, Kane, Cook and Lake Counties. The incorporators and first board of directors are D. C. Dunlap, C. F. Dunlap, Henry L. Rice, Robert S. McCreedy and G. A. Bergtold, all of Chicago, Ill.

The stockholders of the Toledo, St. Louis & New Orleans R. R. Co. have authorized the sale and conveyance of the main line from Effingham to Carmi, together with a branch line from Clay City to Benton, to the Chicago, Paducah & Thebes Ry. Co. The sale of the main line from Carmi to Brookport to the Gulf Lines Connecting Co. of Illinois was also ratified. The new companies are backed by St. Louis and East St. Louis capitalists. It is claimed that both these lines will be built and equipped by the time the Panama Canal is completed, as several roads are seeking outlets to the gulf coast.

Indiana.

The Evansville, Chrisney & Eastern Ry. Co., which is planning the construction of an electric railway for Boonville to Chrisney, has elected the following officers: President, J. P. Chrisney; vice president, former United States Senator James A. Hemenway; secretary, M. A. Abbot; treasurer, Fred Bergman; directors, James A. Hemenway, T. P. Tillman, Fred Bergman, E. E. Watts and J. P. Chrisney.

The Baltimore & Ohio R. R. is planning to have work started the first of next month on its contemplated improvements at Garrett, Ind. These will include a roundhouse, turntable and pits, and the enlargement of the shops.

Alex McGavock, Beloit, Wis., has completed his work on the Erie R. R., and one of his outfits, consisting of two steam shovels, cars, etc., is now stored at Hammond, Ind., ready to move onto some other job.

Iowa.

The Keokuk, Nauvoo & Fort Madison Electric Co. has issued $450,000 worth of 5 per cent bonds to build its interurban line through Lee County, Iowa, and Hancock County, Illinois.

Kansas.

The Interurban Construction Co., O. A. Boyle, President, Wichita, Kan., a subsidiary company of the Arkansas Valley Interurban Ry., will shortly start preliminary surveys for extensions.

The Union Traction Co., D. H. Siggins, President, Coffeyville, Kan., is reported to be planning to have work started this month on its extension from Cherryvale to Parsons.

Kentucky.

About 9 miles of track have been laid on the proposed new line of the Shelby Creek R. R. in Kentucky connecting with the Consolidated Coal Co.'s property at Jenkins, Ky., and it is hoped to have the road open for operation by July.

The Morehead & North Fork R. R., of Clearfield, has filed new articles of incorporation with a capital stock of $500,00. The road at present is operating 30 miles of line. A. W. Lee, Clearfield, Pa., is Vice President, and G. H. Gearhart, Clearfield, Ky., is General Manager.

A resolution has been adopted by the legislature for the appointment of a commission of senators and representatives to investigate the proposition to have the electric street car line in Frankfort extended nearer to the State Capitol, and appropriating $1,000 for the carrying out of the plan. The Kentucky Traction & Terminal Co., Lexington, Ky., operates the car line at Frankfort.

Louisiana.

The Franklin & Abbeville Ry., W. Y. Kemper, Chief Engineer, Franklin, La., is considering building an extension from Milton, the present terminus on the Vermilion River, through the First and Second Wards of Lafayette Parish to some point in the First Ward not yet agreed upon. It is stated that if the proper encouragement is forthcoming, the extension will be made and a bridge built across the Vermilion at Milton. A tax levy will be asked in favor of the proposed extension.

It is believed that the Franklin & Abbeyville Ry. has under consideration a plan to extend its line from Milton, La., the present terminus on the Vermilion River, through the First and Second Wards of Lafayette Parish to some point in the First Ward. If the work is undertaken, it will be necessary to build a bridge over the Vermilion River. Jules Godchaux, Raceland, La., is General Manager of the railroad.

Maine.

⦿McGregor Bros., Rumford, Me., have been awarded the contract for building a railroad between Oquossoc and Kennebago for the Rangeley Lakes & Megantic R. R., a Maine Central R. R. line. The work covers about 11 miles of line.

The Maine Central R. R. is having surveys made north of Kenio Station under the charter granted the Somerset Ry. in 1905. These surveys are probably being made for use as information for the future. It is not believed that any action looking toward building will be taken very soon by the railroad company.

Maryland.

Advices from Cumberland, Md., state that the John B. Carter Construction Co., 712 Keystone Bldg., Pittsburgh, Pa., having completed its contract on the Western Maryland Ry. extension as far as the Big Savage tunnel, has removed its outfit to the Knobmont yards of the railroad near Cumberland, where dump-cars, steam shovels, engines, etc., are being overhauled preparatory to removing to another contract.

Massachusetts.

Construction work will probably be started this spring or summer on the proposed electric railway of the Boston & Eastern R. R. This company proposes a line from Post Office Sq., Boston, through East Boston, Revere, Lynn, Salem and Beverly. It will run over a private right of way. John H. Bickford, 110 State St., Boston, Mass., is Chief Engineer.

The Boston & Providence R. R. (New Haven & Hartford Line) has signified before a legislative committee that it is willing to finance the proposed electrification of its line by a bond issue of $6,000,000.

The State Railroad Commission has approved the petition of the Milford, Attleboro & Woonsocket Street Ry. Co., Milford, Mass., for authority to issue $50,000 20-year 5 per cent bonds.

Michigan.

The Port Huron & Northern Ry. Co. has filed its articles of incorporation. This company as previously noted in these planning the construction of a 5 road from Port Huron northwar shore of Lake Huron, through keport Lexington; then to Croswell and er pla with Sandusky as the terminus the section. William E. Bolles, 501 Wyne Bldg., Detroit, Mich., is Treasurer.

Minnesota.

⦿Helmer Bros., Chisholm, Minn have awarded the contract for 25,000 rst ties and 25,000 ft. of piling for e Me Electric R. R. The Duluth Tracti Co., luth, has the general contract for urnis the ties for this road. John Runqu t, Du as noted in our last issue, has the nstruc contract.

The Canadian Northern Ry. is ann relay 100 miles of track on its li Ranier and Virginia, Minn. Mu stretch is in low swampy territory.

Missouri.

The Springfield & Western R. just completed the permanent su first section of the Springfield-J which takes it to Paris Springs, i County, the well known summe re Southwest Missouri. It is 28 mi Springfield. M. M. Hollenback, Mo., is Chief Engineer.

Montana.

⦿Clifton, Applegate & Co., of Mont., and 507 Huton Bldg., Spok have been awarded the contract fo ing work for the Georgetown exte Butte, Anaconda & Pacific R. R. tract covers 17 miles of grading b present western terminal of the Brown's spur, six miles west of and the Southern Cross mine at the proposed destination of the ext work includes 10 bridges. The gr will cost about $200,000.

The Flathead Power & Tracti Polson, Mont., has filed its articles ration at Missoula. This company tal stock of $150,000, of which $ been subscribed. It proposes the c of an electric line from Polson to D incorporators and directors are F. R. M. Stritzel, T. R. Arnold, F. M. A. Myhre and A. W. Pipes, all

New Jersey.

The Jersey Central Traction Co N. J., has applied to the Borough Red Bank, N. J., for a franchise car line on Mechanic and Spring company wants to extend its line Bank to Long Branch and needs the two streets named. It will r private right of way from the bor to Long Branch and then down that place.

New York.

Application has been made to Board of Hempstead by Edward C. a franchise for a trolley line connect stead Village and Baldwin. The be on South Franklin St. in the Hempstead and on the Baldwin Rd.

North Carolina.

The Yadkin River R. R. Co., the tion of which was mentioned in o issue, proposes the construction of line from a connection with the S R. at North Wilkesboro up the Ya to the mouth of Elk Creek. From the line will follow Elk Creek through Cooks Gap to Boone. S now being made. The capital for c has been secured and the work will company forces. W. J. Grandin, Ti is President and H. C. Landon, Nor boro, N. C., is Chief Engineer.

It has been announced by W. A. General Manager of the Golds Springs & Swansboro R. R., Goldsb that good progress is being made the necessary right of way and t

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

, Engineer in charge of the surveying has about completed that part of the mary work. According to the survey Goldsboro, N. C., to Seven Springs, 3 has been cut off the distance by the road, which is 16 miles, the Golds- seven Springs & Swansboro R. R. mak in 13 miles. It will cross the Neuse 3 miles above Seven Springs, from it runs by White Hall 13½ miles to ill and thence 14 miles to Richlands the estimated 12½ miles from Richlands ksonville and 17 miles from there to oro, the line complete will be 70 miles. Pritchard, Swansboro, N. C., is Presi

B. McCanless, President of the new sry & Monroe R. R. Co., recently con- with officials of the Seaboard Air Line regard to making connections with at the Union depot at Monroe, N. ngineers are now going over the pro- of the new line and it is expected tual construction work will be started

ncers of the Elkin & Alleghany R. R. an two surveys for the construction of posed line and steps are being taken commencing construction work im- At a meeting of the Board of rs at Raleigh, N. C., J. A. Mills was President; H. G. Chatham, First Vice- ent; J. C. Smoot, Second Vice-Presi- nd Alex. Chatham, Jr., Secretary-Treas-

Stone Mountain R. R. has two lines d, one branching off the Southern at g River Station and following the river mountain near Trip Hill, and the other nching off from the E. & A. at Roar- hotel. G. W. Hinshaw, Winston- N. C., is interested.

North Dakota.

s in the vicinity of Lawton have a preliminary organization looking ing of the construction of a branch Devils Lake & Northern R. R., Jos. M. President, Devils Lake, N. Dak., from er place to Edmore.

Ohio.

O. & R. L. Culbertson, Rockefeller Cleveland, O., have been awarded the t for grading work at Youngstown on ke Erie & Eastern R. R. (Pittsburg & rie R. R. line). The work covers about cu. yds. of excavation and about 5,000 of concrete

nance is before the City Council of nd to provide a $440,000 bond issue for 's share of the cost of the Big Four grade crossing separation work at W. , Cleveland. The work will cost about , of which the railroad will pay 65 per

are being taken to organize a com- build a new interurban line from De- along the old Wabash and Erie canal Haven, from which point it is planned its cars into Fort Wayne by way of io Electric tracks. K. B. Haymaker, e, O., is the promoter.

case of the Lake Shore & Michigan Co. against Port Clinton for new right through the corporation has been in common pleas court. Over $1,000,- l be spent at Port Clinton in improv- Lake Shore system.

Oklahoma.

es of incorporation have been filed with retary of State, Oklahoma City, Okla., Fort Smith & Wilburton R. R. It is d to build a line from Arkoma, Le ounty, to Wilburton, in Latimer Coun- a., a distance of 50 miles. According incorporation papers the road is to be cted at a cost of $8,000 a mile. M. C. mes A. Burke, C. T. Kinney, John of Fort Smith, Ark., and J. E. Rey- nd M. W. Murray of Arkoma, are pro- the enterprise, and the main offices road will be maintained at Arkoma.

C[illegible] the railroad proposition mentioned in our last issue, and have unanimously voted to raise $2[illegible] ter in the direction of Ada, Okla., a distance of about [illegible] to draw up the articles of incorporation. The road will [illegible] contractor of Fort Smith, Ark. The line when completed will connect the Missouri, Oklahoma & Gulf, Oklahoma Central, Frisco and S[illegible]

The Bartlesville Interurban Ry. Co., Bartlesville, Okla., has announced its intention of extending its line from Dewey, the present terminus, [illegible]

The Shawnee-Oklahoma Interurban Ry. Co., C. T. Edwards, President, Shawnee, is understood [illegible] for financing its 40 miles of new line, and it is believed that construction work will be under way by May 1. This line is to run through Dale [illegible] homa City.

Oregon.

The Oregon & Southern Ry. Co., projecting a 180-mile electric line in southern Oregon between Ashland, Roseburg and Marshfield, is reported to be about ready to let contracts for the first 63 miles of its road. The officers of the company are J. A. Doyle of Medford, Ore., president; George Godfrey, Spokane, treasurer; H. M. Farren, Medford, director of maintenance; J. R. Mitchell of Spokane, chief engineer, and L. N. Rosenbaum of Seattle, general counsel.

The Portland Railway, Light & Power Co., Portland, Ore., has offered for sale $16,000,000 worth of a new $75,000,000 bond issue. Of the amount offered for sale a part will be used to take up existing bonds of the Oregon Water Power Co. and the Portland General Electric Co., both of which concerns were merged with the Portland Railway, Light & Power Co. when the latter corporation was organized. Between $2,000,000 and $4,000,000 will be available for improvements already planned for construction this year.

Arrangements have been made with the engineering department of the Oregon-Washington Railroad & Navigation Co. for the construction of a spur track from The Dalles, Ore., to the amusement park, where the annual fair is held.

Advices from Merlin, Ore., state that representatives of the West Coast R. R. are working in that vicinity securing right of way for the proposed railroad from that point to Coos Bay and eventually through Jackson County. It is learned that they already have secured the right of way from Coos Bay to within a few miles of Merlin. The contracts call for the road to be completed within two years from date.

Deeds for right of way and railroad grounds at La Pine, 30 miles south of Bend, Ore., have been filed at Prineville, and it is believed that work on the extension of the Oregon-Washington R. R. & Navigation Co.'s line to La Pine will be commenced this summer. Ralph Budd, Portland, Ore., is Chief Engineer.

Pennsylvania.

◉McMenamin & Sims, 415 Arcade Bldg., Philadelphia, Pa., as noted in our last issue, have been awarded a contract for additional track work on the Sunbury Division of the Pennsylvania R. R. The contract includes about 8,000 cu. yds. earth excavation from K. D. tower to Kipps Run, 100,000 cu. yds. earth excavation on the part to West End Pond Hill siding and 200,000 cu. yds. excavation from Pond Hill siding to Honey Pond yard. About 8,000 cu. yds. of embankment and 3,500 cu. yds. of concrete masonry are also included. None of the work is to be sublet.

Borough Council of West Chester has granted a franchise to the Philadelphia & West Chester Traction Co., Upper Darby, Pa., for extending its tracks on North Walnut St. to the proposed new freight station.

Surveys have been about completed for the proposed electric railway from Spring City to Sanatoga, via Linfield and Parkerford. C. T. Leland, Philadelphia, Pa., is interested.

The Pennsylvania R. R., Alex C. Shand, Philadelphia, Pa., has approved the plans for a modern grain elevator to be erected at Girard Point, Philadelphia, and the di[illegible] the [illegible] sum necessary to erect the structure. It will probably cost $1,000,000. The erection of this elevator is the first practical move of the Pennsylvania in a comprehensive plan to rehabilitate its terminal facilities along the water front. These plans, which involve the expenditure of several million dollars, have [illegible] by the company's engineers and will be started as soon as the railroad finds itself in a position to go ahead with the work. The changes involve extensive improvements at Washington Ave., including a new pier for transatlantic purposes. The company also contemplates erecting a modern pier for the exclusive handling of iron ore cargoes so as to compete more evenly with the Reading's pier at Port Richmond.

Representatives of the Pittsburg Ry. Co., F. Uhlenhart, Jr., Chief Engineer, 435 Sixth Ave., Pittsburgh, Pa., have announced to the City Council of Pittsburgh, Pa., the company's improvement program, which is authorized to be completed within two years. The company proposes to spend $5,881,000 on improvements and extensions, including track elevation, power houses, bridge reconstruction and new rolling stock. The plan includes the purchase of 200 more steel cars, an increase of the present power plant capacity of 25 per cent, and the reconstruction of 70 miles of track. The first of the improvements are already financed and the stockholders are called to meet April 29 to vote on increasing the capital stock from $48,000,000 to $73,000,000, to take care of the railways, gas and electric extensions.

The Pottstown & Phoenixville Ry. Co., C. Taylor Leland, Secretary, 2215 Land Title Bldg., Philadelphia, Pa., is understood to be planning to begin work in the spring on the electric road which is intended to unite the Pottstown and Reading Street Ry. and the Montgomery & Chester County Traction line. The Pottstown & Phoenixville Ry. will probably be made the parent company, the interests named being under the same control. According to the plans, the holding company will have $1,000,000 capital stock, of which $500,000 will be issued, and put out $1,000,000 first and refunding mortgage 5 per cent bonds to retire liens on the two underlying companies and provide for construction work. The proposed line will go through Pottstown, Royersford, Spring City, Phoenixville and Valley Forge.

There is a report, which cannot be confirmed, that the Bessemer & Lake Erie R. R. is negotiating the sale of the Western Allegheny R. R. to the Canadian Pacific Ry. The Bessemer & Lake Erie R. R. is a subsidiary of the United States Steel Corporation, owning stock control of the Western Allegheny, which runs through rich coal regions from Newcastle to Dewey, Pa., and is itself the owner of considerable coal property.

The Pennsylvania R. R. has agreed to the placing of tunnels under the railroad between Braddock and North Braddock to eliminate grade crossings in certain streets. The railroad company is to do the work of placing the tunnels in Ajax St. and Verona Ct., and that of placing a foot bridge over the railroad tracks to Frazier St., Braddock, for use of parochial school students from North Braddock.

The Buffalo, Rochester & Pittsburgh Ry. is, according to reports, arranging to build a 4-mile extension in Indiana County touching Jacksonville, Pa. E. F. Robinson, Rochester, N. Y., is Chief Engineer. It is understood that bids on this work have already been received.

It is reported that engineers of the Philadelphia & Reading Ry. are now preparing plans for the elevation of its tracks through Manayunk, Pa., a suburb of Philadelphia. The improvement [illegible] h will eliminate all grade

✣ indicates work now open for bids. ◉ indicates a contract let recently.

crossings, will require an expenditure of about $2,000,000.

South Dakota.

At a recent meeting of the Board of Directors of the Rapid City, Black Hills & Western R. R. it was decided to expend the surplus earnings of the road for three years on improvements. The proposition to build a line west from Mystic, S. Dak., will be favorably considered providing the property owners along the line offer sufficient encouragement. H. A. Brome, Rapid City, S. Dak., is General Manager of the company.

It is probable that the Chicago & Northwestern Ry. will this season construct the branch from Iroquois to Doland. The right of way has been purchased and paid for, and it is believed the work of construction will commence as soon as spring opens.

Tennessee.

⊙Walton & Co., Fall Mills, Va., as noted in our last issue, have a contract for work on the Lewisburg & Northern line of the Louisville & Nashville R. R. The work is located 12 miles north of Lewisburg, Tenn., and includes 50,000 cu. yds. earth excavation, 250,000 cu. yds. rock excavation, a 1,500-ft. double-track rock tunnel and about 10,000 cu. yds. of concrete masonry. None of this work is to be sublet.

⊙Walton, McDowell Co., Brentwood, Tenn., as previously noted in these columns, have the contract for constructing 19½ miles of roadbed for the Lewisburg & Northern line of the Louisville & Nashville R. R. This contract begins at Nashville and extends north. It includes about 400,000 cu. yds. earth excavation, 800,000 cu. yds. of rock excavation and 10,000 cu. yds. of concrete ma-

Texas.

⊙The Frisco Lines have closed a contract with W. D. Haden of Galveston for 100,000 yds. of shell to be delivered at Seadrift on the Port O'Connor branch. This shell will be used in ballasting the north end of the Brownsville line. It will be dredged in the bays near Seadrift and unloaded from barges at that place and from there hauled over the line. A deal has also been consummated whereby the Brownsville line will secure a gravel pit near Sam Fordyce. The gravel will be used in ballasting the lower end of the line.

The Trinity Valley Traction Co. has completed surveys for its projected line and has secured the capital for its construction. Contracts have not been let as yet, nor is the company ready to ask for bids. The projected length of this line is 120 miles and its route takes in Dallas, Waxahachie, Corsicana and Palestine, Tex. J. V. Watkins, Dallas, Tex., is President.

A conference was recently held at Dallas, Texas, between Joseph J. Jermyn, President of the Gulf, Texas & Western Ry. Co., Ben B. Cain, Vice President and General Manager, and W. Frank Knox, Treasurer and General Secretary, for the purpose of making final arrangements for the extension of the road south from Jacksboro, Texas, to Oran or Salesville, with a view of getting a connection with Weatherford and Mineral Wells.

At the annual meeting of the Fort Worth & Rio Grande Ry. (Frisco line) to be held on April 2, one of the items of business will be to increase the capital stock of the Brownwood North & South R. R., from $30,000 to $225,000. It is understood that the additional capital is to provide for the projected extensions.

The annual budget of the Santa Fe System provides for the following expenditure on the Gulf, Colorado & Santa Fe Ry., F. Merritt, Chief Engineer, Galveston, Tex.: Terminal yards, $326,000; protection of banks, grade revisions, etc., $133,000; track fastenings and appurtenances, $123,000, water and fuel stations $117,000, increased weight of rail $75,000; bridges, trestles and culverts, $61,000; elimination of grade crossings $55,000, block and other signal apparatus $7,000, station buildings and fixtures $88,000; shops, engine houses and turn tables, $59,000. The line between Duke and Sealy is to be increased in weight from 65-lb. steel rail to rail of 90-lb. steel, this item making up a total of $75,000. The 65-lb. steel will be removed and relaid on a section north of Beaumont on the Beaumont division, some also going on the Gulf & Interstate. The section of track between Temple and Cleburne will come in for betterments in protection to banks and grade division, this appropriation totaling $83,000, while the track between Cleburne and Gainesville and from Gainesville to Red is to get work of the same nature at a cost of approximately $50,000. Among betterments is an item of $5,000 for shop machinery and tools at Galveston; a $2,000 wooden tank for water in the west yards, Galveston, a $5,000 steel tank at Hitchcock, another $5,000 steel tank at Sealy, an appropriation of $5,000 for drainage at Alvin and an appropriation of $2,000 for similar purposes at Rosenberg.

The Stamford & Eastern R. R. has about completed location surveys and it is understood that grading work will be started at once. P. G. Burns, Houston, Tex., is Chief Engineer.

The Palacios, San Antonio & Pecos Valley Ry. has completed surveys and has secured the capital for the construction of its projected 75-mile line from Palacios to Yoakum. Construction contracts will be let as soon as all right of way is secured. J. P. Pierce, Palacios, Tex., is President and H. L. Montandon, Palacios, is General Manager.

A plan is under consideration for the construction of an interurban line from La Grange to Bellville. Charles L. Langhammer, Bellville, and George E. Lenert, La Grange, are interested.

All of the towns between Dallas and Greenville and Greenville and Wolfe City have now granted franchises to the Eastern Texas Traction Co. for its proposed interurban line. Maj. Joseph F. Nichols, Greenville, Tex., is President.

Utah.

It is rumored that a party of English and American capitalists have under consideration the organization of a company to build a railroad from Salt Lake City to San Francisco and eastward from Salt Lake to a connection with the Denver, Northwestern & Pacific, at Steamboat Springs. Those said to be interested in this proposition are: Thomas Lipton, William Spry, Governor of Utah, Frederick K. Brind, former State Engineer, of Utah, and Rudolph Spreckles of San Francisco, Cal.

Work is being rushed on the double tracking of the Oregon Short Line R. R. between Salt Lake City and Ogden, Utah, and it is expected that the new line will be open for operation by May 1.

The directors of the San Pedro, Los Angeles & Salt Lake R. R., E. G. Tilton, Chief Engineer, Los Angeles, Cal., has ratified the action of the stockholders in authorizing a bond issue of $70,000,000. A former issue of bonds to the amount of $60,000,000 will be retired and $48,355,000 of bonds sold will be redeemed out of the proceeds of the new issue. There will remain $21,665,000 for improvements and extensions. One extension already announced is a 10-mile branch to Ophir mining camp in Utah.

The Utah Coal R. R. Co., the incorporation of which was mentioned in our Feb. 7 issue, is understood to have completed surveys for its projected 125-mile railway in central Utah. It is stated that the Utah Construction Co., Ogden, Utah, will do the construction work.

Vermont.

The Boston & Maine R. R., L. Curtis, Construction Engineer, Boston, Mass., is understood to be planning to have construction work started early this spring on its lines between South Vernon and Brattleboro, Vt., and between Windsor and White River Junction. The first mentioned line will be 10 miles long and the second will be 14 miles long. These lines will be built to avoid using the Grand Trunk Ry's tracks between the abo tioned points.

Virginia.

⊙David W. Flickwir, Roanoke, been awarded the contract for seco work from Evergreen, Va., to Phoel 13.2 miles, for the Norfolk & Weste R. R.

Contracts will be let shortly and construction work begun this month on the projected line of the Richmond, Washington & Chesapeake Ry. The road will be built from Doswell, Va., through the counties of Hanover, Caroline, King William, King and Queen, Essex, Richmond, Westmoreland, Northumberland and Lancaster to a point on the Great Wicomico River. Channing M. Wal, 181 Hanover Ave., Richmond, Va., is President.

The Tenth Ward Improvement League, Norfolk, Va., has decided to petition the City Council to grant permission to the Norfolk & Western R. R. to enlarge and improve the terminals at Lambert's Point. C. S. h ill is Chief Engineer of the railroa R oke, Va.

Washington.

It is understood that bids will in a few days on another section of t Defiance line of the Northern Pacific . This section will cover the distance between the tunnel and the station. A. R. Cook, ac Wash., is Principal Assistant Enginee o Northern Pacific. W. L. Darling, Paul Minn., is Chief Enginer.

The Washington-Oregon Corporation, Vancouver, Wash., will start work at once on construction of a single track electric through Vancouver Barracks, the U. tary Reservation within the city lim work will cost about $50,000. License the line has been granted recently by Department.

W. L. Tribble, Spokane, Wash., 30. a mentioned in our issue of Feb. 28, was warded the contract by the Yakima Valley Tr portation Co., for the first 6 miles of proposed Selah extension, has esli camps near North Yakima. The new will necessitate an expenditure of 0 Part of this contract requires the rem more than 80,000 yds. of rock along mil of right of way and the constructi of two-span truss steel bridge across the ach River. This work will take five mont ing which day and night shifts of each will be employed.

At a recent session of the City Council of Port Townsend, Wash., a 99-year fr was granted the Port Angeles, Lake es & Seattle R. R. Co. to enter the c over certain streets. The franchise as dr ed b G. W. Morrow, the promoter, was chaged s as to limit his company to the exclu e use of only one-half of the width of the treet. This action was not satisfactory to r and he formally notified Mayor Harv bals that he would not accept of th f chise, but would ask the City Counc a to grant the franchise as originally a The survey of the road has been c pl from Port Angeles via the head of Pt Discovery Bay, and the Chimacum V Port Ludlow and Oak Bay. One of e two latter points will be the eastern t minus from which a ferry will be operate direc to Seattle. The proposed line to Por Townsend is to be a branch. The compan has franchise from Port Angeles, a larg portion of the right of way has been quired through both Jefferson and Clallam Counties and it is expected that construction n main line will be commenced within da

It is reported that the Chicago, Mi a & Puget Sound will build at once its o ed Beverly-Hanford branch between t erly crossing of the railroad, on the Cum River, and Hanford, below Priest Rap . The line will cost $1,000,000. Engineers railroad have nearly completed loca g the line and grading crews will be assembl in a short time. E. O. Reeder, Seattle, Wsh., is Chief Engineer.

West Virginia.

⊙seph Fuccy, Clarksburg, W. Va., is re- rt to have been awarded the contract for g for the extension of his Clarksburg Electric R. R. from Middlebourne to a distance of 16 miles.

Norfolk & Western Railroad has in service the recently completed 4 ile tretch of double track between Huger nd vian, W. Va. This work included three nns as well as other heavy cutting and adg. and cost $900,000. The completion ts work recalls the fact that the road w as but about 2½ miles of single track t. Pocahontas division. This single track s tween Alnwick and Wharencliffe, and ntract for double tracking it has not en let. This work will also be of an tr ely heavy nature and will eventually ne, thus completing the double track

are the [illegible] with the exce[illegible] nel, w[illegible] the [illegible]

The [illegible] is rep[illegible] con[illegible] south [illegible]

Wisconsin.

It [illegible] mander [illegible] to the [illegible] tain [illegible] Wis. A survey for the line has already been started and it is expected that construction work will be completed on the road within the next two years.

Canada.

The Grand Trunk Pacific Ry. is understood [illegible] Napadeggan, the first divisional point west of Moncton, N. B., to Fredericton, a distance of 49 miles, to provide a more direct route to tide water at St. John, N. B., through a connection with the St. John Valley. It is stated that final decision with regard to this route has not been arrived at as yet.

The Canadian Pacific Ry. is to erect a 20-stall round house at Coquiltam, B. C., at a [illegible]

Mexico.

The Mexico Tramways Co., Harro Harrsen, General Manager, Apartado 124 Bis, City of Mexico, is reported to have about completed plans for beginning construction work on the proposed extensions to Toluca and to Puebla. The Toluca extension will be about 60 miles long and the Puebla extension will be about 125 miles. Surveys for both of these have been completed for some time.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣ s will be received until April 8, by oners of Talladega County, Talledefor draining, grading and surfacing el approximately 4½ miles of the -Mardisville road. The cost of the s estimated at $8,000. W. S. Keller is Highway Commissioner, Montgomery,

ard of Review of Lawrence County, laid out the route of the pike roads re to be built in the county providing 00 bond issue is voted upon favor- an election to be held on March 18. is the county seat.

ds were received on March 4 by the n County Commissioners' Court, n, Ala., for grading, draining and sur- with sand-clay approximately 5 miles te Aid road. The work is being re- sed. W. S. Kellar, Montgomery, is gineer

Arizona.

e Paving Commission of Phoenix, Ariz., Hackett, Chairman, has awarded the t for additional paving in the city of x to the Barber Asphalt Co., at $2.15 yd., for bitulithic, $0.50 per lin. ft., bing, $0.30 for gutters, $2.25 for flumes, alley gutter, and $2.50 for angle irons.

Arkansas.

ds will be received until 2 p. m., March Board of Street Improvement District, 6, Little Rock, Ark., for grading, drain- d paving with vitrified brick, asphalt, ic concrete, creosoted blocks or bitulith- ement on concrete foundation within strict. Extent of proposed work is ap- ately the paving of 14 blocks on con- ase. Plans and specifications may be d from Sam W. Reyburn, Chairman t No. 186, care of Union Trust Co., Rock, Ark.

California.

E. Rollin of Oakland, Cal., has been d the contract by that city, Frank R. son City Clerk, for the construction of wide cement sidewalk on both sides of ve., from East 14th St., to East 30th St., Bids were opened Feb. 26.

s have been made by City Engineer Hamlin of Los Angeles, Cal., for the ction of 238,176 sq. ft. of macadam and 25,000 to 45,000 ft. of asphalt pavement m foundation. The work will also in- 17,000 cu. yds. of excavation. The con- will probably be let the latter part of onth. E. D. Vincent is official in charge.

Colorado.

ator Guggenheim in the U. S. Senate, amendments to the agricultural ap- ation bill to provide for road construction in national [illegible] lows: San Juan [illegible] county, $25,000; Battlement forest, $10,000; Leadville and Holy Cross forests, $15,000; Rio Grande forest, $15,000; Cochetopa forest, $5,000; Leadville and Gunnison forest, $5,000; Tennessee Pass highway, $5,000.

Connecticut.

✣Bids will be received until 11 a. m., March 18, by Board of Contract & Supply, Hartford, Conn., for furnishing the street department with road oil to be delivered at such times in carload lots as directed by Superintendent of Streets. The oil shall be what is known as asphaltic road oil, containing from 30 to 40 per cent of residuum asphalt. A certified check for $1,000 must be filed with each bid. J. Buths is Secretary.

Idaho.

The City Council of Moscow, Ida., has passed an ordinance providing for a considerable amount of paving. An election will probably be held to vote bonds for the improvement.

Illinois.

✣Bids will be received until 10 a. m., March 15, by Board of Local Improvements, T. A. Dicks, Secy., Broadlands, Ill., for grading and paving five blocks of streets with brick. Specifications are on file with the Secretary.

⊙The Board of Local Improvements of Lincoln, Ill., has awarded the contract for the paving of Lincoln Ave., Ottawa St., 10th St. and Peoria St., to John E. Bretz of Springfield, Ill., at $41,846. The improvement includes a total of $7,961 lin. ft. of paving distributed as follows: Lincoln Ave. 3,042 ft., Ottawa St. 1,265 ft., 10th St. 1,325 ft. and Peoria St. 2,329 ft. Other bidders were John Cherry of Jacksonville, Ill., Jannsen & Zeler of Pekin, Ill., and A. D. Thompson of Peoria, Ill.

⊙Following bids were received by the Board of Local Improvements of Monmouth, Ill., for the construction of the South B. St. paving, contract awarded March 2: E. A. Lord, Monmouth, $11,380; P. H. Tiernan, Macomb, Ill., $11,894; Pronger & Fletcher, Blue Island, Ill., $12,303; Jensen & Zoeller, Pekin, Ill, $11,586; Richard Tuckey, Monmouth, $12,266; Burlington Construction Co., Burlington, Ia., $11,068, reported to have been awarded contract.

The Board of Local Imprevements of Rockford, Ill., has decided to improve East State St., from Third St. to 150 ft. east of Prospect St., and from Charles St. to the east line of Seventh St., with macadam instead of brick, as previously intended. This improvement will be over a mile in length. Edwin Main is City Engineer.

City Engineer George Dewey of Cairo, Ill., has completed the estimates for the paving of Ninth St., between Commercial and Washington Aves., with brick.

The Board of Local Improvements of Peoria, Ill., has acted favorably on the proposed paving of Globe St., from Main to State, with brick. City Engineer Leonard D. Jeffries has estimated the cost at $6,017.

City Engineer Farnsworth of Ottawa, Ill., has estimated the cost of paving the south side of the city at $214,067 and the cost of paving the west side at $152,225. The specifications for the work call for a 5-in. concrete foundation, concrete curb and gutter, vitrified brick and cementg rout filler, for the west side, and the same for the south side except that the foundation will be only 4-in. The work will be in charge of the Board of Local Improvement. C. W. Campbell is a member of the board.

The citizens of Rossville, Ill., will vote April 16 on the proposition to pave the two main streets of the village, Chicago and Attica Sts.

Indiana.

✣Bids will be received until 10 a. m., March 15, by Board of Public Works, Indianapolis, Ind., for the following street work: Improvment of College Ave., from south property line 28th St., running east to north end of bridge over Fall Creek, by grading and paving the roadway; improvement of College Ave., from north enl. of bridge over Fall Creek to north property line 30th St., by grading and paving the roadway; for the improvement of College Ave., from north property line 30th St. to south property line 38th St., by grading and paving the roadway.

✣Bids will be received until 2 p. m., April 2 (bids rejected March 5), by Board of Grant County Commissioners, Marion, Ind., for the construction of a gravel road in Jefferson Township and two macadam roads in Franklin and Center Townships. E. H. Kimball is County Auditor.

✣Bids will be received until noon, April 2 (readvertisement), by Board of Dearborn County Commissioners, Lawrence, Ind., for the construction of highways in Jackson Township. W. S. Fagley is County Auditor.

⊙Nathan C. Gibson of Idaville, Ind., has been awarded the contract by the Board of White County Commissioners, Monticello, Ind., for the construction of the W. A. Bryan stone road in Jackson Township at $15,854. Bids were opened March 5.

⊙Clay Engle of Decatur, Ind., has been awarded the contract by the Board of Adams County Commissioners, Decatur, for the construction of a macadamized road in Monroe Township for $2,500. Bids were opened March 4.

⊙Patrick H. Layne & Sons, Crawfordsville, Ind., has been awarded the contract by the Board of Montgomery County Commissioners, Crawfordsville, for repairing of highways at $5,195. Bids were opened March 5.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

⊙The Board of Huntington County Commissioners, Huntington, Ind., has awarded the following contracts for the construction of four highways in Warren Township, for which bids were opened March 7: Chas. M. Nash, R. F. D. 1, Unionvale, Ind., Jacob Ott road, $4,350, and Levi Kivett road, $9,545; Kilty, Heck & Kilty, R. F. D. 1, Bippus, Ind., Kilty road, $10,450, and Jackson road, $10,650. Harold Guthrie is County Auditor.

⊙Thos. Wilson, R. R. 1, Brooksville, Ind., has been awarded the contract by the Board of Franklin County Commission, Brooksville, for the construction of a macadam road in White Water Township for $9,800. Bids were opened March 6.

⊙J. G. Berger has been awarded the contract by the Gibson County Commissioners, Princeton, Ind., for the construction of a gravel road in Johnson Township at $3,100. Bids were opened March 7.

⊙John S. Rogers of Bloomington, Ind., has been awarded the contract by the Monroe County Commissioners, Bloomington, for the construction of a stone road in Bloomington and Benton Townships at $846. Horace Blakely is County Auditor. Bids were opened March 5.

⊙The Board of Shelby County Commissioners, Shelbyville, Ind., has awarded the contract for the construction of two roads in Noble Township, for which bids were opened on March 7, to Wm. Avery of Waldron, Ind., for $8,900.

⊙John Buckley of Montpelier, Ind., has been awarded the contract by the Board of Blackford County Commissioners, Hartford City, Ind., for the construction of a macadam road in Harrison Township at $11,001. The road is to be 15,000 ft. in length. Bids were opened Feb. 5.

⊙C. H. Defrees of South Bend, Ind., has been awarded the contract by the Board of Public Works of that city for the paving of Portage Ave. with brick at $1.26 per sq. yd. Bids were opened Feb. 28.

⊙W. W. Crane of Marshfield, Ind., has been awarded the contracts by the Board of Warren County Commissioners, Williamsport, Ind., for the construction of the Benedict gravel road and the Fleming gravel road in Steuben and Jurdan Townships for $13,735 and $8,379 respectively. Bids were opened March 4.

The Board of Public Works of Michigan City, Ind., has begun preliminary steps for the paving of Hermitage Ave., from the east line of Shawmut Park addition. Plans prepared by H. M. Miles, City Engineer, have been approved by the Board. Brick will be used.

The voters of Washington Township, Delaware County, Ind., at a recent election voted in favor of the building of a gravel road 5¾ miles in length. The roadway will be in the center of the township and slightly to the west. The estimated cost is $21,000. Muncie is the county seat.

Following bids have been submitted to the Board of Public Works of Indianapolis, Ind., for paving: Republic Construction Co., $2.43 per lin. ft., on each side of the street, for paving Ruckle St., from 30th to 33rd St., with asphalt, and $2.39 per lin. ft., on each side of the street, for bitulithic. The same company for improving Wallace St., from Washington to New York St., bid $2.63 for asphalt, while A. Bowen bid $2.41 for brick.

The contract for the construction of a 7-mile pike in Pleasant Township, Switzerland County, Ind., for which bids were to have been opened on March 4 by the Commissioners, Vevay, Ind., has not been awarded. The matter has been continued until the April term. Scott Culbertson is County Auditor.

Iowa.

✣Bids will be received until March 15, by City Council, Waterloo, Ia., it is reported, for the construction of asphalt or concrete pavement.

Plans are being made by Engineer J. H. Farrington of Iowa Falls, Ia., for the construction of 70,000 sq. yds. of concrete pavement and 10,800 ft. of concrete curb, including 8,000 cu. yds. of excavation. Contracts will be let in May. The work will be in charge of the Street and Alley Committee.

A movement is underway to secure street paving in Grundy Center, Ia., this year. Mayor F. W. Reisinger and H. S. Beckman are circulating petitions for the paving of 21 blocks.

Maryland.

A bill has been introduced in the State Legislature of Maryland by Senator Goslin increasing the appropriation for roads under the Shoemaker Road law, from $200,000 a year to $300,000. The money is to be used to aid those counties contributing one-half the cost of the roads to be improved.

The Farmers' Association of Frederick County, Frederick, Md., county seat, has indorsed a new road law for the county which is the same as the Caroline County law and provides for a road engineer at a salary of $1,500 annually. S. B. King is President of the Good Roads Association of Frederick, Carroll and Montgomery Counties.

Massachusetts.

✣Bids will be received until noon, March 18, by Metropolitan Park Commission, John Rablin, Engineer, 14 Beacon St., Boston, Mass., for paving and regulating the Charles River Dam, Boston and Cambridge. Proposals must be accompanied by a certified check for the sum of $2,000. The estimate of the amount of work to be done is as follows: 8,800 sq. yds. subgrade to be prepared, including excavation, grading and barring and removing paving blocks; 8,300 sq. yds. concrete base to be laid; 8,800 sq. yds. granite block paving to be relaid, with Portland cement grout joints; 2,700 lin. ft. straight and curved edgestones to be reset; 2,500 sq. yds. brick sidewalk to be relaid. Pamphlets containing further information for bidders, form of proposal, contract, specifications and bond may be obtained, and plans may be seen at the office of the engineering department, 14 Beacon St.

Michigan.

✣Bids will be received until noon, March 20 (all bids rejected March 5), by Board of Houghton County Road Commissioners, Houghton, Mich., for the construction of the following roads: Ontonagon Road, beginning at Houghton and running to Atlantic, about 2½ miles of bituminous macadam; Hancock-Calumet Road, 1½ miles of bituminous macadam; Baraga Road, beginning at the Snake River and running to the county line, a distance of 4½ miles. This will be an earth road 24 ft. between ditches. Plans and specifications may be seen at the office of the Board of County Road Commissioners, Shelden-Dee Bldg., Houghton, Mich. R. Martin, Engineer.

✣Bids will be received until noon, March 22, by Board of Muskegon County Road Commissioners, Muskegon, Mich., for furnishing and delivering about 11,000 cu. yds. of road-building material. The material shall consist of a standard quality of limestone, field stone or trap rock. It shall be broken into cubical shape and not be of splinter or slab form, and evidence must be produced, if required by the Board to show that the material will be acceptable to the Michigan State Highway Department.

The citizens of Monroe, Mich., at a recent election voted the issuance of bonds in the sum of $25,000 for paving purposes.

Kansas.

⊙Following bids were received by the city of Topeka, Kans., A. R. Young, City Engineer, on Feb. 27, for paving work: (1) Standing for engineer's estimate; (2) bid of Capital City Vitrified Brick & Paving Co., Topeka (awarded contract); (3) Ritchie Bros., Topeka; (4) McGuire & Stanton, Leavenworth, Kans.; (5) Hoff & Williams, Muskogee, Okla.; (6) Olson & Schmidt, St. Joseph, Mo.; (7) Western Paving Co., Oklahoma City, Okla.; (8) Spencer, Luttj & Folks, Topeka; (9) Cleveland Trinidad Paving Co., Cleveland, O.; (10) A. Jaicks, Chicago, Ill.; (11) Roach & Manigan, Memphis, Tenn.; (12) Kaw Paving Co., Topeka; (13) Thogmartin & Gardi, Fort Scott, Kans.; (14) W. W. Jones, Topeka:

BIDS RECEIVED FEB. 27 BY THE CITY OF TOPEKA, KAN., FOR PAVING WORK

Items	Quantities		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Vit. blocks, 3-in. concrete base, asphalt filler	Sq yds	60,606	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vit. blocks, 4-in. concrete base, sand Filler	Sq yds		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Asphaltic base, 1-in. concrete base	Sq yds	9,474	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Excavation	Cu yds	35,180	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Combined curb and gutter, 6x18 in	Lin ft	18,084	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Curb reset	Lin ft	292	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
New catch basins, complete		12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8-in. vit. sewer pipe	Lin ft	30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10-in. vit. sewer pipe	Lin ft	146	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12-in. vit. sewer pipe	Lin ft	1,207	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
New concrete walk	Sq ft	3,951	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
New brick walk	Sq ft	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brick walk taken up and relaid	Sq ft	6,658	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Old pavement taken up and relaid	Sq yds	1,388	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Manholes raised	Lin ft	27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Manholes lowered	Lin ft	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Inlet raised	Lin ft	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cement steps	Sup ft	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Minnesota.

Th city of St. Paul, Minn., will shortly bids for an asphalt plant to be run city and to mix asphalt for repairing e streets. Oscar Claussen is City Engineer.

Th Minnesota State Highway Commis- on, ouis W. Hill, Chairman, St. Paul, will the construction of a state highway long, under provisions of the Elwell m Thief River Falls east, in Penning n tunty.

Th City Council of Rochester, Minn., has isse a resolution ordering the paving of air St., from Zumbo St. to the Northwest- ght of way, and Fourth St., from the st ne of Franklin to the west line of roaway. The streets will be paved with ed wood blocks and will be 60 and 40 ide respectively. The Council voted air the paving of College St., with creo- blocks.

Mississippi.

Tl Mississippi State Senate, Jackson, has the Walker bill creating a State High- epartment and establishing a State Commission, for the purpose of con- a system of good roads. The bill ates the office of State Highway En- nd authorizes state aid for the estab- construction, maintenance and re- public highways and bridges. It fund and makes an appropriation for the act into effect.

Missouri.

Tl Boone County Commissioners, Colum- ., will purchase the Rocheport toll road il 15 for a consideration of $3,200. The ll be made part of the Columbia special strict

Tl Jackson County Court, Independence, as authorized the construction of a 60- dway from Levasy to the Lafayette line along the route of the old Santa il. This road will be a part of the pro- trans-state highway. No provision has made as yet for macadamizing this

T Board of Public Improvements of St. Mo., has sent bills to the Municipal bly calling for $262,532 in street im- nents. The measure, with the kinds of ements, are as follows: Wood—Taylor Forest Park to Maryland, $13,613; Sev- St., Market to Washington, $16,575. hic—King's Highway, Arsenal to Van- er and Old Manchester, $38,091. Brick dfellow Ave., North Market to Maffitt, 3; Potomac St., Louisiana to Grand, 5; North Market St., 15th to Glasgow, 2; Walnut St., 17th to 18th, $3,311; 17th lark to Market, $12,078; Angelica St., f to First, $21,338; Angelica St., First h, $13,238. Asphalt—North Market St., ellow to Hamilton, $9,281; 13th St., to Cass, $15,078; 23rd St., Washington Fallon, $26,498; Utah St., Michigan to ana, $9,011. Grading and construction anitoid sidewalks on Virginia Ave., be- Meramec and Gasconade, except parts y paved with brick, stone or granitoid, S; total cost, $1,150. To establish, open iden High St., from Franklin to a point of O'Fallon. To establish the width e roadway and sidewalks of Delmar between King's Highway and Union.

New Jersey.

elley-McFeeley Co. of Camden, N. J., probable contractor for the construction out 108,342 sq. yds. of macadam pave- and about 20,841 sq. yds. of concrete gut- n the Borough of Haddonfield, N. J., for bids were opened March 4. The approx- amount of the bid is $108,000. Allen er is Village Clerk. Contract to be led March 11.

yor Ernest C. Hinck of Montclair, N. s proposed a comprehensive plan for the struction of the city's streets, and, act- n his suggestion, the Town Council will estimates on the cost of paving Orange and Upper Mountain Ave. It has been propose[illegible] the cost [illegible]

New York.

✣Bids [illegible] 29, by [illegible] ough of [illegible] paving w[illegible] dation the roadway of Myrtle Ave., from Vanderbilt Ave. to Broadway, together with all work incidental thereto. The Engineer's estimate of th[illegible] sq. yds. of grade 1 granite pavement with grouted joints, outside railroad area (one year mainten[illegible] grade 1 granite pavement with grouted joints, within railroad area [illegible] stone pave[illegible] concrete, outside railroad area; 720 cu. yds. of concrete, within railroad area; 16,900 lin. ft. of new curbstone, set in concrete; 700 lin. ft. of old curbstone, reset in concrete; 20 new sewer manhole heads and covers; 250 sq. ft. of old crosswalks, relaid. The time allowed for the completion of the work and the full performance of the contract will be 100 working days. The amount of security required will be $35,000.

✣Bids will be received until 8 p. m., March 22, by Board of Trustees, Geneseo, N. Y., for the following: For grading, curbing and paving Court St. (from Wadsworth to Main), and Bank St., for a distance of about 300 ft. from Main St. For grading and paving "Fountain Square," Main St., according to Plans and Specifications which may be seen by applying to the Street Superintendent at the Village Building. William D. Shepard is Village Clerk.

⦿The Board of Contract & Supply of Rochester, N. Y., has awarded the contract for the asphalt repairs for 1912 to Whitmore, Rauber & Vicinus, for $49,500. Other contracts awarded are: Vassar St., asphalt pavement, Whitmore, Rauber & Vicinus, $6,704; Alexander St. brick pavement, F. L. Hagaman, $13,060; Quincy St., brick pavement, Thomas Holahan, $8,668.

⦿The Onondaga County Board of Supervisors, Syracuse, N. Y., has awarded the contract for the construction of the DeWitt-Cicero road to Joseph McCormick for $37,940, and for the building of the Salina-Clay road for $27,235. The contract for the Syracuse-Cedarvale road was awarded to R. Hopkins at $28,487.

Engineer H. F. Hamel has submitted plans, specifications and estimates to the Village Board of Canastota, N. Y., for the proposed brick pavement in North Main St., estimated to cost $27,000. Plans were approved. J. L. Robertson is Village Attorney.

The Onondaga County Board of Supervisors, Syracuse, N. Y., has passed a resolution providing for the construction of 6 miles of county road between the village of Onondaga Hill and the town of Lafayette. The new highway will begin at the terminus of what is called the "Cemetery road," and will continue across Onondaga Hill to Lafayette. It will cost between $5,000 and $6,000 per mile.

The Onondaga County Board of Supervisors, Syracuse, N. Y., has adopted the report of Harry Conklin, superintendent of the penitentiary quarries, for an appropriation of $15,000 for quarry development work as follows: $4,500 for the construction of a switch from the Delaware, Lackawanna & Western Railroad into the quarry and $3,500 for the purchase of a drilling outfit. There will be established a new crusher plant and several smaller pieces of machinery.

The Common Council of Auburn, N. Y., has been petitioned for the laying of asphalt pavement on Lewis St., between East Gensee and Franklin Sts.

North Carolina.

⦿Brittain & Calhoun have been awarded the contract by the Murphy Township Highway Commission, M. L. Mauney, Secy., Marphy, N. C., for grading the Hanging Dog Road and a short section of Peach Tree St., a distance of approximately 8 miles, at $.282 per cu. yd. unclassified. The work will consist of approximately 68,000 cu. yds. grading, 1,200 lin. ft. vitrified pipe, 550 cu. yds. rubble masonry, 6,300 lbs. structural steel. G. W. Scott, Courthouse Bldg., is Engineer. Bids were opend March 4.

North Dakota.

Following bids were received by the City Council of Grand Forks, N. Dak., for the paving of De Mers Ave., from the approach to the bridge to the Northern Pacific R. R. tracks at the other end of the avenue: Grand Forks Concrete Co., blome, $2.38 per yd., total $35,951; Warren Bros., bitulithic, $2.66 per yd., total $39,110; General Contracting Co., creosote blocks, $3.35 per yd., total $46,723; plain concrete, $1.60 per yd., total $27,211; brick, cement filler, $3.14 per yd., total $45,943; stone on concrete, $3.39 per yd., total $47,169; stone on sand $2.98 per yd., total $42,598. Contract will be awarded March 23.

Ohio.

✣Bids will be received until noon, April 1, by G. A. Boeckling, President and General Manager of the Cedar Point Resort Co., Sandusky, O., for the construction of about 6½ miles of paved roadway from the Huron Road to the Cedar Point Resort. A certified check for $3,000 must be filed with each bid.

✣Bids will be received until March 26, by Board of Stark County, Canton, O., for paving Marlboro Road from Marlboro to the Lexington Township line, a distance of 1½ miles and 16 ft. wide.

✣Bids will be received until 10 a. m., March 20, by Board of Stark County Commissioners, Canton, O., for the construction of 1.14 miles of improved road on what is known as the Massillon-Millersburg Road in Tuscarawas Township by grading, curbing, paving and drainage in accordance with the plans, profile, specifications, etc., now on file in the office of J. H. McConnell, Auditor of Stark County, Ohio. Following are the estimated quantities, viz.: 12,766 cu. yds. excavation, including approaches; 10,334 sq. yds. brick paving, including filler and sand cushion; 10,334 sq. yds. four-inch concrete foundation; 12,132 lin. ft. 14-in. Standard concrete curb laid; 12,132 lin. ft. 4-in. by 15-in. stone curb set; 34 lin. ft. Standard concrete marginal curb laid; 4,000 lin. ft. 4-in. curb drain tile, complete (if needed); 12 in. ft. 15-in. storm sewer pipe furnished and laid; 10 lin. ft. 24-in. storm sewer pipe furnished and laid; 10 lin. ft. 30-in. storm sewer pipe furnished and laid; 16 lin. ft. 8-in. storm sewer pipe relaid; 154 lin. ft. 12-in. storm sewer pipe relaid; 1 Standard catch basin furnished and built complete; 7 trees to be removed and destroyed. The above items of sewer pipe and drainage are optional with the Commissioners and Surveyor as to whether they will be used or not. Each proposal must be accompanied by a certified check on a Stark County bank for the sum of $500.

✣Bids will be received until noon, March 19, by H. H. Canfield, Clerk, Cleveland Heights, at his office at the town hall or at 309 Beckman Bldg., Cleveland, O., for furnishing the necessary labor and material for the improvement of Superior St. from the north line of the village southerly to the center line of Lee Rd., by establishing a grade, grading, draining, paving the same with brick, asphalt or macadam and constructing sidewalks, according to the plans and specifications on file at the office of said Clerk at the town hall and at the office of the F. A. Pease Engineering Co., at No. 931 Williamson Bldg., Cleveland, O. Sealed bids will also be received by said Clerk at said places and time for furnishing the material and labor necessary for the improvement of Arlington Rd. from the north line of Parkway to the south line of Fairmount Blvd., by establishing a grade, grading, draining and constructing sidewalks, according to the plans and specifications on file at the office of said Clerk at the town hall and at the office of said company.

⦿E. M. Gebhart & Co., of Dayton, O., have been awarded the contract for paving with

✣ **indicates work now open for bids.** ⦿ **indicates a contract let recently.**

brick North Main St., from the end of the present pawing to the corporation line at Highland Ave., for $29,000, by the Board of Contol. Trimball brick will be used.

A petition asking for the paving of Oberlin Ave., from West Erie Ave., to West 22d St., has been submitted by Postmaster Chas. Doll to the City Council of Lorain, O.

The City Council of Bryan, O., has called a special election for March 26 to vote on the question of issuing bonds for street paving. Bonds in the sum of $60,000 are to be voted upon. Following streets are to be improved: South Main, East High and Union, North Main, West High, East Wilson, West Wilson and Center, and Mulberry.

⊙H. S. Enck of Lima, O., has been awarded the contract by the village of West Unity, O., Henry Reifel, Village Clerk, for paving parts of Jackson, Main and Liberty Sts., with vitrified block. Bids were opened March 7.

⊙The Ohio Engineering Co., Clyde, O., has been awarded the contract by the Director of Public Service of Lorain, O., for the paving of Pearl Ave., and 8th St., with sheet asphalt at $30,787 and $10,057 respectively. Bids were opened Feb. 27.

Following bids were received by the Council of Uhrichsville, O., for the paving of Uhrich and North Water Sts.: P. A. Romig, E. A. McCollam and E. E. Brown, all of Uhrichsville. The bids range from $2,487 to $2,493 for the Water St. paving and from $6,569 to $6,794 for Uhrich St.

The City Council of Upper Sandusky, O., has retained Engineer Louis A. Boulay of Toledo, O., to prepare plans and specifications for the paving of Wyandot Ave. and Eighth Sts.

Following bids were received by the Board of Control of Lorain, O., for paving work: Pearl Ave., between East 28th and 34th Sts., and Eighth St., between Washington and Oberlin Aves.: Ohio Engineering Co., brick with slag concrete, $30,585; sheet asphalt with stone curb and slag concrete, from $32,887 to $55,687, for three grades of asphalt; sheet asphalt with stone filler and slag concrete, $30,787 on Obispo asphalt, and $30,647 on California asphalt. The Asphalt Block Paving Co. submitted the only bids on asphalt block, bidding $10,062 and $10,562 for 2-in. and 2½-in. blocks.

Oklahoma.

The City Commissioners of Lawton, Okla., have sold bonds in the sum of $159,952 to Bolger, Moser & Willaman Co., of Chicago. Ill. This issue was for the paving, curbing and guttering of 48 blocks of city streets.

Oregon.

✣Bids will be received until 5 p. m., March 18, by Charles Gregory, Auditor, Dallas, Ore., for the grading and macadamizing approximately 20 blocks and the street intersections in the said City of Dallas, Oregon. Said bids may be any part or all of the following described work, towit: 1. For crushing the required amount of rock. 2. For delivering the required amount of rock upon the above mentioned blocks and intersections. 3. For crushing and delivering the required amount of rock upon the above mentioned blocks and intersections. 4. For the preparation of the sub-grade and the macadamization of the above mentioned blocks and intersections. Said delivery shall be from the City's rock quarry, located about three miles northwest of Dallas, to and upon the blocks and intersections above mentioned.

Following bids were received by the City Council of Portland, Ore., for street work: Monroe St. from Union Ave. to East Seventh St.—Oregon Independent Paving Co., asphalt pavement, $5,442; Barber Asphalt Paving Co., asphalt pavement, $6,090; Warren Construction Co., bitulithic pavement, $6,200; East Twelfth St. from Killingsworth to Holman, grading and concrete curbs and walks—Giebisch & Joplin, $4,860; Kibbe & Welton, $5,060; E. J. Kerrigan, $5,288; East 25th St., district grading and concrete curbs and walks—Joplin & Meeks, $9,020; Giebisch & Joplin, $9,455; Manning & Co., $11,311; Kibbe & Welton, $9,661; Stevens & White, $10,835; O'Neil & Co., $9.626; East 37th St. from Holgate to Schiller, grading and concrete curbs and walks—Kilkenny Bros., $1,549; Taylor-McKittrick Co., $1,470; M. Hanson, $1,414; O. M. Patton, $1,436; Carter Bros., $1,386; K. G. Lundstrum, 1,637; R. L. Ringer, $1,557; Oregon Independent Paving Co., $1,367; J. Keating, $1,494; East 43rd St. from Belmont to East Stark, grading and concrete curbs and walks—Manning & Co., $2,060; M. Hanson, $1,808; East 63rd St. from East Burnside to East Glisan, grading and concrete curbs and walks—Carter Bros., $4,323; Joplin & Meeks, $3,972; Scott & McDougall, $4,410; Jeffery & Bufton, $4,333; Giebisch & Joplin, $4,278; Keenan Bros., $4,604; Stevens & White, $4,845; G. H. Howitt, $4,400; Manning & Co., $4,391; East 36th St. from Holgate to Schiller, grading and concrete curbs and walks—J. Keating, $5,516; Oregon Independent Paving Co., $1,399; Kilkenny Bros., $1,582; R. L. Ringer, $1,589; K. G. Lundstrum, $1,660; Carter Bros., $1,412; O. M. Patton, $1,471; M. Hanson, $1,446; East Seventh St. from East Main to East Salmon, Warren Construction Co., bitulithic pavement, 1,716; Oregon Independent Paving Co., asphalt pavement,, $1,540; Oregon Hassam Paving Co., Hassam pavement, $1,571; Barber Asphalt Paving Co., asphalt pavement, $1,603; East 16th St. from Halsey to Weidler, Oregon Independent Paving Co., $1,022; Barber Asphalt Paving Co., asphalt pavement, $1,083; Oregon Hassam Paving Co., Hassam pavement, $1,065; East 11th St. from Killingsworth to Durham, grading and concrete curbs and walks—Giebisch & Joplin, $6,938; Kibbe & Welton, $6,458; E. J. Kerrigan, $6,567.

⊙Warren Construction Co. has been awarded the contract by the City Council of Portland, Ore., for the construction of a hard-surface pavement on Kearney St., from 15th to 25th, at $1.37 per sq. yd., or a total of $22,337. The road is to be redressed with bitulithic. Other bidders were: Carbolineum Wood Preserving Co., wood block pavement, $37,098; Giebisch & Joplin, wood block pavement, $40,141, asphalt pavement, $25,901; Barber Asphalt Paving Co., asphalt pavement, $27,991; Oregon Independent paving Co., asphalt pavement, $26,278; Oregon Hassam Paving Co., Hassam pavement, $26,937.

Pennsylvania.

⊙Director of Public Service J. G. Armstrong and Mayor W. A. Magee of Pittsburgh, Pa., awarded the following contracts for which bids were opened Feb. 20: Grading, paving and curbing with brick—Orinoco St., to M. O'Herron Co., at $6,168.55; Cairo St., to Ott Brothers Co., at $4,008; Parviss St., to A. V. Purnell, at $3,681; Volt alley, to M. O'Herron Co., at $1,875; Durango alley, to J. B. Sheets Co., at $1,433. Grading, paving and curbing with block stone—Burchfield Ave., to M. O'Herron Co., at $2,861; Federal St., to M. O'Herron Co., at $8,804; Robinson St., to M. O'Herron Co., at $4,959; Warren St., to M. O'Herron Co., at $12,519. Grading, paving and curbing with blockstone and brick—Hazelton St., to Neelen & Daly, at $3,751. Grading, paving and curbing with asphalt—Panke Ave., to Booth & Flinn, at $2,096; Murray Ave. from Pocussett S., to Booth & Flinn, at $23,893; Murray Ave. from Flemington St., to Booth & Flinn, at $29,442; Haights St., to Barber Asphalt Paving Co., at $3,396. The contract for the grading, paving and curbing of Atherton Ave. was held, pending the passage of the ordinance.

⊙The street committee of the City Council, Wilkes-Barre, Pa., has awarded the following contracts for paving works: Warner-Quinlan Co., at $2.05 per sq. yd., for paving Horton St. with asphalt; D. M. Rosser Co., at $2.73 per sq. yd., for paving from South Main St. to Franklin St., with Belgian block; also at $.80 per ft. for White Haven redstone curbing between these two points.

The Director of Public Works of Philadelphia, Pa., is authorized to ask for paving bids in alternate on plain granite or wood block and brick in an ordinance recently introduced in Select Council.

The Board of Commissioners of Abington Township, Abington, Pa., Charles O. Kruger, President, has approved an ordinance to borrow, by means of a bond issue, $16[illegible]00 for road improvements. The question of the final passage of this loan measure, however, [illegible] rest with the voters of the York road township at a special election which will [illegible] cal[illegible] for April 9.

South Carolina.

⊙The City Council of Columbia, S. C., [illegible] awarded the contract for the construction [illegible] bitulithic pavement on Sumter St., between Blanding and Washington Sts., and o[illegible] block on Taylor St., between Sumter and Main Sts., to the Atlantic Bitulithic Co., at $1.7[illegible] per sq. yd., and the contract for the constru[illegible] sheet asphalt on Gervais St., and La[illegible]el [illegible] 10 blocks in all, to the West Construc[illegible]n at $2.12 per sq. yd.

South Dakota.

The City Council of Mitchell, S. D., [illegible] decided in favor of paving Main St., [illegible] ing five streets up to the alleys. Th[illegible] will commence at the Milwaukee Sta[illegible]n [illegible] be continued to the Omaha Station, a st[illegible] of 9 blocks. Cement will be used. [illegible] the work will be received early in A[illegible]

The city of Lead, S. D., L. D. Lee, [illegible] gineer, proposes to do a considerable [illegible] of paving during the year. H. L. He[illegible] is Mayor.

Tennessee.

The citizens of Dickson County, Tenn., at a recent election voted against the issu[illegible] bonds in the sum of $100,000 for goo[illegible] Charlotte is the county seat.

Following bids were received by t[illegible] City Commission of Memphis, Tenn., for [illegible] improvement of Mulberry St., betwee[illegible] B[illegible] and Calhoun Ave.: Everett Prosser, [illegible] L. W. Johnson, brick, $27,821; S[illegible] Bitulithic Co., bitulithic, $26,176.50; [illegible] Manigan Paving Co., brick, $23,548; w[illegible] block, $27,952; asphalt, $23,499; E. J. [illegible] strom, wood block, $28,121; H. P. S[illegible] Co., asphalt, $21,908; M. Larkin & Co. b[illegible] $24,878; wood block, $27,078; Pounc[illegible] ing and Construction Co., brick, [illegible] Memphis Asphalt and Paving Co., [illegible] $20,576. Following bids were received [illegible] improvement of East Georgia Ave., [illegible] Lauderdale and Walnut Sts., with D[illegible] paving; L. W. Johnson, $13,275; J. W. [illegible] ell, $15,051; F. D. Harvey Co., $15,845 Memphis Asphalt and Paving Co., $14,586.

Texas.

⊙W. D. Haden has been awarded the contract by the Galveston County Commis[illegible] Galveston, Tex., for supplying approx[illegible] 10,000 cu. yds. of mudshell for upk[illegible] of county roads, to be delivered at points on G. C. & S. F. and F. H. & R. R. The contract price is $.85 per cu. yd.

⊙The Dallas County Commissioners, Dallas, Tex., have awarded the contract [illegible] building of three miles of the West [illegible] beginning at the foot of Commer[illegible] pike to Cullom & Bauvousett. This [illegible] only contract awarded on the construction and repair of the four cardinal and eight intermediate roads of the county, for [illegible] bids were received Feb. 29. It is proba[illegible] the rest of the work will be done un[illegible] direction of the Commissioners' Court. [illegible] in the sum of $500,000 were recently vo[illegible] [illegible] this work.

Petitions have been filed with the City Council of Houston, Tex., providing f[illegible] laying of pavement on the following [illegible] on a 5-in. concrete foundation: Fann St., between McKinney and Leeland Ave., [illegible] durable pavement; Webster Ave., between Main and Crawford Sts., brick pave[illegible] McGowen Ave., between Crawford S[illegible] a[illegible] the San Antonio and Aransas Pass r[illegible] crossing, bitulithic pavement; Holman [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Main and Crawford Sts., creosoted blocks; Louisiana St., between Berry uart Ave., bitulithic pavement; West a Ave., between Main St. and the Gal- Harrisburg and San Antonio railroad ly, bitulithic pavement; Milby St., be- Dallas and Leeland Ave., shell pave- St. Emanual St., between McGowen ernenberg Ave., bitulithic pavement; cinto St., between McGowen and Rosa- bitulithic pavement; Fannin St., be- McGowen and Eagle Ave., bitulithic nt; Westmoreland Ave., between Gar- e. and Louisiana St. and Berry Ave., ic pavement.

lection will be held in Corpus Christi, n April for the purpose of voting on tance of bonds in the sum of $150,000 eet paving.

lection will be held in Grand Saline , Grand Saline, Tex., on April 6 for rpose of voting on the issuance of n the sum of $50,000 for good roads.

City Commissioners of Fort Worth, have ordered the advertising for bids completion of the paving of North St. from the bridge over the Trinity, of the court house, to Marine Creek to include 4,750 ft. of pavement. The ill include 37,791 sq. yds. of pavement. ed to cost $2.40 per front ft. The total estimated at $79,361.

Vermont.

citizens of Brattleboro, Vt., on March the issuance of bonds in the sum of for the construction of new sidewalks. Hopkins is City Clerk.

voters of Brattleboro, Vt., have been by the Board of Selectmen to vote on oposition to construct sidewalks at a $20,000. David T. Perry is Road Com-

Virginia.

ds will be received until noon, March Council Committee on Streets at the of H. L. Shaner, City Engineer, Lynch- Va., for paving Rivermont Ave. The al items of work to be done are as fol- 50,000 cu. yds. excavation, 18,000 cu. ench excavation, 56,000 sq. yds. paving, linear feet curb. Plans can be seen, ations and forms of proposals ob- at the office of the City Engineer, burg, Va.

Washington.

ds will be received until 2 p. m., March Board of King County Commissioners, Wash., for furnishing the necessary and material (Jap or Chinese labor lowed) for the construction of the r Boulevard extension. The work con- the construction of clearing and grub- constructing standard 24-ft. roadway ssary culverts, ditching, etc., as per and specifications now on file in the Engineer's Office, Seattle, Wash. O. se is Clerk of the Board.

✣ds will be received until March 14, it orted, by City of Spokane, Wash., for g Post. St. from Central to Wellesley at an estimated cost of $16,400, and 38th Ave. from Perry to Grand Boule- an estimated cost of $9,200.

he City Council of Colfax, Wash., has ree contracts to the Warren Construc- Co. for the construction of bitulithic ent for approximately $93,000, or $2.14 yd.

⊙he Board of Public Works of Seattle, a., has awarded the contract for planking ickerson St. road to John G. Engstrom, W. 52nd St., Seattle, Wash., at $2,983. idders were: Heurer & Ayers, $3.- Johnson, $3,423; J. A. Bailey, $3,423; & Jessen, $3,761; L. H. Goerig, $3,377; Zinkan, $3,652.20; Tom Hansen, $3,- ; J. Ruthe, $3,162.20; Will Kopta, $3,- ; Jahn Contracting Co., $3,338.; J. A. chern Co., $3,608.40.

Engineer W. H. North of Bellingham, ., has made a preliminary estimate of the total cost of the Meridian St. improvement which shows that an 18-ft. pavement can be laid from Broadway St. to the city limits for approximately $15,000.

Sen[illegible] has introduced a bill in the State Senate, Olympia, appropriating $10,000 for the construction [illegible] Mount Baker, all within the limits of the Washington national forest. This money will be in addition to that which is to be raised by Galcier Township, amounting to $1,200.

The Municipal Commission of Tacoma, Wash., and the Board of County Commissioners have practically agreed upon the route for a new paved highway to South Tacoma. The hard-surface road will be constructed along Union Ave., from the city limits beyond Rigney hill toward Center St., following the route to the present flume line until the county road is reached. From this point the road will swing east toward South M St., following the flume line, alongside of which also runs the old bicycle path. W. C. Raleigh is City Engineer.

City Engineer A. L. Strong of Mt. Vernon, Wash., has been instructed to proceed with plans and specifications for the paving of about 1½ miles of city streets at a cost of about $100,000.

West Virginia.

✣Bids will be received until noon, March 22, by Board of Affairs, Bluefield, W. Va., for paving with bituminous macadam Tazewell, Russell, Duhring, Ramsey, Walnut and other streets. W. H. Campbell is City Engineer.

✣Bids will be received until noon, April 3, by F. F. McCullough, Clerk, Cabell County Court, Huntington, W. Va., for construction with brick, stone or macadam, of two miles of road on Hamlin pike and two miles on the James River and Kanawha turnpike. Contracts will be let in mile sections.

Wisconsin.

✣Bids will be received until 7:30 p. m., March 15, by Board of Public Works, Two Rivers, Wis., for the construction of approximately 16,000 sq. yds. of macadam pavement with tar filler; 16,000 sq. yds. of macadam pavement; 11,600 lin. ft. of cement curb and 15,500 ft. of cement gutter.

✣Bids will be received until March 26 by Committee of Street Assessment, Janesville, Wis., it is reported, for about 5,513 sq. yds. of brick paving, 860 sq. yds. of brick paving relaid, 1,520 lin. ft. of combined cement curb and gutter, 31 lin. ft. of stone protection curbing reset, 56 lin. ft. of brick protection curbing, 800 sq. yds. of new foundation, and 900 cu. yds. of excavation.

✣Bids will be received until 2 p. m., March 21, by Board of Public Works, J. P. Keating, Secretary, Neenah, Wis., for furnishing necessary labor and material for improving Wisconsin Ave., from Walnut St. to Park Ave. by grading and paving with sheet asphalt, concrete or cement, asphalt block, sarcolithid, tar macadam, creosote block.

✣Bids will be received until 3 p. m., March 27, by City Clerk, De Pere, Wis., for furnishing labor and material for the construction of sheet asphalt, asphaltic concrete, concrete wearing surface or asphaltic macadam poured process on 6-in. concrete foundation on the following streets: Main Ave., from the west end of bridge over Fox River to the west line of Fifth St.; Fourth St., from the south line of Maine Ave. to the north line of Grant St.; Fifth St., from the south line of Main Ave. to the north line of Grant St.; Grant St., from the east line of Fifth St. to the C. & N. W. Ry. right of way.

✣Bids will be received until 10:30 a. m., March 20, by Department of Public Works, H. E. Briggs, Commissioner, Milwaukee, Wis., for paving streets with permanent bituminous pavement on concrete foundation, under contracts 20, 21, 22 and 23. The largest contract included is No. 22 for paving Lisbon Ave., from Thirtieth St. to Fortieth St., in the Nineteenth Ward—Cu. yds. cutting, 2,348; sq. yds. of pavement, about 11,352; lin. ft. of straight stone curb, 551; lin. ft. radius stone curb, 420; lin. ft. curb resetting, 940; days allowed for completion, 90. Bidding check or cash deposit, $3,100.

✣Bids will be received until 10:30 a. m., March 20, by Department of Public Works, H. E. Briggs, Commissioner, Milwaukee, Wis., for furnishing the necessary labor and material for constructing cement curb and sidewalk on 24th Ave. from Greenfield Ave. to Mitchell St.; Conway St. from Logan Ave. to South Bay St.; Idaho St. from Clement Ave. to Nevada St.; Short St. from Grove St. to Greenbush St.

✣Bids will be received until 10:30 a. m., March 20, by Department of Public Works, H. E. Briggs, Commissioner, Milwaukee, Wis., for furnishing the necessary labor and materials for paving roads with permanent bituminous pavement on concrete foundations, under 19 contracts, the largest being No. 8, as follows: Burleigh St., from Third St. to Humboldt Ave., in the Twenty-first Ward—Cu. yds. cutting, 4,078; sq. yds. of pavement, about 19,022; lin. ft. of straight stone curb, 915; lin. ft. of radius stone curb, 808; lin. ft. curb resetting, 4,795; days allowed for completion, 90; liquidated damages per diem, $183; bidding check or cash deposit, $5,500.

The Chicago-Milwaukee Good Roads Association, Milwaukee, Wis., was recently incorporated to assist in securing the construction of a road between those two cities. The incorporators are: Lee A. Dearholt, F. A. Cannon, Harry W. Lewis, George A. West, William MacLaren, Nat Stone, Alvin P. Kletzsch and P. C. Avery.

The Milwaukee County Board, Milwaukee, Wis., has adopted the highway committee's report and named the following roads as county highways to be improved as fast as the funds at the disposal of Highway Commissioner H. J. Kuelling will permit: Grand Ave., from the viaduct to the Hawley road, three-quarters of a mile; Janesville plank road, two miles west to the Hamley road; North Fond du Lac road, one mile from the city limits, northwesterly; Mukwonago road, from Wallis to Oklahoma Ave., two miles; Layton Ave., 1½ miles westerly from Cudahy; Rawson Ave., 1½ miles westerly from South Milwaukee; Loomis road, from the Kilbourn road two miles south; Watertown plank road, from the city limits to Wauwatosa, 1½ miles; Kilbourn road, from the south limits of the city to the county line, 10½ miles; Green Bay road, from the Hampton road south, according to the petition of the town of Milwaukee; New Chicago road, from the city limits southeast, according to the petition of the town of Lake. The first work will be done on the Janesville plank road, and as fast as possible the other roads which have been adopted as county highways and part of the prospective state system of highways, will be taken in hand and improved.

Canada.

✣Bids will be received until 11 a. m., March 20, by Board of Control, Chairman, Winnipeg, Man., for supply of asphalt required by the city during the year of 1912. Specifications are on file with the City Engineer, 223 James St. M. Peterson is Secretary of the Board.

✣Bids will be received until noon, March 18, by George R. Boyd, Town Clerk, Welland, Ont., for the construction of approximately 37,000 sq. yds. of vitrified brick, bitulithic, asphalt block or granitoid pavement. George H. Burgar is Chairman of the Road and Bridge Committee.

⊙The City Commissioners of Saskatoon, Sask., have awarded the following contracts for the construction of approximately 621,000 sq. ft. of concrete sidewalk and 100,950 lin. ft. of curbing, for which bids were opened Feb. 16: Bitulithic & Contracting, Ltd., Winnipeg, Man., 63,000 at $2.90; Elo Oso Paving Co., Vancouver, B. C., 40,000 sq. yds. of sheet asphalt, $2.85 per yd.; also 20,000 sq. yds. of asphaltic concrete, $2.80.

✣ indicates work now open for bids • indicates a contract let recently.

BRIDGES—STEEL AND CONCRETE

Alabama.

⦿Austin Bros., Atlanta, Ga., have been awarded the contract for the construction of a steel bridge in Lauderdale County, Ala. The structure will consist of two spans, one 75 ft. and the other 30 ft. with 12 ft. roadway. The cost of the work is $2,250. Bids were opened Feb. 13.

Arkansas.

✣Bids will be received until March 14, by James Lawson, City Collector, Little Rock, Ark., it is reported, for the construction of a concrete bridge.

In connection with the new railroad planned by the Ozark Land & Timber Co. in Arkansas a new bridge will be constructed over the White River. George D. Locke, Rogers, Ark., is President of the company.

Commissioners of Lawrence County, Powhatan, Ark., will shortly take up the matter of constructing a steel suspension bridge over Elevenpoints River at Imboden. The cost of the structure proposed is estimated at $4,000

Delaware.

A conference will be held by the members of the Levy Court, Wilmington, Del., with the officials of the Wilmington & Philadelphia Traction Co. in regard to the company running double track across the bridge which the county officials propose to build across the Christian River to replace the present structure at Third St. The cost of the work is estimated at about $150,000.

Georgia.

Anderson and Hart Counties, Ga., are taking up the matter of building a steel bridge over the Savannah River at Brown's Ferry. An engineer who surveyed the river for the purpose of locating the structure has announced that the cost will amount to about $30,000. Anderson, Ga., is county seat of Anderson County.

Idaho.

The Lewiston Commercial Club, Lewiston Idaho, has had plans made for the erection of the proposed steel bridge across the Clearwater River at Lewiston. Five sites on the Clearwater River in the vicinity of the O. W. R. & N. steel bridge have been considered, of which one will be selected. The structure will be of steel, supported by concrete piers. Permanent plans will be prepared shortly.

Plans and specifications have been prepared by W. A. McLeod, City Engineer, Nampa, Idaho, for the construction of a highway and railroad bridge over the Phyllis Canal at Third St., estimated to cost $2,000.

Illinois.

✣Bids will be received until 2 p. m., March 15 (extension of date from Feb. 28), for the construction of three reinforced concrete bridges in Collinsville Township, Madison County. William Grenard, Town Clerk, Collinsville, Ill.: Chris. Andrews, span, 14 ft.; Rdy., 20 ft.; type, R. C. box; 115 cu. yds.; steel, 9,480 lbs.; ¾-mile from Sand Bank switch. Diedering, span, 12 ft.; Rdy., 16 ft.; type, R. C. Sub. and Super.; 46 cu. yds.; steel, 3,092 lbs.; 1½ miles from Maryville Kalbfleisch, span, 14 ft.; Rdy., 20 ft.; type, R. C. box; 182 cu. yds.; steel, 13,896 lbs.; 1 mile from Sand Bank switch. All material for the above bridges will have to be shipped in. Present structures for 1 and 3 are, 5½-ft. steel tubes; No. 1 has a 9-ft. wood bridge. On account of the condition of the excavation, it is requested that a personal examination of the bridge sites be made before bidding on same. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Ill.

⦿The contract for the construction of a reinforced concrete bridge over Big Indian Creek in Serena Township, La Salle County, Ill., has been awarded to the Miller-Hey Construction Co., Waterloo, Ia., at $3,720. The structure will consist of two 45-ft. spans with 18-ft. roadway. A. E. Bach is County Clerk, Ottawa, Ill. Bids were opened March 4.

⦿Frank A. Hawley, Urbana, Ill., has been awarded the contract for the construction of the concrete abutments for bridges on the first section of the Kankakee & Urbana Traction Co.'s line from Urbana to Paxton, Ill., at a bid of $2,250.

The Board of Hancock County Supervisors, Nauvoo, Ill., met recently to take up the matter of appropriating $12,000 toward the construction of bridges on the new river road.

Indiana.

⦿The Commissioners of Spencer County, Rockport, Ind., have awarded the contract for the construction of 37 bridges to the Vincennes Bridge Co., Vincennes, Ind., at $16,553. Bids for 39 structures were opened March 4 but two of the structures were not let. J. L. Stevenson is County Auditor.

Iowa.

A bill has been introduced in the House of Representatives, Washington, D. C., by Representative Green of Iowa, to authorize the Central Railway Bridge Co., an Iowa corporation, to construct a street railway, steam railway, foot and vehicle bridge across the Missouri River at or near Council Bluffs. The proposed structure, it is understood, will be located between the bridge of the Union Pacific and the bridge of the Illinois Central railway, and will cost upwards of $1,000,000.

The Tri-City Ry. Co. desire to place a permanent bridge over Mad Creek at Muscatine, Ia., in order to accommodate the heavy interurban cars which will be operated on the line between the city and Davenport, Ia. J. F. Porter, Davenport, Ia., is President of the company.

The City Council of Sioux City, Ia., has authorized the City Clerk to advertise for bids for the construction of a bridge over Floyd River at 11th St. in the Cole's addition. According to plans of city engineer the structure will be of steel girder type.

The following bids were recently received for reflooring the Market St. bridge with creosote blocks, Ottumwa, Ia.: Ottumwa Supply & Construction Co., $22,380; A. W. Van Hafften, Minneapolis, $23,086; Ottumwa Bridge Co., $23,650. Cook Construction Co., Des Moines, $24,235; Midland Bridge Co., Kansas City, $27,344. The bids are about $4,000 lower than previous bids that were rejected.

Kansas.

✣Bids will be received until 2 p. m., March 23, by Board of Wyandotte County Commissioners, Wyandotte, Kan., for the necessary labor and material for the reconstruction of the West Kansas Ave. bridge over the Kansas River. Plans and specifications are on file with F. M. Holcomb, County Clerk.

Kentucky.

Plans are under way for the construction of a bridge over the Ohio River at 14th St., Louisville, Ky. Charles B. Gibson is President of the Louisville bridge company.

A communication has been received by the City Council, Covington, Ky., from the Chief Engineer of the Louisville & Nashville that the company wishes to have a concrete floor in the proposed new bridge to replace the present archway at Kruse Ave. The estimated cost of the new structure is $32,000.

Louisiana.

The Police Jury of Natchitoches Parish, Natchitoches, La., has authorized th President to advertise for bids for the reconstruction of the bridge over Saline Bay St. Maurice which was destroyed providing the Police Jury of Winn agree to bear one-half the expense.

It is reported that the petition circulated at Lake Charles, La., asking the Police Jury to call a special tax election for the purpose of constructing a bridge over the Calcasieu River is being met with approval.

Massachusetts.

Edward F. Shaw, Boston, Mass., bridge expert, recently consulted with the gineer of Holyoke, Mass., on the pl estimates for the bridges to be built first and second-level canal on Cabot plans for the lower bridge were agree but the upper bridge took considerabl and no definite conclusion was reache slight elevation of the roadway abo water and the widening out of the st made the building of this bridge a de proposition than in any other bridge city. The requirements of the state bridge for street railway traffic must for a weight of 50 tons have added problem.

Michigan.

The Osborne Engineering Co., Clela O., has made preliminary estimates construction of the proposed bridge o Black River at Military St., Port Mich., including incidental expenses, of old bridge, dredging, paving, etc. A tion will be held in April to vote on the sition and if carried complete plans an ifications and bids will be received. T bridge has a 140-ft. swing span, throug 18-ft. roadway and 9-ft. walks. Th structure will probably be double le bridge, 70-ft. clear channel, roadway 40 ft., double track car line, paved with block and 10 to 12-ft. walks. Alternat will be considered for Scherzer or oth ented bridges. E. R. Whitmore is Cit gineer.

The Grade Separation Commissic Grand Rapids, Mich., in the annual recommends the elevation of all steam ra tracks within the corporate limits an erection of eight viaducts. The plan a total cost of $2,085,000. According plans 21-ft. clearances are figured fo viaducts, 3 ft. more than the state la quires. The city is to pay 35 per cen the railroads 35 per cent of the cost.

Minnesota.

⦿The contract for the construction steel bridge over the Vermilion River in tion 31, town of Vermilion, Minn., has awarded to the Iblings Bridge Co., M apolis, Minn., at $1,600. Bids were o March 4 by P. A. Hoffman, County Au Hastings, Minn.

The Council Roads and Bridges Comm Minneapolis, Minn., and officials of the Northern Railroad Co. have reached an ment providing for the following impro ments in return for the vacation of the end of Sixth St., north, by the city: To special assessments on all street improvements on Fifth St., Sixth Ave., north, Seventh St. and Holden Sts., which abuts their property to extend the bridge at Seventh St. over tracks and to widen it; to widen the Fifth St. north, bridge by repairing it; to deed a strip of land which would allow the widenin Sixth Ave., north, to 100 ft. from Fift Seventh Sts.

Plans are being prepared by G. C. Wa Engineer, Grand Rapids, Minn., as menti in our issue of Feb. 28, for the constru

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

ft. steel and concrete bridge over n Grand Rapids Township, Itasca, contract will be let shortly for the n of the same. A profile of the

s shown in the accompanying illus- gh McEwan, Grand Rapids, Minn., n charge of the work.

Missouri.

ard of Public Works, Kansas City, awarded the contract for the con- of a reinforced concrete bridge to present structure over Brush 8th and Main St. to H. B. Thomp- harp Bldg., Kansas City, Mo. The include construction of bridge com- furnishing all materials. Waddell gton, Kansas City, Mo., are Con- gineers. Bids for the work were [illegible]

een announced by Maxime Reber, of the Board of Public Improve- Louis, Mo., that work will soon on the proposed 12th St. viaduct. ture will extend from Spruce St Ave. and at both approaches will e as 12th St. The material used ncrete and the cost is estimated at

New Jersey.

ted that the Atlantic & Suburban Co. is planning the construction of ed concrete bridge over Inside are at Atlantic City to replace the n structure. R. A. Cale is Super- of the company, Pleasantville, N. J.

New York.

yman Loomis of Lewis County, New introduced a bill at a meeting of bly, Albany, N. Y., providing for riation of $45,000 for the construc- concrete bridge over the Black al at Lyons Falls.

nection with the contemplated n the New York Central lines Tonawanda and North Tonawanda, company is planning the construc- double track swingbridge over the he structure as proposed will be 600 the present main line bridge.

aring held recently before the Com- of Public Service, J. Sergeant w York City, in the matter of the of grade crossings through Ozone J. Carlile, Principal Assistant En- ong Island R. R., Jamaica, N. Y., two plans. One which met the ap- of all the property owners who the meeting was to carry the tracks vation of about 20 ft. through the over a mile by means of a series rches, to have openings of 30 n piers of 5 or 6 ft. in thickness at The tracks would be carried over and Grafton, Belmont and Liberty Rockaway Plank road by means girder bridges. The structure would nough to provide for the four tracks exist on the street surface at grade. the high-class concrete work used in uction would, it is said, be an or- structure. The cost of the work $833,440, excluding connections with Lalance & Grosjean factory, an ice a coal yard, which would cost $50,- 0,000. The other plan provided for mbankment with concrete retaining bridges over the highway, instead This would cost $754,530. Commis-

[illegible]

North Carolina.

[illegible] Davie Counties, N. C., at a recent meeting at Salisbury, N. C., rejected all bids received for the construction of the proposed steel bridge over the Yadkin River at South River.

Ohio.

✣Bids will be received until noon, March 25, by W. H. Bodurtha, County Auditor, Delaware, O., for the necessary labor and material for the construction of the substructure of the Hall bridge over Little Walnut Creek in Berkshire Township and for the labor and material for the substructure of the Worline bridge over the east branch of the Olentangy River in Oxford Township. Plans and specifications are on file with the County Auditor.

✣Bids will be received until 11 a. m., March 30, by Board of Cuyahoga County Commissioners, Cleveland, O., for the construction of bridge work per Report No. 2913, concrete bridge, Bennett Road, Royalton Township; Report No. 2914, concrete bridge, Bennett Road, Royalton Township; Report No. 2917, arch extension, Fairmount Road, Cleveland Heights Township; in accordance with the form of contract and specifications to be furnished by Frank R. Lander, County Surveyor. J. F. Goldenbogen is Clerk.

⊙Contract 17, including the masonry and approaches to and the substructure of the viaduct over the tracks of the Hocking Valley, South High St., Columbus, O., has been awarded to Fritz-Rumer-Cooke Grant Co., at $85,000. Bids were opened March 5 by S. A. Kinnear, Director of Public Service. C. R Boulton is Clerk of the Department.

⊙Commissioners of Van Wert County, Van Wert, O., recently awarded the contracts for the construction of a number of bridges as follows: Construction of Carlo bridge and repair of Blame St. bridge, to the Croghan Construction Co. of Fremont, O., at $792 and $125 respectively; construction of Collins and Ley bridges to Oregonia Bridge Co., Lebanon, O., at $562 and $206 respectively; construction of Riehey and Ley bridges to the Brookville Bridge Co., Brookville, O., at $717 and $824 respectively; repair of Fry and Mohr bridges to Joseph Mueller, Venedocia, O., at $178. Carl J. Simon is County Surveyor.

Plans prepared by Corrigan, McKinney & Co. for the construction of a 120-ft. span bridge over the Cuyahoga River at Clark Ave., Cleveland, O., have been rejected by the City River and Harbor Commission and new plans will be prepared for a structure with a 200-ft. span.

Oregon.

⊙The contract for the construction of the reinforced concrete bridge on East 31st St. across Sullivan's Gulch, Portland, Ore., has been awarded by the city executive board to the International Contract Co., 501 Central Bldg., Seattle, Wash., at $65,396. Other bidders on the work were published in ENGINEERING & CONTRACTING, Feb. 28.

City Council of Portland, Ore., has passed an ordinance appropriating $15,000 to provide for the illumination of the bridges over the Willamette River. [illegible]

Nothing definite has, as yet, been decided in regard to the construction of the proposed [illegible] over the Clackamas River.

In regard to the proposed new bridge to replace the Sellwood Ferry on Spokane Ave., Portland, Ore., it is stated that there are no proceedings pending for the construction of the bridge, although there is some talk of the improvement. T. M. Hurlburt is City Engineer.

The House of Representatives, Washing- D. C., has passed a senate bill authorizing the County Commissioners of Lincoln County, Mont., construct three bridges over the Kootenai River at Libby, Troy and Rexford. The contract for these structures was let some time ago to the Coast Bridge Co., Portland, Ore.

Waddell & Harrington, Kansas City, Mo., are, it is reported, to prepare plans for the construction of a new steel bridge over the Sandy River near Troutdale. The cost of the structure is estimated at approximately $25,000. The work will be in charge of the Multnomah County Commissioners, Portland, Ore.

Pennsylvania.

⊙The Department of Public Works, Pittsburgh, Pa., has awarded the contract for the construction of the Atherton Ave. bridge over the tracks of the Pennsylvania R. R. to the Cranford Construction Co., at $93,128.

The Board of Londonderry Township Supervisors recently conferred with the Dauphin County Commissioners, Harrisburg, Pa., in an effort to have them pay a portion of the cost of the construction of a bridge over a mill race near Round Top.

Commissioners of Chester County, West Chester, Pa., and Board of Delaware County Commissioners at a recent conference decided to repair the old covered wooden bridge over the Brandywine Creek.

The School Board of East Pike Run Township, according to advices from California, Pa., will take steps to secure the construction of a bridge over Pike Run between Daisytown and Red Hill.

Plans for the superstructure of the proposed Seventh St. bridge at Altoona, Pa., have been completed by F. S. Merrill, Pittsburgh, Pa., and bids for the work will, as mentioned in our Feb. 28th issue, be asked shortly. Frans Engstrom is City Engineer.

The Mayor has approved the resolution for the plans and specifications for a steel bridge to be built at Hickory St., connecting 11th and 17th wards, Scranton, Pa.

The County Commissioners at a recent meeting at Harrisburg, Pa., decided to assist Londonderry Township in constructing a bridge over Iron Creek and assume half the expense.

An ordinance has been introduced into the City Council of Philadelphia, Pa., authorizing the construction of new bridges over the Philadelphia, Baltimore & Washington R. R. at 65th St. and at 72d St. The ordinance also provided that the railroad pay $40,000, one-half the expense.

At a recent meeting of the County Commissioners at West Chester, Pa., the matter of building the proposed bridge over Chester River at Fifth St., Chester, Pa., was discussed.

Commissioners of Luzerne County, Wilkes-barre, Pa., have employed Oscar C. Thompson, Phoenixville, Pa., to examine the Water St. bridge, Pittston, Pa., and recommend repairs necessary.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

South Dakota.

It has been decided [illegible] of Pennington County, Rapid City, S. Dak., to construct two bridges over the Cheyenne River in the near future, one at Creston and the other at Wasta. Steps will immediately be taken to call for a special election to vote for bonds, the issue of which will amount to about $50,000. As planned in the specifications prepared by Engineer Hartgering, the Wasta bridge will be 600 ft. in length, with four spans of 150 ft., be 6 ft. above the highest known water, with a 5 per cent approach 110 ft. long at the west, and a 200 ft. 3½ per cent grade at the east end. The bridge will be located 100 ft. down stream below the P. R. C. bridge.

Tennessee.

Representatives from Eastern Arkansas in convention at Memphis, Tenn., recently passed resolutions asking an amendment of the bill for the construction of the proposed new railroad bridge over the Mississippi River, to have the company provide wagon ways and trolley tracks and approaches.

At a conference between the officials of the C. N. O. & T. P. and the N. C. & St. L. railroads and the Commissioners of Chattanooga, Tenn., the plans prepared by Wilbur J. Watson, Cleveland, O., for the construction of the proposed McCallie Ave. viaduct was approved and the engineer instructed to advertise for bids. The plans call for a concrete arch to cost $126,000.

Texas.

The Commissioners' Court, San Angelo, Texas, has been petitioned by property owners to issue $70,000 in bonds to provide funds for the construction of four viaducts over the Concho River and one causeway.

The Commissioners of Tarrant County, Fort Worth, Texas, have appointed an advisory committee to act with the commission regarding the expenditure of the $1,800,000 road and bridge funds recently voted by the people of that county.

A conference was recently held by Mayor Fisher, Galveston, Texas, with general managers of the Galveston Terminal lines in regard to the construction of a viaduct at the 37th St. railroad crossing.

Washington.

⦿The Board of Public Works, Seattle, Wash., has awarded the contract for the construction of the proposed overhead foot bridge at Pike St. to M. C. Heinemann, 2114 E. Gler St., Seattle, Wash., at his bid of $7,065.

The City Council of Tacoma, Wash., has authorized the Commissioner of Light & Water to proceed with the construction of a bridge to carry the pipe line over the river at McMillin. An underground crossing was also under consideration.

Virginia.

The Townfields Bridge Co., Cape Charles, Va., has been incorporated with a capital stock of $5,000 and proposes the operation of a toll bridge over King's creek in Northampton County. The incorporators are G. F. Parramore, President; G. F. Parramore, Jr., Secretary; J. V. Morre and F. Rucker Wilkins, all of Cape Charles, Va.

At a recent meeting of the Common Council, Richmond, Va., a resolution was introduced instructing the streets committee to [illegible] plans and specifications fo [illegible] James River bridge to replace the [illegible] ture.

Wisconsin.

[illegible] bid received by Highw missioner George W. Ubbelohde for the struction of the proposed bridge over boygan River in the western part of of Sheboygan Falls was submited t berg Iron Works, Sheboygan, Wis.,

Soundings and estimates of the been completed by the city engine Crosse, Wis., for the construction of the bridge connecting Isle La Plume with mainland near the foot of Market t. cost is estimated at about $1,600.

It is reported that the Chicago, M & St. Paul R. R. will replace the ol wood trestle over the Yahara River near S Wis., with a new concrete structur F King, Milwaukee, Wis., is Assistant

Canada.

✣Bids will be received until noo M 13 by A. W. Chapman, County Cle ville, Ont., for furnishing and ere superstructures of one 110-ft. high tr one 100-ft. high truss span, one 6 truss span, and one 60-ft. low truss sp reinforced concrete floors, all in a with plans and specifications of Allen, County Engineer.

⦿The contract for furnishing the material and constructing a fender Redwood bridge has been awarded of Control, Winnipeg, Man., to Holn Winnipeg, Man., at $13,156. Bids we Feb. 26. M. Peterson is Secretar of Board.

IRRIGATION, DRAINAGE, LEVEES AND CANAI

Arkansas.

✣Bids will be received from 1 until 2 p. m., April 9, bv C. B. Bailey, Engineer, Wynne, Ark., for the construction of about 442,000 cu. yds. of levee work. The work is designed as floating dredge work and the average section of the levee is as follows: Crown, 4 ft.; height, 7 ft.; slopes, 2:1. The total length is about 21 miles and the work lies on the west side of Dunklin County and is designed to prevent the overflow of the St. Francis River. The estimated cost is 15 cts. per cu. yd., which includes the cost of clearing the right of way. Certified check for $3,500 made payable to C. B. Bailey, will be required from each bidder. Map, profile and specifications will be mailed by the engineer to prospective bidders upon the receipt of one dollar.

Petition has been filed in the Jackson Circuit Court at Newport, Ark., and hearing will be held on March 23, for the formation of a large drainage district embracing the Over Cup Slough Basin, in Jackson and Woodruff Counties. The contemplated ditch is 15 miles long, starting near Auvergne at the head of Over Cup Slough, and running south along the Rock Island much of the way, to the Woodruff County line and emptying into Cache River below Simmons' Switch.

California.

✣Bids will be received until 2 p. m., March 25, by Board of Directors of the Turlock Irrigation District, Anna Sorensen, Secretary, Turlock, Calif., for the construction of lateral 5½ and change in laterai 7. Burton Smith is Engineer.

Illinois.

✣Bids will be received until March 30 for tile work in Sub District No. 4 of Drainage District No. 2, Pittman, Ill. The cost of the work is estimated at nearly $23,000. J. W. Dappert, Taylorville, Ill., is Engineer.

Revised plans for the Wood River Drainage project have been filed in the Madison County Court at Edwardsville and March 15 has been set as the time for hearing objections. The plans call for an improvement to cost $185,000, making a great saving over the original plans offered and objected to by the railroads and some of the big corporations. The new plans were prepared by the engineers of the railroad companies, and provide for indefinite extensions of the project if it becomes necessary.

Iowa.

All bids received March 4 by E. M. Callender, Wright County Auditor, Clarion, Ia., for the improvement of County open ditch No. 10, Belmont Township, were rejected. It is probable that the work may not be readvertised for several months, and possibly not at all. The work is as follows: Sec. 1, 950 ft. 14 in. average cut 3.3 ft.; Sec. 2, 500 ft. 16 in. average cut 2.95 ft.; Sec. 3, 400 ft. 18 in. average cut 2.69 ft.; Sec. 4, 1,200 ft. 20 in. average cut 3.03 ft.; Sec. 5, 500 ft. 22 in. average cut 3.08 ft.; Sec. 6, 4,000 ft. 24 in. average cut 3.85 ft.; Sec. 7, 800 ft. open ditch, 250 cu. yds. Bottom of open ditch, 3 ft.; slope of sides, 1 to 1.

Indiana.

✣Bids will be received until 11 a. m., March 16, by County Surveyor, Valparaiso, Ind., for the construction of the Weiler Ditch, including 1,195 ft. of 6-in., 3,784 ft. of 8-in., 1,300 ft. of 10-in., 11,023 ft. of 12-in., 1,000 ft. of 18-in., and 4,533 ft. of 20-in. drain tile. Shipping point, Hurlburt, on the Erie R. R. Certified check for $200 is required with bids. G. F. Stinchfield is Engineer.

Iowa.

✣Bids will be received until 2 p. m., April 10, by Board of Clinton County Supervisors, Clinton, Ia., for the construction of ditches and tile drains in Drainage District No. 11. F. W. Leedham, Clinton, Ia., is County Auditor and Reuben C. Hart, Clinton, Ia., is County Surveyor. Official advertisement will be found elsewhere in this issue.

Kansas.

The East Side Drainage Distri Lungstrom, Secretary, Topeka, will dike along the Shunganunga Creek Vinewood car line bridge to 12th peka, a distance of about one block, as the ground is in condition to be wor

Louisiana.

⦿Dameron & White, New Orleans, been awarded the contract at 45 cts yd. for the building of the South B to Protection levee, about 25,000 cu. East Baton Rouge Parish, La., M River, left bank, for the Pontchartra District.

⦿Eskald & Alexander, New Orle have been awarded the contract at $3 constructing a lock with concrete wal Inland Waterway between Vermilion White Lake, for the U. S. Governme

⦿Joseph Messina, Donaldsonville, been awarded a contract to build a dr for the Bayou Nolan Drainage Dis West Baton Rouge and Iberville Par

The Surburban Realty Co., New La., has sold $200,00 of bonds part proceeds of which will be used to pay drainage of some 7,000 acres of lan Charles Parish. Work is to be sta mediately.

Michigan.

✣Plans and specifications are on fi office of ENGINEERING & CONTRACTING Dearborn St., Chicago, Ill., for the c tion of the Toll Gate drain. Bids work will be opened March 22 by W [illegible] Drain Commissioner of County, Mich. Official advertisement work appeared in our issues of Feb. March 6. This consists in laying of of 48-in., 3,330 ft. of 30-in., and 3,43 24-in. reinforced concrete pipe, 1,300 f in. sewer pipe; 910 ft. of 12-in. and of 8-in. drain tile. It also includes [illegible] 33 manholes and 6 catc

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible], 30-in. pipe, 14.83 ft.; 24-in. pipe, [illegible] 12 and 8-in. tile, 6.26 ft. All [illegible]stings and other appurtenances [illegible]shed the contractor on the ground [illegible] Commissioner.

[illegible] be received until 10 a. m., April [illegible] of County Road Commissioners, [illegible] Chairman, Bessemer, Mich., for [illegible]e necessary labor and material [illegible] brubbing, grading and ditching [illegible] of road. The work will include [illegible] [illegible]irt; 55,000 sqs. of grubbing; 270 [illegible]ring. Specifications are on file at [illegible] H. A. Harper, Engineer, Besse[illegible] Official advertisement will be [illegible]ere in this issue.

[illegible]l be received until 8 p. m., March [illegible] Bd of Public Works, Grand Rapids, [illegible] straightening channel of Plaster [illegible]en Burton and Clyde Park Aves., [illegible]ructure for two highway bridges [illegible]n and erection of two bridges. [illegible] the plans and specifications on [illegible]

Minnesota.

[illegible]ahler Contracting Co., Little Falls, [illegible] been awarded a contract at $15,680 [illegible]ng County Ditch No. 11, bids for [illegible]pened March 5 by S. G. Ber[illegible] Auditor, Roseau, Minn. The [illegible]r about 17½ miles of ditches [illegible]ut 110,625 cu. yds. of excava[illegible]

[illegible]l Court of Marshall County has [illegible]inary hearing in the matter of [illegible] No. 27 and has appointed an [illegible]make a survey of the proposed [illegible]G. Lundgren, Warren, Minn., is [illegible]

[illegible] be received until 3 p. m., March [illegible]B. Lemire, County Auditor, Aitkin, [illegible] the construction of Judicial Ditch [illegible]cluding 4,322 ft. of main ditch and [illegible]of laterals. It will be all clay tile [illegible]

[illegible]will be received until 2 p. m., April [illegible]te Auditor, St. Paul, Minn., for the [illegible]f the Mustinka River State [illegible]averse County, Minn., involving the [illegible]on of 13 miles of main outlet ditch [illegible],0 cu. yds. of excavation. The work [illegible]

[illegible]cellent floating dredge job suitable [illegible]-yd. machine. Further information [illegible]btained of George A. Ralph, St. Paul, [illegible]ate Drainage Engineer. Official ad[illegible]nt will be found elsewhere in this [illegible]

[illegible] will be received until 3 p. m., March [illegible]hn B. Lemire, County Auditor, Ait[illegible]n., for the construction of Judicial [illegible]. 2, including about 43 miles of main [illegible]al ditches and involving about 582,-

[illegible] McCauley, [illegible] gineer in ch[illegible]

Mississippi.

◉[illegible] has been [illegible] cu. yd. for constructing [illegible] for the Black Creek Drainage Dis[illegible] to about 144,000 cu. [illegible] bids for doing it were opened Mar[illegible] Lexington, Miss. R. H. & C. A. McWilliams, 28 E. Jackson Blvd., Chicago, Ill., have been awarded the contract at 9.49 cts. per cu. yd. for digging about 22 miles of open ditches for the Drainage Commission of Sunflower County, Miss. The work includes about 750,000 cu. yds. of excavation. Bids were opened March 5 by D. M. Quinn, Indianola, Miss.

Missouri.

✣Bids will be received until 2 p. m., March 15, by Julius Pitzman, 615 Chestnut St., St. Louis, Mo., Engineer in Charge, for grading 60 acres of land west of Forest Park and south of the Washington University. Excavation amounts to about 250,000 cu. yds.; 2,500 cu. yds. must be moved each working day. Work may be divided amongst three or four contractors if desired. Deposit of $1,000 required with bids for the entire work, or $500 with bids for any portion thereof. Bids will be opened at the Title Guaranty Trust Co., March 15.

✣Bids will be received until 10 a. m., March 21, by W. E. Roy, Secretary, Valley Drainage District, Shelby County, Mo., P. O. Hagers Grove, Mo., for the excavation of the main canal.

Nebraska.

Bids were opened Feb. 29 at the office of the U. S. Reclamation Service, Mitchell, Neb., for the construction of Dam No. 3 of the North Platte project, of which Andrew Weiss, Mitchell, is Project Engineer. The bids re[illegible] standing for bid of Bartlett & Kling, Cedar Rapids, Ia.; (2) for M. A. Wogan, Denver, Colo.; (3) Philips Construction Co., and Wm. O'Gara, Denver, Colo.; (4) Kilpatrick Bros. & Collins Construction Co., Beatrice, Neb.; (5) Maney Bros. & Co., Oklahoma City, Okla.; (6) McArthur Bros. Co., Chicago, Ill.; (7) W. O. & S. B. Morrison, Denver, Colo. and (8) John L. Mullen, Lincoln, Neb.

Items.			(2)		(4)	(5)			
[illegible]	acres	$150.00	$135.00	$250.00	$130.00	$175.00	$200.00	$198.00	[illegible]
[illegible]	[illegible]	.25	.48	.40		42	66	.46	.67
bonus.	000 c.y.f.	.02	.02	.02		.02	.02	.02	02
[illegible]	,000 cu. yds.	.70	.64	2.65	1.25	1.20	2.00	2.30	1.31
[illegible]	c.y.f.	03		.03	.03	.03	.03	.03	.03
[illegible]	cu. yds	.25	1.00	.60	.50	60	1.50	.70	
[illegible]	200 c.y.f.	02	.02	.02	.02	.02	.02	.02	02
[illegible]	100 cu. yds.	.70	1.40	2.65	1.25	1.20	2.00	3.00	.98
s B, bonus.	100 c.y.f.	.03	.03	.03	.03	.03	.03	.03	.03
[illegible]	200 lin. ft.	.50	1.85		1.00	1.00	1.00	1.08	.66
[illegible]	000 cu. yds	.25	30	.30	.30	.35	.25	.38	.62
[illegible]	000 cu. yds.	.45	.53	90	.55	1.20	.45	.55	1.31
[illegible]	100 cu. yds.		.93	.90	1.25	1.50	1.50	1.20	1.96
[illegible]	900 cu. yds.	.70	80	3.00	1.25	1.20	2.00	.95	1.31
[illegible]	50,000 cu. yds.	.25	.30	30	.25	.21	.25	.38	.67
[illegible]	000		.53	.90	.45	1.20	.45	.58	1.96
[illegible]	100 cu. yds.	1.00	.93	.90	.95	1.50	1.50	1.30	1.31
[illegible]	000 cu. yds.	.25		26	.17	.19	.20	.16	.21
[illegible]	000 cu. yds.	.25	30	35	.40				.18
[illegible]	000 cu. yds		40	.35		.42	.47	.50	79
embankment slope	6,000 cu. yds.	.25	.90	65	.50	.60	.50	.55	.79
[illegible]	000 cu. yds.	.25		1.10	1.00	.48		1.10	.98
gravel	11,500 cu. yds	.25	1.84	1.35	1.50	1.20		2.50	1.64
[illegible]	000 B.M.	20.00		40.00	37.00	60.00		45.00	46.00
[illegible]	600 lin. ft.	.25		2.50	1.00		1.50	1.25	1.31
[illegible]	500 cu. yds.		7.55	7.75	6.50	9.60		6.40	8.50
B (conduit)	220 cu. yds.	3.50		12.00	8.00		12.00	12.50	10.00
[illegible]	460 cu. yds.	3.75	5.00		5.70	12.00	9.00	11.00	9.00
[illegible] wall	700 cu. yds.	3.00			6.75	12.00	8.00	9.90	9.10
[illegible]	,250,000 lbs.	.01			.01		.05	.02	.01½
		[illegible]	$442,609	$469,957	$491,194	$519,312	$554,057	$561,558	$662,924

New York.

✣Bids will be received until 11 a. m., March 28, by Commissioner of Public Works, Room 5 Municipal Bldg., Buffalo, N. Y., for the completion of the improvement of Section 2-A of the Buffalo River and Cazenovia Creek Improvement, comprising 1,500,000 cu. yds. of earth excavation and some pile protection. Plans and specifications are on file with George H. Newton, Deputy Engineer Commissioner, Room 7 Municipal Bldg., Buffalo, N. Y. Official advertisement will be found [illegible]

Ohio.

Recommendation has been made to the City Council of Dayton, O., that immediate action be taken to authorize bonds for the work of straightening the Great Miami River below Washington St. The estimated cost of the work is $450,000, of which $254,100 would be for changing the channel and building levees, this work requiring the handling of 1,210,000 cu. yds. of earth. Gaylord Cummin is City Engineer.

Memphis, Tenn., and Vicinity.

◉"Cap'n John" Prescott of Memphis announces that he has secured contract for the construction of about 90,000 yds. of gravel roadway in Lee County, Miss., near Tupelo. This is a very difficult piece of work, the haul on gravel running as high in some places as ten miles, and averaging about two or three miles. It is said that one contractor has already "gone broke" on this job, but "Cap'n John" says that he will pull out of it all O. K. with money in his jeans. He states that he will put his outfit, which he states is "small but sweet," on the work, and will also employ additional teams to bring the total up to about 100 teams, and then will rush the work. At present Mr. Prescott is finishing up one or two contracts in Memphis, and says that Spring will be open good before he will be able to start on his new work.

Word comes from levee builders up and down the river that now, when the weather shows a few signs of clearing up enough to work, the river jumps so high that they will have to hustle to keep from getting wet, if the rise continues. At present, it has reached the flood stage at Memphis, and shows signs of going some higher, what with the heavy rains of the past few days, and the melting snow and ice up North.

Bill Beach wants to make connections with some good construction firm. He has lately been working for Billy Bryan at the latter's gravel pit and can be reached at Billy's office. Bill is an old levee builder.

It is proposed by Dunklin County Drainage District No. 25 to build a levee across the Dunklin County cut-off, which connects the St. Francis and the Varney River. This levee will turn all river traffic away from the Dunklin cut-off, and boats will have to travel the main stream of the St. Francis River. The Drainage Commissioners, however, contend that this will be more than offset by the advantages of having this country protected. Maj. Clarke S. Smith has called a meeting to be held at the court house of Kennet, Mo., on March 20th, at 10 o'clock, when the matter will be thoroughly gone over, and it is presumed that the levee will be constructed

✣ indicates work now open for bids. ◉ indicates a contract let recently.

The N. C. & St. L. R. R. will shortly build [illegible] way near Overton Park. The Park Commissioner and officers of the N. C. have perfected arrangements whereby the railroad company will construct the subway, while the Park Commission will bear the cost of grading and all ornamental work. Mr. J. A. Omberg, Jr., Memphis, was appointed to close up the matter.

At a meeting of the Builders' Exchange, recently, President C. R. Miller introduced a resolution providing that in future when bids are received by architects for the construction of buildings, these bids shall be opened in the presence of the general contractors who have a bid in on the work. It was also decided that when their bid was accepted, the successful contractor shall immediately notify his subs, if he does not propose to do the work himself. A committee was appointed by President Miller to confer with the architects, and reach some agreement regarding the matter under discussion.

Officials of the Bank of Commerce & Trust Co. announce that they will shortly construct a new building adjoining their present headquarters, and which will be constructed on the same plans as the present building, there by increasing their office space. This building will be seventeen stories high, constructed of terra cotta, and modern in every respect. When completed it will give the effect of twin skyscrapers. In order to construct the addition, the old Leuhrman Hotel, a landmark of Memphis, will be torn down, and it is said that a new record in putting up a big building will be made in Memphis. Cost will be about $500,000.

The past week has been one of rain and bad weather and but little progress has been made on work under way in this territory. Levee operations have been all shut down, so the boys who are building the dikes near Memphis report, and the same news has been coming in all week from the little railroad work that is being done contingent to these headquarters. Street work has perhaps been the most seriously hampered; one large street builder remarked that never before in his long career did a week pass without his being able to at least do a little work, but that during the week just ended he never turned a spade. The Rayburn Ave. subway, the first of the series being built in Memphis, was seriously inconvenienced by the wet weather, the banks having "sluffed" into the excavated street and the railroad companies will now have to take out the excess material at a great expense and on account of the condition of the material there is no telling how long it will have to dry before being handled. Chief Engineer Shultz had some planks placed against the walls as a further protection and no doubt no more dirt will now cave into the street.

It is reported on good authority that the Illinois Central has sent four surveying parties out from Haleyville, Ala., to complete the details of the line to Birmingham, and as soon as profiles can be prepared, bids on the work will be asked for and construction started at once. The Haleyville-Birmingham line has often been talked of by Illinois Central officials; much of the territory has already been gone over by their engineers and there remains but little of the total 75 miles to be detailed preparatory to the compilation of profiles. It seems reasonable that the I. C. would now want to begin early construction on this line on account of the fact that the Frisco and L. & N. have just perfected an arrangement whereby the former road cannot only enter New Orleans but can make a strong bid for the Mississippi and Florida coast business which has heretofore been considered the property of the Illinois Central and its branch road, the Georgia Central. By entering Birmingham from Memphis over its own rails, as the new line will enable the I. C. to do, and further will furnish a shorter and quicker road than the Frisco has, the former system will be able to hold its own, or perhaps have an advantage of the other roads in competition for the Panama Canal business. So aside from the statement which has been made to the reporter of ENGINEERING & CONTRACTING by one who knows whereof he speaks in I. C. matters, the contractors in this section all state that it is reasonable to expect the road to start construction as soon as possible, for over a year will be consumed on the contract after the actual work has once begun. One contractor estimated the total yardage on the new line to be about 5,000,000 cu. yds., the greater part of which will be rock and steam shovel work. Then a great deal of choice team work, both grader and wheeler, will be encountered. Referring to the new line, one contractor remarked: "Los a mercy! I can jus' hear those big bulleys smackin' their lips for that contract!"

T. J. Foley, Assistant General Manager of the Illinois Central, was in Memphis all last week in an endeavor to perfect a new working arrangement with the conductors of the Y. & M. V. R. R. While in Memphis Mr. Foley had nothing to say regarding new work of his company, the latter coming directly under the head of Mr. Park, the vice-president.

When the local levee builders learned of the desire of Senator Gallinger of New Hampshire to discontinue the building of levees along the Mississippi River by the government, many were considerably worried, for it would not be a hard matter, they claimed, to persuade the uninitiated northern and eastern representatives to believe that levees were not really a good thing for the southern territory and that they did not forward the interest of navigation, under which law they are built. But there are many sound minded contractors who think that the United States will always keep up the levees on which so much money has already been expended; no United States engineer will ever say that they are a detriment to the land and many will contend that they not only prove a land protection, but by preventing the caving of banks they assist the government in maintaining at all seasons of the year a navigable channel, which before the levees were built was impossible to a very great extent. Some of the choicest literature on levee construction has been furnished by army engineers and it would be a hard matter to find an opinion which was not in hearty favor of the building of new dikes and the maintenance of those already constructed. Thus, if congress were to accept the opinion of the army engineers regarding the value of levees, there is little doubt but what Senator Gallinger's resolution would meet with disapproval and final defeat. Then, too, the southern representatives would doubtlessly join as a body to combat the abandonment of the levee system and after all the arguments had been produced the chances are that the levees would receive a big boost instead of a blow. But, even though the government would discontinue the levee construction, on any ground, the various state and county levee boards along the Mississippi could not afford to drop the work and leave uncompleted so many miles of bank protection as exists at present. It would be a hard matter indeed to persuade or convince the southern farmer that a levee is of no value to his land; too many cotton crops have been raised with water 10 feet against the dike protecting his plantation to make him sit up and take notice to such line of talk. He has seen the damage wrought by the breaking of an embankment, when a whole season's planting has been wiped out in a few hours. He has looked over unprotected land, cut deep with fissures and covered with driftwood, valueless for anything but a breeding place of malaria and mosquitoes, after the Spring floods of the Mississippi had receded, and later he has seen this land after a levee had been built in front, bloom into a well cultivated plantation on which a bale of cotton to the acre could be raised. One state levee engineer pointed out that at the present time more than half of the levee work along the Mississippi River is paid for and carried on by state boards, the cost of which is pa in turn by the farmers and not by the go ernment, and that conditions would be changed even though the United States d cided to do no further levee work. But must not be denied that the government e pends a vast sum yearly on levees whi otherwise would have to be borne by so one else and the resources which the ar engineers possess in this line are unexcell by the state boards. Coupled with the le building, the government carries on a sy of revetment work which not only pro the banks of the river, but proves a gr source of strength to the levees themselves This latter advantage, of course, is not e joyed by the State Levee Boards.

Sam Bush was in town last week from Red River levee work at Texarkana. Sam says he has over 400 teams on the li and that everybody is making good progre However, the contractors are looking f rise in Red River soon and are bein prepare for that emergency, for acc Sam, Red River comes up in twe and without warning and in that sp can float away the "whole count." says there is no danger of his outfit floated away, for he has selected a ground on which he will herd his place his plunder. Sam is looking out good foreman to take charge of hi

Pat Madden, of old time levee b fame, is hard at work on the Red Rive and from noises that emanate from s piling up dirt at a great rate. Pat wi haps go back to the Rock Island or Kent, Ark., when he finishes his lee

⊙Lee McCanlis has taken a contra grading the Harbert Avenue Sub-divis Memphis and as soon as this contract his hands will get into the street paving Lee says there are about 50,000 c grading in his present contract.

Beverley Turner has placed his ea the Rayburn Ave. subway proposition Chief Engineer Shultz, working th much per day. Bev says while the g hard and the ground in bad condi managed to make feed for his mule more than many of the boys have bad weather.

Old Poke Roper is preparing to ru erations on his Union Ave. contr embraces about 10,000 cu. yds. of g Poke says never before has he se bad winter and never before, eith had such a little amount of dirt to then not be able to do it within fiv which time he has been trying to fin Ave.

Pat McCadden has just returned phis from an inspection of the L. & near Birmingham, Ala. Pat has n whether or not he will move his out of that work, for he says he has a g and it will take good work to satis

Mike Roach is in the West look various interests of his firm. Mike Ft. Worth before his return to Me see how the paving concern is doing the ter place.

⊙Mike Larkin was awarded the contr for paving Mulberry St. in Memphis 5th, the material to be used being w Although the Memphis Asphalt & P were the low bidders by approxim 000 for asphalt, alternate bids being City Engineer Weatherford took th that Mulberry St. would have to s ceptionally heavy traffic on account ing the only good outlet from the U tion just finished and that asphalt w stand up under the unusual strain. the property owners agreed with the gineer and asked that he accept block bid.

On March 7, Chancellor Heiskell the injunction against the asphalt pla Roach-Manigan Paving Co. on the that it was not a public nuisance and it might now operate in its present without further interruption. This s

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ght by the property owners in [illegible]
cle, one of the fashionable residence
Memphis, sought to enjoin the
npany from operating its asphalt
the ground that the fumes emanat-
the asphalt were a detriment to
at the smoke was obnoxious and the
source of worry. Inasmuch as the
one likely to come up in any city
phalt paving was being carried on,
l and foreign contractors lent their
Roach-Manigan Co., and the case
contested, some of the best lawyers
uth being employed. The Chancellor
under consideration for [illegible]

a [illegible]
R[illegible]
that if he [illegible] plant to move to another location, other people would have to smell the fu[illegible]

that the present property owners were objecting to; that the plant must be close to town so the asphalt would be hot when laid and not have chance to cool off on account of a long haul and that the contractors had taken the work with the view of their plant being conveniently situated to the streets on which the material was to be laid. If the property owners felt they had sustained dam- [illegible] could seek redress in a court of justice, but that he could not enjoin the plant from carrying on its operations.

Texas.

✣Bids will be received until March 18, by John M. Murch, County Auditor, Galveston. Texas for ditch work near Hitchcock, involving approximately 10,900 cu. yds. of material. Plans and specifications are on file with the auditor. A certified check for $100 must be filed with each bid.

⊙The Clark Land Co., according to advices from Roswell, Tex., has awarded the contract to Irwin & Sons for a concrete dam to be built [illegible]

WATER-WORKS

Alabama.

ecatur Water Supply Co. of Alabama
tl incorporated, as noted in our Feb.
does not contemplate making any
ents or additions in the near future.
lamilton, American Trust & Savings
rmingham, Ala., is Treasurer of the

rted the citizens of Stevenson, Ala.,
voted the issuance of bonds to
of $14,000 for the installation of
f waterworks. J. K. Shofner is

Arizona.

own of Nogales, Ariz., has purchased
rworks system operated in that town
nsideration of $60,000. S. M. Frank-
ucson, Ariz., represented the Nogales

California.

city of Lindsay, Calif., on Feb. 20
the contract for the installation of
works system to Chambers & Heafey
and, Calif. Plans and specifications
epared by Consulting Engineer Ned
er of Lindsay.

oard of Trustees of Santa Ana, Calif.,
decided to ask for bids for the con-
of an auxiliary water system. A
reservoir and cast-iron mains will be

ity of Red Bluff, Calif., contemplates
hing the water system of the Antelope
Co., at present operating in that city.
McAllister and Emil Engelcke of San
co, are directors of the company. W.
ng is City Engineer.

Diego, Calif., has passed an ordinance
ng for an issue of $1,000,000 municipal
ment bonds.

Colorado.

uestion of bonding the town of Milli-
lo., for a waterworks system will be
itted at the coming election. It is pro-
o issue $15,000 in bonds for artesian

Delaware.

Georgetown, Del., water plant, which
t to be disposed of at public sale, has
ppraised at $25,000. A movement is
way for the acquisition of the plant by

Florida.

s will be received until noon, May 20,
Trustees of City Bonds, Titusville, Fla.,
construction of a water works system
e city, including pumping station, ele-
reservoir, water mains, fire hydrants,
lant to to be complete. George M. Rob-
Chairman of the Trustees. Official ad-
ment will be found elsewhere in this

Board of Bond Trustees of Live Oak,
t is reported, has decided to authorize
litional issue of $3,000 in bonds to equip
ty waterworks with electric motors and
necessary machinery.

Georgia.

The City Council of Augusta, Ga., has called a special election for the purpose of voting on the proposition to bond the city for public improvements. It is proposed to improve the waterworks, protect the river and erect a new city hospital. The estimated cost of the improvements is $100,000. The election will be held in [illegible]

The citizens of Whigham, Ga., at a recent election voted the issuance of bonds to the amount of $12,000 for waterworks improvements and for the construction of an electric light plant.

The citizens of Meigs, Ga., at a recent election, voted the issuance of bonds in the sum of [illegible] for [illegible]

Idaho.

⊙The A. C. Bird Co., of Salt Lake City, Utah, has been awarded the contract by the city of Preston, Ida., for the construction of a municipal water system for $57,827. The system will contain 21 miles of pipes, seven of which will be within the city limits and covering a large portion of the city. The source of supply is a spring 14 miles from the the city in the mountain. The company also purchased the $75,000 bonds issued for the improvement. C. H. Green of Spokane, Wash., is Engineer. Contract was let Feb. 24.

Illinois.

✣Bids will be received until 2 p. m., March 30, by Fire and Water Committee, C. W. Snyder, Chairman, Canton, Ill., for the construction and erection upon foundation at the Ave. D pumping station in the city of Canton, of a pumping engine of the Meyer valve gear type, compound condensing, high duty fly wheel type. C. R. Beam is City Engineer.

✣Bids will be received until 2 p. m., March 30, by Fire and Water Committee, C. W. Snyder, Chairman, Canton, Ill., for the construction at Ave. D pumping station in the city of Canton of two 150 h. p. horizontal water tube boilers. Specifications may be obtained of Joseph Waugh, City Clerk. C. R. Beam is City Engineer.

The City Council of Evanston, Ill., has amended its annual budget to include an appropriation of $150,000 for a new filtration plant. A bond issue will shortly be held to vote bonds to this amount for the improvement.

The Alton Water Co., Alton, Ill., has engaged Chester & Fleming, Consulting Engineers, Union Bank Bldg., Pittsburgh, Pa., to prepare plans and specifications for additional sedimentation capacity.

Plans and specifications are being prepared for a complete water supply system and a sewer system and sewage disposal plant for the city of Ashton, Ill., estimated to cost $75,000. The Aetna Engineering Bureau, 17 N. La Salle St., Chicago, Ill., are Engineers.

Iowa.

✣Bids will be received until about March 20, by Perry Town Lot & Improvement Co., Perry, Ia., for the construction of about 9,300 ft. of 4-in. water mains to be laid on the additions owned and being improved by the company at Perry. Charles E. Wilson, Perry, Ia., is Secretary and Engineer.

Kansas.

⊙The Neptune Meter Co. has been awarded the contract by the Board of Water & Light Commissioners of Ottawa, Kans., for future delivery of between 300 and 700 water meters, price not made public. Bids were opened Feb. 27 by W. O. Meyers, Supt.

Kentucky.

The Board of Commissioners of Newport, Ky., contemplates placing the question of issuing bonds for the installation of a filter for the waterworks on the ballots this fall.

Louisiana.

⊙The City of Kentwood, La., W. D. Welsh, Mayor, has awarded the following contracts for furnishing and delivering f. o. b. Kentwood, any or all of the following articles, bids opened Feb. 17: American Cast Iron Pipe Co., Birmingham, Ala., 3 or 6-in. and 8-in. pipe at $26.85 per ton; General Fire Extinguisher Co., New Orleans, La., 35 hydrants at $21.52 each, 6-in. gate valves at $8.55, 8-in. gate valves at $14.15, manholes, frames and covers at $6.95; Carolina Portland Cement Co., one car of cement at $1.84 per bbl.; Ahrene & Ott Mfg. Co., New Orleans, La., lead, $5.17. Geo. F. Conant, Kentwood, is Engineer.

Massachusetts.

The Board of Aldermen of Pittsfield, Mass., has adopted an order calling for the issuance of $300,000 in bonds under the Pittsfield water loan act.

Michigan.

Commissioner Dick Dewey of Pontiac, Mich., has recommended the purchase of another pump, a duplicate of the present one at the station of 5,000,000-gal. capacity, to insure fire protection.

Minnesota.

⊙J. G. Robinson of St. Paul, Minn., has been awarde tehc ontract by the City Council of Hill City, Minn., for the installation of a complete waterworks system, for which bids were opened March 7, at $10.99. The work includes pipe mains and trenching, well, power house and foundations, tower and tank, engines and pumps, 600 ft. of 2½ hose, one hose cart, etc. D. V. Case & Broomhall, Duluth, Minn., are Engineers and Architects.

The citizens of Kerkhoven, Minn., will vote March 26 on the issuance of bonds for the installation of a new waterworks system, estimated to cost $15,000. J. J. Johnson is Village Recorder.

Mississippi.

The Industrial Development Co., Jackson, Miss., has been incorporated with a capital stock of $100,000 to develop and own gas, oil and waterworks. J. L. Enochs, Jackson, is interested.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Missouri.

⊙The Memphis Steel Construction Co., Memphis, Tenn., has been awarded the contract by Board of Managers State Hospital, Nevada, Mo., for the erection of a steel water tower with a capacity of 100,000 gals., at $4,450. Bids were opened March 4 by J. J. Alford, Secretary of Board.

Montana.

The city of Shelby, Mont., proposes to install a water system this summer. The preliminary plans show that there will be at least 40,000 ft. of trench to dig through earth and clay. Plans and specifications will be ready in April and bids will be opened about May 1. There will be about 28,000 ft. of 8-in. wood pipe and 12,000 ft. of 6-in. wood pipe and 12,000 ft. of 6-in. wood pipe used in the system. J. E. Nolan is City Engineer.

Nebraska.

The City Council of York, Neb., has decided to submit to the voters at the spring election the question of granting a new franchise to the present water company, the franchise under which the company is operating expiring May 1. The next franchise will require the water company to make many new improvements in the plant, such as extension of mains, erection of a new water tower to pump 1,000,900 gals. of water daily if necessary. The city has the right to purchase the plant in 1914 for a consideration of $50,000, plus amount expended in improvements.

The village of Louisville, Neb., will in the near future advertise for bids on the construction of a system of waterworks, estimated to cost $16,000. C. A. Richey is Chairman of the Board of Trustees. D. K. Barr is Village Clerk.

New York.

✣Bids will be received until 3 p. m., March 25, by Board of Contract & Supply, Yonkers, N. Y., for furnishing and installing one 10,000,000-gal. high-duty pumping engine and appurtenances. J. V. Mahony is Secretary of the Board.

✣Bids will be received until 11 a. m., March 26, by Board of Water Supply, 165 Broadway, New York City, N. Y., for furnishing and delivering bronze ladders, steel gratings, wrought iron pipe railings and steel plates for the upper gate chamber of Ashokan Reservoir at Brown's station in the town of Olive, Ulster County, N. Y. J. P. Morrisey is Secretary.

⊙The Board of Contract & Supply of Rochester, N. Y., has awarded the contract for furnishing 25 tons of lead for the waterworks department to the Rochester Lead Works at $2,075, and the contract for furnishing the same department with stop gate stones to Joseph D'Argento, at $398.

A petition is being circulated among the taxpayers of Sodus, N. Y., to decide whether or not they are in favor of a municipal water system.

The taxpayers of Mount Morris, N. Y., have voted favorably upon issuing $140,000 water bonds for the construction of a new waterworks system and $45,000 for new sewer system. These amounts being the estimated cost of same. Plans have been completed for the work. The date for letting of contract has not been decided upon. J. Aubrey Striker is Village Secretary.

North Carolina.

Plans and specifications are being prepared by Consulting Engineer W. M. Piatt of Durham for the making of improvements to the pumping station of the waterworks, estimated to cost $150,000. The work will include additional pumping machinery having a capacity of 4,000,000 gals. daily, reinforced concrete building, 6,000,000-gal. filtration plant, and a 1,000,000-gal. concrete storage reservoir.

Ohio.

✣Bids will be received until noon, April 1, by J. M. Logan, Director of Service, Cambridge, O., for the necessary labor and material for repairing two old pumping engines now in power house of the water works. A certified check for $300 must be filed with each bid.

The City Council of Nottingham, O., has authorized the extension of the village water mains on several recently-opened streets.

The State Board of Health has rejected the plans submitted by the city of Portsmouth, O., for the installation of a new waterworks system, estimated to cost $300,000. The work would include a pumping station, mechanical filtration plant, reservoir and mains for new locations, supply to be secured from Ohio River. John M. Williams is Director of Public Service.

Oklahoma.

⊙The City Council of Sallisaw, Okla., has awarded the contract for making extensions to the present waterworks system to McKitchen & McKitchen of McAlester, Okla., for $27,500. Kennedy Fleming of Oklahoma City bid $30,000 on the work.

⊙Edward G. Ficke of Tulsa, Okla., has been awarded the contract by the City Council of Pawhuska, Okla., Albert York, City Clerk, for the making of extensions to the water system at $12,389. The work includes 6-in. and 4-in. cast-iron pipe, 26 fire hydrants, 6-in. and 4-in. gate valves. Rock excavation will cost $1.65 per cu. yd. Bids were opened March 4.

Two miles of 24-in. water mains will be laid under the direction of city water department officials of Muskogee, Okla. The City Council has decided to do all work, heretofore done on the contract system, by day labor.

The town of Kenefic, Okla., has voted the issuance of bonds to the amount of $15,000 for the installation of a waterworks system.

It is reported the citizens of Idabel, Okla., on March 11 voted the issuance of bonds in the sum of $35,000 for the installation of a waterworks system.

Pennsylvania.

✣Bids will be received until 7:30 p. m., March 19, by Board of Water Commissioners, E. J. Deininger, Secretary, Reading, Pa., for furnishing 195 tons of cast iron pipes and special castings, 18 gate valves, 382 water meters, 470 corporation cocks and 3,060 tons of coal and for the removal of scrap material and cast iron water main; also for laying water pipes during the fiscal year.

South Dakota.

✣Bids will be received until 8 p. m., April 4, by City Council, Madison, S. D., for furnishing and installing one pump of 400 gal. per minute and one 600 gal. per minute capacity; one 40 h. p. and one 60 h. p. motor, one 100 B. H. P. oil engine; fuel storage tank, etc. Missouri Valley Engineering Co., Mitchell, S. D., are Engineers. William Rae is City Auditor. Official advertisement will be found elsewhere in this issue.

The citizens of Yankton, S. D., will vote in April on the proposition to issue bonds for the installation of a waterworks system. Hugh C. Liebee is City Engineer.

Tennessee.

✣Bids will be received until March 19, by city of Jellico, Tenn., for furnishing two 750,000-gal. pumps; two 75-h.p. internal furnace boilers, open-feed water heater and for constructing brick pump house. Walter G. Kirkpatrick, Jackson, Miss., is Engineer.

⊙The Board of Public Works of Nashville, Tenn., has awarded the contract for furnishing 200 water meters to the National Meter Co., of New York City, at $10 each.

Texas.

Consulting Engineer James H. Fuertes, 140 Nassau St., New York City, has submitted his report to the City Commission of Dallas, Tex., for the installation of a water purification plant. The report provides for the establishment of a mechanical filtration plant at the Turtle Creek pumping station and the use of sulphate of lime and sugar iron in the settling basins there to soften and cl fy the raw water. The estimated cost is $,000.

Plans will be prepared by Consul [illegible] Bl las, Tex., for the making of extensi waterworks system of Waco, Tex., to cost $400,000. The work will pumping plant complete, with settli and filters, standpipe of 400,000-gal. and some pipe lines. Water will from the river. Bond election will April 2. S. J. Quay is Superintenden terworks.

The city of Cleburne, Tex., has s in the sum of $178,000 for waterwor to Harris Trust & Savings Bank of Chi go.

It is reported the city of Decatur, sold bonds in the sum of $8,000, k wn waterworks and electric light bonds Wo will shortly be started on the rebuildi of plans which were destroyed by fire.

Vermont.

The citizens of Rutland, Vt., on voted against the issuance of bond to amount of $50,000 for the installati filtration plant and a new reservoir. P Clement is Mayor.

Virginia.

The city of Clifton Forge, Va., chased from the Clifton Forge Light Co., all of its pipe lines, riparian rights of way for $180,000.

The City Council of Culpeper, Va., pointed a committee with W. S. Ch Chairman, to investigate the advisabili stalling a mechanical filtration plant.

Washington.

⊙Haydon & Sons, 4642 Eastern A tle, Wash., have been awarded the by the Board of Public Works of [illegible] water North 66th St. et al., for $3,295. Ele were received on the work.

The utilities committee of the Cit cil, Seattle, Wash., has recomme passage a bill appropriating $30,000 construction of a water main under th Waterway. A bill was also recomme d passage appropriating $5,000 from th fund for the installation of a pump fornia Ave. and West Othello St., the highest part of West Seattle hil

An ordinance for a municipal gravity water system has been int the City Council of Chehalis, Wa proposed to issue bonds in the sun 000.

The city of Granger, Wash., has s in the sum of $15,000 for the install a water system.

The city of Twisp, Wash., is adverti g the sale of $9,500 in bonds for the instal of a gravity water system. F. E. Se Town Clerk.

Wisconsin.

✣Bids will be received until 10 a. m. 20, by City Clerk, De Pere, Wis., for [illegible] first-class fire h [illegible] Baeten is a member of the committee Department.

✣Bids will be received until 8 p. m., by W. F. Voss, Secretary, Watertow for connecting well No. 1 with pumps power house and installing a centrifug in well No. 2.

Wyoming.

✣Bids will be received until 10 a. m., 25, by James J. Winthrow, City Clerk, dan, Wyo., for the construction of a mately 7,430 ft. of sections of 4-in. ca water pipe.

Burns & McDonnell, Consulting En Scarritt Bldg., Kansas City, Mo., hav their report to the City Council of Wyo., on the proposed construction of ter-works plant. It is recommended t water be taken from just above the of Sulphur Creek.

Canada.

✣Bids will be received until 11 a. m., 19, by Chairman, Board of Control, Wi

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

., fo supply of labor and materials re-
ed in the erection of approximately 10,-
ft. in length of 36-in. wooden stave pipe
Sp ification and form of tender, to-
er w conditions governing tenders, as
ribe by by-law, may be obtained at the
City Engi[illegible] 223 [illegible]

M [illegible]
✣[illegible]

[illegible]

⊙The Siemens Bros Dynamo Works, McArthur Bldg., Winnipeg, Man., has been awarded the conrtact by the Board of Control of Winnipeg, M. Peterson, Secretary, for supply and installation of three 50 k. w. transformers and accessories at Well No. 3 at $2,690. Bids were opened Feb. 8.

SEWERAGE AND GARBAGE DISPOSAL

Florida.

ty Council of Pensacola, Fla., has .. contract for the making of sewer . to the Turner Construction Co., to between $10,000 and $15,000.

Idaho.

r J P [illegible] repared plans for the construction of 6-in., 8-in. and 10-in. sewers, [illegible] manholes, 7 combined manholes nks and 1 lamphole. The estimated work is $70,105. Bids will be re- March 28. J. M. Bistline is Mayor. ns is City Engineer.

ll be received until 7 p. m., March H. Berg, City Clerk, Pocatello, he construction of a system of lat- [illegible] s prepared by J. P. Congdon, City

Illinois.

rd of Local Improvements of Ill., has awarded the contract for tion of a sewer on Jefferson St., McAuley for $1,880. The Merri- ction Co. of Monmouth, Ill., sub- bid of $2,046 on the work.

y Engineering Department of Peoria, eparing plans for a new sewer for Ward which will cost approxi- 000. The area embraced runs St., south to Laramie, or the city uns north to Lincoln Ave., from ence to Western, thence to Sev- it Seventh to Laramie. Leonard is City Engineer.

Indiana.

H. M. [illegible] Ill., has prepared plans for the con- f a sewer in Baltimore St., from Oak. A public hearing will be . 14.

l of Public Works of Gary, Ind., petitioned by citizens in the vicinity Ave., for the construction of a sewer ocks long. The estimated cost is

Iowa.

will be received until 8 p. m., March W. W. Cummings, Chairman Street ee, Ottumwa, Ia., for the construc- sundry Trunk and Main sewers and ances according to plans and spec- on file at the office of the city en- The work will include 3,655 ft. of k sewers; 2,226 ft. of 8-ft.; and 1,400 -ft. brick sewers. Total of certified required $1,950.

will be received until 8 p. m., March . A. Dougherty, City Clerk, Carroll, the construction of pipe storm sewers ll. Plans and specifications may be of the City Clerk. Official advertise- ll be found elsewhere in this issue.

contract for the erection of the Na- Sewer Pipe Co.'s plant at Webster ., has been let to W. J. Zitterell of y at $115,000. This includes the con- n of the main factory building, the eds, engine rooms, dry rooms, boiler office building, kilns and smoke stacks. imately $50,000 worth of machinery installed. Work on the plant will be April 1 and must be completed by Dec. Crowter is President of the com-

⊙W. E. Rosencrans of Ames, Ia., has been awarded the contract by the City Council of Fort Dodge, Ia., for constructing a sanitary sewer on Second Ave., south between 19th and 21st Sts. for $1,095.

The Perry Town Lot & Improvement Co., of Perry, Ia., B. C. Dilenbeck, President, contemplates constructing additional sewers this summer. Chas. E. Wilson is Secretary and Civil Engineer of the company.

Kansas.

✣Bids will be received until 11 a. m., March 30, by Maj. G. G. Bailey, Constructing Quartermaster, Fort Leavenworth, Kan., for the construction of a sewer to the N. C. O. quarters.

✣Bids will be received until noon, March 25, by Robert P. Seyfer, City Clerk, Mulvane, Kan., for the construction of a sewer system for the city. The work will embrace the trenching and laying of about 16,000 lin. ft. of 8, 10, 12 and 15 in. pipe, constructing manholes, lampholes and flush tank. Plans and specifications will be on file at the office of the City Clerk and at the office of L. C. Lawton, Division Engineer of the Santa Fe Railroad, Newton, Kan. Copies of specifications and bidding blanks, etc., may be obtained from the Engineer, at Newton, Kan.

Kentucky.

⊙H. H. Snyder & Co., Todd Bldg., Louisville, Ky., have been awarded the contract by the Sewer Commission of that city, J. B. F. Breed, Chief Engineer, for the construction of the Barney Ave. sewer, for which bids were opened on Feb. 23. The work will include 2,043 ft. of 8-in. sewer and 22-in. to 33-in. storm water drain, 230 cu. yds. of concrete and 2,043 ft. of 8-in. and 10-in. pipe, 580 ft. of 22-in. vitrified pipe and 900 cu. yds. of rock excavation.

Louisiana.

City Secretary Wm. J. Sandoz of Opelousas, La., will sell bonds March 30 in the sum of $40,000 for the installation of sewers in First Sewerage District. Walter G. Kirkpatrick, Jackson, Miss., is Engineer for the system of sewers.

Maryland.

The Joint Committee representing Prince George and Montgomery Counties, Md., at a meeting held in the office of Attorney J. H. Ralston, Washington, D. C., it was decided to draft a bill for introduction in the Maryland legislature, providing for the appointment of a commission to consider the proposed project of connecting the sewerage systems of the various Maryland towns lying along the District line with the system of Washington, D. C.

Massachusetts.

The Board of Aldermen of Brockton, Mass., has passed an ordinance providing for the following loans: $30,000 for playgrounds; $10,000 for drainage purposes; $10,000 for parks; $30,000 for sewerage purposes and $50,000 for a new school building in Montello.

Michigan.

The village of Birmingham, Mich., has sold bonds in the sum of $25,000 for sewer construction, to the Union Trust Co., of Detroit, Mich.

Minnesota.

✣Bids will be received until 5 p. m., March 22, by City of Albert Lea, Minn., C. J. Dudley, Clerk, for the construction of a sewer system including approximately 1,490 ft. of 10-in. pipe and 6,800 ft. of 8-in. pipe and 30 manholes. William Barneck is City Engineer.

⊙Fraser & Danforth, 411 Hickney Bldg., St Paul, Minn., have been awarded the contract by the city of Stillwater, Minn., Lewis W Clarke, City Engineer, for the construction of the South Hill outlet sewer for $11,500 Bids were opened March 5.

The Board of Public Works of Duluth, Minn., has passed a resolution calling on the &city engineer to specify which storm sewers, in his opinion, should be constructed the coming year.

Improvements are contemplated on Park Point, Duluth, Minn., the coming spring and summer that will total over $100,000. It is proposed to put in a complete sewer system and pave Minnesota Ave., its full width from Eighth to 43rd St.

City Engineer Andrew Rinker of Minneapolis, Minn., contemplates commencing work immediately on the construction of a sewer tunnel up Nicollet Ave., to relieve the sewer congestion in the Nicollet Ave. business district.

Mississippi.

The city of Natchez, Miss., will build about one-half mile of 8-in. pipe sewers. T. K Winchester is superintendent of sewer construction. Walter G. Kirkpatrick, Jackson, Miss., is Consulting Engineer.

Missouri.

✣Bids are being received, it is reported, by Board of Public Works, St. Joseph, Mo., for the construction of the South Park main sewer from 6th and Atchison St. and laterals to 22d and Commercial and 22d to Garfield Sts. The cost is estimated at about $19,000.

Consulting Engineer Alexander Potter, 114 Liberty St., New York City, has submitted plans to the City Council of Springfield, Mo., for the construction of sewage plants at the outlets of the two main sewers. The estimated cost of the two disposal plants is $100,000. H. G. Horton is City Engineer.

The contract for constructing a sanitary and storm sewer in Sewer District No. 200 in the city of Hannibal, Mo., B. F. Smiley, City Engineer, has not been awarded; bids opened Feb. 29. The work will be re-advertised.

Nebraska.

✣Bids will be received until March 25, by City of Omaha, Neb., for the construction of storm sewers estimated to require an expenditure of about $54,000. Plans and specifications are on file at the office of George W Craig, City Engineer.

⊙The Midwest Engineering Co., 301 McCague Bldg., Omaha, Neb., has been awarded the contract by the city of Fullerton, Neb., for sewer districts Nos. 2 and 3.

Plans are being prepared by Engineer Wm. Grant of Lincoln, Neb., for the installation of a sewer system in the town of Sidney, Neb., estimated to cost $22,000. A bond election will be held March 25 to vote on the improve- [illegible] bonds carry.

New Jersey.

✣Bids will be received until 9 p. m., March 20, by Common Council, Beverly, N. J., for furnishing all material and doing all work necessary to the complete construction of about 7 miles of vitrified pipe sewers, from

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

5 to 15 ins. in size, with Y [illegible] manholes, flush tanks and other necessary appurtenances, and of a sewer disposal works, including the necessary piping, grading, etc. Plans may be seen and specifications and forms of proposal obtained at the office of the City Clerk, Beverly, N. J., or at the office of Clyde Potts, C. E., Engineer, 30 Church St., New York City. Each bid must be accompanied by a certified check on a solvent bank for $5,000.

✣Bids will be received until 8 p. m., March 19, by Township Committee of South Orange Township, Maplewood, N. J., for the construction of certain sewers in the Hiltonia District of South Orange Township. The work embraces the furnishing and laying of approximately 12,400 ft. of 8-in. sewer; 1,600 ft. of 10-in. sewer, together with manholes, flush tanks and appurtenances. A certified check for $200 shall accompany each proposal. The attention of contractors is called to the necessity of constructing a thoroughly watertight sewer. Plans and specifications can be seen, and bidding sheets secured, at the office of the consulting engineer, Alexander Potter, 114 Liberty St., New York City, on and after March 7, 1912. Plans and specifications can also be seen at the office of the township committee, Maplewood, N. J.

New York.

✣Bids will be received until 3 p. m., March 25, by W. J. H. Robinson, Village Clerk, Hobart, N. Y., for the construction of a sewerage purification plant consisting of seapage tanks and sand filtering beds; also for the construction of sewers as follows: 2,700 ft. of 12-in. vit. pipe sewers, 3,900 ft. of 10-in. vit. pipe sewers, 11,400 ft. of 8-in. vit. pipe sewers, 400 ft. of 6-in. vit. pipe sewers, 3,500 ft. of 4-in. vit. pipe sewers, 20 ft. of cast iron pipe; together with manholes and other appurtenances. Plans and specifications can be examined and proposal sheets obtained either at the office of the Village Clerk in Hobart, N. Y., or at the office of Orson A. Miller, City Engineer, Oneonta, N. Y. All bids must be accompanied by a certified check for 5 per cent of the bid.

✣Bids will be received until 11 a. m., March 20, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for the necessary labor and material for constructing sewers in 11th Ave. between 74th and 76th Sts. and an outlet sewer in 74th between 11th and 10th Aves.; also for necessary labor and material for constructing a sewer in Sterling Place, between Rochester and Utica Aves.

✣Bids will be received until 11 a. m., March 20, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for six sewer construction contracts, the largest being No. 1, for furnishing all labor and material for the construction of outlet sewers in Ocean Parkway, East Side, between Ave. J and Ave. M, and in Ave. M, between Ocean Parkway and Coney Island Ave.

✣Bids will be received until noon, March 19, by George Cromwell, President, Borough of Richmond, New York City, for furnishing the necessary labor and material required for constructing the necessary supply and outfall pipe lines, pile foundations, etc., in connection with the construction and maintenance of an experimental sewerage disposal plant at West New Brighton, Borough of Richmond, together with all work incidental thereto, under Contract No. 1.

⊙The Board of Contract and Supply of Rochester, N. Y., has awarded the contract for the construction of the Parsons St. sewer to John J. Regan for $2,183. The Board, it is reported, has also awarded a contract for furnishing 25 rubbish wagons to W. H. Rowerdink at $225 each.

⊙The Board of Contract and Supply of Rochester, N. Y., has awarded the contract for the construction of the Genesee Park Blvd. sewer to John Petrossi Co., for $20,803.

The Metropolitan Sewerage Commission, a board of engineers created by the city and state of New York to make plans for the sanitary disposal of New York's sewage, has sent to Mayor William Gaynor the second in a series of reports in which the necessity for colossal main drainage works, such as those of London, Paris and Berlin, is shown. The commission recommends that the city be divided into four drainage areas in each of which there shall be a number of central points in which the sewage is collected and there purified to such an extent that the remainder can be discharged into the harbor without danger to health or the possibility of nuisance. The members of the commission are George A. Soper, President; James H. Fuertes, H. DeB. Parsons, Charles Sooysmith and Linsly R. Williams.

Ohio.

✣Bids will be received until noon, March 19, by W. J. Springborn, Director, Department of Public Service, Cleveland, O., for the construction of sewers in the following streets, avenues, courts, thoroughfares: Abbey Ave., S. W., between Lorain Ave. and West 20th St.; Baxter Ave., S. E., between Broadway, S. E., and East 65th St.; Cathedral Ave., S. W., between West Seventh St. and 370' easterly; Crestwood Ave., S. E., between Woodhill Rd., S. E., and City Limits; Grandview Ave., S. E., between Woodhill Rd., S. E., and City Limits; Clement Ave., S. E., between East 66th St. and East 67th St.; Wichita Ave., S. W., between Pearl Rd., S. W., and Westerly City Limits; West 30th St., between Natchez Ave., S. W., and Tampa Ave., S. W. Each bid must be made in accordance with the plans and specifications which may be seen at the office of the Chief Engineer, Room 305 City Hall. W. H. Kirby is Secretary.

✣Bids will be received until noon, March 25, by F. A. Woodard, Clerk, Andover, O., for furnishing the necessary labor and materials for the construction of a sewage disposal works for the village. B. F. Hewit, Jefferson, O., is Engineer.

✣T. J. Hurley, Windsor St., Marion, O., has been awarded the contract by the Board of Public Service of that city for the construction of sewers in Park St., and Summit St., at $1,778. The work includes 2,019 lin. ft. of 6-in. pipe, 1,194 lin. ft. of 4-in. lateral connections, 7 manholes with iron covers and frames, average cut 7 ft., with 305 cu. yds. of rock excavation. E. A. Scott, Marion, is Engineer. Bids were opened March 1.

Safety Director F. E. Harman of Lima, O., has requested the state board of health for a 30-day extension to prepare plans for the construction of a sewage disposal plant in Lima.

Oklahoma.

⊙The city of Girard, Kans., has awarded R. T. Foster of Oklahoma City, Okla., the contract for the installation of a sewer system and sewage disposal plant at $15,389 and $6,584 respectively; Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., Engineers. Other bidders on the sewer system were: Koch & Kost, Joplin, Mo., $23,856; Hamilton Bros. Construction Co., Taylor, Tex., $24,179; J. P. Gooch, Vinita, Okla., $25,008; J. R. Ramsey, Topeka, Kans., $19,397 and R. J. & Wm. Boyd, Kansas City, Kans., $18,774. Other bidders on the disposal plant were: Koch & Kost, $8,205; Hamilton Bros. Construction Co., $8,484; J. P. Gooch, $7,324; J. R. Ramsey, $6,771, and R. J. & Wm. Boyd, $9,159. Bids were opened Feb. 15.

⊙The Oklahoma Engineering Co., of Oklahoma, Okla., has been awarded the contract by the city of Sallisaw, Okla., Alex. S. Foreman, Town Clerk, for the construction of a sanitary sewer system at $28,711. The work will embrace 49,700 ft. 8 to 18-in. vitrified sewer, average cut from 6 ft. to 8 ft.; 90 manholes; 17 lampholes; 14 flush tanks; 500 cu. yds. rock excavation, and disposal plant. Bids were opened Feb. 27.

Oregon.

It is reported the City Council of Enterprise, Ore., has retained Engineer E. E. Koon of Chicago, Ill., to prepare plans for the installation of a sewer system.

Pennsylvania.

⊙Director of Public Service J[illegible] and Mayor W. A. Mage[illegible]burgh, Pa., have awarded the following contracts for which bids were opened [illegible] 20: Federal St., M. O'Herron Co., at $1[illegible]; Warner St., Thomas Cronin Co., at $1[illegible]; Russell St., to Neelen & Daly [illegible]; Frankstown Ave., to Masi Bros., at [illegible]298; [illegible] St., to Nick Diulius at $1,020; [illegible]rway, to William J. Lynd, at $428.

The City Council of Lansdale, [illegible]., is considering the construction of a ne[illegible] sew[illegible] system and disposal plant, to conform [illegible] the requirements of the State [illegible] Health, and involving an expe[illegible] $100,000.

The City Council of South Bethlehem, Pa., contemplates having plans prepar[illegible] for the installation of a sewerage system [illegible] cost approximately $100,000.

The Town Council of New C[illegible], Pa., has decided to construct se[illegible] sewers on some of the streets of [illegible]

South Carolina.

It is not probable that an elect[illegible] called in Anderson, S. C., for the [illegible] voting on the issuance of bonds in [illegible] $25,000 for a sewer system as [illegible] stated. J. H. Godfrey is City Cler[illegible]

Tennessee.

⊙The contract for the construct[illegible] "Alley 345" sewer, for which bids [illegible] by the Board of Public Works [illegible]ville, Tenn., has been let to E. T. [illegible] of Nashville, for $4,295.

⊙The Dysand Construction Co. [illegible] Ga., has been awarded the contract [illegible] of St. Elmo, Tenn., for the instal[illegible] sewer system, including 12 miles [illegible] and a disposal plant for $60,000. [illegible]man Fairleigh Engineering Co., Ch[illegible] Tenn., Engineers. Bids were opene[illegible]

Texas.

The City Officials of San Antoni[illegible] the near future will install a numb[illegible] tanks in different portions of th[illegible] the purpose of permitting further [illegible]nections with the main sanitary s[illegible]tem.

Washington.

⊙The Appling-Griggs Co., of T[illegible] Wash., has been awarded the co[illegible] building the branch asylum sewer [illegible] from the asylum buildings due w[illegible] distance of 2,375 ft. to the Umatill[illegible] $2,568. The sewer is to be 12-in. ir[illegible] Other bids were: Sharon & Eddin[illegible], Chas. W. Connor & Son, $3,325; [illegible] Johnson, $3,300, and Beddow & Mil[illegible]

West Virginia.

The citizens of Warwood, W. [illegible] shortly vote on the proposition to is[illegible] in the sum of $15,000 for the inst[illegible] a new sewerage system.

Wisconsin.

⊙Contracts have been awarded by Board of Public Works of Oshkosh, Wis[illegible] the construction of six different s[illegible] follows; Chris Johnson, 12-in. pipe [illegible] Eighth St., between Nebraska St., [illegible]mit east, $0.39 per lin ft.; Chris Jo[illegible]in. pipe sewer in Sixth St., betwee[illegible] and Minnesota Sts., $0.43 per lin. [illegible] pipe, $0.48; Louis Larsen, 10-in. p[illegible] in Seventh St., between Knapp and S[illegible] east, $0.53 per lin. ft., 12-in. pipe [illegible] lin. ft.; Chris Johnson, Ninth St. [illegible] Knapp and Summit east, 12-in. pipe [illegible] lin. ft.; Louis Larsen, Burdick St. [illegible] Murdock St. and Bent Ave., 12-in. [illegible] per lin. ft.; Chris Johnson, Ashland [illegible]tween Harris Ave. and Murdock [illegible] pipe, $0.43 per lin. ft.

⊙Kirchen Bros of Hudson, Wis., [illegible] awarded the contract by the State [illegible] Control, St. Paul, Minn., for sewe[illegible] sewage purification of the State Asyl[illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

at $14,932. Bids we [illegible]

Canada.

be received until noon, March
Mayor, Halifax, N. S., for the con-
[illegible] Plans and [illegible]

✣ [illegible] vertical panel switch [illegible]

✣Bids will be received until noon, March 29, by City Commissioners, Saskatoon, Sask., for necessary labor for laying approximately [illegible] and for constructing all manholes, flush tanks, setting fire hydrants, gate valves, etc.

The City Council of Oak Bay, B. C., has passed a by-law to authorize the raising of $275,000 for sewer construction.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

District of Columbia.

will be received until 10:30 a. m.,
Maj. F. C. Boggs, General Pur-
r, Isthmian Canal Commission,
D. C., for furnishing under canal
umber piles and paving brick.
be received until 10:30 a. m.,
Maj. F. C. Boggs, General Pur-
r, Isthmian Canal Commission,
D. C., for furnishing under canal
crossovers and turnouts for
locomotive tracks for all locks.
be received until noon, April 3,
W. C. Langfitt, U. S. Engineer,
N. W., Washington, D. C., for
building dam and construction
remodeling Georgetown reser-

be received until 11 a. m., April
F. Cheatham, Depot Quarter-
n Bldg., Washington, D. C., for
el, reinforcing rods, expanded
wire fabric, pipe columns,
pipe, plumbing fixtures and
ent and steel sheets for man-
[illegible]

Illinois.

be received until 11 a. m.,
Board of Administration, Spring-
he construction of approximately
4½x6 ft. open concrete tunnel,
crete work, for heating system at the
tate Hospital, South Bartonville, Ill.
y no sheeting required. It is clay
ans and specifications may be in-
[illegible]
Hospital, or to the undersigned
Ill. Frank D. Whipp is Fiscal
fficial advertisement will be found
this issue.
will be received until 2 p. m., April
R. Kennedy, City Clerk, Alton, Ill.,
ing the streets of the city of Alton.

Massachusetts.

be received until 8 p. m., March
mittee on Central Fire Station,
livan, 527 Revere St., Revere, Mass.,
rection and completion of a Central
other than heating and plumb-
r the heating and for plumbing
building are also invited. Bids for
ral contract must be accompanied by
d check for $500; bids for the heat-
ertified check for $100, and bids for
contract by certified check for $100;
ks to be made payable to the town of
Plans and specifications may be seen
ntral Fire Station, Broadway, Revere,
e office of Penn Varney, Architect.

will be received until noon, March
Leighton Beal, Secretary, Boston
Commission, 15 Beacon St., Boston,
r furnishing and delivering 1,730 tons
e cold-twisted rods, 20 tons of square
ls and 250 tons of round plain rods,
to be of open hearth steel.

Michigan.

will be received until noon, April 5,
Col. F. R. Shunk, U. S. Engineer,
Minn., for furnishing and placing
the foundation embankment for the
ter extension at Marquette, Mich.
dvertisement will be found elsewhere
[illegible]

✣ [illegible] moval of pier work at Ludington Harbor, Mich.

✣Bids will be received until 3 p. m., April [illegible] gineer, 337 Federal Bldg., Detroit, Mich., for [illegible]

Minnesota.

✣ [illegible] nishing the necessary labor and material for the erection of a frame school house and [illegible]

Missouri.

✣Bids will be received until noon, March [illegible] by J. G. Babb, Secretary of the University of Missouri, Columbia, Mo., for the erection of a physics building on the grounds of the University at Columbia, Mo. James P. Jamie- [illegible] Architect.

✣ [illegible] Commission, 1307 Leggett Bldg., St. Louis, Mo., will receive bids until March 21 for [illegible]

New Jersey.

✣Bids will be received until 3 p. m., March 21, by Department of Commerce and Labor, Charles Nagel, Secretary, Washington, D. C., for the construction complete of a pier for the Philadelphia, Pa., immigration station, Gloucester, N. J.

New York.

✣Bids will be received until noon, April 1, by Col. W. M. Black, U. S. Engineer, 710 Army Bldg., 39 Whitehall St., New York City, for constructing dikes in Hudson River, N. Y.

✣Bids will be received until 3 p. m., March 20, by the State Commission in Lunacy, Capitol, Albany, N. Y., for tuberculosis pavilions construction, including heating, plumbing and electric work at the Kings Park State Hospital, Kings Park, N. Y. T. E. McGarr is Secretary of the Commission.

✣Bids will be received until noon, April 1, by Col. W. M. Black, U. S. Engineer, 39 Whitehall St., New York City, for constructing dikes in Hudson River, N. Y. The work consists in furnishing and securing in place the piling, timber work, metal accessories and stone or other filling on the following dikes: Van Weis, Cedar Hill, Willow Island, Stonehouse Bar, Stuyvesant and Fordham Point, all located on the Hudson River between Hudson and Albany, N. Y. The total estimated quantities of material in the several dikes are [illegible]

North Dakota.

✣ [illegible] necessary labor and materials for the erection [illegible] Indian School, N. Dak.

Ohio.

✣Bids will be received until 2 p. m., March [illegible] the steel or steel and iron hull light draft [illegible]

✣ [illegible] by John H. Brown, Director of Public Safety, Lakewood, O., for furnishing complete combination chemical and water pump- [illegible]

✣ [illegible] 19, by Board of Trustees, Ohio University, Athens, O., for furnishing of the material and performing the labor necessary to construct a training school building according to the plans and specifications, descriptions, bills and estimates, prepared by Frank L. Packard, Architect, Columbus, O., which plans and [illegible] Secretary of the Board of Trustees, I. M. [illegible] architect.

Oregon.

✣ [illegible] 18, by C. W. James, Superintendent, Oregon State Prison, Salem, Ore., for furnishing materials for the erection of 24 steel cells at the prison. W. C. Knighton, Capitol Bldg., Salem, Ore., is Architect.

✣Bids will be received until 4 p. m., March 28, by A. L. Barbur, Auditor, Portland, Ore., for furnishing the fire department of the city of Portland with 50 positive non-interfering successive fire alarm telegraph boxes according to the plans and specifications on file in the office of the Superintendent of the Fire Alarm and Police Telegraph, City Hall.

Texas.

✣Bids will be received until noon, April 1, by Capt. T. H. Jackson, U. S. Engineer, Dallas, Texas, for iron and steel delivered at Kleburg, Texas, on the Texas & New Orleans R. R.

Wisconsin.

✣Bids will be received until noon, March 15, by Board of Trustees, Public Museum, Milwaukee, Wis., for furnishing all material and labor for work on the public museum. Bidders are required to submit bids for the work as follows, towit: 1. Marble and terrazzo tile floors. 2. Carpenter work. 3. Painting and glazing. The carpenter work is to be completed within four months from the letting of the contract, and the painting and glazing must be finished within thirty days after the completion of said carpentry [illegible]

[illegible]

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

DITCHING AND TILE DRAINS.

Pu[illegible] passed by the Board of Supervisors of Clinton County, Iowa, notice is hereby given that said Board will receive sealed bids for the construction of ditches and tile drains in Drainage District No. Eleven (11), Clinton, Iowa, on the 10th day of April, 1912, at 2 o'clock P. M.

1st. That sealed bids will be received per cubic yard for excavation on ditch work, and per lineal foot of tile drains, on tile work, on the following sections.

2nd. Said District is divided into two (2) Sections.

3rd. Section "A" is composed of the "A" ditch.

9,400 ft. 18-ft. bottom, slopes 1½ to 1; 6,600 ft. 14-ft. bottom, slopes 1½ to 1; 7,000 ft. 6-ft. bottom, slopes 1½ to 1; 6,600 ft. 4-ft. bottom, slopes 1½ to 1; 2,000 ft. 3-ft. bottom, slopes 1½ to 1; 4,000 ft. 2-ft. bottom, slopes 1½ to 1.

Lateral No. 1—3,600 ft. 2-ft. bottom, slopes 1 to 1; 2,000 ft. 10-inch tile, slopes 1 to 1.

Lateral No. 2—2,700 ft. 12-inch tile, slopes 1 to 1.

Lateral No. 3—2,700 ft. 2-ft. bottom, slopes 1 to 1; 1,700 ft. 12-inch tile, slopes 1 to 1.

Lateral No. 4—600 ft. 10-inch tile, slopes 1 to 1.

Lateral No. 5—3,200 ft. 2-ft. bottom, slopes 1 to 1.

Lateral No. 6—4,000 ft. 12-inch tile, slopes 1 to 1.

Lateral No. 7—1,400 ft. 12-inch tile.

Lateral No. 8—800 ft. 10-inch tile.

Lateral No. 9—2,600 ft. 2-ft. bottom, slopes 1 to 1.

Lateral No. 10—2,700 ft. 12-inch tile

Lateral No. 11—900 ft. 10-inch tile.

Lateral No. 12—7,000 ft. 2-ft. bottom, slopes 1 to 1.

Lateral No. 13—2,600 ft. 2 ft. bottom slopes 1 to 1.

Lateral No. 15—1,400 ft. 12-inch tile.

Lateral No. 16—2,000 ft. 2-ft. bottom, slopes 1 to 1.

4th. Section "B" is composed of the "B" ditch.

2,800 ft. 7 ft. bottom, slopes 1½ to 1, 7,700 ft. 6-ft. bottom, slopes 1½ to 1; 1,600 ft. 2-ft. bottom, slopes 1½ to 1; 10,300 ft. 2-ft. bottom, slopes 1 to 1.

Lateral No. 18—4,400 ft. 2-ft. bottom, slopes 1 to 1.

Lateral No. 19—3,300 ft. 2-ft. bottom, slopes 1 to 1; 1,400 ft. 10-inch tile.

Lateral No. 20—1,000 ft. 10-inch tile

Lateral No. 21—4,200 ft. 15-inch tile.

Lateral No. 22—9,000 ft. 2-ft. bottom, slopes 1 to 1.

"C" Ditch.

6,000 ft. 5-ft. bottom, slopes 1½ to 1; 5,200 ft. 4-ft. bottom, slopes 1½ to 1; 2,700 ft. 12-inch tile; 1,100 ft. 10-inch tile.

Lateral No. 23—1,000 ft. 2-ft. bottom, slopes 1 to 1.

Lateral No. 24—3,100 ft. 12-inch tile

Lateral No. 25—3,100 ft. 12-inch tile.

Lateral No. 26—3,000 ft. 10-inch tile.

Lateral No. 27—6,800 ft. 2 ft. bottom, slopes 1 to 1; 700 ft. 12-inch tile.

Lateral No. 28—2,800 ft 2-ft. bottom, slopes 1 to 1.

Lateral No. 29—3,500 ft. 3-ft. bottom, slopes 1 to 1.

Lateral No. 30—1,400 ft. 3-ft. bottom, slopes 1 to 1; 2,600 ft. 15-inch tile.

Lateral No. 31—1,500 ft. 2-ft. bottom, slopes 1 to 1.

Lateral No. 32—2,000 ft. 10-inch tile

Said work to be commenced on the 1st day of July, 1912.

Section "A," 258,570 yardage; Section "B," 150,100 yardage. Above are estimated quantities only.

Section "A" to be completed on or before January 1st, 1914.

Section "B" to be completed on or before January 1st, 1914.

5th. All bids must be in sealed envelopes, indorsed with the bidders name and marked on the outside "Proposal for District No. 11," and same must be made on blank forms, which can be obtained at the County Auditor's Office, and each bid must be accompanied in a separate envelope by a cash deposit or certified check, made payable to the County Auditor of Clinton County, in the sum equal to 10 per cent of the amount of the bid, which sum will be forfeited and become the property of Clinton County in case the successful bidder should fail to enter into a contract or give the required bonds in a sum equal to 25 per cent of the estimated cost of the work to let.

6th. Contractors are requested to make two separate kinds of bids, one contemplating cash payment, including 80 per cent monthly estimate; the other on payment in bonds issued by the Drainage District delivered on completion of all work.

7th. Said work to be done in accordance with the plans and specifications now on file with the County Auditor at the Court House, in Clinton, Iowa.

The Board reserves the right to reject any and all bids, and re-advertise for new bids.

County Auditor.

ROAD GRADING.

Sealed Bids will be received by the Board of County Road Commissioners of Gogebic County, for all or any portion of the following work.

For furnishing all tools, material, labor, etc., necessary for Clearing, Grubbing, Grading and Ditching of approximately 37 miles of road. An approximate estimate of the amount of work to be done is as follows:

180,000 cu. yds. of dirt.
55,000 sqs. of grubbing.
270 acres of clearing.

Specifications, plans and profile, as well as any other information, may be had at the Engineer's Office at Bessemer, Mich.

A certified check in the sum of $1,000.00 will be required to accompany said bid, which check shall be forfeited if the successful bidder fails to enter into contract within 10 days from the award of the bid.

Bids to be considered must be filed with the County Clerk, on or before Tuesday, April 2, 10 o'clock A. M.

The Board of County Road Commissioners reserves the right to reject any bid or part of a bid, if it be deemed for the best inte est of the county to do so

G S BARBER
Chairman.

H. A. HARPER,
Engineer.

Very truly yours,
H A HARPER

CANADIAN PACIFIC RAILWAY COMPANY—DEPARTMENT OF NATURAL RESOURCES IRRIGATION BRANCH

TENDERS FOR STEEL HIGHWAY BRIDGES.

Sealed tenders, addressed to the undersigned, will be received up to noon of April 15th, 1912, for the design, manufacture and erection complete on piers to be provided by the Railway Company of the following Steel Highway Bridges

2 Bridges—span 125 feet.
4 Bridges—span 100 feet.
14 Bridges—span 75 feet.
9 Bridges—span 60 feet.

Contract, specification, form of tender and general instructions may be had on application to the undersigned. A deposit of $25 will be required before specifications will be given out, which will be returned on receipt of a bona fide tender

Tenders will only be received from parties who can show a reasonable acquaintance with work of the required character, and that they have the facilities and plant necessary for work of such magnitude.

A certified cheque or cash deposit to the amount of 5 per cent of the tender must accompany all bids as a guarantee that the bidder will enter into a contract for the work should it be awarded to him and which will be forfeited as liquidated damages should the bidder default.

Cheques or deposits of the unsuccessful bidders will be returned within ten days after the award of the contract.

The right is reserved to the Company to reject any or all tenders and to waive defects.

A. S. DAWSON,
Chief Engineer

Calgary, Alberta, March 1st, 1912.

CONCRETE TUNNEL.

STATE OF ILLINOIS—BOARD OF ADMINISTRATION.

Springfield, March 4, 1912.

Sealed bids will be received by the Board of Administration in its office in Springfield, Illinois, up to eleven a. m. Monday, March 25, 1912, and then and there publicly opened, for the construction of approximately five thousand feet of four and a half feet by six feet open concrete tunnel, plain concrete work, for heating system at the Peoria State Hospital, South Bartonville, Illinois. Practically no sheeting required. It is clay soil

The right is reserved to reject any and all bids.

Plans and specifications may be inspected on application to managing officer Peoria State Hospital, or to the undersigned at Springfield, Illinois.

FRANK D. WHIPP,
Fiscal Supervisor.

WATER WORKS.

Titusville, Fla., March 9, 1912.

Bids will be received by the Trustees of City Bonds of the City of Titusville Florida, until noon of May 20th, 1912, for the construction of a water works system for the city, including pumping station elevated reservoir, water mains, fire hydrants, etc. Plant to be complete. Bidders must submit their own plans and specifications. Instruction to bidders and map of the city may be obtained on application to the Trustees of City Bonds

TRUSTEES OF CITY BONDS.
By Geo M Robbins Chairman

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

CITY OF TORONTO.

PPLY OF RAIL, TIES AND FASTENINGS

[illegible]
ssed to the Chairman of the Board of ntrol, City Hall, Toronto, Can., up to n on Tuesday, March 19, 1912, for the pply of the following:

1. 250 tons 45-lb. "T" rail, A. S. C. E. tion.
2. 100 kegs 5"x9/16" spikes.
3. 1,400 pair angle bars for 45-lb. "T"
4. 25 kegs ¾"x3" bolts.
5. 810 tons 80-lb. "T" rail similar to Lorain Section [illegible]
6. 972 tons 90-lb. girder rail similar Lorain Section 392.
7. 1,100 pair splice bars for Lorain tion [illegible]
8. 2,250 pair splice bars for Lorain ction 392.
9. 60 kegs [illegible] track bolts and [illegible] (200 lbs. per keg).
10. 5,300 pair of ⅞"x5' 3¾" steel tie [illegible]
11. 6,000 steel ties and necessary rail fastenings.
12. 4,000 wood ties [illegible]

Specifications and form of tender may be obtained on application to the Department of Railways & Bridges, City Engineer's Office, Toronto.

Envelopes containing tenders must be inly marked as to contents.

Prospective tenderers will please only k for the specifications coving those ms on which they propose to tender.

Quick delivery will be required for Items [illegible] 4 and 12.

The tenderers shall submit with their ders the names of two sureties (ap-oved of by the City Treasurer, not members of the City Council or Officers of the Corporation of the City of Toron-to) or in lieu of said sureties, the bond a guarantee company approved of as oresaid.

The lowest or any tender not necessarily accepted.

G. R. GEARY, (Mayor).
Chairman of the Board of Control.
ty Hall, Toronto,
February 26th, 1912.

RADING, DRAINING AND PAVING.

Sealed bids will be received by the oard of Street Improvement, District No. 86, Little Rock, Ark., until 2 o'clock p. ., Wednesday, March 20, 1912, for grading, draining and paving with vitrified ick, asphalt, asphaltic concrete, creo-ted blocks or bitulithic pavement on ncrete foundation within said district. xtent of proposed work is approximately e paving of fourteen blocks on concrete se.

Plans and specifications may be had om Sam W. Reyburn, Chairman, District o. 186, care Union Trust Co., Little Rock, rk., to whom all bids should be ad-ressed. Bids must be accompanied by ertified check for $500. The right is eserved to reject any and all bids.

SAM W. REYBURN, Chairman.
R. W. RIGHTSELL, Secretary.

TENDERS AND DESIGNS FOR AN AQUEDUCT, CANADIAN PACIFIC RAILWAY COMPANY, DEPARTMENT OF NATURAL RESOURCES, IRRIGATION BRANCH.

Sealed tenders, addressed to the undersigned and endorsed "Proposals for Brooks Aqueduct," will be received up to noon of May 1, 1912.

The site of the work is about four miles southeast of Brooks, Alberta, a station on the main line of the Canadian Pacific Railway 125 miles east of Calgary. The aqueduct is about 10,000 feet long and 54 feet maximum height, and is designed to discharge 910 cubic feet per second.

Tenders will be received based either on the design prepared by the company's engineer or on designs to be submitted by the bidder. The engineer's design involves the furnishing and placing of about 23,400 cubic yards of concrete and 3,640,000 pounds of reinforcing steel, together with excavation and filling to the amount of 40,000 cubic yards.

All labor and materials required will be at the expense of the contractor.

Bidders will be required, either personally or by representative, to visit and inspect the site and satisfy themselves as to local conditions, supply of material, etc.

Plans, specifications and full information may be obtained on application to A. S. Dawson, Chief Engineer, Calgary.

A deposit of $300.00 will be required before plans or specifications will be given out, which will be returned on receipt of the same in good condition.

All proposals must be accompanied by a certified check payable to A. S. Dawson for 5 per cent of the amount of the tender, to be forfeited as liquidated damages in case the bidder neglects or refuses to enter into a contract should the work be awarded to him.

Proposals will not be considered unless made out on the form provided. Interlineations, alterations or qualification of prices, except as therein provided for, may invalidate proposals.

The company reserves the right to reject any or all tenders and to waive defects.

A. S. DAWSON
Chief Engineer, Dept. of Natural Resources, Canadian Pacific Railway.
Calgary, Alberta, March 1, 1912.

STORM SEWER.

Carroll, Iowa.

Bids will be received by the City Clerk at his office in Carroll, Iowa, up to 8 o'clock P. M. of March 26th, 1912, at which time they will be publicly opened and read, for the construction of pipe Storm Sewers in Carroll as follows: 24-inch, 505 ft.; 22-inch, 620 ft.; 18-inch, 1,330 ft.; 15-inch, 2,120 ft.; 12-inch, 935 ft.; 10-inch, 810 ft.; Man Holes, 48, and Castings, 15,000 pounds.

Plans and Specifications may be had upon application to the City Clerk at Carroll. J. A. DOUGHERTY,
City Clerk.

RIVER IMPROVEMENT.

[illegible] office of the Commissioner of Public Works, Room 5, Municipal Building, Buffalo, N. Y., and be opened at 11 o'clock A. M., March 28th, 1912, for the completion of the improvement of Section 2-A of the Buffalo river and Cazenovia Creek Improvement, comprising 1,500,000 cubic yards earth excavation and some pile protection.

This is to produce a rectified river channel with a typical section of 190 feet bottom width by 22 feet deep.

Plans, specifications and further information may be had by applying to the Deputy Engineer Commissioner, Room 7, Municipal Building, Buffalo, N. Y.

The City reserves the right to reject any or all bids.

Certified check for $15,000.00 or bond approved by the Mayor for 25 per cent of estimated amount of contract to accompany bids.

The formal advertisement required by law appears in the official paper of the City, The Buffalo Commercial, on March 6th, 7th, 13th, 14th, 20th and 21st, 1912, which form should be followed in bidding.

This is not a prescribed notice.

DITCH CONSTRUCTION.

St. Paul, Minnesota, March 4, 1912.

Sealed proposals will be received at the office of the State Auditor, of the State of Minnesota, until 2 o'clock P. M., Tuesday, April 2nd, 1912, for the construction of the Mustinka River State Ditch, in Traverse County, Minnesota, involving the construction of about 13 miles of main outlet ditch, and the excavation of about 350,000 cubic yards of earth. The work is located from 1 to 10 miles from Wheaton, Traverse County, Minnesota.

This is an excellent floating dredge job, and is suitable for a 1½ ward machine. Excellent roads cross the line of the ditch at various points. For full particulars address

GEORGE A. RALPH,
State Drainage Engineer.
St. Paul, Minnesota.

PUMPING PLANT.

Madison, South Dakota.

Sealed bids will be received by the City Council of the City of Madison up to 8:00 P. M., April 4th, and then opened, for furnishing and installing one pump of 400 Gal. per min. and one of 600 gal. per min. capacity. One 40 H. P. and one 60 H. P. motor, one 100 B. H. P. oil engine, fuel storage tank, etc.

Plans and specifications may be obtained from the City Auditor by depositing $5.00, which will be returned upon return of plans and specifications in good condition. Or they may be seen at the Builders' Exchange, St. Paul, Minn., and Aberdeen, S. D., and at the office of the Missouri Valley Engineering Company, Mitchell, S. D. Check for $300.00 required with bid. GEO. H. WASKEY,
WM. RAE, Mayor.
City Auditor.
Madison, S. D., March 7th, 1912.

U. S. ENGINEER OFFICE—Little Rock, Ark., Jan. 31, 1912. Sealed proposals for constructing the two (2) steel hull, 24-inch pump dredges H. S. Taber and Robert McGregor will be received here until 12 o'clock noon, April 9, 1912, and then publicly opened. Information on application CLARKE S. SMITH, Major, Engrs.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SEWER SYSTEM.

Not[illegible] [illegible] posals w[illegible] [illegible] Commissioners of Sioux Falls, S. D., until 11 o'clock a. m. on the 26th day of March, 1912, for the construction af a System of Sewerage for said City, in accordance with plans and specifications therefor, marked "Plan C," on file in the office of the City Auditor of said City.

The work will be divided into six divisions and bids may be made upon the work as a whole or upon any one or more of said divisions.

All bids must be upon the basis of a cash payment for the work and must be on blank forms furnished for that purpose and each bid must be accompanied by a bond running to said City in a penal sum of at least 50 per cent of the amount of the bid in accordance with Section 1343 of the South Dakota Political Code for the year 1903, or in lieu thereof by a duly certified check for a sum equal to 10 per cent of the amount of the bid, made payable unconditionally to the order of the City Treasurer of the City of Sioux Falls, S. D., as a guarantee that the bidder will enter into a contract and will furnish the required bond within fifteen (15) days after notice of the award to him of the work contained in his proposal.

Alternative bids may be made upon the basis of using vitrified pipe, reinforced concrete pipe or stone for all single sewers 24" or more in diameter and also for using either of these materials or plain concrete for the storm water section of all double sewers in which the storm water section is more than 20" in diameter, and the right is reserved by the Board of Commissioners to designate which class of material shall be used in each division after the bids have been opened, and to award the contract for such classes as they may deem for the best interests of the City.

Plans and specifications may be seen and schedule of quantities and blank forms of proposals obtained at the offices of S. B. Howe, City Engineer, Sioux Falls, S. D., and L. P. Wolff, Consulting Engineer, St. Paul, Minn., and at the office of Engineering & Contracting, Chicago, Ill.

Each bid must be endorsed on the outside with a statement showing the work covered by the bid and must be filed with the City Auditor before the hour above named.

The right is reserved to reject any or all bids.

By order of the Board of Commissioners of the City of Sioux Falls, S. D.

WALTER C LEYSE, City Auditor.

MISSISSIPPI RIVER COMMISSION, 1st and 2d Districts, U. S. Engineer Office, Memphis, Tenn., Feb. 20, 1912. Sealed proposals for furnishing about 637,000 lbs. wire, silicon bronze wire, wire strand, wire cables, staples and clips, and 140 coils of manila rope, will be received at this office until noon of Mar. 19, 1912, and then publicly opened. Information on application. CLARKE S. SMITH, Maj. Engrs.

U. S. ENGINEER OFFICE, Duluth, Minn., Mar. 5, 1912. Sealed proposals for furnishing and placing rock in the foundation embankment for the breakwater extension at Marquette, Mich., will be received here until noon April 5, 1912, and then publicly opened. Information on application. Francis R. Shunk, Lt. Col., Engrs.

SEWER CONSTRUCTION.

On March 22, 1912, I will let the contracts for the construction of the Toll Gate Drain, at the City Hall, in the City of Lansing, Mich. This job very closely resembles a sewer job and consists in the laying of 4,350 feet of 48-inch, 3,330 feet of 30-inch, and 3,430 feet of 24-inch reinforced concrete pipe, 1,300 ft. of 18-inch sewer pipe; 910 feet of 12-inch and 360 feet of 8-inch drain tile. It also includes the construction of 33 manholes and 6 catch basins. The depths will average as follows: 48-inch pipe, 7.82 ft.; 30-inch pipe, 14.83 ft.; 24-inch pipe, 14.26 ft.; 18, 12 and 8-inch tile, 6.26 ft. All pipe, tile castings and other appurtenances will be furnished the contractor on the ground by the Drain Commissioner. The improvement to be paid for with orders drawn upon the County Treasurer and secured by a tax upon the district drained by the drain. Certified check or certificate of deposit upon a bank of this county or a draft in the sum of $1,000.00 required from all prospective bidders as evidence of good faith. Specifications, blue prints, etc., and further information may be had by application to the undersigned.

WALTER R. CARVEN,
Drain Commissioner of Ingham County.
Mason, Mich.

LAYING WATER MAINS.

NEW CASTLE, IND.

New Castle, Ind.

Sealed proposals will be received by the City Council of the City of New Castle, Ind., at the Council Chamber until 7:30 p. m., March 18, 1912, and will be publicly opened at that hour for laying approximately 10,000 feet of 8", 10" and 12" cast-iron water mains and accessories. All the above, according to plans and specifications on file at the office of City Clerk. Each bid must be accompanied by a certified check of 10 per cent of amount of bid made payable to the City Clerk.

Instructions to bidders, specifications and blank proposals may be obtained from the City Clerk or from Chas. Brossmann, Consulting Engineer, Union Trust Bldg., Indianapolis. The right is reserved to reject any or all bids or accept such bids as are to the best interest of the City of New Castle.

GEO. M. BARNARD, Mayor.
L. M. JOHNSON, City Clerk.

BRIDGE.

Pasadena, Cal.

Sealed bids will be received until 10 a. m., March 26, for the construction of a reinforced concrete arch bridge, 1,460 ft. in length, 28-foot roadway and two 5-foot sidewalks. Estimated cost, $185,000. Plans and specifications can be obtained from Waddell & Harrington, Kansas City, or the City Engineer, Pasadena, upon a deposit of $20.00. The city reserves the right to reject any and all bids. Each bid must be accompanied with a certified check, draft or cashier's check equal to 10 per cent of bid. Further particulars in regard to bids and bidding blanks must be obtained from Heman Dyer, City Clerk.

HALLOCK AND MEDINA DRAINA DISTRICT.

Sealed bids will be received by Hall and Medina Drainage District of Pe County, Illinois, at the office of Wm. Kellogg, Attorney, in Peoria, Illinois, March 18, 1911, for the following scribed work: New channel for Hall Hollow Creek, 7,800 cu. yds. clean present channel of Hallock Hollow Cr and changing outlet of Crow Creek, 3, cu. yds. Additional information may secured from

HARMAN ENGINEERING CO.,

The Essence of Engineering Law

The gist of legal opinion on matters of every-day interest to the contractor will be found in compact form for easy reference in

THE LAW OF CONTRACT

By Alexander Haring, LL.B., M. Am. Soc. C. E., Professor of Bridge Engineering, New York University.

Leading cases are quoted at length with dicta and decisions from scores of others.

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X[illegible]I. Volume No. 12. MARCH 20, 1912

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[illegible]d as second-class matter, April 17, 1907, at the Post Office at Chicago, Illinois, under act [illegible] Copyright [illegible] by the Myron C. Clark Publishing Co.

[illegible] Methods of Recording, Inter[illegible]ing and Estimating Road and Pavement Maintenance Costs.

[illegible] ...w attempt briefly to indicate cor- [illegible] the cost of maintaining roads and [illegible]

[illegible] of maintaining a pavement may be [illegible] iring small areas, and (5) resur[illegible] renewing large areas.

[illegible] all true maintenance costs, but it [illegible] maintenance that should properly [illegible] water-bound macadam is surfaced [illegible]inous macadam, the new surface [illegible]d is not so much a renewal of any [illegible] surface as it is the construction [illegible]vement upon an old one as a base. [illegible] uilt upon an old base, most of its cost [illegible] be charged to new construction and [illegible] maintenance. To do so is merely to [illegible]est accounting practice as applied [illegible]

[illegible]er criterion to apply in such cases [illegible] new construction all expenditures [illegible] the appraised value of the original [illegible]nd charge to maintenance all ex[illegible] that merely keep the structure in[illegible]t its original value.

[illegible]ately the accounting relating to [illegible] ways has usually been so imperfect [illegible]d to maintenance. This has happened [illegible] erroneous, tendency to charge to main[illegible] all bituminous surfacing of old mac[illegible]s. Consequently road maintenance [illegible] seemingly taken an enormous leap [illegible]d during the last few years, when, in [illegible] that has caused the upward leap. [illegible]e present cheap wooden cross-ties [illegible]ways replaced with expensive steel or [illegible]te ties in the course of the next few [illegible] and were the entire cost of such re[illegible] charged to track main[illegible] result in a great jump in maintenance [illegible]y expenses during those years; but it would be incorrect accounting to make the charges in that manner.

If the surface of a macadam road has worn down an inch, and if it is resurfaced with a 3-in. layer of new stone, the common practice is to charge the cost of the entire 3 ins. to maintenance. This is incorrect. Only one-third of the cost of resurfacing should be charged to maintenance in this case, and the remaining two-thirds should be charged to new construction, for only 1 in. of the three represents renewals of pre-existing macadam.

As above indicated, there should be five separate maintenance accounts in any general system of recording pavement maintenance costs. But under special conditions three items may suffice: (1) Cleaning; (2) ordinary repairing, or patching, and (3) renewing.

The item of renewing should cover the cost of entire renewals of large areas of the pavement, as when a previously patched asphalt is taken up and replaced by a new asphalt surface. Unfortunately few cities have so kept their maintenance records as to show the cost of repairing separated from the cost of renewing. Hence it happens that engineers frequently err in estimating ordinary repair costs, because, failing to realize that the recorded maintenance costs often include costs of renewing as well as repairing, they assume that the recorded maintenance costs relate solely to ordinary repairs. The Cambridge paving commission made this error in their recent report. Their estimate of 5.4 cts. per square yard per annum for "ordinary repairs" of macadam is excessive, for the 5.4 cts. includes a large part, if not all, of the renewals due to entire resurfacing.

Every complete maintenance record of pavements should show the date of original construction, and the successive dates of resurfacing a given yardage. Also there should be traffic censuses taken at intervals so that the maintenance statistics may be properly interpreted.

If the ages of the wearing coats of given areas of all pavements in a city are known, the "weighted age" of each class of pavement can be, and should be, calculated. The weighted age is found thus:

[illegible] sq. yds.	[illegible] in years	[illegible]
10,000	[illegible]	[illegible]
[illegible]	[illegible]	70,000
[illegible]	[illegible]	[illegible]
[illegible]		390,000

Multiply the yardage of each pavement area by its age, total the products (yds.xyrs.) and divide by the total yardage to get the weighted age of the pavements of a given class. In the above example the weighted age is 390,000 ÷ 33,000 = 12 nearly. Knowing the weighted age of a given class of pavements in a city, the average annual repair and renewal costs have much more significance than they would otherwise have.

The average maintenance costs of a single year, or even of a few years, may be very deceptive, and particularly so if the weighted age of the pavements is unknown. Obviously when a pavement is new, say less than five years old, the repairs may cost very little and the renewals nothing at all. Conversely if the weighted age is more than half the total life of the pavements, repairs and renewals may be large, growing progressively larger as the weighted age approaches the full life.

An engineering periodical recently made the statement that the bonding of counties and states to build roads is a dangerous practice, and the periodical pointed warningly to an expenditure of $1,000 per mile for the maintenance of state roads in New York state during 1910. The periodical made several mistakes in citing that year's maintenance cost in New York state as an example. Preceding years had all shown far less maintenance costs, for one thing; and, for another thing, most of the $1,000 per mile was expended for what was really new construction—the placing of bituminous wearing coats upon old water-bound macadam. "A little knowledge is a dangerous thing," particularly when maintenance costs are involved.

In deducing average maintenance costs, not only should the average of a large area of pavements for a given year be calculated, but for as long a term of years as possible. Otherwise, ridiculous errors will be made.

Much has been recently said about the increased cost of road maintenance due to motor cars. Sight seems to have been lost of the fact that once the old water-bound macadam roads have been properly protected from disintegration by bituminous binders or coatings on the surface, or otherwise, future maintenance costs of macadam will probably be as low as they were before the advent of the motor car. During the present transition stage, many costly experiments are being made, and many poor bitumens are being used for surfacing roads. Eventually economic resurfacing methods will become generally known, as they are now known to many engineers. Eventually, also, the sellers of certain pseudo-asphaltic road oils will find it impossible to market as "asphaltic" what is little more than a carbonaceous [illegible] refining processes. [illegible] dently for a general decrease in road maintenance costs, provided there is not a very great increase in road traffic.

In closing this discussion it may not be amiss to outline a complete and correct method of estimating the annual cost of any pavement. To do so, we shall take an asphalt pavement for example.

Let us assume that the concrete base and grading cost $1 per square yard and that the asphalt top costs $0.90 per square yard. Let us assume that it costs 10 cts. per square yard to remove and cart away the asphalt top when resurfacing becomes necessary, and that resurfacing occurs every 20 years. Assume that the interest rate on bonds is 4 per cent and that sinking funds will draw the same rate of interest. Then we may estimate the annual cost of the pavement [illegible] per square yard per annum:

	Cts. per sq. yd.
Interest on base [illegible]	[illegible]
Interest on top, [illegible]	[illegible]
Total interest	[illegible]
Depreciation of base [illegible]	[illegible]
Depreciation of top [illegible]	[illegible]
Removal of old top, 10 cts. [illegible]	[illegible]
Ordinary repairs (patching)	[illegible]
Total interest, deprec. and repairs....	14.9
Cleaning, etc............................	3.0
Grand total annual cost	[illegible]

The depreciation items cover the cost of renewing the pavement at the end of its life. For illustration, rather than because any definite life can be assigned to a concrete base, the life of the base is assumed at 50 years. Then from a sinking fund table (such as that on page 13 of the second edition of Gillette's "Cost Data"), it is found that $0.00655 (or nearly $0.007) deposited annually and drawing 4 per cent will amount to $1 in 50 years (the assumed life of the base). From the same table, it is found that $0.03358 (nearly $0.034) will redeem $1.00 in 20 years (the assumed life of the asphalt top).

Not infrequently engineers make the mistake of estimating also the annual deposit in a sinking fund to redeem bonds issued for a pavement, and of adding this annual cost to the other costs above given. This is unquestionably wrong when the estimates thus made are called the total annual cost of the pavement. A bond issue is merely an expedient for deferring the payment of the first cost, and a sinking fund annuity to redeem a bond issue is not properly a part of the annual cost of any structure. Were it so, the annual cost of a structure might be varied at will, for any change in the term of years for which a bond is to run results in a change in the sinking fund annuity. Thus, a 5-year bond would require an annual deposit of $0.185 in a 4 per cent sinking fund, whereas a 50-year bond would require only $0.007 annual deposit.

If, however, a pavement bond matures exactly at the end of the life of the pavement, then a sinking fund to redeem the bond is precisely the same thing as a depreciation fund to replace the pavement. But it should be clear that only one and not both annuities should be charged as a part of the annual cost of the pavement.

Largely because so many engineering colleges have failed to teach thoroughly the principles of economics and accounting, it has come to pass that the most amazing mistakes are made by men who stand high in the engineering profession—mistakes in interpreting maintenance costs, mistakes in calculating annual costs of structures and machinery, mistakes in recording costs of all kinds, mistakes in estimating proper rates of charge for products. This is one of the reasons business men are so commonly given to speaking lightly of engineers as business managers. A new generation of engineers, better versed in economics, is remoulding public opinion as to the business ability of engineers. Incidentally they are also raising the standard of the whole engineering profession at the same time.

An ignorant public has been largely to blame and corrupt politicians have been more to blame, for the insufficiency of appropriations for properly recording the maintenance costs of pavement. The tenure of office of city engineers has been short, partly because of politics under the "spoils system," but largely because of inadequate compensation of engineers and their subordinates. In view of such facts it is hardly to be wondered that American records of pavement maintenance costs are so generally unsatisfactory. With the coming of the commission form of government and with the growing popular appreciation of the fact that the modern engineer is a business manager as well as professional man, we confidently look for great improvement in the records relating to pavement unit costs and an ultimate reduction of such costs.

EARTH AND ROCK SECTION

Dredges and Dredging in Mobile Harbor, Alabama; Records and Cost of Dredge Work.

Three types of dredges have been employed in improving and deepening the ship channels in and about Mobile Harbor. These are the clam shell, the seagoing suction and the hydraulic pipe line. In an article in "Professional Memoirs" for March-April, 1912, Assistant Engineer J. M. Pratt describes the work of these dredges. A comparison of output and cost is made between a clam shell and a hydraulic dredge. Records of work are given of one seagoing hopper dredge and three hydraulic pipe line dredges, including costs and statement of delays. Structural defects and advantages of the dredges are specified. The paper, considerably condensed, follows:

COMPARISON OF CLAM SHELL AND PIPE LINE DREDGE.

The Mobile Harbor dredged channel extends from Chickasaw Creek, 4.8 miles above the mouth of Mobile River, to deep water in the lower portion of Mobile Bay, a total distance of 33½ miles. The material along the upper six miles of this channel consists principally of sand and clay with some mud. Along the next eleven miles it is mud and sand with a strata of shells at the lower portion. The material along the remainder of the channel is composed of a soft blue mud having a specific gravity, as it lies on the bottom, of about 1.36. From the head of the channel in Mobile River to a point ten miles below, the dredged material either has to be deposited on shore or towed several miles in scows, because the water on the edges of the channel is too shoal for loaded scows to get out. Mobile Bay varies in width from eight miles at its upper end to 22 miles at a point just below its middle and to three miles at its lower end, measured from east to west. Accordingly, a dredge would be protected from storms, unless of unusual severity, while working in the channel in Mobile River, and be better protected while working in the upper portion of Mobile Bay than in the lower portion, thus making delays in dredging on account of weather conditions much less in the upper than in the lower bay and reducing them to a minimum in the river. All of these considerations make it difficult to form a comparison between two dredges working in this channel, unless engaged near the same locality at the same time. However, a fairly good comparison may be obtained of a clam shell and a hydraulic pipe line dredge by taking the records made in 1909 by the clam shell dredge *A* and the hydraulic dredge *B*, both belonging to contractors and working under the same contract a few miles apart in middle and lower Mobile Bay. The yardage dredged represents the amount excavated from the theoretical section in either case, or the amount paid for and not the total amount removed. The time extends from April 1 to July 12, the hydraulic dredge working two days longer in July than the clam shell, which discontinued work on the 10th. The material in either case was mud, although that obtained by dredge *A* was much softer and more easily handled than where the hydraulic dredge was working during April and May. In June this dredge reached a point near where dredge *A* had been working, and her results were largely increased. These dredges are believed representative of their respective types; the material was deposited by each about [illegible] to 1,500 ft. from the channel. Dredge *A* has an 8½ cu. yd. clam shell bucket and dredge *B* has a 20 in. centrifugal pump with a [illegible] suction and 20 in. diameter discharge. [illegible] shows the amount dredged per month and [illegible] delays to each dredge.

The time lost in either case does not include Sundays or legal holidays, but is [illegible] tion of the total effective working time. [illegible] work was done at a contract price of 9 [illegible] per cubic yard, but during the last two [illegible] tracts work has been done at this locality [illegible] a little less than 6 cts. per cubic yard. [illegible] uring on this basis and estimating the value of each outfit to be: $75,000 for dredge *A* and attendant plant, and $125,000 for dredge *B* and attendant plant, the value of each [illegible] earning power is as follows, omitting amounts less than $1:

Month	Cu. yds.	Time lost. Hrs.	Time lost. Mins.
Dredge A.			
April 1 to 30	[illegible]	[illegible]	[illegible]
May 1 to 31	[illegible]	179	[illegible]
June 1 to 30	[illegible]	[illegible]	[illegible]
July 1 to 10............	70,567	55	55
Total	[illegible]	[illegible]	[illegible]
Dredge B.			
April 1 to 30............	226,294	114	10
May 1 to 31	[illegible]	160	[illegible]
June 1 to 30............	410,821	66	45
July 1 to 12	[illegible]	[illegible]	[illegible]
Total	1,024,041	386	10

DREDGE A.

[illegible] cu. yds. dredged, at 6 cts..	
Interest on $75,000 for 3⅓ months, at 6 per cent	$ 1,2[illegible]
Depreciation at 10 per cent per annum, for 3⅓ months	2,08[illegible]
Cost of operating dredge, 3⅓ months	14,30[illegible]
Amount earned	

DREDGE B.

1,024,041 cu. yds. dredged, at 6 cts..	
Interest on $125,000 for 3⅓ months at 6 per cent	$ 2,08[illegible]
Depreciation at 10 per cent per annum, for 3⅓ months..............	3,472
Cost of operating dredge, 3⅓ months	28,333
Amount earned	$

TABLE II.

	No. of loads	Time loading Hrs. Min.	Time dumping Hrs. Min.	Going to dump Hrs. Min.	Coming from dump Hrs. Min.
Previous to installation of auxiliary pipe.					
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Average per load..........		[illegible]	4.86	7.67	8.28
Average time per 200 yards..........		30.55	4.30	6.79	7.33
Total time per 200 cu. yds. dredged, 48.97 min.					
After installation of auxiliary pipe.					
[illegible]	[illegible]	[illegible]	13 28	32 44	31 23
Average per load..........		[illegible]	[illegible]	5.17	5.25
Average time per 200 yards..........		[illegible]	2.29	[illegible]	5.34
Total time per 200 cu. yds. dredged, 24.96 min.					

TABLE II.

Fiscal year.	[illegible]	Gross cost.	[illegible]
[illegible] Island Pass			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Bar and Channel			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Island Pass	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]d total	[illegible]	[illegible]	[illegible]

[illegible]

[illegible] a little over three months the [illegible] dredge carried [illegible] $7 [illegible] shell dredge, though the latter [illegible] of the best ever seen in this district. [illegible]draulic dredge experienced fewer de[illegible] general, and could work as long dur[illegible]gh weather as the clam shell dredge.

TABLE IV.

[illegible] Effective Working [illegible]

	Hrs.	Min.
[illegible]	[illegible]	[illegible]
[illegible] pipe line	[illegible]	[illegible]
[illegible] swinging wires	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible] vessels to pass	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible] of Time Lost While in [illegible]

	Hrs.	Min.
[illegible]ing location of plant	143	50
[illegible]	[illegible]	[illegible]
[illegible] boilers and ordinary re[illegible]	[illegible]	[illegible]
[illegible] repairs	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible] and holidays	1,080	00
Total	2,808	05
[illegible] to be accounted for (Sep[illegible]ber 21 to June 30)	6,792	00
[illegible] expended		
[illegible]	[illegible]	
[illegible]	11,320.17	
[illegible] subsistence	5,551.60	
[illegible] engine room	3,702.46	
[illegible]	[illegible]	
[illegible] or additions to outfit	4,775.64	
[illegible] repairs	[illegible]	
[illegible]iry, ice, miscellaneous expenses	720.83	
[illegible]al operating cost	$56,519.88	
[illegible] ordinary repairs	1,197.24	
[illegible] expenses, superintendence, sur[illegible]	[illegible]	
[illegible] cost of dredging	[illegible]	

[illegible]atter, of course, having to quit work [illegible] if became too rough to land scows along[illegible]

[illegible] HOPPER DREDGE "CHARLESTON."

[illegible] has a 15 in. pump with [illegible] side and a bin capacity of about [illegible]ds. She is 122½ ft. long, 30 ft. wide and [illegible]ted with self-propelling machinery, giv[illegible] speed, when light, of about 8 miles per [illegible] She draws 12 ft. when light and about [illegible]t. when loaded, and carries one week's [illegible]ly of coal and water. Her work consisted [illegible]ly in deepening and maintaining the chan[illegible] through the outer bars connecting the Mo[illegible] Harbor, Pascagoula and Gulfport chan[illegible] with deep water in the Gulf of Mexico. [illegible]e localities are known as Mobile Outer [illegible] Horn Island Pass and Ship Island Pass, [illegible]ectively. During portions of the time [illegible] engaged on the Mobile Outer Bar it was [illegible]rough for her to work, and on such occa[illegible]s while waiting for favorable weather [illegible] worked in the lower part of the Mobile [illegible] ship channel. Here the material is [illegible] soft and light; so much so that it would [illegible] settle in the bins, and when once filled [illegible] a mixture of this material and water [illegible]as a question as to whether the extra [illegible]erial gained by pumping longer compen[illegible]d for the additional time and material lost [illegible]ard, as the overflow carried off a large [illegible]entage of material.

Anothe[illegible] with this dredge which decreased considerably its output in this kind of material. It was found that when the drag was lowered below the surface of the material that is buried in the mud, the pipe would continually choke and the drag would then have to be lifted in order to admit sufficient water to clear it. This, of course, would put a great deal of water in the bins which could not be disposed of and simply decreased the amount of material carried at each load. If the drag were kept near enough to the surface of the material to prevent choking a large percentage of water was admitted, and the result was practically the same. The only way then to obtain a maximum amount of material in the shortest time was to bury the drag below the surface of the material, move slowly along the cut as before and admit just enough water in the drag to pump the material without choking it or having to raise the drag. This was accomplished by cutting a hole in the top of the drag and fastening thereon a pipe, 5⅜ ins. in diameter and 12 ft. long, which extended up the outside of the main suction pipe and was fastened thereto. A valve was placed in the upper end of this 5⅜ in. pipe, as this was always above the surface of the material on the bottom, and just enough water admitted to enable the pump to work properly. When shifting the dredge from this locality to the other bar this pipe was removed and a steel plate put in its place, filling up the hole in the drag. The value of this pipe to the dredge when working in very soft material may be seen from Table II, which shows the work done just before and after its installation.

A considerable portion of the loading time, as shown in the first part of the table, was consumed in clearing the suction and attempting to get a load of material by forcing out of the bins the water brought in when clearing the suction.

The reduction of the time going to and from the dump was due to a new cast-steel propeller having been installed instead of the old cast-iron one. This change was made at the same time the pipe was installed and made a considerable increase in the speed of the dredge. These two changes practically doubled the efficiency of the dredge in soft material. The work done by this dredge and its cost are given in Table III.

CONTRA[illegible]

Contract dredging work on Mobile outer bar has cost 30 cts. per cubic yard. This work was done between 1903 and 1906.

In accordance with the Horn Island Pass project, which provided "that a contract or contracts can be made at a sum not to exceed the unit price of 11 cts. per cu. yd. * * *" the dredging work was advertised in 1905, but no bids were received. Therefore, the contract price at this locality was greater than 11 cts. per cubic yard, perhaps considerably.

On June 12, 1899, a contract for dredging across Ship Island Bar was awarded at 22½ cts. per cubic yard. This work would probably be done at a considerably lower price [illegible] Island Pass, because a large portion of the latter work is on the inside of Horn Island and in soft mud. Of course the "*Charleston*" seemed to do cheaper work at Ship Island, but that is due to the fact that she had remarkably good weather while there and had been put in first-class condition just before going there. Thus no large repair bills were charged against this work, in addition to which the dredge was much more efficient and had a far better crew than during a portion of the time at Horn Island. Balancing this work with contract dredging and assuming the contract cost at Horn Island Pass and Ship Island Pass to be 12 cts., the amount made by the United States plant is as follows:

COST OF CONTRACT WORK.

Mobile Outer Bar.	
[illegible]	$[illegible]
Horn Island Pass.	
[illegible]	[illegible]
[illegible]	
[illegible]	[illegible]
Total	$[illegible]

TABLE VI.

[illegible]

	Hrs.	Min.
Time:		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Handling swinging wires	235	30
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]
Distribution of Time Lost While in Commission:		
Changing location of plant	356	30
[illegible]	[illegible]	[illegible]
Washing boilers and ordinary repairs	1,796	04
[illegible]	[illegible]	[illegible]
Sundays and holidays	1,416	00
Total	[illegible]	[illegible]
Total time to be accounted for	8,760	00
Money Expended:		
Payrolls	$[illegible]	
Fuel	[illegible]	
Water	[illegible]	
Supplies, subsistence	[illegible]	
Supplies, engine room	3,786.36	
Total	[illegible]	
Other supplies	8,172.34	
Renewals of additions to outfit	5,609.87	
Ordinary repairs	[illegible]	
Laundry, ice, miscellaneous expenses	575.13	
Total	[illegible]	
Extraordinary repairs	3,191.55	
Office expenses, superintendence, surveys, etc.	12,772.58	
Total	[illegible]	

COST WITH UNITED STATES DREDGE CHARLESTON

Gross cost[1]	$149,055.76
Interest for 4 years at 6% on $47,000[2]	11,280.00
Deterioration at 10% per annum	18,800.00
Total	$179,135.76
Amount made over contract work	$ 98,764.56

[1] This includes superintendence, surveys, office expenses, none of which should be included in a comparison with contract work.

[2] Value of plant.

[3] Does not include 111,622 cu. yds. of mud removed from the Mobile Harbor ship channel. This should be included at a cost of about 5½ cts. per cu. yd., the approximate contract cost at present.

TABLE V.

Improvement.	Material removed. Cu. yds.	Operating cost: Total.	Operating cost: Per cu. yd. Cents.	Total cost.	Gross cost per cu. yd. Cents.
Pascagoula River, Miss.	449,713	$33,316.13	7.41	$40,724.99	9.06
Biloxi Harbor, Miss.	109,088	3,830.20	3.51	4,222.49	3.87
Wolf and Jordan Rivers, Miss.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
East Pearl River, Miss.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gulfport Harbor, Miss.	919,892	34,644.60	3.77	39,596.91	4.30
Total	[illegible]	[illegible]	[illegible]	$[illegible]	[illegible]

*This is the total yardage dredged from within the limits of the project, from 1 to 2 ft. being allowed for [illegible].

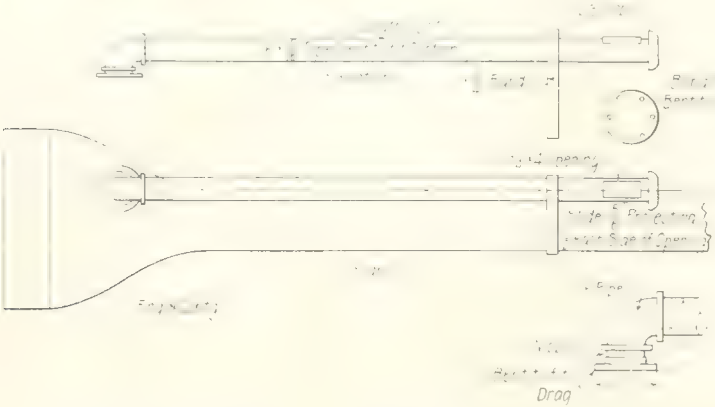
The total [illegible]

TABLE VI.

Month.	Place measurement. Cu. yds.	Av. width of cut. Feet.	Depth before dredging. Average Feet.	Depth after dredging. Average. Feet.
July 6 to [illegible]	[illegible]	[illegible] to 225	15 to 16	[illegible]
August 1 to 31...	[illegible]	200	16 to 19	[illegible]
September 1 to 15	[illegible]	200 to 225	17 to 21	21 to 23

HYDRAULIC PIPE LINE DREDGE PASCAGOULA

The dredge *Pascagoula* was built by the Ellicott Machine Co. of Baltimore, Md., in 1909, under specifications prepared in this office under the direction and direct supervision of Maj. H. Jervey, corps of engineers, then in charge. She has a steel hull 150 ft. long, [illegible] wide, [illegible] ft. deep and draws about 6¼ ft Her ladder well is 30 ft. long and 11½ ft. wide. The cost of this dredge and attendant plant is shown below:



Improved Suction Pipe for Seagoing Hopper Dredge "Charleston."

Cost of dredge	$1[illegible],600.00
Cost of outfit	1,806.13
Cost of attendant tug boat	21,500.00
Cost of attendant launch	3,215.40
Cost of pipe line, complete with all accessories	1[illegible],648.92
Cost of one coal and one water barge	[illegible]
Total	$18[illegible],769.[illegible]

The floating pipe line is supported by strongly built wooden pontons, each 25 ft. 4 ins. long, 4 ft. 6 ins. wide and 5 ft. deep, with rakes on each end for easy handling. They are narrow and high, in order, first, that the least resistance may be offered to the current or sea, and secondly to place the pipe line high enough so that seas will pass under it instead of breaking against it broadside. Large timber winches with wire cables and anchors attached are placed on the pontons here and there, as the occasion requires, in order to keep the pipe line straight and hold it during a blow. The sections of pipe are 40 ft. long and consist of riveted boiler steel ⅜ in. thick. Each section of pipe is supported by two pontons. The connections are made with rubber sleeves. They are held on the pontons by wooden saddles, which are clamped together and fastened to the pontons with bolts. The pontons draw about 23 ins. when light and about 32 ins. when the pipe is full. This pipe line recently rode out a severe storm at Gulfport, Miss., when the tide rose 6 ft. and the sea was so rough that several vessels and considerable property were damaged. The pipe line is about 1,200 ft. long, and it cost complete with 300 ft. of shore pipe and a full set of rubber dredging sleeves $15,649.

TABLE VIII.

Distribution of Effective Working Time:

	Hrs.	Min.
Pumping	1,316	01
Handling pipe line	121	20
Handling swinging wires	17	[illegible]
Placing dredge	6	[illegible]
Waiting for vessels to pass	1	33
Total	1,4[illegible]	[illegible]

Distribution of Time Lost While in Commission:

	Hrs.	Min.
Bad weather	13	15
Washing boilers and ordinary repairs	183	53
Extraordinary repairs	204	44
Other causes	114	43
Sundays and holidays	[illegible]	00
Total	[illegible]	[illegible]
Total time to be accounted for (March [illegible] to [illegible])	[illegible]	00

Money Expended:

Labor	[illegible]
Fuel	5,421.02
Supplies, subsistence	2,479.18
Supplies, engine room	1,845.42
Other supplies, rope, sleeves	4,913.56
Launch supplies	[illegible]
Renewals or additions to outfit	551.47
Ordinary repairs	122.54
Laundry, ice, miscellaneous	152.84
Total operating cost	$23,434.81
Extraordinary repairs	26.40
Office expenses, superintendence, surveys, etc.	1,239.11
Total cost of dredging	$[illegible]

Working on the Pascaguola River this dredge removed 1,233,653 cu. yds., place measurement, at the following costs:

Item.	Total.	Per cu. yd.
Operating cost	$[illegible]	4.58 cts.
Total cost	66,002	5.35 cts.

The distribution of time and money was as given in Table IV.

Table V shows the location, amounts and costs of further work of the *Pascagoula* and Table VI gives the distribution of time and money.

During July, August and September of the present fiscal year, this dredge accomplished the work shown in Table VII in Gulfport ship channel, where the material is very soft:

From July 1 to Sept. 30, 1911, she accomplished the work shown in Table IX.

HYDRAULIC PIPE LINE DREDGE BARNARD

The United States dredge *Barnard* is a self-propelled pipe line dredge with center drag 7 ft. wide. Her discharge pipe is 36 ins. in diameter. It is floated on steel pontons and kept on one side of the channel by means of a baffle plate, against which the material strikes as it comes out of the end of the pipe while the dredge is moving up and down the channel. Owing to the narrow, crooked cut this dredge makes, it can not be used to advantage in any material except the very softest kind—so soft, in fact, that it will flow readily and fill up the cut made. It is not a success even in this kind of material, as there is necessarily a great loss of efficiency in operating this style of dredge. The only place in [illegible] trict where the *Barnard* was used [illegible] degree of success was in the channel [illegible] port, Miss. Her record in this [illegible] given in Table X.

TABLE IX.

Month	Average width of cut Feet	Average depth before dredging Feet	Average depth after dredging Feet	Pl
July	140	[illegible]	29 to 31	[illegible]
August	150	[illegible]	28 to 32	[illegible]
September	135	[illegible]	1[illegible] to 29	[illegible]
Total				[illegible]

The small amount dredged in September due to the fact that the dredge wa under semi-annual repairs from Sept. 1 to, also because several large wrecks and un ous logs were encountered, making ine sary to stop operations every few in over a considerable part of the time.

The amount dredged, as shown, moved from within the limits of the allowing 1 ft. for over-depth. The total dredged, inside and outside project lins, 861,945 cu. yds.

HYDRAULIC PIPE LINE DREDGE WAH

This dredge was also built by the Elli Machine Co. of Baltimore, Md., and chased by this office and commenced in Mobile Harbor, about 3 miles be mouth of Mobile River, in March, 19 has about the same attendant plant dredge *Pascagoula*, and the same kind line.

Up to June 30, 1911, she had remove 985 cu. yds. at the following costs:

Item	Total	P
Operating cost	$23,43[illegible]	
Total cost	2[illegible]	

The distribution of time and expen is shown in Table VIII.

TABLE X.

Month. 1907.	Location.		Yardage.	Field cost.
June		(Dredge reached district June 28)		$ [illegible]
July	Pascagoula River, Miss.		1,837	5,340.56
August	Pascagoula River, Miss.	(Worked 3 days)	64,643	5,248.84
September	Pascagoula River, Miss.		47,593	5,014.45
October	Gulfport, Miss.		167,869	6,518.43
November	Gulfport, Miss.		199,252	[illegible]
December	Gulfport, Miss.		253,651	6,277.93
1908.				
January	Gulfport, Miss.		251,563	7,098.03
February	Mobile Harbor, Ala.	(Worked [illegible] days)	29,209	6,603.64
March	Fort Morgan, Ala.	Filling reservation		7,093.46
April	Fort Morgan, Ala.	Filling reservation		[illegible]
April	Gulfport, Miss.	(Worked 10 days)	47,750	6,965.19
May	Gulfport, Miss.	([illegible] portion of month)	84,427	
June	Gulfport, Miss.		261,[illegible]	6,755.70
Total for fiscal year 1908.			1,409,342	$[illegible]

The outputs and unit costs for the 1909-1911 were as follows:

Item	Total
1909—Pascagoula River, 586,353 cu. yds.	
Operating cost	[illegible]
Total cost	[illegible]
1909—Gulfport Harbor, 1,589,620 cu. yds.	
Operating cost	[illegible]
Total cost	59,129
1910—Gulfport Harbor, 3,005,270 cu. yds.	
Operating cost	[illegible]
Total cost	110,168
1911—Gulfport Harbor, 1,156,938 cu. yds.	
Operating cost	[illegible]
Total cost	54,927

TABLE XI.—1909.

Distribution of Effective Working Time:

	Hr
Pumping	2,7
Going to and from wharf and anchorage	[illegible]
Placing dredge	[illegible]
Total	[illegible]

Distribution of Time Lost While in Commission:

	Hrs
Changing location of plant	17
Bad weather	[illegible]
Washing boilers and ordinary repairs	1,92
Extraordinary repairs	1,0
Other causes	[illegible]
Sundays and holidays	1[illegible]
Total	[illegible]
Total time to be accounted for	[illegible]

Expended:

[illegible]	$1[illegible]439.[illegible]
boilers	24,[illegible]
galley	129.00
[illegible]	[illegible]
subsistence	11,[illegible]
ngine room	4,816.[illegible]
[illegible]	[illegible]
or additions to outfit	8,484.[illegible]
repairs	441.[illegible]
miscellaneous expenses	
	926.[illegible]
operating cost	$[illegible]
[illegible]	[illegible]
ses, superintendence, sur-	
	10,905.54
cost of dredging	$[illegible]

[illegible] time and [illegible] is given [illegible] XII.

TABLE XII.—1910.

[illegible] Effective Working [illegible]

	Hrs.	Min.
[illegible]	[illegible]	[illegible]
[illegible] and anchorage		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
r vessels to pass	10	41
	2,[illegible]	[illegible]

tion of Time Lost While in [illegible]

	Hrs.	Min.
ng location of plant	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible] ordinary repairs	[illegible]	[illegible]
[illegible] repairs	[illegible]	[illegible]
[illegible]	72	[illegible]
[illegible]	1,0[illegible]4	00
	[illegible]	[illegible]
[illegible] of not working		
	2,624	[illegible]
ime to be accounted for	8,760	00

uble crew maintained until Sept. 2.

Expended:

[illegible]	$[illegible]
[illegible]	[illegible]
[illegible]	1[illegible] 00
subsistence	1[illegible]
gine room	5,442.70
lies, paints, rope, etc	2,922.39
r additions to outfit	8,455.50
[illegible]	[illegible]
[illegible] miscellaneous expenses	
	[illegible]
[illegible] cost	$91,19[illegible]
[illegible]	[illegible]
nses, superintendence, sur-	
	13,216.28
al cost of dredging	$110,168.63

[illegible]RATION OF DREDGES

h paper can not be closed without refer- the operation of dredges in general, spud type pipe line dredges in particu- o matter how perfectly the dredge, ery and attendant plant are constructed, ults accomplished may be very unsat- ry unless they are properly managed, d and repaired. Contractors' dredges een delayed waiting for fuel, or while ng boiler tubes only a few months old, mply to using the salty or brackish in Mobile Bay rather than pay the small necessary to have fresh water brought n; still others have been delayed on ac- of the breaking of a spud, no extra having been provided. The above are few of the causes for delays that have noted. In addition the moral effect on ews in such cases is a large incident in smanagement of the dredge, as the dif- e between the crew on a well managed, ept dredge and that on one that is the e, where a breakdown is expected at me, is very pronounced. It is believed e plant should be kept in thorough re- nd in first-class working condition at es, instead of running it as long as pos- -perhaps a year or more—as some con- rs do, before giving it a general over-

s believed that time and money are saved eping the dredge in thorough repair at es, briefly for the following reasons:

Those parts that are liable to break ause delays while the dredge is operat- re looked after.

It is cheaper to repair at the instant needed rather than put it off until con- le wear has occurred or perhaps a down causing probable damage to other

The spirit of the crew, which adds y to the efficiency of the plant, is greatly [illegible] condition at [illegible]

A [illegible] that are liable to break [illegible] should always be on hand [illegible] there may be [illegible] place and kept out of the way in some warehouse. It takes time to furnish some of these [illegible] the United States is over $300 per working day, this amount would have to be paid anyhow and might be exceeded two or three times by the loss of a single day's work, if [illegible] and their attendant plant in this district are docked twice a year for a general overhauling, and for painting below the water line, and all repairs that can not be made while the dredge is operating are attended to at this time. These two overhaulings consume about one month out of the year. During this time only such work is given to the ship yards and shops as can not be done by the regular crew of the dredge in the required time—that is, within the time needed for the general overhauling.

In addition to the above time used in overhauling the plant, twelve hours are consumed each week in washing and scaling boilers and repairing or overhauling such parts as need it in order to keep them in good condition. The dredge starts work at 12 o'clock Sunday night and works continuously, unless interrupted, until 12 o'clock noon, Saturday. This means that 26 working days are consumed during a year in this way, which is practically a calendar month, making about two calendar months consumed in overhauling and repairing the plant during the year. But during the rest of the time the dredge is ready for work, and the crew is anxious to show what can be done. Contractors in this district work continuously from 12 o'clock Sunday night till 12 o'clock Saturday night, but their plant is never in good condition, and sooner or later they have a large repair bill with a long period of lost time, besides having a plant that has greatly depreciated in value and efficiency. The government dredge, on the other hand, is kept in a state of best efficiency at all times, while during a portion of the time the contractor's dredge is not working nearly up to her standard. As a result of the twelve hours per week devoted to the upkeep of the plant all machinery and boilers on the government dredges in this district are in excellent condition, and no time is lost on account of repairs to them. Each man in the crew is in excellent spirits and anxious to work at all times, not as a mere machine, but as an active, eager, interested element on a large work, each feeling that something depends on him and taking a personal pride in the output of the dredge. The usual work of overhauling and greasing cables, washing boilers, shifting pipe line, overhauling machinery and other things that can not be attended to while the dredge is operating is attended to by the regular watch on duty Sunday. The men on this watch, of course, alternate each Sunday with another watch. Three shifts are made per 24 hours in the crews in the engine, boiler and lever rooms, each man working eight hours, while only two shifts are made in the deck crew.

The crews on the dredges *Pascagoula* and *Wahalak* are about the same as those on similar dredges belonging to contractors, and consist generally of about 40 men, as follows

Masters	1
Stewards	1
Lever men	[illegible]
Deck hands	17
Chief engineers	1
Assistant steam engineers or machinists	3
Oilers	4
Stokers	5
Carpenters	1
Blacksmiths	1
Cooks	[illegible]
Waiters	[illegible]
Total	40

In addition to the above, the crew of the attendant tug boat consists of eight men, and of the launch three men.

The subsistence in the raw state costs from $12 to $15 per man per month.

One of the most difficult and important duties connected with the supervision of dredging operations is the selection of an efficient crew. Excellent results can be obtained with an ordinary dredge, and less than ordinary results from an excellent dredge, depending on the crew employed. The most important positions to fill are those of master, chief engineer and lever men. It has been noticed that a change of masters alone resulted in an increase of 50 to 75 per cent of the yardage dredged. The master is responsible for the dredge and for its proper operation, and each department is subject to his orders. He and the chief engineer generally select their own deck hands, oilers, stokers and any others not in the civil service, unless the position to be filled is directly in line of promotion to the higher grades. Any failure of the master to select the proper men or maintain discipline or infuse the proper spirit in his crew or to familiarize himself with all the workings of the dredge at all times, or to set an example for forethought and industry will soon become noticeable in the results accomplished.

But no matter how able is the master, he can do little without the assistance of a capable, experienced, energetic chief engineer. The chief engineer has charge of the machinery and boilers and all repairs, machine shop and blacksmith shop work, and on one of the modern dredges he must be an expert. Considerable sums of money and much valuable time, consumed in repairs, can be saved and many breakdowns avoided by watching the little things about the plant, in addition to which a great many improvements can generally be made here and there. The chief engineer must be constantly on the alert, and must know how to handle the engineers, machinists, blacksmith, oilers and stokers under him in order to get even fair results.

Next in importance to the master and chief engineer are the lever men. In the absence of the master they are in charge of the dredge, but their principal duty is to see that the greatest efficiency is obtained in dredging material. They are not only responsible, under the master, for the quantity of material dredged, but for the position and condition of the cut formed.

Having the three positions above named filled with competent, efficient men, it becomes comparatively easy to fill the other positions; for, with those three as a nucleus, a good crew can be built up; but, and here the trouble comes in, able masters, energetic chief engineers and efficient lever men are so scarce that fortunate, indeed, is the contractor or district officer who has these three positions well filled.

TABLE XIII.—1911.

Distribution of Effective Working Time:

	Hrs.	Min.
Pumping	1,1[illegible]2	[illegible]
Going to and from wharf or anchorage	14	10
Placing dredge	[illegible]	[illegible]
Waiting for vessels to pass	[illegible]	[illegible]
Total	1,2[illegible]	[illegible]

Distribution of Time Lost While in Commission:

	Hrs.	Min.
Changing location of plant	.....	..
Bad weather	1	[illegible]
Washing boilers and ordinary repairs	313	40
Extraordinary repairs	6	00
Other causes	[illegible]	09
Sundays and holidays	402	00
Total	7[illegible]	[illegible]
Time lost on account of not working at night	2,028	00
Total time to be accounted for (Dec. 16, inclusive)	4,056	00

Money Expended:

Pay rolls	$17,21[illegible]
Fuel for boilers	14,916.26
Fuel for galley	84.00
Supplies, subsistence	5,127.55
Supplies, engine room	1,915.70
Other supplies, paints, ropes, etc	2,961.97
Renewals or additions to outfit	3,888.08
Ordinary repairs	1,470.25
Laundry, ice, miscellaneous expenses, etc.	389.58
Total operating cost	$47,968.[illegible]
Extraordinary repairs	999.38
Office expenses, superintendence, surveys, etc	5,959.02
Total cost of dredging	$54,927.19

ROADS AND STREETS SECTION

Instructions of Illinois Highway Commission for Making Road Surveys.

The Illinois Highway Commission, of which Mr. A. N. Johnson is the engineer, has issued recently a manual of instructions for the guidance of its engineers. In this manual it is specified that all road surveys under the direction of the engineers of the commission shall be made in accordance with the following instructions:

TRANSIT AND LOCATION SURVEY.

The transit line should be established following approximately the center line between fences. At a distance of every 100 ft. on this line temporary points or stations are to be established and at plus stations where it will be necessary to take a cross section at any point on account of changes in ground. These points can be readily preserved for several hours by driving a heavy spike through a piece of cloth into the ground.

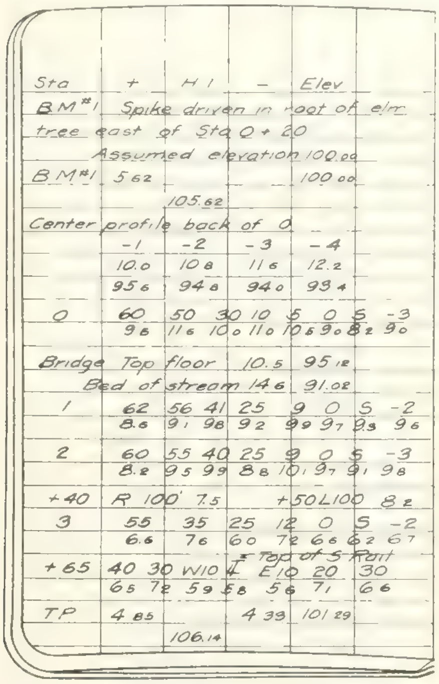

Sta + H I — Elev
BM#1 Spike driven in root of elm
tree east of Sta 0 + 20
Assumed elevation 100.00
BM#1 5 62 100 00
105.62
Center profile back of 0
-1 -2 -3 -4
10.0 10 8 11 6 12.2
95 6 94 8 94 0 93 4
0 60 50 30 10 5 0 5 -3
9 6 11 6 10 0 11 0 10 5 9 0 8 2 9 0
Bridge Top floor 10.5 95 12
Bed of stream 14 6 91.02
1 62 56 41 25 9 0 S -2
8.6 9 1 9 8 9 2 9 9 9 7 9 3 9 6
2 60 55 40 25 9 0 5 -3
8.2 9 5 9 9 8 8 10 1 9 7 9 1 9 8
+40 R 100' 7.5 +50 L 100 8 2
3 55 35 25 12 0 S -2
6.6 7 6 6 0 7 2 6 6 6 2 6 7
= Top of S Rail
+65 40 30 W10 ℄ E10 20 30
6 5 7 2 5 9 5 8 5 6 7 1 6 6
TP 4 85 4 39 101 29
106.14

Fig. 1—Left Hand Page of Road Survey Note Book, Showing Level Notes.

Opposite the stations established in the road and at points far enough removed to be clear of all construction or travel, stakes should be driven. These stakes should be 24 by 2 by 1 in., and driven to a depth of 15 or 18 ins. Stakes should be numbered beginning with 0, each 100 ft. to be a unit; plus stations are to be marked with a number of the previous station with +25 or +58, etc. In numbering, hard kiel or carpenter's pencil should be used. The distance from the center of the stake to the station point on the transit line should be measured to the nearest 0.1 ft. after the stake is driven and recorded with the notes. Station 0 must be referenced to some permanent monument or to established lines, and the center line of the road surveyed, i. e., as so many feet south of the south corporation line of the village of Oblong on line of Range road in township of Oblong, Crawford County, or 50 ft. north of corner stone at intersection of Alton road and South road, Central township, Bond county, etc., etc.

Wherever it is necessary to make a deflection in the transit line, the transit is to be set up at the point of deflection, and the angle of the course ahead with that of the rear course measured, always measuring from the back sight around to the right to the fore sight. The angles are to be measured to the nearest minute and where local disturbances do not prevent, magnetic bearings at each course should be observed. As a rule, deflection points should be made at even stations or half stations, a half station being designated by the number of the previous station as 4 + 50.

At all deflection points stakes should be set on both sides of the road in a line through the point of deflection at right angles with the back course. These stakes will be used as reference stakes and should have a small nail driven in the top when measurements to the nearest 0.01 ft. are to be taken to the deflection point in the transit line. Reference stakes should be driven flush with the ground and another stake driven nearby for a marker.

After the location of the transit line as described, offset measurements are to be taken at each station or oftener if necessary, locating the sides of traveled way, fences and walls, ditches, and all other features of the location that may in any way affect the proposed construction. Remember that no harm is done if too much is included, but an omission may cause much additional expense.

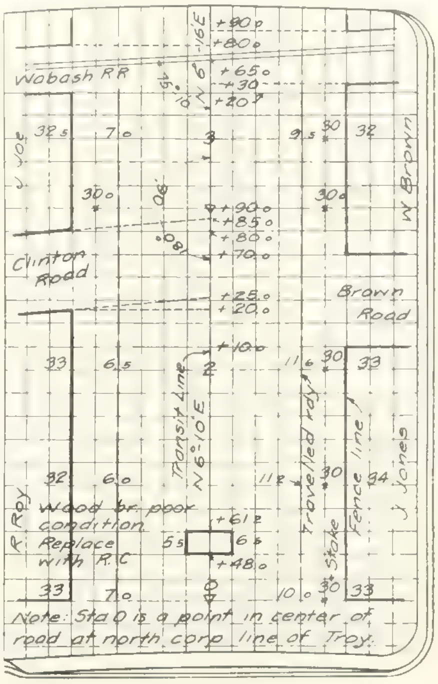


Fig. 2—Right Hand Page of Road Survey Note Book Showing Transit Notes.

Measurements should be taken locating all bridges, culverts, and cross drains with their abutments or retaining walls, an arrow showing the direction of the flow. The clear span and clear depth should be shown and a concise description of the structures given with details as to its present condition and recommendations for its reconstruction if it is to be rebuilt.

The location of all cross roads, cross walks, private entrances and buildings near road should be given. Landowners' or tenants' names should be obtained and division fences located.

Remember that the principal information desired is the location of the traveled way, fences, stakes and notes on the character of bridges, culverts, and other drains. When necessary make a special bridge inspection report for each bridge to be rebuilt. Places in the road habitually bad, spongy, or so-called bottomless, should be located, giving stations.

LEVELS.

After the transit and location surveys have been made, the levels are run as follows:

The lines are to be run with an engineer's level. Place permanent bench marks at either end of the work and at convenient intermediate points which are to be established well out of the way of any construction. The number of bench marks should at least four or five to the mile and ofte if required. Bench marks should be on permanent objects on which a rod can be conveniently held, so that they can be readily identified in the field. The roots of trees with low hanging limbs are not convenient nor is a point so far back from a line of trees along a road that all view of the bench mark is shut off, except from a point directly oppo-

A line of check levels should be run touching every bench mark, and separate notes should be kept of the check survey.

Readings for ground elevations should be to nearest 0.1 of a foot. Ground elevations are to be taken at the center of the road at each station or 100 ft. and as much oftener as may be necessary to show irregularities in the profile.

At each section where a center reading is taken, side readings are to be taken to show accurately the cross section of the road. Six or eight readings usually will be necessary. To take a cross section, first take reading on the rod on the top of the stake at that particular station, and a ground reading at the same point. Enough readings are to be taken at other points across the line of the road to show the true shape of the banks, gutters and ditches on each side and the road between. The distance of each rod reading from the stake is to be recorded as well as the reading itself.

Elevations are to be taken of the following points:

(a) The bottom of openings at each end of all culverts, indicating them as east and west or north and south ends.

(b) Bridge floors and tops of abutments or bridge seats.

(c) On the bottom of ditches at their entrance and exit and about 100 feet from each end of a culvert bridge so as to give the grade of the stream bed near the culver

(d) High and low water in stream (estimated).

(e) Water surface of streams as fou

(f) 100 ft. in either direction on cross roads or intersecting roads and important entrances.

(g) All rails of intersecting railroad or trolley tracks.

(h) Cross walks and ends of brick pavements contiguous to the work.

A center profile shall be run for 300 ft. beyond the end of the survey and 300 ft. back of the starting point.

Photographs of the road must be taken at least six to the mile, taking one at either end of the road and about 1,000 ft. apart, and as many additional photographs as may be necessary to show those sections of the road which may present special construction features.

The Earlier Bituminous Concrete Pavements of Washington, D. C.

Bituminous concrete pavements were laid in Washington, D. C., as early as 1870, and at time that city had over 1,000,000 sq. yds of this type of pavement. In view of the rapidly increasing use of bituminous macadam in highway construction a description of the early bituminous pavements should prove of interest to road engineers. Such a description was given by Capt. Mark Brooke, Assistant to the Engineer Commissioner of the District of Columbia, in a paper presented before the Section D of the American Association for the Advancement of Science. An abstract of Captain Brooke's paper follows:

Washington today has 3,000,000 sq. yds. of bituminous pavement, other than asphalt block, of which 1,200,000 sq. yds. are cement concrete base, and 800,000 sq. yds. on a base of bituminous concrete. Of this amount 600, have at some time been resurfaced phalt over the original pavement and n 200,000 sq. yds. of old tar and tar- pavements exist as originally laid.

[illegible] time the history of these pave- may be divided into three [illegible], in each of which a different class of s was laid. The first period is that 71 to 1878, the period of the old pat- ypes, to which the designation "con- has been applied locally. The second was from 1886 to 1893, when a type [illegible] base pavement [illegible] r distillate" was laid, and the third is d in the last two years, during which limited amount of bituminous macadam [illegible]

[illegible] 1871 and 1875 about 700,000 [illegible] bituminous base pavements were laid arious patents, among which were the he Filbert or Vulcanite, the Scharf, [illegible] hey were generally similar in char- d in all of them the attempt was made [illegible] ly graded aggregate should be bonded bituminous cement into a dense con-

Bailey pavement consisted of a founda- ut 1 ft. in depth of stone from 2 to 10 size, into which was poured a cement d of a mixture of asphalt fluxed with und slate, soapstone, pulverized dry ells and stones. Upon this foundation [illegible] r which was poured a mixture of sphalt and oil of pitch. On this sec- was laid a third, 1½ in. in depth, [illegible] gravel, [illegible] hes mixed with the tar of asphalt All these layers were then rolled heavy roller.

Parisen pavement, of which about 70,- yds. were laid between 1872 and 1875, nstructed as follows: A base course 4-in. stone thoroughly mixed with lake asphalt, fine screened gravel and [illegible] nd rolled. In the voids in the surface course was rolled a light course of ips or gravel mixed with medium tar rtland cement. The surface was then with a coat of the cement used in e. On top of this was a 2-in. course el, gypsum and Portland cement mixed tumen in the proportion of ¾ medium coal tar, ⅓ mined Cuban asphalt and ped" or Trinidad asphalt. After roll- s course, it was painted and the last was repeated. The object of the paint was stated, was to serve as a seal and a bond between the adjacent courses, inventor claimed as one of the ad- s of this pavement that the base were firmly bound and the spaces d solid.

Scharf pavement, of which about 200,- yds. were laid, consisted of three , a base course of 4 to 7 ins. deep, ed of a mixture of stone and stiff bitu- tained from the slow distillation of coal en a 2-in. course of stone mixed with nt of 1 gal. of pitch to ½ lb. of as- and a wearing surface of small stones avel, hydrated lime, cement, pitch and

Vulcanite or Filbert was the simplest truction and proved the most lasting the patented pavements. It was com- of a mixture of 80 lbs. of asphalt, 30 either rosin, pitch coal tar or pine tar; of sulphuric acid, 90 lbs. of lime, and . of sand, fine gravel, ground iron cin- d broken stone. The sand and aggre- ere first mixed and dried, and then the ingredients added, and the mixture to a suitable consistency. The hot e was then spread upon the sub-grade lled. The proportion of cement in this e, approximately 14 per cent, is slightly than the percentage of asphaltic ce- n our own present standard top mix-

foregoing descriptions have been taken he specifications in the patents record- [illegible] should be taken as descriptive of a theory rather than a condition, as they probably do not accurately describe the pavements as actually laid in many cases. These specimens of the different pavements which have been preserved could scarcely be identified by the patent descriptions, and different samples of [illegible] they all possess one common characteristic, small proportion of voids.

The cost of these pavements varied from $1.74 to $3.70 per sq. yd. Many of them proved unreliable and had to be resurfaced within a few years. The trouble appears to have been in the wearing course, for whenever a new asphalt or Vulcanite surface has been laid on the old pavement it has stood many more years of service.

Of the 190,000 sq. yds. of Evans pavement, laid for the larger part in 1873, nearly the entire amount was resurfaced within two years. Two- thirds of the Parisen pavement was resurfaced within five years and the remainder within the next three.

Part of these pavements were resurfaced with asphalt and a portion with the Vulcanite pavement. The Scharf and Vulcanite proved much more durable, and many of them have been resurfaced or replaced only in the last few years in which they have been in service.

The experience with bituminous concrete as a whole was so unsatisfactory that when the first board of commissioners was established in 1878 it expressed its intention of abandoning this class of pavements in the following terms:

> In [illegible]
>
> While [illegible] in the city is such as to lead to their con- [illegible] also given rise to many perplexing problems in the grades of streets upon which they have been used, and as, when properly laid, their cost is as great, if not greater, than the [illegible] abandoned.

From that time on sheet asphalt on a 6-in. hydraulic cement base has been the standard pavement of this city, and no more bituminous concrete was laid for a period of nine years.

The opinion thus expressed seems to have been modified in the succeeding years, for the report of the engineer department for 1887, aftr quoting the report of 1878, goes on to say:

> In the [illegible] years has elapsed and the well-preserved con- [illegible] coal-tar pavements has led many to believe that the faults of the earlier pavements are not irremediable and that with proper care such pavements [illegible] the asphalt in most respects, and superior in [illegible]

The annual expenditure for maintenance of the bituminous concrete for the 15 years ending July 1, 1886, was 5½ cts. per sq. yd. For the first five years the average cost was 3.7 cts. and for the second five years 6.6 cts.

The 100,000 sq. yds. of Vulcanite, which at that time had been down 14 years, averaged only 2.9 cts. per yard per year during that period, about the cost today of maintaining our standard pavement.

It is not probable, however, that there would have been a return to the bituminous type had it not been for the action of Congress in virtually compelling the abandonment of the hydraulic base pavement.

The paving appropriation act of 1886 contained a clause to the effect that no contract should be made for laying concrete or asphalt pavement at a higher price than $2.00 per yard for a quality equal to the best previously laid. Bids were then taken on a pavement with a 4-in. natural cement base and some laid at the $2 price. The following year Congress stipulated that the cost should not be higher than $2 for a quality equal to the best laid prior to July 1, 1886, and with the same depth of base. This condition, with varying limitations, has been retained in every appropriation act to this day. This meant that asphalt could not be laid on less than a 6-in. base, and as bids could not be obtained for this pavement at $2, recourse was had to a bituminous concrete, and during the next five years 425,000 sq. yds. of such pavement were laid.

This pavement, laid under District specifications, was of two kinds, known locally as the "coal-tar distillate" and the "combination."

Both pavements were 7 ins. in depth and consisted of 5½ ins. of base and binder and 1½ ins. of wearing surface, the difference being in the character of the top course.

The base consisted of stone passing a 3-in. ring, rolled to a depth of 4 ins. and then coated with a No. 4½ coal tar paving cement, 1 gal. to the yard.

The binder course was composed of screened stone not larger than 1¼ ins. and No. 4 coal tar cement. The stone for this course was heated, mixed with the cement in the proportion of 1 gal. of cement to a cubic foot of stone, then spread on the base to a depth of 2 ins. and then rolled.

The wearing surface of the "distillate" pavement was composed of about 60 per cent sharp sand, 25 per cent screenings, 14 per cent paving cement and small quantities of hydraulic cement, slaked lime and sulphur. The cement consisted of about 30 per cent asphalt to 70 per cent No. 4 coal tar.

The surface of the "combination" pavement consisted of the standard asphalt top mixture laid on the tar base and binder courses just described.

These pavements continued to be laid until 1893, when they were abandoned for the hydraulic base pavement, the cost of which had come within the $2 limitation fixed by Congress.

While both the "distillate" and concrete pavements are of the same general type, the difference in construction and quality is very marked.

The pavements of the period from 1871 to 1878, which run in depth all the way from 8 to 14 ins., are a dense, tough concrete in which the stone is thoroughly coated, and the voids, small as they are, completely filled with a tar which appears as bright and fresh as though just laid. The distillate pavements, on the other hand, which have a uniform depth of 7 ins., are brittle, the base course deficient in tar and, such as there is, inert and lusterless. The difference in the quality of toughness will be appreciated from the fact that in our resurfacing contracts we have different prices for the removal of bituminous pavements of the class laid before and that laid after 1880, paying $1.85 per cubic yard for the removal of the former and $1 for the latter. The older pavements are much more homogeneous in character, and even in those that were laid in successive courses there is no well-defined line of demarcation between the successive layers. However, the large quantity of cement, in some cases as much as 4 gals. to the square yard, used in the old pavements made them objectionable, wavy and in more than one instance, on a grade, they have been known to flow over the top of the curb.

The theory of these pavements was that they would form an indestructible base for a wearing surface which would be renewed as occasion demanded, and many of them, particularly of the distillate class, were laid with very flat sections, with a view to crowning, which was anticipated as the result of successive resurfacings.

As a matter of fact it proved impracticable to resurface them properly, as the old surface did not wear away uniformly, and it was impossible to strip it from the base, so intimately bonded were the two courses. Moreover, the street engineering of those days was rather crude, and many faulty grades were established. In a number of cases the surface deterioration was undoubtedly partially due to the poor drainage resulting from insufficient crown. It is rather from the necessity of correcting these conditions than from any other inherent defects of the pavements themselves that they are being replaced instead of being resurfaced.

The average age of all the street pavements resurfaced in Washington last year was slightly over 25 years, and it is safe to say that the old bituminous concrete averaged over 30 years.

There are not many old pavements left today. The Vulcanite pavement on De Sales St., laid in 1875, has never been resurfaced. The south side of Pennsylvania Ave., N. W., from 18th to 21st St., is a Scharf pavement laid in 1875 and resurfaced in 1887 with a tar distillate top. F St., in front of the Willard Hotel, is a Scharf pavement laid in 1873 and resurfaced in 1878 with an asphalt top The Scharf pavement on Vermont Ave., in front of the Arlington Hotel, than which there was no better pavement in this city until gas recently got into it, was laid in 1871, and resurfaced in 1878 with an asphalt top over the original pavement.

Cost of Operating a Steam Road Roller on Macadam Pavement Work.

Contributed by F. W. Robinson, Assistant City Engineer, Webb City, Mo.

The following data give the cost of operating a 15-ton macadam road roller for the two seasons of 1910 and 1911. The roller was bought new in 1906 at a cost of $3,000, these two years making the fourth and fifth seasons, respectively, in use. In all it has been used to roll 150,000 sq. yds. of water bound macadam, gravel and asphalted macadam pavements, and in addition was used on some three or four miles of county road work. It has also been used to a small extent to pull plows and rooters in opening side ditches and making street excavation, and for rolling down refilled sewer trenches. As nearly all the macadam roads and pavements in this locality are constructed of hard flint rock the large wheels are pretty well worn and will need replacing after another season or two. With that one exception the roller is in very good condition, considering the number of different men who have handled it, and only a few minor renewals have been necessary.

The following tables give the actual cost of operation for the two seasons:

1910—67.4 Days of 8 Hours Each.

	Total.	Per day.
Engineman, 67.4 days, at $2.50..	$168.50	$2.500
Coal, 32.79 tons, at $4.00	130.36	1.934
Water, free	00.00	0.000
Repairs and supplies............	105.26	1.562
Interest, 6% of $3,000...........	180.00	2.671
Depreciation, life 25 years, 3% compound, 2.75% of $3,000.....	82.50	1.224
Total	$666.62	$9.891
Cost per sq. yd. of rolling 26,006 sq. yds. of asphalted macadam, including sub-grade, 6 ins. thick		$0.0156
Cost per sq. yd. of rolling 15,062 sq. yds. of gravel pavement, including sub-grade, 6 ins. thick		0.0126
Average sq. yds. rolled per day of 8 hrs., asphalted macadam		630
Average sq. yds. rolled per day of 8 hrs., gravel		787

1911—96.75 Days of 8 Hours Each.

	Total.	Per day.
Engineman, 96.75 days, at $2.50..	$241.88	$2.500
Coal, 40.5 tons, at $2.55 average.	103.26	1.067
Water, free	00.00	0.000
Repairs (15.8 days at $2.50 plus $10.00)	49.53	0.512
Oil and grease	5.40	0.056
Interest, 6% of $3,000...........	180.00	1.858
Depreciation, life 25 years, 3% compound, 2.75% of $3,000....	82.50	0.851
Total	$662.57	$6.846
Cost per sq. yd. of rolling 34,152 sq. yds. of asphalted macadam, including sub-grade, 6 ins. thick		$0.0176
Average sq. yds. rolled per day of 8 hrs., asphalted macadam		388

It will be noted that with a much cheaper cost per day for operation in 1911 than in 1910 there is a decrease in the amount rolled per day, with a corresponding increase in cost per square yard. The reason for this seeming inconsistency is that in 1910 the roller did nothing but roll the sub-grade and pavement proper, and was called out only when there was sufficient sub-grade or pavement prepared to constitute a full day's work, while in 1911 it was kept on the job continuously after the asphalting started and was also used to pull the two 500-gal. portable asphalt kettles forward as the work progressed. By the difference in the amount of pavement rolled per day for the two seasons a loss of about 40 per cent of time is shown for 1911 compared with 1910, and that figure represents pretty closely the time spent in pulling the kettles and lying idle waiting for the work to progress far enough to make it worth while to move back and roll the completed pavement.

There are several reasons for the difference in cost of operation per day for the two seasons. The same engineman was employed both seasons at the same wages, and that item as well as interest and depreciation remain the same for both years. In 1910 the coal was purchased of local dealers at retail prices, while in 1911 a far better grade was obtained at a much lower price by buying a full car. The reason for the large difference in cost of repairs and supplies was due to the fact that the man who ran the roller in 1909 did not take proper care of it and when the present engineman took hold in 1910 a pretty thorough over-hauling was necessary. It might be well to state that the average man whose only experience has been with a threshing engine is not very apt to be fit to run and maintain in good condition a road roller. The present engineman, who is an old locomotive engineer and a good machinist, did practically all the repairing on rainy days and Sundays, and the roller had to be taken to the machine shop only once in the last two years. The reason so good a man was secured at such a low price is because he gets straight time the year around, and when not out with the roller is employed at other work.

Experience with Concrete Pavements in Davenport, Iowa, and Vicinity.

The city of Davenport, Ia., began the construction of Portland cement concrete pavements in 1909, the first street so paved being completed in the fall of that year. This work comprised about 3,000 sq. yds. In 1910 about 16,000 sq. yds., widely distributed and in small sections, were laid. The following year 18,000 sq. yds. were laid in Davenport, and in the adjoining town of Bettendorf, with a population of about 900, about 29,000 sq. yds. were laid in one job on the main street. Some interesting information regarding the experience with this type of pavement was given by Mr. A. M. Compton, Commissioner of Public Works of Davenport, Ia., in a paper read before the recent convention of the Iowa Engineering Society. The following matter has been abstracted from Mr. Compton's paper.

The city of Davenport some years ago paved several rather steep hills with beveled vitrified brick with a telford macadam strip 10 ft. wide in the center. These macadam strips washed badly and were in an impassable condition within a few years. These macadam center strips were recently replaced with a one-course concrete pavement from 4 to 6 ins. thick and corrugated with a "hit or miss" tamper. The grade of these hills varies from 9½ per cent to 12 per cent and in one instance the paving receives very heavy traffic. It has been noticed that teamsters generally prefer to drive on the concrete center strip rather than on the brick sides. The only signs of failure so far have developed at the transverse expansion joints which were left unprotected save for a sand filler. In fact none of the concrete pavements at Davenport so far have shown any failure under traffic save at the expansion joints.

In 1909-10 the concrete pavement was laid under specifications briefly as follows: A 5-in. base of 1:3:5 concrete with a wearing surface of 1:1 sand mortar, corrugated transversely with tooled grooves about 8 ins The mineral aggregate was river sand a in. crushed lime stone. A transverse sion joint filled with pitch was required 50 ft. In 1909 the price on the old laid was $1.25 per square yard; in 19 price varied from $1.27 to $1.37 per yard. This same year a number of re alleys were paved with one course concrete 6 ins. thick and rough finish, at an average price of $1.11 per square yard. During the fall and winter of 1910-11 was noticed that almost without exception these blocks of paving 50 ft. long and 30 f had developed irregular contraction While these cracks were negligible as they were without question a failure a rimental to the life of the pavement.

With the idea of a general bettering the work and in an endeavor to do so materially increasing the cost the specifications were changed before the season to read substantially as follows: A 5-i of 1:3:5 concrete with a 2-in. wearir face of one part cement to two part and with a 1-in. transverse expansion every 25 ft., and a 1-in. longitudinal sion joint along either curb and contraction joint midway between the verse expansion joints. All joints tool rounded edges and to be fille with asphalt. This divided the w blocks 12½ by 30 ft. and so far has pra eliminated all contraction cracks. Th crete pavement under this specificatio laid in 1911 for prices ranging from $ $1.30 per square yard.

During the season the city also laid thousand yards of concrete pavement c ing of a single-course 6 ins. thick of 1½ concrete with the mortar flushed to th face floated and either broom finished rugated as the grade of the street re This was laid under contract at a cost to $1.00 per sq. yd.

During this same season it was requi the Department of Public Works to street the sub-soil of which was de treacherous, consisting largely of saw m use such as sawdust, chips, bark, etc. above the natural surface of the grou a depth of from 6 to 12 ft. and saturate river water. Both railroad and street r tracks which parallel and adjoin this settle from 18 to 24 ins. annually wher cross this fill. As this street would b ject to heavy and high speed traffic, thought that a flexible type of pavemen as the various forms of macadam neither withstand the traffic without c repair nor would it tend to be in th self-supporting over what seemed almo tain excessive and unequal settlemen was finally decided to use reinforced c pavement to consist of 7 ins. of 1:3: crete with 0.5 per cent steel mesh rein ment placed near the lower surface concrete. It was thought that this type more successfully withstand the settleme still come within the requirements of moderate first cost. It was planned wi idea of placing either a brick or an a wearing surface upon it if, in the futu surface should disintegrate or ravel bad der traffic.

The successful contractor laid this ment in the summer of 1911, using a su amount of American Steel & Wire Co. fencing as reinforcement, for the price per square yard. During and imme after its construction there was several of excessive and continued rainfall, l the sub-grade in a jelly-like condition. curbing settled badly but so far no sig failure in the pavement have develope even contraction cracks, though duri life so far it has experienced a range o perature of 113°.

Owing to the very general demand of erty owners this season by petition, an erwise, for concrete paving, the specific were again changed in the effort to obt possible the best and most substantial crete pavement compatible with a mo first cost. The present specifications are ly as follows: A 5-in. base of 1:3:5 co which is to be laid a wearing surface not than 1½ ins. in thickness at any point onsisting of one part cement, one part nd and one part ¼-in. to ½-in. gravel [illegible] transverse expansion joints consisting eosoted long leaf yellow pine blocks 1 in. ickness to be placed with the grain ver- 20 ft. apart and the same longitudinal along the curbs [illegible] rices received so far this season upon vement to be built under this specifica- have varied from $1.00 per sq. yd. to per sq. yd.

the work at Bettendorf it was demon- l that the type of concrete pavement ting of a single course of 1:2½:4 con- 6 ins. thick, could be laid satisfactorily [illegible]

per [illegible] concrete paving to be mixed 1:2½:4 with mortar flushed to the surface with a [illegible] tamper, floated and broomed; expansion and contraction joints to be placed dividing the work into blocks 12½x20 ft., and all to be filled with an asphalt filler. Th[illegible] concrete curb, 12,000 lin. ft. of 12-in. concrete curb. This latter was placed around a 10-ft. center boulevard strip which was left for the purpose of receiving a probable street railway line. The successful bidder on this work took the contract at the price of 85 cts per sq. yd. for pavement, 30 cts per cu. yd. for excavation, and 18 cts. and 20 cts. per foot, respectively [illegible]

was first broken in the middle of Septemb and the pavement was completed and open traffic in the middle of December.

During the past season, several thousan square yards of concrete roadways and driv in private grounds have been constructed u der the supervision of Davenport engineer Both the single-course type and the two-cour type have been used with equally satisfacto results. One feature of this work has bee the coloring of the concrete to prevent the o jectionable sun glare from the dead whi surface, this feature being particularly notic able when the roadway is directly edged wi grass and trees. From ½ to 1 lb. of lan black per barrel of cement was used, and th resulting slate-colored or light gray effect [illegible]

WATER SUPPLY, SEWERAGE AND SANITATION SECTION

M hods of Garbage Collection in Milwaukee, Present and Proposed.—The Estimated Saving in Cost Under New Method.

method of garbage collection now in in Milwaukee is inefficient and un- ical. The quality of service rendered tisfactory to the public. A study of thods of garbage collection was first ken by the Bureau of Economy and cy soon after its organization late in The attention of the bureau was called lack of efficiency in the system now in the numerous complaints of poor serv- eived every day from householders in ts of the city. In a report of the Bu- epared by Robert E. Goodell and pub- in January, 1912, an economic study is f the present method of garbage col- on, and recommendations are made with ew to increasing the efficiency of that sec- f the department of public works.

[illegible] METHODS OF [illegible]

employees of the section are the super- nt of collection, a hoistman, a time- per, and the force of collectors. All ex- the collectors are appointed from the Service lists. Garbage collectors are ex- t from City Service rules and are hired ctly by the superintendent of collection. y are paid at the rate of $3.00 per day. hough in all municipal activities, eight rs is recognized as a working day, garbage lectors, through a practice of a number of rs' standing, have come to consider the lection of two loads as constituting a day's rk regardless of the time consumed.

here are 95 collectors employed during winter, and about the middle of May three litional men are put on for the summer nths. Garbage is collected from all resi- ces in the city without direct charge to householders. With slight exceptions the ne applies to business places.

or the purposes of garbage collection, the is divided into small districts which were d out without any particular study of the 's needs. When the districts as they stood uary 1, 1911, were platted on a map of the it was found that in several cases two three of them overlapped. Every collector assigned either two districts from each of ich he is supposed to get one load a day one large district from which two loads a are to be collected. The main idea in king such assignments was to equalize the rk by giving each man either a long and hort haul or two medium length hauls. A dy made of the total mileage required of h driver showed that this plan comes very from accomplishing the desired results.

About the first of May, 1911, the bounda- s of the districts were altered by the su- intendent of collection, doing away with overlapping, but otherwise making very le material change in the conditions.

In winter collections from residences are made once a week, and from the business section, hotels, and other buildings, from one to five times per week as needed, the collectors working five days a week. In summer the collectors work six days a week. While it seems to have been the intention to collect twice a week from residences during the summer, there are no records to show that this has been done very regularly. In the business section the summer service is from one to six collections per week as needed.

All garbage is collected during the night. Collectors are required to start not earlier than midnight and to make their last deliveries to the incinerator by 8 A. M., during the summer months, and by 9 A. M. in winter.

Every load of garbage collected is weighed on the scales at the city incinerator and recorded by the timekeeper. Each day, the total receipts are summarized and a report is rendered to the weighmaster of the incinerator for the information of the superintendent of the incinerator. The record sheets are also used as a basis for making up the payroll of collectors.

All garbage collected by the city, is delivered to the city incinerator for disposal. After the loads are weighed, the wagons go to the cranes where the hoistman hooks the chains onto the full boxes and unhooks them when the boxes are returned empty. At this point the work of the section of collection ceases, and all further handling of garbage is done by the division of garbage disposal.

The superintendent of garbage collection supervises the work of the collectors, and weighing of loads. He also receives and investigates complaints from householders.

The wagons in use are single-horse, with removable sheet metal boxes which are equipped with hinged covers. The capacity of a wagon is about 1½ cu. yds. The horses and running gears are furnished by the drivers and the boxes are owned by the city. There is no regular time set for cleaning the wagon boxes. When the boxes are cleaned, the operation consists of turning a fire hose on the outside of the wagon, and then sweeping out with a broom the small amount of water that happens to get inside the box. The inside of the boxes is not flushed.

There is a State law which provides that suitable covered receptacles for garbage, ashes, and rubbish shall be furnished by the property owner, and a city ordinance requiring that receptacles be placed at a point on the premises most accessible to the person collecting the garbage. Neither of these regulations is rigidly enforced.

The Bureau secured data regarding the amount and character of garbage collected from each district. These data were compiled from the records of the weighman at the incinerator. Table I shows the number of loads and weight of garbage collected in the first four months of 1911.

[illegible]

Average Winter Load.—The statement of the weight of garbage delivered at the incinerator given in the report of the Commissioner of Health for the past five years, show an average weight per load considerably in ex cess of the above figure. However, prior t the summer of 1910, actual weights were take on occasional loads only, while since that time every load delivered to the incinerator ha been weighed; hence it was deemed advisabl to base calculations entirely upon figures ob tained under the present method. Figure from 16 cities on the weight of garbage, fro reports by Charles V. Chapin, M. D., in Mu nicipal Sanitation in the United States, show an average weight of 1,405 lbs. per cubic yard With the 1½-cu. yd. wagon used in Milwau kee, this would indicate a weight of over 2,10 lbs. per load. While it is true that occasiona loads run as heavy as this, it hardly seems justifiable to use such figures in preference to those obtained by careful observation over a long period of time. For these reasons, all calculations in this report are based on an average winter load of 1,200 lbs.

With the view of using the data obtained from the records of garbage delivered, to the best advantage, in determining the need for changing the collection districts of the city, a careful study of the class of buildings and the character of the population in each collection district and the length of haul for each collector was made by the bureau. As an aid in the study, the collection districts, as defined by the superintendent of garbage collection, were laid out on a map of the city, and the City Engineer was requested to indicate the distance from the center of each district to the incinerator, by the shortest route.

Members of the staff of the Bureau made an inspection trip for the purpose of studying the characteristics of all parts of the city. As a result of this study it was decided to make an arbitrary division of the city into nine large districts.

In order to obtain data on the actual work of collecting garbage as it is at present carried on, a field investigation was made by the bureau. This investigation was carried on over a period of two weeks in the following manner: An observer was assigned one collector to be followed one night. He went to the address of the collector, furnished by the superintendent of garbage collection, at midnight, and noted the time the collector left his barn. He then kept a record of the collector's movements until he returned to his barn after his night's work. In this way, information was obtained of the time spent in collecting a load, the time on the road to and from the incinerator, and the time at the incinerator.

The fact that the work was done at night presented many obstacles. [illegible] the wagons are small and are frequently made illegible by dirt. The location of the number on the side of the seat makes it possible for the driver to hide it entire by hanging the end of his blanket over it. This was found to be the practice in many cases. Many facts of value in throwing light upon the efficiency of the garbage collection service were obtained in the field investigation.

Twenty-one collectors were seen by observers when they started out from their barns. The time of leaving the barns may be classed as follows:

Hour of leaving.	Number.
Midnight or earlier	2
Midnight to 1 a. m.	5
1 a. m. to 2 a. m.	6
2 a. m. to 3 a. m.	5
3 a. m. to 4 a. m.	1
After 4 a. m.	2
	21

Seventeen collectors were observed both when leaving the barn and returning to it. Of these, two worked over eight hours; five worked from seven to eight hours; six worked from six to seven hours; three worked from five to six hours; and one man worked only three and one-half hours. The average time worked by these men was six hours and thirty-six minutes or 82½ per cent of the time for which they were paid. As these collectors were chosen at random from all parts of the city, it is safe to assume that the figures obtained are representative of conditions throughout the city. This assumption is further supported by reports of observers that other collectors, living near the particular ones hey were following, started out at about the same time.

When the time required to haul the loaded vagons to the incinerator is examined, it is ound that collectors working in the outskirts lrive in at a higher rate of speed than those vorking closer in, or in other words, there is tendency of collectors to loaf on the short auls.

Dividing into groups the loads upon which bservations were made the following conitions were found:

roup.	Average length of haul in miles.	Average rate of drive in miles per hour
I	1.96	3.01
II	2.24	3.13
III	3.00	3.62
IV	3.59	3.64
V	4.48	4.48

From this it would seem that a driving rate f four miles per hour can reasonably be expected of the collectors, and such a rate is sed in further calculations.

Probably one reason why so many collectors d not start on their round at midnight is ecause hoisting at the incinerator did not ben until 3 A. M. In the nineteen cases oberved it was found that had those nineteen ollectors started out at midnight, twelve of em would have arrived at the incinerator fore hoisting time. This would indicate at collections should begin at a later hour d continue longer in the forenoon than at esent, or that hoisting should start earlier d steps be taken to compel the collectors start out promptly at midnight.

SUGGESTIONS RELATIVE TO THE PRESENT METHOD OF COLLECTION.

A careful study of the reports returned by e observers leads to the following general ductions as to the wastes and poor service the public in the present system: 1. A jority of the collectors are giving less than day's work in returned for a day's pay. 2. some instances, the horses furnished by collectors are old and broken down and irely unfit for the work required. 3. Some the collectors, because of their age or from er causes, are physically unable to render service which the nature of the work uld reasonably demand. 4. The present ustment of districts to give a collector a g and short haul does not accomplish what s expected of it, because, instead of making long haul, collectors frequently steal a d from some one's else territory closer in. s means that outlying districts are neglected and collectors from whose districts the loads are stolen lose time in going over ground already covered by some one else. 5. Collectors waste time in many cases, so that even the short hours worked is too much time for the amount of work accomplished.

SUGGESTIONS FOR REORGANIZATION.

In recommending changes in the system of garbage collection, the Bureau of Economy and Efficiency desires to present a plan whereby each collector can be required to work eight hours a day in a definite territory, for the condition of which he can at all times be held responsible. An analysis of the results of the investigations conducted by the bureau shows that such a plan would make possible a reduction in the number of collectors employed.

Calculations were made to determine the required number of wagons working a full eight-hour day to keep the garbage of the city cleaned up. These calculations were based on the amount of garbage collected in the first four months of 1911. The weight of the average load is taken as 1,200 lbs. The average length of haul was determined. The time requiring in hauling was based on a rate of four miles per hour. The average time at the incinerator, for weighing and unloading, was taken as ten minutes. The average time required to collect a load was taken as the average of the loads observed during collection.

The net result of the calculations shows that theoretically all the garbage should be removed from the entire city every week by 70.62 wagons. This figure involves fractional parts of wagons and loads in each section, an impracticable arrangement. When necessary adjustment to place the service on a practical basis are made, 76 wagons are required to collect the garbage.

No Additional Wagons Needed in Summer.—All of the figures so far shown are based upon the handling of winter garbage with wagons working only five days a week. While the weight of garbage to be handled in the summer months is greatly in excess of that in winter, the increase can readily be handled by working the same number of wagons six days a week. The fact that in the summer months, the volume of garbage does not increase in the same proportion as its weight is of considerable importance in this consideration.

A comparison of the four months of June, July, August and September of 1910 with the first four months of 1911, showed that the total weight of garbage collected from the city in summer was 39.9 per cent greater than that collected in winter.

The record of garbage delivered during the summer of 1910 shows that the wagons readily handled 1,422 lbs. per load, and this figure has been taken as the average summer load. In other words, a full wagon load in summer will weigh 18.5 per cent more than a full wagon load in winter. How the increase in the average weight per load and collecting six days a week instead of five will care for the extra amount of garbage to be collected during the summer is concisely shown as follows:

Assuming 100 as representing the total weight of garbage handled in the winter months by a given number of wagons.

Total weight handled in winter, wagons working five days a week	100
Increase handled in five days in summer on account of 18.5% increase in weight of load	18.5
	118.5
Increase handled by working six days instead of five, 20%	23.7
	142.2

From this it can be seen that the 76 wagons, necessary to collect the winter garbage, can handle a 42.2 per cent increase in summer, while the actual increase is only 39.9 per cent.

There are very apparent reasons why night collections reduce the efficiency of the service. At the best, work must be slower in the dark than by daylight, but the greatest danger of inefficiency is that the collector who may be inclined to loaf under cover of the dark is free from observation and possible criticism of the public or his immediate superiors. liable figures show that in most cities garl is collected during the day time. With hours arranged so that the work would finished at noon, all collections could be m in daylight, except possibly on the shor days of winter. Proper care of the wag would remove the principal objection to hav them on the streets during business hours.

The main obstacle in the way of chang the hours of collection in Milwaukee is of crane equipment at the incinerator. Th are at present two cranes, which handle g bage at night and in the early morning, a then work on ashes through the day. As th are both working to very nearly capacity, change which would involve delivery of g bage and ashes at the same time would te to cause a blocking of the work.

Wagon boxes should be kept clean a should be deodorized frequently. In most cit there are rules governing the care of wagons. While there is a great variety of quirements as to disinfection or deodorizati daily washing seems to be the general practi

Present arrangements at the incinerator not permit of as thorough cleaning of wag as is desirable. The boxes should be tipp up so that the hose could be turned on t inside, but if this were done by the cranes, would seriously interfere with hoisting. There is, however, an unused crane availal which is operated by a small hoisting engi and which is so located as to be easily ada able to this work. A steam line could be r from the incinerator boilers at a very sm cost, and with power obtained in this ma ner, the only cost of operation would be t wages of an engineer at $3 per day or $8 per year. Such a man would not be kept bu all day with the wagon washing and he wou be available for miscellaneous work arou the plant, for which additional help is fr quently employed at present.

It is recommended that the necessary a rangements be made so that every wagon b will be thoroughly washed every day after t delivery of the last load. In addition to th cleaning, each box should be sprayed at lea once a week with a disinfecting and deodori ing fluid. The most effective and probabl cheapest deodorizer will be found in the co tar group, of which there are many compound on the market. If such cleansing as is suggested be required, a frequent inspection o the wagons should be made by some one de tailed from the office of the superintendent o street cleaning in order to insure a prope compliance with the requirements.

Frequency of Collections.—The frequency o collections is widely variable in different citie and it is difficult to determine a general prac tice. The needs of Milwaukee would well b served by a careful observance of the presen rules, namely: Winter collection, business sec tion five times a week; all other sections onc a week. Summer collection, business sectio six times a week; all other sections twice week.

An effort should be made to get a recor of all boarding houses in the residence districts, accommodating ten or more guests, and such places should be given the same servic as the business section.

SAVINGS AND IMPROVEMENTS UNDER THE PROPOSED SYSTEM.

Under present methods, collections are made five days a week for about 30 weeks of the year. About 22 weeks, from May 15 to Oct. 15, the wagons are worked six days a week. There have been 95 wagons working during the winter, but the street cleaning department has deemed it advisable to put on three more for the summer months.

At $3 per day, one wagon costs for 22 weeks of six days each, $396, and for 30 weeks of five days each, $450, or for the entire year $846.

The collection costs under the present system are therefore:

98 collectors (during 5 summer months) at $396	$38,808
95 collectors (balance of year) at $450	42,750
Total cost of collecting under present system	$81,558

e collection cost under the proposed re[illegible]ting are:

[illegible]llectors (for the entire [illegible]) ... $81,2[illegible]

[illegible] reduction of the number of [illegible]llectors ... [illegible]

[illegible] added cost of keeping wagons clean [illegible] of engineer at $3 per day ... [illegible]

[illegible] possible by adoption of recom[illegible]dations of the Bureau of Economy [illegible] Efficiency ... $[illegible]

SUMMARY OF RECOMMENDATIONS

ted concisely, the recommendations of ti Bureau of Economy and Efficiency are as f ows: 1. The number of collectors should b mmediately reduced to 76 apportioned over tl city. The change may be made in one sec- n at a time if desired, but the reduction for entire city should be accomplished within weeks from the time of starting. 2. A full hour day for every collector should be sted upon. 3. Each collector should be e responsible for keeping the garbage ned up in a definite territory, with instruc- t is that repeated, well founded complaints vl be sufficient cause for discharge. 4. ght collections, starting at midnight in sum- r and 1 a. m. in winter should be continued the present. This point should be given ther careful consideration with a view to anging the crane facilities at the incinerator that collections can be made from 4 a. m. 12 m. the entire year. 5. The wagons should washed thoroughly, inside and outside, ry day after the delivery of the last load the incinerator, an extra engineer being ployed and the unused crane utilized for s purpose. 6. The wagon boxes should be infected at least once a week. 7. The gons should be frequently inspected to see t they are kept clean and free from odor. Collections from the business section should made five times a week in winter and six es a week in summer, from all other parts the city at least once a week in winter and ice a week in summer.

A supplementary report made Dec. 1, 1911, tes that in considering putting into opera- n the system proposed in the foregoing ort the question arose as to the injustice of uiring collectors to work an eight hour y for $3, while $3.50 per day is the rate gularly allowed for single teams employed r all other city work. [illegible]vever, with an crease of 50 cts. per [illegible] for collectors, ere would still be a savi[illegible]ssible as shown the following figure[illegible]

tal cost of collecting [illegible] system.. $81,758
st of 76 wagons at [illegible] day each.. 75,012

ving by reduction o[illegible] ber of col- ectors ... $ 6,746
ss added cost of k[illegible] gon clean.. 846

t annual savi[illegible] ... $ 5,900

In September [illegible] superintendent of

street [illegible] permen[illegible] collect[illegible] used are two-horse, bott[illegible]

water tight and while they appear to be satisfactory for handling garbage in cold weather they undoubtedly cannot be used in hot weather on account of the leakage. However, the practicability of using the larger size wagons has been demonstrated fully. The cost of operating one of them is $5 per day for a driver with two horses and $2 per day [illegible]

[illegible] These are the rates paid for all other cit[illegible]

The bureau made calculations along th[illegible] [illegible] wagons of 4 cu. yds. capacity would be re[illegible] [illegible] cost of such service with that of the old system, the following figures are shown:

[illegible]

Practice will probably show that it is no[illegible] [illegible] and there will be possible a still further reduction of cost. Several double wagons are bein[illegible] used at present with very satisfactory results and the number is being gradually increased.

As previously stated, the bottom dumpin[illegible] wagons now owned by the city will be objectionable in hot weather and an equipmen[illegible] of special 4-yd. wagons should be provided. The cost of such equipment would be approximately $10,000, which would practically b[illegible] paid for by the first year's savings.

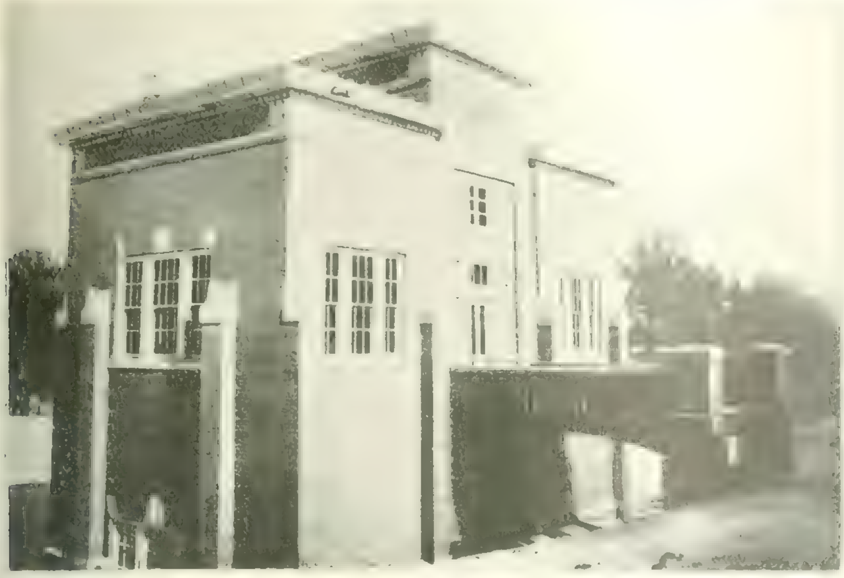


Fig. 1—Exterior View of Kansas City, Mo., Hypochlorite Water Sterilization Plant.

Use of Reinforced Concrete in the Hypochlorite Water Sterilization Plant at Kansas City, Mo.

[illegible] the [illegible] 1911 [illegible] installation of the hypochlorite process for th[illegible] approximate sterilization of the entire municipal water supply of Kansas City, Mo., was s[illegible] remarkably successful in diminishing the sickness and death rate in the city on account o[illegible] typhoid fever as well as other forms of intestinal disease, that the Kansas City Fire an[illegible] Water Board undertook the construction of [illegible] permanent building and apparatus for the ap[illegible]plication of this purification process to th[illegible]

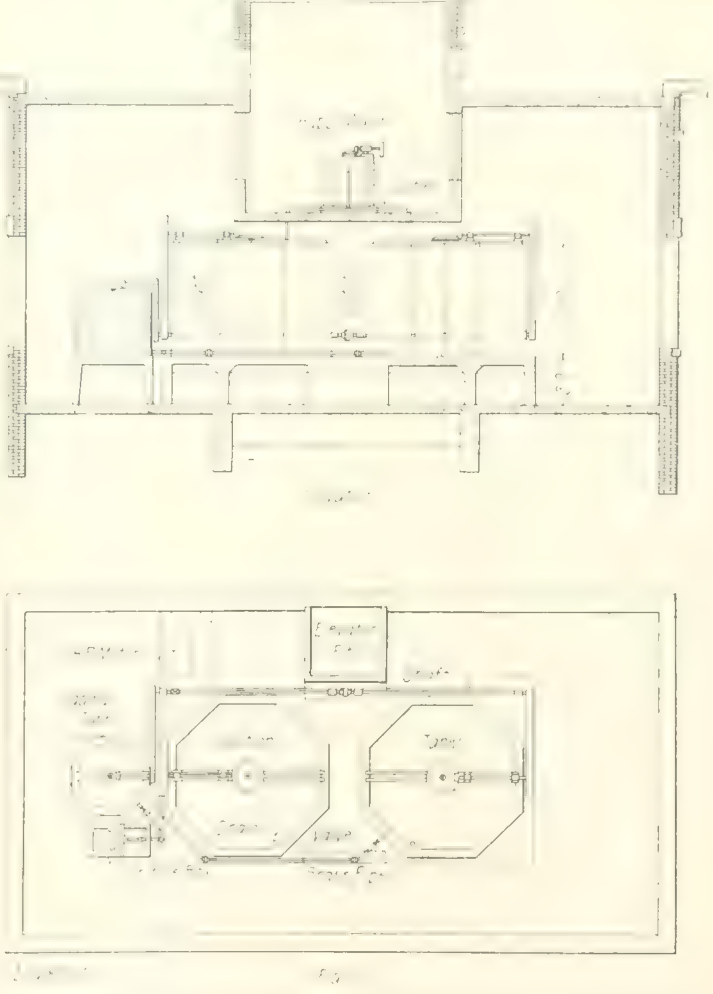


Fig. 2—Plan and Elevation of Kansas City Hypochlorite Plant.

[illegible] by Walter M. Cross, City Chemist, in a paper presented before the National Association of Cement Users at its annual convention last week at Kansas City, Mo.

A separate building, shown in Fig. 1, was constructed to make possible the satisfactory storage, handling and making of the solution of hypochlorite ready for mixing with the sedimented water.

The building itself was designed by W. C. Root, an architect, and the apparatus for use in connection with the sterilization process was installed under the direction and supervision of Burton Lowther, Engineer in charge, and S. Y. High, Superintendent of the Water Works Department.

The apparatus for the handling of the hypochlorite and the supports for it are of reinforced concrete. It is to be observed that no other material is so well suited for use in connection with this sterilizing agent as good concrete for the reason that all other materials that are capable of oxidation are promptly attacked by the hypochlorite solution and become rapidly deteriorated. The prime consideration with regard to this class of installation is to employ such methods of construction and to use material that is so permanent in character as to obviate the necessity of repairs which would force the discontinuance of the application of the sterilizing agent even for an hour.

The basement of the building is used for storage of the reagent that is kept in reserve. The main floor is used to house the dilution tanks and the feeding devices, while on the floor above is placed the tank in which the hypochlorite is reduced to paste of a creamy consistency before being delivered to the dilution tanks beneath, all as shown in Fig. 2. This pasting tank, 3 ft. in diameter and 4 ft. high, is provided with a stirring device carrying two rather heavy rollers disposed horizontally at its lower end. The rollers clear the bottom of the concrete tank only by a fraction of an inch, thus insuring the mashing and disintegration of all of the small lumps that are invariably present in commercial calcium hypochlorite. Owing to the fact that the action of the reagent on bronze is to form on the surface of it a fairly insoluble and protective coating of metallic carbonate and oxychloride, that metal appears to be the most available for use on all bearings and stirring or disintegrating devices that come in contact with the solution. Leading from the concrete pasting tank are pipes so arranged that the contents of the tank may be discharged into either of the large dilution tanks on the floor beneath. The outlet of the pasting tank is placed at a considerable distance from its bottom so as to avoid the possibility of drawing off with the paste any fragments of considerable size. The pipes carrying the paste are so arranged as to be readily cleaned in a few minutes in the event that they become clogged. Ultimately they are sure to become clogged if they are not occasionally cleared because of the formation in them of carbonate from carbon dioxide absorbed from the air.

The dilution tanks are hexagonal in form, 9 ft. in maximum diameter and 7 ft. high. Their walls are 6 ins. thick. Although the difficulty experienced in properly disposing the reinforcing iron in the construction of a hexagonal tank is much greater than is the case in the building of a round one, the hexagonal tank is to be preferred on account of the fact that in a round tank a rotary stirrer does not produce nearly such thorough agitation and mixing of the solution of hypochlorite as the same stirrer can do in the hexagonal tank. The paste is mixed with water in the dilution tanks until a uniform solution of a strength of two per cent occurs. The use of the two tanks makes it possible accurately to adjust the strength of the solution in one dilution tank while the contents of the other is being utilized. The dilution tanks are placed on supports high enough to permit the use of a gravity feed to the orifice box which is placed on the floor of the room housing the big tanks.

Bronze pipes, 1½ ins. in size, so arranged as to be readily cleaned in the event of stoppage, connect the dilution tanks with a gauging tank 4 ft. in diameter. This gauging tank contains a float, scale and pointer so arranged that the man in charge can accurately check the speed of outflow of solution from his orifice box into the big water main carrying the entire city water supply from the settling basins to the pumps. The solution passes through the gauging tank to the orifice box. Each division on the guage represents one gallon of the hypochlorite solution.

The orifice box is oblong in shape and carries a float of about 250 cu. ins. displacement. The float operates a valve which, by either opening slightly or closing, maintains the hypochlorite solution in the orifice box at a constant level. One end of the orifice box is of plate glass to enable the operator to see at a glance that the solution is filling the box to the proper height. Attached to the plate glass and covering a hole in it, is a hard rubber disc having near its perifery several slits the adjustment of which represents the size of a stream of the two per cent hypochlorite solution that will be the proper amount to treat the quantity of water passing through the main. All movements of the hypochlorite solution after its preparation are by gravity. Ample opportunity for the hypochlorite after its addition to the water to react with any putrescible organic matter and germs, is afforded during the time in which the water passes through the centrifugal pump, the flow line and a natural storage basin at the Turkey Creek pumping station before it is pumped to the domestic water users.

All of the stirring devices are run by an electric motor belted to a line shaft carrying clutches so placed as to make possible the running of any one of the stirrers whether or not any of the others are running.

The principle involved in the construction of practically all hypochlorite installations for the purification of water by the oxidation of germs and putrescible organic matter in municipal water supplies, is substantially the same as that in Kansas City. Concrete, usually reinforced, is, so far as I know, universally used in the construction of all permanent apparatus for the preparation and solution of the hypochlorite for mixing with the water to be purified.

Figs. 1 and 2 will give a fairly good idea of the disposition of the various parts of the purification installation.

BRIDGES AND BUILDINGS SECTION

Inspection of Surface Finishes for Concrete Work.

Contributed by Jerome Cochran, C. E., formerly Designing Engineer, Trussed Concrete Steel Co., Detroit, Mich.

The series of articles on the inspection of concrete work, of which this is the sixth, has been planned in opposition to the general assumption on the part of writers that standards or methods of construction have been long ago established and have become common knowledge. The first article on "Directions and Suggestions for the Inspection of Concrete Materials" appeared in this journal for Jan. 31, 1912; the second article on "Proportioning and Mixing Concrete" appeared on Feb. 7, 1912; the third article on "Inspection of Forms and Centering" appeared on Feb. 21, 1912; the fourth article on "Inspection of Steel Reinforcement" appeared on Feb. 28, 1912; and the fifth article on "Inspection of Concreting" appeared on Mar. 6 and 13, 1912. The following article relates to the inspection of concrete surface finishes. It will be followed by an article on water-proofing concrete work.

Since the character of a concrete structure is judged largely by the appearance of the exterior, the finishing of such surfaces becomes very important. In some structures the appearance is the most important part of its design and construction. The manner of finishing surfaces must be governed by the size and class of the structure and the style of architectural decoration.

Imperfections in Exposed Concrete Surfaces.

Exposed concrete surfaces frequently present a patchy or unsightly appearance. In fact, it is not such an easy matter to secure a smooth surface of even grain and uniform color on a concrete structure. In a very large majority of cases, concrete structures are disfigured by a lack of uniformity in color, dark or light patches being conspicuously noticeable, while in other cases a streaky appearance is to be seen. The imperfections in the exposed surfaces of concrete are usually due to one or more of the ten well-known causes which may be summed up as follows:

1. Variations in the nature of the cement, sand and stone.
2. Lack of uniformity in the amounts of ingredients in each batch.
3. Insufficient mixing in any or all batches of concrete.
4. Lack of care in placing the concrete next the mold.
5. Lack of proper protection after placing concrete.
6. Efflorescence and discoloration of the surface.
7. Unsightly construction joints.
8. Imperfectly made forms.
9. Dirt on the forms.
10. Adhesion of forms.

Variations in Concrete Materials. It is generally desirable that no change in the brand or quality of cement be made throughout the work. Different brands of cement may give different colors to the finished work. After a brand of cement has been accepted by the engineer and the contractor has purchased the same, no other brand should be permitted upon the work except by special permission of the engineer. The frequent changing of brands of cement is not only harmful to the work but also causes delay in testing. If more than one brand is used, the colors must be such as not to show marked variations in appearance of the completed work. Only one brand should be used at the same time in any section of the work, the idea being to prevent mixing of brands, but two brands may be used in succession on the same day.

All sand used in concrete that will be exposed to view should be of a bright, uniform color. No sand should be used for the outside finish of any concrete which contains small particles of coal or lignite, although sand of this character may be used in the interior portion of heavy pieces of concrete work. The sand used for concrete surfaces and for mortar facings should be clean and sufficiently coarse. It should be free from all foreign matter, excepting loam or clay, which may be permitted, if the quantity does not exceed 3 per cent., and when these materials do not occur as a coating on the sand grains.

Broken stone or gravel for exposed concrete surfaces should be clean, and should be free from loam, clay, shale, and all perishable and foreign matter, or other improper substances. It should be washed, or screened, or both, if necessary, to remove such substances.

The water used in mixing the concrete should be free from iron or other impurities that tend to discolor the concrete.

[illegible] h will cause imperfections in the ex- [illegible] ake certain that the specified propor- re accurately and uniformly adhered to. [illegible]

itted and honey-combed spots.

[illegible] ete is unmixed in the handling, the sur- be irregularly colored and will con- l and honey-combed spots.

[illegible] and place it properly, unless care is rotect it until it is hard enough to of itself. All exposed surfaces of [illegible] stantly moist by sprinkling with clean short intervals. An excellent prac- cover the surface with burlaps which ept saturated. This not only fur- necessary moisture, but protects the n the direct rays of the sun. Rain green work will make it rough and Too rapid drying is apt to result ecking. These hair cracks may usu- revented by keeping the surface wet siderable time.

spaded or mortar face finish, extreme ld be taken to protect the surface ger of injury by frost. A thin scale [illegible] rom mortar facings which have been his, of course, is objectionable where finish is desired. In no case should nure be placed over very green con- protect it from freezing, as it will surface of the concrete.

ence and Discoloration of the Sur- the concrete is not water-tight, and ly if there is water or earth against f the concrete, efflorescence, or a ting on the surface is likely to ap- fflorescence results from diffusion of e suphates of lime and alkalies to the e. In other words, it is due to water ating through the concrete and dissolving le salts, which are left as a white, substance on the surface when the porates. Efflorescence tends to dis- time, and rarely is sufficient in to cause any complaint.

manure should not be placed directly green concrete, as it is very apt to dis- the work and in some cases is thought ve caused a slight disintegration of the f the concrete coming in contact with s probable that only green concrete is y manure, as it has been used widely e floors, manure bins, etc., without lence of failure.

[illegible] *Joints.*—All con- rk should be finished in its entirety shutting down, but when this is not the resulting joint should be formed e it will least impair the strength and ap- ance of the structure. If the placing of concrete does not proceed continuously and night, an unsightly line on the sur- [illegible] show where the two days' joined. Care should be taken in the ion of and in the manner of constructing esulting joint if the concreting does not eed continuously.

the appearance of the finished face is of rtance, special care must be exercised in r to prevent unsightly construction joints ghtly lines on the surface may be almost ely eliminated by nailing a bevel or trian- r strip against the form and finishing the [illegible] to the inner edge of this strip, thus ucing a regular groove instead of the l ragged division line. The writer has ob- ed in a great many concrete structures where one day's work joined that of an- r, unsightly construction joints could be easily noticed, and in some cases these ts or lines were inclined, sloping at about angle of repose of the wet concrete.

nperfectly Made Forms.—Some of the [illegible] that must be taken to secure a [illegible] already been [illegible] considering the forms [illegible] ual boards of the [illegible] close, the concrete will run [illegible] ards and leave an ugly fin of lip [illegible] ncrete. Swelling of lumber in forms [illegible] row the face of the concrete out [illegible]. The appearance of corners in the [illegible] may be improved by bevel strips within [illegible]. Knot holes in forms should be properly plugged with clay. Forms which are imperfectly constructed with different thicknesses of lumber used indiscriminately will not produce results which are compatible with ordinary conditions.

Dirt on the Forms.—Imperfections in the exposed surfaces of concrete may be caused by dirty forms. All dirt must be removed from the forms just before placing the concrete. All forms having been previously used should be thoroughly cleaned and prepared before being used again.

Adhesion of Concrete to Forms.—Concrete surfaces are frequently impaired by the adhesion of the surface to forms, owing to proper provision not being taken to prevent it. Many different methods are employed to prevent this adhesion as will be described later.

Finishing Surfaces.

Treatment of Concrete Surfaces.—There are various ways of correcting the above defects in exposed concrete surfaces or of securing a surface of better appearance than any left by the most perfect forms. These will next be considered, attention being given first to the methods of finishing a plain smooth surface and then to the methods of finishing that secure a more ornamental surface. Except for the crudest work, all concrete surfaces should be treated.

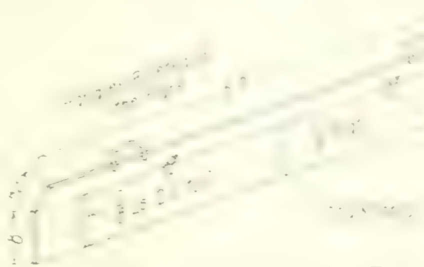


Fig. 1—Type of Metal Facing Form.

Specifications for Surface Finish.—Specifications should be particular and explicit regarding the character and nicety of the surface finish required. If they are not, the inspector should learn from the engineer the quality of work he has in mind and should see that the contractor clearly understands the requirements.

Careful Inspection Needed.—Perfection of surface finish is a matter of attention and skillful workmanship, and the inspector has chiefly to watch the workmen.

Classes of Finishes.—Finishes are of two classes: (1) Those in which the molding is so done that the finish is a part of the molding process; (2) those in which the molded surface is treated after the forms are removed. Faults in finishes of the first class must be prevented during molding by careful workmanship, for after the concrete has once set they can be remedied only by patching, which is generally very unsatisfactory, or by giving the whole surface one of the finishes belonging in the second class.

Types of Finish.—The above two general classes of finish for concrete may be further divided into the following types of methods of treatment:

(1) Plain, spaded, mortar face and troweled finishes; (2) Introduction of various ingredients into mortar or concrete; (3) Removal of surface in various ways; (4) Coating surfaces in various ways.

1. Plain, Spaded, Mortar and Troweled Finishes.

Plain Finish.—In some structures, where the appearance need not be regarded, the concrete can be left just as it comes from the forms, and if sufficient care has been taken in building the form work and placing the concrete, a very satisfactory finish will result. Care must be taken to avoid noticeable voids or stone pockets. Such treatment will result in a sandy finish.

Dry Surface Finish.—A dry surface finish may be obtained by using a fine stone in the aggregate, mixing fairly dry, and not spading the concrete next to the forms.

Spaded Finish.—A good finish may be obtained by spading the concrete so as to bring the finer particles to the surface and force the larger particles back so they are not exposed. Where spading is faithfully done, an absolutely smooth surface is the result, whether the mixture be dry, medium, or very wet. In the case of a dry mixture, however, spading must be done with greatest care by experienced hands, in order to get uniform results; but with a medium or very wet mixture, it is very easy to obtain first class work. With a wet mixture, spading is generally required only as an added precaution against the possibility of voids in the face of the work, and is really necessary in few cases.

Spading is best done with a special flat-bladed spade, having the blade perforated with holes or slots, which will screen back the stones and allow the mortar to pass and thus cover every stone. In narrow forms, instead of a spade a hoe may be used with the blade bent nearly in line with the handle. In spading, be careful not to pry with the spade, as this may spring the forms.

The method of spading is applicable only where forms are used. Necessarily, therefore, imperfections in these forms are to be carefully avoided. The smoother the forms for this class of work the better will be the appearance of the work.

Mortar Face Finish.—If a mortar (or a granolithic) finish be specified, it may be obtained by placing the facing mortar and concrete backing at the same time and tamping them together. The certainty of a bond is in this manner assured. The facing material may be applied to the forms just ahead of the backing, which is placed against and rammed into it. Another way to obtain a mortar finish is to place a loose board against the forms and tamp the concrete behind the board. The board is then removed and mortar run into the space that it occupied. Both methods have been successfully used, the second, however, being only applicable to comparatively dry concrete backing. Still another method of obtaining a smooth surface is to use a very wet concrete and throw it violently against the form, so that the aggregates rebound leaving in effect a mortar facing. This is, however, not to be recommended for fine work, as the forms are apt to be indented, and the alignment impaired, but ordinarily this method is effective. A fourth method of using granolithic plates will be described later.

The mortar (or granolithic) finish should be maintained between the concrete and the face form in a thickness of about 1 inch. The inspector, of course, will be governed by the thickness given in the specifications or in the absence of such information, he will be governed by the engineer's decision in the matter, provided a mortar facing has been specificed. Care must be taken that the concrete is rammed into and perfectly united with the mortar facing. The tamping or ramming, however, must not be so hard as to force pieces of stone through the facing, but just hard enough to bond thoroughly the facing and backing. The facing should show a smooth dense surface without pits or irregularities. This is most likely to be secured by thorough and systematic ramming.

Moldings, cornices, and other ornaments requiring mortar surface, should be formed by spreading plastic mortar upon the interior of finely constructed molds, just as the concrete is being laid. Mortar facing is not an easy job and requires workmen well experienced in this class of work.

Use of Granolithic Plates or Metal Facing Forms.—Possibly the best method of placing the facing material consists of what might be called a metal facing form or mold, constructed and used as follows:

The metal facing [illegible] the facing material on vertical surfaces generally consists of short lengths of iron plates 8 ins. or 10 ins. wide and about 6 ft. long with three angle irons riveted to each plate, the size of the angle depending upon the thickness of the facing material [illegible] Fig. 1. The metal facing form, however, may be any convenient width and length, depending on the nature and size of the work. An angle is placed at the center and one about 6 ins. from each end of the plate, one edge of which is provided with handles and slightly flared to assist in depositing the material.

The metal facing form is placed against the wall form with the handles up and the angles tight against the form. The space between it and the back of the wall is then filled with ordinary concrete backing of the specified proportions and the space between the metal form and the face form filled with facing material or mixture. Several of these metal forms may be used in line, with their ends lapping, and smaller lengths used to fill out a given length of wall form. Some difficulty may be experienced in carrying up a long line of this kind of concreting, especially at corners and at the junction of two sheets. It cannot be worked well in a narrow space.

The facing mortar should be kept slightly higher than the backing, to prevent the backing from running forward and disfiguring the front surface. Care must be taken that the metal facing form is not permitted to remain until initial set takes place, but be frequently jarred and raised slightly at short intervals to prevent the formation of shuts and seams and air spaces between mortar and the concrete. A trowel should be worked rapidly along the form, to remove air bubbles. Perfect success is secured only at the expense of great care. The facing mortar should be mixed wet and in small batches. Care must be taken to keep the forms perfectly clean or discolorations will be the inevitable result. A mortar facing shows the impress of small roughness on the form more readily than does concrete and particular care is necessary to secure a smooth surface on the form when a mortar facing is adopted. Even the grain of smoothly dressed wood, is clearly impressed on the plastic material.

Proportions for Mortar Facing.—The facing mixture should not be of too rich proportions, in order that surface cracks may be avoided. As to the richness of the mortar facing, two parts sand by measure to one volume packed cement is usually sufficient, though a more glossy finish may be made if desired, by using equal parts of cement and sand. Good results, however, may be obtained with mortar composed of one part of cement to three parts of sand or screenings. The writer does not recommend mortar richer than a 1:2 mixture. It is better to avoid too great a variation between the richness of the mortar used for facing and that used in the body of the concrete. Too rich a mixture, or a surface mixture, richer than the body concrete, will cause hair cracks.

Crushed marble screenings may be used if obtainable. These screenings or sand must not be too fine and should not exceed ¼ in. Limestone, granite or other stone screenings, different colored gravels and sand may be substituted for the marble chips.

Proportions for Granolithic Finish.—Granolithic is a facing or surfacing mortar composed of crushed granite and cement. A granolithic finish is more frequently used for foot walks and other places where resistance to wear is required, but may be used to surface walls, to line reservoirs, etc. If a granolithic finish or surface is specified it may be made by placing against the face forms in advance of the body concrete or in case of horizontal surfaces, on top of the concrete base, a fine granolithic or facing concrete composed of one (1) part of Portland cement, one and one-half (1½) parts of coarse sand and two and one-half (2½) parts of pebbles or crushed granite or other approved stone as may be selected, screened to pass 1-2-in. and be retained on ¼-in. screen, thoroughly mixed and soft enough for full flushing. The granite is sometimes specified to contain no particles larger than ⅜ in. to 1 in., and about one and one-half to two and one-half parts are used to one volume of Portland cement. Where both fine and coarse aggregates are used in the mixture for the facing material a 1:1⅜:3, or 1:2:3 or even a 1:2:4 concrete with Portland cement, sand or stone screenings and crushed or screened gravel may be used.

Thickness of Mortar Finish.—The thickness of mortar facing employed in practice varies from ½ in. to 3 ins., but the usual practice is to make it 1 in. to 1½ ins. thick. There is more danger, perhaps, of making the mortar facing too thick than too thin, thereby using too much cement.

Thickness of Granolithic Finish.—Granolithic finish when applied to a concrete base should be laid at the same time as the concrete and should not be less than ½-in. thick for floors, 1-in. for sidewalks, and 2-ins. for concrete pavements. Do not attempt to put a top coat less than 2 ins. thick on a set concretebase, and even then be prepared to see unsightly shrinkage cracks on the surface.

Consistency of Mortar Facing.—The mortar facing for vertical surfaces should be mixed rather wet, since it must completely fill the metal facing mold, but care must be taken not to have it too thin or the stones from the concrete behind will be pushed through it during the subsequent filling and ramming. Mortar facing or finish on an exposed horizontal or nearly horizontal surface should be mixed to a plastic consistency and should be put on immediately after the concrete is deposited, care being taken that the surface of the concrete is clean.

Colored Facing Mortar.—A colored facing mortar may be obtained by using a suitable colored aggregate or by mixing coloring matter (mineral pigment) in the mortar. The first is the better, since it gives a durable color and does not injure either the strength or durability of the mortar facing. Introduction of various ingredients into mortar or concrete will be discussed more fully below.

Spaded and Troweled Finish.—The coarse aggregate should be well pushed back from the face of the form to allow the mortar to flush to the surface. The forms must be stripped while the concrete is still green enough to be worked with a trowel. The surface should be troweled hard and smooth; but excessive troweling is likely to cause innumerable hair cracks in the finished surface. The scope of this method is limited to instances where the forms may be quickly removed, or removed in sections.

Wetting of Forms.—Forms must be properly treated either for a spaded or a mortar face finish. Concrete or mortar will adhere very strongly to forms if no special provision be taken to prevent it. Many different methods are employed to prevent this adhesion as will be described below.

All forms, if not coated with some oil or soap, should be thoroughly wetted before the concrete or mortar facing is poured. A sprinkling of the inside with a hose is not sufficient. The hose should be applied to both sides thoroughly until the boards take up no more moisture. When dry spots appear, wet them. If the wood is thoroughly wet with water before the concrete is laid, there is not much danger of concrete adhering. The great objection to water is that it is not always possible to thoroughly wet the forms and many times it is absolutely impossible to keep them wet without adding too much water to the concrete already poured. In freezing weather steam should be used in place of water to drench the forms, immediately before placing the concrete.

Better results can generally be obtained with petrolatum cut down with three parts of hot kerosene and then applied with a brush. Linseed oil may also be used. Fatty oils should not be used, as they act on fresh concrete by disintegrating and discoloring it. Hot paraffine is sometimes used. The objections to oil are the expense, the weight of oil-soaked forms in handling and the liability of making the wall dirty. The oil is to be used in oiling forms should be thick and enough to act as a filler for the forms however, must be taken not to get thi thick, as grease spots in concrete l unsightly appearance. If the walls plastering or any subsequent treatm oil skin, if any, must first be remove quality of oil known as "sludge" at refineries, or its equal, is recommende oil should be thin enough to flow an grain of the wood. Grain marks ca duced to some extent by oiling the with gloss oil and then throwing f against the oiled surface with a bell slight oiling of forms will result i economy in saving of forming lumb excess of oil must not be used. The be applied every time the forms are se oil form work after the steel reinfo has been placed if by so doing the come in contact with the metal.

Cheap soap boiled and applied hot forms gives very good results in pre the adhesion of concrete to forms. soft soap does not injure the surf diminish the strength of the concr should be used instead of oil or grea the surfaces are to be whitewashed, or plastered, as the oil or grease is to discolor the whitewashing or pl Soap should be thoroughly dissolved to the consistency of very thin paste plied hot with brushes. The use helps make a dense surface and does terfere materially with subsequent ment, provided the surface of the con washed well with clean water before the whitewashing, plastering, etc. jections to the use of soap are that it pensive and is seldom applied proper

Paper, unless it is oiled, will stick concrete and is hard to remove. The paper needs constant attention in orde cure satisfactory results. It is somew ficult to keep the paper absolutely sm that the final surface does not show w Unless the paper is very oily it will ad the concrete, necessitating that it be off so as to effect its removal, as a th soaking very seldom removes the pa tirely.

Edward Godfrey in his book crete," page 98, recommends that painted with linseed oil be used as a for rough forms. It is waterproof and therefore not absorb water from the co it would also prevent the leaking of th mortar that occurs at cracks or joints wooden forms. It would probably be mical for the reason that it does not planed boards in the forms and it co doubt be used repeatedly. It would help to keep the frost out of the concr

Making Good Defects in Surface F

With all the means used to cover irregularities in forms and make the smooth there will still be some roughn commercially avoidable. Some treatm the surface after the removal of the f generally necessary. Noticeable voi stone pockets, should be filled with mixed in the same proportions as the in the concrete. Mortar for patching ularities and pockets in concrete work contain the same proportions of ceme sand as the concrete, or it will set a di color. Corners may break off in re the forms. These should also be pla A patchy surface may show that a bad of concrete was used or that the concr been mistreated during setting. It ha found, however, that patches appear where care has been taken to use the cement and a uniform mixture.

2. Introduction of Various Ingre Into Mortar or Concrete.

Different Sized and Colored Aggre If a permanent colored concrete surf desired, it may be obtained by properly ing a surface faced with a mixture co of Portland cement and an aggregat proper size and color. By varying the size and proportions of the aggregates face finishes of practically any desired re can be obtained, the possibilities ated only by the number of different s available and the combinations of he surface must be scrubbed, sand r otherwise treated, so as to expose gregates. Pebbles, burnt clay or rick, white marble chips, blue trap er colored marbles, etc., together d gray matrix of the cement mortar, mbined to give almost any desired n of colors and surface effects, ging an animated texture to the other- len and lifeless material. A great f finishes may be produced by using marble, gray trap rock, red and nite and limestone screenings, black marble chips, different-colored peb- w sand, brick dust, etc. Obviously, effects are desired with this course ent, the concrete must be deposited tional care.

White Cement and Screenings.—A ncrete surface may be obtained by part white Portland cement with 2 coarse white sand or marble screen- applying the mixture as a finishing rtar facing. After the coating or ing has set hard, it should be with dilute sulphuric acid, 1 part parts water. The acid solution applied by painting on with a r three successive coats and the n washed with plenty of clean White pebbles of various sizes can mployed and the aggregate may be r from the size of coarse sand to that n inch or more in diameter. White rble dust used in making concrete inished work a lighter color than by using ordinary sand.

Matter.—Coloring matter mixed in sometimes used to give a uniform concrete surfaces, especially where ent sur-colored surface is not desired. h easier to produce color effects by of stucco than by endeavoring to ored cement or some coloring n the mortar of the mass concrete used in the entire body there is material in that which is not ex- it is difficult to get uniformity by means, unless it is a case where is permissible. Either for facing r mass work, however, coloring ma- ave been successfully employed, the ral color being added to the Portland efore mixing. A little lamp black used to advantage in ordinary con- elieve the dirty color of the concrete a much more pleasing and uniform can ever be obtained with straight

of Coloring Matter.—Don't use coloring matter containing oils, acids. Coloring matter containing ll attack the akaline substances in nd destroy it. Only those coloring should be employed which consist xides of the various elements, since are liable to disintegrate. Care must, be taken in the selection of the matter. The quantity and quality of ing matter must be such as not to he strength of the concrete. Most substances are bleached by the ce- l are of short life. Lamp black has commonly employed, giving differ- es of gray according to the amount ight colors are difficult to obtain and ot be in keeping with a masonry , except in architecture.

s of Colored Mortar.—Sample speci- ntaining different proportions of the coloring matter and of Portland hould be made and allowed to become before being submitted to the engi- approval. It will be the duty of the to see that these samples are prop- pared. In any large work where the oloring matter is desirable and there ime to properly prepare samples or ute thorough tests, the advice of a hemist should be sought. Samples of mortar will go a long ways by indi- st what colors may be used without t to the work. It is cheaper to pre- pare samples before- hand than to cut out work already done.

Pro [illegible]

proportions [illegible] ing adel [illegible] turning those [illegible]

Black, 2 lbs. [illegible]

Blue or green, 5 to 6 lbs. ultramarine.

Brown [illegible]

Gray, 1 lb. [illegible]

Red, 6 to 10 [illegible]

Yellow or buff [illegible]

It will be seen that any desired color may be obtained by varying the proportion of mineral coloring matter. The dry mineral colors, mixed in proportions of two to ten per cent. of the cement, give shades approaching the color used. The addition of mineral colors to cement causes a loss of strength except ultramarine, but this is generally not very important, since the color is used only in the mortar facing, or surface coat. Ultramarine seems to add somewhat to the strength of cement. It is unwise to use more lampblack than mentioned above, and the writer would suggest that just about half of the amount be used. Don't use artificial coloring matter in excessive quantities.

[illegible] Colored [illegible]—Variations in character of cement and sand will affect the result obtained in using coloring matter. Sand for the colored facing mortar must be perfectly dry and the cement, sand and coloring matter should be mixed dry before the water is added. It is sometimes customary to mix the coloring matter with the cement dry, before any sand or water are added. This mixing should be thorough, so that the mixture is uniform in color. In mixing the ingredients, the greatest care and exactitude are essential. If improperly mixed, the surfaces are apt to be spotty. After this mixing the combination is treated in the same way as clear cement. The coloring of the mixture when freshly made must be deeper than that actually required in the finished surface, as the colors will bleach considerably on drying out. It is, therefore, advisable to experiment a little to find how much color is needed to give the desired shade. This may be done by preparing sample specimens containing different proportions of the coloring matter and of Portland cement and allowing them to become quite dry before observation.

Directions for using coloring matter may generally be had of the makers. The inspector must carefully follow these printed directions.

3. Removal of Surface in Various Ways.

If made right, the concrete surface will have a skin of neat cement. It is generally desirable for appearance sake to remove this, and there are several ways to do it, depending upon the length of time that the concrete has set, before it can be made accessible for treatment. The time that elapses from the placing of the concrete until the surface can be exposed depends upon the kind of concrete and the nature of the part of the structure in question. If the concrete surface is hard, more vigorous work is required to make it smooth and to take off the skin of cement.

SCRUBBED OR BRUSHED FINISH.

A scrubbed or brushed finish is obtained by removing with a brush the surface film of cement which forms over the aggregate, thus exposing the aggregate to view. This method of treatment gives a rough texture to the surface, and by the use of selected aggregate for the concrete, any desired effect can be obtained. The roughness of the surface breaks up the light, the color of the aggregate adds variety and life, and the result is a more artistic surface.

Preparation of Forms.—For scrubbed or brushed surfaces, all that is required of the forms is that the face lagging be kept true to surface and that the joints be tight. When it is proposed to scrub or brush the surface of the concrete before it is more than twenty-four hours old, the forms must be constructed with the idea of being removed without damage to the rest of the structure. For surfaces too large to concrete in one day, the forms should be so constructed as to permit of the removal of sections of the face form. In other words, forms should be built in sections and so arranged that each section can be taken away at the proper time, to give access to the face of the concrete, without taking away the standards which provide strength for the forms as a whole.

Placing of Concrete.—Either the small aggregate, viz., sand, or the larger aggregates, together with the smaller aggregates, viz., the sand and stone, may be exposed by scrubbing or brushing. There is a slight difference in the placing of the concrete, depending upon whether the large or small aggregates are to be exposed. Specifications should be explicit as to whether the smaller or larger aggregates are to be exposed by scrubbing or brushing. If they are not, the inspector should learn from the engineer which aggregates are to be exposed and should see that the contractor clearly understands the requirements. In case the smaller aggregates are to be exposed, the concrete should be carefully spaded between the concrete and the surface in the form, as this brings to the surface finish particles of sand and the cement itself. In case the large aggregates are to be exposed, no spading should be done, but all the tamping of the concrete should be done in the middle of the wall, as this causes the pushing of the larger aggregates against the surface of the form.

Great care must be taken in successive casting to prevent marks showing (after scrubbing or brushing) where the new and old work join.

Removal of Forms.—For scrubbed or brushed surfaces, the forms must be removed from the work as soon as possible, and the concrete surface brushed while still green. Forms should be removed within twenty-four hours of the placing of the concrete, during warm, dry weather; otherwise, to remain as much longer as conditions require, which will be determined according to the temperature of the weather, setting quality of the cement, type of work, mixture used, etc. Heavy walls in dry concrete could probably have the forms removed in twelve hours or so after concrete is placed, and the surface could be thus treated. The forms, however, should not be removed so soon on a high section of wall.

Treatment by Scrubbing or Brushing.—The process consists in scrubbing or brushing the concrete surfaces with ordinary fibre (or wire) brushes and water until all of the surface cement has been washed off, leaving the gravel or broken stones exposed and in good relief. If necessary, a small amount of muriatic acid should be added to the water. The concrete surface should be scrubbed until the surface film is removed and the aggregate is exposed to a uniform degree, and then rinsed off with water. Water should be freely used from a hose and the amount of force exerted in the scrubbing or brushing will give shallow or deep cutting effects as desired. When the forms are removed at the right time, three or four passages of an ordinary scrubbing brush with plenty of water is all that is required. Cement particles removed by the brush must be thoroughly flushed off the surface by clean water, else they will adhere in patches and form rough blotches.

For scrubbing the surface ordinary scrubbing brushes with stiff palmetto or other fibre bristles with a light stream of water from a hose or can will generally be sufficient if the concrete has not set too hard. If set is harder, wire brushes followed by fibre brushes and rinsing may be used. Fine and coarse brushes should be used. A cheap and effective brush can be made by clamping or fastening together a sufficient number of sheets of wire cloth in such a manner as to make a brush about four inches wide. Such a brush will generally be found more effective than the ordinary wire brush for brushing green concrete surfaces.

Precautions.—Care must be taken that the pebbles are not dislodged. The time for scrubbing is when the concrete is still green, but if the concrete is too soft to permit scrubbing, the work must be delayed a sufficient length of time. It is not possible to state how old the work should be before removing the forms and scrubbing the surface. This will depend upon a number of conditions: the character of the work, cement and aggregate used, consistency of the mixture, and very much upon the weather conditions. Care must be taken that the scrubbing is not done too soon, as little particles of aggregate will be removed, resulting in a pitted, unsightly surface. The scrubbing or brushing should be started just as soon as it is possible to do so without removing particles of aggregate. When this can be done can only be determined by experimenting with the particular surface. The hose should be used without a nozzle, as the pressure may gouge out stones. Water may also be applied with buckets. Some care must be exercised to make the scrubbing uniform, as too much or too little pressure on the brush will make considerable difference in the appearance of the finished surface. The scrubbers soon get accustomed to this, however, and learn to vary the pressure with the state of hardness of the surface. In scrubbing concrete surfaces, care must always be taken to avoid roughening or blunting corners of the work, and to maintain all edges sharp.

Sand Blasting.—If, for any reason, a portion of the face form cannot be or fails to be removed before the concrete has become too hard for removing the surface film by scrubbing, the hard face may be treated by sand-blasting or tool-dressing, to a texture matching the scrubbed portion.

Patching Defective Work.—If any void spaces appear, or if spalls are broken off, the defects should be patched with similar mix immediately after the scrubbing, using the hand or a wooden float—not a steel trowel—for applying and smoothing the patches. After they are sufficiently set (say within from 5 to 24 hours), all patches should be scrubbed to the same texture as the general surface and be rinsed clean and kept moist for several days.

Pebble-Dash Facing.—The concrete should be composed of gravel and rounded stone not exceeding 1 in. in its smallest diameter. When the forms are removed the cement and sand must be brushed from around the face of the gravel with fibre or steel brushes, as described above, leaving approximately half of the gravel exposed. Brushing should commence within twenty-four hours after the concrete has set.

Instead of exposing the pebbles in the aggregate proper, the following method of artificially exposing aggregate may be employed: After erecting the forms of rough boards in the usual manner, in courses of three feet or less, plaster inside of these forms with wet clay, and to this wet clay apply different colored pebbles in sizes of 1 inch down to those that will be retained on a ¼-in. screen. The pebbles will thus stick to the clay. Concrete may now be poured in and the forms removed in the usual time. The clay is to be washed off with a hose and the concrete surface scrubbed slightly with a brush. Care must be taken that the pebbles are not dislodged. Any colored pebbles desired may be used in this way and the pebbles will give some very delightful and varied effects. Other methods of securing pebble-dash finishes will be discussed later.

Cut-Stone Facing.—A method similar to the one used in obtaining a "Pebble-dash" may be employed in giving to concrete the appearance of cut stone. In this case, crushed rock is substituted for the gravel, the character of the rock depending upon the color and texture desired in the finish. After the removal of the forms the cement and sand must be brushed from around the face of the stone next the face exposed to view, followed by clean water.

RUBBED FINISH.

It has been found that it is not always practicable to remove the forms so soon; hence, the concrete sets up hard, and the scrubbing or brushing, as mentioned above, has little effect on it. To meet this objection, the concrete may be rubbed with a soft brick or block of concrete. These are rubbed with a circular motion. The process of rubbing consists in grinding down the surface of the concrete sufficiently to remove all impressions of the timber or other irregularities, and where but little coarse aggregate is used, or where the aggregate has been spaded back from the forms as referred to in a previous paragraph.

Preliminary Preparations.—In no case on an exposed surface of the concrete should joints of any component pieces of the forms, nor the grain of the wood, be visible. Some preliminary treatment will, therefore, be found necessary, such as chipping off rough projections, as those left by cracks in the form, filing off the arrises, etc.

Treatment by Rubbing.—The method of procedure consists in thoroughly wetting the concrete after the forms are removed, and then rubbing with a circular motion the wet surface with a coarse carborundum stone (No. 16), bringing the surface to a lather. After this stone has been used sufficiently to take off the rough projections and irregularities, the lather must be washed off with a brush and the surface again wet, and then dusted with a mixture of dry sand and cement, the proportion being 1 part Portland cement and 2 parts dry sand. This coating must be well rubbed into the surface with the coarse carborundum stone (No. 16). Care must be taken not to allow any of the mortar to remain on the surface. To give the final finish, a No. 30 carborundum stone should be used and the whole surface well rubbed.

Best results may be obtained where the concrete has not set hard, preferably a day or two old. A vigorous use of water is also advisable. In the absence of carborundum stone, a block of hard wood, sandstone, old concrete, emery or pieces of white fire brick or briquettes of one cement to one sand, made in molds about the size of a building brick, handles being pressed in while soft, may be used. By dusting on a thin coating of cement and sand in the proportions stated above, gives a lighter surface than troweling, fills any voids that may be in the surface, and leaves the concrete more waterproof than it would be originally.

A cement wash may be substituted for the dry cement and sand, being composed of one part Portland cement to two parts of fine sand. This wash should be applied immediately after the concrete surface has been thoroughly rubbed with a piece of sandstone or carborundum stone, and the surface rubbed with a No. 16 carborundum stone and the work afterwards washed down with clean water. The grout should be used simply to fill surface imperfections and must not remain as a film on the surface. The result, after the setting of the grout, is a very smooth surface. In hot weather it should be frequently dampened for several days to prevent the small surface cracks so often seen in a finish of this kind.

Precautions.—In rubbing concrete surfaces, care must always be taken to avoid roughening or blunting corners of the work, and to maintain all edges sharp. Plenty of water should be used, either by dipping the sandstone or other rubbing block into the water, or by throwing the water on the wall with a white-wash brush or small broom.

ACID WASH FINISH.

Applying dilute hydrochloric and sulphuric acid to concrete surfaces consists of another type of the scrubbing or brushing process described above. A desirable surface, however, may be obtained by simply brushing and washing with a hose and clean water, but the final acid treatment in connection with brushing and washing produces a still better finish, as the acid thoroughly cleans the surface of the aggregate, thereby intensifying the color and texture of same. This process is generally applied in cases where the surface has hardened to such an extent the brushing involves too great an item of work. An acid wash finish is applicable to all types of concrete work, and when the cement has been properly dissolved away from the particles of aggregate, the various shades of browns and reds of gravel may be very pleasingly brought out. The disadvantages connected with this method are the high cost and the difficulty of handling the acid to apply it and the fact that the acid that wastes and is not neutralized may penetrate into the base of the and destroy the concrete.

Preliminary Preparations.—The work should be deposited in a fairly ture and care taken not to use which are disintegrated or affected sulphuric, hydrochloric or acetic aci and crushed granite give good res limestone generally disintegrates action of the acid.

Treatment by Etching.—The procedure consists in thoroughly scru brushing the concrete after the fo removed, as described above for the or brushed finish, and then washing diluted solution of acid applied with The acid may be applied with an calcimining brush. While wet with surface must be quickly worked over ordinary scrubbing brush and the aci diately removed with clean water through a hose. After the scrubbnig pleted great care must be used to re traces of acid, otherwise the acid tinue to etch out the cement in places a permanent discoloration of the surfa it to have a mottled, streaky appeara acid should not be allowed to remai surface for any length of time—not an hour—and must be thoroughly wa with a hose and clean water. Hyd acid is preferable.

Amount of Dilution.—The amount tion for hydrochloric and sulphu should be determined by experime varies with the age of the concrete. T the concrete the stronger should the be. For concrete which is about tw old, ordinary commercial acid may luted with three parts of water. Wh few days old a dilution of one part five or six parts of water should be mixture of the two acids will pr stronger action than the use of one al

A solution of one part commercial acid to two or three parts of clea should generally be used on sur which standard Portland cement is u a sulphuric acid solution of the same when white Portland cement and whit grates are used in the facing mixture

Rewashing Surfaces Composed Aggregates With Acid.—Should the become stained after being scrub washed by placing course upon cours wall is erected, the wall should be wa with water played on the surface b of a hose each night, as the day's completed, and after the wall is comp the top, the whole surface should over one part commercial muriatic a four to six parts water, the solution atic acid being applied with an ordinar wash brush, having very little expose The acid should be left on the wal fifteen to thirty minutes, after which be washed off with a hose, and where the stains are most noticeable, face should be scrubbed with an scrubbing brush.

Removal of Efflorescence.—Efflores white deposit on the surface of concr be removed by using a weak solutio drochloric (muriatic) acid, one part to six or ten of water. The wash s well rubbed into the pores of the with a brush and then rinsed off wi water as soon as the efflorescence ha peared. Efflorescence may also be by the application of soap and alum on the surface.

TOOLED SURFACES.

Concrete surfaces are sometimes with a pointed or toothed tool in a similar to that used in treating natur This chips off the mortar which m flushed to the surface, cuts away litt cles of the mortar from the aggregat The roughening of the surface breaks light, gives a lighter color to the mort and, besides this, exposes the color aggregate below. A variety of text surface may thus be obtained by tool pneumatic tools or by hand. In other fine picking, chiseling or hammering atic tools or by hand will produce [illegible] effects, according to circumstances. additional color on the concrete adds a deal to its appearance. The dressing moves most of the traces of the form es away with irregularities which may in the work. While the result may be e, tooling concrete surfaces is rather sive and slow work and is [illegible] sed. Another objection in tooling con- surfaces comes in the removal of the mortar, which is the most waterproof the concrete. If there is [illegible] toward porosity in the mass of the con- t will absorb more moisture after tool- in before it, and will accentuate the from frost. On well-made and prop- portioned concrete there is, however, [illegible] any danger from [illegible] as the l is of itself very dense and water-

method of finishing the surface cannot ly be applied to gravel concrete, as bles will be dislodged before being

[illegible]

ry to the practice most favorable for a l or brushed finish, the concrete must hardened before tooling. This does ith the need of building form work [illegible] moved in sections as is [illegible] scrubbed or brushed work. t is decided beforehand to tool the ess pains need be taken in dressing zing of the forms. Care must be taken with the forms, for unless form which is uniform in thickness is em- it becomes necessary to tool some the surface deeper than others. may be constructed of rough lumber, convenient, and the form marks and s on the concrete surface removed by tooling.

the concrete is to be tooled, from [illegible] days must elapse before the concrete is r enough, especially where distinct edges rp, clean surfaces are desired.

e of stone in the concrete should be [illegible] ¾ in. to 1 in. Small egate will give the best results, ow- he absence of large pieces of hard n the concrete.

lammering.—A dressed finish may be by dressing the concrete surface pointed or toothed hammer and wash- ith muriatic acid diluted about one-half arefully washed off. This must be done the concrete has thoroughly set. Bush nering may be used for fine detail work, ed concrete block and for imitations of al stones. Bush hammering is the most ar methods, while other forms of finish been employed with satisfactory results. h hammering may be done either by or with a pneumatic (or compressed tool. In hand hammering the concrete d be allowed to stand at least three s after placing, preferably longer. The ete must not be too green, or the pick loosen the stones and thus spot the sur- with objectionable blemishes, and possi- pening up some internal cavities and ng a leak in the wall. On the other the concrete should not be allowed to too long, for the labor will be unnec- ily great. Three months is about the for concrete becomes practically as hard e stone going to form the larger aggre- and hand hammering has very little effect whatever upon the concrete.

rious weights and sizes of hammers have used. Preference should be given to a ner light in weight, and having but few s.

cautions.—In tool-dressing, care must s be taken to avoid roughening or blunt- orners of the work, and to maintain all sharp. The concrete must not be too , or the pick will loosen the stones.

SAND BLASTED SURFACES

e exposed aggregate effect can also be ned by what is known as the sand blast The operation of impinging sand by s of compressed air against the surface e concrete produces a finish similar to produced by scrubbing or brushing green concrete, as dese[illegible] expert, can be [illegible] usually done by an [illegible]

It is not necessary [illegible] set the forms so they may be [illegible] faces, for the concrete should be thoroughly hardened [illegible] especially if sharp edges are desired.

[illegible] or irregularities in [illegible] necessary should be done several days before the surface is sand blasted.

[illegible] samples of sand blasting should be submitted to the engineer for his approval before any sand blasting is commenced.

[illegible] tion of the sand-blast consists in forcing a stream of thoroughly dried silica sand, or crushed quartz, through a small nozzle by means of air pressure at 50 to 75 pounds per square inch at the nozzle. The nozzle should not be over ¼ inch in diameter and must be held within a few inches of the surface to be cut. But a slight cutting of the surface, the appearance of sandstone is obtained. Deeper cutting will remove more of the mortar which has been flushed against the forms and the aggregate will be exposed.

[illegible]—Strips nailed to the forms to make moldings, joints and courses should be left in place while the surface is being sand blasted. Otherwise, the sharp angles and edges will be rounded off in a rough and unsightly manner. The area protected by the strips should be left unfinished, unless otherwise desired.

Precautions.—In sand-blasting, care must always be taken to avoid roughening or blunting corners of the work, and to maintain all edges sharp. The concrete must not be too green or the sand blasting will loosen the stones.

Material for Sand Blasting.—A clean, coarse, thoroughly dried silica sand or crushed quartz should be used for sand blasting, and for use with a ¼-in. nozzle the sand should be screened through a No. 8 screen, and through a No. [illegible] used.

4. Coating Surfaces in Various Ways.

[illegible]

A washed or grout finish may be obtained by finishing the concrete surface with a thin mortar grout rubbed into the concrete with a float and then brushed over with a wet brush. If a non-staining cement is used for this purpose, a very good appearance can be effected which will look uniform. The chief objection to grout coatings is that they have a tendency to peel or craze. In other words, hair cracks are apt to appear. A compressed-air machine may be used where there is a large amount of grouting of surfaces to be done.

Preparation of Surfaces.—All exposed surfaces must present a smooth, uniform surface of cement mortar, the concrete being well spaded, for only by thorough spading can air bubbles be worked out. The stones must be carefully but judiciously spaded away from the face; too much and unskillful spading will permit an upward flow which will wash the cement from the concrete at the face. Forks, spades, or other suitable instruments should be used for this purpose, being small enough to be pushed along all faces of the walls.

After the forms are removed, all disfigurements must be effaced, and if there are any open, porous places, they must be neatly filled with a 1:2 or 1:3 mortar before applying the wash. Any ridges due to cracks or joints in the forms should be rubbed down smooth and hard with a float, and the rubbing continued until the marks of the forms are entirely effaced.

Washed or Grout Finish.—A washed or grout finish may be obtained by removing the forms within ten to twelve hours after the concrete has been deposited, under ordinary temperature, and finishing with a thin mortar grout, well rubbed into the concrete with either a wooden float or a piece of sacking and then brushing over with a wet plasterer's brush. The walls should be wetted with water before applying the wash.

The grout may be mixed in the proportions of one part Portland cement to one or two parts of coarse sand and should have the consistency of whitewash. A good mixture is one of Portland cement to two of fine sand mixed thin enough to be applied with a whitewash brush.

The grout may be applied in any manner, provided a uniform appearance is produced, without leaving a scale on the work. If applied with a trowel, the grout should be stiff and applied in a very thin coat and troweled or rubbed so that only the pores are filled and no body of the mortar left on the surface. Grout finishes should serve only to fill the small pits and ores in the surface coating. Care must, therefore, be taken to see that the workmen do not get a coat of the grout on similar to a skim coat of plaster, as that will generally peel in cold weather. The grout coating may also be applied to a thoroughly wet surface by throwing with considerable force by means of an ordinary whisk broom.

Grout coating or washes should be kept damp for at least a week by hanging dampened sheets close to the surface.

Coloring Grout Finishes.—The color of the finished surface will be considerably lighter if plaster of Paris is substituted for about one-quarter of the cement. Where a dark finish is desired, a grout may be made by mixing neat cement and lampblack in equal parts. One pound red iron ore to ten pounds cement mixed dry, and then made into a thin grout and applied to a well-cleaned concrete surface with a white-wash brush, gives a brick-red color; a rich, dark red is given by one pound red iron ore to three pounds cement. The sooner this is applied after the concrete has set, the more likely is it to remain permanent.

Plaster of Paris Wash.—A very pleasing finish may be given by applying to the set concrete a thin wash composed of equal parts of Portland cement and plaster of Paris, though the permanence of such a wash may be open to question. The concrete surface should be cleaned from any oil or grease that may have come from the forms and the wash applied with a white-wash brush. This mixture gives a very light gray finish, and where a trifle darker shade is desired, one part plaster of Paris to three parts Portland cement may be used.

[illegible]

Sometimes it is desired simply to whitewash a surface to secure a uniform color, though the permanence of such a wash is very questionable. White-wash, however, when made right and properly applied, gives a coating that resists wear well and that retains its brilliancy for years.

Preparation of Surfaces.—Concrete surfaces to be white-washed should be prepared in the same manner as that for grout washes described above.

Whitewash Finish.—The following formula for a whitewash finish has been taken from Baker's Masonry Construction, page 179, edition of [illegible]

"Slack with warm water half a bushel of lime, covering it during the process to keep in the steam; and strain the liquid through a fine sieve or strainer. To the slaked lime add the following: 1 peck of salt previously well dissolved in warm water, 3 pounds of ground rice boiled to a thin paste and stirred in boiling hot water, ½ pound of powdered Spanish whiting, 1 pound of glue which has been previously dissolved over a slow fire, and 5 gallons of hot water. Stir well and let the mixture stand for a few days, covered from dirt. Strain carefully and apply hot with a brush or a spray pump. Coloring matter may be put [illegible] any shade."

PAINTED SURFACES.

Tinting or coloring of concrete surfaces may be obtained by the [illegible] prepared for the market. In fact, there are on the market, sold under [illegible] proprietary trade names, a multitude of special paints and finishes for concrete surfaces, giving a wide range of color effects and also serving more or less efficiently the purpose of weatherproofing and damp-proofing. The ordinary paints, especially of the cold water variety, are usually not very satisfactory. Several special preparations, however, have proved of value.

Enamel paints may be used. Care must be taken, however, that no water or frost is allowed to get behind the enamel, otherwise it will cause the enamel to peel off.

Preparation of Surfaces for Painting.—Concrete surfaces should be free from oils, grease or other foreign matter and thoroughly cleaned and dried before painting. No surface is free from dirt and foreign matter, and it requires the removal of such substances, either by wire brushing or acid treatment, to secure a firm bond and penetrating quality to the surface. No acids should be used unless properly neutralized and washed off with water and the surface allowed to dry out thoroughly. No surface treatment or reagent is generally necessary after proper aging of the surface—six months to a year.

Concrete surfaces may be treated with a solution of zinc sulphate and water, mixed equal parts by weight, and applied with an ordinary bristle brush, after the concrete is dry. The concrete should be at least 48 hours old, preferably 72 hours, before applying the zinc sulphate solution. Concrete surfaces to receive oil paints may also be thoroughly washed with 7 to 8 per cent. solution of muriatic acid and followed by a good wash of clean water. After the treated surface has thoroughly dried, the paint may be applied, using enough turpentine in the priming coat to make it almost flat and increasing the amount of oil each succeeding coat.

Printed Directions to be Followed.—Where special preparations are used in painting concrete surfaces, care must be taken to follow closely the directions of the manufacturer of the preparation. When these paints are used the inspector must follow the printed directions for applying each.

Spraying Machines.—Compressed-air spraying machines may be used for applying cold water paints to concrete surfaces. Care must be taken that the paint is applied uniformly.

PLASTERED SURFACES.

Plastering as a method of finishing concrete surfaces should not be employed, as it is practically impossible to apply mortar in thin layers and make it adhere for any length of time, due to differences in expansion of the materials of different composition and age. Scaling of the plaster coat is particularly noticeable in the case of walls above ground, which are subject to varying degrees of temperature. A plaster coat, however, is sometimes applied to a concrete wall to make it waterproof, as will be described in the writer's next article. The treatment of concrete surfaces by exposing the aggregated as described above, will generally be found a cheaper and better method of securing a more pleasing surface than by plastering or by the use of a full smooth mortar surface, the mortar being a part of the body of the concrete, with the stone in the concrete worked back so as not to be exposed as described above. It is much safer to avoid plastering. It is, of course, advisable to fill with mortar any voids that may appear in the face of the work, but such places should be few and far apart.

Preparation of Surface.—In case a plaster finish is called for, the concrete surface to be plastered must be specially treated to receive the plaster coat, depending upon whether the wall is new or old. It cannot be too strongly insisted that proper precautions be taken to make the plaster stick. The best results are obtained by placing the plaster immediately after the forms have been removed and while the concrete is still green. In this case, very little or no preparation of the concrete is necessary to receive the plaster, which is applied before the wall has dried out. If the concrete wall is old, much care must be taken in preparing it for the plaster. In many cases it is well to wash or scrub the surface, or to pick it to make it rough, before applying the plaster. The surface should generally be quite rough, so as to form a clinch for the plaster. The excess of cement likely to have flushed to the surface must be removed and the surface thoroughly cleaned and well wetted before applying the plaster, or it will crack and fall off. Instead of applying the plaster finish directly to the concrete surface, the method of using a lath to support the plaster may be employed, as will now be described.

Metal Lath and Furring.—The metal lath must be of sufficient rigidity to readily take mortar when supported by furring spaced about 16 inches, center to center. The lath is generally wired to the furring angles or channels every 8 inches with No. 18 annealed galvanized steel wire, care being taken to have sufficient lap in the lathing. The lath should be tied together and also to the furring, so that there can be no settlement or sagging of the lath or the furring to which the lath is attached.

The furring should have sufficient space for the mortar to push through the mesh and clinch without interference from the backing to which the furring is attached. Furring and laths should leave an air space of at least ¾ inch for exterior walls, it must be protected from rusting by being entirely galvanized or treated by any other equally efficient process.

Use of Nails as Furring.—At frequent intervals wire nails may be driven in the forms on the inside, so that the pointed ends project about two inches outside of the rough concrete after the forms have been removed. Before applying the plaster a small iron nut may be put on each projecting nail; the concrete work being then covered with a wire lath of 2½ meshes to the inch and No. 20 wire, and the nails bent over it with the blow of a hammer. The nuts will serve to keep the wire lath a distance of about ¼ in. from the old concrete surface. The nails should be about 3 ins. long with a bend of ¾ in. at one end. The nuts may be either square or hexagonal, about ¼ in. high.

Metal Lath and Wooden Furring.—Concrete walls may be provided with 1¼ ins.x3 ins. thoroughly dry and seasoned furring strips about 18 ins. apart, to which may be fastened substantial metal lath and this plastered with lime mortar.

Proportioning, Mixing and Placing Plaster.—A fairly rich mortar should be used for plastering. Lime paste added to the mortar is advisable in some cases, especially for concrete building walls. This increases the adhesion and lessens the liability of cracking. If a hard surface is desired, only a small amount of the paste should be used. The mixing must be thoroughly done. The lime mortar should be mixed at least four days before using, and the cement should not be added until the mortar is ready to be used, and should be mixed in small quantities as the work progresses.

The first, or scratch, coat may be composed of one part Portland cement, three parts sand and one-half part hair putty. This hair putty should consist of long cattle hair or fibre, thoroughly worked into good lime putty. Before coating the surface the base should be thoroughly saturated with water so as to avoid suction of moisture from the covering coat, which would impair its strength and durability. Care must be taken to apply the plaster at once, and before the surface has an opportunity to dry. By throwing on plaster with considerable force, it bonds better than by spreading it. If the first coat is thrown on the second is more apt to adhere. The face of the first coat must be well scratched to make a key for the second coat, and should be thoroughly dry and surface cracks appear before the second coat is applied.

The second coat may be composed of one part Portland cement, two and one half parts [illegible] sand and with not over five per cent putty and the cow-hair omitted. The scratch coat should be dampened before the second coat is applied. Before the second coat has set hard, it may be jointed to present the appearance of stone work.

The third, or finishing coat may consist of one part Portland cement to two parts of sand or screenings, with not more than five per cent. of lime putty. (Crushed marble screenings may be used for the facing mortar, unless otherwise desired.) To this finishing coat may also be added pebbles or other non-combustible material as may be desired to obtain a variation in the finished appearance. Screenings or sand must not be too fine but should be from ¼ in. in diameter down. If desired, the last coat may be thrown on in order to produce a rough surface.

In all cases, one coat must follow the previous one, as soon as it has sufficiently set to allow of so doing. There should be no difficulty in causing the layers to adhere to each other, if properly applied. The concrete should be well sprinkled before the plaster is laid, as the interior concrete, being dry, will otherwise absorb moisture and prevent adhesion. Where a total thickness of not more than one inch is required, it is practicable to apply it in two coats; i. e., omitting the second coat above specified.

Joints should be allowed at intervals and made as inconspicuous as possible. Plaster should never be applied when the temperature is below freezing.

The finished surface should be protected for at least two weeks with canvas curtains or bagging saturated with water.

Thickness of Plaster Coat.—A plaster coat should either be very thin—that is, just enough to fill irregularities (as described above for grout washes)—or it should be one to three inches thick, so that it will have some strength in itself.

Splatter-Dash Finish.—An inexpensive manner of plastering is what is called a splatter-dash coat. A splatter-dash or so-called "slap-dash" finish can be secured by throwing the finishing coat to the first or second coat, as the case may be, with a trowel from a distance of two or three feet from the work, but it takes an expert to do good work in this manner. A rough surface is generally better in appearance and less liable to crack than a smooth surface.

Pebble-Dash Finish.—A pebble-dash finish may be made by throwing on mortar and leaving it regular but rough. The cement and lime paste should be mixed to the consistency of thick cream and washed pebbles added in the proportion of five parts plaster to one part pebbles by volume.

Pebble-Dash Finish (Alternate Method).—A pebble-dash surface may also be obtained by applying the finishing coat of plaster fairly wet and then throwing clean pebbles into the fresh plaster. The pebbles should be about ½ in. in diameter and should run uniform. The pebbles must be wet just before throwing them on the fresh plaster. The work should be started at the top and the pebbles thrown with a sweeping motion such as is used in sowing seed. The pebbles must be distributed uniformly over the surface and must be thrown with sufficient force to embed them securely. Care must be taken not to disturb the cement after it has started to set, and in order to avoid this, the surface must be covered with the pebbles immediately after the fresh plaster is applied. Particular care must also be taken to make the whole surface continuous; that is, one patch of plaster must not be allowed to dry before the adjoining space is covered. This is a simple and inexpensive, yet thoroughly practical method of securing an artistic effect.

5. Other Methods of Exterior Finish

Cut Stone Finish.—Strips of wood may be nailed into the forms to give the effect of cut stone to the surface when the forms are removed.

Clapboard Finish.—Exterior forms may be arranged by letting the outside boards [illegible] inch thick lap over each other, the expo-

[illegible] lap[illegible] finish [illegible] it comes from the forms [illegible] [illegible] [illegible] er ad rougher the surface the bolder the uld be. Long retaining walls ferably have panels to relieve the surface.

se.d Patterns (Colored Clay Tile, Etc.). or satisfactory methods of securing col- s faces are by the employment of col- [illegible] Colored tile has been used with cess. There are several methods these clays can be inserted in the

be first glued to perforated forms n bill posters' paste, and the mass posited as usual. When the con- perly set, wetting the forms with dissolve the paste so as to allow of the forms. Before the forms l they must be thoroughly flushed Such tile work can also be ections at the pottery, and the slabs and nailed to the forms, the mass [illegible] netimes used to secure the slabbed forms or centering, no discolora- rust taking place with the lapse ere copper tacks have been used. felt should be placed between the l the face of the mosaic, if such be order to prevent the smaller particles rom running on to the face of the staining it. The prepared orna- is then backed up and surrounded dy of concrete.

r method of inserting tile or pattern to place them piece by piece in the r the removal of the forms, in which [illegible] an outline to suit the design, should for their reception. These panels ed in at any convenient time with edded in cement mortar. In pro- ace into which to set tiles, pieces of the exact size of each tile or tile bbed in sections, should be nailed the forms, so that the forms can ved without pulling them from the When the forms are removed, these board will remain in the surface of rete, and should be left in until what- face finish desired for the remainder vork has been completed. They are oved, thus leaving recesses, conform- e design, and the tiles or ornamental placed in these recesses, being ce- in with a mortar, varying in color to with the design. Belt courses olumns or along facades, ornamental lns and innumerable other points have utifully ornamented by this means.

[illegible] o be faced with brick work, care must to imbed a sufficient number of metal tying the face brick work to the con- One tie should be used for about every are feet of surface, except in earth- ountries, where there should be one quare foot. Wire ties should be at in. in diameter, with one end bent. l of the tie should be thrust through hole in the forms immediately after rete is placed and before it has set. e removal of forms, the projecting the tie should be bent at right angles bedded in the mortar between the

ing brick masonry every brick must ed and thoroughly saturated with wa- should be laid in the best hydraulic mortar, with such thickness of joint le of bond as prescribed by the engi- shown on plans. No broken bricks e used in the face of any wall, except cessary to make closures for properly oning the several courses or to break

Facing.—If stone facing is used for work, the stones should be of an ap- quality. The stone must be of a com- xture, free from loose seams, flaws, [illegible] stand the action of the weather. [illegible] facing should [illegible] dressed to true beds and vertical joints, unless otherwise desired. [illegible] should be laid [illegible] course below. All parts should be cleaned, [illegible] given on plans. All cornices, moldings, capitals, keystones, brackets, etc., should be built into the work in the proper positions, etc., [illegible] shown on plans.

Method and Cost of Constructing a Reinforced Concrete Retaining Wall With Rear Anchorage.

[illegible]

This work was done for the state of Ohio [illegible] ft. long and the other 400 ft. The design of the wall is shown by the accompanying sketch. The wall was built around an island about 10 ft. from the bank. The space between the bank and wall was afterwards [illegible] below the top of the wall, but to do this work the lake was [illegible] a beach in front of the wall about 200 ft. wide.

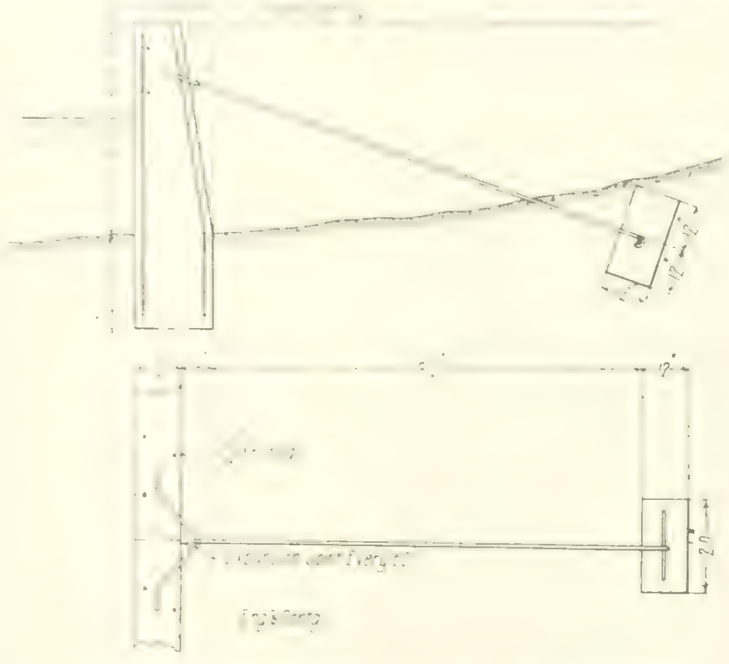
When the walls were built two openings 10 ft. wide were left in each section so that the dirt could be hauled through. The backfill was a sandy clay and amounted to about 2,000 cu. yds. It was ploughed and hauled in No. 00 slip scrapers. The average haul was 150 ft. and cost 21 cts. per cubic yard including plowing, teams being paid 50 cts. per hour.

The concrete plant consisted of a ⅓ cu. yd. Chicago mixer mounted on skids. The material was hauled about 1 mile from the railroad [illegible] from there it was wheeled up runways to the mixer which was fitted with a batch hopper, and from the mixer it was wheeled to the job and placed. As two setups of the plant were made, one in the center of each section the longest haul was about 125 ft.

In placing the concrete the trench was dug for the foundations and the concrete and steel placed, then the forms were placed. These were built in sheets 12 ft. 6 ins. long and 5 ft. high, and were made of ⅞-in. tongue and grooved stuff with 2x4-in. uprights on 2-ft. centers. The forms were held together with wiring and two rows of 1x4-in. walling on each side. The concrete was poured in 50-ft. sections, and forms enough were built for two sections, so that while one section was being poured the carpenters could be working on the next. As the forms were wrecked on the second day after pouring it was necessary to put the laborers to digging foundation or filling it ahead on every third day until forms could be built.

This work was started Nov. 15, 1910, and was finished on Jan. 3, 1911, during fairly cold weather. At first the green concrete was covered with tarpauline and heated with steam from the mixer. Two rows of 1-in. pipe were used on each side of the wall for radiation, but this was not found to be very satisfactory as about 150 ft. of wall froze for a depth of an inch. On nights when the wind was blowing it was impossible to keep the heat under the tarpaulins. On the rest of the wall salt was used and no trouble was experienced. About a quart of salt to a sack of cement was used. The salt was thrown into the mixer and mixed with the concrete.

This work was done by R. E. Boothe & Son, the writer being in charge of the job.



Sketch Plans of Retaining Wall with Rear Anchorage.

The costs were as follows:

Concreting (281 cu. yds.):	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] from job	21.00
Coal and oil	[illegible]
Total	$460.00
Cost per cubic yard	$1.64—
Forms:	
1 carpenter, 190 hours at 30 cts.	$ 57.00
2 carpenters, 190 hours at 25 cts.	95.00
2 laborers, 100 hours at 20 cts.	40.00
Total	$192.00
Cost per square foot of forms	$0.024
Cost per cubic yard	$1.15

Digging the foundation ditch cost 6 cts. per foot.

The Economies of Silo Construction of Permanent Materials (Concrete and Clay Tile); Construction Methods and Costs.

III.

Contributed by M. L. King, Department of Agricultural Engineering, Iowa State College, Ames, Iowa.

CONCRETE SILOS.

For any concrete silo of reasonable size, that is a diameter of less than 20 or 25 ft., and a height under 50 ft. the 6-in. wall is plenty [illegible] ditions of curing, a concrete wall less than 6 ins. in thickness; therefore, the standard [illegible]

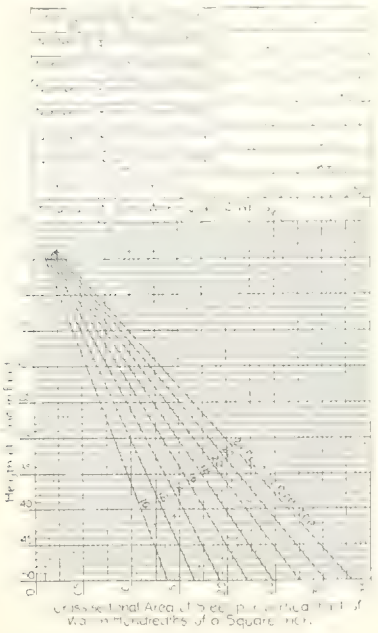


Fig. 1—Diagram for Determining Area of Reinforcing Steel Required at any Depth in Silos of Various Diameters.

are common. The proportions will naturally depend upon the character of the aggregate used.

The walls must be dense and smooth, and the silo well shaped, that is round and plumb. The reinforcing is an important and essential feature of any kind of a silo. Silage pressure was determined experimentally by F. H. King of the Wisconsin Experimental Station 20 or 30 years ago and his figures have been varified by practice. The pressure will vary somewhat in different cases, but it is safe to say that it will be 11 lbs. per square foot for each foot in depth. Thus at a depth of 30 ft. the pressure would probably be 330 lbs. per square foot and at a depth of 35 ft., 385 lbs. per square foot.

A few masonry silos are standing today which have little or no steel in them. This, however, does not indicate that it is safe at all to skimp on the supply of steel for there are many bursted masonry silos any one of which would have been saved by the use of the amount of steel shown in the accompanying table. Silos containing quantities of steel similar to this have never been known to burst.

Figure 1 shows the cross sectional area or steel required in silos from 10 to 24 ft. in diameter for the top foot and each successive foot until the depth of 50 ft. is reached. If the point is noted where one of the heavy diagonal lines representing a silo of the required diameter intersects a horizontal line representig the depth of the silo, the area of the steel required to resist the bursting pressure on a section of the silo wall 1 ft. wide will be found on the scale directly below.

If the depth is chosen as the mean depth of a 3-ft. section, or if the bands of steel are placed 3 ft. apart, three times the area of the cross section obtained should be used. At the top of the chart directly above the point of intersection, the number of strands of wire, bars and rods of common dimensions required may be obtained. For example, suppose it is desired to determine for a 20 ft. silo the reinforcement of a section 2 ft. 6 ins. wide located at a mean depth of 20 ft. from the top. From the chart it is found the line representing the silo diameter intersects the 20 ft. depth line directly over the 0.11 on the lower scale. This times 2½ or .275 is the area of the steel required. From the scales above it is found that this is equal to 16 No. 9 wires or nearly one ⅝-in. round rod. For other sections the reinforcement may be found in a similar manner. The sizes of the hoops and steel reinforcement required by the chart is conservative, averaging a trifle stronger than practice, but is not wasteful of steel.

In Fig. 2 is shown the number of wires No. 9 or No. 3 which should be placed in each mortar joint of any silo varying in diameter from 12 to 20 ft. and 40 ft. or less in height, with mortar joints 5 and 8 ins. apart. The left half of the plate is for mortar joints 8 ins. apart while the right half is for mortar joints 5 ins. apart. Most standard material is such as to be laid in one of these two ways. The top row of figures on either side of the plate indicates diameters. The left figure of the double column below each large figure indicates the number of No. 9 wires, while the right of the double column indicates the number of No. 3 wires for each joint. The preceding wire sizes or numbers refer to the American Steel & Wire Co. gauge. The distance from the top of the silo should be the basis of calculation at all times.

Photograph Fig. 3 shows a portion of a crack in a 20x40-ft. double wall concrete silo. This silo did not have a sufficient quantity of horizontal reinforcement and consequently there were seven of these cracks on extending from the top to the bottom silo. A sum of $15 more would have this $800 job good. A word to the wis ly should be sufficient.

Vertical reinforcement is commonly mended for concrete silos, but it is o or no importance and there has never failure of this character in any mason except where a very thin wall has beer or the horizontal steel was placed ove apart. Some vertical reinforcement visable on each side of the door, and i a continuous door is required the amo reinforcement necessary may be taken the detailed construction of concrete frame of the Iowa silo shown in the pre article upon that subject.

Up until four years ago wooden door were found practically in all masonry but it is difficult to make the joint b the masonry and wood air-tight. The would necessarily be replaced in time a form properly shaped for the co would cost less than one of these w door frames. Two forms would be re while half a dozen door frames wo needed, therefore, the only logical th do is to use door forms set between th forms which form a shoulder on the

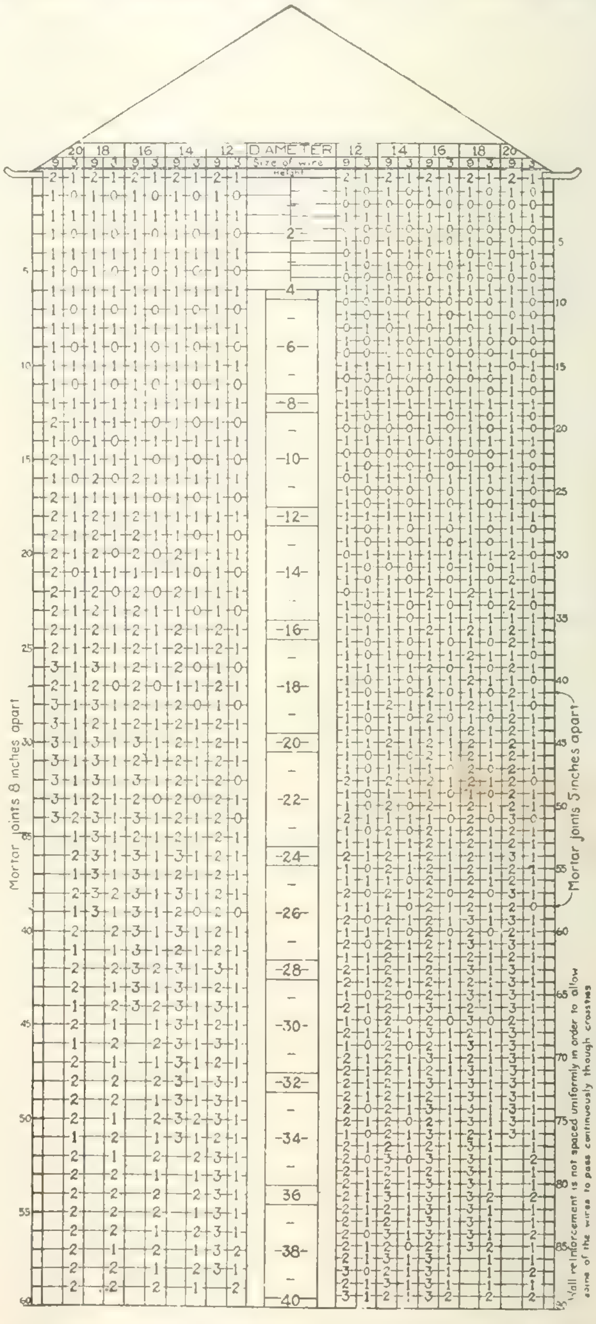

20 18 16 14 12 DIAMETER 12 14 16 18 20
9 3 9 3 9 3 9 3 9 3 Size of wire 9 3 9 3 9 3 9 3 9 3
Height
Mortar joints 8 inches apart
Mortar joints 5 inches apart
Wall reinforcement is not spaced uniformly in order to allow some of the wires to pass continuously though crosses
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
5 10 15 20 25 30 35 40 45 50 55 60
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85

Fig. 2—Diagrams for Determining Number of Strands of No. 9 and No. 3 Rei ment Required in Each Mortar Joint of Block Silo.

[illegible] pening in which the door may [illegible] case of the cement block silo the same door frame idea may be followed shown in the clay block silo.

gard to the kind of forms to use s a large variety from which to one of which is shown by Fig. 4. will always be a demand on the confor silos of different diameters there- will be to his advantage to use ad- forms. Also it is well to have forms

—View Showing Crack in Wall of Inadequately Reinforced Silo.

[illegible] character that the gang [illegible] ctly the same amount of work each ith a set of forms which are filled up ay it is practically necessary to fill herefore the gang must be of such a it it can fill the forms in one day, re- of conditions while under favorable tances, good weather, etc., the forms be filled easily in three-fourths of a d the gang not work up to its maxi- pacity. If two sets of forms are used [illegible] more elastic, as [illegible] will not need to be excessively [illegible] that the two will [illegible] certain day it will [illegible] with the quality of the work [illegible] accomplished the next day.

[illegible] to these conditions was reported some time [illegible] cultural Experiment Station. Cuts of this set of forms are shown by Fig. 5 and a description is taken direct from the bulletin.

These forms resemble those used by Mr. R. L. Sollett, of Goldfield, Iowa, in the construction of his silos. Two sections of staves [illegible] the proper circle and nailed firmly together. The staves rest on a $\frac{7}{8}$-in. square cleat nailed to the hoops. The inner hoops are made solid and to remove them one side is driven down and the hoops sprung out of round. The outside hoops are made with clamps by which they may be opened for removal as shown. Three outside and three inside hoops are required. The purpose of having two sections of forms is two-fold. First, the second set of forms is accurately located by the first before the second is moved, and also by using 30-in. staves 5 ft. of wall may be built each day and the form need not be disturbed until the contained wall in at least 18 hours old. Second, no tamping of fresh concrete occurs on the unsupported wall as there is always a section of the forms below the one being filled. The 30-in. stave length was chosen because longer staves are apt to bend and the length is handy for fitting in the doors which [illegible] ins. apart.

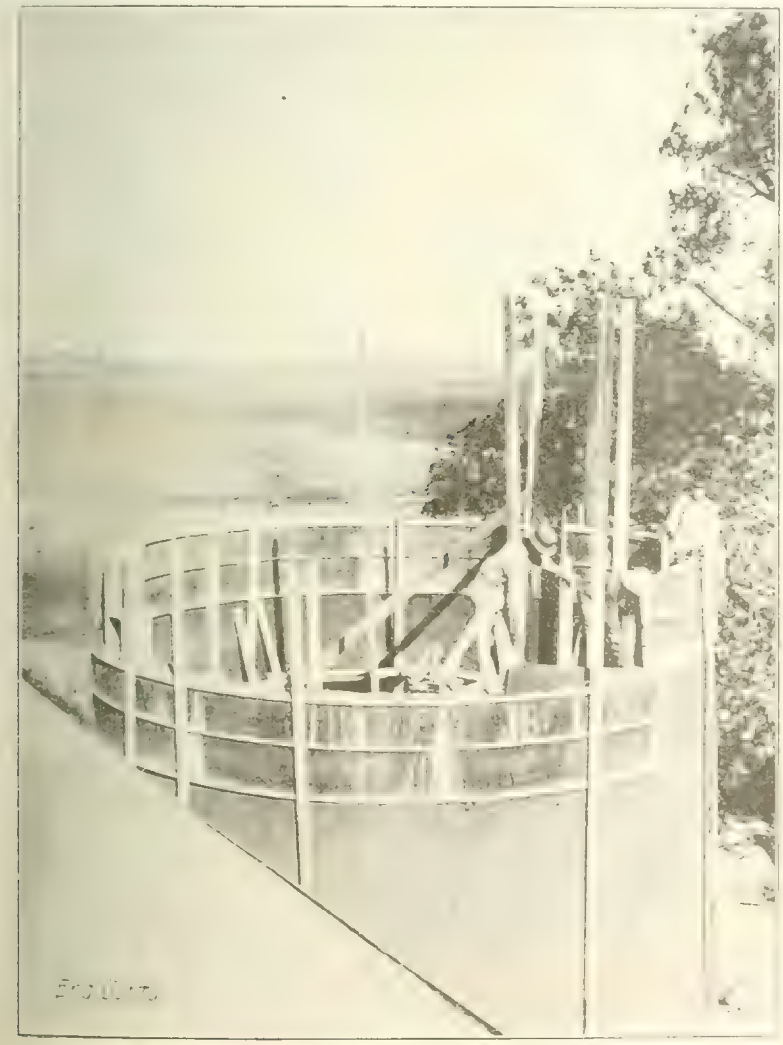


Fig. 4—View Illustrating a System of Silo Forms

The same staves will serve for any diameter of silo and the hoops can be made adjustable within a limited range so that a few sets of hoops will equip a contractor for any diameter of silo. This system of forms has been found to be fully as cheap as any. With this type it is convenient to use scaffolding of the same plan as shown in the article on clay block silo construction. There are several patented systems embodying scaffold and forms. These are quite generally advertised and may be learned of in that way. There are several systems not patented.

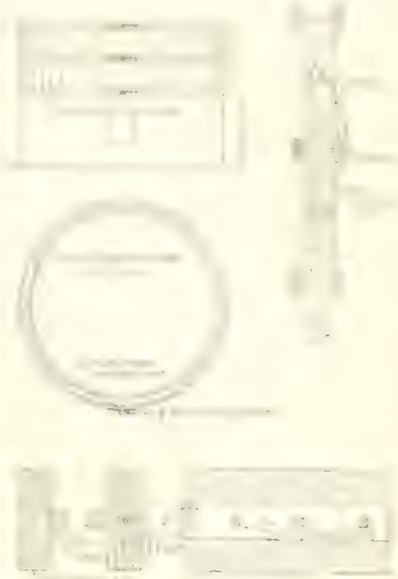


Fig. 5—Details of Wood Stave Forms for Silo Walls.

Perhaps the most complete data on the cost of concrete silos have been collected by the Universal Portland Cement Co., and published in its book on concrete silos. These data cover the cost of 78 monolithic and 30 cement block silos. They are summarized as follows:

	Per Ton of Capacity Monolithic.	Block.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
pacity more than 200 tons....	2.18	....
[illegible]	[illegible]	[illegible]

It should be borne in mind in connection with these cost data that it is difficult to get accurate reports on cost of labor from the average farmer as he is apt not to figure all labor. For example the writer helped build two 20x40-ft. silos near Elburn, Ill. These silos hold approximately 280 tons and are reported to have cost $2.41 per ton capacity making a total cost of $675. This was the contract price, but in addition the farmer furnished at his own expense all aggregate, forms for the roof, and a few other miscellaneous materials. The owner at that time estimated the total cost at about $1,000. This figured more nearly $3.57 per ton.

It may be of further interest to know that no concrete mixer was used on this job and that the contractor made little if any profit. It should be further stated that these two silos had double walls, the inner wall being 5½ ins. thick and the outer wall 3½ ins. thick with 3 ins. of air space between. This case is simply cited to show how difficult it is to collect accurate, dependable data. In fact it is safest for the small contractor to build a few by the day. The most common terms of contracting are such as to shift most of the variables onto the farmer. That is, he furnishes sand and gravel, does all of the hauling, furnishes board for all men, and aids in the construction. Also the farmer often pays for the material and the freight upon the same at the time of delivery. The contractor is really independent of local or weather conditions as his men are paid only for the time they work and the farmer boards all men regardless of the weather.

STEAM AND ELECTRIC RAILWAY SECTIO

Notes on Contract Ballasting, Missouri Pacific Ry., Including Tables for Calculating Volume of Ballast Applied; Also Cost and Progress Recording Forms Used.

Contributed by D. W. Stradling, C. E., Formerly Resident Engineer, Missouri Pacific Railway.

During the year 1909 gravel ballast was applied to about 70 miles of the Colorado division of the Missouri Pacific Ry. system between Mile Post No. 491 (east of Brandon, Colo.) and Mile Post No. 560 (east of Lolita, Colo.). Nine miles of the work was performed by railway company forces and the remainder was done under contract by the L. J. Smith Construction Co. of Kansas City, Mo. Several miles of track west of Mile Post No. 560 were ballasted in 1908 by railway company forces.

The contract price was 52 cts. per cubic yard for loading, hauling and unloading ballast, and 25 cts. for applying ballast; total contract price for ballast under the track, 77 cts. per cubic yard. The contractor also performed the work of skeletonizing the track (removing all earth and other material from between the ties and away from the ends of ties [see Fig. 1), renewing and respacing of ties, 18 ties per 30 ft. rail or 20 ties per 33 ft. rail, for the contract price of 15 cts. per tie renewed. The railway company furnished and delivered the necessary ties and spikes for renewals.

According to the contract the railway company furnished the following material and equipment and assumed the following risks:

(1) Gravel pit and all land and right of way necessary for its proper operation.

(2) All ballast cars.

(3) Lidgerwood unloaders and plows.

(4) Necessary bunk and boarding cars, if the company had any available, which was generally the case.

(5) Cabooses and water cars, if the company had any not in use. Contractor had to put all rolling stock loaned to him into proper condition for transportation and maintain same in such condition.

(6) Water, except where the railway company had to purchase, in which case contractor had to reimburse the railway company.

(7) Ties and spikes for renewals, delivered along the track.

(8) Raise all bridges, platforms and other structures to elevation necessary to allow room for ballast.

(9) Telegraph operators and telegraph appliances necessary for proper operation of contractor's trains in main line movement.

(10) Half of salary of assistant train master, who had charge of main line movement of contractor's trains.

(11) Transportation over its lines for men, material, tools, complete working outfit, provisions and supplies, except free transportation of fuel, was limited to Kansas and Colorado and fields.

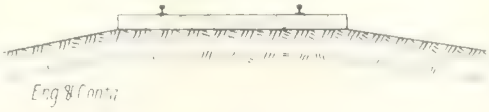


Fig. 1.

(12) Storage tracks for 50 cars at ballast pit, and tracks at junction with main line, necessary for properly handling arriving and departing trains.

(13) Where contractor was required to throw track more than 12 ins. the railway company paid the additional cost of throwing track.

In addition to loading, hauling, unloading and applying ballast, skeletonizing track and making tie renewals, the contractor had to furnish the following labor, material, equipment and supplies, and assumed the following risks:

(1) All necessary labor and superintendence.

(2) Locomotives.

(3) Steam shovels.

(4) Repair and maintain all rolling stock furnished by the railway company.

(5) All tools.

(6) Fuel and other supplies.

(7) Pay for water where railway company had to purchase same.

(8) Half of salary of assistant train master.

(9) Pay for flagmen to protect trains where skeletonizing or ballasting gangs were at work.

(10) Keep track safe for trains, running at proper reduced speed, where skeletonized or where ballasted track had not been accepted.

(11) Maintain suitable runoffs from b sted track to unballasted track.

(12) Maintain all public and private cr sing and keep all stream channels clear, etc.

(13) Pay all damage claims caused by s en gines, cars, trains, steam shovels or other equipment, employes, agents or sub-c ra ors.

(14) Assume all risk, loss or damage hich may occur on the work until completed eliv ered to railway company and accepted y i chief engineer of maintenance of way.

(15) Pay for all damage to equipment i oth than main line movement, owner of equ ne to bear damage to equipment occurrin wh in main line movement.

(16) Pay for all damages on account i juries to persons or injuries result death, or for damages to property sustaid account of defective equipment, whet e gaged in main line movement or otherve.

(17) Pay for all damages on account i juries to persons or injuries resulting in a or for damage to property caused by eg gence of trainmen or enginemen in ma li movement.

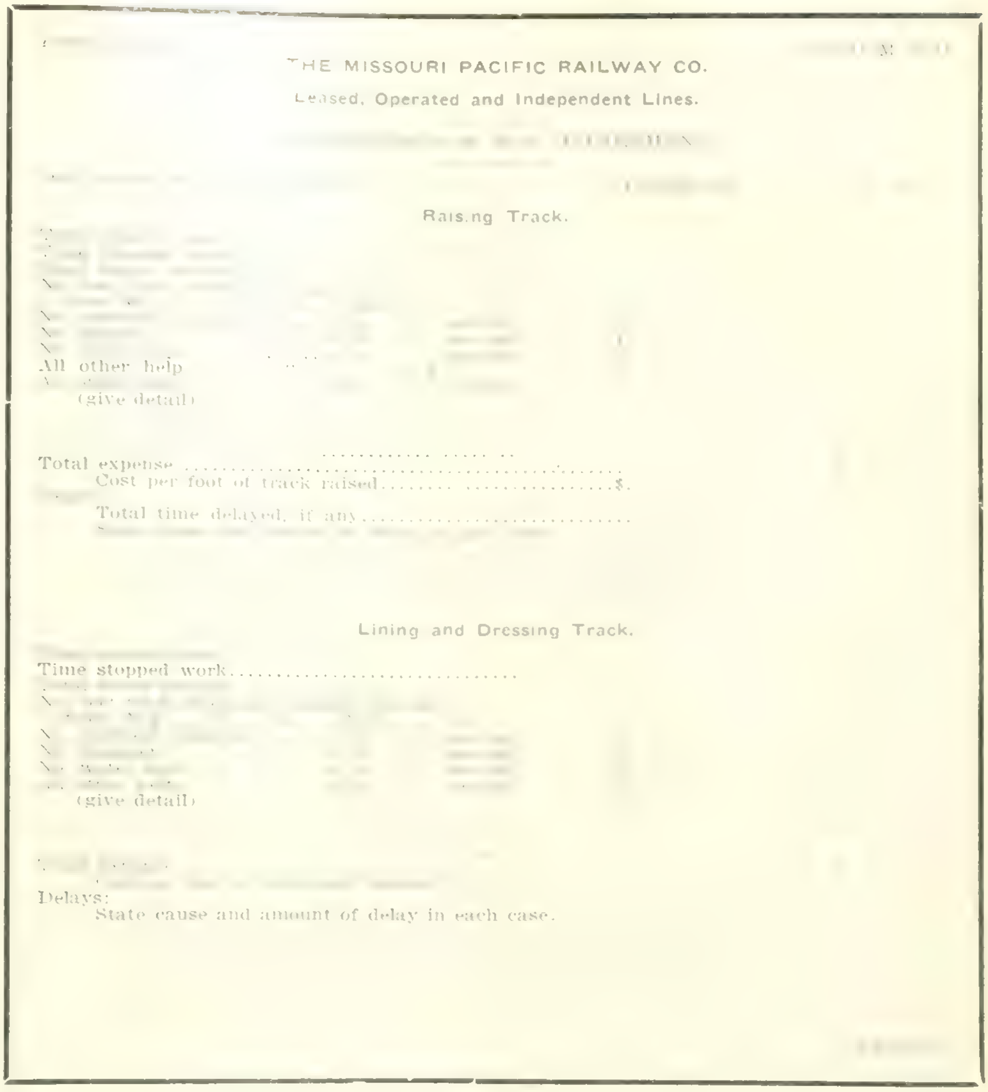
Where the railway company had occa n call upon the contractor for extra wc cessitating the use of any of his machi y equipment, exclusive of labor and fr where it was necessary for contractor any additional equipment belonging railway company the following price g erned:

Locomotives, size of cylinders to 18 ins....
Locomotives, size of cylinders over 1 to 22 ins., per day.........
Steam shovels, 40 to 60 tons, per day..
Steam shovels, 60 tons and over, per day
Steam Wreckers (to include necessary ol block, sleeping and commissary ca.
30-ton wrecker ......
40-ton wrecker ......
50-ton wrecker ......
78-ton and over, wrecker......

The gravel ballast was obtained f n large pit located at North Fowler, Colc ne Mile Post No. 590. The average distan t ballast was hauled during 1909 by th c tractor was about 65 miles. The contr superintendent located his office at o Fowler, where a large camp was main ne including facilities for repairing rolling coaling station for locomotives, etc. a needed for steam shovel, locomotive a other purposes was hauled to the camp it

TABLE I.—VOLUMES OF 100

	.01	.02	.03	.04	.05	.06	.07	.08	.09	.10		.11	.12	.13	.14	.15	.16	.17	.18	.19	.20		.21	.22	.23	.24	.25	.26	.27	.28	.29	.
.30	.02	.03	.05	.06	.08	.10	.11	.13	.14	.16	.30	.18	.20	.22	.24	.26	.28	.30	.31	.33	.35	.30	.37	.39	.41	.43	.45	.48	.50	.53	.55	
.31	.02	.03	.05	.06	.08	.10	.11	.13	.14	.16	.31	.18	.20	.22	.24	.26	.28	.30	.32	.34	.36	.31	.38	.40	.42	.44	.46	.49	.51	.54	.56	
.32	.02	.03	.05	.06	.08	.10	.12	.13	.15	.17	.32	.19	.21	.23	[illegible]	.27	.29	.31	.33	.35	.37	.32	.39	.41	.44	.46	.48	.50	.53	.55	.58	
.33	.02	.03	.05	.06	.08	.10	.12	.13	.15	.17	.33	.19	.21	.23	.25	.27	.29	.31	.34	.36	.38	.33	.40	.42	.44	.47	.49	.52	.54	.57	.59	
.34	.02	.04	.05	.07	.09	.11	.13	.14	.16	.18	.34	.20	.22	.24	.26	.28	.30	.32	.35	.37	.39	.34	.41	.44	.46	.49	.51	.53	.56	.58	.61	
.35	.02	.04	.05	.07	.09	.11	.13	.14	.16	.18	.35	.20	.22	.25	.27	.29	.31	.33	.36	.38	.40	.35	.42	.45	.47	.50	.52	.55	.57	.60	.62	
.36	.02	.04	.05	.07	.09	.11	.13	.14	.16	.18	.36	.20	.23	.25	.28	.30	.32	.34	.37	.39	.41	.36	.43	.46	.48	.51	.53	.56	.59	.61	.64	
.37	.02	.04	.05	.07	.09	.11	.13	.15	.17	.19	.37	.21	.23	.26	.28	.30	.32	.35	.37	.40	.42	.37	.44	.47	.49	.52	.54	.57	.60	.62	.65	
.38	.02	.04	.05	.07	.09	.11	.13	.15	.17	.19	.38	.21	.24	.26	.29	.31	.33	.35	.38	.40	.43	.38	.46	.48	.51	.53	.56	.59	.62	.64	.67	
.39	.02	.04	.06	.08	.10	.12	.14	.16	.18	.20	.39	.22	.24	.27	.29	.31	.34	.36	.39	.41	.44	.39	.47	.49	.52	.54	.57	.60	.63	.65	.68	
.40	.02	.04	.06	.08	.10	.12	.14	.17	.19	.21	.40	.23	.25	.28	.30	.32	.35	.37	.40	.42	.45	.40	.48	.50	.53	.55	.58	.61	.64	.67	.70	
.41	[illegible]	.04	.06	.08	.10	.12	.14	.18	.19	.21	.41	[illegible]	.26	.28	.31	.33	.36	.38	.41	.43	.46	.41	.49	.52	.54	.57	.60	.63	.66	.69	.72	
.42	[illegible]	.04	.07	.09	.11	.13	.15	.18	.20	.22	.42	.24	.27	.29	.32	.34	.37	.39	.42	.44	.47	.42	.50	.53	.55	.58	.61	.64	.67	.70	.73	
.43	[illegible]	.04	.07	.09	.11	.13	.15	.18	.20	.22	.43	.24	.27	.29	.32	.34	.37	.40	.42	.45	.48	.43	.51	.54	.56	.59	.62	.65	.68	.72	.75	
.44	[illegible]	.05	.07	.10	.12	.14	.16	.19	.21	.23	.44	.25	.28	.30	.33	.35	.38	.41	.43	.46	.49	.44	.52	.55	.58	.61	.64	.67	.70	.74	.77	
.45	[illegible]	.05	.07	.10	.12	.14	.16	.19	.21	.23	.45	.26	.28	.31	.33	.36	.39	.42	.44	.47	.50	.45	.53	.56	.59	.62	.65	.68	.72	.75	.79	
.46	.02	.05	.07	.10	.12	.14	.17	.19	.22	.24	.46	.27	.29	.32	.34	.37	.40	.43	.45	.48	.51	.46	.54	.57	.60	.63	.66	.69	.73	.76	.80	
.47	.02	.05	.07	.10	.12	.14	.17	.19	[illegible]	.24	.47	[illegible]	.30	.32	.35	.38	.41	.44	.46	.49	.52	.47	.55	.58	.62	.65	.68	.71	.74	.78	.81	
.48	.02	.05	.07	.10	.12	.15	.17	.20	.23	.25	.48	.28	.30	.33	.35	.38	.41	.44	.47	.50	.53	.48	.56	.59	.63	.66	.69	.72	.76	.79	.82	
.49	.02	.05	.08	.10	.13	.15	.18	.20	[illegible]	.25	.49	.28	.31	.33	.36	.39	.42	.45	.48	.51	.54	.49	.57	.61	.64	.68	.71	.75	.78	.82	.85	
.50	.03	[illegible]	.08	.10	.13	.16	.18	.21	[illegible]	.26	.50	.29	.32	.34	.37	.40	.43	.46	.50	.53	.56	.50	.59	.62	.66	.69	.72	.76	.80	.83	.87	
.51	.03	.05	.08	.10	.13	.16	.18	.21	[illegible]	.26	.51	.29	.32	.35	.38	.41	.44	.47	.51	.54	.57	.51	.60	.64	.67	.71	.74	.78	.82	.86	.89	
.52	.03	.05	.08	.10	.13	.16	.19	.21	[illegible]	.27	.52	.30	[illegible]	.36	.39	.42	.45	.48	.52	.55	.58	.52	.61	.65	.68	.72	.75	.79	.83	.87	.90	
.53	[illegible]	.05	.08	.10	[illegible]	.16	.19	.21	.24	.27	.53	.30	[illegible]	.36	.39	.42	.45	.49	.52	.56	.59	.53	.63	.66	.70	.73	.77	.81	.85	.89	.92	
.54	[illegible]	.06	.08	.11	.14	.17	.20	.22	[illegible]	.28	.54	.31	.34	.37	.40	.43	.46	.50	.53	.57	.60	.54	.64	.67	.71	.74	.78	.82	.86	.90	.93	
.55	[illegible]	.06	.08	.11	.14	.17	.20	.22	[illegible]	.28	.55	.31	.34	.38	.41	.44	.47	.51	.54	.58	.61	.55	.65	.69	.73	.76	.80	.84	.88	.92	.95	
.56	.03	.06	.08	.11	.14	.17	.20	.23	.26	.29	.56	.32	.35	.39	.42	.45	.48	.52	.55	.59	.62	.56	.66	.70	.74	.77	.81	.85	.89	.93	.97	1
.57	.03	.06	.08	.11	.14	[illegible]	.20	.23	.26	.29	.57	.32	.36	.39	.43	.46	.49	.53	.56	.60	.63	.57	.67	.71	.75	.79	.83	.87	.91	.95	.99	1
.58	.03	.06	.08	.11	[illegible]	.17	[illegible]	.24	.27	.30	.58	.33	.37	.40	.44	.47	.50	.54	.57	.61	.64	.58	.68	.72	.76	.80	.84	.88	.92	.97	1.01	1
.59	.03	.06	.09	.12	.15	.18	.21	.24	[illegible]	.30	.59	.33	.37	.40	.44	.47	.51	.54	.58	.61	.65	.59	.69	.73	.78	.82	.86	.90	.94	.99	1.03	1
.60	.03	.06	.09	.12	.15	.18	.21	[illegible]	.28	.31	.60	.35	.38	.42	.45	.49	.53	.56	.60	.63	.67	.60	.71	.75	.79	.83	.87	.91	.96	1.00	1.05	1
.61	.03	.06	.09	.12	.15	[illegible]	.22	.25	.29	.32	.61	.36	.39	.43	.46	.50	.54	.57	.61	.64	.68	.61	.72	.76	.80	.84	.88	.93	.97	1.02	1.06	1.1
.62	.03	.06	.10	.13	.16	.19	.22	.26	.29	.32	.62	.36	.40	.44	.47	.51	.55	.59	.63	.66	.70	.62	.74	.78	.82	.85	.89	.94	.99	1.03	1.08	1.1
.63	.03	.06	.10	.13	.16	.19	.23	.26	.30	.33	.63	.37	.40	.44	.47	.51	.55	.59	.64	.68	.72	.63	.76	.80	.84	.87	.91	.96	1.01	1.05	1.10	1.1
.64	.03	.07	.10	.14	.17	.20	.23	.27	.30	.33	.64	.37	.41	.45	.48	.52	.56	.60	.65	.69	.73	.64	.77	.81	.86	.90	.94	.99	1.03	1.08	1.12	1.1
.65	.03	.07	.10	.14	.17	.20	.24	.27	.31	.34	.65	.38	.42	.46	.49	.53	.57	.61	[illegible]	.70	.74	.65	.78	.83	.87	.92	.96	1.01	1.05	1.10	1.14	1.1
.66	.03	.07	.10	.14	.17	.21	.24	.28	[illegible]	.35	.66	.39	.43	.47	.50	.54	.58	.62	.67	.71	[illegible]	.66	.80	.84	.89	.93	.98	1.03	1.07	1.12	1.16	1.2
.67	.03	.07	.10	.14	.17	.21	[illegible]	.28	.31	.35	.67	.39	.43	.47	.51	.55	.59	.63	.68	[illegible]	.76	.67	.81	.85	.90	.94	.99	1.04	1.09	1.13	1.18	1.2
.68	.04	.07	.11	.14	.18	.22	.25	.29	.32	.36	.68	.40	.44	.48	.52	.56	.60	.64	.69	[illegible]	.77	.68	.82	.87	.91	.96	1.01	1.06	1.11	1.15	1.20	1.2
.69	.04	.07	.11	.14	.18	.22	[illegible]	.29	.32	.36	.69	.40	.44	.49	.53	.57	.61	.65	.70	[illegible]	.79	.69	.84	.88	.93	.97	1.02	1.07	1.12	1.18	1.23	1.2
.70	.04	.07	.11	.14	.18	[illegible]	.26	.30	.33	.37	.70	.41	.45	.50	.54	.58	.62	.67	.71	.76	.80	.70	.85	.90	.94	.99	1.04	1.09	1.14	1.20	1.25	1.3



THE MISSOURI PACIFIC RAILWAY CO.

Leased, Operated and Independent Lines.

Raising Track.

All other help
(give detail)

Total expense ....
Cost per foot of track raised........ ....$.
Total time delayed, if any..............................

Lining and Dressing Track.

Time stopped work...............................
(give detail)

Delays:
State cause and amount of delay in each case.

Fig. 2.

m a railway water tank already [illegible] short distance east of North Fowler. [illegible] was loaded by steam shovel into cars [illegible] the Rodger Ballast Car Co. for the [illegible] Pacific system, which were loaned to [illegible] actor. Storage tracks at the pit and [illegible] nction with the main line prevented [illegible] the steam shovel and to the con- [illegible] road locomotives. Loaded cars were [illegible] ways made up into a train waiting for [illegible] tive, so that it could start on its next [illegible] soon as it had "set in" its train of [illegible] taken coal and water, etc.

[illegible] ing operations were kept in progress [illegible] places in order to keep the shovel [illegible] ballast trains busy all the time, and [illegible] superintendence, [illegible] supplies, etc., could be thereby re- [illegible] nd finally in order to complete the [illegible] on time. A camp of bunk and board- [illegible] was set out at each point where a [illegible] f work was going on. Water was [illegible] to camps in water cars, usually flat [illegible] equipped with [illegible] tubs. The locomotive hauling the [illegible] ain would take the water cars to the [illegible] ailway water tank when necessary to [illegible] n. As all water needing it was soft- [illegible] he railway company at its tanks, this [illegible] supply was of special benefit to the [illegible] in a region where so much [illegible] is found. Ice was shipped [illegible] lots by the contractor, and each camp [illegible] me made refrigerator for storing ice, [illegible] putting an inside planking in one- [illegible] f box car and filling the space between [illegible] ing and the sides, top and bottom of [illegible] sawdust. A bulkhead [illegible] construction was put across the car [illegible] doors. A tight fitting door of double [illegible] d intermediate sawdust construction [illegible] in the bulkhead. Ice was unloaded [illegible] ng plank from the road car, a regu- [illegible] tor car, standing on the main [illegible] d opposite the camp refrigerator [illegible] or more kitchen cars equipped with [illegible] range, utensils, etc., and one or [illegible] ing cars with tables lengthwise of [illegible] were part of each camp. Each gang [illegible] ished with sufficient hand cars to go [illegible] om the work. One general foreman [illegible] ne keeper, who also served as com- [illegible] clerk, were in charge of each camp. [illegible] nen were placed in charge of parts [illegible]

[illegible] ing was the first work done. All [illegible] between the ties and around the ends [illegible] s was removed down to a level with [illegible] m of the ties, and the roadbed given a [illegible] away from the track for drainage

[illegible] roadbed after it has been skeletonized. Ballast inspectors, who were placed in charge of each piece of work as soon as skeletonizing was started, had considerable trouble at times in getting the laborers to take the material out properly from under the rails and from between ties spaced too closely together. Spades instead of shovels would often be better for doing this work. Some form of spade with a curved handle which would allow the users to stand up erect, or nearly so, would probably

[illegible] BY SKETCH FIG. [illegible]

.33	.34	.35	.36	.37	.38	.39	.40		.41	.42	.43	.44	.45	.46	.47	.48	.49	.50		.51	.52	.53	.54	.55	.56	.57	.58	.59	.60	
[illegible]	[illegible]	.71	.74	.76	[illegible]	.81	.84	.30	.87	[illegible]	.93	.96	[illegible]	1.02	1.05	[illegible]	1.12	1.15	.30	1.19	1.22	1.26	1.29	1.33	1.37	1.41	1.45	1.49	1.53	.30
.67	.70	.73	.76	.79	.81	.84	.87	.31	.90	[illegible]	[illegible]	.99	1.02	1.05	[illegible]	1.12	1.15	1.18	.31	[illegible]	1.26	1.30	[illegible]	1.37	1.40	1.44	1.49	1.53	1.56	.31
[illegible]	[illegible]	[illegible]	[illegible]	.80	.83	.86	.89	.32	.92	[illegible]	.99	1.02	1.05	1.08	1.11	1.14	1.18	1.21	.32	1.26	1.29	1.33	1.36	[illegible]	1.44	1.48	1.52	1.66	1.60	.32
.70	.73	.76	.79	.82	.86	.89	.92	.33	.95	[illegible]	1.01	1.04	[illegible]	1.10	1.13	1.17	1.20	1.24	.33	1.27	1.31	1.35	1.39	1.43	1.47	1.51	1.56	1.60	1.64	.33
[illegible]	[illegible]	.78	.81	.84	.88	.91	.94	.34	.97	1.00	1.03	1.06	1.09	1.13	1.16	[illegible]	1.23	1.27	.34	1.31	1.35	1.39	1.43	1.47	1.51	1.55	1.60	1.64	1.68	.34
.73	.76	.79	.82	[illegible]	[illegible]	[illegible]	[illegible]	.35	[illegible]	1.01	1.05	1.08	1.11	1.15	1.19	1.22	1.26	1.30	.35	1.34	1.38	[illegible]	1.46	1.50	1.54	1.59	1.63	1.67	1.72	.35
.76	[illegible]	.82	.85	[illegible]	.91	.94	.97	.36	1.00	1.04	1.07	[illegible]	1.14	[illegible]	1.22	1.25	1.29	1.33	.36	1.37	1.41	1.46	1.50	1.54	1.58	1.63	1.69	1.72	1.76	.36
.77	.80	.83	.86	.89	.93	[illegible]	.99	.37	[illegible]	1.06	1.10	1.13	1.17	1.21	1.24	1.28	1.31	1.35	.37	1.39	1.44	1.48	1.53	1.57	1.62	1.66	1.71	1.76	1.80	.37
[illegible]	.82	.85	.89	.91	.95	.98	1.01	.38	1.05	1.09	1.12	1.16	1.20	1.24	1.27	1.31	1.34	1.38	.38	1.43	1.47	1.52	1.56	1.61	1.66	1.71	1.76	1.80	1.85	.38
[illegible]	.84	.87	.90	[illegible]	[illegible]	[illegible]	1.04	.39	[illegible]	1.11	1.15	1.19	1.22	1.26	[illegible]	1.34	1.38	1.42	.39	1.46	1.51	1.55	1.60	1.64	1.69	1.74	[illegible]	1.84	1.89	.39
[illegible]	[illegible]	.89	.92	.96	[illegible]	1.03	[illegible]	.40	1.10	1.14	1.17	1.21	1.25	1.29	1.33	1.37	1.41	1.45	.40	1.50	1.54	1.59	1.63	1.68	1.73	1.78	1.83	1.88	1.93	.40
[illegible]	.88	.91	.95	.98	1.02	1.05	1.09	.41	1.13	1.17	1.20	1.24	1.28	1.32	1.36	[illegible]	1.44	1.48	.41	1.52	1.57	1.62	1.67	1.72	1.77	1.82	1.87	1.92	1.98	.41
.86	[illegible]	.93	.97	1.00	[illegible]	1.07	1.11	.42	[illegible]	1.19	1.23	1.27	1.31	1.35	1.39	1.43	1.47	1.51	.42	1.56	1.61	1.65	1.70	1.75	1.81	1.87	1.92	1.97	2.03	.42
[illegible]	.92	.95	.99	1.02	1.06	1.09	1.13	.43	1.17	[illegible]	1.26	1.30	1.34	1.38	1.42	1.47	1.52		.43	1.60	1.65	1.69	1.74	1.79	1.85	1.91	1.96	2.01	2.07	.43
[illegible]	.94	.97	1.01	1.05	1.09	1.12	1.16	.44	[illegible]	1.24	1.28	[illegible]	1.36	1.40	1.45	1.49	1.54	1.58	.44	1.63	1.67	1.71	1.76	1.83	1.89	[illegible]	2.04	2.08	2.11	.44
[illegible]	.96	.99	1.03	1.07	1.11	1.14	1.18	.45	[illegible]	1.26	1.31	1.35	1.39	1.44	1.48	[illegible]		1.62	.45	1.67	1.72	1.77	1.82	[illegible]	1.93	1.99	2.04	2.10	[illegible]	.45
[illegible]	.97	1.01	1.05	1.09	1.13	1.17	[illegible]	.46	1.25	1.29	1.34	1.38	1.42	1.47	1.51	1.56		1.65	.46	[illegible]		1.81	1.86	1.91	[illegible]	2.03	2.08	2.13	2.19	.46
[illegible]	.99	1.03	1.07	1.11	1.15	1.19	1.23	.47	[illegible]	[illegible]	[illegible]	1.41	1.45	[illegible]	[illegible]	1.59	1.64	1.69	.47	1.74	1.79	1.85	1.90	1.95	[illegible]	2.07	2.12	[illegible]	2.24	.47
.98	1.01	1.05	1.09	1.13	1.18	1.22	1.26	.48	1.31	1.35	1.40	1.45	1.49	1.54	[illegible]	1.63	1.67	1.72	.48	1.77	1.83	1.88	1.94	1.99	2.06	2.13	2.17	2.23	2.29	.48
1.01	1.04	1.08	1.12	1.16	1.20	[illegible]	[illegible]	.49	1.33	1.37	1.42	1.47	1.51	1.56	1.61	[illegible]	1.70	1.75	.49	1.81	1.86	1.92	1.97	2.03	2.09	2.16	2.21	2.27	[illegible]	.49
1.03	1.06	[illegible]	1.14	1.18	1.23	[illegible]	1.31	.50	1.36	[illegible]	1.45	1.50	[illegible]	1.59	1.64	1.69	1.74	1.79	.50	1.85	1.90	1.96	2.01	2.07	2.13	2.19	2.26	[illegible]	2.39	.50
1.05	1.08	1.12	1.16	1.21	[illegible]	[illegible]	1.34	.51	1.39	1.43	1.48	1.53	1.57	1.62	[illegible]	1.72	1.78	1.83	.51	1.89	1.94	[illegible]	2.05	2.11	[illegible]	2.24	2.30	2.37	2.43	.51
1.06	[illegible]	1.14	1.18	[illegible]	1.27	[illegible]	1.36	.52	1.41	1.46	[illegible]	1.55	[illegible]	1.65	1.70	[illegible]	1.81	1.86	.52	1.92	1.98	2.03	2.09	2.15	2.22	2.29	2.35	[illegible]	2.48	.52
1.08	1.12	1.16	1.21	[illegible]	1.30	[illegible]	1.39	.53	1.44	1.49	[illegible]	1.58	[illegible]	1.68	1.74	[illegible]	1.85	[illegible]	.53	1.96	2.02	[illegible]	2.13	2.19	2.26	2.33	2.40	2.47	2.53	.53
1.10	1.15	1.19	1.23	[illegible]	1.32	1.37	1.41	.54	1.46	[illegible]	[illegible]	1.62	1.67	1.72	[illegible]	1.83	1.88	1.94	.54	2.00	2.06	2.12	2.18	2.24	2.31	2.38	[illegible]	[illegible]	[illegible]	.54
1.12	1.17	1.21	1.26	1.30	1.35	[illegible]	1.44	.55	[illegible]	1.54	1.60	1.65	1.70	1.75	1.81	1.87	1.93	1.98	.55	2.04	2.10	2.16	2.22	2.28	2.35	2.42	2.49	[illegible]	2.63	.55
1.15	1.19	1.24	1.29	[illegible]	1.38	1.42	1.47	.56	[illegible]	1.57	1.63	1.68	1.73	1.79	[illegible]	1.91	[illegible]	2.02	.56	2.08	2.14	2.21	2.27	2.33	2.40	2.47	2.54	2.61	2.68	.56
1.17	1.21	1.26	1.31	1.35	1.40	1.44	[illegible]	.57	[illegible]	1.60	1.65	1.71	1.76	1.82	1.88	[illegible]	1.99	[illegible]	.57	2.11	[illegible]	2.24	[illegible]	2.37	2.44	2.51	2.58	[illegible]	[illegible]	.57
1.19	1.23	1.28	1.33	1.38	1.42	1.47	[illegible]	.58	1.58	1.63	1.69	1.74	1.80	[illegible]	[illegible]	1.98	[illegible]	2.09	.58	2.16	2.22	2.29	2.36	2.42	2.49	2.56	[illegible]	2.70	2.77	.58
1.21	1.26	1.31	1.36	1.41	1.45	1.50	1.55	.59	1.61	[illegible]	1.72	1.77	1.83	1.89	[illegible]	2.01	2.07	2.13	.59	2.20	2.26	2.33	2.40	2.46	2.53	2.60	2.67	2.74	2.81	.39
1.23	[illegible]	1.33	1.38	1.43	1.48	[illegible]	1.58	.60	[illegible]	1.70	1.86	1.81	1.87		1.99	[illegible]	2.11	2.17	.60	2.24	2.30	2.37	2.44	[illegible]	2.57	2.65	2.73	2.80	2.88	.60
[illegible]	1.30	1.35	1.40	1.45	1.51	1.56	1.61	.61	1.67	[illegible]	1.78	[illegible]	[illegible]	1.96	2.02	2.09	2.15	2.21	.61	[illegible]	[illegible]	2.42	2.49	2.55	[illegible]	2.69	[illegible]	2.83	2.91	.61
1.27	1.32	1.37	1.42	1.48	1.53	[illegible]	1.64	.62	[illegible]	1.76	[illegible]	[illegible]	1.94	[illegible]	2.06	2.11	2.17	2.25	.62	[illegible]	[illegible]	2.46	2.53	2.59	2.66	2.73	[illegible]	2.87	2.94	.62
[illegible]	1.35	1.40	1.45	1.51	1.56	1.62	[illegible]	.63	[illegible]	1.79	[illegible]	1.91	[illegible]	[illegible]	2.09	2.16	2.22	2.29	.63	[illegible]	[illegible]	2.50	[illegible]	2.64	[illegible]	[illegible]	[illegible]	2.93	3.01	.63
1.32	1.37	1.42	1.48	1.53	1.59	1.64	1.70	.64	1.76	[illegible]	1.89	1.95	2.01	2.07	2.14	2.20	2.27	2.33	.64	[illegible]	[illegible]	[illegible]	2.62	2.69	2.77	[illegible]	2.93	3.01	[illegible]	.64
1.35	1.40	1.45	1.51	1.56	1.62	1.67	[illegible]	.65	1.79	1.85	1.92	1.97	[illegible]	2.11	[illegible]	2.23	2.29	2.37	.65	[illegible]	[illegible]	2.61	[illegible]	[illegible]	[illegible]	2.90	2.98	3.06	3.15	.65
[illegible]	1.42	1.47	1.53	[illegible]	1.64	1.70	[illegible]	.66	[illegible]	[illegible]	1.95	[illegible]	[illegible]	2.15	2.21	2.28	2.34	2.41	.66	[illegible]	2.57	2.64	[illegible]	[illegible]	2.87	2.95	3.03	3.11	[illegible]	.66
1.39	1.44	1.50	1.56	1.62	1.67	1.73	1.79	.67	1.85	[illegible]	1.98	[illegible]	[illegible]	2.18		2.31	2.38	2.45	.67	2.53	2.61	[illegible]	[illegible]	[illegible]	2.93	3.01	3.10	[illegible]	3.26	.67
1.42	1.47	1.53	1.59	1.65	1.70	1.76	1.82	.68	[illegible]	[illegible]	2.01	[illegible]	2.15	2.22	2.28	[illegible]	[illegible]	2.49	.68	2.57	[illegible]	[illegible]	[illegible]	[illegible]	2.98	3.06	[illegible]	3.24	[illegible]	.68
1.44	1.50	1.55	1.61	1.67	1.73	1.79	1.85	.69	[illegible]	1.98	[illegible]	2.11	[illegible]	2.25	[illegible]	[illegible]	[illegible]	2.54	.69	[illegible]	[illegible]	[illegible]	[illegible]	2.96	3.04	3.12	3.20	3.29	3.38	.69
1.47	1.52	1.58	1.64	1.70	1.76	1.82	1.88	.70	1.95	2.01	2.08	2.14	2.22	2.29	2.36	2.44	2.51	[illegible]	.70	[illegible]	2.74	[illegible]	[illegible]	[illegible]	[illegible]	3.17	3.26	[illegible]	3.43	.70

TABLE II.—BALLAST TABLE, SHOWING CU. YDS. PER 1

	.30	.31	.32	.33	.34	.35
.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
.31		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
.32			[illegible]	[illegible]	[illegible]	[illegible]
.33				19.38	19.59	19.80
.34					19.80	20.01
[illegible]						[illegible]

	.36	.37	.38	.39	.40
.30	19.39	19.60	19.82	20.03	20.24
.31	19.60	19.81	20.03	20.24	[illegible]
.32	[illegible]	[illegible]	20.24	20.45	[illegible]
.33	20.01	20.22	20.44	20.65	20.86
.34	[illegible]	20.43	20.65	20.86	21.07
.35	[illegible]	[illegible]	20.86	21.07	21.28
.36	[illegible]	20.85	21.07	21.28	21.49
.37		[illegible]	21.28	21.49	21.70
.38			21.50	21.71	21.92
.39				[illegible]	22.13
.40					22.38

	.41	.42	.43	.44	.45
.30	20.46	20.67	20.89	21.10	21.32
.31	20.67	20.88	21.10	21.31	21.53
.32	[illegible]	21.09	21.31	21.52	21.74
.33	21.08	21.29	21.51	21.72	21.94
.34	21.29	21.50	21.72	21.93	22.15
.35	21.50	21.71	21.93	22.14	22.36
.36	21.71	21.92	22.14	22.35	[illegible]
.37	21.92	22.13	22.35	22.56	22.78
.38	22.14	22.35	22.57	22.78	23.00
.39	22.35	22.56	22.78	22.99	[illegible]
.40	22.57	22.78	23.00	23.21	23.43
.41	22.79	23.00	23.22	23.43	23.65
.42		23.21	23.43	23.64	23.86
.43			23.65	23.86	[illegible]
.44				24.07	24.29
.45					24.51

	.46	.47	.48	.49	.5
.30	21.54	21.76	21.98	22.	22.4
.31	21.75	21.97	22.19	22	
.32	21.96	22.18	[illegible]	22	
.33	22.16	22.38	22.60	22	
.34	22.37	22.59	22.81	23	
.35	22.58	22.80	23.02	23.	
.36	22.79	23.01	23.23	23	23.6
.37	23.00	23.22	23.44	23	
.38	23.22	23.44	23.66	23	
.39	23.43	23.65	23.87	24	
.40	23.65	23.87	24.09	24.	
.41	23.87	24.09	24.31	24.	
.42	24.08	24.30	24.52	24.	
.43	24.30	24.52	24.74	2	
.44	24.51	24.73	24.95	2	
.45	24.73	24.95	25.17	2	
.46	24.95	25.17	25.39	2	
.47		25.39	25.61	25.	
.48			25.83	26	
.49				26	
.5					

[illegible] and would considerably increase the amount [illegible] As there are thousands of miles of earth ballasted track still remaining to be ballasted in the south and west, it would probably pay some implement manufacturer to place such a tool on the market.

[illegible] selected ballast was distributed for track raising by two different methods, depending on the equipment used. Some of it was side dumped from Hart convertible cars by means of Lidgerwood rapid unloaders and center plows. The other method employed Rodger center dump cars and the ballast was spread by Rodger plow cars. When ballast was unloaded, the following general method of track raising was employed, some minor variations from it being used by different foremen: A sight board or "spot board," painted white with a black stripe running parallel to its sides, was placed level across the track about 300 or 400 ft. ahead of the gang. One end of the sight board was supported on the top of a ballast stake (ballast stakes had been previously set by the railway company engineers to the proposed height of top of rail) and the other end rested on top of a stake driven by the sight board man to the same height as the ballast stake. Level bubbles placed at either end on top of the sight board made this easy to do. One man was kept busy attending to the spot board and cleaning out ballast from between the ties near the rail joints to provide level, firm bearing places for the track jacks on the subgrade. Either two or four track jacks were used for raising track, depending on condition of track, size of gang, and other conditions of the work. Faster work can be done with four jacks if the gang is large enough and it is easier on the jackmen. Each jack was handled by two men, who carried it, placed it, and raised and lowered it. Two more men for each jack in use stayed with the jacks to tamp up one or more ties at joints and centers to hold track. After such ties were tamped up they were given two or three blows with a heavy sledge to settle them down to hold a uniform surface needed both for surfacing in the remaining ties and to avoid sags and humps in the work. Extreme settlement under the first train passing over the work was also thereby avoided. Jacks were used on the outside of the rails, as is customary for safety to trains. Foremen in charge of the track raising part of the gang generally used two short sighting blocks (whose height corresponded to the height of the black stripe on the sight board above the lower edge of the sight board), one placed on top of the rail at the joint being raised and the other on top of the rail at the last joint raised. By sighting over the latter block towards the sight board the raising of the joint at the jacks was properly stopped when the top of the block on that joint was in line between the top of the block on the finished joint and the black stripe on the sight board. Some foremen did not use the sight blocks, but lined the top of the joint being raised by sighting from the top of a finished joint towards the bottom of the sight board. In all cases the sight board was provided with settlement blocks nailed under its lower edge to rest on the top of the ballast stake and the opposite support across the track. This provided for settlement of the track under traffic leaving the top of rails level with the top of ballast stakes. From 1 in. to 2 ins. was found necessary for height of settlement blocks, depending on the condition of ballast, weather, subgrade, etc. Only one rail was raised to proper surface by means of the sight board, usually the right hand rail, looking ahead; except on curves, where the low rail was raised first. Ballast stakes were set as usual for low rail. The other rail was raised to level or to proper super elevation by means of the usual level board with notches in one end for outer rail on curves. All joints were surfaced up by sighting at the sight board. Centers and quarters were raised by eye.

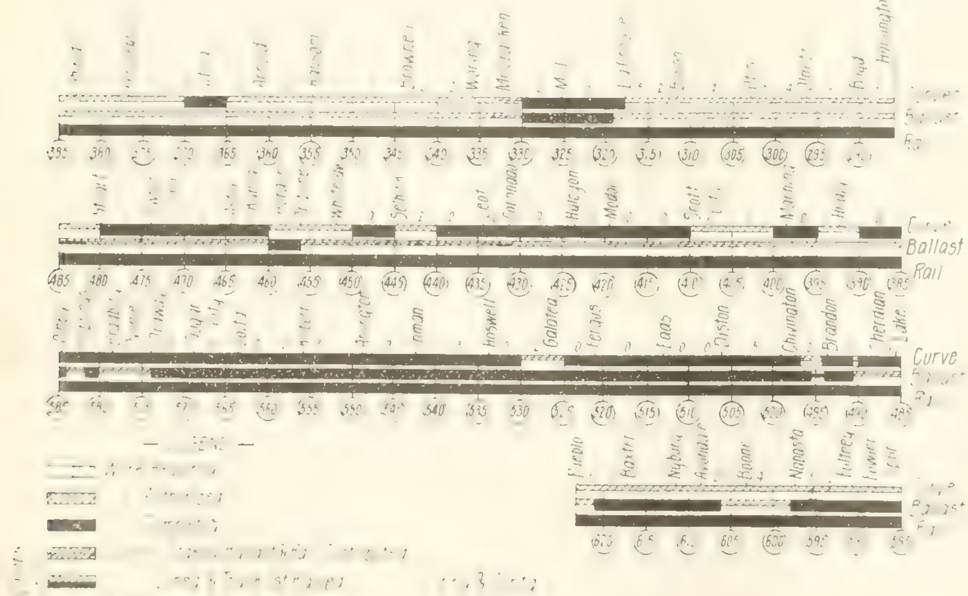


Fig. 3.

On this work where tie renewals were being taken care of along with the ballasting four men followed the jacks pulling spik claw bars from all ties marked wit spots on the rail over them, and fi other ties condemned by the ballast ins who spent much of their time on this of the work. From six to ten men were to take out bad ties for each ballastin depending on their frequency in the From six to twelve men in each gan needed to put in new ties, which so had to be carried 200 or 300 ft. when th been poorly distributed or where an un ed large number of additional bad tie condemned by ballast inspectors. Ma that appeared to be good enough for year's service when inspected before tra raised, afterwards showed up to be i bad condition underneath or broken un rails, due to rail cutting or spike Where the number of such ties was lar ties often had to be trucked on pu from places where too many had be tributed; also a second distribution was times necessary. When possible the bal spectors went over their respective and counted the number of new ties between the successive telegraph poles fifth pole having the number of the pr mile post printed on it and also the nu that pole, counting from the precedi post. This information was furnished road master for distribution purpose the ties in the track were respaced befo were tamped up. This was done by tw pounding on the same side of the ti man standing outside of each rail. mauls or sledges were used. Spike should not be used, as they split up t too much. Not less than two men an four or six men were needed for the spacing. Red or yellow lumber cray used to mark the proper spacing of the the outer edge of one rail head. Tie squared across the track by eye. Th souri Pacific system uses suspended rai placed "square" on long tangents and "l on curves and short tangents under 1,0 length. The tie space marks were pla the rail by the ballast inspector or an as by means of a long narrow wooden s gage on which the proper spacing was or marked with crayon. The gage w one-half as long as the rails, viz., eithe for use with 30 ft. rails or 16½ ft. with 33 ft. rails. Each inspector was pr with one or more gages for use with ea of rail length. With the gage laid on the right hand rail and the rear en joint, the person using the gage walke between the rails and marked the space on the head of the rail opposite the ma the gage. The gage was then pushed the rail until the rear end was oppos point where the front end had previous (which point was marked on top of th and the space marks were placed on t half of the rail. This operation was co all along the track, one mile being ge kept marked ahead of the gang. The faded or got rubbed off by the bal placed too far in advance of the gan short lengths of rail and where broken occurred some ingenuity was required portioning the distance between the

RAISE OF [illegible] TO 0.7 FT., IN SECTION SHOWN [illegible]

.52	.53	.54	.55		.56	.57	.58	.59	[illegible]		[illegible]	[illegible]	.63	.64	.65		.66	.67	.68	.69	.70
[illegible]	23.09	23.32	23.54	.30	[illegible]	24.00	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	25.28	[illegible]	25.84	.30	26.08	26.31	26.54	26.78	27.02
23.08	23.30	23.53	23.75	.31	23.98	24.21	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	25.59	25.82	26.05	.31	26.29	26.52	26.75	26.99	27.23
[illegible]	23.51	23.74	23.96	.32	24.14	24.42	24.64	[illegible]	[illegible]		[illegible]	[illegible]	25.80	[illegible]	26.26	.32	26.50	26.73	26.96	27.20	27.44
[illegible]	23.71	23.94	24.16	.33	[illegible]	24.62	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	26.00	26.23	26.46	.33	26.70	26.93	27.16	27.40	27.64
[illegible]	23.92	24.15	24.37	.34	24.60	24.83	25.05	[illegible]	[illegible]		[illegible]	[illegible]	26.21	26.44	26.67	.34	26.91	27.14	27.37	27.61	27.85
23.91	24.13	24.36	24.58	.35	24.81	25.04	25.26	[illegible]	[illegible]		[illegible]	[illegible]	26.42	26.65	26.88	.35	27.12	27.35	27.59	27.82	28.06
24.12	24.34	24.57	24.79	.36	25.02	25.25	25.47	25.70	[illegible]		[illegible]	[illegible]	26.63	26.86	27.09	.36	27.33	27.56	27.80	28.03	28.27
[illegible]	24.55	24.78	25.00	.37	25.23	25.46	25.68	25.91	[illegible]		[illegible]	[illegible]	26.84	27.07	[illegible]	.37	27.54	27.77	28.01	28.14	28.48
[illegible]	24.77	25.00	25.22	.38	25.45	25.68	25.90	26.13	[illegible]		[illegible]	[illegible]	27.06	27.29	27.52	.38	27.76	27.99	28.23	28.46	28.70
24.76	24.98	25.21	[illegible]	.39	[illegible]	25.89	26.11	26.34	[illegible]	[illegible]	[illegible]	[illegible]	27.27	27.50	27.73	.39	27.97	28.20	28.44	28.67	[illegible]
[illegible]	25.20	25.43	25.65	.40	25.88	26.11	26.33	[illegible]	[illegible]		[illegible]	27.25	27.49	[illegible]	27.95	.40	28.19	28.42	28.66	28.89	29.13
25.20	25.42	25.65	25.87	.41	[illegible]	26.33	26.55	26.78	27.01	.41	[illegible]	[illegible]	27.71	27.94	28.17	.41	28.41	28.64	28.88	29.11	29.35
25.41	25.63	[illegible]	[illegible]	.42	26.31	26.54	26.76	26.99	[illegible]	.42	[illegible]	27.68	27.92	28.15	28.38	.42	28.62	28.85	29.09	29.32	29.56
[illegible]	25.85	26.08	26.30	.43	[illegible]	26.76	26.98	27.21	[illegible]	.43	[illegible]	[illegible]	28.14	28.37	28.60	.43	28.84	29.07	29.31	[illegible]	29.78
[illegible]	26.06	26.29	26.51	.44	26.74	26.97	27.19	27.42	[illegible]		[illegible]	28.11	28.35	28.58	28.81	[illegible]	29.05	29.28	29.52	29.75	29.99
[illegible]	26.28	26.51	26.73	.45	26.96	27.19	27.41	27.64	[illegible]		[illegible]	28.33	28.57	28.80	29.03	.45	29.27	29.50	29.74	29.97	30.21
[illegible]	26.50	26.73	26.95	.46	27.18	27.41	27.63	27.86	[illegible]		[illegible]	28.55	28.79	29.02	29.25	.46	29.49	29.72	29.96	30.19	30.43
[illegible]	26.72	26.95	27.17	.47	[illegible]	27.63	27.85	[illegible]	28.31	.47	[illegible]	28.77	29.01	29.24	29.47	.47	29.71	29.94	30.18	30.41	30.65
[illegible]	26.94	27.17	27.39	.48	27.62	27.85	[illegible]	28.30	28.53	.48	28.76	[illegible]	29.23	29.46	29.69	.48	29.93	30.16	30.40	30.63	30.87
[illegible]	27.16	27.39	27.61	.49	27.84	28.07	28.29	28.52	28.75		[illegible]	29.21	29.45	29.68	29.91	.49	30.15	[illegible]	30.62	30.85	31.09
27.17	27.39	27.62	27.84	.50	[illegible]	28.30	28.52	28.75	28.98	.50	[illegible]	29.44	29.68	29.91	30.14	.50	30.38	30.61	30.85	31.08	31.32
[illegible]	27.61	27.84	28.06	.51	[illegible]	28.52	28.74	28.97	29.20	.51	29.43	29.66	29.90	30.13	30.36	.51	30.60	30.83	31.07	31.30	31.54
[illegible]	[illegible]	28.06	28.29	.52	28.52	28.75	28.97	29.20	29.43	.52	[illegible]	29.89	30.13	30.36	30.59	.52	30.83	31.06	31.30	31.53	31.77
.53	28.06	28.29	28.51	.53	28.74	28.97	29.19	29.42	29.65	.53	29.88	30.11	[illegible]	30.58	30.81	.53	31.05	31.28	31.52	31.75	31.99
	.54	[illegible]	28.74	.54	28.97	29.20	29.42	29.65	29.88	.54	30.11	30.34	30.58	30.81	31.04	.54	31.28	31.51	31.75	31.98	32.22
		.55	28.96	.55	29.19	29.42	29.64	29.87	30.10		[illegible]	30.56	30.80	[illegible]	31.26	.55	31.50	31.73	31.97	32.20	32.43
				.56	29.42	29.65	29.87	30.10	30.33		30.56	30.79	31.03	31.26	31.49	.56	31.73	31.96	32.20	32.43	32.66
					.57	29.88	30.10	30.33	30.56		[illegible]	31.02	31.26	31.49	31.72	.57	[illegible]	32.19	32.43	32.66	32.89
						.58	30.32	[illegible]	30.78	.58	31.01	31.24	[illegible]	31.71	31.94	.58	32.18	32.41	32.65	32.88	33.11
							.59	30.78	31.01	.59	31.24	31.47	31.71	31.94	32.17	.59	32.41	32.64	32.88	33.11	33.34
								.60	31.24	.60	31.47	31.70	31.94	32.17	32.40	.60	32.64	32.87	33.11	33.34	33.51
										.61	31.70	31.93	32.17	32.40	32.63	.61	32.87	33.10	33.34	33.57	33.80
											.62	32.16	32.40	32.63	32.86	.62	33.10	33.33	33.57	[illegible]	34.03
												.63	32.64	32.87	33.10	.63	33.34	33.57	33.81	31.04	34.27
													.64	33.10	33.33	.64	33.57	33.80	34.04	34.27	34.50
														.65	33.56	.65	33.80	34.03	34.27	34.50	34.73
																.66	34.04	34.27	34.51	34.74	34.97
																	.67	34.50	34.74	[illegible]	35.20
																		.68	[illegible]	35.21	35.44
																			.69	[illegible]	35.67
																				.70	35.90

these cases had to be reduced from the standard spacing in ke the tie spacing fit in properly. ties in the track care was taken ends of the ties on the right the track when facing St. Louis. ack the ends of the ties nearest to s of the road bed were lined and laced between the tracks, which appearance to the tracks. The ties was placed down, thus in- life to the ties. New ties were soon as they were placed in the hey came at joints or where sev- e put in in succession, in which re spiked for safety and to hold lar spiking gang of four to eight the tamping gang spiking the ew ties. Old ties taken out of re given to ranchmen who had h the railway company to re- ties in payment for plowing the guards just outside of the right

nts of the ties outside the rails were ed up with shovels, and an equal side of and next to the rails was The space in the middle of the tie s left untamped to prevent center the track. About twenty men un- -foreman were employed in tamping ving gravel into the track if side One man kept busy with each gang ter tools. He was usually provided ush car which carried the water l all surplus tools. Any men work- assisted him in lifting the car off of when trains had to pass. One or were needed all the time to carry m the supply barrel to the gang, erally was spread out along a con- stretch of track. Summing up the posing a large ballast gang would be as follows:

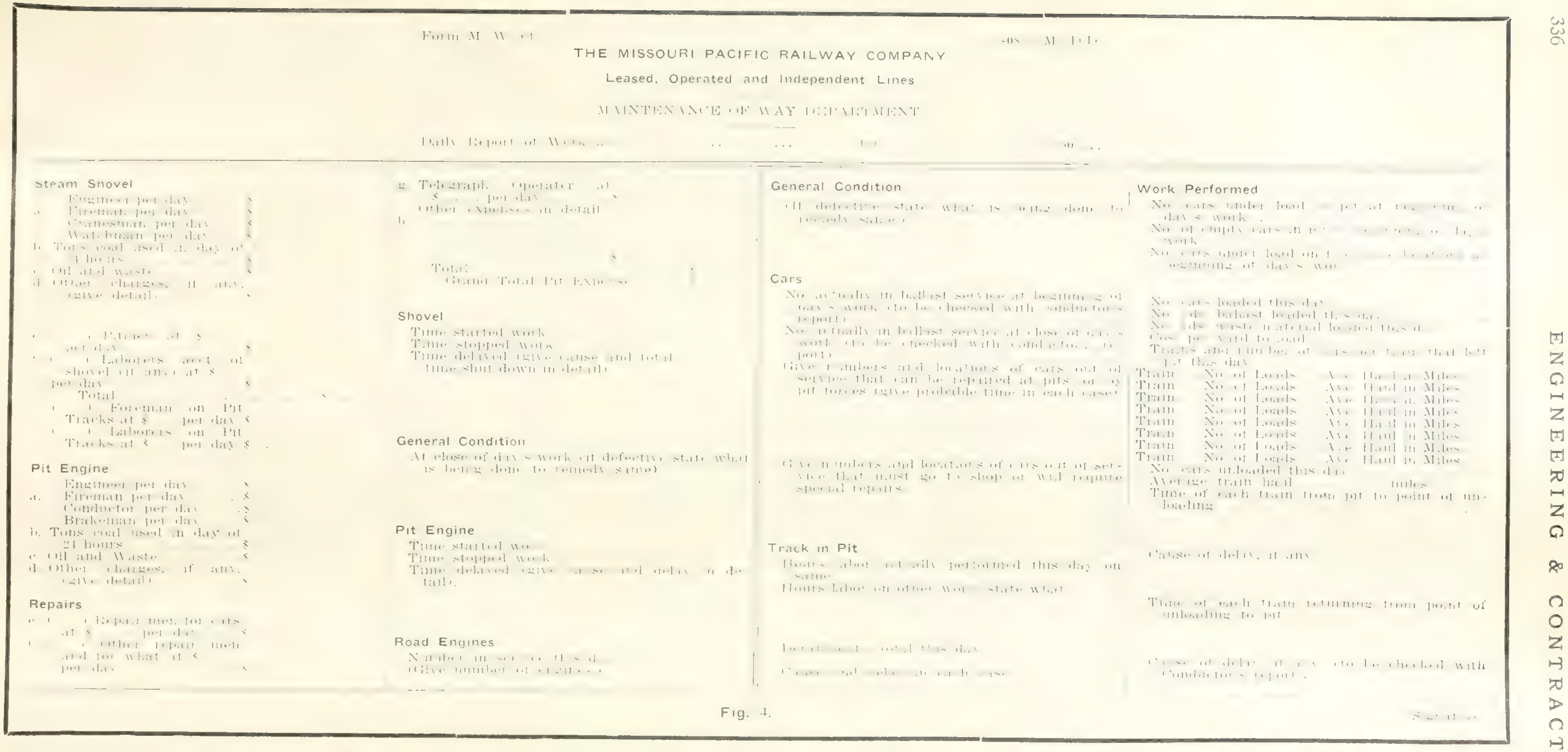
foreman.
for raising track
for tamping and putting in [illegible]
n.
nen.
an.
oard man.
[illegible]
rs with jacks for joint ties.
rs putting ties in track.
rs spacing ties.
s spiking ties.
rs tamping ties and handling ballast.
per and commissary clerk.
and helpers in boarding cars.

fifteen minutes' time was needed be- arrival of each passenger train to a proper runoff from raised track unraised track. Work on runoffs was started for freight trains until they se up to the work, which frequently n for five to ten minutes. Of course was protected by flagmen in both di- also with slow orders and slow nd lanterns placed at each end of the work. As soon as track was raised on a few miles of the line engineers set center stakes along that portion of the work and the opportunity was taken to rerun all curves carefully and put spiral or easement curves at the ends of each curve of 2° or over. Talbot's "Railway Transition Spiral" is the standard spiral curve in use on the Missouri Pacific system.

Where the center stakes called for track to be thrown more than 12 ins. the contractor was paid cost of throwing all additional distance over 12 ins. After track was lined to center stakes ballast was center dumped for dressing

TABLE III.—FINAL ESTIMATE, BALLAST APPLIED, M. P. 491 PLUS 10 TO M. P. 560. COLORADO DIVISION, MISSOURI PACIFIC RY.

M. P.	to M. P.	[illegible] 6-in. raise.	Prisms.	Over 6-in. raise.	Sws.	Total.	Bridges.	Final total.
491-10	492	948.56	46.23	4.50	0.00	999.29	0.00	999.29
492	493	1412.42	20.10	33.62	0.00	1470.14	0.00	1470.14
493	494	1411.88	67.50	47.33	40.00	1566.71	14.94	1551.77
494	494-1	48.10	5.60	.22	0.00	53.92	0.00	53.92
[illegible]	497	1059.45	6.46	7.18	0.00	[illegible]	0.00	1073.09
497	498	1193.85	11.28	15.44	0.00	1220.57	0.00	1220.57
498	[illegible]	1393.45	6.00	27.48	0.00	1426.93	0.00	1426.93
499	499-21	895.12	13.92	38.78	0.00	947.82	0.00	947.82
507-28	508	96.19	2.17	.45	0.00	98.81	0.00	98.81
508	[illegible]	1428.18	61.86	3.36	0.00	1496.40	0.00	1496.40
509	510	1396.92	71.90	11.41	0.00	1470.23	0.00	1470.23
510	511	1380.89	88.59	0.00	0.00	1469.48	4.00	1465.48
511	512	1384.10	70.77	15.07	0.00	1469.94	0.00	1469.94
512	513	1431.12	34.90	20.36	40.00	1526.38	10.96	1515.42
513	514	1434.06	5.66	10.83	40.00	1490.55	0.00	1490.55
514	515	1367.53	50.39	9.39	0.00	1427.31	0.00	1427.31
515	516	1411.08	14.11	22.48	0.00	1447.67	0.00	1447.67
516	517	1404.94	17.91	17.70	0.00	1440.55	3.74	1136.81
517	518	1396.92	84.10	14.58	0.00	1495.60	3.74	1491.86
518	519	1494.10	85.46	33.53	0.00	1603.09	3.74	1499.35
519	519-10	454.16	34.07	[illegible]	0.00	503.09	0.00	503.09
519-10	520	983.30	21.03	19.05	0.00	1023.38	7.38	1016.00
520	521	1403.00	46.28	38.18	0.00	1487.46	11.76	1475.70
521	522	1403.20	23.38	43.81	[illegible]	1470.39	11.76	1458.63
522	523	1405.40	83.61	50.74	0.00	1539.75	0.00	1539.75
523	524	1411.30	[illegible]	39.15	0.00	1537.67	0.00	1537.57
524	525	1407.20	77.80	17.15	0.00	1502.50	0.00	1502.50
525	526	1412.25	37.95	37.30	0.00	1487.50	0.00	1487.50
526	527	1403.50	32.92	82.12	0.00	1518.54	0.00	1518.54
527	528	1405.40	31.25	117.08	0.00	1607.73	0.00	1607.73
528	529	1430.90	49.22	58.90	0.00	1539.02	0.00	[illegible]
529	530	1399.20	41.10	77.52	0.00	1517.82	[illegible]	1570.82
530	531	1399.59	21.49	47.80	20.00	1488.88	0.00	1488.88
531	532	1402.40	12.39	77.72	20.00	1512.51	3.74	1508.77
532	533	1448.40	28.79	49.96	0.00	1527.15	0.00	1527.15
533	534	1406.40	76.91	46.08	0.00	1529.39	0.00	1529.39
534	535	1450.40	43.87	89.98	0.00	1584.25	0.00	1584.25
535	536	1409.40	79.36	55.10	0.00	1543.86	31.17	1512.69
536	537	1419.70	32.59	48.67	0.00	1500.96	32.78	1468.18
537	538	1402.70	62.84	73.25	0.00	1538.79	14.69	1524.10
538	539	1408.80	74.28	31.97	0.00	1515.05	28.40	1486.65
539	540	1409.04	51.23	52.12	0.00	1512.75	7.06	[illegible]
540	541	1397.90	14.46	13.70	0.00	1426.06	8.46	1417.60
541	542	1443.40	70.80	46.03	0.00	1560.23	12.35	1347.88
542	543	1403.80	[illegible]	30.08	40.00	1550.63	4.45	1546.18
543	544	1406.70	66.03	38.42	20.00	1531.15	0.00	1531.15
544	545	1412.20	89.48	[illegible]	20.00	1654.98	8.83	1646.15
545	546	1408.10	17.18	20.88	0.00	1446.16	4.00	1442.16
546	547	1410.20	43.10	0.00	0.00	1453.30	4.01	1449.29
547	548	1410.90	82.99	0.00	0.00	1493.89	23.29	1470.60
548	549	1410.20	33.62	0.00	40.00	1483.82	15.71	1468.11
549	550	1411.30	31.99	0.00	20.00	1463.29	3.07	1460.22
550	551	1410.10	35.52	0.00	0.00	1445.62	22.68	1422.94
551	552	1409.80	53.07	16.81	0.00	1479.68	0.00	1479.68
552	553	1411.30	68.03	59.96	0.00	1539.29	0.00	1539.29
553	554	1410.28	32.05	76.38	40.00	1558.71	0.00	1558.71
554	555	1412.95	33.96	106.46	0.00	1553.37	21.79	1531.58
555	556	1411.30	24.63	65.88	40.00	1541.81	0.00	1541.81
556	557	1397.90	39.49	60.09	0.00	1497.48	36.50	[illegible]
557	558	1412.40	50.48	33.08	0.00	1495.96	0.00	1495.96
558	559	1413.20	41.52	24.11	0.00	1478.93	27.53	1451.40
559	560	1411.50	116.15	71.84	10.00	1599.49	0.00	1599.49
		81869.93	2832.89	2353.59	380.00	67436.77	382.53	87054.24
1	2		4			7	8	[illegible]



Form M. W. [illegible]

THE MISSOURI PACIFIC RAILWAY COMPANY

Leased, Operated and Independent Lines

MAINTENANCE OF WAY DEPARTMENT

Daily Report of Work at ... for ... 19..

Steam Shovel

Engineer per day $
a. Fireman per day $
Cranesman per day $
Watchman per day $
b. Tons coal used in day of 24 hours $
c. Oil and waste $
d. Other charges, if any, (give detail) $

( ) Pitmen at $ per day $
( ) Laborers account of shovel or any at $ per day $
Total
( ) Foreman on Pit Tracks at $ per day $
( ) Laborers on Pit Tracks at $ per day $

Pit Engine

Engineer per day $
a. Fireman per day $
Conductor per day $
Brakeman per day $
b. Tons coal used in day of 24 hours $
c. Oil and Waste $
d. Other charges, if any, (give detail) $

Repairs

e. ( ) Repair men for cars at $ per day $
f. ( ) other repair men and for what at $ per day $

g. Telegraph Operator at $ per day $
Other expenses in detail
h.
$
Total
Grand Total Pit Expense

Shovel

Time started work
Time stopped work
Time delayed (give cause and total time shut down in detail)

General Condition

At close of day's work (if defective state what is being done to remedy same)

Pit Engine

Time started work
Time stopped work
Time delayed (give cause and delay in detail).

Road Engines

Number in service this day
(Give number of engines)

General Condition

(If defective state what is being done to remedy same)

Cars

No. actually in ballast service at beginning of day's work (to be checked with conductor's report)
No. actually in ballast service at close of day's work (to be checked with conductor's report)
Give numbers and locations of cars out of service that can be repaired at pits or by pit forces (give probable time in each case)

Give numbers and locations of cars out of service that must go to shop or will require special repairs

Track in Pit

Hours labor actually performed this day on same
Hours labor on other work state what

[illegible] total this day

[illegible] in each case

Work Performed

No. cars under load in pit at beginning of day's work
No. of empty cars in pit at beginning of day's work
No. cars under load on [illegible] at beginning of day's work

No. cars loaded this day
No. yds. ballast loaded this day
No. yds. waste material loaded this day
Cost per yard to load
Trains and number of cars in each train that left pit this day
Train No. of Loads Ave. Haul in Miles
Train No. of Loads Ave. Haul in Miles
Train No. of Loads Ave. Haul in Miles
Train No. of Loads Ave. Haul in Miles
Train No. of Loads Ave. Haul in Miles
Train No. of Loads Ave. Haul in Miles
Train No. of Loads Ave. Haul in Miles
Train No. of Loads Ave. Haul in Miles
No. cars unloaded this day
Average train haul miles
Time of each train from pit to point of unloading

Cause of delay, if any

Time of each train returning from point of unloading to pit

Cause of delay, if any (to be checked with Conductor's report).

Signature

Fig. 4.

and raising any sags where track i more than provided for when it raised. Generally only part of the g ly the most experienced men, were lining the track, while the remainin the gang either continued the skeleton or fell back behind the lining gang a the dressing up work. After dress track the contractor trucked any

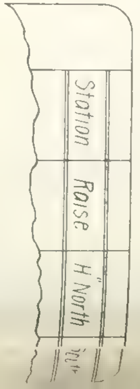


Fig. 5.

last to points where an insufficient am been dumped or placed it at the en ties where specified in the standa cross section "E," Table II.

Considerable trouble was experienc matter of bad expansion of track wh raised and just after raising. Frequ variety of temporary reverse curve sarily made in the track rear a avoid delaying trains after fruitles to get expanded track straight. Be ting work each night, when track off, it was put in good line and sur runoffs, and careful attention was p track in general on newly raised sec work done by the contractor's gangs a according to the instructions of a re

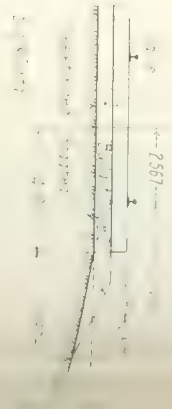


Fig. 6.

gineer for each division and his spectors, assistant engineers, and corps. Most of the duties of the spector have already been mentione dition to careful inspection of work of ties needed, counting of new tie placed in the track by the contrac and looking after the tie space ma had to see that proper slow orders order signals were provided for, ar extra ties, spikes, and ballast, keep a all ballast dumped, prevent improp and clay from being put in the trac that contractor's men did not forg out bad ties that frequently stuck i grade when track was raised. The r ly pulled the spikes out of rotten track was being raised.

Besides their field duties ballast had daily and weekly force and pr

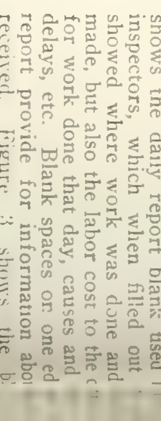


Fig. 7.

ports to make out and mail two copi the resident engineer and one to the assistant engineer at St. Louis. shows the daily report blank used inspectors, which when filled out showed where work was done and made, but also the labor cost to the c for work done that day, causes and delays, etc. Blank spaces on one ed report provide for information abo received. Figure 3 shows the b Weekly Progress Report Blank, w means of a diagram colored accordi scheme explained at the top of t showed the total amount of each work completed during the month. shows the Daily Report Blank ma the principal assistant engineer and sident engineer by ballast inspectors at ballast pits. It showed the amount loaded, empty and loaded cars on pty and loaded trains arriving and and cost of operations at the pit, other desirable information. Figure he Weekly Force Report furnished ncipal assistant engineer by resident It furnished complete report of all the ballast pits. Of course such a

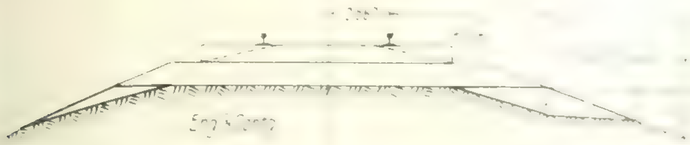


Fig. 8.

sent in to St. Louis for each ballast ation.

ident engineers and their assistants easure and calculate the amount of lied. Payment for ballast unloaded [illegible] was made on a car load measure basis. Payment for ballast applied according to actual measurement tion. Considerable time and much e work was saved in the calcula- olume of ballast applied from the s by means of two tables prepared urpose. Table II was prepared by sident Engineer L. Craine and Table pared by Former Resident Engineer ton. The field notes showed the nt of raise at each 100 ft. station, lifference in height of the track be- after raising, which information was m profiles of the track taken to f 0.01 ft. before and after raising. lifference in height between the sub- the center of the track and the sub- the ballast stakes on one side of the a corresponding difference on the e of the track. These differences n at a distance of 4.50 ft. out from ecause ballast stakes were so set. st two differences were called H H south, and the field notes were the following (Fig. 5) after being p for calculation of volume:

ng to Fig. 1, which shows the method skeletonizing track, it will be seen op of the road bed was made level length of the ties, 8 ft., and then uniformly to the sides for drainage. as prepared for obtaining the volume in a 100 ft. station in the triangular eath a horizontal line drawn through f the 8 ft. level portion of the road table has to be used twice for each ation because H north generally dif- H south. Furthermore the 100-ft. prisms is supposed to extend 50 ft. from the actual stations as marked ad bed by the ballast stakes. This on is made to avoid averaging H station 110 say with H north at sta- and a similar averaging of H south. od used in calculating Table I, or ght be termed its derivation will be t before explaining the way the table

g to Fig. 6 (which shows section [illegible] r track has been raised, omitting di- and details not needed for derivation la used in preparing Table I) for the of the nomenclature used, the follow- e derivation of the formula:

=½ length of tie.

distance from end of tie to stake

Fig. 6:

$x : H :: (1+2R+2x) : 3.067$

$x) \times (3.067) = (1+2R+2x) \times H$

$067x - 2xH = H + 2RH$

$x(3.067 - 2H) = H(1+2R)$

V [illegible]

27

[illegible]

To illustrate how Table I was prepared by use of this last formula for V, assume raise = $R = 0.34$ ft. and assume $H = H = 0.31$ ft., then

$$\frac{1.852 \times .31(1+68)^2}{3.067 - .62} = \frac{1.6187}{[illegible]} \text{ cu. yd.,}$$

as shown in Table I in vertical column under altitude of triangle 0.31, on horizontal line for raise=0.34. This latter illustration also shows how the table, I, is used in obtaining the volume of ballast in a triangular prism of 100 ft. length, average height at $H = 0.31$ ft., where average raise=0.34 ft. The table is used twice for each 100 ft. on account of there being two prisms, one on each side of the track.

Table II is simple to understand and is used to obtain the amount of ballast above the horizontal line drawn through the top of the 8 ft. level portion of the road bed. Table II was prepared from the following calculations:

Size of tie, 6 ins. by 8 ins. by 8 ft. $= 0.50 \times 0.67 \times 8.00 = 2.680$ cu. ft. Subtract 2 ft. by 3 [illegible]

0.754 cu. ft.

[illegible]

1.926 cu. ft. per tie.

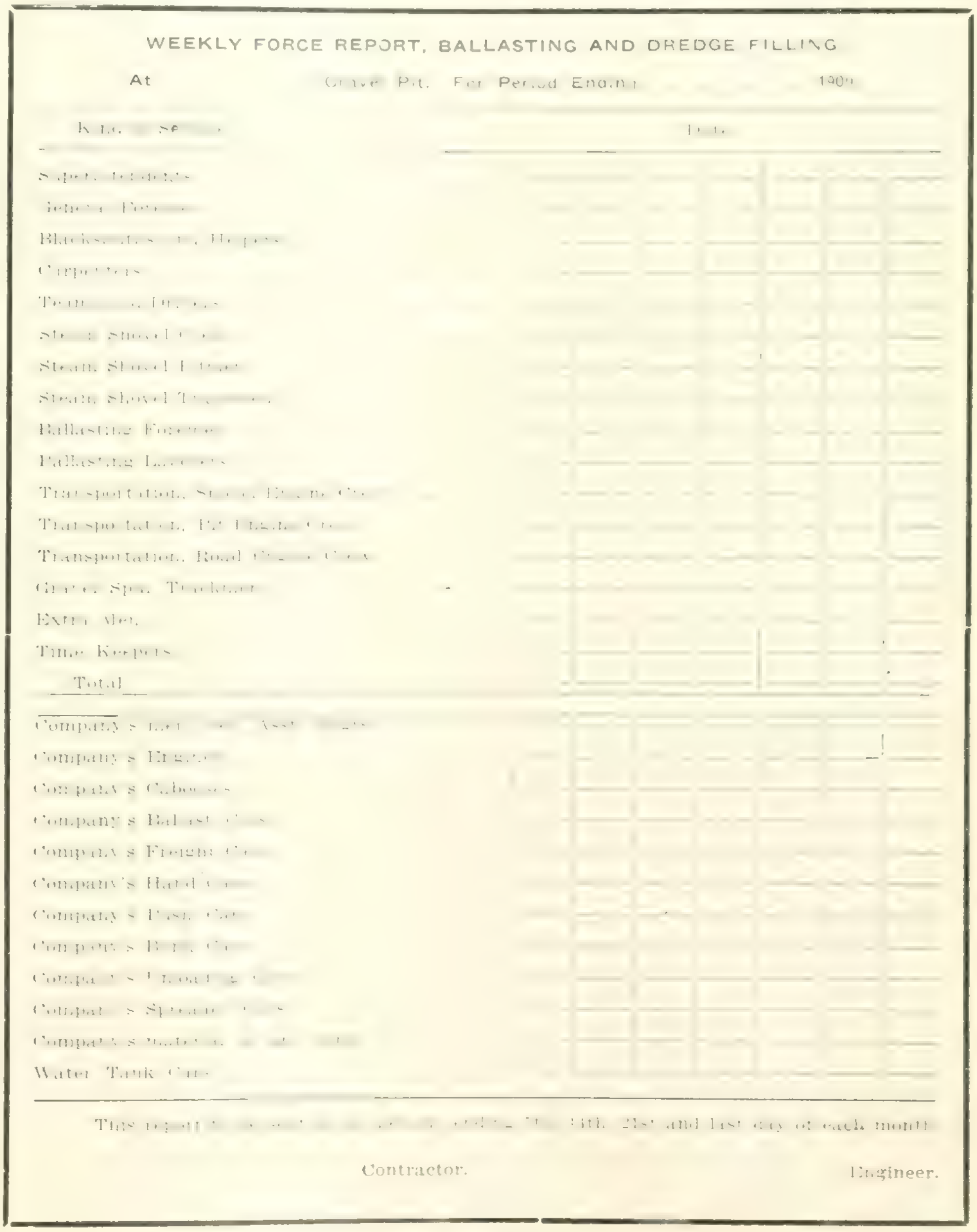
$$\frac{20 \text{ ties}}{33 \text{ ft. rail.}} \times 100 \text{ ft.} = \frac{2000}{33} = 60.6 \text{ ties per 100 ft.}$$

$1.926 \times 60.6 = 116.72$ cu. ft. per 100 ft. displaced by ties.

3 ft. 6 ins. × 6 ins. = 3.5 × 0.5

2 ft. 3 ins. × 6 ins. (2 wedges) = 2.25 × 0.5

5.75 × 0.5 = 2.875 sq. ft. per lin. ft.



WEEKLY FORCE REPORT, BALLASTING AND DREDGE FILLING

At Gravel Pit. For Period Ending 1909

Kind of Service Date

Superintendents

General Foremen

Blacksmiths and Helpers

Carpenters

Team [illegible]

Steam Shovel [illegible]

Steam Shovel [illegible]

Steam Shovel [illegible]

Ballasting Foremen

Ballasting Laborers

Transportation, [illegible] Engine Crew

Transportation, Pit Engine Crew

Transportation, Road Engine Crew

Gravel Spur Trackmen

Extra Men

Time Keepers

Total

Company's [illegible]

Company's Engines

Company's Cabooses

Company's Ballast Cars

Company's Freight Cars

Company's Hand Cars

Company's Push Cars

Company's [illegible] Cars

Company's [illegible]

Company's Spreader Cars

Company's [illegible]

Water Tank Cars

This report [illegible] 14th, 21st and last day of each month

Contractor. Engineer.

Fig. 9.

2.875 × 100 ft. = 287.50 [illegible] Volume above bottom of ties.

287.50—116.72 (displayed by ties) = 170.78 cu. ft. = 6.35 cu. yds. ballast above bottom of ties per 100 ft. station.

The quantities below bottom of ties was obtained by averaging end areas, viz.: Assume 0.40′ raise at one end of a 100-ft. station, and a 60′ ft. raise at the other end of the station, then

$$\frac{(8.00 + 200) + (10.00+0.4\times2\times2) \times 0.40}{2} =$$

4.32 sq. ft., end area below bottom of ties at end of 100′ station, where raise is 0.40 ft.

$$\frac{(8.00 \times 200) + (10.00+0.6\times2\times2) \times 0.60}{2} =$$

6.72 sq. ft., end area below bottom of ties at end of 100-ft. station where raise is 0.60 ft.

$\frac{4.32 + 6.72}{2} \times \frac{100}{27} = 20.44$ cu. yds. 20.44 cu. yds. (below bottom of ties) + 6.35 cu. yds. 35 cu. yds. (above bottom of ties) = 26.79 cu. yds. = total volume ballast in 100-ft. station except in prisms, which would be obtained from Table I. Referring to Table II., looking in vertical column headed 0.60 on horizontal line for 0.40, one reads 26.79 cu. yds., the same amount as calculated above.

Table No. III. shows the final estimate of ballast applied, M.P.491 + 10 Poles + oM.P. 560. The volumes shown in column No. 8 are deducted from the volumes shown in column No. 7 to obtain column No. 9. The final estimate shows that an average amount of 1,404.1 cu. yds. of ballast were applied per mile of track. At 77 cts., this amounts to $1,081.16 per mile cost of ballast under the track. This does not take tie renewals into account, which varied considerably from mile to mile. Ballasting by contract was continued on the Colorado Division of the Missouri Pacific System through the year 1910, and the writer believes is still going on on parts of the Missouri Pacific System.

Estimated Cost of Cable Railways in Chicago.

Although cable railways are no longer built where conditions are such that electric railways can be operated, still there are many cities that have streets so steep that cable railways must be used. Consequently data as to the cost of cable railways are frequently of use to the estimator or appraiser.

Ten years ago there were many miles of cable lines in Chicago, which have since been converted to electric lines. In his Report on the Chicago Transportation Problem, in 1902, Mr. Bion J. Arnold appraised the cable railways of the Chicago City Ry. Co. and of the Chicago Union Traction Co. The following estimates are taken from that report:

The Chicago City Ry. Co. owned 34.75 miles of single cable track, and the cost of reproducing it new was estimated by Mr. Arnold to be as follows per mile of single track:

5,095 lin. ft. straight track at $10.70	$54,516
185 lin. ft. curved track at $35.00	6,475
170 pulley wheels and supports at $5.00	850
Proportion of special track work	[illegible]
Proportion of vault construction	4,500
Moving and reconstructing underground obstructions	[illegible]
Total	[illegible]
[illegible] per cent for engineering, supervision and administration	[illegible]
Grand total (including paving, gates, [illegible])	[illegible]

The total cost of reproduction new was estimated to be as follows:

34.75 miles of track at $86,323	$2,999,726
10,818 HP. of engines in 3 stations (with 5,400 HP. of boilers and all accessories) at $40.00	432,720
Winding machinery, tension carriages, pits, subways, sheaves, etc., at $30 per HP. of engine capacity	[illegible]
Buildings, stack and foundations, at $18 per HP. of engine capacity	194,724
775 cable cars complete	930,000
Cable car grips	20,720
Total, exclusive of real estate	$4,902,430

Due to the fact that this cable line was likely soon to be replaced by an electric line, Mr. Arnold estimated its depreciation at 73.7 per cent, so that its depreciated value was $1,228,972, exclusive of real estate.

The Chicago Union Traction Co. had 36.33 miles of single track cable line whose cost of reproduction was estimated to be the same as that of the Chicago City Ry. ($86,323 per mile), but it also had 11.27 miles of less expensive single track which was estimated to cost as follows per mile:

[illegible] lin. ft. straight track at $9.[illegible]	[illegible]
185 lin. ft. curved track at $25.00	4,625
170 pulley wheels at $5.00	[illegible]
Proportion of special track work	5,000
Proportion of vault construction	3,726
Moving and reconstructing underground obstructions	[illegible]
Total	$67,839
1[illegible] per cent for engineering, supervision and administration	6,784
Grand total (including paving, etc.)	$74,623

The total cost of reproduction new was estimated to be as follows:

36.33 miles cable track at $86,323	$3,136,116
11.27 miles cable track at $74,623	841,003
15,550 HP. of engines in 8 stations (with 8,100 HP. of boilers and all accessories at $40.00	[illegible]
Winding machinery, etc., at $40.80 per HP. of engine capacity	634,000
Buildings, stack and foundations, at $47 per HP. of engine capacity	731,000
Lighting plant	20,000
299 grip cars, including trucks and grips	[illegible]
Trailer cars and other rolling stock	1,153,200
Total, exclusive of real estate	$7,496,120

The depreciation of the cable lines was estimated at 76.7 per cent, so that the depreciated value was only $1,746,749, exclusive of land.

Cost of Repairs to Freight Cars.

The average cost per car mile for actual repairs to freight cars on eleven western railways was 66 cents during the year 1911. The detailed figures, abstracted from an article in *The Railway and Engineering Review,* are shown in the accompanying table. The repair costs do not include renewals and depreciation and are therefore different from those reported to the Interstate Commerce Commission as cost of maintenance.

The average age of freight cars in service in 1911 was 9.9 years; the average life of a car, omitting wrecked cars, is 21.24 years; during its life it is repaired, on an average, once a month; the average repair cost each time is $6.26; during the life of a car its repairs average about $1,600, or twice its original cost.

If the average repairs cost twice the original cost and the life is taken at 21 years, then three times the cost of the car is expended in 21 years or the freight car equipment must be entirely renewed once in seven years.

Year.	Cost of actual repairs. Av. per car.	Av. per car mile.	Av. times each car repaired.	Av. cost per time repaired.
C., B. & Q.—				
1911...	[illegible]	[illegible]	[illegible]	[illegible]
1910...	70.33	0.570	10.6	6.64
1909...	64.85	0.575	10.4	6.21
C. & N. W.—				
1911...	47.90	0.561	13.4	3.62
1910...	42.30	0.511	12.8	3.29
1909...	39.56	0.485	10.7	3.72
C., R. I. & P.—				
1911...	74.77	0.67	17.8	4.20
1910...	75.65	0.67	16.1	4.53
1909...	64.85	0.640	14.7	4.41
Col. & Soc.—				
1911...	67.10	1.10	7.1	9.45
1910...	94.54	1.179	10.2	9.27
1909...	99.93	1.548	7.1	14.16
Gt. N.—				
1911...	40.62	0.507	10.3	3.96
1910...	43.16	0.49	10.3	4.21
1909...	35.97	0.432	4.4	7.65
Wabash—				
1911...	71.44	0.50	18.5	3.86
1910...	65.21	0.517	15.6	4.17
1909...	53.01	0.473	13.7	3.88
C., M. & St. P.—				
1911...	68.22	0.619	9.2	7.40
1910...	61.33	0.576	9.0	7.76
1909...	50.62	0.529	7.3	6.94
N. P.—				
1911...	53.46	0.66	13.8	3.86
1910...	56.60	0.62	11.8	4.78
1909...	41.77	0.460	10.5	5.85
I. C.—				
1911...	91.99	0.907	11.1[illegible]	[illegible]
1910...	134.01	1.417	11.01	[illegible]
1909...	104.71	1.182	10.1	11.65
A., T. & S. F.—				
1911...	61.53	0.574	[illegible]	[illegible]
1910...	81.24	0.669	1[illegible]	[illegible]
1909...	90.72	0.837	13.9	[illegible]
U. P.—				
1911...	....	....	*	[illegible]
1910...	100.83	0.505	*	[illegible]
1909...	102.98	0.552	*	[illegible]
Averages—				
1911...		.6606	†	‡
1910...		.7021	†	‡
1909...		.7011	†	‡

*Figures not given.
†About 12 times per year [illegible]
‡$6.26 each time

Storm King Tunneling Record.—[illegible] tunnel at Storm King, which carries th[illegible] of the Catskill Aqueduct under the Hud[illegible] River, is some 1,100 ft. below water le[illegible] difficulties were encountered which [illegible] work from comparison with spee[illegible] made in other tunnels. Several meth[illegible] employed for carrying out the work, t[illegible] being under contract for a portion of [illegible] and under day labor for the balance. I[illegible] when 200 ft. of the tunnel had been [illegible] contract for the balance of the work [illegible] to the T. A. Gillespie Co. From t[illegible] until Jan. 30, 1912, when the tunnel w[illegible] through over 2,500 ft. of tunnel wer[illegible] from the east shaft or an average [illegible] 360 ft. a month. From the west sh[illegible] ft. were driven at an average of 2[illegible] month. The tunnel is cut in a circula[illegible] 17 ft. in diameter through hard gra[illegible] is now being lined with concrete wh[illegible] leave it 14 ft. 6 ins. in diameter. T[illegible] will be completed in about one year

Gatun Spillway Closed.—No [illegible] now flowing through the spillway [illegible] Dam and the Gatun Lake is slowly ris[illegible] rangements have been made, howe[illegible] means of under sluices at elevation [illegible] to allow a discharge if it should be[illegible] to keep the water from rising ab[illegible] specified level. Since the abandonme[illegible] old main line of the Panama railroad [illegible] villages on it between Gatun and [illegible] no construction work in the Gatun L[illegible] would be interfered with unless th[illegible] should rise to a height of 30 feet a[illegible] level. The surface of Gatun Lake wa[illegible] vation 16.2 feet on Saturday, March [illegible] the height of the Chagres River at B[illegible] 16.2 feet. Under the prevailing d[illegible] flow, the lake is rising at the rate of [illegible] day, with a differential of decrease[illegible] extensions of the area affected as [illegible] spreads.

Steam Shovel Record.—On Mar. [illegible] ton B[illegible] shovel working [illegible] cut at Panama, loaded 283 [illegible] dump cars in a working day of eig[illegible] a total of 2,830 yards of earth exca[illegible] ing that period. During this time, [illegible] was actually at work six hours and 55 [illegible] was waiting for cars 50 minutes, and [illegible] dipper 15 minutes. It has a dipper [illegible] capacity. This is the greatest amoun[illegible] terial excavated by a 70-ton shovel in [illegible] in the Canal proper since the comme[illegible] of work.

If water is encountered in shaft[illegible] amounting to less than 1,500 gal. [illegible] says *Echo des Mines,* it will pay to f[illegible] ordinary pumping system in sinking. [illegible] ever, the amount of water is 3,000 [illegible] more it will pay to use the freezing [illegible] For amounts between 1,500 and 3,000 [illegible] min. the choice depends more or le[illegible] local conditions. The cost of sinking [illegible] 18 ft. chain shafts is estimated at $8[illegible] 300 feet; $140,000 for 600 ft. and $25[illegible] 120 ft., including cost of refrigeration [illegible]

Civil Service Examinations.—The [illegible] States Civil Service Commission will [illegible] examination on April 24-25, 1912, for [illegible] tion of junior chemist in the Bureau o[illegible] at Pittsburgh, and at Washington, D. [illegible] position pays from $1,080 to $1,380 per [illegible]

NEWS SECTION

torial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

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Contracts for two of the three big railroad construc- [illegible] were taken the first part of the month, have now been awarded. The Chicago & Northwestern Ry., as noted sue, awarded the grading contract Peoria line to Winston Bros., of Minn., and the masonry contract , White Construction Co., Chi- elaware, Lackawanna & Western varded the contracts for its pro- of line west of Scranton, Pa., to Waltz & Reese, Stanhope, N. Burke, Connell Bldg., Scranton, McFarlin & Burke, 90 West St., ity; D. W. Flickwir, Terry Bldg., ; W. H. Gahagan, 189 Montague N. Y.; James A. Hart Co., 256 [illegible] Bldg., Philadelphia, Pa.; P. Mc- North 32d St., Philadelphia, Pa.; Contracting Co., Scofield Bldg., and A. M. Talbot Co., 1 Madi- w York City. This D., L. & W. s one of the largest contracts let ar. As to the third construction Grand Trunk Ry. line in Massa- definite action toward awarding s been taken at this writing.

ble number of railroad-construc- s have been let during the past a, among them being the following: vans, Aurora, Ill., for constructing l electric line of the Illinois Cen- tween Lisbon, Ill., and Wedron: rt, Philadelphia, Pa., and Henry attery Pl., New York City, for two large reinforced concrete ver the Bush and Gunpowder Rivers, Havre de Grace and Baltimore, Md., Philadelphia, Baltimore & Washington subsidiary company of the Pennsylva- [illegible] News Contracting Co. [illegible] t., Roxbury District, Boston, Mass., for constructing Sec. 4 of the subway at Boston for the Boston mission; H. E. Culbertson Co., l, O., for about 6 miles of second- grade reduction work for the eleva- he tracks of the Pittsburgh, Cincin- cago & St. Louis Ry., through Piqua, Utah Construction Co., Ogden, Utah, ructing the St. John & Ophir R. R., -mile line extending from St. Johns, Ophir: the Miller Construction Co., iven, Pa., for grading and masonry a 5-mile extension of the Jackson- e line of the Buffalo, Rochester & R. R. in Indiana County, Pens

way of drainage work the largest f the past few days appears [illegible] awarded to the Canal Construction hicago, Ill., and to Forestal & Feyen, Minn. The former contract amounts $106,000 and calls for 1,665,000 [illegible] xcavation for the Dead Timber Drain- trict in Arkansas. The Forestal & ntract requires about 1,890,000 [illegible] excavation for Drainage District No. ena Vista County, Iowa.

f the larger government contracts on ds have been opened the past week constructing West Canal, Sec. 2, at Sault Ste. Marie, Mich. The MacArthur Bros. Co., Fisher Bldg., Chicago, Ill., at $670,170, was the low bidder on this work. The work calls for about 555,000 cu. yds. of excavation, chiefly in Potsdam sandstone.

The Board of Water Supply of New York City is calling for bids on another good sized contract in connection with the Catskill aqueduct work. This contract calls for the construction of the Wallkill blow-off, including about 7,000 ft. of concrete conduit 7 ft. inside diameter, about 80 ft. of cut-and-cover aqueduct, a blow-off chamber, and necessary castings for valve and aqueduct connections.

The largest piece of work in the way of irrigation development on which bids have been asked the past week appears to be the one for the construction of the earth dam and works on the North Platte project of the U. S. Reclamation Service. Bids on this work opened on Feb. 29 were rejected and new bids are now being called for until April 22. This work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earth fill, 157,000 cu. yds. gravelly material, 14,000 cu. yds. unscreened gravel, 11,500 cu. yds. screened gravel, and 14,000 cu. yds. concrete.

Bids on a good sized sewer job at Rochester, N. Y., were opened last week, the probable contractor for the work being the T. A. Gillespie Co., New York City, at $265,254. This work consists in furnishing and laying about 9,300 ft. of 66-in. pipe for the discharge of the effluent from the disposal works, into deep water in Lake Ontario. About 2,300 ft. will be laid in open trench, and the remainder will be submerged and laid in a dredged trench

A New Engineers' Club. Societies of Engineers are formed usually for the purpose of advancing engineers' knowledge and practice, etc., etc., etc. Out in Idaho an organization of engineers has been effected which has for its primary purpose something entirely different. In brief, its object is matrimony. Seven young engineers connected with an irrigation project in Idaho have organized a bachelors' club for the purpose of receiving proposals from lonely leap year maidens. According to the statement of one member of the club, all of the bachelors will have an equal chance to obtain a wife from among those who enter into correspondence with the club. When a letter is received from an anxious bachelor girl each member of the bachelors' club will be entitled to send his photograph, accompanied by a letter telling of his qualifications, to the girl, and it is expected that she will choose the one she wants.

Revised Estimate. A correspondent in the Bulletin of the General Contractors' Association of New [illegible] hat in the ring" on a new candidate for the honor of being the first to apply scientific management. In support of his candidate he gives the following quotation from Irving's Life of George Washington: "Four of his negroes employed as carpenters were hewing and shaping timber. It appeared to him in noticing the amount of work accomplished between two mornings, that they loitered at their labor. Sitting down quietly, he timed their operations, how long it took them to get their cross-cut saw and other implements ready; how long to clear away the branches from the trunk of a fallen tree; how long to hew and saw it; what time was spent in considering and consulting; and after all, how much work was effected during the time he looked on." The quotation was taken from an entry in Washington's diary. It looks from this as though it would be necessary to revise the time-honored estimate of Washington: "First in war, first in peace, and last in the American League, by the addition of another first.

At Panama. It has been a long time since anything exciting has happened to the big ditch at Panama. So long, in fact, that it would seem that the newspaper correspondents in whose fertile minds most of the disasters of the past have had their beginnings and ends, had gone to other fields. Some of these correspondents, however, are still at their posts, as is shown by press dispatches of the past week. According to these dispatches clouds of steam and blue smoke have been rising from the excavation in the bottom of the Culebra cut, and every drill hole in the affected area is tested with a thermometer before dynamite is put in to prevent a premature explosion. Nothing less than a sleeping volcano, dormant for centuries, lies underneath the cut and is threatening the safety of the canal. To be sure, the geologist of the Canal Commission declares that the smoke is due only to the oxidation of pyrites and has no volcanic significance. But then he is only a scientist, and where there is smoke and steam there must be a volcano—or else there will be no "copy" for a news story.

Hod Carriers' Logic. Union hod carriers in a Massachusetts city have gone on strike because they were compelled to carry building material in wheelbarrows instead of hods. The cause of the dissatisfaction is said to be due to the alleged violation of the clause in the working agreement of the union to the effect that material for construction shall be brought in hods to the elevators where it is hoisted by machinery to the masons. The insertion of a hod carrying clause in a union working agreement is nothing more than an imposition on a contractor. It is just as easy on the workman to transport bricks with a wheelbarrow as it is with a hod. Were it not for the height of present-day buildings the hod carriers would insist on using ladders for carrying up materials instead of by means of hoists.

Bond issues aggregating $8,725,000 have been authorized by the voters of Seattle, Wash. The largest proposition was $7,000,000 port bonds for construction of the harbor island terminals, similar to the Bush terminals at Brooklyn, N. Y., and to be leased to a syndicate of New York and Seattle capitalists.

The Annual Convention of the National Association of Cement Users.

The eig[illegible] tional Association of Cement Users was held in Kansas City, Missouri, March 11-16. The convention was well attended and interest in the business of the convention was well sustained from day to day.

The [illegible] Monday evening with the usual addresses of welcome and response. Dr. Walter M. Cross, City Chemist [illegible] describing the apparatus used in applying the hypochlorite process to the city's water supply. The mechanical features of the plant were described and important structural features were pointed out.

There were two sessions on Tuesday, Thursday and Saturday, and three on Wednesday. Several papers were not presented at the times announced in the program, owing to the inability of some of the authors to be present on time. Two or three papers scheduled were not presented at the convention, but will appear later in the published proceedings of the association. In general, the papers were presented as announced, and many of them were of a high order of merit.

The session on Tuesday forenoon was devoted to the consideration of aggregates for concrete and to committee reports. Mr. W. M. Kinney, assistant inspecting engineer of the Universal Portland Cement Company, presented a paper entitled, "Discussion on Aggregates for Concrete." This paper and the discussion of it, emphasized the need for a more general appreciation of the importance of good quality in the inert material employed in making concrete. Too much attention has been paid to cement testing, comparatively speaking, and not enough attention has been paid to the quality of sand employed. It was remarked that the quality of the sand is even more important than the strength of the cement. Any standard brand of the latter is pretty sure to be satisfactory, while the belief that almost any sand will do has led to many failures which have been charged against poor cement and workmanship. It was also pointed out that a 1:2:4 concrete, for example, is a substance of very variable strength, depending on the stone and sand used quite as much as on the cement.

The annual address of President Humphrey was extremely interesting, as showing the development of the application of concrete in Europe. He stated that much progress is being made in the construction of concrete structures in Europe, and that, too, in spite of the severe handicap imposed in some countries by stringent building regulations. This is especially true in England, where building commissions are ultra-conservative. On the continent there is great boldness in the design, notably so in France, and especially so in Austria. The latter country leads the world in skill in the application of concrete to structures of all kinds. Very beautiful ornamental effects are secured by means of panelling, recessing, etc. The structures are light and graceful in mass and outline, as shown by numerous lantern slides.

Elevating machinery is not used in Austria in building concrete buildings. The heighth of such buildings is limited by law to five or six stories at the most. Men and women carry the concrete in tubs, placed upon their heads, up winding inclined platforms. Many women are employed on this work, some being paid as little as 12 cents a day for their work.

Round timbers are used wherever possible in form work. Forms are tied together with strings, because nails are so expensive. This also saves the lumber, which is used over and over again.

Reinforced concrete railroad ties are used extensively in Italy, where wood ties are very expensive. About 300,000 are in use at the present time and over 1,000,000 more are being made. The locomotives are much lighter on Italian railways than are our locomotives in America, so concrete ties are more applicable there than here. A wood block is imbedded in the tie and the rail is fastened down by means of a screw which is turned into the wood. The life of these ties is as high as seven years on tangent track. On curves, the life of ties never exceeds two years and rarely exceeds three months. The ties fail, from impact, just inside the rails, although many efforts have been made to cushion the base of the rail at the tie. Concrete pipe is made in all lengths up to 12 feet, and even in excess of this in some cases. Poles and posts of all kinds are made of reinforced concrete.

An interesting paper was presented by F. J. Morse, of the Heath & Milligan Mfg. Co., of Chicago, on "Cement Coatings in Color." These coatings were not offered as a substitute for good concrete, but as a corrective surface treatment to be applied to cracked and excessively porous concrete. Based on the Chicago labor scale, these coatings may be applied at the following unit prices per 100 square feet of surface area: On stucco or pebble dash, $2.50 for the first coat and $2 for the second; on sand finish, $2 for the first coat and $1.50 for the second coat; and on cement floors, $1.75 and $1.25 for the first and second coats, respectively.

Wednesday forenoon, tests on reinforced concrete buildings under load were described by Prof. Talbot and Mr. Slater, of the University of Illinois. The method of making the tests were described in detail. Not enough data of this character have been collected on which to base general conclusions, but the points on which additional information is needed are recognized clearly and the scope of future tests is thereby prescribed. Papers were presented on the design of concerte flat slabs.

Mr. James L. Darnell presented a paper on the "Present Status of Unit Construction." Numerous views of buildings under construction by this method were shown. A paper emphasizing the necessity of field tests for concrete, prepared by Fritz E. Von Emperger, of Vienna, Austria, was translated and read by Secretary Krauss, of the association.

A. O. Cunningham, chief engineer of the Wabash railroad, described the use of concrete on that railway system. Various standard abutments, arch and girder bridges and culverts were shown by the lantern.

The suitability of concrete for gas holder tanks was considered in a paper prepared by H. W. Alrich, engineer of the Consolidated Gas Co., of New York City. Mr. Alrich considers steel preferable to concrete for this purpose. Steel costs less, as a rule, and steel gas holders are built in less time than concrete holders.

Mr. E. Lee Heidenreich, of Kansas City, read a paper on the design of concrete grain elevators. Formulas to govern the design of these structures were given. A very extensive application of reinforced concrete for this purpose was predicted by Mr. Heidenreich.

W. S. Gearhart, state highway engineer of Kansas, showed views of types of good and bad highway bridges now in use in Kansas. The application of concrete to structures for this purpose was highly commended.

The session of Thursday evening was devoted to the consideration of the good roads problem and to concrete pavements. Mr. F. P. Wilson, city engineer of Mason City, Iowa, and Mr. E. W. Groves, city engineer of Ann Arbor, Mich., presented papers detailing their experience with concrete pavements. Both are enthusiastic about pavements of this type. Mr. Wilson gave the specifications which he has prepared to govern the construction of concrete pavements in Mason City.

Mr. Gustave Kaufman, chief engineer of the Wilson & Baillie Mfg. Co., of Brooklyn, N. Y., prepared a paper on the advantages and durability of cement sewer pipe, based on the application of this material in sewer building in Brooklyn. Brooklyn has 400 miles of cement sewers, some of which are 50 years old.

A very good paper on "The Manufacture and Use of Concrete Drain Tile," was presented by C. E. Sims, secretary o state Cement Tile Manufacturers' Mr. Sims spoke of the careless, ig haphazard methods emloyed in th ture of cement drain tile in the ear the industry. He said it was sur the public did not lose confidence terial in the years when it was us lessly.

Mr. L. J. Hotchkiss, assistant b neer of the C., B. & Q. R. R., read "Concrete Fence Posts." The app posts of this character to railroad considered. The plant for the m of these posts on the Burlington trated and the details of desig process of manufacture were illus described. The plant described tu posts in ten hours, at an average co 15 cents each. The posts are 4 diameter at the top and 5 inches at and are 7 feet long. The reinforc the method of fastening the wire were clearly shown by the lanter

Several other really good papers sented which cannot be mentione account of limitations of space. T tion, as a whole, demands very favo ment.

Several very important committ were received as information an voted on by letter ballot, following t tion. The association is making a mendable effort to standardize sp governing all classes of concrete tion. It is a moral certainty that t fications ultimately will be used by majority of engineers and archi practically all cement users will be by them. Consequently, cement us co-operate through the medium of [illegible] tion, to get these standard sp adopted and perfected as expeditiou sible. The educational work being d association is excellent. The great association seems to be to ascertain mate and proper use of cement. of scientific research pervaded t City convention. The problems cons the whole, were problems invol economies of construction materia was no disposition shown to den other construction materials have t mate fields of application.

PERSONALS.

Mr. David D. Drummond, Vice-Pre General Manager of the Chicago Po ment Co. for the past 13 years, di cago on March 8, 1912. Mr. Drum born in Scotland, but had lived in try since boyhood. For the past fe had experienced very indifferent h is survived by a widow and three s

Mr. W. W. Chaffin, engineer of tr tion of the Pennsylvania R. R. at Fo Ind., has become assistant city Ft. Wayne.

Mr. S. C. Dunlop, formerly assis neer in charge of sewer constructi city of Charleston, S. C., has resign the engineering staff of the Lehigh R. at Geneva, N. Y.

Mr. H. M. Steward has been appo engineer of maintenance of way of Elevated Ry.

Mr. B. P. Tilden, formerly constr gineer on the Great Northern Ry. several years on railway constructio ida, died recently in Bismarck, N. D been serving there recently as count of Burleigh county.

Mr. John Ericson, City Engine cago, is now devoting his entire tin way and harbor improvements. He relieved from his duties as City Eng Col. H. E. Allen is now acting City Col. Allen was formerly chief mech gineer and is a graduate of Annapo

Mr. T. J. Buchanan was appointe tendent of the Halletsville, Tex., wa and electric light plants on March plants are owned by the city.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

[illegible] ham Railway, Light & Power Co., Bir- [illegible] from Gate City to Irondale, a dis- [illegible]

[illegible] franchise to Louis Hart, Gadsden, [illegible] ates to build a railroad up Lookout [illegible] miles long and will reach Black Creek

Arizona.

[illegible] me 300 miles of trackage. It is said [illegible] ny plans on making the new road a [illegible] e through Box Canyon, to Phoenix. [illegible] sing the Colorado river at the dam [illegible] by the company to prevent floods. [illegible] it at Los Angeles. This the com- [illegible] gineers estimate would shorten the [illegible] ween Los Angeles and El Paso. [illegible] connection at Phoenix with the [illegible] nd Maricopa Railroad. This route [illegible] present main line.

California.

[illegible] uncil of Richmond has granted a [illegible] to H. C. Cutting of Richmond for [illegible] se for a street railway line on Cut- [illegible]

[illegible] nterey & Pacific Grove R. R. Co., [illegible] between Monterey and Solmas. [illegible] pany is controlled by the United [illegible] of San Francisco.

[illegible] rthern Electric Ry. Co., Chico, Cal., [illegible] have completed location work for [illegible] branch, and it is believed that con- [illegible]

Tidewater & Southern Ry. Co., the in- [illegible] ssue, is projecting 135 miles of line, [illegible] te running southeasterly through Stan- [illegible] Mercedes, Madera and Fresno coun- [illegible] ith branches. Surveys have been made [illegible] he construction capital has been se- [illegible] in part. Construction contracts will be [illegible] on, Cal., is President and J. H. Wallace, [illegible] rancisco, is Chief Engineer.

[illegible] San Diego, Riverside & Los Angeles R. [illegible] has filed its articles of incorporation [illegible] e County Clerk at San Diego. Accord- [illegible] articles, the company is capitalized [illegible] 000 with over $4,000,000 paid in, and [illegible] rmed to construct an electric road be- [illegible] San Diego and Los Angeles. Articles [illegible] orporation for the Universal Construc- [illegible] Investment Co. were also filed. The [illegible] is to operate the proposed road. Wil- [illegible] Luvet and Maurice Salzeman, of Los [illegible], and John F. Scott, J. R. Carlisle and [illegible] Gaston, of San Diego, are directors of [illegible] ilroad company.

Southern Pacific, according to informa- [illegible] rom San Francisco, Calif., is rushing [illegible] on the double track between Oakland [illegible] nd Sacramento via Benecia, Calif., and [illegible] xpected to have the improvement com- [illegible] by July 1. By that date it is expected [illegible] ve completed also a second track from [illegible] mento to Colfax. The latter is to be [illegible] by eastbound trains, owing to the lower [illegible] The present track will be devoted to [illegible] ound traffic. East of Truckee a short [illegible] ce and west from Reno for some miles [illegible] ond track is finished; also, west a few [illegible]

[illegible] tral California; Oregon Eastern. This move is in addition to the construction of the Chico [illegible] Northern and Goose Creek and Southern, in Northeastern California, and Northwestern Nevada and Southern Oregon. The Nevada & [illegible] Central Pacific, to Mojave in this State, by way of Tonopah Junction and Keeler. Between Hazen and Tonopah Junction and Keeler and Mojave the road is broad gage, but between Keeler and Tonopah Junction it [illegible] made entirely broad gage, and eventually will form part of a new route between Los Angeles and Ogden and between Los Angeles and Portland, east of the Sierra Nevada. The Sacramento Southern, from Sacramento to Walnut Grove on the east side of the Sacramento River, eventually will be extended across the San Joaquin River and on to Avon, near Martinez, in Contra Costa County. At Avon the line will connect with the Central California, which runs by way of the San Ramon Valley, Pleasanton and Dumbarton Point, across Upper San Francisco Bay to Redwood City. The Oregon Eastern is the line between Weed and Natron or by the way of Klamath Falls. Most of it has already been built. It is to be a second rail route between California and Oregon.

Work will be commenced on the Stockton Terminal & Eastern R. R. within the city of Stockton, Calif., in about two weeks. According to the proposed plans the road enters the city along Roosevelt St., in The Oaks, to Union St. and will run south to Fremont St., west along Miner channel to Miner Ave. and American St., and thence along the middle of the avenue to McLeod's Lake. The tracks will then turn south across Miner channel on Center St. to the waterfront. The railroad company has a 47-year franchise for 647 ft. of wharf space. A track will be run along Union St. as far as Weber Ave. to enable passengers to connect with the Western Pacific, Southern Pacific and Traction lines. A track outside the eastern limits of the city runs south from the main line to the Southern Pacific and Santa Fe, to facilitate the switching of freight cars from the steam roads to the interurban line.

Colorado.

The 1912 budget of the Denver & Rio Grande R. R., J. G. Gwynn, Chief Engineer, Denver, will, it is understood, include an appropriation of $7,000,000 for improvements. Of this sum about half will be spent in Colorado. The bulk of these improvements will consist of new track, station sidings and replacing old rails. In Utah double tracking of the main line westward from Grand Junction to Salt Lake will comprise the biggest improvement. On this work alone it is planned to spend at least $1,500,000. The preliminary survey is now under way and within two or three months the work will be started.

Georgia.

Promotion work is well along for a new railroad to run south from Dublin, through McRae to Barrows Bluff, on the Altamaha River, and thence south to Douglas, about 75 miles from Dublin. It is proposed eventually to extend the line south through Pearson and Homerville to Fargo in the extreme southern end of Clinch County, there connecting with the Georgia Southern & Florida into Jacksonville. An extension north from Dublin to Milledgeville up the Oconee River Valley may also be built. W. C. Smith, Douglas, Ga., [illegible]

Engineers of the Louisville & Nashville Railroad Co., are reported to be working in the vicinity of Rising Fawn, Ga., looking over the prospective right of way for the construction of a branch between Gadsden, Ala., and Chattanooga, Tenn., paralleling the Alabama Great Southern.

Illinois.

⊙N. W. Evans, Aurora, Ill., has been awarded the contract for constructing the proposed electric line of the Central Illinois R. R. between Lisbon and Wedron.

⊙The Cleary-White Construction Co., 17 N. La Salle St., Chicago, Ill., as noted in our last issue, has been awarded the contract for all of the concrete work for the Peoria line of the St. Louis, Peoria & Northwestern Ry., a Chicago & Northwestern line. The work extends from Peoria, Ill., to a point near Milward, Ill., and includes 30,000 cu. yds. earth excavation, dry and wet, for masonry work; 5,000 cu. yds. rock excavation in conection with masonry work, about 60,000 cu. yds. of concrete masonry and 175,000 lin. ft. of pile foundation. This contract has been awarded about seven days, but the construction company already has a large part of its equipment and organization already on the ground. The structures will consist of piers, abutments, and arches—one will be a triple 30 ft. arch structure and there will be two viaducts, each some 600 ft. long, made up of a series of piers, with buried abutments at ends. There will also be a large bridge over the Sangamon River near Springfield. Besides the above, there will also be a considerable number of abutments, piers, and arches over other railroads, highways and streams. None of the work is to be sublet

Plans are understood to be about consummated whereby 15 railroads entering Chicago will combine to purchase the old Chicago Belt Line. The project will mean an expenditure of at least $25,000,000 before the plans of the roads are carried out. The present system of handling freight will be completely reorganized, chaotic traffic congestion will be eliminated and the numerous transfers of freight from one road to another which at present delay transit will be done away with. Besides a main clearing center in the clearing yards, now owned by the Chicago Union Transfer Co., the new plans provide for an auxiliary clearing yard at South Chicago. All tracks will be elevated and grade crossings will be done away with. The following is a list of the purchasing roads: Burlington, Chicago, Milwaukee & St. Paul, Chicago & Alton, Northwestern, Santa Fe, Wabash, Chicago & Eastern Illinois, Grand Trunk, Baltimore & Ohio, New York Central, Monon, Rock Island, Erie, Illinois Central, Pennsylvania.

The Centralia & Central City Traction Co., H. M. Warner, President, Centralia, Ill., is considering extending its line four miles to Sandoval, and may undertake this work this spring.

Iowa.

It is now stated that construction work will be started this spring on the proposed line of the Davenport, Iowa City & Western Traction Co., providing franchises are secured and the people furnish the right of way. C. E. Coon, a contractor of Omaha, Neb., is President.

The Keokuk, Nauvoo & Fort Madison Electric Ry. Co. has filed a trust deed securing $450,000 of bonds to be used in the construction of its projected line. This company proposes to build a line from Keokuk through Hancock County to Fort Madison with branch line to Nauvoo and Carthage. Chas. H. Petsch, St. Paul, Minn., is President.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

The Chicago, Milwaukee & St. Paul Ry., C. F. Loweth, Chief Engineer, Chicago, Ill., [illegible] 000 this year for improvements to its main line in Iowa. These are understood to include double tracking from Sabula to Van Horne and from Perry to Council Bluffs. The track will also be straightened by the elimination of many curves.

Kansas.

The Union Traction Co., D. H. Siggins, President, Coffeyville, Kan., has placed orders for rails, ties, etc., for the extension of its line from Cherryvale to Parsons and the commencement work is awaiting only the signing of contracts for right of way.

Kentucky.

The Covington, Big Bone & Carrollton Ry. projecting a 54-mile line the route touching Carrollton, Ghent, Warsaw, Big Bone Springs, Union, Florence, Erlanger, Edgewater, Ludlow, Covington and Cincinnati, has partly completed its surveys and has secured $1,000,000 of construction capital. The company will do its own construction work. J. J. Weaver, Ludlow, Ky., is Chief Engineer.

The Long Fork Ry. Co., of Prestonburg, Ky., has been incorporated with a capital stock of $10,000 and proposes to build a 20-mile railroad through Floyd and Pike Counties. The incorporators include James Salisbury, B. F. [illegible] Brown.

Louisiana.

The New Iberia, Lafayette & Northwestern R. R. has made surveys for a projected 54-mile line the route of which is from Eunice via Church Point, Lafayette and St. Martinsville to New Iberia. F. M. Welch, New Iberia, La., is President and H. A. Genung, New Iberia, is Chief Engineer.

A new company, to be known as the New Orleans, Clinton & Birmingham Ry., has been formed and purposes the construction of a 40 to 45-mile line from Clinton in a southeasterly direction. The capital for construction has been secured, but surveys have not been made as yet. Isidor Mayer, Clinton, La., is interested

The Franklin & Abbeville R. R. has surveys in progress for a 35-mile extension from Milton through Maurice, Duson and Church Point to Eunice. The capital for construction has been secured and construction contracts will be let in about 60 days. Jules Godcheux, Godcheux Bldg., New Orleans, La., is manager, and Walter G. Kemper, Franklin, La., is Chief Engineer.

Maryland.

⊙Bran & Stuart, Philadelphia, Pa., and Henry Steers, 17 Battery Pl., New York City, have been awarded the contract for constructing two large reinforced concrete bridges over the Bush and Gunpowder Rivers, between Havre de Grace and Baltimore, Md., for the Philadelphia, Baltimore & Washington R. R., a subsidiary company of the Pennsylvania R. R. The sum of $2,075,661 has been allotted for two bridges and for additional tracks automatic block signals and other improvements.

It is understood that the Western Maryland Railway Co., is desirous of making some track changes between Cavetown and Smithsburg, Md., involving the elimination of a reverse curve and grade reduction. According to reports the company has purchased a tract of land between the places to enable it to carry out its plans. J. Carmichael, Baltimore, Md., is Engineer Maintenance of Way.

According to reports from Hagerstown, Md., work will be started at once by contractors on the additional track laying work between Weverton, Md., and Harper's Ferry. It is said that steam shovels, teams and about 300 men will be employed on the job.

Massachusetts.

⊙Hugh Nawn Contracting Co., 82 Savine St., Roxbury District, Boston, Mass., has been awarded the contract at $532,540 for constructing [illegible] of the Boylston St. railway at Boston for the Boston Transit Commission. Bids were opened March 12. The work calls for about 1,900 lin. ft. of open-incline and two-track subway extending from Kenmore St. to Massachusetts Ave.

Michigan.

Preliminary steps have been taken for the organization of a $25,000 corporation to make surveys and secure rights of way for an electric railway from Muskegon to Manistee. As projected this line will be about 90 miles long, would cost $1,500,000 and would touch the following points: Muskegon, North Muskegon, Dalton, Whitehall, Montague, Rothbury, New Era, Shelby, Mears, Hart, Pentwater, Ludington and Manistee. E. H. Christ, Chairman of the Board of Public Works of Grand Rapids, Mich., is interested.

The Michigan Railway Engineering Co., has been incorporated in Michigan with principal offices at Kalamazoo, Mich. The capital stock of the company is placed at $50,000.

The Port Huron & Northern Ry. Co., which proposes the construction of a steam, electric or gasoline line up the lake shore from Port Huron, Mich., to Lexington and on into the Thumb district, has presented a proposed franchise to the City Council of Port Huron asking that it be placed before the voters at the April election. The franchise provides for tracks across and along all the city's main thoroughfares.

Duluth and the Ranges.

BY PETER [illegible]

⊙J. G. Robertson, contractor from St. Paul, was awarded a waterworks job at Hill City, Minn., amounting to $10,000. He will start work immediately.

⊙Preston & Neil were awarded a contract by the city of St. Paul to lay five miles of 24, 30 and 36-in. water pipe. The amount of this contract was $22,000, and is for labor only, as the material will be furnished by the city.

⊙P. G. Pastoret of the Pastoret-Lawrence Co. was a caller and stated that his firm had been awarded a sewer contract for the Van Buren system in St. Paul, Minn. The amount of this contract was $45,000. They will start on this work immediately.

Mr. R. H. Rossiter, representing the Marion Steam Shovel Co., Marion, O., was a caller on us a few days ago. Mr. Rossiter stated that business with his firm was very good, and that prospects in general were very bright for a good year for contractors.

Walter Burr, Assistant General Freight Agent of the St. Paul, Minneapolis & Omaha Ry., was a caller last week looking up the movement of contracting equipment for the coming season.

A. J. Perrin, railroad contractor, left for a trip to Spokane last week.

John H. Hodges, United States Engineer in charge at Duluth, Minn., has recommended for acceptance the bid of $20,155, made by Sang & Miller, Duluth contractors, for building a stone breakwater at Ashland. Bids were asked on this work some time ago, but only two firms responded. The other bidder was the Great Lakes Dredge & Dock Co. of Chicago, who agreed to do the work for $31,065.

The Zenith Dredge Co. of Duluth, which was awarded a dredging contract by the Island Creek Coal Co. amounting to $50,000, have already started on this work. The Zenith Dredge Co. has a great deal of work on hand for the coming season.

It has been reported that the Canadian Northern R. R. is contemplating relaying all of their track between Virginia and Ranier, Minn., a distance of about 100 miles. There is nothing authentic to this rumor at the present time.

It is with great pleasure that we report that D. M. Philbin of Duluth, who for a number of years has been general superintendent for the Great Northern Railway Co. for the Lake District, will leave that position to devote his entire time to the Great Northern ore properties. These properties were the ones that were under lease to the Steel Corporation, and which they relinquished some tir Mr. Philbin has a great many friends territory, having lived here a number o and is one of the most popular railw cials in this district. This promotic well-deserved one, and Mr. Philbin is who is very capable of taking care every detail.

E. A. Dahl, the Duluth contractor, h South for a month's vacation.

P. McDonnell, the prominent pavi contractor of Duluth, who has been sick f some time, has recovered and is hustling ar d a well as ever.

We are glad to state that Greer Th pson general superintendent of the Drake & [illegible] C . steam shovel operators in t ritory, who was very sick at Pasedena C has recovered and is able to get arou is expected he will be back here in open up their operations for this seaso

Mr. C. E. Jamison, railroad contract secured some work from Foley, W h Stewart on the Soo Line at Dakota, h chased a new steam shovel, and alrea the same in operation.

Richard Evans, railroad contractor, few hours with us last week. He any work at the present time; but is market for some, and could put fivete shovels to work immediately.

The outlook for the coming season's tions in this vicinity continues to look and we think without a doubt that th be a lot of work done in this vicinity The labor situation has not improved yet, and as we stated in our previou unless a large number of laborers co this territory, there will be a shortag the season's work opens.

Mississippi.

The Homochilto Lumber Co., whi have general offices at Scranton, Pa., lected the site for its lumber mill at M Miss., and has had surveys made f projected logging railroad.

Engineers of the Illinois Central R Co., are reported to be surveying in the city of Jackson, Miss., locating the pro new shops at that place. The cost work according to rumors will amo about $1,500,000. Nothing official has been obtained in regard to this work

Missouri.

⊙The contract for the erection of Mc freight sub-station of the Kansas City nal Railway Co. has been awarded to F Sons, general contractors of Kansas Ci This building will be a two-story brick ture, concrete foundation, steel fram reinforced concrete floors, size 56x178 estimated cost of the building complet the neighborhood of $65,000.

The Hancock-McMahon Contracting C 917 Tennessee St., Lawrence, Kan., ha pleted its contract on the Kansas City- seph Electric line for all of the heavy work, including bridge across the Platte and its outfit consisting of five mixer ricks, etc., is now ready to move ont other contract.

St. Louis Items.

BY A. B. KOENIG

⊙John Scott & Sons have sublet the Il nois Central work at Bloomington, I Kaiser & Maloney.

⊙Stubbs & McCormick secured the work from Kaiser & Maloney on the Central R. R. work at Bloomington, I

J. J. McInerney writes us from Den Ark., that he has about finished his there and is in the market for some work for his 15-team outfit.

Kinser Const. Co. has opened an offic in the Third National Bank Building.

Dan Sullivan will hear of something interest by writing Mulvill Bros., Altc

Sten Lund, 736 Reserve Bank Bldg., 300 teams for railroad work in Oklahon Southern Missouri. He also has a lot o crete work to sublet.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] the Canal [illegible] ll., informs us that they have two idle at the present time. Gand is few days with his folks at Ches-

Maloney, Times Bldg., St. Louis, [illegible] about 75,000 [illegible] ublet on the Illinois Central R. R. ngton, Ind. Free transportation for outfits over the Illinois Central R. R. indham will finish his work at Cen- in about ten days and will be in [illegible] gfield, Ill., will catch him.

Bros. have about finished their [illegible] in a few days.

[illegible] Louis Portland Cement Works, [illegible] Black Jack, Mo. Up to the present company has been unable to dis- f his relatives. Any information same will be thankfully received uis Portland Cement Co., Pros- Louis, Mo.

Fruin, 80 years old, one of the contractors in St. Louis, died re- heart disease in his home, 6417 Co- Although known to be suffering disease and practically retired work on that account for several id been going about as usual, ap- and was sitting talking with his Miss Katherine Fruin, when he sud- l. Fruin was born in Glen Aher- Tipperary, Ireland, and came to States with his parents when three [illegible] ttled in Brooklyn, N. Y., where s reared and educated in the pub- until he was 16 years old, when associated with his father in the g business. He was married in to Miss Katherine Carroll, with came West in 1860, following the his father. He went out to New after a brief stay came to St. 1861. In the civil war he was con- th the quartermaster's department of Army at St. Louis. He later was ing contractor for nearly 30 years. eral street railroads, the city wa- at Bissell's Point, and constructed nals of most of the railroads enter- ouis. His most notable works in were the Missouri Pacific and St. San Francisco railroads to Pacific, Burlington R. R. terminals from Side to the Missouri River. The of his firm, known as the Fruin- Construction Co., extended from erritory to the Atlantic Ocean. In quit the firm and retired for a brief later he organized the Fruin-Colnon ng Co., of which he was president at of his death. Fruin took an active n public affairs. He was a Demo- was appointed by former Gov. Wm. to a position on the Board of Police oners of St. Louis. Fruin's wife ears ago, leaving him with two chil- on, John J. Fruin, of Tulsa, Okla., atherine Fruin, who lived with r—and two grandsons, Herman and ruin, who survive him.

[illegible] spent a couple of days [illegible] ave was looking wise and not say-

for the erection of a Physic's Build- e grounds of the University of Mis- Columbia, Mo., will be received at of the architect, James P. Jamieson, rity Bldg., St. Louis, Mo., until noon, 2. A deposit of $10 is required for of plans and specifications, to be re- upon their return on or before receipt Bids must be addressed to the Board tors of the University of Missouri, ked on the outside, "Bids for Physic's

annon of Hannon & Haley [illegible] tion Co., returned from their Kansas

[illegible]

✣Walter S. Stifer, [illegible], Cape Girardeau, Mo., will receive [illegible] proposals at his office until [illegible] for the con- [illegible] hotel building [illegible] McBride of [illegible]

Minnesota.

[illegible] projected electric railway of the Sioux Falls & Southern Minnesota Traction Co., from Sioux Falls east to Albert Lea, passing through a number of towns in Southern Minnesota. H. W. Knight, Chicago, Ill., is interested in this project.

Montana.

⦿As mentioned in our last issue, Clifton, Applegate &Co., Anaconda, Mont., and Spokane, Wash., have been awarded the contract for the construction of the Georgetown extension of the Butte, Anaconda & Pacific R. R. At present the sites for the location of warehouses and camps are being selected. The main camp and warehouse will be located at Browns spur. Other camps will be located at the mouth of Warm Springs canyon, Cable road fork, Silver Lake and Georgetown. Bruce Allison of Missoula will have charge of the carpenter crew and will begin the erection of the buildings immediately.

In addition to the several outfits which were put on the Great Northern line between Lewiston and Moccasin, Mont., for which Sims & Carey, St. Paul, Minn., have the general contract, Contractor Callahan has his large steam shovel outfit now installed about 10 miles out of Moccasin and has started work. This outfit in addition to the steam shovel employs three "dinky" locomotives and nearly 50 dump cars. Rapid progress is now being made by this outfit. Contractor O'Neill of Iowa has arrived upon the ground with about 25 teams and has built his camp just out of Moccasin. He has a contract for five or six miles of grading upon which the work will be done with plow and scraper. Other outfits are expected to be located at various points along the line within the next month and early spring.

The Montana Co-Operative R. R. Co., of Carbon County, incorporated recently with a capital stock of $1,500,000, proposes a line to run down the length of Red Lodge Creek, 15 miles west of Red Lodge, with a terminal at Joliet. The incorporators are J. Alex Caldwell, Sanfrid Renlund, H. E. Newkirk and A. N. Whittington.

Construction work is to be started shortly on the Three Forks, Helena & Madison Valley R. R., which proposes a 12-mile spur from Three Forks into the Radersburg Mining District. The spur will connect with the Chicago, Milwaukee & Puget Sound Ry., but will be operated independently. J. Q. Adams, Three Forks, Mont., is interested.

Nebraska.

Ground for the new terminals of the Chicago, Rock Island & Pacific west of the 16th St. viaduct at Omaha, Neb., have been practically cleared of the old buildings and within a couple of weeks grading will begin. The hills will be cut down and the low places filled to grade. The material for the new freight house will be hauled right onto the grounds, trackage for this purpose to be laid as soon as the grading is completed.

New Hampshire.

The Southern New England R. R. Co., a subsidiary of the Grand Trunk Ry., organized to build a line from White River Junction, Vt., across the state of New Hampshire, has effected its organization, and announcement has been made by President E. H. Fitzhugh, St. Albans, Vt., that surveyors were to be put to work at once to determine the most feasible route for the line.

New Jersey.

The New York & New Jersey Interurban Co., of which H. J. Biel, President of the United Cigar Stores Co., New York, is one of the promoters, has started work in Sussex County on the construction of a 50-mile rapid-transit railroad. The line is to extend from Greenwood Lake to Paterson and thence to Jersey City.

Hearing will be held by Maj. R. R. Raymond, U. S. Engineer, at 10:30 a. m., April 8, at Court House Bldg., Cape May Court House, N. J., on the application of the Wildwood & Delaware Bay Short Line Ry., Wildwood, N. J., for approval of plans for construction of bridges over waters of Sunset Lake, Hanns Canal, Grassy Sound and Old Turtle Creek, the closing of Shaws Creek and building of trestle in next Run in Middle Township, Cape May County, N. J.

New York.

The State Public Service Commission has passed the petition for the elimination of the three grade crossings south of Jamesville on the Delaware, Lackawanna & Western R. R. The estimated cost, including 10 per cent for engineering and surveying, totals $30,791.07. Of this one-half will be met by the company, one-quarter by the state and one-quarter by the locality.

A bill is before the State Legislature to extend the time for constructing the Cortland & Auburn Ry. This company was incorporated several years ago and proposed to build a line running from Cortland to near Glen Haven, on Skaneateles Lake, and then to the city of Auburn.

The Erie R. R. has completed preliminary surveys for a 3-mile spur into the center of the village of Warsaw.

It is understood that negotiations are underway whereby an American banking syndicate will furnish some $60,000,000 for the building of a government railway in Spain which will pierce the Pyrenees with costly tunnels. It is rumored that John F. Stevens, Waldorf Astoria, New York City, will have charge of the construction of the railroad, either as contractor or supervising engineer.

North Carolina.

The Board of Aldermen, Raleigh, N. C., has granted the Raleigh, Charlotte & Southern Ry. Co. a franchise to enter Raleigh and cross certain streets and avenues. The road has the privilege of crossing the city between West St. and Glenwood Ave., parallel with the Seaboard connecting with the Raleigh & Southport on the other side of the town. The company has agreed to construct steel or concrete bridges over the principal streets of the city. E. S. Duncan is First Vice President of the road.

Ohio.

⦿H. E. Culbertson Co., Cleveland, O., has been awarded the contract for about six miles of second-track and grade-reduction work for the elevations of the tracks of the Pittsburgh, Cincinnati, Chicago & St. Louis Ry., through Piqua, O.

Preliminary legislation is before the City Council of Lorain, O., for the construction of a subway under the Baltimore & Ohio R. R. at East 28th St. The railroad company has expressed its willingness to go ahead with the work. The subway will cost about $140,000, half of which will be paid by the city. C. M. Osborne is City Engineer.

The Toledo, Defiance & Fort Wayne Ry. Co. is planning a 100-mile interurban line from Fort Wayne, Ind., to Toledo, O. Surveys for the line have been made, but the capital for construction has not been secured as yet. T. C. Jack, Defiance, O., is Secretary and General Manager.

It is rumored that the officials of the Baltimore & Ohio Railroad have decided to construct a large round house and repair shop in the Canal Dover, O., yards this Spring. At present the shops are located at Holloway.

Oklahoma.

⦿Grading work was started on Feb. 20 on the extension of the Clinton, Oklahoma Western Ry. westward from Butler, Okla. The

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] Maney Bros., Empire Bldg., Oklahoma City, Okla., [illegible] have the general contract. All the grading work has been sublet and the general contractors will do the bridging, tracklaying and building of depots. The work includes about 1,000,000 cu. yds. earth excavation, 50,000 cu. yds rock excavation, and 3,000 ft. pile trestle. The following have sub-contracts on the work: Acklin Bros., Oklahoma City; Mat Cunyan, F. L. Adams, T. C. Lininger, Dan Sweeney, Bob Rutman, J. H. Martin, Oklahoma City; Pat Gleason, Kansas City, and J. R. Hole, Woodward, Okla.

Press reports quote President Mudge of the Chicago, Rock Island & Pacific as stating that that railroad will start to work on its Ardmore-Waurika line about Jan. 1 next. The old Frisco right of way between the two points has been purchased so as to avoid that clause of the state constitution requiring railroads to domesticate before they can secure a right of way, and the Frisco and Rock Island will use the line jointly. The line from Ardmore will pass through the towns of Oil City, Hewitt, Joiner City and Cornish to Waurika, about 60 miles.

It is reported that the Rock Island will place engineers in the field shortly for an extension from Chattanooga, Okla., to Electra, Tex., to tap the recently discovered oil field in the Electra Valley.

The Enid Interurban Traction Co., H. M. Spalding, General Manager, North Enid, Okla., is to build a 3-mile line connecting Enid and North Enid.

The Oklahoma & Northwestern R. R., a new project, has surveys under way for a line from Putnam City to Woodward. Representatives of the company state that they hope to complete surveys and settle right of way questions by the beginning of the summer months, so that grade work can be commenced then. E. A. Wagner, Oklahoma City, is interested.

The Missouri, Oklahoma & Gulf Ry., J. J. Harrison, Chief Engineer, Muskogee, Okla., will shortly let a contract for a 3-mile industrial line from the town of Bromide to the limekilns and the glass sand quarries near that place.

The Midland Valley R. R. is reported to have surveys under way for an extension from Glenn Pool through Keifer and Sapulpa to Tulsa.

The Bartlesville Interurban Ry. Co. has completed preliminary surveys for a 16-mile extension paralleling the Santa Fe from Dewey to Copan and Caney, Kan. The construction capital has been secured, but the date for awarding contracts has not been determined on. J. J. Curl, Bartlesville, Okla., is President and T. S. Askin, Bartlesville, Okla., is Chief Engineer.

It has been announced by J. H. Johnston, Oklahoma City, Okla., Assistant to William Kenefick, President of the Missouri, Oklahoma & Gulf R. R., that all contracts for the Oklahoma City-Henryetta extension will be let about April 1. President Kenefick is going over the north division and dividing up into sections that portion of the division to be built by the Fidelity Construction Co., which includes the heaviest construction portions and also apportioning into sections the part he desires to let to sub-contractors. After completing this task Mr. Kenefick will return to Muskogee and will complete the letting of all contracts for the Wagoner-Joplin division. As soon as this is disposed of he will start out over the Oklahoma City division and sectionize the line between here and Henryetta, selecting the heavy construction sections for the Fidelity people and those upon which steam shovels are not required for subcontract work. The work likely will be completed and the company ready to let out all Oklahoma City division contracts by April 1.

Oregon.

Articles of incorporation have been filed with the County Clerk at Portland by M. J. [illegible] Canby Molalla Ry. Co. This company plans to build an electric line from Canby through the southeastern section of Clackamas County. Plans of the organization also include the construction of other lines. The company is organized for only $100,000, but it is understood that Eastern and Walla Walla interests are supporting the enterprise. An auxiliary company has announced plans for constructing a dam across the Molalla River above Canby for the storing of water for irrigation and power purposes. It is the ultimate plan of these interests to construct an electric line from Canby into the Tualatin Valley district and thence to Portland.

Pennsylvania.

⊙The following have been awarded the contracts for the proposed change of line of the Delaware, Lackawanna & Western R. R. west of Scranton, Pa.: Waltz & Reese, Stanhope, N. J.; Timothy Burke, Connell Bldg., Scranton, Pa.; Hyde, McFarlin & Burke, 90 West St., New York City; D. W. Flickwir, Terry Bldg., Roanoke, Va.; W. H. Gahagan, 189 Montague St., Brooklyn, N. Y.; James A. Hart Co., 256 Broadway, New York City; Reiter, Curtis & Hill, Arcade Bldg., Philadelphia, Pa.; P. McManus, 224 North 32d St., Philadelphia, Pa.; Robt. Grace Contracting Co., Scofield Bldg., Cleveland, O.; A. M. Talbot Co., 1 Madison Ave., New York City.

⊙The Miller Construction Co., Lock Haven, Pa., has been awarded a contract for the grading and masonry work for a 5-mile extension of the Buffalo, Rochester & Pittsburg Ry.'s Jacksonville Mine line in Indiana County, Pa.

South Dakota.

Articles of incorporation have been filed at Pierre, S. Dak., by the Upaliki & Southern Ry. Co., which proposes the construction of a railroad between Upaliki and Flintville, Mo. The company is capitalized at $100,000 and the incorporators include Thomas Graham, E. P. Flint, George D. Talmadge and E. C. Talmadge, all of Chicago, Ill.

Tennessee.

The East Tennessee Traction Co. has been chartered with a capital stock of $100,000, and propose to build an interurban line from Chattanooga to Cleveland, a distance of 30 miles. The company will enter the city of Chattanooga over the tracks of the Chattanooga Railway & Light Co. The incorporators are: John W. Adams, George B. Adams, B. C. Roper, Lewis M. Coleman and William L. Frierson.

The Chattanooga, Rome & Atlantic Interurban R. R. Co. has made application for permission to exercise the franchise it holds through Chickamauga Park. It is the intention of the company to build its line through Chickamauga Park over the right of way held through the franchise granted to S. W. Devine, Chattanooga.

Announcement has been made that construction work will be started early this spring on the Elkhorn & Allegheny Ry. from Thurmond, near Roaring Gap, 13 miles west of Elkins, toward Bristol. This new road will make connection with the Virginia & Southwestern at Mountain City and will thus give the North Carolina mountain territory direct communication with Bristol. The line will be 75 miles in length. John A. Mills, Raleigh, N. C., is President.

It is persistently reported that the Southern Ry. will, at an early date, double track the line from Morristown, Tenn., to Bull's Gap or Rogersville Junction. The citizens of Morristown have offered to donate 65 acres of land providing the company will make the city a "turn around" and coal distributing point.

Texas.

⊙J. T. Hughes, Dallas, Tex., and Brown & Ashburn, Mineral Wells, Tex., are reported to have been awarded grading contracts for the new Stamford & Eastern R. R.

Arrangements are being made to form a company to build an interurban electric railway between Seguin and New Braun[illegible] [illegible] New Braunfels and San [illegible]. These two lines will be about 50 mi[illegible] long. The parties interested in these lines [illegible] also interested in the Guadalupe Water P[illegible] of Seguin, Tex., which proposes to [illegible] a series of dams and hydro-electric [illegible] on the Guadalupe River. Among those interested are Walter J. Crawford, W. B. Du[illegible] Beaumont, E. W. Brown of Orange, J[illegible] bott and F. C. Weinert of Seguin.

The East Texas Traction Co., capit[illegible]zed [illegible] $2,000,000, of which $1,000,000 is cert[illegible]d [illegible] subscribed and $200,000 paid in, has [illegible]ed charter with the Secretary of Stat[illegible] T[illegible] company was formed for the announ[illegible] purpose of constructing an interurban rai[illegible]ay between Dallas and Wolfe City via G[illegible]nville. The principal offices of the compan[illegible] are be located at Greenville. This is the [illegible] which has been promoted by Joseph [illegible] ols of Greenville, Tex.

The Northern Texas Traction C[illegible] H. Clifford, General Manager, Fort W[illegible] is planning to expend $50,000 to $100,0[illegible] year for double track work betwe[illegible] Worth and Handley.

The Executive Committee of the [illegible]xa[illegible] Pacific Ry., C. C. Chamberlain, Chie[illegible] E[illegible] neer, Dallas, Tex., is understood to [illegible] der contemplation plans for raising fr[illegible] 000,000 to $15,000,000 for the purpose [illegible] ing off the floating debt and making im[illegible] ments.

Citizens of Robert Lee, the county [illegible] Coke County, have offerd a $50,00[illegible] for a railroad connection. The tow[illegible] miles distant from the nearest railroa[illegible]

An election will be held at Den[illegible] March 30 to vote on granting a fran[illegible] the Missouri, Kansas & Texas Ry., [illegible] construction of a cut-off between th[illegible] Worth and Dallas line in the south [illegible] the city.

Tracklaying has been started on th[illegible] toria extension of the St. Louis, Bro[illegible] & Mexico Ry. at Bloomington, Texa[illegible] estimated that a half mile of track [illegible] laid per day and that the entire stre[illegible] be completed within a month. L. A. [illegible] ger is Engineer of Construction, an[illegible] F[illegible] Jonah, St. Louis, Mo., is Chief Engine[illegible]

Negotiations are under way by off[illegible] the San Antonio, Uvalde & Gulf R. R[illegible] cure a site of 30 acres to locate the [illegible] the company at Terrel Wells, San [illegible] Texas.

Committees from Lubbock, Texas, [illegible] field, Seminole and Pecos, Texas, rece[illegible] at Brownfield to discuss the constru[illegible] the Pecos Valley Southern Railway [illegible] road from Pecos to Lubbock throug[illegible] S[illegible]nole and Brownfield.

Utah.

⊙Articles of incorporation have be[illegible] by the St. John & Ophir Railroad C[illegible] the county clerk at Salt Lake City, Uta[illegible] capital stock of the company is $150,00[illegible] officers are: J. Ross Clark, president [illegible] Whittemore, vice president; W. H. C[illegible] secretary and treasurer. These with [illegible] Cherrington and W. A. Clark, Jr., w[illegible] the board of directors. All of the offi[illegible] connected with the Salt Lake rout[illegible] road will run from St. John on t[illegible] Lake route to Ophir, a distance of te[illegible] In speaking of the new road, J. Ros[illegible] said: "My brother, Senator William A[illegible] has decided to build the road. It will [illegible] with his own capital and will not be a [illegible] the Salt Lake route. We will make [illegible] tions with it, however, and will handle [illegible] traffic there. Work on the new road [illegible] commenced in March by the Utah C[illegible] tion Co., with which I closed a cont[illegible] behalf of my brother."

It is reported that the American F[illegible] Salt Lake City, Utah, is planning to bu[illegible] Thompson's & Ballard Railroad, [illegible] County,, connecting the mines with th[illegible] ver & Rio Grande at Thompson's, a [illegible] of 5 miles. Among those interested in t[illegible] company are: B. F. Bauer, H. S. A[illegible] sen, P. C. Kittle, Henry Cohn and ihn.

ilworth & Helper Railroad Co., has [illegible] further development of railroads n Utah. The officers and directors company are: C. N. Strevell, Salt sident and general manager; James n, Salt Lake, vice-president and F. A. Druehl, secretary; Walter oria, Ill.; Charles W. Buckley, Chi- nan B. Holter, Helena, Mont.; M. r, Salt Lake; Joseph Geoghegan, and H. C. Edwards, Salt Lake.

are to be started at once for the pro- urban railway from Salt Lake City in Utah County. It is hoped to struction work this spring or early mer. This line will cost something 000. H. A. Strauss of the Falk- struction Co., 30 N. La Salle St., [illegible]

Virginia.

thern Neck Construction Co. has zed to build the Richmond, Wash- Chesapeake Ry. mentioned in our The railway is to be about 8 and will extend from Doswell to a. The construction company is a corporation, with Walter Fairchild t. Channing M. Ward, 1817 Han- Richmond, Va., is President of the

Washington.

riman railroad interests have pur- trol of the Bellingham Bay & Brit- ia Ry. and the Bellingham Ter- including the largest part of the water front, for a sum said to 00,000. The Bellingham Bay Ry. m Bellingham 45 miles eastward to necting at Sumas with the Cana- and Northern Pacific. The Cana- runs trains over it by traffic agree- vns the most valuable part of Bel- water front and has the only dock

Commission of Centralia has right of way through the city to ia Electric Light & Traction Co., rporation recently formed for the building an electric line from Cen- Rochester. The company's power already been completed and d active construction on the line [illegible]

in Whitman County are raising the purpose of building a 10-mile m La Crosse on the Oregon-Wash- lway & Navigation Co.'s line to The spur would tap a rich farming lying along Willow Creek and Al- t. practically all in Whitman County. orts quote J. Lord, president of the tional Bank, Olympia, as announc- ancial backing has been obtained posed line to connect Olympia with ne of the Northern Pacific, eight of the city. It will be necessary a strip of the old Union Pacific grade ld by the Spokane, Portland & Seattle y. If the Hill railroad officials refuse it it, condemnation proceedings already will be completed. It is proposed to soline motor cars from Olympia to meet ins on the main line between Tacoma ortland. The Olympia Terminal R. R. as franchises in Olympia and Tumwater network of tracks and spurs over the ia water front all protected by common auses. It is stated that every effort had ade to get railroads to come to Olym- The Chamber of Commerce of Olympia get no satisfaction from any of them. was decided to build to the railroads.

s understood that Porter Bros., Port- Ore., and Grant Smith & Co., who, as oned recently in Engineering & acting, have the contract for a of the Point Defiance line of the ern Pacific, have started work on the

[illegible]

The Board of [illegible], Seattle, Wash., [illegible] Ry. Co., to construct [illegible] a spur track [illegible]

West Virginia.

The Fairmont & Clarksburg Traction Co., J. A. Watson, General Manager, Fairmont, W. Va., will let contracts, it is reported, about April 1, for the construction of its proposed line from Watson to Clarksburg, 16 miles. W. J. Morrow, Will Perrington, John Majors, [illegible] man are interested.

Work will be started at once on the construction of the New Northern Pacific shops at Yardley, near Spokane. This work will call for the expenditure of about $100,000. M C. Murphy has the contract.

Bids are to be taken at once by the city of Seattle, Wash., for a municipal logging road to run from Moncton to Camp No. 2 in the Cedar River Valley. The specifications include: 160 tons of rail, 600 pairs of angle splice bars; twelve 200 lb kegs of track bolts; 7,500 ties; clearing, grading, grubbing, etc.

Wisconsin.

The Fairchild & Northeastern Ry., Willard Foster, Vice President, Fairchild, Wis., expects to let contracts within the next two weeks for its 42-mile extension from Fairchild to Caryville.

A company has been organized at Lancaster for the purpose of handling the preliminary work for the proposed Short Line Electric R. R. The capital stock will be $25,000, which will be used for surveys and other work. W. W. Smith, Platteville, Wis., is interested.

Among the reports concerning the improvement work planned by the Chicago & Northwestern Ry., is one to the effect that the company will construct a new roadbed on the Minnesota and Madison divisions.

A movement has been launched at Fond du Lac., Wis., to induce the Chicago, Milwaukee & St. Paul Ry. to build a line from that city along the east shore of Lake Winnebago tapping a number of summer rosorts and terminating at Hilbert Junction.

The State Railroad Commission, Madison, Wis., has granted the Chicago, Burlington & Quincy Ry. a certificate of necessity and convevience empowering it to double track its line between Stoddard, Vernon county, and Desoto, Crawford county, and from McCartney to Blake, in Grant county, in the southwestern corner of the state. This line skirts the Mississippi river. The contemplated improvements include reballasting of the roadbed and improving the track generally. T. E. Calvert, Chicago, Ill., is Chief Engineer of the C. B. & [illegible]

The State Railroad Commission, Madison, Wis., has issued an order instructing the Chicago & Lake Superior Ry Co. to extend its line from Cambridge to Rock Dale, in Dane county, a distance of two and one-half miles. The company already operates a line from London to Cambridge, a distance of 3.17 miles, and is the shortest independent road in the state. The company is controlled by B. L. Delamater of Cambridge, Wis.

Canada.

⊙The Guelph Radial Ry. Co., J. U. Pequegnat, Secretary, Guelph, Ont., has awarded the following contracts for the supply of material to be used in the extension of the St. Patrick's Ward branch to the city limits: Steel rails, Drummond & McColl, Montreal; ties, Contractors' Supply Co., Toronto; wire, Dawson & Co., Montreal.

Engineers of the Canadian Pacific have completed the running of a new line to Collingwood from a point named Baxter, on or near the Toronto-Sudbury section of the C. P. R. R. The surveyors left Collingwood a few days ago for Guelph to continue their survey from this city to Beeton, which is ten miles south of Baxter. For a considerable time there has been talk of the C. P. R. R constructing a railway connecting southwestern Ontario with the Sudbury section of the road at a point north of Toronto. A year ago a line was surveyed from the neighborhood of Schaw on the Toronto-Windsor division to the Guelph Junction road, a few miles south of Guelph. It seems as if the present work is being done in continuation of this line northeastward.

The Montreal Tunnel Co., Ltd., of Montreal, Que., has been incorporated with a capital stock of $15,000,000 and proposes to construct and maintain railways and steamship terminals, tunnels, approaches, etc. The incorporators are Duncan McDonald, Henry Timmins, Duncan McMartin, John Carson, Patrick Dubee and other Montreal capitalists.

The Toronto Suburban Street Ry. Co., 1688 Dundas St., W. Toronto, Ont., has begun grading operations for the completion of its line from Weston to Woodbridge. Construction work will also be put under way shortly on a new line to Georgetown.

A by-law will be voted on by the citizens of St. Thomas, Ont., to raise $30,000 for the improvement of the city's street railway. Three new cars will be purchased, the lines on Ross and William streets extended, and the present plant and equipment overhauled.

The Canadian Parliament has authorized the construction by the Canadian Pacific Ry. of the following new lines in Saskatchewan and Alberta: From a point at or near Hawarden on its Moose Jaw northwestern branch to a point at or near Floral, or Cheviot, on its Pleasant Hills branch or to a point between these two places in the province of Saskatchewan. From a point on its Estevan-Forward branch in township 2 or 3, range 12, 13 or 14 west of the second meridian in a westerly and norwesterly direction to a junction with its Weyburn-Lethbridge branch in township 5 or 6, range 25 or 26 west of the second meridian in the province of Saskatchewan. From a point at or near Cedar Lake on its Hardisty subdivision in a southerly direction to a point in township 39 or 40, range 11 or 12 west of the fourth meridian into the province of Alberta. In a norwesterly and northerly direction from a point on its line from Wilkie, authorized by paragraph (B) of section 3 of chapter 74 of the statutes of 1907 to a point near the north Saskatchewan River in township 51, 52 and 53, 54, 55, or 56, range 1, 2, 3, 4, 5, 6, 7 or 8 at west of the fourth meridian in the provinces of Saskatchewan and Alberta. From a point at or near Kipp on its Crows Nest subdivision in an easterly and northeasterly direction to a point in township 12 or 13, west of the fourth meridian in the province of Alberta. From the northwesterly terminus of the line from Asquith, authorized by paragraph (B) of section 3 of the statutes of 1910 in a westerly and northwesterly direction to a point at or near Battleford in the province of Saskatchewan. From a point at or near Dricana in an easterly and southeasterly direction to a point in township 20 or 21, range 11, 12, 13 or 14 west of the fourth meridian in the province of Alberta.

The Central Railway of Canada has completed all arrangements for a new station and terminals in Montreal, and has submitted its plans to the Railway Commission. The station will be located in the eastern part of the city. It is announced that the contract for the line between Montreal and Ottawa has been let and that active construction work will commence in the spring.

Mexico.

The National Rys. of Mexico, H. M. Taylor, Director of Construction, City of Mexico, opened bids on March 15, for clearing, grading and masonry on the proposed line from Allende, kilometer 52 of the Monclova Division, old Mexican International R. R., to the Hacienda de San Carlos, State of Coahuila.

[illegible] Co., Ltd., with headquarters at Toronto, Ont., [illegible] $25,000,000 [illegible] Ont., are interested in this project.

[illegible]

ning, according to reports, the construction of a branch line from its international division at Allende to Los Vacas, a distance of about 70 miles. In connection with this work it is believed that a bridge will be erected over the Rio Grande River connecting Los Vocas with

Del Rio, Texas. The Kansas City [illegible] which has a line under [illegible] from San Angelo, Texas, to Del Ri[illegible] connections with the [illegible] Mexico providing a through route [illegible] co.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids are being received by town of Uniontown, Ala., D. P. Coleman, Mayor, for laying concrete walks and curbing with gutters estimated to cost about $10,000.

✣The Board of Revenue, Mobile County, Mobile, Ala., will let the contract March 28 for 100,000 cu. yds. of road surfacing material, chert, clay gravel, sand gravel, screened gravel and oyster shells. C. L. Strange, Room 11, Bank of Mobile Bldg., Mobile, is County Highway Engineer.

A new macadam road is to be built from Calera, Ala., to Birmingham under the supervision of the state highway engineer. The survey for a considerable distance has been completed and practically all the deeds for right of way have been secured. W. S. Keller, Montgomery, Ala., is State Highway Engineer.

The Alabama State Highway Department, Montgomery, announces that steps will shortly be taken for graveling the road between Montgomery and Wetumpka. The Elmore County Commissioners, Wetumpka, will donate $4,000 toward the construction of the road while a like amount will be expended on the road by the state.

Arkansas.

✣Bids will be received until 10 a. m., March 20, by J. F. Houck, 309 Main St., Little Rock, Ark., Chairman for Improvement District No. 197, for grading, draining, and paving with macadam, tarvia macadam or bitumated concrete approximately 10,000 sq. yds. Plans and specifications are on file with W. J. Terry, Secy., or Ford & McCrea, Gazette Bldg., Little Rock, Ark., Engineers.

✣Bids will be received until noon, March 25, by Board of Commissioners for Street Improvement District No. 192 (West Seventh St.), Little Rock, Ark., for grading, draining, curbing and paving with wood block, asphalt or brick approximately 16,850 sq. yds. of pavement. Bids must be addressed to A. Brizzolara, Chairman of the Board, in care of the Mercantile Trust Co., Little Rock, Ark. Ford & McCrea are Engineers.

The City Council of Lake Village, Ark., is taking steps toward putting in a considerable amount of paving.

Property owners of Porter St., Helena, Ark., are agitating the proposed paving of a district in that vicinity, including Porter St., with vitrified brick.

California.

The citizens of Coronado, Calif., on March 5 voted the issuance of bonds to the amount of $75,000 for the building of the sea wall to the height originally intended and in the sum of $80,000 for the paving of Orange Ave., with asphalt on a concrete base.

District of Columbia.

✣Bids will be received until March 22, by Maj. H. L. Pettus, Depot Quartermaster, Washington, D. C., for furnishing and delivering at the National Cemetery roadway, Culpeper, Va., 600 gals. tarvia and 10 cu. yds. of clean sharp sand.

✣Bids will be received until 2 p. m., March 28, by Commissioners of the District of Columbia, Washington, D. C., for laying about 2,000 sq. yds. of cement concrete base in Michigan Ave. N. W. west of First St. Specifications may be obtained of the Clerk of the Engineering Department, 427 District Bldg.

The Engineering Department of the District of Columbia has announced that work will be commenced immediately on the resurfacing of portions of 17 streets in Washington. The approximate cost of the spring repairs will be $125,000. The following are the streets which are to be resurfaced: M street northwest, between 18th St. and New Hampshire Ave., $17,000; Eighth St. northwest, between S St. and Florida Ave., at $7,200; Ninth St. northwest, west side, between F and G Sts., at $1,200; Tenth St. northwest, between K and M Sts., at $6,400; 11th St. northwest, between Pennsylvania Ave. and E St., at $4,200; 15th St. northwest, between New York Ave. and H St., at $7,000; L St., northwest, between 14th and 16th Sts., at $10,000; H St. northwest, between 18th St. and Pennsylvania Ave., at $2,300; Fourth St. northeast, west side, between T and U Sts., at $1,600; New York Ave. northeast, between North Capitol and First Sts., at $5,000; Pennsylvania Ave. northwest, between 19th and 21st Sts., at $8,-$11,000; South side of Pennsylvania Ave. northwest, between 19th and 21st Sts., at $8,000; Pennsylvania Ave. northwest, between Third and Sixth Sts., at $32,000; O St., between Tenth and 11th Sts. northwest, at $2,200; North side of New York Ave. northwest, between 14th and 15th Sts., at $3,800; N St. northwest, between Tenth and 11th Sts., at $1,400; East Capitol St., between Sixth and 11th Sts., at $11,000.

Florida.

✣Bids will be received until 10 a. m., March 29, by C. W. Ellis, Chairman Board of Commissioners, Duval County, Jacksonville, Fla., for the clearing and grading of the river road from the city limits of South Jacksonville to the Style Road. Plans and specifications are on file with Gail L. Barnard, County Engineer.

✣Bids will be received until 10 a. m., March 22, by C. W. Ellis, Chairman Board of Duval County Commissioners, Jacksonville, Fla., for the clearing and grading of Lake Shore Blvd. through Lake Side Park. Plans and specifications are on file with Gail L. Barnard, County Engineer.

Illinois.

⊙Bids have been received by the city of Pana, Ill., A. C. Stanfield, Engineer, for constructing brick pavement on a number of streets, the contract being awarded on March 14 to John Cherry, Jacksonville, Ill., at $69,197. The unit bids on the work were as follows: (1) standing for bid of John Cherry; (2) for bid of O. T. Dunlap, Edwardsville, Ill.; (3) bid of D. E. Murray, Pana, Ill.; (4) bid of John E. Bretz, Springfield, Ill.; (5) bid of Richard Egan, Springfield, Ill.; (6) bid of A. K. Meeker, Muncie, Ind.; (7) bid of Everett Prosser, Cairo, Ill., and (8) bid of Pronger & Fletcher, Blue Island, Ill.:

		(1)	(2)	(3)	(4)	(5)	(6)	[illegible]
Brick pavement, sq. yds.	[illegible]	$1.62	$1.64	$1.63	$1.67	$1.69	$1.66	[illegible]
Excavation, cu. yds.	15,525	.20	.25	.25	.22	.30	.23	
Fill, cu. yds.	18	.40	.40	.40	.20	.38	.30	[illegible]
Concrete curb and gutter, lin. ft.	[illegible]	.47	.47½	.52	.46	.54	.46	
Marginal curb, lin. ft.	[illegible]		.30	.28	.26	.30	.20	[illegible]
Gutter, lin. ft.	474	.25	.30	.33	.32	[illegible]	.25	
Vit. clay pipe, 6-in., ft.	50	.15	.20	.14	.15	.40	.15	[illegible]
Vit. clay pipe, 8-in., ft.	171	.22	.22	.21	.20	.45	.20	[illegible]
Vit. clay pipe, 10-in., ft.	869	.30	.30	.28	.30	.50	.25	
Vit. clay pipe, 12-in., ft.	869	.40	.40	.38	.40	[illegible]	.35	[illegible]
Vit. clay pipe, 15-in., ft.	592	.45	.45	.43	.43	.60	.43	[illegible]
Catch basins	27	25.00*	25.00	25.00	22.00*	25.00	[illegible]	[illegible]
12-in gutter grates	7	1.50	1.50	1.50	1.50	1.50	1.50	[illegible]
Oak header boards, lin. ft.	1,062	.05	.03	.05	.05	.15	.05	

*$18 for catch basins for two alleys.

The Board of Local Improv[illegible]ents [illegible] Springfield, Ill., has adopted a resolution authorizing the paving with brick of Reynolds St., from Sixth to 19th St. with brick.

The City Council of Collinsville, Ill., has decided to pave the St. Louis road, from Main St. to the western limits of the [illegible] street will be 36 ft. wide and paved [illegible] blocks.

Ordinances have been passed by the Council of Jerseyville, Ill., for the [illegible] tion of several miles of brick an[illegible] pavement.

The citizens of Malta, Ill., at a re[illegible] tion voted the issuance of bonds i[illegible] of $8,500 for the purpose of constru[illegible] roads.

The City Engineer of Cairo, Ill., [illegible] pleted the estimate for the paving [illegible] St., between Commercial and Wash[illegible] Aves., and an ordinance for the sam[illegible] drawn. It is probable that Sevent[illegible] tween Commercial and Washington [illegible] also be paved in the near future.

Plans have partially been complete[illegible] Engineer Geo. L. Farnsworth of Ot[illegible] for the construction of vitrified brick [illegible] at an estimated cost of $340,000. [illegible] will be let in two jobs and will inc[illegible] crete foundation, concrete curb and [illegible] filler. The contracts will be let th[illegible] E. G. Bradford is Mayor.

Plans have been prepared by City [illegible] L. D. Jeffries of Peoria, Ill., for the [illegible] tion of approximately 50,000 sq. yds [illegible] pavement at an estimated cost of $21[illegible] work will include concrete foundatio[illegible] curb 6x22, grout and pitch filler. Co[illegible] be let some time this month.

Indiana.

✣Bids will be received until 4 p. [illegible] 1, by City Clerk, Goshen, Ind., fo[illegible] First and Pike Sts.

✣Bids will be received until 2 p. [illegible] 2, by Board of Grant County Commis[illegible] Marion, Ind., for grading, graveling [illegible] adamazing the Simeion G. Kern et a[illegible] Pleasant Township. Plans and profil[illegible] file at the office of E. H. Kimball, [illegible] Auditor.

✣Bids will be received until 2 p. [illegible] 2, by Board of Grant County Comm[illegible] Marion, Ind., for the grading, grav[illegible] macadamizing of the S. R. Fankbon[illegible] road in Center Township. Plans a[illegible] ifications are on file with E. H. Kimb[illegible] tor of Grant County.

✣Bids will be received until 2 p. [illegible] 2, by Board of Grant County C[illegible] ers, Marion, Ind., for grading, grav[illegible] macadamizing J. H. Weaver et al. [illegible] Pleasant and Franklin Townships. [illegible] Kimball is County Auditor.

✣Bids will be received until 7 [illegible] 21, by Board of Public Works, Fort [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

W Becker, Clerk, for the following im- ents: For the paving of Butler St., the east property line of Clinton St. to t property line of Lafayette St.; for [illegible] of Kinnaird Ave., from the [illegible] line of Fairfield Ave. to the east line of Broadway (excepting the in- [illegible] of South Wayne Ave.); [illegible] of Walnut St., from the west property [illegible] Fairfield Ave. to the east property line [illegible] St.; for the paving of South Wayne [illegible] from the south property line of Creigh- [illegible] the south property line of [illegible]; or the paving of Harrison St., from th property line of the alley south of St. to the north property line of Butler [illegible] the intersection of Williams [illegible]; or the paving of Fourth St., from the operty line of Calhoun St. to the west line of Clinton St.; for the paving of Ave., from the east property line of Ave. to the west property line of War- r the paving of Superior St., from perty line of Calhoun St. to the rty line of Wells St.; for the pav- Ave., from the west property line Ave. to the west property line of ; for the paving of Maiden Lane, rth property line of Main St. to roperty line of Pearl St.; for the Wells St., from the north property Superior St. to the bridge crossing Mary's River; for the paving of Har- from the north property line of the south property line of Su- for the paving of Harrison St., rth property line of Superior St. property line of Mary E. Trent- division; for the paving of Wayne e west property line of Grant Ave. property line of Glasgow Ave.

[illegible] be received until April [illegible] ity, Ind., for the construction of ls. of pavement on Baltimore St. [illegible] City Engineer.

[illegible] received until 10 a. m., March [illegible] d of Marion County Commission- lis, Ind., for furnishing one road use on Marion county highways; Marion County Court house. W. s County Auditor.

ll be received until 11 p. m., April l of Hendricks and Morgan Coun- [illegible] Danville, Ind., for the tion of a county line road. L. W. Danville, Ind., is Auditor of Hen- [illegible]

ll be received until 10 a. m., April l of Clark County Commissioners, e, Ind., for the construction of a Jeffersonville township. George W. s Auditor of Clark County.

ill be received until 10 a. m., April of Porter County Commissioners, Ind., for the construction of gravel berty and Jackson townships. C. is County Auditor.

ill be received until noon, April 2, f Dearborn County Commissioners, rg, Ind., for the construction of [illegible] in Jackson and Clay town- S. Fagely is County Auditor.

ll be received until noon, April 2, f White County Commissioners, Ind., for the construction [illegible] stone road in Cass township. A. G. ounty Auditor.

ll be received until noon, April 2, f Sullivan County Commissioners, nd., for the construction of a stone Curry township, gravel road in Gill p and gravel and stone road in Hamil- nship. B. C. Crowder is County Aud- [illegible]

ill be received until 10 a. m., April [illegible] of Howard County Commissioners, nd., for the construction of four ls in Center township, one in Clay and one in Howard township and [illegible] township. A. B. Easterling [illegible] Auditor.

s will be received until 2 p. m., April 2, f Scott County Commissioners, [illegible]

✣ [illegible]

[illegible] Auditor.

✣ [illegible]

[illegible] of a gravel road in Chester township. Daniel [illegible]

✣Bids will be received until April 2, by [illegible]

✣ [illegible] 2, by Board of Grant County Commissioners, Bloomington, Ind., for the construction of two stone roads in Bloomington township. Horace Blakely is County Auditor.

✣Bids will be received until 2 p. m., April [illegible] Marion, Ind., for the construction of a gravel road in Jefferson township. E. H. Kimball is County Auditor.

✣Bids will be received until 2 p. m., April [illegible] Marion, Ind., for the construction of a gravel road in Liberty township. E. H. Kimball is County Auditor.

✣Bids will be received until 2 p. m., April 1, by Board of Morgan County Commissioners, Martinsville, Ind., for the construction of gravel roads in Monroe and Jefferson townships. J. S. Whitaker is County Auditor.

✣Bids will be received until 11 a. m., April 1, by Board of Jennings County Commissioners, Vernon, Ind., for the construction of a pike road on line between Spencer and Geneva townships.

✣Bids will be received until 2 p. m., April 1, by Board of Crawford County Commissioners, English, Ind., for the construction of a rock or macadamized road in Whiskey Run township. J. Evan Jones is County Auditor.

⊙The Board of Posey County Commissioners, Mt. Vernon, Ind., J. R. Haines, County Auditor, has awarded the following contracts for road work for which bids were received on March 11: Mt. Vernon Construction Co., Mt. Vernon, J. W. Wiggins road at $1,749; G. R. Adams & Co., Princeton, Ind., C. E. Showers road at $1,461 and Uril Reynolds road at [illegible]

⊙The Marion County Commissioners, Indianapolis, Ind., have awarded the following contracts for road work for which bids were received March 11: Zaring & Co., Indianapolis, furnishing 130 cars of stone at $1.15 per ton; Ohio & Indiana Stone Co., Terminal Traction Bldg., Indianapolis, furnishing 40 cars of stone at $0.99 per ton; A. B. Meyer & Co., Indianapolis, furnishing 40 cars of stone at $0.99 per ton; Barrett & Co., Cincinnati, O., furnishing 40,000 gals. of Tarvia binder at $0.10½.

⊙The City Council of Newcastle, Ind., has passed a resolution providing for the paving of Plum St., Walnut St., Church St., Central Ave., Livery St. and Vine St.

⊙The City Council of New Castle, Ind., has awarded the contract for the paving of South 11th St., between Broad and Lincoln Sts., to Charles W. Minniek at $16,889, and the contract for the paving of Broad St., west to the corporate limits to James Garvey at $15,087.

⊙The Board of Public Works of Indianapolis, Ind., has awarded the contract for the paving of North Pennsylvania St., from 27th to 28th Sts., to the Union Asphalt Construction Co., at $3 per lin. ft., on each side of the street. The same company submitted a bid of $2.85 per lin. ft., using tar macadam pavement.

Chas. Sykes-Geo. W. Sykes, Newport, Ind have been awarded the contract by the Board of Vermillion County Commissioners, Newport, for the construction of a gravel road less than 3 miles in Vermillion township at $10,300 and a gravel road in Eugene township [illegible] March 11 by H. T. Bayne, County Auditor.

[illegible] Crawford County Commissioners, English, [illegible] pike road in Ohio township. J. Evan Jones is County Auditor.

[illegible] Ind., has ordered City Engineer H. W. Klaus- [illegible] the improvement of Fletcher Ave., from State Ave. to St. Paul St., with wooden block, asphalt bituminous concrete or brick roadway.

City Engineer Harry Thompson of Logansport, Ind., is making a preliminary survey of Burlington Ave. Specifications will soon be prepared. The street will be paved with brick and will cost approximately $39,000.

The town of Bourbon, Ind., is arranging to improve about two miles of streets the coming summer with paving. A resolution has been adopted favoring the building of eight miles of stone roads. These roads would be built by the County Commissioners, Plymouth, [illegible]

The viewers for the proposed McCullough Blvd., have filed their report in the office of Clark County Auditor George W. Stoner, Jeffersonville, Ind., showing the total length of the road is 1.64 miles. It is estimated that 7,971 cu. yds. of rock will be required on the road and the estimated cost is placed at $11,598. Paris Spurgeon is County Surveyor.

The Marion County Construction Co. submitted the low bids to the Board of Public Works of Indianapolis, Ind., on the paving of Jefferson Ave., from Michigan to 10th Sts., as follows: Asphalt $3.24 per lin. ft.; bitumineral, $3.10; bituminous concrete, $2.90. The Board received the following bids on the furnishing of 400 tons or more of asphalt to the city asphalt repair plant: Barber Asphalt Co., Trinidad pitch lake, $22.40 a ton; Mexican asphalt, $19. Standard Asphaltum & Rubber Co., Sarco refined gilsonite, $28.40 and Sarco refined asphalt, $20.40. John Baker, Jr., Texaco asphalt, $20.40; R. F. Conway Co., Cuban asphalt, $21.75. American Asphaltum & Rubber Co., pioneer asphalt, $20.23. Standard Oil Co., standard asphalt binder, $0.06½ per gal., or $15.60 a ton. Union Oil Co., of California, California asphalt, $22.

The Board of Public Works of Kokomo, Ind., has set March 25 as the date for hearing on the proposed improvement of the roadway of South Courtland Ave., from Markland Ave. to the north side of the south sidewalk of Water St. Ben Havens is City Clerk.

Iowa.

✣Bids will be received until 8 p. m., March 25, by J. F. Golden, City Clerk, Creston, Ia., separately for curbing and paving a number of streets in accordance with plans prepared by City Engineer Theodore S. DeLay. Certified checks payable to the City Treasurer must be filed as follows: $500 for curbing and $3,500 for paving. The job comprises about 50,000 yds. of paving and 45,000 lin. ft. of curbing or combined curbing and gutter requiring 6,591 cu. yds. of crushed stone or gravel; 5,770 tons of sand for foundation and curb work; 11,118 barrels of cement for foundation and curb work. If bituminous concrete or bitulithic be used it will require 450 tons of bitumen and 4,550 tons of mineral aggregate for bituminous surface.

✣Bids will be received until 2 p. m., April 1, by Town Council, La Porte City, Ia., for the construction of 6,100 yds. of brick block paving on concrete base. G. E. Stebbens is Town Clerk and R. B. Slippy, 401-2 Marsh Pl. Bldg., Waterloo, Ia., is Engineer.

✣Bids will be received until 7:30 p. m., April 3, by P. M. Banks, City Clerk, Webster City, Ia., for the construction of about 35,800 sq. yds. of brick block, cement concrete, asphaltic concrete, or bitulithic concrete pavement. The work will include also 27,300 lin. ft. C. H. Currie is City Engineer. Official advertisement will be found elsewhere in this issue.

⊙Following bids were received at Fairfield, Ia., on March 6 for paving work for which

Hall & [illegible] gineers [illegible] Cedar Rapids, Ia. [illegible] Co., Des Moines, Ia.; (3) M. A. Camery, Harlan, Ia.; (4) Dearborn & Jackson, Cedar Rapids, Ia.; (5) National Construction Co., Omaha, Neb.; (6) Independent Construction Co., Davenport, Ia.; (7) Wm. Horrabin, Iowa City, Ia.; (8) Spaulding & Kearns, Fairfield, Ia.; (9) Burlington Construction Co., Burlington, [illegible] Construction Co., Leavenworth, Kan.; (11) J. C. Blunk, Ottumwa, Ia. (awarded contract on asphalt filled brick pavement and creosoted block); (12) Wright & Ball, Bedford, Ia.:

[illegible]	[illegible]	$ 2.15	$ 2.00	$ 1.99	$ 1.95	[illegible]	$ 2.10	$ 2.13	$ 1.92	[illegible]	[illegible]
[illegible]	[illegible]	1.97	[illegible]	1.84		[illegible]	1.92	1.97	1.77	[illegible]	[illegible]
[illegible]							2.44	[illegible]		[illegible]	
[illegible]	[illegible]						1.89	[illegible]			
[illegible]					1.89		1.69	2.20		[illegible]	
[illegible]	[illegible]			[illegible]	.78	[illegible]	.56	[illegible]	.60		
[illegible]	[illegible]	[illegible]	.40	.40	.38	.33	.34	.44	.35	[illegible]	
[illegible]	[illegible]	.60	.60	[illegible]	.60		.49	.71	[illegible]	[illegible]	
False curb, 295 ft.	[illegible]	.26		.60	.38	.28	.34	[illegible]	.25	[illegible]	
[illegible]	[illegible]	.35	.40	.39	.30	[illegible]	.45	.37	.50	[illegible]	
[illegible]	[illegible]	.05	.025	.032	.035	.03	.035	.03	[illegible]	[illegible]	
[illegible]	[illegible]	28.00	30.00	17.00	30.00	15.00	[illegible]	26.00	15.00	[illegible]	[illegible]
Manholes	[illegible]	30.00	30.00	26.00	50.00	25.00	40.00	45.00	35.00	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	.37	.45	.35	.50	.53	.75	[illegible]	
[illegible]	[illegible]	.50	.35	[illegible]	.45	.45	.70	.64	.75	60	

Property owners on Church St., west of Ninth St., and on South 12th St., between Church and Main St., city of Marshalltown, Ia., have petitioned the City Council to pave four blocks with concrete at a cost not to exceed $1.35 per sq. yd.

The City Council of Winterset, Ia., has ordered the city solicitor to prepare resolutions of necessity concerning the paving of all of Court Ave. and West Jefferson and North First Sts.

The city of Waverly, Ia., will consider objections to a resolution of necessity calling for the paving of a number of streets with brick, concrete or asphaltic macadam on April 16. F. A. Lee, City Clerk. Ralph B. Slippy, 401-2 Marsh Place Bldg., Waterloo, Ia., is Engineer.

Kansas.

The City Commissioners of Coffeyville, Kan., have passed a resolution providing for the grading, curbing and paving of West Ninth St., from Willow to Gillam, a distance of 9 blocks.

Louisiana.

⊙Krehler Bros. Co., 68 Court Ave., Memphis, Tenn., has been awarded the contract by the city of Bastrop, La., for the construction of concrete sidewalks at $.0965 per sq. ft.; also crossings at $0.11 per sq. ft.; also fills at $0.40 per cu. yd. Bids were opened March 12.

Maine.

The citizens of Dresden, Me., on March 11 voted the following appropriations: Common schools, $700; contingent expenses, $900; highways, $1,500; bridges, $100; brown tail moth destruction, $150; state road, $400; graveling roads, $300. W. R. Hondlette is Town Clerk.

The citizens of Eliot, Me., on March 11 voted the following appropriations: Road and bridges, $1,500; state roads, $400; common schools, $1,000; high school, $1,400. Joseph H. Dixon is Town Clerk.

The town of Brunswick, Me., has voted to raise by temporary loan $15,000 for the improvement of Main St., between Mill Hill and [illegible]

Maryland.

A bill has been introduced at Annapolis, Md., by Senator Goslin which creates a loan of $4,300,000. Of this $4,000,000 is to be apportioned between the city and the counties in the same ratio that the $5,000,000 loan of 1906 was apportioned, that is to say, four-fifths to the counties and one-fifth to the city. The present opinion is that the appropriations contained in the loan act will be something like the following:

For [illegible] of the [illegible] Road Commission [illegible] the counties	[illegible]
For the city of Baltimore, [illegible]	[illegible]
For the Frere roads in Calvert, Charles and St. Mary's counties	300,000
For the old Philadelphia road in Cecil.	40,000
For [illegible]	

[illegible] on the Delaware [illegible] with the Maryland State road system [illegible] the Washington boulevard [illegible]

Massachusetts.

The City Council of Boston, Mass., on March 11 passed a loan order appropriating $364,000 to be expended by the Street Commissioners in extending Arlington St., from Boylston St. to Columbus Ave.

Michigan.

✣Bids will be received by the City Clerk at Benton Harbor, Mich., until 8 p. m. of March 21, 1912, for material and labor for constructing approximately 13,000 sq. yds. asphaltic concrete pavement on 5-in. cement concrete foundation and 59,000 lin. ft. cement curb and gutter. The council reserve the right to reject any and all bids at their discretion if it is advisable to so do. A certified check of $500 will be required. B. Spalding is City Clerk.

⊙The Globe Construction Co. of Kalamazoo, Mich., has been awarded the contract by John J. Campbell, Clerk of the township of Winsor, Pigeon, Mich., for the construction of 15 miles of macadamized road of Class E specifications of Michigan State Highway Department. The contract price is $3,798 per mile. Bids were opened March 11.

⊙The Asphalt Block Paving Co., of Toledo, O., has been awarded the contract by the City Council of Flint, Mich., for the construction of a pavement on East Second St., from Harrison to Crapo St., at $19,370. D. E. Newcombe is City Clerk. Bids were opened Feb. 29.

No bids were received on March 1 by the Board of County Road Commissioners, Petoskey, Mich., for the construction of a county road to be known as Petoskey Turnpike, Part 1. G. W. Dickinson, Petoskey, is Clerk of Emmet County.

The taxpayers of Sebewaing Township, Huron County, Mich., on March 9 voted the issuance of bonds in the sum of $75,000 for good roads. It is proposed to build concrete roads on the main highways leading into the village of Sebewaing. Bad Axe is the county seat of Huron County.

Minnesota.

✣Bids will be received until 11 a. m., April 1 by Al. P. Erickson, Hennepin County Auditor, Minneapolis, Minn., for furnishing regraveling contract number 5, road number 14, also contract number 6, road number 12, being state highway number 2, also contract number 7, road number 108, according to plans and specifications on file in the office of the County Surveyor.

✣Bids will be received until March 21, by Board of Public Works, St. Paul, Minn., for the paving with asphalt of Fifth St., from Broadway to Cedar and from Wabasha to St. Peter; also Fourth St., from St. Peter to Seven Corners. Fifth St. will involve laying about 13,300 sq. yds. of pavement, and the cost will run from $25,000 to $30,000. The Fourth St. job involves laying about 9,600 sq. yds. of asphalt and will cost about $20,000. Oscar Claussen is City Engineer.

⊙Wilhelm Johnson, 122 College Ave., Crookston, Minn., is the probable contractor for the construction of cement sidewalks during the season. The price bid is $0.09 per sq. ft. for sidewalks, $0.40 per lin. ft. for curb and gutters, $0.35 per lin. ft. for straight curb and $0.18 per sq. ft. for street crossings. Bids were opened March 12 by A. M. [illegible] Clerk.

Bids were received by the City [illegible] East Grand Forks, Minn., James [illegible] Clerk, on March 2, for the paving [illegible] Ave., from the northeasterly lin[illegible] St. to the Northern Pacific Ry [illegible] tracks, from Warren Bros. Co., Bo[illegible] Grand Forks Concrete Co., Gran[illegible] Dak., and the General Contractin[illegible] Co., [illegible]neapolis, Minn. The work includ[illegible] 11,[illegible] yds. of pavement, 890 yds. of new [illegible] sq. yds. of concrete pavement in [illegible] resetting 3,200 lin. ft. of curb. Th[illegible] from $1.60 to $1.65 on concrete [illegible] $2.66 on bitulithic, $2.66 on asph[illegible] $3.35 on creosoted wood blocks al[illegible] R. S. Blome granitoid. The cont[illegible] awarded March 23.

The Minnesota Highway Com[illegible] Paul, has made an appropriation [illegible] to the counties of the state for [illegible] divided as follows: St. Louis, $[illegible] $3,000; Itasca, $6,000; Koochich[illegible] Beltrami, $5,500; Clearwater, $2,5[illegible]; [illegible] $2,000; Marshall, $5,100; Polk, $3,[illegible]; [illegible] $2,500; Cass, $3,500; Hubbard, $5,0[illegible] $3,500; Carlton, $4,750; Kanabec, $[illegible] $3,000; Norman, $3,000; Mahno[illegible] Clay, $4,500; Wilkin, $3,000; Otte[illegible] Kittson, $4,000; Wadena, $2,800; [illegible]

Plans and specifications have b[illegible] ted to the Board of County Com[illegible] Minneapolis, Minn., by the coun[illegible] for the improvements of roads No[illegible] known also as the Center and [illegible] Parts of Center road will be re[illegible] regraveled in the village of Broo[illegible] and the town of Brooklyn.

Missouri.

The City Commissioners [illegible] Mo., have passed ordinances pr[illegible] paving to cost $150,000. Eighteen [illegible] paving, in addition to curbing an[illegible] are included in the list. The la[illegible] contracts of the list follow: P[illegible] from 18th St. to [illegible] St. [illegible] Parallel Ave. to New Jersey Av[illegible] Central to Reynolds Ave.; all t[illegible] with bitulithic pavement. State [illegible] 12th St. to 18th St., rock aspha[illegible] St., from Orville Ave. to Ohio A[illegible] Ave., from Fourth St. to Sixth [illegible] be paved with Hassan paving. [illegible] from Valley St. to 12th St., brick [illegible]

The Jasper County Court, Ca[illegible] has ordered the question of the [illegible] of the Carthage special road di[illegible] submitted to vote at the regular [illegible] tion. It is proposed to make th[illegible] miles square.

Montana.

⊙The Two Miracle Concrete [illegible] Kalispell, Mont., has been award[illegible] tract by the Town Council of Chi[illegible] for constructing concrete side[illegible] walks, curbs, gutters, furnishing [illegible] electroliers, wiring and conduits [illegible] Bids were opened March 11.

New Jersey.

The Atlantic County Commissi[illegible] Landing, N. J., received bids fr[illegible] lowing for the paving of the Ma[illegible] port section of the new coast b[illegible] continuation of Atlantic Ave. in [illegible] and Ventnor: Edward L. Bad[illegible] [illegible] Co., Charles [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

McFeely Co., Rose Paving Co., and F. Ponder. The bids [illegible] $51,522.

New York.

[illegible] Council of Fulton, N. Y. [illegible] a resolution recommending that the [illegible] ceed at once to make plans [illegible] pavement in West First St., part [illegible] part macadam [illegible]

[illegible] President William J. Peach of Pu- Y., has estimated the cost of paving ness section of the town with brick at Bonds will be issued for the im- [illegible]

Common Council of Auburn, N. Y., ir objections to the proposed paving klin St., from North St. to the Five vith vitrified brick on March 19. Plans epared by City Engineer Aldrich.

ayers of the village of Nunda, N. h 5 voted in favor of the proposi- e $5,000 to pave Main St., and the re at the same time the new state nstructed.

North Carolina.

e been prepared by Engineer B. M. eville, N. C., for the laying of 10,- 0 sq. yds. of sidewalks, estimated tween $18,000 and $20,000. The include concrete or granite curb, ls. of excavation and cinder foun- ntract will be let during week of W. E. Shuford is official in charge.

Ohio.

ll be received until 11 a. m., April rd of Cuyahoga County Commis- eveland, O., for the improvement Ridge Road No. 2 from East line Township to the county line in nship. Plans and specifications are h F. R Lander, County Surveyor. check for $1,000 must be filed with J. F. Goldenbogen is Clerk of the

ill be received until 11 a. m., April rd of Cuyahoga County Commis- eveland, O., for the improvement [illegible] North Woodland Road [illegible] Road [illegible] and W [illegible] ships in accordance with the form t and specifications to be furnished R. Lander, County Surveyor. A cer- for $1,000 must be filed with each Goldenbogen is Clerk of the

ill be received until noon, March ard of Franklin County Commis- olumbus, O., for furnishing the labor and material for the follow- For improving and macadamizing y Road, located in Perry and Clin- ships, Franklin County, Ohio, be- the intersection of the McCoy Road Dublin Road on the east side of the r and on the line between the lands V. McCoy and The Dominion Land e easterly to the Perry Township continuing easterly with the town- [illegible] Kenny Pike, thence south the Kenny Pike to the Hess Pike, in all of 19,087 ft. For improving [illegible] m the Robinson Free Turnpike west lage of Mudsock; thence south to and Darby Creek Free Turnpike. istance of 5 and 86-100 miles, and Norwich and Brown Townships. ng and macadamizing the Cole Road, National Road north to the Geyer [illegible] Prairie and Brown Townships. For and macadamizing the Hart Road, Hilliard and Darby Creek Pike to Cemetery Road [illegible] located in Norwich Township. The files, specifications and estimates of for doing this work are on file in of the surveyor of Franklin County,

✣ [illegible]

✣ [illegible] ment to Hillside block pavement between various stations in accordance with plans and specifications on file with F. R. Lander, County Surveyor. A certified check for $1,000 must be filed with each bid. J. F. Goldenbogen is Clerk of the Board.

✣ [illegible] Board of Stark County Commissioners, Canton, O., for the improvement of the Massillon-Navarre road for a distance of three-fourths of a mile. J. H. McConnell is County Auditor.

⦿The Director of Public Service of Cincinnati, O., has awarded the contract for the paving of Powers St. with macadam and brick, from Sylvan to Fisher Sts., to the Kirschner Construction Co., at $10,211.

⦿ [illegible] Cincinnati, O., have awarded the contract for the improvement of the Harrison pike, from Cheviot to the Chesapeake & Ohio Railroad, to John Snyder of Cincinnati, at $60,794. The John Reubel Conctruction Co., bid $61,293 on the work.

The Hamilton County Commissioners, Cincinnati [illegible] $6,562 as the cost of improving the Miles road and have instructed the surveyor to prepare plans and specifications.

The Ross County Engineer, Chillicothe, O., is now preparing plans for the following sections of improved road in that county; Robt. D. Alexander, County Auditor: Frankfort Pike, 1½ miles; Columbus Pike, 1 mile; Richmondale Pike, Chillicothe, 1 mile; McArthur Pike, Chillicothe, 1 mile and Lyndon & Greenfield Pike, 1 mile. Bids will be received on same as soon as the plans are approved and work will then proceed. James H. Marker is State Highway Engineer.

Oklahoma.

⦿Chas. H. Shaw of Lawton, Okla., has been awarded the contract for the construction of 75,489 sq. yds. of Oklahoma natural rock asphalt at an estimated cost of $1.69 per sq. yd. The work will include 20,936 ft. of straight combined curb and gutter, estimated at $0.70, 3,115 ft. of radius combined curb and gutter, estimated at $0.70, and 21,036 cu. yds. of excavation. The total estimated cost is $159,732.

Oregon.

The citizens of Eugene, Ore., at a recent election voted the issuance of bonds in the sum of $75,000 with which to pay the cost of hard-surface pavement for street intersec- [illegible]

The Umatilla County Commissioners, Pendleton, Ore., have retained C. H. Martin to take charge of the $100,000 worth of road improvements planned for the coming season. A 10-ton steam roller and other apparatus were recently purchased and immediately upon their arrival will be put in service on the Court St. road just east of the city limits of Pendleton, where 10 miles of road work will be done.

The City Council of Albany, Ore., has passed resolutions providing for the extension of the First St. pavement eastward from Montgomery to Main, for the paving of Fourth St., from Washington to Main, and for Fifth St. from Elm to Main Sts.

Pennsylvania.

⦿Following bids were received by the City Council of McKeesport, Pa., for the repaving of Walnut St., and Market St.: Walnut St.—James Topley & Co., $40,841; J. B. Sheets & Co., $51,983; J. W. Butler, $39,411; W. W. Kelley, $50,401; Bowman Bros. Co., $37,268, awarded contract; Bolar Contracting Co., $44,-404; Ridge Bros. Co., $37,727; D. B. Hough Co., $47,826; P. F. Rhoades & Son, $42,169. Market St.—Bolar Contracting Co., $3,771; D. B. Hough Co., $3,805; P. F. Rhoades & Son, $3,575; James Topley & Co., $3,484; Bowman Bros. Co., $3,005, awarded contract; Ridge Bros. Co., $3,292; W. W. Kelley, $4,137.

The Town Council of Mauch Chunk., Pa., [illegible]

Steps have been taken by the Town Council of Bridgeport, Pa., for the permanent im- [illegible] Kalb St., from Front to Fourth, and Fourth [illegible] Borough Engineer and Solicitor have been directed to prepare specifications and invite bids for the paving of the highways with either Pinegrove brick or Barber asphalt, the bid to be submitted at the first Council meeting in April.

The City Council of Yardley, Pa., intends to pave Main St. with modern paving.

The Borough Council of Freedom, Pa., has passed an ordinance providing for macadamizing the Harvey Run road from Third Ave. to the east end borough line, there to connect with the proposed state highway as petitioned for by the authorities of New Sebwickley Township

Tennessee.

The City Council of Nashville, Tenn., has been petitioned for the improvement of Church St., from 12th to 21st Ave., with vitrified brick paving laid on a concrete base.

Texas.

Petitions have been presented to the City Council of Houston, Tex., providing for the paving of the following streets: Pierce Ave., between Main and Brazos Sts.; Elgin Ave., between Main and Austin Sts.; Burlington Ave., between Hawthorne and West Alabama Sts.; Rosalie Ave., between Main and Bagby Sts.; Stratford Ave., between Baldwin and Ariel Sts.

The City Council of Taylor, Tex., will call an election at an early date for the purpose of voting a bond issue of $30,000 for paving the business section.

The McLennan County Commissioners, Waco, Tex., have decided to spend $4,000 dragging 60 miles of dirt road this year.

The Tarrant County Commissioners, Fort Worth, Tex., have appointed an advisory committee to act with the commission regarding the expenditure of the $1,600,000 road and bridge funds recently voted by the people of that county.

An agreement has been reached by members of the Cooke County Commissioners' Court, Gainesville, Tex., to dispose of the $100,000 issue of good road bonds to be used in building roads in Gainesville precinct. Work will be commenced at once.

Petitions have been filed with the City Commission of Houston, Tex., calling for the laying of about six miles of pavement, which, it is estimated, will cost several hundred thousand dollars. City Engineer F. L. Dormant is compiling figures on the cost of laying pavements out of the various kinds of paving materials, to be incorporated in a statement which he will furnish to the city officials and property owners who are asking to have the streets paved.

The Bexar County Auditor, San Antonio, Tex., is asking bids for three 400-gal. oil wagons and one oil distributor, to be used in keeping roads oiled and in good condition by the County Commissioners. Bids are also being asked for the grading of the Fredericksburg road from the 13¾-mile point to the old Boerne stage road, the Boerne road from the Fredericksburg road to the junction of the Monarch road, and the Monarch road from the junction of the old Boerne Road to the Pena Hill road.

Utah.

⦿T. W. Brown, Tooele, Utah, has been awarded a contract at $10,250 for improving the pipe line of the Smith Willow Irrigation [illegible]

[illegible] considerable [illegible] this year. John A. Hendrickson is interested.

Virginia.

The Board of Supervisors of Henrico County, the State Highway Commission and the city of Richmond, Va., contemplate building a park to park boulevard. The estimated cost of the grading, macadamizing and graveling necessary to build a double-drive boulevard, not counting the cost of the bridge, is $45,144. W. C. Saunders, Richmond, is Chairman of the Henrico County Board of Supervisors. P. St. Julien Wilson, Richmond, is State Highway Commissioner.

Washington.

✣Bids will be received until March 25 by the Board of Thurston County Commissioners, Olympia, Wash., it is reported, for the construction of two miles of road on the Olympia-Little Rock road. Plans and specifications are on file with the County Engineer.

✣Bids will be received until 2 p. m., March 26, by Board of King County Commissioners, O. A. Case, Clerk, Seattle, Washington, for furnishing the necessary labor and material (Jap or Chinese labor not allowed) for the construction of the Kent-Auburn road. The work will include the construction and grading, necessary culverts and bridges as per plans and specifications on file with the county engineer. The improvement is 23,184 ft. long.

✣Bids will be received until April 6, by County Commissioners, Bellingham, Wash., for the construction of warrenite or concrete pavement 16 ft. wide and necessary culverts as follows: one mile permanent road on Northeast Diagonal, estimated to cost $14,500; one mile on Northwest Diagonal, estimate, $13,800; 1½ miles on Nouksack-Sumas road, estimate $22,500. The work will be in charge of Charles Lindberg, Bellingham, Wash., Engineer of Whatcom County.

⊙Ager & Shields, Bellingham, Wash., have been awarded the contract by the Board of County Commissioners, Bellingham, for the construction of the Hannegan Road at $1,840. Bids were opened March 7. Chas. Lindbery is County Engineer.

⊙W. G. Rex of Shelton, Wash., has been awarded the contract by the Board of Mason County Commissioners, A. W. Hurst, Chairman, Shelton, for the construction of one mile of permanent road at $6,825. The work [illegible] grading and [illegible] width of 60 ft., with culverts, bridges and other necessary essentials. Bids were opened March 5.

⊙The Keasal Construction Co., of Tacoma, Wash., has been awarded the contract by the Board of Lewis County Commissioners, Chehalis, Wash., for the construction of one mile of concrete road and the building of one reinforced concrete culvert at $14,447. The road is known as the Cowlitz and Olympia road and will be 5,280 ft. long. Bids were opened by H. H. Swofford, County Auditor, on March 4.

⊙Wm. Wrede of Castle Rock, Wash., has been awarded the contract by the Town Council of that place, C. R. Bell, Town Clerk, for the grading of improvement district No. 4 at $778. Bids were opened March 5.

West Virginia.

✣Bids will be received until noon, April 5, by Board of Affairs, Bluefield, W. Va., for the paving of various streets with bituminous macadam and concrete curb and gutter. The work will include approximately 38,000 sq. yds. of pavement. A certified check for $500 must be filed with each bid. W. H. Campbell is City Engineer.

Wisconsin.

✣Bids will be received until April 8 by City of Waukesha, Wis., for the improvement of several streets. The work includes 12,443 cu. yds. of excavation; concrete curb and gutter, 21,980 lin. ft.; 32,486 sq. yds. of bituminous macadam; 1,950 sq. yds. of brick. M. R. Butler is City Engineer.

⊙The Kenosha County Highway Commission, Kenosha, Wis., has let contracts for the purchase of machinery to the amount of $3,685. The list includes a steam roller, which will be supplied by the J. I. Case Co., of Racine, Wis., at $2,068, and a sprinkling wagon at $140. The Austin Western Co., of Chicago, Ill., secured the contracts for the following: Giant road grader, $400; light road grader, $135; scarifier, $450; new plow, $23; 10 wheelers, $420, and six drag scrapers, $37.50.

The Rock County Board of Supervisors, Janesville, Wis., has authorized the highway committee to purchase a scarifier machine to be used in rebuilding roads. S. S. Jones, Clinton., Wis., is Highway Commissioner.

The Milwaukee County Board, Milwaukee, Wis., has voted an appropriation of $30,000 on which the highways commissioner may draw for road laborers. The amount will be used during the coming summer for m of various county highways.

The Dodge County Commissioners, Wis., have purchased the following necessary for work on the highway the new law: Gasoline roller, stean one complete crushing outfit consisti No. 9 crusher with a 25-ton bin in th tions, with a rotary screen separat stone; two sprinklers, six dump wag graders, two wheel scrapers, two drag and other implements of minor im Work will be started on the roads as the machinery arrives, which early in April.

Canada.

✣Bids will be received until 11 a. m 22, by Chairman Board of Control, W Man., for furnishing one 10-ton asphalt roller to be delivered at the ci on or before May 10, 1912. Specificat on file with City Engineer, 223 Jam M. Peterson is Secretary of the Boar

✣Bids will be received until 5 p. m G. Tate, City Clerk, Vernon, B. C., supply and delivery of one 12-ton roa either single cylinder or compound [illegible] Tenders must state [illegible] which delivery can be guaranteed. a plete specifications must be furnished roller proposed to be supplied. Al must quote price f. o. b. Vernon. B marked cheque made payable to tl Treasurer equal to 5 per cent of th bid must accompany each tender.

✣Bids will be received until noo by City Commissioners, Saskatoon, S laying approximately 23,100 sq. yds stone block pavement. James Clin one of the commissioners and Georg is City Engineer.

⊙The City Commissioners of Sa Sask., have awarded the contract fo struction of concrete sidewalks and Western Pavers, Ltd., of Winnipeg $.17 for walks and $.32 per lin. ft., also to Robinson Foster of Spoka at $.16¾ per sq. ft. for walk and $.3 ter. Bids were opened Feb. 16.

Engineer D. T. Black, Welland prepared plans for the construction sq. yds. of either vitrified brick, aspha bitulithic, or granotoid pavement on concrete foundation, with concrete curb and grout filler. The contract either the 18th or 20th of March

BRIDGES—STEEL AND CONCRET

Alabama.

Detailed plans are being prepared for the construction of a reinforced concrete viaduct to be erected over the tracks of the Southern, the Illinois Central and the Frisco Railroads at Birmingham, Ala. The structure which will cost, it is estimated, $30,000, will be about 130 ft. long with 40 ft. roadway and 8 ft. sidewalks. The contract for the structure will probably be let by the Southern Ry. A. B. Ilsley, Washington, D. C., Bridge Engineer. Maury Nicholson is City Engineer of Birmingham, Ala.

Arizona.

The Board of Control, Territory of Arizona, Phoenix, Ariz., has postponed indefinitely the letting of contract for the construction of a 102-ft. steel highway bridge over Chevalon Creek for which bids were received on Jan. 30. Robert A. Craig is Secretary of the Board.

California.

The Chamber of Commerce of San Francisco, Calif., has requested the Oakland, Calif., body to pass a resolution favoring the movement toward the construction of a suspension bridge connecting the two cities. The proposition has been taken up by Congress.

It is probable that a concrete arch bridge will be built over Stony Creek just a mile north of Orland. Test holes are now being bored to ascertain the depth to which it will be necessary to put the foundation. L. C. Stiles, Willow, Calif., is Engineer of Glenn County and will be in charge of the work.

Colorado.

The Engineering Department of the Denver & Rio Grande R. R. is working on preliminary plans for the construction of viaducts over the tracks at Fourth South and Sixth South Sts., Denver, Colo.

At a recent meeting of the City Council of Denver, Colo., bills providing that $55,000 each be appropriated for the construction of the West Colfax and Larimer St. viaducts were introduced.

Delaware.

✣Bids will be received until April 2 (readvertisement), by Levy Court of Kent County, Dover, Del., for the construction of a new iron bridge over Dupont mill dam just northwest of Dover.

Florida.

The Board of Trade, Miami, Fla., has endorsed the proposition of the East Florida Traction Co. to build a bridge over Bayou, a point about one mile north city. Permission has been asked by th pany of the United States War Depa

Idaho.

The State Land Board of Idaho, Idaho, has endorsed the efforts being secure the construction of a bridge o Snake River between the counties of and Owyhee and has also recommend the commissioners of the county as protect in any way possible. It is that an appropriation will be ma next legislature, to provide funds structure.

Illinois.

✣Bids will be received at the Tow Hanover, Ill., up to 10 a. m., March 2 for the construction of one reinforce crete culvert in Hanover Townshi Daviess County. L. Ballein, Town Hanover, Ill. Carley Culvert—Eight ft., reinforced concrete box, 95 ft. lo ft. fill on top of culvert; roadway, wings, 13½ ft. long. Three walls ft. long, are to be placed on the down side to prevent wash. Estimated conc structure, 170.6 cu. yds.; reinforcing

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible]
[illegible]
have to be cleaned. The culvert is
Mr. Carle's farm [illegible]
of Hanover, on the Hanover railroad.
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ted on or before Aug. 1, 1912.
information may be had by an
[illegible]
e Illinois Highway Commission
seen at the Town Clerk's office
tained upon application in writ-
Illinois Highway Commission,

be received until 11 a. m., April
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Public Works, of Chicago, Ill.,
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April 24 (readvertisement) for
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substructure of a highway bridge
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and approach spans of the old
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tailpits dry during construction
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[illegible]
bers in place, 15,000 ft., B. M.;
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iles, 8,000 lin. ft.; Norway pine
in. ft.; driving piles, 32,000 lin.
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follows: For making preliminary
for testing tailpit, for pumping out
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ructure, etc. Dredging 6,000 cu. yds.;
3,000 cu. yds.; excavation requir-
1,500 cu. yds.; oak timbers in
000 ft., B. M.; pine lumber in place,
B. M.; white or burr oak piles,
ft.; Norway pine piles, 1,400 lin. ft.;
es, 2,400 lin. ft.; concrete in piers,
etc., 3,300 cu. yds.; cement mortar
g, 250 cu. yds.; handling and erecting
abutment [illegible] reinforcing brass and rods, [illegible] will be found [illegible] issue.

◉Bids were [illegible] at the office of J. H. [illegible], Clerk, Lamoille, Ill., and the contract for the construction of two reinforced [illegible] bridges let to Thomas H. Gibbons, [illegible] Corner, O., at $5,400. The structures will be [illegible] and 100 ft. in length.

◉The contract for the construction of an 80-ft. riveted steel truss bridge with a reinforced concrete floor and abutments over Dry Run in Laura Bradley Park, has been awarded by the Park Board, Peoria, Ill., to the Schmitt Construction Co., at $1,[illegible].

◉The contract for the construction of a 16-ft. reinforced concrete bridge in Houston Township, Adams County, Ill., has been awarded to Strickler & Gerrish, Golden, Ill., at $611. Bids were opened at the office of G. T. Pierce, Town Clerk, Bowen, Ill., March 1.

◉The contract for the construction of the 150-ft. steel bridge over the Salt Fork of the Vermilion River at Cheney Ford in Oakwood Township, Ill., has been let to the Paris Bridge Co., Paris, Ill., at $5,900. The work includes 110 tons of steel in the superstructure, 325 cu. yds. of concrete in the abutments and about 3,510 yds. earth in the approach grades. J. F. Fisher, 17 W. Harrison St., Danville, Ill., is Engineer.

◉The Kankakee-Urbana Traction Co. has let the contract for the construction of three steel bridges on the right of way between Urbana and Rantoul to Decatur Bridge Co., Decatur, Ill., at $2,230. The contract includes furnishing the steel, the erection and painting of bridges. The first is to be a 62-ft. plate girder over the Saline branch on North Cunningham Ave., a 30-ft. skew span with 15-ft. abutments 2½ miles this side of Thomasboro and the third a 30-ft. span over Carle branch, a mile this side of the latter village. Eight other bids were submitted as follows: Ahrens Iron Works of Cincinnati, O., $2,067 for furnishing steel only; Pan-American Bridge Co. of Newcastle, Ind., $2,535, furnishing, erection and painting; Noelke-Richards Co., of Indianapolis, $1,730, for furnishing steel only; Continental Bridge Co., of Peotone, Ill., $2,118, for steel only; Rochester Bridge Co., of Rochester, Ind., $2,163, for steel only; Central States Bridge Co., of Indianapolis, $2,000, for furnishing steel only; Leavitt Manufacturing Co., of Urbana, $1,840, for furnishing steel only; McClintock-Marshall Construction Co., of St. Louis, $1,834, for steel only.

◉The contract for the construction of a 100-ft. riveted truss steel bridge with 16-ft. roadway in Perre Township, Pike County, Ill., has been awarded to the Missouri Bridge & Iron Co., St. Louis, Mo., at $3,130. The structure will have a concrete floor, will rest on concrete abutments and have 4 16-ft. reinforced concrete wings. Bids were opened March 13 at the office of the Town Clerk, Perry, Ill.

The Alta Sita Improvement Association has been organized at East St. Louis, Ill., to bring about the construction of a viaduct over the Southern R. R. tracks at 26th St. The estimated cost of such a structure is $200,000.

Indiana.

✣Bids will be received until 10 a. m., March 28, by Board of County Commissioners, Fort Wayne, Ind., for the construction of the proposed new bridge over the Maumee River between Lakeside and the East Side on Coombs St. Bids will be received on both concrete arch and steel plans, while bidders may submit their own plans. The county plans, as adopted, provide for a bridge of three concrete arches, each with a span of 92 ft. and for a 2-span steel bridge, each span being 138½ ft. long.

✣Bids will be received until 2 p. m., April 2, by Board of Wabash County Commissioners, Wabash, Ind., for the repair of a bridge over the Wabash River, Wabash, Ind. The work will include reflooring with creosoted block. Daniel Showalter is County Auditor.

◉The Board of Wayne County Commissioners, Richmond, Ind., has awarded the contracts for the construction of eight bridges as follows,: Four structures to the Burk Construction Co., Newcastle, Ind., at $3,150, $639, $515 and $560 respectively; Isaac Smith, Richmond, Ind., for four bridges at $3,690, $3,690, $1,850 and $1,596 respectively. L. S. Bowman is County Auditor. Bids were opened March 9.

Iowa.

The Board of County Commissioners, Ida Grove, Ia., on March 5 rejected all bids received by Richard Varner, County Auditor, for the construction of bridges and roads during the coming year.

It is reported that surveys have been made and plans completed by the Chicago, Milwaukee and St. Paul Ry. engineers for the construction of a new steel bridge to replace the present trestle on the south road out of Boone, Ia.

The City Council of Des Moines, Ia., has instructed the City Engineer to prepare plans for the construction of a bridge over the Racoon River at its junction with Seventh St.

Kansas.

A delegation of citizens of Walnut and Medford Townships recently conferred with the Board of Reno County Commissioners, Hutchinson, Kan., in regard to an appropriation sufficient to construct a bridge over Peace Creek.

Frank Curry, President of the East Side Shunganunga Drainage Board, has asked the city of Topeka, Kan., to assist the county in rebuilding the Davies bridge over the creek near Topeka. It is thought that it will be a matter of a short time before all the old bridges will be replaced by new structures.

The contract will be let shortly for the construction of the proposed Mill St. viaduct over the tracks of the Union Pacific and the Chicago, Rock Island & Pacific Ry. Company's tracks. The plans proposed call for a reinforced concrete structure to cost approximately $86,000. The City Commissioners of Kansas City, Kan., are in charge of the work.

Louisiana.

The Engineering Department of the city f New Orleans, La., recently examined the bridge over the New Basin Canal on the line of Magnolia St., and furnished the City Council an estimate of the cost of repairing the existing swing bridge and an estimate of the cost of erecting a new bascule bridge to replace the old structure. Nothing definite has as yet been decided by the City Council. W. H. Hardee is City Engineer, and T. L. Willis is Principal Assistant.

Michigan.

Among the questions to be submitted to the voters of Kalamazoo, Mich., at the April election is one providing $16,000 for the construction of a new concrete bridge over the Kalamazoo River at Mill St.

Minnesota.

The Park Board has decided to recommend to the Common Council of St. Paul, Minn., the passage of an ordinance instructing the Great Northern R. R. to construct a permanent bridge over the tracks at Lexington Ave.

Mississippi.

✣Bids will be received until April 1, by Board of Supervisors, Batesville, Miss., f r the construction of three steel bridges. Plans and specifications are on file with R. W. Draper, Chancery Clerk, Batesville, Miss.

Nebraska.

◉The Board of Jefferson County Commissioners, Fairbury, Neb., has awarded the contract for the construction of all wood, pile and iron bridges to be constructed in the county during 1912, to the Standard Bridge Co., Omaha, Neb. C. H. Shaffer is County Clerk.

Residents of Dakota County, according to advices from Dakota, Neb., are quite positive steps will be taken shortly toward the construction of a bridge over the Missouri River connecting South Sioux City, Neb., and Sioux City, Ia. The cost of such a structure would not be less than $200,000, it is estimated.

The City Council has passed an ordinance instructing the railroads to construct a viaduct over their tracks at Nicholas St., Omaha, Neb. The matter will come up for trial [illegible]

New Jersey.

✣Bids will be received until March 20 by County Board of Chosen Freeholders, Paterson, N. J., for the construction of steel and concrete bridge over the upper and lower raceways on Ellison St. extension and on Lafayette Ave. over Goffle Brook and also for the construction of a culvert on Saw Mill road.

Maj. R. R. Raymond, United States Engineer, will hold a hearing at 10:30 a. m., April 8, at the Court House building, Cape May Court House, N. J., on the application of the Wildwood & Delaware Bay Short Line Ry. for approval of plans for the construction of bridges over Sunset Lake, Hanns Canal, Grassy Sound and Old Turtle Creek, the closing of Shaws Creek and building a trestle in Next Run in Middle Township, Cape May County, N. J.

New York.

✣Bids will be received until noon, March 23, by Samuel Rea, President of the New York Connecting Railroad, Penna. Railroad Station, New York City, for the foundations and masonry of the Bronx Viaduct about 4,000 ft. long, extending from the crossing over the New York & Harlem Railroad to Bronx Kills. Plans and specifications are on file with Gustav Lindenthal, Consulting Engineer, 45 Cedar St., New York City.

✣Bids will be received until 2 p. m., March 21, by Arthur J. O'Keefe Commissioner of Bridges, New York City, N. Y., for the electrical equipment of the 3d Ave. and Willis Ave. bridges over the Harlem River.

✣Bids will be received until noon, April 9, by Duncan W. Peck, Superintendent of Public Works, Albany, N. Y., for the construction of five lift bridges over the Barge Canal at the following points: Union St., Spencerport: Washington St., Adams Basin; Park Ave., Brockport; Hulberton; Gasport. The work will be let under Contract 105.

◉Bran & Stuart, Philadelphia, Pa., and Henry Steers, 17 Battery Pl., New York City, have been awarded the contract jointly by the Philadelphia, Baltimore & Western R. R. for the construction of two new reinforced concrete bridges over the Bush and Gunpowder Rivers between Havre de Grace and Baltimore.

It is reported that the Ways and Means Committee, Albany, N. Y., has reported favorably $300,000 instead of $100,000 for the construction of the Vischer's Ferry bridge.

North Carolina.

By the terms of a franchise recently granted, the Raleigh, Charlotte & Southern Ry. Co., by the city council of Raleigh, N. C., the company agrees to construct steel or concrete bridges over the principal streets of the city.

North Dakota.

The Streets and Alleys Committee of the City Council, Grand Forks, N. Dak., will hold a meeting shortly to take up the petition recently filed by residents of the south side, asking that an investigation be made of a proposed plan to connect Cottonwood St. and De Mers Ave. by building an overhead viaduct or subway under the Great Northern tracks.

Ohio.

✣Bids will be received until noon, April 5, by Board of Hamilton County Commissioners, Cincinnati, O., for building under Specifications No. 300, culverts on the road between the lands of Woltering and Birck in Green Township. A certified check for $500 must be filed with each bid. Albert Reinhardt is Clerk.

✣Bids will be received until 11 a. m., April 17, by Board of Cuyahoga County Commissioners, Cleveland, O., for the construction of bridge work per Report No. 2919 rebuilding bridge, McCracken Road, Bedford Township, in accordance with plans and specifications on file with F. R. Lander, County Surveyor. J. F. Goldenbogen is Clerk of the Board.

✣Bids will be received until 11 a. m., April 15, by Clifton Sipes, County Auditor, Mt. Gilead, O., for the construction of a reinforced concrete bridge over Whetstone Creek near Mt. Gilead. The structure, according to plans, will have two 50-ft. spans with 18-ft. roadway and a footway of 4 ft.

Oklahoma.

Owners of the Peoples Electric Ry., Muskogee, Okla., plan among other improvements the construction of a bridge over the Arkansas River for the joint accommodation of the interurban road and of Haskell Blvd. R. D. Long is Superintendent of the company.

Oregon.

A committee has been appointed by the Portland, Ore., Commercial Club to raise the city's share of the cost of having preliminary surveys made for the construction of the proposed Columbia River bridge. A conference will be held with a similar committee of Vancouver, Wash. F. R. Riley, Portland, Ore., is Chairman of the committee and E. B. Piper is President of the Commercial Club.

Pennsylvania.

◉Kinbrough & Elder, New Castle, Pa., have been awarded the contract by the County Commissioners for the construction of three bridges in Eastbrook, Washington Township and Neshannock respectively, at $4,959. The bids received were as follows: George Axe, Eastbrook, $2,987.62; Washington Township, $1,487.92; Neshannock, $1,386.87; total, $5,862.41. J. N. and M. G. Miller, Eastbrook, only, $2,425. J. J. Burns, Eastbrook, $2,401.13; Washington, $1,623; Neshannock, $1,496.80; total, $5,520.93. Nelson Meredith Co., Eastbrook, $2,732; Washington, $1,992; Neshannock, $1,882; total, $6,606. G. A. and F. M. Wagman, Eastbrook, $2,494; Washington, $1,625; Neshannock, $2,194; total, $6,313. Walter Deifenderfer & Co., Eastbrook, $2,875; Washington, $1,728; Neshannock, $1,600; total, $6,203. Woods-Golder Construction Co., Eastbrook, $2,494; Washington, $1,647; Neshannock, $1,724.75; total, $5,865.75. A. A. Hough, Eastbrook only, $2,396. Kimbrough & Elder, Eastbrook, $2,329; Washington, $1,340; Neshannock, $1,290; total, $4,959. The bridges will be of concrete construction.

◉The Board of Supervisors, Marshall County, Marshalltown, Ia., has let the contracts for furnishing bridge material for the year of 1912 as follows: For supplying lumber, F. B. Stewart, Des Moines, Ia.; for supplying cement, Kreutzer & Wasem, Marshalltown, Ia., at $1.12 per 500 lbs.

◉The Board of Montgomery County Commissioners, Norristown, Pa., has awarded the contract for the construction of new steel girder highway bridge over the Schuylkill River at Pawlings, Chester County, Pa., to G. W. Ensign, Camphill, Pa., at $24,497. Bids for the work were opened March 12.

At a recent conference of the officials of the Bessemer & Lake Erie R. R., the Baltimore & Ohio R. R., councilmen and members of the Chamber of Commerce, it was decided to make a new survey for the construction of the proposed $100,000 viaduct to connect the north and south sides of the city of Butler, Pa.

It is believed that the Lewisburg & Tyrone R. R. Co. will shortly take definite steps toward the construction of a steel bridge at Lewisburg, Pa., to replace the present wooden structure. H. S. Meily, Tyrone, Pa., is Division Engineer.

Plans have been prepared for the [illegible] of a bridge over the Allegheny [illegible] Oil City, Pa. According to the draw[illegible] structure will have a clearance of [illegible] the draw and will be 15 ft. above [illegible] level.

The Grade Crossing Committee o[illegible] barre, Pa., has instructed the City [illegible] B. K. Finch, to make a survey of [illegible] posed site for the construction of t[illegible] at North Wilkesbarre to connect [illegible] east end.

South Dakota.

✣Bids will be received until 7:30 p[illegible] 1, by John W. Summers, City Audit[illegible] ton, S. Dak., for the construction o[illegible] forced concrete bridge over the Rh[illegible] on Pine St., Yankton.

✣Bids will be received until 2 p. [illegible] 3, by H. L. Arnold, Miner County [illegible] Howard, S. Dak., for the constru[illegible] such steel and concrete bridges [illegible] County as may be determined neces[illegible] ing the year of 1912.

◉The contract for the constructi[illegible] new bridges and repairing old stru[illegible] Union County, S. Dak., has been l[illegible] Western Bridge & Construction Co. [illegible] the work were opened March 5 [illegible] Munsen, County Auditor, Elk Point[illegible]

Commissioners of Pennington [illegible] Rapid City, S. Dak., have ordered a [illegible] to be held at an early date for dec[illegible] question of issuing bonds for the [illegible] tion of the proposed Wasta bridge [illegible] in our last issue. Engineers have [illegible] examinations and surveys and have [illegible] a general plan and profile of the loc[illegible] same may be obtained of James H. [illegible] City Engineer, Rapid City, S. Dak. [illegible] H. Lea, Pierre, S. Dak., is State E[illegible]

Texas.

An election will be held shortly t[illegible] the issuance of $18,000 of bonds for [illegible] struction of bridges in Bee County. [illegible] Beeville, Texas, is county seat.

Vermont.

Selectmen of Colchester and So[illegible] lington, Vt., have authorized Engin[illegible] Sinclair, Burlington, Vt., to design a r[illegible] concrete bridge to replace the old hi[illegible] at the gorge near Winooski. It is [illegible] to have Mr. Sinclair draw plans for [illegible] which shall be raised over the track[illegible] Central Vermont Ry., which pass ju[illegible] opening of the Colchester side of th[illegible] This would avoid any danger from [illegible] grade crossing.

Washington.

◉The contract for the constructio[illegible] steel superstructure of the bridge [illegible] North Fork of the Lewis River nea[illegible] land, Wash., will be let by W. J. [illegible] State Highway Commissioner, [illegible] Wash., about April 15. As mentione[illegible] issue of Feb. 28, the Jahn Contra[illegible] of Seattle, Wash., were awarded the [illegible] for the substructure at $16,565.

It is reported that the Chicago, M[illegible] & Puget Sound R. R. will, in connec[illegible] the construction of the proposed s[illegible] Sumner, Wash., to the factory, co[illegible] bridge over the Stuck River.

Wisconsin.

✣Bids will be received until noo[illegible] 26, by City of Cumberland, Wis., for [illegible] ing all labor and materials for the er[illegible] a 50-ft. steel girder bridge over the [illegible] East Elm St. in the city. Plans and [illegible] tions are on file with the City Cler[illegible] Wright.

◉The contract for the constructio[illegible] new bridge at Sturgeon Bay, Wis., [illegible] awarded to Clemens A. Ries, Sh[illegible] Wis., at $12,635. Other bids rece[illegible] A. Green, Green Bay, Wis., $12,[illegible] Greilling Bros., Green Bay, Wis., $1[illegible]

✣ indicates work now open for bids. ◉ indicates a contract let recently.

IRRIGATION, DRAINAGE LEVEES AND CANALS

Arizona.

[illegible] started [illegible] ights Association, of which J. F. [illegible] Grande, Ariz., is President [illegible] being made at the [illegible] It is expected [illegible] shtly. J. H. Quinton, Los Angeles, sulting Engineer.

Arkansas.

ids ill be received from 1 until 2 p. m., 9. C. B. Bailey, Engineer, Levee Dis- Wynne, Ark., for the construction [illegible] igned as floating dredge work and [illegible]; height 7 ft.; slopes, 2:1. The [illegible] vest side of Dunklin County and o prevent the overflow of the St. r. The estimated cost is 15 cents which includes the cost of clearing way. Certified check for $3,500, to C. B. Bailey, will be required bidder. Specifications will be gineer on receipt of $1.

e opened March 7 by J. T. Cos- Dead Timber Drainage District eola, Ark., for 1,665,000 cu. yds. of ti and 8 bridges, the contract being [illegible] Construction [illegible] St., Chicago, Ill., at $106,000.

California.

[illegible] States Reclamation Service, Los , for furnishing electrical ap- or Truckee-Carson Project. Fur- nation may be obtained of the U. S. on Service, 605 Federal Bldg., Los or at Washington, D. C. F. H. [illegible] Director [illegible] nent will be found elsewhere in

nt Reclamation District No. 78, son, President, Fresno, Cal., pro- ruct a levee in an easterly direc- ctions 31 and 32-17-19 at a cost

Colorado.

A. McDowell Construction Co., , has been awarded the con- [illegible] nal, now the property of the Amer- [illegible]

te Land Board has granted a perma- gation of 43,000 acres in San Miguel rose counties to Bulkeley Wells and hisholm, who will add to it a tract acres of private lands and plan to he whole area. It is estimated that ation system will cost $4,500,000. the project will be commenced im- The construction required includes miles of heavy rock work, about 10,- f tunneling, three inverted siphons gest being about ½-mile, maximum ft.), two reservoir dams, the larger ft. in height, in all about 100 miles its, ditches and laterals, and at least f narrow gage railroad. Robert McF. acerville, Colo., is Chief Engineer for

Illinois.

will be received until noon, April 2. Pomeroy, Treasurer, Clark Drainage f Emma Township, White County, at ty Bank, Carmi, Ill., for the construc- the following open ditches: Main ngth 13,800 ft., bottom width 6 to 12 [illegible] 30 ft., cuts ranging [illegible] t., containing 52,149 cu. yds. excava- ateral No. 1—Length 2,000 ft., bottom t., top width 16 to 18 ft., except upper which is to be 4 ft.; base cuts, 4 to [illegible] 3,753 cu. yds. Lateral N

[illegible] station on the L. & N. R. R. Certified check [illegible]

✣ [illegible] Creek Drainage District No. 2, R. R. 2, Belleville, Ill., for the construction of drainage work in the district, including a main ditch 1¾ miles long, 18 ft. wide at bottom, 9 ft. deep, slopes 1 to 1, requiring 160,000 cu. yds. of excavation. No clearing to be done. Belleville railroad station is three miles from the work. Certified check for 5 per cent required with bids. The engineer is W. C. Wolf, Belleville. Bids will be opened at the town hall in Smithton, Ill.

Iowa.

⊙Forestal & Feyen, St. Paul, Minn., have been awarded the contract for the construction of Drainage District No. 34 of Buena Vista County, for which bids were opened March 7 at Storm Lake, Ia. The work includes the following excavation: Sec. 1, 412,000 cu. yds., Sec. 2, 884,100 cu. yds.; Sec. 3, 22,800 cu. yds.; Sec. 4, 155,800 cu. yds.; Sec. 5, 49,900 cu. yds.; Sec. 6, 49,000 cu. yds.; Sec. 7, 60,000 cu. yds.; Sec. 8, 60,500 cu. yds.; Sec. 9, 60,400; Sec. 10 64,500 cu. yds.; Sec. 11, 61,000 cu. yds.; also about 40 concrete bulkheads for inlet protection

Maryland.

A bill has been introduced in the State Senate, Annapolis, by Senator Milbourne, providing for a general drainage system for reclaiming the sawmp lands of the state. The funds are to come from the beneficiaries of the work, but provision is made for advancing the sum of $10,000 for preliminary operations.

Michigan.

MacArthur Bros. Co., Fisher Bldg., Chicago, Ill., at $670,170, was the low bidder for constructing West Canal Sec. 2, at Sault Ste. Marie. Bids for this work were opened March 12, by Col. C. McD. Townsend, U. S. Engineer, Detroit, Mich. The estimated quantities for the work are as follows: Excavation Class A, 85,000 cu. yds.; excavation Class B (full rate), 470,000 cu. yds.; channeling, 78,000 sq. ft.; crib construction, framing and placing timber, 25,000 cu. ft.; crib filling, 3,500 cu. yds.; concrete (exclusive of cement) 22,000 cu. yds.; furnishing and delivering cement, 27,000 bbls.; furnishing and laying drain pipe, 3,200 lin. ft. The material to be removed consists chiefly of Potsdam sandstone bed rock, portions of which are hard and in strata 5 ft. or more in thisckness, while other portions are soft, shaley, and freely seamed. The material overlying the rock consists of broken or soft rock, gravel, bowlders, hardpan, clay timbers, crib work, etc., all in unknown proportions.

Minnesota.

✣Bids will be received until 3 p. m., April 2, by J. B. Lemire, Aitkin County Auditor, Aitkin, Minn., for the construction of Judicial Ditch No. 2 in Aitkin County. P. J. McCauley, Old Capital Bldg., St. Paul, Minn., is Engineer in charge of the work, including the excavation of about 582,461.4 cu. yds. of earth, the clearing of about 43 miles of right-of-way, the leveling of about 43.09 miles of road, and the building of 28 bridges. The total estimated cost of said ditch is approximately $73,000. The estimated cost of said excava- [illegible] right-of-way, $5.50 per acre; of leveling of roads, $75 per mile, and of constructing bridges $100 to $150 each, according to kind. The work consists of about 582,461.4 cu. yds. of main, lateral and branch ditches and is located from ½ to 7 miles from the villages of Palisade and Bain in said county, on the Minneapolis, St. Paul & Sault Ste. Marie Railway.

✣Bids will be received until 2 p. m., April 9, by P. D. McKellar, Auditor, Jackson County [illegible] of Judicial Ditch No. 13, in Jackson and Nobles Counties. The work will include approximately 194,692 cu. yds. of excavation.

✣Bids will be received until 11 a. m., April 3, by Jesse L. Herrying, Faribault County Auditor, Fairmont, Minn., for repairing 5,100 ft. of Judicial Ditch No. 2, of Martin and Faribault Counties.

✣Bids will be received until 11 a. m., April 3, by H. P. Edwards, Auditor of Martin County, and Jesse L. Herring, Auditor of Faribault County, at Fairmont, Minn., for the construction of Judicial Ditch No. 12 in the two counties. The work includes 64,965 cu. yds. of earth to be removed; bottom width of ditch, 10 ft.; slope, ½ to 1; length, 7.22 miles; deepest cut, 11.8 ft.; also 13,650 ft. 6-in. tile, 4.9 ft. av. depth, 8.4 max. depth 32,855 ft. 8-in. tile, 5.7 ft. av. depth, 10.5 max. depth; 30,713 ft. 10-in. tile, 6.1 ft. av. depth, 1.1 max. depth; 9,771 ft. 12-in. tile, 5.9 ft. av. depth, 9.9 max. depth; 3,500 ft. 14-in. tile, 7.8 ft. av. depth, 10.1 max. depth; 4,500 ft. 16-in. tile, 6.4 ft. av. depth, 8.6 max. depth; 13,813 ft. 22-in. tile, 8.5 ft. av. depth, 13.7 max. depth; 6,282 ft. 24-in tile, 8. ft. av. depth, 10.7 max. depth. Starting point of open ditch is about 1½ miles from Guckeen on the C. & N. W. R. R. Average haul for tile about 3¾ miles from Guckeen. Soil is black loam, with clay subsoil. Bids to be accompanied by certified check for 10 per cent of each bid, payable to the Auditors of said counties. Right reserved to reject any or all bids.

✣Bids will be received until 3 p. m., March 22, by John Feig, County Auditor, Olivia, Minn., for digging Judicial Ditch No. 10, Renville and Kandiyohi Counties, including approximately 5,569 ft. of 6 to 12-in. tile work.

✣Bids will be received until 3 p. m., April 9, by I. P. Byhre, Auditor of Cass County, Walker, Minn., for the construction of Cass County Judicial Ditch No. 1, in Cass and Aitkin Counties, Minn. The work will be in charge of E. V. Williard, Old Capitol Bldg., St. Paul, Minn., and involves the excavation of about 193,000 cu. yds. of earth, the clearing of about 61 acres of right-of-way, and leveling of about 5 miles of roads, the estimated cost of all of which, exclusive of engineering, viewing and incidental expenses, is approxi- [illegible] about five and three-quarters mile of main and lateral ditches and the straightening and dredging out of about nine miles of the channel of the Willow River. It is located from three to seven miles from the villages of Remer, Cass County, and Shovel Lake, Aitkin County, on the Minneapolis, St. Paul & Sault Ste. Marie Railway.

⊙Sam Christensen, Jackson, Minn., has been awarded the contract, at $20,742, for constructing Judicial Ditch No. 20, of Martin County, bids for which were opened March 12, at Fairmont, Minn. The work includes: 692 cu. yds. of earth at outlet and one retaining wall and the following tiling: 6,460 ft. of 6-in. tile, av. depth 4.38 ft., max. depth 6.08 ft.; 9,500 ft. of 8-in. tile, av. depth 4.85 ft., max. depth 7.23 ft.; 8,700 of 10-in. tile, av. depth 6.06 ft., max. depth 11.58 ft.; 4,200 ft. of 12-in. tile, av. depth 7.4 ft., max. depth 10.12 ft.; 3,700 ft. of 15-in. tile, av. depth 8.81 ft., max. depth 10.85 ft.; 2,900 ft. of 16-in. tile, av. depth 7.12 ft.; max. depth 8.58 ft.; 1,600 ft. of 18-in. tile, av. depth 6.9 ft., max. depth 8.63 ft.; 8,600 ft

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] 9.78 ft.; 6,750 ft. of 22-in. tile, av. depth 7.89 ft., max. depth 13.53 ft. Soil is mostly black loam with clay sub-soil Average haul is about 11 miles and nearest railroad station is Fairmont.

⊙The Ceylon Cement Tile Co., Ceylon, Minn., has been awarded the contract, at $10,971, for constructing County Ditch No. 26, of Martin County, bids for which were opened March 12, at Fairmont, Minn. The work includes: 7,800 ft. of 22-in. tile, av. depth 8.15 ft., max. depth 12.40 ft.; 2,300 ft. of 20-in. tile, av. depth 9 ft., max depth 12.05 ft.; 1,600 ft of 18-in. tile, av. depth 6.3 ft., max. depth 6.55 ft.; 1,600 ft. of 16-in tile, av. depth 6.6 ft., max. depth 7.15 ft.; 1,500 ft. of 15-in. tile, av. [illegible] 12-in tile, av. depth 4.84 ft., max. depth 7.25 ft.; 5,325 ft. of 10-in. tile, av. depth 4.75 ft., max. depth 9.34 ft.; 4,800 ft. of 8-in. tile, av. depth 4.75 ft., max. depth 6.55 ft.; 2,250 ft. of 7-in. tile, av. depth 3.62 ft., max. depth 4.15 ft. Soil is black loam with clay sub-soil. Average haul is about two miles, part of ditch being within limits of Village of Ceylon on C. [illegible]

⊙[illegible] Stocking, County Auditor, Glencoe, Minn., for constructing county tile ditches Nos. 21 and 22, the contracts being awarded as follows: Ditch 21, A. Henrickson, Askov, Minn., at $1,925; Ditch 22, C. F. Ulricksen, Mason City, Ia., at $1,684.

⊙W. J. Gleason, Aitkin, Minn., has been awarded the contract for constructing Judicial Ditch No. 25 of Warren County, the work calling for 740,283 cu. yds. of excavation.

Montana.

✣[illegible] 22, by Lewis Tellefson, Secretary Farmers' Co-operative Canal Co., Choteau, Mont., for the construction of the Harvey Lake Reservoir dam and also the outlet canal for same. Plans may be seen with J. W. Shields, Conrad, Mont., and J. S. Sulgrove, Choteau, Mont.

Missouri.

Board of Public Works of Kansas City, Mo., has approved the plans and will shortly [illegible] of the Missouri River along the harbor line east from Grand Ave. to the mouth of the Blue Louis R. Ash is City Engineer.

Mississippi.

[illegible] for a drainage district in the vicinity of Moorhead, Miss. L. W. Washburn, Clarksdale, Miss., is the Engineer.

Nebraska.

✣Bids will be received until 2 p. m., April 22 (readvertisement of work on which bids were received Feb. 29, as noted in our last issue), by United States Reclamation Service, Mitchell, Nebr., for the construction of an earth dam and auxiliary works on the North Platte project, about nine miles north of Minatare, Scottsbluff County, Nebraska. The work involves the handling of about 840,000 cu. yds. of material, of which 630,000 cu. yds. is earth fill, 157,000 cu. yds. gravelly material, 14,000 cu. yds. unscreened gravel, 11,500 cu. yds. screened gravel, 14,000 cu. yds. concrete and 12,000 cu. yds. brule clay excavation, besides 45 acres of sod stripping, 600 ft. of wells and casing, 3,200 lin. ft. of drains and the handling and placing of 250,000 lbs. of reinforcing steel. For particulars address the United State Reclamation Service, Mitchell, Nebr.; 519 Commonwealth Bldg., Denver, Colo., or Washington, D. C. F. H Newell, Director, Washington D. C., and A. Weiss, Mitchell, Nebr., is Project Engineer. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 5 p. m., April 10, by United States Reclamation Service, Mitchell, Nebr., for the construction of an embankment and spillway for an earth dam on the North Platte project, about nine miles north and one mile east of Scottsbluff, Scottsbluff County, Nebr. The work involves the handling of about 175,000 cu. [illegible] which about one-tenth is [illegible] particulars address the U. S. [illegible] tion Service, Mitchell, Nebr., or [illegible] monwealth Bldg., Denver, Colo. [illegible] Weiss, Project Engineer, Mitch[illegible] Official advertisement will be found else[illegible] in this issue.

North Carolina.

A Board of Commissioners for [illegible] Swamp and Jacob Swamp Draina[illegible] has been elected and as soon as le[illegible] ments can be complied with will [illegible] $150,000 in bonds. Bids for the [illegible] for the construction work will be [illegible] shortly. The work to be done cons[illegible] miles of dredge work canal, with [illegible] width ranging from 14 ft. to 20 [illegible] average depth of about 6 ft., requi[illegible] 000 cu. yds. of excavation. The excav[illegible] be in sand and clay. Nearly all [illegible] is in timber. There will also be 5 [illegible] hand ditch, requiring about 60,000 [illegible] cavation, 2,500 yds. of levee and 2[illegible] river improvement. Twenty-three [illegible] be required. F. F. Wetmore, Lum[illegible] C., is the Engineer.

Oregon.

Work will probably be started [illegible] middle of March for draining La[illegible] near Salem, Ore. This lake co[illegible] 1,200 or 1,500 acres of land, much [illegible] what is known as peat land. The [illegible] volves the removing of a dam use[illegible] nishing mill power at the lower en[illegible] Labish and then the digging of dra[illegible] als or ditches through the land affec[illegible] overflow. Contracts have already b[illegible] removing the dam. J. O. Hayes, [illegible] Cal., is interested.

Texas.

Advices from Kingsville, Tex., [illegible] surveys have been under way for [illegible] tion system for watering 50,000 acr[illegible] lying southwest of that place. [illegible] states that Robert J. Kleberg is in[illegible] the project.

WATER-WORKS

Alabama.

The City Commission of Montgomery, Ala., upon the recommendation of the City Engineer, has decided to refit the artesian wells of the municipal waterworks system with Baker air lifts, to be purchased from the Hudson Engineering Co. The cost will be about $3,000.

Arkansas.

⊙The City Council of Dermott, Ark., has awarded the contract for enlarging the present water system to R. M. Galbraith of Pine Bluff, Ark. A steel tank of 100,000 gals. capacity is to be erected, an 8-in. well will be put down, and 3,000 ft. of water main is to be laid. Work will begin within one week.

The City Council of Springdale, Ark., has passed an ordinance creating an improvement district for the purpose of building a water works.

The Commercial Club of Foreman, Ark., is agitating the sinking of a deep well and the installation of a waterworks system.

California.

✣Bids will be received until March 25, by Board of Trustees, Orland, Calif., for the construction of a municipal water and sewer system.

The citizens of Modesto, Calif., at a recent election voted the issuance of bonds in the sum of $80,000 to reconstruct the municipal water system.

The Riverside Land & Irrigating Co. has made a proposition to the City Council of Riverside, Calif., whereby it proposes to furnish the town with water, to be pumped to a reservoir on the summit of the mountain, which is 550 ft. above the city. The city engineer has been instructed to investigate its feasibility.

The Oak Park Water Co., Oak Park, Calif., William Collins, Supt., contemplates expending $14,000 installing a concrete pump house.

Georgia.

The City Officials of Atlanta, Ga., recently made an inspection of the new waterworks reservoir and decided that about 15,000 cu. yds. of earth are needed to reinforce the base of the dam on the northwest side. The estimated cost of the work is $5,000. Capt. R. M. Clayton is Chief Engineer of Construction.

The Water Commission of Macon, Ga., has retained Consulting Engineer George W. Fuller, 170 Broadway, New York City, to review and pass upon the plans and specifications submitted by Designing and Constructing Engineer Bullock for the contemplated extension of the city's waterworks system.

Illinois.

✣Bids will be received until 8 p. m., April 8, by Village of River Forest, Ill., for constructing a reinforced concrete reservoir of 150,000 gals. capacity. The over-all dimensions of the reservoir are 72 ft. by 28 ft. by 13 ft. Plans may be seen at the office of Alvord & Burdick, Hartford Bldg., Chicago, Ill., Engineers. J. E. Adams is President of the Village Board. Official advertisement will be found elsewhere in this issue.

⊙Wm. Tunny of Joliet, Ill., has been awarded the contract by the Board of Local Improvements of that city [illegible] Welch, Secy., [illegible] the laying [illegible] main in Chicago St., at $2,783. [illegible] opened March 4.

⊙Wm. H. Cater Contracting [illegible] been awarded the contract by [illegible] Council of Berwyn, Ill., John H[illegible] Clerk, for the sinking of a 16-in[illegible] well at the water works for $4,7[illegible] were opened March 5.

Civil Engineer Charles H. Dun[illegible] ria, Ill., is preparing plans for the [illegible] tion of a new water works system [illegible] ria Heights, Ill., estimated to [illegible] 000. The work will include a [illegible] with a capacity of $60,000 gals., t[illegible] 12-in. wells 40 ft. deep, one triple [illegible] pump 8x10, 220 lbs. of 350 gals. [illegible] H. P. motor, 9,000 ft., of 10-in. [illegible] pipe, 10,000 ft., of 8-in. cast iron p[illegible] ft., of 6-in. cast iron pipe, 20,000 ft. [illegible] cast iron pipe, 75 hydrants, valves, [illegible] pump house. Contracts for this [illegible] be let about May 15.

⊙The following contracts for [illegible] ing water supply pipes have been [illegible] by the Board of Local Improvem[illegible] cago, Ill. E. J. Glackin is Secreta[illegible] Board. Euclid Ave., Simon Ry[illegible] gan St., Ed Connor; E. 120th St., [illegible] nor; Bennett Ave., Mal Murphy; [illegible] coln St., Mal Murphy; MacFarl[illegible] Mal Murphy; Princeton Ave., Ed [illegible] S. Winchester Ave., Mal Murph[illegible] Ave., Simon Ryan.

⊙Following contracts were award[illegible] City Council of Tampico, Ill., for th[illegible] tion of a waterworks system: [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

mp $315, to Fairbanks & [illegible] Ill.; hydrants [illegible] each, 6-in. valves $11.50 each, [illegible] each, valve boxes $4 each, [illegible] fg. Co., Chicago, Ill.; steel tank [illegible] to bottom of tank and [illegible] 2,675, to Chicago Bridge & Iron [illegible] water pipe $24.25 per [illegible] 25.75 per ton, special [illegible] lb., to U. S. Cast Iron Pipe & C.; belt 10-in $1.20 per ft., to C. A. [illegible] hicago; wrought iron pipe for ll fittings, to Geo. B. Limbert & [illegible] Arthur M. Morgan, [illegible]

ille, Ill., City Council has passed a e granting the Belleville Deep at Co. a franchise to connect its [illegible] the East St. Louis [illegible] Water Co., on East State St., is and furnish Mississippi River [illegible]

ncil of Quincy, Ill., has em- F. Jennings, Chemist, Chicago, [illegible] water furnished by the city water [illegible]

Iowa.

[illegible] until [illegible] Donnellson, Ia., for the follow- [illegible] of 8-in., 1,130 lin. ft. of 6-in., 4-in. cast iron pipe; 15 hydrants; eel tank. A check for $500 must the tank and for 10 per cent of id on the balance. Hall & Adams, [illegible]

Kansas.

[illegible] t an additional basin that would 0 and an additional high pressure he rebuilding of the low pressure st of $70,000 should be pro- ice. Bonds will probably be

Kentucky.

Council of Murray, Ky., has sold sum of $25,000 for the construc- aterworks system to W. E. Cov- f Paducah, Ky. The construction [illegible]

ner Leonard Bauer of Newport, ed the City Commission to in- rks in Newport similar to the in Maysville.

Maine.

ns of Eliot, Me., on March 11 ke a contract with the town of furnish the town water at $1,000 [illegible]

Massachusetts.

[illegible] Water Commissioners of n, Mass., plans to lay 4,600 ft. of n Bridge road the coming season, ear North Main St., in Florence [illegible] Maple St., Florence. From $15,- will be expended in new work. Kinney is President of the Board.

tract for furnishing 300 water he water department of Everett, which bids were asked by the [illegible] et.

Michigan.

ns of Grand Haven, Mich., have ssuance of bonds in the sum of the installation of a waterworks

Missouri.

se of Delegates of St. Louis, Mo., a resolution asking Water Com- . E. Wall to draw plans for suffi- es to prevent a possible water

[illegible] the private water system of the brewing concern. The capacity of the plant will be [illegible] water will be used for the manufacture of ice, and for refrigeration of railroad ship- [illegible]

[illegible] Fruin-Colnon Construction Company. The contract for the filter plant has been awarded the Kellerman Construction Co. Alum and lime will be use in the coagulating process, instead of iron and lime, as at the city purification plant.

Montana.

✣Bids will be received until March 25, by the City of Great Falls, Mont., for pipe and materials for the construction of a 12-in. water main from Second St. to 21st St., starting at Second St. and extending east on Third Ave. south to Sixth St., thence north on Sixth St. to Fourth Ave. north, thence east on Fourth Ave. to 21st St.; also the completion of the 8-in. supporting line on 21st St. from Fourth Ave. north to Eighth Ave. north, including about 358 tons of 12-in. cast iron pipe, class "C," 24 tons of 8-in. cast iron pipe, class "B," 12 12-in. gate valves; two 12x12 crosses.

Nebraska.

⊙The Anderson-Friedman Construction Co., of Omaha, Neb., has been awarded the contract for the construction of a building for the filtration plant at Fort Omaha, for which bids were asked by the Quartermaster until Feb. 15, at $1,957. The Norwood Engineering Co., of Florence, Mass., secured the contract for the installation of the filter system at $2,950.

New Mexico.

The city of Raton, N. Mex., on April 2 will vote on the issuance of bonds in the sum of $400,000 for the purpose of purchasing and extending the present water system or to construct a new system. Hiram Phillips, Third National Bank Bldg., St. Louis, Mo., is Engineer.

New York.

✣[illegible] April 2, by Board of Water Supply, 165 Broadway, New York, N. Y., for the construction of the Wallkill Blowoff, including about 7,000 ft. of concrete conduit, 7 ft. inside diameter, about 80 ft. of cut and cover aqueduct, a blow-off chamber and necessary castings for valve and aqueduct. The work is located $1\frac{1}{4}$ miles northeast and southwest respectively of Gardiner and New Hurley Stations on the Wallkill Valley R. R., Ulster County, N. Y. J. P. Morrissey is Secretary.

⊙E. F. Kitson, 40 Exchange Pl., New York City, has been awarded the contract for the making of extensions to the water distributing system at West Point, N. Y., for which bids were received on March 12 by Maj. B. T. Clayton, Quartermaster, West Point, at $5,251, plus necessary rock excavation at $3.75 per cu. yd.

⊙Following bids were received Feb. 15 by the Commissioners of the Manhasset-Lakeville Water District, Manhasset (L. I.), N. Y., for the construction of a system of waterworks, for which Johnson & Fuller, 150 Nassau St., New York City, are Engineers; contract awarded on Feb. 29: (1) Standing for bid of Harrison Construction Co., 837 Broad St., Newark, N. J.; (2) W. G. Fritz, Dover N. J., [illegible] Roth & Weston, 355 Fulton St., Jamaica, N. Y.; (4) R. G. Breckenridge & Co., 23 Walnut Ave., Rockville Centre (L. I.), N. Y.; (5) Clancy & Van Alst, 401 Broadway, Long Island City, N. Y.; (6) The Hicks-Johnson Construction Co., 150 Jackson Ave., Long Island City, N. Y.; (7) A. M. Harper, Inc., 56 Second St., Newburgh, N. Y.; (8) Charles Ippolito, 83 Cone St., Orange, N. J.; (9) L. B. Jacobs, Newark, Del.; (10) Henry F. Fox, 81 E. 125th St., New York City; (11) Cooper [illegible]

⊙Bids were received by E. B. Talbot, Clerk [illegible] wall-on-Hudson, N. Y., on Feb. 27, from 14 firms for constructing a storage reservoir for the village. The contract has been awarded A. M. Harper of Newburgh, N. Y., on the following itemized bid

[illegible]

A bill has been introduced at Albany by James J. Frawley, Chairman of the Senate Finance Committee, appropriating $15,000 to be expended under the direction of the State Commission in Lunacy, Albany, in providing an adequate water suply for the Kings Park State Hospital on Long sIland

Plans are being prepared for the installation of a waterworks system in Sodus, N. Y., at an estimated cost of $30,000. The Town Board is in charge.

Extensions are planned for the waterworks system of Oneida, N. Y., at an estimated cost of $6,500. Plans are also being prepared for the installation of a water softening plant which will cost approximately $25,000. A special election will probably be called to vote an appropriation for the improvement.

Ohio.

⊙The White Sulphur Construction Co., White Sulphur, O., has been awarded the contract by the Delaware County Commissioners, Delaware, O., for the construction of the Felkner road in Scioto Township, 1.02 miles in length at $2,295. Bids were opened March 9.

⊙Thomson Meter Co., 100-110 Bridge St., Brooklyn, N. Y., has been awarded the contract by the Department of Public Service of Cleveland, O., Thos. J. Clifford, Contract Clerk, for furnishing $\frac{5}{8}$, $1\frac{1}{2}$, 2, 3 and 4-in. disc water meters for the Cleveland water department at $39,000. The contract prices are: $\frac{5}{8}$-in., $6.10; $1\frac{1}{2}$-in., $25; 2-in., $40; 3-in., $70, and 4-in., $140. Bids were opened February 27 and the contract awarded March 15.

Oklahoma.

The city of Ardmore, Okla., contemplates improving its waterworks system at a cost of $50,000. The improvements will consist of the installation of two 150-h.p. duplex pumps, with a combined daily capacity of 2,000,000 gals.; also two 150-h.p. steam boilers and a 14-ft. dam across Caddo Creek.

Hiram Phillips, Third National Bank Bldg., St. Louis, Mo., J. W. Billings of Houston, Tex., and John W. Alvord of Chicago, Ill., are now engaged on a report on plans for providing a larger water supply for the city of Oklahoma City, Okla. It will probably be about four months before the report is submitted. Plans are being submitted that will cost approximately $1,500,000.

The city of Stillwater, Okla., will soon make extensions to the water works system, and as an additional source of water supply will sink a large open caisson well. Plans and specifications are being prepared by The Benham Engineering Co., Consulting & Supervising Engineers, 812-14 American National Bank Building, Oklahoma City, Okla. City will also do some paving in the business district and bids will probably be received about May 1.

The city of Hennessey, Okla., will probably let contracts about April 1 for the making of extensions to the waterworks system at an estimated cost of $10,000. The work will include the construction of a reservoir and 750 ft. of mains and the extension of the plant system. R. W. Nylie is President of the Board of Trustees, in charge of the work.

Oregon.

Civil Engineer R. A. Emmitt of Klamath Falls, Ore., has made a proposition to the City Council of that city, whereby he offers to install a water system and furnish the city with pure water at a cost not to exceed $135,000.

Pennsylvania.

The Borough Council of Phoenixville Pa., has adopted a report favoring the construction of a 3,000,000-gal. mechanical filtration plant in accordance with plans which have been approved by the State Health Commissioner.

Director of Public Works Joseph G. Armstrong of Pittsburg, Pa., proposes to begin actual work early in April on the extensive plans made by the Public Works Department for providing filtered water for the north side.

South Carolina.

The City Council, Public Works Commission and the Sewerage Commission of Rock Hill, S. C., have adopted a report of Consulting Engineer Thomas W. Cothran of that city to go to the Catawba River for a permanent water supply for the city of Rock Hill. The new water supply will cost about $50,000.

The Waterworks Department of Columbia, S. C., will immediately take up all old water mains on Laurel St. to Washington St., on Sumter St., and one block on Taylor St., from Sumter St. to Main St., and relay with new ones, to provide for the proposed new pavement. W. F. Stieglitz is Superintendent of the water department.

South Dakota.

The citizens of Bowdle, S. Dak., at a recent election voted the issuance of bonds in the sum of $15,000 for the installation of a waterworks system.

The citizens of Lake Preston, S. Dak., will vote March 27 on the proposition to issue bonds in the sum of $5,000 for the extension and improvement of the municipal waterworks system.

The Missouri Valley Engineering Co., Mitchell, S. Dak., is preparing plans for the construction of a water works system in McGehee, Ark. Plans will be completed and bids asked in the near future.

Tennessee.

⊙The Board of Public Works of Nashville, Tenn., has awarded the contract for supplying the city with sulphate of alumina for purification of the water during the next year to the General Chemical Co. of Chicago. About 24 car loads will be required for the year, the price being about $13,000.

Texas.

W. L. Rockwell, engineer in Texas for the irrigation department of the United States, is making tests of the soils of Tule Lake near the city of Corpus Christi, Tex. If the tests show the imperviousness of the bottom of the lake plans will at once begin for the building of dykes and for the impounding of storm water sufficient to supply the city with an abundance of water, and at the same time irrigate more than 5,000 acres of agricultural land.

A waterworks company has been organized in Forest Hill, a suburb of Fort Worth, Tex., with a capital stock of $10,000 for the purpose of installing a water system. E. R. Swinney is President and L. C. Collier is Secretary-Treasurer. The contract for the sinking of the well has already been let.

The Gunter Water Supply Co., of Gunter, Grayson County, Tex., has been incorporated with a capital stock of $5,175. The incorporators are: J. D. Bowen, H. J. Barnes, W. J. Wall and others.

The City Council of Huntsville, Tex., has decided to install an electric pump and necessary apparatus to better fire protection for the Sam Houston Normal institute and that part of town adjacent.

Washington.

⊙The Kahn Co., of Seattle, Wash., has been awarded the contract for making improvements to the waterworks system at Shelton, Wash., at $4,300.

Commissioner Hamilton F. Gronen of the department of light and water, city of Tacoma, Wash., has called to the attention of the City Council the necessity of laying cast iron water mains under the South End Sts., at an estimated cost of $30,000.

Engineer J. C. Ralston of Spokane, Wash., has submitted his report to the Water Rate Commission of Sandpoint, Ida., relative to an appraisement of the system of the Sandpoint Water & Light Co.

Wisconsin.

✣Bids will be received until 10:30 a. m., March 23, by Department of Public Works, H. E. Briggs, Commissioner, Milwaukee, Wis. for carting water pipe, hydrants and special castings as may be required by the water department.

✣Bids will be received until 10:30 a. m., March 23, by Department of Public Works, Milwaukee, Wis., for furnishing about 1,000 tons of 6-in. class "C" cast iron waterpipe; also for 200 tons of 12-in. and 300 tons of 16-in. Class "C" cast iron water pipe.

✣Bids will be received until 10:30 a. m., March 23, by Department of Public Works, H. E. Briggs, Commissioner, Milwaukee, Wis., for furnishing the water department 200 fire hydrants of the Single Valve Mathews or Improved Stowell pattern.

✣Bids will be received until 10 March 23, by Department of Pub H. E. Briggs, Commissioner, Milwaukee for furnishing the Water Department 2/4-in. corporation stop cocks.

✣Bids will be received until 10 a. m. March 23, by Department of Pub Works Milwaukee, Wis., for furnishing the water department, 100 tons of special castings, consisting of 3 ways, 4 ways, curves, etc., from 3 to 16 ins. diameter, for class " water pipe, according to the American Water W association's standard specification for iron water pipe and special castings adopt May 12, 1908.

The Wisconsin State Railroad Commission Madison, will fix a just compensation to paid the Racine Water Co. by the y of R cine for its plant on April 1.

Nothing definite can be known s to installation of a water works Horicon, Wis., until after April and sibly not at that time J. Ed City Clerk.

Wyoming.

Detailed plans have been comp water works system for the city of Wyo., by Consulting Engineers Bu McDonnell, Scarritt Bldg., Kansas C Mo. A bond election has been called April 16 for $65,000 for the impr

⊙H. E. Holdredge of Th Wyo., has been awarded the c the Town Council of that place, Clerk, for the construction and x of the water system. The contra $3,685. Bids were opened Marc 4

Canada.

⊙The contract for the construction concrete reservoir to be built at B. C., has been awarded to the (E Construction Co., Crary Bldg., Sea at $32,730. Other bidders were Williams, Stitt & Mathieson, $41,4; Contracting Co., $36,687; H. P. Co $41,631; El Oso Paving Co., $42, son & Co., $42,135; Robt. McLea R. H. Travers, $42,454 and W. $39,997.

⊙The City Commissioners Albert, Sask., have awarded th for furnishing 27,000 lin. ft., of 6-in. cast iron pipe to the National Works, Ltd., Toronto, Ont., at 3.40 ton. Bids were opened March 1.

The Waterworks Board of Niagara F Ont., has adopted a resolution di city engineer and city solicitor to Government for permission to sink new nel and wheelpit, and, in fact, to construct entirely new waterworks plant.

The ratepayers of Port Stanley O March 11 voted a by-law to expe on a waterworks system.

Consulting Engineer H. G. Hck Syracuse, N. Y., has approved th pl the city of Berlin, Ont., for the pros tensions to the waterworks, entail penditure of $100,000.

SEWERAGE AND GARBAGE DISPOSAL

Arkansas.

⊙Williams, Hays & Payne, of Fort Smith, Ark., have been awarded the contract by the city of Fort Smith, Roy M. Johnson, Secretary, for the construction of certain storm water sewers or underdrainage for Garrison Ave., at $12,845. Bids were opened March 4.

Plans are being prepared by the Missouri Valley Engineering Co., Mitchell, S. Dak., for the installation of a sewer system in McGehee, Ark. Bids will be asked immediately upon the completion of the plans.

California.

✣Bids will be received until March 25, by Board of Trustees, Orland, Calif., for the construction of a municipal sewer and water system.

✣Bids will be received until March 28, by City Clerk, Anaheim, Calif., for Section 1, of the Outfall sewer.

Plans and specifications for a gravity sewer to carry off sewage from the county hospital have been submitted to the Board of Supervisors, Sacramento, Calif., by County Surveyor Frank C. Miller.

The City Council of Oakland, Calif., is re-advertising for bids for the construction of sewers in Districts Nos. 1, 2 and 3, owing to an irregularity in the proceedings.

The Board of Public Works of Los Angeles, Calif., has recommended to the City Council that Maple Ave., from S to Washington St., be sewered befo ceedings are started to pave the a

The City Engineers of Pasaden bra and South Pasadena, Calif., re a meeting in the last named city fc pose of arranging for the maki liminary survey for the propos sewer, projected to answer the ne San Gabriel valley cities. S. J. V is City Engineer of Pasadena.

It is reported the Trustees of C have retained Consulting Engineers & Whitman, Sacramento, to prepare specifications for the installation c system.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

for the city of Bakers[illegible] nsen, A K Warren and [illegible] submitted their report [illegible] on the installation [illegible] "Estimating [illegible] system on the use [illegible] throughout, except [illegible] must be reinforced [illegible]

[illegible]

[illegible] for general expenses [illegible]

[illegible]

[illegible] Concrete System [illegible]
h proposed system based on the use [illegible]d concrete pipe for the 30, 36 n. iameters:

u er 30 in., as in above esti- ... $ 92,815
[illegible]vations and backfill.... 76,660
is before.................. 6,340
[illegible] septic tank [illegible]
............................$176,845
nt r general expenses.........$ 17,685
al $194,530

Illinois.

[illegible] y Board of Local Improvements, l.. for the construction of a sew- St., from North Cherry St. to ary St. The work will include [illegible] D. B. Swanson is a member of [illegible]d

l be received until 9 a. m., March [illegible] Local Improvements [illegible] or the construction of a vitrified s er in Henderson St., North Hen- West North St., Hawkinson Ave., e ve., and Olive St. D. B. Swan- man of the Board.

Curtis, of Joliet, Ill., has been contract by the Board of Local nts of that city, Wm. S. Welch, e construction of sewers in Mis- . and Grant Ave., at $1,637. Bids r March 4.

[illegible] prepared by Engineer [illegible] Charleston, Ill., for the construc- sewers in Hillsboro, Ill., estimated 00. The contract will not be let u.

neer L. D. Jeffries, 308 City Hall, l will prepare plans shortly for the of the South Peoria sewer system, cost $500,000. Brick and vitrified used.

are the low bids received by the ocal Improvements, Chicago, Ill., cting sewers in the following clid Ave. system, $930, Geo. Pon- ter Ave., $2,407, Nic. Mancini; $975, Simon Ryan; W. 14th St., lo Santucci; Walden Parkway, on Ryan; Center Ave. system, Mansini; N. 44th Ave., $3,704, lty Co.; W. 63d St. system, $32,657, lty Co.

ineer Edmund Main is making new outlet for the proposed sewer heast End of Rockford, Ill. It is run the main trunk of the system rrison Ave. and west to the river.

Council of Collinsville, Ill., has Sewer District No. 3, which pro- sewer system in Collinsville, to e portion of the city and affording system.

Council of Princeton, Ill., has rdinance providing for the laying of sewer. This sewer will run Creek, between Church and Sher- a manhole to be located in North in a southerly direction to a point h of the north line of lot 9 in ition. The estimate cost of the 135.

[illegible]

✣[illegible]

•[illegible]

•[illegible] of brick and tile. The contract price is $54,764. Bids were opened March 12.

The city of Jeffersonville, Ind., it is reported, will shortly grant a franchise to James [illegible] who are conected with the Jeffersonville Water, Light & Power Co., to install a sewerage [illegible] city is to have the privilege of purchasing the system within 25 years.

The Board of Public Works of South Bend, Ind., has taken steps toward the building of two trunk sewers on Ford and on Sample Sts., [illegible]

Charles Brossman, Consulting Engineer, Indianapolis, Ind., has been retained by the Board of County Commissioners of Marion County, Indianapolis, to prepare plans and [illegible] Marion County Hospital for the Incurable Insane at Julietta.

Iowa

✣Bids will be received until 8 p. m., March 21, by Otto P. Geiger, City Recorder, Dubuque, Ia., for the construction of an 8-in. tile pipe sanitary sewer in Queen St., from the present manhole in Queen St. northerly in Queen St. to a point opposite the center of Lot 46A, Stafford's Add., in accordance with the plans and specifications prepared by the City Engineer and now on file in the office of the City Recorder. It is estimated by the City Engineer that it will require: 970 lin. ft. [illegible]

✣Bids [illegible] March 21, by Otto P. Geiger, City Recorder, Dubuque, Ia., for the construction of an 8-in. tile pipe sanitary sewer in Kniest St., from the present manhole in Lincoln Ave. northerly in Lincoln Ave. to Eagle Point Ave., thence northeasterly in Eagle Point Ave. to Prince St., thence northwesterly in Prince St. to Sanford St. to the east line of Saunders Sub., in accordance with the plans and specifications prepared by the City Engineer and now on file in the office of the City Reporder. It is estimated by the City Engineer that it will require: 1,850 lin. ft. of 8-in. tile pipe, 8 manholes, and 1 flush tank manhole.

The City Council of Davenport, Ia., has passed a resolution providing for the construction of the first portion of the proposed intercepting sewer for the city river front. The sewer will extend from the foot of Gaines St., along Brown, Warren, Myrtle and to Marquette St. The estimated cost of this section is $50,000.

The Town Council of Grundy Center, Ia., has decided to extend the sewer system of the town a distance of four blocks.

The city of Sioux City, Ia., will shortly ask for bids on the laying of sewers in Morning Side Ave., at an estimated cost of $5,000.

The City Council of Fort Dodge, Ia., has passed a resolution for a sanitary sewer which will drain Round Prairie and the north end of the city. The sewer will be 5.9 miles long, according to figures of City Engineer C. H. Reynolds. W. L. Tang is City Clerk.

The City Council of Muscatine, Ia., has ordered the construction of sewers in Sub-Sewerage District No. 1, of Main Sewerage District No. 4. The estimated cost of the work is $4,938. T. H. Brennan is City Recorder.

Louisiana.

The bonds recently issued by the officials of Morgan City, La., for the installation of a sewer system, have been sold. It is probable that construction work will begin within 60 or 90 days. X. A. Kramer, Magnolia, Miss., is Engineer.

Maryland.

Following bids were received by the Board of Awards of Baltimore, Md., on Sanitary Contract No. 19, Storm-Water Drains: B. F. Sweeten & Son, 1500 E. Madison St., Baltimore, Md., $51,285; James Ferry & Sons, Inc., Pittsburgh, Pa., Grafton Sta., $59,406; The J. Connelly Construction Co., 429 Schofield Bldg., Cleveland, Ohio, $59,835; Ryan & Reilly Co., 612 Union Trust Bldg., Baltimore, Md., $61,096; Gallagher, Boyle & Muller, 120 Law Bldg., Baltimore, $61,419; Wm. McCarthy & Co., 3 Oliver St., Baltimore, $63,877; The Whiting-Turner Const. Co., Sexton Bldg., Baltimore, $67,896.

Massachusetts.

✣Bids will be received until 2:30 p. m., March 25, by Metropolitan Water and Sewerage Board, 1 Ashburton Place, Boston, Mass., for building upon foundations constructed by the Commonwealth, the superstructure of the Southern Extra High Service Pumping Station in Hyde Park. The building, which is to be of red brick with Quincy granite and terra cotta trimmings, is to include an engine-room 64 ft. x 47 ft., a boiler-room 41 ft. 2 ins. x 41 ft., and a brick chimney 75 ft. in height. Plans for the work may be seen, and pamphlets containing further information for bidders, forms of proposal, contract and specifications, can be obtained at the office of Dexter Brackett, Chief Engineer of Water Works, 1 Ashburton Place.

The City Council of Boston, Mass., on March 11, passed a loan order appropriating $400,000 for sewerage works within the watershed of the Charles River Basin.

Michigan.

The Board of Public Works of Grand Rapids, Mich., has approved the plans and specifications for the east side trunk sewer pumping station.

Minnesota.

⦿The Pastoret-Lawrence Co., of Duluth, Minn., has been awarded the contract by the Board of Local Improvements of St. Paul, Min., for the construction of the Thomas-Van Buren sewer system at $34,480. Other contracts awarded by the Board were Snelling-Edmund sewer system, Gilbert W. Haggart of Fargo, N. Dak., at $39,000; St. Anthony Ave. sewer, Fraser & Danforth of Rochester, Minn., $14,000.

The city of Stillwater, Minn., Lewis W. Clarke, City Engineer, rejected all bids received on the North Hill outlet sewer, for which bids were received on March 5.

The City Council Committee on Sewers of Minneapolis, Minn., will have available for trunk sewer construction $200,000, and for laterals $450,000. Petitions for laterals have already been received that will cost approximately $353,000, and trunk lines of $245,000. Preliminary lists of petitions for sewers in the different wards reach the following totals:

	Estimated	To be	City's
W[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Third	100,867	42,812	33,055
[illegible]	[illegible]	[illegible]	[illegible]
Fifth	114,830	5,944	103,386
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Ninth	63,167	34,151	29,016
[illegible]	[illegible]	[illegible]	[illegible]
Eleventh	26,005	14,676	12,329
[illegible]	[illegible]	[illegible]	[illegible]
Thirteenth	51,547	35,563	15,984
T[illegible]	[illegible]	[illegible]	[illegible]

Engineer J. E. Carroll of Crookston, Minn., has prepared an estimate of the cost of installing a sewer system and waterworks in Red Lake Falls, Minn. The citizens will shortly be asked to vote on the proposition to bond the town for the improvements.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Missouri.

✣Bids will be received [illegible] by [illegible] California, Mo., for the construction of about 3 miles of sewer laterals and outlet sewer and three septic tanks. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Engineers.

⊙The Board of Public Works of St. Joseph, Mo., has awarded the contract to the Olsen-Schmidt Construction Co., for the building of the South Park sanitary sewer at $14,338. [illegible]

⊙W. W. Cook & Son, of Junction City, [illegible] the contract by the City Council of Union, Mo., Geo. H. Vossbrink, City Clerk, for the installation of a sanitary sewer system at $8,211. The work includes the following quantities: 1,962 ft. of 12-in. vit. sewer pipe, 3,856 ft. of 10-in. vit. sewer pipe, 11,098 ft. of 8-in. vit. sewer pipe, 6,272 ft. of 6-in. vit. sewer pipe, 54 10x6-in. Y branches, 290 8x6-in. Y branches, 190 6-in. Y branches, 534 6-in. stoppers, 52 manholes, [illegible] 15 lampholes. Excavation 7,360 cu. yds. Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., Engineers. Bids were opened March 4.

The city of Springfield, Mo., has sold bonds in the sum of $100,000 for the construction of sewage plants at the outlets of the two main sewers to Emery, Peck & Rockwood, of Chicago, Ill. H. G. Horton is City Engineer. Alexander Potter, 114 Liberty St., New York City, is Consulting Engineer.

The Board of Public Works of St. Joseph, Mo., has decided that the proposed extension of lower Whitehead sewer in Atchison St., Fifth to Sixth, with which the South Park sewer is to connect, shall be of reinforced concrete. The estimated cost is $8,000.

A proposition to bond Wellsville, Mo., for $18,000, for a water works and sewerage system [illegible] submitted to the voters at the April election.

Montana.

The voters of Libby, Mont., at a recent election, voted the issuance of bonds in the sum of $15,000 for the construction of a main sewer through the town.

New York.

The citizens of Glen Falls, N. Y., on March [illegible] the proposition to appropriate $115,000 for the refund of sewer bonds.

Included in the annual estimate of the budget of the village of Waterloo, N. Y., are the following: Street, park and bridge fund, $3,500; water, $2,410; light, $4,200; sewers, $350.

The citizens of Middleport, N. Y., will shortly vote upon the proposition to issue bonds in the sum of $100,000 for the installation of new sewers and a water system.

The Board of Estimate of New York City has passed a resolution appropriating $50,000 for an issue of special revenue bonds to pay for the improvement of the 26th Ward sewage disposal plant. The capacity of the plant will be increased, a laboratory will be established and necessary experimental apparatus purchased.

The voters of New Hartford, N. Y., on March 19 voted on the proposition to connect the sewers of the village with the sewers of the town of Hartford, known as Sewer District No. 1. The estimated cost is $6,400. A. M. Scripture, New Hartford, is Engineer.

City Engineer Aldrich of Auburn, N. Y., has presented plans to the Common Council for a sewer in Lake Ave., from Silver Ave. to Swift St., and in Swift St., from Lake Ave. to Burt Ave. It is proposed to drain the sewer into the Second ward sewer, which empties into the Owasco outlet.

Assemblyman Herbert E. Allen of Oneida County, N. Y., has introduced a bill providing for the establishment of a sewer district in Onondaga Valley and East Onondaga under the town law so that a contract may be entered into with the city to connect the two sewer systems.

The City Council of Buffalo, N. Y., has approved the bills drawn by the corporation counsel providing for the issuance of $2,500,000 worth of bonds, the proceeds from the sale of which to be used to enlarge the public trunk sewers of the city and to reimburse the new construction account of the bureau of water for expenditures for district mains, etc., during the last four years.

North Carolina.

The City Council of Wilmington, N. C., has offered the Wilmington Sewerage Co. $50,000 for the existing sewerage plant, provided the offer is accepted within 10 days, and the plant, if secured by the city, would be used in connection with the municipal system it is proposed to build.

The City Commissioners of Dunn, N. C., will shortly ask the citizens to vote on the proposition of installing a sewerage system.

Ohio.

✣Bids will be received until noon, March 26, by Director of Public Service, W. J. Springborn, Cleveland, O., for the construction of sewers in the following streets, avenues, courts, thoroughfares: Ardmore Ave., S. W., between Pearl Rd. S. W. and W. 45th St.; Behrwald Ave. S. W., between Pearl Rd. S. W. and W. 45th St.; Cypress Ave. S. W., between Pearl Rd. S. W. and W. 39th St.; Eliza Ave. S. E., between E. 53d St. and E. 54th St.; Harvard Ave. S. E., between E. 131st St. and E. 136th St.; Jeffries Ave. S. E., between Warner Rd. S. E. and Turney Rd. S. E.; Leavitt Ct. S. E., between E. 75th St. and Minnie Ave. S. E.; E. 90th St., between Harris Ave. S. E. and Kinsman Rd. S. E.; W. 97th St., between Denison Ave. S. W. and 175 ft. northerly; W. 99th St., between Denison Ave. S. W. and southerly end. Each bid must be made in accordance with the plans and specifications which may be seen at the office of the Chief Engineer, Room 305 City Hall. W. H. Kirby is Secretary.

⊙Following contracts for sewer works have been awarded by the Board of Control of Dayton, O.: Shafer & Dill, Chapel St., $1,007; Clover and Dover Sts., $730; Hawthorne, Dunbar and Fifth Sts., $1,308; Leonard St., $740; Hecker & Kirchner, alley west of Main near Richmond, $2,846; Huston Av., $1,577; Simms St., $468; Foundry St., $304; Boyd & Cook., Linden Heights, $3,158; Main from McPherson to Adrian Sts., $1,161.

The Allen County Commissioners, Lima, O., have granted the petition of residents along Bellefontaine Ave., asking for a sewer in that thoroughfare. Surveys are being made by the county surveyor.

Engineer B. M. French has submitted his preliminary estimates of the cost of constructing new storm water sewers throughout the city of Salem, O., to the City Council. It is thought that $300,000 would be required for the work.

The City Council of Canal Dover, O., has instructed City Engineer Arnold to prepare plans, specifications and estimates for the construction of the new sanitary sewer in the north end, to be built along the route of the Calico ditch.

The Sewer Committee of the City Council, Cincinnati, O., has completed an inspection of the routes of 57 proposed sewer improvements.

The City Council of New Philadelphia, O., has instructed the city engineer to prepare plans and specifications for storm sewer extensions to be constructed in Ray St. and Belmont Ave.

Legislation for the construction of a 30-in. overflow sewer from Broadway at 12th St. to the river, city of Lorain, O., is being prepared by City Solicitor Hughes. The estimated cost is $4,000.

The City Council of Celina, O., has taken steps toward the submission at the May primary of a proposition to bond the city for a sanitary trunk sewerage system.

The city of Cambridge, O., anticipates laying 12,000 ft. of sanitary sewers and the building of a disposal plant. A bond issue of $60,000 for the latter will be voted upon March 26. Preliminary plans and estimates have been made by City Engineer Karl M. [illegible]grove.

Plans have been prepared by Ci[illegible] G. C. Cummin, Monument Ave., [illegible]ayton, O., for the construction of new sani[illegible] at an estimated cost of $5,000. Th[illegible] include 14-in. iron pipe, 8-in. vitrif[illegible] 300 ft. of syphon. The contract [illegible] April 6. F. O. Eichelberger, Co[illegible] Place, Dayton, is in charge of the [illegible]

Oregon.

A committee from the Mont[illegible]lla, Ore., Board of Trade has been appoin[illegible] to [illegible] the laying of sewers on East Gli[illegible] tween East 60th and East 82d Sts.

The City Council of Bend, O[illegible] has re[illegible]tained Engineers J. B. & R. E. K[illegible] of Chicago, Ill., to prepare plans and s[illegible]cification[illegible] for the installation of a sewer syst[illegible].

At the regular city election [illegible] question of increasing the sewer b[illegible] indebtedness to $200,000 so that a trunk [illegible] be put in in line with the recomme[illegible] the State Board of Health, will b[illegible] to the voters of Eugene, Ore.

Pennsylvania.

⊙George M. Harris of Meadvil[illegible] been awarded the contract for th[illegible] two miles of sewer pipe in Sebring[illegible].

The Borough Council of New Br[illegible] it is reported, will employ an eng[illegible] over the ground, estimate the cos[illegible] out a plan for a union disposal pla[illegible] New Brighton, Beaver Falls, P[illegible] Heights and College Hill.

The Borough Council of Eddy[illegible] has passed an ordinance extending [illegible] on Saville Ave., from Ninth St., t[illegible] house, at an estimated cost of $10,0[illegible]

Borough Engineer S. Cameron [illegible] Norristown, Pa., on March 7 sent [illegible] to consulting engineers asking for [illegible] of the cost to prepare plans, specifi[illegible] their services in an advisory cap[illegible] sewage disposal plant for Norrist[illegible] presented by March 22.

City Engineer R. E. Neumeyer, [illegible] Bldg., South Bethlehem, Pa., recent[illegible] plans for the construction of an [illegible] sewer of 24-in. diameter, estimat[illegible] $27,000, and a disposal plant, estima[illegible] $80,000. The State Board of Hea[illegible] proved these plans and an election [illegible] ly be held to vote bonds for the imp[illegible] The work will also include a pump[illegible]

Texas.

The City Council of Bay City, [illegible] March 10 accepted the plans of [illegible] Shepperd of Denver, Colo., for th[illegible] tion of a first-class sewer system. [illegible] tions will soon be made to hold [illegible] to vote bonds in the sum of $30,[illegible] for improvement.

A number of subscriptions [illegible] for the installation of a p[illegible] age system in the town of Mart, Tex. [illegible] system will be owned by the citize[illegible]

The Board of Commissioners [illegible] Da[illegible] Tex., has asked the taxpayers to [illegible] bonds for the following improvemen[illegible] works improvement bonds, $400,000 city [illegible] bonds, $475,000; school bonds, $200,00[illegible]; [illegible] station bonds, $125,000; sanitary se[illegible] bonds, $100,000.

Washington.

City Engineer Morton Macartne[illegible] of [illegible]kane, Wash., has submitted plans for [illegible] downtown intercepting sewer to the [illegible] Council for approval. The sewer [illegible] the river in Peaceful Valley and [illegible] Main Ave., to Stevens St., south [illegible] Ave., and branch east and west [illegible] It will intercept and carry to the river [illegible] flow of six trunk sewers and a [illegible] smaller laterals, giving the busine[illegible] Browne's addition, Cannon's additi[illegible] central portion of the south hill [illegible] Fourteenth Ave. better sewer out[illegible] Main Ave. between Monroe and S[illegible] the diameter of the sewer will be 7 [illegible] where it will vary from 4 to 6 ft. in [illegible] The estimate has not yet been pre[illegible] it will be upward of $250,000.

Wood Block Pavement

Most Economical in the End

Although the first cost of a wood block pavement is high, the fact that it involves no maintenance expense and has a greater durability than any other pavement makes its use in the end highly economical. Macadam, for example, costs less in the initial expense than Wood Block, but its maintenance cost is so high, if the traffic amounts to anything, that the economy of this form of construction over Wood Block Pavement is doubtful.

The report of Monroe County, New York, for example, in 1911 gives in scientific fashion the cost of building and maintaining East Avenue in Pittsford. It is three-quarters of a mile long and was built with waterbound trap rock in 1899 at a cost of $13,898.70. In the first seven years its maintenance expense was $762.69. In 1907 the maintenance cost $1,178.87; in 1908, $2,224.91; 1909, $3,366.16; 1910, $12,112.77; 1911, $3,950.24. This gives a total maintenance cost of $37,564.34 for three-quarters of a mile of road for 13 years, or $2,889.56 per year. At this rate the road for 10 years would cost $28,895.60.

A Wood Block Pavement could be built for $2.50 per square yard, curb included, or $18,000 for this area, and the maintenance cost would be nothing, as this price would include a five-year guarantee. The maintenance expense would continue to be nothing for many years after, whereas macadam, at the end of 10 years, needs complete rebuilding. The use of wood block in this situation would have saved $10,000.

Wood Block Pavements have won their fame on city streets of heavy traffic, but their great durability entitles them to be considered as [illegible]

[illegible]

U. S. WOOD PRESERVING CO., 165 Broadway, NEW YORK

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SUPERSTRUCTURE OF INDIANA STREET BRIDGE.

DEPARTMENT OF PUBLIC WORKS

Chicago, March 12th, 1912.

Sealed proposals will be received by the City of Chicago until 11 a. m., Wednesday, April 24th, 1912, at room 406 City Hall, for furnishing all materials, tools, labor and appliances, and for performing all operations necessary for the complete construction and erection of the superstructure for a bascule bridge over the North Branch of the Chicago River at Indiana street, including all necessary machinery thereto, according to plans and specifications on file in the office of the Department of Public Works of said city, room 406 City Hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Superstructure Indiana Street Bridge," and be accompanied with Three Thousand Dollars in money or a certified check for the same amount on some responsible bank located and doing business in the City of Chicago and made payable to the order of Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

A deposit of Twenty-five Dollars will be required for the safe return of plans and specifications.

Bidders are invited to submit alternate bids on plans prepared according to their own designs, which designs must conform to rules and requirements, which can be obtained at the office of the Commissioner of Public Works.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Publice Works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

L. E. McGANN,
Commissioner of Public Works.

STREET PAVING.

Sealed proposals will be received by the City Clerk at Benton Harbor, Michigan, until 8 o'clock on March 21, 1912, for material and labor for constructing approximately 13,000 sq. yds. asphaltic concrete pavement on 5 in. cement concrete foundation and 59,000 lin. ft. cement curb and gutter The Council reserve the right to reject any and all bids at their discretion if it is advisable to so do. A certified check of $500.00 will be required.

B. SPAULDING,
City Clerk.

U. S. ENGINEER OFFICE, Duluth, Minn., Mar. 5, 1912. Sealed proposals for furnishing and placing rock in the foundation embankment for the breakwater extension at Marquette, Mich., will be received here until noon April 5, 1912, and then publicly opened. Information on application. Francis R. Shunk, Lt. Col., Engrs.

SUPERSTRUCTURE OF 35TH STREET BRIDGE.

DEPARTMENT OF PUBLIC WORKS

Chicago, March 12, 1912.

Sealed proposals will be received by the City of Chicago until 11 a. m., Wednesday, April 24, 1912, at Room 406, City Hall, for furnishing all materials, tools, labor and appliances and for performing all operations necessary for the complete construction and erection of the superstructure for a bascule bridge over the South Fork of the South Branch of the Chicago River at 35th street, including all machinery necessary thereto, according to plans and specifications on file in the office of the Department of Public Works of said city, Room 406, City Hall.

Proposals must be made out upon blanks furnished at said office, and be addressed to said department, indorsed "Proposals for Superstructure of 35th Street Bridge," and be accompanied with Three Thousand Dollars in money or a certified check for the same amount on some responsible bank located and doing business in the City of Chicago and made payable to the order of the Commissioner of Public Works.

The Commissioner of Public Works reserves the right to reject any or all bids.

A deposit of Twenty-five Dollars will be required for the safe return of plans and specifications.

Bidders are invited to submit alternate bids on plans prepared according to their own designs, which designs must conform to the rules and requirements, which can be obtained at the office of the Commissioner of Public Works.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the Commissioner of Public Works of his ability and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names, as well as the name of the firm, with their address.

L. E. McGANN,
Commissioner of Public Works.

PAVING.

Bids will be received until 7:30 p. m., April 3, by P. M. Banks, City Clerk, for improvements as follows: Paving with one of the following kinds of pavement: Brick-Block, Cement Concrete, Asphaltic Concrete and Bitulithic Concrete, approximately 35,800 square yards.

Combined Curb and Gutter—approximately 27,300 linear feet.

C. H. CURRIE,
City Engineer.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE—Washington, D. C., March 11, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, California, until 2 o'clock p. m., April 8, 1912, for furnishing electrical apparatus for Truckee-Carson Project, Nevada. For particulars address the U. S. Reclamation Service, 605 Federal Building, Los Angeles, California, or Washington, D. C. F. H. NEWELL, Director.

SUBSTRUCTURE OF 35TH STREET BRIDGE.

DEPARTMENT OF PUBLIC WOR

Chicago, March 12, 19

Sealed proposals will be received b he City of Chicago until 11 a. m., Wed s- day, April 24, 1912, at Room 406, City ll, for furnishing all materials, tools, l or and appliances and for performing all operations necessary for the com te construction and erection of the b- structure for a bascule bridge over he South Fork of the South Branch of he Chicago River at 35th street, inclu g the approaches thereto, as well as th e- moval of all obstructions found at he bridge site which might interfere th the construction of the new bridge d the diversion of the sewers on both es of the river, according to plans and sp- fications on file in the office of the e- partment of Public Works of said y, Room 406, City Hall.

Proposals must be made out on blanks furnished at said office, an e addressed to said department, indo d "Proposal for Substructure of 35th St et Bridge," and be accompanied with Te Thousand Dollars in money or a cert d check for the same amount on some - sponsible bank located and doing busi ss in the City of Chicago, and made pay le to the order of the Commissioner of - lic Works.

The Commissioner of Public Works - serves the right to reject any or all b .

A deposit of Ten Dollars will be - quired for the safe return of plans d specifications.

Bidders are invited to submit alter te bids on plans prepared according to t r own designs, which designs must conf m to rules and requirements, which can e obtained at the office of the Commissi er of Public Works.

No proposal will be considered u ss the party offering it shall furnish evid e satisfactory to the Commissioner of - lic Works of his ability, and that he s the necessary facilities, together with - ficient pecuniary resources, to fulfill e conditions of the contract and speci - tions, provided such contract should e awarded to him.

Companies or firms bidding will give e individual names, as well as the nam f the firm, with their address.

L. E. McGANN,
Commissioner of Public Works.

REINFORCED CONCRETE R ERVOIR.

Sealed bids will be received by the - lage of River Forest, Illinois, up to 8 p o'clock, A. D. April 8th, 1912, at the o e of the Village Board in the Village H River Forest, Illinois, for constructin a reinforced concrete reservoir of 150 0 gallons capacity. The over-all dimens s of the reservoir are 72 ft. by 28 ft. 13 ft.

Plans may be examined at the offic the Village Board or at the office of e Engineers in Chicago.

VILLAGE BOARD,
River Forest, Il
J. E. Adams,
Presiden

CALLS FOR BIDS

ate, $2.40 an inch, single column. **Copy received until Monday noon.**

U TRUCTURE OF INDIANA STREET BRIDGE.

[illegible]

Chicago, March 12th, 1912.

[illegible]

t Chicago until 11 a. m., Wednesday,

[illegible] City Hall.

rn ing all materials, tools, labor and pl ces, and for performing all operan necessary for the complete conru on and erection of the substructure bascule bridge over the North a of the Chicago River at Indiana including the approaches thereto, l as the removal of all obstructions at the bridge site which might ine with the construction of the new [illegible] diversion of the sewer [illegible] st side of Indiana street, according s and specifications on file in the of the Department of Public Works [illegible] City Hall.

[illegible] must be made out [illegible] at said office, and [illegible] to said department, indorsed for Substructure Indiana [illegible] be accompanied with [illegible] Dollars in money or rted check for the same amount on responsible bank located and doing ss in the City of Chicago, and made e to the order of the Commissioner [illegible] Works.

Commissioner of Public Works rethe right to reject any or all bids.

eposit of Ten Dollars will be refor the safe return of plans and cations.

ers are invited to submit alternate n plans prepared according to their esigns, which designs must conform es and requirements, which can be ed at the office of the Commissioner [illegible]

proposal will be considered unless rty offering it shall furnish evidence ctory to the Commissioner of Puborks of his ability and that he has cessary facilities, together with sufpecuniary resources, to fulfill the ions of the contract and specificaprovided such contract should be ed to him.

panies or firms bidding will give dividual names, as well as the name firm, with their address.

L. E. McCANN,
Commissioner of Public Works.

ITCH CONSTRUCTION.

t. Paul, Minnesota, March 4, 1912.

ed proposals will be received at the of the State Auditor, of the State nnesota, until 2 o'clock P. M., Tues-April 2nd, 1912, for the construction e Mustinka River State Ditch, in rse County, Minnesota, involving nstruction of about 13 miles of main ditch, and the excavation of about 0 cubic yards of earth. The work cated from 1 to 10 miles from ton, Traverse County, Minnesota.

s is an excellent floating dredge nd is suitable for a 1½ ward ma- Excellent roads cross the line of itch at various points. For full parrs address

GEORGE A. RALPH,
State Drainage Engineer.
St. Paul, Minnesota.

TENDERS AND DESIGNS FOR AN AQUEDUCT, CANADIAN PACIFIC RAILWAY COMPANY, DEPARTMENT OF NATURAL RESOURCES, IRRIGATION BRANCH.

Sealed tenders, addressed to the undersigned and endorsed "Proposals for Brooks Aqueduct," will be received up to [illegible]

The site of the work is about four miles southeast of Brooks, Alberta, a station on the main line of the Canadian Pacific Railway 125 miles east of Calgary. The aqueduct is about 10,000 feet long and 54 feet maximum height, and is designed to discharge 910 cubic feet per second.

Tenders will be received based either on the design prepared by the company's engineer or on designs to be submitted by the bidder. The engineer's design involves the furnishing and placing of about 23,400 cubic yards of concrete and 3,640,000 pounds of reinforcing steel, together with excavation and filling to the amount of 40,000 cubic yards.

All labor and materials required will be at the expense of the contractor.

Bidders will be required, either personally or by representative, to visit and inspect the site and satisfy themselves as to local conditions, supply of material, etc.

Plans, specifications and full information may be obtained on application to A. S. Dawson, Chief Engineer, Calgary.

A deposit of $300.00 will be required before plans or specifications will be given out, which will be returned on receipt of the same in good condition.

All proposals must be accompanied by a certified check payable to A. S. Dawson for 5 per cent of the amount of the tender, to be forfeited as liquidated damages in case the bidder neglects or refuses to enter into a contract should the work be awarded to him.

Proposals will not be considered unless made out on the form provided. Interlineations, alterations or qualification of prices, except as therein provided for, may invalidate proposals.

The company reserves the right to reject any or all tenders and to waive defects.

A. S. DAWSON,
Chief Engineer, Dept. of Natural Resources, Canadian Pacific Railway.
Calgary, Alberta, March 1, 1912.

STORM SEWER.

Carroll, Iowa.

Bids will be received by the City Clerk at his office in Carroll, Iowa, up to 8 o'clock P. M. of March 25th, 1912, at which time they will be publicly opened and read, for the construction of pipe Storm Sewers in Carroll as follows: 24-inch, 505 ft.; 22-inch, 620 ft.; 18-inch, 1,330 ft.; 15-inch, 2,120 ft.; 12-inch, 935 ft.; 10-inch, 810 ft.; Man Holes, 48, and Castings, 15,000 pounds.

Plans and Specifications may be had upon application to the City Clerk at Carroll.

J. A. DOUGHERTY,
City Clerk.

[illegible]

TENDERS FOR STEEL HIGHWAY BRIDGES.

[illegible] signed, will be received up to noon of April 15th, 1912, for the design, manufacture and erection complete on piers to be provided by the Railway Company, of the following Steel Highway Bridges:

[illegible]

4 Bridges—span 100 feet.

[illegible]

9 Bridges—span 60 feet.

Contract, specification, form of tender and general instructions may be had on application to the undersigned. A deposit of $25 will be required before specifications will be given out, which will be returned on receipt of a bona fide tender.

Tenders will only be received from parties who can show a reasonable acquaintance with work of the required character, and that they have the facilities and plant necessary for work of such magnitude.

A certified cheque or cash deposit to the amount of 5 per cent of the tender must accompany all bids as a guarantee that the bidder will enter into a contract for the work should it be awarded to him and which will be forfeited as liquidated damages should the bidder default.

Cheques or deposits of the unsuccessful bidders will be returned within ten days after the award of the contract.

The right is reserved to the Company to reject any or all tenders and to waive defects.

A. S. DAWSON,
Chief Engineer.
Calgary, Alberta, March 1st, 1912.

ROAD GRADING.

Sealed Bids will be received by the Board of County Road Commissioners of Gogebic County, for all or any portion of the following work.

For furnishing all tools, material, labor, etc., necessary for Clearing, Grubbing, Grading and Ditching of approximately 37 miles of road. An approximate estimate of the amount of work to be done is as follows:

180,000 cu. yds. of dirt.
55,000 sqs. of grubbing.
270 acres of clearing.

Specifications, plans and profile, as well as any other information, may be had at the Engineer's Office at Bessemer, Mich.

A certified check in the sum of $1,000.00 will be required to accompany said bid, which check shall be forfeited if the successful bidder fails to enter into contract within 10 days from the award of the bid.

Bids to be considered must be filed with the County Clerk, on or before Tuesday, April 2, 10 o'clock A. M.

The Board of County Road Commissioners reserves the right to reject any bid or part of a bid, if it be deemed for the best interest of the county to do so.

G. S. BARBER,
Chairman.

H. A. HARPER,
Engineer.

Very truly yours,
H. A. HARPER.

PROPOSALS

PUMPING PLANT.

Madison, South Dakota.

Sealed bids will be received by the City Council of the City of Madison up to 8:00 P. M., April 4th, and then opened, for furnishing and installing one pump of 400 Gal. per min. and one of 600 gal. per min. capacity. One 40 H. P. and one 60 H. P. motor, one 100 B. H. P. oil engine, fuel storage tank, etc.

Plans and specifications may be obtained from the City Auditor by depositing $5.00, which will be returned upon return of plans and specifications in good condition. Or they may be seen at the Builders' Exchange, St. Paul, Minn., and Aberdeen, S. D., and at the office of the Missouri Valley Engineering Company, Mitchell, S. D. Check for $300.00 required with bid.

GEO. H. WASKEY,
WM RAE Mayor
City Auditor.
Madison, S. D., March 7th, 1912.

U. S. ENGINEER OFFICE—Little Rock, Ark., Jan. 31, 1912. Sealed proposals for constructing the two (2) steel hull, 24-inch pump dredges H. S. Taber and Robert McGregor will be received here until 12 o'clock noon, April 9, 1912, and then publicly opened. Information on application CLARKE S. SMITH, Major, Engrs.

DEPARTMENT OF THE INTERIOR UNITED STATES RECLAMATION SERVICE—Mitchell, Nebraska, March 1, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Nebraska, until 5 o'clock p. m., April 10, 1912, for the construction of an embankment and spillway for an earth dam, on the North Platte Project, about nine miles north and one mile east of Scottsbluff, Scotts Bluff County, Nebraska. The work involves the handling of about 175,000 cubic yards of material, of which about one-tenth is brule clay. For particulars address the U. S. Reclamation Service, Mitchell, Nebraska, or 519 Commonwealth Building, Denver, Colorado. ANDREW WEISS, Project Engineer.

Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Nebraska, until 2 o'clock p. m., April 22, 1912, for the construction of an earth dam and auxiliary works, on the North Platte Project, about nine miles north of Minatare, Scottsbluff County Nebraska. The work involves the handling of about 840,000 cubic yards of material, of which about [illegible] cubic yards is earth, [illegible] cubic yards gravelly material, 14,000 cubic yards unscreened gravel, 11,500 cubic yards screened gravel, 14,000 cubic yards concrete, and 12,000 cubic yards brule clay excavation, besides 45 acres of sod stripping, 600 feet of wells and casing, 3,200 linear feet of drains, and the handling and placing of 250,000 pounds of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Nebraska; 519 Commonwealth Building, Denver, Colorado, or Washington, D. C. F. H. NEWELL, Director.

U. S. ENGINEER OFFICE—Boston, Mass., Mar. 18, 1912. Sealed proposals for rock excavation in Boston Harbor, Mass., will be received here until 12 M. April 17, 1912, and then publicly opened. Information on application. FREDERIC V. ABBOT, Col., Engrs.

The STARY AUTOMATIC FLUSH TANK SIPHON
All Sizes
All Types
For Flushing Sewers
[illegible]
F. STARY & SONS Cedar Rapids, Iowa

New and Standard Books

Send for Complete Catalog of the Following Books:

Handbook of Cost Data. SECOND EDITION.
By Halbert P. Gillette, M. Am. Soc. C. E., Managing Editor of "Engineering-Contracting." The 1910 edition of this book contains nearly 1,900 pages. Postpaid, $5.00.

Diagrams for Designing Reinforced Concrete Structures.
Including Diagrams for Reactions and Strengths of Steel Beams, by G. F. Dodge, M. West. Soc. Engrs. 13 × 15½ inches; 104 pages. Postpaid, $4.00.

Cost of Electric Transmission Lines.
(Both Conduits and Pole Lines.)
The title of this book, by Clarence Mayer, is "Telephone Construction-Methods and Cost," which is somewhat a misnomer in that it does not indicate its wide scope. It is 6 × 9 ins.; 300 pages. Postpaid, $4.00.

Engineers' Pocketbook of Reinforced Concrete.
By E. Lee Heidenreich. "Mr. Heidenreich's pocketbook is nearer the ideal than any on the same subject heretofore published." —Engineerings News, Jan. 14, 1909. Leather; 4½ ×6¾ ins.; 374 pages. Postpaid, $3.00.

The Reinforced Concrete Pocketbook.
By L. J. Mensch, M. Am. Soc. C. E. A book by an experienced engineer and successful contractor. Leather; 4¼ × 6¼ ins.; 216 pages. Postpaid, $4.00.

Concrete Bridges and Culverts.
(Both Railway and Highway.)
By H. Grattan Tyrrell. Leather; 4½ × 6¾ ins.; 272 pages Postpaid, $3.00.

Tables for Structural Engineers.
By Edward Godfrey. Leather; 4 × 6½ ins.; 218 pages. Postpaid, $2.50.

Solid Bitumens.
Their Physical and Chemical Properties and Chemical Analysis, by S. F. Peckham. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $5.00.

Graphic Statics.
By Charles W. Malcolm. This book has been adopted as a textbook by a large number of engineering colleges. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $3.00.

Cost Keeping and Management Engineering.
By Halbert F. Gillette and Richard T. Dana. Cloth; 6 × 9 ins.; 360 pages. Postpaid, $3.50.

Theory and Design of Reinforced Concrete Arches.
By Arvid Reuterdahl, Chief of Bridge Dept., City of Spokane. Cloth; 6 × 9 ins.; 132 pages. Postpaid, $2.00.

Railroad Location Surveys and Estimates.
By F. Lavis, M. Am. Soc. C. E. Cloth; 6×9 ins.; 270 pages. Postpaid, $3.00.

The Trackmen's Helper.
By J. Kindelan. Cloth; 5¼ × 7½ ins.; 350 pages. Postpaid, $1.50

Practical Switchwork.
By D. H. Lovell. Cloth; 4¼ × 6¼ ins.; 174 pages. Postpaid, $1.00.

Maintenance of Way Standards.
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S[illegible]ence of Management Defined, [illegible] the Scope of This Science.

[illegible] overy of general truths [illegible] general laws [illegible]

[illegible] fundamental [illegible] principles are themselves but [illegible] entific acts indicate that the acts [illegible] the laws of a science. Scientific [illegible]ng before a science is developed. [illegible]nagement has existed from the [illegible] management, however, is of very [illegible]

[illegible]tific law is a formal statement that [illegible] consequences invariably follow cer- [illegible]

[illegible]ence, then, is a comprehensive code of [illegible] laws, accompanied by an exposition [illegible]uth of the laws. An exposition of [illegible] st prior to the existence of a science. [illegible] *code of demonstrable and formally* [illegible]

[illegible]nagement is slightly scientific if it [illegible] only one of the laws of the science [illegible]gement, and it becomes increasingly [illegible] as a larger number of the laws are [illegible]. It is not true, therefore, to say [illegible] given management is not scientific, [illegible] scarcely conceivable that all the laws [illegible]cience of management are ignored by [illegible]ager. However, there are many de- [illegible] scientific management.

[illegible]gement consists in directing the ener- [illegible] men, but, since most human energies [illegible]ied through the medium of tools or [illegible]s, it follows that management in- [illegible]tudy of the efficiency of tools, or ma- [illegible] The same reasoning leads us to see that scientific management involves a study of every principle of science that relates to the particular class of production under the direction of the scientific manager; for, without such study human energies can not be economized in the greatest degree.

The popular idea attributes to a manager only the art of directly controlling men, and, in fact, this is the idea of many who profess to teach and apply "scientific management." The most scientific manager, however, is one who has knowledge not only of the psychological laws that control the action of the human mind, but of the physical laws that limit or assist the mind in accomplishing a physical result.

The whole science of management usually involves four processes, or steps:

First, supervising the planning of the plant.

Second, supervising the building of the plant.

Third, supervising the operation of the plant.

Fourth, supervising the distribution of the products of the plant.

We use the word plant to denote the tools, machines or devices with which men effect production of utilities, whether the utilities be physical entities or merely work, such as transportation, lighting, etc.

The first process—the planning of the plant—is one that should ordinarily involve more or less inventing, and it is the process that engineers and inventors have had most to do with. In fact, their activities have been very largely confined to the process of planning.

The second process—building the plant—has been mainly conducted by a class of men known as builders and contractors, although there has always been a considerable overlapping of the first and second processes.

The third process—operating the plant—has usually been conducted by "business men," and, until recent years, they have had only the slightest knowledge of the first and second processes. They have been primarily men who could "handle men," whether as employers or as seekers of capital with which to extend their operations.

The fourth process—distribution of the product—has been conducted by salesmen and merchants, who have ordinarily understood very little of the first, second and third processes.

It is clear that a complete science of management must contain laws that apply to every one of these four processes. It is also clear that certain of these laws will be of universal application; that is, they will apply to the manager engaged in designing, to the manager engaged in building, to the manager engaged in operating, and to the manager engaged in selling. It is equally clear that many of the laws of management can be applied only to one or two of the processes. Finally, it takes but little consideration to see that the manager of the first process—designing the plant—must usually possess a considerable knowledge of the three remaining processes, if the greatest degree of economy of ultimate production is to be secured. For example, the engineer who designs a railway should certainly understand the process of building it. It remained for A. M. Wellington to show the engineering world in his "Economic Theory of Railway Location," that the railway locator should also understand a great deal of the process of operating a railway, and the process of marketing its product, which is transportation.

In our estimation, Wellington was one of the greatest teachers of scientific management that the world has produced. Other engineers had appreciated the relation of operating income and expenses to the locating of a railway—and the design of a railway consists largely in its location—but it remained for Wellington to elaborate a science of location founded on the principle that the best location is the one that yields the largest difference between capitalized gross income and the total capitalized cost.

In a subsequent issue we shall discuss [illegible] location and design

---

The "Divining Rod"—Commenting on the belief that [illegible] "water witch" enables the holder to locate ore and water, the Mining & Engineering World offers the following explanation of the so-called phenomenon:

Belief in the wonderful powers ascribed to divining rods evidently is widespread. At various times we have expressed the opinion that the belief in the "divining rod" is a delusion. Investigations by reputable men have failed to indicate that the forked stick is in any way affected by the presence of hidden water or ore bodies. It has been shown that such results as have been claimed for it were probably due to involuntary muscular action on the part of the operator emanating from within himself.

We have no doubt that the belief in it is in most cases honest and is the result of desire rather than of demonstrated fact.

The Character of the Reported Volcanic Heat in Culebra Cut, Panama Canal.

Recent press dispatches reporting the appearance of volcanic heat and gases in Culebra Cut have excited curiosity particularly as their quotation from an official report indicated some more stable foundation for the news item than reportorial imagination. In the "Canal Record" for March 6 there is found the official report of the heated areas and the explanation of their cause by Commission Geologist, D. F. MacDonald. We give the report and explanation in full as follows:

Under date of Feb. 12 the Division Engineer of the Central Division reported as follows regarding heated material on the west side of Culebra Cut at Culebra:

A little less than three weeks ago I found that the material at the locality described, which consisted of stratified sediments [illegible] [illegible] low grade, was sending up in the early morning quite a thick cloud of white steam or vapor. I examined the spot a day or two afterwards and found that for a width of about 20 ft., length of about 100 ft. and a depth of about 15 ft., the entire mass of material recently blasted appeared to be heated to a considerable temperature. Steam was escaping from numerous small openings and from four principal vents, or openings; the smallest of the four being about three inches in diameter and the largest about one foot. The temperature was so high that the hand could not be held at the month of the larger openings for more than a second or two, and when withdrawn was quite moist, showing quite unmistakably the presence of steam or heated vapor. The sides of two of the vents were encrusted both with white and yellow powdered material, the yellow appearing to be sulphur. What the white powder was I am unable to state.

I have observed this locality almost daily for over two weeks, and within the past four or five days there has been quite a change in two important characteristics. The temperature has increased and a pale blue smoke, instead of steam, is now emerging from the vents. The odor of sulphuric acid, which was very marked when only steam was emerging, is fully as marked today. To give an idea of the temperature of the larger vent I took a nine-inch brown Manila envelope and held it at the mouth of the largest vent for three seconds, when it was totally destroyed although it did not ignite in flame. I then took a piece of the white pine covering of a dynamite box and held it for three minutes within the mouth of the largest vent and on withdrawing it, it was completely charred, so that another three or four minutes' exposure would probably have carbonized it completely. * * * * * *

I would respectfully recommend that the Commission Geologist be requested to make a careful examination and submit, as promptly as possible, a report on this matter, as it is one of great interest to the work and undoubtedly concerns the safety of our men who are handling dynamite. As you may recall, we have had premature explosions in the past on at least two occasions due to chemical heating of the rock, and I am convinced that the material which I have described was hot enough to have readily fired dynamite at any time within the past three weeks.

In accordance with the above recommendation the Commission Geologist, D. F. MacDonald, made an investigation and has submitted the following report:

The marl shales, through which Culebra Cut extends, in the region opposite the Culebra railway station, have, from time to time, on exposure to the atmosphere, become hot. The intensity of this heat has varied from noticeably warm to a temperature sufficient to readily char wood, without, however, causing it to burst into a flame. The duration of this heating has been from a few days to several weeks. These shales are dark, thin bedded, soft, and easily crumbled, and some of the layers are largely fine basic tuff, or volcanic ash, loosely cemented by lime. Other beds contain more carbonaceous material, with some local partings of lignite, an inch to a foot or more thick. The most easily weathered minerals of which these rocks are composed have been but little acted on by the atmosphere, and this, together with their composition, is evidence that they were derived from nearby volcanic mountains, and deposited as a succession of thin beds in a shallow estuary of the seat, which extended across the Isthmus at that time. That this material was originally deposited in water is known from its clearly stratified condition; that the water was shallow is evidenced by fragments of fossil plants and thin beds of lignitic shale, indicating swamp conditions, which are interbedded in it; and that the water was an arm of the sea is demonstrated by the fossilized marine animals, such as oysters, corals, pelecypods, and foraminifera, which it contains. The time when these conditions existed is known in geology as the early Tertiary or Oligocene period of earth history, and the fossilized animals of that period have certain specific marks, by which the specialist may distinguish them from animals of earlier and of later time.

After exposure to the atmosphere by drilling, or blasting, certain local areas of this formation become, in the course of a few days, warmed up, and as the heating goes on the carbonaceous matter in the shales is gradually oxidized off and they tend to assume a gray to dull reddish color. The first working hypothesis entertained, in looking toward a solution of this heating phenomenon, was that possibly the heavy blasting had furnished heat enough to break down the calcium carbonate present to the oxide form, and that ground water and atmospheric moisture reacted on this to slake it and thus probably generate sufficient heat to start the oxidation of the carbonaceous material. This hypothesis was, however, rendered untenable by three lines of evidence:

(1) The heating was much more local than the calcium carbonate, and the carbonaceous matter.

(2) The heating bore no definite relation to the lime and carbon content of particular beds.

(3) Colonel Gaillard has observed that in some instances the heating began in the holes some time after they had been drilled but before the ground had been blasted at all.

Another line of inquiry was suggested by finding a small amount of pyrite in some of the beds which were heating. It was suspected that this, through its oxidation, was a factor in furnishing the initial heat of the action. In April, 1911, samples of the beds then heating were sent to the chemical laboratory of the United States Geological Survey with instruction to make qualitative tests for sulphur and other products that might serve, through oxidation, as the main spring of the action. These tests revealed the presence of sulphuric acid to the amount of 1.92 per cent, also minute crystals of gypsum. This confirmed the hypothesis that pointed to the pyrite present as the substance acted on by atmospheric oxygen to develop the initial heat.

The most aggravated case of heating so far noted is now going on in Culebra Cut, about 350 yards north of the foot of the stairs at the observation tower near Culebra Station. The mass of heated ground here is about 500 ft. long by 20 ft. wide, and the action reaches a depth of perhaps 15 or 20 ft. Blue smoke, which contains a high precentage of sulphur dioxide, issues from vents in the mass, and fragments of wood inserted in these are readily charred and consumed. A small amount of steam may also be detected emanating from local moist spots, but this is mainly due to the vaporization of ground water. In the investigation of this heated mass samples were taken, and these were tested qualitatively for sulphuric acid and for sulphates of calcium, aluminum and magnesium. The tests were made by Mr. Jacob of the Hospital Laboratory Staff at Ancon, and they revealed the presence of all of the above substances, both in the shale and as the white coating on the moist spots and steam vents of the mass. The yellow deposit near the larger vents is sulphur. Sulphuric acid, especially, was shown to be present in considerable quantity. The origin of the sulphuric acid here was at first a puzzle, because the examination of many samples, with the naked eye and with the microscope failed to reveal the presence of pyrite. Finally samples of 8 to 10 lbs. were taken, ground
large mortar for some minutes, an
trated to a few ounces by wa
ing." This concentrate showed
of pyrite, much of which could sc
with the naked eye. Under the
small crystals of pyrite were no
siderable magnetite, present as bl
some sub-angular to fairly roun
quartz.

The mainspring of the action he
the other instances observed, ha
been the oxidation of the pyrite
why this oxidation has been so ra
ive, seem to be as follows

(a) The finely divided
character of the pyrite gives ma
exposure to atmospheric agencie
promotes oxidation.

(b) The very warm, moist atm
tropical sun shining directly on
faces produces a temperature suffi
greatly promote oxidation, especial
ence of slight moisture.

(c) Once oxidation of the py
started the heat thus generated t
erate chemical action and thus t
creases in geometric progression.

(d) When the heat of pyrite ox
es the comparatively low tempera
tion of the hydrocarbons present
shale, they, too, become oxidized a
er add to the temperature. Fin
carbon content tends to become oxi
in part, and gives maximum int
action.

(e) Some heat is also generated
of the free sulphuric acid on the
nate for the formation of gypsum.
chemical actions added their quot
heat.

As the temperature rises all ch
is vastly stimulated and the heat
to a maximum. After the most r
able substances are consumed the
dies down toward normal temper
may be reached in a few weeks or
intensity and duration of the heat
ly upon the percentage of finely d
volatile matter and fixed carbon i

In order to alleviate the dang
ture explosion from loading dyna
which have become hot, Colonel
inaugurated the practice of testing
vicinity of the heating areas, by
them a small iron pipe longer th
This is withdrawn at the end of ten
quickly passed through the hand
not only is heating detected but t
the heated zone with respect to
the hole is also made known; fo
is at times only local and may
above, the bottom of the hole.

Certain geological consideration
suggested by a study of this heati
non, the chief of which are:

(a) Chemico-thermal springs.
jointing, fissuring, or change of
level gives free access of oxyg
face waters to beds which contain
finely divided pyrite and carbonac
a heating up of such beds is like
Groundwater flowing over such heat
coming to the surface in the gener
them, would constitute thermal, or

(b) The very fine pyrite
nated through the carbonaceous s
described, seems to have resulted fr
of sulphur from decaying animal a
life on the ferro-magnesian silicat
which are abundant in these sedim

A working model of a set
locks embracing the intermediat
summit level has been constru
Gorgona Shops, Panama, b
maker, Mr. Taylor T. Curran.
scale of 1 in. to the foot a
only the construction of the loc
but also the method of operatin
and other machinery. It will
hibition at Philadelphia at th
tional Navigation Congress, Ma
and will also probably form
Canal exhibit at San Francisco.

EARTH AND ROCK SECTION

Gravel Washing Plant for Railway Ballast; Structural Details and Methods and Cost of Operation.

[illegible] gravel for ballast at a [illegible] per ubic yard in the track is being pro- [illegible] the new plant of the Richmond, ericksburg & Potomac and the Washing- Southern railways. In addition sand is

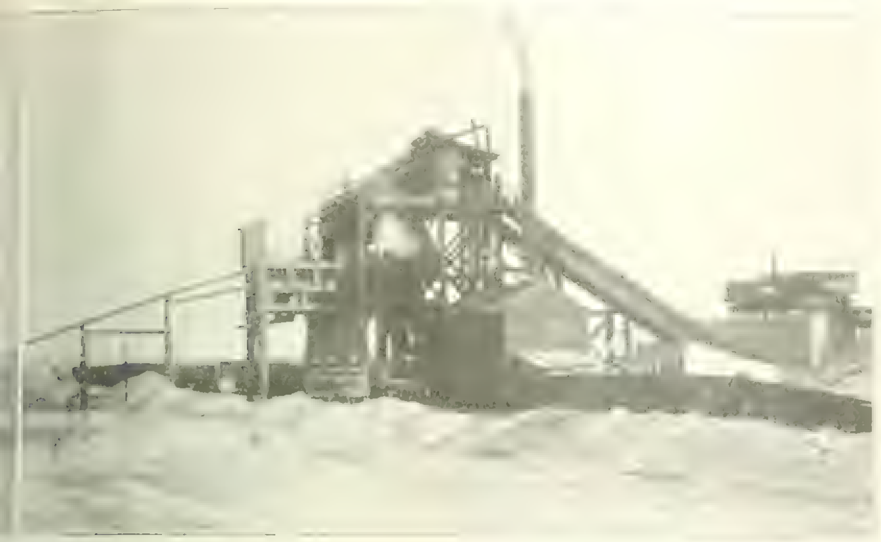


Fig. 1—View of Gravel Washing Plant for Railway Ballast.

[illegible] building purposes at [illegible] located 57 miles from Richmond, r is described in a paper appended to pt of the Committee on Ballast of the c Railway Engineering Association. owing information is abstracted from ar:

avel lies in a bed from 10 ft. to 20 oth, about 800 ft. wide and 4,000 ft. [illegible] bed is estimated to contain [illegible] cu. yds. of serviceable material.

ant consists of a large concrete hopper which the pit-run gravel is dumped n which it is carried by a pan conving a speed of 30 ft. per minute, or 0 cu. yds. per hour, on an incline of ne top of the trestle some 45 ft. high, is discharged into a steel-lined box, n plan and 1 ft. deep in front, or ute. The water, discharged from a le, 1 in. wide and 24 ins. long, con- a 6-in. discharge pipe, strikes the s it falls into the box, washing it er a steel-lined chute, 6 ft. wide and , with a slope of 3 ins. to the foot.

found necessary, in order more com- wash the gravel, to place a series of ss the chute, making the gravel tum- them, thereby retarding its progress ining a more complete washing.

[illegible] laced at an angle of about 45° with . The screens are about 9 ins. apart, of double-crimped tool steel wire. of No. 6 wire, one mesh to the inch; nd of No. 10 wire, two meshes to the ll gravel that does not pass these two falls into the ballast bin, which is 36 and 12 ft. wide and about 12 ft. deep. er 6 ft. of this bin is sloped toward ter, so that the gravel will fall by through the openings in the bottom.

the material which passes these two along with the water falls upon a sec- el-lined chute which is 8 ft. wide, 9 [illegible] his chute the material is discharged another screen, of double crimped l wire No. 12, four meshes to the inch. [illegible] wide and 7 ft. long, where it is discharged as sand into a settling tank about 12x13 ft. and [illegible] of gravel where the gravel had been previously excavated.

The settling tank is water-tight and is fitted at the bottom with two conical steel hoppers, 6 ft. in diameter at the top and 10 ins. in diameter at the base, 5 ft. deep. The bottoms of the steel cones are fitted with a steel cone plug which makes them nearly water-tight. The plugs or cones are operated from the top. The idea of having two of the conical hoppers was to grade the sand, the coarse sand settling in the first hopper and the fine sand in the farther one, there being a distinct difference in the two grades of sand. For this sand we have found ready sale, as it is of excellent quality for building purposes and concrete work, the finer sand making excellent engine sand.

The ballast bin is steel-lined throughout and has three openings at the bottom, fitted with 20x20-in. rack and pinion valves, spaced so as to empty into the center and two ends of the ballast car, giving a uniform loading without necessitating the moving of car. The material is distributed in the ballast bin about equally over the three openings.

The water is brought from Massaponax Creek through a gravity canal, 900 ft. long, to a concrete-lined well, 7x5 ft. and 11 ft. deep, the bottom of the well being four ft. lower than the creek at the intake. This canal is a 20x20-in. open wood flume for 500 ft. where it runs into a 20x20-in. wood box, covered by some 8 ft. of earth. This box is about 370 ft. long, where connection is made with an 18-in. terra cotta pipe, which runs under the engine foundation and pull-out track into the well, which is located close to the engine. This flume is always submerged. The pump is an Emerson No. 4 pump with a 6-in. suction, rated for a 5-in discharge. The rated capacity is from 800 to 1,200 gals. per minute. To overcome friction it was fitted with a 6-in. discharge. The steam is furnished by a 90 h. p. return tubular boiler, which is under same roof as engine and pump. There is also a No. 5 pulling pump, rated at 350 gals. per minute, for the purpose of pumping water into a 25,000-gal. tank about 1,400 ft. distant, which is used by ballast and spotting engines. This tank is located on the pull-out track, just north of the coal bin.

At this point there are the office and bunk houses for both white and colored help. The bunk houses are separated. The superintend- [illegible] provided with both lodging and board.

The concrete hopper into which the pit [illegible] 18 ft. above the foundation, 36 ft. long and [illegible] thick. The inside of the hopper slopes from the top all ways toward the center opening, which is 18x20 ins., and provided with a steel sliding door which governs the feed on the conveyor. The slant sides of the hopper are [illegible] bent over into the 2 ft. outside walls. They are fastened together with ½-in. rods spaced about 12 ins. apart. The track on the hopper is carried on 12x14-in. wood stringers, one of which is immediately over the outside wall, the other carried on 12x14-in. cross stringers, spaced 6 ft. on centers, and imbedded in the outside walls. The track over the hopper is fitted with a bar screen, bars spaced 4½ ins. apart, so as to prevent roots, stumps, boulders, or large lumps of clay from being carried to the washing plant.

The approach to the hopper is on a 2 per cent grade ascending, which terminates at a point 150 ft. from the end of the hopper, thence by a 1 per cent descending grade, which continues over the hopper, where it breaks into a 2.5 per cent descending, then to a 5 per cent descending grade for about 150 ft., then to an 18 per cent ascending grade. At the junction of the 5 per cent and 18 per cent grades there is located a spring switch, the track leading away from the switch being on a descending grade to the pit level, the idea being to do most of the shifting by gravity. The loaded cars after being pushed up the 2 per cent approach to the hopper are unloaded, dropped from the 5 per cent grade by gravity, and up on the 18 per cent grade which gives them a kick back through the spring switch and down to the pit level, where they are taken by the engine to be reloaded.

Fig. 2—View of Nozzle and Chute in Gravel Washing Plant.

It is intended to cover the 112 miles of double track with washed gravel, thereby securing a dustless roadbed. In order to [illegible] this new grades were given, making a lift [illegible] track from 3 to 16 ins., taking out some slight sags that were in tracks. Of course, where the track was lifted as much as 6 ins. the old ballast could be worked under the ties, but at the other points the old sand and gravel ballast was thrown out to make roadbed. Ballast was loaded into the Rodgers drop bottom ballast cars and delivered in track, using a Rodgers plow for levelling down. This work was carried on by an extra force, renewing all ties that were not good for two years, regaging track and properly spacing ties ahead of new ballast. The renewal of ties and regaging was charged to maintenance; surfacing track was charged to reballasting. It required from 3,200 to 3,800 cu. yds. to the double track mile. The force employed at the pit consists of the following: One general foreman, one clerk, one shovel engineer, one craneman, one shovel fireman, four men at shovel, one engineer in charge of plant, one towerman who operates the machinery at top of plant, also looking after the screens, one foreman on hopper, one hopper and two helpers, one sand loader, one gravel loader and two droppers of cars. In addition to this there are three men on cars closing them up and calking and getting them ready for sand. Shifting track is generally done by section force and is, of course, charged to pit expense.

Since the starting of the washing plant there have been 371,877 cu. yds. of washed gravel shipped, of which 354,439 cu. yds. were used for ballast and 17,438 cu. yds. for concrete and other purposes. From this total amount of gravel we have taken 78,232 cu. yds. of sand, most of which has been sold for building purposes. Of course, the hauling of this has been revenue to the company.

The cost of the washed gravel and sand is distributed as follows:

	Cents per cu. yd.
Loading rough gravel	8.95
Washing [illegible]	11.34
Hauling	11.11
Placing in track	26.15
Total	57.55

This cost includes hire of all engines, train crews, coal and supplies; rental of shovel, coal, supplies and repairs; one cent per cubic yard to cover cost of gravel in pit and 10 per cent depreciation on plant and tracks; but no credit is taken in these figures for sand sold.

We have found by actual test that the washed gravel is nearly self-draining; it will not retain over 11½ per cent of water, while the pit-run gravel will retain 55 per cent. It has been demonstrated that the washed gravel will withstand any amount of continued rain and not slop, while the pit-run would, causing rough track in continued wet spells.

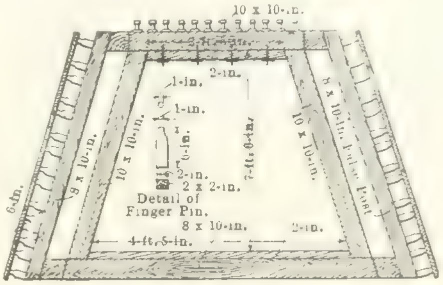
The Finger Pin Method of Protecting Tunnel Timbering in Swelling Ground.

Provision against swelling ground is more important in mine timbering than in timbering tunnels and shafts for other civil engineering works. In these last works timbering is usually a temporary support which may ordinarily be replaced with permanent lining before swelling becomes great enough to cause much trouble. When in rare cases swelling has to be taken care of by the timbering and engineers and contractors may draw useful lessons from mining practice. We therefore illustrate here from the "Engineering and Mining Journal" a method developed at the Comstock Lode and also used elsewhere to protect drift timber sets in swelling ground.

As indicated the lagging is held back against the swelling ground by means of finger pins, as they are called, pieces of fir 2x2 ins. in section, about 6 ins. long and sharpened at their small ends to a diameter of about 1 in. Two of these pins are put in at each end of a plank, with the larger end against the post as the pressure on that end is less per square inch than that on the small end of the pin. The pin therefore is forced through the lagging as the ground swells, and the lagging is impaled upon the pins. In this way the posts are protected. As soon as the ground has moved in enough so that the lagging is almost against the posts, the ground is eased off, pieces of 2-in. plank are put in to cover the holes, and again the planks are impaled on the pins.

The drawback to this simple sprag-pin drift set is that the head timberman and shift-bosses fail to keep close watch of the sets, and before it is discovered the ground is liable to have moved in to the post and broken the timbers. To guard against this the finger-pin method was combined at the Goldfield Consolidated mines with the old method of false sets as is shown in regard to the side lagging in the accompanying drawing. Then, in case the sets are forgotten only the timbers of the false set will be broken.

It is impossible to use these finger pins in supporting the top lagging as owing to unequal weight jack-knifing is sure to occur. Consequently, the procedure is to carry the roof lagging on false caps resting on blocks over the tops of the posts, but where old mine rails are obtainable, they probably make the best lagging for the roof in swelling ground. The rails are used with the bottoms against the caps. Then the ground as it swells will force itself down between the rails and hang down in festoons until it drops off of its own weight. This is the method used at the Copper Queen mines in supporting the roof of drifts in badly swelling ground. Rails are also used for side lagging in the worst ground.



Sketch of Drift Set Illustrating Method of Using Finger Pins in Swelling Ground.

In case that the ground in the bottom of a drift swells, the best thing to do is to keep the bottom covered with several inches of standing water or sand. This keeps the air away from the ground and prevents further oxidation of the decomposing minerals, generally the feldspar.

The oxidation of certain minerals in the rock is, in general, the cause of swelling ground, although in some cases it does seem as though the swelling, especially in talcy ground, is due to real flowage of the rock itself. In holding swelling ground, therefore, the plan is to ease the timbers as little as possible each time so as to try to get a considerable layer of thoroughly oxidized ground exposed to the air so that further oxidation behind the outer layer will be prevented as much as possible.

Method of Constructing a Steel Sheet Pile Cofferdam in 37 Ft. of Water for the Removal of the Battleship "Maine."

As an example of deep water cofferdam work the cofferdam built in Havana Harbor for removing the wreck of the battleship "Maine" furnishes a lesson to civil engineers which has been somewhat overshadowed by the general human interest in the purpose of the work. Considered as an engineering structure purely the "Maine" cofferdam is notable for its lateral dimensions and depth and for certain novel construction features. Its success indicates somewhat wider possibilities for cofferdams than has perhaps generally been assumed. The data which follows are taken for the most part from the reports of the Government engineers in charge of the work.

The preliminary investigations showed the wreck to be lying in 37 ft. of wat ft. from the nearest landing point ments showed that the keel aft la of 48 ft. The mean range of slightly more than 1 ft. and the ex about 2½ ft. The material in th the harbor consists mostly of clay parts of the harbor with mud. A ing, as made in the preliminary i is shown by Fig. 1. For the first in depth, the harbor bottom wa was mixed with shells and coral a depth of 60 ft. the clay was Rock was found at various interv 98 and 119 ft.

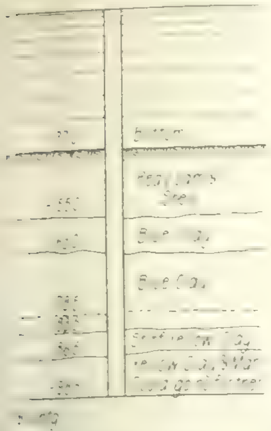
The plans adopted called for th tion of a sheet steel pile cofferda the wreck as shown by Fig. 3. was the result of studies of vari of cofferdams, which could be e minimum cost with the material which could be built on a clay and which would withstand a head sea water and soft clay. The s dam was eliptical and it was ma cylinders—twelve 50 ft. in diame 40 ft. in diameter. These cylinders of steel sheet piles driven to a dep The cylinders were tangent to eac were connected by sheet piles j curved line, the outer perimeters ders and triangles were filled wit the harbor bottom nearby. The passing through the centers of a was eliptical in shape with major axes of 395 and 216 ft. respective

A contract was made with the L Steel Co. to deliver on the wharf Blanca, 4,430 tons of interlocking ⅜-in. webs and weighing 35 lbs. foot, in lengths of 25, 35, 40 and splice bars, bolts and nuts necess sembling into 70 ft. piles; at $33.7 ton. There were also to be 1,154 same piling made in 3-way pieces f the arcs joining the main cylinder. 2. These pieces were similarly ar splicing at $38.76 per short ton. also 108 tons of splice bars, bolt at $33.76 per short ton. The specif quire open hearth steel containing than 0.04 phosphorus and with strength of 65,000 lbs. per square a minimum elastic limit of 32,50 square inch; the interlock to stand 9,700 lbs. per linear inch, and in not to vary more than ¼ in. from a Monthly payments were to be made cent and less $13.50 per gross latter amount was to be paid the in one year less the value of all vaged and placed in cars at New

During October, November and 1910, floating plant was collected a to meet the conditions of the work and [illegible] centrifugal pump, connected to motors and fitted fo sea water under maximum and heads of 65 ft. and 5 ft. respecti bought. Also two 3,700-lb. No steam pile hammers were bought. tion a steam hammer was obtained T. L. Huston Co., and one was h the Cuban Engineering Co. Ordi piles were bought for guides for th forms and these forms were made first of the year 1911 the plant asse in use on the work included the fo

2 tugs (hired).
2 launches (hired).
1 [illegible] clamshell dredge (loaned [illegible]
  Gov't).
1 hydraulic suction dredge (loaned
  Eng. Dept.).
2 pile drivers (loaned by Cuban Go
1 pile driver on derrick scow (loaned
  Navy).
2 100-ton decked scows (bought).
1 coal barge (loaned by U. S. Navy).
1 steam lighter (loaned by U. S. Eng.
3 dump scows (loaned by Cuban Gov't
1 50-ton decked scow with 15 hp. engi

Method of Driving Sheet Piles.— piles were delivered and stored Blanca wharf on Dec. 6. They handled here and loaded on scows w plied the drivers. Driving was beg inder *S* on Dec. 6. The four dri work was carried on in cylin[illegible] and *F*. The first step in [illegible] was the driving of a center accurately on line of the eclipse axis of the cylinder. Around this



pical Boring Made in Preliminary Investigation.

sembled the floating wooden cir[illegible] in position by the center pile. [illegible]g, which was to be 75 ft. long, [illegible] in two pieces bolted together. A [illegible] rm and allowed to settle into [illegible] weight. The top was usually [illegible]ve the water. A bottom piece [illegible] then strung through the inter[illegible]rst pile and suspended through [illegible]ntil its 35 ft. top could be bolted [illegible] as then allowed to settle as much [illegible] its own weight. This system [illegible] using 50 and 40 ft. bottom [illegible]y. After sufficient piles had [illegible]ng was commenced. The clos[illegible]nder was made by the last 15 [illegible]hich were set and then driven [illegible] The closure was made in the [illegible] of the cylinders forming the outer [illegible] cofferdam. Two three-way piles [illegible]h cylinder about 16 piles out[illegible]ter line of the elipse. The first [illegible] the short arcs joining the cylin[illegible] were driven until they reached [illegible] thus leaving 2 ft. of projecting [illegible]m water level. After passing [illegible] the driving was slow. Follow[illegible]thly progress in driving:

	No. [illegible] set.	No. [illegible] set.	No. [illegible] driven
[illegible]	1,053	1,031	1,219
[illegible]	[illegible]	[illegible]	[illegible]
			3,190

[illegible] piles driven, 2,486 were in the [illegible] and 294 in the connecting arcs. [illegible] an average of 149 piles per cylinder [illegible] arc.

[illegible] *of Filling.*—The "Barnard" dredged [illegible] first month 3,000 cu. yds. of ma[illegible] the Cuban dredge, "Sagua," 5,075 [illegible]he material was placed in cylinders [illegible]nd *L*, and dumped outside cylinder [illegible] bottom had a greater depth of [illegible]ial. The dredging was done on an [illegible] bar near the site of the wreck. [illegible] is composed of irregular beds of [illegible]in strata of coral rock and is over[illegible] soft mixture of coral sand and clay [illegible]ge thickness of 8 ft. The soft [illegible]re wasted and only the hard [illegible]ed. The depths of these bor[illegible]ged from 20 to 40 ft. after ex[illegible] was comparatively easy for the [illegible]o make the requisite selections but [illegible]e was poorly built and gave con[illegible] annoyance by breakdowns.

[illegible]rnard" is a self-propelling hydraulic [illegible]signed for use on the Mississippi. Its [illegible]d acts by being dragged over the [illegible]hile the dredge is in motion and [illegible] discharges over the side or at the

[illegible] ficulty and [illegible] The char[illegible]

it is considered that with a [illegible]scharge which contained not more than [illegible] per cent of dredged materials, an ordinary dump scow alongside could have a [illegible] cu. yd. pocket filled in 15 minutes. As the beds of hard materials were not uniformly distributed horizontally and vertically, much soft stuff, unfit for filling, was brought up mingled with the better grades.

At the beginning of the work samples of material were weighed wet, which gave 114 lbs. per cubic foot for the soft stuff and 124 lbs. per cubic foot for the tough clay. The Board of Engineers was averse to filling by hydraulic fill on account of the great tangential strain on the interlocks of the piles in the cylinders, which the liquid mud would produce and on account of the length of time which the hydraulic fill would require for settling and drying out. However, it was found that the "Sagua" could not dredge the 70,000 cu. yds. required within a reasonable time and that no other suitable dredge could be obtained for a reasonable cost. The filling which had been made by the "Bernard," however, showed excellent qualities of compactness and quickness of settlement so that the Board was finally convinced that the filling could be made by hydraulic dredging. It therefore accepted an offer made by the T. L. Huston Co. to hire their new dredge "Norman H. Davis" for this purpose. This dredge is of the type which operates at a fixed point with a spiral cutter at the bow. It was brought to the work on March 27, 1911, and during the remainder of the month was employed in clearing and wasting soft overlying materials from a space about 400 ft. from the cofferdam. The filling of the cylinders was carried on by the "Norman H. Davis" until May 11, 1911, when she was discharged, having dredged 57,048 cu. yds. of materials and filled all cylinders and arcs except cylinders *A* and *B*. The overflow from the fill caused further deposit outside and inside the [illegible].

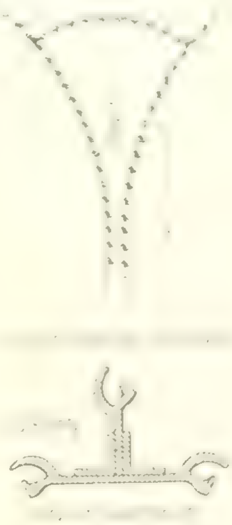


Fig. 2—Detail of 3-Way Pieces for Forming Arcs Joining the Main Cylinders.

In order to obtain some record of the internal pressures in the cylinders, 11 pressure gages were placed, four in cylinder *H*, at depths of 20, 30, 40 and 50 ft. below mean low water; four in cylinder *F*; and three in cylinder *G*, and one outside cylinder *F* on a pile. Drain boxes of 2x12 ins. planks, having an outside cross section of 3x3 ft., were placed in cylinders *L*, *M*, *N*, *O*, *Q*, *F*, *G*, *H*, *J*, and *K*. They were located on the axis and extended to a depth of 50 ft.

Sluiceways for flooding the cofferdam when necessary were placed across the tops of cylinders *B* and *C*. That in *B* had a section of 3x3 ft. and that in *C* a section of 3x7 ft. They were closed by sliding wooden gates.

The steel piles having been driven to within [illegible] cylinders were built up to an elevation of 4 ft. [illegible]

The cylinders were not all in contact at the points of tangency and to hold the fill within the sections 45 ft. palm piles were driven between each pair of cylinders. One to three of these were required at each place. A riprap base was made inside the cofferdam to hold these piles and they were also lashed to the adjacent cylinders with wire rope at [illegible]

[illegible] 1911, cylinder *B*, which had been practically filled with materials dredged by the "Bernard" and [illegible] small clam shell bucket rigged on one of the pile drivers, opened between the third and fourth piles from the three-way pile of the arc *A-B* and spread to a width of 15 ft. The entire fill sank about 3 ft. and a portion spilled out leaving a slope of about 1 on 1. A portion of the remaining fill was dredged out and 11 injured and bent piles were withdrawn. It was found that the break had occurred at the closure piles. In this cylinder one of the first closed the closure was made with five piles driven with a No. 3 Vulcan hammer. It was noted when driving that the closure was made with difficulty, the last piles driving very hard. Orders were then given to make future closures with not less than 15 piles. When the injured piles were withdrawn it was found that the fingers of the interlock of the closure pile had been straightened so that when the pressure of the fill was applied, the interlock opened. It was evident that the straightening had been done in the driving with too small a number of piles to allow sufficient total play in the interlock and too heavy a hammer. The piles showed plainly where the driving out had occurred. The break was repaired by driving 13 new piles in place of those bent and removed of which twelve were ordinary steel piles and one was wedge shaped, 12½ ins. wide at the bottom and 35 ins. wide at the top. The cylinder was refilled.

On May 8, after the fill had reached an elevation of +3 in cylinder *N*, the 13th pile from the three-way pile of the arc *N-O*, parted from its neighbor and left an opening in the cylinder about 30 ft. wide at the top. The adjacent piles were bent down until their tops were about 7 ft. below the surface of the water, a portion of the fill flowed out but the greater part remained in the cylinder, showing slopes about 1 to 1. No change showed in the sector *N-M*, near the break. Thirty-five piles were withdrawn—a task of great difficulty since the upper parts were badly bent, the portions below the mud level not having been moved. This was more remarkable since the site of cylinder *N* had been dredged to a depth of about 50 ft. to clear away wreckage and refilled with new material to a depth of about 30 ft. A new closure was made with 43 piles, making a total of 3,200 piles in the dam. The cylinder was refilled

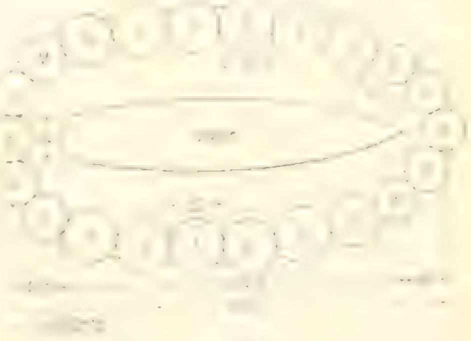


Fig. 3—Arrangement of Steel Sheet Pile Cofferdam.

[illegible] being completed so as to permit the unwatering of the cofferdam to begin June 5, 1911. On removing the piling and examining into the cause of the breakage it was found that in driving one of the piles had become twisted and had left the interlock of the adjacent pile at its splice, and that this pile, which had a 40-ft. top, must have been defective, for under stresses caused by the fill it tore through its web at about its middle line from bottom to top.

Pumping.—The two pumps previously mentioned in the list of plant had been placed on floats within the cofferdam. An electric cable for light and power had been laid between a small transformer house built on piles just outside of the cofferdam and the Luz Wharf at Havana. On April 25 the cable was dragged by the steamship "Havana," the cable was broken at the transformer house and burned out. A new cable had to be laid which was completed by the middle of May. On June 5 unwatering was started with the 8-in. pump was reduced to —5. On June 15 and 16 the water was again pumped and lowered to —10. On June 20 the water was lowered to —15. A slight movement inward was observed on the part of the cylinders and on the 22nd the [illegible] was raised to —1[illegible] [illegible] the [illegible] were kept under a head of between 10 and 12 ft. during the remainder of the month. Pumping was carried on at intervals and the action of the cofferdam carefully observed. By July 26 actual pumping was practically completed and attention was directed toward the clearing away of mud for the examination of the wreck.

Leakage through the cofferdam was very slight, raising the level inside about ½ ft. in 6 hours. Investigation having shown that the clay filling in the cylinders was yet very plastic, the drainage of the cylinders and the grading of the top of the fill by removing the clay from the inner perimeters of the cylinders to the outer, was begun and carried on vigorously. Eight thousand cubic yards of stone was ordered and as delivered was placed in the inner sectors between the cylinders. The cylinders were drained by placing steam siphons in the drain boxes and i
8-in. perforated pipes sunk into th
which were not provided with large drains.

Leaks of some magnitude developed in
cylinder *F* and an examination by the diver
showed that many of the bolts holding the
fish plates which connect the piling of cylinder
F had been jogged out in the driving and
the water was entering through the bolt
holes. These were plugged as far as possible
and a deposit of clay was placed outside the
cylinder and banked up to a height of about
—23. In the latter work the bolts had
[illegible] before driving, but sever
cylinders had been driven before this
done. An examination by the diver was
of these cylinders and such bolt holes as
found empty were plugged. By
June the dam was fairly tight and the
filling was rapidly consolidating, clay
the inside of the cylinder tops being piled up
on the outside as the fill settled.

Up to the time of the completion of the
cofferdam some $463,000 had been
on the work.

ROADS AND STREETS SECTIO

Methods of Staking Out Curb and Paving Work.

During the past summer Mr. Theo. S. De Lay, Consulting Engineer, Creston, Ia., conducted an inquiry as to the methods employed by engineers in Iowa in staking out curb and paving work, and also in calculating the cubic contents of a concrete wall. The following three questions were asked in a circular addressed to numerous civil engineers in Iowa and adjacent territory:

1.—In setting stakes for sidewalks, curbs, gutter, etc., do you set the top of the stake to grade or do you drive the stake to a firm bearing, take its elevation and furnish the constructor a grade sheet, telling how much to cut or fill from the top of each stake?

2.—In providing for the crown and grade of pavement after the curbs are in, do you set the stakes across the driveway, or do you give the constructor a grade sheet showing cut or fill from a line between the curb tops, at each station, for the crown, quarters and other points if needed, and let the constructor set his own stakes, by means of a line or boning rods, as he is ready for them?

3.—In calculating the cubic contents of a concrete wall, would you follow the old masonry custom of calculating all openings solid and doubling all angles or would you figure the actual cubic contents, nothing being indicated in the contract and specifications?

Replies to these questions were received from 41 engineers. A summary of the information obtained from these replies was given by Mr. DeLay in a paper presented at the recent meeting of the Iowa Society of Engineers.

On question 1 25, or 61 per cent, of the engineers replying favored the method of setting the stakes to a firm bearing and indicating cut or fill from the top of the stake, either by grade sheet or marks on stake, profile, etc. The remaining 39 per cent favored the practice of setting the top of the stake to grade.

On question 2 22, or 54 per cent, of the engineers replying favored requiring the constructor to take his guide from a line between the curb tops as indicated by a grade sheet, profile, cross section or other written instruction; 14 engineers favored setting stakes to grade across the driveway, and five engineers favored methods other than either of these. Many of the answers to these two questions indicated that the writer used both methods and Mr. DeLay was compelled to use his judgment to determine which method was favored.

On question 3, 35, or 85 per cent, of the engineers replying, favored calculating the actual cubic contents of a concrete wall, four engineers favored the old masonry custom and two engineers gave indefinite replies.

In his paper Mr. DeLay gives his own opinion of the methods followed as follows:

In regard to question 1, I am of the opinion that it is best to set stakes for sidewalks, curbs, gutters, etc., to a firm bearing, drive the top of the stake close to surface, take elevations and give the constructor a grade sheet or other written instruction telling the amount of cut or fill from the top of each stake. I am of this opinion for the following reasons:

First, this method is the easiest and quickest method and I presume that every competent engineer is sufficiently busy to feel the appeal of that point.

Second, one set of stakes serves for both preliminary grading and finish work, and the second levelling which should be done just before the finish work serves to check both any disturbance of stakes and any error of the first levelling.

Third, stakes set by this method are all solid and out of the way of accidental injury and are not so readily visible as to attract the attention of mischievous or malicious persons.

Fourth, the use of the grade sheet or written instruction compels the constructor to keep track of the stations and it is thus easy to direct him with instructions written on the grade sheet when a deviation from the usual form of construction, as different exposure of curb, different slope of sidewalk or the location of a catch basin, is desired at any particular point.

Fifth, stakes set by this method are more likely to survive to the final inspection than are stakes set to grade and may then be very useful in evidence should any serious errors of the constructor escape the daily inspection.

Sixth, if it is necessary to make a preliminary survey and establish grade for the work, the stakes may be set on the preliminary and the levels taken on them are sufficiently close to surface for making profile and establishing grade. The same stakes may then be used throughout the work, giving the engineer the benefit of three levellings, if need be, on the same stakes.

In regard to question 2—I am of the opinion that it is best to set no stakes across driveways for indicating crown and grade of paving after curb is in but to mark the curbs in short stations, give the constructor a grade sheet, cross section, or profile showing cut or fill from a straight line between the curb tops at each station for crown, quarters, and other points if needed, and let him set his own points by means of a line, boning rods, Tee boards, templates or other suitable devices. I am of this opinion for the following reasons:

First, this method is the easiest for the engineer because he can prepare the instructions for the whole job at once and have the matter off his hands.

Second, it is best for the cons
having once mastered his system
points, he can go ahead and pr
points for subgrading, foundation,
just when and where he is ready to
without waiting for the engineer,
ing his force going and saving loss
money.

Third, with this method every in
struction is preserved and available
work is finished, while with the
setting stakes across the driveway
are necessarily destroyed when th
completed and no evidence is avail
the engineer's notes to determine wh
takes if found are due to errors o
neer or constructor. Now it is
any constructor ever existed who,
stakes were destroyed, would ac
even to himself that he failed to se
in exact accord with the stakes
workman employed will sustain the
of the constructor, while the eng
have, for purposes of establishing
curacy of the destroyed stakes, onl
dence of himself and possibly his
together with the level notes, which
to the ordinary person. Is it at all
then that, where the system of sett
across the driveway is used, erro
regularities in the crown and gra
finished pavement are popularly att
mistakes of the engineer? How m
satisfactory would it be to so arr
anyone may stretch a line between
tops and with tape and foot rule
definitely if the finished surface is
ance with the written instructions
cating the responsibility for errors
ner intelligible to any person.

Fourth, the knowledge that respons
errors can be definitely placed at
will make both engineer and constru
careful, thus helping to produce wo
will be a credit to both.

In regard to question 3, the vote
method of measuring up concrete
so nearly unanimous that this matte
no discussion further than to suggest
in the interest of good engineering
obscure and questionable practices
old masonry custom should be disco

An act has been introduced in t
toba legislature, which asks for a
$200,000 from the government for go
It provides that any municipality w
avail itself of the provisions of the
make application to the Highway Co
er who will draw up a scheme of impr
which must be finally approved by th
The council shall then have aut
[illegible] for the sale of de

Data on Hauling Stone with a 22-Horse Power Traction Engine and Stone Spreading Cars, Gatchellville Road, York County, Pennsylvania.

John F. Hammond, Contractor and Engineer.

[illegible] this road nearly 11,000 tons [illegible] required, and [illegible] the location and the [illegible] s from other nearer depots, all to be hauled from New York, at [illegible]

[illegible] nuts, bolts [illegible] miles from [illegible] are most advisable to [illegible] larger castings. [illegible] of several days and conse[illegible] the stone [illegible]

–View of Traction Outfit Used in Hauling Stone for Road Construction.

[illegible] ensive and slow, as a team of usually found among the farm- nove over two tons per day, $3.50 or $1.75 per ton. An a prominent traction engine vas called in and driven over ressed himself as very doubt- l succeed with a traction en- rades on the pitches of some e 30 per cent. and the traction [illegible] gin our work at the southerly w Park and work over the vith the traction outfit; this ally adopted, with the result s article, which I think may be thers, as I consider it a very this kind of machinery, not t with under ordinary condi- l shows the traction outfit in les of the finished road were 7 per cent on some of the hills ible distance. The records on e is based were started on Aug. miles, one-half of the road, had continued up to Nov. 14, 1910, was completed. These records means of information and to y by compelling daily report of ed, wages paid and work done. t (Fig. 2) was made as simple that no excuse could be offered it. It will be seen that no red of the men, only figures. cards produced immediate re- rk and very largely increased f the plant. All repairs and re- parts for engine and cars were lays or at night. From the con- f the engine and heavily load- [illegible] rd as solid rock, and the continued r made a deep dust, composed of ntly used screenings required by lvania specifications, gave us much [illegible] the engine [illegible] portable forge, bench, vice, jacks, and other tools ready to take to the side of the engine in case of necessity; by these precautions we did not lose one workable day between Aug. 1 and Nov. 14, 1910. Another important consideration is the water supply which must be not only pure but readily accessible and quickly gotten from the supply into the engine tanks. We pumped directly from a barrel sunken in the bed of a brook into a large tank placed on the road side, high enough to fill the engine tanks by gravity; but made the mistake of not having our outlet from the large tank of sufficient size to fill our engine tanks as quickly as we might have done, and delays occurred at the tank that were needless and anoying. Water was pumped into the supply tank by a small one-cylinder gasoline pump which operated very cheaply, and only required the services of the engine driver to start and stop it as he passed on his trips. The wages paid to the engine crew was; Engineer, $3.50 per day; fireman, $1.75 per day, steady time for ten hours daily; overtime at same hourly rate. The fireman operated the stone spreading cars, making the spread of even thickness, which requires considerable experience and should be closely watched by the overseer as the tendency is to spread too deeply, and superfluous stone would have to be removed at an extra expense. Supervision in our case was figured at one-third of the superintendent's time, or $2.28 per day with no extra time allowance. Interest and depreciation are figured on the new value of the machinery—$5,050 on June 1, 1909, and on an estimated life of four years, or 25 per cent depreciation per year, with an interest charge on the capital invested of 5 per cent. The sum of the interest and depreciation, however, are figured for the whole year and divided into the days that we actually worked. This is hardly fair to the machine, as it might have done more days' work and thus reduced this item. The life of the machine is also very conservative, and probably should be eight to twelve years instead of four years.

The following tabulations show our conclusions and we think may be considered quite accurate. I have not thought it necessary to make an analysis of the repair account, which consisted of castings, bolts, nuts, valves, pipe elbows, engineer's and fireman's time and many small items:

[illegible]

Analysis of Operating Account

[illegible]	[illegible]
3.49 tons coal at $5	17.45
[illegible]	[illegible]
[illegible]	164

Daily Expense.

[illegible]	[illegible]
[illegible]	3.50
[illegible]	1.75
[illegible]	[illegible]
[illegible]	.21
[illegible]	.03
Grease (cups and gears)	.20
[illegible]	.002
[illegible]	.002
[illegible]	.06
[illegible]	6.417
[illegible]	0.961

Tonnage Hauled

[illegible]	[illegible]
[illegible]	1,176
Nov. 14, 1910	[illegible]
Total tons	4,666

Cost Per Ton Hauled.

		Cents.
Operation	[illegible] / 4,666	0.202
[illegible]	310.17 / [illegible]	0.066
Depreciation	596.78 / 4,666	[illegible]
[illegible]	89.37 / 4,666	0.017
Supervision	239.40 / [illegible]	0.051
		0.464

Extreme haul, 9.44 miles. Start, 5.00 miles.
Average length of haul, 7.22 miles round trip [illegible]

Engineer's Report.

[illegible]
Engineer's time on operation..........hours.
Fireman's time on operation...........hours.
[illegible]
Cylinder oil......gals. Gasoline..........gals.
[illegible]
Engineer's time on repairs.............hours
Fireman's time on repairs..............hours
Other time on repairs..................hours
(Give numbers on parts.)
Trains hauled.... Cars..... Cubic yards.....
Road surface. Station...... Station......

If delays occurred, state cause............

Give numbers of repair parts used.

Supplies used not otherwise mentioned..

If you have paid out cash for any supplies on the road, state its amount and what for

Fig. 2—Form of Card Report.

A Combined Road Scraper and Roller.

A combination of a road scraper and roller has been used with excellent success in the maintenance of earth roads near Fairmount, N. Dak. This machine, as will be seen from Fig. 1, consists of an iron frame, the rear ends of which are bent out and down to accommodate the bearings of the roller. This roller is made of metal and is filled with concrete. Behind it is a shelf on which one or more concrete blocks can be placed so as to furnish extra weight, as desired. The front end of the frame is carried on two small flanged wheels, which serve to guide the machine. The scraper is suspended from the central part of the frame, and is connected by rods to a rock shaft, each end being adjusted vertically by bell crank hand levers.

This machine can be handled with four horses and the driver can also manipulate the scraper blade with the levers. The effective width of the roller and blade is 7 ft. The total weight of the outfit with the concrete blocks is about 2,200 lbs. Of this the roller accounts for 750 lbs., the machine proper, 650 lbs., and the rear weights, 800 lbs. The machine costs about $100.

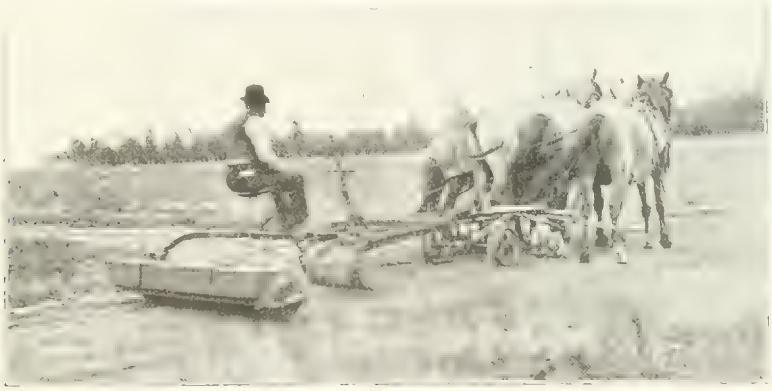


Fig. 1—View of Combined Road Scraper and Roller.

Although it has been found that the cost of crowning a new earth road with this device is about the same as with an ordinary road grader, its principal field of usefulness appears to be in the maintenance of the ordinary earth surface. On the fairly level sand loam earth roads in the vicinity of Fairmount it has been found that with this machine from three to five miles of 16-ft. road can be put in first class condition in a 10-hour day. On the basis of 20 cts. per hour for the driver and 20 cts. per hour for each two-horse team, the cost of operation per 10-hour day would be $6. If three miles of road were dragged and rolled in one day, the cost would be $2 per mile. This machine is the invention of W. K. Stebbins, of Fairmount, N. Dak., to whom we are indebted for the above information. It has been patented and is manufactured by Mr. Stebbins.

Instructions to Operators of Steam Rollers.

The successful working of a steam road roller depends more upon the operator than upon any other single factor. For that reason the following instructions issued by the Illinois State Highway Commission for the guidance of its road roller operators should be of interest:

When the operator arrives on the job in the morning, the watchman will have steam raised. The operator's first duty then is to oil his machine, and in doing so he should carefully inspect it to see that every hard oiler is filled and properly screwed down, and that all sight feed oilers are filled and adjusted so that the proper feed will be secured, and that the lubricator or cylinder oil pump is filled and in working order.

Having oiled the machine, the cylinder cocks should be opened and steam allowed to blow through the cylinder for a few moments to warm it and blow out all condensed water. The engine, which should have been thrown out of gear over night, is run light for a few minutes in order to work out all wet steam and water from the cylinder and pipes. Try the safety valve by means of the lever attached to it for that purpose to see that the seat is not stuck. Then run the steam up to the pressure at which the safety valve is supposed to release so as to make sure that it pops at the proper pressure. The safety valves on Kelly rollers are set at 120-125 lbs. and on Iroquois rollers at 150 lbs. Nos. 10 and 11 are set at 145 lbs.

When the roller is being used to compact earth sub-grade or shoulders, or crushed stone, it should be run at a speed not to exceed 100 ft. per minute, and this speed should be regulated by means of the governor and not by means of the throttle, so that the engine may be operated at all times with the throttle wide open.

The roller should always be operated with the reverse lever set in at the last notch either forward or backward, except when it is being used on a hard smooth surface, or for puddling, in which case the reverse lever may be set in the second notch.

When spikes are used in the rear rolls for any purpose, care must be taken to set the scrapers far enough back from the wheels to clear the ends of the spikes. Carelessness in this respect will result in broken springs on the scrapers. After the spikes have been removed and the plugs replaced in the wheels, care must be taken to drive them in flush with the surface so that they will not catch on the scraper when it is set tight against the wheel.

When for any reason it is necessary to repack piston or valve stems, or the stem on the governor or throttle, all the old packing should be removed and replaced with new packing. For the governor stem and for the throttle valve stem, lamp wicking or hemp, dipped in a mixture of cylinder oil and graphite, will be found to be most satisfactory. For the valve stems and piston rods, Garlock ring packing of a size to fit will be provided, and this should be used. When a gland or valve is repacked the packing nut should not be set up tight at the beginning, but should be gradually tightened as the packing works down. Care must also be taken not to set the packing up so tight as to bind on the rod.

Leaky valves or pet cocks should not be permitted, because the dripping from them will render the machine unsightly, and the leakage will increase each day until it is remedied. Leaky valves should be ground as soon as the leak is noted, using emery dust and cylinder oil. Pet cocks can usually be repaired in the same way, but should it be found impossible to stop the leak by grinding, they should be removed and replaced with new ones.

On every roller there are two means of determining the water level in the boiler: one is by means of the water glass, and the other is by means of the gage cocks. Both should be used, but it is dangerous to depend on the water glass for determining the height of the water. It is a well known fact that the water glass does not always correctly indicate the water level on account of scale or other obstruction in the passages from the boiler to the water glass. By using the gage cocks frequently, any inaccuracies in the water glass will be detected. With the Kelly roller dry steam can be secured when the water glass is entirely full, when the roller is on level ground, and the water level should never be allowed to get below the middle of the glass. With the Iroquois roller it will be found that on hard work, wet steam will result unless the water level is carried very low, but on this machine there should always be at least 1 in. of water in the glass.

Low water in the boiler is very likely to result in an explosion, but should the operator escape the explosion, serious injury to the plates and tubes is sure to result, if the water is allowed to get below the crown sheet, and under no consideration should the roller operator continue the use of his machine with insufficient water.

In making repairs and adjustments on the roller, care should be taken to use the proper tools and wrenches. Solid steel wrenches or socket wrenches are provided for most of the machine nuts which will require adjustment and tightening from time to time, and these should always be used in preference to the monkey wrench. If a monkey wrench is used on hexagonal machined nuts or on bolts, there is danger of rounding off the corners until no wrench will fit. If it is absolutely necessary to use a monkey wrench [illegible] nuts, the monkey wrench should be set tight on the nut before an attempt is made to turn it. Under no consideration should a stilson or alligator wrench be used [illegible] kind of a nut or bolt head. Such use of a pipe wrench is particularly disastrous [illegible] nuts and connections.

The ash pan should be cleaned out [illegible] three times a day, and under no consideration should the ashes be allowed to accumulate until they close the space underneath the bars. Unless the under side of the [illegible] kept free the bars will burn out very rapidly. When cleaning the ash pan, the roller should be maneuvered into such a position that ashes can be scraped on to the shoulders, [illegible] must never be scraped on to the macadam.

The rollers steam so readily that there is no excuse for using the blower to get up steam except under very unusual conditions or heavy work.

The boiler should be fired frequently with a light fire, the fuel being thrown in against the side plates and the back and [illegible] places in the fire. By firing frequently and using a small quantity of fuel at a time a bed of coals will gradually be built up which will be of sufficient thickness to maintain steam very readily without the use of the blower. Never under any consideration turn on the blower with the fire door open, because when this is done, a draft of cold air is drawn through the flues and the constant repetition [illegible] will cause the flues to leak. [illegible] when a new fire is made, after the roller [illegible] been out of service for some time, it may be desirable to use the blower to expedite [illegible] raising of steam, and occasionally when the roller is doing very heavy work it may be necessary to use the blower in order to maintain steam. But these conditions are very unusual, and on ordinary macadam work the use of the blower is absolutely unnecessary.

Each roller is furnished with a flue scraper and the flues should be cleaned thoroughly once a day, if the roller is in continuous operation. At the same time the smoke box on the front end should be cleaned out.

The only parts of the roller which [illegible] be painted in the field are the fire box [illegible] front end of the boiler, and for this purpose a special paint will be provided and nothing [illegible] should be used.

When the roller is in regular use, [illegible] be washed out at least once a week, [illegible] irregular work after 60 hours of [illegible] Each Saturday night the roller and [illegible] tank should be placed in a convenient place for this purpose, and before the work [illegible] on Monday the roller should be [illegible] n doing this, all wash out plugs oved; and all scale and accumu- l sediment forced out by means r pressure from the pump which the water wagon. In order to lation of water around the legs a pipe nozzle is furnished. It a shape as to permit the forc- around all sides of the leg of there is considerable accumula- ent in the leg, it will also be use a flexible wire for stirring g the material so that the water out. Care should also be taken all sediment and scale from the l crown sheet as well as from t of the boiler. Thorough and ning out is absolutely essential ming, and if carefully done will en the life of the boiler, and de- nount of repairs necessary.

plugs which are removed for the boiler are replaced, they led with cylinder oil and then slightly when replaced. If they leak after pressure comes on the nay be again tightened slightly, ated until all leakage stops. If while the boiler is cold, it will lt to remove them on next wash-

sheet of the roller is provided plug in a brass nut, and if in the fusible plug is melted out, must be removed and another inserted. The new plug should n until it projects through the lug nut about an equal distance Then the ends should be rivet- he plug nut is replaced in the it should be first dipped in nd then screwed into the crown t set up tightly. If while cold in the crown sheet as tight as eans of the wrench provided for it will be very difficult to re- e will be no danger of leaking ut is screwed in with the fingers htened slightly with the wrench.

[illegible] and there are certain [illegible] nuts on the machine which receive considerable strain from this cause. This is particularly true of the bolt in the main axle [illegible] and the bolts which hold the crown gears on the spider. When giving the roller the daily oiling, all [illegible] should be tightened before the roller is put in operation. The bolts which attach the main yoke casting to the front end of the boiler will also be found to require attention from time to time, and they should be examined occasionally and tightened, if necessary.

When the outfit is loaded for shipment, the valve in the pipe between the two tanks should be closed and the front tank drained, by removing the plug from the bottom. The plate on the front end should then be removed and the bottom of the tank covered with pieces of board. All drip cocks, the steam gage, safety valve, ejector, cylinder cocks, oil cups and the packing nuts from the front end of the valve stem and throttle, the governor belt, and all tools and wrenches, should be packed in the tank. The steam gage should be wrapped in a sack or placed in a small box to prevent the glass from being broken.

All padlocks and keys, invariably, must be tied together with a cord and placed inside the tank with the fittings.

After everything has been packed, the plate should be replaced and secured with three or four bolts.

N. B.—Use the rear tank of the Iroquois roller.

The poker, scraper, and flue cleaner should be put inside the water sprinkler. The jack screw, oil cans, waste, shovel, hose and miscellaneous supplies should be put in the tool box.

Do not leave any padlocks on boxes during shipment.

Cover all engine parts and the jacket of the roller with hard oil. Pump a quantity of [illegible] two or three times by hand, so as to oil the inside of the cylinder.

Throw the roller out of gear during shipment; let down the cab curtains and *wire them* so that the wind cannot loosen them.

When a roller is in operation in the late fall, it will be necessary to take precautions to prevent the smaller pipes on the machine from freezing and bursting. In such weather, you must close the stop cocks between the injectors and the boiler, open all drip cocks on the steam lead from the dome, and close the valve at the dome, thereby draining all the small pipes on the machine. Be sure that every valve and drip cock is open. Open all valves in the lubricator and drain it thoroughly. If very severe weather is encountered, instead of removing the fire at night, it should be banked and kept over night so as to keep the water slightly warm in the boiler.

When moving the roller over wet ground, or on embankments of loose material, it may have a tendency to slip, and, if such slipping occurs, the operator should immediately close the throttle, stopping the roller; and under no consideration should he try to move again until means have been taken to prevent further slipping. Usually the easiest way out of such difficulty is to put one or two spikes in the wheel which is on the lower side of the machine when slipping occurs, and then place a post or tie croswise of the wheel just beneath the spikes. Usually the roller will then pull itself up on to this post and raise the wheel so that it will be possible to place a plank underneath. With this plank as footing, the roller will usually move itself out of any ordinary situation. If it is found impossible to raise the machine in this way, a jack screw and blocking should be secured and the lower side of the machine jacked up and suitable supports placed under the wheels before attempting to move out on to safe ground. In an emergency of this sort, never take any chances of injury to the machine, but make careful preparations for getting it out of the difficult position. Consult immediately in a case of this sort with the engineer in [illegible]

TER SUPPLY, SEWERAGE AND SANITATION SECTION

facture of Concrete Sewer or the Brooklyn Bureau of Sewers.

ewer pipe has been used in the wer system for over 50 years. In g over 400 miles of such pipe id and are now giving satisfactory ce good workmanship is essential ssful use of concrete in sewers, employed in manufacturing the oklyn becomes of interest. These re described in a paper by Gus- an before the recent convention nal Association of Cement Users. of Mr. Kaufman's paper relating facture of the pipe is here given

used in the Brooklyn system is n., 9 in., 12 in., 15 in., 18 in., and alent capacity. The 6 in. and 9 in. in section. All pipe is made in s, with hub joints, with the ex- in. which is made in sections 2¼ he 12 in. pipe is circular bore. base, and the 15 in., 18 in., and 24 shaped bore, with a flat base. The the pipe walls are as follows:

ircular	Thickness of wall. Ins.
[illegible]	[illegible]
....	1⅝

rs are as follows:

	Depth of collar. Ins.	Thickness of joint. Ins.
[illegible]	1 5/16	
1		3/16
1	1⅝	
1	1	3/16
[illegible]		1/4

This concrete pipe up to the year 1890 was made by hand. At that time pipe made by machine was introduced by the Wilson and Baillie Manufacturing Co. With the hand made pipe it was always difficult to mix the ingredients of the concrete thoroughly unless the workmen were closely watched. This frequently resulted in a pipe far from homogeneous in texture.

In the manufacture of the machine-made pipe the cement, sand and trap rock are measured and thoroughly mixed in a machine mixer, evenly fed to the molds, and rammed by machinery with iron rammers regulated to produce continuous and uniform blows of any impact desired. The result is a perfectly homogeneous product of equal density throughout.

The machine used for manufacturing the pipe consists of a mechanical tamper and a revolving table upon which the molds are placed. The tampers have a vertical reciprocating motion and at the same time move outward and inward rapidly so as to conform to the line of the travel of the mold, which, owing to its oval form, presents, at each revolution, varying diameters to the successive tamping bars. There are eight tampers, made of the best tool steel, running 200 tamps a minute, each. Only one rammer is down at a time. The head, which consists of the actuating machinery for the tampers, is counter-balanced upward as the mold is being filled with concrete. The head is raised by the density of the concrete and in this way an even and regular product is obtained which it is impossible to achieve by hand. The force of the blow of each rammer is estimated at 800 lbs. The area of the arm of the rammer is about one inch square.

The proportions of the concrete materials, which have been used in the later years, are one and one-half parts of the best grade of Portland cement, one part of sand, and three parts of trap rock screenings, containing 20 per cent of stone dust. The percentage of water used to the whole bulk varies from 10 per cent to 15 per cent, according to the condition of the ballast. The mix, when dumped on the floor, is apparently dry but will ball in the hand with some pressure. An extra mix is used in forming the collar for the reason that as the rammers do not exert a direct blow on the material in the offset compression of the material must be depended upon.

The mixed concrete is delivered to the machines in barrows and is fed into the hoppers by two men, one on either side. As soon as the flask is full, and the core automatically lifted clear, the flask is taken up by a pipe truck and wheeled into the stripping rooms where it is allowed to stand usually 30 minutes, when it is stripped. After the pipe have set over night a spray of water is turned on and the pipe kept damp until at the expiration of six days when they are removed from under cover and placed in the yard. The pipe, at the expiration of 30 days, are set sufficiently to be handled in the work.

Spurs for house connections are connected on the pipe. A hole is cut at the proper point on the side of the pipe and a mold is placed in the interior. Cement mortar is then spread over the mold and the connection piece is bedded in place [illegible] is wiped around the joint on the outside. After the mortar is removed the inside joint

[illegible] with [illegible] galvanized iron pipe [illegible]

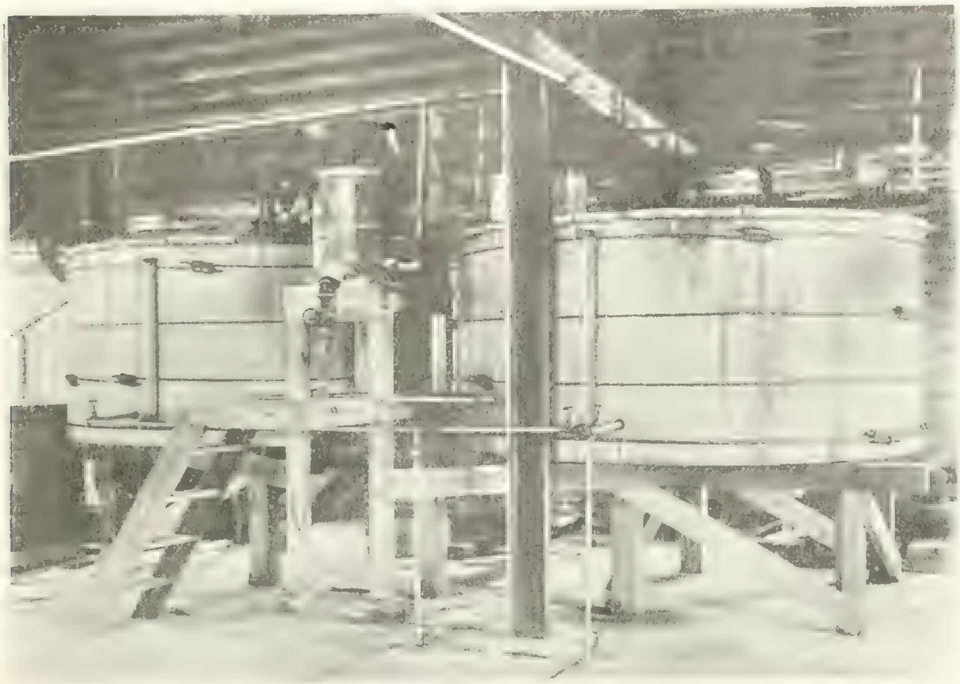


Fig. 1—General View of Emergency Hypochlorite Plant at Evanston, Ill.

finished with a trowel. This method has been found to be entirely satisfactory.

The Design of the Evanston, Ill., Hypochlorite Plant—The Decrease in Typhoid Fever Cases Following Installation of Plant.

Contributed by C. C. Saner, Deputy Commissioner of Public Works, Evanston, Ill.

During the month of November, 1911, 17 cases of typhoid fever were reported to the Health Department of the City of Evanston, Ill. This with a population of 25,000 is 68 cases per 100,000. Of these cases ten were reported between the 15th and the 20th day of the month. The examinations of the water at the laboratory of the Health Department showed a bacterial content ranging from 400 to 5,000 per c. c., with gas formers ranging from 5 to 20 in 10 c. c. Normal rate of typhoid for Evanston is six cases per month, with more in winter months. Cases rise with bacterial count. These conditions led to an examination of the methods of treating polluted water with hypochlorite of lime, and finally the ordering by the water committee on Dec. 5th of the installation of the plant.

The intake is located 6,000 ft. east of the pumping station in Lake Michigan and is brought in through a 42-in. cast iron pipe. A tee special casting is located inshore, one branch of which leads to a tunnel, connected by a shaft to the bottom of the settling well; the other branch leads direct to the settling well and discharges through a submerged tee. These intake pipes are valved so that either one can be used or both shut off and the water fed direct to the wet wells. The settling well is 30 ft. in diameter and 30 ft. deep, holding about 15 ft. of water when in use. The settling well and wet wells are within a well house and it is here that the plant for mixing and applying the hypo was constructed.

The plant consists of a mixing machine for making the hypo into a thin paste with water. A general view of the plant is shown in Fig. 1. The mixer is set so that the overflow drains into two wooden tanks 8 ft. in diameter and 3½ ft. deep. The mixing tank and dilution tanks are drained to a sewer with a 2-in. wrought iron pipe. Power for mixing and stirring the dilution tanks is furnished by

ing leads to an orifice box [illegible] so that the solution can be drawn from either tank or both tanks at once. The orifice box sets on the floor of the well house and feeds into ¾-in. galvanized iron pipes leading to the grids. Below the orifice box a valve is set and below this valve a "T" through which a pressure pipe is connected. This pressure pipe is necessary as the holes in the grids are liable to get stopped up and by closing the valves just above the "T" pressure can be applied to the grids and the sediment washed out of them.

The grids consist of ¾-in. galvanized iron pipes, tees and plugs as shown in Fig. 2, each lateral pipe having two ¼-in. holes drilled in and placed on the down stream side of the pipe. One grid is placed over the top of the shaft, the other in the 36-in. "T" at the side of the well. By placing the grids at these points the water is treated when it enters the well and has about 20 minutes contact before reaching the suctions of the pumps.

The plant as constructed was made up of parts ordered from several different manufacturers, and most of the parts were sent by express. Two weeks after the order was given to install the plant, application of the hypochlorite was started. The mixing was done by hand at first. The operation of the plant requires no extra help, and but a small amount of work from the regular employees. At present 50 lbs. of hypochlorite are being used with 1,420 gals. of water. After this mixture has been thoroughly stirred in the dilution tanks it is allowed to stand for at least an hour before any of it is drawn off, as a good quantity of insoluble material is always present and causes stoppage in the orifice box and the valves.

Each gallon of the above solution contains .0352 lbs. of hypo, which analyzes 37 per cent available chlorine. The engineer is furnished with the following simple formula from which he operates the orifice box. Let N = number of gallons pumped per minute

$\frac{1,000,000}{N} = M$ or number of minutes to pump 1,000,000 gals.

Q = Number of pounds of hypochlorite to be added to each 1,000,000 gals. of water.

$\frac{Q}{M} = P$ or pounds [illegible] added each minute.

$\frac{P}{0.352}$ = Number of gall[illegible] to be added per [illegible]

When any considerable varia[illegible] speed of the pumps is noticed by [illegible] engin[illegible] he counts the revolutions and get[illegible] the p[illegible] age. After he has calculated th[illegible] gallons of hypo to be added pe[illegible] minute gets the setting for the orifice box [illegible] print furnished by the manufactu[illegible]

The treatment was started wit[illegible] 1,000,000 gals. and was increase[illegible] to 10 lbs., after which it was dec[illegible] to 3 lbs., and has since been rais[illegible] The gas formers have been ke[illegible] for considerable periods entirely [illegible] The total count has been reduce[illegible] to a[illegible] 100 per c. c.

The period of incubation of ty[illegible] about three weeks, the date for t[illegible] drop of the curve was set at about J[illegible] 15, since that period the cases have [illegible] one in five days. Fig. 3 shows th[illegible] cases in November, December, J[illegible] February.

On two occasions the taste of th[illegible] ite has been noticed in the water [illegible] of these occasions an odor was [illegible] the time the odor was noticed [illegible] 1,000,000 gals. were being add[illegible] amount had been added for th[illegible] previous [illegible] No satisfactory ex[illegible] been given for the occurrence. [illegible] tion of from 3 to 5 lbs. per 1,0[illegible] properly applied does not give an[illegible]

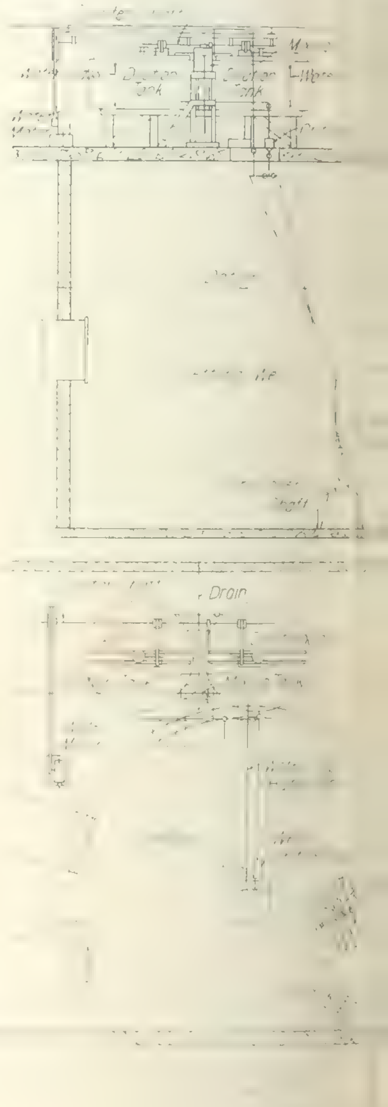


Fig. 2—Plan and Section of Evans[illegible] H[illegible] chlorite Plant.

[illegible] water such as is raw [illegible] will produce a [illegible]terial content.

The cost of the plant which wa[illegible] was about $750. This includes [illegible] on the stirring [illegible] New York, and other charges oportionately high on a plant [illegible] rite treatment is considered an isure only, and in any case the laced in short notice as it was The City of Evanston will un- a filtration plant of the rapid thin the next year, as this is [illegible] e water supply.

cormy to the Consumer Result- Fm the Purchase of Coal nder Specifications.

the wide use of coal, the vast ney involved in the industry, and wide variations in the aracteristics of coal, it seems ve stop to consider it, that the [illegible]

Coal contr [illegible]

[illegible]

has been satisfact [illegible] the sys- [illegible]

On public and political contracts the [illegible]

much less expensive items such as steel, pig iron, cement, electrical materials, paper, etc., are often purchased on the most rigid specifications and guarantee.

Following the public demand for efficiency and honest purchasing, the political and public institutions have in many cases been the leaders in scientific methods of purchasing coal. Thus in 1907 the U. S. Government adopted a form of B.T.U. specifications which is now in use by practically all Government departments. The methods used by the Government and the method now in use by other consumers are, generally, based on the same fundamental principle, which is the "delivery of heat units." While there are several different methods of regulating and figuring the value of a delivery, practically all of them consider the analysis of as much importance as the weight of the coal.

Our concern is now setting the price on $1,500,000 worth of coal delivered annually to

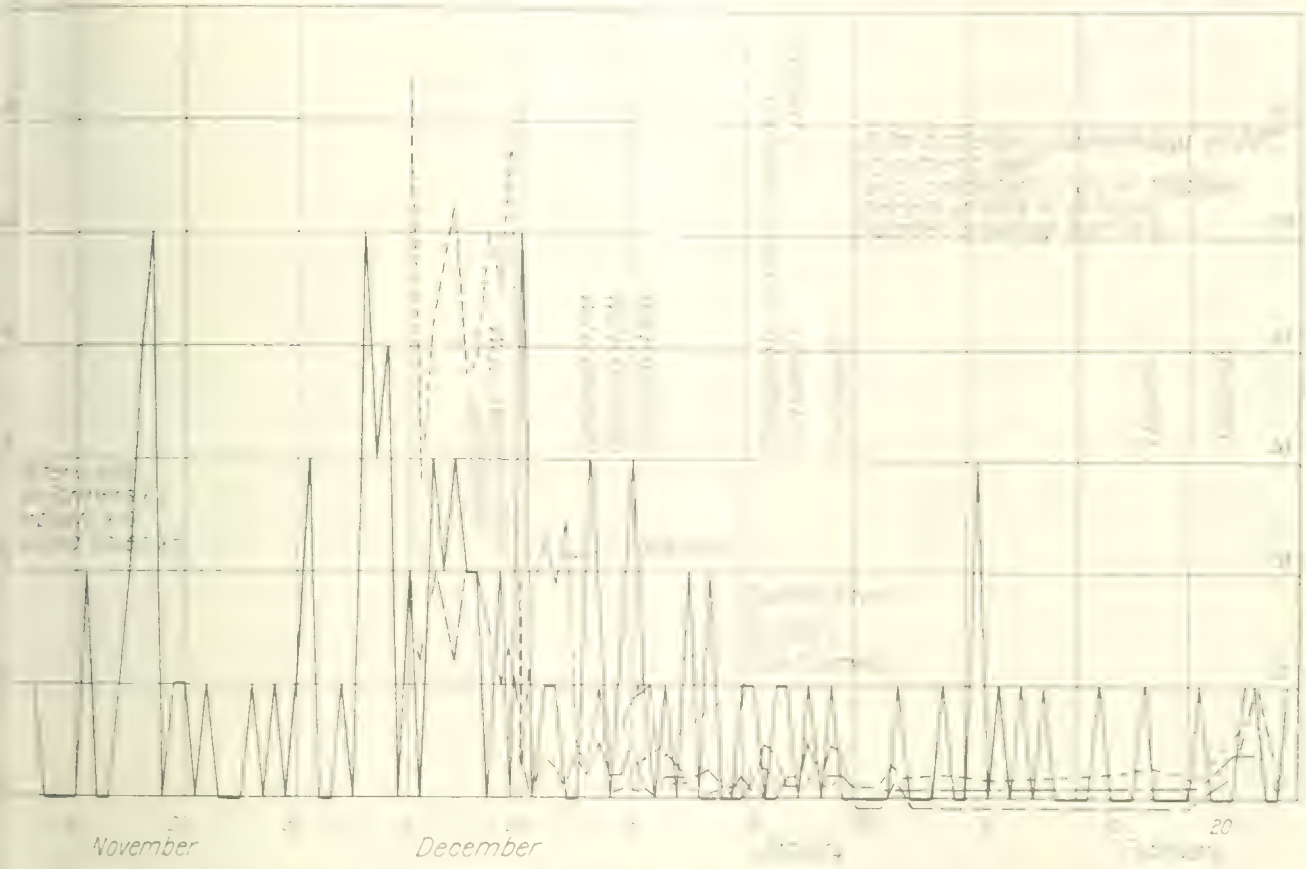


Fig. 3—Diagram Showing Fluctuations in Bacterial Count and Typhoid Cases at Evanston.

of this material along modern lines o slow in starting and developing. tage to the consumer arising from se of coal according to specifica- shown clearly in a paper read recent annual meeting of the Illi- [illegible] e-president of the Gulick-Hender- f Chicago. The adoption of this he economic operation of pumping plants merits the careful con- the superintendents of such

value and burning qualities have n the underlying basis of consid- erever it has been possible to ween one or more grades or sizes Ve find all sorts of crude methods aking these decisions and too often at a consumer simply knows that of coal seems to burn better than ithout really knowing whether or cheaper for him, than some other

a few years ago the larger con- ployed the boiler test to determine r not coal was efficient or up to the control of the testing engineer and firemen by means of which the results can be controlled at will. Furthermore, even if the tests are honestly and efficiently made, they are useless in the case of a legal fight as it is always possible to show that the conditions of testing are constantly changing to a greater or less extent due to the formation of boiler scale, weather, load and firing requirements.

Along with and following this method of specifying and regulating deliveries a chemical analysis showing the amount of moisture, volatile matter, fixed carbon, ash and heat value was frequently incorporated in the contract together with the guarantee of evaporation obtained by the boiler test method. This was often a strengthening clause and was many times the basis of making settlement where substitution was clearly evident.

It can not be said that any of these methods were ever universal nor is the new and improved B.T.U. system in universal use. In many cases the fuel which forms from 10 to 25 per cent of the yearly expense, is bought without any supervision whatever, while the all of the Cook County institutions, stations of the Sanitary District of Chicago, power and heating plants of the South Park Commissioners and the West Chicago Park Commissioners. All schools under the Board of Education, as well as many private plants, buildings in the Chicago loop district, and power plants in smaller cities.

Our recent work for the Merriam Commission investigating the various purchases in the City of Chicago, was beneficial in showing the abuses which often gradually grow out of the old or slack methods of purchasing.

The result under the old method was that the men in actual charge of these purchases welcomed an opportunity to purchase their coal supply on a specification and under a system which would not only give them good coal at a low figure, but also relieve them of the responsibility or the criticism due to the continued and expensive abuses under the old and more common system. Since the adoption of the Merriam Commission recommendation in this respect the Public Works Department of the City of Chicago is getting a better grade of coal and saving hundreds of thousands of dollars by the elimination of [illegible] recommendations [illegible] trade itself in connection with this big item of expenditure.

The B.T.U. system as applied to public institutions briefly is as follows: Bids for the delivery of fuel are advertised for in the usual way. The advertisement differs little from the common form and often simply states that an amount of coal is desired and that the same will be purchased in accordance with the B.T.U. system, specifications for which may be had by application, etc.

The specifications as we prepare them differ in detail for different institutions, due to the variations in the coal requirements and business methods of the office. All embrace clauses to cover the following principal points and it will be seen that a specification should cover something more than the mere physical properties of coal.

1st. Conditions under which proposals are to be made must be clearly defined, the bond, certified check, and other general conditions must be explained.

2nd. Special requirements such as time and place of delivery, amount of coal required, strike clause (if any), liability of contractor ,and clauses covering the purchase on open market must be clearly and specifically drawn. Since a specification is usually the basis of and a part of a contract, it must be legally drawn and fair to both the contractor and consumer as an unfair contract may not stand the test of the court even though it may have been accepted by the contractor.

3d. A general description of the coal wanted should be included in the specifications. This description is usually composed of the chemical analysis limits together with a paragraph relating to size, as follows:

DESCRIPTION OF COAL WANTED

Bituminous lump containing not less than 12,500 B.T.U. per pound of dry coal and not to exceed 14 per cent of ash dry coal. Lump coal shall contain all the lumps as mined and shall be so screened as not to contain to exceed 20 per cent by weight of coal which will pass through a 1¼-in. circular perforated screen.

These limitations are the basis on which future deliveries are to be enforced. Similar chemical and physical restrictions can be drawn to cover other grades and sizes of coal, such as screenings, chestnut anthracite, washed and unwashed nut, etc.

4th. A specification must contain a clause covering and providing for a means of rejection of a shipment should it be far below the limit of the specification as to quality and size.

If coal inferior as to size and quality is kept and burned, it may be accepted and paid for on the basis of deductions made in accordance with the terms of the specifications.

The penalty for excess of fine coal is usually based on a deduction of something like 1½ per cent of the contract price for each 1 per cent excess of fine material as limited above. For example, if lump coal containing not to exceed 20 per cent fines at about $2 per ton was contracted for, and mine run coal containing 32 per cent of fines was actually delivered, the deductions due to fineness would be 1½ per cent of $2 for each 1 per cent of fine coal in excess of the 20 per cent of allowed or a net deduction of 36 cts. per ton. This deduction would be made in addition to any deduction originating from lower heating value.

5th. The real essence of the specification lies in the clause covering methods of payment. This paragraph must literally be bull strong and hog tight.

Believing that each individual contractor should know the analysis and heating value of the coal he is attempting to sell, the responsibility of stating the exact guarantee as to moisture, ash and heat value, is placed upon him. A sheet is provided whereon he may place this detailed information together with the price per ton and the number of heat units which he is willing to guarantee to furnish for one cent.

The testing and payment clause clearly states in words how the B.T.U. for one cent shall be figured and is briefly stated as follows:

Multiply the number of heat units per *pound of coal as delivered* by two thousand. This gives the number of heat units delivered in every ton. Divide this product by the price of the coal per ton expressed in cents plus an arbitrary correction for ash amounting to one-half the percentage of ash expressed as cents.

Since the analysis of coal is often expressed on the dry basis, the heat value as delivered must be determined by deducting for the percentage of moisture. Thus the calculation resolves itself to this formula:

$$\frac{\text{B.T.U. dry coal} \times \text{per cent dry coal (100 less per cent of moisture)} \times 2{,}000}{\text{Price per ton in cents} + (0.5 \times \text{per cent of ash dry coal})}$$

The result of this simple calculation gives the number of heat units for one cent which the bidder proposes to deliver. Samples are taken from all subsequent deliveries and upon these samples analyses are made and by a converse calculation the value of the coal as delivered is determined accurately.

The specifications state the high and low limits of analysis which will be accepted under any conditions. Coal accepted is paid for on the showing of the analysis.

The method of sampling, chemical analysis and other details of the process are now fairly well standardized and while there are still differences of opinion in minor details, nevertheless it is a fact that they are as well standardized and can be as accurately handled as in the sampling and testing of other materials of commerce, such as iron, steel, cement, etc.

After the preparation and adoption of a scientific and fair specification the personal element again enters and unless the work is honestly and accurately done, without fear and without favor, the system becomes a failure. Although the system has enjoyed a steady growth, still much of the criticism and many of the objections are based entirely on the inefficiency and dishonesty of the testing.

The best of apparatus and the most careful and straightforward work are required. Needless to say the tester must have no affiliations or connections with the coal trade and his efforts must be to maintain the absolute confidence of the coal trade as well as that of the consumer.

We have among our contracts several cases where the contractors have continually earned a bonus due to their care in the selection of good coal. There are other cases where they always run behind due to over bidding their coal either through accident or intent. We believe that the bonus should be paid where it is earned and likewise believe in making deductions where the coal is below the guarantee.

ADVANTAGES OF THE B.T.U. SYSTEM.

The B.T.U. system has many advantages especially for public bodies and large purchasers where outside influences are likely to interfere.

1st. Bidders are all placed on exactly the same basis for consideration. Since awards should be made on the basis of the maximum number of heat units for one cent, there can be no possible controversy if this rule is followed. For example, bids are received from three different bidders on Illinois or Indiana lump. No. 1 bidder agrees to furnish "Atlas Lump" on the basis of 75,000 B.T.U. for one cent. No. 2 agrees to furnish "Perfection" Lump with 100,000 B.T.U. for one cent, while No. 3 agrees to furnish "Economy Lump" with a guarantee of 125,000 B.T.U. for one cent. At a glance a child could tell which is the cheapest and best bid. Under the old method the bidder offering "Perfection Lump" would have a big advantage, especially if he were politically backed up, as even any ordinary "taxpayer" would be expected to know that "Perfection" was better than either of the other two names.

2nd. Since only price and quality enter into the calculations upon which awards are made, it will be evident that "trade names" have no influence whatsoever. Thus it is often possible for dealers to offer coal of good quality from small and comparatively unknown mines and if the bidder is responsible such bids can be accepted without any possible chance of loss.

3d. The consumer is insured against the delivery of poor coal, since the penalties tend to stimulate the delivery of only the best coal to those plants where regular tests are made.

4th. A specific and equitable basis of payment is provided for, should coal be below [illegible] Coal rejected under th of contracting was often accepted at cont price and burned up simply because of the delay in getting it removed.

5th. A definite basis for [illegible] contract and otherwise regulating deliveries, etc., is provided.

6th. Constant testing and insp healthful influence on the pla means of the results operating enabled to get bettter efficienc men. Furthermore, the knowle stant and regular testing is being lates the best efforts of the contr nish uniform coal.

7th. The system can be cheap and efficiently applied at a cost well with the limits for inspection and testing and sel ing one to two cents per ton.

Of course, it may be truly said trade as a whole oppose the sy of the dealers oppose it because their chances for the substitution of poor coal. Other operators pro coal naturally are at a disadvanta use their powerful influences to re old hit and miss methods. Few oth to consider how it has really ope field for fair and equal competiti on public business. In general, ho this opposition is and has been it is plain to be seen that their o based on reasons of personal gain really favored the system too st purchasers would not want it.

With all of the opposition from however, there are always plent Generally there are now more bi than when bids were received un methods.

The Board of Education of C merly received only three or fou some of these were from affiliated Last year there were 29 bidders al ent and actually after contracts. Park Commissioners received 10 much smaller amount of coal and Chicago Park Commissioners usin coal received 14 bids.

It often is said as an argument against adoption of the system, that the be raised to cover the element o due to possible variations in the c most certainly has not been the re as we have been able to observe. price per ton has usually been low same grade of coal than when th method of purchasing was emplo increased competition governs this extent.

The B.T.U. system gives the co means of discrimination by means the lodge consumers always profit I mean that the bidders are usuall sell coal in large quantities cheaper would be willing to sell the sam coal smaller consumers. Thus he may get $2.55 per ton for coal from the sumer and be willing to accept the big consumer directly across from the small consumer. So he bids the coal to the big consumer the B.T.U. basis, and takes a dec 5 cts. per ton and the small consu knows that he is paying more than neighbor.

The savings by the installation of tem in the Board of Education of has been figured to exceed $100, greater part of this saving is due creased competition and consequen prices due to the assurances of fair afforded by the method. A part the penalties deducted for the delive ferior coal and no account is take large unknown saving by the use of grade of coal received. Similarly, ings are being made in other private plants

Therefore, judging from th growth of our own part of this w since we constantly hear of th others and of new large consumers to take bids on this or a similar bas safe in predicting a gradual and stead and improvement in the system.

omic Study of the Four Alter- ethods Considered for the sal of the Garbage, Rub- and Ashes of Toronto.

I.

[illegible] of March 13 we [illegible] ment of the rec[illegible] and Gregory, relative to [illegible] e refuse of the city of Toronto. ublished in the issue of March 27. [illegible], however, compel a further [illegible] this abstract, so in the [illegible] the first two projects are consid- [illegible] remaining projects will be [illegible] our next issue. [illegible] is detailed study, of the problems [illegible] method of [illegible] lered, of much greater value than description of a completed plant.

ing the question of the disposal [illegible] rubbish and ashes [illegible] once that the most economical that which, as a whole or in [illegible] will [illegible] method of disposing of the of refuse. Thus, if the dis- garbage alone is by the reduc- t is necessary to consider also the rubbish and ashes. Only the entire cost of the most ef- s of garbage disposal, together sal of the other refuse, can a and estimate of cost for a city [illegible]

[illegible] Toronto, four projects have l, the first two, projects A and he incineration of the garbage, two, projects C and D, the re- garbage, as follows:

Incineration of the garbage, [illegible] lable part of the rubbish.

Incineration of the garbage, [illegible] the salable part of the rubbish.

Reduction of the garbage and f the rubbish *without* utilizing rt of the rubbish.

Reduction of the garbage and f the rubbish with utilization part of the rubbish.

t a clear understanding of these be had they will be described length.

PROJECT A.

of the garbage, rubbish, and a [illegible] the rubbish.—In this project it at all of the garbage and rub- incinerated and also a portion but only such amount of ashes necessary to produce a suitable s to insure satisfactory incinera- assumed that 20 per cent of the should be ashes. The remain- es would be removed to dumps filling up and reclaiming low [illegible]

n of the number and location incinerators depends somewhat of hauling the refuse after it cted. After a careful examina- onditions in Toronto and study the conclusion has been reached population of approximately hed, two incinerators would be ith two incinerators the average f the garbage and rubbish would greater than with three incinera- [illegible] increase in cost of the [illegible] more than offset by the saving in [illegible] two incinerators instead of [illegible]

therefore, proposed in this project refuse incinerators would be in- ne located on property owned by he Cattle Market and the other which would have to be secured ity near Greenwood avenue. Both have been selected with a view to acent to a railroad in order to pro- the economical removal of the clinker.

[illegible] use incinerator [illegible] largely as at present, the [illegible] and rub[illegible] when mixed with garbage, is somewhat reduced in volume, also for the reason that the rubbish will absorb a certain amount of moisture from the garbage and, by thereby providing a greater surface for evaporation, will [illegible] taining less moisture and improve the condi[illegible] that the combined collection would be cheaper. The ashes would be collected separately and only such portion as would be needed to provide a suitable mixture for incineration, as mentioned heretofore, would be delivered to the incinerators.

As the city at present is divided into three main collection districts it is suggested that, with this project, the city would be redistricted so as to provide only two main collection districts, namely, an eastern district and a western district. That portion of the refuse collected in the eastern district, and which would be burned, would be delivered to the proposed refuse incinerator near Greenwood avenue, and similarly that portion of the refuse collected in the western district, and which would be burned, would be delivered to the proposed refuse incinerator at the Cattle Market.

Each of these two refuse incinerators would have a net rated capacity of burning 215 tons of mixed refuse per 24 hours. Each incinerator would be provided with four furnaces each capable of burning from 70 to 75 tons of mixed refuse per 24 hours. It is assumed that only three furnaces at each incinerator would be required to be in operation at one time, in order to burn the 215 tons in 24 hours, the fourth furnace being held as a reserve. A railroad siding would be built on the property at each incinerator on which cars would be set to receive the clinker removed from the furnaces.

It would not be planned to provide boilers and equipment to produce power, due to the fact that under the quite unusual conditions existing at Toronto, there would be no market for the power should the same be produced. Careful estimates which have been made indicate that it would cost considerably more to reduce electric current at the incinerators, by the utilization of the waste heat from the furnaces, than to buy the same from the Hydro-Electric Commission. In view of this extraordinary fact it cannot even be recommended to produce power for operating the mechanical equipment in the incinerators but rather to buy it from the Hydro-Electric Commission.

Clinker, when crushed and screened, is suitable for use in certain classes of concrete work and for road-foundations, etc. Where there is a market for such material and where a sufficient [illegible] the same, it is desirable to install clinker mills for crushing and sorting and produce a salable product. At the Milwaukee incinerator a clinker mill is to be installed at an expense of about $2,800 and it is expected that the crushed and screened clinker will sell for about 75 cts. per cu. yd., and yield an annual return of over $6,000. Inquiry of the city officials in Toronto has not led us to believe that at the present time there would be a market for such material and, therefore, clinker mills have not been included in the estimates of the cost of construction. Should a market for the clinker be found at a later date, clinker mills could easily be installed and at only a slight additional expense.

The estimated cost of construction of the two 215-tons refuse incinerators, without providing means for sorting out the salable part of the rubbish, but including land, fencing, railroad sidings and paving the courtyards around the buildings is $478,400.

The estimated annual cost of operation of the two refuse incinerators when handling the [illegible] other projects considered, are included fixed [illegible] per cent to retire the bonds in 20 years, with [illegible] cent per annum. The estimated cost of labor [illegible] instead of 300 days in order to allow for extra labor which may at times be required.

In Tables I, II and III are given, somewhat in detail, the estimated cost of construction of the two incinerators and also the estimated annual cost of operation of the same when handling the refuse from a population of 600,000 and from a population of 400,000, but without utilizing the salable part of the rubbish.

In certain cities in Europe the practice of collecting the refuse by means of motor-operated wagons has recently been inaugurated, each wagon being equipped with a storage battery. The waste heat from the incinerators is utilized to produce electric current, a part of which in turn is used to charge the storage-batteries. By the utilization of the waste heat in this manner it has been possible to reduce the total cost of collection and disposal.

In Toronto, it may be that it would be more economical to collect the refuse by means of motor-operated wagons, the electric current being purchased from the Hydro-Electric Commission, than to continue the present method of collection, but in any event it would not be economical to produce, at the incinerators, the electric current for charging the batteries, for the reason before stated, that current, even with no cost of heat production, can be purchased cheaper from the Hydro-Electric Commission than it can be produced at the incinerators. In view of this fact we have not gone into the cost of collecting the refuse in motor-operated wagons.

TABLE I.—ESTIMATED COST OF CON- [illegible] TON REFUSE INCINERATORS FOR A POPULATION OF 600,000 WITHOUT UTILIZING THE SALABLE PART OF THE RUBBISH.

[illegible], 215 tons of [illegible]

	[illegible] erator [illegible] market.	Green- [illegible] Ave
At cattle market (owned by [illegible]		
[illegible]	[illegible]	1,000
Railroad Siding:		
[illegible]	[illegible]	
[illegible]		600
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2,000
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	5,000
[illegible]	[illegible]	120,000
Storage hoppers	16,000	16,000
[illegible]	10,000	[illegible]
Clinker hoists	2,000	2,000
[illegible]	[illegible]	1,000
[illegible]	[illegible]	2,000
[illegible]	[illegible]	2,700
[illegible]	[illegible]	3,000
	$204,000	$212,000
Engineering and contingencies, 15 per cent	30,600	31,800
Total estimated cost	$234,600	$243,800

Grand total, $478,400.

TABLE II.—ESTIM[illegible] OPERATION OF TWO 215-TON INCINERATORS WITH A POPULATION OF 600,000 WITHOUT [illegible] PART OF THE RUBBISH.

Weight of [illegible] annually [illegible]
Weight of [illegible] tors annually [illegible]
Average weight of refuse burned at each [illegible]
Av[illegible]

		Total.	Per ton of refuse handled.
[illegible]		[illegible]	[illegible]
La[illegible]		[illegible]	[illegible]
[illegible] at $0.[illegible]		[illegible]	[illegible]
Power and light		720	0.013
Maintenance and repairs		3,425	0.061
Estimated annual cost of operation of one incinerator		$ 44,000	$0.782
Estimated annual cost of operation of second [illegible]		[illegible]	[illegible]
		[illegible]	[illegible]
Fixed Charges:			
Interest, 4 per [illegible] $478,400	[illegible]		
Sinking fund, 3.72 per cent on $478,400	17,800	36,940	0.328
Total estimated annual cost of operation		$124,940	$1.110

TABLE III.—ESTIMATED ANNUAL COST OF OPERATION OF TWO 215-TON REFUSE INCINERATORS WITH A POPULATION OF 400,000 WITHOUT UTILIZING THE SALABLE PART OF THE RUBBISH.

	Tons.
Weight of refuse burned at each incinerator annually	[illegible]
Weight of refuse burned at two incinerators annually	75,000
Average weight of refuse burned at each incinerator daily	125
Average weight of refuse burned at two incinerators daily	250

320 working days.

ONE INCINERATOR.

		Total.	Per ton of refuse handled.
Supervision and weighmaster		$ 4,800	$0.128
Labor		[illegible]	[illegible]
Removal of clinker, 7,500 tons at [illegible]		[illegible]	[illegible]
Power and light		720	0.019
Maintenance and repairs		2,630	0.070
Estimated annual cost of operation of one incinerator		$ 32,800	$0.874
Estimated annual cost of operation of second incinerator		32,800	0.874
		[illegible]	[illegible]
Fixed Charges:			
Interest, [illegible] $478,400	[illegible]		
Sinking fund, 3.72 per cent on $478,400	17,800	36,940	0.493
Total estimated annual cost of operation		[illegible]	[illegible]

PROJECT B.

[illegible] portion of the ashes with utilization of the salable part of the rubbish.

This project is in many respects similar to Project A, just described. Instead, however, of collecting the garbage and rubbish together, they would be collected separately and the rubbish, after being delivered at the incinerators, would be sorted over, the salable part would be picked out and sold and the remainder mixed with the garbage and ashes and burned in the furnaces. As in Project A only a portion of the ashes would be delivered at the incinerators, the remainder being used for filling.

As in Project A it is proposed that two refuse incinerators would be installed and at the same locations previously mentioned. Also, as in Project A, it is suggested that two main collection districts be formed.

The two refuse incinerators would be similar to those proposed under Project A except that each would have a net rated capacity of burning only 195 tons of mixed refuse per 24 hours. Each incinerator would be provided with four furnaces, each capable of burning 65 tons of mixed refuse per 24 hours. In addition to the equipment required for incineration, additional equipment would be provided for the sorting out and handling of the salable part of the rubbish. For reasons previously stated no clinker mill is provided and no power would be produced.

The estimated cost of construction of the two 195-ton refuse incinerators, including means for picking out and handling the salable portions of the rubbish, and including land, fencing railroad sidings and paving, is $489,300.

The estimated gross annual cost of operation of the two incinerators, including fixed charges, when handling the refuse from a population of 600,000 as mentioned above, and including the cost of picking out and handling the salable part of the rubbish is $166.570. In Buffalo, the average receipts from the sale of material picked out from the rubbish for a period of over four years, as given in Table IV, p. 295, ENGINEERING AND CONTRACTING, March 13, 1912, were $2.34 per ton of rubbish handled. We have no reason to believe that the receipts at Toronto would vary much from those obtained at Buffalo, but we have taken a figure slightly less, namely, $2.25 per ton of rubbish handled. On this basis it is estimated that the receipts from the sale of the material picked out from the rubbish would be $67.500 per annum, thus giving a total estimated net annual cost of operation of $99,070.

The estimated gross annual cost of operation of the two incinerators, including fixed charges, when handling the refuse from a population of only 400,000 is $131,570, and the estimated receipts from the sale of material picked out from the rubbish $45,000, giving a total estimated net annual cost of operation of $86,570.

In Tables IV, V and VI are given somewhat in detail the estimated cost of construction of the two 195-ton refuse incinerators and also the estimated annual cost of operation of the same when handling the refuse from a population of 600,000 and from a population of 400,000, and with utilization of the salable part of the rubbish.

Projects A and B both involve incineration. With a population of 600,000, the estimated annual cost of operation of Project A, in which all the rubbish is burned, is $124,940. In Project B, in which the salable part of the rubbish is picked out and sold, the estimated net annual cost of operation is $99,070. From a comparison of these two estimates it is seen that the picking out of the salable part of the rubbish will result in an estimated annual saving of $25,870.

TABLE IV.—ESTIMATED COST OF CONSTRUCTION OF TWO 195-TON REFUSE INCINERATORS FOR A POPULATION OF 600,000 WITH UTILIZATION OF THE SALABLE PART OF THE RUBBISH.

Net capacity of each incinerator, 195 tons of refuse per 24 hours.
Net capacity of two incinerators, 390 tons of [illegible] per 24 hours.

	Incinerator at cattle market.	Incinerator near Greenwood Ave.
Land:		
At cattle market (owned by [illegible]		
[illegible] Greenwood [illegible]	[illegible]	[illegible]
Fence	$ 1,250	1,250
Railroad Siding:		
At cattle market	3,900	......
Near Greenwood Ave.	......	1,200
[illegible]	[illegible]	[illegible]
Incinerator:		
Building:		
[illegible]	[illegible]	[illegible]
Foundations	8,600	8,600
Superstructure	21,500	21,500
[illegible]	[illegible]	[illegible]
Equipment:		
[illegible]	[illegible]	[illegible]
Storage hoppers	14,000	14,000
Cranes	10,000	10,000
Clinker hoists	2,000	2,000
Clinker platform	1,000	1,000
Ventilating apparatus	2,000	2,000
Sorting bins	4,350	4,350
Rubbish conveyors	5,000	5,000
Presses and punches	6,000	6,000
Miscellaneous equipment	4,000	4,000
Lavatory and locker house	4,000	4,000
Scale, scale house and office	3,000	3,000
	$208,000	$217,500
[illegible]		
15 per cent	31,200	32,600
[illegible]	[illegible]	[illegible]

Grand total, $489,300.

TABLE V.—ESTIMATED ANNUA[illegible] OPERATION OF AND INCOME [illegible] TON REFUSE INCINERATORS [illegible] A POPULATION OF 600,000 WIT[illegible] TION OF THE SALABLE PA[illegible] RUBBISH.

Weight of refuse delivered at each [illegible] erator annually [illegible]
Weight of refuse delivered at two [illegible] erators annually [illegible]
Weight of refuse burned at each [illegible] tor annually [illegible]
Weight of refuse burned at two in[illegible] tors annually [illegible]
Average weight of refuse delivered [illegible] each incinerator daily [illegible]
Average weight of refuse delivered [illegible] incinerators daily [illegible]
Average weight of refuse burned a[illegible] incinerator daily [illegible]
Average weight of refuse burned [illegible] incinerators daily [illegible]
320 working days.

OPERATION

One Incinerator.

		Tot
Supervision and weighmaster		$ [illegible]
Labor		4[illegible]
Removal of clinker, 10,000 tons at [illegible]		[illegible]
Power and light		1,0
Maintenance and repairs		5,5
Estimated annual cost of operation of one incinerator		$ 64
Estimated annual cost of operation of second incinerator		64,[illegible]
		$1[illegible]
Fixed Charges:		
Interest, 4 per cent on [illegible]	$19,[illegible]	
Sinking fund, 3.72 per cent on $489,300	18,200	37.
Total estimated gross annual cost of operation		$166,
Income from Sale of Mate		
Rubbish handled, 30,000 tons at [illegible]		[illegible]
Total estimated net annual cost of operation		$[illegible]

TABLE VI.—ESTIMATED ANN[illegible] OPERATION AND INCOME FRO[illegible] TON REFUSE INCINERATORS [illegible] POPULATION OF 400,000 WITH [illegible] TION OF THE SALABLE PAR[illegible] RUBBISH.

Weight of refuse delivered at each [illegible] annually [illegible]
Weight of refuse delivered at two in[illegible] erators annually [illegible]
Weight of refuse burned at each inci[illegible] tor annually [illegible]
Weight of refuse burned at two inci[illegible] tors annually [illegible]
Average weight of refuse delivered [illegible] one incinerator daily [illegible]
Average weight of refuse delivered [illegible] incinerators daily [illegible]
Average weight of refuse burned at [illegible] incinerator daily [illegible]
Average weight of refuse burned at [illegible] incinerators daily [illegible]
320 working days.

OPERATION.

One Incinerator.

Supervision and weighmaster		$ 6,0
Labor		33,9
Removal of clinker, 6,600 tons [illegible]		[illegible]
Power and light		1.4
Maintenance and repairs		3.5
Estimated annual cost of operation of one incinerator		$ 46.9
Estimated annual cost of operation of second incinerator		46.9
		[illegible]
Fixed Charges:		
[illegible]	[illegible]	
Sinking fund, 3.72 per [illegible]	[illegible]	[illegible]
Total estimated gross annual cost of operation		$131.5
Rubbish handled, 20,000 tons [illegible]		[illegible]
Total estimated net annual cost of operation		$ 86,5

[illegible]

ing in the Culebra Cut at Pana [illegible] 1,254 [illegible] car measurement, in 8 hrs. Th greatest amount of material ever in one day in the Culebra Cut commencement of operations.

DRAINAGE AND IRRIGATION SECTION

cedure Followed in Public Drain- ge Itch Work in Southern Minnesota With General Costs of Ditch Work.

[illegible] public ditch work, particularly in portions of the states, is outlined y Mr. C. W. Gove, County Sur- om, Minn., before the Minnesota nd Engineers Society. This paper method of mapping, making pro- cording surveys and estimates general interest. We abstract the

ion must describe the starting rminus particularly, and the route way. The lands to be affected are ribed also in a general way, al- present law does not seem to re- le petition. The petition requests [illegible]

These branches are [illegible] the purpose [illegible]

more than one branch in order to reach other tracts, we do not attempt anything like thorough drainage. However, these branches usually follow the natural watercourses and pass through the large sloughs which are a menace to all the lower lands and a breeding place for mosquitoes and blackbirds. They cross highways in many places, furnishing outlets for the drainage of the road grades and ditches, making possible the construction and [illegible] though the full benefits of the system will not [illegible]

the office. The watershed line is sketched in on the map with a colored pencil, and the divides between the different branches are marked in a different color so that the approximate area to be drained by each branch [illegible]

drained and the available fall, although these are not all that should be considered. Land that is rolling, or hilly, with deep ponds, will require larger tile than flat lands, for the reason that the rolling land does not absorb much of the rainfall, and the water runs off quickly into the ponds from which the tile must take nearly all of it in a short time in order to save crops, while in the case of low flat land that is nearly all tiled, as such lands should be, the soil absorbs all of the rainfall and the drains carry off the surplus gradually. Text books and bulletins on land drainage give tables and formulas for calculating the [illegible]

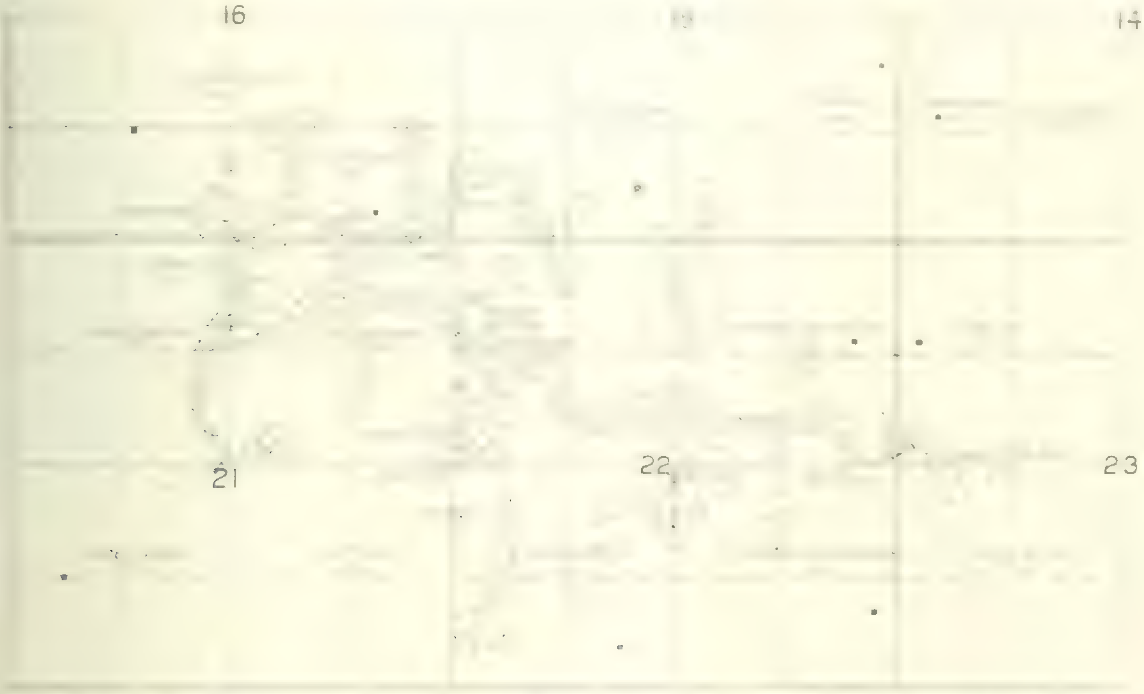


Fig. [illegible] Map of [illegible] Ditch No. [illegible] Illustrating [illegible] of Mapping a Ditch System.

[illegible] sary in order to give every tract [illegible] t points as is necessary for the ge of all the low lands thereon. the case of a large district, re- e number of branches and sub- , which are usually constructed of tile. eral practice is to follow every small rcourse to its head, or to the line on which the headwaters lie. [illegible]

before reaching the headwaters, to give the man who owns land by the main ditch, and who will be for the construction thereof, the full tereof, it is necessary not only to take the overflow that comes down the ain ditch, but also that from all as well. It has been demon- clearly during the past wet land cannot be successfully e subject to overflow from un- [illegible]

to him in order to furnish him an well as to protect the lower land from If the watercourse extends farther cessary to extend the branch through [illegible] drained, it is complete enough to drain most of the worst places and to prevent surface overflow.

In large districts with a large number of branches, confusion can be avoided by the use of some simple system of numbering. The simpler the system the better. We have tried several and have settled upon the following as the most satisfactory. Beginning at the lower end of the main ditch, designate the first branch as Branch *A*, and if it has any sub-branches designate them as Branch *A 1*, *A 2*, etc., beginning at the lower end. The next branch entering the main will be Branch *B*, and its sub-branches *B 1*, *B 2*, etc. Thus each main branch, which is in reality a smaller district, is grouped by itself and any branch can be readily located on the map. In case there are more branches than letters in the alphabet, use them over again by doubling them, as *AA*, *BB*, *CC*. [illegible]

field man is provided with a map drawn to a scale of 3 or 4 ins. to the [illegible]

data that will assist in making up the map in [illegible]

suit all cases, and, after all, choosing the size is to a certain extent a matter of judgment. Larger tile than is necessary will be a waste of money and on the other hand, if it is too [illegible] and the only re[illegible] tile with larger. [illegible]

get the main br[illegible]

least 4 ft. deep. The branches ar[illegible] to enter the main at least 2 ft. above the [illegible] tom, if the main is an open ditch; if tile, the branches enter near the top of the main so that each branch has a free outlet even when the main is nearly full.

The first tiling in Minnesota wa[illegible] people from Illinois who had seen t[illegible] [illegible] al system [illegible]

the standard depth, but from our observation and experience we are convinced that in this part of the state a minimum depth of 4 ft. is the best. The tile does not cost a cent more for a deep drain then for a shallow one and we consider [illegible] ft. depth worth at least twice [illegible] in depth [illegible] construction is a good [illegible]. The [illegible] course, would not apply to any land with hardpan or impervious clay subsoil.

For the general map we find a scale of 600 ft. to 1 in. the most convenient, and make the sheets 30x36 ins. for convenience in blueprinting and handling. The blue prints are numbered and bunched in regular order, and in case of large districts a map is drawn on a small scale showing the whole district. This small map shows the lines of the ditches and the tracts of land with the names of the owners but the ditches are not drawn to scale and the map is made for the use of the viewers and contractors in locating the various branches. The large map is drawn to scale and shows every stake, the numbers of the sections and all division lines, the number of acres in each tract and the owner's name on each tract. The highways, streams, sloughs, lakes, and farm buildings are also shown.

The main ditch is numbered down stream and the branches up stream from the main, so that any extensions may be made and the numbers will come in regular order.

In making the tabulated statement we use our own blank form, which is shown in Fig. 2, and which provides space for about five times as many stations as the regular blanks furnished by the supply houses, and can be used on an ordinary typewriter. Each station is estimated separately and each branch footed so that the cost of any station or of any branch can be readily found. The footings are all tabulated and totaled to show the total estimate. In making the estimates we use tables showing the number of cubic yards of excavation in one station of 100 ft., in any width of bottom and side slope, for each 0.1 ft. in depth. For estimates of tile work we use a table showing the cost per station for excavating, laying the tile and filling the trenches as one item, a different table for each size over 9 in. tile, the tables showing [illegible] each 0.05 ft. in depth. The cost of tile delivered at the ditch is entered as one item, and the two are added to make the estimated cost of construction. Anc contains the estimated cost of the survey and notices and inspectic station which added to the cost tion and carried to the right h makes the total estimate per stat 2 is a sample page filled out. Fig are sample pages of the tables for and tile drains, above mentioned.

The profiles are drawn to a sca to 1 in. horizontal, and 10 ft. to 1 The stations are numbered along of the profile and the depth writte tical line between the grade line face. The size of the tile and g be shown on the profile and all p the grade line is broken should with an X mark. All points whe are to connect should be marked circles which also show the eleva branch.

The officials whose duty it is the ditch and to enter into a cont construction are usually not exp such matters and know very technical terms, and the same is tr contractors. We have therefore to put on the plans only such dat of assistance in the location and of the ditch.

The engineer's work is not finisl filing of his report. He must sur inspect the work of construction, lieve this requires as much experier and even more good every day than the making of the preliminar the plans and estimated cost. To be inspector of tile work a man shou some personal experience in the trenches and the laying of tile. H understand the difficulties under workmen are laboring and will k to look for defects and where sp ing will be required. A little ca places, together with a little kindl and advice will insure a good pie in a place where a careless or in workman might cause a good deal for himself as well as the inspect We believe it is the duty of the e inspector to help the work along a the contractor to take advantage of conditions, to instruct the workme best methods of doing the work he can to get the best possible w

[illegible] For [illegible]

EXHIBIT [illegible] ENGINEER'S REPORT IN DITCH PROCEEDINGS

[illegible] Ditch No. 14. .....*Jackson*..... County, Minn.

No. of Stake at foot of each station.	Size of tile	Depth of [illegible] feet	[illegible]ging, laying tile and back-filling trenches.	Cost of tile per station delivered at ditch.	Total.	Preliminary survey, viewers' expenses, special meetings, posting notices, printing [illegible] and other general expenses, also other items as noted below	Total estimated cost per station
			MAIN DITCH				
0		4.	......			....	
1	8"	4.35	$4.55	$ 8.00	$12.55	$2.00	$14.55
2		4.25	4.75	8.00	12.75	2.00	14.75
3		3.95	4.40	8.00	12.40	2.00	14.40
4		3.90	4.10	8.00	12.10	2.00	14.10
5		4.25	4.40	8.00	12.40	2.00	14.40
6		5.65	7.20	8.00	15.20	2.00	17.20
7		5.60	8.70	8.00	16.70	2.00	18.70
8		6.65	12.65	8.00	20.65	2.00	22.65
9		5.15	9.25	8.00	17.25	2.00	19.25
10		4.55	7.00	8.00	15.00	2.00	17.00
11		4.30	5.00	8.00	13.00	2.00	15.00
12		3.75	4.30	8.00	12.30	2.00	14.30
13		3.70	3.75	8.00	11.75	2.00	13.75
14		4.05	4.05	8.00	12.05	2.00	14.05
15		3.75	4.05	8.00	12.05	2.00	14.05
16		4.25	4.20	8.00	12.20	2.00	14.20
17		4.15	4.55	8.00	12.55	2.00	14.55
18		4.47	4.75	8.00	12.75	2.00	14.75
19		6.49	8.40	8.00	16.40	2.00	18.40
20		6.06	13.10	8.00	21.10	2.00	23.10
21		7.03	13.80	8.00	21.80	2.00	23.80
22		6.45	14.40	8.00	22.40	2.00	24.40
23	10"	5.92	12.80	8.00	20.80	2.00	22.80
24		6.89	13.40	12.00	25.40	2.00	27.40
25		6.56	14.40	12.00	26.40	2.00	28.40
26		5.93	12.95	12.00	24.95	2.00	26.95
27		4.80	8.10	12.00	20.10	2.00	22.10
28		3.75	5.80	12.00	17.80	2.00	19.80
29		3.80	4.75	12.00	16.75	2.00	18.75
30		4.00	4.95	12.00	16.95	2.00	18.95
31		4.20	5.40	12.00	17.40	2.00	19.40
32		4.55	6.00	12.00	18.00	2.00	20.00
33		4.80	6.65	12.00	18.65	2.00	20.65
34		5.10	7.20	12.00	19.20	2.00	21.20
35		5.45	7.95	12.00	19.95	2.00	21.95
36		5.70	8.60	12.00	20.60	2.00	22.60
37		6.50	12.55	12.00	24.55	2.00	26.55
38	12"	7.15	14.70	12.00	26.70	2.00	28.70
39		6.65	14.85	16.00	30.85	2.00	32.85
40		7.10	14.85	16.00	30.85	2.00	32.85
	Carried Forward...		$327.25	$396.00	$723.25	$80.00	$803.25

Fig. 2—Form for Tabulated Statement of Ditch Work.
(Original size 8½x14 ins.)

6-IN., 8-IN. and 9-IN. TILE.

3 ft. to 4½ ft. deep; 40 and 2½ cts.
4½ ft. to 6 ft. deep; 50 and [illegible] cts.
6 ft. to 12½ ft. 60 [illegible]

Ft.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
6	2.40	2.50	2.60	2.65	2.75	2.85	2.95	3.05	3.10
7	3.30	3.40	3.50	3.55	3.65	3.75	3.85	3.95	4.05
8	4.20	4.30	4.40	4.45	4.55	4.65	4.75	4.85	4.90
9	6.25	6.35	6.45	6.55	6.65	6.80	6.90	7.00	7.10
10	7.30	7.45	7.55	7.65	7.75	7.85	7.95	8.10	8.20
11	8.40	8.50	8.60	8.70	8.85	8.95	9.05	9.15	9.25
12	12.25	12.40	12.55	12.65	12.80	12.95	13.10	13.25	13.40
13	13.70	13.80	13.95	14.10	14.25	14.40	14.55	14.70	14.85
14	15.10	15.25	15.40	15.55	15.70	15.85	15.95	16.15	16.25
15	16.55	16.70	16.85	17.00	17.15	17.30	17.40	17.55	17.70
16	18.00	18.15	18.30	18.45	18.60	18.70	18.85	19.00	19.15
17	19.45	19.60	19.75	19.85	20.00	20.15	20.30	20.45	20.60
18	20.90	21.00	21.15	21.30	21.45	21.60	21.75	21.90	22.00
19	22.30	22.45	22.60	22.75	22.90	23.04	23.20	23.35	23.45
20	23.75	23.90	24.05	24.20	24.35	24.50	24.60	24.75	24.90
21	25.20	25.35	25.50	25.65	25.75	25.90	26.05	26.20	26.35
22	26.65	26.75	26.95	27.05	27.20	27.35	27.50	27.65	27.80
23	28.10	28.25	28.40	28.55	28.70	28.85	29.00	29.15	29.30
24	29.60	29.75	29.90	30.05	30.20	30.35	30.50	30.65	30.80
25	31.10	31.25	31.40	31.55	31.70	31.85	32.00	32.15	32.30

10-IN. TILE.

3 ft. to 6 ft.; [illegible] and [illegible]
6 ft. to 12½ ft. [illegible]

Ft.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
6	3.00	3.10	3.20	3.30	3.45	3.55	3.65	3.75	3.85
7	4.10	4.20	4.30	4.40	4.50	4.60	4.75	4.85	4.95
8	5.15	5.25	5.40	5.50	5.60	5.70	5.80	5.90	6.00
9	6.25	6.35	6.45	6.55	6.65	6.80	6.90	7.00	7.10
10	7.30	7.45	7.55	7.65	7.75	7.85	7.95	8.10	8.20
11	8.40	8.50	8.60	8.70	8.85	8.95	9.05	9.15	9.25
12	12.25	12.40	12.55	12.65	12.80	12.95	13.10	13.25	13.40
13	13.70	13.80	13.95	14.10	14.25	14.40	14.55	14.70	14.85
14	15.10	15.25	15.40	15.55	15.70	15.85	16.00	16.15	16.25
15	16.55	16.70	16.85	17.00	17.15	17.30	17.40	17.55	17.70
16	18.00	18.15	18.30	18.45	18.55	18.70	18.85	19.00	19.15
17	19.45	19.60	19.75	19.85	20.00	20.15	20.30	20.45	20.60
18	20.90	21.00	21.15	21.15	21.30	21.45	21.60	21.75	21.90
19	22.30	22.45	22.60	22.75	22.90	23.05	23.20	23.35	23.45
20	23.75	23.90	24.05	24.20	24.35	24.50	24.60	24.75	24.90
21	25.20	25.35	25.50	25.65	25.75	25.90	26.05	26.20	26.35
22	26.65	26.80	26.95	27.05	27.20	27.35	27.50	27.65	27.80
23	28.10	28.25	28.40	28.55	28.70	28.85	29.00	29.15	29.30
24	29.60	29.75	29.90	30.05	30.20	30.35	30.50	30.65	30.80
25	31.10	31.25	31.40	31.55	31.70	31.85	32.00	32.15	32.30

The depth given is the sum of both ends or twice the average depth.

Fig. 3—Tables for Computing Cost of Tile Drains.

get the work finishe[illegible] in [illegible] time. He must insist [illegible] is not his place [illegible] getting every possible [illegible] making the job as [illegible] ome inspectors seem to think they ing their duty unless they are in uble with some one, but our ex-

EXHIBIT 4.

Schedule of Op[illegible] 12-ft [illegible]

	.2	.3	.4	[illegible]	[illegible]				Ft
53.30	[illegible]	[illegible]	69.60	74.80					
109.60	115.60	121.80	127.80	134.10		[illegible]	[illegible]	[illegible]	
173.30	[illegible]	[illegible]	194.10		[illegible]	[illegible]			
[illegible]	251.90	259.60	[illegible]	274.80					
323.00	331.10	339.60	347.80	[illegible]	[illegible]	[illegible]		[illegible]	
408.90	417.80	427.00	436.30	445.20	[illegible]			[illegible]	
[illegible]	511.90	521.80	531.80		[illegible]		[illegible]		
[illegible]	613.40	[illegible]	[illegible]	645.20		[illegible]	[illegible]		
711.10	722.20		745.10	756.70	[illegible]			[illegible]	
[illegible]	838.50	850.70	862.90				[illegible]		
949.60	962.20		988.10	1,000.70	[illegible]		[illegible]	[illegible]	
1,080.00	1,093.30	1,107.00	1,120.70	1,134.10		[illegible]	[illegible]	[illegible]	[illegible]
1,217.80	1,231.80	1,246.30	1,260.70	1,274.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,363.00	1,377.80	1,393.00	[illegible]	1,423.00	[illegible]	[illegible]	[illegible]	[illegible]	
1,515.60	1,531.20	1,547.00	1,562.80	1,578.70	[illegible]	[illegible]	[illegible]	[illegible]	
1,675.60	1,692.00	1,708.50	1,725.00	1,741.70	[illegible]	[illegible]	[illegible]		
1,843.00	[illegible]	1,877.40	1,894.70	1,912.00			[illegible]	[illegible]	
[illegible]	2,035.70	2,053.70	2,071.70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
2.200.00	2,218.70	2.237.40	2,256.10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Fig. 4—Table Giving Quantities of Excavation for Open Ditches.

ads us to believe that if the in- m. knows what constitutes a good sts upon getting it, he can get by assisting whenever an oppor- than by antagonizing everybody. xtent of the work in this part of n only say that I have been able a for a portion of it in the coun- n, Martin, Faribault and Cotton- t it is very incomplete. In Jack- here are now either finished or onstruction three county ditches idicial ditches. In Martin County itches and twenty Judicial ditches, County seven county ditches and ditches, in Cottonwood County ditches.

ns range in size from 2,000 acres s. The largest one is known as No. 14 of Martin and Faribault covers about 30,000 acres. It is the southeastern part of Martin d the southwestern part of Faribault tlet is in Badger Creek, a tributary he Earth River. The plans call for of open ditch, with a bottom width and a depth of 6 to 14 ft., with figured at 1 to 1. There will be main and branches amounting to a 100 miles, ranging in size from 6 e very small branches to 24 ins. for pal branches. The cost was esti- $250,000 and the contract was let for nt of the estimate. This ditch will 50 cars of tile which must be taken ge distance of nine miles from the n. The open work will be done ating dredges, which are now on and will be ready to begin work

tract was let for $147,004. This ditch covers an area of about 15,000 acres in Minnesota and receives the surplus from about 10,000 acres in Iowa. The outlet is in Otter Creek, also a tributary of the Blue Earth River.

Judicial ditch No. 8 of Martin County is located in Town 103, Range 30, and covers an area of about 5,000 acres. The plans call for three miles of open ditch and 20 miles of tile. The cost was estimated at $37,000, and the contract was let for a little less than that.

Judicial ditch No. 3 of Martin County is located in Town 103, Range 30, and covers about 7,000 acres, has five miles of open ditch and 16 miles of tile. The estimated cost was $57,945 and the contract was let for $57,300.

Judicial Ditch No. 9 of Martin County covers an area of 1,800 acres and is all constructed of tile, about 7½ miles. The cost was estimated at $14,758.76 and the contract was let for $13,444.

Judicial ditch No. 13 of Jackson and Nobles Counties covers an area of about 15,000 acres and the plans call for about ten miles of open ditch and 60 miles of tile from 6 ins. to 26 ins. The contract has not yet been let, but the cost is estimated at $107,000.

Judicial ditch No. 6 of Jackson County covers an area of 1,800 acres and is all conplans call for seven miles of open ditch and 40 miles of tile. The estimated cost was $66,212 and the contract price was $65,600.

Judicial ditch No. 8 of Jackson County calls for seven miles of open work and 24 miles of tile. The estimated cost was $51,932, and the contract was let for $51,000. This ditch covers about 7,000 acres.

There are many other smaller ditches but those mentioned will serve to show about the cost per mile. The area given covers the whole watershed and about one-third of that

There is nearly always more or less opposi-

from those who do not understand the methods or the benefits. Many property owners think they are being forced into an enterprise that is going to make some one rich at their expense, and that it will cost them more than if they were permitted to do the work themselves. We encourage them to figure on the work and to bid on the part in which they are interested and it has been found in the majority of cases that they cannot afford to take it at the contract price. This is only one advantage of the system. The main advantage being the drainage of all sloughs in one system planned with that end in view. Another advantage is the easy payments, giving the property owner an opportunity to use his ready money in completing the drainage of his farm and get the benefit in the increased crops and ease of management thereof.

Methods of Tile Draining Gumbo, Hardpan and Seepy Land in Kansas—General Instructions and Costs.

knowledge of the drainage characteristics of different classes of soils. In a paper before the Kansas Engineering Society, Mr. H. B. Walker, Drainage Engineer, Kansas Agricultural College, Manhattan, Kan., discusses methods of tile draining the three broad classes of soils encountered in Kansas. In addition, general directions for making and mapping surveys and for estimating costs are given. Average costs are tabulated. The paper in abstract was as follows:

In the first place tile drainage treats directly of the regulation of soil moisture. Secondly, the engineer should realize that the soil is the farmer's business capital. With these two things in mind it must be evident that in order successfully to design tile drainage systems for the regulation of soil moisture, we should be familiar with the drainage characteristics and capabilities of the different soils that represent the farmer's capital. It is not necessary for the engineer to be a soil expert in order successfully to carry on the drainage work, but he should at least be familiar with the different types of soils encountered in his immediate vicinity.

The soils that are the most frequently encountered in Kansas that require drainage are usually locally divided up into the three following types: Gumbo, hardpan and seepy soils. Although this is not strictly a scientific classification, it is one that is readily understood by the Kansas engineer.

Gumbo soils are often spoken of as a loam with sufficient plastic clay to make them very sticky and adhesive when wet and hard when

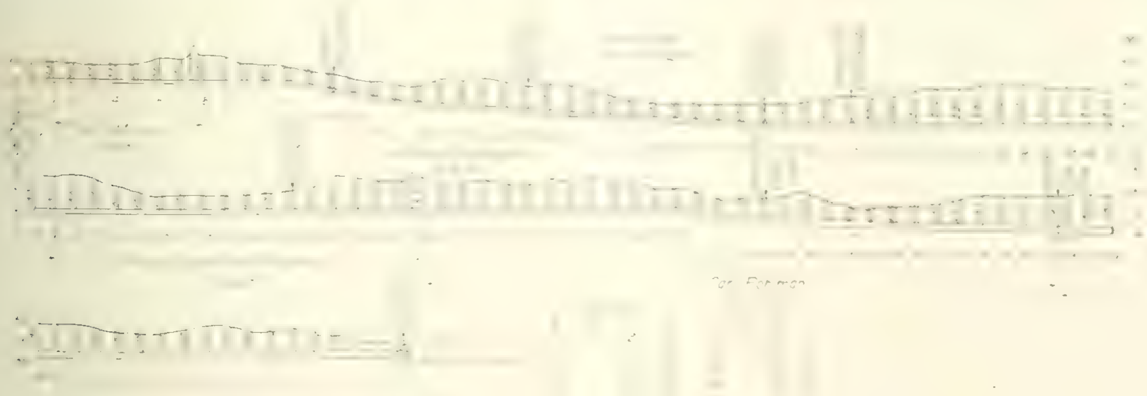


Fig. 5—Profiles of Judicial Ditch No. 14, Minnesota, Illustrating Standard Practice.

[illegible]

longed drought. Our gumbos are, generally speaking, black in color, although occasionally gumbos of a lighter hue are found in certain river valleys. These latter are sometimes spoken of as "crayfish" soils. The gumbo land is, practically speaking, limited to the river valleys. It is usually found along the bluff line at an elevation ranging from 3 to 6 ft. below the stream bank. Their low elevation, together with their great moisture retentive qualities, make such soils very difficult to cultivate when exposed to excessive moisture conditions. They are, however, very fertile when properly cultivated.

The drainage properties of gumbo soils are naturally very poor, yet by artificial drainage they can be made very desirable agricultural lands. There has always been a general impression among land owners that gumbo would not tile drain. In many instances failures have been reported, yet where care has been used in construction, these soils have been successfully tile drained. It should be remembered that the purpose of the underdrain is to regulate soil moisture or, in other words, to regulate the water within the soil. For this reason the engineer should not recommend the tile drainage of gumbo areas until good surface drainage has been secured. If surface ditches cannot be constructed to carry away the storm waters, ample provision must be made to carry it under ground by increased size of tile drains and properly constructed catch basins. On account of the extremely high rate of precipitation in the eastern portion of the state, it is very doubtful if underground drains can yet be economically constructed for removing any large amount of storm water from agricultural lands. A little preliminary level work and careful inspection will usually suggest some practical method of removing this storm water by surface ditches.

The physical properties of gumbo soils do not permit the free percolation of water by gravity. The drainage pores are poorly defined and tortuous. With such soil conditions the necessity for good surface drainage is at once appreciated. However, the excessive soil moisture can only be removed by under drainage. Proper tiling affords a means of escape for this excessive water and once removed, the air that replaces the moisture serves to increase the friability of the sticky soil and unlock the stored-up plant food.

Frequent and rather deep under drainage is required to properly develop such areas. The compact, sticky character of the soil offers a great resistance to the action of gravity upon the free water so that tile drains will not lower the water table for any considerable distance on each side of the tile drain. Moreover, on account of the great depth of soil, the water table should be lowered as much as possible in order to increase the available amount of plant food. These areas on account of their flatness usually require a gridiron system of drains. Great care should be exercised to locate the mains so that all natural fall can be utilized. The laterals should be placed in such directions as will require the least number of junctions, give the greatest length of tile line and at the same time adhere whenever practicable to the natural slope of the land. The usual depth of tile is about 3 ft., with spacings of parallel lines about 60 to 70 ft. apart. The engineer should remember, however, that the outlet or fall available may somewhat modify the depth so that it may be more economical to decrease the depth and spacing than to invest large sums of money on a deeper outlet. However, the author is inclined to believe that the economic depth exceeds 3 ft. and spacings can economically be as low as 40 ft. Again, where funds are limited the spacing may be increased with the expectation of doubling the number of laterals later. These details must be considered and determined by the engineer, who should be able to judge from the natural and economic conditions the plan to follow that will give the most satisfactory results for his client.

HARDPAN [illegible]

The close-grained refractory soils of the upland areas are a second class that the engineer will often encounter in his drainage work. These areas have a fairly rich surface soil with good drainage properties, but the sub-soil being finely divided, compact and of uneven surface, prevents not only the free percolation of water downward, but its free lateral movement as well. These sub-soils become very sticky, pasty and putty-like when wet and very hard when dry. The extremely thick nature of many of these sub-soils frequently accounts for the poor natural drainage of the soil above it. In some cases soils are encountered where comparatively thin layers of sub-soil are so compact and cemented together as to prevent the free movement of water by gravity. These latter soils are known as hardpan lands. Generally speaking, however, any upland soil that has a refractory heavy sub-soil is locally known as hardpan. Such soils are benefited not only by the removal of the excessive moisture lying above the compact sub-soils, but by the aeration of the compact masses resulting in their slacking, thereby increasing the depth and friability of the soil. Such areas should be carefully studied by the engineer before any definte plan of drainage is laid out. Usually there is ample surface drainage and it remains largely to place the underdrains where they will give the greatest service. On rolling land the tile line should be placed diagonally across the slope, and on flat lands parallel with the greatest fall. The economic depth will vary with the depth of surface soil. Where the sub-soil is 8 ins. or less below the natural surface, it is doubtful if such land can at present be economically improved by drainage and aeration. This depth of surface soil will necessarily regulate the depth and spacing of the drain. All tiles, even in hardpan lands, should have a cover of at least 24 ins. The most satisfactory spacing for present economic conditions will vary from 50 to 80 ft. apart for the ordinary wet upland prairie.

Great care should be exercised in refilling the trenches. The top soil from the excavation should be placed in the bottom of the trench when refilled. This changes the structure of the sub-soil over the tile and permits the free percolation of the water to the drain, thus adding greatly to the success of the project—a thing that should always be kept in mind by the engineer.

SEEPY SOILS.

A considerable percentage of the wet land in this state is caused from seeps. Land which has apparently good natural drainage is very wet and marshy. The local engineer should be able to control these places with as little cost as possible and still secure satisfactory results. Judging from the general character of "springy" land, it is at once evident that the source of the excessive moisture is from a higher elevation than that of the wet outcrop. To successfully reclaim such places it is necessary to intercept the underflow before it has an opportunity to rise to the surface. It is found in actual practice that a single tile line placed at right angles to the slope above the wet outcrop and deep enough to intercept the line of underflow will, in most cases, successfully drain the wet seepy area. The principal thing for the engineer to remember in draining such tracts is to place the drain deep enough and follow the general contour of the slope, yet always dropping farther down the slope as the outlet is approached. The size of drain should usually be larger than that used for the ordinary type of soils. All wet areas, especially along bluff lines in the river valleys, should be carefully inspected to determine the possibility of a tendency for the land to be seepy before definite drainage plans are laid out. The economic drainage of such areas can only be accomplished as outlined above.

SURVEYS AND ESTIMATES.

Some simple preliminary levels should be run following the inspection of the soil in order to determine the relative elevations of the area to be drained. These elevations need only to be taken at the controlling points in the field (that is, the outlet, extreme low points and high ridges) and their relative distances can be carefully estimated for preliminary grade calculation maximum cuts and required depth The extent and elaborateness of t nary work will depend largely upon raphy and size of the field. All notes should be fully recorded in neer's field book with sketches sh relative location of the controlling other topographical features likely value in the final location of the dr preliminary notes should be amp engineer to give a reasonable estin cost of the proposed work.

In making estimates the follow should be carefully considered: (tile, (b) cost of digging and laying, ing the tile, (d) refilling the trench neering and contingencies. The c will vary with the locality and pri always be secured from some r manufacturer before the final estima The cost of digging and laying is u mated at so much per rod, depen the size of tile and depth of trench can be estimated at from 2 to 5 ct Hauling should be figured on a basi per ton per mile with a minimum of $3 per day for a man and team.

Table I shows the average weig ferent sized clay drain tile, cost and laying and cost of refilling for 4 to 12 ins. in diameter.

About 10 per cent should be ad total cost for engineering and contin

All drains should be carefully sta the field previous to construction stakes should be set every 50 ft. fo drains and every 100 ft. for the later stakes should be set about 18 ins. of the proposed center line of the all stakes should be carefully num set to the numbers face toward Hub stakes should be set about 4 ins 4 ins. to the left of the line stake flush with the ground. All chang direction of the trench should be joining the straight sections of the long easy curves. Where sharp c necessary line and hub stakes sho every 25 ft. All levels for cuts taken from the tops of the hub rod readings taken to the nearest of a foot. The cuts issued should puted from top of hub stake to trench. These should be issued in hundredths or in inches and feet, by the contractor.

In establishing grades, controlli should first be determined and the joined by such grades as will res most efficient and economical drai tem. Grades as low as 1 in. in 100 not be used for sizes less than 6 ins. eter unless unavoidable. For sizes diameter or greater, grades of 1 in. are satisfactory when properly laid. always be kept in mind, however, th flat grades are used a relatively lar is necessary. The size of drain will with the amount of surface water moved. For general conditions wher face drainage is good, tiles designed from ¼ to ½ in. of water every 24 be found amply large for our conditi

When establishing grades for later a drop of 3 ins. in the first 3 ft. of t tile line should be allowed at the jun laterals should enter the main line at of about 30°. The trenches shoul cavated with smooth, regular grade grading should be measured from of the ditch to top of hub stake by proved method of grading from a sur mand that all tile be laid with the joints possible and that all unavoida joints greater than ¼ in. be properly with broken pieces of tile.

After the tile have been laid t should be checked by the engineer. be done by taking levels at frequent on top of the tile line and adding outside diameter of the tile to the ing before determining the grade. Th ings should be taken at random along

TABLE I—AVER

Av. weight per ft. of length.	or less.	feet	per rod.
6½	$0.33		
8½	.33	.1	
	.33		
1			
	.45		
35	.50		

man giving the approximate "plus reading. Amp ade for warped tile, yet all pieces nd to be "off grade" or having f" should be ordered taken out and ar afterwards rechecked.

Kasas conditions engineers should not the use of tiles smaller than 4 ins. 3-in. tile have been extensively used, but many failures due to filling up are reported annually. The kind of tile may be

should be rejected. Cement tile made from mixtures leaner than 1 to 4 should never be recommended. For the larger sizes a 1 to 3 same, first quality clay tile are preferred since they are easily inspected and of known durability. If soft tile or cracked tile are laid at all, they should be placed together at the upper ends of the lateral drains as far as possible from subsequent trouble. Cracked pieces should be laid so that the line of fracture is at an angle of 45° with the vertical and horizontal axis of the drain.

The above discussion only briefly brings out a few of the main phases of tile drainage work. While they are largely elementary, they are fundamental and should be considered by the Kansas local engineer in developing the tile drainage work in his vicinity. This paper was prepared with only Kansas conditions in mind and was not intended to apply generally. Special reference was made to soil conditions, as this is an important phase of drainage work that is too frequently neglected by practicing engineers.

EAM AND ELECTRIC RAILWAY SECTION

and Construction of a Rein- Concrete Telegraph Pole Line the Hackensack Meadows, New Jersey.

nstruction and d concrete telegraph poles are t paper by Mr. George Gibbs, M. E., before the National Association nt Users as follows:

facilities required on the New al Division of the Pennsylvania he company's telephone and tele- The line for this purpose forms the New York-Philadelphia m its point of intersection with l Division at the east side of the r near Newark, N. J., and con- le line along the right of way inuous five mile stretch of semi- w swamp land known as the Meadow," to the tunnel portal Hill, the Hackensack River being way of the section. The ground vered with a heavy growth of the top stratum is a peaty bog, ft. deep, underlaid with varying y, fine sand and mixed sand and ry considerable depth. It will be ore, that the problem was to pro- esign of pole which would not only in itself, but which could be set in a undation in a soft and uncertain It was desired to make the line en- ure against interruption by severe by fires in the swamp reeds. It ap- nder these conditions, that the ordi- wooden pole would not be wholly y, either as regards strength for avy service, or as regards safety from ent meadow fires.

se of reinforced concrete poles for ose appealed to us, but very few re- ta about either the cost or service h poles were obtainable. In Europe or had observed the quite extensive ncrete poles, chiefly for electric trans- purposes, but details of their con- were not at hand. These poles are y of structural steel covered with a coating of concrete, and sometimes ood encased in concrete, and much has been expended in devising spe- ns of composite poles, but with what success it is difficult yet to say.

esirability, however, of securing a reproof line across this section of the s so great that the writer undertook in his office a simple form of rein- oncrete pole, which could be manu- on or near the work and at a cost ould not be prohibitive. Without data to go upon the design evolved what experimental, and probably the re given will not be of very great e in fixing a precedent for an ordinary telegraph pole, as our conditions called for heavier construction than is usually required. The data, however, are given for what they are worth, as indicating a heavy and difficult piece of construction to meet a special condition.

Design of Line.—Altogether 202 poles were required, spaced from 70 to 135 ft. apart, with an average standard spacing of 120 ft.; the variations in span being due to numerous railway and highway crossings. The height of the tops of the poles above the ground also varies with the local conditions from 25 to 50 ft., and the total length of the poles from 35 to 65 ft. The loading called for an ultimate capacity of 60 open telegraph wires and two 40-pair telephone cables and one signal control cable. The open wires are of copper, Nos. 7 and 8 B. & S. gage, and the cables are Nos. 13 and 16 B. & S. gage insulated wires, with a lead covering. The cables are carried by steel messenger wires. The weight of the wires and cables is 10½ lbs. per running foot, giving a total loading for the average span of 1,268 lbs. per pole, or, including cross arms, insulators, brackets and fittings, of 1,500 lbs. per pole. In addition to this static vertical loading, emergency conditions were assumed of an extra loading of ½ in. of ice on the wires and a wind pressure of 8 lbs. per square ft. on wires and 13 lbs. per square foot on the poles. The stresses under these conditions were not to exceed the elastic limits of the wires and of the carrying structures. These assumptions are equivalent to a vertical loading of 7,600 lbs. per pole and a horizontal force of 4,000 lbs. exerted 1 ft. below the pole top. The normal sag of the wires at 60° is 4½ ins. and the normal tension is 273 lbs. for No. 8 wires and 130 lbs. for No. 9 wires. The maximum hot sag at 130° is 11 ins.; the tension in the wires under maximum wind pressure with the ice loading and at 20° is 702 lbs. and 470 lbs. respectively for the two sizes of wires.

Fig. 1—Details of Reinforced Concrete Telegraph Pole, Pennsylvania R. R.

The design adopted is a pole, square in cross section with chamfered corners, and having a taper of ½ in. in 5 ft. The concrete is of 1½:2:4 mixture, assumed to have an ultimate strength in compression of 2,000 lbs. per square inch. The reinforcement is composed of mechanical bond bars tied together into a square skeleton frame, and in the complete pole this reinforcement is covered by a 1-in. minimum thickness of concrete. Figure 1 and Table I give details of the complete construction.

In order to manufacture the poles economically a yard was established adjacent to the right of way and with side track connections for delivery of materials. The ground was levelled and set with stringer pieces, 3 ft. apart, of old wooden car sills, so as to furnish a convenient surface upon which to erect the timber forms. This yard permitted the simultaneous manufacture of six poles and the storing in place of 90 poles during the period of seasoning. In the process of manufacture the skeleton reinforcement is first made up, as shown by Fig. 2, the twisted steel mechanical bond bars being tied together to form a square skeleton frame; this frame is then suspended at the proper height above the ground and the sectional wooden frames put in position around it. The concrete mixture is then poured in and carefully tamped. In this way six poles were made per day and were left in place at least 16 days to season.

Foundations.—After a number of experiments it was found best to set the poles in pits excavated in the marshy stratum. These pits were generally about 9 ft. square and 5 ft. deep, and a timber grillage was placed around the base of each pole and about 5 ft. below the top of the ground. This grillage, Fig. 3, consisted of six cross-ties bolted together and to the pole and partly planked over by 3 in. rough lumber. The pole, which projected below the grillage and was pointed at the butt, was jetted down, Fig. 4, by compressed air into the sandy layer, so that the grillage would rest at the bottom [illegible]. The [illegible] then backfilled with rock and clay. Poles on curves are cross-guyed, and the terminal and railway crossing poles are head-guyed with steel cables.

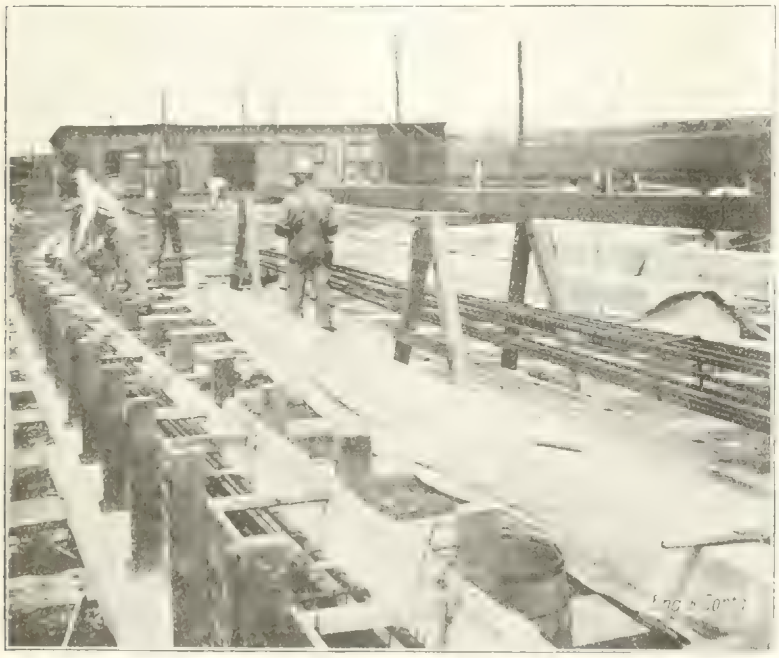


Fig. 2—Sequence of Operations in Molding Reinforced Concrete Pole.

In order to determine the stability of the foundations, as above described, as well as the transverse strength of the pole itself, a test was made of a 55 ft. pole set in a 13 ft. deep foundation. The test consisted in applying a horizontal pull 39.5 ft. from the ground. The breaking load was 4,360 lbs. and the point of fracture 20 ft. (see Fig. 5) from the ground, at the top of the 32 ft. reinforcement bars. The foundation itself was found to be amply secure.

TABLE I.

Length	Equivalent pull 1 ft. from top	Edge distance [illegible] steel	Area, steel	Extreme fiber stress in concrete compression	Unit comp. stress in steel	Weight of pole	Cu. ft. concrete	Weight of steel, lbs.	[illegible] ft. of wire wrapped around pole
30 ft	4,066	1.75	3.38	1,953	19,059	5,000	33.15	819	[illegible]
35 ft	4,321	1.75	3.63	2,087	20,480	6,200	41.44	1,077	273
40 ft	[illegible]	1.75	4.03	1,917	19,667	7,600	50.75	1,309	[illegible]
45 ft..	4,647	1.75	4.40	1,987	20,428	9,200	61.58	1,493	[illegible]
50 ft......................	4,763	1.87	4.73	1,886	19,692	11,006	73.24	1,792	431
55 ft......................	4,860	1.87	5.00	1,832	19,155	13,000	86.58	1,974	490
60 ft......................	4,945	2.00	5.30	1,812	19,083	15,000	101.28	2,249	553
65 ft......................	5,020	2.00	5.48	1,976	18,791	17,600	117.23	2,575	618

Cost.—The actual cost of labor and material [illegible] these [illegible] unit cost for an average length pole of 40 ft., weighing 7,600 lbs., was as follows:

Forms, labor and material	[illegible]
Concrete, labor and material	[illegible]
Reinforcement, labor and material	[illegible]
Total per pole...........................	$77.50

The above does not include cost of preparing site, engineering, etc., and is for the bare poles (without fittings or foundation timbers).

To obtain the cost of the poles erected there must be added the cost of loading, distribution, foundations and setting, cross arms and fittings, but these items were special to the particular location and would be of little use as [illegible] general information. It [illegible] stated, however, that the cost of hand g and erecting these heavy poles was con erably more than would be the case for wood poles; furthermore, care must be taken in ading and unloading them and special appli es are required for their erection.

In the special case in question it wa [illegible] that the cost of the line erected com e was not greatly in excess of that of an qually stable wooden pole line, as in order meet such a condition it would have been essary to employ H frame poles and set em in [illegible]ally expensive foundation pits. In e ca

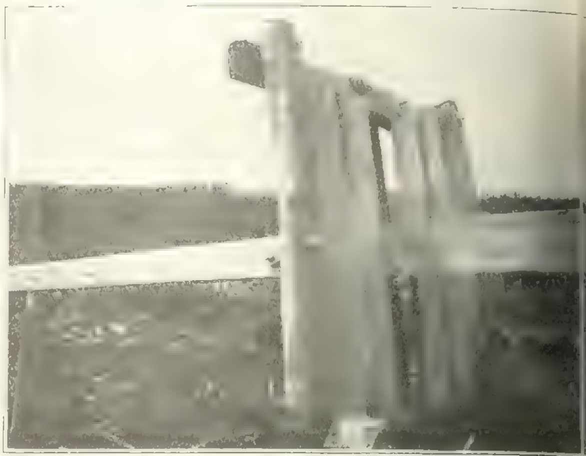


Fig. 3—View Showing Grillage Pole Foundatio

of this line it is interesting to note foundations and setting cost considera than the poles themselves.

To sum up, it may be said that for ticular case of this heavy line havi difficult foundation conditions, the u reinforced concrete pole resulted in a safe and neat appearing construction additional cost to that of a wooden inferior in all these respects. For the class of telegraph lines, however, the would anticipate that concrete poles w ways cost more than the wooden p struction, as ordinarily designed and e

The House committee on intersta merce has adopted a bill for the ment of the Panama Canal Zone President is given authority The maximum toll is $1.25 per ton a minimum must not be below an sufficient to maintain and operate the American ships are not to be given ence over ships of other nations.

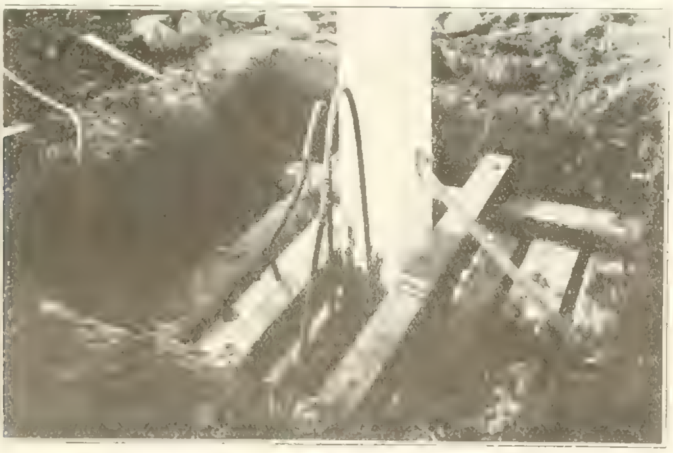


Fig. 4—View Showing Jetting Down of Pole Foundation.

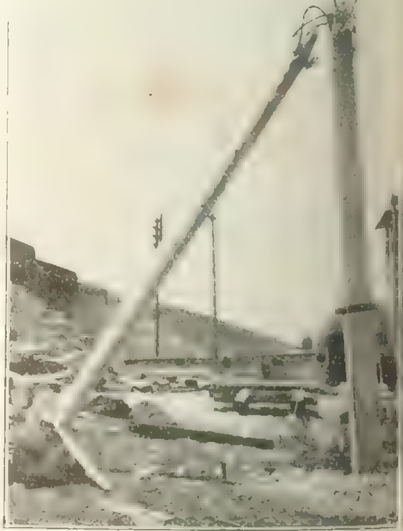


Fig. 5—View Showing Break of Teste Pole.

Delopment of the Railway Rail n the United States.

f the development of the railway 1 and structure to its present standle the subject of three papers which of the report of the Committee the American Railway [illegible] These papers may be summar- [illegible]

—View Showing Poles Placed Ready for Erection

Fig. 7—View Showing Erection of Poles With Derrick.

ient up to the time the subject p by the American Society of rs, together with the questions ality of earlier and later rails, il steel as compared with Amer- P. H. Dudley. (2) The history tion of the American Society of rs with rail design and specificar with the questions of lower eavier rail sections, by Dr. Thos. (3) The question of the im- f rail design and specifications erican Society of Civil Engineers' to the present time, together sion on the subject of fixed perscard, by Mr. W. C. Cushing.

Fig. 8—View of Completed Pole Line

History of Rail Development.*

first ten miles of the Philadelphia & Railroad (chartered in 1830), strap e laid upon stone sills, which were in is parallel lines. The strap iron rails ft. long and were attached by small iven into cedar plugs in the stone

[illegible]

been built in this country.

tween 1840 and 1850 so many accidents occurred from their use that in New York State, in 1844, their further employment was discontinued.

Robert Stevens, in 1830, for the Camden & Amboy R. R. designed a T-section of iron rail, nearly similar to those of the present type in use. That is the only form of the early rail which has remained as a survival of the fittest of the many different sections employed. Pear-shaped iron rails were imported from England, and many of these, made out of refined iron, lasted several years under the light wheel loads, but when they increased to 10,000 or 12,000 lbs. upon the drivers the rails failed with great rapidity.

Broken rails were so numerous in the sixties that the railroad officials tried the Booth steel-capped rail, which had a surface of about ¼ in. of crucible steel rolled on to a stem of wrought iron, but the surfaces were not welded and did not last long in the track.

Bessemer rails were rolled in England and tried by many of the railroads, commencing about 1860, and in 1863 a number of trial orders were placed for similar rails in this country. The cost at the time of $100 to $120 per ton, in gold, to which was added the premium of 40 or more per cent in our currency, forced the railways to use as light a section as possible of the steel. Many of the sections of 56 to 58 lbs. per yard, 4 ins. in height with comparatively a thick base but thin heads, were imported and tried. The steel rails in places of severe service would outlast ten to fifteen of the best iron rails which could be secured. Bessemer steel works were inaugurated in this country about 1866.

The sections were only 4 ins. to 4¼ ins. in height, and the deflections of the rails under the passing wheel loads permitted nearly the entire concentration of the wheel load on each cross-tie. The rail sections were stiff enough to distribute only a small part of the load in the wheel spacing and while the cost of maintenance for track work was high the loss of metal per yard was quite small. The light sections did not permit the development of the wheel loads and enlargement of the locomotives and cars as much as was desired by the railroads for the demands of transportation. The loss of metal per yard in service proved to be so small that the consensus of opinion was general that from the excellent wear of the thin-headed sections a residual section might be designed of sufficient strength to carry the traffic and add to the head the amount of metal desired for wear. The base of the rails were made thinner and 50 per cent or more of metal put into the heads of the rails. These sections when rolled out of practically the same chemical composition did not give the results of former sections, owing to more massive heads and coarser structure of metal incident to the greater heat units in the metal of the head to cool.

The change in this form of section was made by a committee of Engineers in about 1870 and sections they recommended were in service in 1874. The excellent results which they expected to obtain were not secured in subsequentt service and the increased demands of transportation for better and smoother rails that would reduce the generated wheel effects of the moving trains was so important and there was such a diversity of opinion in reference to the sections of rails that in 1878 I designed my Track Indicator and constructed a car in which the measurements of the undulations of the tracks could be made. One part of the mechanism of the apparatus summed the undulations in the rails under the special truck, into feet and inches per mile, by which a comparison could be made of the different conditions of the track per mile. It also recorded by large diagrams, on a scale of 1 in. of paper to 50 ft. of track, the actual vertical undulations and low joints in the tracks. The conditions or smoothness of the steel was an important factor, and also the stiffness of the rails.

This led to the design of the 5-in. 80-lb. rail for the New York Central & Hudson River R. R. in 1883, which was rolled and

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H Dudley

[illegible] lbs. to the ordinary 65-lb., 4½-in. rails, then used for the heaviest service, and making an 80-lb. section, 5 ins. high, the actual stiffness of the section was increased 66 per cent over the ordinary 65-lb., 4½-in. rail. The section was rolled and placed in the tracks in July, 1884, and demonstrated at once that the increased stiffness in the rail was of decided advantage to the stability and capacity of the track, and raised the standard of maintenance.

Several of the Eastern roads adopted either a 5-in. 80-lb. section or one of heavier weight, the Pennsylvania Railroad making a 5-in., 85-lb. section. I made for the Boston & Albany Railroad a 5-in. 95-lb. section and rolled it out of 0.06 phosphorus and 0.65 carbon steel for their heavy gradients and sharp curvature. They commenced to lay the rail in 1891 and completed the entire line in 1897. In 1892 my 6-in. 100-lb. rail was laid through the tunnel of the Harlem Line. This gave a greater stability to the track than was possible in sections with 5⅛-in. 80-lb. rails.

Investigations by the American Society of Civil Engineers.*

The first action taken by an organized body of engineers in relation to the character and quality of the rails used on the railroads of this country was had by the American Society of Civil Engineers in 1874, in the appointment of a Committee to investigate and report on "The Form, Weight, Manufacture and Life of Rails." This committee made a progress report in June, 1874, again in May, 1875, and a final report in June, 1876.

At these dates the use of steel rails was in its infancy, and comparatively few had been laid on American railroads. Such as had been laid had been down too short a time to warrant the Committee in drawing conclusions in regard to them; hence, the reports of this Committee dealt almost exclusively with iron rails, with only incidental reference to the use of steel, and therefore they have no bearing on the questions now before us.

Steel rails first appeared as an established commodity in the market reports in 1868. From the first they rapidly began to displace the old iron rails, and in 1882 the latter had ceased to appear as a market commodity.

Sections.—During the first 50 years of railroad development many different sections had come into use, and there was no common standard. In 1887 the American Society of Civil Engineers again appointed a Committee, this time charged to consider "the proper relation to each other of the sections of rails and wheels." This Committee made a progress report in 1888, and a final report in 1889, and in the following year, 1890, following the subject still further, another Committee was appointed to prepare and submit to the Society a series of "Standard Sections," for rails of different weights per yard.

The Committee made a preliminary report in 1891, and a final report in 1893. This latter report was accompanied by a series of sections for rails, weighing from 40 lbs. to 100 lbs. per yard, varying by intervals of 5 lbs. These sections were approved by the Society, and promulgated as the "A.S.C.E. Standard Sections."

They met with favor and were adopted by many railroads, so that in a very few years about two-thirds of the output of the rail mills conformed to those sections.

Specifications.—As might be expected, with the engineers of the country acting independently, with imperfect understanding as to the effect on the finished product of different elements in different proportions, accented by more or less variation in the process, as practiced at different mills, a large number of specifications came into existence, differing in their requirements as to chemistry and physical requirements.

The oldest specification now before the writer bears date 1876, and makes no mention of the chemistry. It required a tensile test from each heat, the test piece to be cut from the head of the rail. 1879, requires that the carbon shall be between 0.30 and 0.50 per cent, but it is silent as to other elements. In later issues, manganese and phosphorus were added, and still later silicon.

This is probably typical of the process of development of rail specifications generally, but, as already stated, the resulting specifications differed from each other in many respects.

With the growing prosperity of the country, there was an increasing demand on the transportation facilities, which led to a gradual increase in the weights of rolling stock. This was met by the engineers by correspondingly increasing the strength of the rails. But it was soon found that the larger sections wore out faster on curves than the smaller sections had done. This was due to the fact the larger sections cooled more slowly and underwent a partial annealing rendering the metal softer and less resistant to the grinding action of the flanges against the side of the head. Some engineers sought to remedy this by specifying an increased proportion of carbon, varying with the size of the section. This added still further to the diversity of the specifications.

The Improvement of Rail Design and Specifications, from 1893 to the Present Time.*

The period between 1893, the year of the adoption of the standard rail sections of the American Society of Civil Engineers, and the First Annual Convention of the American Railway Engineering and Maintenance of Way Association in 1900, was occupied by the railway engineers in the study of the behavior in the track of the rails rolled according to the new designs, which were rapidly put into service by the different railroads of the country.

A preliminary meeting of the railway engineers was held in Chicago on October 21, 1898, for the purpose of organizing the American Railway Engineering and Maintenance of Way Association. In order to hear the first reports of Standing Committees, the first convention was held in March, 1900, in Chicago, and among the Standing Committees was one on Rail.

The report of the Committee was largely historical, but it was developed at that and subsequent meetings that the subject was going to be one of the most important and most interesting of those to come before the Association in the future.

The work of the Committee of the American Society of Civil Engineers was undertaken with the object of improving the design or cross-section of rails, and did not undertake the preparation of specifications for their manufacture or inspection, but each railway company issued its own specifications, which were not specifications for manufacture, but for inspection. These specifications differed from each other in various details, such as the method of testing, the allowable variations from the templates, the smoothness of the surface and the workmanship generally, while but little was said about the chemical composition. Indeed, this state of affairs must have been quite annoying and expensive to the rail manufacturers, and, as all railroads were striving for exactly the same object, viz., to obtain the best material which would make an absolutely safe steel rail, the unification of the specifications seemed to be very desirable, and if it could be brought about, the existence of the Association would be entirely justified.

At the Annual Convention in 1901, it was ascertained that the rail sections or designs of the American Society of Civil Engineers were in use by about 70 per cent of the railroads of the country, and it soon developed in the discussion that the rail steel in use by the railroads was not giving very good satisfaction. This dissatisfaction pertained to all sections of rails, and the railway engineers thought that the trouble was largely due to the temperature of rolling being entirely too high, leading to the expression of one member that "the material was squirted through the rolls." The engineers of the
facturers, who were also members
sociation, contended, on the other
the fault was due to the rail sec
especially to the thin base desig
American Society of Civil Engineer
developed that the railway engineer
the trouble was entirely due to impr
esses of manufacture, while the rail
turers' engineers placed the fault
sign of the rail cross-section.

It was apparent, therefore, that th
tee must study both the question
and the question of rail manufactur
ter with the special object of dev
and methods of inspection which w
surely determine whether the mat
up to the requirements of service
was quite evident that this work w
long duration, because it was nece
more study than ever before should
upon both the question of rail desi
manufacture, and it would be ne
proceed slowly and carefully, in ord
the misinterpretation of statistics
mation.

Prior to this time, so much had
by railway engineers about the nec
rolling at lower temperature that,
the Kennedy-Morrison process of ho
just before the final passes until the
the desired temperature, after which
put through the final passes at that
ture, was introduced by Carnegie S
pany, and great expectations of the
the results were held. At the same
rail manufacturers began rolling at l
perature and claimed to accomplish
results. The process did not, howe
the results expected, as the effect
skin deep, for when the skin wor
ordinary metal was exposed underne
rails rolled after its introduction
rather more failures than usual, and
time the value of rolling at low te
has been rather uncertain. This exp
mentioned to show that the value
changes in process of manufacture
be developed after long experience,
one of the reasons why an investi
this kind is bound to cover a long
time.

In 1895, at Zurich, Switzerland, t
national Association for Testing Mat
organized to bring about "the de
and unification of standard methods
for the determination of the properti
terials of construction, and of other
and also the perfection of apparatus
purpose." On June 16, 1898, or b
months prior to the organization of t
ican Railway Engineering and Maint
Way Association, there was formed,
delphia, the American section of the
tional Association, which, a few ye
was renamed "The American Society
ing Materials." The American sec
composed of manufacturers as well a
sulting engineers, railway engineers,
ers, and had already begun the stu
specifications. Therefore, at its Ann
vention in 1901 the Rail Committe
American Railway Engineering A
submitted the rail specifications reco
by the American Branch of the Int
Association for discussion, in ord
the subject under way.

Specifications for steel rails hav
consisted of three general parts:

(1) Chemical requirements or p
(2) Physical requirements; and
(3) Details of manufacture.

Up to that time the various rail
panies emphasized one or more of th
according to their individual preferen
perience. Some almost ignored the
requirements, others were more or l
orate in their physical requirement
some barely touched upon details of
ture, and others treated the subj
elaborately.

[illegible]

chemical properties of these propose
cations for Bessemer steel rails were
the Carnegie Steel Co., and they are
standard chemical specifications of

[illegible]

[illegible]

[illegible] Testing Materials, with scarcely tions. [illegible]

fications for foreign use were prac- [illegible] charges which [illegible] fications by the steel manufacturers American Society for Testing Ma- to the present time are to make for 60 to 70-lb. rail .35 to .45, and [illegible]

w exceptions, the railroads of the ates have accepted these chemical s as recommended by the rail man- because they have considered that cal properties were only a minor e specifications for rail steel, com- the physical requirements.

Properties.—Two general methods the physical requirements had been to the year 1900, viz., a bending mall bar ½ in. to ¾ in. square and 20 ins. long, and a drop test, which [illegible] Some railways used one method, her and some both, but by 1900 test had been generally aban- r of the drop test.

omary to make a test of *every* steel, and to let the weight fall ing heights, according to the pleas- maker of the specifications. The specifications of the American tained this method of testing the erties by dropping the weight of very fifth heat of steel, from a [illegible] 17 ft. for rail weighing 65 to yard, 18 ft. for rail weighing 75 per yard, and 19 ft. for rail weigh- 100 lbs. per yard, but these condi- [illegible] Engineering Association, as there ong feeling among the railway en- at more severe conditions of testing ssary. They felt that the chemical ld be left to the greater ex- chemical knowledge of the rail- s, but that they must be the ones he physical tests which the fin- must stand in order to be accepted important service as carrying the fic of the country. In 1904, there- neering Association decided that stead of *every fifth heat* of steel. d, and that the height of the e increased.

ascertained that the rail butts sted under the falling weight had he bottom of the ingot, and it le a part of the specifications that should be taken from the top on account of the probability metal would be less perfect at that [illegible]

every heat instead of every fifth erly, was considered little short on in the method of testing at [illegible]

lanufacture.—Except in the case npanies, the specifications in re- ls of manufacture were not elab- ecifications being confined almost llowing for variations from the plate and from the length of the thness and perfection of finish.

[illegible]

f the agitation for colder rolling. ania R. R. had introduced into [illegible] at the last pass should be at a ferably a dull red, but in 1901 l it with a so-called "Shrinkage h was intended to control the f the rail when being finished, by hat the shrinkage, after the rail should not exceed a certain num- s. This clause was also intro- e proposed specifications of the Association, making an additional nt in the details of manufacture.

there has been a great deal of ar- [illegible]

I.

			80-90 lbs	90-100 lbs.
Carbon			.43 to .53	
	[illegible]	.10	.10	.10
Silicon	.20	.20	.20	.20
	.70-1.00	.75-1.05	.80-1.10	.80-1.10

[illegible] into the specifications of the American branch of the International Association of Testing [illegible] rial should be discarded from the top of the [illegible]

When that clause was adopted, in 1901, and for a number of years afterwards, the positions of the rail manufacturers and the railway engineers were reversed, the railway engineers believing that it was best to specify a definite amount of discard, while the rail manufacturers took the opposite view. It was well expressed by an engineer of one of the steel companies, who said: "I do not think this Association, nor any other, should state definitely how much should be sheared from the bloom. The matter is entirely one-sided. If we agree here that 25 per cent shall be sheared from the bloom, we might assume that would settle it, but it will not. The Association will be perfectly safe in making the claim that sufficient shearing will be done to eliminate piping. If the manufacturers can remove the piping by shearing 15 per cent they will not agree to shear 25 per cent. The object in shearing is to get rid of the piping, and the only matter of agreement will be to reach the point where sufficient shearing is done to remove the piping. For that reason, I think the Association will make a mistake to demand that 25 per cent be sheared off."

The railway engineers of today unanimously agree with that point of view, and their position has been further strengthened by an additional test, which will be described later. Furthermore, the records of rail failures which have been kept for a number of years disclose the incontrovertible fact that, where a 15 per cent discard might do for one ingot, 50 per cent would not be adequate for another.

In 1902, the American Society of Civil Engineers deemed it advisable, in view of the continual criticism of the sections of rail which they had previously designed, to take up once more the study both of rail design and specifications, and accordingly a committee was appointed for the purpose.

The Committee of the American Society for Testing Materials also continued its study of the rail question, and joint meetings of all three committees were held so that each would derive benefit from the work of the other.

On April 25, 1906, the Committee on Standard Rail and Wheel Sections was appointed by the American Railway Association, and on Oct. 24, 1906, the Committee was directed to report in addition on the subject of specifications for the manufacture of steel rails, in connection with its report on standard sections. The rail manufacturers were asked to co-operate with the committee by sending representatives to study the question with it at its meetings, and in addition the committee employed disinterested men of national reputation in their knowledge of steel making and the properties of steel, to give expert advice [illegible] a report was submitted, Oct. 30, taining the recommended rail s [illegible] Hearth steel. [illegible] of the properties of steel and its manufacture, and final report was submitted by the committee on April 22, 1908, with the recommendation that there were many details of [illegible] results in service of the new types of section, rolled under the new specifications, which would require considerable time and much careful study, and that they could be more efficiently and more appropriately handled by the American Railway Engineering Association. The sections and specifications were, therefore, referred to the American Railway Engineering Association, with the request that they follow up the question in its various [illegible] sults, with a view to determining whether any changes should be made, either in the specifications or designs.

As the question of discard was dealt with in these reports quite fully, it is advisable to make quotations therefrom, because the earnest consideration given to the question led to the development of an additional test, which is considered of great importance in determining the quality of metal by eliminating a large number of the so-called "piped rails," or rails with interior defects:

[illegible]

The Manufacturers, however, presented considerable evidence which tended to show that a fixed minimum percentage requirement would be not only unfair but unscientific, claiming that the extent of piping and segregation is influenced by the size of the ingot, the rate of pouring into the mould, and other details of mill practice.

With regard to the discard question, the committee has always been of the opinion that it would be preferable to test the finished product rather than specify as to details of mill manufacture.

In pursuing its investigation of this discard [illegible] from Mr. Wm. Mcealf to the effect that it would be reasonably practicable to apply the above theory to the manufacture of rails by arranging to test to destruction a number of rail butts representing a certain portion of the total output, and to base rejections on the results of these tests.

In order to avoid the unnecessary waste of good material, the committee set about to devise means by which the rejection of defective material could be insured without requiring an arbitrary and definite percentage of discard in every case, and a committee of the Pennsylvania Railroad System pursuing the same line of investigation, had adopted a tentative specification which provided for a physical test of this nature, and which further provided that when physical defects were discovered all top rails of the heat should be rejected. This would result in a discard of about 25 per cent to 30 per cent of the entire metal in the heat whenever physical defects were discovered, and it was felt that a requirement of this nature would not only provide for the rejection of defective material, but would insure the greatest care on the part of the manufacturer.

A trial lot of the rails of a section corresponding to Type "B" was recently rolled under these specifications as to discard, and the results convinced the committee that a development of this idea would prove the best solution of the discard problem.

In connection with the Details of Manufacture, an important addition was made by requiring that the brand on the rail should also contain a letter marking the position which the rail originally occupied in the t, so as to enable a study to be made of ffect of that position.

On June 5, 1907, a committee of the Civil and Mechanical Engineers of the Pennsylvania R. R. system and two rail manufacturers was appointed to take up the study of the rail question, and design new rail sections and recommend new specifications, with the object of improving the quality of the material used in rails manufactured for that system.

[illegible] meeting was held [illegible] and the new rail design, known as the "P. S" sections, were adopted on Sept. 20, 1907. Tentative specifications were recommended on Nov. 15, 1907 [illegible] rail rolled in accordance therewith. They were subsequently modified, on criticism of the manufacturers, and issued Feb. 4, 1908.

The new rail designs of the Pennsylvania R. R. system and the American Railway Association provided for a more even distribution of the metal in the head, web and base, and for a thicker base, to meet the views of the rail manufacturers, who believed that a better distribution of the metal would result in an improved quality, due to more favorable rolling conditions. All of these sections are still in service and are being closely watched to determine whether the expected improvement will be realized.

The Pennsylvania R. R. system specifications have been modified several times, in the light of additional experience, and contain the improvements which have been brought about from time to time through the experiences and researches of its own committee and the committees of the other associations.

So far as the chemical requirements are concerned, they are practically the same as adopted by the rail manufacturers, and other associations.

The physical requirements are determined by the drop test with the standard machine, and, in addition, the test piece is nicked and broken to reveal the presence or absence of interior defect.

In the details of manufacture, the discard is required to be sufficient to secure sound rails, and the shrinkage clause to regulate the temperature of rolling is retained. The rails are marked for position in the ingot, for the purpose of subsequent identification, in order to study the effect of that position.

Similar studies and investigations are being conducted by the New York Central Lines, the Harriman Lines, Baltimore & Ohio R. R., Norfolk & Western Ry., Lehigh Valley R. R., Reading Ry. and other companies, and the specifications are being improved as new knowledge is obtained. The first named company has been foremost in the study of the effect of titanium in steel making.

Through the assignment of the rail question to the American Railway Engineering Association by the American Railway Association, the work of the committee was given an official character, and its real work commenced. The first thing of importance accomplished was the introduction of a standard drop testing machine at all the rail mills, so that the results obtained at any one mill were comparable with those obtained at any other. Up to that time, 1908, machines of different design and setting were used, and the results were unreliable. With the year 1909 began the collection of a large amount of information, obtained from research work, bearing on the disputed points of rail manufacture, and on proving or testing.

In 1910, the specifications for Bessemer rail formerly adopted by the American Railway Engineering Association were withdrawn, and new ones ,for both Bessemer and open hearth, were presented for consideration by the association, which embodied all the improvements in the methods of determining the physical properties and the details of manufacture which had been brought forward up to that time. It was recognized, however, that numerous disputed points could only be cleared up by experimental research conducted by a trained engineer physicist, and accordingly such an investigator was added to the committee to devote all his time to that work. The engineer of tests, M. H. Wickhorst, since his appointment, has been constantly busy with research work, and has added a great deal to our knowledge of the subject. He had made reports on the following subjects:

Influence of Carbon on Deflection.

Drop, Bending and Tensile Tests on Bessemer, Titanium Bessemer, and Open-Hearth Rails, rolled by different mills, including chemical analyses and etched sections.

Investigation of a Split Head Rail.

Segregation, as Influenced by Fire Clay on Ingot.

Strength of Rail Head.

Drop Tests of Rails—Effect of Impact Energy variously distributed.

Flow of Rail Heads under Wheel Loads.

Segregation and other Rail Properties as Influenced by Size of Ingot.

Tests of Steel Rail Ingots and Derivative shapes Made at Watertown Arsenal.

Influence of Rolling Temperature on the Properties of Bessemer Rails.

In all of this work, Mr. Wickhorst has been afforded every facility by the rail manufacturers for carrying on the investigations, and their machinery, material and laboratory assistants have been placed at his disposal. In addition, their officers have been freely consulted by the committee, and have attended some of its meetings.

While at the present time the American Railway Engineering Association has not adopted standard specifications for rails, yet it has had constantly before it for consideration and study a set of proposed specifications which have embodied the best knowledge of the subject, and they have been changed from time to time in the light of new experimental investigation. The most energy has been devoted to the improvement of methods of testing to determine the physical proprties, and practically no changes have been made in the chemical requirements from the standard specifications of the rail manufacturers. The railway engineers prefer to subject the finished material to such tests as will cast aside the defective rails. Their specifications, therefore, include many additional tests over those in use ten years ago. The results of the work of the American Railway Engineering Association have been closely followed by the railway companies and *vice versa,* so that the specifications of the railway companies have been improved from time to time, and now embody the additional tests devised. Rails have been rolled in accordance with these new specifications for several years, and it is believed that a marked improvements is apparent in the rails being laid in the tracks since their adoption.

A Sand-Drying Plant for a Street Railway With Some Costs of Drying Sand.

The volume of sand used by a large street railway system for sanding track is considerable and to supply this sand in ample amounts and properly prepared for use involves considerable expense. Mr. C. L. Hawkins of the Engineers' Club of St. Louis, describes in a paper before that club which has recently been published in the Journal of the Association of Engineering Societies, a rather unusually elaborate sand-drying plant and gives some costs of its operation and also of drying sand at an older and less efficient plant. An abstract of this paper follows:

The amount of sand used per month varies from about 300 cu. yds. during the dry summer months to 1,300 cu. yds. during the winter months, the total for the year being about 6,000 cu. yds. All of this sand is dried at the one plant and delivered to bins, holding about 35 cu. yds. each, located at the car barns and at various places along the tracks. There are 34 of these small bins and their total capacity is 1,400 cu. yds., or about one winter month's supply. The sand used is ordinary Mississippi River bar sand dredged by the Union Sand & Material Co. and contains considerable gravel and from 3½ per cent to 5 per cent of moisture when it arrives at the drying plant.

At the first central drying plant built by the St. Louis Transit Co. the wet sand was shoveled by hand from steam railway cars into a shallow bin, in the bottom of which there was a system of steam pipes heated by exhaust steam from the power house. An inclined screen located above these pipes separated the gravel from the sand by allowing the sand to fall into a screw conveyor which carried it to a bucket elevator leading to an elevated bin. The gravel was rem [illegible] through openings at the lower the screen.

This method of drying did not pr sat factory and the capacity of the plant as not sufficient to supply the demand, so e drying was then done with six "Champic sand drying stoves, fed by hand, the sa being shoveled from the cars into piles n each stove. The dry sand was wheeled fr these stoves to the old elevators which cried it to the elevated bin. A revolving sc n was placed above the bin to separate th gravel from the sand. The cost per cubic oot of dry sand by this plant was as follow

Item.
Labor
Coal
Freight
Sand
Interest deprec., taxes, etc., at 10%
Total

The amount of moisture evapor d pound of coal was 1¼ lbs.

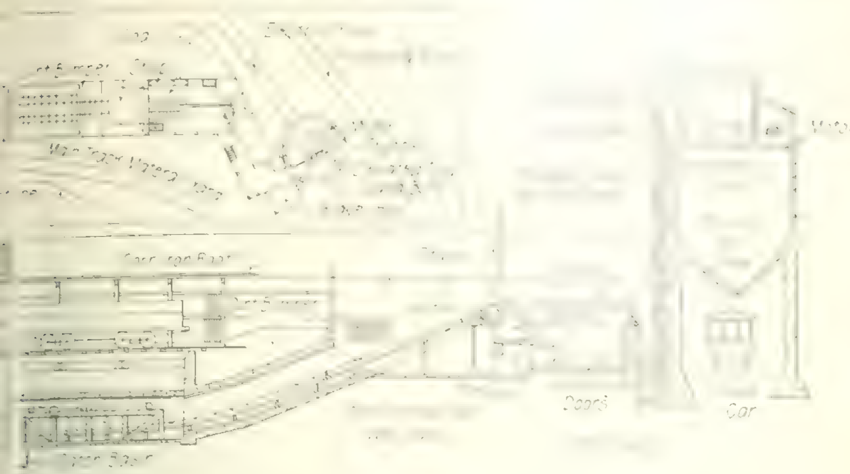
After the elevated bin was destre fire about June 1, 1910, the dry s wheeled up a runway and dumped into work cars. The cost of labor foot of dry sand was increased to and the cost for interest, depreciatio etc., was reduced to approximate making the total cost about 4.155 cts. foot. This plant could not have sup demand for dry sand even during ter, though the work was carried and day, so the design of a new p started at once.

The cross-section of the plant sh course of the sand from the time it is from the Union Sand Co.'s side-dun railway cars until it falls from the bins into the work cars ready for tributing bins. The wet sand is dum rectly into the wet sand pit. Two ap veyors carry it from the openings bottom of the pit and deliver a unifo of sand to a belt conveyor leading to tary dryer. This dryer consists of a ing steel cylinder 4 ft. in diameter ft. long, supported above a hand-fired burning slack bituminous coal. The line of this cylinder is set on a grade ½ in. per ft. The sand is received at per end and is tossed about by six lifting blades while an exhaust fan d hot gases around the cylinder and th it through openings in the periphe bringing the hot gases in direct cont the sand as it travels toward the l discharge end of the dryer. A buc vator conveys the dry sand to a r screen located on top of the reinforc crete bin. From this screen the sa directly into the bin and the grave through a chute leading to an elevate bin.

The wet sand pit was designed to ho 3,000 cu. ft., or about two days' suppl ft. of this will slide into the openin little or no shoveling. The convey chinery below required a space abou wide, so the pit was made the same with the sides sloped back at the top the sand as it falls from the side-du The floor of the pit is 13 ins. thick an inforced with ¾-in. square rods 6 in The walls of the pit are 2 ft. thick not reinforced. The sloping sides we inforced with ½-in. square rods 12 ins. apart, more for use in case of derailment cars than for sand loads, as the sides a ported by a dirt backing. The four the tunnel leading from the machiner were made 15 ins. thick and reinforc ¾-in. square rods 9 ins. on centers. T bumper on top of this tunnel is at the a 2 per cent grade, 1,200 ft. long, and count of the damage that might resu careless switching, the tunnel was ma siderably stronger than the dead or liv required. For temperature reinfo ½-in. square bars were used in th forced parts of the pit and tunnel.

In the design of the dry sand bin 8,200 cu. ft., fluid pressure at 100 l per used in computing the side and forcement. The circular [illegible] posts at the botom of the bin was hold four-tenths of the total sand e conical bottom was designed for The vertical side walls of the bin thick, and the ring reinforcement rom ⅜-in. square bars 12 ins. [illegible]

[illegible] etc.,



Cross Section of Sand Drying Plant for the United Railways Co., St. Louis, Mo.

the top to ¾-in. square bars 6½ ters at the bottom. Vertical tem- ods are ½-in. square bars 18 ins. conical bottom is 9 ins. thick with rcement varying from ¾-in. square s. apart to ⅝-in. bars 9 ins. apart. reinforcement in the bottom con- 0 bars ¾-in. square, 30 of which opening at the bottom, while the at the one-fourth, one-half and hs points. The circular beam is with eleven 1-in. square bars, seven are at the bottom. The roof was s. thick with reinforcement running The columns are 24 ins. thick square hoops 12 ins. apart and . square vertical bars; the opposite are tied together with No. 12 wire rtical bars are embedded about 40 n the circular beam and also in the ation.

ne construction work was done by g and mechanical departments of y. Machine mixed gravel concrete nix was used where reinforcement ed and 1:3:5 for the plain concrete. for the concrete was supplied by a nkling car equipped with an air for lifting the water to the mixer. nstruction of the dry-sand bin the ation was poured at one time, then p to about the ¾ point. The inside e forms for the lower part of the n, up to the 7-in. wall, were built und in sections. After the entire inside form had been placed, all s, except those in the roof and the orcement in the 7-in. wall, were securely fastened with wires or and small concrete blocks. The n was then placed and anchored to ating. After this section was con- side walls were poured in three oving the same forms up about 4 ne. The roof and the last of these ere poured at one time.

vel bin was built of wood, as was rame of the building surrounding and the wet-sand pit. The frame vator tower and the screen house the dry-sand bin were made of angles. All of these buildings ed with corrugated galvanized iron. veying and screening machinery was y the Link Belt Co. The con- veyors consist of 3-16-in. steel over- rugated pans 9-in. pitch and [illegible] attached to a steel bar link chain on rollers. The 14-in. conveying de of four-ply rubber belting with bber covering and carries the sand

[illegible] The plant is operated by two or three men (from one of the car houses), depending on the condition of the sand; these men unload the cars, fire the furnace, watch the moving parts and keep them properly oiled, and keep the plant clean and in good order. On one of the first tests before the machinery speeds were properly adjusted the following results were obtained:

Moisture	[illegible]
Length of test, hours	[illegible]
Cubic feet of sand dried	[illegible]
Pounds of coal used	[illegible]
Power used, kw. hours	[illegible]
Weight of water evaporated per pound of coal, lbs.	2.45
Tons of sand dried per hour	[illegible]
Tons of sand dried per ton of coal	[illegible]
Cost of operating machinery per cu. ft. of sand	[illegible]
Cost of power per cu. ft. of sand	0.0009
Cost of coal per cu. ft. of sand	0.0016
Sand and freight per cu. ft. of sand	[illegible]
Interest, depreciation and taxes (12%)	0.0104
Total	[illegible]

After this test the dryer speed was increased and a new test made. The sand at this time contained 3¼ per cent of moisture.

The length of test, hrs.	13.5
Cubic feet of sand dried	3,200
Pounds of coal used	4,400
Power used, kw. hours	300
Weight of water evaporated per pound of coal, lbs.	2.55
Tons of sand dried per hour	11.84
Tons of sand dried per ton of coal	73
Cost of labor per cu. ft. of sand	$0.0026
Cost of coal per cu. ft. of sand	0.0012
Cost of power per cu. ft. of sand	0.0009
Cost of sand and freight per cu. ft. of sand	[illegible]
Interest, depreciation and taxes (12%)	0.0104
Total	[illegible]

During the coming winter it is expected to decrease this cost considerably. The total cost of drying 6,000 cu. yds. of sand by the stove method, including the cost of maintenance, etc., of the necessary dry-sand storage bin, would amount to about $7,290 per year. The total cost of drying at the new plant, figured at $0.0323 per cu. ft., is $5,232.60, a saving of $1,957.40 per year, $510 of which is due to the saving of $3 per car for switching charges.

The total production of pig iron in Germany in 1911 amounted to metric 15,534,223 tons, as contrasted with 14,793,325 tons in the preceding year, or an increase of 74,898 tons. It is of some interest to note that, owing chiefly to the development of the "minette" iron ore resources in Lorraine and Luxemburg in the past few years, the production of pig iron in Germany has doubled since 1901.

Cost of Maintaining Anchored and Unanchored Track.

[illegible] anchored track and track anchored to prevent creeping of ties is shown in an article in the Railway Age Gazette. The data are taken from records made on the mainte- [illegible] of level grade, light gravel ballast, 85 lb. [illegible] are based on the north bound track, as the [illegible] track had been put in service 14 months before, and one mile in the center of the stretch was anchored, leaving 1½ miles on the north and one mile on the south end not anchored. Where the track was anchored, 640 anti-creepers were applied, two per rail length, opposite joints against opposite end of joint ties. The anti-creepers have received no maintenance and have shown no failure, although they had been in service 14 months at the time of inspection.

The character of the work done on the two pieces of track in 14 months is stated in the columns below:

[illegible]
Track resurfaced once.
[illegible]
Ties spaced twice.
[illegible]

The total maintenance cost for the mile where the anti-creepers were applied, including the cost of anti-creepers, is as follows:

[illegible]	[illegible]
Applying 640 anti-creepers at ½c each	3.20
[illegible] $1.55 per day	248.00
Total	$363.20

The total cost of the next mile north of the mile where the anti-creepers were applied, subject to the same conditions of traffic, roadbed, etc., but unanchored, is given below:

Cost of resurfacing twice, each time 10 men, 16 days, at $1.55 per day, $248	$ 496.00
[illegible]	[illegible]
Cost of driving back rail twice, each time 10 men, 2 foremen, 6 days, at [illegible]	[illegible]
Total	$1,246.20

This shows a saving in 14 months of $883 in favor of the anchored track.

It will be noted that the original cost of the anti-creepers and of their application have been included in the first 14 months. These costs are properly chargeable over the total number of years anchors are in service, which in all cases is at least as long as the life of the rail on which they are applied. This would make the saving considerably greater than has been estimated. Furthermore, this maintenance cost does not include injury done to ties, spikes and joints, which was considerable where anchors were not applied, as the creeping had pulled the ties badly askew, bending or completely destroying the spikes and often causing broken joints. Where the anti-creepers were applied, this wear and tear were hardly worth considering.

The above figures were obtained directly from the railway, and the roadmaster stated that he could have maintained this 3½ miles of track in better shape with three men less per year had he been allowed to anchor the balance.

The municipality of Amsterdam has announced an international gas exhibition in that city, to be opened Sept. 14 next and closed Oct. 6, with a possible extension of a week's duration. The exhibition will be held in the Industrial Palace, a large, many-windowed edifice, with spacious rooms and a garden. The main object is to exhibit the various appliances used for illumination and for other purposes, both domestic and industrial. It is also expected to have lectures on appropriate topics relating to gas.

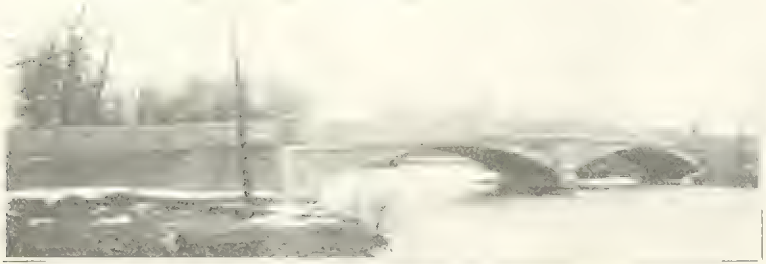
BRIDGES AND BUILDINGS SECTIO

Method and Cost of Constructing a Reinforced Concrete Road Bridge.

[illegible]

Engineer, Carlisle, Pa

[illegible]



View of New Reinforced Concrete Highway Bridge in Cumberland County, Pa.

the three. One of the latter type at Williams Grove collapsed in September from the weight of a traction engine, and within a couple of weeks plans were drawn, a dozen bids received, contract awarded, and construction started on the building of a reinforced concrete bridge to replace the wreck.

The new bridge has two spans of 53 ft. each, making the waterway about 110 ft. or, including wing walls, a total length of 205 ft. The clear opening above low water is 8 ft. and the roadway is 14 ft. in the clear. The intrados radii run 60, 72 and 63 ft. from pier to abutment, and the bridge has a camber of 2 ft. The thickness of the arch ring is 12 ins. at the crown and 24 at the springing line. The parapets, which are 3 ft. high and 10 ins. thick are provided with four expansion joints in each arch length, and the usual expansion joints are provided in the main bridge.

An upper and lower row of ¾-in. twisted bars placed 6 ins. c. to c. were used for the longitudinal reinforcing and to both sets were fastened ½-in. transverse rods on 24-in. centers. The longitudinal rods were continued into the footings of both pier and abutments. The spandrel reinforcing both vertical and horizontal was ½-in. twisted bars placed 24 and 12 ins. apart, respectively. The vertical reinforcing was fastened to the reinforcing of the arch wherever possible, and extended up into the parapets. Horizontal rods were also placed in the parapet walls at the same intervals.

The footings extended to a depth of 3 ft. below low water, and rested on an excellent foundation of gravel and boulders. All concrete for pier and abutments was a mixture of 1:3:5 and a mixture of 1:2:4 was used for all work above the springing line. A ½-cu. yd. batch mixer was used. The construction required 50 working days which covered a period of about three months. The concreting, however, was done in 11 working days by an average force of foreman, engineer and ten men. The foreman received $5 per day and laborers, carpenters and mixer engineer were paid from $1.75 to $2.75, but as they all performed labor work it was impossible to separate the actual details of form erection, etc., so far as carpenters and mixer man are concerned.

The uprights and braces for the drums were made principally from the heavy lumber of the old bridge and were spaced 10 ft. apart longitudinally and 2 ft. transversely. The ribs were of 2x12-in. stuff and were spaced on 2-ft. centers. The lagging was ⅞ in. thick and tongue and grooved. The falsework was all footed on large concrete blocks in the stream bed and 2-in. cubes were used to hold the reinforcing away from the drums, these were then left in the finished work. Four- [illegible] the pier.

The contract price was $2,629, which did not include the wing walls; these latter were built by force account at a cost of $593.28, making a grand total of $3,222.28. Engineering and inspection cost the county $231.50. The contractor was The Nelson-Merydith Co., [illegible] construction was in charge of the writer, for whom G. C. Brehm was resident engineer. The following table of costs and materials covers all items for the main contract except contractors' office and traveling expenses.

The main bridge contained a little less than 200 cu. yds. which would make the cost $11.69 per cubic yard, or $1.44 per square foot of roadway.

	Total	Per cu. yd.
Excavation:		
[illegible] hrs. foreman	[illegible]	
[illegible] hrs. labor	[illegible]	
Total	[illegible]	
Abutments, 23 cu. yds.:		
[illegible] hrs. foreman	[illegible]	[illegible]
[illegible] hrs. labor	[illegible]	1.861
[illegible] bbls. cement	[illegible]	1.304
[illegible] cu. yds. sand	[illegible]	0.488
[illegible] cu. yds. stone	[illegible]	[illegible]
Total	[illegible]	$5.170
[illegible]		
Forms:		
[illegible] hrs. foreman	[illegible]	$0.177
[illegible] hrs. labor	[illegible]	0.622
Total	[illegible]	$0.799
Reinforcement:		
[illegible] hrs. foreman	[illegible]	$0.115
[illegible] hrs. labor	[illegible]	0.369
[illegible] lbs. steel	[illegible]	3.717
Total	[illegible]	$4.201
Concrete:		
33 hrs. foreman	$ 16.50	$0.171
491 hrs. labor	91.70	0.955
126 bbls. cement	126.00	[illegible]
[illegible] cu. yds. sand	[illegible]	0.473
86½ cu. yds. stone	105.10	1.094
Total	[illegible]	[illegible]
Removing Forms and Finishing:		
155 hrs. labor	$ 33.12	$0.345
Grand total arches	$897.95	[illegible]
Spandrels and Parapets, 72 cu. yds.:		
Forms:		
[illegible] hrs. foreman	[illegible]	[illegible]
[illegible] hrs. labor	[illegible]	0.900
Total	[illegible]	[illegible]
Reinforcements:		
[illegible] hrs. foreman	[illegible]	$0.064
[illegible] hrs. labor	[illegible]	0.076
7,185 lbs. steel	143.70	1.995
Total	[illegible]	$2.135
Concrete:		
[illegible] hrs. foreman	[illegible]	[illegible]
286 hrs. labor	54.07	0.751
94 bbls. cement	94.00	1.306
[illegible] cu. yds. sand	[illegible]	0.472
64½ cu. yds. stone	78.37	[illegible]
Total	[illegible]	[illegible]
Removing Forms and Finishing:		
[illegible] hrs. foreman	[illegible]	$0.117
[illegible] hrs. labor	[illegible]	1.576
Total	[illegible]	$1.693
Grand total spandrels	$678.33	$9.420
Roadway:		
[illegible] hrs. labor	[illegible]	
43 cu. yds. stone	52.25	
Total	[illegible]	
[illegible]		
[illegible] hrs. foreman	[illegible]	
[illegible] hrs. labor	[illegible]	
[illegible]	[illegible]	
Total	[illegible]	

[illegible]	[illegible]
[illegible]	[illegible]
Grand total for bridge.	$2,233.1
Summary:	
[illegible] hrs. foreman	
[illegible] hrs. labor	
250 bbls. cement	[illegible]
[illegible] cu. yds. sand	
[illegible] cu. yds. stone	
25,025 lbs. steel	[illegible]
7,820 ft. B.M. lumber	[illegible]
[illegible]	[illegible]
Total	[illegible]

Method of Waterproofing an levato Pit.

[illegible]
Civil Engineer.

A coal elevator on the New Yor & Hudson River R. R. was found th leaky pit, the water sometimes ris above the floor. In addition to wate the pit it was decided to anchor the more securely on account of the ex sition of the elevator and the possib from the wind.

[illegible] operated by steam from the engine [illegible] and by means of th was drained nearly dry. Examinatio several small leaks in the concret the worst being around the irons se concrete to brace the stringers on wh operated the skips.

After cleaning out the coal from and hoppers work was commenced ping the walls to a height of 8 ft. w mers, the leaks being all in the flo pit. After being roughened the w plastered with waterproof cement.

The next step was to examine mo the apparent leaks and it was deem sary to remove the angle irons from in order to prevent the water from [illegible] them. On account of [illegible] of water an opening was made in th provide a sump and relieve the press the other leaks. After the sump wa the pit filled 6 ft. deep with water. [illegible] were installed and the overcame the water so that the w [illegible] A sump was then put in p could later be capped after the comp

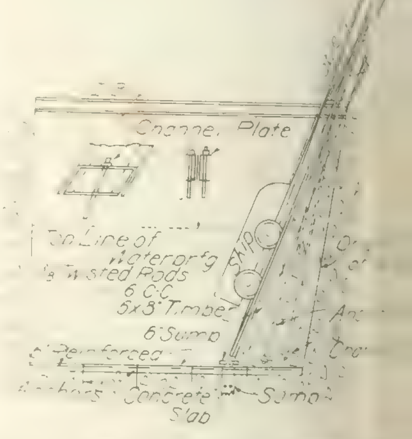


Fig. 1—Section Through Elevator P S ing Method of Anchoring New and Elevator Leg.

the work.

While the three syphons were wo the sump and relieving the pressure other leaks these were enlarged and fi quick setting cement.

Four inches above the floor, hol drilled in the walls 12 ins. apart, an floor, anchor irons were set 9 ins concrete and projecting 6 ins. above to the holes in the [illegible] reinforcing rods 6 ins. apart [illegible] floor in both directions. These were by the anchor irons and [illegible] intervals. The alternate rods were e holes in the walls so that [illegible] red in the wall [illegible] crete slab was put in place and coat- aterproof [illegible]

1 shows the position of the elevator timbers on which the skips ran were 4 t. out from the wall at the bottom 1 on the wall at its top. The space he timbers and the wall was filled olid mass of concrete, to form an a for the elevator structure, and in ried long steel rods connected with of the structure. Channel irons on of the rods gave an added bond.

rk was done in cold weather and it essary to take some precautions to reezing the concrete. The gravel ered on the ground in cars. The e covered over with tarpaulin and live owed to run over the sand beneath lin. This kept the sand warm and ost. The water was also heated by steam pipe into the barrel from water was taken during the work. ete was mixed by hand in a proportion e of cement to five of gravel. During oncreting of the anchorage, the con- to be handled twice because of the osition of the forms, the mixing ng necessarily across the pit from . The labor on the work was as

	Hours.
[illegible]	[illegible]
[illegible]	[illegible]

87 cu. yds. of gravel were used, 187 [illegible] cement, 11 steel rods [illegible] 58 steel rods ⅜ in. x 18 ft., 16 an- :15 ins., 2 anchor rods 1¼x15 ft., s 10 ins. x 2 ft., and waterproof r 1,018 sq. ft. The work was done aterproofing Co. of New York.

ed Concrete Flat Slab Bridges for Railways.

t slab reinforced concrete bridge has ost extensive use and has come to st development for railway use on ays running west from Chicago. es on the development of this bridge estern railways are given in a paper . Finley, Assistant Chief Engineer, North-Western Ry., before the Na- nent Users' Association. An abstract [illegible]

he introduction of concrete for the on of railroad bridges no type of has met with more success than the a bridge. For years after the intro- of concrete it was a common prac- se, for small openings, say up to 8 old railroad rails imbedded in con- orm the top covering. In those days more or less second-hand rail that used economically for this purpose s thought that in using the material ay a cheap and satisfactory structure produced. It was soon discovered, that second-hand rails were not al- ilable and if available they could be etter use than burying them in con- r culvert construction. In spans an 9 ft. and up to 30 ft. it was the for a number of years, to use I- bedded in concrete. Among some the idea was to use beams of suf- rength to carry the live load and the concrete only as taking the place bracing. This form of construction very careful work in the field, inas- it is difficult to make a satisfactory [illegible] and large [illegible] represented by an I-beam, and with est care in the selection of the mate- placing of the concrete it was dif- nt it from cracking or separating beams. Although there were a num- atisfactory bridges built of this type, as gradually abandoned. As confi-

[illegible]

maintenance charge eliminated but the first cost of construction is considerably reduced [illegible] monolith it is possible to use less material in the side walls than would be required for an arch of corresponding span.

In railroad construction numerous instances occur where it is necessary to provide a wide and low opening and this condition is admirably met by the flat slab type of bridge. Before the introduction of this type of construction it would be necessary to provide an arch that would entail very much more expense than the flat slab bridge. Of recent years the flat slab bridge has been used to good advantage in cities where the railroads were eliminating grade crossings by the elevation of their tracks. In the ordinary 66-ft. street where the city permits supports in the center of the street and on the curb lines it is possible to use the flat slab type of bridge for spanning these openings. This results in a very economical form of construction as well as one that can be made pleasing in general appearance. It also reduces to a minimum any maintenance expense. A steel structure for a similar opening requires painting every four or five years and if this work is not attended to the structure soon presents an unsightly appearance. This condition is very prominent in our elevated railroads in cities where the maintenance is not kept up.

Fig. 2—Plan of Elevator Pit.

Twenty years ago, in railroad construction, it was the universal practice to use, in openings from 6 to 30 ft., open deck I-beams. These were usually placed upon concrete or stone masonry abutments and presented as much difficulty in maintaining good track as much larger spans for the reason that the dump ties were just as troublesome to keep up as the same ties on a 150-ft. span. I know of no greater use for flat slab bridges than in the replacing of these open floor I-beam spans. It is usually possible to remove these I-beams and replace them with flat slab bridges, carrying the ballast across the bridge and making a uniform track surface. The I-beams can be used for other purposes or they have at least a salvage value that goes toward reducing the cost of the improvement. I have in mind a certain stretch of railroad of about 36 miles that has over 20 small openings from 6 to 25 ft. made up of I-beams with open floors. However carefully the track work was kept up it meant a bad riding track as each one of the bridges represented an unyielding space that was very noticeable to the traveling public.

Some Unit Costs of Reinforced Concrete Factory Buildings.

The customary manner of recording the cost of buildings is in dollars per square foot of floor or in cents per cubic foot of volume. Such costs of reinforced concrete building work as are available have not usually been reduced to these units and comparison between reinforced concrete building costs and the cost say of mill building construction is not easily made. Square foot and cubic foot costs of a number of reinforced concrete buildings are given, however, by Mr. Chester S. Allen, of Lockwood, Greene & Co., of Boston, Mass., in a paper presented before the National Association of Cement Users. The main features of this paper follow:

As a general proposition we have found that reinforced concrete is the lowest priced fire-proof material suitable for factory construction and while it is true that its first cost will generally run from 5 per cent to 20 per cent higher than first-class mill construction we have recently had several instances where, with lumber at a high price, reinforced concrete has worked out cheaper than brick and timber. It is especially adapted to heavy construction and for heavy loads of 200 lbs per square foot and over where the spans are 18 to 20 ft. centers not even timber can compete with it.

The unit costs of projected or completed buildings are commonly figured either as so much per cubic foot or so much per square foot of area occupied. Table I gives the unit costs both on the square foot and the cubic foot basis, together with a general description, of a number of reinforced concrete industrial buildings of different types erected during the past two years. It will be seen from an examination of this table that the average cost per square foot of these buildings, excluding the one-story structures, was $1.12, while the average cost per cubic foot was 8.7 cts. The one-story structures both had reinforced concrete sawtooth roofs and the average cost per square foot was $1.77 while 8.5 cts. was the average cost per cubic foot. The above costs are for the finished buildings including plumbing but do not embody heating, lighting, elevators, sprinklers, and power equipment. The cost per square foot of floor area was obtained by dividing the cost of the building by the total number of square feet of floor area exclusive of roof area but including basement floors and the cost per cubic foot by dividing the cubical contents into the cost of the structure.

While no coal pockets are included in Table I it has been our experience that above 3,000 tons capacity reinforced concrete elevator coal pockets cost from $5.50 to $7.50 per ton of capacity. Standpipes, exclusive of the foundations, average from 2½ to 3 cts. per gallon of capacity.

On much of the reinforced concrete work which has been done under our supervision it has been possible owing to the contract being either on a percentage or a cost plus a fixed sum basis for us to obtain quite accurate and comprehensive cost data. This data, of course, is only of particular value where all the local color of each specific case is known but the average results are at least interesting.

The average unit cost of the 1:2:4 concrete in the floors including the beams, girders, and slabs was $6.10 per cubic yard and for the columns $6.70 per cubic yard. Where 1:½:3 mixture was used for the columns the average cost was $7.60 per cubic yard. This cost was made up of the items of cement, sand, stone or gravel, labor and plant. The cement, of course, varied greatly with the demand but the average net cost was $1.35 per barrel including 3 cts. for tests. The sand averaged 80 cts. per cubic yard and the crushed stone $1.25 per cubic yard. The cost of labor of unloading the materials and mixing and placing the concrete varied from 65 [illegible]

TABLE I.—UNIT COSTS [illegible] CONCRETE INDUSTRIAL BUILDINGS.

Type of Building.	Dimensions, feet.	No. stories.	Story height, ft. ins.	Live load, lbs. per sq. ft.	Type of Construction.	Col. Spacing, ft.ins. ft.ins.	Total Cost Per sq. ft.	Total Cost Per cu. ft.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	17 [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Factory	223x 56	2	[illegible]	[illegible]	[illegible] girder	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		125	Sawtooth skylight	13 0x21 4	1.79	0.07
[illegible]	[illegible]	[illegible]			Sawtooth skylight	20 0x20 0	1.75	0.10
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
						{19 0		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]						0.76	0.05
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

plant consisting of freight, depreciation or rental of mixing and hoisting towers, erection of same, power and coal, and losses and waste on the small tools ranged from 50 cts. to $1.50 per cubic yard of concrete placed.

Next to the proper design of the structural features of a concrete building the economical design of the form work is of paramount importance. The truth of this statement is borne out by the fact that on the average job the cost of the forms amounts to about one-third the cost of the entire structure. On the buildings under consideration the average cost of the forms for the floors including beams, girders, and slabs was 10 cts. per square foot and for the columns 13 cts. per square foot. The lowest cost was in a building of the so-called "mushroom" or flat slab type of construction where by the intelligent use of corrugated iron for the slab forms the cost of the floor forms including wall beams was 7 cts. per square foot and the highest cost was for an artistic but not elaborate overhanging cornice on a 12-story building which was 32 cts. per square foot. This last item rather forcibly demonstrates that any attempt at architectural development is very apt to be a costly proposition.

The cost of the labor of making, erecting and stripping the forms varied according to the price of lumber, design of the structure, method of forming, character of the supervision and the skill of the workmen from 4¾ to 12 cts. per square foot. The cost of lumber, nails and oil, divided by the square feet of forms averaged from 2¼ to 4½ cts. per square foot.

The cost of bending and placing the reinforcing steel including the necessary wire averaged $10 per ton, the range being from $5.75 per ton to $17.20 per ton.

Granolithic floor finish 1¼ ins. thick when laid before the concrete below it had set so as to form one homogeneous slab cost on the average of 4½ cts. per square foot. When put on after the rough concrete slab the cost averaged 7 cts. per square foot.

Inasmuch as the only economical design of a reinforced concrete structure is one which closely resembles that of the steel skeleton type, the relative cost of the various materials commonly used for curtain walls under the windows may be of interest. The writer has used brick, vitrified tile, concrete blocks, cast concrete slabs and solid concrete walls for this purpose.

The most common type of curtain wall has been either on 8-in. or 12-in. brick wall resting on the concrete wall beam. The average cost of these walls has been 45 cts. per square foot. There is practically no difference in cost between the 8-in. and the 12-in. brick curtain wall as the saving in material is offset by the great amount of extra labor in culling and laying the thinner wall.

An excellent and inexpensive spandrel wall is constructed by using 8x12x18 in. vitrified tile. This is a non-absorbent wall and when properly laid in cement mortar makes a tight weather proof curtain wall. The cost of this wall averages about 25 cts. per square foot. If the tile is plastered both sides the cost is about 38 cts. per square foot.

Where 8-in. concrete curtain walls were cast in place after the skeleton frame was completed the average cost was 40 cts. per square foot and when poured simultaneously with the columns 48 cts. per square foot. Four-inch cast concrete slabs cost about 35 cts. per square foot.

While concrete blocks make a very cheap and light curtain wall, the price being about the same as for the 8-in. tile, the writer's experience with them has been rather unfortunate on account of their extreme porosity.

Where the location of the buildings have demanded special treatment of the exposed surfaces we have generally specified rubbing with a block of carborundum. The average cost of this work has been 4 cts. per square foot. In two instances portions of the structure have been bush hammered with a resulting average cost of 7 cts. per square foot.

Concrete piles were used on the foundation of several of the buildings and the average cost of the piles was $1.15 per linear foot.

The most common methods of waterproofing concrete structures are by the introduction of foreign ingredients into the concrete, by the application of a compound to the concrete surface, by the use of paper or felt waterproofing and by accurately grading and proportioning the aggregate and the cement.

Where an addition of hydrated lime in the proportions of 10 per cent to the weight of the cement has been used the added cost to a cubic yard of 1:2:4 concrete has been 50 cts. Patented compounds similar to Hydrolithic cement have cost from 25 to 35 cts. per square foot of surface covered. On horizontal or inclined surfaces we have sometimes used a granolithic surface of rich mortar of Portland cement and sand, or Portland cement and screenings in the proportions of 1:1 laid at the same time as the base and troweled as in side walls construction. The cost of this work has been about 5 cts. per square foot.

Taken as a whole, the lowest possible cost on a reinforced concrete building can be obtained only by a careful study of each particular case to determine the cheapest type of construction and most economical spacing of columns. As a general proposition we have found that for light loads with ordinary beam and girder construction the most economical spacing of columns has been 18 ft. each way and for flat slab construction 20 ft. each way. For heavy loads such as 300 lbs. per square foot and over, it has been our experience that the cheapest column spacing for beam and girder construction is 15x15 ft. and for flat slab construction 17x17 ft. In arriving at the most economical layout it is always well to bear in mind that the construction which allows the greatest simplicity of form units together with the maximum number of repetitions of same is invariably the one that will work out cheapest in the end. The fact that the actual amount of concrete or steel required for a certain floor construction is less than that required in another by no means implies that this is actually the cheapest floor construction, as the unit labor of the form work may easily have been increased out of all proportion.

The Age of the Earth.—A series of investigations which has been utilized in attacking the problem of the age of the earth is connected with the microscopic colored circles found imbedded in primitive granites and other rocks. These, which have for a long while received no explanation, prove to be the efflorescence of the "alpha" rays from minute specks of zirconium, and it is certain that millions of centuries have elapsed while the rays have been penetrating the surrounding rock. Altogether, geologists say, we should be wrong in regarding the world as less than 1,000,000,000 years old.

LETTERS TO THE EDITR.

Cost of Engineering and Inspecon in Small Towns.

Sir: I shall be glad if you will a[illegible] whether you have any data bearing on [illegible] pal construction work, as to cost of eng[illegible] in small towns varying from 5,000 to [illegible] inhabitants. I recently saw an article [illegible] the magazines which gave a percentage [illegible] ing to cost on a rising scale. This [illegible] under consideration by the Common C[illegible] this city and they are desirous of ge[illegible] liable information. Also any data wh[illegible] may have on the custom regarding [illegible] ployment and payment of inspectors [illegible] nicipal contract work would be of g[illegible] sistance.

CITY ENGI[illegible]

(The editors will be glad to receive [illegible] lish replies to the above inquiry.—Ed[illegible]rs

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Stopping Leaks in Air Recei[illegible]rs

A convenient method of stopping [illegible] around a loose rivet in an air recei[illegible] steel water tank or even in an em[illegible] repair of a boiler is described in th[illegible] E[illegible]neering and Mining Journal. It [illegible] made entirely from the outside by [illegible] of a taper bolt with a copper sleev[illegible].

The head of the faulty river is cut [illegible] the rivet knocked out of the hole [illegible] the rivet may be drilled out. A tap [illegible] large enough to pass through t[illegible] and threaded up to 1½ in. of the la[illegible] is inserted in the rivet hole and a [illegible] copper pipe B, of the same intern[illegible] eter as the diameter of the bolt, is [illegible] over the threaded portion of the tap [illegible] it should project ¼ to ⅜ in. on ea[illegible] of the plates. A washer and nut a[illegible] put on and the nut screwed up with l[illegible] handle wrench. The bolt can be u[illegible] withstanding pressures up to 200 l[illegible] sq. in. with safety.

A steam shovel, No. 225, workin[illegible] borrow pit at Folks River, Pana[illegible], cavated 57.790 cu. yds. of earth a[illegible] during 24 working days in Februar[illegible] material is being used for filling t[illegible] for the Cristobal Terminal docks. [illegible] lowing is the record for the month:

By car measurement, cu. yds.	57[illegible]
By cross section, cu. yds.	51[illegible]
Cu. yds. per car	[illegible]
Days worked	[illegible]
Hours under steam	[illegible]
Hours worked	[illegible]
Cu. yds. per hour worked	[illegible]
Per cent of time under steam that shov[illegible] worked	[illegible]
General daily average place meas., [illegible] yds.	[illegible]
Delays	Ho[illegible]
Mining	[illegible]
Repairs	[illegible]
Waiting for cars	[illegible]
Switching	[illegible]
Derailments	[illegible]
Moving shovel	[illegible]
Cutting out (5 times)	[illegible]
Total	[illegible]
Per cent of total delay to time under steam.	[illegible]

A concession has been granted [illegible] executive authorities of Venezeula, [illegible] cordance with article 9 of the prese[illegible] ing code, to Dr. Rafael Max Val[illegible] giving him the right to explore t[illegible] and sub-soil of the states of Cucre, [illegible] gas, Anzoategui, Neuva Esparta, T[illegible] Trujillo, Merida, Zulia, Lara, Falcon, [illegible] bobo, Yaracuy and Delta del Orino[illegible] afterwards to exploit, refine, export [illegible] general to dispose of as most conv[illegible] but in accordance with the terms [illegible] contract, all asphalt, petroleum, naph[illegible] pitch which he may discover in his ex[illegible] tions. It is understood that this c[illegible] is made in the interest of America[illegible] talists, and that a separate corporati[illegible] be formed to take over and work the[illegible] cessions.

NEWS SECTION

Eitorial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

Comment The Doings of the [illegible]
—Government Drainage Bill—
Bridge Letting—We Note That—
Famous Bridge Expert.. ..
Annual Exhibition of Railway [illegible]
Annual Convention of the American Rail- [illegible]
Irrigation, Drainage, Levees and Canals....46D

Doings the eek.

Railroad construction work, judging at least from the contracts let, has been rather dull the past few days. Bids on a number of big jobs are under consideration and it is probable e of these contracts will be placed in ays. The Grand Trunk Ry. has not ade any announcement as to the sucontractor for its new line in Massa- nor has announcement been made as ward of contract for the additional of the Point Defiance line of the u Pacific. The bids on the new Fernassen R. R., a 124-mile Southern Pa- in California, will not be opened end of this month. Contracts for a ible amount of betterment work for ash R. R. will be let in the near It is also expected that the Erie R. place contracts for work to be done s double-tracking plans.

the railroad contracts let recently llowing: McCabe & Steen, for and bridging on the new Missouri, a & Gulf R. R. extension in Misd Oklahoma; Walter Denison, Woodkla., for 15 miles of work from Wag-Okla., on the Missouri, Oklahoma & R.; L. J. Smith Construction Co., City, Mo., for double-tracking the e from Needles, Cal., to the Colorado Maney Bros. & Co., Hamilton, Cal., grading for the 26-mile extension of thern Electric Ry. from Yuba City to Cal.; the Utah Construction Co., Ogah, for the extension of the Idaho n Ry. from Smiths Ferry, to Payette Idaho, a distance of 47 miles; the Construction Co., Salt Lake City, an bcontract on the last mentioned work; Hinds, 43 Scott St., Toronto, Ont., structing the new Canadian Pacific ore line in Ontario, the work covering s of line and calling for the expendi- about $10,000,000; the Hancock-Mc-Construction Co., Wagoner, Okla., for oncrete work and bridge piers for the , Oklahoma & Gulf R. R. extension agoner, Okla., to Pittsburg, Kan.; Mc- & McQuigge, Toronto, Ont., at about for constructing the roadbed for the ke Branch of the Temiskaming & n Ontario Ry.; H. C. Henry, Seattle, for constructing the Beverly-Hanford he Chicago, Milwaukee & Puget Sound

on a good-sized government lock job en opened by the U. S. Engineer at le, Tenn. The work called for the tion of concrete locks B and C on the land River, the Mansfield Engineering dianapolis, Ind., at $486,784, being the ders. Another good-sized government which bids are to be opened April 17 U. S. Engineer at Boston, Mass., r about 78,792 cu. yds. of rock ex- in Boston Harbor.

e way of drainage work the largest t of the past week appears to be the arded Engle Bros. of Monterey, Ind. ntracts calls for the construction of y L. Kelman drain in Indiana and involves 2,661,000 cu. yds. of excavation. The contract price was $164,000. Another step toward the straightening and improvement of the river at Dayton, O., has been taken. The City Council has passed an ordinance appropriating $385,000 for the work, and it is likely that bids will be asked in the near future. The work of changing the channel and building levees will involve the handling of 1,210,000 cu. yds. of earth.

Among the larger highway contracts let recently are the following: Texas Grading Co., Houston, Tex., at $5,939 per mile, for the construction of 17 miles of gravel roads for Cedar Parish, La.; C. H. Boyles, Jackson Ave., Spokane, Wash., at about $1,000,000 for 48 miles of roadwork for the Canadian Pacific Ry. near Edmonton, Alberta.

Government Drainage Bill.

A bill appropriating $25,000,000 for the drainage of the swamp and other wet lands of the United States is now before the House of Representatives. The bill provides that $5,000,000 be apportioned annually to this feature of Government work from 1912 to 1916, inclusive. It further provides that the community or company which organizes the drainage district would pay one-half the expense of the drainage and the Government the other half. It will be interesting to note the action Congress takes on this bill. Last week the Senate acted favorably on a bill appropriating $207,000 for three public buildings in Wyoming. One of these, a $75,000 edifice, is to be erected in a town having a population of 281; a $67,500 structure is to house the post office in a community of 975 people, and a $65,000 building is to be furnished for a city of 1,524 population. Many a statesman secures a firmer grip on his job by virtue of the appropriations he gets for public buildings in his district. A government building is a tangible asset for such statesmen. It remains to be seen whether they will take the same view of a drainage ditch.

County Bridge Letting.

A bridge letting in a rural district, attended by circumstances too often characteristic of lettings in similar districts, was described in a paper read at the recent annual meeting of the Minnesota Engineers' Society. Plans and proposals for a number of reinforced concrete bridges, with alternate plans for steel bridges at several of the sites were advertised for by the County Commissioner. The specifications gave the span length, height and width of roadway; and called for a loading of 200 lbs. per sq. ft. or a 20-ton road roller. Bidders were requested to visit the site of each bridge and submit a plan and a lump sum bid for the structure. On the appointed day, 15 bidders appeared at the county seat and submited their plans and proposals before the hour of closing bids, 6 P. M. They were then informed that the bids would be opened next day. The visitors had the privilege of buying eats, smokes and liquid refreshments during the evening. The next morning the bids were opened; approximately 125 plans were submitted to the five farmers, who, assisted by the County Surveyor, proceeded to analyze the plans and tabulate the bids. It was finally decided to let the concrete bridges to a local cement street paver, and the steel bridges to a relative of one of the county officers. The Commissioners possibly decided that, as they knew nothing about the relative value of the plans, that they would take a chance on men whom they knew, regardless of other considerations. The lowest bidder was informed that they did not like his plans. A number of the bidders submitted plans furnished by manufacturers of reinforcing. Some of the plans were excellent, and others were like the present day millinery, fearfully and wonderfully designed. One bidder said that a live load of 80 lbs. to the square foot was good enough for designing any bridge. Another had on his business card, John Doe, Manufacturer of Cement Blocks, and written across the card in ink, for this especial occasion, "and Reinforced Concrete Bridge Engineer."

We Note That—

It has remained for barbers in Hammond, Ind., and other cities of the Calumet region to discover a new use for Portland cement. They have discovered that employees of the cement plants in these districts have concrete faces. The barbers claim that in the plants the cement dust settles in the men's beards, perspiration moistens it, and when they go out into the open air, it sets and faces are covered with concrete, reinforced by stiff whiskers. This takes the edge off the razors. Steps are being taken to invent a tonsorial sand blast.—The inhabitants of a small town in New York may take steps to establish a public water supply. The proprietor of the one hotel in the place, enraged because the town voted for no-license, has chained his pump, and the families that have been accustomed to getting their supply there are now being charged 5 cts. a pail for water.

A Famous Bridge Expert.

In politics the viewpoint depends on whether you are on the inside looking out or on the outside looking in. A recent issue of a daily newspaper in a large western city carried the following headline: "Famous Municipal Bridge Expert Resigns; Charges the Administration With Acting in Bad Faith." From the headline naturally it would be concluded that some celebrated bridge engineer had severed his connection with the city. On reading the article that went with the headline it was found that the "famous municipal bridge expert" was the foreman of the city bridge repair department, in which capacity he had had charge of making repairs to the wooden bridges, sidewalks and steps of the city. Evidently this newspaper was on the losing side.

Fourth Annual Exhibition of Railway Appliances.

The fourth annual [illegible] appliances was held in the Coliseum at Chicago, March 18 [illegible] grown each year and [illegible] exhibitors of railway materials and appliances of every description.

One of the new devices shown was the boltless rail joint of the Enright Fray Railway Equipment Co. The joint consists of a button plate, two side plates and two wedges which, when assembled, hold the rail securely and in perfect alignment. The joint is being tried out on the Illinois Central R. R. main line entering New Orleans.

The Fairbanks-Morse Co. exhibited this year two engine outfits running under their own power. The generating outfit is a 9 hp. electric oil engine direct connected to a 5½ K.W. generator. The outfit starts and operates on oil but will also operate on gasoline or the lighter distillates.

The American Steel & Wire Co. exhibited a variety of the company's products and showed especially galvanized steel posts and wire fencing for railway work. These posts are designed to be driven and it is stated that as many as 600 have been driven in a day's work. In placing these posts on prairie land the method is to drive along the line of right of way with a wagon, place the posts in the ground, and drive them with a mallet, the man driving them standing in the wagon and another man holding them plumb.

The Carnegie Steel Co. exhibited a combination steel and concrete sheet pile which is intended for docks and permanent cofferdams. The concrete pile is made to the desired length and 12x18 ins. in section. At the center line of the section measuring along the 18-in. way the lip is set in the block along one side and the tongue of the ordinary Carnegie sheet pile is set in on the opposite side so that when these piles are fitted together in the cofferdam, the lip and tongue perform the same functions which they do in an ordinary steel pile cofferdam and give a much greater stiffness and are particularly useful for permanent work.

The Lackawanna Steel Co. had an interesting exhibit of illuminated photographs showing the cofferdam and wreck of the battleship Maine which was recently raised from Havana Harbor. The cofferdam around the Maine was built with Lackawanna steel sheet piling of the regular 12-in. section.

The Clyde Iron Works exhibit contained a model of the Holcomb Back Dumping Drag Line Bucket which was described in the pages of Engineering & Contracting of Jan. 31, 1912. The company's improved hoisting engine, which was described in the above mentioned article, was also on exhibition.

David Lupton's Sons Co. exhibited an interesting form of steel window sash for mill buildings and operating devices for these. The devices show that considerable study has been made of methods of ventilating and lighting workshops and the best means have been sought for solving these problems.

The Ruby Manufacturing Co., of Jackson, Mich., exhibited a sectional steel building such as should prove economical for work where portable houses need to be used. The house is built with interlocking sections and can be readily put together and taken down. It is a waterproof building and may be used for storage of cement, tools, etc.

The C. W. Hunt Co. exhibited this year an automatic side dump car which is used in many coaling plants throughout the country. The car is made to operate from under a bin and from which it takes a charge of coal, gravel or other material, down a grade of about 3 per cent to the top of a bin where it automatically discharges. A counter weight is arranged so that the car is thrown back to its original position under the first bin for another load. Installations for handling coal are in use where the coal is transported a distance of 400 ft. and one trip a minute is made with a 1½-ton car.

Annual Convention of the North Dakota Society of Engineers.

The fourth annual convention of the North Dakota Society of Engineers was held at Grand Forks on Feb. 15 and 16, with President Samuel F. Crabbe in the chair. Twenty-six members were in attendance and a large number of visitors. Lengthy morning and afternoon sessions were held on both days according to a program of addresses, discussions and business as prepared and announced. The annual banquet was held on the evening of Feb. 15 at the State University, which is near Grand Forks.

A chief feature of the meeting was the discussion on concrete, particularly on local concrete materials, of the effect of freezing and thawing, and related topics naturally arising in North Dakota; this occupied the whole of the first afternoon session, being held at the university under the direction of the Concrete Committee, Prof. A. J. Becker, chairman.

Mr. M. L. Hibbard, of Fargo, discussed fuel gas and the economies secured by its use.

Mr. C. P. Brown, of Fargo, spoke fully on the proper methods to be employed in the construction of street railway tracks in paved streets. Prof. R. H. Slocum of the State Agricultural College discussed waterworks. Mr. J. A. Jardine of Fargo brought forward the proper specifications for county highway bridges.

Road construction as best and most economically carried forward in this region received considerable consideration, and a committee was appointed to recommend specifications for such work under the different soil and topographic conditions occurring in the state.

The conditions of employment and ruling rates of compensation under which the civil engineers and, in particular, the county surveyors of the state are working was the subject of an excellent address by W. A. Baker of Wahpeton, and the whole question was fully discussed by all. At the annual meeting of the previous year, a committee was appointed to prepare a draft of a law to regulate this work. E. F. Chandler, the chairman of this committee, submitted a bill providing for the licensing under proper restrictions as regards qualifications proved by examination, etc., of all those desiring to engage in public land surveying, to hold the office of county surveyor, to act as county road superintendent, or inspector of county bridges. This proposed bill, which had been printed and circulated among the membership some weeks in advance, was thoroughly considered and, after minor amendments, was unanimously recommended to the favorable consideration of the state legislature at its next session.

It was voted to hold the next annual meeting at Bismarck at about the middle of January, 1913. A midsummer meeting will perhaps also be arranged for July at Williston. The following officers were chosen for the coming year: President, Henry Lykken, city engineer, Grand Forks; First Vice-president, T. R. Atkinson, state engineer, Bismarck; Second Vice-president, S. F. Crabbe, county drainage engineer, Fargo; Secretary-treasurer, E. F. Chandler, professor in charge of civil engineering course, State University.

Annual Convention of the American Railway Engineering Association.

The thirteenth annual convention of the American Railway Engineering Association was held at the Auditorium Hotel in Chicago, March 19, 20 and 21. President Cushing called the convention to order shortly after 9 a. m., on Tuesday, and in his opening address stated that the association membership had passed the 1,000 mark during the year. Since 1899 the association has distributed some 27,000 pages of reading matter in the shape of bulletins, proceedings, etc. In the future, since the membership has passed the 1,000 mark, an economy may be effected by mailing these bulletins as second-class matter. The president reviewed the engineering progress in the country during the past year, [illegible] the progress on the [illegible], the New York Barge canal, the Ca kill aqueduct, the New York Cen al Ter minal, the Chicago & Northwester Term [illegible] and other large railway en projects.

The businesslike manner with ch the conventions of this association a cor ducted make for excellence in th quality of the material presented and pr ide fo the presentation of an immense a unt o material contained in the committe report and for its discussion and accepta ce in short space of time.

During the first day's session, r orts o the following committees were ceiv Rules and Organization; Signals locking, with a minority report; n an Steel Structures; Wooden Bri Trestles; Yards and Terminals; Ba st. Ties. On the second day were ge reports of the committees on Trac way; Rail; Water Service; Mason servation of Natural Resources; and Accounts, and Electricity. n third day, reports were received n committees on Economics of Rail y cation; Signs, Fences and Crossing ings; Grading of Lumber; Wood es tion, and Uniform General Contrac

The reports were all prepared a ed in bulletins previous to the mee g at the meeting were read by th man. Conclusions reached were s accepted one at a time accordin to printed form, by vote of the co or as amended in discussion.

The report of the committee and regulations recommended no to the previous rules adopted, but rules a list of 26 instructions wa The report on signalling and i ing was a progress report, as also a minority report, and they were rec information. The committee on i steel structures reported a set o cations for bridge erection, which proved for publication in the man the report on wooden bridges and e the following subjects were conside year: (1) Formulae for use in dete strength of sheet piling. (2) Re experience in actual bearing power and practical results of the use o lae. (3) Use of guard rails for bridges and trestles and (4) fire pre The committee made no recomme at this meeting, but gave the result progress made.

The report on the proper depth o showed that, from available data, 9 8½ ft. ties spaced 24 ins. to 25.5 ins should have a depth of 24 ins. [illegible] last to produce a uniform pressure subgrade and a combination of layer of 18 ins. to 14 ins. Cinder and upper layer of 6 to 10 ins. o approximating 24 ins. in depth, wi ties spaced 24 ins., produce nearly t results. This definition of depth o was approved.

The committee on ties reported at it was not feasible to lay down rules for the size and spacing of tie on the A, B and C classification of of traffic, but that it would be co [illegible] practice for Class A and Class B roads to space ties from 1 ins. face to face; the width of th tie not so important if 10 to 12 ins. sp followed, provided, however, the m width of face is limited to 7 ins. Th mittee recommended the practice o tie renewals.

As to metal and concrete ties, th mittee concluded that a combination crete and metal, or of asphalt an has not yet proved a success, bec the fracture caused by vibration a cessive weight and consequently d in handling and deterioration of filling. Also that a combination tie and wood gave promise of develop economic substitute; that the all oid satisfactory under heavy me- traffi

mmittee on track, revised plans and switches and submitted them plans representing good prac- were adopted by the conven- se plans are for the No. 8, 11 and ogs and No. 11 spring frog and 16½ ft., 22 ft. and 33 ft. switches. cifications presented by the com- frogs, crossings and switches opted. The committee on yards nals considered several subjects, [illegible] and adopted: First, the engine hould be so located as to offer s to both the main line and yards west possible reverse or conflict- nents, and second, the facilities arranged to permit rapid han- n engine in its terminal in the s needs.

mittee on water service present- ations for steel tanks for water hich were amended slightly and

mmittee on masonry reported [illegible] and repairing [illegible] orced cement, and methods of [illegible] under water, [illegible]

mittee on electricity reported its perate with other associations ng the same lines, in order to a standard. The convention e committee's report according- slight amendment. Other com- ported progress and gave infor- to the work accomplished.

ual dinner was held on the eve- [illegible] second day. The retir[illegible] ent, Mr. W. C. Cushing, toastmaster. Mr. L. F. Lorie, of the D. & H. R. R., who was on "Labor Unionism," was unable ent, but his address was read by rge H. Burgess, chief engineer of H. Hon. F. D. Monk, K. C., M. er of Public Works of Canada, ssed the problems now of inter- h countries; Mr. Ray Morris, of eld & Co., New York, addressed on "Railway Development from Point of View." Following the smoker was held.

PERSONALS.

orge Lee was named to succeed H. H. Fairchild as a member of [illegible] board of the state [illegible]

as. F. Robinson, superintendent tleboro, Mass., water department, ned on account of pressure of siness.

W. Scripps, member of the ighway Commission, San Diego, has resigned. He is succeeded chard Goodbody.

rd C. Phillips, assistant city Boulder, Colo., was unani- ected to fill the vacancy caused signation of Mr. Fred Dungan, eer.

G. Tyrrell, consulting engineer, Ev- on March 12, delivered an illus- n the subject of "Bridge Build- e Engineering Society of North- [illegible]

hrstadt, of the House of Dele- [illegible] introduced a bill creating the position of superin- bitimuinous paving in the street t, at a salary of $175 per month.

F. Loweth, Chief Engineer of the Milwaukee & St. Paul Railway, an address before the Civil Engi- ub of the University of Illinois, y, March 15. His subject was Efficiency."

W. P. Ramsey has been appoint- er of construction for the eastern e Canadian Pacific Railway, with Montreal. Mr. Ramsey is a na- ury, and has been in the service

14 years [illegible]

[illegible] r of public [illegible]

Co. has the contract.

Mr. Francis P. Smith, M. Am. Soc. C. E., chemical and consulting paving engineer, [illegible]

Columbia university.

Mr. George W. Tillson, M. Am. Soc. C. E., consulting engineer to the President of the Borough of Brooklyn, New York City, on March 11 delivered an illustrated lecture on "The Comparison of Pavements," before the Graduate Students in Highway Engineering at Columbia University.

Mr. Frank D. Chase, Assoc. M. Am. Soc. C. E., architect of the Western Electric Company, has opened offices in the Peoples Gas Building, Chicago, for the practice of architecture and industrial engineering, making a specialty of manufacturing plants and mercantile buildings.

Mr. S. R. Alexander, who has been connected with the city engineer's department of Baltimore, has been appointed assistant harbor engineer to succeed Mr. Chas. E. Sutler, who resigned some time ago, to accept a position with the Furst Concrete Scow Contracting Company.

Mr. John Rablin, M. Am. Soc. C. E., Chief Engineer Massachusetts Metropolitan Park Commission, on March 15, 1912, delivered an illustrated lecture on "The Construction and Maintenance of Park Roads," before the graduate students in highway engineering at Columbia university.

Mr. Charles Thompson Harvey, a well known engineer of New York, died at his home March 13, at the age of 83. He had a large share in important engineering projects during the Civil War and reconstruction periods. He planned the first elevated railroad in New York City and built the Sault Ste. Marie ship canal.

Mr. E. L. Cousins, engineer of the Toronto harbor commissioners, is to be sent on a tour of inspection of some of the United States harbors along the Atlantic Coast. He will leave at the end of this week and will be accompanied on part of the tour by Government Engineer J. G. Sing, who is consulting engineer to the board.

Mr. J. E. Richard was elected president of the Engineering Society of the School of Practical Science of Toronto, at the recent annual meeting. Mr. W. P. Curtis was elected vice-president: Mr. S. F. Rutherford and Mr. G. M. Smith, second vice-presidents; Mr. M. F. Verity, treasurer, and Mr. H. R. McKenzie, corresponding secretary.

Mr. I. K. Pond, of Chicago, ex-president of the American Institute of Architects, delivered an address before the students and faculty of the College of Engineering of the University of Illinois, Friday, March 8, on the practical development of historical forms of ornament in connection with the architectural development of various countries.

Mr. Arthur D. Little, President of Arthur D. Little, Inc., chemists and engineers Boston, was elected a member of the Corporation of the Massachusetts Institute of Technology at its meeting on March 13. Mr. Little is President of the American Chemical Society and a member of the Executive Committee of the Eighth International Congress of Applied Chemistry.

Mr. W. H. H. Allen has incorporated the W. H. H. Allen Construction Company under the laws of W. Virginia. The capital stock is $100,000. Mr. Allen was senior member of the firms of Allen and Kefauver, Allen & Sons [illegible] District Construction Company. This company built the Connecticut Ave. bridge over Rock Creek at Washington, D. C.

Col. T. L. Waggener, a pioneer railroad builder, died on March 10, at Colorado Springs, Colo. He came to Colorado 35 years ago from Kentucky, and engaged in civil engineering work. He was formerly with the Colorado Midland & Oregon Short Line. His chief work however, was the construction of the Cripple Creek Short Line. His death was due to a general break-down. He had resigned only a week previously as city engineer of Colorado Springs.

Mr. Chas. S. Churchill, chief engineer of the Norfolk & Western Ry., was elected president of the American Railway Engineers' Association at the recent annual convention in Chicago. The other officers are as follows: Vice-president, Mr. W. B. Storey, Jr., Atchison, Topeka & Santa Fe; treasurer, Mr. Geo. H. Bremner, Chicago, Burlington & Quincy; secretary, E. H. Fritch, Chicago. Directors for three years elected, were F. A. Delano, W. L. Darling and W. B. Scott.

Dr. H. W. Spangler, dean of mechanical and electrical departments, at the University of Pennsylvania for the past 23 years, died at his home last week. He was born at Carlisle, Pa., in 1858, and was graduated from the United States Naval Academy in 1878. He was afterward an engineer in the navy until 1899, and during the Spanish-American war again served in the navy for a short time. He was called to the university in 1881 to take the chair of assistant professor of mechanical engineering.

Mr. W. S. Kinnear, president of the Kansas City Terminal Company, has resigned and will go to New York to accept the presidency of the United States Realty & Construction Company, at a salary of $50,000 a year. The United States Realty & Construction Company is one of the largest of its kind. One of its subsidiaries is the Geo. A. Fuller Construction Company, which has the four-and-a-half million dollar contract to build the new union station for the Kansas City Terminal Railway Company. Mr. Kinnear came to Kansas City from Detroit, where he was in charge of a tunnel built under the Detroit river for the Michigan Central Railway.

Mr. J. C. Stevens, a prominent Portland, Ore., engineer, sailed on March 15 for Spain. He will be absent several years in connection with the development of a large land irrigation project and water power development. His family will follow in about two months. Mr. Stevens was graduated from the University of Nebraska in civil engineering, was assistant state engineer of Nebraska from 1902 to 1903, was assistant engineer United States Reclamation Service in 1903 and 1904, and transferred to the United States Geological Survey in 1905, being chosen as district engineer in charge of the investigation of water supplies in the Columbia River District, embracing Oregon, Washington and parts of Idaho and California. He resigned from the Government service in July, 1910, to enter in general engineering practice and has been engaged in making estimates and reports on various irrigation and power projects in the Northwest, also being a member of the State Conservation Commission. Mr. Stevens was secretary of the Oregon Society of Engineers and is secretary of the local branch of the American Society of Civil Engineers.

TRADE NOTES.

The Tennessee Copper Co. has placed the order with the Ruggles-Cole Engineering Co. for one of its class A-8 dryers for drying iron ore.

The Ideal Electric & Mfg. Co. announces that Mr. Succop has been appointed General Sales Manager of the company and will make his headquarters at the main office, Mansfield, O.

The Ruggles-Cole Engineering Co. has recently shipped some large tanks of Monel metal to a prominent western chemical works. The construction included Monel metal sheets, rods, castings and rivets.

The Ruggles-Coles Engineering Co., 50 Church St., New York, has received an order from its London office for one of its class A-10 dryers which has been sold to the city of Tedcaster, Yorkshire, England, for drying sewage cake.

The Price Electric Co. of 413 Sibley St., St. Paul, Minn., has completed an arrangement with the Ideal Electric & Mfg. Co. of Mansfield, O., to represent the latter company. A large stock of Ideal motors, generators, etc., will be carried.

M. J. Palson, refrigerating engineer, Gloucester, Mass., has contracted with the Robb Engineering Co., Ltd., for twelve ammonia absorbers, ranging in size from 29½ to 37 ins. in diameter; also for three generators 30 to 36 ins. in diameter by 16 ft. long.

Mr. V. O. Johnston has severed his official connection with the Lincoln Sand & Gravel Co., of Lincoln, Ill., and is now General Manager of the Sabula Sand & Gravel Co. of Sabula, Ia. This company is installing a plant at Sabula, which will have a capacity of 20 cars per day.

The Petrolithic Good Road Development Co. has been organized with Mr. J. Y. Sanders as President and Howard Egleston, as Chief Engineer and General Manager, for the purpose of introducing the Petrolithic system of road building in the southern states. The offices of the company are in the Hibernian Bank Bldg., New Orleans, La.

A meeting of the representatives of seven steel mills was held recently at the La Salle Hotel, Chicago, and a permanent association was perfected for the purpose of promoting publicity and use of reinforced steel for concrete work. The organization will be known as the Rail Steel Bar Manufacturers' Association. Mr. Ed. E. Hughes, Franklin, Pa., is President, Mr. J. G. Joseph, Buffalo, N. Y., is Vice President, and Mr. A. S. Hook, Chicago, is Secretary and Treasurer.

George B. Carpenter & Company, the oldest concern in the West dealing in Contractors' Supplies, cordage, cotton duck, rubber goods, etc., are moving from their location on the corner of South Water and Fifth Ave., Chicago, which they have occupied for more than 60 years. For a long time they have maintained a large warehouse and separate factory located on the north side, but the pressure of a largely increased business obliges them to seek roomier quarters for their store. They will occupy the new and spacious building on the northwest corner of Wells and Michigan Sts., Chicago. This building is an up-to-date structure of eight stories, with about 125 by 125 feet of floor space, abundantly equipped with elevators, has an enclosed court for loading wagons and all the modern devices for handling merchandise with the greatest possible despatch. One of the floors will be devoted entirely to contractors' tools and machinery.

The International Motor Co. announces that it has just acquired the properties of the Hewitt Motor Truck Co. and all the business of this concern has been taken over commencing March 1. Sales and Executive Departments on that date became amalgamated with the International Motor Co., whose headquarters are at Broadway and 57th St., New York City, with works at Allentown, Pa., Plainfield, N. J., and New York City. The association of the Mack, Saurer and Hewitt trucks makes the position of the International Motor Company one of the most formidable factors in the motor truck industry in this country. The range of sizes which this organization offers will include every variation in live load capacity ranging from 1,500 lbs. up to ten tons. The acquisition of the Hewitt interests especially strengthens the line of heavy duty trucks offered by this organization, as the Hewitt trucks have made a most enviable reputation in the last few years, being in service of some of the largest wholesale coal dealers, lumber merchants and engineering contracting firms.

The Marion Shovel & Dredge Co. of Marion, O., which has purchased the entire business including patents, designs, patterns, good will and name of The Osgood Dredge Co. of Albany, N. Y., in order to perpetuate the name, has consolidated under the name of The Marion-Osgood Co. The home office is located at Marion, O., on East Center St., opposite Hotel Marion; the eastern office of the company is located at 51 State St., Albany, N. Y., with Mr. John K. Howe in charge as Consulting Engineer and Eastern Sales Manager. The shops are located at Marion, O., just south of the city between the Hocking Valley and Pennsylvania Rys. and has direct connection with both of these roads. The company will manufacture a full line of steam shovels, dipper dredges and ballast unloaders. The company has delivered a 1½-yd. shovel to Mr. H. S. Kerbaugh of Philadelphia, Pa., and has orders for two 6-yard shovels for Mr. Kerbaugh. It is also building a 4-yard dredge for the Empire Engineering Corporation of New York City and is well along with a 1½-yd. dredge for the United States Government for use on the Tennessee River. Drawings and patterns are well along and the work started on a shovel built to handle a 2½ or 3-yd. dipper.

The Universal Portland Cement Co. of Chicago and Pittsburgh devoted the larger part of its exhibition space at the Fifth Annual Chicago Cement Show at Chicago to a display demonstrating the use of concrete as a paving material. A painting in color extended along the back of the five booths used, and showed in perspective the view down a paved street. In the first of the five booths a two-coat concrete pavement was shown. This was composed of a wearing surface of 1 part cement, 1½ parts of a mix of (3 parts 1¼ in. to 1½ in. granite, 2 parts granite screenings). The base consisted of one part cement, 3 parts torpedo sand, 5 parts limestone. The expansion joints were protected by Baker steel plates. In the second booth a brick wearing surface was laid after the recommendation of the National Brick Manufacturers Association upon a standard concrete base. The base was composed of 1 part cement, 3 parts torpedo sand and 6 parts limestone. In the third booth a concrete pavement with a wearing surface of bitumen and sand such as is used at Ann Arbor, Mich., was laid upon a base composed of 1 part cement, 2 parts torpedo sand, and 4 parts screened gravel. The fourth booth was a representation of a type of pavement that covers 33 miles of road in Wayne county (Detroit), Michigan. This single-coat concrete pavement is composed of 1 part cement, 1½ parts torpedo sand and 3 parts screened gravel. The expansion joints were placed 25 ft. apart, and protected by Baker steel plates. This exhibit proved especially attractive to engineers and highway commissioners generally. The fifth booth showed a pavement with a wearing surface of 1 part cement, 1½ parts of a mix of (3 parts ¼ in. to ½ in. gravel and 2 parts torpedo sand.) The base consisted of 1 part cement, 3 parts torpedo sand and 5 parts gravel. The expansion joints in this case were protected by 2x2¼x3/16 in. angle iron. The reinforcing material used was No. 7 triangle mesh.

The Bucyrus Co. has taken over the manufacture of the Atlantic type shovel, heretofore built by the American Locomotive Co., and under a license from patentee, Mr. A. W. Robinson, it is their expectation to continue building all of the sizes previously built, and to eventually have a complete line of Atlantic wire-rope shovels, in addition to a complete line of Bucyrus chain type shovels, which they have been building for 30 years. The building of the Vulcan shovels has been transferred by the Bucyrus Co. from Toledo, O., to the new plant at Evansville, Ind. A stock of repair parts for all shovels will be carried at Montreal, New York, San Francisco, Spokane, in addition to a very full supply at the South Milwaukee and Evansville plants. Particular attention will be given to the prompt filling of repair orders. In connection with its recent reorganization, several radica have been made in the sales force. with Jan. 1, Mr. Carl Horix, former Manager of the Vulcan Steam Sh took charge of the Chicago office of rus Co. as Central Sales Manager. are Mr. E. L. Byron, formerly Eas Manager of the Vulcan Steam Sho pany, Mr. W. S. Russell and Mr. B ston, both formerly connected with t Co. The offices are at No. 622 Bldg. Mr. Carl S. Reed, formerly Sales Manager of the American L Co., is now Eastern Sales Manag Bucyrus Co., with offices at No. 50 C New York City. With him are Gawthrop, for several years with th Co., and Mr. Edward G. Lewis, forn nected with the Good Roads Machin Duluth office has also been establi Mr. E. C. Hingston in charge. Mus ited of Montreal, Canada, with office bec, Toronto, Winnipeg, Vancouve and Calgary, retain the agency in which they have had for several ye man B. Livermore & Co. of San will handle steam shovels, wreckin pile drivers and ballast plows in and the same products, with the ac drag line excavators, in Nevada, Arizona. Stuart A. Taylor Co. agency for all of the Bucyrus Comp ucts, with the exception of dredges, ington, Oregon and Idaho. Arra have been made with the Yuba Co Co. for the handling of dredges on cific Coast, Alaska and the Yukon. quiries will be referred to them at California St., San Francisco, Cal. N. Steinbarger continues to represent pany at Denver, Colo., with offices in t Bldg. Mexico will be covered by Wiggin of Mexico City, Mexico. B. Massey, for a number of years i of the New York office of the compan located at the General offices in So waukee, preparing for an extensive tr in the interest of the company's fore ness

CATALOGS.

Rock Drill.—Paper, 3½x6 ins. Wickes Brothers, 443 Claremont A sey City, N. J.

This booklet gives a line drawin ing the details of the Murphy Littl pion Drill and also contains other tions with descriptions of the cons

Lohmannizing.—Circular, 16x8 i Brier Hill Steel Co., Youngstown,

Describing the difference betw vanizing and lohmannizing, this says "It's the difference between and an amalgamation." A descri the Lohmann process is illustra described.

Machinery.—Paper, 3½x9 ins., Wickes Brothers, corner West an Sts., New York City.

This catalog lists equipment ow this company and in other war Index, illustrations, specificatio prices are given.

Koehring Mixer.—Paper, 4½x8 pp. Koehring Machine Co., Milwaukee, Wis.

This catalog contains a brief illustrated description of the Koehring Mixer.

Marine Electric Service.—Paper, x10 ins., 40 pp. General Electric Co., Schenectady, N. Y.

Bulletin No. 4926 describes the pieces of apparatus and supplies f rine use and contains data of general est to motor boat owners. Reproducti in colors of the flags of the principa clubs are scattered throughout the b

Gramm Motor Trucks.—Paper, ins., 8 pp. The Gramm Motor Tru Lima, Ohio

This catalog gives a general descript of Gramm trucks in sizes 1, 2, 3 and The catalog is illustrated and brief specifications for each model are given.

AILWAYS, STEAM AND ELECTRIC

Alabama.

Taloosa Ice & Light Co., of which
Jison, Birmingham, Ala., is Presi-
as submitted a proposition to the City
of Tuscaloosa, looking [illegible]
ction of a street railway at that place.
ral Springs Hotel Co. will let
April 15 for the [illegible]
the electric railway from Gadsden
Mountain. The construction will
ntain work involving side cut-
Hart, Gadsden, Ala., is President.
opened March 12, at the [illegible]
President of the Eufaula & Chat-
lley Railroad, Eufaula, Ala., for
on of the proposed line. The
the work will be let shortly.

Arizona.

aso & Southwestern R. R. [illegible]
ve made preliminary surveys for
anch line to Fort Huachuca, and
hat as soon as work is completed
son extension construction will be
e branch.

Arkansas.

tt, Monticello & Northern R. R.
rporated and proposes to con-
e from Cremer Junction, five miles
Crossett, to Fountain Hill, thence
t. a total distance of 48 miles, in
of Ashley and Drew. The cap-
$300,000, of which $2,000 per
n subscribed.

Board of Railway Incorporation
ed the charter of the Meno & Hot
y. Co. for three years. It is un-
hat negotiations for financing the
pending and that it is expected ar-
s will be completed for beginning
n work within a short time. John
Mena, Ark., is President.

iller, Lamar, Mo., President of the
& Northern Railroad, will, accord-
orts, commence work immediately
posed extension from McCreanor,
Pine Bluff. Later it is planned to
an extension from McCreanor to
rk., where it will tap the Missouri
Arkansas R. R. This connection
de before starting the construction
uthern division out of Pine Bluff.
be built to Monticello, Star City,
and other South Arkansas points.
when completed on the North and
be more than 300 miles long.

hite River Valley Ry. Co. has been
charter by the State Board of Rail-
porators, Little Rock, Ark., to build
in Phillips County from Hugo, a
the Iron Mountain, to Webb, a
f 10 miles. The company is incor-
ith a capital stock of $20,000. The
are W. H. Howe, O. D. Howe, J.
W. L. Fernald and W. R. Satter-

California.

Northern Electric Ry. Co., A. D.
General Manager, San Francisco,
led the contract for all grading on
ion from Yuba City to Colusa to
ros. & Co., of Hamilton, Cal. The
rs a distance of about 26 miles, and
rdage of about 400,000. The con-
for the completion of the first sec-
ay 1, 1912, and of the second sec-
ly 1st of the same year.

A. Smith Timber Co., of which C.
Minneapolis, Minn., is President,
construction work soon on a pro-
-mile railroad from Sacramento to
holdings.

ction work on the uncompleted part
ary St. railway at San Francisco will
ed early next month by the Board
s of that city. Marsden Manson is
eer.

[illegible] projected the line would be about 8 miles long. Dr. Frank Rattan, Martinez, is interested.

The Central California Traction Co., San [illegible] Galt.

The officials of the Western Pacific Ry. are understood to have about completed arrangements for securing a loan of something like $20,000,000, which will be used for improving the line, building terminals and constructing branch lines. T. J. Wyche, San Francisco, is Chief Engineer.

The Fresno Northeastern R. R. Co., of Fresno, has been incorporated with a capital stock of $1,000,000, the directors being G. C. Ward, A. N. Kemp, W. E. Dunn, H. P. Baumgaertner, Albert Crutcher.

Steps are being taken for the formation of a company to build a railroad from Eureka to Yreka, 80 miles. Preliminary surveys have been made, and the necessary capital for the construction of the road is reported to be assured. N. B. Dotson, Pasadena, Cal., is interested.

Advices from Richmond state that the Spring Construction Co. has begun the grading of the Key Route right of way from the present terminal of its Sacramento street line through Albany and into Contra Costa county.

Colorado.

It is reported that after the expiration of the fiscal year, June 30, the Santa Fe system will make improvements in the vicinity of Pueblo, Colo., estimated to require an expenditure of $2,000,000. The work will include repair shops and a large roundhouse in Pueblo and a new system of switching yards, which is badly needed. A new depot will be built at Fowler and smaller ones at two other points between Pueblo and Fowler.

Preliminary surveys have been completed by H. G. Palmer, Consulting Engineer, Yorkville, Ill., for the proposed route of the railroad from Montrose into Paradox valley. This 100-mile road will form part of a north-and-south line along the western slope of the Rockies, developing a rich virgin land lying between Gallup, N. M., Paradox and Grand Junction, Colo., and Thermopolis, Wyo. It will connect with several big systems.

The Grand Junction & Grand River Valley Ry. Co., Grand Junction, Colo., is reported to have completed financial arrangements for the extension of its electric railway from Grand Junction to Clifton. Construction work is to be started shortly.

It is now stated that active construction work on the extension of the Laramie, Hahn's Peak & Pacific R. R., R. D. Stewart, Chief Engineer, Laramie, Wyo., will be resumed April 1. Tunnel boring was continued all winter. This line has tapped the coal fields of northwestern Colorado and is to be extended to Steamboat Springs, Routt county; Craig, Moffat county, and Meeker and Rangely, Rio Blanco county.

Connecticut.

The New York, New Haven & Hartford R. R., Edw. Gagel, Chief Engineer, New Haven, Conn., is reported to be making new surveys looking to the double-tracking of the Housatonic line between New Milford and Hawleyville. Above New Milford there will be extensive reduction of grade with a view to the straightening of tracks and future de- [illegible] Rutland system.

Georgia.

[illegible] Ga., has taken action looking toward the bringing of some company into the city to build interurban lines as well as a local street railway line.

Meeting of the newly formed Waycross & Western R. R. Co. was held at Waycross, Ga., on March 20, for the purpose of effecting the permanent organization. This road will be 70 miles long, and material for a considerable part of it is said to have been ordered. Construction work is to be started when all right of way is secured.

Articles of incorporation have been filed with the Secretary of State, Atlanta, Ga., by the Columbus, Chattahoochee Valley & Gulf Ry. Co. The company proposes to sell 500,000 shares of common stock at $100 per share and build a railroad from Georgetown to Atlanta, via Columbus, a distance of about 180 miles. The road would pass through Quitman, Stewart, Chattahoochee, Muskogee, Harris, Troup, Heard, Coweta, Campbell and Fulton. The incorporators are John D. Little, Atlanta, and Josiah Flournoy, J. Johnson Williams, L. H. Chappell, Arthur Bussey, P. J. Williams, L. F. Humber, Henry R. Goetchius, T. T. Miller and E. P. Ewsley, all of Muscogee County.

Idaho.

⦿The Utah Construction Co., Ogden, Utah, is reported to have been awarded the contract for the extension of the Idaho Northern Ry. from Smith's Ferry to Payette Lakes, a distance of 47 miles. The Wasatch Construction Co., Salt Lake City, Utah, is understood to have secured the first eight miles of the extension.

The Oregon Short Line R. R. is reported to have offered to extend its line from Mackay to Clayton if the owners of mines in that district will put up the sum of $50,000.

Preliminary work is understood to be well along for the proposed branch line from American Falls to Rochland, and it is possible that construction work may be started this summer. Judge A. Z. Watson, Chicago, Ill., is interested in this project.

The Chicago, Milwaukee & Puget Sound engineering crew in charge of James Coyle has completed a preliminary survey between Plummer, Idaho, on the main line, and a point on the Oregon-Washington Railroad & Navigation Co.'s line in Washington. The first survey calls for a line from Plummer to Bell, where the Lake Creek branches off the O. W. R. R. & N. Co.'s main line.

Illinois.

⦿Alex McGavock, Beloit, Wis., has secured 250,000 cu. yds. of shovel work and 91,000 cu. yds. of team work on the new Chicago & North-Western line, for which Winston Bros. have the general grading contract. The work is located at Mason City, Ill., and Green Valley, Ill. Mr. McGavock will have his headquarters at Mason City and will put three shovels at work and several team outfits. He will be glad to hear from any of his old men.

The County Supervisors at Springfield, Ill., have granted a right of way to the Springfield Northwestern Interurban Co., along the fairgrounds at Springfield. This company proposes a line from Springfield to Mason City, and also from Springfield to Petersburg. Ralph N. Baker, Springfield, is President.

The Illinois Traction System, H. E. Chubbuck, General Manager, Peoria, Ill., has placed an order for $50,000 worth of steel rails, to be used for extensions and replacing light rails.

The Chicago & Western Indiana R. R., E. H. Lee, Chief Engineer, Chicago, Ill., has

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

arranged for the [illegible] dated mortgage 4 per cent bonds. From the proceeds of the sale $540,000 will be used for a bridge over the Calumet River, track elevation and additions to the belt line, while $398,000 will be expended in repaying to proprietary companies bonds canceled in March, 1911. Construction and capital betterments will require $426,900.

The Milwaukee, Peoria & St. Louis R. R. Co., projecting a line from Peoria to Rockford, has secured a large part of its right of way. Construction work at the southern end of the line may be started some time in May. As outlined this line starts on the east side of the river at Peoria; runs along the east bank of Marshall, Hennepin, county seat of Putnam, which town now has no railroad connection; crosses the river at Depue, using the trackage of the New York Central lines for the bridge and into Seatonville; thence to Rockford. Frank B. Reid, Chicago, Ill., is President, Robert D. Clarke, Peoria, Ill., is Vice-president, and George E. Stocking, of Rochelle, is Treasurer.

An appropriation of $22,700,000 has been made by the Santa Fe system which will include heavy expenditures in the engineering department. The budget includes $2,000,000 for double-tracking on the coast line, $1,000,000 for terminal yards and improvements on the Colorado division and $500,000 for a new office building in Galveston, Tex. New equipment will cost $5,700,000, while the balance of the $22,700,000 will be devoted to general improvement work throughout the system.

Under the provision of the ordinance submitted by D. C. Dunlap and William Armstrong, Engineer and Attorney respectively of the Elgin Terminal Ry. Co., to the City Council, Elgin, Ill., the proposed road will have but few grade crossings in the city, the majority of the route being either subway or elevated.

Advices from Bloomington, Ill., state that the Tampico-Hooppole branch of the Dixon, Rock Falls & Southwestern Ry. has passed from the control of President J. J. Burns to R. H. Mathis, Prophetstown, and other financiers of Hooppole, Yorktown, and Tampico. It is said that the company will be reorganized and the line extended from Sterling and Tampico to Geneseo. About 15 miles of line has already been constructed.

A meeting of the bond holders of the Alton, Jacksonville & Peoria R. R. Co. was recently held to reorganize and make plans to continue the construction of the line to Jerseyville, Ill. Edgar M. Davis is President and C. H. Segar, Alton, Ill., is Vice President.

Indiana.

The Indianapolis, Newcastle & Northeastern Traction Co. has been incorporated with a capital stock of $10,000 and proposes to operate and acquire street and interurban railways in Indianapolis, Shirley, Kennard, Newcastle, Hagerstown, Richmond, Lynn, Winchester and Muncie. Joseph T. Elliott, George B. Elliott and C. Edgar Elliott are directors, and Helen E. Clayton and Henry H. Hornbrook are other incorporators. It is reported that the new corporation has the backing of the Union Trust Co., Indianapolis, receivers for the Indianapolis, Newcastle & Toledo Electric Railway. It is also stated in certain quarters that the Indiana Union Traction Co. is interested in the company and is about to carry out a long contemplated plan to extend a line from Muncie to Newcastle.

Kentucky.

The Chicago, Memphis & Gulf R. R., S. G. Latta, President, Dyersburg, Tenn., is understood to be preparing to award contracts for the continuation of its line from Hickman, Ky. Contractors have been over the routes and it is believed that the line will be continued to a connection with the Illinois Central probably in the vicinity of Clinton, Ky.

The Licking Valley & Elk Fork R. R. Co., of Winchester, Ky., has been incorporated with a capital stock of $100,000, the incorporators being Jacob H. Fulmer, Jr., J. Lemuel Darrow, T. G. Stuart, S. R. Collins and Abner Graham.

Louisiana.

The Baton Rouge Electric Co., 317 Main St., Baton Rouge, La., is to apply to the City Council for a right of way over certain streets for a street car line extension. The proposed route is to begin on Front street, near the Yazoo and Mississippi Valley depot, come down to Florida street, out Florida to Tenth, then across to North boulevard, crossing North boulevard at the Convention street school, down East boulevard to Reddy street, and beyond to South Baton Rouge. The City Council, however, will only be asked for extension as far as Reddy St., as that is the end of the city limits.

The New Orleans Southern & Grand Isle Ry., C. E. A. Carr, General Manager, New Orleans, La., has engineering plans under way for a considerable amount of betterment work.

A local company composed of J. L. Edmonds, N. S. Dougherty, Allen Dougherty, Henry Ronaldson and Dudley Weber, have applied to the City Council of Baton Rouge for a franchise to build a line to South Baton Rouge and to the Standard Oil plant.

The Yazoo & Mississippi Valley R. R., S. S. Morris, General Superintendent, Memphis, Tenn., is said to be planning a number of trackage changes at Baton Rouge. It is stated that the company proposes to build additional tracks beyond the university, where it has lands abutting the bluffs of the university, to come in behind the Stumberg and Dodson property and, crossing North St., in the rear of the Armour Packing Company warehouse, split the three blocks as far as Florida St. This would relieve the congestion on the river front.

Michigan.

Resolution has been adopted by the City Council of Detroit, Mich., directing Commissioner of Public Works Haarer to put in a supplemental estimate of $6,000 to cover the cost of making preliminary plans for a subway in Woodward Ave., with a branch in Michigan Ave. to the new Michigan Central station.

Business men of Mt. Clemens, Mich., have under consideration the construction of a short line railway to tap the Bay City division of the Michigan Central R. R. at Utica, Mich., a distance of 7 miles.

Minnesota.

Promoters of the Waumandee Valley R. R. have asked the Board of Trade, Winona, Minn., to secure private subscriptions of $2,000 for the preliminary survey of the right of of way from Fountain City to Winona. The new road as planned will extend from Eau Claire, Wis., to Fountain City, running through the Waumandee Valley. A. E. Rau of the Northwestern Construction Co., St. Paul, Minn., and J. M. Smith, Whitehall, Wis., are promoters.

Mississippi

The Meridian Light & Ry. Co., Meridian, Miss., is to begin work at once on the construction of a new street railway line along 4th St. east to 16th Ave.; thence north along 16th Ave. to 5th St.; thence east along 5th St. to 15th Ave.; thence north along 15th Ave. to 13th St.; thence east to the cotton mills.

Missouri.

The City Council of Kansas City, Mo., has passed an ordinance granting the Kansas City Southern Ry. permission to build a switch track in May St., from 5th to a point south of 8th St., with spurs to several industrial and shipping interests.

The Bismarck, Bellevue Valley & Western R. R. Co., of Bismarck, chartered last week with a capital stock of $300,000, proposes a 20-mile line running from Bismarck, in St. Francois county, to Sunlight, in Washington county. E. E. Evans, of St. Louis, holds 280 of the 300 shares of stock.

St. Louis Items

BY A. B. [illegible]

⊙The contract for grading 60
west of Forest Park and South
ton University was awarded to
Manus & Joyce of Keokuk,
about 350,000 cu. yds. of earth
on this job.

⊙McCabe & Steen were awa
tract for track laying and bridgi
Missouri, Oklahoma & Gulf R.
in Missouri and Oklahom
open an office at Fairland, Okl
of McCabe & Steen, was in to
day looking for a lot of box ca
as Commissary and camp cars
Missouri, Oklahoma & Gulf R.

⊙Walter Denison of Woodwar
taken 15 miles of work from Wa
on the Missouri, Oklahoma & G
has some nice work that he c
wheeler outfits. He is moving
teams and a number of subs
100 in all from off the Wichita F
western R. R., which road he h
pleted on to this new work. He
office in Waggoner, Okla., on Ap

⊙J. W. Wilson & Son of St.
awarded the contract for build
physics building for the Univer
souri at Columbia, Mo. Their
000. They built the Rothwell gy
two churches here. The bid doe
lighting, heating and plumbing,
bring the cost of the building up
The building will be located near
tural building on University ave
be of stone in the collegic-gothic
tecture.

R. E. O'Brien of Cameron,
Joyce, arrived here with a part
fit to begin work on their grad
in the west part of the city.

About $5,000,000 has been ra
Louis capitalists to build an interu
line from Dallas to Waco, Tex.,
the street railway system of the
The new system is expected to
tion by Oct. 1, 1913. The new
be known as the Southern Tracti
of Texas, was underwritten by t
Union Trust Company, G. H. W
and William R. Crumpton Com
disposed of the entire bond issue
000 exclusively among St. Louis
enterprise is ranked as the largest
cial transaction handled solely b
capital, announced here for years
line will be virtually an extension
as Traction Co., running betwee
and Dallas. The main line will ru
las, south, through Ferris to W
tance of 100 miles. A branch line
structed from Ferris to Corsicana
of thirty-four miles. The compa
take over the seventeen miles of
Street Railway Company. Arrang
been made to enter Dallas over the
street railway company of that city
line is located mostly over priva
way. The proposed line also will p
Waxahachie and Hillsboro and
seats and principal towns of McLe
varro, Ellis and Hill counties whic
"Black Land" belt of Texas. The
pany does not propose to take ove
er-house of the Waco Street Rai
pany, but will get its power thro
solidation of electric light and p
serving Waco and other towns
route. Steel bridges and concrete
will be built and 80-lb. steel rails
on the Dallas-Waco line and 70-lb.
Ferris-Corsicana branch. The c
enterprise will be $5,500,000. Th
Traction Company, the franchise
owned by J. F. Strickland and Osc
of Dallas, is capitalized at $7,500,00
$5,000,000 is common stock and $
per cent cumulative preferred st
bond issue of $5,000,000 disposed
Louis bears 5 per cent interest a
in thirty years. The second mortg

to the amount of $5[illegible] first mortgage bonds are a first [illegible] 134 miles of Interurban lines and [illegible] miles of street railways [illegible] [illegible] of the [illegible] of $2[illegible]

More than $1,[illegible] along the right of way [illegible] $425,000 will be held in trust. Con[illegible] [illegible] up on account of cold weath. Will [illegible] as weather [illegible]

gner, several years ago one of the [illegible] and best known [illegible] again to be a factor in the Memiction world. Mr. Wagner, who, elected president of the Builders' ft Memphis three years ago for M., where he went in search of established a construction busi[illegible] e exchange, with which he once [illegible] to the builders are being received campaign for doubling the force ation promises to be highly suc[illegible]

[illegible] W. F. [illegible] was a visitor here the other day. [illegible] ble track work on the Pierre R. between Detroit and Toledo. [illegible]

[illegible] any county that desires to em[illegible] of their "feed and keep." The [illegible] t any applications will be made [illegible] could the highways be improved ov. Hadley is of the opinion that he weather settles and the work ling can be resumed, more than vill be anxious to "hire" the la[illegible] convicts, and he feels sure a sin[illegible] nt will provide a solid plan for [illegible] of the male [illegible] g. Under the act passed by the re providing for the gradual the contract system of working ision is made under which they oyed upon the highways, start[illegible] next April and adding 300 each r until the last convict is out of the contractors and the last of the penitentiary. This meas[illegible] ed at the demand of every po[illegible] ty in the state to abolish contract bor and find some employment for ts where their labor will not be in ith the products of outside labor. [illegible] highways [illegible] over the state, and many hun[illegible] sands of dollars have lately been the shape of bonds to pay for these which, under the most favorable s, are costly improvements, rang[illegible] to $6,000 a mile. Labor is the and in no way would it be possible able-bodied men for their board and in the case of convicts or men serv[illegible] entences, and it is expected that this ty will not be overlooked. In fact, [illegible] several counties [illegible] oss-state highway between St. Louis sas City have been considering the ty of applying for these convicts just as the season will permit of outside an advantage. Applications can be [illegible] Andrae for 300 [illegible] any time after April 1, but the coun[illegible] nties getting these convicts must bear [illegible] to clothing, which [illegible] state will continue to furnish. Gov. xpressed the opinion that this method ng convicts presently will uproot the system entirely. He has been com[illegible] g with a number of states—Colorado, regon and North Carolina where are worked on the public highways.

[illegible]

[illegible] ern and western contractors were in town the [illegible]

Mile Costello of Costello Bros., Indianapolis, Ind., spent a day with his folks. We may report something new about this firm in next issue.

[illegible] were here bidding on the 350,000 yards of grading let in the west end of the city.

Compensation for the three receivers of the [illegible] each, in a decree handed down by Judge Elmer B. Adams in the United States District Court. The decree also authorizes the compensation [illegible] ceivers, at $18,000 annually. The amounts are to be paid in equal installments on the first day of every month. The decree further reads that upon the discharge of the receivers from their trust they may apply for and the court will award such additional compensation as [illegible] tion, it is understood, if asked, will constitute a certain percentage of the money handled during the trust. The order of Judge Adams followed a petition filed by the three receivers of the road, F. A. Delano, W. K. Bixby and Edward B. Pryor, asking for the judge to name a specified sum.

Harrington Bros. have their outfit still at work at West Frankfort, Ill. Will finish their work shortly and in the market for more grading work. The Harrington boys have a crackerjack team outfit and have a reputation of finishing their work always ahead of contract time.

Preliminary arrangements are being made for the extension of the Chicago, Memphis & Gulf R. R., the new railroad built into Hickman, Ky., last fall, from Hickman to Metropolis, Ill. It is hardly expected the line will be extended the entire distance this year, but there is little doubt of its building part of the way, for enough to make connection with the Illinois Central at some point probably in the vicinity of Clinton, Ky. Contractors have been looking over the proposed routes for the past week, and last week the C., M. & G. surveyors began making survey from Hickman toward Moscow. As soon as the river recedes and the water is off of the upper bottoms, a final survey will be made. They are anxious to make extension and it is said when once the work begins it will be pushed more rapidly than their last year's work between Tiptonville and Hickman.

John P. Carroll is representing the W. J. Newman Co. of Chicago who have the contract for excavation of the new Railway Exchange building here. Carroll informs us that he can use a lot of more teams on this work. Will furnish wagons.

R. H. Lawrence left here for Davenport, Ia., to accept a position with the Walsh Construction Co.

G. W. Gist, 532 Woodbine, Oak Park, Ill., has two steam shovels idle.

Frank Neher, Engineer on a part of the new extension of the Memphis-Marianna cutoff of the Iron Mountain R. R. was in town a couple of days. Neher reports lots of rain down in Arkansas this winter.

A. D. Cunningham, the well known engineer, left here the other day to survey a new line. Cunningham says that this road has not advanced far enough to be made public as yet.

[illegible] $100,000, were introduced at last week's meet[illegible] streets, together with the improvement of [illegible] and the completion of last winter's work, will round out the city's street improvement pro[illegible] Butler Ave., between Main and 4th Sts., brick or wood block. Bellevue Blvd., between Madi[illegible] gravel. Woodlawn St., between Chelsea and the city limits, gravel. Richmond Ave., between Mississippi Blvd. and Orleans St., gravel [illegible] Southern Ry., gravel. Lane Ave., between Decatur St. and Waldran Blvd., old stone. Beech[illegible] ville Sts., gravel. Nelson Ave., between Coop[illegible] from College St. east, gravel. Somerville St., between Walker and McLemore Aves., gravel. The first alley south of Union Ave., between Main and Front Sts., and an alley between that alley and Gayoso Ave. will also be improved. Several contracts have been let this year, and [illegible] no contract has yet been let. These two items will represent an expenditure of about $120,000. They are as follows: Mulberry St., between Beale and Calhoun Aves.; Georgia Ave., between Lauderdale and Walnut Sts.; 4th St. between Union and Court Aves.; Linden Ave., between Main and 4th Sts.; Bates alley, Center Lane and Courthouse Lane. Much street work begun last year was held up on account [illegible] be completed this year, and it will cost about $400,000, so that the total street work to be [illegible] Subway work, for which the city will pay $250,000, is also planned. This will round out about a million dollars for street and subway improvements. George C. Love, commissioner of the streets, bridges and sewer said the other day that the city expected to complete these streets this year. "We don't intend to let any streets lie over next winter," he said. "We had enough of that last year. The street work we have planned can be completed this year." Bond issues of $670,000, a quarter of a million of which is for subways, have been authorized by the board of city commissioners. They will be issued next month. The street work will be done under the operations of the front foot assessment law.

[illegible] ing parties here last week. We were unable to discover their destination.

Mr. Kaiser of Kaiser & Maloney left here the other day for Louisiana to bring up their outfit to their new Illinois Central work at Bloomington, Ind.

L. E. Hamblet of the Petersen & Fell Boarding & Commissary Co. left here for Winnipeg, Manitoba to take charge of their office there. Mr. Hopkins taking Hamblet's place in the office here.

◉The L. J. Smith Construction Co., Kansas City, Mo., secured the contract for double tracking the Santa Fe from Needles, Cal., to the Colorado River.

The Memphis Street Railway Co. of Memphis, Tenn., is going to construct a number of loops in the business section, also extend several of their lines this spring and summer.

Montana.

It is reported at Great Falls, Mont., that the surveyors of the Chicago, Milwaukee & Puget Sound have completed work between that city and Lewiston and according to the survey the line will shorten the distance about 25 miles.

The Billings & Central Montana Ry. Co. has been incorporated with a capital stock of $1,500,000, of which $75,000 has been sub[illegible]

[illegible] selshell County. The directors are R. E. Shepherd, A. R. Scott, E. E. Tiffany, C. C. [illegible]

New Jersey.

[illegible] N. J., has applied to the City Council of Long Branch, N. J., for a franchise to con- [illegible] 3rd St. This is in line with the plans of the company for a route through Little Silver and Elkwood Park, entering Long Branch at the foot of Myrtle Ave.

The State Legislature has passed the bill allowing the building of a tunnel from Philadelphia to Camden, to provide rapid transit from that city to all points in South Jersey. This measure raises the franchise limit to 50 years, under which it is believed capitalists will take hold of the proposition and make the Philadelphia-Camden tunnel a quick reality.

New Mexico.

A plan is under consideration for the construction of a railroad from Silver City, N. Mex. Morris E. Lock, representing eastern parties, made a trip through the section to be reached by the proposed line, and will probably make a proposition to the Business Men's Associaton of Silver City.

New York.

Petition is being circulated at Oswego, N. Y., asking the Syracuse, Lake Shore & Northern R. R. Co., Oswego, to construct a belt line. The plan as proposed calls for the extension of the city lines down West 3rd St. to the lake and thence along the lake shore to the match factory and box shop, joining the Boulevard line at 1st Ave.

Bids as follows were received March 6 by the State Commission in Lunacy, Albany, N. Y., for constructing an electric railway at the Mohansic State Hospital: Thomas O'Hern, Yonkers, N. Y., $49,560; A. A. Parker, Waterford, $55,838; John J. Hart, Peekskill, $58,244; Frank Besch, Albany, $66,900; Frank J. Gallagher, Brooklyn, $77,072; Conners Bros. Co., Lowell, Mass., $86,685; A. F. Chapman & Co., Buffalo, $52,203; Henry E. Fox, New York, $59,547; Stobaugh Contracting Co., New York, $67,431.

Nevada.

Promotion work is under way for the construction of the proposed railroad from Winnemusca, Nev., to Caldwell, Idaho. Col. E. R. Place, Caldwell, is interested in this project.

North Carolina.

Stockholders of the Greensboro, Roxboro & Henderson R. R. Co. recently held a meeting at Greensboro, N. C., for the purpose of perfecting an organization and electing officers. Stock amounting to $10,000 has been subscribed. Arrangements have been made for a survey from a point in Alamance County to Greensboro. The Lynchburg, Danville & Carolina, a road which is believed to be closely allied with the Chesapeake & Ohio, has already completed a survey from Danville to Alamance, the route running along Haw River, and the Greensboro, Roxboro & Henderson promoters hope to form a connection with them, thereby gaining a C. & O. connection at Lynchburg and a deep waterway connection. The ultimate aim of the Lynchburg, Danville & Carolina is to reach the Atlantic coast. It is believed they have Southport in view as an objective point.

Surveys have been completed and actual construction work started on the proposed new railroad between Sparta, N. C., and Roaring Gap. It is expected to have the road completed before Spring season opens up.

The Elkins & Alleghany Ry. Co. is constructing its proposed line from Elkin to Sparta, N. C., with convict labor, and will not contract any of the work. John A. Mills, Raleigh, N. C., is President and General Manager.

The Pigeon River Ry. Co. has completed surveys and has secured the capital for the construction of its projected 21-mile railroad from Canton, N. C., [illegible] The company is doing its own construction work. R. F. Whitman, Philadelphia, Pa., is President; H. F. Holt, Newport, Tenn., is Chief Engineer, and John C. Arbogast, 201 Oates Bldg., Asheville, N. C., is General Manager.

North Dakota.

A company is being organized at Minot, N. Dak., for the purpose of constructing a 6-mile street railway. Part of the surveys for the line and part of the construction capital has been secured. L. J. Palda, Jr., Minot, N. Dak., is interested.

Ohio.

Judge Stephen Young, after a hearing recently held at Port Clinton, O., instructed the Lake Shore & Michigan Southern and the city to prepare plans for the elevation of tracks through the city and submit same as soon as possible.

The Columbus, Kenton & Toledo Traction Co., of Kenton, O., has been incorporated with a capital stock of $50,000 and proposes to establish a through short line between Toledo and Columbus, either by building the road complete or forming a connection on the north with one of the several roads entering this city. Burr Fennel, Kenton, O., is interested.

The directors of the Stark Electric R. R. Co., F. L. Mowry, General Manager, Alliance, O., have decided to extend their road from Alliance northwest to Akron, a distance of 23 miles. The Stark Electric will provide the preliminary financing, and the future financial requirements for the week will be announced later. From Alliance the new line will run due north to New Baltimore, and it is expected that much of the entire new road will be in operation by the coming autumn. When this fork is completed the Stark Electric will connect Canton, Salem, Alliance and Akron. While the distance from the Alliance to the Akron city limits will be 21 miles, it is planned to operate for two miles in addition within the city of Akron. It is stated that grading will be started as soon as weather conditions permit.

Oklahoma.

⊙The Hancock-McMahon Construction Co., Wagoner, Okla., has been awarded the contract for all the concrete work and bridge piers for the Missouri, Oklahoma & Gulf R. R. extension from Wagoner, Okla., to Pittsburg, Kan. This includes the crossings of seven streams—crossing the Grand River twice and the Neosho River once, together with smaller streams. Three camps will be installed at once and additional camps later.

The St. Louis, Oklahoma & Pacific Railroad Construction Co., of Alva, Okla., incorporated recently with a capital stock of $300,000, is understood to have been formed for the purpose of building the projected railroad from Alva to the Colorado line and to Des Moines, N. M. This line has been promoted by H. A. Noah, Alva, and is said to have been financed in France. The incorporators of the construction company are: H. E. Noble, T. M. Hess, J. E. Patterson, N. R. Gascho and M. M. Fulkerson.

It is stated that active construction work will be under way by May 15 on the line of the Ardmore, Duncan & Lawton R. R. A small construction gang is already at work between Lawton and Duncan. J. L. Harmon, Lawton, Okla.

The Fidelity Construction Co., J. W. Hoffman, President, Muskogee, Okla., has taken bids for the subcontracts on the first 100 miles of the new extension of the Missouri, Oklahoma & Gulf Ry.

It is rumored that the Midland Valley R. R. is preparing to build an extension from Stigler, Okla., to McAlester, by way of Blocker or Featherstone. A survey for the line was made about two years ago. It is believed that the road will extend ultimately on to Texas. C. Kaighn, Muskogee, Okla., is Chief Engineer.

Oregon.

⊙Reports from Roseburg, Ore., state that the contract for the construction of burg-Coos Bay Ry. has been let construction work will be commenc J. Arnold Doyle, Victoria Hotel, Wash., is President of the compa

The Portland, Eugene & Easter 502 Fenton Bldg., Portland, Ore., grading work on three miles of n Eugene, franchise for which wa March 12.

Pennsylvania.

The Pittsburgh, Summerville & R. and its equipment will be sold by of Jefferson county March 30. Th be subject to a mortgage on the p which the Union Trust company of is trustee, and to a lease on the li the Pennsylvania. The line is 17 extending from Summitville to Cla

The Philadelphia & Garrettford Co., Upper Darby, Pa., has filed the authorizing an extension to Media. tificate sets forth that the line wil structed on roads and highways in U by, Springfield, Nether Providence in Media, with the line extending al St., Media.

The City of Wilkes-Barre, Pa., at a special election on April 13 $925,000 of bonds, for the elimi grade crossings. The greater sha expense of this improvement will by the railroads concerned. B. K. City Engineer.

Rhode Island.

The Grand Trunk Ry. and the N New Haven & Hartford R. R. have an agreement in the controversy proposed freight yards of the roa point where the Canadian road's ne the Southern New England ters this state at Woonsocket. Haven road acquired the land ov the Southern New England planned tracks in entering from Blackstone, Woonsocket and began the erection houses which would completely bloc new road at that point. The case was into court and an injunction obtaine Southern New England. The two roads have now effected a compr which the trains of the New England on the New Haven's land for some and then pass along on a viaduct tres 800 ft. long over the New Haven's houses.

South Dakota.

Promoters of the proposed railroad Mitchell, S. Dak., and Blunt have in making arrangements for $100,000 ital for the project. Among those are Dan Walsh, C. A. Fraser and J.

Tennessee.

The Memphis Street Ry. Co., T. wiler, President, Memphis, Tenn., is ing building a 1½ mile extension o son Ave. system at Memphis.

H. M. Byllesby, Chicago, Ill., an ciates, have been given an option on t erties of the Nashville Street Railway Co., of Nashville, in consideration of cash. The option is good until May when the stockholders are to surrende of the 40,000 shares of the company. sive development of properties at N Chattanooga and Louisville, the wate for which is located at Ocoee, Hales Great Falls, Tenn., is contemplated.

The Harriman, Knoxville & Easter a new line from Tossett to Harrim necting with the main line of the L and Nashville into Knoxville, was f opened on March 16.

The Louisville & Nashville R. R. h tioned the City Council of Oaksville, for right of way in that city and it i that the company is planning to expen $200,000 for an uptown terminal.

The Cincinnati, New Orleans & Te cific Ry. (Queen & Crescent Route), ported to be considering buying the D

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Co.'s river line and extending [illegible] county to Decatur.

Texas.

minary surveys have been started at r, Tex., for the proposed street railway uilt in that city for Ralph E. Shafer omas O'Hara, Dayton, O. According erms of the franchise part of the line in operation by Nov. 5 next.

g work is to be started [illegible] on the interurban lines to be built rom Dallas to Corsicana and Waco Southern Traction Co., of which J. F. nd, 300 Commerce St., Dallas, Tex., dent. Work will probably be begun eously at Waco and in Dallas County. Waco and Corsicana lines are to be the same time and be in operation not in October, 1913. Two large bridges constructed on the lines, one across ity and the other over the Brazos, on th end of the line. The sum [illegible] has been appropriated for the bridge roaches over the Trinity, just south [illegible]

ation has been made to the [illegible] of Dallas by E. P. Turner, of that franchises giving the right to occupy treets in Dallas for interurban and t car purposes.

n Antonio & Aransas Pass Ry., J. r, General Manager, San Antonio, has ed eight city blocks at Corpus Christi sed by the company for the purpose ing additional terminal trackage. The acquired adjoins the yards of the and the work of building [illegible] will begin shortly.

rt Worth, Mineral Wells & North- C., of Fort Worth, chartered last th a capital stock of $100,000, pro- perate either by gas, electricity or , denatured alcohol or naphtha motor, from Forth Worth to Mineral Wells to Roswell, N. M. It will [illegible] of Tarrant, Parker and Palo Pinto . The incorporators who will act as rd of directors for the first year are: Handford and Paul Hurley, of Fort ames A. Watkins, of Little Rock, h subscribed for 250 shares of stock par value. Fifty per cent of the cap- ck is paid in. Of this $17,000 is rep- l in surveys, engineers' surveys and which formerly belonged to the Fort Mineral Wells & Western R. R. Co.

special meeting of the directors of the vood North & South R. R., at Brown- on March 20 it was voted to increase ital stock from $30,000 to $225,000. iderstood that this increase will be used ending the road.

rding to an annuncement at San An- y Robert Pattison, of London, Eng- member of the European Contract ich is financing and constructing the ntonio, Rockport & Mexican Ry., con- n work will be started early next at Rockport. As previously noted in olumns surveys for the Rockport end road were started early in January, l & Son, Rockport, being the locating rs. R. R. Russell, San Antonio, Tex., ident of this road.

ication has been made to the City Com- f Fort Worth, Tex., for a franchise tor car line to run south on Willing m its intersection with Elizabeth boule- Capps St. and on through Falsem to limits. The application was [illegible] G. Newby, L. R. Scarborough, H. C. Matt Blanton and C. R. Keith [illegible] Worth.

ling on the short cut of the Houston as Central R. R. from Giddings to Stone Texas, is being pushed with all possible The Morey-Faulhaber Construction f St. Louis, Mo., has 100 teams and rs besides an elevating grader on the ve miles northeast of Caldwell, Texas. M. Johnston & Son, of St. Elmo, [illegible]

[illegible] mile section [illegible] west [illegible] Caldwell. The con[illegible] will be steam shovel work [illegible] has not been let, as yet. F. B. Cushing, Houston, Texas, is [illegible]

Track laying will be started on the San [illegible] J. E. Franklin, St. Louis, Mo., President of [illegible] Fowlerton via Campbellton in Frio County. A. R. Ponder is Superintendent of Construction, Crystal City, Texas.

Engineers have been staking out the route for the first 20 miles of the extension of the Orange & Northwestern R. R., a Frisco line. L. Miller, Orange, Tex., is President.

Utah.

The Ogden Rapid Transit Co., Ogden, Utah, has secured the franchise for the final stretch of its road in Ogden Canyon, thus assuring its proposed extension from the Hermitage to Huntsville in the Ogden Valley. About seven miles of line will be required and work on this will be started soon.

The City Commissioners of Salt Lake City have granted a franchise to the Salt Lake & Los Angeles Ry., J. E. Langford, General Manager, Salt Lake City, to operate electric cars over certain streets. The S. L. & L. A. Ry. is a steam road, at present operating 15 miles of line.

Virginia.

It is reported that the Kentucky & Virginia R. R., which terminates at Wise, Va., will be extended down Indian Creek and through Pound Gap, on the Kentucky-Virginia border line connecting at Jenkins, with the Sandy Valley & Elkhorn R. R. The distance is 20 miles through a territory rich in coal and timber. The survey was made several months ago and rights-of-way are now being secured. It is said the Norfolk & Western is behind the K. & V.

Vermont.

The Boston & Maine R. R., F. D. Hall, Electrical Engineer, Boston, Mass., as lessee of the Fitchburg R. R., has announced its intention of electrifying that portion of the road between the north line of Williamstown, Mass., and the east line of the town of Petersburg, N. Y. This section is about nine miles long.

The Boston & Maine R. R. and the Central Vermont R. R., after two or three years of negotiations, have finally reached an agreement regarding construction work in Brattleboro. As a result the Boston & Maine R. R., E. H. McHenry, Vice-president, Boston, Mass., will abandon its intention of building a new line between Brattleboro and South Vernon, 14 miles, on the New Hampshire side, and instead will build a double track line between the two places on the Vermont side of the Connecticut River. Construction work on this will probably be put under way shortly.

Washington.

⊙The contract for the construction of the Beverly-Hanford line of the Chicago, Milwaukee & Puget Sound R. R. has been let to H. C. Henry, Seattle, Wash., and grading will be started at once.

West Virginia.

⊙Joseph Fucey, Weston, W. Va., who has the contract for grading for the extension of the Clarksburg Northern R. R. (electric) between New Martinsville to Shirley, as noted in our March 13 issue, will sublet a portion of the work the latter part of next month, as soon as location is completed.

⊙The Elk & Little Kanawha Ry., C. P. Peyton, Chief Engineer, Charleston, W. Va., is reported to have awarded a contract to J. J. Boxley & Son, Rosedale, W. Va., for the 5-mile extension from Rosedale to Tanner. It is stated that contracts are also to be let for the contiruation of the extension from Tanner to Russet, 18 miles.

Wisconsin.

The Chicago, Burlington & Quincy R. R., W. L. Breckinridge, Engineer Maintenance of Way, Chicago, Ill., expects to extend double track this year from Blake north to McCartney, 12 miles, in Grant County, and from Stoddard south to Victory, 10 miles, in Crawford County. All arrangements are made for prosecuting this work which will begin [illegible] Milwaukee & St. Paul Ry. will start work on the improvement of the terminals at Mil[illegible] the ground. The present capacity of the yards is about 7,000 cars and it is planned to increase it to 10,000 or 11,000 cars capacity.

Canada.

⊙McCaffery & McQuigge, Toronto, Ont., have been awarded the contract at about [illegible] Elk Lake Branch of the Temiskaming & Northern Ontario Ry. This line is about 30 mile long and is to run from Earlton, Ont., to Elk Lake. The contract includes 420 acres of clearing, 75 acres of close-cutting, 75 acres of grubbing, 1,000 cu. yds. of rock excavation, 340,000 cu. yds. of earth excavation, and two trestles.

⊙Deeks & Hinds, 43 Scott St., Toronto, Ont. have been awarded the contract for constructing the new Canadian Pacific Lake Shore road, which will branch from the present Toronto-Montreal line at Agincourt and rejoin it 20 miles west of Smith's Falls, a total distance of 198 miles. The contract will amount to something like $10,000,000. It includes the construction of a number of tunnels, the largest of which will be about 850 ft. It is understood that about 30 subcontracts will be let on the work.

⊙Contract for about $1,000,000 worth of road work in connection with the Canadian Pacific Ry., near Edmonton, Alberta, has been let to C. H. Boyles, Jackson Ave., Spokane, Wash. About 48 miles of road are to be built, the work including several bridges and oil tanks.

⊙John Timothy, 426 14th St., Edmonton, Alberta, will sublet about 400,000 cu. yds. of the work on his contract for the Canadian Pacific Ry. from Lethbridge east. This contract includes some 750,000 cu. yds. of earth excavation.

Government subsidy has been asked for a railroad which it is proposed to construct to the Yukon. As projected the line is to run from Haines Mission to Fairbanks, Alaska, skirting the coast for 40 miles to the Canadian boundary with a branch line to Dawson.

The Winnipeg Electric Ry. and its heat, power and light plant are reported to have been purchased by the J. P. Morgan interests of New York, for $30,000,000. The company has been operating about 100 miles of line.

Resolutions have been introduced in the Quebec legislature to grant $10,000,000 for railway construction in this province. It is stated that the subsidies will take the form of land grants to the railways and of these it is understood that some will be convertible into money later on under certain conditions.

The Edmonton, Dunvegan & Peace River Ry., of which J. D. McArthur, the railroad contractor of Winnipeg, Man., is President, has surveys under way for the proposed line to Peace River. Two parties are working from Edmonton, and one of them at last reports had got as far as the Athabasca River.

Among the new subsidies for railroads to be granted by the Canadian Government are the following: For a line from the National Transcontinental Ry. at or near mileage 837 west of Moncton, to the mouth of the Nottaway River, on James Bay, 300 miles. To the Simcoe, Grey & Bruce Ry. Co., from Orillia to Kincardine, 50 miles. To the Algoma Central & Hudson Bay Ry. Co., between its junction with the Canadian Pacific Railway and with the National Transcontinental Railway, 65 miles. To the Rainy River Radial Ry. Co., [illegible]

✣ indicates work now open for bids. • indicates a contract let recently.

[illegible] Lake [illegible] miles. To the Lake Erie & Northern Ry. Co., (a) from Galt to Port Dover, 58 miles; (b) from Paris to Ayr, 10 miles. Total, 68 miles. [illegible] Rock Lake Mine to the Canadian Pacific Ry., 50 [illegible]

Among the subsidies renewed by the Canadian Government [illegible] 50 miles. The Algoma Central & Hudson Bay R[illegible] from the Soo to a point on the Canadian Pacific Railway between White River and Dalton; a second from Michipocoten harbor [illegible] and the third from a point on the Canadian Pacific Railway towards the National Transcontinental Railway. To the Algoma Eastern Ry. Co., 103 miles, to a point between Little Current and Sudbury towards the Algoma Central & Hudson Bay Railway, seventy-six miles, and from a point near Sudbury northerly 440 miles. To the Tillsonburg, Lake Erie & Pacific Ry. Co., from Ingersoll to Stratford, 35 miles. To the Las Seul, Rat Portage & Keewatin Ry., from Kenora to the line of the National Transcontinental Railway, 22 miles. To the Toronto, Lindsay & Pembroke Ry. Co., from Golden Lake to Bancroft, 51 miles.

A resolution is before the Dominion Parliament providing for the payment of a subsidy of $6,400 per mile for the main line and branches of the Temiskaming & Northern Ontario Ry., aggregating 300 miles. The total subsidy will therefore be $1,920,000.

Eslich & Hartnett, of Spokane, Wash., have begun moving their outfits to the vicinity of Fort Steele, B. C., where they have [illegible] subcontract for building 25 miles
for the Canadian Pacific.

Mexico.

The concession granted to the Railways of Mexico for the const[illegible] exploitation of a railroad from [illegible] the Centre, passing through Som[illegible] Chalchihuites to the city of Durang[illegible] modified to allow a branch to [illegible] Sombrerete. The concession is fo[illegible] and carries the usual conditions.

A concession has been granted [illegible] partment of communications to A.[illegible] Inc., to construct and work a railro[illegible] the states of Puebla and Oaxaca th[illegible] city of Puebla with Lake Chacal[illegible] Pacific coast, passing by the coa[illegible] Tezoatlan and Tiaxiaco. The ga[illegible] one meter four hundred and thirt[illegible] meters.

ROADS, STREETS AND PAVEMEN

Arkansas.

✣Bids will be received until noon, May 1, by Board of Improvement, Paving District No. 7, 9½ North Sixth St., Fort Smith, Ark., for repaving Garrison Ave. The work, according to the specifications on file with City Engineer, includes approximately 35,000 sq. yds. M. H. Reed is Engineer of the Board. Official advertisement will be found elsewhere in this issue.

⊙Radcliffe, Gibson & Dillingham have been awarded the contract by the city of Little Rock, Ark., for the construction of 40,000 sq. yds. of asphalt pavement in the Louisiana St. Improvement District No. 169 and Gaines St. Improvement District, at $91,500. The work includes 5-in. concrete foundation and concrete curb. Ford & McCree, Little Rock, are Engineers.

California.

The Board of Trustees of Placerville, Calif., has ordered six blocks of new cement sidewalk laid on the south side of Main St., from the Ohio house to the Producers' Fruit house and on the north side from Forni's to the Hangtown creek bridge.

The Town Trustees of Oak Park, Calif., have been petitioned for the paving of the entire business section with asphalt.

Connecticut.

⊙The Texas Oil Co., of New York City, has been awarded the contract by the Board of Contract & Supply of Hartford, Conn., Joseph Buths, Secy., for furnishing the street department with road oil to be delivered at such times in carload lots as directed by superintendent of streets. The oil shall be what is known as asphaltic road oil, containing from 30 to 40 per cent of residuum asphalt. The contract price is $.044 per gal. Bids were opened March 18.

Georgia.

✣Bids will be received until 8:30 p. m., April 9, by City Council and J. M. Wester, Mayor, Elberton, Ga., for furnishing the labor and material necessary for the following work: 25,000 sq. yds. of bituminous macadam street paving, 5,000 sq. yds. of concrete gutters. Each bid must be accompanied by a certified check for $2,500, made payable to the Mayor. Plans and specifications can be seen at the offices of the consulting engineers, or specifications may be obtained by writing them at Box No. 582, Savannah, Ga. H. S. Jaudon Engineering Co., Savannah, Ga., are Engineers.

An election will be held in Buford, Ga., on April 13 for the purpose of issuing bonds in the sum of $20,000, of this amount $10,000 will be applied to the paving of Main St.; $5,000 for school purposes, and $5,000 for waterworks.

Idaho.

The [illegible] of [illegible], Ida., on March 17 [illegible] of the formation of a paving district. J. N. Parks is Mayor.

Illinois.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secy., until 11 a. m., April 3, for furnishing materials, tools, labor, etc., necessary to construct pavements in the following streets: N. Ashland Ave., 3,840 lin. ft. concrete curb and gutter, 7,700 sq. yds. asphalt; Blanche St., 1,740 lin. ft. concrete curb and gutter, 2,730 sq. yds. asphalt; Cornelia Ave., 4,900 lin. ft. concrete gutter, 7,700 sq. yds. asphalt; Crowell Ave., 750 lin. ft. concrete curb and gutter, 1,120 sq. yds. asphalt; Dickens Ave., 2,340 lin. ft. concrete curb and gutter, 3,700 sq. yds. asphalt; Diversey Ct., 2,400 lin. ft. concrete curb and gutter, 3,730 sq. yds. asphalt; 88th St., 1,360 lin. ft. (12 in. x 8 in.) concrete curb and gutter, 2,150 sq. yds. asphalt; Ems St., 2,015 lin. ft. concrete curb and gutter, 3,000 sq. yds. asphalt; 14th Pl., 2,550 lin. ft. gravel concrete curb and gutter, 4,900 sq. yds. asphalt; 42nd Ave., 12,500 lin. ft. concrete curb and gutter, 20,300 sq. yds. asphalt; 51st Ave., 2,755 lin. ft. gravel concrete curb and gutter, 4,550 sq. yds. asphalt; 53rd Ct., 4,665 lin. ft. concrete curb and gutter, 7,215 sq. yds. asphalt; Frankfort St., 1,995 lin. ft. concrete curb and gutter, 2,975 sq. yds. asphalt; Francisco St., 1,300 lin. ft. concrete curb and gutter, 2,110 sq. yds. asphalt; Hames Ct., 2,700 lin. ft. concrete curb and gutter, 4,100 sq. yds. asphalt; Hollywood Ave., 380 lin. ft. concrete curb and gutter, 540 sq. yds. asphalt; Houston Ave., 5,190 lin. ft. concrete curb and gutter, 13,500 sq. yds. asphalt; Leavitt St., 1,400 lin. ft. concrete curb and gutter, 2,300 sq. yds. asphalt; Lincoln St., 1,330 lin. ft. concrete curb and gutter, 2,170 sq. yds. asphalt; Paulina St., 2,220 lin. ft. (12 in. x 8 in.) gravel concrete curb and gutter, 4,450 sq. yds. asphalt; Robey St., 1,290 lin. ft. gravel concrete curb and gutter, 2,020 sq. yds. asphalt; W. 25th St., 1,350 lin. ft. concrete curb and gutter, 2,450 sq. yds. asphalt; 37th St., 2,330 lin. ft. concrete curb and gutter, 3,820 sq. yds. asphalt; Wrightwood Ave., 3,040 lin. ft. concrete curb and gutter, 5,000 sq. yds. asphalt; Belden Ave. system, 6,195 lin. ft. concrete curb and gutter, 9,495 sq. yds. asphalt; Washington Ave. system, 6,710 lin. ft. concrete curb and gutter, 10,020 sq. yds. asphalt; Central Park Ave. system, 33,890 lin. ft. concrete curb and gutter, 52,360 sq. yds. asphalt. The work includes a 6-in. Portland cement concrete foundation, sewer construction, manhole and catch basin construction and adjustment, earth cutting or filling, etc. Plans and specifications on file with John B. Hayes, Chief Clerk of Paving Division.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 3rd, for furnishing and delivering at 15th Pl. and Loomis [illegible] automobile trucks for use in the [illegible] Streets, according to specification[illegible] office of the Commissioner.

✣Bids will be received by the [illegible] Local Improvements, Chicago, Ill[illegible] a. m., April 3rd, for furnishing a[illegible] ing labor, materials, etc., necessar[illegible] struct house drains in the followi[illegible] Ave. N, Catalpa Ave., Chauncey A[illegible] Ave., Ellis Ave., S. 40th Ave., W. [illegible] W. Jackson St., Jefferson Ave., S[illegible] E. 103rd Pl., Princeton Ave., W. 73 [illegible] Sawyer Ave., Shields Ave., Washin[illegible] and Yale St., according to specifica[illegible] file at office of the board.

✣Bids for earth work, on the [illegible] and Shiloh Valley road will be re[illegible] the Town Clerk of Mascoutah To[illegible] Mascoutah, Ills., until 1 p. m., on [illegible] at which time they will be opened i[illegible] Hall at Mascoutah, Ill. Work to [illegible] The work to be done consists in the [illegible] tion of earth approaches to the Sil[illegible] bridge, the embankment to be built [illegible] terial taken from borrow pits alon[illegible] embankment. The average height is [illegible] the width on top 24 ft. The total qu[illegible] embankment is approximately 28,000 [illegible] The soil is light clay. Work to be co[illegible] on or before Oct. 1, 1912. More de[illegible] formation may be had by an exami[illegible] the plans and specifications prepare[illegible] Illinois Highway Commission which [illegible] seen at the Town Clerk's office or [illegible] obtained, upon application in writing, [illegible] Illinois Highway Commission, Sp[illegible] Ill.

⊙Frank H. Ramsey, of Danvill[illegible] been awarded the contract by the [illegible] Local Improvements, T. A. Dic[illegible] Broadlands, Ill., for grading and pa[illegible] blocks of streets with brick at $12,3[illegible] work will include 5-in. concrete fo[illegible] with cement filler, $1.50 per sq. yd., c[illegible] curb and gutter of cement on 6-[illegible] foundation at $.49, marginal stone cu[illegible] per lin. ft., and inlets at $25 each. B[illegible] opened March 15.

⊙G. W. Low & Co., Oblong, Ill., ha[illegible] awarded the contract by the town [illegible] City, Ill., for the construction of gr[illegible] flood gates on the Clay City and [illegible] road in Clay City Township for $.16 [illegible] yd. The embankment will be 10,271 [illegible] The flood gates, four in number, w[illegible] $900. Bids were opened March 23.

⊙The Board of Local Improveme[illegible] Morris, Ill., has let the contract for t[illegible] ing of portions of Benton and Was[illegible] Sts. to Keyes & McNamara of LaSa[illegible] at $19,876.

⊙The contract for the construction [illegible] South B St. pavement has been aw[illegible] the Board of Local Improvements [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] to the Burlington [illegible] ngton, Ia., at $11,068.

[illegible] ard of Public Works [illegible] McGann, Commissioner, has award [illegible] tract for the construction of a new [illegible] to Heatherington & [illegible] lis, Ind., for $44,938. The contract [illegible] two and three [illegible] Laflin Sts., with a capacity of 2,000 [illegible] finished asphalt a day.

[illegible] sidents of Woodriver Township, [illegible] County, Ill., will vote April 2 on [illegible] position to levy a 10-year assessment [illegible] for the building of 15 miles of hard [illegible] the township. Edwardsville is the [illegible]

[illegible] ard of Local Improvements of Ster- [illegible] has ordered the paving of East [illegible], and Fourth St., from First Ave. [illegible] Park.

[illegible] Council of Chicago Heights, Ill., [illegible] d ordinances providing for nearly [illegible] worth of public improvements. Four [illegible] improvements consist of grading, [illegible] paving streets at an estimated cost [illegible]. Among the streets are the fol- [illegible] Vincennes Ave., McEldowney St., 14th St., 13th St., Otto Blvd., and [illegible] estimated at $82,298; Hickory St., [illegible] e., School St., Aberdeen St., Thorn [illegible] Pl., and McEldowney Pl., estimated [illegible]; 16th St., Vincennes Ave., Otto [illegible] t End Ave., and 14th St., estimated [illegible]; 16th St., from Chicago road to [illegible] estimated at $4,226. W. E. Len- [illegible] Clerk.

[illegible] of Urbana, Ill., will pave Market [illegible] Orchard St., the former bounding the [illegible] addition on the east and the latter [illegible]

[illegible] ard of Local Improvements of High- [illegible] has passed an ordinance calling [illegible] ing of one and one-half miles of [illegible] vements at an estimated cost of [illegible]

[illegible] for furnishing Portland cement to the [illegible] of Engineering until December 1, [illegible] ere received by L. E. McGann, Com- [illegible] er of Public Works, Chicago, Ill. The [illegible] Portland Cement Co., Continental [illegible] Bank Bldg., Chicago, submitted the [illegible] $1.20 per bbl. by carload, $1.39 by [illegible] in a certain zone. Bids opened [illegible]

[illegible] furnishing and delivering approxi- [illegible] cu. yds. of crushed stone or [illegible] received by L. E. McGann, Com- [illegible] er of Public Works, Chicago, Ill. The [illegible] ll Improvement Co., 133 W. Wash- [illegible] St., were lowest bidders as follows: [illegible] cts. per cu. yd., by team within [illegible] per cu. yd. Bids opened March [illegible]

[illegible] wing are the low bids submitted to L. [illegible] ann, Commissioner of Public Works, [illegible], Ill., for furnishing and delivering [illegible] mately 2,850 cu. yds. of torpedo sand [illegible] December 31, 1912: The American [illegible] nd Gravel Co., 133 W. Washington St., [illegible], submitted the lowest bids as follows: [illegible] er cu. yd. by carload lots, $1.70 per cu. [illegible] team. Bids opened March 20th.

Indiana.

[illegible] ds will be received until April 17 by [illegible] of Public Works, Logansport, Ind., for [illegible] nstruction of improvements to 11th [illegible] m Wabash River bridge to Toledo St. [illegible] ther gravel or crushed stone.

[illegible] ds will be received until 7:30 p. m., [illegible], by City Council, Attica, Ind., for the [illegible] ement of Park Ave. and Jackson St. [illegible] Turman is City Clerk.

[illegible] ds will be received until 2 p. m., April [illegible] Board of Daviess County Commission- [illegible] ashington, Ind., for the construction [illegible] vel roads in Steele, Barr and Wash- [illegible] townships. L. S. Core is County Au- [illegible]

[illegible] ds will be received until 10 a. m., [illegible], by Board of Tippecanoe County Com- [illegible] ners, LaFayette, Ind., for the construc- [illegible] three gravel roads [illegible] Auditor

✣ [illegible]

✣ [illegible] ty Auditor

✣ [illegible]

⊙The Randolph County Commissioners, Winchester, Ind., have awarded the contracts for the construction of 11 roads under the three mile road laws as follows: I. G. Johnson, Elmer Ward gravel road in Greensfork Township, $5,688; John O. Potter, Muncie, Ind., Wm. H. Chenoweth, macadam road in Washington, with curb and gutter on Sherman St., Lynn, $5,684; Greenville Gravel Co., Wm. S. Bowen gravel road in Greensfork, $5,340; Greenville Gravel Co., Oliver B. Clements stone road in Washington, $8,000; A. T. Coggshall, J. H. Adamson stone road West River and Washington, $4,694; Greenville Gravel Co., Armenus A. Hinshaw stone road in Washington, $1,615; Ohio & Indiana Stone Co., D. H. Engle stone road in Washington, $3,042; Stace Catey, Elisha W. Reynard stone road in White River and West River, $4,520; Greenville Gravel Co., Dexter Sickle stone road in Washington, $8,586; Greenville Gravel Co., Wm. B. Beverly stone road in Washington, $1,550; Perry McKinsey, R. H. Johnson gravel road in Wayne, $7,444.

⊙W. W. Hatch & Son of Goshen, Ind., have been awarded the contract by the City Council of South Whitley, Ind., for the construction of street pavement at about $30,000. Bids were received from 10 firms.

City Engineer Harry M. Miles of Michigan City, Ind., has submitted plans to the Board of Public Works for a brick pavement, 18 ft. wide, laid on a foundation of sand, for Hermitage Ave., from the east line of the city park to Shawmut Park, east of the Hermitage. The estimated cost is $11,500.

Iowa.

✣Bids will be received until 7:30 p. m., April 3, by P. M. Banks, City Clerk, Webster City, Ia., as mentioned in our last issue, for grading, curbing, guttering, combined curb and gutter and paving a number of streets in the city. Bids will be received on brick, block, portland cement concrete pavement, asphaltic concrete pavement and bituminous concrete pavement. Official advertisement will be found elsewhere in this issue. Specifications are on file at the office of ENGINEERING & CONTRACTING, 806 S. Dearborn St., Chicago, Ill.

✣Bids will be received until 7:30 p. m., April 1, by E. G. Finch, City Clerk, Newton, Ia., for the construction of about 40,000 sq. yds. brick, concrete or bitulithic pavement and 25,000 lin. ft. of curbing. A certified check for $2,000, payable to the City Treasurer, must be filed with each bid. The work must be started by May 1 and finished not later than Oct. 1. Official advertisement will be found elsewhere in this issue.

⊙The City Council of Cedar Rapids, Ia., has awarded the contracts for furnishing tools, labor and materials for paving, curbing and guttering portions of a number of streets, for which bids were opened March 15: Wm. Horrabin, Iowa City, 40,700 sq. yds. of asphalt at $1.67; McCarthy Improvement Co., Davenport, Ia., 34,000 sq. yds. of concrete pavement at $0.92.

The City Council of Sioux City, Ia., has provided for the expenditure of approximately $66,000 in improvements. The city clerk has been instructed to advertise for bids for the paving of upper Jackson St., with concrete, estimated to cost $35,000; also for the resurfacing of Third St. with vitrified brick or creosoted wood blocks at an estimated cost [illegible]

[illegible] decided to pave 33½ blocks instead of 44½, which was the first estimate. It is proposed to pave the following streets: North, Second Ave. to Center; First Ave., Lincoln to North, Second, Church to Lincoln; 13th, Main to Summit; State, Sixth to Seventh; Seventh, Church to Summit; Third, Church to Main; Fourth, Church to Main; Fifth, Church to State; Eighth, Church to Main; Church, Fifth to Seventh Ave.; Seventh Ave., Main to Church; Sixth Ave., Church to Linn; Linn, Sixth Ave. to First St.; First, Linn to Church. F. E. Northup is City Solicitor.

Louisiana.

⊙The Caddo Parish Police Jury, Shreveport, La., has awarded the contract for constructing 17 miles of gravel or macadam road to the Texas Grading Co., of Houston, Tex., at $5,939 per mile for gravel, including cost of entire road, the parish furnishing all materials. Five more miles of road will be done this year, making 22 miles in all. The parish will expend about $130,000 a year for the next five years. Bids were opened March 15. J. T. Bullen is Parish Engineer.

Maryland.

Property owners of Rockville and Darnestown election districts, according to advices from Rockville, Md., have visited Annapolis and urged a bill authorizing the bonding of those districts for road improvements. It is desired to pike the Rockville-Potomac road 2 3-5 miles from Rockville to the Potomac district line, and similarly to improve the road of 6½ miles from Watts' Branch, near Rockville to Travilah. The bill provides for bonding in $35,000.

Massachusetts.

The City Council of Lawrence, Mass., has been petitioned by a number of citizens of the district across the Spicket River and members of the Arlington District Improvement Society to pave Park St., from Hampshire to Lawrence Sts., with granite blocks. M. A. Scanlon is Mayor.

The city of South Hadley Falls, Mass., will let contracts in about 6 weeks for the construction of 1,150 ft. of granite block pavement on a concrete foundation, estimated to cost $10,880. The work will include cement concrete foundation and sand filler; granite curb already in place. Patrick O'Connor is in charge.

Michigan.

⊙Jas. A. McKay has been awarded the contract by the city of Lowell, Mich., for the construction of 9,580 sq. yds. of brick pavement at $19,170. The work also includes 770 sq. yds. of asphaltic concrete. E. H. Christ of Grand Rapids, Mich., is Engineer. Bids were opened March 18.

The citizens of Jackson, Mich., will vote April 1 on the following paving extensions. Jode Harrington, City Recorder: On Jackson St., from Cortland to Mason; on First St., from Morrell to Greenwood; on Jackson St., from Trail to Ganson; on Trail St., from Jackson to Mechanic; on Wildwood, from Wisner to M. C.; on Pearl St, from Mechanic to Cooper. Total $31,000.

The City Council of Grand Rapids, Mich., has appointed a Pavement Commission to secure for the city a uniform pavement for the streets.

The citizens of Milan, Mich., have voted in favor of paving the streets of the village. Jesse Button is Village Clerk.

The Board of Houghton County Road Commissioners, Houghton, Mich., has again rejected al bids received on March 20, being a re-advertisement from March 5, for the construction of 4½ miles of macadam roads. The work will be done by day labor. R. Martin, Shelden-Dee Bldg., Houghton, is Engineer

Minnesota.

The City Council of Duluth, Minn., has been petitioned for the paving of East 14th St., between Sixth and 14th Aves. The council is also considering a petition for the improve-

[illegible] Ave. east.

The East Lake Street Commercial Club of Minneapolis, Minn., has adopted a resolution urging the City Council to pave Bloomington Ave., from Franklin Ave. to 33d St.

Mississippi.

✣Bids [illegible] April 11, by Board of Mayor and Aldermen, Booneville, Miss., for the construction of 18,000 lin. ft. of concrete sidewalk including 5,000 cu. yds. of grading and excavating. Plans and specifications are on file with city engineer. E. W. Walton is Mayor.

Missouri.

⦿Cameron, McManus & Joyce of Keokuk, Ia., and Kansas City, Mo., have been awarded the contract by the Title Guaranty Trust Co., of St. Louis, Mo., Julius Pitzman, 615 Chestnut St., St. Louis, Engineer in Charge, for grading 60 acres of land west of Forest Park and south of the Washington University, at $.169. The excavation amounts to about 350,000 cu. yds., 2,500 cu. yds. to be removed each working day. The average haul is 600 ft. Bids were opened March 15.

The Board of Public Works of St. Joseph, Mo., has issued designating notices for the paving of the following named streets and alleys: Francis, 28th to 30th, hassam; State, 26th St. to Ashland Ave., asphalt; 22nd St., Mitchell Ave. to Duncan; mineral rubber asphalt; Mulberry, 22nd to 24th, mineral rubber asphalt; alley between Frederick and Buchanan Aves., and 13th and 16th Sts., concrete.

On March 19 three commissioners were elected for the McCredie-Stephens-Store-Hereford special road district, located in the northwest part of Callaway County, Mo. It is proposed to make permanent road improvements. Fulton is the county seat.

Montana.

The Yellowstone County Commissioners, Billings, Mont., have been petitioned by citizens of the Broadview territory for the construction of 40 miles of new roads.

New Jersey.

✣Bids will be received until 4 p. m., April 1, W. C. Van Duyne, 52 Grove St., Bloomfield, N. J., for furnishing all labor and material necessary to grade, flag and curb the following streets in the city of Newark, N. J.: North 11th St., from Bloomfield Ave. to a point about 150 ft. south of Abington Ave.; N. 12th St., from Bloomfield Ave. to a point about 150 ft. south of Abington Ave.; N. 13th St., from Abington Ave. to a point about 135 ft. south of Abington Ave.; Abington Ave., from the Bloomfield town line to North Tenth St.; Beardsley Ave., from N. 12th St. to Bloomfield Ave.; south side of Bloomfield Ave., from N. 13th St. to North Tenth St. (flagging only). Bids will be compared on a basis of the engineer's estimate of quantities, which is as follows: 5,050 lin. ft. 5x20 in. bluestone curbing, medium axed; 14 sets 5x20 in. bluestone corners, medium axed, 6 ft. radius; 272 lin. ft. concrete curb and gutter; 19,690 sq. ft. concrete sidewalk, 4 ft. wide; 4,520 sq. ft. concrete sidewalk, 5 ft. wide; 575 cu. yds. excavation (embankment not to be paid for). The work will be commenced within ten days after execution of contract, and must be completed within 30 working days. The amount of bond for the fulfillment of the contract will be the sum of $3,500. General instructions to bidders, blank forms of proposals, plans, specifications, and all necessary information may be obtained at the office of W. C. Van Duyne, Engineer, 52 Grove St., Bloomfield, N. J.

New York.

✣Bids will be received until 3 p. m., April 1, by Board of Contract and Supply, Isidore Wachsman, Secy., Albany, N. Y., for furnishing and delivering road oil for the Bureau of Parks and for furnishing and delivering arsenate of lead for the Bureau of Parks.

⦿The Village Trustees of Sag Harbor, N. Y., have awarded the contract to lay a mile stretch of Peekskill gravel on the corporation street connecting the East Hampton and North Haven State roads, to Dunbar & Co. of New York City for approximately $1,000.

The Common Council of Lockport, N. Y., has passed a resolution calling for the improvement of Market St., from Union St. to Lake Ave.; also the improvement of the latter street from Market to the Old Niagara Road, to connect with the improved road running to Wright's Corners.

The Oswego County Board of Supervisors, Oswego, N. Y., will advertise during the first week in April for bids for the construction of the proposed new highways in the eastern end of the county, involving the expenditure of approximately $136,500. The cost of the first, known as the Pulaski-Williamstown road, the distance of which is nearly 7 miles, is placed at $70,190. The cost of the second, known as the Volney-Palermo road, the length of which will be 5.22 miles, is estimated at $66,400. W. W. Rounds is Chairman of the Highway Committee, Board of Supervisors.

The citizens of Canastota, N. Y., J. S. Robertson, Village Attorney, voted against the issuance of bonds for the proposed paving work.

North Carolina.

✣Bids will be received until 2 p. m., April 1, by Murphy Township Highway Commission, Murphy, N. C., for constructing the Valley River road a distance of 7½ miles, and Notla road a distance of 4 7-10 miles. Work will consist of approximately 67,000 cu. yds. grading, 1,500 lin. ft. vitrified pipe, 600 cu. yds. masonry. Marble township will let four miles at same time. Grading and plan mostly team work, and rest sidehill. Plans, profiles and specifications are on file at the office of G. W. Scott, Engineer, Court House Bldg.

North Dakota.

✣Bids will be received until 8 p. m., April 8, by E. R. Orchard, City Auditor, Fargo, N. Dak., for the construction of approximately 40,000 sq. yds. of paving. Bids will be considered on creosoted blocks, vitrified brick, bitulithic, blome concrete, bituminous concrete, cement concrete, sheet asphalt, dollarway or Westrumite. Bids for this work received March 11 have been rejected. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 7 p. m., April 1, by City Council, Wahpeton, N. Dak., for the construction of various kinds of sidewalks, curbs, gutters and crossing. Clark M. Olson is City Auditor.

Following bids were received by E. R. Orchard, City Recorder of Fargo, N. Dak., on March 11 for the construction of pavement in the Fourth and Fifth Wards, for which plans and specifications were prepared by City Engineer F. L. Anders: (1) standing for bid of S. Birch & Sons, (2) James Kennedy, (3) O. C. Chapin, (4) Central Westrumite Co., (5) R. S. Blome, (6) Kettle River Co., (7) Warren Bros., (8) P. McDonnel, (9) M Ford, (10) General Construction Co., (11) Kaw Paving Co.:

FOURTH WARD

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cement concrete, 61,[illegible]98 sq. yds.	[illegible]	[illegible]						.	...
Bituminous concrete, 49,2[illegible] sq. yds.	1.[illegible]	1.64						$2.10	$1.40
Sheet asphalt, 49,275 sq. yds.	[illegible]	1.[illegible]						2.20	2.00
Bitulithic, 49,275 sq. yds.	[illegible]	1.[illegible]					$2.2[illegible]	.	...
Brick, 49,2[illegible] sq. yds.	[illegible]	[illegible]						2.[illegible]0	2.3[illegible]
Creosoted block, 49,2[illegible] sq. yds.	[illegible]	[illegible]				$2.68			.
Dollarway, 49,2[illegible] sq. yds.	..		$1.2[illegible]			...		.	.
Westrumite, 49,275 sq. yds.	..			$1.8[illegible]					.
Blome granitoid, 61,[illegible]98 sq. yds.	.				$2.20				.

FIFTH WARD

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cement concrete, 20,175 sq. yds.	$1.30	$1.40						.	
Bituminous concrete, 15,598 sq. yds.	1.39	1.64				.		$2.10	$1.40
Sheet asphalt, 15,598 sq. yds.	1.9[illegible]	1.7[illegible]			.	.		2.20	2.00
Bitulithic, 15,598 sq. yds.	2.16	1.85	.....	.....	.....	.....	$2.23		...
Brick, 15,598 sq. yds.	[illegible]2	[illegible]0						2.54	2.3[illegible]
Creosoted block, 15,598 sq. yds.	2[illegible]					$2.68			.
Dollarway, 15,598 sq. yds.			$1.2[illegible]						
Westrumite, 15,598 sq. yds.				$1.89	..				
Blome granitoid, 20,175 sq. yds.					$2.20				

Ohio.

✣Bids will be received until noon, March 30, by the Director of Service, Galion, O., for the construction of approximately 10,381 sq. yds. of brick, asphalt block, or wood block pavement on [illegible] St. E. C. Clerk.

✣Bids will be received until 30, by Director of Public Service, O., for grading and macadamizi way, constructing concrete curbs laying cross walks and constructi drains, culverts and retaining wal ley Ave. W. J. Voller is Clerk of ment of Public Service. Henry Traction Bldg., Cincinnati, O., gineer.

⦿John Ruebel Construction Co ginia Ave., Cincinnati, O., has be the contract for the improvement lowing county work, under Speci 298, bids opened March 15 by th County Commissioners, Cincinnat provement of Round Bottom roa the Norfolk and Western Railwa Clermont County line, in Anderso The contract price is $8,189. A hardt is Clerk.

⦿Urban & Clementy of Massillo been awarded the contract by the ty Commissioners, J. H. McConne Canton, O., for the construction o of brick pavement at $23,870. Th be done on the Massillon-Millersb Tuscarawas Township and will in cu. yds. of excavation, 10,344 sq. y pavement, including filler and san 10,344 sq. yds. of 4-in. concrete 12,132 lin. ft. of 14-in. standard co laid; 12,132 lin. ft. of 4-in. by curb set; 34 lin. ft. of standar marginal curb laid; 4,000 lin. ft. o drain tile, etc. Bids were opened

⦿C. J. Chinnock of Warren, O awarded the contract by Mahoni Commissioners, Youngstown, O., f provement of the Beaver road fr worth to New Buffalo at $13,887.

⦿The Board of Control of Tole awarded contracts for the improve streets out of the 13 streets to be this spring, as follows: Michigan ison to Jefferson, sheet asphalt, C Anderson, Grand Rapids, Mich., Collingswood, Central to Cherry, sh Carpenter & Anderson, $11,321; Ce Lagrange to Hartman, vitrified br Grzybowski, $4,239; Nessle St., Pa Michigan Central railroad, asphalt phalt Paving Block Co., $15,983; Oak to Utah, vitrified brick, P. $4,405; Grand Ave., Monroe to Fos asphalt, Carpenter & Anderson, $7, Ave., Oakwood to Green, sheet asp Streicher, $11,988; 11th St., Illinois dale, vitrified brick, P. Watters, $2,7 St., Indiana to Vance, Metropolit Henry Sheehand & Son, $6,894; Dorr to Nebraska, Metropolitan blo Sheehand & Son, $17,508. Delaw Auburn to Albion, vitrified block, Pe $14,228; and Utah St., First to G vitrified brick, P. Watters, $7,175.

The citizens of Jefferson, O., h to bond the city in the sum of $17,0 its share of the paving which will be summer. Tar-concrete will be used. tract for the paving will be let ab 15. B. F. Hewitt is Village Engine

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

ncil Committee on Judic [illegible] d, O., voted to recommend the the ordinance authorizing [illegible] n the issue of $900,000 bonds for on of Cedar, Carnegie, Chestnut l Aves.

e been prepared by [illegible] er of Warren, O., for the laying yds. of brick, wood or asphalt ment, to cost approximately he date for letting of contract has ided upon. C. L. Creig, Director, of the work.

Oregon.

arren Construction [illegible] contract by the city of Portland, hard-surfacing of Alameda Park the pavement at $1 [illegible] park contains 120 acres of land.

Pennsylvania.

will be received until 7:30 p. m., by Borough Council, Freeport, Pa., provement of Third St., from Mar- gh Sts., and Mulberry alley, from Sixth St. The work will include ely 700 cu. yds. of grading; 2,000 curbing; 2,800 sq. yds. of vitrified A check for $ [illegible] kadden, Borough Clerk, must be ach bid. G. B. Findley is Borough

ngton Township Commissioners, County, Pa., are preparing for $164,000, to be used for road im- A special election will be held s to consider a measure to bor- ney. Norristown is the county

gheny County Commissioners, Pa., have passed a resolution sub- llowing list of roads it is pro- rove to the Grand Jury, which is to authorize the expenditure of necessary to carry through the of about 30 miles of road at an t $800,000. [illegible] r and Indiana Townships; Clin- nkfort road, Finley Township; ad, Verona Borough; Brighton n Township; Glass Run extension, Tarentum and [illegible] nd West Deer Townships; Kit- (Etna revised), Shaler and nships; Oakwood road, Chartiers Elliott and Crafton roads, Chartiers Glassport and Elizabeth extension, Borough; Center Road, Eliza- ugh, Ingomar and Perrysville nklin and McCandless Townships; and Russelton road, East and West nships; Carson St. extension, Mif- ship and Lower St. Clair Borough.

partment of Public Works of Phil- Pa., intends to repave all streets in and around hospitals in the city, as veral of the prominent streets, with

South Carolina.

n Council of Fort Mill, [illegible] ied the contract to A. E. Legare, en- l contractor of Columbia, S. C., for lain St. A bituminous macadam will be laid, also concrete curbs and . There are about 3,000 sq. yds. of

n has begun in Greenville, S. C., for 150,000 bond issue for street paving, ion to that effect having been pre- introduction in the City Council.

County, S. C., has sold bonds amount 0 for road work. E. W. Waglon, , is Engineer. Wade Stockhouse, official in charge.

Tennessee.

. Wofford, Brownlow Vines and P. who were recently awarded the con- the building of Washington Coun- of the Memphis-to-Bristol highway , commenced work March 15 with men. One squad of men has been n the section between Johnson City in Springs, one between Johnson City

Texas.

✣ [illegible]

✣ [illegible] m., April [illegible] ty Judge, Victoria, [illegible] m Road District [illegible]

✣ [illegible] 30, by County Commissioners' Court, Dallas, Texas, for furnishing the county with approx- [illegible] to be used in the construction of the cardinal and intermediate roads. G. L. Fearn is County Auditor.

✣Bids will be received until 11 a. m., March 30, by Commissioners' Court, Dallas, Texas, for the construction of the Seagoville and Molloy bridge road, beginning at the Molloy bridge and extending in an easterly and westerly direction; the Hutchins bridge and Rylie road from Hutchins bridge in an easterly and westerly direction; the Wilmer bridge road, beginning at the Wilmer bridge and extending in an easterly and westerly direction. G. L. Fearn is County Auditor.

✣Bids will be received until 2 p. m., April 2, by C. G. Krueger, County Judge, Bellville, Texas, for the construction of public roads within and for Road District No. 1 of Austin County, Texas, in accordance with plans and specifications on file with A. Ludwig, Sealy, Texas.

The City Counci of Denison, Tex., has employed Julian C. Feild, 105-6-7-8 Feild Bldg., Denison, to prepare plans, specifications, etc., for the construction of from five to six blocks of pavement. The estimated cost is $35,250. Brick and macadam will be used.

Bids are being received by the Bexar County Auditor, San Antonio, Tex., for the grading of the Culebra road from the 11¾-mile point to the 19-mile post, and for grading the Brown-Hoffman road from the Culebra road north for about ¾ of a mile.

The City Council of Taylor, Tex., postponed the election which was to have been held March 19 for paving the main streets, until after April 2.

The property taxpayers of Justice Precinct No. 1 held a meeting March 23 at the court house in Greenville, Tex., for the purpose of determining whether an election will be ordered to issue the sum of $100,000 in bonds to macadamize 80 miles of public roads.

Plans have partially been prepared by Acting City Engineer W. Irving Blan of Terrell, Tex., for the following improvements: Paving, estimated to cost $45,000; 4 to 8 miles of sidewalks, waterworks, estimated at $25,000; sewerage, estimated at $20,000.

Virginia.

The Supervisors of Augusta County, Staunton, Va., on a petition of 300 taxpayers, decided to petition the Circuit Court to order an election on a bond issue of $1,000,000 for good roads. The election would be held about April 30.

Washintgon.

✣Bids will be received until April 3, by City Engineer, Olympia, Wash., for the paving of Main St. with brick or other material.

✣Bids will be received until 2 p. m., April 2, by County Auditor, Cowlitz, Wash., for the construction of concrete culverts and concrete road 16 ft. wide on the Cowlitz and Olympia road.

✣Bids will be received until 1 p. m., April 2, by J. M. Shields, County Auditor, Olympia, Wash., for the construction of a portion of Asplund road, in Section 9, Township 34, N. R. 4 east, for the construction of Cedar Road and for hardsurfacing portion of State Aid road No. 82, known as Fidalgo Bay State Aid road. Rock may be purchased of the County of Skagit.

⊙ [illegible] Wash., have awarded the contract for the paving of Seventh Ave., Howard to Bernard St., with bitu-mass, to the Spokane Bitu-Mass Co., for $7,870.

The Whatcom County Commissioners, Bellingham, Wash., are asking for bids on the permanent improvement of three roads, which insures the expenditure of about $50,000 of state road funds. The work will include approximately 3½ miles of paving to be distributed over the Northeast Diagonal, the Northwest Diagonal and the Sumas roads. Charles A. Lindbery is County Engineer. W. G. Roberts, Olympia, is State Highway Commissioner.

West Virginia.

✣Bids will be received until 1:30 p. m., April 15, by Board of City Commissioners, Huntington, W. Va., for the paving of a number of alleys and portions of Seventh Ave. with vitrified paving brick. John Coon is Commissioner of Streets and Wharves and A. B. Maupin is City Engineer.

The County Court at Fairmont, W. Va., will let contracts within two months for the construction of 25 miles of brick pavement in Mannington District, Mannington, W. Va. A ground stone foundation, cement curb and sandstone and shale filler will be used. The work will cost approximately $250,000.

Wisconsin.

⊙The Board of Public Works of Two Rivers, Wis., has awarded the contract to the Schuette Cement Construction Co., of Manitowoc, Wis., for the construction of 16,000 sq. yds. of tar macadam, 11,000 yds. of macadam, 11,600 lin. ft. of cement curb, 15,500 lin. ft. of cement gutter, at $26,399. Bids were opened March 15.

The Board of Public Works of Superior, Wis., D. J. Arris, President, will let contracts in about one and one-half months for the construction of 1½ miles of macadam pavement. E. B. Banks, Superior, is Engineer.

The White Construction Co., of Milwaukee, Wis, submitted the lowest bid to the City Council of Green Bay, Wis., for the laying of asphalt and macadam. The McGrath Construction Co., of Green Bay, was low on the laying of asphaltic macadam on Crooks and Oakland Sts., also on concrete on Oakland, Crooks, Shawano and East Walnut. W. W. Reed is City Engineer.

Canada.

✣Bids will be received until 6 p. m., April 8, by J. McTeigue, City Clerk, Port Arthur, Ont., for paving the following streets: Pearl street from Water to Court, curb and gutter, 1,836 lin. ft.; pavement in sq. yds., 4,360. Bay street from Cumberland to Algoma, curb and gutter, 2,930 lin. ft.; pavement in sq. yds., 4,784; track laying, 3,250 sq. yards. Algoma street from Bay to Queen, curb and gutter, 4,000 lin. ft.; pavement in sq. yards, 5,785; track laying, 4,340. Totals, curb and gutter, 8,766; pavement in sq. yds., 14,929; track laying, 7,590 sq. yards. Tenders will be received for sheet asphalt, asphalt block and bitulithic. Further instructions as to specifications and forms of tender may be obtained from L. M. Jones, City Engineer, Port Arthur. A marked check for ten per cent of the estimated amount of contract must accompany each tender.

✣Bids will be received until noon, April 2, by Robert Cooper, County Clerk, Welland, Ont., for furnishing for the construction of roads under the County Good Roads System, crushed stone, per ton, and rubble stone, per cord, f. o. b. cars quarry, and delivered in car lots at different points of the County of Welland.

✣Bids will be received until noon, April 2, by Robert Cooper, County Clerk, Welland, Ont., for the following machinery for the use of the Corporation of the County of Welland, for use on county roads, as follows: 2 steam road rollers, of about 10 tons weight each; 2 portable rock crushers, having a capacity of about 10 tons per hour; 2 portable bins for storage of stone, having about 25 tons capacity; 2 revolving screens and 2 chain ele-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] equipped with all minor implements and attachments, 2 [illegible] wagons; 1 traction engine of 18 h. p., adapt[illegible] 2 wheeled scrapers.

⊙C. H. Boyles, Jackson Ave., Spokane, Wash., has been [illegible] $1,000,000 [illegible] with the Canadian Pacific Railway near Edmonton, Alta. The road will be 48 miles long; several bridges and oil tanks are included in the work.

[illegible] Legislature [illegible] $250,000 from the government for good roads. Any municipality wishing to avail itself of the provisions of the act shall make application to the Highway Commissioner, who shall [illegible] must be finally approved by the Council of the municipality. The Council shall then have authority to pass by-laws for the sale of debentures, but it was agreed between the delegation and the Premier that a clause will be added to the act making it necessary to submit these by-laws to the electors. All by-laws passed and debentures issued under the authority of this act must be approved by the Municipal Commissioner. The government has power to guarantee the payment of the debentures, or to invest its funds in the purchase of debentures. The act will provide that all works done under the act are to be let by contract by the Municipal Council after due advertisement, to the lowest responsible tenderer. The Council of any municipality may form areas not in any case larger than one township, which shall be known as good roads districts unless a majority of the owners of the property affected file an objec[illegible] Council shall have power to make ments in such districts, and to deter percentage of the cost shall be bor property immediately benefited, and centage by the municipality at large ures which are issued to cover ex in good roads districts, are not t chased by the province. Besides to this act practically as draf mier Roblin announced the intenti government to increase the good ro ance from $100,000, the amount paid to from $150,000 to $200,000 this promised to introduce legislation to before the close of the session.

The Welland County Council, Ont., has passed a by law for the of debentures for $100,000 to comm construction of good roads

BRIDGES—STEEL AND CONCRET

California.

✣Bids will be received until April 10 by Board of Santa Cruz County Supervisors, Santa Cruz, Calif., for the erection of a 100-ft. steel truss bridge over Soquel Creek, in Santa Cruz County. Plans call for concrete cylinder piers on pile foundation and 63-ft. steel viaduct approach. The cost of the work is estimated at $5,000. Plans and specifications may be had of A. M. Baldwin, Santa Cruz., Calif., County Surveyor.

It has been announced that the Northern Electric Ry. Co., A. D. Schindler, General Manager, San Francisco, will commence work immediately on the construction of the joint bridge at Meridian, Calif.

The Oakland & Antioch Ry. Co. has petitioned the City Council of Oakland, Calif., for permission to construct and maintain a bridge across 59th St., east of College Ave., along the line of its right of way. The matter was referred to W. J. Baccus, Commissioner of Streets.

Colorado.

✣Bids will be received until 2 p. m., March 30, by Board of Morgan County Commissioners, John A. Murray, Fort Morgan, Colo., Clerk, for the construction of a bridge across Beaver Creek, 1½ miles west of the town of Hillrose, on state highway, 30-ft. span, reinforced concrete, steel I beams. Specifications on file in office of County Surveyor at Fort Morgan, Colo. Certified check for $250 must accompany each bid.

Two new bills were introduced at a recent meeting of the Board of Supervisors, Denver, Colo., as substitutes for all bills pending relating to the extension of Broadway and the construction of the West Colfax Ave. viaduct. One of the new bills provides for the appropriation of $65,000 from the permanent improvement fund to buy property condemned for the Broadway extension not under controversy. The other appropriates $60,000 from the same fund to acquire right of way for the West Colfax Ave. viaduct from Boulevard F to about First St., and from that point as far towards Osage St., the other terminal, as possible. It has been announced that State Treasurer Roady Kenehan was willing to turn over the $75,000 appropriated by the Legislature for the viaduct as soon as the city's appropriation was made. With $135,000 available it is believed that a right of way extending a distance beyond First St. can be obtained. The viaduct bill may also provide for an approach to the viaduct from Larimer St.

Commissioners of Logan County, Sterling, Colo., recently visited Procter for the purpose of investigating the feasibility of erecting a bridge over the Platte River at that place

District of Columbia.

[illegible] construction of a new bridge over the Rock Creek at Calvert St., Washington, D. C.

Florida.

✣Bids will be received until 11 a. m., April 9, by Commissioners of St. Lucie County, Fort Pierce, Fla., for the construction of 700 lin. ft. of trestle bridges.

Idaho.

⊙Commissioners of Bonner County, Sandpoint, Idaho, have awarded the contract for the construction of a steel bridge over the right of way of the Spokane International Ry. to the Hennepin Bridge Co., Minneapolis, Minn., for $2,000.

Illinois.

✣Bids will be received at the County Clerk's office, Ottawa, Ill., up to 2 p. m., April 3, for the construction of one reinforced concrete bridge in Grand Rapids Township, La Salle County. Robert Poundstone, Town Clerk, Grand Ridge, Ill. Hibbs Bridge—Span, 36 ft.; roadway, 18 ft.; distance from finished roadway to bottom of footings, 10 ft.; length of wings, 12 and 16 ft.; estimated amount of concrete in structure, 89 cu. yds.; reinforcing steel, 14,371 lbs.; all material will have to be shipped in; nearest railroad station, Grand Ridge, on the C., B. & Q. R. R., 2 miles; general condition of roads, good; average load, about 4,000 lbs. Existing structure is a 26-ft., steel truss on stone abutments, same to be removed. Average flow of stream, 6 ins. deep and 6 ft. wide. Excavation will be full depth of abutments, in a black loam to a gravelly clay. Work to be completed on or before Aug. 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Ill.

✣Bids will be received in the Council Room, at Pecatonica, Ill., until 3 p. m., April 5, for the construction of one reinforced concrete viaduct in Pecatonica Township, Winnebago County. Jas. S. Tarbert, Town Clerk, Pecatonica, Ill. Pecatonica Bridge—Four spans, each 55 ft. in the clear; roadway, 18 ft.; distance from finished roadway to bottom of footings, 30 ft.; wings, 16 ft. long, running parallel with the roadway. Embankment slopes at each abutment to be paved with stone from the present abutments and piers. Estimated amount of concrete in the entire viaduct, 793.3 cu. yds.; reinforcing steel, 92,280 lbs.; steel in expansion plates and rockers, 5,878 lbs. All material will have to be shipped in. Local gravel 1¾ miles from the bridge, for 50 cents per load. Not familiar with its quality. The bridge is located ⅛-mile north of Pecatonica; railroad service is the C. & N. W. and electric line. The existing structure is made up of three 71½-ft. steel a on stone abutments and piers. C to provide temporary bridge, remov bridge and do all back filling and n approach fills to the new bridge. flow of stream, 6 ft. deep and 150 Foundation soft; piling will pr necessary. All proposals must be nied by a certified check for the sum Periodical payments will be made work, to the amount of one-half the value of work completed during th Work to be completed on or befor 1912. More detailed information ma by an examination of the plans and tions prepared by the Illinois Highw mission, which may be seen at th Clerk's office or may be obtained plication in writing, from the Illino way Commission, Springfield, Ill.

✣Bids will be received by L. E. Commissioner of Public Works, Chic until 11 a. m., April 3, for furnishing livering labor, materials, tools, etc., for the reconstruction of old pile pr and construction of new pile protec Rush St., Madison St., Adams St. St. bridges. Cash or certified check must accompany proposal.

⊙The Board of Fulton County Sup Lewistown, Ill., has referred the m building a bridge over the creek in dotte Township to the Road and Brid mittee. The contract for the constru a bridge over Swegle Creek in Youn ory Township was awarded to the Bridge & Iron Works, Clinton, Ia.,

⊙The contract for the construction reinforced concrete bridges in Co Township, Madison County, Ill., h awarded to Joseph Klein, Freeburg, $4,321. William Grenard, Collinsvil is Town Clerk. The contract March 19.

⊙The contract for the construction ft. concrete skew deck girder bridge i District No. 2, Cass County, Ill., h awarded to Walter Beake, 627 S. Ri Appleton, Wis., at $2,607. Bids were March 19. L. O. Skiles, Virginia, County Clerk.

It is reported that arrangements ha made by the Chicago & Western Indiar road for the sale of $1,365,000 cons mortgage 4 per cent bonds. From t ceeds of the sale $540,000 will be u the construction of a bridge over th met River, track elevation and addit the belt line. E. H. Lee, Chicago, Chief Engineer of the road.

Petitions have been filed with the C sioners of La Salle County, Ottawa, referred to the Road and Bridge Com asking for the construction of bridges lows: Two structures over Otter Cr cost $2,000 and $1,200 respectively;

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Township to cost $1,750, bridge ermillion River at La Salle, Ill.

re opened for furnishing tools, rials, etc., necessary to construct draw bridge with approaches, over t River at 92d St, by [illegible] mmissioner of Public Works, Chi- on March 5. Following are the ds of the National Contracting Co., adison St., low bidders:

and re-erect present draw [illegible]

thick oak planks, 42,000 ft [illegible] $49 [illegible]

timber furnished and [illegible] 190,000 ft B. M. at $12 [illegible]

timber and lumber [illegible] in place 10,000 ft B. M. at [illegible]

piles of any other kind [illegible] 00 lin ft at $0.1 [illegible]

s, 23,000 lin ft at $0.40 [illegible]

driving and pulling each [illegible]

ore test piles, [illegible] piles at $. [illegible]

rip rap put in place, 1,200 cu. [illegible]

s used for pile clamps [illegible]

steel for repair work [illegible]

for repair work, 1,000 lbs. at [illegible]

for repair work, 1,000 lbs. at [illegible]

steel and iron for repair work [illegible] at $.0 [illegible]

Indiana.

ll be received until [illegible] April [illegible] rd of Cass County Commissioners , Ind., for the reflooring, reroofing ng of the Lewisburg bridge over h River. J. E. Wallace is County

ll be received until noon, May 8, of Lake County Commissioners, nt, Ind., for the construction of ast Chicago, Ind. C. A. Johnson Auditor

will be received until noon, April 3, of Lake County Commissioners, oint, Ind., for the construction of West Creek and Cedar Creek town- A. Johnson is County Auditor.

will be received until 10 a. m., April d of Boone County Commissioners, Ind., for the construction and re- bridges. D. M. Clark is County

will be received until 2 p. m., April ard of Jasper County Commission- selaer, Ind., for the construction of r of bridges. J. P. Hammond is Auditor.

will be received until 11 a. m., March ard of Vigo County Commissioners, ute, Ind., for the construction of a Lost Creek township. N. G. Wal- ounty Auditor.

will be received until 11 a. m., March ard of Vigo County Commissioners, aute, Ind., for the construction of in Lost Creek township. N. G. Wal-

issioners of Tippecanoe County, La Ind., have awarded the contract for ruction of two bridges over the Wa- er to the Lafayette Engineering Co., vs: Steel and concrete bridge at erry, $45,000; similar structure at rt, $51,735.

County Commissioners, Columbus, e awarded the contracts for the con- of the Arnholt bridge and the Fol- e to J. L. Waggoner, at $885 and $185 ly.

igo County Council recently held a at Terre Haute, Ind., and considered appropriations of $8,000 for the con- of new bridges and $4,000 for re- the old structures.

Iowa.

will be received until noon, April unty Auditor, Marshall County, Mar- n, Ia., for five concrete bridges, as No. 322, 70 ft. clear waterway; No. ft. clear waterway; No. 935, 180 ft. terway; No. 1,110, 70 ft. clear waterway; No. 1,513, 70 ft. clear waterway; in compliance with specifications now on file in [illegible] visors.

⊙The Board of Cedar County Supervisors, Tipton, Ia., awarded the contracts for furnish- [illegible] piling, Wheeler Lumber Co., Des Moines, Ia., [illegible] .09¾ to .12 per ft. for cedar piling ranging from 8 to 18 ft. in length; for 20-ft. concrete culverts with wings 1 ft. 6 ins., Clinton Bridge Co., Clinton, Ia., as follows: 3x3 ft., $180; [illegible] ft., $225; 8x8 ft., $270; 9x9 ft., $270; 10x10 [illegible]

Plans have been prepared by W. H. Steiner, City Engineer, Marshalltown, Ia., for the construction of the South Third Ave. viaduct over the tracks of the Chicago & Northwestern and the Minneapolis & St. Louis R. R. The [illegible] Railroad Commissioners for approval, provides for the end of the north approach to the viaduct to start at the south line of Nevada St. The south end of the viaduct is placed a short distance north of the Linn Creek bridge.

It is said that the Board of County Supervisors, Marshalltown, Ia., will let a contract early in April for the construction of five concrete bridges to cost approximately $20,000.

Kansas.

The Board of Control, A. O. Rorabaugh, Chairman, Wichita, Kan., has under consideration the construction of the proposed 11th St. bridge.

Kentucky.

It is reported that the Louisville & Nashville R. R. is rushing the installation of new bridges at various points along the Cumberland Valley Division and within another year larger and stronger bridges will supplant all present structures on the [illegible]

Maryland.

A conference was recently held at the Naval Academy, Annapolis, Md., for the purpose of taking up the proposition to build a new bridge over the Severn River. Under the bill providing for the construction of a boulevard from Baltimore to Annapolis this bridge is part of the route, though the State Roads Commission has declined to take control of it. Now the plan is for a new structure that would combine the county bridge and the railroad bridge of the Maryland Electric Railways (Short Line). Among those present at the meeting were: Com. W. C. Cole of the navy, in behalf of the Navy Department; President Smith of the Anne Arundel County Commissioners; J. T. Heyward, general manager of the Short Line, officials of the State Roads Commission, and others.

The Commissioners of Talbot County, Easton, Md., have prepared a legislative bill providing for the issuance of bonds amounting to $30,000 or $40,000 for the construction of a new steel or concrete bridge over Miles River to replace the old wooden bridge.

Minnesota.

✣Bids will be received until 2 p. m., April 1, by Board of Control, Ramsey County, St. Paul, Minn., for the erection and completion of Pathological Laboratory and garage at the City and County Hospital. Daniel Kelley is Chairman.

⊙The Stites Steel Bridge & Concrete Co., 1241 N. Kingshighway, St. Louis, Mo., has been awarded the contract for the construction of two reinforced concrete bridges in Rural Township, Rock Island County, Ill. Bids were opened March 14 at the town hall, Coal Valley, Ill. J. W. Caughey, Town Clerk, Orion, Ill.

It is announced that plans will be prepared under the supervision of Carl E. Nagel, Bridge Engineer of the State Highway Commission, Minneapolis, Minn., for the construction of about 100 bridges to be built by counties throughout the state, during 1912.

A special election was held at Brainerd, Minn., April 12, to vote on the question of bonding the county for $35,000 to provide funds for the construction of a bridge over [illegible]

Commissioners of Teton County, Choteau, Mont., have awarded the contract for the construction of a new bridge over the Muddy at Collins to A. Y. Bayne & Co., Minneapolis, [illegible]

A conference was recently held by Jesse F. Osborne, Mayor, Joplin, Mo., and C. E. Johnson, Chief Engineer of the Kansas City Southern R. R., in regard to the construction of the proposed Broadway viaduct, but nothing definite was decided upon on account of the absence of A. H. Rogers, President of the Southwest Missouri Railroad. It was suggested, however, by Mr. Johnson that the original plans for an ornamental steel viaduct to cost $120,000 be abandoned for one to be built of reinforced concrete at a cost of [illegible]

Missouri.

✣Bids will be received until 1:30 p. m., April 2, by C. E. Jacoby, Engineer, Drainage District No. 3, Carrollton, Mo., for the following bridge work: Chrisman bridge, between Sec. 31 and Sec. 32, Trotter Township, 75 ft. steel bridge, with 15-ft. approaches; also 70-ft. wooden bridge with 15-ft. approaches, for the same site. Ballard bridge, in Sec. 4, Wakenda Township, 80-ft. steel bridge, with 20-ft. approaches; also 70-ft. wooden bridge 15-ft. approaches, for the same site. Hickory Ford bridge, in Sec. 10, Wakenda Township; present bridge, 66-ft. pin connected pony truss, resting on laced steel legs to be removed and replaced so as to allow dredge boat of R. B. Gordon & Co. to pass and excavate the main canal of Drainage District No. 3. Each bid must be accompanied by cash deposit of $25,000 or a certified check of the same amount.

Montana.

In accordance with an agreement between the city of Lewiston, Mont., and the Great Northern Ry., the city will build a permanent bridge over the creek at First Ave.

Nebraska.

✣Bids will be received until noon, April 23, at the County Clerk's office in Keya Paha County, Springview, Neb., for the construction of two bridges across the Niobrara River; one bridge to be located at the site of the present wagon bridge at the village of Carns, and the other bridge to be located about 14 miles north of the town of Bassett at the location of the old McCully bridge. Bids will be received for both of the above bridges on alternate designs, as follows: Carns bridge—First: One reinforced concrete girder bridge composed of 40-ft. spans, approximately 320 ft. in length, all as per plans and specifications. Second: One reinforced concrete arch bridge, composed of 50-ft. spans, approximately 320 ft. in length, all as per plans and specifications. Third: One steel, low truss bridge composed of four 80-ft. spans with concrete abutments and piers, all as per plans and specifications. McCulley bridge—First: One reinforced concrete girder bridge composed of 40-ft. spans, approximately 280 ft. in length, all as per plans and specifications. Second: One reinforced concrete arch bridge, composed of 50-ft. spans, approximately 280 ft. in length, all as per plans and specifications. Third: One steel low truss, pin-connected bridge, composed of four 70-ft. spans with concrete abutments and piers, all as per plans and specifications. All bids must be sealed and accompanied by cash deposit or certified check for $1,000. All certified checks to be made payable to Mr. John Scheie, County Clerk of Keya Paha County. Bids will be publicly opened at the County Clerk's office in Springview, Neb., at 1 o'clock p. m., April 23, 1912. Copies of plans and specifications may be had upon application and payment of $5.00 at the office of the State Engineer.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

✣Bids will be received until noon, April 30, at the County Clerk's office in Washington County, Blair, Neb., for the construction of one bridge across the Elkhorn River, located [illegible] the town of Arlington, as follows: First: One reinforced concrete arch bridge composed of two 90-ft. spans, approximately 180 ft. in length, all as per plans and specifications. Second: One steel inclined chord bridge composed of one 180-ft. span, approximately 180 ft. in length, with concrete abutments, all as per plans and specifications. All bids must be sealed and accompanied by cash deposit or certified check for $1,000, all certified checks to be made payable to Mr. O. T. Anderson, County Clerk of Washington County. Bids will be publicly opened at the County Clerk's office in Blair, Neb., at 1 p. m., April 30, 1912. Copy of plans and specifications may be had upon application and payment of $5 at the office of the State Engineer.

The Board of Supervisors, Adam County, Hastings, Neb., has received and referred to the Bridge Committee, petitions for the construction of the following bridges: Ayr Township, 16-ft. bridge between Sec. 1 and 2; Logan Township, 16-ft. bridge between Secs. 10 and 11; Hanover Township, 16-ft. bridges between Secs. 15 and 22, and 12 and 13; also one between Secs. 33 and 34, size not specified; Cottonwood Township, between Secs. 14 and 23, [illegible] 15, [illegible] Township, 2[illegible] ft. bridges between Secs. 8 and 17, and 17 and 18.

A special election will be held by the Commissioners of Lincoln County, North Platte, Neb., to submit to the voters the proposition of issuing $15,000 of bonds for the construction of a new cement bridge to replace the old wooden structure across the North Platte River, west of North Platte.

New York.

⊙The contract for the construction of the steel and concrete bridge extending from the new Erie R. R. freight offices to he Chenango St. viaduct, Binghamton, N. Y., has been let by A. E. Badgley to Shapley & Wells.

A bill has been introduced into the State Senate, Albany, N. Y., providing for an appropriation of $12,000 for the construction by the State Highway Commission of a bridge over the Au Sable River on the Port Kent-Plattsburgh road, at a point about one-half mile west of the Delaware & Hudson River R. R. Co.'s bridge. The measure has been referred to he Finance Committee.

A bill has been introduced in the Senate providing for the appropriation of $60,000 for the extension of the Main St. bridge at Lockport, N. Y., several rods west to the line of Saxton St.

The Senate Finance Committee recently held a hearing at Albany, N. Y., on the Union Bridge Bill. This bill, which provides that the state shall appropriate as its share of $60,000 for the acquisition of a bridge connecting Troy, N. Y., and Waterford, and that the counties touching either approach shall expend a proportionate amount and the city and town a given sum which is regulated by the state law. The proportion is 50, 35 and 15 per cent for the state, counties and towns or city, respectively.

Assemblyman D. L. Edwards has introduced a bill providing for an appropriation of $15,000 from the state and a similar amount by the city of Syracuse and the Rapid Transit Railroad Co., for the construction of a new bridge over the Erie Canal at West Genesee St., Syracuse, N. Y. A bascule bridge to replace the present hoist structure is contemplated, according to plans to be drawn by City Engineer H. C. Allen. No part of the state fund, if the bill passes, is to be available until the city and the Rapid Transit have deposited their share of the $45,000.

North Dakota.

✣Bids will be received until 10 a. m., April 16, by Board of County Commissioners, Grand Forks, N. D., for the construction of any and all steel and concrete bridges during the year of [illegible] Hans Anderson is County Auditor.

Ohio

✣Bids will be received until 1 p. m., April 12, by County Commissioners, Logan, O., for the erection of a bridge at Murray City, O. First—For performing the labor and furnishing the materials necessary to the erection of substructure for said bridge by the cubic yard. Second—For the superstructure for said bridge as per plans and specifications on file in the office of County Commissioners. Bids on plans submitted are solicited. W. D. Brandt is County Auditor.

✣Bids will be received until 1 p. m., April 1, by Board of Ashtabula County Commissioners, Jefferson, O., for making the fills of the approaches to a bridge on Pine St., Jefferson Village. J. S. Matson is County Surveyor.

⊙The contract for grading and filling the 31st St. bridge approach, in Sheffield Township, has been awarded to the National Tube Co., Lorain, O., at $19,500. Bids were opened March 18, at Elyria, O. Charles Chandler is Clerk of the Lorain County Commissioners.

Commissioners of Butler County, Hamilton, O., have instructed L. A. Dillon, County Engineer, to prepare plans for the construcion of a new bridge over the Seven Mile Creek in Milford Township; also a culvert.

Two sets of plans have been prepared for the construction of a bridge to replace the East Federal St. structure at Youngstown, O. The plans call for a bridge from Federal St. to the intersection of Himrod and Wilson Ave. They differ only in the width of the structure for which the plans are drawn. Neither set of plans provide for a bridge across the river to Cedar S. F. M. Lillie is City Engineer.

City Council has passed a resolution declaring it necessary to construct two new bridges at Bond Hill, on the Reading road, to replace the present wooden structures. Arthur Espy is Clerk, Cincinnati, O.

Oregon.

The Commissioners of Multnomah County, Portland, Ore., have under consideration the construction of a 300-ft. span over Sandy River at Troudale. The plans and specifications are being prepared by Waddell & Harrington, Engineers, Kansas City, Mo. As soon as the plans are ready the work will be advertised. T. J. Cleeton is County and Probate Clerk.

Pennsylvánia.

✣Bids will be received until noon, April 12, by Dauphin County Commissioners, Harrisburg, Pa., for the construction of a reinforced concrete arch bridge and a twin arch stone bridge over Clark's Creek, Middle Paxton township, 4 miles northeast of Dauphin borough. D. Frank Lebo is Clerk.

⊙Directors of the Lewisburg Bridge Co., Lewisburg, Pa., have awarded the contract for the construction of the new steel bridge over the river to replace the present wooden structure to the Pennsylvania Steel Co., Steelton, Pa., at $65,000. The structure will be double tracked to accommodate the Lewisburg & Tyrone Branch of the Pennsylvania R. R.

⊙The Board of Montgomery County Commissioners, Norristown, Pa., as mentioned in our last issue, awarded the contract for the construction of steel girder bridge over the Schuylkill River at Pawlings to George W. Ensign, Camphill, Pa., at $22,497. Bids were received as follows: (1) Standing for bridge with concrete piers and abutments, and (2) for bridge with stone piers and abutments: Schuylkill Construction Co., (1), $29,470; (2) $30,340; Carl R. Campbell, Montrose, (1), $31,970, (2), $32,895; William H. Decant, Reading, (2) $38,200; George W. Ensign, Camp Hill, (1) $24,497.50; J. P. Long, King-of-Prussia, (1) $31,250, (2), $32,450; Julius Solomon, Jr., Philadelphia, (1) $31,250, (2), $39,966; York Bridge Co., (1) $34,995; L. H. Focht & Son, Reading, (1) $30,854; B. A. Sheeler, Sanatoga, (2) $26,700; Enos L. Seeds, Philadelphia (1), $31,400.

⊙The contract for the construct abutments for the new Seventh St. been awarded by the Board of Pu Altoona, Pa., to Murphy & Appleb Pa., at [illegible]

The State Water Supply Commis risburg, Pa., has approved the fol plications for the construction o Pennsylvania R. R. Co., for permis construct a bridge over the Schuylk Royersford; Commissioners of Be ty, for permission to construct a concrete viaduct across the Schuylki Reading; Linde Air Proudcts Co., sion to construct a bridge over Tu near Blackburn; Pennsylvania R. permission to replace the existing b the Schulykill River near Auburn.

The Municipal Art Jury of Ph Pa., has approved plans of the Pe R. R. Co. for the construction of and concrete bridges on the Ph Washington & Baltimore line over 72d Sts., to take the places of the o structures, which recently collapse Clark, Wilmington, Dela., is Assist neer of the railroad.

E. M. Rine, General Superintende Delaware, Lackawanna & Wester Scranton, Pa., is reported as having that as soon as the Engineering D can make plans and secure necessar sion from the City Council of Scran will be started eliminating the grade within the city limits. The first su will be built under this policy will Tripp's crossing. The work on thi gin as soon as the frost is out of th The crossing at West Elm St. will f that at Ash St. wil be taken up as the two West Scranton subways ar As a rule the crossings are to be ab the construction of subways. There ever, be one exception. The comp construct a viaduct from Washbur Dewey Ave., which will do away Jackson St. crossing, one of the mos ous and congested in the city.

South Dakota.

⊙The contract for the constructi bridges in Hutchinson County, S. D., awarded by P. J. Hofer, Olivet, County Auditor, to the Federal Bri Des Moines, Ia. Bids were opened M

Citizens of Clear Lake, S. Dak., ha the State Engineer to prepare plans a fications for a new bridge to be b the river near that place. The struc be of reinforced concrete and 60 ft. i

Texas.

The Missouri, Kansas & Texas it is said, has engineers investigating t bility of constructing a bridge over orado River at Austin, Texas, in co with a contemplated extension of south.

Commissioners' Court of San Ange as, has under consideration the issu $70,000 in bonds for the construction ducts across the Concho River.

Brenneke & Fay, Fullerton Bldg., S Mo., have been employed to prepare p the construction of four concrete brid the Trinity River, near Fort Worth, estimated to necessitate an expendi about $600,000.

Utah.

At a mass meeting of the West S zens, Salt Lake City, Utah, it was v support the Viaduct Committee in it to have the City Commission pass th nance providing for the construction Denver & Rio Grande Ry. two viadu at Fifth South and the other at South St.

Virginia.

In his annual message to the City Mayor Richardson, Richmond, Va., mended the erection of a new free bri

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Washington.

[illegible]
McMillan, Wash., [illegible]
of Pierce County Commissioners,
Wash., [illegible] the Washington [illegible]
Tacoma, Wash., at $9,250. The struc-
have concrete floor and abutments.
wart is County Auditor. Bids were
rch 16.

rted that the Great Northern Ry.
struct seven steel bridges between
and Whitefish, Wash., also 12 cul-
place wooden bridges and fill seven
[illegible]

the relaying of the line with 90-lb. rails as mentioned under our Railway Columns. O. S. Bowen, Spokane, Wash., is Resident Engineer.

Wisconsin.

Board of Commissioners, Outagamie Coun- [illegible]

a Scherzer rolling lift bridge at Kimberly instead of a double draw, as originally planned. The government has approved either type.

City officials of Sheboygan, Wis., have again [illegible]

over the belt line of the Chicago & North- [illegible]

Canada.

✣Bids will be received until March 30 by H. E. Johnson, Town Clerk, Wallaceburg, Ont., for the construction of reinforced concrete approaches to the East Branch bridge of the River Sydenham at Wallaceburg.

Mexico.

It is reported that surveys have been made at Los Vacas, Mex., for the construction of the proposed international railroad bridge that is to connect Mexico and the United States and will be built by the National Rys. of Mexico and the Kansas City, Mexico & Orient Ry. C. H. Webster, Sweetwater, Texas, is Chief Engineer of the K. M. O. Ry.

IRIGATION, DRAINAGE, LEVEES AND CANALS

Florida.

be received until 11 a. m. ,April
missioners of St. Lucie County,
, Fla., for the construction of
roads, bridges and docks. The
ses approximately 100,000 cu. yds.
and embankment, 90,000 cu. yds.
ice material, 700 lin. ft. of trestle
docks, also 75,000 cu. yds. of em-
Plans, profiles and specifications
at the office of the engineers, D.
M. Rogers, Fort Pierce, Fla.

Illinois.

be received until 11 a. m., March
missioners of Sub-District No. 4,
No. 2, town of Pitman, Montgom-
Ill., for furnishing, unloading
at Waggoner, Ill., hauling
g tiles and for trenching and lay-
s and refilling the trenches after
The work will include approxi-
,830 lin. ft. of 18 to 30-in. tile. J.
ert, Taylorville, is Engineer. Plans
obtained of Edward Pearman, Town
Ill.

Indiana.

l be received until 10 a. m., May
ard of Jasper County Commissioners,
er, Ind., for the construction of a
Monon township. Paul Ward is
Commissioner.
Bros., Monterey, Ind., have been
contract at $164,000 for construct-
L. Ketman drain, bids for which
ened March 4 by E. C. Williams,
tion Commissioner, Medaryville, Ind.
in is to be 148,200 ft. long and will
2,661,000 cu. yds. of excavation.
were opened March 16 at Valparaiso,
constructing the Weiler Ditch, the
being awarded to Krich Tyndsee &
atur, Ind., at $4,280. The work in-
¼ miles of 6-in. to 20-in. tile drain
an average depth of 4½ ft. Guy
ld, Valparaiso, is the engineer.

Iowa.

will be received on April 16, by
of Supervisors, Dickinson and Os-
unties, Ia., at the court house, Sibley,
the construction of Joint Ditch No.
work will include 15,000 ft. of open
d approximately 108,182 cu. yds. of
on, also the following tile work,
ng of material and laying of the fol-
mounts: 17,100 ft. of 6-in. tile, 8,900
-in. tile, 36,600 ft. of 8-in. tile, 3,400
9-in. tile; 33,550 ft. of 10-in
2,500 ft. of 12-in. tile, 12,900
4-in. tile, 5,875 ft. of 15-in. tile, 10,-
f 16-in. tile, 8,200 ft. of 18-in. tile, 11,-
of 20-in. tile, 11,300 ft. of 22-in. tile,
of 24-in. tile, 800 ft. of 28-in. tile,
of 30-in. tile, and 1,500 ft. of 32-in.
mplete details may be had from V. A.
auditor, or L. A. Wilson, engineer, at
a., or John S. Blow, auditor, at Spirit

Louisiana.

✣Bid will be received until noon, March 28, by Board of State Engineers, 213-215 New Orleans Court Bldg., New Orleans, La., for the construction of the following-named new levees on Red River, Right Bank, Rapides Parish, La.; Cutoff Bayou Levee, approximate contents, 75,000 cu. yds. Deposit required $250; Wilson Levee, approximate contents, 45,000 cu. yds.; deposit required, $200. Frank M. Kerr is Chief State Engineer.

The Hibernian Alluvial Land Co, in which James J. Bailey, New Orleans, La., is interested, has secured a tract of 5,000 acres of alluvial land in St. Bernard Parish, and the work of draining it and the installation of drainage plants will be started at once.

Farmers of the First, Second and Eighth Wards have appointed a committee to appear before the Police Jury at Lafayette, La., to secure the establishment of drainage districts and the survey of the territory to ascertain the proper levels.

Plans are under consideration for the reclamation of 390,000 acres of swamp lands in Vermillin, St. Mary, Iberia and Cameron Parishes. These lands are owned by James Deering and Charles Deering, of Chicago, Ill. W. J. Lauderback, financial agent for the Deerings, and his chief engineer, George A. Sanderson, are now in Louisiana, looking over the projected work.

Minnesota.

✣Bids will be received until 11 a. m., April 4, by J. L. Herrin, Faribault County, Blue Earth, Minn., for the construction of Judicial Ditch No. 2, of Faribault County. The approximate amount of work and material to be furnished in the construction of such ditch is as follows: Open work requiring the removal of 4,412 cu. yds. of earth at outlet, and the tile portion requiring 3,700 ft. of 24-in. tile; 10,700 ft. of 18-in. tile, 1,600 ft. of 16-in. tile, 4,400 ft. of 15-in. tile, 7,700 ft. of 14-in. tile, 14,900 ft. of 12-in. tile, 23,000 ft. of 10-in. tile, 40,000 ft. of 8-in. tile, 18,650 ft. of 6-in. tile. The soil is black loam with clay subsoil; no timber. Nearest railroad station, Delavan, on the C., M. & St. P. Average haul, about 4 miles. No. 1 clay tile to be used in construction of tiled portion. Also retaining walls constructed where needed. All bids must be accompanied by certified check for 10 per cent of the amount of each bid, payable to Jesse L. Herring, County Auditor.

✣Bids will be received until 2 p. m., April 9, by P. D. McKellar, County Auditor, Jackson, Minn., for the construction of Judicial ditches Nos. 14 and 16, estimated to cost $7,677 and $23,000, respectively.

Mississippi.

Some changes have been made in the work of constructing Judicial Ditch No. 2 in Rock County, and as a consequence the contract will not be let on March 27 as advertised. The work will be advertised again. John Kelly, Luverne, Minn., is County Auditor.

North Carolina.

✣Bids will be received until April 3, by Commissioners of Wayne County Drainage District No. 1, Goldsboro, N. C., for the construction of 14½ miles of drainage ditches, requiring excavation of 290,000 cu. yds. J. R. Wooten is Chairman.

Ohio.

◉Chapman Bros., Celina, O., have been awarded the contract at $25,000 for dredging Wabash Ditch No. 541 in Mercer County. Bids for this work were opened March 21 at Celina, O.

◉Price & Hurley of Marion, Ohio, have been awarded the contract by Walter R. Carven, Ingram County Drain Commissioners, Mason, Mich., for the construction of the Toll Gate drain at $26,750, for which bids were opened March 22. The work includes excavating and laying 48-in., 30-in., 24-in., and 18-in. reinforced concrete pipe, construction of 33 manholes, 6 catch basins and bulkhead. The pipe will be furnished by the Reinforced Concrete Pipe Co., of Jackson, Mich.

The City Council of Dayton, O., has passed an ordinance appropriating $385,000 for river straightening and improvement, and it is likely that bids for this work will be asked in the near future. Gaylord Cummin is City Engineer. The work of changing the channel and building levees will involve the handling of 1,210,000 cu. yds. of earth.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE.)

The river and the weather have combined to prevent the levee builders from working this season—and the combine is so strong that several of the largest contractors have moved their forces from the river and taken other work until such time in the late summer as operations on the levees can be carried on to advantage. During the unusually severe winter just ended, some of the boys have managed to keep at work about one-third of the time, but now that the Mississippi is on a rampage which will force it high above all banks and up against the levees, hands have been thrown up generally and the contractors have now to sit by and wait—unless they are fortunate enough to secure other work. The flood stage on the Memphis gage was passed last Saturday, the 23rd, and the indications at that time pointed to a stage of 40 ft. before the river would begin to fall. This will put all of the levee contractors out of business and force seepage water into most of the borrow pits along the stream. Old time contractors and river men predicted last December, when the river reached flood stage, that the one high water would be the only flood this season and inasmuch, they said, that the rise came so early, the levee contractors might look for an ideal spring with no seepage water to bother them. But alas and alack! The old Mississippi has again destroyed her traditions and bids fair to make a new mark for herself this year.

✣ indicates work now open for bids. ◉ indicates a contract let recently.

Word comes from the Mc[illegible] Brothers' outfit at Wilson, Ark., that they have secured other work in the city and will move their outfit on the next boat to Memphis. Charley Siler and Pat McCadden at Pecan Point have gone onto high ground with their teams and are prepared for a lay-up. Lowrance Brothers, Martin Jennings, Bill Stephenson and Henry McCarten, at work on the hugh Atherton loop in Louisiana, are looking around now for safe quarters and are ready to quit work at a moment's notice. L. C. Dulaney in the Greenville district will have to discontinue work for the time being, and while as yet we have heard nothing from the other boys on the big creek, they will all be seriously inconvenienced by the rapidly approaching flood and no doubt will be amply prepared to withstand a protracted high water.

And speaking of floods and high waters, the United States inspector has decided to raise the danger mark on the Memphis gage to 35 ft. instead of 33, as it has been since the establishment of the Weather Bureau. This is on account of the fact that the levees have made the river come higher each year in this section by confining the water within narrower limits. The change takes place April 1, and contractors should not overlook the fact and be misguided by any references to flood stage when the new mark is in effect.

A serious blow was dealt the proposed extension of Second St. in Memphis, from Beale Ave. to the Union station, a distance of about 1½ miles, when Mayor Crump said he rather favored Third St. extension instead of Second St., and forced the street railway company to abandon their tracks on Second St., giving them the privilege of Third St. instead. It was proposed by many property owners on Second St. to tear down all buildings between Beale and the Union station, create a 50 ft. street, which would be paved with wood block and turn same over complete to the city. The scheme involved the expenditure of over a million dollars, and contractors had their eye on the tremendous amount of grading which would be necessary and several street pavers were whetting their appetite for the wood block contract. But all seems knocked in the head for the present, and the promoters of the project have thrown up the sponke on account of Mayor Crump's disapproval.

The Chicago, Memphis & Gulf R. R., with headquarters at Dyersburg, Tenn., has sent out invitations to a few of the larger construction firms in this section to submit bids on March 28th for the construction of ten miles of roadbed from Hickman, Ky., east to a connection with the Illinois Central. Later it is proposed to continue the line to Jackson, Tenn. The work will be a team proposition for the ten miles on which bids are asked; the other portion, which as yet is not in shape to let, is supposed to call for steam shovel equipment. W. O. McMillian, with headquarters at Hickman, Ky., is chief engineer. The Chicago, Memphis & Gulf has taken over the old Dyersburg Northern road and in financial circles is known to be an Illinois Central R. R. proposition. John Watkins, formerly president of the Bank of Commerce & Trust Co., of Memphis, a big I. C. banking institution, is a controlling stockholder in the C., M. & G. When constructed, this road will prove an outlet from the Mississippi River to Jackson, Tenn., and the south for the I. C. R. R.

Word reaches Memphis contractors that the Erie R. R. has asked for bids on 4,000,000 cu. yds. of double and single track work in Pennsylvania. The Memphis contractors are interested owing to the fact that John D. Lynch, of Monmouth, Ill., is to be a bidder on the work. Many of the local contractors have written to John Lynch stating that they want part of his work in the event he is the successful bidder and on account of the high water. John won't have much trouble in getting the boys from this section on his new contract. John Lynch is well known in Memphis. He built most of the Southern Illinois Central lines and his reputation as a contractor is unexcelled. He possesses a big lot of steam shovels and a well organized force and knows how to handle the most difficult proposition that may arise. Of the Erie work, little is known by contractors here. It is the outcome of the $25,000,000 bond issue just negotiated by that company for the purpose of improving its road through Pennsylvania and for double tracking certain stretches in order that the road might be in a better position to compete with the Pennsylvania and New York Central for business between Chicago and New York. Contract for the 4,000,000 yds. will be let by March 30th. W. J. Harahan, the vice-president and chief engineer, is a Memphis boy who has had a rapid success in railroad circles. He was first associated with his father, the late J. T. Harahan, ex-president of the Illinois Central, in the engineering department of the L. & N. R. R. Later he became vice-president of the I. C., in charge of operation and engineering. He married a Memphis girl about ten years ago and numbers among his friends many of the leading contractors in this section.

S. J. Latta, president of the Chicago, Memphis & Gulf R. R., was a visitor to Memphis last week conferring with certain prominent contractors regarding the extension of his road from Hickman to a connection with the I. C. President Latta said his road had all the funds needed for the present improvements and extensions planned by the board of directors, and that within the present year he will have made wonderful progress in the proposed new lines. Mr. Latta stated that the successful contractor on the ten miles on which bids are now being asked would have to begin work within ten days after award of contract and good and ample security would have to be given that the contract would be finished before early fall, at which time it is expected to have trains running over the new line.

Big Bill Beach has accepted a position with the McSpadden Construction Co., of Texarkana, Ark., and is to be in charge of one of the team outfits engaged in building the big Red River levee in Miller County, Ark. Bill is of the same school of contractors as Henry McCarten, Tim Shea, Bill Stephenson and Charley Siler, all men who have built hundreds of miles of levees and know how to handle a negro and a mule as well as the average man knows how to handle his knife and fork.

A delegation of prominent Mississippi citizens called on the United States senate commerce commission in Washington last week asking that the government aid in constructing a chain of levees from Vicksburg to Bayou Sarah. It was pointed out to the committee that on the west bank of the river the government had constructed earthen dikes for bank protection and has neglected the east side entirely. The embankments existing on the opposite side of the stream forces an excess of water onto the east shore, which, having no protection, is yearly flooded and greatly damaged. Senator Williams of Mississippi is a great champion of the new project and it is thought by army engineers that the Mississippi River Commission on its May allottment trip will authorize the improvements prayed by the citizen's committee. Should the River Commission approve of the plan, it will mean that the Vicksburg army engineer will have many million yards of levee work to advertise in June, 1912. Capt. J. A. Woodruff of the Vicksburg office could not be seen for an expression on the new work.

Apropos of the project to levee from Vicksburg to Bayou Sarah, in the event this idea is not consummated, the levee boys will have but little work during the coming season. The Mississippi River Commission on its next trip will approp
of the money at its disposal for
of banks, instead of for levee
according to a prominent army
knows what he is talking abou
the former class of work is do
governments own forces, it allow
for the levee contractors. It is
the state levee boards are sched
some little contract work durin
spring months, but this will be
up quickly by a number of sm
contractors and will not nearly
of the big levee forces who ne
contracts of over 3,000,000 yds.
them busy. Mike Roach, of Road
sell, is already preparing to mov
his outfits to Texas, while Bob
and Lowrance Brothers are aw
trip of the River Commission be
make any definite move for th
summer. Sam Bush has his Ro
R. R. work in Arkansas to fall
with his large outfit and followin
contractors, and as Sam says, "
bothered about levee work this

It was a disappointed lot of ci
contractors who heard Heiskell
ford's message last week annou
list of streets which were to be p
ing 1912. Weatherford, who is
neer and a good one at that, had
construct about $1,000,000 worth
streets; in fact, he had complete
on this amount of work and
Street Commissioner Love with t
sary "dope." It is understood
Love recommended the streets a
by his engineer and the public
the information previously printed
columns of the vast amount of
might be expected during the
But when the proposition came bef
Crump the latter said that certain
of a reduction of expense had be
before his election and that the
ises must be fulfilled, therefore
neering department must reduce i
and only construct such streets
absolutely necessary. Acting on
mand, Heiskell Weatherford has
public to a correspondent of En
& Contracting the following str
which he proposes to do, with the
sanction during the season now
open: Mississippi Blvd., between
Iowa, brick; Butler, between M
Fourth, brick or wood block;
Blvd., between Madison and La
phalt; Willet St., between Poplar a
ton Park Ave., gravel; Woodlawn,
Chelsa and the city limits, grav
mond Ave., between Mississippi
leans, gravel; Oakview St., betwee
and the Southern Ry., gravel; La
between Decatur and Waldern, ol
Beachwood Ave., between Green
Summerville, gravel; Nelson Ave.,
Cooper and the Parkway, gravel;
from College St. east, gravel; Sun
St., between Walker and McLemo
el; two alleys in the uptown distric
repaved with brick. The above wi
sent a total expenditure of appro
$120,000, and with the other stree
ously let, this year will make a tota
priation of something less than $2.

E. A. Kingsley of Little Rock
through Memphis last week from
nati, where he has been inspecting
be used in the pavement of Arkans
Helena, Ark. The brick will be fu
by the Carlyle Paving Brick Co.,
be floated down to Helena by barg

Chief Engineer Morris of the
ham & Northwestern R. R. was in
last week conferring with contracts
ing the extension of certain lines
nessee near Jackson.

Mike McClavey was in town la
looking over the city streets wi
to putting in a bid on some grad
levee outfit having been tied up acc
the high water.

zens of the little town of Cov- nn., are doing all in their power e new Memphis-Bristol [illegible] ough their city. Floyd [illegible] M. A. Walker are appointed [illegible] to make some good propositions d committee at its next meeting ille, with a view to getting it wards Covington. Speaking of highway which will [illegible] he entire state, it is proposed to mber of big grading contractors ier and make the state of Ten- proposition to build the road for per mile, figured out on a basis of cubic yard. This latter way is only businesslike method of he big highway [illegible] ie work will drag out indefinitely ost will run very high. If a large on firm is awarded the contract e limit placed on the work, it can o much cheaper in the end and a much more rapid [illegible] red that Mike Roach, W. J. Oli-

[illegible] be asked to co-operate with the movement [illegible]

The five contractors mentioned are the largest operators in the state and are capable of formulating a plan which is sure to be successful if carried out.

Texas.

[illegible] purchased 8,000 acres of prairie land, nine miles west of that place, for about $250,000. The land will be drained and subdivided.

County Commissioners' Court, Orange, has received the report of L. F. Daniel, C. E., Beaumont, Tex., on the surveys for the proposed drainage district, including 30,000 acres in the northern part of the Orange County. The estimated cost is $30,000. Final hearing previous to calling the election to vote bonds will be held April 13.

The La Pryor Irrigation Co., of San An- [illegible] eral canal and ditches. The incorporators are: A. R. Helzschuher, F. R. Young and G. Grant White, of San Antonio, James U. Grant, of La Pryor, and E. A. Hutchins, of Columbus.

Washington.

[illegible] Shelton, Wash., have awarded the contract for constructing two miles of ditch requiring about 20,000 cu. yds. of excavation to August Wallin, Aberdeen, Wash., at the following figures: Earth excavation, 30 cts. per cu. yd.; hardpan, $1 per cu. yd., and rock $1.10 per [illegible]

Mexico.

Francis V. Lister, City of Mexico, has petitioned the Mexican Government for permission to drain the Carpintero lake at Tampico. He requests six months further time in which to complete the plans. The drainage will be by pumps and he will leave canals to [illegible] canals.

WATER-WORKS

Arizona.

l be received shortly by Capt. J. Constructing Quartermaster, Fort Ariz., for constructing an 8-in. wa- from Garden Canyon to the post, 9 miles.

Arkansas.

rilton Waterworks Co., Morril- has awarded a contract to the lter Mfg. Co., of Philadelphia, Pa., stallation of a filtering system.

ckard of Speer & Dow, Fort Smith, been granted a franchise by the cil of Benton, Ark., for the installa- waterworks system, to include a 10,- andpipe

zens of Waldon, Ark., are agitating on of a city water and electric light

California.

ity of Orange, Calif., has let the or the construction of a reinforced eservoir 90 ft. in diameter, 12½ ft. settling basin, to the B. R. Davis- acting Co., of Monrovia, Calif., for luding frame and composition roof. ates, of Santa Ana, Calif., City En- Orange, will be in charge of con- work. The capacity of the reservoir gals. Mayberry & Parker, Pacific Bldg., Los Angeles, are Consulting . Bids were opened March 4.

Colorado.

will be received until 10:30 April 12, ucting Quartermaster, Fort Logan, the construction of an irrigation m for the parade ground, athletic

Florida.

will be received until 7 p. m., April ommon Council, Fort Pierce, Fla., construction of waterworks, sewers ic lights. Bids will be received by furnishing material and construc- will include approximately: One se and pumping plant building; 500 -in., 8-in. and 10-in. C. I. P.; 50 two- ants; 4 10-in. gate valves; 8 8-in. s; 20 6-in. gate valves; 8,000 ft. gal- ⅛-in. pipe; 32 valve boxes; 1 duplex 0 gals. per minute; 1 duplex pump. per minute; 1 75,000-gal. tank upon wer; 1 100,000-gal. concrete reser- 50 h.p. boilers; 1 100 K V. A. A. C. ; 1 50 K. V. A. A. C. generator; 1 witchboard, complete; 7 miles of pole ruction, complete; 7 miles of 6-in., 8- , and 12-in. sewer pipe, also flush manholes, etc., etc. All bids are subject to rejection. Plans, profiles and specifications may be seen at the office of the engineers. Specifications will be forwarded upon receipt of $3. D. D. & C. M. Rogers, Engineers, Fort Pierce, Fla.

Georgia.

An election will be held in Buford, Ga., on April 13 for the purpose of voting on the issuance of bonds in the sum of $20,000; of this amount $10,000 will be applied to the paving of Main St.; $5,000 for school purposes, and $5,000 for waterworks.

The citizens of Meigs, Ga., at a recent bond election voted the sum of $20,000, of which $5,000 is for waterworks and $15,000 for electric lights.

Idaho.

Work will begin April 1 on the new water works system at Asotin, Ida., to cost $35,000. Six miles of pipe will be laid of 6-in. and 8-in. in diameter, standpipe of 300,000-gal. capacity constructed 200 ft. above the town. H. W. Mitchell of Seattle, Wash., is Supervising Engineer.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 4, for furnishing and delivering approximately 500 tons (2,000 lbs.) of pig lead, to contain not less than 99.5 per cent lead, to be marked with refiners' name and brand. The lead to be distributed as follows: Pipe yard "A," Avers and Wabansia Aves., 150 tons; pipe yard "B," 2354 S. Ashland Ave., 150 tons; pipe yard "E," 104th St. and Stewart Ave., 200 tons. Cash or certified check for $2,000 must accompany proposal.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 1, for furnishing labor, tools, material, etc., necessary to design, construct and erect discharge mains, valves and venture meters for the Lake View pumping station, Montrose and Clarendon Aves., according to specifications on file at office of the Commissioner. Cash or certified check for $1,000 must accompany proposal.

✣Bids will be received by L. E. McGann, Commisisoner of Public Works, Chicago, Ill., until 11 a. m., March 30, for furnishing and delivering all tools, labor, material, etc., necessary to repair or renew all asbestos fireproof coverings for steam, exhaust and hot water piping, boilers, breechings, heaters, drugs and tanks, at the various water pumping stations in the city. Contract includes pipes, ells, tees, valves and flanges from ½ in. to 4½ ins. in diameter, and covered with a covering of from 1 in. to 5 ins. thick.

✣Bids will be received by L. E. McGann, [illegible] until 11 a. m., March 30th, for furnishing and delivering 312 charcoal iron boiler tubes 3 ins. outside diameter, No. 10 gauge (B. W. G.) each 11 ft. 8½ ins. long, 32 charcoal iron stay tubes, 3 ins. outside diameter, 11 ft. 8 ins. long, 140 Hawley Down Draft furnace tubes, each 5 ft. 2 ins. long, to be made of lap welded special charcoal iron, or seamless cold drawn steel, as specified.

✣Bids will be received until 11 a. m., April 3, by L. E. McGann, Commissioner of Public Works, Chicago Ill., for furnishing, delivering and erecting complete in the Lake View Pumping Station, Montrose and Clarendon Aves., 1 vertical triplex single acting pump driven by direct connected triple expansion condensing engines. General data relating to engine is as follows: Normal capacity per 24 hours, 25,000,000 U. S. gallons, normal speed 62 R. P. M., maximum speed 73 R. P. M., normal head, exclusive of friction, 120 ft., maximum head exclusive of friction 140 ft., working steam pressure at throttle 175 lbs., high pressure steam cylinder 15 ins. diameter, low pressure steam cylinder, 50 ins. diameter, diameter of fly wheels 13 ft., weight of fly wheels, 18,000 lbs. Cash or certified check for $6,000 must accompany proposal.

◉The City Council of Havana, Ill., has let the contracts for the new equipment and improvements to be made in the city water works department: Laidlaw-Dunn-Gordon Co., Chicago, Ill., putting in the 2,000,000-gal. high duty Corliss type pumping engine, $8,625; Babcock & Wilcox, two water tube boilers, without brick work, $2,499; Platt Iron Works, feed pump, $80; Platt Iron Works, heater, $186; A. Kallander Co., furnishing water and steam pipe work in building and the suction and discharge pipe, moving pump, setting up heater, etc., $1,400; J. B. Clow & Sons, Chicago, cast iron pipe, $24.15 per ton; also special casting at $0.02½ per lb., totaling $2,500.

Following is the low bid received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the water works shops, 2304 S. Ashland Ave., 9,000 lbs. of 98 per cent pure ingot copper and 9,000 lbs. of copper trolley wire: Great Western Smelting and Refining Co. 41st St. and Lowe Ave., $0.14½ per lb. for copper and $0.13¾ for trolley wire. Bids received March 20.

Following is the low bids received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering approximately 25 tons of No. 1 red scrap brass to the water works shops, 2304 S. Ashland Ave.: Great Western Refining and Smelting Co., 41st St. and Lowe Ave., $0.11⅜ per lb. Bids received March 20.

✣ indicates work now open for bids. ◉ indicates a contract let recently.

Indiana.

⦿Hutyill & Co., of New Castle, Ind., have been awarded the contract by that city. L. M. Johnson, City Clerk, for the laying of cast iron water pipe approximating 10,000 ft. of 8, 10 and 12-in. Charles Brossman, Union Trust Bldg., Indianapolis, Ind., is Engineer. Bids were opened March 18.

Iowa.

⦿Guy E. Smith of Indianola, Ia., has been awarded the contract for the making of extensions to the water mains in Dilenback's addition, Perry, Ia., at $0.469 per ft. The work includes 9,698 ft. of 4-in. water mains, 7 fire hydrants, 1 gate valve and 489 ft. of 1-in. galvanized pipe. Chas. E. Wilson is City Engineer. Bids were opened March 20.

Kansas.

The citizens of Baldwin, Kan., have voted bonds to the amount of $18,000 for the extension of the waterworks system.

The committee appointed to devise a better water system for Coffeyville, Kan., has recommended that the city spend $133,000 for more lines, purification plant, etc. An election will be held to vote on the proposition.

Louisiana.

⦿A. Josey of Beaumont, Tex., has been awarded the contract at Shreveport, La., for the drilling of a fresh water well for fire protection and a salt water well for a public natatorium on the Lousiana Fair grounds. The contract price is $3,700.

The officials of Morgan City, La., have purchased a plot of ground for $3,000 on which will be constructed the water works plant.

Maryland.

The Maryland Water Co., of Cecil County, Md., has made application to the Public Service Commission for permission to issue $100,000 worth of bonds. Of the amount $30,000 worth of bonds are to be retained in the treasury and $70,000 issued. The money from the sale of the bonds is to be applied as follows: To pay off existing bonds, due May 1, $30,000; for the purchase of mill property, water rights and power at Elkton, Md., $25,000; to construct filtration plant, $5,000.

Massachusetts.

✣Bids will be received until 2 p. m., April 4, by Clerk of the Board of Public Works, for laying water pipe in the city of Pittsfield, Mass. The work will be let in sections including the following quantities: In Section 5, the principal items of work are the laying of about 6,200 ft. of 20-in. cast iron pipe and about 2,400 ft. of 12-in. pipe. In Section 6 the principal items are the laying of about 9,700 ft. of 20-in. pipe and about 1,000 ft. of 12-in. pipe; in Sec. 7, the main item is the laying of 6,000 ft. of 24-in. cast iron pipe. A. B. Farnham is Engineer.

The Water Department of Westfield, Mass., has under serious consideration the advisability of constructing a large storage reservoir in connection with the Granville system. The reservoir would hold approximately 165,000,000 gals.

The Water Board of Wakefield, Mass., has voted an appropriation of $15,000 to install water meters.

Michigan.

The citizens of Manchester, Mich., have voted bonds to the amount of $27,000 for the installation of a waterworks system.

The citizens of Chesaning, Mich., have voted against the issuance of bonds in the sum of $5,000 to extend the water mains and erect a stand pipe.

Mississippi.

It is proposed to install a 180-h.p. tubular boiler and erect a 200,000-gal. steel plate tower in the city of Natchez, Miss. T. K. Winchester is Superintendent.

Missouri.

✣Bids will be received until noon, April 2, by Board of Public Improvements, St. Louis, Mo., J. C. Travilla, President, for letting No. 10,453. For making excavations, hauling and laying complete in accordance with specifications, about 4,870 ft. of 36-in. water pipe, 30 ft. of 12-in. water pipe, 162 ft. of 6-in. water pipe, 50 cu. yds. rock excavation removed, 100 lbs. of wrought iron straps and bands furnished, 6 fire hydrants set. Deposit required, $474.13. William T. Findly is Secretary.

The Union Depot Bridge & Terminal R. R. Co., Kansas City, Mo., contemplates extending the Kansas City water mains over its bridge across the Missouri River to a tract of land in Clay County where it is proposed to develop an industrial city. F. W. Fratt is President.

Nebraska.

✣Bids will be received until 7 p. m., April 16, by city of Rosalie, Neb., for the construction of a water works system estimated to cost $8,700. Grant & Letton, 401 F. & M. Bldg., Lincoln, Neb., are Engineers.

New Jersey.

✣Bids will be received until 2:30 p. m., March 29, by Board of Water Commissioners, Atlantic City, N. J., for furnishing one 10,000,000-gal. horizontal or vertical condensing steam turbine engine and centrifugal pump. Each bid must be accompanied by a certified check for $1,000. L. Van Gilder is Engineer and Superintendent.

Engineer Arthur A. Reimer has submitted his report to the East Orange Water Board, East Orange, N. J., on the probable cost of a connection between the Newark water mains and the system of East Orange. The figure covers the work of laying an 18-in. pipe from the Newark main in Bloomfield Ave. to connect with two 12-in. mains in East Orange, near the site of the abandoned wells of the Orange Water Co. The estimated cost is $9,000.

The citizens of Glen Ridge, N. J., have voted bonds in the sum of $44,000 for the purchase of the plant of the Orange Water Co., within the borough. The plant within the borough consists of the pipe line, hydrants and other accessories.

The New Jersey House of Representatives has passed the Leavitt bill permitting the city of Trenton to acquire lands by agreement or condemnation to construct a purification and filtration plant.

The Water Commission of Atlantic City, N. J., will probably relay two water mains across six miles of meadow from the Absecon source of supply. The present 24 and 30-in. mains are said to be in a bad condition. Warren Somers is a member of the Commission.

The city of Trenton, N. J., has decided to build a 30,000,000-gal. mechanical filtration plant for the purification of the municipal water supply taken from the Delaware River. Plans will be completed May 20. A. C. Gregory, Trenton, is Engineer of Sewers & Water, and Johnson & Fuller, 150 Nassau St., New York City, are Consulting Engineers.

New York.

The citizens of Wolcott, N. Y., have voted the issuance of bonds in the sum of $45,000 for the installation of a municipal waterworks system.

North Dakota.

Citizens of Beach, N. Dak., are agitating the installation of a system of waterworks.

Ohio.

Plans are being prepared by the Moore Engineering Co. of Cleveland, O., for the making of extensions to the waterworks system of Clyde, O., estimated to cost $25,000. The work will also include a power plant and electric light extension. Contracts will be let in about 60 days.

City Engineer Robt. L. J. Wagar of Sandusky, O., will have estimates ready by April 1 for the enlargement of the filter plant. An estimate has been completed of a 1,500 K.V.A. municipal electric station in conjunction with the waterworks, estimated to cost $160,000.

Oklahoma.

✣Bids will be received until 10 a. m., April 13, by Willard S. Levan, City Clerk, Holdenville, Okla., for furnishing f. o. b. ca terworks spur (on the Chicago, R & Pacific R. R., 3 miles east of H Okla.), machinery to be used in the and improvement of the water wor of Holdenville. Goodwin & Harper, ritt Bldg., Kansas City, Mo., are Official advertisement of the wor found elsewhere in this issue.

⦿Contract for 24-in. vitrified sew be used in the water line from the on the Murphy tract to the water been awarded by the City Council Okla., to the Builders' Supply C

Oregon.

✣Bids will be received until A City of Carlton, Ore., for the const a new gravity water works system, to cost $34,000. Stannard & Richa Engineers.

City Recorder John N. Sievers of Ore., will sell bonds April 9 in th $20,000 for the purpose of building taining a waterworks system. H Cross is Mayor.

Pennsylvania.

The city of Lancaster, Pa., has s in the sum of $30,000, the proceeds for waterworks improvement.

South Carolina.

The Town Council of Barnwell, been petitioned to call an election on tion of installing an electric light a works plant.

Tennessee.

✣Bids will be received until noon by Ennis M. Douglass, City Clerk, Tenn., for furnishing fire hydrants. fied check for $250 must be filed with

✣Bids will be received until noon by Ennis M. Douglass, City Clerk, Tenn., for furnishing the city with rants as per the following specificati be delivered to fire department hea Union Ave. and Front St., 50 fire 3½ ft. from top of main to sidewalk 6-in. bell connections, fitted with tw one 4-in. nozzle, Memphis standar Hydrant to open to right, with square ⅞ in. at top, and 1 in. at bottom. deep. For 100 6-in. auxiliary bell gate, with bronze metal double-face open right, with square head nut, standard. For 100 double adjusta boxes and covers. Twenty-five hy be delivered 30 days after awardin tract, balance in 90 days. Certified $250 must accompany each bid as a of good faith.

⦿The city of Jellico, Tenn., has the following contracts for waterw sewer work for which Walter G. Ki Birmingham, Ala., is Engineer; bid March 18: Bellinger & Neely, Jellic ing system of house sewers; P Works, Atlanta, Ga., for furnishing 000-gal. pumps; Columbian Iron Chattanooga, Tenn., for furnishing se ings. The 4.8 miles of sewers will 000. A. B. Wallace is City Secretar

Texas.

Civil Engineer James F. Brook tine, Tex., has made estimates an mendations to the City Council o Tex., on the installation of a system water works. The engineer recom system costing $85,000.

Complete plans and specifications waterworks filtration plant for the cit las, Tex., will be ready by April plans adopted by the city are for the of at least 15,000,000 gals. a day. for the installation of the plant on of the boiler room of the old Turt pumping station. It is to cost $152 a purification cost per year of about J. H. Fuertes of New York City is ing Engineer. William M. Holland

The Eagle Lake Water & Light C Lake, Colorado County, Tex., has corporated with a capital stock of $15,

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

rs are: George Herder, J. [illegible] l G. E. Russell.

on Water & Light Co., [illegible] been incorporated with a capital 0,000 to take over the present city l

n will be held in Sulphur Springs, pril 2 for the purpose of voting on of bonds in the sum of $30,000 ng the waterworks by the con- a pipe line two mi[illegible] Creek and the building of a station.

Vermont.

ll be received until noon, April [illegible] s of the Greensboro Water Co., Vt., for laying the water pipes The work will include the fol- oximate quantities: 5,400 ft. 8-in. aid, 2,800 ft. 6-in. pipe to be laid, pipe to be laid. [illegible] be set. Excavating and [illegible] and digging ditches [illegible] S. Ingalls is one of the directors.

ma Light & Power Co. has been rding to advices from White River , as a holding company to take perties of the Hartford Water which furnishes water to West N. H., and White River Junction, [illegible] Electric Light & Gas furnishes light and power anon and Hanover, N. H., and Junction and Hartford, Vt. P. Chase of Hanover, N. H., is Frank Collins of West Lebanon is nager.

Virginia.

rge K. Anderson of the Circuit n Forge, Va., has issued an order for an election by the citizens of Clifton Forge [illegible] of its bonds with which to purchase the property and franchise of the Clifton Forge Light & Water Co.

The citizens of Colonial Beach, Westmoreland County, Va., at a recent election voted [illegible] for the installation of a waterworks.

An election will be held in Chatham, Va., on April 18 to vote on the proposition of issuing bonds in the sum of $10,000 for the installation of water meters; also sewer system.

Washington.

The City Council of Cathlamet, Wash., has adopted resolutions providing for an extension of the water system.

An election is to be held in Centralia, Wash., April [illegible] installation of a municipal gravity water system.

Wisconsin.

✣Bids will be received early in April by town of Belleville, Wis., for the construction of a waterworks plant estimated to cost about $15,000. W. G. Kirchoffer, Madison, Wis., is Engineer.

✣Bids will be received until 1 p. m., April 4, by O. O. Wilgand, County Clerk, Shawano, Wis., for the erection of a 40,000-gal. steel tank and 80-ft. steel tower. W. G. Kirchoffer, Madison, Wis., is Engineer.

Consulting Engineer Arthur Morgan, 169 Jackson Blvd., Chicago, Ill., has been retained by the city of Manitowoc, Wis., to prepare plans and specifications for increasing the water supply and improving the water works plant.

Petitions for the calling of a special election [illegible] system have been circulated in Palmyra, Wis. The Business Men's Club, Dr. J. A. Kiethley, President, is agitating the movement.

The Bureau of Economy and Efficiency of Milwaukee, Wis., has recommended a new reservoir on the south side, another high service station on the west side and more modern pumping engines at the Noth Point station.

Wyoming.

[illegible] system of Thermopolis, Wyo., has been award- [illegible]

Canada.

Consulting Engineer Allen Hazen of New York City, designer of the filtration plant at the Island, is reported to have informed the city officials of Toronto, Ont., that the plant must be enlarged or meters installed to prevent water waste. City Engineer C. H. Rust estimates that it would cost $120,000 to make seven additional filter beds and $710,000 to make 13 beds.

⊙Chapman & Walker, Ltd., Toronto, Ont., have been awarded the contract by the Board of Control of Winnipeg, Man., M. Peterson, Secretary, for the furnishing of a 5,000,000-gal. horizontal turbine pump to the water- [illegible] March 4.

The contact for supplying about 35 miles of steel pipe from 3 to 10-in. in diameter to the Municipality of Edmonds, B. C., for which bids were received March 11 by W. Griffiths, Clerk, has not been awarded. Will probably be decided March 25. Cleveland & Cameron, 506 Winch Bldg., Vancouver, B. C., are Engineers.

WERAGE AND GARBAGE DISPOSAL

Arkansas.

Miller Engineering Co., Southern Bg., Little Rock, Ark., has been award- tract for the construction of sewers cently organized sewer district of il Ark., at a cost of approximately

y Council of Russellville, Ark., has l the formation of a sewer district the larger portion of the city.

California.

nance Committee of the Board of rs, San Francisco, Calif., has rec- d the appropriation of $60,000 for sion of the Pierce St. sewer from St. through the exposition site to

ngineers Benjamin Dupuy of South , S. J. Ornum of Pasadena and R. ridge of Alhambra have presented rt on the outfall sewer question to city committee, at a meeting held in asadena. The report recommends urification plant be erected at some point to take care of the sewage of cities, rather than that an outfall be constructed at this time. The prob- for a population of 300,000 as sug- ll be as follows: For the first six m the Pasadena septic tank [illegible] seven-tenths of one per cent, 33 ins. next 18 miles on a grade of two- f one per cent, 42 ins. For the last on a grade of one-tenth of one per ins. This will cost exclusive of right for the first six miles $112,000, for 18 miles, $448,320, for the last six 43,630. Total, $703,950.

ngineer W. S. Farley of Richmond, as started work upon plans for a ensive sewer and surface drainage sys- igned to meet both the present and rowth of the city.

oard of Public Works of San Fran- alif., has passed a resolution requesting the supervisors to set aside $160,000 for the extension of the Sunset sewer across Golden Gate Park from Lincoln Way to Cabrillo St.

The City Council of San Diego, Calif., has passed ordinances authorizing improvements amounting to more than $600,000, and will fix a date for a bond election. The improvements are as follows: Fire department, $80,000; sewer extension, $120,000; bridges and repairs of streets, $55,000; comfort station in the plaza, $50,000; water extension, $256,452; replacing old pipe, $14,059; Point Loma reservoir, $12,000; City park reservoir, $35,000; miscellaneous items for repair and maintenance, $87,100.

Florida.

⊙Isaac Mickler of Chattanooga, Tenn., has been awarded the contract by the Board of Public Works of Bradentown, Fla., O. W. Spencer, Clerk, for the construction of a sanitary sewer system at $24,500. Bids were opened March 5.

The citizens of Jacksonville, Fla., have been asked by the City Council to consider a bill which, if passed by the council, will provide for laying sewers on Post St., from Osceola to Acosta St., in Riverside.

Georgia.

✣Bids will be received until April 12, by Board of Health, Atlanta, Ga., for the construction of a garbage crematory. The cost of the improvement is estimated at about $400,000.

The Sewer Committee of the County Commissioners, Atlanta, Ga., has agreed to lay a sewer, 1,000 ft. on both sides of Ponce de Leon Park and the baseball park, to take care of the sewer branches in that vicinity; the building of 400 ft. of sewer on Highland Ave., reaching the Southern Ry.; building of 500 additional ft. of sewer at the McDaniel St. outlet, and the completion of the Proctor Creek sewer.

Plans are being prepared by Engineer J. N. Hazelhurst of Atlanta, Ga., for the construction of new sewers and a disposal plant for the city of Lakeland, Fla., estimated to cost $75,000. The work will also include street paving, to cost approximately $180,000. Bonds are to be sold. C. F. Brush is City Engineer.

Idaho.

The Sewer Committee of Sandpoint, Ida., plans to begin work the first of April on the lateral on Main St., between Third and First Aves., and on the several laterals in sewerage improvement district No. 2. It is estimated that $50,000 worth of sewer work will be done this summer. All work will be done by day labor.

Illinois.

✣Bids will be received until 2 p. m., March 30, Board of Local Improvements, Alton, Ill., for the construction of sewers in accordance with plans and profiles and specifications on file with the City Clerk. J. E. Schwaab is Secretary.

✣Bids will be received until 1 p. m., April 1, by Board of Local Improvement, Murphysboro, Ill., for the construction of the East Side Sewer System. The contract includes 26,500 lin. ft. of vitrified sewer pipe 8 to 22 ins. in diameter. Ralph A. Rollo, City Engineer.

✣Bids will be received until 4 p. m., April 1, by the Board of Local Improvements, Galva, Ill., for furnishing the necessary labor and materials for the construction of sanitary sewers and cast iron water mains. The work will include: For sewer improvement, 594 ft. of 8-in., 2,040 ft. of 6-in., 9 manholes and one combined manhole and flush tank. For water mains improvement, 2,420 ft. of 4-in. cast iron pipe, 5 double nozzle fire hydrants, 2 4-in. valves with boxes. W. S. Shields Co., 1200 Hartford Bldg., Chicago, Ill., are Engineers.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 1, for furnishing and

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

delivering at the [illegible] St. and Center Ave. [illegible] racks, according to specifications on file at office of the Commissioner.

⦿F. E. Kaminski of Watertown, Wis., has been awarded the contract for sewer and water improvements in the south end of the city by the Board of Local Improvements of Moline, Ill., at $4,463. The contract calls for the laying of 6-in. water main and 8-in. sewer on 23d Ave., from 21st to 27th St.; on 25th St., from 23d Ave. to 19th Ave.; and on 19th Ave., from 25th St. west.

⦿E. R. Harding Co., Racine, Wis., has been awarded the contract by the Board of Local Improvements of Galesburg, Ill., for the construction of the East Main St. sewer to take care of that district between the Burlington tracks and the public square at $17,041. The other bidders were E. B. Waggoner, Oshkosh, Wis., $18,308 and J. B. McAuley, Galesburg, $17,631. City Engineer Frank Connolly's estimate for the work is as follows: 967 lin. ft. of 24-in. sewer, $2,630; 3,424 lin. ft. of 18-in. sewer pipe, $9,456; 1,902 lin. ft. of 15-in. sewer pipe, $3,481; 16 manholes at $757; 15 catchbasins at $443; 6 storm water inlets, $66; 315 lin. ft. 10-in. pipe, $230; court costs, etc., $1,023.

⦿Greene & Sons, contractors for the sewer system in Marseilles, Ill., have sublet the contract for tunneling under the canal at Aurora St., and laying the tile to T. E. Willett of Marseilles.

The citizens of Earlville, Ill., will vote at the city election in April on the proposition of putting in a system of sewers.

City Engineer John Schwaab of Alton, Ill., has prepared a recommendation to the City Council that septic tank sewer systems to cost about $20,000 be installed in Upper Alton, the contour of that part of Alton forbidding the building of a sewer to empty into the river.

The annual budget for the coming fiscal year in Springfield, Ill., totals $803,498, which includes the following sewer work: Mildred Park sewer, $20,000; Ridgely sewer, $10,000 and town branch sewer, $5,000.

Indiana.

⦿The contract for the construction of the sewer in Portland, Ind., has been awarded to Griffith & Sprinkle of Portland at $7,469. J. W. Fitzmaurice of Winchester, Ind., and N. N. North of Bluffton, Ind., also bid on the work.

⦿The City Council of Boonville, Ind., has let the contract for the building of the South Side sewer system to John L. Newman & Co., of Evansville, Ind., at $54,764. Work is to be started within 30 days and completed by Dec. 1.

Iowa.

Councilman Dorr Lamb, of the water and sewer departments, Marshalltown, Ia., is preparing to have estimates made of the cost of water and sewer extensions that will be necessary in those streets that are to be paved. About 11 blocks of sanitary sewer and about eight blocks of water main extensions will be necessary. The cost is estimated between $7,000 and $8,000.

Plans have been prepared by Engineer H. G. Vollmer of Burlington, Ia., for the construction of the Mt. Pleasant St. sewer and the Linden St. sewer. An election was held March 25 to vote on the proposition.

Kansas.

The City Commissioners of Newton, Kan., have instructed City Engineer F. E. Devlin to proceed with plans for the storm sewer. As outlined by the engineer, the sewer will consist of a main sewer, north and south of the track.

Kentucky.

The governor has signed the bill authorizing the city of Louisville, Ky., to vote on the question of issuing $2,000,000 of bonds for sewer extension.

Louisiana.

✣Bids will be received until noon, April 25, by Sewerage and Water Board, 508 City Hall, New Orleans, La., for: 1. Contract 39 D, [illegible]bine. 2. Contract 41-D, two hydraulically operated sluice gates. 3. Contract 42-D, construction of lined and covered canal on Claiborne, from Elysian Fields to Lafayette Ave. 4. Contract 43-D, iron screens for pumping station No. 1. Specifications with blank form of proposals will be furnished on application at the office of the board. Geo. G. Earl, General Superintendent.

Maryland.

✣Bids will be received until 11 a. m., April 3, by Board of Awards, Baltimore, Md., for the construction of lateral sewers in District No. 17. Plans and specifications may be obtained of the Sewerage Commission, Charles England, Chairman, 904 American Bldg., Baltimore, Md. The work will include the following approximate quantities: 14,000 lin. ft. vitrified pipe sewer, 8 ins. to 15 ins. diameter; 10,000 lin. ft. vitrified pipe house connections.

Specifications have been presented to the Sewerage Commission of Baltimore, Md., by Chief Engineer Calvin W. Hendricks for the construction of a sewer in the district bounded on the south by Pratt St., on the north by Lexington St., on the west by Light St., and on the east by Frederick St. Specifications have also been submitted for the continuation of the sewer from Lexington St. to Center St., and from Frederick St. to Jones Falls as the northern and eastern boundaries.

The citizens of Laurel, Md., at a recent special election voted against the proposition to allow the mayor and city council to borrow $35,000 for a complete sewerage system. George P. McCeney is mayor.

Massachusetts.

✣Bids will be received until 3 p. m., April 2, by Committee on Sewerage, Charles S. Holden, Chairman, Attleborough, Mass., for laying cast iron and vitrified pipe, building brick manholes and other appurtenances. The approximate quantities of the work to be done according to the estimate of J. J. Vankenburg, Engineer, are as follows: Laying 250 lin. ft. of 16-in. castiron pipe; laying 2,040 lin. ft. of 12-in. castiron pipe; laying 6,380 lin. ft. of 12-in. vitrified pipe; laying 15,550 lin. ft. of 10-in. vitrified pipe; laying 88,500 lin. ft. of 8-in. vitrified pipe; laying 2,870 lin. ft. of 6-in. vitrified pipe; laying 4,000 lin. ft. of 5-in. underdrain pipe; building 624 manholes; 30 cu. yds. concrete masonry; 600 cu. yds. rock excavation; 700 cu. yds. gravel foundations; 2,000 ft. B. M. timber foundations.

The citizens of Amesbury, Mass., have voted in favor of the installation of a sewerage system at an estimated cost of $160,000. An election will be held April 1 to select a list of sewer commissioners.

Michigan.

✣Bids will be received until 8 p. m., March 28, by Board of Public Works, E. H. Christ, President, Grand Rapids, Mich., for transporting and erecting pumps, piping, motors, transformers and crane for the East Side sewage pumping station, according to the plans and specifications on file at the office of the Board.

✣Bids will be received until 8 p. m., March 28, by Board of Public Works, Grand Rapids, Mich., for the construction of the East Side Sewage pumping station according to plans and specifications on file with the board and Williamson & Crow, Architects. E. H. Christ is President of the Board.

The citizens of Jackson, Mich., on April 1 will vote upon the construction of the following: Sewers—Harmon Drain Extension; South Branch of Harmon Drain; on High St. from Harmon Drain west to present sewer; on High St. from Harmon Drain to Merriman St.; on Merriman St. from High St. to Harmon Drain; on Second St. from Washington St. to Union St.; on West Ave. from Union St. south 200 ft.; on First St from McBride St. to Morrell St.; on Third St. from Union St. north 750 ft.; on Greenwood Ave. from First St. to Randolph St Total, $9,500. Laterals—On Railroad St. from Page Ave. to first alley west of Summit; on Page Ave. from Elm Ave. to Russell St.; on East Ave. from Main St. to Railroad St.; on Pringle Ave. from Pleasant St. to Gorham
St.; on Seymour St. from Gar
LeRoy St.; on Orange St. from L
North St.; on Seymour St. from
north 350 ft.; on Park Ave. fr
St. southeast 1,300 ft.; on Bate
LeRoy St. north 320 ft. Total, $
Harrington, City Recorder.

The citizens of Almond, Mich.,
election voted against the issuanc
in the sum of $15,000 for a sewer

The City Council of Detroit,
allowed nearly $1,000,000 worth o
provements for the coming year
the sewer improvements granted
eastern section of the city. Four
the Mt. Elliott Ave. sewer, and fiv
St. sewer were approved. Other
tensions in Martin and Lakewood
nor's Creek road, Forest, Warre
Hazlett, Westminster and Bethune
allowed.

Minnesota.

✣Bids will be received until
March 29, by City Council, at the
N. Knott, City Clerk, Minneapolis,
furnishing the city a ⅓-cu. yd. con
for use in sewer construction.

✣Bids will be received until
March 29, by City Council at the
N. Knott, City Clerk, Minneapolis,
furnishing steel reinforcing rods
sewer construction.

✣Bids will be received until
29, by City Council, at the office
Knott, City Clerk, Minneapolis,
furnishing one hot concrete mixe

✣Bids will be received until 8
18, by Lester J. Fitch, City Recor
Minn., for the construction of a
and sludge bed, according to plans
fications on file with the City Rec

⦿Ilstrup & Olson, 220 Security
neapolis, Minn., have been awarde
tract by the city of Albert Lea, M
Dudley, Clerk, for the construction
system including approximately 1,
10-in. pipe, 6,800 ft. of 8-in. pipe, ar
holes. The contract price is $12,981
Barneck, City Engineer. Bids w
March 22.

The City Council of Willmar,
jected all bids received March 18
Gunderson, City Clerk, for the inst
a sewer system, being higher than
available for the work. The work
clude sanitary sewer system, storm
water sewer and septic tank, sludge
The total length is approximately
including the drain tile for the outle

A trunk sewer is to be const
Woodland, a suburb of Duluth, M
spring, which will run from Wo
about 33d Ave. east, then a short
the south and empty into the lake.
owners have been assessed $9,000
provement.

The Board of Public Works of
Minn., has ordered the construction
erage system on Griffith, East T
Fourth and other streets at an esti
of $30,000.

City Engineer Walling of Wino
is completing plans and specificatio
new sanitary sewers which are
stalled on Huff St., between Third a
and on Winona, between Second
Sts.

The City Council of Proctor, Min
sidering two plans for the installa
sewer system. One calls for the b
the main trunk sewer through We
and empty in the bay at an estimat
$70,000. The other calls for a
system, estimated to cost $45,000.

Missouri.

✣Bids will be received until no
4, by J. H. Langston, City Clerk, S
Mo., for the construction of the sout
northern sewage disposal works in a
with plans and specifications on file
city clerk and Alexander Potter, C
Engineer, 114 Liberty St., New Y
Official advertisement will be found
in this issue.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

oard : Public Works [illegible] has let the contract for the con- f the third section of the Brush ver to Leon H Jordan [illegible] r, an intercepting one, will extend n to Holly Sts., and will be rein- crete and monolithic concrete con-

ard of Public Works of Kansas has let the contract for an inter- int district sewer to extend from ind Cleveland Ave. to Raytown ng near 29th St., most of the way, Roberts at $5,908. It [illegible] both vitrified clay and monolithic

Council of Carthage, Mo., has es- nother sewer district, No. 9, cov- ory north of Central Ave., to the xtending west from Main St. to Between Mound and Limestone nds ½ block west of Maple St.

Montana.

lson-Smith Co. has been awarded [illegible] the City [illegible], for the construction of a lateral fth alley southwest between Fifth Sts., at $1,286.

ens of Lewistown, Mont., will vote the proposition to issue bonds in $60,000 for the purpose of con- e east side sewer system.

[illegible] ainst the issuance of bonds in the 00 for the installation of a sewer other election will be held in the E. J. Parkinson, is City En-

Nebraska.

l be received until 11 a. m. (cen- April 18, by Quartermaster, Fort ., for furnishing all labor and ma- he construction of a reinforced wer and accompanying work at

[illegible]

department with sewer pipe dur- to L. B. McCoun & Co. Other con- [illegible] lumber; L. B. McCoun, cement; n, sand; Wearne Bros., cast iron, l Co., lubricating oils; Union Oil International Oil Co., asphalt; fining Co., road oils.

New Jersey.

. Christie, 38 Thomas St., New- has been awarded the contract by mmittee of South Orange, N. J., struction of sewers in Hiltonia South Orange at $15,963. The work the construction of 12,400 ft. of 8-in. and 1,600 ft. of 10-in. sewers. Alex- otter, 114 Liberty St., New York City, ulting Engineer. Bids were opened

New York.

g bids were received March 13 by r, Secy. Board of Contract and y of Rochester, N. Y., for the con- of Contract No. 4, including Division nd part of No. 7, of the sewage dis- stem: (1) standing for bid of T. A. Co., New York City (awarded con- (2) Central Dredging Co., Cleveland, Lake Erie Dredging Co., Buffalo, N. Houston Barnard, Rochester, N. Y. awarded March 14:

	(1)	[illegible]	(3)	[illegible]
[illegible]	$1.50	[illegible]	[illegible]	$1.00
tlet pipe, land, 2,200 lin. ft......	20.00[2]	28.94	20.00[3]	15.00[5]
[illegible]	26.00[2]	28.50	30.00[4]	[illegible]
and plank, 10,000 ft. B. M......	60.00	50.00	[illegible]	50.00
[illegible]	7.50	10.00		7.00
rib	20,000	17,500	[illegible]	[illegible]
[illegible]	3.00	3.25	2.50	4.50
[illegible]	$265,254	$293,707	97,420	$321,641

[illegible]
lso bid $33 per lin. ft. for ingot iron pipe lake section.
lso bid $32 per lin. ft. for cast iron pipe land section.
lso bid $42 per lin. ft. for cast iron pipe lake section.
[illegible]
lso bid $39 per lin. ft. for ingot iron pipe lake section.
[illegible]
lin. ft. on cast iron pipe land section, $46 per lin. ft. on cast iron pipe lake section, $48 tim-
[illegible]

[illegible] Clerk.

[illegible] agent, giving him the exclusive and perpetual right to construct, maintain and operate sew- [illegible]

The citizens of Akron, N. Y., on March 19 [illegible] tax for the purpose of having maps and plans [illegible]

The opening of the bids for furnishing the necessary labor and material required for constructing the necessary supply and outfall pipe lines, pile foundations, etc., in connection with the construction and maintenance of experimental sewerage disposal plant at West New Brighton, Borough of Richmond, New York City, together with all work incidental thereto, under Contract No. 1, has been postponed from March 19 to March 26. George Cromwell is President of the Borough of Richmond.

Ohio.

✣Bids will be received until noon, April 4, by Director of Public Service, W. J. Springborn, Cleveland, O., for the construction of sewers in the following named streets, avenues and thoroughfares: Cass Ave. N. W., between W. 54th St. and W. 58th St.; Denison Ave. S. W., between W. 73d St. and W. 90th St.; Gilbert Ct. S. W., between W. 58th St. and W. 61st St.; East 165th St., between St. Clair Ave. N. E. and Wayside Rd. N. E.; Rosewood Ave. S. E., between Warner Rd. S. E. and Turney Rd. S. E.; Woodside Ave. N. E., between Eddy Rd. N. E. and Easterly End; Park Ave. S. E., between E. 66th St. and E. 71st St., and East 66th St., between Park Ave. S. E. and Clement Ave. S. E. Each bid must be made in accordance with the plans and specifications which may be seen at the office of the Chief Engineer, Room 305, City Hall. W. H. Kirby is Secretary of the department.

✣Bids will be received until noon, March 30, by Director of Public Service, St. Bernard, O., for the improvement of Langley Ave., by constructing an 8-in. vitrified pipe sewer from Mitchell Ave. to Delmar Ave. W. J. Voller is Clerk. Henry A. Nunlist, 1112 Traction Bldg., Cincinnati, O., is City Engineer.

⊙The Department of Public Service, Cleveland, Ohio, has awarded the following contracts for the construction of sewers in a number of streets; bids opened March 19: John Gallagher, Cleveland, 2 streets, $2,564; A. J. Galvin, Cleveland, 2 streets, $2,254; B. W. Ernst, Cleveland, 3 streets, $5,671, and the Amata Construction Co., Cleveland, 1 street, $211.

Plans are being prepared by Engineer Tom P. Brown of Wooster, O., for the construction of about three miles of sanitary sewers in the Board of Trade allotment.

The Efficiency Board of Cleveland, O., has adopted a resolution indorsing the plan to proceed with the immediate erection of a sewage testing station on the lake front at a cost of $20,000. R. W. Pratt is City Sanitary Engineer.

Following low bids were received on sewer work by the Department of Public Service of Youngstown, O.: Marshall St. sewer and grading, E. Diorio, $3,050; Dry Run District Sewer, No. 1, Ed Couricote, $13,341; Dry Run District Sewer, No. 2, P. & P. J. Grady, $4,971; Dry Run District Sewer, No. 3, P. & P. J. Grady, $9,723; Court, Harrison and Willard Sewer, E. Diorio, $1,149.

Oklahoma.

⊙The contract, as noted in our last issue, for the installation of a sewer system in Sallisaw, Okla., for which Winters & Dove, 810 First National Bank Bldg., Fort Smith, Ark., are engineers, was awarded to the Oklahoma Engineering Co., Oklahoma City, Okla. The itemized bid is as follows:

CHARACTER OF WORK.	
[illegible]	[illegible]
Furnish. and lay. 10-in. vit. sewer pipe, [illegible]	[illegible]
[illegible]	[illegible]
Excavat. and refill. trench, 6 to 8 ft. deep, [illegible]	[illegible]
[illegible]	[illegible]
Furnish. material and build. manhole 5 ft. deep, 90 ft.	20.00
Furnish. material and build. add. depth of M. H., 115 ft.	6.00
[illegible] 14 ft.	50.00
Furnish. material and build. lamphole, 17 ft.	6.00
Furnish. and plac. extra Portland concrete, 25 cu. yds.	10.00
Rock excavation, 500 cu. yds.	3.00
Furnish. and lay. 8-in. c. i. pipe, Class A, 84 ft.	1.50
Furnish. and lay. ¾-in. gal. iron pipe, 2,395 ft.	.10
Earth excavation for disposal plant, 1,750 [illegible]	[illegible]

Time of completion, 5 mo.

Oregon.

A committee from the Montavilla, Ore., Board of Trade has been appointed to urge the laying of sewers on East Gilsan St., between East 60th and East 82nd Sts.

Plans for a trunk sewer for Westmoreland and the eastern part of Sellwood have been prepared by City Engineer Tom Hurlburt of Portland, Ore. The sewer is to be known as the "Insley Ave. Trunk Sewer." It begins near the south side of Westmoreland on E. 22nd St. and extends south to Insley Ave. and on Insley Ave. to the Wiliamette River. A tunnel under Sellwood for a considerable distance will be required for this trunk sewer. Two sets of plans as required have been prepared. Concrete sewer will cost $159,233 and the monolithic and lock-joint sewers is estimated to cost $166,099. That part of Sellwood east of E. 15th St. will be in the new district, as the western part has already been provided with sewers. This trunk will provide sewerage for Eastmoreland, Westmoreland and eastern Sellwood. The sewer system for Westmoreland is now being constructed and will be connected with the Insley Ave. trunk sewer.

Pennsylvania.

✣Bids will be received until 6 p. m., April 1, by Benjamin McClusky, Secretary, Forest City, Pa., for the construction of a storm water sewer on Grand Ave., Erie St., Center St., Depot St., North St. and South St., in all about 845 ft. of 20-in. pipe, 500 ft. of 18-in. pipe, 1,880 ft. of 15-in. pipe, 1,430 ft. of 12-in. pipe with the necessary wyes, beds, etc., also for the construction of such receivers, manholes and catch basins as may be required. The Borough to furnish all pipe. A certified check for $500 must accompany each bid.

⊙Following bids were received by the Borough Council of Old Forge, Pa., for the installation of a system of sewers: Contractor Brown of Duryea, Pa., $45,709; James Costa, $45,274; C. B. Snyder & Co., $41,694; Antonio Biancardi, $44,999; Monie & Co., 10 per cent of entire cost, borough to furnish materials;

M. Stipp, Scranton, $50,950; Retta & [illegible], $43,956; Attorney W. J. Douglas, 10 per cent of cost for furnishing contractor; Stephen Flanagan & Son, Scranton, Pa., $39,974; J. T. Reilly, $44,886. Bids were rejected and new bids opened March 21.

A considerable amount of sewer work will be done in Scranton, Pa., during this year. Already the City Council has passed legislation to provide new sewers and pavement in the city that will cost $318,242. According to bureau of engineering, W. A. Schunk, chief, the following sewer contracts have been let, and will be started as soon as the weather opens up: Capouse Ave., from Woodlawn St. to Park St., $521.67; Relief sewer, Sixth Sewer District, Thomas Kearney & Co., $4,486; Relief sewer, Fifth Sewer District, Thomas Kearney & Co., $1,861; relief sewer, 17th Sewer District, Thomas Kearney & Co., $10,429; relief sewer, Tenth Sewer District, Jones & Markwick, $22,000; Section K, 17th Sewer District, $51,163, to the M. Stipp Construction Co.; system of sanitary sewers, Tenth Ward, Fabrizio D'Andrea, $30,199. Street ordinances passed, and upon which work will be started this year, are: Oakford Ct., Mulberry to Vine, estimated cost $2,629; Kressler Ct., Center to Linden, $4,516; Lee Ct., Spruce to Center, $1,473; Moir Ct., Linden to Mulberry, $2,653; Hitchcock Ct., Linden to Mulberry, $2,188; Hitchcock Ct., Mulberry to Vine, stone block, $2,779; Hitchcock Ct., Vine to Olive, $2,627; Vine St., Kellum Ct. to Taylor Ave., $2,069; Poplar St., Capouse Ave. to D. & H. tracks, stone block, $8,044; Monroe Ave., Ash to Poplar, $5,391; Mulberry St., Prescott to Arthur, $15,821. Contracts let, too late to start last year: Prospect Ave., Front to Locust, $54,517; Boulevard Ave., East Market St. to Olyphant Ave., $25,575.

Borough Engineer Alexander Gray of Charleroi, Pa., has been empowered by the Borough Council to employ a sanitary engineer to assist him in drawing up plans and specifications for a sewage disposal plant.

The State Board of Health of Pennsylvania has approved the plans and specifications for the construction of a sewage purification plant in South Bethlehem, Pa., estimated to cost $100,000. The Council will report on the matter April 1. R. E. Veminger of South Bethlehem is Engineer.

Texas.

Assistant City Engineer Eugene Couch of Dallas, Tex., is working on plans for a storm sewer and retaining wall to preserve the grounds of the David Crockett School on Carroll Ave., East Dallas, from the overflow from Peak Branch.

The City Council of Houston, Tex., has recommended the building of another sewerage station, costing in the neighborhood of $125,000. City Engineer F. L. Dormant and Commissioners J. J. Pastoriza and R. L. Jones recently made an inspection trip over the territory.

The citizens of Nacogdoches, Tex., on March 19 voted $30,000 in bonds for paving, $20,000 for a light plant and $15,000 of sewerage.

J. G. Sutton, City Secretary, Beaumont, Tex., has been instructed to re-advertise for bids for the construction of sewers as follows: 1,600 ft. of concrete or brick, 7½x5 ins. on Long Ave.; 1,800 ft. on Wall St., to be not less than 27-in. vitrified pipe; 1,125 ft. of 18-in. vitrified pipe on Mariposa St.; 400 ft. on 15-in. vitrified pipe on Bismarck St.; 1,700 ft. of 12-in. vitrified pipe on Orange St., including all manholes, catch basins and "wye" branches. No bids for this work were received on March 19. The estimated cost is $30,000.

Virginia.

The citizens of Colonial Beach, Westmoreland County, Va., at a recent election voted the issuance of bonds in the sum of $37,000 for public improvements as follows: $20,000 for sewers and $17,000 for waterworks.

Washington.

⊙The Wallin Co. of Shelton, Wash., has been awarded the contract for the putting in of the Shelton Valley drainage works at $7,550.

The City Council of Cathlamet, Wash., has passed an ordinance providing for the establishment of a sewer district.

City Engineer Walter Rehorn of Walla Walla, Wash., has estimated the cost of laying a sewer in Green Park addition at $7,446. The main sewer would be 10 and the ends 6 ins. in diameter.

Plans have been prepared by Engineer T. J. Wright of Kennewick, Wash., for the construction of new sewers, estimated to cost $50,000, including a main and lateral sewer. The contract will be let about April 15.

West Virginia.

✤Bids will be received until 1:30 p. m., April 1, by Board of City Commissioners, Huntington, W. Va., for building the following lateral sewers: 12-in. lateral sewer in the alley between Rookwood and Ninth Aves., from 19th to 20th Sts., 420 ft.; 12-in. lateral sewer on the west side of 20th St., from alley between Rookwood and Ninth Ave. south, 92 ft. Plans and specifications for the above sewers are on file in the office of A. B. Maupin, City Engineer.

✤Bids will be received until noon, April 12, by Board of Affairs, Bluefield, W. Va., for trench excavation, laying a 15-in. vitrified-clay sanitary sewer and constructing a 54-in. concrete storm sewer laid in same trench. The work will include approximately 3,000 ft. of storm sewer and 3,400 ft. of sanitary sewer. W. H. Campbell is City Engineer.

✤Bids will be received until 1:30 p. m., April 1, by Board of Commissioners, Huntington, W. Va., for the construction of the following lateral sewers: 12-in. lateral sewer in the alley between Rookwood and 9th Aves., from 19th to 20th Sts., 120 ft.; 12-in. lateral sewer on the west side of 20th St., between Rookwood and 9th Ave., s Plans and specifications for the ab are on file in the office of A. B. Ma Engineer. J. Coon is Commis Streets.

Wisconsin.

✤Bids will be received until 2 p. 3, by City of Marinette, Wis., for struction of a 36-in. 2-ring brick sew Hillis is City Engineer.

⊙Aug. F. Schoenoff of Menom has been awarded the contract by t of Colfax, Wis., Henry B. Anders Clerk, for the installation of a sani system at $2,152. Bids were opened

The City Council of Racine, Wi scinded its recent action to hold a to vote bonds in the sum of $185,0 construction of three trunk sewers

The Board of Public Works Wis., has recommended to the Cit the construction of sewers in Dist and District No. 2.

Wyoming.

Detailed plans have been complete itary sewers to be built at an estimat about $35,000, in the city of Cody, bond election has been called for A the improvement. Burns & McDon ritt Bldg., Kansas City, Mo., are En

Canada.

✤Bids will be received until noo 29, by City Commissioners, Moose J for the installation of approximatel of 8 and 10 in. sewer mains and 6 mains. Further information and be obtained of J. Antonisen, City En

✤Bids will be received until 5 p. 8, by D. G. Tate, City Clerk, Vern for the supply and delivery of 60 manhole frames and covers, comp either cast or galvanized iron mu All prices to be f. o. b. Vernon.

✤Bids will be received until noo 29, by City Commissioners, Saskato for furnishing the labor for construc lin. ft. of storm sewers, manho basins and appurtenances. George is City Engineer.

✤Bids will be received until noo 30, by E. Harrison, Oak Bay Mu Victoria, B. C., for constructing a m sewer. The work includes 12,600 ft crete sewer.

✤Bids will be received until noon, by G. W. Robinson, Secretary-T Lethbridge, Ont., for the grading, et ing: Approximately 2½ miles of sewers, approximately 3½ miles o walks (curb and gutter in addition), mately 7 miles of grading. A depo amount of $500 must accompany on each contract. A bond in the am $8,000 will be required of successfu Plans and specifications can be ob A. C. D. Blanchard, City Engineer.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ET

Alabama.

✤Bids will be received until 11 a. m., April 22, by Maj. A. F. Flagler, U. S. Engineer, Mobile, Ala., for construction of the 80-ft. twin screw motor survey boat Dauphin.

Arkansas.

The Missouri Valley Engineer Co., Mitchell, S. Dak. is preparing plans for an electric light plant for the city of McGehee, Ark. Plans will be completed and bids asked in the near future.

Arizona.

✤Bids will be received until 2 p. m., April 22, by Commissioner of Indian Affairs, Washington, D. C., for the erection of a brick hospital building at the Moqui Indian School, Arizona.

California.

✤Bids will be received until 11 a. m., April 11, by Lieut. Col. Thomas H. Ress, U. S. Engineer, Custom House, San Francisco, Calif., for dredging a channel across the flats in San Pablo Bay to the mouth of Petaluma Creek, Cal.

✤Bids will be received until 3 p. m., April 23, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures of the United States Post Office at Riverside, Cal. The building is to be two stories and basement of approximately 6,200 sq. ft. ground area, stucco faced, with tile roof, and of fireproof construction throughout. Drawings and specifications may be obtained custodian of the site at Riverside, at this office, at the discretion of the ing Architect.

✤Bids will be received until 8 p. 1, by M. J. Desmond, City Clerk, Sa Calif., for two motor-propelled che gines equipped with double 80-gal. tanks of approved design.

⊙City Council of Oakland has awa contract to H. A. Grahmah for ere apron wharf in the Key Route basin per lin. ft. for Section 1, and $30 pe for Section 2.

⊙C. E. Grunsky, San Francisco, been awarded a contract by R. L. Oakland, and R. P. McKaig, for the tion of a 1,700 ft. wharf at Port Wa

✤ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] Watsonville, to cost $1[illegible] Wstern States Gas & Electric Co., lledby H. M. Byllesby & Co., Chicago, exnd $100,000 for improvements at [illegible] The work will include the [illegible] ebtding of a 5-mile flume, the imnerof the dam, the dredging of two [illegible] and construction of new [illegible] ills M. McCalman, Placerville, is En[illegible] of the work.

[illegible] specifications for the [illegible] dock ereed for the city of San Diego, Cal., eetompleted by E. M. Capps, Harbor eri San Diego.

[illegible] Los Angeles [illegible] Chief Harbor Engineer Homer [illegible] submit an estimate covering the [illegible] bulkhead [illegible] Deadman's Island [illegible] Terminal Island. [illegible] a bulkhead, it is said the city [illegible] reclaim [illegible] wharves, docks [illegible]

Connecticut

[illegible] has been organized [illegible] proposes to erect [illegible] y 00,000 hotel building on Asylum St., tfd. Harry Bond, Hartford, is Sec[illegible]

Delaware.

[illegible] be received until 10 a. m., April [illegible] rmaster, Fort DuPont, Delaware [illegible] r constructing, including plumb[illegible] ric lighting, of the quartermas[illegible] t Fort Dupont.

[illegible] be received until 11 a. m., April [illegible] R. R. Raymond, U. S. Engineer, [illegible] dredging Appoquin[illegible]

[illegible] be received until 11 a. m., April [illegible] R. Raymond, U. S. Engineer, Del., for dredging Murderkill [illegible]

District of Columbia.

[illegible] will be received until 10:30 a. m., Maj. F. C. Boggs, General Pur[illegible] r, Isthmian Canal Commission, D. C., for furnishing under Ca[illegible] 3, galvanized roofing, steel rope, netal, pig iron, pig tin, slab zinc, er, hand cars, push cars, wheel[illegible] vels, picks, monkey wrenches, s, nails, hacksaw blades, hose ner and pick handles, mop han[illegible] ooms, stable brooms, scrubbing rns, garbage cans, brass unions, cotton canvas, leather, toilet pa[illegible], rosin, caustic soda and crude [illegible]

[illegible] be received until 2 p. m., April [illegible] C. Boggs, General Purchasing [illegible] mian Canal Commission, Wash[illegible] or until 11 a. m., April 3, at [illegible] the Assistant Purchasing Agent, [illegible] Point St., San Francisco, Calif., [illegible] g under Canal Circular 695, elec[illegible] ring a period of 15 months, be [illegible] 3.

[illegible] be received until 10:30 a. m., [illegible] r, Isthmian Canal Commission, [illegible] D. C., for furnishing under Ca[illegible] lar 694: Hand cars, push cars, nuts, [illegible] ksaw blades, hammer handles, cot[illegible] Manila rope, cotton canvas, metal[illegible]

[illegible] will be received until 2 p. m., April [illegible] mmissioners of the District of Co[illegible] Washington, D. C., for furnishing [illegible] vering 1 two-passenger motor car, [illegible] gasoline type, for use in the fire [illegible] nt.

[illegible] will be received until noon, April 8, [illegible] General William Crozier, Chief of [illegible] Washington, D. C., for furnish[illegible] mortar carriages, model 1896.

[illegible] will be received until 10:30 a. m., by Maj. F. C. Boggs, General Pur[illegible] Officer, Isthmian Canal Commission, [illegible] ton, D. C., for furnishing under [illegible] ircular 692, paints, oils, japan drier, white zinc, red lead, white lead, putty, shellac, turpentine, turpentine substitute, kerosene, gasoline, coal tar, lye, sal soda, sea coal facing, graphite, ammonia alum, aluminum sulphate [illegible] waste and [illegible]

Florida

✣Bids will be received until 3 p. m., April 20, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including [illegible] ratus, electric conduits, wiring and interior lighting [illegible] The building is of three stories, with basement and unfinished attic, and has a ground area of approximately 7,200 sq. ft. Fireproof construction throughout, stone facing, tile and copper roof. Drawings and specifications may [illegible] Miami, Fla., or at this office, at the discretion of the Supervising Architect.

Georgia.

✣Bids will be received until 11 a. m., April 10, by Constructing Quartermaster, Fort Screven, Ga., for the construction complete, including plumbing, heating, electric wiring and fixtures of the band barracks and detached lavatory at that place.

Illinois.

✣Bids [illegible] April 11, by Commanding Officer, Rock Island Arsenal, Rock Island, Ill., for furnishing under Supply Schedule No. 955 [illegible] complete, installed, equipped with Bohm siphon system or equal; dimensions, 12 ft. 2 ins. wide and 7 ft. 9½ ins. deep and 7 ft. high over all.

✣Bids [illegible] April 12, by Lt. Col. George A. Zina, U. S. Engineer, Chicago, Ill., for dredging in Chicago Harbor and River, Ill.

✣Bids will be received until 8 p. m., April 8, by Board of Education, Winnetka, for various trades which will enter into the construction of a complete school building in the village. Plans and specifications are on file with W. A. Otis and E. H. Clark, Architects, 607, 105 S. Darborn St., Chicago, Ill. The structure, which will be of brick, is estimated to cost $45,000.

✣Bids will be received by Chas. F. Seyferlich, Fire Marshal, Chicago, Ill., until 11 a. m., April 4, for furnishing approximately 20,000 gals. of gasoline for use in the fire department.

Iowa.

✣Bids will be received [illegible] April [illegible] by [illegible] ton, Ia., for furnishing the following supplies for the city commencing April: Lumber, sand, cement, official printing, coal for the waterworks and electric light plant.

⊙Cameron, McManus & [illegible] 139 [illegible] Bldg., Kansas City, Mo., have been awarded the contract by the Mississippi River Power Co. for hauling of material for the company's transmission line between Burlington, Ia., and St. Louis, Mo.

Kansas.

✣Bids will be received until 2 p. m., May 7, by [illegible], Secretary of the State Board of Control, Topeka, Kan., for the installation of a 30 kw. direct current generator attached to a 50 h.p. side crank high speed engine, at the School for the Deaf, Olathe, Kan., to be executed in strict accord with the plans, details and specifications prepared by Chas. H. Chandler, State Architect.

✣Bids will be received until noon, April 1, by Board of County Commissioners, Wichita, Kan., for building a dormitory at the Sedgwick county poor farm. J. L. Leland is County Clerk.

Kentucky.

✣Bids will be received until 4 p. m., March 29, by Board of Tuberculosis Hospital, L. J. Dittmar, President, 121 W. Chestnut St., Louisville, Ky., for the erection of a hospital building at the Waverly Hill Sanatorium. Plans and specifications are on file with Joseph & Joseph, Architects, Commercial Bldg., Louisville, Ky.

✣Bids will be received until 3 p. m., April [illegible], by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures), of the United States post office at Somerset, Ky. The building is one-story and [illegible] and has a ground area of approximately 4,800 sq. ft. [illegible] brick [illegible] Drawings and specifications may be obtained from the custodian of site at Somerset, Ky., or at this office, at the discretion of the Supervising Architect.

Maine.

✣Bids will be received until noon, April 15, by Lt.-Col. W. E. Craighill, U. S. Engineer, 537 Congress St., Portland, Me., for constructing a breakwater at Isles of Shoals, Me. and N. H. The work consists in building a rough stone breakwater about 650 ft. in length, measured along the crest. The elevation of the top of the breakwater is to be 15 ft. above mean low water. The width on top will be 20 ft., and the side slopes on vertical on 1½ horizontal on the outer or southeast face, and 1 vertical on 1 horizontal on the inner face. No preparation of the bottom to receive the stone will be required. The bottom is practically all rock. About 450 ft. of the breakwater site lies below mean low water, with depths varying from zero to 18 ft. The remaining 200 ft. is exposed at low tide. About 34,000 tons of stone will be required.

✣Bids will be received until noon, April 15, by Lt. Col. W. E. Craighill, U. S. Engineer, Portland, Me., for the construction of a breakwater at Isles of Shoals, Me., and N. H.

Massachusetts.

✣Bids will be received until noon, April 22, by Col. Frederic V. Abbot, U. S. Engineer, Boston, Mass., for dredging in Mystic River, Mass.

✣Bids will be received by Col. Frederic V. Abbot, U. S. Engineer, Boston, Mass., for rock excavation in Boston Harbor, Mass.

✣Bids will be received until noon, April 17, by Col. Frederic V. Abbot, U. S. Engineer, 25 Pemberton Sq., Boston, Mass., for rock excavation in Boston Harbor, Mass. The rock excavation required is the removal of 20 groups of ledges, 19 in the upper main ship channel and one in Broad Sound, Boston Harbor. These ledges are to be removed to a minimum depth of 35 ft. below mean low water. The material is believed to be slate rock. The following schedule shows the quantities:

No. of ledge [illegible]	Area in sq. ft. [illegible] contour	Greatest cutting, feet above grade below M. L. W.	Average cutting, feet above grade below M. L. W.	Cu. yds. [illegible] in place
11	22,358	7.6	2.0	2,048
[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]
13a	38,199	8.0	2.7	4,539
13b	[illegible]	8.[illegible]	1.6	6,397
13c	[illegible]	[illegible]	[illegible]	1,[illegible]
13d	34,614	8.7	4.3	6,154
[illegible]	[illegible]	[illegible]	1.9	1,0[illegible]
13f	32,943	[illegible]	4.3	5,884
13g	38,949	7.6	3.5	5,780
13h	47,259	8.1	4.4	8,587
13i	43,123	8.1	4.5	7,963
13j	48,440	7.8	4.9	9,769
13k	[illegible]	[illegible]	[illegible]	6,2[illegible]
16	88	0.5	0.1	[illegible]
17	59	0.9	0.2	[illegible]
18	8,627	7.3	2.2	865
19	3,610	7.0	2.1	353
20	25,955	7.7	3.7	4,050
[illegible]	219	[illegible]	0.5	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Totals	494,895	...	...	78,792

Official advertisement for this work will be found elsewhere in this issue.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Michigan.

✣Bids will be received until [illegible] April 18, by Lt. Col. C. S. Riche, Grand Rapids, Mich., for the extension of piers at South Haven, Mich.

✣Bids will be received until 3 p. m., April 18, by Lieut. Col. C. S. Riche, U. S. Engineer, Grand Rapids, Mich., for dredging at South Haven, Manistee and Arcadia harbors, Mich.

✣Bids will be received until 3 p. m., May 7, by Col. C. McD. Townsend, U. S. Engineer, 337 Federal Bldg., Detroit, Mich., for pumping plant [illegible] lock at St. Mary's Falls Canal, Sault Ste. Marie, Mich.

✣Bids will be received until 3 p. m., April 12, by Col. C McD. Townsend, Detroit, Mich., for hire of one dredging plant and two drill boats for Detroit River.

✣Bids will be received until 3 p. m., April 12, by Col. C. McD. Townsend, U. S. Engineer, Federal Bldg., Detroit, Mich., for hire of tug for Detroit River.

Minnesota.

✣Bids will be received until 2 p. m., April 18, by C. F. Hauke, Acting Commissioner of Indian Affairs, Washington, D. C., for furnishing the necessary labor and material for the erection of a frame hospital and installation of water and sewer systems at the White Earth Indian School, Minnesota.

Mississippi.

✣Bids will be received until 3 p. m., April 24, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures of the U. S. Post Office at Corinth, Miss. The building is two stories and basement with a ground area of approximately 4,900 sq. ft. First floor is fireproof, stone and brick facing and tin roof.

Missouri.

✣Bids will be received until 11 a. m., March 30, by Quartermaster, Jefferson Barracks, Mo., for reconstructing and repairing double set of officers' quarters, building No. 4.

✣Bids will be received until 3 p. m., April 22, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring and lighting fixtures of the U. S. Post Office at Mexico, Mo. The structure has a fireproof construction, brick and stone facing and tin roof.

Nebraska.

✣Bids will be received until 11 a. m. (Mountain time), April 4, by Quartermaster, Fort Robinson, Nebr., for the construction, steam heating, electric wiring and fixtures required for the improvement of the hospital at that post.

New Jersey.

✣Bids will be received until 8 p. m., April 8, by Board of Education, H. L. Collins, Secy., Summit, N. J., for the erection and completion of a four-room school building located on the north side of Morris Ave., to accordance with plans and specifications on file with Cady & Krug, 69 Union Pl., Summit, N. J.

✣Bids will be received until 8 p. m., March 30, by Board of Education, Caldwell, N. J., for the erection and completion of a public school building in accordance with plans and specifications prepared by E. E. Twist, Architect, News Bldg., Passaic, N. J.

New York.

✣Bids will be received until noon, April 11, by Col. W. M. Black, U. S. Engineer, Army Bldg., New York City, for furnishing and delivering lumber and piles in Hudson River, N. Y.

✣Bids will be received April 15, by State Fair Commission, Albany, N. Y., for the construction of a new cattle building to be erected at the State Fair grounds. The building will have a floor space of 85,000 sq. ft. Stalls will be built for the accommodation of 896 head of cattle.

✣Bids will be received until 1:30 p. m., March 29, by Depot Quartermaster, New York City, for furnishing one gasoline fire engine.

✣Bids will be received until 3 p. m., April 29, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction (including plumbing, gas piping, heating apparatus, electric conduits, and wiring and lighting fixtures of the United States Post Office at Penn Yan, N. Y. The building is to be one story and basement of approximately 3,800 sq. ft. ground area, brick faced, tin roof, wood trim, and non-fireproof construction. Drawings and specifications may be obtained from the custodian of the site at Penn Yan, N. Y., or at this office at the discretion of the Supervising Architect.

North Carolina.

✣Bids will be received until 3 p. m., March 29, by Lieut. R. V. Edwards, Constructing Quartermaster, Fort Caswell, N. C., for furnishing and installing door and window screens on two double officers' quarters, plans 260, at Fort Caswell, N. C.

Ohio.

✣Bids will be received until 9:30 a. m., April 12, by Cuyahoga County Building Commission, Cleveland, O., for furnishing, delivering and erecting in new court house building complete fire hose equipment, which will include fire hose, hose reels and nozzles. John J. Boyle is Secretary of the Commission.

✣Bids will be received until 9:30 a. m., April 12, by Cuyahoga County Building Commission, Cleveland, O., for furnishing and erecting in place in the new court house building, metal filing cases.

✣Bids will be received until noon, April 6, by Director of Public Safety, Charles W. Stage, Cleveland, O., for the construction of a new steel hull and the installation of machinery boilers and fire apparatus. Plans and specifications may be obtained of the Director. H. F. Stillman is Secretary. A certified check for $1,000 must be filed with each bid.

✣Bids will be received until 4 p. m., April 10, by Cleveland Public Library Board, 1443 East 3d St., Cleveland, O., for furnishing all the materials and labor necessary for the construction of a library building at the northwest corner of Quincy Ave. and E. 79th St., in accordance with plans and specifications prepared by Henry D. Whitfield, Architect.

✣Bids will be received until noon, April 9, by Maj. John C. Oakes, U. S. Engineer, Room 415, Custom House, Cincinnati, O., for furnishing of all material, labor and appliances for and the complete reconstruction of the top of Dam No. 8, Muskingum River, which is about 525 ft. in length. The site of the proposed work is at Eagleport, O., on the Baltimore & Ohio R. R., Ohio & Little Kanawha Division, about 56 miles above Marietta, O. The river is navigable between the site and its mouth at Marietta and Zanesville and Dresden, O. The approximate quantities are: Excavation, 5,000 cu. yds.; concrete, 5,515 cu. yds.; cement, 5,600 bbls.; piling, 5,000 lin. ft.; timber (sheet piles), 75,000 ft. b. m.

✣Bids will be received until noon, April 16, by Board of Hospital Commissioners, Cincinnati, O., for the necessary labor and material for the construction of 18 buildings composing the main group of the New General Hospital. Samuel Hannaford & Sons, Hulbert Block, Cincinnati, O., are Architects.

⊙The Lima Natural Gas Co., W. Market St., Lima, O., has awarded a contract to Oscar Current, Red Key, Ind., for relaying with 10-in. pipe some 15 miles of trunk gas line extending from the Ashland County field to Lima.

Oklahoma.

✣The City of Kingfisher, Okla., will receive bids soon for materials for the erection of an electric light plant. Plans and specifications are being prepared by The Benham Engineering Co., Consulting & Supervising Engineers, 812-14 American National Bank bldg., Oklahoma City, Okla.

Pennsylvania.

✣Bids will be received until 3 26, by James Knox Taylor, Supervis tect, Treasury Department, Washing for the construction complete plumbing, gas piping, heating appar tric conduits and wiring, and interi fixtures) of the United States pos Johnstown, Pa. The building is one basement, stone faced, of fireproo tion (except roof), and has a grou approximately 8,300 sq. ft. Drawing cifications may be obtained from the of site, Johnstown, Pa., or at thi the discretion of the Supervising

⊙H. H. Wehmeyer, 1004 W. Le Philadelphia, Pa., has been awarde tract at $149,388, for the erect 18-division school building at 9th Lindley Ave., for the Board of Ed Philadelphia.

Rhode Island.

✣Bids will be received until 3 12, by Capt. A. E. Waldron, U. S. New London, Conn., for dredging catuck River, Rhode Island.

South Carolina.

✣Bids will be received until 3 p. 9, by James Knox Taylor, Supervisi tect, Treasury Department, Washi C., for the construction, including gas piping, heating apparatus, ele duits and wiring, and interior lig tures for the U. S. Post Office at S. C., in accordance with drawings ifications which may be obtained of todian of site at Abbeville, S. C. T ture is two stories in height of appr 3,850 sq. ft. ground area, brick fa stone trim, tin roof and non-firep struction with the exception of the f

✣Bids will be received until 3 p. 27, by James Knox Taylor, Supervisi tect, Treasury Department, Washingt for the construction, including plum piping, heating apparatus, ele and wiring, and interior lighting fi the United States Post O..ce at Gaff The building is one story and basem has a ground area of approximately ft.; non-fireproof construction thr brick and terra cotta facing and Drawings and specifications may be from the custodian of site at Gaffn or at this office at the discretion of th vising Architect.

✣Bids will be received until 3 p. 25, by James Knox Taylor, Supervisi tect, Treasury Department, Washingt for the construction complete, includin ing, gas piping, heating apparatus, elec duits and wiring and interior lighting of the U. S. Post Office at Lauren The building is to have a ground are proximately 4,500 sq. ft.; two stories a ment, faced with stone and brick and floor of fireproof construction.

Virginia.

✣Bids will be received until noon, by Lieut. Col. Mason M. Patrick, U gineer, Norfolk, Va., for dredging excavation in James River, Va.

Wisconsin.

Bids as follow were received Mar Lieut. John N. Hodges, U. S. Engin luth, Minn., for building rubble mound land, Wis., harbor, (1) being bid per rock from the quarry in place in th mound, 16,000 tons, and (2) bid per rock from the top of the pier head place in the mound, 350 tons, (3) total Lakes Dredge & Dock Co., Chicago, $1.90; (2) $1.90; (3) $31,065. Sang & Duluth, Minn., (1) $1.24, (2) $20,155 (recommended for acceptance

Wyoming.

✣Bids will be received until 11 a. m 18, by Capt. F. S. Armstrong, Cons Quartermaster, Fort D. A. Russell, W construction complete, of one isolati pital.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Engineering & Contracting

Devoted to the Economics of Civil Engineering Design
and to Methods and Cost of Construction

Published every Wednesday by The Myron C. Clark Publishing Company, 608 S. Dearborn St., Chicago, Ill.
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[illegible]TION RATES Payable in A[illegible] [illegible]
[illegible] Panama Canal Zone and [illegible]

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[illegible]ience of Management: The [illegible]ws of Plant Location and Design.

II.

[illegible] [illegible]f management covers not merely the [illegible]ndling of men but the indirect con- [illegible]ll human activity. Hence any com- [illegible] [illegible]nclude the economic principles to be [illegible] [illegible]ation" is a scientific exposition of [illegible] to be pursued in locating a steam [illegible]

[illegible]nfortunately Wellington did not [illegible] the particular law of scientific man- [illegible] that he sought to apply, but it may [illegible]ed by induction, and when so de- [illegible] *[illegible]he capitalized annual income from [illegible] shall exceed by the greatest pos- [illegible]unt the total capitalized cost of the*

[illegible]may be called the law of plant loca- [illegible]

[illegible]erms in the foregoing law may need

[illegible]*italize* is to divide an annual income [illegible]se by the rate of interest paid for [illegible]

[illegible]*tal capitalized cost* of a plant is the [illegible] its first cost and the amount obtained [illegible]alizing its annual operating expense. [illegible] if the interest rate is 6 per cent and [illegible]ost of constructing and equipping a [illegible] $1,000,000, and if its annual operating [illegible] is $240,000, we have a "total cap- [illegible] $5,000,000.

[illegible]ll be noted that the application of [illegible] involves a study of every one of the [illegible]xcesses or steps that occur in producing [illegible], that is it involves not only study [illegible] planning, (2) building and (3) oper- [illegible] plant, but (4) selling its product. [illegible] Wellington's time, the railway loca- [illegible] given very little attention to the [illegible] demonstrated that complete scientific control of the process of locating the most economic railway is impracticable without a study of operating expense and of income. Too great emphasis can never be placed upon the importance of this managerial principle, nor can too great credit ever be given to Wellington for his remarkable exposition of it.

This law of plant location and design may be broadened so as to express one of the great fundamental principles of economics. The law as above stated is tantamount to a rule for securing the maximum profit that can be secured by skillful location and design of the plant. But, since the profit made in a commercial enterprise is augmented by economy that can be effected, it follows that a plant should be so located and designed that, taken in coordination with other plants from which it receives and to which it delivers products, the total capitalized cost of the coordinated plants shall be a minimum.

[illegible] plant that acts in co-ordination with other transportation plants, namely the horses and wagons or motor trucks that deliver produce to the railway and take it away from the railway. Hence the locator of a railway should estimate the cost of hauling produce to the railway and away from it, as well as the cost of hauling on the railway; and he should solve for a minimum cost by so locating the railway as to secure the minimum total capitalized cost of all the co-ordinated plants—horses and wagons, motor trucks and railway. It is an application of this law in crude form that leads to the location of a railway approximately through the centers of gravity of producing and distributing localities.

Stated in its broadest sense the law of plant location and design is this: *To secure economy so locate and design a given plant that, taken in co-ordination with other plants from which it receives and to which it delivers produce, the total capitalized cost of the co-ordinated plants shall be a minimum.*

A wagon road, for example, should be regarded by its locator and designer not merely as a separate plant, but as a plant co-or- [illegible]s, i. e., horses and wagons, railways, etc.

A factory should not ordinarily be located without careful consideration of the costs of transporting raw materials to it and finished products from it, yet many a factory has been located with very little thought given to these co-ordinate elements of total cost. Where the materials and product are heavy, such disregard of the law of plant location and design may be fatal to the financial success of the factory.

Once the location of a plant has been scientifically determined, the design remains to be decided upon; and, since this is no longer an element affected by consideration of co-ordinate plants, we may eliminate that element from the law of location and design, which then gives the law of plant design:

To secure maximum economy, so design a plant as to secure a minimum total capitalized cost or its equivalent, a minimum total unit cost of production.

Since it is feasible to express most costs in algebraic form, it is usually possible to derive a formula for the total capitalized cost (or for the unit cost), in which all the constants and variables are correctly given. When this can be done, an engineer will usually find it desirable to solve for a minimum value of the total capitalized cost by the method of calculus wherein the first differential coefficient is placed equal to zero. In this way very simple general formulas or rules may frequently be derived for use in designing plants or plant elements. In previous issues we have given several examples of this method of solving for a minimum plant cost.

It may be said that there is no need of formally stating the laws of plant location and design, since their truth is self-evident when the significance of the language is understood. But that a scientific principle is self-evident when formulated is no reason why it should not be formulated, for prior to such formulation it is usually noticeable that many men frequently fail to apply the principle at all and many others apply it imperfectly. Large factories located at places remote from both raw materials and from markets are so often seen as to make it evident that the business managers who [illegible] not apply the law of plant location. But far more frequently seen than this error in management is the error in plant design that arises from failure to capitalize all the operating cost. Some managers are prone to be unduly impressed by the first cost of a plant. On the other hand, other managers are equally prone to invest too much in plant through failure to capitalize plant depreciation. It can scarcely be said that the foregoing laws of plant design and location need no verbal enunciation when so many instances of flagrant disregard of the laws exist as do exist today. Even self-evident truths are often ignored until dignified by the name of scientific law. This is particularly noticeable in regard to the fundamental law of scientific management, namely that for greatest economy of production the payment for services should be proportionate to the performance. This proposition is so simple as to be almost self-evident; yet it is applied in but the crudest fashion under existing wage systems. Indeed, those who would be the greatest gainers by its application—the members of labor unions—are usually loudest in their protest against the law of management. We must, therefore, divest ourselves of any idea that the science of management is lacking importance because its laws are readily comprehended, or because some of them are self-evident.

The Unit of Measure for Concrete.

The modern unit for measuring the volume of masonry was originally the perch. The perch of masonry was a variable quantity. It signified different volumes to different persons and in different localities. Generally it signified a volume of about 25 cu. ft. The demand grew for some more fixed unit and gradually the cubic yard took the place of the perch, at least in all engineering works, as the unit of measure for masonry. With the substitution of concrete largely for stone masonry the cubic yard unit was continued. The first works in concrete were of the massive character of stone masonry and the adoption of the same unit for measuring volume was natural. When the development of reinforcing made it possible to use concrete in thin walls and slabs and for girders the cubic yard unit still continued, although it was recognized as at times a unit of awkward size for measuring thin plates and other sections because of the fractions involved. All data that we possess relating to volume of concrete construction—cost data, records of output and rates of progress—are based on the cubic yard unit.

On a following page we publish the proposed rules for the measurement of concrete construction which have been submitted for consideration by a committee of the National Association of Cement Users. We believe that some additions covering concrete pavement and concrete sewers are to be reported and then the complete code is to be submitted to the association members, who will vote on its adoption. In general the rules presented deserve approval. The idea of classifying separately items of different character such as concrete, form work, and surface finish and of making the unit of measure fit the nature of the work is sound. Certainly the measure of surface finish should be the square foot. The same unit is perhaps the most logical single unit for measuring formwork. Formwork data, particularly cost of forms, should, however, in our opinion, be recorded by at least two units of measure. The square foot may well be one and the thousand feet board measure should be another. Personally we confess a desire always to see also the cost of forms in terms of the much reviled per cubic yard of concrete unit of measure. Passing by this path of discussion, however, we will proceed to the unit suggested for the measurement by volume of concrete construction.

The rules state that "the unit of measure for all concrete shall be the cubic foot." In the committee report by which the code of rules was prefaced, there are given examples of a bridge and of a building "measured under the proposed rules," and in these examples all quantities of volume are given in cubic yards. The examples would appear to contradict the rule. By our reading of the rule we should have expected to see, say the volume of 1:3:6 concrete in the bridge piers, expressed as 27,000 cu. ft. instead of as 1,000 cu. yds. Indeed if the rule means anything we cannot see why the quantity referred to should be anything other than 27,000 cu. ft.

Assuming that the rule quoted means the only thing that one is justified in assuming from its wording and context, which is that the cubic foot shall replace the cubic yard as the volume unit of measure for concrete, we may reasonably ask why the new unit was chosen? As was noted above practically all past records based on volume measurement are in cubic yard units. Costs are given per cubic yard and so are plant and labor outputs and rates of progress of construction. Indeed we know of only one case of published cost data involving any considerable amounts of work in which the cubic foot was the unit chosen instead of the cubic yard and these costs were all of work done by one firm. There was doubtless a reason in the minds of the committee members for advising the change from the cubic yard unit to the cubic foot unit, and in view of the universality of the older unit this reason should have been stated. It is not stated in the published report of the committee nor was it stated so far as we can ascertain in presenting and discussing the report before the convention.

There are certain facts in favor of using the cubic foot unit. Linear measurements are invariably taken off in feet and fractions and when the cubic foot unit is used a multiplication of the proper linear measurements gives the volume directly in standard units. To illustrate, if we have a wall panel 10 ft. x 12 ft. x 4 ins. we get at once 40 cu. ft. If we were using the cubic yard unit we should have an additional calculation, namely, dividing 40 by 27, to obtain the volume in standard units and the result would be moreover an awkward vulgar fraction or an inexact decimal. Of course we should not avoid fractions wholly by using the cubic foot unit, but we should greatly reduce their occurrence in computing data based on volume measures. Also, while we should reduce the number of fractional quantities, we should increase 27 times all the amounts to be considered. It has been pointed out that there is a nicety in having the unit of area and the unit of volume the exact square and cube of the standard linear unit. There is, but it is not worth fussing over.

As nearly as one can see the only advantage of the cubic foot over the cubic yard as the volume unit of measure for concrete work is that it does away with one calculation (dividing by 27) in reducing linear dimensions to units of volume, and that it decreases the number of fractional volume units that will ordinarily be obtained in figuring concrete work. Set against these advantages we have the fact that practically all comparative data now possessed by engineers and contractors, all costs, all records of output, all rates of progress, all measures of magnitude will have to be reduced to the new unit if they are to be used. This is true not merely of published data, it is true of that greater volume of mental data possessed by engineers and contractors and by which they measure new performances. To tell a contractor that you have just completed a bridge abutment containing 30,375 cu. ft. of concrete for 21 cts. per cubic foot does not give him any useful mental picture until he has made the calculation necessary to find that the work contained 1,125 cu. yds. of concrete and cost $5.68 per cubic yard. It is very true that the accumulation of data measured by the new unit will after a time replace the older data and that the engineer and contractor will in time adjust his mental measures to the new units, but why make this demand? We are not unsusceptible to conviction that the cubic foot unit may be a desirable change, but the committee which suggests it has done nothing to induce this conviction.

Why Engineers Should Ma Goo Mayors of Cities.

The election of Mr. George F. Cotteri mayor of Seattle, Wash., suggests he specia fitness of experienced municipal e ineers t serve as mayors of cities. Since ery hig percentage of the business trans ed by city is handled by the public wo s depar ment or, in the case of new constr ion wo other than the natural extensions existin works, is handled by commissions appointe for that purpose, the value to the city of mayor with experience in engi ring e terprises is apparent.

In the case of Mr. Cotterill it happen that he was not chosen mayor on co his engineering knowledge, but it s that, other things being equal, his xp as an engineer will make him a or. petent executive than a lawyer, bu nes or politician could hope to become, ven actuated by the high motives of the engineer. Mr. Cotterill h the engineering department of Seattle for the past eight years d quently is thoroughly in touch w needs of the city.

We have mentioned lawyers, bu es and politicians because mayors al chosen from those classes. It pr al be conceded that an engineer is te to cope with the public works pro m city than are the others mention, certain other questions these othe held by some to possess advantag o engineer. Naturally the lawyer is skilled in the legal wording of ordi nc contracts, but the lawyer mayor i g no less in such matters by the rul s city's legal department than is th e mayor. The business man, as the m derstood, does not possess a single d over the modern engineer, who capable business man himself. W lis weigh even single qualifications o t tician against those of the engine will be done by voters and newspa r the choice between these types is o re politician has only one advantage his ability to handle the various ti the city council. However, the who of present day municipal reform is to make this latter consideration d ing weight. Moreover, no citizer is qualified than the engineer to lead in renovating the old-fashioned ci On all questions of a general nature n are at least as well qualified as are to advise and lead the city co il.

Those who are familiar with th work the Chicago Commission on Cit tures may recall that the experts by the commission estimated that $2,5 wasted in the year of 1909 in the catch basin cleaning department. A point brought out was the loss of 90 the city in street repair contracts. ers will remember recent articles and relating to the Chicago water wor which pointed out, among other t two thirds of all the water pum city pumping stations is lost by le ag waste. All these matters have adv sel tected the citizens of Chicago. the fact that the engineering depa n the city repeatedly called attention to similar conditions, former mayors cils failed to take any action on suc We do not doubt that an engine would have instituted reforms in t ters as soon as they were brou attention.

City engineers often are unable and build public works according to eir judgment on account of interfer e their plans by officious mayors and This condition is responsible for the so called poor municipal engi this and other countries. The reme malady, in some cases at least, is th of an engineer to the office Wherever this condition exists no doubt that a well qualified municipa would make a strong candidate office.

rtainly is no reason why engineers ain reluctant to enter politics in . If they are actuated by a high rve their fellowmen they will here [illegible]

salaries usually commanded by engineers. Public service of this kind would not unfit the engineer for resuming professional practice after his term of office was over.

GENERAL ARTICLES

osl Rules for the Measurement Concrete Construction.

[illegible] concrete construction for the purmaking itemized estimates or bidr of recording costs is desirable. actice might be brought about, a was appointed about a year ago nal Association of Cement Users and report rules for measuring he report of this committee was the association at its recent conte code of rules presented was e enlarged by adding rules covte paving and concrete sewers, revision, to be submitted to vote ers on its adoption. The original t the additions, is published here:

[illegible]

Monolithic.

[illegible]

ast Concrete Trim and Ornamental

[illegible]

Finish.

ng general rules shall govern the [illegible] specifically noted:

rk shall be measured net as fixed the structure.

ase shall non-existent material be over extra labor.

[illegible]

I. CONCRETE.

[illegible] concrete shall be the cubic foot.

te shall be measured net as placed the structure or building.

[illegible] the following exceptions:

luction shall be made for reinforces, I-beams, bolts, etc., embedded in except where they have a sectional ore than 1 sq. ft.

deduction shall be made for pipes or concrete having a sectional area of [illegible]

deduction shall be made for chamveled, or splayed angles to columns, [illegible] bevel or splay is more than 4 ins. sured diagonally across the surface.

ass of concrete having a different pro cement, sand or aggregate shall be and described separately in accordh the accessibility and location or of the work.

[illegible] ure shall be measured and described [illegible] in pouring.

e with large stones and rocks em[illegible] as one item and described according ichness of the mixture and the perof rock.

[illegible] held to include the forms.

ease shall an excess measurement of be taken to pay for the cost of forms labor in placing.

te in stairs shall be measured by the t and shall include surface finish when [illegible]

ructural Cast Concrete.—The term l cast concrete is taken to include [illegible]

The unit of measurement shall be the cubic foot, and this shall be measured net as provided for monolithic concrete.

The various members shall be measured on the ground before erection.

[illegible]

Reinforcement shall be measured separately [illegible]

The unit of measure for erection shall be the pound weight of the finished member.

Cast concrete with crushed stone or gravel aggregate shall be assumed to weigh 150 lbs. per cubic foot.

(c) Cast Concrete Trim and Ornamental Work.—Cast concrete building trim shall be measured by the cubic foot, but the measurement shall be the smallest cube which will contain the piece measured and not the actual net volume of the piece.

No allowance shall be made for forms.

Mitre blocks for cornices, etc., shall be measured separately from straight molded work.

Circular work shall be measured separately from other work.

Vases, seats, pedestals, balusters, and other similar items shall be taken by number and description.

No allowance shall be made for reinforcement.

No allowance shall be made for surface finish.

(d) Sidewalks.—Sidewalks shall be measured by the square foot.

The one measurement shall include concrete finish, lining in squares, and cinder or stone foundation.

Curbs and curb and gutter work shall be measured by the lineal foot and separated according to character and size, and shall include foundations, forms, finish, and cost of special tools, if any.

In measuring curbs the full height, width or thickness shall be taken.

The measurement of sidewalks shall be taken the full width.

Circular corners and curbs and gutters shall be measured separately by number, stating radius and length measured on the curve.

Vault lights shall be measured by the square foot, the measurement to include glass, forms, steel and finish. Beams under vault lights shall be measured by the lineal foot. In measuring vault lights the measurement shall go at least 4 ins. beyond the outside line of the glass in each direction.

2. FORMS.

The unit of measure for form work shall be the square foot of actual area of the surface of the concrete in contact with the forms or false work.

Forms shall in every case be measured and described as a separate item and in no case shall the measurement of concrete be taken to include forms.

No deduction shall be made in the measurement of surface of concrete supported by forms because of forms being taken down and reused two or three times in the course of construction.

The unit price for superficial measurement of forms shall be deemed to include the cost of struts, posts, bracing, and bolts, wire ties, oiling and cleaning and repairing forms.

No allowance shall be made for angle fillets or bevels to beams and columns, etc., but curved moldings shall be measured and described separately as hereinafter provided.

No deduction in measurement of forms shall be made for openings having an area of less than twenty-five (25) square feet.

No deduction shall be made in floor forms for heads of columns.

No deduction shall be made in column and [illegible] etc.

No allowance shall be made for pockets in column forms for clearing out rubbish.

The measurement of column forms shall be the sum of the girth of the sides or circumference multiplied by the height from the floor to under side of floor slab above.

The measurement of beam forms shall be the net length between columns multiplied by the sum of the breadth and twice the depth below the slab, except for wall beams and other beams at an edge of floor, which shall have the thickness of the floor slab added to twice the depth.

Wall forms shall be measured for both sides of concrete wall when forms are required for both sides.

Allowance shall be made by number for pockets left for future beams.

Forms to octagonal, hexagonal, and circular columns shall be measured and described separately from forms to square columns.

Caps and bases to columns and other ornamental work shall be measured by number and fully described over all dimensions.

The curved moldings in form work shall be measured by the lineal foot.

Forms to circular work shall always be measured separately from forms to straight work.

No measurement or allowance shall be made in slabs or beams for construction joints to stop the day's concreting.

Construction joints or expansion joints to dams and other large masses of concrete shall, however, be measured.

Forms to cornices shall be measured by the lineal foot, and the girth stated. (The term girth shall be taken to mean the total width of all curved and straight surfaces touched by the forms.) Plain forms to back of cornice to be measured separately.

Forms to different parts of structural building shall be measured and described separately according to their position in the building and cost and character of the work involved.

Forms to window sills, copings, and similar work in situ shall be measured by the lineal foot.

Forms to the upper side of sloping slabs such as saw tooth roofs shall be measured whenever the slope of such slab with the horizontal exceeds an angle of 25 degrees.

Forms to the under side of stairs shall be measured by the superficial foot.

Forms to the front edge of the stairs shall be measured by the lineal foot.

Forms to the ends of steps shall be measured by number of risers.

[illegible]

The unit of measure of steel reinforcement shall be the pound weight.

Steel rods for reinforcement shall be measured the net weight placed in the building.

The weight shall be calculated on the basis of a square bar 1 in. by 1 in. by 12 ins., weighing 3.4 lbs.

No allowance shall be made for rolling margin.

No allowance shall be made for cutting or waste.

No allowance shall be made for wire ties, spacers, etc.

In estimating reinforcement the bars shall be measured by the lineal foot as laid. All laps shall be allowed for.

The bars of each different size shall be measured and described separately, as also straight bars, bent bars, stumps, and hooping.

Pipe sleeves, turnbuckles, clamps, threaded [illegible] bond shall be measured separately by number [illegible]

Wire cloth, expanded metal, folded fabric and other steel fabrics sold in sheets or rods, shall be measured and described by the square foot. The size of mesh steel in tension and weight per square foot shall be stated. No allowance shall be made for waste, cutting, etc.

[illegible] from plain.

[illegible]

The unit of measure for finish of concrete surfaces shall be the square foot. Finish shall always be measured and described separately.

No measurement or allowance shall be made for going over concrete work after removing of forms and patching up voids and stone pockets, removing fins, etc.

Granolithic finish shall be measured by the square foot and shall include all labor and materials for the specified thickness.

Finish laid integral with the slab shall be measured separately from finish laid after slab has set

No allowance shall be made for protection of finish with sadwust, sand or testing.

Grooved surfaces, gutters, curbs, etc., shall be measured separately from plain granolithic and shall be measured by the square foot to lineal foot, as the case may require.

The following shall be measured by the square foot:

Cement wash (state how many coats).
Rubbing with carborundum.
Scrubbing with wire brushes.
Tooling.
Picking.
Plastering, etc.

Inspection of Waterproofing for Concrete Work.

Contributed by Jerome Cochran, C. E., formerly Designing Engineer Trussed Concrete Steel Co., Detroit, Mich.

The series of articles on the inspection of concrete work, of which this is the seventh, has been planned in opposition to the general assumption on the part of writers that standards or methods of construction have been long ago established and have become knowledge. The first article on "Directions and Suggestions for the Inspection of Concrete Materials" appeared in this journal for Jan. 31, 1912; the second article, on "Proportioning and Mixing Concrete," appeared on Feb. 7, 1912; the third article, on "Inspection of Forms and Centering," appeared on Feb. 21, 1912; the fourth article, on "Inspection of Steel Reinforcement," appeared on Feb. 28, 1912; the fifth article, on "Inspection of Concreting," appeared on March 6 and 13, 1912; and the sixth article, on "Inspection of Surface Finishes for Concrete Work," appeared on March 20, 1912. The following article relates to the inspection of waterproofing for concrete work.

It is foreign to the purpose of this article to consider the designing of waterproofing systems, which presupposes that the designer is thoroughly familiar with the physical and chemical nature of the materials he proposes to employ, and their effect upon the concrete structure, etc., but simply to give such general and specific instructions as are necessary to insure proper and adequate inspection of waterproofing after the plans and specifications are completed and the contract let.

General Requirements.

For all outside concrete works, like walls, roofs, etc.; for basement floors and walls, and for tanks, cisterns and similar construction, the concrete should be rendered waterproof. In other words, except for mass concrete foundations, all work should be made as water-tight as possible.

Specifications for Waterproofing.—Specifications should be particular and explicit regarding the method to be employed for making concrete water-tight. They should be suited to the conditions surrounding the particular job so as to obtain a structure that will be entirely free from dampness and the percolation of ground or outside water. It is a mistake to leave the work entirely to the contractor by not specifying the exact materials and the methods to be employed, as is quite often done. The specifications must be clear in the matter of indicating what is absolutely required without any alternative, and what is named as indicating in general the character of the product, and in which alternative materials, methods or results will be allowed. In other words, the contractor should know in advance how the waterproofing specifications are to be interpreted, so far as it is possible to give this information in the specifications. In case they are not clear, the inspector should learn from the engineer the quality of work he has in mind and should see that the contractor clearly understands the requirements.

[illegible]

Inspection of Waterproofing Materials.—Although there is a tendency among manufacturers of waterproofing materials to improve the quality of their product, yet this does not relieve the necessity of careful inspection of waterproofing materials delivered for important concrete work. Before cement is allowed to go into the work, it is generally tested either at the site or sent to some laboratory for testing. Sand and broken stone or gravel is usually carefully examined for cleanliness, etc., for use in concrete, but how often is the trouble taken to find out whether the waterproofing materials specified have been supplied, or these substituted by a cheaper material? Why should not these materials be tested as they come on the work, in the same way as other construction materials are tested? Why pay for asphalts when oil substitutes are being made? Why accept soap or powdered lime when waterproofing compounds or proprietary ingredients are being bought? Engineers should not consider the careful inspection of waterproofing materials as an additional refinement in connection with rendering concrete water-tight, but as an absolute necessity, and should establish the unconditional rule of not permitting any waterproofing material to go into their work until they are fully satisfied by careful inspection that the material is of good quality and capable of giving them the very best results.

Results of Incompetent Inspection.—In applying waterproofing, success depends on the perfection of every detail. Are these details looked after as they should be? Usually not. How many inspectors can tell whether the concrete surfaces are too wet, or too rough, or in a proper condition to receive the waterproofing? The best materials, applied to improperly prepared surfaces, are worthless. How many inspectors can tell whether the waterproofing materials specified have been supplied, or these substituted by a cheaper material? All asphalts, tars and black paints look alike and to many are one and the same thing, and for lack of competent inspection, the best designed waterproofing systems may result in a complete failure.

Why is it that bad conditions are often discovered in waterproofing concrete structures where the plans and specifications have been all that they should be? Because the work is done with incompetent and inexperienced workmen—defective material, good work not properly protected, or even injured, or conditions unsuited to the work. After the structure is completed and leaks are discovered, the engineer puts the responsibility on the contractor, he in turn on the engineer's inspector. In fact, there is a general shifting of responsibility. The result is a loss to all concerned, in money and in reputation.

Intelligent Inspection Needed.—Success with any system of waterproofing requires considerable supervision on the part of an intelligent superintendent or inspector who has a practical and technical knowledge of the work in hand. It is a very serious mistake not to place in charge of the waterproofing an inspector who thoroughly understands such work.

So many failures have been reported from the application of waterproofing when the walls were not in a proper condition to receive the waterproofing, and from the fai[illegible] to protect the waterproofing from inju[illegible] to unnecessary exposure, back-fill[illegible] causes, that a competent inspecto[illegible] always on the work and no work [illegible] absence.

There should be proper and adequate inspection of waterproofing at all times during the construction of the work. [illegible] waterproofing is dependent, to a large extent, upont the quality of workmanship in its application. A common and serious mistake is often made in attempting to do the work with incompetent and inexperienced workmen. All the more reason why we should have intelligent inspection. With proper adequate inspection, where the plans and specifications are all that they should be, waterproofing of concrete structures becomes as certain and permanent as possibly can be expected.

The inspector will find it one of his duties to secure successful results in the matter of making concrete water-tight.

METHODS OF WATERPROOFING [illegible]

Classes of Waterproofing.—The methods of rendering concrete [illegible] may be classified under two broad [illegible] as follows: (1) The *Integral,* in which concrete is made impermeable or [illegible] prior to setting; (2) *External* [illegible] *Treatment,* in which the concrete is [illegible] by a protective shield, or in which the [illegible] proofing is applied to the surface [illegible] crete.

Both of these methods may be—and [illegible] instances are—effectively combined in [illegible] same construction.

Methods of Waterproofing.—Th[illegible] classes of waterproofing concrete may [illegible] ther subdivided into a number of [illegible] or methods of waterproofing, differing [illegible] one another in marked characteristics.

Integral methods, for example, [illegible] two subdivisions as follows: (1) Ac[illegible] grading and proportioning the aggregates [illegible] the cement so as to secure a concrete [illegible] as to be waterproof; (2) Mixing [illegible] stance with the concrete, such as [illegible] lime or a manufactured compound to [illegible] the mixture water-tight.

Surface Treatment methods of waterproofing may be subdivided according to the [illegible] rials used, as follows: (1) Applying [illegible] proof coating to the concrete after [illegible] place, such as alum and soap water washes, cement mortar coating, and [illegible] ing, etc.; (2) Surrounding the structure with layers of waterproofing materials, such as asphalt and felt, to keep water away.

For brevity, the above methods will [illegible] nated: (1) Dense or Impermeable Concrete; (2) Introduction of Foreign Ingr[illegible]; (3) Special Treatment of Surfa[illegible] Surface; (4) Layers of Waterproofing Material—Membrane Method.

It is often advisable to combine two or more of these methods. Directions and [illegible] for practically applying these methods [illegible] now be taken up.

Dense or Impermeable Concrete.

Concrete masonry, properly designed [illegible] placed, may be made waterproof without [illegible] addition of special waterproofing m[illegible] Where concrete is to be made [illegible] without additional treatment or [illegible] of waterproofing ingredients, the ag[illegible] should be so selected as to have m[illegible] of voids. A dense, even mixture [illegible] should be the primary expedient o[illegible] water-tight concrete. In general, [illegible] stated that in monolithic construction [illegible] mixture, a rich concrete and ag[illegible] proportioned to secure great den[illegible] the majority of cases give the desired [illegible]

PROPORTIONING AND LAYING CO[illegible]

Proper proportioning of ingredients, grading of aggregates, thoroughness [illegible] ing, and careful methods of placing a[illegible] tors of the utmost importance in [illegible] dense concrete which will be im[illegible] water.

of *Aggregates.*—In concrete, the mortar should exceed the volume the aggregate, and to obtain this [illegible] be so selected as to have a mini- ls. The advantage of grading is to e voids and reduce the actual sur- the aggregate to which the cement [illegible]

[illegible] should be proportioned so as to densest possible concrete with an ement. Mixtures from 1 cement ınd and broken stone to 1 cement sand and stone will usually give [illegible] vith accurate grading by scientific ıter-tight work may be obtained nt and 10 of sand and stone. A her than 1:3 is liable to crack or proportions usually employed to olation are, with ordinary mate- : and with carefully graded mate- or 1:3:5.

ncrete properly proportioned may ater-tight somewhat more easily stone concrete, but a mixture of roken stone will give good results this regard, but in the matter of [illegible] fewer channels through which the ıss than an aggregate consisting of e and sand, provided the character proportioning of the finest par- e same in both cases.

ggregate.—Concrete made with gate is much more impervious than ing only smaller sizes. Coarse [illegible] is far superior to aggregate rang- [illegible] wever, that the fine material can ore satisfactorily. This depends [illegible] rials and care in laying, concrete large aggregate will produce ex- ts. If a very fine broken stone, h, and containing crusher dust, the coarser aggregate, the addi- l may increase the porosity and ility, because concrete containing stone is practically a mortar, and ırticles of stone or crusher dust [illegible]

[illegible]

The thicker the wall the less water through it in proportion. It is however, to specify definite thick- revent percolation under different f water, because of variations in pro- used for concrete work and methods ıg. Rain water under a head of 3 been known to percolate through a ll of excellent concrete and dry con- while a 3-in. wall under 4-ft. head r has proven perfectly tight.

Concrete.—The mixing of concrete [illegible] hly homogeneous mass.

istency of Concrete.—A rather wet should be used in preparing concrete ater-tightness is desired, as wet mix- o not pass water as readily as dry In other words, the best way to keep ut of concrete is to put lots of water the manufacture. However, a con- ay be too wet to produce the most eable product, if impermeability is On the other hand, a deficiency of will result in a much more permeable han the use of what might be con- an excess. The writer wishes to em- the importance of using the right t of water. It is not possible here to what percentage of water should be s it varies with different cements and ates and should be determined by ex- nts for any particular combination that used

concrete should be so mixed that it will ırry the man ramming, and which when or tamped on by him, will cause it to ." With the wet mixtures of concrete enerally used in engineering work, con- ossesses far greater density, and is correspondingly less porous, than with the older, dryer mixtures.

[illegible] pockets. It would be much better if the [illegible] operation, but as this is usually impracticable [illegible] great care. A mixture of common muriatic [illegible] acid to three of water should be used to clean the old surface of the joint, after which the acid should be thoroughly washed away before applying grout or cement mortar.

The concrete should be allowed to dry slowly, being well protected from the direct rays of the sun. This can be accomplished by covering the concrete, in the case of vertical walls, with burlap, which is kept wet by sprinkling for about a week

[illegible] waterproofed is of much magnitude there is danger, should the concrete itself be made water-tight, that with the aging of the concrete shrinkage cracks will develop and thus nullify the waterproofness of the concrete by causing seams through which the water can percolate; consequently, when work is to be made water-tight, suitable provision should be made for contraction by special joints, or by steel reinforcement without joints.

Making Good Defects.—Any places showing rough or any points where leakage occurs should be plastered with a coat of 2 to 1 cement mortar in which may be mixed some waterproofing ingredient, approved by the engineer, and the wall left in a water-tight condition.

[illegible] When water is permitted to percolate continuously through a mass of concrete, the permeability will decrease in a marked degree. Usually after the flow of water has continued for a few hours, it is found to diminish rapidly in quantity, apparently due to the filling of the pores with the very fine particles carried in suspension by the water. If this action take place at all, it is produced very rapidly. On the other hand, if it is not thus rapidly produced, the effect of the water is apt to be injurious, because it and the chemicals it contains will dissolve certain parts of the concrete which will then be carried away and the whole mass become honeycombed, even to the point of failure.

The writer has frequently observed that when concrete was green, there was a considerable seepage through it, and that in a short time absolutely all seepage stopped.

RICH SURFACE COATINGS.

A rich mortar facing is practically impervious to water, especially if it is well troweled until a dense face is secured. Lime paste is sometimes added for smoothness in working. It is essential that the facing be well troweled.

Granolithic Finish.—On horizontal or inclined surfaces, a granolithic surface of Portland cement and sand, or Portland cement and screenings in proportions of 1:1, or 1:2, may be laid and troweled, as in basement floors, sidewalks, reservoirs and tanks. This should be laid while the concrete base is still green, and with the same, that is, Portland cement, and carefully troweled in place. The granolithic finish varies from ½-in. for floors to 2-ins. for concrete pavements. There is some danger, however, when such a surface coating is used of its cracking and peeling, off if exposed to the direct rays of the sun. If it is covered with water, as in the bottom and sides of a reservoir or tank, no danger of this kind should be apprehended.

Troweling Surface.—Where the concrete can be worked before it has set, the surface may be troweled until a dense mortar face is secured. Troweling brings the cement to the surface, and produces a dense, hard surface, which is practically equal to a surfacing of rich mortar. For a vertical surface the forms must be stripped while the concrete is still green enough to be worked with a trowel. The surface should be troweled hard and smooth; but excessive troweling is likely to cause innumerable hair cracks in the finished surface. The scope of this method for vertical surfaces is limited to instances where the forms can be quickly removed, or removed in sections. No trouble need be experienced with horizontal or inclined surfaces, as the mortar finish would be placed at the same time as the concrete base. Troweling is very effective for the top surface of an arch and the exposed surface of a sea wall or the inclined face of a dam.

Introduction of Foreign Ingredients.

[illegible] by adding some finely divided material which will fill the minute pores which form in the concrete as it hardens. As has been said, extra cement will do this or by theoretically proportioning the ingredients to eliminate the voids. For many conditions this is all that is required, but no matter what the richness of the concrete, there is always the probability of improper setting, and in many cases it is advisable to add water repellants and finely divided foreign materials to obtain waterproofness. There are two methods of rendering concrete water-tight by the introduction of foreign ingredients, viz.: (1) adding a single inert void-filling substance; and (2) adding one or more substances which by action upon the cement or between themselves may produce a void-filling material.

There are two distinct classes of void-filling materials: (1) Those that have a capillary attraction for water, i. e., lime, puzzolan cement and clay, which reduce permeability by obstructing the voids; (2) Those that have a capillary repulsion for water, i. e., alum and soap, wax, and a number of proprietary compounds.

Waterproofing Ingredients.—The principal advantage of adding foreign ingredients or void-filling material into a mortar or concrete is to permit the use of a lean mixture, the fine particles of the waterproofing ingredients tending to reduce the volume and dimensions of the voids. In case of a rich concrete, the cement generally furnishes enough fine material to fill at least the larger voids

[illegible]

Hydrate of lime is an exceedingly impalpable material and is often employed for reducing the permeability of concrete. It is much finer than the finest Portland cement; hence the material fills the voids in the concrete mass, making a denser and therefore more nearly waterproof substance. Hydrated lime is practically pure calcium hydrate, is of mineral nature, contains no organic material and is, therefore, not subject to decay or disintegration. The great advantage accruing in using hydrated lime as a waterproofing material over other substances lies in the fact that while most of these latter substances decrease the ultimate strength of the cement from 5 per cent to 20 per cent, the hydrated lime does not decrease it at all, but rather increases it.

Percentage of Hydrated Lime.—The percentage of hydrated lime to use varies with the proportions of concrete and the character of the materials. The percentage of hydrate of lime used in practice varies from 5 per cent to 15 per cent of the weight of the cement. For a 1:2:4 concrete, add dry hydrated lime equal to about 8 per cent of the weight of the dry cement; for a 1:2:2½:4½ concrete add about 12 per cent, and for a 1:3:5 concrete add about 15 per cent. The addition of hydrate of lime in the above proportions will render concrete practically water-tight under a pressure of 60 pounds per square inch. Smaller per cents will give satisfactory results under smaller pressures.

Mixing Lime.—The lime and cement should be thoroughly mixed dry before placing in the mixer, as the lime will be more efficacious acting directly on the cement, rather than be dissipated throughout the aggregate. If the lime is mixed wet the putty should be so thinned that it can be as easily and uniformly distributed through the whole mass as is the water. Since hydrated lime is a very fine, dry powder [illegible] mixed with the concrete.

PUZZOLAN CEMENT.

Puzzolan cement being largely composed of lime acts substantially the same as lime in making concrete water-tight, except that lime adds very little to the strength of the concrete, while puzzolan cement adds considerable strength. Mixtures of Portland and puzzolan cements have been found to well resist the action of sea water.

[illegible] *cement.*—The action of puzzolan cement is not mechanical alone, but chemical, and the effect on the strength of the resulting mortar or concrete depends upon the exposure to which it is subjected. The oxidation of sulphides in dry air is destructive of puzzolan cement mortars and concretes so exposed. It will turn white and disintegrate, due to the oxidation of its sulphides at the surface under such exposure. However, puzzolan cement is specially valuable for waterproofing concrete to be exposed to sea water, since it is not acted upon by the sulphates in the sea water.

CLAY.

The addition of pure clay, finely powdered and free from any trace of vegetable matter, materially increases the water-tightness of concrete, especially of lean mixtures; but the concrete is not necessarily free from absorbing moisture.

Effect of Clay.—The effect of clay varies with the richness of the mortar, i. e., with the proportion of cement. Clay is ineffective with rich well-proportioned concrete, since the cement furnishes sufficient fine material to fill the voids. The clay, if finely pulverized, helps to fill the voids of the sand and causes the cementing material to coat the grains better and thus bind them more strongly together. The exact effect of the clay, however, depends chiefly upon the fineness of the sand grains and upon the per cent of the voids in the clean; but depends also upon the thoroughness of mixing and the amount of water used, for if the clay forms a coating on the sand grains and is not removed in the mixing, a small amount of clay is deleterious. Moderate doses of clay have no deleterious effect on the strength of mortars or concretes for ordinary exposures.

The presence of the clay retards the setting of the cement—natural usually more than Portland—and makes the mortar more susceptible to the action of frost.

Percentage of Clay.—Finely divided colloidal clay, in proportions running from 5 to 15 per cent, produces a fairly efficient waterproofing effect in concrete. The proportions should vary with the character of the aggregates and the richness of the mortar, i. e., with the proportion of cement. In certain cases 5 per cent of clay to the weight of the sand has been found effective. With lean concretes, from 10 to 15 per cent of finely powdered clay, either added directly or by the substitution of a dirty for a clean sand, increases the water-tightness without materially decreasing the strength.

Fineness of Clay.—The clay should be finely divided—preferably to diameters that will entirely pass a 200-mesh sieve.

Mixing Clay.—Success with the use of clay depends upon the thoroughness with which it is incorporated into the concrete. Even distribution throughout the mass is absolutely necessary.

Use of Clay and Alum Sulphate.—Clay may be used in combination with alum sulphate for increasing the water-tightness of concrete.

PULVERIZED ROCK.

Rock pulverized as finely as Portland cement, has been used to increase the water-tightness of concrete, especially of lean mixtures.

Use of Pulverized Rock.—For mortars not richer than 1:3, and concrete made with these proportions of cement and sand to the stone, the impermeability may be increased by the addition of rock pulverized as finely as the cement and equal to it in weight. If, however, the natural sand is very fine or contains dust, the addition of pulverized rock is not so beneficial.

ALUM AND SOAP.

Alum and soap may be used as ingredients of concrete for increasing water-tightness. The alum and soap combine and form a flocculent, insoluble, water-repelling compound. Not only are the voids partially filled by this capillary repellent compound and thereby decreasing the permeability of the concrete, but the permeability is further decreased by the water-repelling property of the compound. In other words, the alum and soap mixture deposits aluminum silicates in the voids.

Proportions of Alum and Soap.—Various proportions of alum and soap have been used. The best proportions are: alum 1 part and hard soap 2.2 parts, both by weight. These proportions are the chemical combining weights for alum and the best hard soap, and are exact enough for any good well-seasoned hard soap. Soap varies in the amount of water it contains, and where soft soap is used, a greater proportion should be employed according to the amount of water in it. Soft soap contains from 55 to 95 per cent of water. An excess of soap is preferable to an excess of alum, since the excess soap will unite with the free lime of the cement and form calcium soap, which is a finely divided, water-repelling compound. An excess of alum, however, does no harm, since alum is itself a fair waterproofing material. This may account for the reason why widely divergent proportions of alum and soap have given fairly successful results in practice.

Approximately 1 per cent, by weight, of powdered alum may be evenly mixed with the cement, and the same proportion of soap may be dissolved in the water in making the concrete. The amount of alum and soap is practically limited to alum equal to 1½ per cent of the water and soap equal to 3 per cent, because it is impossible to dissolve more than about 3 per cent of hard soap in cold water. Where it is desirable to use greater amounts, the soap may first be dissolved in hot water, which may afterwards be mixed with a large portion of cold water. Alum equal to 1½ per cent of the water and soap equal to 3 per cent, is enough to render any reasonably dense concrete practically, if not absolutely, waterproof.

Mixing Alum and Soap.—The alum in the form of a fine powder may be mixed with the cement, and the soap may be dissolved in the water used in mixing the concrete; or both the alum and the soap may be dissolved in the water. In the latter case the water should be frequently stirred to prevent the compound from accumulating in large masses on the surface of the water which it is not easy to break up. Even distribution throughout the water is absolutely necessary. Since the alum is the more soluble, it may be dissolved in (say) one-fifth of the water and the soap in the remaining four-fifths. The two portions may then be mixed together, care being taken to stir the water thoroughly as the mixing progresses. Success in the use of alum and soap depends upon the thoroughness with which it is incorporated into the concrete. Even distribution throughout the mass is absolutely essential for rendering concrete water-tight.

ALUMINUM SULPHATE AND SOAP.

Aluminum sulphate (sometimes, but improperly, called alum) and soap has been found to increase the water-tightness of concrete. Aluminum sulphate is cheaper than alum.

Proportions of Aluminum Sulphate and Soap.—The best proportions are 1 part aluminum sulphate to 3 parts of hard soap. An excess of soap is better than an excess of aluminum sulphate, since the excess soap will unite with the free lime of the cement and form calcium soap, which is a finely divided, water-repelling compound. An excess of aluminum sulphate, however, does no harm, since aluminum sulphate is itself a fair waterproofing material.

Mixing Aluminum Sulphate and Soap.—Success in the use of aluminum sulphate and soap depends upon the thorough
which it is incorporated into the
Even distribution throughout the ma
lutely necessary.

LIME AND SOAP.

Lime and soap may be used as
concrete for increasing wate
The lime and soap combine and fo
soap, which is a finely divided wat
compound. Calcium soap is a pro
manufacture of candles and may
and added directly to the cement.
essential element of several propriet
proofing compounds.

Proportions of Lime and Soap.—
to Prof. I. O. Baker in his book on
Construction," 1909 edition, the p
portion is unslaked lime 1 part
soap 12 parts; but, since it is im
dissolve more than about 3 per ce
soap in cold water, the amounts
in practice are unslaked lime 0.2
and hard soap 3 per cent of the we
water. These proportions will gi
cent of void-filling compound and
any reasonably good concrete absolu
tight.

Mixing Lime and Soap.—Before
containing the lime and soap is use
be thoroughly stirred to mix the i
and to keep the precipitate in susp

PROPRIETARY COMPOUNDS AND OTH
DIENTS.

There are several other materials
be used to make concrete impervious
some of them being so-called waterp
pounds of unspecified compositio
proprietary compounds will be
first and then those of a fatty or wa
afterwards.

Proprietary Compounds.—There ar
market several proprietary compo
under various trade names, and int
direct incorporation in the concrete
majority of these on the market are
form, to be mixed with the dry ce
some are in the form of a soluti
added to the water used in mixing
crete. Some of these proprietary c
are sold mixed with the cement
use, while others are not sold but a
by the proprietors.

In purchasing proprietary compo
must be taken to select such as ha
to be permanent in effect, as some
compounds used for waterproofing
lose their effect after a few days'
to the weather and are entirely wort
the case of many so-called waterpr
pounds of unspecified composition
gether without regard to chemical
the effect upon the endurance of the
is absolutely unknown. In some c
have been found to contain a large p
of inert substances which interfere
nominal setting of the concrete and
decrease its strength while exerting
tive influence upon its permeabilit
in regard to the permanency and w
qualities of these various proprieta
pounds are not always available, an
be necessary to use much care and
in selecting them, otherwise their
prove a disappointment and a nee
pense. It is not proved that these pr
compounds are any more effective th
of the means described above for
concrete water-tight.

When patented compounds are u
inspector should see that the manu
printed directions are followed, as n
pends on experience to make a succes

Waterproof Portland Cement.—So
prietary compounds are sold mixed w
land cement ready for use. Appare
water proof qualities of this cement
tained by using some secret substa
the cement during the process of man
the chemical action taking place in
way that it closes the pores in the
without injuring in any way the stre
the cement.

Other Ingredients.—There are sever
materials that may be used to make

but none of them is as [illegible] tive as those mentioned [illegible] are: wax, paraffine, resin, [illegible] il emulsion. Alum alone, or [illegible] ne, may be used, but [illegible] se soap in connection with them, r mentioned.

lye are sometimes used [illegible] not recommend the use of [illegible] sometimes destroyed by contact e water, and therefore the lye injur the cement. However, if lye is care must be taken not to have an ex- A ight excess of alum does not de- the trength of the cement mortar or e. t an excess of lye does.

MIXING AND PLACING CONCRETE.

[illegible] ingredient is added to concrete [illegible] impermeable to water, it should [illegible] incorporated; and the concrete [illegible] a plastic consistency, and should [illegible] mixed, carefully placed, and amped.

[illegible] The proportions rto suit the character of the work uirements which the concrete must principal advantage of introducing ingredients into concrete is to [illegible] whatever ingredient is used tend- e the volume of the voids. Every [illegible] itself, [illegible] aper to obtain the required wa- y using extra cement than by

[illegible]

f any proper waterproofing in- s depends upon the thorough- ich it is incorporated into the en distribution throughout the utely necessary.

ry compound in powder form led dry to the cement in the cified by the manufacturer and [illegible] ained. Under no circumstances mpound be added after the rtially set or has been mixed e sand should be slightly moist- ixing with the cement.

crete.—All the concrete should in one continuous operation, each ing thoroughly spaded to insure nsity. Great care should be taken the concrete so that maximum ll be secured.

and New Concrete Surfaces. e difficult problems to be encoun- his work is the bonding of old to ete. In cases where joints are ab- navoidable, care must be taken to roughen the old surface and have ghly wet and slush-coated imme- ore placing additional concrete. If id by the engineer, the surfaces of [illegible] should be thoroughly th material prepared for such pur- mixture of common muriatic acid in the proportion of one of acid to vater may be used to clean the old the joint, which should be followed ugh washing with water to remove No concrete should be placed upon ncrete thus treated until a compe- ctor has passed on its condition, h the new concrete may be laid.

(To be continued.)

f Power With Small Units of Various Types.

mparative cost of power produced s types of generators in installations size is of interest in the design and of construction plants. At a recent f the American Society of Mechan- ineers several series of costs were l from these we abstract the follow- of general value:

45 h.p. Producer Plant.—The plant ed in a woodworking shop of the Lumber Co., New Haven, Conn., ecords were presented by Albert W. l, Jr. The engine is rated at 45 h.p. .m. and is of the four-cycle hit-and- [illegible] suction type with stationary [illegible], and the [illegible] varied by a hand adjusted throttle valve in [illegible] hour, and the load variable. [illegible] imately 467 lbs. of pea anthracite per day, or [illegible] cost per b.h.p. per hour of 0.56 cts. No account is taken of the cost of water, as the only cost is that of pumping.

The first cost of the plant, including pro- [illegible] same, was, in round figures, $3,500. The operating expenses per day were found to be:

[illegible]	[illegible]
Labor	[illegible]
Repairs and depreciation	1.16
Interest [illegible]	[illegible]
[illegible]	[illegible]

The ashes from the producer were, however, screened, and coal secured in this manner may be estimated at $2 per ton, which reduces the real operating expenses to $5.08 per [illegible]

Comparison of Oil and Steam Engine Power.—The cost of power of the following engines was compared by E. H. Lockwood and I. [illegible] engine, horizontal, single-acting, center crank, four-stroke cycle, jacket water-cooled; fuel, petroleum fuel oil at about 3 cts. per gallon at the factory; ignition, hot chamber, on the Hornsby-Akroyd system; cylinder dimensions, diameter 27 ins., stroke 33 ins., rated horse power 125, used to drive a direct-connected 220-volt generator, the power being used for light and power, and average output being about 90 h.p. The engine was carefully tested for output and fuel consumption and was found to be quite economical of fuel. The [illegible] hand engine, and a Fitzgibbons boiler of the same rated boiler horsepower.

ACTUAL COST OF OPERATION OF OIL ENGINE.

Fuel oil, 14 gals. per day	$3.78
Labor, half time of one man	1.50
Oil, waste, water, [illegible] per day	1.00
Cost per day	$6.28

Reduced to the basis of 300 days per year, and divided by 90 (h.p.), the above cost amounts to $20.93 per h.p. per year.

FIXED CHARGES FOR SAME ENGINE.

Cost of engine and generator, 10 per cent of $6,000	$600.00
Cost of heating boiler, 10 per cent of $1,000	100.00
Insurance, taxes, etc., per year	250.00
Total fixed charges per year	$950.00
Fixed charges per year per hp	$ 10.55

Combining the two costs, the total cost per horse power per year, operation and fixed charges, is $30.48.

ESTIMATED COST OF OPERATION OF STEAM ENGINE.

Fuel per day, 2¼ tons	$8.21
Labor, time of one man	3.00
Oil, waste, etc., per day	0.50
Total per day	$11.71

Reduced to the basis of 300 days, and divided by 90 (h.p.), the above cost amounts to $39.04 per h.p. per year.

FIXED CHARGES FOR SAME ENGINE.

Cost of steam engine and generator, 10 per cent	$350.00
Cost of boiler, 10 per cent	200.00
Repairs, insurance, and taxes	250.00
Total fixed charges per year	$800.00
Fixed charges per year per hp	$ 8.88

The two costs combined give a total cost of 1 h.p. per year, operation and fixed charges, of $47.92.

This showing is favorable to the oil engine, but it must be remembered that the steam engine has a useful by-product of exhaust [illegible] be made for the steam used in this way by [illegible] ing, which, estimated at 1 ton per day on the [illegible] engine is reduced, but is still above the oil [illegible] summary:

[illegible]

Both the above are on the basis of 1 h.p. per day of 10 hours, 300 days per year.

Technical Considerations in the Designing, Molding and Driving of Reinforced Concrete Piles.

[illegible] concrete piles and an analysis of hammer [illegible] the National Association of Cement Users. An abstract of this paper is given below:

It is well established that concrete piles are a satisfactory substitute for wooden piles [illegible] type or the "cast-in-place" type. Piles of this "cast-and-driven" type are made of reinforced [illegible] cured before being driven. Piles of the "cast-in-place" type are made by forming a hole in the ground and filling it with concrete.

The history of piles of the "cast-and-driven" type is intimately connected with the development of reinforced concrete and in the same manner has been embarrassed by patent litigation. In March, 1907, a final decision was reached in the British High Courts of Justice that the fundamental idea of the reinforced concrete pile was covered by Brannon's patent of 1871, and that subsequent improvements must be limited to the details of reinforcement.

It is nearly ten years since the writer began the design and manufacture of concrete piles. During this period, by a process of elimination, an efficient method of reinforcing has been developed, which is correct in design and economical in cost.

Method of Reinforcement.—All piles of the "cast-and-driven" type must be reinforced with longitudinal rods, because the pile is hoisted and handled by a line from the pile-driver which is fastened at or near the butt. Consequently, the pile has to sustain its own dead weight by being raised, as well as shocks and impact against obstacles, before reaching its position in the leads of the pile-driving machine. With the point on the ground and the other end being elevated, the pile must act and be designed as a beam supporting its own dead weight and shocks. The limiting proportions of depth or thickness of pile to the unsupported beam length produces heavy tension and compressive stresses, with considerable deflection.

It has been observed that when handling a pile of this type, it rarely fails in compression in the concrete, but cracks are usually discovered on the tension side. These cracks can be accounted for by the slipping of the usual longitudinal rods used in the concrete while the pile is being hoisted. While such cracks are not sufficiently serious to condemn the pile, they may affect the permanency of the reinforcement. In order to overcome this defect all longitudinal rods should be anchored at the ends, those at the butt opposite each other being bent over into a loop and welded together, while those at the point are all brought together and electrically welded into one piece. Twisted and deformed rods are advantageous for longitudinal reinforcing, as the allowable bond stress is higher than for plain rods. The uniform circumferential spacing of longitudinal rods is very important, because any side of the pile may be subjected to tensional stresses, and whichever side is in tension there must be sufficient steel in position to take the strain. The circumferential spacing of the longitudinal rods is secured by means of a special spacing device placed at intervals of about 5 ft. throughout the length of the pile.

[illegible] ability to resist axial loads. Therefore, longitudinal reinforcing should have a helical wrapping of wire throughout the length of the pile, the pitch of which must not exceed 3 ins. This wire wrapping will assist in taking care of diagonal tension stresses resulting from the handling of the piles.

Practical experience indicates that the butt end of the pile which receives the impact of the hammer should be especially reinforced. This has been done by means of a special reinforcement consisting of a unit cage of flat bands, held 2 ins. on centers by a spacing bar for a distance of 2 ft. In the plane of each band a flat wire spiral is fastened to the cage. The embeddment of this unit cage in the butt of the pile forms a resilient cushion to receive the impact of the hammer. In no case, in the driving of thousands of piles with this cushion, has the butt itself been broken.

Methods of Driving.—Piles of the "cast-and-driven" type are handled and driven by means of an ordinary pile driver. The ability to vary the fall of the drop-hammer is of great utility in overcoming the variable resistances to be met with in the driving. It has been found advisable to increase the weight of the ordinary drop-hammer in ratio of weight of hammer to weight of pile of from 2 or 3 to 1, so that the weight of the drop-hammer for driving the concrete piles will vary from 7,000 to 12,000 lbs.

Steam hammers are not as efficient or desirable for driving concrete piles as are drop-hammers. This was shown last fall on a contract when a test was made between a No. 2 Vulcan steam-hammer and a heavy drop-hammer, under the same conditions, using the same kind and size of concrete pile. The heavy drop-hammer did not break the pile, whereas the steam-hammer broke several below the cushion. Further, the steam-hammer did not drive as many piles in a given time as did the drop-hammer.

The following explanation is offered as it applies also to the driving of the heavy steel casings or core used in the making of the "cast-in-place" type of pile. The limited fall (3 ft.) and light ram (3,000 lbs.) of the steam-hammer, while delivering twice as many blows per minute as the drop-hammer, loses a large part of its energy in overcoming the proportionately heavier weight of the pile, steel casing or core.

The following analytical treatment by Mr. Barton H. Coffey, M. E., of New York confirms and justifies the practice of the writer in using hammers as heavy as 12,000 lbs. for driving concrete piles, and it may be asserted with some feeling of confidence that if penetration is to be the gage for measuring the supporting power of a pile, the ratio of the weight of the hammer to the weight of the pile or core that is driven, must be taken into consideration.

The advantage of using a heavy hammer is evident from the following analysis:

Let M equal mass of hammer $= \frac{W}{g}$.

Let W equal wt. of hammer.

Let X equal wt. or mass of pile in per cent of hammer.

Let V equal velocity of hammer on striking pile.

Let V_1 equal common velocity of hammer and pile.

Momentum of hammer $= MV$ (on striking pile).

Momentum of hammer and pile at common velocity $= M(1+X)V_1$.

These are equal provided no external force acts, which we will assume for the present is the case.

Then $MV = M(1+X)V_1$, therefore

$$V_1 = \frac{V}{1+X} \qquad (I)$$

The energy in hammer on striking pile is

$$\tfrac{1}{2} MV^2 \qquad (II)$$

The energy in both hammer and pile at common velocity is ½ M $(1+X)$ V_1^2 which upon substituting the value of V_1 becomes

$$\tfrac{1}{2} \frac{MV^2}{1+X} \qquad (III)$$

The difference between (11) and (111) represents the *loss of kinetic* energy in the system at point of common velocity or greatest compression. In other words, the percentage of the original energy of hammer that has gone into compressing pile and hammer, distorting or crushing them, and into heat, broadly-internal work-done upon each other by the striking bodies, obviously, the smaller this percentage of internal work, the less liability there is of crushing or distorting the pile. To resume, (11)—(111)=

$$\tfrac{1}{2} MV^2 - \tfrac{1}{2} \frac{MV^2}{1+X} = \tfrac{1}{2} MV^2 \left(1 - \frac{1}{1+X} \right)$$

(IV) equals the internal work.

The following table gives internal work for various values of X in per cent. of the total kinetic energy of the hammer:

Value of X	Internal work
.25	20%
0.50	33%
0.75	43%
1.00	50%
1.50	60%
2.00	67%
3.00	75%

If your hammer weighs four tons and the pile one ton there will be 20 per cent internal work at maximum compression, whereas if the pile weighs eight tons the internal work will be 67 per cent.

There is an external force acting against the pile, i. e., the frictional and displacement resistances of the earth. Two extreme cases may be assumed limiting all other. (1) There is no external force. There the internal work will be simply that necessary to overcome the inertia of the pile and put it in motion. In this case the table is rigorously accurate. (2) The external force is great enough to prevent any movement of the pile. In this case the entire kinetic energy of the hammer goes into the internal work and the relative weights of hammer and pile are immaterial.

All intermediate cases where movement occurs are a combination of 1 and 2, where obviously it is advantageous to employ a heavy hammer.

Manufacture.—The procedure in constructing "cast-and-driven" piles commences with the preparation of the molding bed. This, of course, will vary with the site but it is desirable to select a flat and convenient location near the place of driving. It is very important that the bed shall be stable, so that settlement due to the weight of the piles is avoided. Where the ground is soft and yielding, pine stakes 2x4 ins. x 3 ft. long pointed at the ends are driven to a solid bearing. These stakes are located at intervals of about 4 ft. in each direction and the tops cut to a uniform level. The 4x4 in. pine sills are toe-nailed to the top of the stakes in longitudinal rows about 4 ft. on centers. Upon these sills a 2-in. solid wooden floor is placed, which forms the molding bed. It is desirable that this bed shall be uniformly level to receive the forms for the piles.

The forms are made of two pieces of 2x8 in. dressed pine battened together and placed on edge to form the sides of the pile. The bevels or angles for tapered or octagonal piles are made by placing loose pieces of bevelled wooden strips at each corner of the form. The steel reinforcement is delivered on the work in factory made units, so that it can be placed in the forms at once. When a reinforcing unit is suspended and centered in position, the concrete of a wet consistency is deposited and carefully puddled. As soon as the concrete of the pile has solidified, the forms are stripped and used for making other piles. The number of forms required will vary with the quantity of piles to be made and the prospective salvage in the lumber.

The curing of concrete in the no ner delays the driving of the piles of not less than three weeks, greater length of time is desirable in cold and damp weather. There stock of cured piles is always frequently occurs that this type of be used at all, and resort is had of the "cast-in-place" type. This open to question on account of t of plain concrete to resist even mc sion. In fact, it is almost axioma concrete piles must be reinforced. crete pile is subjected to strains very serious tensile stresses in the stresses may result from superim or a lateral strain from the soil.

Further, the making and storing piles for use at any time necessita financial investment.

In order to avoid the above-me jections, the writer has adopted t of steam curing of "cast-and-dri This enables such piles to be made within three or four days and place of driving on the same basis as t "cast-in-place" type.

The means used for steam curin with circumstances, location of speed required for delivery of the number needed, etc. During the the writer has used concrete piles driven within 10 days, and, as a res experience, confidently recommends piles can be made, cured and d mediately.

On the work with which the connected, the piles were allowed normal manner for five or six days then gently hoisted from the moldi a derrick, using an equalizing spr bridle, the chains of the bridle bein so that the pile was balanced. then placed in stacks of 25 or 30 and from one another by wooden blocks, attention being given to securing a ing for each pile.

A light wooden shed, practica tight, was built entirely around the piles. The steam was conducted d a boiler through a 1-in. pipe to thr openings inside the shed. The st valve was opened and the piles wer to live steam for two or three d they were found to be ready for dr being first exposed to steam, the condensed on the surface of the remained until absorbed by the conc the temperature of the steam was This steam treatment should be dist from heat applied indirectly or baki celerating the set and hardening the The writer sees no reason why boil should not be used for the same p the conditions are favorable for ado method.

Precautions should be exercised i sure that the concrete has solidified it has received its initial set, before to steam treatment.

The prospective field that is open the steam treatment for the rapid concrete seems to the writer to solv ficulty incidental to the present m procedure in the construction of a of concrete structures.

The attention of the members of ciation is directed to the publicatio tests of the Structural Materials La of the United States Geological Surve in it is conclusively shown "that a tive strength considerably (in some ca 100 per cent) in excess of that obtai mally after ageing for six months, obtained in two days by using steam for curing mortar."

Practicing engineers will have lit culty in modifying the writer's meth using improved schemes for quick c the piles with steam; and in this co it may be of interest to state that th has already underway the constuc steel moulds and appliances for th treatment of concrete piles.

for Increasing the Striking ower of Rock Drills.

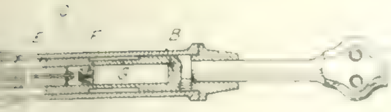


Diagram of the Cylinder of the .

[illegible] energy required for the up stroke ill piston, for use in the down or ke of the piston, has recently to the Wizard rock drill. The [illegible]

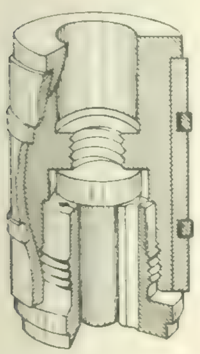
functions is the formation of a compressed air or steam which piston from striking the back cylinder. The manner in which perates may be described as fol- [illegible]

er chamber contains the rifle bar ston *B*. The steam or compressed nishing power for the down e chamber *C* and passes through [illegible] al port *E* in this bar and through nto the compression chamber *G*. ston starts on the return stroke he chamber *G* is compressed and ve *F*. The maximum volume of about 14.52 cu. ins. Its me is 1.02 cu. ins. With pres- s. per square inch, within the mber the pressure will be in- 985 lbs. per square inch when 1.02 cu. ins. This pressure ac- t the return stroke gives an y to the piston on the forward g it to strike a harder blow and nber of blows per minute.

device, as may be noted from n, consists of a piston made with teel body, having a check valve n, and a phosphor bronze bush- the steel body. It is attached to [illegible] per fit.

re Granite & Mining Co. has been fitted with the cushion device [illegible] of the drill. It was feared at cushion chamber in using steam water-logged by steam condensation found that this is not the case, due high temperature obtained in com-

ll using air for power has been in the Breakwater Company at Bellevue,



-Sketch Showing Sectional View of oning Device for the Wizard Drill.

[illegible]

Methods and Records of Winter Quarrying, Using Electric Drills.

A great many quarries heretofore compelled to suspend operations with the advent [illegible] perienced in the operation of steam and compressed air tools, such, as the freezing of air lines, machines, etc., are having recourse to electrically operated tools attended by results which compare favorably with those obtained by the use of air or steam tools working under ideal weather conditions.

Fig. 2—View of Electric Air Outfit in Operation.

At the quarries of the Buffalo Cement Co., located at Buffalo, New York, winter operations are being carried on with electrically operated drills. Current for these drills is furnished by a Westinghouse 50 k.w. 220 volt, direct current, generator, direct connected to [illegible] 250 r.p.m.

The transmission line is carried into the quarry, 1,500 ft. distant from the power house, where it is distributed throughout the quarry. In running the transmission lines, wooden poles with wooden cross arms and solid bare [illegible] convenient points for tapping.

Fig. 1—Shows Sequence of Drilling Holes.

The low cost of installation and maintenance of the electric transmission line as compared with steam pipe lines, forms quite an item in the economical operation of these quarries. Time and money spent in moving pipe lines, requiring the services of a skilled mechanic; the loss in transmission, leaky joints, etc., are a few of the difficulties which have been obviated by the installation of electric drills. Once installed the electric transmission line becomes practically permanent.

The methods of carrying on the drill operations are generally the same as those familiar in very nearly all quarrying operations, a few unique features, however, are especially worthy of note. The bench method is employed entirely—two continuous benches being worked varying in height with the lay of the rock. The accompanying sketch, plan Fig. 1, shows the method used to obviate any necessity for moving the drilling machines, which are of the 5C Temple-Ingersoll type, from bench to bench. The top machine is kept constantly ahead of the lower machine; while the top machine is drilling at *A*, the lower one is drilling at *B*. *A* and *B* are blasted after moving machines to A^1 and B^1. During drilling operations at these points, the spoil thrown by blast onto the lower bench at B^2 is being

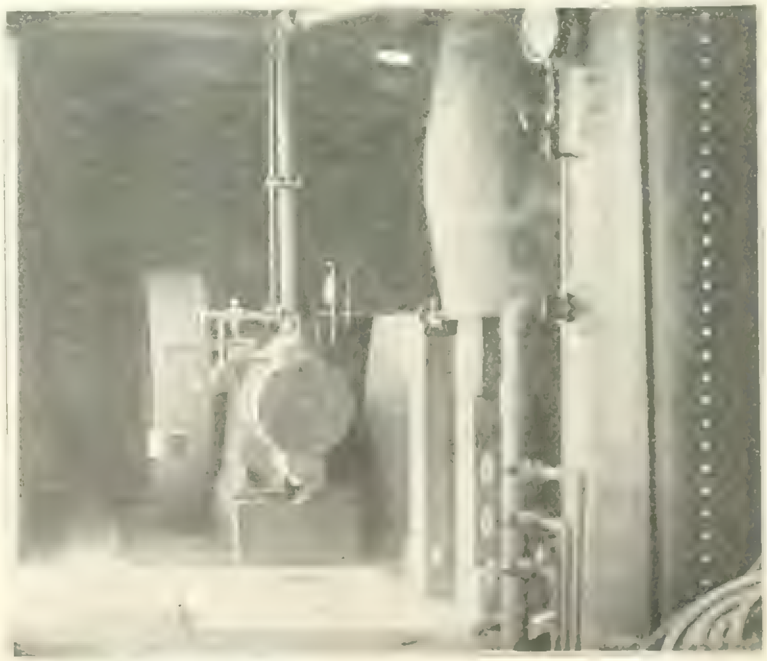


Fig. 3—View of Interior of Narrow Gage Car Containing Steam-Driven Compressor Plant.

[illegible] away. In this [illegible] moving machines about is greatly reduced. Figure 2 shows a machine at work.

The quarries of this company contain both limestone and a black flint rock of seamy formation, with a tendency to cave in places. The latter rock is extremely hard and difficult to drill.

The drilling is all done on contract. Each machine, of which there are five, is operated without a helper, one general utility man being employed to handle steels and otherwise assist in drilling operations.

The average drilling round in the limestone consists of from 10 to 20 holes, 8 to 12 ft. deep. An average of from 100 to 120 ft. of hole per day of 9 hours is drilled by each machine. Holes are started 2½ ins. and bottomed 1¼ ins. Black powder is employed in this formation with copper exploders. Holes are tamped with a wooden bar and are shot by electric battery. But one drill is operated in this formation, where its work is intermittent, as it breaks more ground than the company has use for.

The lime rock products of this company are used for foundation and building stone. The serviceable sizes broken, being trimmed by hand to sizes carrying from 6 ins. to 12 ins. From 3,000 to 4,000 tons per year are crushed and ground for local foundry trade, by which it is used as a flux. One grade, a honeycombed rock, containing a low percentage of lime, is crushed and ground for the fertilizer trade.

In the flint formation, holes varying in depth from 5 to 12 ft. are drilled. The average round consists of 30 holes. These holes also are started 2½ ins. and bottomed 1¼ ins. They are loaded with 12 to 14 sticks of 1¼-in. Keystone 40 per cent dynamite. The ground preparatory to being blasted is banked by rock already broken, experience having shown this to be a material aid in breaking it up small, as well as in restricting the spread of the blast. Four Temple-Ingersoll electric air drills are kept constantly at work in this formation.

The flint rock is used principally as ballast, in road building and as a filler for concrete.

An idea of the greater efficiency obtained through the use of the aforementioned drills may be gained by citing the statement of the superintendent in immediate charge, Mr. Fred G. Kuntz, that, with steam drills they were only able to obtain an average of 60 ft. of drill hole per machine per shift, partly due to the delays, experienced with freezing of machines, lines, etc., whereas with the present drills they are obtaining an average of 100 to 120 ft. under identical conditions accompanied by a saving in power of very nearly one-half.

During winter the operations in the quarries consist principally in the drilling, breaking and crushing of the various rock, preparatory to the commencement of mill operations in early spring. With the advent of spring, the steam shovel a Marion 60-ton machine equipped with either a 1½ or 2 cu. yd. dipper, and running on a standard broad gage track, is put into commission loading the flint rock into 2-cu. yd. side-dump cars, following the work of the drills closely.

Rock which is thrown aside by the steam shovel is drilled by means of two small plug drills of the Ingersoll-Rand MV 5 type, air for which is furnished by a small power driven compressor manufactured by the same company. The problem of furnishing air to these drills has been accomplished in a rather unique manner—a narrow 36-in. gage flat car was pressed into service. The compressor, motor, water barrel and air receiver were mounted thereon and completely housed. This outfit follows the work of the shovel, current for driving motor being taken from the drill transmission line. This outfit is shown in the accompanying illustration, Fig. 3.

Flood at Keokuk.—The work of construction at the Mississippi River Power Co. at Keokuk is threatened with a flood. The high water has already submerged the work in the Illinois side and threatens the cofferdam on the Iowa side. It is caused by ice gorges on the river.

Stoping Drills for Railway Tunnel Work.

The accompanying illustration shows the method of drilling in the heading of the second Kingwood Tunnel on the Baltimore & Ohio R. R., by means of stoping drills. The use of stoping drills for large tunnels is a departure from older methods. As described in "Mine and Quarry," the contractors, Messrs. Bennett & Talbott, sank three shafts and worked six headings at once. The bore inside the lining is 31 ft. wide and 24 ft. 6 ins. high above the rails. It carries two tracks. At first, top headings, about 7x12 ft., were driven, the sides being trimmed and the bench shot to the wall plate grade, which was 17 ft. above the sub-grade of the finished tunnel. This method was not entirely satisfactory, as the rock broke in such a way that close timbering was necessary to prevent roof falls.

Headings were then driven instead, about 6 ft. high and 10 to 12 ft. wide, on the wall plate grade. This left about 6 ft. of roof and the sides to be removed, before placing timbers. This plan made it possible to carry the timber much closer to the breast; and the labor and expense previously incurred in erecting stagings for setting the heavy roof beams were dispensed with.

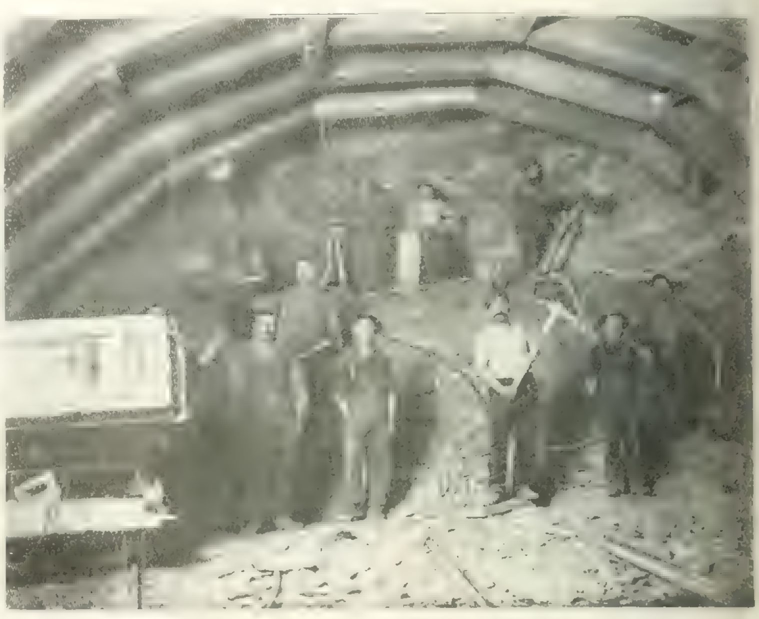


Fig. 1—View of Heading in Kingwood Tunnel, B. & O. R. R. Showing Stoping Dri Put in Roof Holes.

The Sullivan stopers were used for drilling the roof holes, and for trimming the side walls when timbers would not clear. In this work they proved rapid and convenient, and the fact that no mounting is needed for drills of this pattern, accomplished a considerable saving in time and labor. The bench was excavated by two steam shovels.

This tunnel is 4,211 ft. long, and was driven from portal to portal in 14 months. The brick and concrete lining is now well advanced, and it is expected that the new tunnel will be in use about May 1, 1912.

Methods of Channeling in Swelling Rock.

The sides of rock cuts for the channel of the New York Barge Canal are required to be cut with channeling machines. Near Lockport, N. Y., the cut is in swelling rock which gives trouble by closing into the channel cut from the sides. To remedy this trouble the contractors have adopted the plan of blasting out a center cut some 25 to 30 ft. wide before starting to channel. As the canal is 94 ft. in width this leaves a 32-ft. bench on each side, and the danger of shattering the permanent side walls, to avoid which the channelers are employed, is very small. This center cut relieves the side pressure so the channelers will work freely to any required depth of cut.

Another interesting example of this "cre ing rock" occurs in the sandst northern Ohio in the vicinity of Am The usual method of opening a qu district is by cutting two parall about 6 ft. apart and removing they b across the end of the quarry. T room for the expansion which take amounts sometimes to 4 or 5 ins.

Difficulty from side pressure w also en countered by the contractors for the cana and lock at Sault Ste. Marie, Mh., where the Potsdam sandstone is very hd and in layers of irregular thickness and lying in clination

The squeezing, or filling up, of drill hol in certain rocks is not new, and man drill men can give interesting experien such occurrences. An instance wh mentioned occurred in drilling f Iowa. A standpipe and casing we pu a depth of 35 or 40 ft. and their passed through 80 or 90 ft. of sh the shale was sandstone 100 or thickness. This was cut very rapi, of core being removed in a sin work. The drilling was carried the day shift only and after passi the sandstone, the drill foreman o owe his tools one morning found an truc in the hole, just below the standpi Th ing that a dirt cave had filled the h or the standpipe had been shifted by he started his engines and was su pulling up after a foot of drilling to find the core barrel contained a foot of ale He continued to drill and was oblig to through the entire deposit of shale hich had penetrated a few days previou.

Instances of swelling ground are e in ENGINEERING & CONTRACTING and Dec. 20, 1911. The cause is th to the air of the surface of the mainly confined to igneous rocks porphyries and granites whose ma nent is feldspar. It may also occu formed of shales.

Water Power Report.—The Survey of Arkansas has recently preliminary report of the water White River and some of its tribu W. N. Gladson, professor of elec gineering in the University of Arkansas report may be had by addressing Geologist, Fayetteville, Arkansas, closing 10 cts. in postage.

ROADS AND STREETS SECTION

era: Unit Prices of Pavements onstructed in 1911 in 400 American Cities.

[illegible] mpanying tabulations show the [illegible] se tables were compiled were ob- [illegible] officials of the cities mentioned. itions play a prominent part in de- he cost of a pavement and for that es were obtained as to the prevail- of material and cost of labor in Tables showing this information [illegible] es showing the paving work done vars were published in our issues [illegible] April 5, 1911.

[illegible] lanks sent to the city officials in- vas asked on the pavements more ised, and on these general statistics requested. In several cities, how- s types of pavements other than n in the tables were constructed. In some cases, the information was ich fuller detail than can be shown ns. In the following notes thi- is summarized, and the other types it are described briefly.

[illegible]

ties reported that they had laid k pavement during 1911. These ardage and avrage price per sq. pavement, including the base and [illegible]

[illegible]				
[illegible]				
[illegible]				
[illegible]				
Pa..........	395	2.39	11	5
[illegible]				
D. C.....	11,557	1.65*	11	5
[illegible]				

for the work at Jacksonville, Fla., lude the base. Contracts for this ere let in 1911 and were about one- [illegible] of the blocks will be laid on a se. At Newark, N. J., a 3-in. block The total thickness of the asphalt avement at Washington, D. C., was 11 The blocks were 4x5 in. and the ed of 5 in. of gravel and 2 in. of l the cities except Jacksonville and the blocks were laid on a con- the thickness and proportions of were as follows:

	Thickness, ins.	Proportion.
[illegible]		
[illegible]		
[illegible]		
[illegible]		
[illegible]		
New York, N. J.......	4	1-3-5

[illegible]

Oklahoma City, Okla., Oklahoma rock was used in the construction of 23,702 of pavement. This pavement was 7½ k, was constructed on a 5-in. 1-3-5 con- base, the average price per sq. yd. in- the base being $2.05. This does not the grading, which was 35 cts. per cu. he guarantee was for five years. Law- kla., is to construct seven miles of this ent this year.

Texarkana, Ark.-Tex., about $50,000 was

[illegible]

								Concrete Base	
New E[illegible]									
[illegible]									
[illegible]		Grout		[illegible]	5	$0.50	12	6	1-3-7
[illegible]				3.50			11		1-3-6
[illegible]		Cement		2.21					1-3-6
[illegible]		Cement		1.58					1-2½-5½
[illegible]		Cement		3.64					1-3-5
[illegible]		Cement		2.64					1-3-6
[illegible]									
[illegible]		Cement					11		1-3-6
[illegible]		Cement		2.65					1-3-6
[illegible]		Cement		2.53					1-3-5
[illegible]		Cement		2.96					1-3-6
Middle Atlantic Division:									
[illegible]									
[illegible]		Cement		2.55			11		1-3-7
[illegible]		Cement		2.30*					1-3-6
[illegible]		Cement		2.15				6	1-3-5
[illegible]		Cement		2.67	10		11		1-10
[illegible]		Grout							1-3-6
[illegible]		Cement		2.29					1-3-6
[illegible]		Cement		[illegible]	1	.35	11		1-4-8
[illegible]		Cement		2.21[2]	5				1-3-6
[illegible]		Pitch		1.70*		.50	11		1-2½-5
[illegible]		Cement		2.39					1-2½-5
[illegible]		Cement		2.25			11		1-2-5
[illegible]		Cement		2.55					1-3-5
[illegible]				2.35			11		1-2-5
[illegible]		Grout		2.25	5		11½		1-3-6
[illegible]				2.75	3		9	4	1-3-6
[illegible]		Cement	2	2.03*	[illegible]	.35			1-3-6
[illegible]		Grout	1	1.99			11		1-3-6
[illegible]		Grout	1	2.35*		.40			1-3-6
[illegible]		Grout		2.15					1-3-6
[illegible]		Cement							1-3-7
[illegible]		Grout		2.40			12		1-4½*
[illegible]									
[illegible]		Cement	2	2.29			11	5	1-3-6
[illegible]		Grout		2.30					1-3-6
[illegible]		Pitch		2.30*		.40			1-3-5
[illegible]		Grout		2.03					1-3-6
[illegible]		Cement		2.60					1-3-6
[illegible]		Cement		2.39*		.30	12		1-3-5
[illegible]		Cement							
Trenton ...		Cement		1.80*					
West New York...	10,400	Grout		2.45	1			6	1-3-5
[illegible]									
[illegible]		Pitch[7]		1.35*	1[8]	.35	14		1-3-6
[illegible]		Cement		2.50					1-3-5
[illegible]		Cement		1.75			10	4	1-2½-5
[illegible]				1.28		.42	14[10]		
[illegible]				1.53*		.55	14		
[illegible]		Sand		1.83			12		1-3-6
[illegible]		Cement		1.51					1-3-8
[illegible]		Cement		1.95					1-3-5
[illegible]		Cement		1.60		.35	9	4	1-3-5
[illegible]		Cement		2.00			11		1-3-[14]
[illegible]		Cement		2.12					1-3-5
[illegible]		Cement		1.92	2		10		1-3-5
[illegible]		Grout		1.60			11		1-3-6
[illegible]		Sand		1.45*		.45			
[illegible]		Sand		1.25*		.50	14		
[illegible]		Pitch		1.40*		.35			1-3-8
[illegible]		Cement[16]	1	[illegible]		.42		4	1-8
[illegible]		Asphalt		1.87	1		11		1-3-6
[illegible]		Cement		1.07					
[illegible]				1.58			12		
[illegible]		Sand		[illegible]	1	.40	14		
[illegible]		Asphalt		2.25*		.40	12		1-2½-6
[illegible]				2.10			12		1-3-7
[illegible]		Cement		2.03					1-2-4
[illegible]		Cement		2.28			12		1-2-5
[illegible]		Sand		1.31½*		28[20]	14		
[illegible]		Sand[21]		1.98	5		11		1-2½-5
[illegible]		Tar		2.25					1-3-6
[illegible]		Sand	1	1.35*		.33	14		
[illegible]		Cement		2.20		.50	12		1-2-5
[illegible]			2	1.37*		.10			
East North Central Division:									
[illegible]									
[illegible]			2	1.45*		.30	12	6	1-3-7
[illegible]		Asphalt	2	1.56*		.30	12		1-3-7
[illegible]		Cement		1.70		.30	14		
[illegible]		Tar		1.94	1		14		
[illegible]		Tar		1.60	1		11		1-3-6
[illegible]				1.34			11	6	1-12[23]
[illegible]		Cement		[illegible]		.19	12		1-2-5
[illegible]		Asphalt	2			.19	12		1-2-5
[illegible]		Cement			3	.40		4	1-3-6
[illegible]				1.60*		.40	11½		1-3-7
[illegible]							11½		1-3-6
[illegible]		Cement		1.34*		.29			1-3-6
[illegible]		Sand		1.07		.40			
[illegible]		Grout		1.44*	2	.19	12		1-3-6
Fremont	8,000	Sand		1.40*		.32			
[illegible]				1.40*		.30	12		
[illegible]		Sand		1.17			12		
[illegible]		Cement		1.41*		.30	12		1-3-6
[illegible]		Grout		1.55*		.50	11½		1-3-6

Massillon	[illegible]	[illegible]		1.10	1	.30	14	[illegible]	
Mt. Vernon	1,500	Tar	1	1.56*	5	.30	11		
Ravenna	[illegible]	Cement	[illegible]	[illegible]			12	[illegible]	
Springfield	[illegible]	Cement	[illegible]						.....
Wooster	[illegible]	Sand		[illegible]	[illegible]	.30	[illegible]	5	1-3-5
Zanesville, O.	17,000	Sand		1.25	5	.30	[illegible]		
Indiana—									
Anderson	[illegible]	Cement		1.77	5		12		1-[illegible]
Bedford	[illegible]	Cement	[illegible]	1.68	5		11	5	1-3-5
Bloomington	[illegible]	[illegible]		[illegible]				6	1-3-5
Crawfordsville	7,622			[illegible]		.15	12	4	1-4
Elkhart	33,710		1½	1.85	5		11½	6	1-2-4
Evansville	11,500			[illegible]			11	5	1-3-6
Fort Wayne	47,603	Cement	2	[illegible]		1	[illegible]	6	1-3-6
Frankfort	5,158	Grout	2	[illegible]					
Gary	[illegible]	Cement		1.87*					.....
Hammond	[illegible]	Asphalt		1.87	5			6	.....
Indianapolis	31,535			1.96	5				
Kokomo	16,000	Cement	1½	1.50					
La Porte	14,263	Asphalt	1	2.08	5		11	6	1-3-5
Linton		Cement		2.15	5		11		1-3-5
Logansport	8,620	Cement		1.80	0		11	5	1-3-7
Mishawaka	[illegible]	Cement		1.77*		.35	11	5	1-7
Muncie	[illegible]	Cement		[illegible]			11		
Newcastle	[illegible]	Grout		[illegible]			11		[illegible]
Richmond	11,651	Grout		1.95	1			6	1-2-5
Terre Haute	[illegible]	Cement		1.53	5		[illegible]	6	1-9
Illinois—									
Alton	[illegible]	Cement		[illegible]			11	4	[illegible]
Alton	[illegible]	Sand		[illegible]			11		
Bloomington	39,846	Asphalt[41]	[illegible]	1.89	10		10[42]	4	1-3-5
Cairo	[illegible]	Grout		1.61*			11		1-3-5
Chicago Heights	18,094	Asphalt	[illegible]	[illegible]			12	6	1-3-6
Danville	8,150	Cement		1.65			11	5	1-8
Decatur	11,714[43]	Cement		1.28		[illegible]	11		
Edwardsville	27,120[44]	Grout	1½	1.85			10½	5	1-3-5
Granite City	[illegible]	Cement	[illegible]	1.90*		[illegible]	12	6	1-3-5
Harrisburg	13,000	Asphalt		1.90		.35	12	5	1-2½-[illegible]
Jacksonville	..	Asphalt		2.00*			12	6	1-3-7
Joliet	1,750	Asphalt	[illegible]	1.87*		.60	11½	6	1-4-7
La Salle	12,000	Sand		1.60*		.35	12	6	1-3-5
Macomb	[illegible][45]	Sand	4	1.65*		.30	12		
Mattoon	14,000	Grout	[illegible]	1.48*		.30	10½	5	1-3-7
Mt. Carmel	20,000	Cement		[illegible]		.25	12	6	1-9
Oak Park	...	Asphalt	1	1.19			11	6	1-3-6
Olney	4,452	Grout			[illegible]		11	5	1-2½-[illegible]
Ottawa	25,000	Asphalt		[illegible]	[illegible]		[illegible]	[illegible]	
Pekin	[illegible][46]	Asphalt		1.72½			11	5	1-2-5
Peoria	30,100	Grout		1.60	1		11	5	1-3-6
Pontiac	6,333			1.33			11		[illegible]
Rockford	15,240	Asphalt	[illegible]	1.73			10½	5	1-3-6
Springfield	[illegible]	Asphalt		1.59			[illegible]	6	1-3-5
Streator	15,400	Sand	1	1.37			11		.....
Waukegan	1,130	Sand	[illegible]	1.61*		.30	11	5	1-3-5
Michigan—									
Battle Creek	14,425†	Cement	1	[illegible]			11		
Benton Harbor	5,000	Asphalt	[illegible]	1.70*			10	4	1-6
Coldwater	[illegible]	Cement		1.65					
Detroit	[illegible][47]	Tar[48]	2	2.81			[illegible]		
Flint	5,583	Asphalt	1½	1.83*		11	11	6	1-6
Grand Rapids	[illegible]	Grout	[illegible]	1.64½*			11½		
Hillsdale	10,940	Cement		1.52*			12	6	1-7
Kalamazoo	[illegible]	Asphalt	1½	1.84			11½	6	1-8
Pontiac	10,200	Grout	1½	1.79*	10	10	11½	6	1-6
Port Huron	4,745	Grout	2	1.68*		26	12	6	1-8
Saginaw	1,420	Cement	1	1.70*		[illegible]	11	6	1-2½-5
Saginaw	[illegible][49]	Cement	1	1.73*		.30	11	6	1-2½-[illegible]
St. Joseph	10,600	Grout		[illegible]				8	1-6
Wisconsin—									
Fond du Lac	[illegible]	Cement	1½	1.94½			10½	5	1-3-7
Oshkosh	[illegible]	Cement	1½	1.86					
Sheboygan	[illegible]	Cement	1½	1.83½				6	1-3-5
Superior	11,000	Cement	1	2.04*			10	5	1-3-5
Wausau	[illegible]	Cement	1	[illegible]				6	1-2-4
West North Central Division:									
Minnesota—									
Mankato	1,055	Grout		[illegible]			12		[illegible]
Minneapolis	17,765	Asphalt	1	[illegible]			10	5	1-3-5
Winona	[illegible]	Sand	2	[illegible]			12		
Iowa—									
Burlington	3,758	Sand		1.80		.50	10	4	1-2-5
Cedar Rapids	50,868	Sand		1.59*		.38	10		
Council Bluffs	67,048	Sand	1½	2.10*	1		10	5[54]	1-3-5
Davenport	26,735	Sand[55]	2	1.67*		.40	11	5	1-3-6
Keokuk	5,300	.....		1.70*		...	11		.....
Ottumwa	[illegible]	Grout	2	1.81½			12	6	1-3-5
Missouri—									
Brookfield	3,000	Cement		1.38		[illegible]	9		
Columbia	33,975	Sand		1.52*	[illegible]	.46	10		[illegible]
Fulton	9,000	Asphalt		2.00*		40	9	5	1-3-5
Jefferson	26,000	Asphalt		1.60			9		
Kansas City	5,400	Cement	1	2.00			11		[illegible]
Kirksville	7,350	Cement	2	2.06			11	5	1-3-5
Moberly	6,000[59]	Grout	4	1.40*		.30	11		
St. Louis	218,048	Grout	1½	1.65*		.30[60]	11½		[illegible]
Sedalia	20,000	Cement		1.70			10	4	1-3-6
Webb City	7,374	Asphalt	2	2.02			[illegible]	4	1-8
Nebraska—									
Fremont	8,790	Sand		2.25	1		11	5	1-3-5
Lincoln	46,139	Asphalt	2	2.10			11	5	1-3-5
Omaha	116,966	...	...	...		....			
South Omaha	51,916	Grout	1½	2.00	1	...	10½		1-[illegible]-6
Kansas—									
Atchison	17,850	Sand	1	1.33*	1	.37	9	[illegible]	...
Coffeyville	[illegible]	Cement	1	1.54	2	[illegible]	13		
Fort Scott	50,070	Sand		1.40		.35	10		1-2½-[illegible]
Hutchinson	18,000[62]	Asphalt		1.85*		.30	10	5	1-4-5
Independence	42,000	Asphalt	1½	[illegible]	0	.35	11¾		
Kansas City	2.68[64]	Grout	1	1.65			..	6	1-3-6
Leavenworth		Cement	1½	1.40*		.30	9½	4	1-3-6
Manhattan	14,000	Asphalt	1½	[illegible]	1	.30	10	5	1-3-5
Newton	5,000	Asphalt		1.96	1	[illegible]	11	5	1-3-5
Ottawa	17,331	Sand	1½	1.33*	2	.34	9	4	1-3-5
Pittsburg	12,410	Sand	[illegible]	1.40	0	.35	12	..	.....
Topeka	[illegible]	Asphalt	[illegible]	1.69		.35	9½	4	1-2½-5
Wichita	[illegible]	Grout[67]	1	1.90*		[illegible]	[illegible]	6	1-3-6
South Atlantic Division:									
Maryland—									
Baltimore	31,202	Cement		2.09*			12		1-3½-[illegible]
Frederick	8,340	Cement	[illegible]	2.09					1-3-[illegible]
Hagerstown	9,394†	Grout	[illegible]	1.48	2		7½		
West Virginia—									
Clarksburg	17,000	.....	1½	[illegible]			[illegible]		
North Carolina—									
Asheville	27,291	Cement		2.25		10	11		
New Bern	26,000	Grout		1.48	2		7½		

spent in 1911 in surfacing streets w gravel This gravel is a hard gravel, partiall ous formation, and has native clay It has a tendency to bake and har the action of alternate rain and When contained in the gravel in t proportion, it makes an excellent and will not rut up even in the m spells of wet weather. Most of the done with pit-run gravel, the pit b fully selected with a view to the q clay it contained; but a portion was screened gravel, the gravel being s rolled, and then clay thrown over t to be washed in by the action of ra use of a fire hose. No definite estim cost of this work per yard has been but it probably did not exceed sq. yd.

At Cortland, N. Y., 7,000 sq. yds minous slag macadam was constr work being done by the city by forc Slag from an open hearth furnace the slag being crushed and furnish city free of charge. The slag is plac courses, the lower being bound wi loam, and the upper bound with a b material. This is applied by the pour od, two applications being made. average cost on a 28 ft. street, inclu x 6 in. curb and 18 in. x 6 in. concr and excavation, is about $4.00 to $4. ft. of street.

Antigo, Wis., reported the constr 5,000 sq. yds. of Westrumite. The co yd., including base and grading, was 5-year guarantee being given. The to ness was 9 in. The pavement was 7-in. macadam base. Westrumite was at Crookston, Minn., at an average cluding the base, of $1.85 per sq. yd. thickness of the pavement was 7 in. cluding a 5-in. 1—6 pit run concrete 5-year guarantee was required.

A total of 89,110 sq. yds, of Filbe laid at Chester, Pa., last year. The price per sq. yd., including the base, w this including a 5-year guarantee. thickness of the pavement was 6 in. of which 4 in. or 6 in. was a 1-3-6 base.

CONCRETE PAVEMENTS.

Thirty-seven cities reported the con of concrete pavemnt. The more rece opments in this type of street surf shown by these reports, are the u bituminous surfacing and reinforcin cities in Wisconsin reported the con of reinforced concrete pavements. Lac constructed 11,043 sq. yds. of t ment and Sheboygan constructed 1 yds. The average price per sq. yd. in city was $1.25 and that in the second c The Fond du Lac pavement was 6½ consisting of a 5-in. base 1-2½-5 mi 1½ in., 1 cement, 1 sand and 1 granit had a 5-year guarantee. The Sheboyg ment was 6½ in. thick at the gutters in. thick at the center.

Of the bituminous surfaced concr Arbor reported 64,811 sq. yds. This thick and was known as "Dolaway." land, Me., constructed 11,238 sq. yds. 1-2½-5 concrete pavement, surfaced The Portland work cost $1.29 per sq. other concrete pavements, aside fro siderable yardage, constructed under sam and Blome systems, fell into two One-course concrete and two-course As nearly as can be judged from the the following cities constructed pave the first mentioned class:

	Sq. yds.	Av. price per sq. yd.	Thickness, ins.
Bemidji, Minn.	19,826	$0.90	[illegible]
Grand Forks, N. Dak.	2,222	1.26	[illegible]
Kansas City, Mo.	8,100	1.05	[illegible]
Lynn, Mass.	21,402	1.70	[illegible]
Ottawa, Kan.	996	1.03	[illegible]

Ia	100,000	1.20	5	1-3-4½
J.	2,826	1.44	6	1-2½-5
an.	2,137	1.00	6	1-2-4

s which constructed two-course con- nents were as follows:

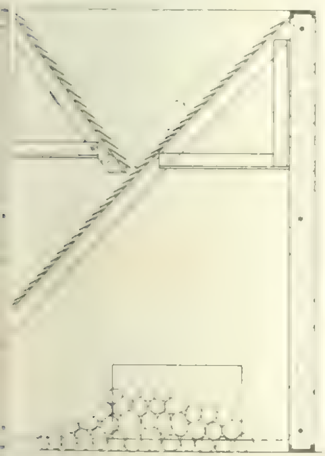
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2,000	[illegible]	[illegible]
[illegible]	23,1[illegible]	[illegible]	[illegible]
Ia.	4,489	1.34	6½
Ia.	14,[illegible]	[illegible]	[illegible]
Ind.	[illegible]	[illegible]	[illegible]
Mich.	12,000	[illegible]	[illegible]
[illegible]	[illegible],900	1.00	[illegible]
Neb.	[illegible]	[illegible]	[illegible]
n. Colo.	18,000	2.20	7
Kan.	18 mile	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]
[illegible]	11,[illegible]	1.18	[illegible]
	[illegible]		
	[illegible]	1	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
N.	[illegible]	[illegible]	[illegible]
Wash.	[illegible]	1.1[illegible]	[illegible]

ng cities gave information as to and proportions of the courses.

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	6	1-6	2	
[illegible]		1-6		1-2
[illegible]		1-3	2	1-2
[illegible]		1-3-		1-2
Ill.	5	1-3-		1-1-1
[illegible]	4			
[illegible]		1-3-	2	1-1-1
a. Colo.		1-3-	2	
[illegible]		1-2-	2	1-2
[illegible]	5	1-6		1-2

Furnace for Drying Sand and Crushed Stone.

the difficulties in road construction, [illegible] macadam work, is the [illegible] of the stone. The accompany- [illegible] shows a furnace which seems [illegible] y adapted for drying stone for [illegible] ither on the job or at the rail-



howing Arrangement of Portable Furnace.

siding. The essential features of ace are the combination of a casing, ied planes forming a hopper, a dis- pening, and a fire chamber. The planes are composed of overlapping spaced as to form slots for the of the products of combustion.

nace is arranged to burn cord wood. be used either as a batch or con- dryer. The discharge door is high that it can discharge directly into arrow without requiring rehandling rial. The device is so constructed letaching the ends by means of the

[illegible]								
Charleston		[illegible]		1.44*				
[illegible]		[illegible]		[illegible]		10		1-4-6
Columbia		[illegible]		2.19		[illegible]		1-3-6
[illegible]								
[illegible]		Cement		[illegible]		10	[illegible]	1-3-5[70]
[illegible]				2.08		11		1-3-6
[illegible]								
Gainesville		[illegible]		1.30*	.25			
East [illegible]								
Kentucky—								
[illegible]	5,000	[illegible]		2.40		[illegible]		1-3-5
[illegible]		[illegible]		1.92*				1-3-7
[illegible]								
Knoxville		Asphalt						1-3-5
West [illegible]								
[illegible]								
[illegible]		Sand		1.73*	.35	12		
Bartlesville	25,740			1.85		[illegible]		
[illegible]					.30			1-3-6
[illegible]				1.90*				1-3-6
Oklahoma City	10,64[illegible]	Grout	1	2.03*	.35			1-3-5
[illegible]								
Mountain Division:								
[illegible]								1-3-5
Utah—								
[illegible]		Asphalt		3.85*				1-3½-7
Pacific Division:								
[illegible]				[illegible]	.40		6	1-3-6
[illegible]	754			2.60*	.50	9 3-5		1-4-7
[illegible]			1	2.95		10		1-3-6
[illegible]								
[illegible]					.30	11	6	1-3-5
[illegible]		Cement						

in city funds. [2] $2.21 for 10,575 sq. yds. are $2.32 for 3,270 sq. yds. [3] 5 per cent of cost held back for 1 year. [4] Bank gravel. [5] Laid by Trolley Co. on macadam base. [6] Does not include base; repairing. [7] Used pitch, also sand and cement grout. [8] 1 to 5 years. [9] Also 3,000 sq. yds. at $1.35. [10] 8-in. broken stone base, 2-in. sand, 4-in. brick. [11] Laid on sand, 10 in. of gravel; no filler used. [12] 8 cts. per sq. yd. retained for 5 years. [13] 10½ and 11½ in., concrete base being either 5-in. or 6-in. [14] 1-3 stone to suit. [15] Laid on 8 in. of sand. [16] Cement, also pitch. [17] 9, 10 and 11-in., depending on 4-in., 5-in. or 6-in. base. [18] Laid on rolled stone base. [19] 6,426 sq. yds. for Borough at $2.25 and 1,511 sq. yds. for street railway at $2.55; latter pavement laid on 12-in. base. [20] 28 cts. to 63 cts. [21] Sand; cement grout at each gutter. [22] 9-in., 10 cts. per sq. yd. [23] Base consists of 5-in. slag and 3-in. gravel. [24] 6-in. crushed stone base. [25] 1-12 of sand and gravel. [26] 19 cts. to 35 cts. [27] On crushed stone base. [28] Laid on 6-in. gravel. [29] 8-in. gravel base. [30] 6-in. gravel base. [31] Laid on gravel base. [32] Laid on broken stone; in addition 23,113 sq. yds. cost $1.43 and 3,348 sq. yds. laid on concrete base cost $2. [33] Cusion sand taken from street. [34] Stone base. [35] In addition 4,160 sq. yds. of alley pavement, sand filler, at $1.48. [36] 1-6 bank run gravel. [37] 11,294 cu. yds. grading included in price per sq. yd. [38] Keep in repairs for two years. [39] 15,450 cu. yds. grading included in price per sq. yd. [40] 6-in. loose macadam. [41] Asphalt, also cement. [42] 10-in. and 12-in., concrete base 4-in. or 6-in. [43] Also 1,530 sq. yds. with asphalt filler at $1.74. [44] To be laid in 1912. [45] Double course on same. [46] Includes 23,542 sq. yds. at $1.68. [47] Also 73,261 sq. yds. of repairing at $2.58 and 147,642 sq. yds. resurfacing at $1.91. [48] Tar or grout. [49] 1 cu. ft. cement to .7 cu. ft. concrete in place. [50] Brick gutters. [51] On concrete base. $1.87 on sand base. [52] Includes 1,364 sq. yds. at $1.83. [53] Sand and asphalt. [54] 5-in. and 6-in. [55] Sand and pitch. [56] 5-in. broken stone base. [57] Also 1,800 sq. yds. resurfacing at $1.50. [58] On macadam base. [59] Brick—two courses. [60] 30 cts. to $1. [61] Macadam base or double course brick; intersections well filled with crusher dust or screenings. [62] Also 32,000 sq. yds. at $1.30 on old concrete base. [63] Macadam base. [64] Miles. [65] 4-in. cinder base; course of brick laid flat, 1½ in. cushion of fine cinders and course of brick on edge. [66] 27,645 sq. yds. with asphalt filler at $1.69, 17,123 sq. yds. with sand filler at $1.49. [67] Also asphalt filler. [68] Includes 8-in. stone, 2-in. gravel and 1½-in. sand. [69] Natural sand base. [70] 1-3-5 slag. [71] Sand base. [72] Along street railway tracks. [73] Broken stone base. [74] Three courses of brick with asphalt filler every 25 ft. for expansion; also ¾-in. asphalt filler along each curb. [75] Some asphalt filler. [76] 1½-in. to 2-in. [77] 9 3-5 to 12.1-in., base 4 to 6-in. [78] In street railway tracks.

TABLE SHOWING AMOUNT, AVERAGE PRICE AND SOME DETAILS OF ASPHALT PAVEMENT [illegible]

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] concrete base.
New England Division:								
[illegible]				$2.00*		[illegible]		1-3-7
[illegible] R. I.				....				1-3-6
Hartford, Conn.	11,250			2.29*		.75		1-3-6
Middle Atlantic Division:								
New York—								
Buffalo	49,494		2	3.31	10			1-10
Mt. Vernon	19,400	1		2.22				1-2-5
[illegible]		1	2	1.88				1-3-6
[illegible]				2.20*				1-3-6
[illegible]				2.10				1-3-6
Utica	16,323		2	1.80				1-3-7
New Jersey—								
[illegible]		1		1.70				1-3-5
Jersey City	10,935			1.90		.40		1-3-5
Newark	1,840			2.21				1-3-6
[illegible]		1	2	[illegible]				1-3-6
Pennsylvania—								
[illegible]				1.33				1-3-8
Harrisburg	167,000			1.49				1-3
[illegible]		1		2.15*				1-3-6
[illegible]		1		1.80				1-3-7
Wilkesbarre	32,322	1		2.10				1-2-5
[illegible]		1	2	1.74				1-3-6
East North Central Division:								
Ohio—								
[illegible]		1	2	1.46	10			1-3-6
[illegible]			1	1.76*				1-3-7
[illegible]		1						1-4-7
[illegible]		1		[illegible]				1-3-6
[illegible]				1.50				1-3-7
[illegible]		1		[illegible]		.40		1-3-6
[illegible]		1	2	1.68				[illegible]

[illegible]								
Evansville			2	1.95½	5		5	1-3-6
Fort Wayne				1.78*			6	1-3-6
Indianapolis				[illegible]				1-8
[illegible]	400						6	1-2-4
Logansport				1.90				1-3-7
Mishawaka	244			1.71*			5	1-7
[illegible]								
[illegible]			2	1.30				
[illegible]		[illegible]					5	1-[illegible]
[illegible]								
Detroit				2.82		.....	6	1-3-6
[illegible]				1.70*		.39		1-2½-5
[illegible]								
[illegible]			2	2.09				.....
[illegible]				1.80*	5			1-3-5
West North Central Division:								
[illegible]								
[illegible]			1½	[illegible]		.40		1-3-6
Fort Dodge	13,[illegible]	1		1.99				1-3-5
[illegible]				1.95				1-3-6
[illegible]								
Kansas City	124,000	1		1.82			5[12]	1-3-6
[illegible]	303			1.70*	5		5	1-4-7
[illegible]								
[illegible]				2.10	[illegible]	.40		1-3-5
Omaha	78,062							
[illegible]								
Kansas City								1-3-6
Kansas City		1½	[illegible]	1.88	5	.....	4	1-3-6
[illegible]		1½	1½	2.00*	10	.45		1-3-6
South Atlantic Division:								
Washington, D. C.	17,745			1.70*		.55		1-3-7
[illegible], Md.				1.74*	5	.51		1-3½-7
Greenville, S. C.	52,398						[illegible]	1-4-6
East South Central Division:								
[illegible]								
Lexington	41,000	1		2.10	5	.....	6	1-3-6
Louisville	[illegible]			1.85*		.52	6	1-3-7
[illegible]				1.88*		.57		1-3-5
Knoxville, Tenn.				1.78*		.57		1-3-5
West South Central Division:								
New Orleans, La.			2	2.58			6	
Oklahoma—								
Muskogee				1.95*		[illegible]	5	1-3-6
Oklahoma City	276,231[18]					.35	5	1-3-5
[illegible]				2.05*		.35		1-3-5
Tulsa		[illegible]	1½	1.75*		.30	5	1-2½-5
Mountain Division:								
Boise, Idaho			[illegible]	1.78*			4	1-3-7
Salt Lake City, Utah	68,300	1½		[illegible]	5	.80	6	1-3½-7
Pacific Division:								
Washington—								
Bellingham		1	2	[illegible]				1-3-6
Hoquiam	5,600			2.30*				1-2½-7[20]
Seattle	[illegible]			[illegible]			4	1-4-7
Spokane	180,[illegible]	1	2	1.75*				1-3-6
Walla Walla	.....	1		2.00*			4	1-4-7
Oregon—								
Medford	[illegible]	1		1.76*		.55	5	1-3-6
Portland	536.090[22]	1		1.80*		.40		1-3-6
California—								
Pomona	18,[illegible]	1		1.62				
Santa Barbara	231,[illegible]		1½	.13¼[25]				
San Diego	.....						5	
San Jose	28,295	..	2	1.80	..	.....	6	1-3-6

*Does not include grading.

[1] Old base. [2] Also had 24,702 sq. yds. asphalt repaving at $2.75 and 34,702 sq. yds. of asphalt surfacing at $2.28. [3] Thickness of cushion. [4] Texaco. [5] 8 cts. per sq. yd. retained for 5 years. [6] On old base. [7] Also includes cost of combined curb and gutter. [8] Resurfacing. [9] Also did 46,498 sq. yds. of repaving at $2.35 and 186,016 sq. yds. resurfacing at $1.30. [10] 1½ in. and 2 in. [11] 5 in. and 6 in. [12] For residence streets. [13] 30 cts. to $1. [14] 4 in. to 6 in. [15] Some 5 in. [16] Naphtha coat. [17] 20 per cent more mortar than voids in aggregate—mortar 1 part cement to 3 parts sand. [18] Cuban or Trinidad asphalt. [19] Oklahoma rock asphalt. [20] 1-2½-7 used; 1-3-6 specified. [21] 1910 prices. [22] Some of pavement is laid with 4-in. base, 1-in. binder and 1½-in. wearing surface. [23] $1 [illegible] [24] Sq. ft. [25] Per sq. ft. [26] Rock asphalt.

holding rods, two or more dryers can be placed side by side, enlarging the capac to the length of a railroad car. could then be shoveled directly from into the dryer, and then reloaded i The walls of the dryer are constr plates and 2-in. angles, asbestos or s used in the space between the plate vent the loss of heat. If sand is use purpose, in moving the furnace thi would clear itself from the botto sidewalls, thus lightening the dryer for this dryer has been granted to Craven, Jr., 32 Ridley Ave., Ridley Pa

Area of Marsh Land Requiring Drainage

Figures recently made public in b the National Drainage Congress give of marsh land in the United States as

New England States	
New York	
New Jersey	
Pennsylvania	
Maryland	
Delaware	
West Virginia	
Virginia	
North Carolina	
South Carolina	
Georgia	
Florida	
Alabama	
Mississippi	
Louisiana	
Texas	
Oklahoma	
Arkansas	
Tennessee	
Kentucky	
Ohio	
Indiana	
Illinois	
Missouri	
Kansas	
Nebraska	
Iowa	
North Dakota	
South Dakota	
Minnesota	
Wisconsin	
Michigan	
Total	

The Mining Scientific Press de the drilling of holes for the foundati of a Cornish pump which was done at isman, Karangahake, New Zealand, 3⅛-in. piston drill weighing 300 lbs., with ordinary drill steel 400 5½-in. per minute with air at 80-lb. pressure. bolts were 6 in. diam. Hexagonal dr 2 in. diam. was used. The starting 6⅝ in. diameter. The finishing drill w diam., 7 ft. long, and weighed 84 lbs. drilling was done at the rate of 1 ft. p hour in hard andesite.

TABLE SHOWING MILEAGE OF PAVEMENT LAID IN 1911 IN A NUMBER OF CITIES AND MILEAGE OF PAVEMENT PROPOSED FOR 1912.

	City Engineer.	Pavement —Laid in 1911— Miles.	Total Cost.	Pavement to be —Laid in 1912— Miles.	Total Cost.
New England Division:					
Maine—					
Portland	Bion Bradbury, Jr.	.93	$ [illegible]		$ 50,000
Saco		[illegible]			
New Hampshire—					
Laconia	Chas. A. French	1½	[illegible]	1½	15,000
Vermont—					
Barre	Geo. A. Reed	[illegible]	[illegible]		
Bellows Falls	J. H. Lawrence			[illegible]	4,000
St. Albans	D. F. McCarthy	1.6			
St. Johnsbury		.4	2,300		
Massachusetts—					
Boston*	L. K. Rourke	....			
Cambridge*	L. M. Hastings	....			......
Easthampton	W. C. Tannatt, Jr.	....		[illegible]	2,000
Everett	Christopher Harrison	.54	24,728		
Holyoke	T. J. McCarthy	1.9	33,200		
[illegible]	C. G. [illegible]	1	5,000		
Greenfield		2			
[illegible]	[illegible]		....		
Lowell	Stephen Kearney	2.7	101,000	2.5	100,000
Lynn	Geo. T. Leland	....	49,331		
New Bedford	Wm. T. Williams	7¾	166,407	[illegible]	[illegible]
Newburyport	J. H. Johnston	1	6,000		
Pittsfield	A. B. Farnham	.5	7,347		
Southbridge	John A. Whittaker	....	36,400		
Springfield*	Chas. M. Slocum	....			
Westfield	John L. Hyde	1	37,796		
Woburn	Wm. B. Jones	1.7			
Worcester	F. A. McClure	7	[illegible]		
Rhode Island—					
East Providence	F. V. Waterman	3.4	32,839	3.9	24,500
Providence	O. F. Clapp	4.1			260,534
Connecticut—					
Ansonia	V. B. Clarke				4,000
Bridgeport*					....
Bristol	C. W. Buell		[illegible]		7,500
Derby	V. B. Clarke			1	6,500
Hartford	R. N. Clark	.5	25,000	.5	
New London*	Geo. K. Crandall		..		
Norwalk	C. N. [illegible]				
Waterbury*	R. A. Cairns				
Willimantic*	R. E. Mitchell				
Middle Atlantic Division:					
New York—					
Amsterdam	F. E. Crane	.37	19,074	[illegible]	
Auburn	E. C. Aldrich	1	[illegible]	1¼	
Binghamton	J. A. Giles	.9	45,768	1	
Buffalo	G. H. Norton	[illegible]	475,762		
Cortland	D. B. Coleman	[illegible]	14,000	1	
Elmira	T. A. Brown	.15	6,786	.18	
Fulton	G. C. Hill	....	....	¾	
Herkimer	Albert Wilber	2½		1	
Hornell	A. F. Bannon, Jr.	.1	2,159		
Hudson	M. J. O'Hara	¾	[illegible]	½	
Jamestown	C. G. Jones	2	100,000	1	
Johnstown	W. E. Natanson	1.3	33,476	[illegible]	
Kingston	J. T. Hallman	....	....		
Little Falls	O. J. Dempster	½	20,000	½	
Mount Vernon*	C. M. [illegible]				
Niagara Falls	F. S. Parkhurst, Jr.	2½	117,[illegible]	[illegible]	
No. Tonawanda	A. P. Smith	¼	9,300	¾	
Norwich	C. E. Harris	1½	50,000	1½	
Oneida*	Tibbits Maher Co.	....	....	...	
Oneonta*	O. A. Miller	....	......		
Plattsburgh	H. J. Langlois	1.8	19,706		
Port Jerviss	Irving Righter	.6	24,500		
Rochester	E. A. Fisher	18.8	1,121,950		
Schenectady	W. T. Wooley	3.9	194,377		
Syracuse	H. C. Allen	1.83	97,495		
Utica	Geo. W. Hackett	3	130,000	3.5	
Watertown	E. W. Sayles	....	7,500	1¼	
Watervliet	P. J. Lamb	.28	....	..	
White Plains*	J. Y. Lavery	....	....	..	
New Jersey—					
Asbury Park	R. L. Savage	....	54,000	...	
Camden*		....	....	....	
Elizabeth*	W. H. Luster	1.42	....	....	
Harrison*	H. P. Kreiner	....	....	....	
Jersey City	C. A. Van Keuren	7	196,900	....	

		Laid in 1911			
		Miles.	Total Cost.		Total Cost.
[illegible]	[illegible]				
[illegible]	R. Sherrerd..	13.7	[illegible]		[illegible]
Brunswick...	F. C. Schneider..		[illegible]		[illegible]
[illegible]	C. E. [illegible]		22,500		
[illegible]	J. Gavett..	5.9	50,000		
[illegible]	[illegible]				
[illegible]	[illegible]				
[illegible]	[illegible]		42,591		
New York..	Carl Griesbach				
[illegible]	[illegible]				
ania—					
[illegible]	H. O. Carson.........	2.4	62,912		
[illegible]	[illegible]		9,000		200,000
[illegible]	[illegible]		24,000		[illegible]
[illegible]	[illegible]		241,431		
[illegible]	E. J. O'Brien.........	....			
[illegible]	J. Tiams.........	....			
[illegible]	[illegible]		24,850		
[illegible]	E. Briggs..........	2	58,730		60,000
n	J. M. [illegible]		59,500		
[illegible]	[illegible]			1	
urg* ...	B. Cowden....				
[illegible]	B. E. Youngman..	.19		6	
[illegible]	H. Trautman..				
[illegible]	H. W. [illegible]		[illegible]	1.5	12,000
[illegible]	B. F. Miller, Jr...		11,000		
gahela	J. A. [illegible]		[illegible]	[illegible]	16,000
[illegible]	H. T. Barker.....		2,500		
[illegible]	C. H. Milholland......	1	35,200	1	
[illegible]	G. F. [illegible]		62,046	1.4	
[illegible]	[illegible]		505,658		
wn*	R. E. Shaner.........	....	....		......
[illegible]	R. S. Van Rensselaer.	¾	17,000		11,000
[illegible]	[illegible]		8,000		
[illegible]	[illegible]		21,581		
[illegible]	Wm. [illegible]		134,499		
[illegible]	[illegible]				
[illegible]	[illegible]		[illegible]		
[illegible]	[illegible]		10,000		
[illegible]	E. M. Wall		29,000	5	75,000
[illegible]	R. A. Fentmyer......	....			
[illegible]	D. F. [illegible]			1	
[illegible]	[illegible]	.1	2,209	.4	
arre	B. H. Finch...	4.6	175,599		
sburg	Frease & Sperling....	1	30,412		34,000
[illegible]	[illegible]		29,000		130,000

rth Central Division:

[illegible]	L. A. Amsden		91,952		
[illegible]	H. W. Alcorn.........	4.5	28,905		
[illegible]	[illegible]				
[illegible]	K. M. Cosgrove.......	....			
[illegible]	P. H. Weber.........	7	[illegible]	[illegible]	
the	H. M. Redd		8,500		
lle	O. W. Stiles..........	3	140,000		
nd	Robert Hoffmann.....	26.6	849,879	30.1	1,216,897
[illegible]	Henry Maetzel.......	17	709,106	25	2,000,000
it	[illegible]			1	20,000
[illegible]	A. M. Fisher		[illegible]		
[illegible]	G. C. Cummins		310,000		150,000
[illegible]	Geo. S. Irwin		30,000	[illegible]	
Liverpool	J. C. Kelly..........	2¾	32,000		
[illegible]	Chas. Latshaw	[illegible]	40,000	[illegible]	65,000
[illegible]	[illegible]				8,000
[illegible]	A. O. Theobald		[illegible]		50,000
[illegible]	F. E. Weaver........	3.33	136,725	[illegible]	150,000
ster*	J. N. Wolfe..........	....			20,000
[illegible]	G. A. Crayton........	1	[illegible]		
[illegible]	C. M. Osborn		55,000		
[illegible]	H. M. Yost		20,818	1	29,875
Vernon	R. S. Blinn..		3,000		30,000
[illegible]	F. M. Brewer.........	....			
[illegible]	J. A. Stewart........	2	[illegible]	2	
[illegible]	....		17,883		......
[illegible]	M. J. Bahin........		97,700		120,000
[illegible]	C. J. Peters........				....
rren ..	Bert C. Smith......				40,000
oster .	Thomas P. Brown..	2	40,000		40,000
[illegible]	J. R. Tanner		22,000	[illegible]	50,000
[illegible]					
[illegible]	G. P. Lanphear......	1.5	46,958		
[illegible]	J. W. Malott		13,515		
[illegible]	V. S. Hanna	[illegible]	30,000		
rdsville ..	H. C. McCluer......			[illegible]	24,000
[illegible]	A. M. Smith	2.1	[illegible]		92,000
[illegible]	[illegible]				
Wayne	F. M. Randall	[illegible]	24,936		
kfort ...	H. M. Hockman......	1.4	34,535		40,000
[illegible]	C. A. Williston......	25.5	286,143		
[illegible]	P. J. Lyons.				
apolis	H. W. Klausmann.	8.7	335,199		146,950
[illegible]	[illegible]				
orte.	[illegible]				
[illegible]	[illegible]			[illegible]	
[illegible]	H. H. Thompson				
higan City...	H. M. Miles.				
shawaka*	J. W. [illegible]				
[illegible]	B. F. Deardorff		62,780	1.2	35,000
[illegible]	A. W. Wright........	2	64,461	[illegible]	65,958
[illegible]	Fred R. Charles......	....		1	4,000
[illegible]	E. B. Douglass.......	1.10		1	17,000
Haute	R. M. [illegible]		4,400		
shington* ...	H. F. O'Neall.........	...			
[illegible]					
[illegible]	J. Schwab		63,739	[illegible]	98,003
[illegible]	Elmer Folsom........	2.2	87,915		
[illegible]	George Dewey........	3.7	179,011	13	
Heights	J. E. Grimes.........	1	[illegible]		
[illegible]	W. H. Martin........	1¼	30,200	2½	
[illegible]	R. McCalman.........	....			
[illegible]	C. A. Shepherd			[illegible]	
[illegible]	Charles [illegible]				
anite City*....	Edmund Hall.........	....			120,000
rrisburg*	C. C. Newson.........	....	24,700	[illegible]	35,000
cksonville* ...	E. M. [illegible]				
[illegible]	H. A. Stevens		[illegible]	2	[illegible]
Grange	Edwin Hancock......	1	[illegible]		12,000
Salle*........	[illegible]		19,200		20,000
[illegible]	Cephas Holmes........	....	[illegible]		
[illegible]	Claude James........	1	28,000		
mouth	[illegible]			1.5	45,000
Carmel.......	G. W. Courter........	1½	[illegible]	[illegible]	80,000

		Laid in		ent to be in 1912	
		Miles.	Total Cost	Miles.	Total Cost.
[illegible]	[illegible]	2.29	87,324		
[illegible]	[illegible]		10,200		
[illegible]	[illegible]		40,000		
[illegible]	[illegible]				79,308
[illegible]	[illegible]			100(?)	
Peoria	Leonard D. Jeffries...		124,241		
[illegible]	[illegible]		12,500	1	25,000
[illegible]	[illegible]	3.77			
[illegible]	[illegible]				
[illegible]	[illegible]				
[illegible]	[illegible]			1	
[illegible]	[illegible]	1			
[illegible]	[illegible]	1.25	14,500		57,000
[illegible]	[illegible]		16,900		13,000
[illegible]	[illegible]		....	..	(?)100,000
[illegible]	[illegible]	[illegible]	23,037		40,000
Benton Harbor...	Chas. R. Wightman..	1.12	10,300		
[illegible]	[illegible]		8,000		
[illegible]	[illegible]			35	11,000
Detroit	[illegible] McCormick.....		[illegible]		1,410,630
Escanaba ...	J. MacKilhean....				31,000
[illegible]	H. Terry.........		13,026		
[illegible]	[illegible]		236,925		
Hillsdale	C. L. [illegible]				20,000
Holland	H. A. Naberhuis..		55,000		33,000
[illegible]	[illegible] Johnston...		27,000		98,000
[illegible]	[illegible]		......		
[illegible]	[illegible] J. Fisher...		12,000		
[illegible]	[illegible] Whitmore..		9,500	3	15,000
[illegible]	[illegible]	3.08	113,777		
[illegible]	[illegible] J. Cleary......		21,500		
[illegible]	[illegible]		16,000		
Fond du Lac......	J. S. McCullough..	1.10	38,045		
[illegible]					
[illegible]	[illegible]				16,000
Merrill	Peter Odegard.....	.28	4,500		....
Marinette	A. L. Hillis.......		12,845		10,000
Oshkosh*	Geo. H. Randall...		38,000		
Rhinelander	....		16,120		
[illegible]	[illegible]	3.8	141,305		
[illegible]	[illegible]		99,784	2.50	125,000
Waukesha	Morgan R. Butler.		3,557		34,001
Wausau	B. C. Gowen.......	.58	28,106		

West North Central Division:

[illegible]					
Bemidji	W. M. Everts	[illegible]	17,843	0.4	12,000
[illegible]	[illegible]		39,964		
Mankato	H. F. Blomquist......	1.6	74,752		
Minneapolis	Andrew Rinker.......	24.5	524,993	1	600,000
Owatonna	Harvey S. Dartt		......		72,000
Winona	H. B. Walling.		16,559		9,000
[illegible]	[illegible]		18,855		
Cedar Rapids.....	T. F. McCauley.......	3.01	104,931		
Charles City......	W. S. Beattie........	....			
Council Bluffs.....	E. F. Stimson.......	1.31	141,942		160,963
[illegible]	[illegible]				
Davenport	A. M. Compton.......	3.49	[illegible]	4.5	220,000
Dubuque	C. H. Baumgartner...	....	45,155		45,155
Fort Dodge.......	C. H. Reynolds.......	1	18,000		
[illegible]	[illegible]				[illegible]
[illegible]	[illegible] Winters.......	2½	[illegible]		35,000
Marshalltown	W. H. [illegible]		17,000		
Mason City.......	F. P. Wilson.........	2	80,000		[illegible]
[illegible]					[illegible]
[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	6,200		
[illegible]	[illegible]	[illegible]	120,000		230,000
Waterloo	C. T. Wilson.........	3.8	157,000		140,000
Missouri—					
[illegible]	[illegible]		50,000		30,000
[illegible]	[illegible]				11,480
Columbia	J. Russell Ellis.......	2	[illegible]		67,000
[illegible]	[illegible]		22,000		....
[illegible]	[illegible]				125,000
Kansas City......	Louis R. Ash..........	15.4	457,000	20	560,000
[illegible]	[illegible] M. [illegible]	[illegible]	15,200		46,000
Lexington	J. A. Wilson..........	....			......
[illegible]	[illegible]		9,000		33,000
Nevada	James M. Clack......	....			30,000
Poplar Bluff......	E. C. Thomas........	....		[illegible]	
[illegible]	[illegible]		1,980	.....	
St. Louis.........	Jas. C. Travilla......	25.34	1,202,876	21	1,005,294
Sedalia	F. T. Leaming.......	1	34,000		77,000
Webb City........	A. J. McKenzie......	2.06	42,509		
North Dakota—					
[illegible]	[illegible] Lykken.		105,574		
Lead	L. D. Lea.....				
Mitchell	S. H. Smith...			1	
Grand Island......	K. W. Kibbey.		4,881		
[illegible]					
[illegible]	[illegible] Hamen........	....	10,988		21,280
Kearney	E. H. [illegible]				
[illegible]	[illegible] Dobson........	4.43	[illegible]	[illegible]	[illegible]
Norfolk	[illegible]				75,000
Omaha	George W. Craig	12.58	[illegible]	12.6	
South Omaha.....	Geo. W. Roberts......	5.8	240,659	6.5	[illegible]
[illegible]					
Atchison	S. K. McCrary.......	1.1	40,071	8.10	32,000
[illegible]	[illegible]		36,102	2¾	65,000
Emporia	Matthew Brown......	2			
Fort Scott........	C. R. Fisher.........	3.4	70,098	3	60,000
Hutchinson	G. L. McLane.				
[illegible]	[illegible] Stivers........	2	89,000		[illegible]
Kansas City......	Wm. Barclay.........	9.85	293,036	10	300,000
[illegible]	[illegible]	[illegible]	30,000		24,000
Manhattan	O. E. [illegible]		115,000		80,000
[illegible]	[illegible] Devlin.........	....	84,050		90,000
Ottawa	Claude S. Pugh.......	3.23	74,440		....
Pittsburg	[illegible]		17,374		51,000
[illegible]	[illegible]	[illegible]	52,000		
[illegible]	[illegible]		145,000		[illegible]
Wellington	John H. Wolfe.......	3.2	70,000		
Wichita	Bert C. Wells........	18.44	849,829		

South Atlantic Division:

[illegible]	[illegible]				
[illegible]	[illegible]		17,431		9,405
[illegible]	E. E. [illegible]		12,495		

City.	Engineer.	Pavement Laid in 1911 Miles.	Pavement Laid in 1911 Total Cost.	Pavement to be Laid in 1912 Miles.	Pavement to be Laid in 1912 Total Cost.
Dist. of Columbia—					
Washington		.8	16,000		
Virginia—					
Danville	[illegible]		4,400	1	30,000
Portsmouth*	[illegible]				
Staunton*					
Suffolk	R. H. [illegible]			[illegible]	[illegible]
West Virginia—					
Clarksburg	[illegible] Bent				
North Carolina—					
Asheville	[illegible]	2.1	53,247		
Goldsboro	[illegible] Gentes			(?)	(?)
Greensboro	M. M. Boyles	¼	4,400	2	25,000
New Bern	[illegible] R. Eagle	1½	60,000		
Raleigh	[illegible] B. Seawell	1½		(?)	(?)
South Carolina—					
Charleston	J. H. Dingle				
Columbia	John McNeal	1	93,904	[illegible]	
Greenville	C. B. Bellinger		213,000		
Spartanburg	J. H. Shores				
Georgia—					
Americus	L. B. Ansley	1.5	83,262	1.5	70,000
Brunswick*	J. L. Zachry				
Dublin	M. J. Grayston	[illegible]	18,000		
Rome	W. M. Wilson	1.7	98,000	1	32,000
Florida—					
Gainesville	G. H. Cairns	1.5	30,000	3	105,000
Jacksonville	L. D. Smoot	1.[illegible]	408,075		
Pensacola	L. E. Thornton			1[illegible]	[illegible]
Tallahassee	J. E. Craig			4	
East South Central Division:					
Kentucky—					
Lexington	J. W. Green	2.[illegible]		2.5	
Louisville	D. R. Lyman	9.1	479,000	9	[illegible]
Owensboro	H. M. Talbott				
Tennessee—					
Knoxville	J. E. Thompson	2	114,307		
Alabama—					
Gadsden	C. L. Marsh			1	
Mississippi—					
Meridian	R. I. Myers	¾		3	30,000
Vicksburg	C. R. Twiss			1¼	[illegible]
West South Central Division:					
Arkansas—					
Fort Smith	W. H. Reed	10			60,000
Helena	L. R. Parmelee			2	
Jonesboro	C. Vogt	1¼	45,800		
Texarkana	C. E. Hayden			1½(?)	
Louisiana—					
Lake Charles	T. H. Mandell				265,000
New Orleans	W. J. Hardee	6½			
Oklahoma—					
Bartlesville	E. D. Kirkpatrick	1¼	65,340	3¼	190,000
Durant	W. P. Danford	¼	38,000	1	40,000
Lawton	Frank B. King			7	159,800
Muskogee	T. P. Clouts	11	500,000	5	200,000
Oklahoma City	Guy V. McClure	27.2	1,192,281	8	370,000
Sapulpa	C. K. Howard			2	45,000
Tulsa	T. C. Hughes	12.1	300,000	9	225,000
Texas:					
Dallas	J. M. Preston	8.2	428,108	12.1	650,897
Greenville	J. H. Rush	7	250,000		

City.	Engineer.	Pavement Laid in 1911 Miles.	Pavement Laid in 1911 Total Cost.	Pavem Laid i Miles.
Houston Heights	H. Wise			(?)
Longview	Aetna Eng. Bureau	1	[illegible]3,000	1
Port Arthur	C. G. Dinwoodie			11½
San Antonio	F. M. Giraud	12.3	121,000	3.8
San Angelo	J. J. Goodfellow	1.2(?)	54,780	4.1(?)
Taylor				(?)
Temple	R. T. Smith			.75(?)
Weatherford	V. D. Roberts			
Wichita Falls	L. C. Hinckley	1½	105,000	
Mountain Division:				
Montana—				
Billings*	C. E. Durland			
Butte	P. A. Gow	.4	39,398	
Great Falls	M. L. Morris	.68	6,128	1.4
Helena	C. W. Helmich			1
Missoula	F. E. Buck			1.7
Idaho—				
Boise*	E. G. Eagleson			
Coeur d'Alene	A. A. Robish			1
Pocatello	J. P. Congdon			1.8
Twin Falls*	Charles H. Mull			
Colorado—				
Boulder	H. E. Phelps	.5	11,000	
Colorado Springs	T. L. Waggener			2¼
Grand Junction	E. R. Romberg	.5	40,000	1
New Mexico—				
Albuquerque	J. M. Gladding			1.5
Arizona—				
Phoenix	H. Turney	1.5	110,000	3
Utah—				
Logan	T. H. Humphreys			1
Salt Lake City	D. H. Blossom	2	206,458	
Pacific Division:				
California—				
Fresno	C. P. Jensen	1.1	60,337	2
Los Angeles	Homer Hamlin	37	1,500,000	35
Napa*	L. L. Jordan			
Pomona*	C. E. Bayley			
Redlands	J. S. Hinckley			2½
Richmond	W. S. Farley	18	105,000	15
Santa Barbara	S. J. Paul	1⅔		
San Bernardino	K. F. Tuttle	3	65,000	5
San Jose	F. W. McCarton	1.1	50,931	4
San Rafael	G. L. Richardson			1½
Santa Cruz	L. G. Williams	.4	6,325	2
Oregon—				
Ashland	F. E. Semon	5	250,000	
Baker	J. W. Bailey	3.4	207,388	1⅞
Medford		9.2	434,536	2¼
Portland	Tom M. Hurlburt	101	7,021,361	60
Salem	Walter Skelton		399,840	
Washington—				
Bellingham	W. H. North	1.3	70,216	4½
Centralia	Stanley Macomber		32,700	
Hoquiam	J. S. McCrossen	.6	60,000	
Seattle	A. H. Dimock	24.8	1,147,415	14
Spokane	Morton Macartney	21.2	1,351,483	
Vancouver	F. M. Kettenring			
Walla Walla	W. R. Rehorn			1

*For details of paving work done in 1911 see the other t

this issue.

TABLE SHOWING AMOUNT, AVERAGE PRICE AND SOME DETAILS OF BITUMINOUS MACADAM TYPES CONSTRUCTED IN 1911 IN A NUMBER OF CITIES.

	Sq. yds.	Av. price per sq. yd. including grading	Thickness, ins.	
New England Division:				
Laconia, N. H.	21,375	$0.712	6	
Barre, Vt.	[illegible]	.65	6	
St. Albans, Vt.	9,000	.96*	8	
Boston, Mass.	29,260	.85	6	
Cambridge, Mass.	45,118	.50		
Everett, Mass.	1,090[1]	1.[illegible]	5	
Holyoke, Mass.	27,253[2]	.64½	6	
Newburyport, Mass.	10,000	.60	6	
Westfield, Mass.	[illegible]	.96		
New London, Conn.	27,600	.90		
Middle Atlantic Division:				
Cortland, N. Y.	7,000		7-8	
Herkimer, N. Y.	16,594			
Hudson, N. Y.	3,500	.70	6	
Johnstown, N. Y.	12,600[1]	1.34	8	
Kingston, N. Y.	8,071	1.20	6	
Little Falls, N. Y.	2,800	1.50	6	0
Mt. Vernon, N. Y.	11,000	1.01	6[4]	
N. Tonawanda, N.Y.		1.57	12[5]	
Norwich, N. Y.	6,000	1.60	8	
Oneonta, N. Y.	4,000[6]	1.43	7	
Rochester, N. Y.	[illegible]	1.55	14	
Schenectady, N. Y.	8,304	1.52*	6	
Syracuse, N. Y.	2,657	1.39		1
White Plains, N. Y.	1,644	1.15	6	½
Elizabeth, N. J.	5,582	1.68	9	1
Kearney, N. J.	18,000	1.22	12	
Plainfield, N. J.	35,400	.75*		
Westfield, N. J.	7,300[7]	.74	4	1
Westfield, N. J.	11,600[7]	.89	6	1
Westfield, N. J.	[illegible]	1.18		1
Carlisle, Pa.	10,000	.74	10	
S. Bethlehem, Pa.	10,000	1.00		
East North Central Division:				
Galion, O.	11,207[1]	.77*	7½	
Hamilton, O.	4,233[8]	.73	8	2
Lima, O.	13,872	.92*		
Norwood, O.	30,000	1.00*	9	
Anderson, Ind.	4,792	1.00	8	0
Fort Wayne, Ind.	26,822[9]	.90*	9	2
Fort Wayne, Ind.	1,883[10]	1.35*	8½	3
Frankfort, Ind.	20,246	.99	8	
Hammond, Ind.	13,871	1.93	8	
Indianapolis, Ind.	8,609	[illegible]	9[11]	
Danville, Ill.	11,200	1.55	11	
Joliet, Ill.	12,000	1.30*	12	2
La Grange, Ill.	18,000	.44		
Oak Park, Ill.		1.72	8½[12]	
Springfield, Ill.	2,200[13]	1.75	7	
Waukegan, Ill.	23,400	.48		
Benton Hbr., Mich.	2,000	.90*	10	
Cheboygan, Mich.	3,000[15]	1.04½*	6	
Escanaba, Mich.	2,640[15]	.65*	8	
Gr'd Rapids, Mich.	9,807	1.00*	8	
Holland, Mich.	12,200[17]	1.27*	8	
Holland, Mich.	10,600[16]	1.09*	8	
Muskegon, Mich.	7,583[19]	1.27	7	
Muskegon, Mich.	1,800[7]	1.04		8
Pontiac, Mich.	9,085[20]	1.35*	8	10
Menasha, Wis.	7,560[21]	1.26*	9½	
Sheboygan, Wis.	15,700[7]	1.31	10	
Waukesha, Wis.	4,619	.77*	8	2
West North Central Division:				
Mankato, Minn.	6,196	.92	7	
Minneapolis, Minn.	11,700[15]	1.37	8	
Burlington, Ia.	1,698[22]	1.83	6	
Dubuque, Ia.	14,005	1.30	12	
Fulton, Mo.	12,500	.85*		
Jefferson City, Mo.	8,000	.95*	8	
Kansas City, Mo.	4,600	1.35	12	2
St. Charles, Mo.	2,800[23]	.69*	10	
Webb City, Mo.	39,058	.71	6	
Grand Forks, N. D.	8,187[24]	2.00	8	
South Omaha, Neb.	42,423[25]	1.90	7½	
Kansas City, Kan.		1.02[26]	12	
Manhattan, Kan.	70,000[27]	1.65	7	
Ottawa, Kan.	27,474	.98*	9	
Salina, Kan.	[illegible]	1.65*	7	
Topeka, Kan.	24,500[28]	1.60*	6	
Wichita, Kan.	4,383[25]	1.62*	7½	
South Atlantic Division:				
Danville, Va.	2,600		6	
Asheville, N. C.	4,328	1.10		
Greensboro, N. C.	3,600	1.25	8	
New Bern, N. C.	9,000	1.25	7	
Greenville, S. C.	20,108	.90	7	
Spartanburg, S. C.	2,000	.50	6	
Rome, Ga.	14,350[25]	1.83	7	1
East South Central Division:				
Owensboro, Ky.	10,500			
West South Central Division:				
New Orleans, La.	5,331[29]	2.74	8	
Durant, Okla.	9,250	1.58*	8	
Muskogee, Okla.	15,000[25]	1.80*	7	5
Muskogee, Okla.	30,000	1.10*	7	
Dallas, Tex.	20,746	1.30		
Longview, Tex.	5,000	1.40*	9	
San Antonio, Tex.	60,782	1.10	11	
Mountain Division:				
Boise, Idaho	9,877[26]	1.25*		
Pacific Division:				
Spokane, Wash.	56,567	1.25*		
Vancouver, Wash.	28,126	.65		
Medford, Ore.	28,058[18]	1.71*		
Medford, Ore.	31,285[18]	1.50*		
Salem, Ore.	40,000	1.68		
Eureka, Cal.	27,000	1.50		
Richmond, Cal.	93,745[26]	.76*		
Richmond, Cal.	21,055[31]	1.59*		
S'n Bernardino, Cal.	211,200	.72		

*Does not include grading.

[1] Bermudez bound. [2] Asphaltum binder. [illegible] crown, 4-in. edge. [4] 2-in. surface, 4-in. 1-2-[illegible] crete base; 5-year guarantee. [5] 3-in. crus[illegible] in. slag. [6] Tarvia. [7] Penetration method, [illegible] via. [9] Tarvia filled. [10] Bituminous concrete [illegible] 1-3-6 concrete base. [11] Includes 6-in. co[illegible] base. [12] Resurfacing with 2-in. [13] Minera[illegible] ber; 5-in. 1-6 gravel concrete base. [14] Res[illegible] ing; penetration method. [15] Asphalt pene[illegible] method. [16] Standard $1, open 65 cts. [17] As[illegible] concrete, 2-in. thick on 6-in. 1-3-7 concrete [illegible] [18] Asphaltic macadam. [19] Asphalt, ma[illegible] mixed on 5-in. 1-7 concrete base. [20] As[illegible] macadam on 6-in. 1-6 concrete base. [21] Ta[illegible] cadam on 6-in. 1-3-5 concrete base. [22] M[illegible] rubber on 4-in. 1-2-5 concrete base. [23] [illegible] binder. [24] Asphalt concrete—6-in. 1-7 co[illegible] base. [25] Asphaltic concrete—5-in. 1-3-6 co[illegible] base. [26] Oil macadam. [27] Asphaltic concre[illegible] in. 1-2-5 concrete base. [28] Asphaltic conc[illegible] 4-in. 2½-5 concrete base. [29] Mineral rub[illegible] concrete base. [30] El Oso asphalt—4-in. cr[illegible] rock bituminous base. [31] Asphalt concrete.

TABLE SHOWING AMOUNT, AND AVE PRICE OF WATERBOUND MACA CONSTRUCTED IN 1911 IN A NUMBE CITIES.

	Sq. yds. including grading.	Av. price per sq. yd.	Thickness, ins.
New England Division:			
Barre, Vt.	4,103	$0.45	6
St. Albans, Vt.	10,000	.60*	8

Vt..	4,175	[illegible]	8	
	30,75[illegible]	[illegible]	6	
Mass...	4,120	.35		
	10,9[illegible]	.40		
Mass...	15,300			
ass....	37,4[illegible]			
Mass...	5,000	1.00		
	21,957	.85		
	100,000			
d. Mass.	83,4[illegible]		12	
Mass..	[illegible]			
Mass ..	[illegible]			
ass....	[illegible]	.67		
ss	2,524[3]			
Mass ..	[illegible]	.93	6-8	
de e, R. I	26,844	[illegible]		
R. I.	3,54[4]		6	
on, Conn	1,534	[illegible]	8	
arc Division:				
N. Y..	8,000	.95	8	
rg N. Y...	14,000	.80	6	
N. J..	9,02	1.00*	12	7
J. .	27,300	.52*	4[5]	
J...	10,300	.50*	4	
J. .	4,926	[illegible]	8	1
J. .	21,600	.58	6	1
J.....	13,[illegible]	.40	4	1
N. J.	31,000	[illegible]	[illegible]	
	15,000	.34	8	
entral Division:				
	[illegible]			
Ind	10,000	.45	10	
	51,245	.85*		
Ind .	[illegible]	1.05	10	
	9,8[illegible]	.85		
d. nd....	16,259	.75	8	
Ind	10,000	.70		
l......	18,963	.54*	8	
		[illegible]		2
......	57,420	.44	9½	
Mich	5,000			
Wis	11,154	[illegible]		1
	[illegible]	.55		
Wis	11,790			
Wis .	4,600[6]	1.01	12	
Wis .	20,100[7]	.69	10	
is....	7,866	1.05	12	
is.......	2,367	.48	9	
entral Division:				
	36,000	.90	[illegible]	2
	[illegible]	.....		
Mo .	9,400	.30*	8	
	32,900			
Kan....	[illegible]	.50	6	[illegible]
	[illegible]	.64*	9	
arc Division:				
, D. C...	36,387	.87*		
	17,[illegible]	.37		
, S. C...	25,000	.30*	6	
h entral Division:				
	15,000	.80	6½	
K.	7,400			
entral Division:				
	12,[illegible]	1.05	9	
ision:				
	7,936	.99	[illegible]	
olo.......	3,420	[illegible]	6	
on:				
Wash .	17,413		7	
	26,233	.75*	10	
	14,400			
	20,000		8	
, Cal.	72,686[9]	1.59*	7	
, Cal....	8,786	.72*	8	

[illegible] grading
[illegible] Surface treatment [3]Cu. yd
[illegible] 7-in. [illegible]Granite top macadam
[8]6-in. to 10-in. [9]Oiled macadam.

Joted in a Tar Exposed to
and Weathering When
d in a Road Surface.

[illegible] are available as to the
ch actually take place in a bitumi-
al when exposed to traffic and
n a road surface. For that rea-
by W. W. Crosby, Chief Engi-
Maryland States Roads Commis-
ed at the Washington meeting of
an Association for the Advance-
ence, is of more than general in-
is paper, which is printed below
full, Mr. Crosby gives the results
le under his direction, on a refined
ad been in service on a road for
ears.

mmer of 1908, a section of lime-
lam was laid and partly water
ding to modern methods, and then
the writer with a coat of refined
tly a mixture of water and coal
follows:

dam surface was thoroughly swept
fine material and until the inter-
en the larger stones composing the
e empty to the depth of about ½
l the dislodgment of these larger
d have immediately ensued. Over
surface was then spread (by grav-
of the tar heated to a temperature
0° F. in an amount of about 1 gal.
The tar was broomed to ensure an
ution and allowed to then remain

TABLE [illegible] PRICE AND SOME DETAILS OF CONSTRUCTION [illegible] PAVEMENT LAID IN [illegible] IN [illegible] CITIES

						Portland Cement Concrete base	
New England Division:							
[illegible]		Cement	$2.24				
[illegible], Vt.	3,263	Cement	[illegible]			[illegible]	1-3-6
Boston, Mass.	19,615[1]	[illegible]	2.65		13	[illegible]	1-3-7
Cambridge, Mass.	12,790		3.80		13	6	1-3-6
Everett, Mass.	7,132[2]		3.33		11		1-2-5
Holyoke, Mass.		Cement	2.85		10	[illegible]	1-3-6
Lawrence, Mass.	1,034[4]	Grout	2.67			6	1-3-6
Lowell, Mass.	[illegible]	[illegible]	3.15			[illegible]	1-4-10
Lynn, Mass.		[illegible]			12	6	1-2-4
Newburyport, Mass...	18,271	[illegible]	[illegible]		[illegible]		
Westfield, Mass.		[illegible]	[illegible]				
Worcester, Mass.		Cement	2.63		10		
East Providence, R.	14,470	Sand	2.20				
Providence, R. I.	[illegible]	Pitch[3]			11		
[illegible], Conn.		Sand	3.85		13	6	1-3-6
[illegible], Conn.	7,900	Cement	3.13			6	1-2-6
[illegible], Conn.	1,753	[illegible]	2.67	[illegible]	11	[illegible]	
Middle Atlantic Division:							
Auburn, N. Y.	2,990[10]	Cement	3.31*		[illegible]	[illegible]	1-3-6
Buffalo, N. Y.	[illegible]	[illegible]	[illegible]	10	[illegible]	6	1-10
Little Falls, N. Y.	[illegible]	Asphalt	3.50		14	6	1-3-6
Rochester, N. Y.	22,489[10]	[illegible]			[illegible]	6	1-3-6
Syracuse, N. Y.	2,030[12]	Grout	3.18			[illegible]	1-3-6
Utica, N. Y.		Cement				6	1-3-7
Watervliet, N. Y.	7,100[3]	[illegible]	3.19		[illegible]	6	1-3-6
Elizabeth, N. J.	3,228[14]	[illegible]	1.80	[illegible]	12		
Jersey City, N. J.	22,959	[illegible]	1.50*		[illegible]		
Kearney, N. J.	2,400[15]	[illegible]	1.47				
Newark, N. J.	79,506[3]	Grout	3.10		[illegible]	6	1-3-6
Pittsburgh, Pa.		Asphalt[17]	2.00*	[illegible]	15	6	1-3-6
Scranton, Pa.	1,160	[illegible]	1.96				
Wilkesbarre, Pa.	279	[illegible]	3.10		12	6	[illegible]
Williamsport, Pa.	810	Gravel	2.25		[illegible]		
East North Central Division							
Ashtabula, O.	3,787[9]	[illegible]	2.90*		[illegible]		
Cleveland, O.	[illegible]	Tar[19]	3.15*			6	1-3-6
Columbus, O.	4,537[20]	Grout	3.50*		13	[illegible]	1-3-7
Detroit, Mich.	1,440[1 21]	Grout	3.80		[illegible]	6	1-3-6
West North Central Division:							
Minneapolis, Minn.	4,128[1]	Sand	[illegible]		7[22]		
Kansas City, Mo.	23,000	Cement	2.98		13	6	1-3-6
St. Louis, Mo.	23,698[1]	Sand	2.60*		[illegible]	6	1-4-7
Omaha, Neb.	12,900						
South Atlantic Division:							
Baltimore, Md.	11,079	Cement[23]	3.61*		[illegible]	6	[illegible]
Danville, Va.	[illegible]	Sand			[illegible]		
Charleston, S. C.	3,209[7]	Sand					
Mountain Division:							
Salt Lake City, Utah		Grout	4.00		13	6	[illegible]
Pacific Division:							
Seattle, Wash.	12,956[1]	Grout	3.80*		[illegible]	6	1-4-7
Seattle, Wash.	31,559[12]	Grout	3.50*		13	6	1-4-7
Portland, Ore.	111,662[24]	Cement	3.50*[25]		11	6	1-3-5

*Does not include grading. †Laid by city.

[1]Granite. [2]Special granite. [3]Pitch pebble. [4]3½x6x4-in. block; 9,631 sq. yds. laid by city labor, part of this being of old blocks. [5]Also 2,886 sq. yds. reset, using pitch filler. [6]Hassam foundation. [7]Recut blocks. [8]Block 6-in. by 8-in. [9]Medina. [10]Includes grading, curbs, etc., complete. [11]13-in. and 14-in. [12]Sandstone. [13]Railroad strip. [14]Belgian. [15]6-in. sand base, 6-in. block. [16]Re-clipped granite laid on sand base. [17]10 per cent retained for 9 months. [18]3-in. granulated slag. [19]Tar, cement. [20]Salisbury granite. [21]Repaving, also 24,674 sq. yds. resurfacing at $2.90. [22]On sand. [23]Bituminous and cement. [24]Basalt rock. [25]$3.50 to $4.

TABLE SHOWING AMOUNT, AVERAGE PRICE AND SOME DETAILS OF WOOD BLOCK PAVEMENT LAID IN 1911 IN 42 CITIES.

						Portland cement concrete base	
New England Division:							
Boston, Mass.	[illegible]	Grout	$3.25		10½		1-3-7
Springfield, Mass.	[illegible]	Sand	3.09		[illegible]	5	1-3-6
Bridgeport, Conn.	52,050	Sand	3.11	[illegible]	10½	6	1-2-6
Waterbury, Conn.	3,592	Cement	3.55			6	1-3-6
Middle Atlantic Division:							
Rochester, N. Y.	[illegible]	Grout	2.77		10	[illegible]	1-3-6
Asbury Park, N. J.	10,000		2.55		[illegible]	[illegible]	1-3-6
Jersey City, N. J.	[illegible]	Grout	3.15*		[illegible]		1-3-5
Chester, Pa.	36,730	Grout	2.74	10[2]	10	6	1-3-6
Pittsburgh, Pa.	[illegible]	Grout		[illegible]	10	6	1-3-6
East North Central Division:							
Cleveland, O.	[illegible]	Sand	2.97*			6	1-3-6
Delaware, O.	[illegible]	Pitch	2.39*		10	6	1-3-6
Indianapolis, Ind.	2,040	Tar	2.75			6	1-8
Peoria, Ill.	[illegible]	Pitch	2.50	1	11	6	1-3-6
Detroit, Mich.	1,849[4]	Tar	3.84		12	6	1-3-6
Sheboygan, Wis.	1,490[6]	Pitch	1.72	[illegible]		6	1-3-5
Superior, Wis.	3,500	Bitumen	2.60*		9		1-3-5
Wausau, Wis.	10,660	Pitch	2.53			6	1-2-4
West North Central Division							
Mankato, Minn.	[illegible]	Pitch	2.38	[illegible]	10	[illegible]	1-3-6
Minneapolis, Minn.	[illegible]	Pitch	2.70[9]		10	[illegible]	1-3-5
Cedar Rapids, Ia.	[illegible]	Tar	2.10*[10]				
Mason City, Ia.	[illegible]		[illegible]	5	[illegible]		1-3-6
Waterloo, Ia.		Asphalt					.....
Kansas City, Mo.	20,000[11]	Sand	3.05	5	[illegible]	6	1-3-6
St. Louis, Mo.	[illegible]	Sand	2.60*	[illegible]	10½	6	1-4-7

						Portland cement	
[illegible]	[illegible]	[illegible]				....	....
[illegible]	[illegible]	[illegible]			[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
South Atlantic Division:							
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]
Americus, Ga.	36,000	Sand	2.21*	0	8	4	1-3-6
[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]		[illegible]
East South Central Division.							
[illegible]		[illegible]					[illegible]
[illegible]	[illegible]	[illegible]					
West South Central Division:							
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
[illegible], Tex.							
[illegible], Tex.		Sand	[illegible]	[illegible]	[illegible]		[illegible]
[illegible], Tex.	[illegible]	Sand	[illegible]	[illegible]	[illegible]		[illegible]
[illegible], Tex.		[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
[illegible], Tex.	[illegible]	Sand	[illegible]		[illegible]		[illegible]
[illegible] Falls, Tex.	[illegible]	Sand	[illegible]		[illegible]		[illegible]
Mountain Division:							
Great Falls, Mont.	[illegible]		[illegible]	[illegible]	1	[illegible]	[illegible]
Pacific Division:							
Spokane, Wash.	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]
Portland, Ore.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Does not include grading.

[1]Two applications of cement grouting: 1-2 and then 1-1. [2]10 years for city's share, 5 years for traction company's share. [3]3-in. yellow pine block, 16 lbs. treatment. [4]Also 182,390 sq. yds. new cedar block pavement at $[illegible]; [illegible] sq. yds. creosoted wood block repaved at $[illegible] and 2,592 sq. yds. cedar block repaved at $2.10; 37,902 sq. yds. creosoted wood block resurfaced at $2.59, and 3,248 sq. yds. cedar block resurfaced at 60 cts. [5]Tar and gravel. [6]6-in. cedar block. [7]3-in. creosoted block. [8]Creosoted southern pine. [9]$2.70 on 4-in. block, $2.45 on 3½-in. [10]$2.10, $2.15 and $2.70. [11]20-lb. treatment. [12]1½ miles to be laid 3-in. x 4-in. x 6-in. to 10-in. block used. [13]Creosoted yellow pine, 16 to 18-lb. treatment. [14]Treated with Avenarius Carbolineum, 3½ lbs. to the cubic foot.

TABLE SHOWING AMOUNT AND AVERAGE PRICE OF BITULITHIC CONSTRUCTED IN 1911 IN 30 CITIES.

	Sq. yds.	Av. price per sq. yd., including base and grading.	Guarantee, years.	Price per sq. yd. for grading if paid separately.	Total thickness of pavement, ins.	Portland cement, concrete base. Thickness, ins.	Proportions.
New England Division:							
Cambridge, Mass.	[illegible]	$2.75	[illegible]	...	[illegible]	5	1-3-6
New Bedford, Mass.	30,077	$2.40*	[illegible]	[illegible]	6	4	1
Springfield, Mass.	9,886	2.60	[illegible]		[illegible]	5	1-3-5
Middle Atlantic Division:							
Herkimer, N. Y.	6,786	2.15			6	4	1-3-6
Little Falls, N. Y.	7,300	2.65	[illegible]		8	6	1-2½-5
Utica, N. Y.	3,220		[illegible]		..		.
Utica, N. Y.	7,641[2]	1.55	[illegible]				.....
Harrison, N. J.	3,061	[illegible]	[illegible]		8	6	1-3-6
Kearney, N. J.	16,705	[illegible]		.	8		1-3-6
Newark, N. J.	119,961	2.13			8½	6	1-3-6
York, Pa.	7,670	[illegible]	[illegible]		8	6	1-3-6
East North Central Division:							
Mishawaka, Ind.	21,137[4]	1.69*		.35	7	5	1-7
West North Central Division:							
St. Louis, Mo.	70,677	1.95*	[illegible]	[illegible]	7		1-4-7
Emporia, Kan.	34,000	1.48*	[illegible]	.40	6	4	1-2½-5
Kansas City, Kan.	2.36[6]	1.99			6	4	1-8-6
South Atlantic Division:							
Portsmouth, Va.	64,[illegible]	2.07			7		1-3-6
Asheville, N. C.	9,185	2.12	[illegible]	[illegible]	7	5	.....
Columbia, S. C.	16 837	2.12	[illegible]	.	7	5	1-3-6
West South Central Division:							
New Orleans, La.	19,[illegible]	2.95	[illegible]	.	8	6	.....
Bartlesville, Okla.	3,[illegible]	[illegible]	[illegible]		[illegible]	4	1-3-6
Dallas, Tex.	73,[illegible]	2.30	[illegible]	.....	7		1-8
Greenville, Tex.	[illegible]	2.29*		.30	[illegible]		1-8
Mountain Division:							
Missoula, Mont.	13,100[8]	2.35*	[illegible]	.60	8		.
Twin Falls, Idaho	89,000	2.40*		.70	6		.....
Phoenix, Ariz.	....	2.09		...	7	5	.....
Pacific Division:							
Centralia, Wash.	14,900	2.19*	[illegible]	.35	6		..
Hoquiam, Wash.	8,965	2.45*	[illegible]	.	8	6	1-2½-7
Vancouver, Wash.	35,[illegible]	1.95*		[illegible]	6		.
Ashland, Ore.	100,000	2.00*		.50	6		.
Baker, Ore.	95,141	2.02		.	7		
Portland, Ore.	753,[illegible]	1.85*		.40	6[9]		
Salem, Ore.	59,[illegible]	1.85*		.60	[illegible]		

*Does not include grading.

[1]Nat. Cement Users' Ass'n specifications. [2]Resurfacing. [3]$2.19-$2.28. [4]Awarded fall of 1911. [5]30 cts. to $1.00. [6]Miles. [7]6-in. to 8-in.; 4-in. to 6-in. concrete base. [8]Contract let in 1911—6-in. crushed rock base, 2-in. top. [9]4-in. broken stone base, 2-in. top.

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untouched for from four to five hours in order to secure what penetration was possible. Then a layer of clean stone chips passing a ¾ in., and remaining on a ¼ in. screen, was evenly spread over the tar. The road was then smoothed by one or two passages of a 10-ton roller and opened to traffic. The resulting surface became in a few days similar in appearance to that of a bitulithic street, and has proved entirely satisfactory ever since. The first winter some complaints were heard as to its slipperiness, but this was probably due to the fact that it was the only piece of tarred road in the vicinity and horses had to become accustomed to it.

The road was the main entrance to a private estate and the traffic over it, though occasionally of heavy weight, was infrequent. The weather was favorable during the progress of the work, being hot and dry all the time.

Since its treatment, and to da
nance has been accorded the roa
face today seems almost the sa
was a month after its complet
spots, in the center of the roa
has worn through so that the
macadam are visible. These sto
are tight and there is apparentl
tegration of the carpet around
such spots. Except for these, wh
the shod feet of horses have
relatively thin places, the carpet
fairly intact.

In the winter of 1911-12, the w
some pieces of the carpet from th
road. It was difficult to remov
carpet from the macadam witho
jury to the latter because of the
of the whole mass. The pitch s
and "live" in the fractures. Fr
ples, bituminous material was re
use of extractors and hot benzi
tractor consisted of a tinned
about 3½ ins. in diameter and
with a coil of copper pipe attach
top to act as a condenser. Ins
was suspended from the coil a
ins. in diameter and 10 ins. long,
ends. On the lower end was
means of strings, two thicknesse
with filter paper between. The
which the bituminous material w
tracted was broken up and placed
cylinder. In the bottom of th
placed about 450 C. C. of C. P
benzine used was guaranteed CP
makers, but as an additional p
was distilled previous to use
"Hempl" rectifying column 2½ ft

A number of the extractors
were used, placed tied together
bath to a depth of about 3 ins., a
kept boiling during the extractio
traction was continued for about
was apparently complete, any
which may have been in the com
held in the road material or aggre

The benzine solution of the bitu
terial extracted was then transf
large Engler flask, and the latter
an oil bath up to the side tube.
was heated gradually to a tempera
C., and held there until no furth
was obtained. To obtain carbon
nous material from the original ta
contain 14 per cent free carbon,
tar was mixed with Ottawa sta
and then the extraction proceeded
the case of the samples from the

The Table I will show th
nations obtained, first, on the or
pound; second, on the carbon free
material of the original compound
on the carbon free bituminous
tracted from the road surface after
of exposure and use.

On comparing these analyses, the
between the figures given for the
terial (carbon free basis) and for
extracted from the road surface,
ally to be according to reasonable
except as to the lowering of the m
The lighter or more volatile cons
the original pitch seem to have pas
the pitch to have become heavier,
more permanent and harder. Th
of the melting point appears at first
It is suggested that this may be acc
by oxidation that occurred in the
ing point constituents of the pitch w
merization resulting. Mr. W. H
reports a similar lowering of the m
of water gas tar being obtainable
ing such material to blowing with
such an explanation seems probabl
more to be regretted that the "fr
compound of the weathered pitch h
so far obtainable.

It was anticipated that some, ev
approximate, determination of the
bon" content of the road surface
posure and use would be most inter
every effort was made to arrive at
in this respect but without any s
would seem to justify the publicat

WING AMOUNT [illegible] MENTS CONS[illegible]TED IN 1911 [illegible]

Division:						
[illegible]						1-2-4
Division.						
J.	2,826	Mix.	1.44	1		
ntral Division:						
[illegible]						1-6
[illegible]	13,000	Mix.	1.30			1-6
[illegible]		Mix				
ls, Ia.	2,178	Mix.	1.16			1-3-5
Ia.	7,900	Mix.	1.60	5		1-3-5
[illegible]						1-3-5
[illegible]						1-2-5
[illegible]					6	
[illegible]						1-2-4
[illegible]						1-7
[illegible]						1-2½-5
[illegible]						1-2-3
[illegible]	2,137	Mix.	1.00*	2	6	1-2-4
tral Division:						
entral Division:						
[illegible]					6½	1-6
[illegible]	23,166	Mix.	1.12		6	1-3-5½
on, Colo.	18,000	Mix.	2.20		7½	1-3-6
n:						
[illegible]					6	
[illegible]						1-3-5
Wash.	15,520	Mix.	1.15		5	
[illegible]		Mix				
[illegible]						1-2-4

[illegible] surface. [2]5-in. base 1-3-5 mix; 2-in. top of 1 cement, —1 small gravel -1 sand [illegible] wearing surface. [4]5-in. base 1-2½-5; 1½-in. top, 1 cement, 1 sand, 1 gravel. [illegible] 1-3-5; -in. top [illegible] [10]6-in. and 8-in. [illegible]

e of the mineral aggregate from [illegible]ved of the bituminous cement, [illegible] the carbon determined by com[illegible]ous portions, but without con[illegible]s. Further, it was apparent that [illegible] cellulose in a considerable [illegible] in the finest portions. The at[illegible]le to float out the cellulose but [illegible]s and the same apparent failures [illegible]ts to dissolve out the cellulose [illegible]al cupric oxide and other re[illegible]ly some other investigator may [illegible] light on the important question [illegible] "free carbon" is really formed [illegible]materials under similar condi-

[illegible]g the figures of the analyses [illegible]ill be noted as a most remarkable [illegible]he initial boiling point of the ex[illegible]n in each case is much lower [illegible]e normal compound which lat[illegible]4 per cent free carbon. Dupli[illegible]s and distillations of the com[illegible]ade for the purpose of checking [illegible] in this regard, and their correct[illegible] assured. In order to check still [illegible]s point, 14 per cent of free carbon [illegible] to a new sample (70 grams) of the [illegible] material secured by the removal of [illegible]arbon" from the original pitch and [illegible]tillation of 50 grams of the product [illegible] smaller flask with the following

ing point.................... 143° C.
erature to 105° C............ None.

[illegible] the opinion of the writer, held for some years in spite of reputable statements to the contrary, is that the distillation of bituminous [illegible] ence of "free carbon" and he thinks confirmation of this is had in the foregoing.

The writer hopes that the above may prove of sufficient interest to warrant further investigations along these lines, and in this connection, would suggest the possible advisability of making a secondary analysis of all bituminous materials containing appreciable amounts (say over 5 per cent) of free carbon contemporaneously with the usual determination on the normal materials, including the portion insoluble in carbon bisulphide. From the foregoing, it may be seen how some advantage could be had, at least in the comparisons with later analyses of the used material, were the determinations also made on the bitumen relieved of the free carbon. Some years ago, the writer considered this point, but at that time was led to adopt the determination of characteristics on the normal or complete material, partly at least because of the then admitted uncertainty as to the effect of the presence of the so-called free carbon. There exists some opinion that the free carbon is simply an inert material present perhaps as a filler at most, but apparently from the above this opinion may be questioned.

National Drainage Congress.—This congress organized last November at the meeting in Chicago of the National Irrigation Congress will hold its annual convention in New Orleans, La., on April 10 to 13, 1912. The objects of this Congress are:

(1) To obtain National appropriations for the carrying on of a definite policy for the conservation of the flood waters of the Mississippi Valley for navigation, irrigation and power, and the maintenance of the outfalls and natural drains for the purpose of drainage as is embodied in the Newlands Bill.

(2) To promote a National policy for draining the wet lands of this continent on similar lines to the work carried on by the Government in the irrigated lands of the West.

TABLE I.

Determinations made on lines proposed by Special Com. Am. Soc. C. E.	First sample of tar-normal compound.	First sample of tar carbon free basis	Ext. from road surface carbon free basis.
Water soluble material	None.	None.	None.
Free carbon insoluble in carbon bisulphide	14%	....	....
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	
Viscosity at 100° C. (Engler)	25.6	15.7 sec.	25 sec.
Viscosity at 25° C. (Lunge)	6.4	....	3.8
Viscosity at 25° C. (Engler)	....	172.8 sec	
Loss on evaporation at 105° C. 3½-in. dish, 21 hrs.	27.75%	38.20%	19.35%
Penetration of this residue at 4° C	Hard.	Hard.	Hard.
Penetration of this residue at 25° C	Hard.	Hard.	Hard.
Melting point of this residue	50° C.	50° C.	38° C.
Loss on evaporation at 170° C. 2½-in. dish, 3 hrs.	24.80%	37.65%	16.15%
Loss on evaporation at 170° C. 2½-in. dish, 5 hrs.	29.80%	45.00%	21.75%
Penetration of this residue at 4° C	Hard.	Hard.	Hard.
Penetration of this residue at 25° C	Hard.	Hard.	Hard.
Melting point of this residue	69° C.	81° C.	48° C.
Loss on evaporation at 205° C. 2½-in. dish, 3 hrs.	25.75%	38.25%	17.30%
Loss on evaporation at 205° C. 2½-in. dish, 5 hrs.	32.25%	45.50%	23.15%
Penetration of this residue at 4° C	Hard.	Hard.	Hard.
Penetration of this residue at 25° C	Hard.	Hard.	Hard.
Melting point of this residue	76° C.	88° C.	51° C.
Initial temperature of distillate	165° C.	128° C.	136° C.
Room temperature to 105° C	None.	None.	None.
105° C. to 170° C	1%	8%	7.3
[illegible]	[illegible]	[illegible]	[illegible]
225° C. to 270° C	14%	14%	3.1%
270° C. to 300° C	4%	8%	3.1%
Loss on evaporation at 105° C. 3½-in. dish, 5 hrs.	19.10%	25.65%	10.65%
Penetration of this residue at 4° C	21	55	37
Penetration of this residue at 25° C	Soft.	Soft.	Soft.
Melting point of this residue	23° C.	Soft.	Soft.
Crosby's Consistometer at 25° C. No. 12 Special* [illegible]	[illegible]		...
Crosby's Consistometer at 25° C. No. 12 Special* [illegible]		[illegible]	....
Crosby's Consistometer at 25° C. No. 12 Special* [illegible]		[illegible]	[illegible]

*On compound after evaporation

NOTE:—All penetrations given are with No. 2 Standard Needle, 100 gram load. Distillation [illegible]

WATER SUPPLY, SEWERAGE AND SANITATION SECTION

Toronto Refuse Disposal.

The concluding article relating to the economic study of alternate methods considered for the disposal of the refuse of the city of Toronto was crowded out of this issue on account of the large space devoted to road and street statistics. The article will be published next week.

Methods and Cost of Relining a Brick-Lined Reservoir with Concrete.

A problem of frequent occurrence in the maintenance of water works properties arises from the necessity of repairing and relining brick-lined reservoirs of the earth embankment type. This relining is now usually constructed of concrete. A reservoir of the type named, at Bellevue, Pa., was relined with concrete. A description of the methods used on the work was contributed to The Cornell Civil Engineer of January, 1912, by Mr. Thomas Fleming, Jr. The following description is taken from that periodical. The specifications and cost data were contributed to Engineering & Contracting by Mr. Fleming.

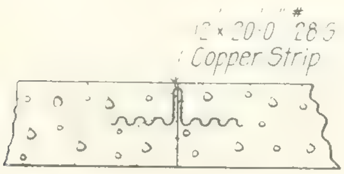


Fig. 1—Sketch Showing Method of Making Copper Joints Between Sections of Concrete.

It was customary 10 or 15 years ago to construct reservoirs with earth embankment and line them with brick. These linings in many instances answered the purpose where an absolutely water tight structure was not essential. Water tight reservoirs of earth embankment design are now invariably lined with concrete.

The reason for the failure of the old type of reservoir to be water tight was, as a rule, absence of expansion joints, lack of homogenity in the lining, porosity of the lining or unequal settlement of earth embankment.

Expansion joints were not used as the theory was that the joints between the bricks would open an infinitesimal amount, thereby taking care of contraction but not to such an extent as to permit leakage. This result was not obtained in practice. In the Bellevue reservoir, to be hereafter described, there was very little leakage in the summer months but several hundred thousand gallons per day in the winter and this in spite of the fact that the brick work consisted of a 2-ft. vertical wall circular in plan and backed with an earth embankment so that there was outside pressure against a masonry arch.

Probably the most serious item is lack of homogenity of material. The slightest settlement in an earth slope embankment at any point is very likely to cause the brick work to settle at the same point and to open the joints between bricks. Where concrete slabs are used, the slab will arch over any small settlement and it will take considerable settlement to break the lining.

As concrete is the material that has proven so successful in new construction, it is naturally looked to for remedying the faulty construction in old work. It is especially adapted to lining work as it is comparatively cheap, can be made impervious when properly placed, can be placed in large units not subject to small settlements in foundation, and can be provided with expansion joints.

Where the old lining has a good foundation and has not settled too unequally it will furnish an excellent backing for a concrete lining. This should be placed in blocks 8 ft. square and 6 ins. thick. The blocks should be laid in checker board style with alternate blocks first and with balance of blocks after the first set have completely set up. There should be a 3-in lap joint left on the bottom of the first set of blocks and a ⅜-in. opening above this along between the adjacent blocks. After the second set of blocks has been poured, the ⅜-in. groove should be filled with a suitable asphaltum compound. The tops of all blocks should be finished with cement mortar before they have set up and this really forms the impervious coating to the concrete.

However, all brick-lined reservoirs do not have flat paved slopes. The Bellevue reservoir of the Ohio Valley Water Co., which supplies a large suburban territory west of Pittsburg, consists of an earth embankment with a vertical lining of brick masonry 2 ft. thick. The reservoir is 130 ft. in diameter and 20 ft. deep. It rests on solid rock foundation which several years ago was covered with a concrete floor. It has a capacity of 2,000,000 gals. The lining consists of brick masonry laid up with mortar joints and is 2 ft. thick. It is backed as previously stated by an earth embankment.

During the winter season the joints between the bricks opened up enough to allow as much as 400,000 gals. per day to leak out. An examination showed that this leakage must be through many infinitesimal cracks in the joints between bricks as there were no well defined points of leakage. The exterior embankment appeared to be in good shape and the leakage appeared to work down next to the wall to the shale formation below and thence through seams in the shale to a nearby ravine.

While the leakage was not seriously threatening the stability of the reservoir, yet it was a serious proposition financially. The cost of pumping water at this plant against the high head (480 ft.) prevailing, was at that time 3 cts. per 1,000 gals. This cost includes only fuel and labor. It was estimated that the leakage averaged 100,000 gals. per day per annum, which amounted to a financial loss of $3 per day, or $1,095 per year. This capitalized at 8 per cent would represent an investment of $13,688.

Several schemes were proposed to stop this leakage, some of them involving patented waterproofing methods, but it w finally cided to reline the reservoir with 8-in. c crete lining. This lining was d gned to constructed in sections 29 ft. lon horizonta and extending the full vertical ight of reservoir. The sections were c nected metal expansion joint. This s ma thin sheets of copper of No. 28 ge 12 20 ft. The sheet of copper w corr and then folded at the center f a wi 4 ins., as shown in Fig. 1. One ge serted in the section to be built w adjacent section was construct the edge was inserted in it, leaving tween the faces of the adjacent stion sections were built alternately. he panying illustration, Fig. 2, show used by the contractor in handli There were forms for four sec ns the work could progress cont took a day to pour one section a section was being poured, the ca bracing the section for the nex and laborers were removing for tions that had been poured two and were setting this form for low two days later.

The form for each section wa in one piece with vertical struts tal nailing pieces. These nailing 2 ins. x 12 ins., cut to the arc and spaced 2 ft. c. to c.; 1-in. nailed to these vertically and 2 struts also vertical were spaced of the form 5 ft. c. to c. The nailed to these struts. The stated that the contractor must holes in the concrete floor for bracing form work. Heavy piec were therefore laid on the floor voir entirely across it and braced wall on the opposite side. The were then nailed to these timbers tion was poured in one day was a 1:2:4 mixture and was pla thoroughly spaded. The filling slowly so that the concrete in of the section would attain its before the pressure from above c a deformation of forms. Upon th tion of a section it was allowed to days before removing the form. T was then gone over with tools, imp removed, and a thin coat of liqu grout was applied. Upon the com

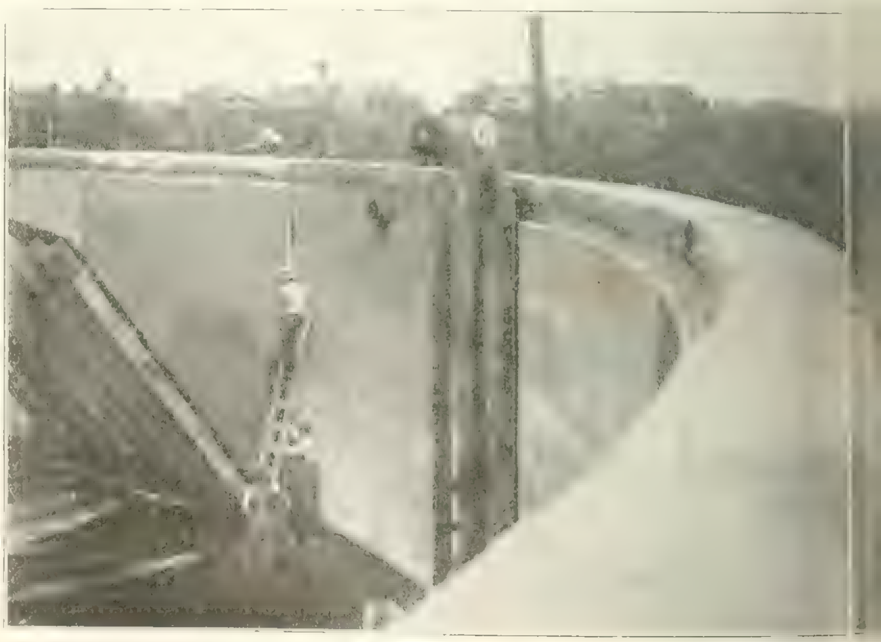


Fig. 2—View Showing Original and Lined Surface of Reservoir and Methcd of ndli Forms.

test showed that [illegible]
water tight. The work had
[illegible] 24 days [illegible]
contract as while the reservoir
mmission it was necessary to
nto the mains, which is a dif-
ler conditions existing at this
work was promptly executed
tor within the contract period.
of the work was $2,028 so that
[illegible]
ars. The contractors were Pihl
Pittsburgh. The engineering, in-
and supervision of construc-
led by the firm of Chester &
[illegible]

ls were received on two types
e first was for lining the old
an 8-in. lining of concrete, and
[illegible]
and 4 ins. of brick, the brick
pe to replace the forms neces-
former type. The all concrete
rable and the bids received for
n were somewhat lower than
for the combination type. An
specifications for both types of
h bids were received follows:

[illegible]
e-brick as hereinafter outlined.
ng.—The concrete lining is to
t Portland cement. 2 parts sand,
el accurately measured by vol-
[illegible]
hole mixture turned until every
[illegible]
ncrete work on the finished sur-
irly smooth and in good condi-
end proper care must be used in
[illegible]
st be used after its initial set
and no retempered concrete will
concrete is to be placed in sec-
[illegible]
nt from bottom to top of reser-
width of 12 ins. A hollow groove
the joint throughout its entire
o be 3 ins. by 3 ins. in cross
roove is to be filled with clay
section of concrete is built, and
plate is to pass through the
groove. Each section is to be
ver four pourings and must be
o form one continuous section.
the surface of the horizontal
[illegible]
pouring and before the second
it is to be thoroughly cleaned and
th cement grout.

[illegible]
sed it is to consist of a 4-in.
[illegible]
ervoir and the space between is
[illegible]
reservoir is to be cleaned as pre-
ified. The brick work is to be laid
[illegible]
ment and two parts sand. The joints
[illegible]
be laid so as to have full mortar
ottom and ends. Before laying all
be dipped in water. The joints are
truck but are to be left rough so as
with the concrete mortar and the
he concrete is to be deposited in
ayers as previously specified for con-
but no expansion joints will be used.
e of the brick work on the interior
rvoir is to be plastered with cement
sisting of one part cement and two
[illegible] mortar is to be applied
will be a minimum thickness of ½ in.
rface is to be left smooth. Mortar
plied as soon as mixed and no mortar
begun its initial set or which is re-
will be permitted to be used.

Suitable form work must be provided [illegible] forms must be securely braced so that there [illegible] insufficient, he shall have full authority to order [illegible] accurately set to line and the surface of the [illegible] they will not injure the surface of the concrete. In case lumber is used the surface should be planed on the side exposed to the concrete. All forms are to be made tight so that no cement mortar will leak out. Forms may be removed as [illegible] any possibility of injuring the surface of the concrete. The water company will not permit existing floor of the reservoir to be cut for placing forms.

The following costs do not include over- [illegible] B. M. of old lumber which was used for form work in addition to the lumber itemized in the list given. The cost of material was much higher than usual, due to the fact that it was necessary to haul it all several miles up a very steep grade where it was necessary to use extra teams for a part of the distance. Prices quoted for hauling were 25 cts. per barrel for cement and $2.10 per 1,000 for brick. There was a total of 201⅔ cu. yds. of concrete used.

[illegible]

Item.		Per cu. yd. concrete.
[illegible]	[illegible]	
[illegible]	[illegible]	
276 tons gravel at $1.45, delivered	400.20	....
Total concrete material........$	928.15	$4.60
4 M. ft. of 1-in. boards at $22.....	88.00	
Tools and lumber................	55.00	
Nails, oil, supplies and incidentals	18.50	
Total form mat'l and incidentals $	161.50	$0.80
[illegible]	[illegible]	
[illegible]	[illegible]	
Labor at $1.85 per day...........	297.30	
Finishing and cleaning up........	54.16	
Total for labor........	$ 761.60	$3.77
Total cost of lining...	$1,851.	

Cost of Constructing a Small Reinforced Concrete Reservoir.

Contributed by C. A. Bingham, Consulting Engineer, Carlisle, Pa.

A small concrete reservoir was constructed at Mt. Holly, Pa., in 1909 by the Cumberland Clay Co. to impound water for various pro-

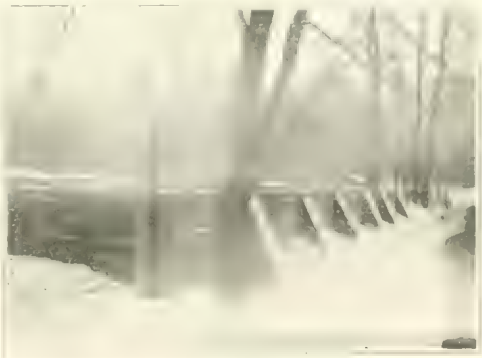


Fig. 1—View of Small Reinforced Concrete Reservoir Filled on Three Sides and Buttressed on the Fourth.

cesses in the refining of clay. The supply is from numerous sump pits throughout the clay mines and tunnels; these sumps are boxes about 4 ft. square which are sunk along the car rails and are placed low enough to drain the headings in which they are placed. The feed pipes are protected by screens.

The reservoir is 73 ft. long and 53 ft. wide and 5 ft. inside depth, thus holding 140,000 gals. About 3 ft. of the wall is in cut, which was shale and tough clay; and the remainder is above the natural surface. The walls are 6 ft. total height, and 12 ins. thick at top and 18 ins. at bottom, with an inside heel 12x15 ins. Batter is all on the outside. On three sides a fill was made to within 18 ins. of top of wall, but on lower side this would have meant an excessive cost so buttresses were built every 10 ft. as shown in the accompanying illustration, Fig. 1.

The walls were heavily reinforced both horizontally and vertically with light rails and other steel on hand and at the corners heavy steel bent to right angles was placed on 12-in. centers, the arms running from 3 to 6 ft. into each side wall. Keyed expansion joints were used every 30 ft. The floor was constructed by a well puddled mixture of clay and gravel and given a surfacing of 4 ins. of concrete and cut in blocks.

A heavy wire fence was placed on top of the wall. The outlets to the mills are controlled by valves and the overflow is taken care of by a small spillway. After three years of service the reservoir is as good as the day completed; the only maintenance being an occasional cleaning of the clay sediment on the bottom. It doesn't leak at all and the walls haven't cracked.

The work was performed by the company forces under plans of the writer; and the sand and gravel was procured on the property. The cost data follow:

Excavation:	
[illegible]	[illegible]
7 laborers 7 days at $1.25 up..............	75.25
[illegible]	[illegible]
Total for 360 cu. yds..................	$119.25
Cost per cu. yd., excavation, 33 cts.	
Concreting:	
[illegible] lumber used)	$ 22.75
Mixing and placing: Foreman 7 days and 7 laborers 7 days......................	75.25
Materials:	
185 bbls. cement at $1.35.................	249.75
192 cu. yds. gravel at $0.40...............	76.80
[illegible]	[illegible]
Total for 144 cu. yds. concrete........	$410.55
Cost per cu. yd., concrete, $3.06.	
Clay floor, fence, miscellaneous (not in- [illegible]	[illegible]
Total cost	$644.20

The cost of the reservoir complete per 1,000 gals. was $4.60

Some Features and Methods of Water Works Operation in Springfield, Illinois.

Four important subdivisions of water works operation, namely, the installation of meters, the free water problem, the extension of mains, and the laying of service pipes, were discussed in a paper before the recent meeting of the Illinois Water Supply Association by W. J. Spaulding, Commissioner of Public Property in Springfield, Illionis. The following matter is abstracted from Mr. Spaulding's paper.

WATER METERS

In the average American city I think the use of meters is almost indispensable. They are especially an advantage here because extravagance is characteristic of Americans. We are also impatient and intolerant toward what might be considered petty regulations. Rules regarding the use of water which I understand are strictly enforced in some European cities, would be looked upon here as pestiferous. The meter will automatically and effectually do the work of many rules and inspectors. In Springfield we were short of water and have not provided enough yet. It seemed to us that to expend large sums to develop our plant and increase the supply while a large portion of the daily pumpage was getting away without doing anybody any good would be like adding waste to waste. Our first step, therefore, was to install meters. This at first was left optional with consumers, but was encouraged in two ways—first, by the city furnishing the meter at its own expense and maintaining it so far as ordinary wear and tear is concerned; and, second, because the consumers usually enjoyed a saving over the old fixture rate.

A year ago next April our city passed an ordinance requiring all services to be metered within two years. On March 1, 1911, we had about 2,200 meters in use. March 1st, this year, we had about 5,000 in use. Our daily pumpage has been steadily decreasing, and we have been able to supply the city from our wells regularly for the past six months. While we had to meet a good deal of prejudice at the start, I think it is safe to say that fully 75 per cent of our consumers are satisfied, and more are being converted every day. I am told that in one large city the past season the supply to all residences was cut off at the curb box to save the water for fire protection. Later the installation of meters was begun. Had that city been on the meter system probably this drastic measure would not have been necessary.

It is necessary only to make the patrons understand that conservation means in the end lower rates and better service for them. The propositoin is simple. For example, if 10,000,000 gals. are pumped through the mains, and only 5,000,000 gals. devoted to legitimate use, the 5,000,000 gals. of waste must be added to the bills of consumers the same as if it had been used. If the 5,000,000 which were wasted had been sold, it is obvious that the rates could have been reduced 50 per cent and the Water Department still would have received the same gross income, less the cost of additional mains.

One matter that should not be overlooked with reference to the meter problem is that a meter is a machine and will get out of order. A water system might better not be metered at all, at least from a revenue standpoint, if the meters are to be installed and then allowed to take care of themselves. I think it is a serious mistake for the consumer to own the meter. The Water Department should own, install, and take care of meters, and so keep its records that it can know the history of every meter from the time it was installed down to date. Our experience is that meters seldom get fast, but continually become slow. In the past summer we started a test of all meters which had been in service more than two years. The test was made at the premises. These tests showed that about four meters out of five were from 5 per cent to 90 per cent slow. It should be explained, however, that these meters had been in for from two to twelve years. Most of them had been in service eight or ten years. To illustrate, we removed a meter which had been yielding 75 cts. per month in revenue, and replaced it with an accurate one. The revenue at this place rose to $13. Reference to the ledger showed the registration had been gradually falling off for several years. Of course, the consumer felt greatly aggrieved and assumed that he was being robbed, but was finally convinced that he was wasting a great deal of water and by a change in management cut his bill down to about $4 per month, which in his case might be considered normal. This is only one of many similar cases. I think it is safe to say that on all meters that had been in more than eight years we were losing 40 per cent in income on the average. Tests for accuracy should be made at regular intervals not more than two years apart. We expect to follow up the work of installing meters and complete it this summer.

FREE WATER.

In our city, as in many others, free water was given to various institutions from the beginning, and these were added to from time to time, until we had a great many such consumers. We have a park system which is provided for by a state law. The revenue is provided for by a special tax levy. It is no more fair for the Water Department to furnish them water free than to pay for the park policemen. The Water Department is no more obligated to furnish the public schools free of charge than to pay their janitor. It is no more entitled to furnish the cemetery with water than to pay the grave digger. In our city we have put these and a number of other free consumers on the pay list. At one school building when the meter was first installed the consumption was at the rate of about $75 per month. This, of course, was largely due to leakage.

In this matter of free water there is a question of equity which is often overlooked in municipal management. It is assumed that a water plant should be self-sustaining, and on this point there is no argument. If the funds of the Water Department are diverted to other uses, it is obvious that in that case water consumers are being made an object of special taxation indirectly through the water rates. For instance, suppose that the water rates were placed high enough so that the revenue would not only support the water plant, but would pay the cost of maintaining the fire department also. Then a citizen would be taxed to support the fire department, not in proportion to the property owned, but in proportion to the water he used, and a substantial portion, say one-half of his water bill, would really be a charge for fire protection. Then fire protection for the whole city would be paid for by water consumers, while nearly one-half the people enjoy the same protection and pay nothing. The furnishing of free water is only another method of diverting the funds of the Water Department away from their proper channel, and to that extent an unfair burden is being placed upon those who pay for water. On account of its importance from a sanitary standpoint, we cannot fail to see the urgency for promoting the general use of a public water supply, and the most certain way to do this is by making it as cheap as possible. A city cannot be made beautiful or sanitary until every working man can enjoy the advantages of city water. In our city only a little more than half of the residents are water takers, and one of our problems is to increase the number.

REVENUE FOR EXTENSION OF MAINS.

The matter of water rates, however, is of no greater importance than the necessity of making the service easily available. That is to say, the distributing main must be accessible to the prospective consumer, and the installing of the service pipe should be made as easy and inexpensive as possible. Home builders cannot take city water if there is no main within reach. At the same time any water department can easily bankrupt itself by draining its resources for water main extensions from which there is insufficient revenue. One of the problems now before our Water Department is the question of how best to provide revenue for extensions. In the past we have been meeting this expense from the revenues. In a prosperous and growing city the cost of water pipe extensions commonly amounts to about 25 per cent. of the gross income.

There are three ways in which this expense may be met, namely, from water revenues, by bond issues, or by a special assessment against the frontage. In the first instance water consumers foot the bill directly; in the second it becomes a permanent interest bearing obligation against water patrons. By either of these two methods it must be provided for in the rates. By the third method it is paid once for all by the owners of the property benefited, and in that case the rates for water could be reduced approximately 25 per cent, and at the same time leave the department the same net income. In the past two years we have had some large additions laid out in the residence part of the city. These additions were not available as home sites without city water. Since there were no consumers immediately to be had the Water Department refused to make extensions. The owners of the additions concluded to lay the main at their own expense, and the argument to justify the expenditure was as follows: Investment for water pipe in front of these lots would amount to about $14 for each 40-ft. lot; that for the expenditure of $14 on the lot its value was enhanced at least double that amount, so that as a matter of fact the investment in water pipe paid a profit of 100 per cent to the owner of the frontage. As the lots were sold the real estate dealer received the money he had invested in the pipe, together with 100 per cent profit on it, so that the Water Department surely could not be said to be in debt him. Therefore, no refun

Now, under the old method of pa ng for water pipe from the water reve owners would have collected the water pipe from the home buil same. The home builder who i lot by putting a house on it woul pay for the water pipe in his wa n as he had become a wate consumer, notwithstanding that he had alrea paid for the pipe twice over when he bou t his l This would seem to be a ridiculo inconsistency which penalizes the home bu der in vor of the lot owner, and at least the case of municipal ownership could just s well h avoided. The cost of sewers a ments is acknowledged as a legit against the frontage and is paid ingly. The value of a water mai a lot is much more certain and sewers or pavement, because the any business or purpose for w could be used that water w necessary or desirable. It is ing an ever flowing spring, flowing under pressure, within re the lot, and though a reside no water at all the fire prot an annual saving in insurance fectly natural that a real estate ow capitalize the value of a wate charge it to the home builder wh lot, just as he would charge for s pavement, or a boulevard. There is more logical or fair than to req pay for the main in the beginnin gets the money back with perhap dred per cent profit?

Charging water pipe to the fron new in this state, and is quite gene nesota, but there they have a spreading the cost over a period collecting the amount with the assessment, which makes the ann so small that it is scarcely noticed the collection in a very inexpensiv advantages to a city of some such far-reaching. Under such a plan would be extended in all directio additions were laid out, instead of back until such time as there are en sumers to make the extension prof avoiding the unfortunate necessity ing many home builders to provide a well and outhouse on their lo when the main is extended, often a ber of residents have become settled fied, and will not put in the serv persons in planning a new house city water but the same persons rearrange an old house. This complishes three things of vital im First, it makes the water availabl who want to use it; second, it reduc of water in two ways, namely, by the water department of the cost sions, and by greatly increasing the patrons; third, and above all, it is equitable plan yet devised.

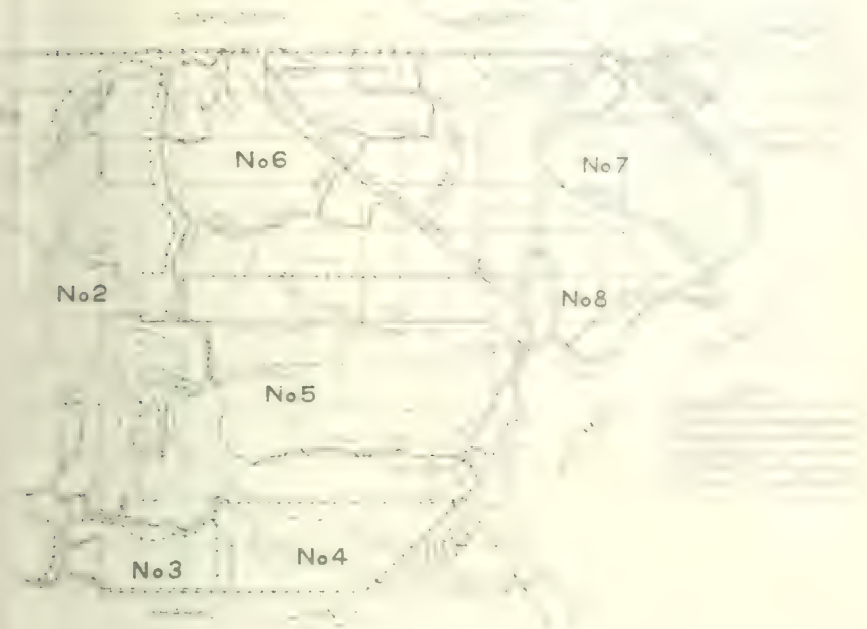
INSTALLATION OF SERVICE CONN

A weak feature commonly found ministration of public water works installing of service pipes is plumbers. In our city it has cost to $50 to install a service pipe. Th double what it would be if the De did the work at actual cost. A w should expect to earn its revenues sales of water, and should theref terested in making it as easy as p citizens to obtain the service. With in mind our city council introduc dinance providing that all services stalled by the Water Department at by this means we are enabled to ma form charge which applies to both and short services alike, so that th who happens to be on the long s street will have to pay no more were on the short side. This was without stirring up a good deal with our local master plumbers, wh to retain this business. We were with political destruction. But su are only incidents in the day

AINAGE AND IRRIGATION SECTION

Sitem for Draining 103,000 Acres in Washington County, Mississippi.

[illegible] sburg, Miss., and 30 miles east ppi River. This area, as shown [illegible] north and south and 11 to 19 [illegible]



ainage District Containing 103,000 Acres in Washington County, Mississippi.

[illegible] ig deadened timber and bodies ep to be reclaimed. Cultivated [illegible] to $20 per acre. Practically all [illegible]

nage and Outlets.—The natural [illegible] e smaller natural channels are structed and lack good outlets f the two rivers and of the larger lakes have become built up higher al level by sediment deposited dur ws. The combined result is a num ns which retain the water that falls is backed in upon them from the and Yazoo rivers until it dries off [illegible]

e the natural drainage is as follows: n four-fifths of the area slopes to west. The northwest corner is Beasley Bayou which has a good the Sunflower River. Likewise a all area in the southwest corner ugh a system of sloughs and bayous harge into the Sunflower River at y county line. All the remainder stern slope drainage is through an connected system of channels, com nly of Jackson and Little Jackson ld Lake, Buck Bayou and Ditchlow ich empty into the Sunflower River own of Murphy. The eastern one e area drains into the Yazoo River. channels are Sky Lake, Bone Creek Bayou in the north and Atchafalaya he south. Between these two larger are several independent bayous directly into the Yazoo. The Atcha-

[illegible] Indeed the overflow from Little Atchafalaya [illegible] corner of the district, and [illegible] goes [illegible] all the way.

Two of the above named natural channels, Ditchlow Bayou and Wasp Lake, would form very good outlets for practically the entire drainage district, except for the high stage of water in the Sunflower and Yazoo rivers during spring freshets. During such periods these two channels, together with Beasley Bayou, Little Atchafalaya Bayou and several smaller bayous, act as intakes rather than outlets and permit the high water from the river to reach and flood the interior of the district. Sometimes when the water has been very high in both rivers at the same time, it has been observed that muddy water backing in from the Yazoo through Little Atchafalaya Bayou meets clear water backing in from the Sunflower through Ditchlow Bayou, the meeting point being at the head of Gooden Lake. During such periods the lowlands in the southeast corner of the district, a tract of about 6,000 acres in the northwest part of township 15 north, range 5 west, and an extensive area in the vicinity of Wasp Lake, become flooded to a depth of from 3 to 5 ft., while most of the remainder of the district is covered with water several inches deep.

Both the Yazoo and Sunflower are subject to backwater from the Mississippi River, and the duration of blocked outlets at the mouths [illegible] almost entirely upon the high stage of water in the Mississippi at Vicksburg. The Sunflower River and its watershed lie wholly within the flat Delta country. It has a deep and well-defined channel, caused by overflows of the Mississippi in former years, and it has a comparatively uniform flow throughout the year. But the Yazoo has its headwaters in the hilly country of northern Mississippi and is subject to erratic fluctuations. Some spring freshets coming down the crooked channel of this stream rise above the banks and cause flooding of the lowlands away from the river. Sometimes these flood waters find their way from the Yazoo across to Bacons Bayou in Leflore county and from there down into Sky Lake and Bear Creek, re-entering the river through Wasp Lake. Some of the water goes even farther over into Jackson Bayou and Dawson Lake, and from there over into the Sunflower through Beasley Bayou and other channels in Sunflower County.

There is now a movement on foot in the Tallahatchie drainage district of northern Mississippi to divert the Coldwater River, one of the principal tributaries of the Yazoo River, into Horn Lake, thence into the Mississippi, thus cutting off a great volume of water coming down from 1,000 square miles of hilly watershed and preventing it from ever reaching the Yazoo. When this plan is carried out, the flooding of Washington county, due to freshets coming down the Yazoo River, will cease, and there will then be only backwater from the Mississippi to contend with. It is also probable that the Mississippi River levee, which now ends at a point 14 miles above Vicksburg, will be extended southward to the mouth of the Yazoo, and when this takes place the effect of backwater will be entirely eliminated. With these two factors combined there should be no more backing of water onto the lowlands between the Yazoo and Sunflower in the Belzoni district, and there would then always be a free outlet at the mouths of Ditchlow Bayou and Wasp Lake.

As indicating the extent and duration of backwater flooding, Table I has been prepared from study of hydrographs of the Sunflower and Yazoo rivers.

Surveys.—The survey was begun Oct. 10, 1910, the field party consisting of Mr. H. A. Kipp, engineer in charge, three assistant engineers, three rodmen, five axmen, a cook and a teamster. Base levels fully checked were run from Belzoni to Silver City on the Yazoo & Mississippi Valley R. R.; from Belzoni to the north county line on the Southern Ry., and from Belzoni to the Big Sunflower River on the north line of township 15. The levels were tied to bench marks set by the United States army engineers along the Big Sunflower River and sea level datum was thus obtained. Levels were run across the district on the east and west section lines, the ends being tied to a line of levels along the Sunflower and Yazoo rivers at either end. Check levels were run from Belzoni to Dawson Lake along the Yazoo & Mississippi Valley R. R. and elsewhere as occasion required, so that all work was checked within the allowable error for good wye-level work. All of the larger watercourses and many of the smaller ones were

TABLE I—ACREAGE [illegible] FLOODED DURING PERIODS OF EXTREME AND AVERAGE HIGH WATER.

			Area Subject to Overflow					
			[illegible]			Average		
Drainage Unit.	Total area. Acres.	Area receiving drainage. Acres.	Area. Acres.	Depth. Feet.	Time. Weeks.	Area. Acres.	Depth. Feet.	Time.
No. 1......	[illegible]							
No. 2	18,876	16,726	2,150	2.5	[illegible]	1,220	0.5	[illegible] months
No. 3	3,343	2,283	1,060		[illegible]			
No. 4	[illegible]586							
No. 5	[illegible]		3,550	2.5	[illegible]	1,630		2 weeks to 6 months
No. 6......	23,059	23,059						
No. 7	1[illegible]	8,135	[illegible]	[illegible]	[illegible]	[illegible]	3.0	0 to 15 weeks.
No. 8......	8,172	8,172						
Total..	103,326	78,752	11,540			5,850		

meandered by the compass needle and stadia method, levels being carried with the meanders and sufficient cross sections taken to determine the size and capacity of the channels. Bench marks were set approximately at section corners, on the bayou crossings and at many other points. Most of the bench marks were made by cutting a notch in the root of a tree and driving in a copper rivet, the elevation being taken on the top of the rivet. It will be understood that the section lines were followed merely for convenience, and only approximately, a great many of the actual section corners not being found at all. Bench marks are described with reference to what seemed to be the locations of these section lines and corners. Considerable difficulty was experienced in running many of the cross levels and meanders, due to the fact that the cane, vines, briers and other tangled underbrush made progress very slow. At other times during the winter high water and ice on the sloughs and bayous in the woods caused great inconvenience. It was deemed advisable to include in the survey that part of Leflore and Yazoo Counties in townships 15 and 16 east of the organized district to the Yazoo River, and all cross-level lines were therefore carried through to the Yazoo River.

A base, or skeleton map, was prepared in camp, using the township plats of the United States general land office for a guide, and upon this map were platted all the data secured by the field party. Later the arrangement for the proposed drainage system was determined from this completed map. About 300 miles of levels and 200 miles of meanders with levels were run, requiring a total of 80 working days. Nearly 115,000 acres were covered, at a cost of about 4 cts. per acre. The cost of the field and office work in connection with the project is as follows:

Field expenses paid by drainage investigations	$2,311
Field expenses paid by drainage district	2,000
Total cost of field work	4,311
Cost of preliminary examination	50
Cost of other work, including report and maps	1,339
Total cost of project	$5,700

Plan for Drainage.—For convenience the drainage district has been divided into eight different units, each one of which may be treated as a separate problem, independent of all the others. The boundaries of these units are generally the natural divides between the various areas under consideration, but a few of them are arbitrarily located along convenient lines and may be shifted at will if found convenient to do so. They are shown upon the map by dashed and crossed lines and each unit is designated by number, from No. 1 to No. 8.

Two of these units, No. 1, lying to the north of Beasley Bayou in the northwest corner of the district, and No. 4, lying in the southeast corner of the district, can not be well drained through outlets within Washington county, and are therefore excluded from this discussion. Unit No. 1 slopes to the north and should properly be included in any scheme for drainage in the southwestern part of Sunflower county, and unit No. 4, which slopes to the south and drains partially into Silver Creek, should be included in any scheme for drainage in the northern part of Yazoo County. That part of Leflore County lying adjacent to the Choctaw boundary will receive some benefit from the drainage of unit No. 7, but can not be included for assessment under the present plan. Also that part of Sunflower county lying adjacent to unit No. 6, and particularly in the vicinity of Sky Lake, will receive a benefit from the drainage of that unit, but can not be included as a part of this scheme until the boundary of the original district is revised to include all lands out to the natural drainage boundaries and until the proper surveys are extended to cover that much more ground.

A system of ditches has been planned to relieve the remainder of the original district, including units Nos. 2, 3, 5, 6, 7 and 8, of its surplus water just the same as though there were permanent and free outlets for each unit at all times, but it should be understood at the outset that all the land will not receive complete drainage at all times. As stated in the discussion of natural drainage conditions, the free outlets depend upon the stages of the Yazoo and Sunflower Rivers, and upon these outlets depend the amount of land which will receive permanent and effective drainage. This amount has been roughly determined by drawing high water contours in the several parts of the district and assuming that all land lying higher than that contour for each unit will receive permanent and effective drainage at all times, and the remainder of the land will receive drainage only at such times as the main outlets are free. The area of land covered by extreme high water is considerably larger than the area covered by ordinary floods, and since extreme high water is of considerably shorter duration than ordinary high water, the overflow land has been classified into two parts, i. e., that which is flooded by average high water and that which is flooded only by extreme high water.

The natural divide between the Sunflower and Yazoo Rivers runs almost due north and south and passes through a point 1 mile west of Belzoni. Therefore, all the lands lying to the west of this line are drained to the west and south and will have outlet in Ditchlow Bayou and two other bayous emptying into the Sunflower River, and all the remainder will be drained to the east and south into Wasp Lake and the Yazoo River. The rate of fall of most of the land varies between 1 and 2 ft. per mile in the directions named, but there are a few places where the ground is perfectly level and others where there is a slope of 6 to 8 ft. per mile. In designing the new drainage system the amount of water which each ditch will be required to carry was first estimated, and then the size of the ditch was computed such as to carry that amount of water. The well-known formula of Chezy for flow in open channels was used in these calculations, as follows:

$$V = c\sqrt{rs}$$

In which V = velocity of flow in feet per second.

c = coefficient of flow depending upon the condition of the channel and determined by Kutter's formula in which the coefficient of roughness, $n = .025$

r = hydraulic radius $= \frac{A}{P}$

A = area of cross section of channel.

p = wetted perimeter.

s = slope, or fall of water surface per unit of length.

$$Q = A\ V.$$

In which Q = discharge of ditch in cubic feet per second.

In order to use dredge boats in the construction of the ditches many of them will have to be made considerably larger than necessary to carry the amount of water as computed by the above formula. The minimum dredge ditch has been fixed at a 14 ft. bottom, 6 ft. deep with side slopes of ½ to 1, which is the smallest ditch that can be excavated with a machine having an 18 ft. hull. All other dredge ditches have also been figured with side slopes of ½ to 1.

Each drainage unit has been designed with one or more main or trunk line ditches with laterals spaced 1 mile apart, the laterals being of sufficient depth to allow good outlets for field sub-laterals. At places where the old bayou and lake channels are of sufficient size and depth, they will be cleared of timber, cleared out and used in connection with the new system of ditches, but in most cases the shallow sloughs have been avoided and the ditches follow the lines of greatest fall. The average depth of cut in most all of the ditches will be greater than the required depth of flow because the bottom grade was made to pass at a certain depth below the lowest surface elevations along the line of each ditch. In some cases, however, it was impossible to establish the bottom grade that l be necessary to deposit the sp certain short stretches of son ditches so as to form levees w fine the waters within the new ing periods of flood flow. In becomes necessary to put in conduct the drainage of the l the levee into the ditch.

The lateral ditches in most along section lines to avoid land into irregular tracts, but t placed where it was necessary in diagonal directions. All of t and 90 per cent of the laterals a be constructed or improved by the remainder, which are very drain only small areas, can be hand labor. One ditch has be be excavated by dynamite blas periment. If it is found th can be economically excavated it will be of great benefit in th of the field or sublaterals whe cleared. The hand-dug ditch dredge ditches, are to be ma slopes of ½ to 1, and the one has been figured with side slope

Those parts of units No. 2 an lie below the 120-ft. contour line storage reservoir during periods and excessive rainfall, and will h brought down from units Nos. 2, the Sunflower recedes and allo to escape. This reservoir contai and its average depth when wat at the 120-ft. level is 2.5 ft. It that depth is 620,730,000 cu equivalent to 3 ins. of rainfall o 56,100 acres of watershed w this reservoir. That part of unit lies below the 119-ft. contour w same manner for that unit. The when the water stands at that l 2 ft., giving this reservoir a cap 173,000 cu. ft., which is equivale rainfall on the 3,340 acres draining into this unit. In unit are approximately 9,550 acres be ft. contour on which the water ft. deep when standing at that le pacity of this reservoir is 519,900 which is equivalent to 9.1 ins. ra 15,600 acres of watershed of that the present plan, however, this res available in connection with th of units 2, 3 and 5 owing to the able outlet south into Sharkey C No. 2 is protected from the over reservoir by a continuous emban the south side of ditch No. 17 keep the water which collects in from entering at the head of G In unit No. 7 there are approxi acres which are below the 120- water level and when the wate this height the average depth is This gives a reservoir capacity of cu. ft., which is equivalent to 4 i fall over the 12,915 acres of wate drain into this unit.

Table II. shows all the necessa the construction of each ditch, in drainage area for each ditch an thereof, the bottom width, the gra of the bottom, the average depth elevations of all grade points, an age of material to be removed. It which of the present channels are in the new drainage system, which stations on the old channels and other improvement is necessa

Cost Estimates. The necessar tion work of the project is here marized and the total estimated co

Drainage unit No. 2
Drainage unit No. 3
Drainage unit No. 5
Drainage unit No. 6
Drainage unit No. 7
Drainage unit No. 8

Total

90,178 acres in entire district fited. Average cost per acre. $2

—DITCH SIZES AND [illegible] INGTON CO., MISS

——Station No.——		Drainage [illegible]						
From.	To.	Acres.	[illegible]			Ft.	Ft.	Cu. yds.
[illegible]	[illegible]	69,830					[illegible]	
89+00	156+00	[illegible]	[illegible]		1.[illegible]			101,620
156+00	[illegible]	[illegible]	[illegible]		[illegible]			67,180
270+80	[illegible]	9,710	[illegible]		1.[illegible]		[illegible]	27,280
323+30	384+00	8,200	[illegible]		1.[illegible]	8.[illegible]		[illegible]
384+00	431+50	6,680	[illegible]		[illegible]			14,170
431+50	493+30	5,400	[illegible]		1.[illegible]		[illegible]	[illegible]
[illegible]	625+00						[illegible]	
[illegible]	65+00	1,000				[illegible]		13,730
[illegible]	65+00	610	Hand labor....	3		[illegible]	[illegible]	6,040
0+00	[illegible]	1,350				[illegible]	[illegible]	49,870
0+00	65+00	660	Hand labor....	3	3.0			
[illegible]	62+50	640	Hand labor....	3		4.[illegible]		5,120
0+00	92+40	840	[illegible]			6.[illegible]	[illegible]	[illegible]
[illegible]	65+00	840	Hand labor....	4		[illegible]	[illegible]	3,790
0+00	92+40	1,100	[illegible]			6.1	[illegible]	[illegible]
0+00	92+40	1,130	[illegible]		6.1	[illegible]		[illegible]
0+00	112+00	2,350	[illegible]			5.0	[illegible]	31,150
[illegible]	140+00	230	[illegible]				[illegible]	[illegible]
0+00	52+80	620	Hand labor....	3	3.3	[illegible]	5,280	[illegible]
0+00	30+00	670	[illegible]		1.7	1.[illegible]	[illegible]	[illegible]
30+00	[illegible]	670	Hand labor....	3	3.4		[illegible]	4,910
[illegible]	27+00	4,340					2,700	
[illegible]	189+30	3,190	[illegible]	[illegible]	1.3		[illegible]	[illegible]
[illegible]	225+00	640	[illegible]	[illegible]		6.0	[illegible]	13,500
[illegible]	65+00	1,000	[illegible]	[illegible]		1.4	[illegible]	1,300
[illegible]	30+00	46,150	[illegible]		1.[illegible]	7.[illegible]		26,460
30+00	116+00	40,970	[illegible]		1.2	4.3	8,600	44,020
[illegible]	247+50	30,790	[illegible]		1.5		10,500	64,130
[illegible]	535+00	25,000					28,750	
[illegible]	610+00	1,000	[illegible]					7,090
0+00	[illegible]	9,400	Dredge	16	1.5	6.3	6,200	27,700
62+00	111+70	7,810	[illegible]		1.5	7.8		28,570
111+70	260+00	3,500	[illegible]	[illegible]	1.3	6.3	[illegible]	59,320
[illegible]	399+00	1,950	[illegible]	[illegible]	[illegible]	6.4	12,000	56,680
0+00	35+00	1,090	Dredge	14	0.0	3.8	3,500	
35+00	83+00	1,000	[illegible]	[illegible]	1.5	3.8	4,800	18,560
[illegible]	196+50	3,990	[illegible]	[illegible]	1.0	6.2		73,220
[illegible]	337+90	1,840	[illegible]	[illegible]	2.4	6.3	15,140	60,560
[illegible]	46+00	5,140	[illegible]	[illegible]	1.5	7.1	4,600	
[illegible]	120+00	5,000	Dredge	14	1.5	10.0	7,400	52,075
[illegible]	276+60	3,640	[illegible]	[illegible]	1.8	[illegible]	15,660	101,960
[illegible]	395+00	1,790	[illegible]	[illegible]	1.8	5.5	[illegible]	40,390
395+00	426+70	850	Hand labor....	4	0.0		3,170	1,860
[illegible]	[illegible]	7,500					20,800	
[illegible]	[illegible]	3,060	Dredge	14	1.5	8.0	6,300	33,600
[illegible]	[illegible]	3,000	Dredge	14	1.5	3.9	7,600	17,510
347+00	465+00	1,700	Dredge	14	1.5		11,800	14,510
[illegible]	123+70	2,340	[illegible]	[illegible]	1.2	5.1	9,870	30,850
[illegible]	280+70	1,550	Dredge	14	1.0	5.0	5,700	17,420
0+00	107+20	1,160	Dynamite	2	4.4	4.6	8,520	9,590
0+00	33+00	300	Hand labor....	3	2.0	3.8	1,700	1,170
0+00	13+00	3,150	Dredge	14	2.0	6.0	1,300	[illegible]
[illegible]	127+00	3,150					11,400	
127+00	187+00	640	Hand labor....	3	[illegible]	[illegible]	4,940	[illegible]
0+00	115+00	[illegible]	Dredge	14	1.2	6.9	10,500	46,820
27+00	79+80	1,700	[illegible]	[illegible]	1.2	7.0	2,700	12,250
79+80	185+40	920	[illegible]	[illegible]	1.2	6.8	5,280	23,135
			[illegible]	[illegible]	1.2	6.6	10,560	44,625
0+00	[illegible]	17,970	Dredge		1.0	1.6	2,750	4,210
162+50	205+00	15,880	Dredge		1.0	4.4	4,250	18,840
[illegible]	272+50	11,670	Dredge	22	1.0	3.8	5,000	16,810
[illegible]	537+00	8,320					26,450	
0+00	124+00	2,870					12,400	
[illegible]	80+00	690	Hand labor.	[illegible]		4.3	8,000	6,550
[illegible]	[illegible]	2,570				...	4,500	
0+00	73+70	870	[illegible]	[illegible]	1.5	6.8	6,170	[illegible]
[illegible]	[illegible]	570	Hand labor..	3	2.0	4.6	4,840	4,370
0+00	100+30	1,920	[illegible]	14	1.0	6.5	10,030	41,645
100+30	162+00	1,000	[illegible]	14	1.5	5.1	6,170	19,290
0+00	[illegible]	2,180	Dredge	14	1.2	0.5	5,800	1,520
58+00	[illegible]	1,200	[illegible]	[illegible]	1.2	5.6	12,080	42,100
[illegible]	45+00	300					4,500	
0+00	171+00	4,480	Dredge	14	[illegible]	[illegible]	17,100	82,950
[illegible]	361+00	2,240	Dredge	14	1.5	[illegible]	19,000	74,590
0+00	345+00	19,000					34,500	
345+00	525+00	6,000	Dredge	14	1.5	[illegible]	7,500	21,860
0+00	66+80	9,000	[illegible]	[illegible]	2.0	6.4	5,000	20,390
0+00	85+80	1,080	Dredge	14	2.0	7.3	8,580	40,930
0+00	75+00	740	[illegible]		4.4	4.4	7,700	6,360
0+00	82+80	950	[illegible]	[illegible]	2.0	7.4	8,280	40,170
0+00	115+00	1,240	[illegible]	[illegible]		[illegible]	11,500	47,750
0+00	74+40	1,240	[illegible]	[illegible]	2.0	9.4	7,440	48,440
0+00	75+00	4,500	[illegible]	[illegible]	1.5	1.4	3,200	2,440
75+00	236+00	3,600	Dredge	14	1.5	6.6	16,100	68,040
0+00	76+90		Dredge	14	2.0	6.1	7,690	29,620
[illegible]	120+00	2,130					[illegible]	
0+00	55+00	740	Hand labor....	3	[illegible]	[illegible]	2,000	[illegible]

[illegible] were employed:

ft. right-of-way per sta......$ 9.00
ft. right-of-way per sta...... 6.00
[illegible]
ft. channel in bayous, per [illegible]
vation, per cu. yd............ 0.08
tion, per cu. yd............ 0.25
[illegible]
[illegible] and legal costs [illegible]

[illegible] of all dredge ditches the [illegible] material is to be deposited [illegible] ft. from the edge of the ditch, and [illegible]k so finished that the margins will be [illegible] the bottom of an even grade. Excepting in cases where the excavated material is to be deposited as levees on both sides of the ditch, there is to be a sufficient number of openings or breaks left in the spoil banks to allow the entrance of field laterals. These openings are to be not less than 4 ft. wide at the bottom and to occur at intervals of not more than one-fourth mile apart and at all places where there are natural depressions or creeks which may become channels for lateral or field drainage.

Where the excavated material is deposited as levee along low ground to confine heavy flows within the banks of the ditch, the same care is to be taken with the work as noted above. The base of the levee is to first be cleared of all vegetable growth and stumps, so as to permit the new material placed in the levee to unite with the ground underneath and thus prevent seepage. The material taken from a minimum dredge ditch will be sufficient to make a levee 4 ft. high, with side slopes of 2 to 1, which will be all-sufficient for [illegible]

In order to provide for the removal of drainage water from the lowland back of the levee into the ditch, sluice gates are to be constructed under the levee embankment at intervals of about one-half mile. These sluices will permit the escape of surface water falling upon the lowland except during such times when the large ditch is flowing full or nearly so, when the gates will be automatically closed. The gates being closed will prevent water of the main ditch from backing in upon the low ground back of the levee, and it is not likely that the water in the ditch will remain so high as to keep the gates closed long enough to do any material damage, excepting in the case of the extremely low ground previously described as reservoirs.

The sluices are to be made of 24 in. iron or corrugated-metal pipe, or of vitrified sewer pipe with cemented joints, and fitted with a flap gate suspended on suitable hinges at the outer end. The pipe is to be at least 25 ft. long, so that when in position under the embankment it will project well out from the toe of the slope at either end, and both ends are to be held firmly in position by a heading of stone or concrete. The outer end of the pipe is to be protected by a grating of heavy rods to prevent driftwood from becoming lodged under the gate, and the other end is to be provided with a sliding valve which can be opened or closed by hand in case the outer valve fails to work properly. Such sluices can be purchased ready-made from either one of several firms which make a specialty of valves, traps, sluices, etc., at a cost of about $35 or $40 each.

The above cost estimates do not, of course, include interior or detailed drainage, which will have to be constructed by the landowners themselves. The plan outlined herein will not provide good drainage outlets for all lands except in the cases previously described, unless the Mississippi River levee is extended to the vicinity of Vicksburg and the Coldwater River in the northern part of the State is diverted and prevented from augmenting the floods coming down the Yazoo River. The starting and completion of the Mississippi River Levee work will depend upon the cooperation of the railroad and landed interests behind the levee with the Mississippi River Commission. All are agreed as to the desirability of having the work done, but when they will agree as to the proper proportion of the cost to be borne by each, and when the necessary funds will become available, are matters of great uncertainty. The proposed Government improvement of the upper Sunflower River for navigation purposes will not effect the drainage in Washington County. Another alternative which would protect the low overflowed land in units Nos. 2 and 5 at all times would be to install a large concrete multiple sluice gate and pumping plant at the mouth of Ditchlow Bayou. The sluice gate would permit the escape of all drainage water during such times when there is free outlet and prevent backwater from the Sunflower coming in upon the lowlands of the interior during periods of high water. The pumping plant, which would require a maximum capacity of 400,000 gals. a minute, would then have to be put into operation and kept running until the Sunflower receded sufficiently to permit the opening of the sluices. Such a plant would cost a great deal more money than the land at present could afford to pay, especially because the overflowed or reservoir land would have to bear the burden of the expense, and if at some future date it is found that such extensive plans are practical the sluice and pump can be installed without any rearrangement of the drainage system herein outlined.

BRIDGES AND BUILDINGS SECTION

Methods and Plant Employed for Mixing and Placing Concrete for Floors, Rand McNally Building, Chicago.

[illegible]

[illegible] high and covers an area of 150x290 ft. In the center of the building there is an open court 68x128 ft. Access to this court is had at each end from the alley way which is to be maintained through the center of the building.

Mixing Concrete.—Advantage was taken of this court space to locate the materials, hoists, mixing plant, and bins. The basement of the building will run under the court, therefore the court was temporarily floored so that teams could drive in from the alley level and deliver the building materials. At each side of the court a mixing plant and hoist tower are located. The material bins are built so that their tops are at the level of the floor of the court. Wagons are driven over gratings which cover the bins. The grating over one bin consists of 3x12-in. plank set 2 ins. apart on edge. Over the other bin 2x12-in. plank have been used, but they have worn so badly that it is doubtful if they will last to complete the work. The contractors will hereafter use 3x12-in. plank for gratings.

The bins are hopper shaped, with two compartments sloping toward their respective gates, which are side by side over the mixer hopper. The bins are built of 3x12-in. plank laid on sloping stringers of the same size, and the whole structure is supported and tied to the steel structure, which will ultimately carry the permanent floor of the court. The gates are of the sliding type, operating up and down by means of a simple lever arm. The hopper is an affair similar in shape to the bin itself. It is divided into two compartments, one for sand and one for gravel. The compartments are proportional in capacity to suit a 1:2:4 mixture, which is the one most commonly used in the work. The hopper is discharged into a ¾-cu. yd. mixer. On one side a McKelvey mixer is used and on the other a Chicago mixer. The cement is dumped through chutes in the court platform, which carry it to storage piles in the basement adjacent to the bins. It is taken from these piles as needed and wheeled in barrows to the man at the mixer hopper.

The mixer is discharged into a bucket which operates in the concrete hoist tower and is hoisted to any point desired where a hopper is hung on the side of the tower and the hoist bucket is discharged into it. From this receiving hopper a short chute is arranged for discharging the concrete into two-wheeled carts.

The force required to mix and hoist the concrete is about as follows: Two men operating sand and gravel gates and dumping bags of cement into hopper; 1 signal man; 1 hoist engineer; 2 men hauling cement in barrows; 1 man at top discharging hopper into carts; 1 man at end of chute cleaning up drippings and keeping men with carts moving, and 1 mixing plant foreman. During cold weather the material on arrival is generally frozen in lumps and an extra man is required to break it up so that it will go through the gratings into the bins. Another man is also required underneath the bins at such times, to help make the materials flow out of the bins and at other odd jobs which may come up. The bin bottoms are at an angle of about 45°, but they nevertheless become clogged at times when the materials are wet. Perforated steam coils are placed within the bins to prevent the freezing of the materials and hot water is supplied for the mixing.

The amount of concrete run by the two plants in an 8-hour day has been as high as 650 cu. yds. on days when everything ran well [illegible] top were able to provide a place to receive it. During bad and cold weather, however, a run of 250 batches per machine is considered a good average for an 8-hour day. This would be about 375 cu. yds.

Placing Concrete.—The concrete is used for floors and for encasing the structural steel beams and columns. The beam forms are suspended from the steel beams and the column form are built square so that in all cases there will be at least two inches of concrete covering the structural steel. The forms for the floor slabs are supported by the beam forms by means of resting the 2x4-in. stringers across the panel between beam forms. The lagging consists of 1-in. boards. These slab forms are braced underneath with light posts supported on the next lower floor. The reinforcing consists of ⅝-in. square twisted bars on 6-in. centers, running across the 16-ft. panels and ½-in. bars on 3-ft. centers running both ways. The floor slab is 10⅝ ins. thick. The reinforcing is placed by two gangs of men working about 4 men, each ahead of each gang placing concrete. The steel is laid in and wired together to hold it in place. To keep it above the forms small pieces of V-shaped sheet steel are used. These are laid under the reinforcing at several points, raising it the required height above the forms. To keep men from walking or wheeling over the reinforcing steel, runways are provided. These consist of built-up sections which are supported on wooden horses about 1 ft. high. The built up sections are about 16 ft. long and consist of three 2x6-in. stringers laid flat and covered with 1x6-in. boards nailed across them. When new they easily support the two-wheeled carts containing about 2 cu. ft. of concrete without much deflection under the load. When they become older and are weakened by rough handling an extra wooden horse is used to divide the span. In the Rand-McNally building, the floor area surrounds the central court and the method of transporting the concrete from the hoist towers to the forms is normally as follows: A double runway encircles the court about half way between the court wall and the outside wall of the building. A double runway runs out to the circular runway from the hoist tower. Concreting is commenced at the farthest points from the hoist tower and branch runways are extended from the main runways to the outside areas. These branches are moved about as needed and are usually placed about 12 to 16 ft. apart so that a cross runway can be laid to join two of them at the extreme end. In this way the carts can be run in one direction, that is, can come out on one branch runway, dump where desired, and then go back by crossing over to the end of the next branch runway and back to the main double runway to the hoist tower.

For this building seven wheelers are employed to carry cement to the farthest points from each tower, about 225 ft. At the point where concrete is dumped there is 1 foreman, 1 man cleaning the forms ahead of the concrete, 2 men spading beams or ramming columns with long sticks about 1 in. square, 2 men spreading and changing branch runways, and 1 man following with a wood float for surfacing. In case snow and ice have accumulated in the beams and columns this is done away with by means of a steam jet handled by one man. The general contractor is the Wells Bros. Co. of Chicago.

Cost of Power for Steel Erection and Stuck Lining on a Large Building Job.

Contributed by Alden W. Welch.

The work considered was this rebuilding of a large boiler house to accommodate about 14 boilers. This work was done for a central station which continued to operate during the entire progress of the work. It wa possible to obtain all the power nec the central station company. This much higher efficiency than could attained had it been necessary fo tractors to generate their own pow

The first contractor whom I sha consider carried the largest contract, that f the steel work. The work that this contrac perform was briefly to raise the ex floor to permit the placing of ne beams and reinforcing rods und specified columns. The existing se about 35 ft. above the first floor, removed. The first floor must be l fect condition. In addition to the three steel stacks were to be erect lined, by this contractor. This strung out quite a period and, alt construction features were carefull up by the inspectors of the cent company, the power demand was to be more or less of a side issue. therefore, not recorded as accura might have been. But in the e thrashed out pretty thoroughly an sults here given may be considered nearly true.

The power demand of the steel was as follows: Steam power for air compressor. The air pressure tained was utilized for driving seve drills for boring rivet holes, and al operation of an air gun for driving Steam was also required for two hoists. Electrical energy was requir operation of two electric drills of capacity as the air drills. Each dem now be considered briefly.

Steam Driven Air Compressor.—Rec showed that the compressor was in days and was actually operated for 1,0 or an average of 6.5 hours per day. heaviest load occurring on this co was 13 h. p., consisting of three 1 drills and two 5 h. p. air drive gu average load was 5 h. p. and this only intermittently. Allowing a lo of 20 per cent for 5 h. p. during 6.5 h find the power required of the comp 1 h. p. for 6.5 hours, or 6.5 h. p. hour per cent efficiency for the compresso the indicated horse power of demand upo the station would be 13 h. p. hours per day 152 days would amount to 1,976 h. p. h the job. Water was required to keep the compressed air cool and was charged f at the rate of 20 cts. per day, making an $30.40 for water. The steam was for on a flat rate of $2 per day, m estimated horse power charge of 15.4 a total charge of $304.

Hoisting Engines.—The work of the hoisting engines consisted in lifting the st from the ground level to the point where t was in progress. This varied from the bunker floor, 80 ft. to the track lev to the roof and 180 ft. to the top of th The simplest way of determining th required for these engines is to re calculations to the basis of one engi ing this I found the power demand to 200 hours 20 h. p. working under a load factor of 20 per cent and at 60 per cent load to 480 h. p. hours, which at the $2 rate means about 16.7 cts. per horse hours, or a total of $80.

Electric Energy.—On the basis of hours it was found that the period of for electric energy covered 500 hou that electricity was used 125 days. O tric drill at 60 per cent load consu watts, and with a 20 per cent load means a demand of 45 kilowatt hours at the rate of 10 cts. per kilowatt hou a cost for electric energy of $4.50.

The total cost of the power that t

bought from the central station [illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
ric energy for drills..........	4.50

[illegible]

amount of the steel contract was 0, which means that it cost the bout $85,000. Therefore, the ratio f the power to the total cost of is about as 1 is to 200, or .005, y 0.5 per cent.

of the three steel stacks was ac- v another contractor, who used an essively in each. One stack was e, and, therefore, but one 15 h. p. n operation at any given time. f operation of each elevator in [illegible]

[illegible]

watts at 50 per cent load operat- load factor of 20 per cent means ur consumption of 176, which at ilowatt hour costs $17.60. The for the work of lining was about a cost to the contractor of about t the ratio of the cost of power cost of the work was as 1 is to about 0.3 per cent.

res are enough to indicate that cost of power is not a deter- In fact it suggests that the larger s, the greater will be the profits tion job, due to the fact that it more work was done by power. saving in labor, and therefore, of which are exceedingly impor- in a contract job.

nts on Notes on Structural Steel Designs.

[illegible]

a reprint of the paper read by ichmann, before the Western So- eers, on Nov. 8, 1911, entitled, ctural Steel Designs."

[illegible]

original art [illegible] Western S[illegible]

[illegible]

of unfriendly [illegible]

[illegible] highly of reinforced concrete, which is but [illegible]

[illegible] and with the attention to detail that is neces- [illegible]

[illegible] problems. It must be admitted, however, that it is not a suitable material for all structural purposes.

Some of Mr. Reichmann's views on the use of Nickel Steel for Structural purposes, are also at variance with those of the writer. In his paper the following statement is made:

> Of recent years, some of our engineers have [illegible] steels of high ultimate strength. Inasmuch as the modulus of elasticity of nickel steel is the same as that of carbon steel, the structures de- [illegible] strength, where the unit stresses are from two and one-half to three times those used for ordinary carbon steel, the deformation and deflection will be from two and one-half to three times those of structures built of ordinary carbon steel.

While it is true that the deflections will be greater, with high unit stresses than with low ones, the unit stresses used for nickel steel are not nearly so high, with respect to the corresponding stresses for carbon steel, as Mr. Reichmann intimates.

The unit stresses advocated by Waddell in his article on "Nickel Steel for Bridges," Trans. Am. Soc. C. E., Vol. LXIII, range from 1.60 to 1.75 times the corresponding values for carbon steel for direct axial stresses with somewhat lower ratios for rivets.

The unit stresses used in the design of the St. Louis Municipal Bridge were from 1.30 to 1.43 times the corresponding values for carbon steel.

[illegible] Manhattan Bridge nor for the eye bars of the Blackwells Island Bridge have unit stresses been used as Mr. Reichmann mentions. In long span bridges, such as the above, the stresses employed for nickel steel should be compared with those that would be used for carbon steel under like circumstances, and not with the stresses [illegible] steel.

As to combining the two metals in the same structure, for example, carbon steel laterals with nickel steel trusses, the writer cannot but feel that Mr. Reichman has over-estimated the [illegible]

[illegible] structures where nickel steel is employed, the dead load stresses are usually as large or larger [illegible] customary to rivet the laterals after the span is swung and the dead load deformation has taken place. The laterals usually make an angle with the chords of approximately 45°, and are approximately 1.4 times as long as the chords between panel points.

[illegible] the unit deformation of the laterals caused by vertical loads on the trusses, will be due to live load only, and will approximately be one half of the unit live load deformation of the chords.

Under the above conditions, and with nickel steel unit stresses, such as were used for the St. Louis Municipal Bridge, the total wind and live load unit stresses in carbon steel laterals in combination with nickel steel trusses will be only from 10 to 15 per cent more than the total unit stresses in the laterals, when the entire structure is of carbon steel, which is not at all a serious matter.

Nickel steel does not lend itself to the usual shop operations as readily as does carbon steel, and is therefore not looked on with much favor by those engaged in bridge fabrication. In the writer's opinion however, it is the coming material for main truss members of long spans, on account of the considerable reduction that can be made, by its use, in the dead load, and in the size of members. The writer is not so much in favor of nickel steel for field rivets, for reasons that he expects to give at some later date.

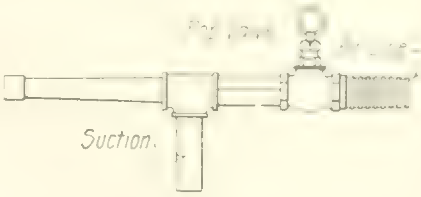
[illegible]

EAM AND ELECTRIC RAILWAY SECTION

y Sand Blast Apparatus for Construction Work.

pensive portable blast device which ed for occasional contract jobs as shops where constant sand blasting [illegible]

This sketch shows of course only e, the air and suction hose being are ordinarily used. The air hose with the air supply which, to give results, should have a pressure of lbs. The suction hose leads to the or pile nearest the work, the best eing to draw from a barrel or other close to work so as to have as ection as possible. The taps call for se. The blast weighs only 6 lbs. so readily handled. The list price is is blast should be convenient for poses in construction work such as and finishing concrete and other and removing rust from metalwork. ufactured by the Niagara Device Co., N. Y., which also makes a similarly [illegible]



Portable Sand Blast Apparatus.

ices Used in the First Appraisal lectric Railways in Chicago.

he expiration of certain street railway s in Chicago, a few years ago, the appraisals made of the property of ways. The first of these appraisals e by Mr. Bion J. Arnold, and [illegible] estimates appear in his "Report on the Chicago Transportation Problem" in 1902. We have taken the following data from that report. In a subsequent issue we shall give similar data from more recent appraisals of other Chicago street railways.

The trolley tracks of the Chicago City Railway and of the Chicago Union Traction Co. were divided into four classes, according to the size of rail which were, estimated to cost as follows per mile of single track, exclusive of pavement:

	Per mile.
4½-in. (65-lb.) girder rail track on chairs	$17,625
6-in. (78-lb.) girder rail track	15,600
7-in. (85-lb.) girder rail track	16,251
9-in. (94-lb.) girder rail track	17,600

Most of the track was the 7-in. girder rail, the detailed estimate for which was as follows:

	Per mile.
133.57 gross tons rails, at $41	$ 5,476
Hauling rails to street at $1 per ton	134
2,640 ties delivered on street at $0.55	1,452
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
1,374 cu. yds. excavation at $0.60	824
Track laying at $0.25 per ft	1,320
[illegible]	[illegible]
Special work at intersections and cross- [illegible]	[illegible]
[illegible]	[illegible]
10 per cent for engineering, supervision [illegible]	[illegible]
Total exclusive of paving	$16,250

The $41 price of rails includes $1 for switching charges and other costs of handling prior to hauling the rails to the work. The 60 cts. per cu. yd. of excavation includes the cost of bedding the ties on the earth foundation.

The prices for the items of the 4½-in., 6-in. and 9-in. rail tracks were the same as for the 7-in., except for the following items:

[illegible]	[illegible]
Cast welded joints for 4½-in. rails, at	3.00
Cast welded joints for 9-in. rails at	5.00

The cost of paving a mile of single track, 8 ft. in width, or 4,600 sq. yds. per mile, was estimated as fololws:

	Per mile.
1. Dressed granite, on 6-in. concrete, at [illegible]	[illegible]
2. Asphalt, on 6-in. concrete, at $2.80	12,880
3. Vitrified brick, on 6-in. concrete, at [illegible]	[illegible]
4. Cedar blocks, on plank and sand, at [illegible]	[illegible]
5. Rough granite, on sand bedding, at [illegible]	[illegible]
6. Cobble stone, bedded in gravel, at $1.65	7,590
[illegible]	[illegible]
8. Oak blocks, on plank and sand, at $170	7,820

These paving prices appear to include all overhead or loading charges, such as engineering, etc.

The estimated cost of the overhead trolley construction was as follows per mile of double track:

100 iron poles, set in concrete, at $28	$2,800
50 cross arms (4-pin), with pins and insulators, at $3.96	198
100 small Brooklyn insulators for spans, at $0.50	50
100 globe strain insulators for spans, at $0.22	22
90 straight line hangers, at $0.325	29
10 feed-in hangers, at $0.50	5
140 soldered 9-in. ears, at $0.16	22
12 line cross-overs, at $3.00	36
8 insulated cross-overs, at $6.00	48
8 two-way frogs, at $3.00	24
3,000 ft. of 5/16-in. galv. strand wire for spans	30
6 strain plates (strain layout), at $0.32	2
12 small Brooklyns (strain layout), at $0.50	6
12 globe insulators (strain layout), at $0.22	3
1,500 ft. ¼-in. galv. strand wire (strain layout), at $7.50	11
20 double hangers (2 dbl. curve layouts), at $0.44	9
20 single hangers (2 dbl. curve layouts), at $0.35	7
1,000 ft. ¼-in. strand wire (2 dbl. curve layouts), at $7.25	7
4 heavy Brooklyns (2 dbl. curve layouts), at $0.70	3
4,246 lbs. of 2-0 trolley wire, at $0.1325	563
2 splicing ears, at $0.50	1
Labor placing spans, trolleys, etc.	225
Total, exclusive of feeder wire	$4,100
Feeder wire, average per mile	4,000
Total	$8,100

Chicago City Ry.—The cost of reproducing new the property of the Chicago City Railway was estimated to be as follows:

37.40 miles of 4½-in. rail track, at $17,625	$ 659,175
111.13 miles of 7-in. rail track, at $16,251	1,805,937
36.72 miles of 9-in. rail track, at $17,600	646,281
Total track	$3,111,393
183.38 miles single track overhead trolley, at $8,100 per mile of double track, incl. feeder	742,692
146.37 miles granite paving, at $11,500	1,683,255
4.31 miles brick paving, at $12,650	54,522
23.29 miles cedar paving, at $6,808	158,558
11.28 miles macadam, at $3,450	38,916
Total track paving and overhead	$ 5,789,317
5,280 KW. electric power stations, at $95	501,600
5,000 KW. electric power stations, at $85	425,000
1,000 HP. storage battery plant	70,866
Rolling stock	2,646,264
Tools, supplies, etc.	75,163
Buildings, other than power plant	1,235,295
Real estate	628,059
Total trolley railways, Dec. 31, 1901	$11,371,564
Cable railways (34.75 miles)	$ 4,902,430
Total, Dec. 31, 1901	$16,273,994
Additions to plant up to Nov. 1, 1902	898,431
Grand total	$17,172,425

The details of the estimated cost of the cable railway plant ($4,902,430) were published in our issue of March 20, 1912. Part of the real estate ($628,059) belongs with the cable railway plant, but the report does not show the distribution of the real estate.

Excluding land and buildings ($1,863,354) the trolley property totaled $9,508,210 on Dec. 31, 1902, and the depreciation of this was estimated to be 19.04 per cent. The depreciation on the total, $17,172,425, was estimated to be 32.6 per cent, a very large part of which is attributable to the cable lines.

Details of the estimated cost of the rolling stock need not be given; for, of 572 trolley cars in service at that time, 512 cars were the now obsolete small cars having 22-ft. bodies.

Of the 185 miles of track, two miles were not electric and were operated with horses.

The cost of the three electric power stations includes buildings, but does not include land.

The Chicago City Railway had a total capitalization of $18,000,000, which was entirely stock, and on which it paid 9 per cent dividends annually. Its income and expenses for the year ending Dec. 31, 1901, were:

Earnings from operation—	
Electric lines (73,403,433 passengers)	$3,647,136
Cable lines (44,041,678 passengers)	2,188,588
Horse lines (418,879 passengers)	20,663
Total earnings	$5,856,387
Operating expenses—	
Electric lines (16,727,540 car miles)	$2,166,354
Cable lines (13,809,620 car miles)	1,438,314
Horse lines (106,090 car miles)	27,487
Total expenses	$3,632,155

Taxes ($237,018) were not included in operating expenses.

Chicago Union Traction Co.—The estimated cost of reproducing the property of the Chicago Union Traction Co. was as follows:

5.83 miles of 4½-in. rail track, at $17,625	$ 102,751
232.16 miles of 7-in. rail track, at $16,251	3,772,756
20.24 miles of 9-in. rail track, at $17,600	356,229
Total track	$4,231,736
251.11 miles single track trolley, at $8,100 per mile of double track, incl. feeder	$ 1,016,996
38.22 miles granite paving, at $11,500	439,530
77.96 miles cobble paving, at $7,590	591,716
5.36 miles brick paving, at $12,650	67,804
5.70 miles asphalt paving, at $12,880	73,416
0.33 miles macadam paving, at $3,450	1,139
124.80 miles cedar paving, at $6,808	849,638
5.86 miles oak paving, at $7,820	45,825
Total track, overhead and paving	$ 7,317,760
3,900 KW. electric power station, at $120.50	$ 470,225
8,250 KW. electric power station, at $92.35	761,894
Rolling stock	1,785,000
Tools, implements, supplies and mchy.	899,405
Total	$11,234,284
Buildings other than power plant	1,322,973
Land	2,161,258
Total trolley and horse lines, Dec. 31, 1902	$14,718,515
Cable railways (47.60 miles)	7,496,120
Grand total	$22,214,635

The details of the cable railway costs ($7,496,120) were published in our issue of March 20.

Part of the real estate ($2,161,258) belongs with the cable railway plant. Excluding land and buildings ($3,484,231) the trolley and horse line property totaled $11,234,284 new, which was estimated to have depreciated 13.6 per cent. The depreciation on the total, $22,214,635, was estimated to be 32.76 per cent, a very large part of which is attributable to the cable lines.

Of the 258 miles of track, 26 miles were not electric and were operated with horses.

The Chicago Union Traction Co. was capitalized for $75,000,000, of which about one-third was bonds and the rest stock. Its operating income and expenses for the year ending June 30, 1902, were as follows:

Earnings from operation—	
Electric lines (98,562,555 passengers)	$4,923,089
Cable lines (57,154,184 passengers)	2,856,972
Total	$7,801,075
Operating expenses—	
Electric lines (20,018,334 car miles)	$2,800,195
Cable lines (10,619,779 car miles)	1,770,524
Total	$4,570,719

Taxes ($614,417) were not included in operating expenses.

Proposed New Street Railway System.—In the same report (year 1902), Mr. Arnold submitted also an estimate of the cost of a comprehensive system of surface trolley lines and subways for the entire city of Chicago. While much of this estimate now possesses only historic interest, there are parts of it that may still be of value to appraisal engineers and others. We therefore give the estimated cost of this street railway system that relates to 746 miles of single track lines, of which 15 miles was to be subway and 21 miles was to be underground electric conduit.

The estimated cost of a mile of underground conduit line was as follows:

	Per mile.
188.57 tons of 120-lb. rails, at $41	$7,731
103.71 tons slot rails (66-lb.), at $43	4,460
33.47 tons conductor bars (21.3-lb.), at $43	1,439
352 cast weld joints, at $5	1,760
352 slot rail splices with bolts	82
Bolts (tram rail, slot rail, hand hole, insulator latch, washers and keys)	192
4,200 tie bars, at 0.25	1,050
Insulators and clips	1,200
310 tons cast iron yokes, pit covers and frames, conduit plates, at $50	15,500
Hauling iron work	600
Special track work (curves, crossings, etc.)	6,000
Conductor bonds	500
Track laying and placing iron work	7,260
2,700 cu. yds. excavation, at $1	2,700
1,500 cu. yds. concrete, at $6	9,000
Sewer connections from manholes, etc.	2,000
Removing and rearranging underground obstructions	
Cable ducts in place	
Add 10 per cent for engineering, supervision and administration	
Total, exclusive of paving and feeder	
Feeder wire	
Total, exclusive of paving	

It is stated that this is an av ge fig for the whole city, but that for c lying d tricts the cost would not exceed 0,000 mile, exclusive of paving, while in e busin district the cost would be $100,0 per m exclusive of paving. Increased co of und ground obstructions, more curves and ot special work, and delays due to c gestion traffic account for the higher cost the bu ness district.

In estimating the cost of a co rehensi modern street railway system f Chica Mr. Arnold proposed to lay heav groov 9-in., 120-lb. rails on concrete bea , with wooden cross ties. This type of rack estimated to cost as follows, per m :

2,000 cu. yds. excavation, at $1.00
800 cu. yds. concrete beams, at $6.00
188.57 tons rails, at $41.00
Hauling rails to street, at $1.00
700 tie rods, at $0.25
176 cast welded joints, at $5.00
Cross bonding
Track laying

Total
Special track (curves, crossgs., etc.

Total
10 per cent for eng., super. and adr

Total exclusive of paving
Add for asphalt paving
Add for granite paving
Add for brick paving

Based on the foregoing unit ces. 745.81 miles of track were estimat as lows:

354.84 miles track, with granite pavin at $42,365
354.84 miles track with brick pavin at $36,615
15.06 miles track in subways, n paved, at $23,965
21.07 miles track, underground co duit type, paved with asphalt, $94,182

Total track and paving, 745.81 mile
724.74 miles sgl. track overhead troll and feeder, at $8,100 per mile db track

Total track, paving and overhead
100,000 KW. power plant, incl. bldgs at $110
200,000 KW. sub-stations, at $30
Batteries for 100,000 KW. sub-station at $20

Total
2,000 dbl. truck cars equipped, at $6,00
250 units of snow plows, sweeper etc., at $4,000
Other equipment, wagons, tools, etc.

Total
Real estate—
Power house site, centrally located
Sites for 15 sub-stations, at $5,000
Site for car shops
Sites for 20 car barns, at $20,000
Site for offices

Total
Buildings other than power—
Car shops and machinery
20 car barns, at $100,000
Office bldg. and fixtures

Total
Subway (9.42 miles long, of which 5.6 miles is for dbl. track and 3.78 mile for sgl. track)

Grand total

The estimated cost of the subway nels is not given in detail. The fol the estimate as given in the report:

Excavation
Timbering
Concrete
Waterproofing
Structural steel
Rearranging water and gas pipes
Rearranging sewers
New sewer
Rearranging pneumatic and electric underground work
Sidewalks, paving, etc.
Stations
Temporary maintenance of traffic, care of abutting bldgs., etc.

Total

per cent for eng., supr. and admin. [illegible] 1,500,000

LABOR AND MATERIAL PRICES, 1911—1912

[illegible] OF WORKING DAY AND PREVAIL[illegible] [illegible]ES OF WAGES IN 1911 FOR LABOR [illegible] STREET PAVING WORK IN [illegible] CITIES.

	Working day, hours	Common labor	Paver	[illegible]
[illegible] Division				
[illegible]	[illegible]	$1.75	$3.50	[illegible]
[illegible]	[illegible]	1.75	—	4.50
[illegible]	9	1.75	5.00	[illegible]
[illegible]	[illegible]	[illegible]		4.00
[illegible]	[illegible]	2.00	3.50	4.50[1]
[illegible]	[illegible]	2.00	5.00	5.00
[illegible]	[illegible]	2.25	4.00	6.00
[illegible]mpton	9	2.00		5.00
[illegible]	8	2.00	5.00	4.50[2]
[illegible]	[illegible]	2.00	2.50	[illegible]
[illegible]	[illegible]	2.00		5.00
[illegible]	[illegible]	1.75		4.50
[illegible]	[illegible]	[illegible]	[illegible]	5.00
[illegible]	[illegible]	2.00	[illegible]	5.00
[illegible]	[illegible]	[illegible]	3.80	[illegible]
[illegible]	[illegible]	2.25[3]	2.75	4.50
[illegible]	[illegible]	2.00	2.00	4.00
[illegible]	[illegible]	2.00	—	5.00
[illegible]idge	9	2.00		4.50
[illegible]	[illegible]	2.25	2.50	5.25
[illegible]	[illegible]	2.00	5.00	5.00
[illegible]	[illegible]	2.00		4.00
[illegible]	[illegible]	1.85	4.00	5.50
[illegible]lence	9	1.75	4.00	3.00[7]
[illegible]nce	9	1.75	2.52	4.50
[illegible]	[illegible]	1.75		5.00
[illegible]	[illegible]	1.65		6.00
[illegible]	[illegible]	1.75	3.00	5.00
[illegible]	[illegible]	1.75		6.00
[illegible]	[illegible]	1.75		4.50
[illegible]k	9	[illegible]		5.00
[illegible]	[illegible]	1.50		5.50
[illegible]	[illegible]	1.75		5.00
[illegible]ntic	10	1.75	4.50	1.75
[illegible]antic Division:				
[illegible]	[illegible]	1.75	[illegible]	[illegible]
[illegible]	[illegible]	1.75		4.50
[illegible]mton	8	1.75	2.00	4.00
[illegible]	[illegible]	2.00	4.00	6.00
[illegible]	[illegible]	1.60		3.50
[illegible]	[illegible]	1.75	2.50	3.50
[illegible]	[illegible]	1.75		4.00
[illegible]	[illegible]	1.75		3.20
[illegible]	[illegible]	1.50	4.00	4.00
[illegible]wn	8	1.60	2.50	4.00
[illegible]		1.75	2.50	4.50
[illegible]		2.00	3.50	4.50
[illegible]		1.75		4.00
[illegible]	[illegible]	1.75		5.00
[illegible] Falls	8	1.62	2.00	6.00
[illegible]		1.60	2.40	5.00
[illegible]		1.85	5.00	4.50
[illegible]	8	[illegible]	5.00	5.00
[illegible]	[illegible]	2.00		5.00
[illegible]rgh	8	1.50	5.00	3.50
[illegible]	[illegible]			
[illegible]		2.00	4.00	5.00
[illegible]tady	8	2.00	2.50	5.00
[illegible]se	8	1.70	4.00	4.50[12]
[illegible]	[illegible]	1.75	4.00	4.00
[illegible]wn	8	1.75	3.00	4.00
[illegible]	[illegible]	1.60	5.00	5.00
[illegible] Plains	8	1.75		5.00
[illegible]	[illegible]	1.75	4.00	4.00
[illegible]	[illegible]	1.50	2.50	5.00
[illegible]	[illegible]	1.75	5.00	5.00
[illegible]	[illegible]	2.00	5.00	6.00
[illegible]		1.75	5.00	5.50[14]
[illegible]	[illegible]	1.75	4.00	5.50
[illegible]ld	8	1.75		[illegible]
[illegible]	[illegible]	1.75		5.50
[illegible]	[illegible]	1.75	3.50	6.00
[illegible]	[illegible]	1.75		5.00
[illegible] New York	9	2.00	5.00	6.00
[illegible] Orange	9	2.00	4.00	5.00
[illegible]				
[illegible]	[illegible]	1.75	2.00	5.00
[illegible]	[illegible]	1.75	2.25	5.00
[illegible]	[illegible]	1.40		3.50
[illegible]	10	1.50	3.00	5.00
[illegible]	[illegible]	1.60		4.00
[illegible]	[illegible]	1.65	3.00	5.00
[illegible]	[illegible]	1.75	2.50	4.00
[illegible]	[illegible]	1.75	2.50	4.50
[illegible]	[illegible]	1.75	[illegible][13]	5.00
[illegible]lle	9	1.80	[illegible]	5.00
[illegible]sburg	[illegible]	1.50	[illegible]	
[illegible]n	[illegible]	1.50	[illegible]	5.30
[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	5.50
[illegible]	[illegible]	1.70	2.70	6.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			5.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
Punxsutawney	9	1.60		
[illegible]	[illegible]	1.60	2.50	5.50
[illegible]	[illegible]			4.00
[illegible]	[illegible]	1.60	2.75	
[illegible]	[illegible]		4.00	4.00
[illegible]	[illegible]	1.75	3.50	5.00
[illegible]	[illegible]	1.50		[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	5.00
[illegible]	[illegible]	1.75		4.50
[illegible]	[illegible]			
Washington	10	1.65	[illegible]	5.00
Wilkes-Barre	9		3.00	4.50
Wilkinsburg	10	1.60		5.00
[illegible]	[illegible]	1.75		4.00
East N[illegible] C[illegible]				
Ohio—				
[illegible]	[illegible]	2.00	2.50	5.00
Barberton	10	1.65	3.00	[illegible]
[illegible]	[illegible]	2.00	3.50	[illegible]
[illegible]	[illegible]	2.00		4.05
[illegible]	[illegible]		4.00	[illegible]
[illegible]	[illegible]	1.75	1.75[16]	[illegible]
[illegible]	[illegible]	1.65	4.00	4.00
Columbus	10	1.90	3.00	4.50
[illegible]		1.80		5.00
Coshocton	9	1.75	2.00	4.00
[illegible]	[illegible]	1.75	2.50	4.50
[illegible]	[illegible]	1.75		3.50
[illegible]	[illegible]	[illegible]	3.00	5.00
Fostoria	10	[illegible]		4.50
[illegible]	[illegible]	2.00	4.00	4.50
Galion	10	1.80	4.00	4.00
[illegible]	[illegible]	2.00		[illegible]
[illegible]	[illegible]	1.50	2.50	3.50
[illegible]	[illegible]	1.75	4.00	4.00
[illegible]	[illegible]	1.75	2.50	[illegible]
Massillon	9	1.80	2.50	4.00
Mt. Vernon	10	1.75	2.00[17]	3.50[18]
N[illegible]	[illegible]	1.75		4.50
[illegible]		1.75		5.00
[illegible]	[illegible]	1.75	3.50	4.50
Springfield	10	2.00	5.00	4.00
[illegible]	[illegible]	2.00	3.00	4.00
[illegible]	[illegible]	1.75	2.50	5.00
[illegible]				
Anderson	10	2.00		3.50
[illegible]	[illegible]	1.75	3.00	4.00
Bloomington	10	1.75	2.50	3.50
[illegible]	[illegible]	1.75	4.00	4.00
Elkhart	10	2.00		4.00
[illegible]	[illegible]	1.60	3.00	4.00
Fort Wayne	10	2.00	2.75	4.50
Frankfort	10	2.00	3.00	4.00
Gary	10	2.00	5.00	6.00
[illegible]	[illegible]	1.60	2.50	3.50
Kokomo	10	2.00		3.50
La Porte	10	2.25	3.50	4.50
Linton	10			
Logansport	10	2.00	5.00	4.00
Mishawaka	10	1.75	4.00	4.25
M[illegible]	[illegible]	2.00		4.00
Newcastle	10	2.00	3.00	4.00
Richmond	10	1.75	2.50	3.75
[illegible]	[illegible]	1.75	2.50	3.00
Terre Haute	9	1.65	2.50	3.50
[illegible]	[illegible]	1.50		
[illegible]				
Alton	10	1.75	2.50	4.00
Bloomington	10	2.25	4.00	4.50
[illegible]	[illegible]	1.50		3.50
Chicago Heights	10	2.00		4.30
[illegible]	[illegible]	2.00		4.00
Edwardsville	9	2.00	4.00	5.00
Freeport	10	2.00	3.00	5.00
Granite City	10	2.00	4.50	5.00
[illegible]	[illegible]	2.00		4.00
[illegible]	[illegible]	1.50		4.00
[illegible]	[illegible]	2.00	5.00	
[illegible]	[illegible]	2.75		6.00
La Salle	8	2.40	4.50	4.80
[illegible]	[illegible]	1.75	2.50	4.50
[illegible]	[illegible]	2.00	3.00	4.00
Mt. Carmel	10	1.75	3.00	4.00
[illegible]				
Olney	9	1.75	2.25	3.50
[illegible]		2.00		
Pekin	9	2.00		3.50
[illegible]	[illegible]	2.00	[illegible]	4.00
[illegible]	[illegible]	2.00	5.00	4.00
Springfield	10	1.75	2.50	4.50
[illegible]	[illegible]	2.00	3.00	4.50
Waukegan	9	2.25	3.00	5.20
Michigan—				
[illegible]	[illegible]	1.75	4.00	4.00
Ann Arbor	9	2.00		4.50
Battle Creek	10	2.25	4.00	5.00
Benton Harbor	9	1.75	2.25	[illegible]
[illegible]	[illegible]	1.75		4.00
Coldwater	10	2.00		4.00
[illegible]	[illegible]	2.25	3.25	5.00
[illegible]	[illegible]	2.00		4.50
[illegible]	[illegible]	2.00	3.50	4.50
Grand Rapids	10	2.00	3.00	4.50
Hillsdale	10	1.75		3.50
[illegible]	[illegible]	[illegible]	2.50	4.00
[illegible]	[illegible]	[illegible]	[illegible]	4.50
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]	[illegible]	5.00	5.00
[illegible]	[illegible]			4.00
St. Joseph	9	1.75	[illegible]	4.00
[illegible]				
Antigo	10	2.00		4.00
[illegible]	[illegible]	[illegible]	3.50	5.00
[illegible]	[illegible]	[illegible]		4.00
[illegible]	[illegible]	[illegible]	—	3.50
[illegible]	[illegible]	[illegible]	—	[illegible]
Sheboygan	10	2.00		4.00
[illegible]	[illegible]	[illegible]	4.50	5.00
[illegible]	[illegible]	[illegible]	. . .	4.50
[illegible]	[illegible]	[illegible]		4.00
West N[illegible] C[illegible] D[illegible]				
[illegible]				
[illegible]	[illegible]	[illegible]	5.00	4.50
[illegible]	[illegible]	[illegible]		4.00
[illegible]	[illegible]	[illegible]	4.00	4.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2.25	4.00
[illegible]				
[illegible]	[illegible]	[illegible]	2.50	4.00
Cedar Rapids	10	2.00	2.50	4.40
[illegible]	[illegible]	[illegible]		1.00
[illegible]	[illegible]	[illegible]	5.00	[illegible]
Creston	10	2.00	3.50	4.00
Davenport	10	2.00	4.00	5.00
Dubuque	10	2.00	2.50	5.00
Fort Dodge	10	2.00		4.50
[illegible]	[illegible]	[illegible]	3.00	4.00
Marshalltown	10	2.00	5.00	4.00
Mason City	10	2.00	4.00	4.00
Ottumwa	10	2.00[25]	2.50[26]	[illegible]
Sioux City	10	2.00	5.00	4.00
Waterloo	10	2.00	3.00	4.50
Brookfield	9	1.80	3.60	3.60
[illegible]				
Columbia	10	1.75	2.00	3.50
Fulton	10	1.75	3.00	3.50
Jefferson City	9	1.75	3.50	3.50
[illegible]	[illegible]		5.00	5.00
Kirksville	9	2.00		3.50
Lexington	10	1.75	2.00[28]	[illegible]
Moberly	9	2.00	3.50	3.50
St. Charles	10	1.75		4.00
St. Louis	10	1.75	4.00	5.00
[illegible]	[illegible]	[illegible]	3.00	3.50
Webb City	9[29]	2.00	4.50	3.50
North Dakota—				
Grand Forks	10	2.50	3.00	5.00
Grand Island	8			
[illegible]	[illegible]		3.50	4.00
Lincoln	8	2.00	3.00	4.00
[illegible]	[illegible]	[illegible]	4.00[31]	6.00
Kansas—				
[illegible]	[illegible]	[illegible]	2.50[33]	3.50[34]
Coffeyville	8	1.75		2.75
Emporia	8	2.00		4.00
Fort Scott	8	1.75	2.00[35]	3.20
Hutchinson	8	2.00	4.00	4.00
Independence	8	1.65	3.00	3.20
[illegible]			2.50	4.00
Manhattan	8	1.75	3.00	4.00
Newton	8	2.00		3.50
Ottawa	8	1.60	2.00	3.20
Pittsburg	8	1.60[36]	2.00	3.00
[illegible]	[illegible]	[illegible]	2.50	3.50
[illegible]	[illegible]	[illegible]	2.50	3.50
[illegible]	[illegible]	[illegible]		3.20
Wichita	8	1.75	2.00	3.25
South Atlantic Division:				
[illegible]				
[illegible]	[illegible]	[illegible]	4.50	5.00
[illegible]	[illegible]	[illegible]	4.50	5.00
Hagerstown	10	1.50	1.80	3.00
Washington, D.C.	8	1.50	2.00[37]	4.00
[illegible]				
Danville	10	1.25	1.50	3.50
Portsmouth	10	1.50		5.00
Staunton	10	1.50		3.50
Suffolk	10	1.25	2.00	4.50
West Virginia—				
Clarksburg	10	1.75	2.50	5.00
North Carolina—				
[illegible]	[illegible]			
Greensboro	10	1.25	[illegible]	[illegible]
Newbern	10	1.25	3.00	4.00
South Carolina—				
[illegible]	[illegible]		3.00	2.00
Columbia	10	1.25		4.00
Greenville	10	1.25	2.00	4.00
[illegible]	[illegible]	[illegible]	1.00	3.00
Georgia—				
Americus	10	1.50	2.25	4.00
[illegible]	[illegible]	[illegible]		5.00
Dublin	10	1.25		
Rome	10	1.50	2.50	3.50
Florida—				
[illegible]	[illegible]	[illegible]	2.00	3.50
Tallahassee	9	1.00		4.00
East South Central Division:				
K[illegible]				
L[illegible]	[illegible]	[illegible]	2.50	4.00
Louisville	10	1.75	3.50	4.00
Owensboro	10	1.75	—	4.00
Paris	10	1.50	—	4.00
T[illegible]				
[illegible]	[illegible]	[illegible]		3.50

[illegible]				
[illegible]				
Gadsden	10	1.25	3.00	3.50
[illegible]	[illegible]	[illegible]		
[illegible]				
[illegible]				
[illegible]	[illegible]			
West South Central Division:				
[illegible]				
Jonesboro	10	1.50	3.50	4.00
[illegible]				
[illegible]	[illegible]			
[illegible]				
[illegible]		[illegible]		[illegible]
[illegible]				
[illegible]				
Oklahoma City..	8	2.00	4.00	4.50
[illegible]		[illegible]		
[illegible]				
[illegible]				
Dallas	..	2.00	....	4.00
[illegible]		[illegible]		
[illegible]				
[illegible]				
San Antonio....	8	1.50	1.50	3.00
San Angelo.....	9	1.75	....	....
[illegible]		[illegible]		[illegible]
Weatherford ...	10	1.50	....	3.00
Wichita Falls...	10	2.00	....	....
Mountain Division				
[illegible]				
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	[illegible]		[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]
Idaho—				
Boise	[illegible]	[illegible]		[illegible]
Twin Falls......	10	3.00	....	5.00
Colorado—				
Boulder	8	2.25	....	5.00
Grand Junction.	8	2.50	5.00	4.50
New Mexico—				
Albuquerque	[illegible]	[illegible]		[illegible]
Utah—				
Salt Lake City..	8	2.25	....	5.00
Pacific Division:				
Washington—				
Bellingham	8	2.25	5.00	6.00
Centralia	8	2.50	7.00	6.00
Hoquiam	8	[illegible]	[illegible]	[illegible]
Seattle	8	2.50	5.50	6.50
Spokane	8	3.00	3.50	6.00
Vancouver	8	2.35	....	6.00
Walla Walla....	8	2.25	....	5.00
Oregon—				
Ashland	10	2.25	....	7.00
Baker	10	2.50	....	5.00
Medford	10	2.75	3.50	5.00
Portland	[illegible]	2.25[illegible]	[illegible]	6.00
Salem	..	....[43]	....	5.00
California—				
Eureka	8	2.50	....	5.00
Fresno	8	2.00	3.50	4.00
Pomona	8	2.00	....	4.00[44]
Napa	8	2.50	4.00	5.00
Richmond	8	2.50	3.00	5.50
Santa Barbara..	8	2.00	....	4.00
San Bernardino.	9	2.25	....	4.50
San Diego	8	[illegible]		
San Jose........	9	2.25	....	6.00
Santa Cruz......	8	2.00	....	....

[1]$4.50 and $5.00. [2]$4.50 per double team; $3.25 per single team. [3]$2.00 to $2.25. [4]$4.00 to $6.00. [5]$3.76 per single team: $5.28 per double team. [6]$2.25 for city. [7]$3.00 per single; $4.50 per double team. [8]$1.75 to $2.00. [9]8 and 9 hours. [10]$4.50 and $5.00. [11]$5.50 and $6.00. [12]9 and 10 hours. [13]Paid at rate of 28½ cts. per sq. yd. laid. [14]$1.75 and $3.00. [15]$3.00 to $5.00. [16]$1.75 and $2.50. [17]$2.00 and $2.50. [18]$3.50 and $4.00 [19]8 and 10 hours. [20]$3.00 and $3.50. [21]$1.50 to $1.75. [22]Paid at the rate of 3 cts. per sq. yd laid. [23]$2.75 to $3.50. [24]$3.50 to $4.50. [25]$2.00 to $2.25. [26]$2.50 to $3.00. [27]$4.00 to $4.50. [28]$2.00 to $[illegible] [29][illegible] and 10 hours. [30]$1.75 and $2.00 [31]$[illegible] and $[illegible] [32]$1.50 and $2.00 [33]$[illegible] and $3.00 [34][illegible] and $4.00 [35][illegible] of [illegible] cts. per sq. yd. laid. [36]$1.60 to $1.75 [37]$2.00 to $3.50. [38]$5.00 and $6.00. [39]$5.00 to $6.00. [40]9 to 10 hours. [41]$2.25 to $2.60. [42]$3.50 to $4.50. [43]Paid at rate of 25 cts. per hour. [44]$4.00 to $5.00

Current Prices of Materials and Supplies Used in Engineering Construction Work.

BRIDGES AND BUILDINGS.

Structural Shapes.—The following are the current prices for structural shapes f. o. b. Pittsburg:

I-beams and channels, 3 to 15 in., 1.15 cts.
I-beams over 15 in., 1.20 to 1.25 cts.
H-beams over 18 in., 1.20 to 1.25 cts.
Angles, 3 to 6 in., 1.15 cts.
Angles, over 6 in., 1.20 to 1.25 cts.
Tees, 3 in. and up, 1.20 to 1.25 cts.
Zees, 3 in. and up, 1.15 to 1.20 cts.
Angles, channels and tees under 3 in., 1.20 to 1.25 cts., plus full extras.
Deck beams and bulb angles, 1.45 to 1.50 cts.
Hand rail tees, 2.00 to 2.15 cts.
Checkered and corrugated plates, 2.00 to 2.15 cts.

Chicago prices for structural materials are: 1.30 cts. to 1.45 cts., mill shipment; are 1.6 cts from store.

The New York quotations are as follows:

Steel bars, 1.26 cts. to 1.31 cts.
Plain structural material and plates, 1.31 cts to 1.36 cts.
Bar iron, 1.30 cts. to 1.35 cts.
[illegible] to 1.75 cts.

New York store prices for small lots:

Beams and channels, 3 to 15 in., 1.80 cts.
Angles, 3x¼ in. and larger, 1.80 cts.
Tees, 1x1x⅛ in., 2.25 cts.

Plates.—The current prices for plates f. o. b. Pittsburg on the basis of net cash in 30 days are as follows:

Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, extras, 1.15 cts. base.

Gages under ¼ in. to and including 3/16 in..	$0.10
Gages under 3/16 in. to and including No. 8.	.15
Gages under No. 8 to and including No. 9...	.25
Gages under No. 9 to and including No. 10..	.30
Gages under No. 10 to and including No. 12.	.40
Sketches, 3 ft. and over in length...........	.10
Complete circles, 3 ft. diameter and over....	.20
Boiler and flange steel......................	.10
A. B. M. A. and ordinary fire box steel......	.20
Still bottom steel...........................	.30
Marine steel	.40
Locomotive fire box steel....................	.50
Plates in widths over 100 in. to 110 in.......	.05
Plates in widths over 110 in. to 115 in.......	.10
Plates in widths over 115 in. to 120 in.......	.15
Plates in widths over 120 in. to 125 in.......	.25
Plates in widths over 125 in. to 130 in.......	.50
In widths over 130 in........................	1.00

Store prices at Chicago are 1.60 cts.; mill shipment, Chicago delivery, 1.30 cts. to 1.45 cts.

Sheets.—Makers' prices for mill shipments from Pittsburg on sheets in car load and larger lots are as follows:

Galvanized roofing sheets No. 28, 2½ in. corrugations........	$2.20 per square
Painted roofing sheets. No. 28...	1.30 per square
Galvanized Sheets:	
Nos. 12, 13 and 14..............	1.90 to 1.95 cts.
Nos. 15, 16 and 17..............	2.05 to 2.10 cts.
Nos. 18 to 22...................	2.20 to 2.22 cts.
Nos. 23 and 24..................	2.30 to 2.35 cts.
Nos. 25 and 26..................	2.55 to 2.55 cts.
No. 27	2.65 to 2.70 cts.
No. 28	[illegible] cts.
No. 29	2.90 to 2.95 cts.
No. 30	3.10 to 3.15 cts
Blue Annealed Sheets:	
Nos. 3 to 8.....................	1.20 to 1.25 cts.
Nos. 9 and 10...................	1.30 to 1.35 cts.
Nos. 11 and 12..................	1.35 to 1.40 cts.
Nos. 13 and 14	1.4[illegible] to 1.4[illegible] cts.
Nos. 15 and 16..................	1.50 to 1.55 cts.
Box Annealed Sheets:	
Nos. 17 to 21...................	1.60 to 1.65 cts
Nos. 22 to 24...................	1.65 to 1.70 cts.
Nos. 25 and 26..................	1.70 to 1.75 cts.
No. 27	1.75 to 1.80 cts.
No. 28	1.80 to 1.85 cts.
No. 29	1.85 to 1.90 cts.
No. 30	[illegible] to [illegible] cts.

Chicago prices for sheets, car load lots, from mill are as follows:

No. 28 black sheets	[illegible] to 2.05 cts
No. 28 galvanized............	3.03 to 3.08 cts.
No. 10 blue annealed...........	1.53 to 1.58 cts.

Store prices at Chicago are:

No. 10	[illegible] cts.
No. 12	[illegible] cts.
No. 28 black	[illegible] cts.
No. 28 galvanized	[illegible] cts.

Freight Rates.—The freight rates from Pittsburg on finished iron and steel in car loads, per 100 lbs., are as follows: Birmingham, Ala., 45 cts.; Boston, 18 cts ; Buffalo, 11 cts.; Chicago 18 cts.; Cincinnati, 15 cts., Cleveland, 10 cts.; Indianapolis, 17 cts.; New York, 16 cts.; New Orleans, 30 cts.; Philadelphia, 15 cts.; St. Louis, 22½ cts.; St. Paul, 32 cts. For the Pacific Coast the rates are 80 cts. on plates, structural shapes and sheets, No. 11 and heavier; 85 cts on sheets Nos. 12 to 16, [illegible] cts. on sheets No. 16 and lighter, and [illegible] cts. on wrought pipe and boiler tubes.

Steel Rivets.—The following current prices for steel rivets are f. o. b. mill at Pittsburg: Structural rivets, 1.45 to 1.50 cts., boiler rivets, 1.[illegible] to 1.60 cts.; also take an advance of 50 cts.

Corrugated Roofing.—New York quotations are for smal lots of 2½ in. corrugated roofing.

	Painted.	Galvanized.
No. 24, per 100 sq. ft......	$3.75	$4.70
No. 26, per 100 sq. ft......	2.85	3.90
No. 28, per 100 sq. ft.	2.50	[illegible]

CONCRETE.

Cement.—The present prevailing prices for Portland cement for Chicago and vicinity are as follows: 80 to 85 cts. on cars and $1.00 to $1.05 by teams.

Reinforcing Bars.—The current prices for concrete reinforcing bars f. o. b. Chicago are as follows:

	Base per 100 lbs.
Plain open hearth steel, car loads.......	$1.30
Plain open hearth steel, less than car loads	1.33
Cold twisted open hearth steel, car loads	1.30
Cold twisted open hearth steel, less than car loads......................	1.33

For shipment from stock current prices for cold twisted reinforcing bars are as follows, stock length 35 ft.:

¾ in. and larger..	..$1.50
⅝ in	[illegible]
½ in.	[illegible]
⅜ in	1.80
5/16 in	1.9[illegible]
¼ in	2.1[illegible]

Expanded Metal Reinforcing.—Prices at Chicago are about as follows:

3-in. Mesh Expanded Metal Reinf

No.	Cross sectional area per 12 in.	Wt. per sq. ft. lbs.	Less than car load lots
06-3	.06		[illegible]½
10-3	.10	.34	1.87½
16-3	.16	.55	2.25
20-3	.20	.68	2.75
25-3	.25	[illegible]	[illegible]
30-3	.30	1.02	[illegible]
35-3	.35	[illegible]	4.50
[illegible]	.40	[illegible]	[illegible]

ROADS AND STREETS.

Vitrified Brick.—The current price fied paving brick f. o. b. Chicago is per M. for No. 1 brick.

Granite Blocks.—New York prices f paving blocks are about as follows: Class granite blocks $1.90 per sq. yd., deliv side dock at New York. The special granite block laid to a ⅜ in. joint and ½ in. variation on top is selling [illegible]

Crushed Stone.—The current prices for crushed stone are about as follows granite, delivered by team, $4; teaming about 65 cts. per cu. yd., making co about $2.35 per cu. yd.

Sand and Gravel.—The present pri pedo sand at Chicago is $1.75 per team. No. 8 gravel is selling at $1.65 p Car rate is 50 cts. less in each case. is quoted at 50 cts. per [illegible]

WATER WORKS AND SEWER

Cast Iron Pipe.—The following are th prices per ton of 2,000 lbs. on cast iron livered in car load lots f. o. b. cars, Cl

4-in. water pipe ....
6-in. to 12-in. water pipe............
Larger sizes ....

Gas pipe is $1 per ton higher.

Present eastern prices on standard bell and spigot pipe are as follows. $21 to $22 per net ton delivered at T larger sizes $20 to $21 per ton.

Spiral Riveted Pipe.—Net prices f riveted pressure pipe, plain ends, with nections, are as follows:

Diameter. Ins.	Thickness U. S. standard gage.	—Prices— Asphalt coated.	Gal
3	20	$0.143	
4	18	.205	
5	18	.247	
6	16	.301	
7	16	.352	
8	16	.403	
9	16	.442	
10	16	.500	
11	16	.548	
12	16	.598	
13	16	.648	
14	14	.810	
15	14	.882	
16	14	.955	
18	14	1.07	
20	14	1.183	
22	12	1.718	
24	12	1.847	
26	12	2.001	
28	10	2.56	
30	10	2.811	
32	10	3.054	
34	10	3.24	
36	10	3.427	
40	10	3.799	

*For standard thickness for [illegible] pipe.

Vitrified Sewer Pipe.—The following Western price list of standard vitrified

Inside diameter, in ins.	Straight pipe, per ft.	Curves and elbows, each.	T and Y branches, [illegible] ft. long, each,	Traps, each	Double branches and breeches, each	Increasers, decreasers and slants, each.	Depth of socket, in.
[illegible]	$0.15	$0.50	$0.60	$1.70	$0.90	$0.45	[illegible]
4	.20	.60	.80	2.10	1.20	[illegible]	[illegible]
[illegible]	.25	.75	1.00	2.50	1.50	[illegible]	[illegible]
[illegible]	.30	1.00	1.20	2.90	1.80	.90	[illegible]
[illegible]	.35	1.25	1.40	3.50	2.10	1.05	[illegible]
8	.45	1.65	1.80	4.50	2.70	1.35	[illegible]
[illegible]	.50	1.75	2.00	5.00	3.00	1.50	[illegible]
10	.60	2.10	2.40	6.00	3.60	1.80	[illegible]
12	.75	2.75	3.00	8.50	4.50	2.25	[illegible]
15	1.00	3.75	4.00	.	.	3.00	[illegible]
18	1.50	4.75	6.00	.	.	4.50	[illegible]
20	1.75	5.75	7.00	..	.	5.25	4
21	2.00	6.75	8.00	.		6.00	4
24	2.50	8.00	10.00	.	.	7.50	4
27	3.25	16.25	16.25	.		16.25	[illegible]
30	4.00	20.00	20.00	.	.	20.00	[illegible]
33	5.00	25.00	25.00			25.00	5
36	6.00	30.00	30.00		.	30.00	[illegible]
42	8.50	42.50	42.50	...	..	42.50	[illegible]

The discounts from the above list present time are as follows

3- 6-in. pipe ....
8-12-in. pipe ....
15-18-in. pipe ....
20-24-in. pipe ....

These prices are per minimum car f. o. b. works at St Louis.

RAILWAYS.

Track Supplies.

	Per lb. Cts.
....	1.20

quoted at $1.35 to $1.40 per 100 lbs.

	Cts.
ion Bessemer rails...	1.28

lbs. rails. . . . . .1.20½ to 1.25	
......................1.25 to 1.30	
	1.50

	Cts. base
square nuts..................	1.90

MISCELLANEOUS

general net prices for Illinois for blasting materials.

Dynamite.

	2,000 lb lots per delivered	200 lbs. or more, per delivered
50 per cent strength dynamite	11.95	15.70

Blasting Batteries.

Electric Fuses.

4 ft. double strength	$3.15

Fuses.

Double tape, per 1,000 ft.	4.75

.....	1.76	1.26					
s.........	.....	1.00					
....	1.20	1.65				.....	1.76
						.....	.....
						.....	1.50
						.....	1.43
l	1.45	1.50				.....	.....
....	2.00	1.10*				.....	1.18
						.....	1.15
....	1.65	.80					
ford......	1.20	1.40					
ort	1.32	1.60					
			.....	.....	.....		
			1.75	.....	.....	.....	.....
						2.10	.....
....	1.86	1.25				.....	1.55
						.....	1.65
e	1.51[1]	1.70				.....	1.65
....	.....	1.70[2]					
t	1.45	1.25					
n	1.45	1.00					
y	1.65	1.10				.....	.....
ic	1.35	1.60				.....	2.14
tic Division:							
		1.40					
....	1.14	.90					
m	1.35					.....	.....
....	1.10	1.15				.....	1.75[5]
....	1.10	1.00					
		1.00[3]	1.25	.92[7]	.....		
....	1.17	1.15					
....	1.30	.78					
		1.50					
....	1.22	2.08					
		1.00				.....	.....
is........	1.32	1.50				.....	1.45[11]
rnon.....	1.20	1.10					
		1.00	1.00	.95	.....		
h Tonawanda	1.15	1.25					
		1.10					
		1.26					
		1.60					
		1.25					
		1.50	1.25	.85	.....		
		1.25					
a	1.20		.....	.....	.....		
ertown	1.35	1.45	1.00	1.10	.....		
ervliet	1.40	1.50					
ury Park......	1.20	2.00					
		1.45*					
		1.50					
		2.50					
Brunswick...	1.15	1.60					
nfield	1.50	1.90					
			2.50	.....	.....		
stfield	1.25	1.90					
st New York...	1.35	1.50					

Butler	1.50						
Carbondale	1.17	1.23	1.00	21.00			
Carlisle	1.30	1.00	1.40			1.55	
		2.00	1.50	1.10			1.50
		.90	.75	.70			
		1.70					
Du Bois	1.10	1.60*	1.60*	.64			
Erie	.95	1.00	.45	.70			
Franklin	1.15		1.25	18.00	21.00		
Greenville	1.10		.90	.62			
Hazleton	1.50		2.00	.84			
Meadville	1.25		.50	.70			
Monongahela	1.20		.....	.70			
New Castle.......	1.00	.65	.75	.60			
Oil City...........	1.10[15]						
Pittsburg	1.80	3.00	1.25	.70	30.00	2.20	1.20[19]
Sayre	1.10	1.25	1.25	22.50†	21.00		
		1.50	1.25	.90	26.00		
South Bethlehem..	1.10	1.50					
Warren	1.10	1.00	1.00	.78			
Washington	1.17		1.05	.50			
Wilkesbarre	1.30	1.25	1.00	1.08			
Wilkinsburg	1.00		.....	1.37			
York	1.20	1.00					
East North Central Division:							
Ohio—							
		1.00[4]	.90	.73	.....		
			1.00	.73	.....		
		...	.....	.....	.....		
		.79[23]	1.25	.....	.....		
Chillicothe	1.30		.50	.67	.....		
Circleville	1.10	.50[4]	.50	.62	.....		
Columbus	1.25	1.00	1.00	.69	23.00		
Conneaut	1.45	1.25[4]	1.25	.64	.....		
Coshocton	1.40						
Dayton	1.30	1.50	1.00	.70	.....		
Delaware	1.50	.75	.90*	.85	.....	1.68	
East Liverpool....	1.20		1.00	.47	.....		
Fostoria	1.10		.90	.70	.....		
Fremont	1.30	1.00	1.00	.72	.....		
		1.40	.....	.....	.....		
Hamilton	1.05	1.25	1.00	.....	.....		
			.50	.75	.....		
Lima	1.25		1.10	.75	28.00		
Lorain	1.30	1.20	1.25	.....	.....		
Massillon	1.00		1.00	.60	.....		
Mt. Vernon.......	1.32		1.30	.70	.....		
		.80*	.80*	16.50†	.....		
Norwood	1.25	2.00	1.50	.....	.....		
			1.00	.87	.....		
Springfield	1.30		1.25	.72	28.50		
Wooster	1.20	.20[22]	1.00	.65	.....		
Zanesville	1.30	1.10	.80	.375	.....		
Indiana—							
Anderson	1.25	1.00	.80	.82	20.00		
Bedford	.95	1.10	1.00	.72	....		
Bloomington	1.20	1.10	1.65	.75			
Crawfordsville ...	1.25						
Evansville	1.15	1.00[4]	1.00	.....	.....		
Fort Wayne.......	1.05	.98	1.10	.87	27.00	1.60	2.50
Frankfort	1.00	1.25	.90	.66	.....		
Gary	1.20	1.20					
Indianapolis	1.30		1.07[24]	2.00	24.00		
		1.00					
		1.50	1.10	21.00†	20.00[25]		
Logansport	1.25	1.00	1.00	.80	.....		
Mishawaka	1.25	1.50[26]	.80	.85	25.00		
Muncie	1.20	1.13	1.00	.72	.....		
Newcastle	1.00	.75[4]					
Richmond	1.25	1.00	1.00	19.00	.....		
			.75	.....	.....		
Terre Haute......	.....		.85	.85	.....		
Washington	1.00	1.10					
Illinois—							
		1.00[15]					
Bloomington	1.00	1.35	1.00	.88	.....		
Chicago Heights...	1.00	.95					
Danville	1.10	1.02					

	Portland cement, per bbl.	Broken stone, per cu. yd.	Sand, per cu. yd.	Paving brick, per sq. yd.	Asphalt, per ton	Creosoted wood block, per sq. yd.	Granite block, per sq. yd.
[illegible]							
Freeport	[illegible]		[illegible]	[illegible]		1.35	
Granite City	1.10	[illegible]	[illegible]	[illegible]		1.50	
[illegible]							
[illegible]		[illegible]	[illegible]				
[illegible]		[illegible]	1.[illegible]				
La [illegible]	[illegible]	1.20	1.5[illegible]				
La [illegible]	1.[illegible]	[illegible]	1.[illegible]	[illegible]			
[illegible]	[illegible]	1.[illegible]	[illegible]				
[illegible]	[illegible]	1.[illegible]	[illegible]	[illegible]	19.00		
[illegible]		1.[illegible]	[illegible]	[illegible]			
[illegible]	1.10	1.[illegible]	[illegible]	[illegible]			
Ottawa	1.21	1.[illegible]	1.[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	[illegible]		
[illegible]	1.10	1.[illegible]	[illegible]	[illegible]		[illegible]	
Rockford	1.[illegible]	[illegible]	1.[illegible]				
Springfield	1.1[illegible]	1.[illegible]	[illegible]	[illegible]	25.00		
[illegible]	1.[illegible]	1.45	1.[illegible]	.78			
Waukegan	[illegible]	1.35	1.00	.88	17.00		
Michigan—							
Alpena	1.2[illegible]	[illegible]	[illegible]				
Ann Arbor	1.[illegible]	[illegible][4]	.....	.....	.....		
Battle Creek	1.00	.....	.....	.80	.....		
Benton Harbor	1.30	1.20	[illegible]	[illegible]			
Cheboygan	[illegible]	.30[4]	1.[illegible]				
Coldwater	1.[illegible]		.50[4]	.82	22.00		
Detroit	[illegible]	1.13	1.25	.85	23.00	1.82	1.85
Escanaba	1.30	.90	.50	.....	19.00		
Flint	[illegible]		1.[illegible]	[illegible]			
Grand Rapids	1.10	[illegible][4]	.65	.84	23.00		
Hillsdale	[illegible]		....	.....	.....		
Holland	1.30	1.[illegible]	1.00	.....	.....		
Kalamazoo	1.14		[illegible]	[illegible]			
Pontiac	1.25	[illegible]	[illegible]	[illegible]			
Port Huron	.95	.60[4]	[illegible]	[illegible]			
Saginaw	1.32	1.[illegible]	1.00	.78	.....		
St. Joseph	1.05	1.60	[illegible]	[illegible]			
Wisconsin—							
Antigo	1.40	1.50	[illegible]				.....
Fond du Lac	1.25	.95	1.2[illegible]				.....
Menasha	1.25	1.25	1.10	.....	.....		
Merrill		.65	....	.....	.....		
Marinette	1.[illegible]	1.15	.75[15]	.....	.....		
Sheboygan	1.[illegible]	1.25	1.00	1.05	.....		
Superior	1.[illegible]	1.25	.75	1.02	28.00	1.40	
Waukesha	1.40	1.35	.75	.....	.....		
Wausau	1.75	1.20	.80				
West North Central Division:							
Minnesota—							
Bemidji	1.50	1.50[4]	....	.....	.....		
Crookston	2.20		1.50	.....	.....		
Mankato	1.20	1.[illegible]	[illegible]			1.55	
Minneapolis	1.25	[illegible]	.70[illegible]	1.0[illegible]			1.[illegible]
Winona		1.25	[illegible]	[illegible]			
Iowa—							
Burlington	1.32	[illegible]	1.[illegible]	[illegible]			
Charles City	1.20	2.50	[illegible]				
Council Bluffs	.97	2.50	1.[illegible]	1.[illegible]	19.00[illegible]		
Creston	1.35	2.40	1.[illegible]				
Davenport	[illegible]	3.00	[illegible]	.93			
Dubuque	1.15	1.[illegible]	1.50	.90			
Fort Dodge	1.60	1.90	1.10				
Keokuk	1.40	1.25	1.40	1.70	25.00		
Marshalltown	1.05	1.00[illegible]	1.00				
Mason City	1.25	1.[illegible]	.70				
Ottumwa	1.20	1.[illegible]	1.00	[illegible]		1.65	
Sioux City	1.12	2.00	1.05				
Waterloo	1.25	1.50	1.00				
Missouri—							
Brookfield	1.60	[illegible]	1.[illegible]	[illegible]			
Columbia	1.15	1.30	1.20	.75			
Fulton	1.40	1.75	2.00	.70	18.00		
Jefferson City	1.60	1.[illegible]	1.[illegible]	[illegible]	18.00		
Kansas City	1.00	1.[illegible]	.90				
Kirksville	1.12	2.00	1.[illegible]	[illegible]			
Lexington	1.40[illegible]	1.50					
Moberly	1.20	[illegible]	1.10	17.00			
St. Charles	.96	1.[illegible]	1.15				
St. Louis	1.00	1.20	1.00	.83	22.00	1.55	1.50
Sedalia	1.40	1.2[illegible]	1.40	.80			
Webb City	1.10	.60[32]	2.00	.85	27.50		
North Dakota—							
Grand Forks	1.65	[illegible]	1.2[illegible]				
Nebraska—							
Fremont	1.60	.90	.90	.....	.....		
Lincoln	1.25	1.75	.75	.90	.....		
South Omaha	1.00	[illegible]	1.2[illegible]	1.0[illegible]			
Kansas—							
Atchison	1.[illegible]	1.6[illegible]	1.15	[illegible]			
Coffeyville	1.00	1.65	1.[illegible]	[illegible]			
Emporia		1.54	1.25	.....	...		
Fort Scott	[illegible]	1.2[illegible]	1.[illegible]	.72			
Hutchinson	1.30	2.00	.60	.90	25.00	1.50	
Independence	1.00	1.[illegible]	1.[illegible]	[illegible]	[illegible]		
Kansas City	1.00	1.[illegible]	1.[illegible]	[illegible]			
Manhattan	1.65	1.65	[illegible]	[illegible]	[illegible]		
Newton	.95	1.2[illegible]	[illegible]	1.[illegible]			
Ottawa	1.10	1.50	.90	.63	17.00		
Parsons	1.35	1.[illegible]	1.[illegible]	[illegible]			
Salina	1.50	1.[illegible]	2.2[illegible]	1.00			
Topeka	1.20	1.80	.75	.80	25.00		
Wellington	[illegible]	[illegible]	1.[illegible]				
Wichita	1.[illegible]	1.1[illegible]	1.00			1.90	
South Atlantic Division:							
Maryland—							
Baltimore	1.08	1.[illegible]	.90	[illegible]			1.90
Frederick	1.30	[illegible]	1.50	1.[illegible]			
Hagerstown	1.25	1.12	1.[illegible]	[illegible]			
District of Columbia—							
Washington	1.00	1.[illegible]	.40	.88			

	Portland cement, per bbl.	Broken stone, per cu. yd.	Sand, per cu. yd.	Paving brick, per sq. yd.	Asphalt, per ton	Creosoted wood block, per sq. yd.	Granite block, per sq. yd.
Virginia—							
Danville	1.[illegible]	2.00	.80	1.10			
Portsmouth	[illegible]	1.65	.75				
Staunton	1.20	1.25	1.50				
Suffolk	[illegible]20	1.65	1.10	[illegible]			
West Virginia—							
Clarksburg		2.00	.77				
North Carolina—							
Asheville	1.90	1.50	[illegible]	[illegible]			
Greensboro	2.00	1.85	.75				
New Bern	1.70	1.90	1.25	.90			
South Carolina—							
Charleston	[illegible]	.....	[illegible]	1.[illegible]			
Columbia	1.50	2.00	1.0[illegible]				
Greensboro	2.00	2.25	.75	32.00†			
Spartanburg	1.75	1.30	.50		[illegible]		
Georgia—							
Americus	1.[illegible]	2.35	1.00				
Brunswick	1.85	3.25	1.00	1.[illegible]			
Dublin	1.[illegible]	1.70[15]	.50				
Rome	1.10	.90	1.25				
Florida—							
Gainesville	1.85	3.00	.50	1.40			
East South Central Division:							
Kentucky—							
Lexington	1.40	.90*	1.60	.70	22.00		
Louisville	1.10	1.00	1.00	16.00†			
Owensboro	1.60	.90	1.25				
Paris	1.75	1.00	.12				
Tennessee—							
Knoxville	1.50	1.[illegible]	1.00				
Alabama—							
Dothan	1.72		1.00				
Gadsden	1.20	1.[illegible]	1.65	21.00†			
Mississippi—							
Meridian	1.35	1.40	1.00				
Vicksburg	1.[illegible]	1.00[4]	.90	[illegible]	20.00		
West South Central Division:							
Arkansas—							
Jonesboro	1.87	1.60	1.65	1.12			
Louisiana—							
New Orleans	1.65	1.90[4]	1.[illegible]	1.[illegible]	[illegible]		
Oklahoma—							
Bartlesville	1.25	1.50	1.50	.70			
Durant	2.00[37]	1.70	1.40	1.16	[illegible]		
Muskogee	1.30	1.50	.90	.80	28.00		
Oklahoma City	1.50	2.00	1.25	.95	40.00		
Tulsa	1.45	1.35	.90	12.00†	28.00		
Texas—							
Dallas	1.50		1.50	27.00†			
Greenville	1.70		2.00				
Longview	1.65	2.20	2.20				
Port Arthur	1.50	.....	1.25[15]			[illegible]	
San Antonio	[illegible]	1.50	1.50		[illegible]		
Temple	[illegible]	1.20[4]	1.50	.65			
Weatherford	2.20	.50[4]					
Mountain Division:							
Montana—							
Billings	[illegible]	1.60[4]	2.50	1.90			
Butte	2.08	1.50	1.00	2.60			
Great Falls	2.52	1.40[4]	1.25			[illegible]	
Helena	2.40	1.40	1.25	1.30			
Missoula	2.40	1.90	2.00				
Idaho—							
Boise	2.70	1.15	1.10	40.00†	[illegible]		
Twin Falls	2.73	2.00	1.6[illegible]	....	....		
Colorado—							
Boulder	2.00	1.25	1.25		.....		
Grand Junction	2.60	.90	.75				
New Mexico—							
Albuquerque	2.[illegible]	1.00[4]	.75	.....			
Utah—							
Salt Lake City	2.25	1.[illegible]	1.00		30.00		
Pacific Division:							
Washington—							
Bellingham	[illegible]	1.25[4]	1.25	1.25	...		
Centralia	2.50	1.40	1.25		...		
Hoquiam	2.75	1.50	.75	3.00			
Seattle	2.00	2.00	.90	1.20	15.00	1.15	
Spokane	2.30	1.50	1.25	1.80	21.00	1.[illegible]	
Vancouver	2.30	1.60	1.50		19.00		
Walla Walla	2.60	1.75	1.60	...	21.00		
Oregon—							
Ashland	2.[illegible]	2.00	1.40				
Baker	2.65	1.50	1.00				
Medford	3.00	1.25	1.25				
Portland	2.00	1.00	.75	1.45	14.00	[illegible]	
Salem	2.35	1.75	1.75	....			
California—							
Fresno	3.00	1.00	1.00	...	15.00		
Pomona	2.50	1.75	.90		...		
Napa	2.40	1.12	.75				
Richmond	2.00	1.25	1.00	....	12.00		
San Bernardino	2.60	1.25	.75		...		
San Diego	2.00	2.00	1.00				
San Jose	2.40	1.75	1.50		16.00		
Santa Cruz	.....	1.25	.75				

*Per ton. †Per M.

[illegible] net. [illegible]Delivered. [3]$1.25 to $1.45. [4]Gravel. [5]Medina [illegible] (pebbles). [7]Corning repressed blocks. [8]Pitch. [9]Rosendale 68 [illegible] binder, per gal. .08. [11]F.o.b. quarry. [12]Sandstone block. [13]Gravel [illegible] [14]2-in. at $2.7[illegible]; 2½-in. at $2.91, 4-in. at $3.64. [15]Delivered on th [illegible] Gravel .80 to $1.00. [illegible].80 to $1.00. [19]$1.50 for Class "A." [illegible] [21]Broken slag. [22]Gravel at bank. [23]Torpedo. [24]Coarse sand .9[illegible] [illegible] filler. [26]Gravel .80. [27]Saco. [28]4-in. at $1.59; 3½-in. at $1.40. [29]Sa [illegible] block $1.[illegible] [30]For 3½-in. [31]By carload. [32]Crushed stone for con [illegible] sists of mine tailings and were had for hauling, which avera [illegible] [33]Joplin Chats at .8[illegible] [34]Per 100 lbs. [35]Trap rock. [36]2-in. at $1.60; [illegible] at $1.7[illegible], 3½-in. at $1.7[illegible], screenings at $1.32. [37]From $1.25 to $2.0[illegible] [illegible] [39]Per 95-lb. bag, bag to be returned. [40]A [illegible] carbolineum wood block. [41]Basalt block.

NEWS SECTION

ditorial Comment Personals Society Meetings Trade Notes Catalog Reviews
Contract News, Embracing Bids Asked, Work Projected, Contracts Let and
Contract Prices on All Classes of Civil Engineering Construction Work.

[illegible]

Doings f the Veek. Prospects continue bright [illegible] ber are still under consid- [illegible] mia ,involving some 4,000,000 cu. yds. ution, and the Southern Pacific will [illegible] & Lassen R. R. in California. The [illegible] hanging fire, and very possibly will until next month, if it is then.

the railroad construction contracts g the past few days are the follow- V. Siggins, 425 East Main St., e, Kan., for grading for the exten- he line of the Union Traction Co. rryvale to Parsons; J. P. Nelson, nio, Tex., for building wharves, warehouses on Harbor Island for sas Harbor Terminal R. R.; Guthrie, ll & Co., Portland, Ore., for grading of line on the Wenatchee north the Great Northern R. R., the con- [illegible] g to about $1,500,000; Nelson Ben- ma, Wash., for constructing a 300 nel at Ruston, Wash., on the Point De- [illegible] uction Co., Davenport, Ia., for con- second track for the Wabash R. R. [illegible] stello Bros., Claypool Bldg., Indian- l., for constructing embankment for for the Wabash R. R. between New l Fort Wayne, Ind.; W. E. Tench & 90 West Grand Blvd., Detroit, Mich., ilding second track for the Wabash R. ween Detroit and Milan, a distance of les; Harlan Bros., Williams, Cal., sub- ct for grading a section of the Marys- olusa branch of the Northern Electric the Montana Construction & Irrigation Three Forks, Mont., for grading the Forks, Helena & Madison Valley R. R. Three Forks to Radersburg, Mont., 25 Arthur McMullen, 13 Park Row, New City, for constructing the foundation asonry for the 4,000 ft. Bronx viaduct [illegible] idge work on the Canadian Pacific Ry. in h Columbia and Alberta; Towles Co., [illegible] burg Northern, extending from Duck [illegible]

o extensive levee and drainage projects bly will come up for letting this year. may be asked the latter part of the year he drainage project of the Little River age District in Cape Girardeau, Scott, ard, Dunklin and New Madrid counties, uri. This work will involve the ex- ture of about $5,000,000 and will call for andling of some 40,000,000 cu. yds. of ial. The other project is that of the Drainage and Levee District in Ten- e. Bids on this probably will be taken in three months. They will call for the nation of 245,000 acres of land, the work [illegible] miles of levee.

In the way of government breakwater work the largest contract of the past week appears to be the one for the completion of the Kelsey Point Breakwater at Duck Island, Conn. This work called for 107,000 tons of stone, the bid of the Estate of John Beattie, Leete Island, Conn., at $1.07 being recommended for acceptance.

The supplemental estimates of the Canadian government for the coming fiscal year include an appropriation of $200,000 for beginning construction on the new Welland Canal, and an appropriation of $100,000 for French River waterway improvements, this being practically a beginning on the Georgian Bay ship canal. The estimates also include $1,000,000 for Quebec harbor improvements, $100,000 for St. John harbor, $1,000,000 for a dominion government building in London, England, $300,000 for new dominion buildings at Toronto and $500,000 for a new departmental building at Ottawa.

The city of Los Angeles, Cal., is preparing for the distribution of its Owen River water supply and plans of pipe lines and conduits for the line have been submitted to the Public Service Commission. The cities to be served with water are Pasadena, South Pasadena, Alhambra, Santa Monica, Venice and smaller communities lying between Los Angeles and Crescent Bay. The trunk line is estimated to cost $886,102.

Paving Work in 1911 and 1912. The statistics on paving, published elsewhere in this issue, indicate that 1911, judging at least from the amount of work done, must have been a prosperous year for the paving contractor. These figures show that the expenditures last year of 259 cities for the construction of pavements amounted to over $39,180,000. There are about 1,200 cities of a population of over 5,000 in this country. With only 20 per cent of these cities expending the above sum, it would not be a wild guess to estimate that the total expenditures last year of the 1,200 cities for paving work must have been at least $80,000,000. The greater part of the $39,180,000 was expended for new work, and probably over 90 per cent of it went for the construction of pavements other than of macadam or bituminous macadam. Of the cities reporting on work done last year, Portland, Ore., expended the largest amount ($7,021,260), Los Angeles, Cal., came next with $1,500,000, Detroit next with $1,410,030 and Spokane, Wash., followed with $1,351,000. St. Louis, Mo., spent $1,202,000, Oklahoma City, Okla., spent $1,192,000 and Seattle, Wash., spent $1,147,000. No reports on the matter were received from the three largest cities of the country—New York, Chicago and Philadelphia. As to paving work proposed for the present year, reports from 213 cities indicate that these places alone will spend a total of $29,600,000 for the construction of new pavements. Reports from over 400 cities were received, but only 213 gave specific figures as to the work to be done this year. Some of the cities reported that estimates for this present year had not been completed, others gave the proposed mileage but not the estimated cost, while others, which expended large sums last year, gave no indication of what would be expended this year. Judging from the figures at hand it seems very probable that the expenditures this year for paving work will exceed those of 1911. An indication of this is seen from the fact that of the cities which reported both the expenditures for 1911 and the proposed expenditures for 1912, the majority indicated that a larger amount would be expended during the current year than was spent in the previous year. Of the $29,600,000 noted above, $11,000,000 is to be expended in 7 cities. Portland, Ore., is to spend $3,000,000, Columbus, O., $2,000,000, Cleveland, O., $1,216,000, Los Angeles, Cal., $1,200,000, Detroit, Mich., $1,410,000, Newark, N. J., $1,000,000 and St. Louis, Mo., $1,000,000.

Fruit Trees Along Highways. Fruit trees are plentiful [illegible] highways in Germany, not [illegible] also for the revenue derived [illegible] The trees commonly planted are pear, plum, cherry and apple, the variety depending upon the location of the roads and the nature of the soil. When circumstances permit the trees are planted on either side of the road, 32.8 ft. apart when the surface of the roadbed is 29½ ins. above the natural surface of the ground or the bottom of the side ditch. When this height is exceeded, the trees are planted 16.4 ft. from each other. The fruit is sold on the tree at auction to the highest bidder, when the green fruit indicates what the probable harvest will be. The proceeds of the sales are expended by the authorities for the maintenance and construction of the roads, and are not used for the benefit of the poor of the respective communities. Guarding against theft and gathering the fruit are left to the purchaser.

In the province of Hanover, the climate and soil of which are not especially adapted for fruit raising, the annual gross income per tree along the roads averages 12.61 cents. From 1876 to 1902 the amount realized from the sale of the roadside fruit was $607,396, an average per year of $22,492. In the state of Hamburg but one experiment has been made in planting fruit trees for shading purposes, and this took place near the state prison in Fuhlsbuettel. The results were entirely unsatisfactory, as it was found that the trees were not particularly attractive for shading purposes and that the fruit was gathered by urchins with considerable damage to the trees themselves. In south Germany, fruit trees are planted to a considerable extent along the roadsides for shading purposes. Fruit trees are planted on the various highways of Bavaria and the crops at a certain time of the year are sold to the highest bidder. The receipts go to the general state fund. In Saxony each fruit tree is numbered; they are generally cherry trees. The crop for the year is sold in lots of 10 or 20 to the highest bidder and the proceeds credited to a fund for the maintenance of roads. The trees are under the supervision and care of the state authorities, the purchaser only picking the fruit.

PERSONAL

Mr. Bartley J. Campbell of Joliet, a well-known concrete contractor, died in South Bend, Ind., last week.

Mr. A. L. Chase, manager of the waterworks plant for the City of Cleburne, Texas, has resigned, the resignation to take effect when another man is secured.

Mr. Wm. Russel Smith, Jr., will deliver a lecture on April 9 before the Engineering Society of York, Pa., on "The Impounding Dam as an Essential Feature in the Conservation of Natural Resources."

Mr. Walter G. Kirkpatrick has been secured by the Commission of Birmingham, Ala., for the position of City Engineer at a salary of $4,200 for the present year. He entered upon his duties April 1. Mr. Kirkpatrick was formerly City Engineer of Jackson, Miss.

Mr. Walter A Sperry of Columbus has been appointed Chief Operating Chemist for the City of Grand Rapids, Mich., a new position created by the Board of Public Works. Mr. Sperry was formerly Assistant Superintendent of Purification and Softening Works of Columbus, Ohio. He began his new duties on April 1.

Mr. C. G. Young announces the removal of his offices from 60 Wall St. to the Bankers' Trust Building, corner Wall and Nassau Sts., New York City. By this move he will have a more commodious suite on the 28th floor and needed facilities for extending his business of engineering-construction and assistance in the financing of public utilities.

Mr. James G. Collins, who was deposed as head of the Bureau of Highways of the City of New York eight years ago, has been reinstated with the right to collect salary and interest for the past eight years. The extraordinary feature of the case is that the Bureau of Highways was abolished about a year ago, so that Mr. Collins has been reinstated to a position which does not exist.

Mr. S. W. Bowen, Resident Engineer for Brennecke & Fay and representing them in charge of the construction of the St. Louis municipal bridges, has left for Ft. Worth, Texas, where the firm has a contract for designing and superintending the construction of four reinforced concrete bridges. He expects while there to start the work of making preliminary surveys and will be gone a week or ten days. He will then return to St. Louis to get the work of designing under way.

Mr. Walter W. Marr, for many years an assistant engineer in charge of pavement construction for the Board of Local Improvements of Chicago, Ill., has resigned his position to take up private work with Mr. Paul Green under the firm name of the Ætna Engineering Co., 17 N. La Salle St., Chicago. Mr. Marr gained considerable prominence for his work in coping with difficult problems connected with the paving of the "loop" district of Chicago. He will be succeeded by Mr. Frank Matthews.

Mr. W. E. Morse, assistant general manager of the Chicago & Northwestern Ry., retired from service on April 1, the resignation being due to ill health. Mr. Morse's resignation entails a reorganization extending throughout the operating and engineering departments. Mr. S. G. Strickland, who has been general superintendent of the road, becomes assistant general manager, and he is succeeded as general superintendent by Mr. W. J. Towne, who has been engineer of maintenance at Chicago. Mr. Towne is succeeded by Mr. H. H. Decker, new division engineer at Winona, Minn., and Mr. Decker is succeeded by Mr. N. E. Thomas, now division engineer of the Madison division at Baraboo, Wis.

Mr. George B. Vilas, who has been superintendent of the Madison division, goes to Chicago as assistant general superintendent, an office which has just been created. Mr. S. S. Long, now division engineer of the Ashland division at Antigo, Wis., follows Mr. Thomas at Baraboo, and Mr. W. J. Jackson goes to Antigo to succeed Mr. Long. Mr. Vilas is succeeded as superintendent at Baraboo by Mr. E. E. Nash, who has been superintendent of the Minnesota division at Winona, and Mr. J. W. Doyle, now superintendent of the Dakota division at Huron, S. D., succeeds Mr. Nash. Mr. H. E. Dickson goes to Huron, S. D., as superintendent of the Dakota division, and is succeeded as superintendent of the Iowa and Minnesota division at Mason City by Mr. H. Rettinghouse, who has been division engineer at Boone, Iowa.

INDUSTRIAL

The Salem (Mass.) Electric Light Co. is to install five Taylor stokers in its power plant and the Weymouth Electric Light and Power Co. of East Weymouth, Mass., are to install two stokers made by the American Engineering Co., Philadelphia.

Bryant & Chapman Co., Hartford, Conn., is to install a 54 in. by 16 ft. 2 in. horizontal return tube boiler with 50 ft. smoke stack and smoke flue and equipped with Macdonald shaking grates, this equipment to be furnished by the Robb Engineering Co., Ltd.

F. M. Bowman, secretary; Wayne Rawley, manager structural works; and A. Bovard, engineer of the Riter-Conley Manufacturing Co. of Pittsburgh, Pa., have resigned these positions and are organizing a large manufacturing concern in conjunction with the Blaw Steel Centering Co.

The MacArthur Concrete Pile and Foundation Co. of 11 Pine St., New York city, has recently secured a contract for driving the pedestal concrete piles for foundations for the Penn St. bridge, Reading, Pa. L. H. Focht & Sons are the general contractors. Charles S. Sanders is the county engineer. A second contract for pedestal concrete piles for the Standard Oil Co. has also been recently secured by the MacArthur Concrete Pile and Foundation Co. These foundations will comprise about 700 pedestal concrete piles for stills, boiler plants, tanks and machinery at the Eagle works of the Standard Oil Co. at Claremont, N. J. The chief engineer is Mr. Parker, and C. E. Graff is the superintendent.

Recent orders of the Scherzer Rolling Lift Bridge Co. show a substantial and continued growth of business, and include many notable foreign orders, among which are a double track railway and combined highway bridge for the Great Central Ry, England, across the Trent River, having a movable span of 160 ft. and a width of 53 ft. 6 ins. out to out. This bridge will be the widest and heaviest movable bridge yet constructed in Great Britain. Two Scherzer rolling lift bridges have recently been completed for the Dublin Port and Docks Board at Dublin, Ireland, and a large railway and highway Scherzer rolling lift bridge is nearing completion for the Swansea Harbor Trust at Swansea, Wales. The very large Scherzer rolling lift bridge under construction across the Nile River at Cairo, Egypt, is rapidly nearing completion and is expected to be in service within a few months. The Buenos Ayres Great Southern Ry. Co. has recently placed under construction the fourth Scherzer rolling lift bridge in the process of modernizing and extending its terminal facilities at Buenos Ayres. The South Indian Ry. Co., in the process of extending its line toward the island of Ceylon, is constructing a double leaf Scherzer rolling lift bridge having a movable span of 225 ft. Within the United States and Canada more than 150 Scherzer rolling lift bridges have been constructed and placed under construction. The more recent railroad bridges placed under construction include a double track bridge for the Central R. R. Co. of New Jersey, a double track bridge for the New York & Long Branch R. R. Co. and bridges for the Southern Ry. Co., Savannah; the Atlantic Coast Line, Navassa, N. C.; Aransas Harbor Terminal Ry., Wildwood & Delaware Bay Short Line, the Cana[illegible]cific Ry. at Fort William, Ont., the [illegible] Northern Ry. across Salmon River [illegible] other across Rideau Canal. The recen[illegible] for electric railway and highway brid[illegible] have been especially numerous, including s[illegible] very large and wide structures, notably [illegible] double leaf structure at Toledo, Ohio, h[illegible]ing a movable span of 211 ft. center to [illegible] bearings, and a width of 70 ft.; [illegible] Lynn, Mass.; Huron, O.; Troy, O.; [illegible]inster O.; Sagamore, Mass.; East Chicag[illegible] Ind. Kimberly, Wis. All of these struct[illegible] designed by the Scherzer Rolling Lif[illegible] Co., having main offices in the Mc[illegible]dnoc[illegible] Building, Chicago, Ill.

CATALOGUES

Du Pont Powder.—Paper, 6x9 ins., [illegible] E. I. du Pont de Nemours Pow[illegible] Wilmington, Del.

This is a catalog which will be [illegible] all users of explosives. It illustra[illegible] describes the methods of handli[illegible] plosives for blasting and gives ill[illegible] directions for the use of all kinds [illegible] ing machines and accessories. Am[illegible] subjects taken up are the following: [illegible] ing caps, machines, mats, crimper[illegible] fuses, galvanometers, rheostats, [illegible] bags and thawing kettles.

Another catalog entitled "High [illegible] sives," 6x9 ins., 142 pp., mentioned i[illegible] vious issue, should also be had by [illegible] the practical information it contains.

Surveying Instruments.—Paper, 6x9 [illegible] pp. Keuffel & Esser Co., Hobok[illegible]

This is an insert sheet for the [illegible] catalog and illustrates four types [illegible] from the assortment of surveying [illegible] ments manufactured by this compan[illegible] folder illustrates and describes an en[illegible] transit with gradienter attachment, [illegible] road transit and Y level.

Keystone Drills.—Paper, 8¼x11¼ [illegible] pp. The Keystone Driller Co., Mon[illegible] Block, Chicago, Ill.

This catalog describes the blas[illegible] method of drilling with well drilli[illegible] chines, describes the Keystone mac[illegible] detail, and descriptions of special [illegible]tions are given.

Metal Culvert.—Paper, 6x9 ins., 16 pp. Canton Culvert Company, Trenton, [illegible]

This is a folder which contains i[illegible]tions and descriptions of the Acme [illegible]able Culverts and also the Imperial [illegible] culvert.

Continuous Coal Cutter.—Paper, 6[illegible] ins., 32 pp. Sullivan Machinery Co. People's Gas Bldg., Chicago, Ill.

This catalog illustrates and descri[illegible] the Sullivan Machinery Company's coal [illegible] for undercutting coal in room and [illegible] mines.

Suspended Bins.—Paper, 6x9 ins., Brown Hoisting Machinery Co., [illegible]land, Ohio.

This catalog illustrates and descri[illegible] the Brownhoist Patent Suspended Bins [illegible] coal and ashes in power plants. Line dr[illegible] are given showing the details of th[illegible] The bins are lined with Ferroincla[illegible] and covered with concrete.

Building Materials.—Paper, 5x7 ins., [illegible] pp. Chicago Building & Special Cor[illegible]tion Co., 220 Lomax Place, Chica[illegible] Ill.

This catalog is issued by the co[illegible] formerly known as Chicago Building Repair Co. It describes the work th[illegible] the company is prepared to do and giv[illegible] information as to its show rooms for [illegible]ing materials.

Industrial Railways.—Paper, 5x12 in[illegible] pp. Ernst Wiener Co., 42-48 C[illegible] St., New York City.

This folder describes and illustrates [illegible] layouts, turn tables, cars, engines and [illegible]ets which are used for construction a[illegible] the equipment of railways for industria[illegible] construction plants.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

n announced by G. A. Berry, Pen- Vice President and Chief Engi- Gulf, Florida & Alabama Ry., that d road would undoubtedly pass ile County, Ala., and would be Greensboro not later than the [illegible]

Alaska.

under consideration and some [illegible] Yukon Territory. As projected to run northward from Haines western-most part of this terri- s to tap the White river copper n that point it will continue on to- inks. The road is understood to king of Toronto capitalists. John [illegible]

Arkansas.

nent has been reached whereby the f the Pine Bluff & Northern Rail- onstruct a line from Pine Bluff, ne point on the Memphis branch Island. The city is to give a [illegible] and will construct a toll Arkansas River.

ntly incorporated Crossett, Monti- thern Railroad Co., mentioned in ie, which proposes the construc- -mile line from Cremer Junction Hill, is backed by men who own Lumber Co. The directors are: tt of Davenport, Ia., president of Lumber Co.; C. W. Gates of Pas- E. W. Gates of Crossett, manager ssett Lumber Co.; A. Trieschman McKimmey of Crossett, Ark.

California.

lowing sub-contracts have been let Bros. & Co., Hamilton, Cal., for ork for the Marysville-Colusa he Northern Electric Ry., men- r last issue. Harlan Brothers of o have been doing the grading on thern Pacific line from Hamilton is Grimes, will do the work on ion of the Marysville-Colusa road, Buena to a point a few miles east ity. The next section, from the property to Sutter City, will be Bell, who has been doing the grad- e Sacramento-Woodland electric ork from Sutter City to the Lon ice will be handled by the Henni- The section from there to Butte slough been arranged for as yet, but from gh to a point half way across district vork will also be done by the Hen- Bell has the contract from there to n. From Meridian to Colusa, on the le of the Sacramento river, the con- s been awarded to Harlan Brothers. [illegible] t Terra Buena and on the Humphrey ments property.

lifornia Central R. R., incorporated th a capital stock of $2,000,000, and ices at San Francisco, proposes to railroad and telegraph lines from Hol- San Juan, San Benito county, and hittenden to Watsonville, Santa Cruz a distance of approximately 30 miles. ectors named are George L. Walker of a, F. I. Guilford of Oakland, P. F. [illegible] and J. L. Fallon of San Francisco.

ed has been filed at Redding, Calif., ng franchises, rights of way, surveys holdings of the Goose Lake & South- . Co. to the Central Pacific Railroad Utah. The Southern Pacific plans to ads across the mountains in the north- t of the State. One line will run from County down the river joining the [illegible] eighteen miles north of Chi[illegible] The Goose Lake & Southern Railroad is projected from [illegible] north of Alturas, through Modoc, Lassen and Shasta counties to Anderson in this county. The length of this road is stated at 227 miles. [illegible] south of Alturas, extending through Modoc, Lassen and Tehama counties to Vina, a distance of 179 miles.

[illegible] has been incorporated with a capital stock of $1,000,000, of which $10,000 is paid in. The first board of directors, according to advices from Los Angeles, Calif., are G. C. Ward of the Redlands Central Ry. Co., Los Angeles, Calif.; A. N. Klemp, W. E. Dunn, H. P. Bumgartner, and Albert Crutcher.

The San Ramon Valley Railroad Co. has filed articles of incorporation with the County Clerk of Martinez, Calif., and proposes the construction of a 7-mile line connecting Danville and Walnut Creek in Contra Costa County. The principal place of business will be San Francisco. The capital stock is $250,000, divided into 2,500 shares, of which $7,400 has been subscribed. The five directors and their subscriptions ars as follows: J. H. Steinhart, $7,000; A. W. Jonas, $100; G. Miller, $100; S. S. Palmer, $100, and George W. Merrill, $100.

Articles of incorporation have been filed with the Secretary of State, Sacramento, Calif., by the San Francisco-Oakland Terminal Railways, which will include the former San Francisco, Oakland & San Jose Consolidated Railway Co., the East Shore & Suburban Railway Co., the Oakland Traction Co., and the California Railway. The consolidation represents a capitalization of $28,175,000, all paid up. Its chief offices will be in Oakland, and the directors are: E. A. Heron of Oakland, W. R. Alberger, Dennis Searles, W. W. Briggs of Piedmont, S. E. Kieffer of Berkeley, F. W. Frost of Alameda, and B. N. Aikens of San Francisco.

The Sacramento Interurban Ry. Co., of Sacramento, has been incorporated with a capital stock of $500,000, of which $30,000 has been subscribed, and proposes to build a line to run from Sacramento across the American and through the Rancho del Paso to and through Fair Oaks, and thence to Folsom, and continuing to Roseville, in Placer county. The directors are M. N. Williamson, Marshall Diggs and Ray C. Waring and A. D. Kilhahl of Sacramento; D. W. Johnson of Los Alimos, and Charles E. Hollister and James Elliott of Courtland.

Canada.

⦿C. H. Boyles, Spokane, Wash., has been awarded a subcontract for bridge work on the Canadian Pacific Ry. in British Columbia and Alberta. The work is located east of Lytton and the contract is reported to amount to about $1,000,000. Mr. Boyles has also been awarded subcontracts for the erection of tanks and boring wells for the Canadian Pacific, this work amounting to about $400,000. He will establish an office at Kamloops, 30 miles east of Vancouver.

Preliminary work has been started on the tunnel through the mountain at Montreal, by which the Canadian Northern Ry. will secure an entrance to the city. The tunnel will be about three miles long and will be driven through rock. S. P. Brown, New York City, is Chief Engineer of the work

Colorado.

Advices from Denver state that the financial interests backing the Denver & Rio Grande R. R. are to purchase from the Colorado & Southern R. R. its interests in the Colorado Midland R. R. [illegible] Grande a double track through the Rocky Mountains to Grand Junction. Under this system, it is stated, the westbound traffic would go over the present Rio Grande route between Pueblo and Grand Junction and the eastbound traffic will be diverted over the Grand Junction to Colorado Springs route of the Midland road. The later road would be rehabilitated, but this will be materially less in cost than the double-tracking of the present Rio Grande route between these points.

Delaware.

The Wilmington & Southern Traction Co., Wilmington, Del., has begun condemnation proceedings to secure right of way for the extension of its line from Rose Hill to Wilmington.

District of Columbia.

The Washington Railway & Electric Co. has applied to Congress for authority to make extensions of its lines in the northeast section of the city to connect the East Capitol and H St. northeast lines by a loop on 14th and 15th Sts northeast. It is desired to construct a single track, with underground conduit, from the eastern terminus of the East Capitol St. line at 15th St. northeast, up 15th St. northeast to H St. or Benning Rd., to construct a similar single track from H St. northeast along 14th St. down to East Capitol St., and to extend the tracks of the C and D Sts. northeast line from 13th to 15th Sts. on both C and D Sts. northeast.

Georgia.

Application has been made for a charter for the Jacksonville, McRae & Northern Ry. Co., which proposes a line to run from Jacksonville on the Altamaha River to Dublin via McRae. At Jacksonville a bridge will be built across the river to Barrow's Bluff, and connection made with a road now running from Barrows' Bluff to Douglas. The road to be built from Dublin to Jacksonville will be approximately 60 miles in length and will be built with McRae and Telfair county capital.

Illinois.

⦿Murphy & Cranven have been awarded a subcontract by Winston Bros., Minneapolis, Minn., who have the general contract for building the new Chicago & Northwestern line from Peoria, Ill., west.

⦿The Walsh Construction Co., Davenport, Ia., has been awarded the contract for constructing second track for the Wabash R. R., between Taylorville & Litchfield, Ill., 33 miles.

Proposition has been made to the Macomb Club, Dr. S. C. Stremmel, President, Macomb, by E. L. Tobie, for the rehabilitation of the Macomb and Western Illinois railway and its extension on the north to the Atchison, Topeka & Santa Fe Ry. in Henderson county and on the south to Rushville, Schuyler county.

The City Council of East St. Louis, Ill., has passed a bill granting the Alton & Mississippi Belt Ry. Co. a franchise to cross Cook and Mississippi Aves. with a double-track viaduct, thus placing the company in position to connect with the Municipal Free Bridge. P. W. Haberman is attorney for the company. L. J. Scherer, East St. Louis, Ill., is promoter of the company.

The following are the officials of the Central Illinois Ry. Co., incorporated recently to build a railroad from Chicago through Bureau and Henry counties to Muscatine, Ia.: D. D. McLean, Princeton, Ill., Chief Engineer; G. E. Ackerman, Kaneville, Ill., President; W. E. Williamson, Marseilles, Ill., Vice President; J. M. Raymond, Aurora, Ill., Secretary-Counsel; H. W. Johnson, Ottawa, Ill., Treasurer. The cost of the work proposed is estimated at $3,000,000. N. W. Evans, Aurora, as previously noted, has some of the grading work.

It is reported that the Chicago, Milwaukee & St. Paul Railroad will spend $26,000,000 for

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

additional double tracking, grade reductions, new equipment and other improvements during 1912. This heavy expenditure, it is said, is the result of the recent agreement with the Union Pacific by which through trains will be run from Chicago to San Francisco, Los Angeles and Portland. About $15,500,000 will be spent for double tracking and grade reductions, $8,000,000 for new equipment, $1,500,000 for enlarging yard facilities, $350,000 for ballasting and $350,000 for the construction of a new branch line of ten miles east of Savanna, Ill.

Indiana.

⊙Costello Bros., Claypool Bldg., Indianapolis, Ind., have awarded the contract for constructing embankment for new track between New Haven and Fort Wayne, Ind., to the Wabash R. R.

The Northern Indiana Ry. Co., South Bend, Ind., has ordered the material for the extension of the Portage Ave. line at South Bend.

Iowa.

As soon as the Winterset line of the Des Moines & Red Oak Ry. is completed the company plans to continue the line through Greenfield to Red Oak. It has been fully surveyed and 80 per cent of the right of way has been secured. Beginning at Des Moines, the road will pass through Madison County southwest to Winterset, a distance of twenty-six miles of this route. The survey then extends west for twenty-six miles through Adair County to Greenfield. The distance from Des Moines is fifty-two miles, as against 117 miles by any present route. After leaving Greenfield, the survey skirts the northern boundary of Adams County and then turns southwest to Red Oak, Montgomery County. George C. Boileau, Red Oak, Ia., is President of the company.

Kansas.

⊙B. V. Siggins, 425 East Main St., Cherryvale, Kan., has been awarded the contract for grading for the extension of the line of the Union Traction Co. from Cherryvale to Parsons. Grading work will be started near Dennis.

A charter has been granted to the Hutchinson & Northern Ry. Co., which is capitalized at $100,000 and proposes to build a line from Hutchinson through Reno, Harvey, McPherson, Marion, Dickinson, Clay and Washington counties to Fairbury, Nebr. The incorporators are W. S. Thompson, O. O. Hitchcock, L. A. Brinker and F. E. Feast, Hutchinson, Kan.

The Missouri Pacific, according to reports, is planning to construct, this spring, a cutoff from Larned to La Crosse, Kan. The line will connect the Conway Springs branch with the main line and will open up to a railroad a rich section of northern Pawnee County. The extension as surveyed will be through the towns of Ash Valley and Rush Center.

The Arkansas Valley Interurban Ry. Co., Wichita, Kan., has a preliminary survey underway of a route from Newton through Goessel, twelve miles north of Newton, and then to Canton, in McPherson county. It is stated that in case the company does not extend its line, which now runs from Wichita to Newton, on into the Goessel and Canton territory, it has been determined by local capital to build the line. In case this is done it probably will be turned over to the Santa Fe or the Missouri Pacific to operate.

W. Coughlin of Denver, Colo., has accepted the position of general manager of the Winnipeg, Salina & Gulf R. R., and at once took up the work of general supervision of all the surveying work being done, and in the future he will have charge of the construction and ultimately the operation of the line. His office will be in the Nesmith Bldg., Salina.

The Joplin & Pittsburg Ry. Co., Pittsburg, Kan., is considering building a line from 4th St. on Chestnut St., to Lincoln Park at Pittsburg.

Preliminary surveys have been started for the projected line of the Hutchinson & Western Interurban Ry. Co., mentioned in our March 6 issue. F. P. Roehr, Hutchinson, Kan., is general manager, and D. B. Harris is chief engineer.

Maine.

The Board of Trade of Belfast, Me., is making efforts to have the Bangor & Aroostook R. R., M. Burpee, chief engineer, Houlton, Me., extend its line from the present terminal at Searsport to Belfast, about six miles. It is intimated that the principal obstacle to carrying out the extension is excessive land damages.

Maryland.

The Westernport & Keyser Electric Ry. Co. is to be incorporated for the purpose of constructing a railroad extending from the terminus of the Cumberland & Westernport Electric Ry., in Westernport, to McCoole, in Allegany county, opposite the town of Keyser, Mineral county, W. Va., and thence across a bridge over the Potomac river to the southern boundary line between Maryland and West Virginia. The incorporators are Andrew Ramsay, Hazelhurst Sprigg and James P. Gaffney, of Allegany county, and Frank C. Reynolds and George C. Dixon, of Mineral county, W. Va.

Michigan.

⊙Arrangements are reported to have been about completed for beginning work on the proposed interurban line of the Battle Creek, Coldwater & Southern Ry., between Battle Creek and Coldwater. John T. Adams, Columbus Savings and Trust Bldg., Columbus, O., has the construction contract.

⊙The contract for building the second track on the Wabash R. R. between Detroit and Milan, a distance of 35 miles, has been let to W. E. Tench & Co., 3090 West Grand Blvd., Detroit, Mich. A large force of men and teams will be put on this work at once.

The Grand Trunk Ry. is said to be planning to begin construction work early this spring on its new 18½ mile line in the Thumb District touching Bad Axe and Cass City. The Detroit & Huron Ry. Co. has been incorporated to build the line. The directors are: A. B. Atwater, assistant to the president of the Grand Trunk, Detroit; C. M. Hays, president, and H. G. Kelly, vice-president of the Grand Trunk, Montreal; Frank W. Hubbard, Bad Axe; Harrison Geer, Detroit, and L. C. Stanley, Detroit, are attorneys for the Grand Trunk system.

The Ann Arbor R. R., J. K. Howard, Engineer Maintenance of Way, Owosso, Mich., is understood to be planning extensive improvements at Owosso, which will call for the expenditure of about $400,000 this year. It is stated that the car shops will be rebuilt on a much larger scale, new yards will be provided and a new depot erected. The company has options on 80 acres of land extending between the corporation limits of Owosso and Corunna and will use about 40 of it for their shops and yards.

Further information is now available concerning the recently incorporated Michigan Railway Engineering Co. of Kalamazoo, Mich., mentioned in our March 20 issue. The stockholders are G. B. Dobbin of Detroit, A. W. McLimont of Kalamazoo and S. W. Smith of New York. It is understood the new concern will be a subsidiary corporation of the newly organized Michigan United Traction Co., which recently took over the holdings of the M. U. R. The engineering company, it is said, will care for the repair and construction work of the traction company. It is probable the electrification of the Fruit Belt line will be the first big undertaking of the company. The entire $50,000 in stock is paid in cash at $100 per share. Dobbins holds 498 shares and the other two incorporators one share each. The articles of incorporation state the purpose of the company to be the construction and repair of buildings, railway terminals and other business pertaining thereto.

Missouri.

A special meeting of the stockholders of the St. Louis, Iron Mountain & Southern Ry. (Missouri Pacific system) is to be ca d soon to approve the new refunding mortg e it is proposed to place upon the property o raise money for betterments and improve nts that road.

St. Louis Items.

BY A. B. KOENIG.

⊙The Walsh Construction Co. of D enport, Iowa, was awarded the contract fo double tracking the Wabash Railroad betw Taylorville and Litchfield, Ill., 33 miles.

⊙Costello Brothers, Claypool Bldg. Indianapolis, Ind., were awarded the cont ct for double tracking the Wabash Railroad tween New Haven and Fort Wayne, Ind., miles. They also secured a lot of nice team ork on this line in Illinois which they will blet in quantities to suit outfits.

⊙W. E. Tench & Co., 3090 W. Gran Boulevard, Detroit, Mich., were awarded e contract for double tracking the Wabash ilroad between Oakwood and Milan, Mich., miles.

⊙Elmer Gant of the Canal Construc n was with us a day. He reports th C Construction Co. being awarded 1,665,0 of floating dredge work in Dead in Drainage District No. 13, near Osceola Ark.

The Board of Public Improvements as set April 19th for hearings on the follow ; proposed alley improvements and reconstr tions: To Improve Alleys—Between Spring, hirty-ninth, Magnolia and Botanical, betwee Etzel, Julian, Blackstone and Goodfellow from Spring to Gustine and between Potor Fairview; from North Market to St.L and between Arlington and Semple; tween Meramec, Gasconade, Compton and Virginia; between North Market, Spalding, King' Highway and Union; from Vandeventer to arne and between Palm and Natural Brid ; between Cottage, Kennerly, Cora and arcus, between Hartford, Arsenal, Morgan Fd and Alfred; from Des Peres to Rosedale d tween Berlin and St. Louis, Kansas ty Colorado Railroad; between Gravois, Potomac, Grand and Grace; from Gustine t Russell and between Wyoming and Conn icut between Wyoming, Connecticut, Ben Morgan Ford; between St. Ferdinan C tage, Cora and Marcus; from Clara to o fellow and between Theodosia anc C Brilliante; between Castleman, Shaw, enm and Tower Grove; between Garfield, orth Market, King's Highway and Union from Clara to Goodfellow and between Cot Brilliante and Garfield; north from Russe place to Oak Hill and between Hartford a Arsenal; between Wells, Eastin, Laur and Rowan; between De Giverville, Westmster, Laurel (partly private) and Hamilton from Clara to Goodfellow and between North Market and Spalding, between Cottage, Lcoln, Spring and Prairie; between Itaska, Nsho, Idaho and Alaska, from Alabama to Colorado and between Fillmore and Wilmiton; west from Athlone to Newstead and b veen Lee and Penrose; from Boyle to Ne tead and between Duncan and Forest Par between Russell, Lesperance, Third and oadway. To Reconstruct Alleys—Betweer Convent, Chouteau, Third and fourth; rom Ohio to California and between Russe and Allen; from Salena to McNair and bween Sidney and Victor; from Twentieth to venty-second and between Cass and Mullahy; from Eighteenth to Mississippi and bween Hickory and La Salle; from Russell t Lesperance and between Third and Broa a between Biddle, O'Fallon, Blair and Fift th; from Beaumont to Leffingwell and be een Morgan and Franklin; from Nineteent astwardly to a line 100 ft. west of and p lle to Fifteenth and between North Mark an Benton; from Fourteenth to Nineteent and between Sullivan and Hebert; from Arl sas to Grand and between Sidney and V or; from Mullanphy southwardly for a di nce of about 254 feet and between Twelft and Thirteenth; from Twenty-third to T ty-fifth and between Warren and Montgom y.

The Frisco has received twenty new p engers locomotives from the American Lo mo-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] Wrks within the past few [illegible] ve [illegible]n placed in service on the main lines.

J. J. cInerney has finished his work on the emp -Marianna cut-off of the Iron Mounin Rlroad at Democrat, Ark., and is shipng h outfit on the Wabash Railroad double ack rk in Illinois.

Plar for the $3,500,000 new Missouri State as outlined by E. W. Stephens, will for a building larger than the old one. rose oor space was 90,000 sq. ft. The floor ace the new building will be 250,000 sq. T commission expects to let first conact the fall. The building will be four ories bove the sub-basement. The heating nt ll be 300 or 400 ft. from the Capitol ildi and the heat will be conveyed through l. The sub-basement will be 12 ft. will be used for pipes and ventilatinery. The first floor and basement ed for vaults and storerooms and the n is now discussing the probability [illegible] he second floor will be devoted to ficers, the Insurance and Labor Coms, and the Adjutant General's office. floor will be for the exclusive use se and Senate chambers and a nummittee rooms. The fourth floor e official home of the State's apfficers, and a number of committee The commission next week will an program for competitive architects. will be asked to submit plans witht two or three weeks. The plans the competition will be in conformhe rules of the American Institute [illegible]

nd, 736 Reserve Bank Building. ty, Mo., can still use a lot of teams l work in southwest Missouri and

ntractors declined to bid on the n of the Belleview Ave. sewer in Mayor Faulstich declared he would bidders for the work. The Alton s declare the engineer's estimate for is too low and the law forbids the being awarded for a higher figure e estimate. City Engineer Schwaab, ade the estimate, said $2,018 for 1,800 sewer, which is his estimate, allowed fit. It is his first instance of confusing to bid on work in the city of

rd of Public Improvements set r public hearings on the following granitoid sidewalk constructions: n, between Liberty and Neosho; side of Arsenal, between Morgan King's Highway; on north side of between Twentieth and Twentyuth side of Angelica, between Blair -fifth; on Arlington Ave., between ket and St. Louis; on Bulwer Ave., rand and Prairie; on Clara Ave., North Market and St. Louis; on , between Prospect and Spring; on Ave., between Natural Bridge and on west side of Compton Ave., be Winnebago and Miami; on Fassen St., n Virginia and Alabama; on Forest between Manchester and Plateau; on rd St., between Bischoff and Northn Lee Ave., between Newstead and ; on north side of Linton Ave., be Belleview and Blair; on north [illegible] Twentieth; on south side of Linve., between Broadway and Twentyon Leffingwell Ave., between St. Louis odier; on north side of Manchester between Sublette and Tamm; on west f Michigan Ave., between Bates and berger; on east side of Michigan Ave., n Bates and Eichelberger; on south f Maiden Lane, between Twenty-fifth fferson; on north side of Maiden Lane, n Twenty-fifth and Jefferson; on Min- Ave between Del r and [illegible] side of McRee Ave., between Spring andeventer; on north side of McRee between Vandeventer and Klemm; on side of McRee Ave., between Lawrence [illegible] tween Broadway and Church; on east side of Ninth St., between Victor and Barton; on Newstead Ave., between Hunt and Manches- [illegible] ami and Potomac; on west side of Ohio Ave., between Potomac and Cherokee; on South Dakota St., between Compton and Virginia; [illegible] Hawk; on Semple Ave., between North Market and St. Louis; on Slattery St., between [illegible] of Montgomery; on St. Louis Ave., between Union and Belt; on Twelfth St., between Hebert and Branch; on Twenty-first St., between Branch and Salisbury; on Twenty-third St., between Hebert and Palm, on Vista Ave., between Grand and Tiffany; on Victoria Ave., between Billon and Tamm; on Waldemar Ave., between Forest and McCausland.

Receivers Delano, Pryor and Bixby of the Wabash Railroad awarded a contract to the Western Steel Car and Foundry Co. of Chicago for 750 automobile freight cars. The company operates a plant at Hegewisch, near Chicago, capable of turning out fifty cars a day. The Western is a subsidiary company of the Pressed Steel Car Co.

The following contractors have been awarded contracts by Costello Brothers on the Wabash Railroad between Taylorville and Litchfield, Ill.: Tom McGregor, 3 miles; Joe Pendergast, 10 miles; J. J. McInerney, 4 miles; C. C. Brady, 7 miles; Chas. Grant, 9 miles.

T. J. Dolan, the hustling secretary of the International Brotherhood of Steam Shovel and Dredgemen, spent a couple of days in St. Louis. Dolan reports the prospects in this part of the country never better nor the outlook brighter for steam shovel work than this spring and all jobs going to brotherhood men.

The Walsh Construction Co. has let the grading of its Wabash R. R. work between Taylorville and Litchfield, Ill., to Costello Brothers, Claypool Bldg., Indianapolis, Ind. The Walsh Construction Co. will do the track laying and ballasting.

Montana.

⦿The Montana Construction Co. & Irrigation Co., Three Forks, Mont., has been awarded the contract by the Three Forks, Helena & Madison Valley R. R., B. L. Allen, Chief Engineer, Garden City, Kan., for 25 miles of grading covering the distance between Three Forks and Radersburg, Mont. Subcontracts in 5-mile sections have been let.

It is reported that the Milwaukee is to at once let grading contracts for the Dry Creek line of the Gallatin Valley R. R. north out of Bozeman. C. A. Goodnow, Chicago, Ill., is President of the Gallatin Valley R. R.

Further information is now available concerning the recently incorporated Bismarck, Bellevue Valley & Western R. R., mentioned in our last issue. The new organization proposes to construct a standard gage railroad 20 miles in length between Bismarck, St. Francois County, and Sunlight, Washington County. The capital stock is $300,000, of which E. E. Evans of St. Louis owns 280 of the 300 shares. C. E. Hamlin, J. R. Roycroft, P. T. Ramsey, H. P. Hathaway, H. C. Albert, W. C. Haessler, E. C. Gimlin, Grant Wyatt and Louis Hudson, all of St. Louis, and E. T. Eversole of Potosi, Mo., each owns two shares of stock.

The Billings Land & Irrigation Co., Billings, Mont., has filed with the County Recorder a deed transferring to the Billings & Central Montana Railroad Co. seven acres of land a short distance east of the city. This fact gives rise to a report that the company is preparing to build the line from Billings to Roundup, Mont.

New York.

⦿Arthur McMullen, 13 Park Row, New York City, has been awarded the contract for constructing the foundation and masonry for the 4,000-ft. Bronx viaduct of the New York Connecting R. R. This viaduct will extend from the crossing over the New York & Harlem R. R. to Bronx Kills, New York City.

Condemnation proceedings will be instituted shortly by the New York State Railways Co. in Irondequoit, N. Y., for the double tracking of Ridge Road between Portland Ave. and the Forest House. As the company has planned to lay the road, it will take 12 ft. on the north side and 4 ft. on the south side of the road at one point. At another it will take 12 ft. on one side and none on the other. B. E. Tilton, 267 State St., Rochester, N. Y., is Chief Engineer.

North Dakota.

The Midland Ry. Co. is securing options on right of way in Jamestown and expects to have its line running into that city by Aug. 1. H. Pravitz, Edgeley, N. Dak., is General Superintendent.

Ohio.

A revised ordinance for the Cleveland & Youngstown R. R. has been presented to the City Council of Cleveland, providing for the construction of the tracks above the streets in the easterly section, instead of below them, as at first proposed.

Legislation has been introduced in the City Council of Cincinnati, calling for the elimination of the grade crossings of the C., H. & D., the Big Four and the B. & O. and all other tracks and switches crossing Queen City Ave., between Colerain Ave. and Harrison Ave. This would entail the building of the viaduct from Colerain Ave. to Harrison Ave. The motion calls on the city engineer to submit a plan and estimate to council.

Oregon.

Resolutions have been filed with the Secretary of State by the Oregon & California R. R. providing for the extension of the Southern Pacific from Salem to Fir, and for a short loop at Forest Grove.

The Mount Hood Railway & Power Co., Lewis Bldg., Portland, is considering building a branch from Russellville to Kelly Butte, the county rock crusher, and from there to a connection with the Hawthorne Ave. carline at the corner of East 60th and Division Sts., Portland, along the Section Line Road.

The Errol Heights Ry. Co. of Portland has been incorporated, the incorporators being Fred A. Jacobs, C. W. Hodson and G. M. Schrock of Portland. The company proposes to build a street car line opening up a suburban district and connecting with lines of the Portland Railway, Light & Power Co

Pennsylvania.

Brighbill & Davis, Erie, Pa., have started work on their construction contract for the Campbelltown & Lebanon Street Ry.

The Westmoreland County Ry. Co., John E. Potter, President, 1627 Henry W. Oliver Bldg., Pittsburgh, Pa., is understood to have secured the right of way and it is believed that construction work on the line from Derry to Blairsville will be started soon.

Mayor Blakenburg of Philadelphia has sent a message to the City Councils recommending that steps be taken to provide for a Division of Subways in the Bureau of Surveys to investigate the subway situation in the city. He asks that $50,000 be appropriated for this purpose.

South Dakota.

The Niobrara & Sioux City R. R., with headquarters at Pierre, S. Dak., and business office at Omaha, Neb., has filed its articles of incorporation. The company proposes a 150-mile line in the counties of Knox, Holt, Cedar and Dixon in Nebraska and Woodbury in Iowa. If built, the line will extend from Niobrara, Neb., to Sioux City, Iowa, and have a branch to O'Neil, Neb. The capital stock is $1,000,000, and the incorporators are: W. E. King, S. G. Peticolas, C. W. Baker, R. R. Kinkead of Omaha, Neb., and Glenn W. Martens of Pierre, S. Dak.

Among the reports concerning the new construction work contemplated by the Chicago, Milwaukee & Puget Sound R. R. is the double tracking of the road between Summit and Aberdeen, S. Dak., a distance of 70 miles; also [illegible] of Bass Lake.

Steps are being taken to incorporate a railroad to be known as the Sioux City, Mitchell & Pierre R. R. for the purpose of building a line between Mitchell and Blunt, with a terminus at Pierre. The following are interested: Theodore Quale, Blunt; J. B. Ross, Miller; T. S. Hall, Gann Valley; A. E. Hitchcock, Mitchell; D. B. Miller, Mitchell; D. J. Jekyll, Highmore; H. B. Wells, Wessington Springs; A. W. Ewart and C. E. Crew, Pierre.

The Chicago, Milwaukee & St. Paul Ry. is reported to be preparing to begin work early next month on the double tracking of 70 miles of line from Summit to Aberdeen, S. Dak.

Tennessee.

⊙The Towles Co., Wise, Va., has been awarded a contract for a section of the Lewisburg & Northern line of the Louisville & Nashville Railroad, extending from Duck River north through Chapel Hill, Holt's Corner, College Grove, Arrington, in Williamson County, a distance of 22 miles. Other contracts for this work were mentioned in previous issues of ENGINEERING & CONTRACTING.

⊙The Noll Construction Co., Chattanooga, Tenn., has been awarded the contract for grading for the new line of the Chattanooga Traction Co. from Chattanooga to Signal Point, three miles. The contract amounts to about $100,000, and includes 20,000 cu. yds. rock excavation.

Texas.

⊙The Aransas Harbor Terminal Ry. Co. has awarded a contract to J. P. Nelson, San Antonio, for the building of the wharves, docks and warehouses on Harbor Island. The improvements contemplated will cost in the neighborhood of $200,000. The wharves and docks will be connected to the mainland at Aransas Pass by a terminal railroad about six miles in length, the material for which is being rapidly assembled.

Surveys are being made for the projected 70-mile line of the Eastern Traction Co., the route of which is from Dallas through Greenville and Wolfe City, Tex., with extensions out from Greenville. The construction capital has been secured and arrangements made for the construction work. Joseph F. Nichols, Greenville, Tex., is President.

The Smith Lumber Co. of Livingston, Tex., has survey corps surveying a railroad between Bronson and Hemphill. Hemphill is the county seat of Sabine county and is eleven miles east of Bronson. It is understood that this road will be extended west to Broadus, on the Cotton Belt, which will give this section a much needed outlet.

The Corpus Christi Traction Co. has been formed and has applied to the City Council of Corpus Christi for a franchise for a street railway system.

Advices from Houston, Texas, state that steel for the San Antonio & Aransas Pass R. R., to be used on the extension between Falfurrias and Edinburg, has begun to arrive and will be pushed on to the scene of construction. About 5,500 tons of steel has already been shipped.

Among the reports concerning new railroad construction in Texas is one to the effect that John L. Spurling of Hamilton, Texas, is promoting a project to build a railroad from Beaumont to Waco, a distance of 225 miles.

It has been reported by J. A. Elkins, chairman of the committee to raise the $100,000 bonus for the construction of a new railroad through Huntsville, Texas, that the necessary amount is practically secured.

The Guadalupe Water Power Co. is stated to be planning to let contracts in about 90 days for the construction of an interurban line from Seguin to New Braunfels. E. W. Brown, Orange, Tex., is president, and G. W. Maxey, Seguin, Tex., is chief engineer.

Utah.

⊙The Utah Construction Co., Ogden, Utah, which has the general contract, as mentioned recently in ENGINEERING & CONTRACTING, for building the Oregon Eastern R. R. from Vale, Ore., west, has awarded a subcontract for the first 5 miles to L. A. Goldsmith, Caldwell, Idaho, and a temporary camp has been established 2 miles west of the city. The next four miles of grading work is being done by Jerry Hurley, a subcontractor who has been working on the Nyssa-Homedale extension and also on the ditches of the Nyssa-Ontario irrigation project. A third contract is to be let for the remaining distance of four miles to the mouth of the Malheur Canyon, where operations have been under way for the past three months. The 13 miles of roadbed from Vale to the canyon is an easy piece of work, as practically no grade is being required. It is learned that 130,000 cu. yds. of dirt will be moved at a price of $17,000. As soon as the first stretch of the grade is completed the first steel of the Oregon-Eastern will be laid and work trains operated between Vale and the Malheur Canyon camps, which at that time will be ready to use all the heavy machinery that at present cannot be hauled out over the rough roads. Another contemplated change is the moving of the headquarters of the Utah Construction Co. from Vale to Section 25, two miles south of town, which has been leased from the road land company. The change has become necessary because of the crowded condition of the present camp north of the railroad yards. Operations at the Malheur Canyon camps are also progressing rapidly, and work is being carried on more advantageously with the arrival of more machinery. At mile post 39 the crews have begun boring of the 2,600-ft. tunnel into the rocky cliff from both approaches. Headway is rapid and soon will be increased through the use of double shifts of crews. At mile post 56 the Banks Bros. are also pushing tunnel work, keeping a small crew on grade work. The starting of grading from Vale will give a greater impetus to all the operations.

A second company has filed an application with the City Commission of Salt Lake City, Utah, for a franchise for the use of certain streets in connection with a proposed interurban line from the city to Provo and Peyson. Preliminary surveys for a portion of the route have been made. Judge William H. King, Salt Lake City, is attorney for the applicants.

The National Fuel Co. of Salt Lake City, Utah, has filed an amendment to its articles of incorporation, empowering it to pledge its credit or to loan money to the Helper Western R. R. Co. to assist the latter in the construction of its line from the mines of the fuel company in Carbon County to the main line of the Denver & Rio Grande, a distance of about 15 miles.

The Commercial Club of Murray, Utah, is promoting a scheme involving the construction of a railroad from that city to a point in the Cotton Wood Canyon, a distance of 7 miles. It is estimated that the project will require a capital of about $100,000. As proposed, the route will be through Halliday and Union, and possibly make a loop and take in several of the nearby villages.

Virginia.

The Tidewater Company, which built and controls the Virginian Ry., has sold $25,000,000 first mortgage 5 per cent 50-year gold bonds of the Virginia Ry. From the proceeds of this sale the $17,000,000 Tidewater Co. 6 per cent notes which have been called for redemption on June 1 next will be paid off. About $1,000,000 of the funds derived from the bond sale will be used for improvements, such as building new sidings, new roundhouses and machine shops at various points on the Virginian Ry. H. Fernstrom, Norfolk, Va., is Chief Engineer of the Virginian Ry.

Washington.

⊙Nelson Bennett, Tacoma, Wash., has been awarded the contract for building the Ruston tunnel on the Point Defiance Line of the Northern Pacific. This tunnel will be 300 ft. long. Mr. Bennett, as noted in our Feb. 28 issue, also has the contract for a 4,500-ft. tunnel for the same line.

⊙The Great Northern Railroad Co., according to advices from Portland, ha to Guthrie, McDougall & Co. land, Ore., a contract for g miles of railroad on the Wenatche branch of the Great Northern, exte ing fr Wenatchee to Pateros. Much of th is hea work and it is reported on good uthor that the construction of this 56 mil of road will cost the company between $2,5 000 and $3,000,000 and that the work will t for at least 18 months. The contract for t grading alone is estimated to amount to re than $1,500,000, as much of the work is f y heav rock and grading. In connection wit the c struction of this line, which will end miles, connecting Wenatchee with O ville miles, from Oroville to Pateros, is in eadi for receiving the tracks. The Gu rie- Dougall & Co., or subcontractors, ar to c mence work about the middle of pr earlier, and the work will be und the rection of A. F. Whitcomb, engineer ch of the new construction work of G Northern, with headquarters in Spo ne

The commercial clubs of Richland d newick have appointed a committee ns of E. A. Palmeter of Richland a Stewart of Kennewick to interview authorities in regard to building a rd Kennewick through Richland to Ha or connect with the road now being lt Hanford.

West Virginia.

⊙Webb Kefauver, Baltimore, Md., is awarded the contract by the Baltimor R. R. for the construction of the rt from Buckhannon up French creek ta nection with the Richwood line at near Centralia.

A syndicate is being formed to u the $2,500,000 general mortgage 5 bonds of the Monongahela Valley Co., which is to take over the Fai Clarksburg Traction Co., the Clark Western and the Fairmont & North located in the soft-coal mining dist West Virginia. The proceeds of this le be used to take up outstanding note Fairmont & Clarksburg Ry. and to capital for extensions contemplated.

The Clarksburg & Western Tract has completed surveys for a projected traction line. S. L. Watson, Fairm Va., is president and Dudley Britt. burg, W. Va., is chief engineer.

Wisconsin.

The Superior & Southeastern Ry. J. Glover, President, New Richmond, Wi to complete about 10 additional miles this summer.

The Badger Railway & Light Co. Kamochulte, President, 403 Grand Av waukee, Wis., has secured over 70 per the right of way for its line from L neva to Whitewater, and it is understo the line will be completed this year.

Canada.

⊙It is reported that John Marsch, Salle St., Chicago, Ill., has been awa large contract by the Grand Trunk grading in British Columbia. Accor the information received the work wil a period of several years and will three outfits.

The Canadian Pacific is planning to lish a downtown freight terminal at Gal and has purchased four acres abutti east end of Main St., at present occup the Victoria Wheel Works. The plans a freight shed 290 ft. in length, and tracks will be laid in the yards with a minal facilities. The sum to be expend exceed $100,000, and may reach doubl amount.

The City Council of London, Ont., is once enter into negotiations with the Trunk Ry. for the abolition of grade cro in the city.

The Grand Trunk Ry. is to build a in North Toronto, somewhere on the ol Line, which it controls, between the Do Yonge St. Plans for the work are now y's offices at Montreal, and it is likely e work will be completed this year.

recent meeting of the directors of the a Falls, Welland & Dunnville Ry. at the n House, Welland, Ont., the following icers were elected: President, F. R. M. P., Dunnville; Vice President, Dr. Boulter, Niagara Falls; Secretary, F. E. r, Marshville; Treasurer, G. H. Burgar, d; Directors, A. E. Dell, Niagara Falls, her officials; Engineer, J. C. Gardner, a Falls; Solicitor, G. H. Pettit, Welland.

eputation consisting of Sir Rodolphe Montreal; Edward Bristol, M. P., To- and Dr. Alfred Thompson, M. P. for kon, has asked the Canadian Govern- r a subsidy for a line of railway which posed to construct to the Yukon. The l is to build a railway from Haine's to Fairbanks, Alaska, skirting the or forty miles to the Canadian boun- [illegible] would be in Canadian territory asked for.

Mexico.

[illegible] the Mexican Government and Henry Weis, representative of the Mexican Pacific Ry. Co., have signed the concession for a railroad from Balsas to Zihuatanejo. A government sub [illegible] due to the importance of the line. The new line will start from Balsas and will follow the left bank of the river to Zihuatanejo, [illegible] branch line also is under consideration to start at a point called Las Palomas, in the state of Guerrero, and connecting with the hacienda Las Balsas at a point called El Organal. The work of locating the line must begin within 30 days under the terms of the concession, the railway company being obligated to notify the department of communications 15 days in advance of commencing work. During the first year counting from the date of signing the contract, the company must complete 100 kilometers of track from Balsas and 50 kilometers from Zihuatanejo, the work to begin simultaneously at the two terminal points. In the period of twenty months, 50 kilometers [illegible] meeting point must be finished.

The Mexican Tramways Co., Harro Harrsen, General Manager, Mexico City, has awarded the contracts to local contractors for the construction of the 17-mile Toluca extension and the 11-mile Puebla extension. W. H. Fiske, Indianilla, Mex., is Chief Engineer of the Tramways Co.

RIDGES—STEEL AND CONCRETE

Alabama.

reported that the officials of the S ilway, Mobile & Ohio, the Alabama & rn, the New Orleans & Northeastern, e Alabama & Vicksburg have signi- eir willingness to share a portion of pense of building a viaduct over the at 22nd Ave., Birmingham, Ala., pro- the city furnishes the approaches.

Arkansas.

e contract for the construction of a te bridge at Little Rock, Ark., has warded to Weideman & Furr, Little Ark. James Lawson is City Collector.

Colorado.

Board of Supervisors, Denver, Col., ssed two bills authorizing the begin- f work on two important public im- ents. One of these bills appropriated for the payment of a part of the hare in the Broadway extension con- fund. The other bill appropri- 50,000 for the beginning of work on the Colfax viaduct.

Delaware.

e Wilmington Southern Traction Co., ngton, Del., has awarded the contract e construction of a viaduct over the f tracks of the Pennsylvania R. R. to hoenixville Iron Co.

District of Columbia.

been announced by E. H. Coapman, n, D. C., Vice President and Gen- ger of the Southern Railway Co., ew bridges will be constructed in Aiken, replace the old wooden structures wn use. The new bridges will probably [illegible]

Idaho.

T City Council of Standpoint, Idaho, has ized the City Engineer to prepare plans stimates of the cost for the construction new bridge on Bridge St. to replace the ructure which has been condemned.

Illinois.

contract for the construction of the d concrete Carley culvert in Han- wnship, Daviess County, Ill., has been to J. J. Leonard Construction Co., que, Ia., at $1,975. L. Ballein, Hanover, Town Clerk. Bids were opened [illegible]

s of Meredosia, Ill., have decided tition the officials of the Wabash Rail- for the construction of a wagon bridge ection with the new railroad bridge place.

a recent meeting of the LaSalle County f Supervisors, Ottawa, Ill., a com- was appointed to look after the coun- terests in the new bridge to [illegible] ross the Vermillion river. The cost of the ructure is estimated at $18,000.

At a recent meeting of the Board of La Salle County Supervisors, Ottawa, Ill., five petitions were filed requesting county aid in building bridge representing an expenditure of $23,450, of which the county is asked to pay one-half. Otter Creek township desires two bridges, costing, respectively, $2,000 and $1,200 each, La Salle township one bridge at $18,500, and Mission township a bridge at $1,750.

The Wabash Railroad will probably take up the matter of building a permanent bridge at Marley, Ill., to replace the temporary structure now in place.

The City Council of East St. Louis, Ill., has granted the Alton & Mississippi Belt Ry. permission to construct a viaduct over Cook and Mississippi avenues. P. W. Haberman is attorney for the company. L. J. Scherer is promoter of the project.

Indiana.

✤Bids will be received until 10 a. m., April 15, by Commissioners of Madison county at Anderson, Ind., for the construction of a steel bridge over Pipe Creek, concrete and steel bridge over Stony Creek, concrete and steel bridge over Hillgos and Clark Ditch and for the following bridge repairs: Two abutments under bridge over Sugar Creek, extension of abutments and repairs to bridge over ditch on Hancock county line, concrete floor and gas pipe railings over ditch on Hancock county line, repair of floor of bridge over Fall Creek, repair of floor of bridge over Lick Creek. Joel B. Benefiel, Auditor.

⊙Board of Rush County Commissioners, Rushville, Ind., has awarded the contracts for the construction of three bridges as follows: Brown bridge to B. R. Newhold, Melroy, Ind., at $472; Gliddon Bridge to Thomas H. Gibbons, College Corner, O., at $1,080; Maple Bridge to the Burk Construction Co., Newcastle, Ind., at $1,190. J. M. Stone is County Auditor. Bids for the work were opened March 20.

⊙The Board of County Commissioners, South Bend, Ind., has awarded the contracts for the construction of three bridges to Van Shyhawk & Kitch Construction Co., Bremen, Ind., as follows: Kern bridge, Union township, $1,223; Storer bridge, Center township, $619; Stucky bridge, Clay township, $737.50.

⊙James W. Kinser, 1312 Second Ave., Terre Haute, Ind., has been awarded the contract by the Board of Vigo County Commissioners, Terre Haute, Ind., for the construction of a bridge in Lost Creek township for $2,470. Bids were opened March 30 by Nathan G. Wallace, County Auditor.

Iowa.

✤Bids will be received by the Board of Supervisors of Cerro Gordo County, Iowa, at the office of the County Auditor at Mason City, Iowa, until 2 p. m. April 8, for the furnishing of materials and labor for the following items: Item 1.—One 23-ft. reinforced concrete arch bridge complete. Item 2.—One 23-ft. reinforced concrete skew slab bridge complete. Item 3.—One 32-ft. reinforced concrete through girder bridge complete. Item 4.—One 40-ft. riveted steel truss bridge with concrete floor and abutments. Item 5.—One 40-ft. riveted steel truss bridge with concrete floor and abutments. Alternate Item 1.—One 30-ft. riveted steel truss bridge with concrete floor and abutments. Plans will be furnished upon request by the Iowa Highway Commission, Iowa State College, Amos, Iowa, or upon application to Geo. E. Frost, County Auditor, Mason City, Iowa.

The following bids have been received by the City Council of Sioux City, Ia., for the construction of a steel or concrete bridge over the Floyd river at 11th St.: Elkhart Bridge & Iron company, Elkhar Ind., steel bridge, pin connected, $5.500, $5,600 and $4,950, and riveted bridge, $5,400 and $5,915. Capital City Construction company, Des Moines, Ia., steel, $6,700 and concrete, four 40-foot spans, $5,300; concrete, four 45-foot spans, $6,000 and concrete four 50-foot spans, $6,950. Marsh Engineering company, Des Moines, steel $6,874, and concrete $9,200. Monarch Engineering company, Falls City, Mich., steel, $4,480. Omaha Structural Steel Works, Omaha, Neb., steel, $4,960. Lewis & Leeder, Sioux City, reinforced concrete, $4,690, 50-foot spans, riveted pony truss, $6,570 and steel, $8,440. Haakinson & Beatty, Sioux City, steel, $6,572 and 130-foot, steel, $5,995. Beach Manufacturing company, Charlotte, Mich., two-span steel $5,900; special specifications, steel $5,000, steel, $4,250. The bids were referred to the department of streets and public improvements.

The City Budget of Sioux City, Ia. includes an appropriation of $19,000 for the construction of bridges.

M. Tschirgi & Sons and City Engineer Charles Baumgartner, Dubuque, Ia., in their report to the Committee appointed to take charge of preliminary work on the Grandview Ave. cut, have advised not to make the cut but to change the route and construct a 500-ft. viaduct over Catfish Creek and the Illinois Central tracks at Rockdale.

Kansas.

✤Bids will be received until April 22, by Board of Wyandotte County Commissioners, Kansas City, Kan., for the reconstruction of the West Kansas Ave. bridge. All bids received March 23 were rejected.

⊙The County Commissioners, Wichita Kan., opened bids March 18, and awarded the contracts for the construction of bridges and small culverts as follows: 54-ft. and 60-ft. standard pile bridges in Waco and Payne townships respectively to Charles E. Carr, Oakdale, Kan., at $630, one [illegible] bridge in Lincoln township to the Wichita Construction Co., Wichita, Kan., at $825; two steel bridges with concrete floors to the Missouri Bridge & Iron Works, St. Louis, Mo., at $1,166; one steel bridge with concrete floor to the Massillon Bridge Co., Massillon, O., at $731; two bridges and culverts to W. M. Blake & Sons, Wichita, Kan., at $3,650.

⦿The Board of County Commissioners, Topeka, Kan., has awarded the contract for the construction of a 40-ft. abutment for the Vassar Creek bridge to the Topeka Bridge Co., at $800.

Kentucky.

City Council of Pineville, Ky., has passed a resolution agreeing to pay one-half the cost of repairing the West Pineville bridge providing the county will pay the other half of the expense.

Maryland.

✣Bids will be received until 1:30 p. m., April 8, by Garrett County Commissioners, Oakland, Md., for the construction of a 3-span low truss iron bridge over Youghiogheny River at Geis, Md. The structure will consist of one 60½-ft. and two 68 ft. spans 12 ft. wide.

Advices from Annapolis, Md., state that a bill has been introduced by Senator Sproesser for State aid in building a new bridge over Spring Gardens from Baltimore to Brooklyn. The bill, it is said, provides for an appropriation of $250,000, one-fourth of the cost of the structure.

Massachusetts.

✣Bids will be received until noon, April 13, by Joseph L. Fowler, Superintendent of streets, Northampton, Mass., for removing present concrete arches and asphalt wearing surfaces on South St. bridge over N. Y., N. H. & H. R. R. tracks and Mill River, and replacing same, and repairing steel work in accordance with specifications and contract on file at the office of the Superintendent of Streets.

✣Bids will be received until noon, April 8, by John F. Merrill, Chairman, Weymouth Back River Bridge Commission, at the office of Harbor and Land Commissioners, 131 State House, Boston, Mass., for the construction of the substructure, guard piers, fenders and approaches for a highway bridge across Weymouth Back River in the towns of Weymouth and Hingham.

✣Bids will be received until noon, April 13, by J. L. Fowler, Supt. of Streets, Northampton, Mass., for removing present concrete arches and asphalt wearing surfaces on South St. bridge over the N. Y., N. H. & H. R. R. tracks and Mill River and replacing same and repairing steel work.

Missouri.

⦿The Board of County Commissioners, Independence, Mo., has awarded the contract for the construction of a reinforced concrete bridge over Rock Creek, north of Mount Washington, to the Canton Bridge Co., Canton, O., at $8,140. The structure will be 83 ft. long with 35 ft. driveway.

⦿The Board of Jasper County Commissioners, Carthage, Mo., has awarded the contract for the construction of bridges as follows: Purcell bridge, superstructure to the A. M. Blodgett Construction Co., for $6,091; substructure to W. W. Williams, of Joplin, for $2,506. Bridge over Jenkins creek, superstructure to the A. M. Blodgett Construction Co. for $1,745; substructure to the Missouri Valley Bridge Co. for $2,544. The concrete arch over Turkey creek to the Missouri Valley Bridge Co., for $6,390. The total of all these contracts is $19,276. The bridges to be erected are as follows: A reinforced concrete arch of 80-ft. span, located northwest of Joplin, across Turkey creek. A steel bridge with concrete floor, of 140 ft. span, across the North Fork of Spring River a mile north of Purcell. There is also an iron trestle 105 feet long at one end of this bridge, and the building of this will be included in the contract for the erection of the bridge. A steel bridge with concrete floor, of 80-ft. span across Jenkins creek, at the west edge of Union township, seven miles southwest of the courthouse.

The old bridge over the Salt Fork, one-half mile west of Napton, Mo., has been condemned by Highway Engineer Latimer and steps will probably be taken toward the construction of a new bridge to replace it.

Nebraska.

⦿The contract for furnishing all material and labor necessary for the construction of the concrete bridges required in Lancaster County, Neb., during 1912 has been awarded to the Lincoln Construction Co., Lincoln, Neb. H. E. Wells, Lincoln, Neb., is County Clerk. Bids were opened March 12.

New Hampshire.

⦿The contract for the construction of two 116-ft. single span highway bridges over the Androscoggin River at Mason St., Berlin, N. H., to the United Construction Co., 467 Broadway, Albany, N. Y., at $14,775. The work will include taking down two old iron spans and furnishing and erecting the new structures, which will have arched concrete floor, concrete roadway and concrete slab sidewalks. L. J. Wertheim is City Engineer. Bids were opened March 21.

New York.

⦿The contract for the construction of the foundation and masonry for the Bronx viaduct for the New York Connecting Railroad has been awarded to Arthur McMullen, 13-21 Park Row, New York City. Bids for the work were opened March 23.

⦿The contract for the construction of a new bridge over Cuyahoga Creek at Aurora St., Lancaster, N. Y., has been awarded to Corry Bridge Co., Corry, Pa., at $11,495. The structure will be of steel girder type. George C. Diehl is County Engineer.

C. H. Snyder, City Engineer, Oswego, N. Y., is preparing plans for the construction of a new bridge over the Oswego Canal at the foot of East Mohawk St. to replace the structure which recently collapsed. The cost of the new bridge is estimated at $2,000.

It has been announced by D. W. Peck, State Superintendent of Public Works, Albany, N. Y., that plans are being completed for the construction of the proposed new bridge over the Oswego river and barge canal at Phoenix. The bridge will be one of the largest in that part of the state and will cost about $145,000, according to present estimates. Over all the bridge will be about 750 feet in length. It will have a 24-ft. roadway, with sidewalk 6 feet wide on each side of the highway. The removable spans of the structure over the river and the barge canal will be double bascule, opening in the center and operated from each side of the span. The state, the counties of Onondaga and Oswego and the towns of Lysander and Schroeppel join in the cost. The cost met by the state will be about half the total.

A hearing was held March 25 at the office of the Public Service Commission, Albany, N. Y., on the matter of constructing a viaduct over the railroad tracks at Pleasant St., Utica, N. Y.

North Carolina.

Commissioners of Guilford County, Greensboro, N. C., have decided to replace all wooden bridges recently wrecked by floods with substantial steel structures.

Ohio.

✣Bids will be received until 11 a. m., April 15, by County Commissioners, Mount Gilead, O., for the construction of a reinforced concrete bridge over Whetstone Creek, near Mt. Gilead. The structure as planned will have two 50-ft. spans with an 18-ft roadway. Clifton Spies is County Auditor.

✣Bids will be received until 1 p. m., April 15, by Board of Tuscarawas County Commissioners, New Philadelphia, O., for steel superstructure to be placed on old substructure of Zoar Station bridge. Fairfield township, according to plans and estimates on file in the County Auditor's office. Each bid must be accompanied by a cash deposit of $300, or certified check payable to W. C. Shott, Auditor of said County.

✣Bids will be received until 1 p. m., April 9, by Board of Wood County Commissioners at the office of C. E. Stinebaugh, County Auditor, Bowling Green, O., for the necessary labor and material for the construction of reinforced concrete arch bridge over Grassy Creek at the following locations: First—About 210 feet south of the southeast corner of River Tract 81, in Perrysburg township, Wood County, O. Second—About 2,430 feet north of the southeast corner of River Tract 81, in Ross township, Wood County, O., in accordance with plans and specifications now on file in the office of the County Auditor.

✣Bids will be received until 1 a. April 24, by Board of Cuyahoga Coun C missioners, Cleveland, O., for the constr tion of a concrete arch bridge at Lake Sh Blvd. Plans and specifications are n at the offices of F. R. Lander, Coun S veyor J. F. Goldenbogen is Clerk Board.

✣Bids will be received until 11 a. 24, by Board of Cuyahoga County Com sioners, Cleveland, O., for the construc of bridgework per Report No. 2920, concrete arch, Lake Shore Boulevard, East Cleveland township. J. F. Goldenbogen is Cl

✣Bids will be received until April 22. Board of Ross County Commissions the repair of the river bridge at Brie Chillicothe, O. The work will incl e pairing abutment, repairing 3 spans steel and flooring with creosoted wood blk. R. D. Alexander, Chillicothe, O., is ounty Auditor.

Commissioners of Cuyahoga County Cle land, O., have formally approved pla specifications for the construction $300,000 piers for the Superior Av. level bridge. J. L. Harrington, Kans is chief consulting engineer of the bo. settlement has yet been made with t railroad, on whose property the west en the bridge is to be sunk. The la transferred to the railroad by the Er L & Improvement Co. A long struggles ticipated before the county secures poss The Erie wants the span of the bridge ng ened at a cost of more than $200,00 This the commissioners refused to do.

Oklahoma.

A special election was held at Oklahoma City, Okla., April 2, to vote on the est of issuing $56,000 of bonds for the constr tion of seven bridges and four concrete the arches being held necessary for outlets for storm sewers, and the across the Canadian and Lightning cre essary for adequate fire protection, a venience of public travel between Oklahoma City and Capitol Hill addition. Bridge No. is to be constructed across Canadian Frisco and Byers avenues, at a cost of Bridge No. 2—Over Canadian at and Reno Ave., cost $2,750; Bridge Over Lightning creek on Avenue "A $6,000; Bridge No. 4—Over Lightnin on Avenue "C," cost $12,000; Bridge Over Lightning creek, on Santa Fe cost $6,000; Bridge No. 6—Over Lightning creek Avenue "E," cost $7,000; Bridge Over Lightning creek, Avenue "G," co $1 000. Concrete arches, Opening No. nam City Blvd. and 37th St., cost Opening No. 9—Putnam City Blvd. a St., cost $2,500; Opening No. 10—Western Ave., south of Ash St., $2,500; Openi 11—Pennsylvania Ave. north of Sy St., $1,500.

Pennsylvania.

✣Bids will be received until 10:30 April 5, by City Controller, Pittsburg Pa for the following bridge repairs: Aik

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

brile crossing the P. R. R., reconstruct-
[illegible]
South Twelfth street bridge cross-
V. & C. R. R., reconstructing floor
eel plates and brick paving. Point
er the Monongahela river, renewal
oadway timber floor and repairs to side-
[illegible]

will be received until 8 p. m., April
retary, Monessen, Pa., for the nec-
ary bor and material for the construction
reforced concrete viaduct for Reed Av.
ordig to the plans prepared by Chester
Pittsburgh, Pa., the structure will
[illegible]
, and 32 ft. wide. A. W. Johns is
ngineer.

will be received until 8 p. m., April
ough Council, Monessen, Pa., for
g a reinforced concrete viaduct,
[illegible]
ed across a ravine which separates
s of the borough. The main span
ft. parabolic arch with approxi-
ft. from base of ravine to floor of
e arch. Plans can be obtained at
[illegible]
Pittsburgh, Pa.

ntown & South Allentown Bridge
own, Pa., W. W. Wysor, Chief
has retained B. H. Davis, Metro-
g., New York City, designing en-
repare plans for the construction
rced concrete bridge about 1,940
[illegible]
eet. It is hoped to have the plans
some time during May.

f Trade of Nanticoke, Pa., will
erence with the Commissioners of
unty at Wilkesbarre, Pa., to take
tter of building a bridge connect-
ke and West Nanticoke.

Tennessee.

[illegible]
t a recent meeting at Toledo, O.,
e contract for the reflooring of
idge between Maumee and Perrys-
W. Johnson, Tontogany, O., at
e new flooring will be of creo-
block.

[illegible]
Designing Engineer for the Mc-
Callie Ave. viaduct at Chattanooga, Tenn., is now completing working plans for the structure [illegible] shortly. The viaduct as planned will be of reinforced concrete and is estimated to cost about $126,000.

The West Cincinnati, O., Business Men's Association has passed resolutions for the construction of a viaduct over the Queen City Ave. near Bogen St., to Beekman St., Fairmount. This plan would eliminate the Queen City crossing of the B. & O. and C. H. & D. railroads and enable the passage of cars going through Lick run and Queen City avenue directly into the canal boulevard and thence into the center of the city, making the passage time from points in the northwestern part of the city to the center of the city less than one-third of the time now required. A committee was appointed to take up the matter with council.

Commissioners of Wood county, Bowling Green, O., have passed a resolution to advertise for bids in July for the enlarging of a culvert over the Shoup ditch.

Texas.

⊙The Wilson County Court, Floresville, Texas, has awarded the contract for the erection of four iron bridges in various parts of the county to the Missouri Valley Iron & Bridge Co., Leavenworth, Kan., at $17,444.

An election was held in Bee County, Texas, to vote on the question of issuing $15,000 of bonds for the construction of five bridges. Dan Troy is County Clerk, Beeville, Texas.

Utah.

⊙It is reported that the U. S. Reclamation Service has awarded the contract to J. Burke & Co., Salt Lake City, Utah, for the erection of a 100-ft. single span steel bridge over the south fork of the Shoshone River, 12 miles above Cody, on the Shoshone project in Wyoming.

Virginia.

✣Bids will be received until noon, April 12, by County Court, Tazewell, Va., for the construction of a 209-ft. bridge with 12-ft. roadway concrete substructure over Clinch River, a quarter mile from Cedar Bluff on the N. & W. Ry. The structure, according to plans on file with Childrey, Sunday Co., Richmond, Va., will consist of two 70 ft. spans and steel approach span. P. St. J. Wilson is State Highway Commissioner, Richmond, Va.

✣Bids will be received until noon, April 6, by Caroline County Clerk, Bowling Green, Va., for the construction of a steel or reinforced concrete bridge over Mattaponi River at Hawes Lane.

⊙Advices from Petersburg, Va., state that the contract for the construction of the new bridge over the Appomattox River has been let to the Harrison Construction Co.

Washington.

⊙The Washington Engineering Co., Tacoma, Wash., has been awarded the contract for the construction of an all-steel bridge over the Puyallup River at $9,250.

West Virginia.

The County Court, Wellsburg, W. Va., recently held a meeting to consider the question of building a bridge at McBrown's Ford and one at Harmon's Creek, near Colliers, in Brooke county. It has not been decided whether the structures will be of steel or concrete.

Wisconsin.

Plans have been prepared by C. V. Kerch, City Engineer, Janesville, Wis., and approved by the Common Council for the construction of a new reinforced concrete bridge over Spring Brook. The bridge will be of girder type and will be supported on two abutments and two pairs of center piers, each consisting of three concrete posts. Each post will carry a pier girder for the support of the floor. The total length will be 72 feet. not including the wing walls, and will consist of three 22-ft spans. It will be 26 ft. wide, leaving 24 ft. clear roadway. No provision has been made for walks as the traffic in that part of the city is very light and the bridge will be paved with brick or macadam. A reinforced concrete railing of simple design will be placed on either side of the roadway.

Citizens of Beloit, Wis. are agitating a movement toward the construction of a new bridge over the Rock River from Public Ave., to Thompson Shops.

OADS, STREETS AND PAVEMENTS

Alabama.

citizens of Greene County, Ala., on
voted on the proposition to issue
n the sum of $120,000 for construc-
hard roads. It is reported the issue
Eutaw is the county seat.

California.

G. Fenton has been awarded the con-
the Board of Trustees of Coronado,
r the grading of Seventh St., from E
ve., at $.30 per cu. yd. for excavating,
yd for embankment and $.06½ per
or paving.

Board of Trustees of Coronado, Cal.,
sed ordinances authorizing the issuing
,000 bonds sanctioned by residents at
ent election. It is planned to com-
work shortly on the paving of Orange
rom the ferry to Coronado Hotel, esti-
o cost $80,000. The remaining $75,000
used on the construction of the sea

Delaware.

wing bids were received by the Levy
of Newcastle County, Wilmington, Del.,
ad work: Road from New Castle to
Corner, 1.36 miles, Junita Paving Co.,
; John A. Clark, $10,890; Ambler Davis
,766; Stewart & Donohue, $12,000; Hor-
Contracting Co., $11,327; W. C. Evans,
; Talley & Crumlish, $13,394. West
r road, extending from Adams' Cross
Roads, 1.63 miles: Patrick J. Mundy, $16,000; Junita Paving Co., $17,472; John A. Clark, $19,550; D. E. O'Connell & Sons, $17,925; John F. O'Neil, $16,132; Corcoran Construction Co., $19,235; Ambler Davis Co., $17,429; William C. Evans, $21,000. Road from Marshalltown to Stanton, .84 of a mile: Patrick J. Mundy, $7,429; Ambler Davis Co., $8,690; Schunemunk Construction Co., $12,603; Junita Paving Co., $9,101; William D. Davis, $7,806; Stewart & Donohue, $10,193; William C. Evans, $9,861; John A. Clark, $8,400. Road from Stanton to the Oak Tree, .6 of a mile: Ambler Davis Co., $5,764; Patrick J. Mundy, $5,600; Schunemunk Construction Co., $8,253; Junita Paving Co., $5,674; Stewart & Donohue, $5,294; William D. Davis, $5,128; William C. Evans, $6,555. Pike's Creek Road, running toward Union for a distance of 3 miles: William C. Evans, $26,978; Stewart & Donahue, $38,500; Patrick J. Mundy, $27,000; Ambler Davis Co., $34,872. Wilmington and New Castle Road, extending from northerly boundary of New Castle towards Wilmington, .71 of a mile: Talley & Crumlish, $7,796; Ambler Davis Co., $6,780; Junita Paving Co., $7,032; Schunemunk Construction Co., $10,620; Horrigan Contracting Co., $7,575; John A. Clark, $7,900; William C. Davis, $6,989; Stewart & Donohue, $8,131.

Florida.

✣Bids will be received until 11 a. m., April 9, by Commissioners of St. Lucie County, Fort Pierce, Fla., for the construction of hard-surface roads, bridges and docks. The work comprises approximately 100,000 cu. yds. for excavation and embankment, 90,000 cu. yds. of hard-surface material, 700 lin. ft. of trestle bridges, two docks, also 75,000 cu. yds. embankment. Plans, profiles and specifications may be seen at the office of engineers, D. D. and C. M. Rogers, Fort Pierce, Fla.

⊙The Duval County Board of Commissioners, C. W. Ellis, Chairman, Jacksonville, Fla., has awarded the contract for the clearing and grading of Lake Shore Blvd., through Lake Side Park, to Sam Spencer at $35 per acre for clearing and $.18 per cu. yd. for grading. Gail L. Barnard is County Engineer.

The Duval County Board of Commissioners, C. W. Ellis, Chairman, Jacksonville, Fla., rejected all bids received March 29 for the clearing and grading of the river road from the city limits of South Jacksonville to the Style Road. Gail L. Barnard is County Engineer.

Georgia.

The city of Buford, Ga., will let contracts in from 60 to 90 days for the laying of one mile of pavement, estimated to cost $10,000. The kind of pavement, foundation, etc., has not been decided upon.

Idaho.

The City Council of Pocatello, Ida., has ordered the paving of 25 blocks of streets in the business district this year, as follows: Thirteen blocks on Center St., from the hospital to 9th Ave., and 12 blocks on Main St., from Halliday St. to Sublette. Bids will be invited on bitulithic concrete asphalt and macadam. J. M. Bristline is Mayor.

Illinois.

✣Bids will be received until 1 p. m., April 6, by Board of Local Improvements, Bement, Ill., for grading, paving and curbing Rodman St. at an estimated cost of $19,899. W. J. Day is President of the Board.

✣Bids will be received until April 13, by Board of Local Improvements, Moline, Ill., for the construction of 9,401 sq. yds. of brick pavement and 6,011 lin. ft. of concrete curb; 20,223 sq. yds. of asphalt pavement and 15,827 lin. ft. of combined curb and gutter, according to plans on file with Lyle Payton, City Engineer. The work will be done on the following streets: Brick on the following streets: On 55th St. from Railroad Ave. to Fourth Ave., which will make a connecting link between East Moline and Moline. On Seventh Ave., from 15th to 17th Sts. On Eighth Ave., from 15th to 17th Sts. On 15½ St. from 8th to 10th Ave. The streets to be paved with asphalt are the following: On 12th St. from 17th to 19th Ave. On 14th Ave. from 9th to 15th St. On Eleventh St. from 12th to 16th Ave. On 11½ St. from 14th to 16th Ave. On 14th St. from 14th to 16th Ave. On 14th Ave. from 16th to 18½ Ave. On 18½ St. from 12th to 14th Ave.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, until 11 a. m., April 10, for furnishing materials, labor, etc., necessary to construct pavements in the following streets: Ave. N, 3,910 lin. ft. sandstone curb, 8,480 sq. yds. granite top macadam; Catalpa Ave., 1,900 lin. ft. (5 in. x 30 in.) sandstone curbing, 3,280 sq. yds. asphaltic macadam; Central St., 6,230 lin. ft. concrete curb and gutter, 9,790 sq. yds. asphalt; Cortez St., 1,465 lin. ft. concrete curb and gutter, 2,075 sq. yds. asphalt; Emerald Ave., 1,240 lin. ft. concrete curb and gutter, 1,820 sq. yds. asphalt; Forrestville Ave., 870 lin. ft. gravel concrete curb and gutter, 350 lin. ft. gravel concrete gutter, 1,850 sq. yds. asphalt; 41st St., 675 lin. ft. sandstone curbing, 1,560 sq. yds. No. 2 granite block; 56th St., 1,262 lin. ft. concrete curb and gutter, 2,550 sq. yds. creosoted wood blocks; Green St., 1,250 lin. ft. concrete curb and gutter, 1,960 sq. yds. asphalt; Homer St., 3,570 lin. ft. concrete curb and gutter, 5,430 sq. yds. asphalt; Huron St., 2,465 lin. ft. concrete curb and gutter, 3,690 sq. yds. asphalt; Lake St., La Salle St., 710 lin. ft. concrete curb and gutter, 1,230 sq. yds. asphalt; Lawrence Ave., 9,750 lin. ft. sandstone curbing (5 in. x 30 in.), 14,990 sq. yds. creosoted wood block; Leavitt St., 2,840 lin. ft. concrete curb and gutter, 4,800 sq. yds. asphalt; Madison Ave., 4,610 lin. ft. concrete curb and gutter, 6,900 sq. yds. creosoted wood block; Melrose St., 9,900 lin. ft. concrete curb and gutter, 16,000 sq. yds. asphalt, 4,900 lin. ft. concrete curb and gutter, 7,680 sq. yds. asphalt; 19th st., 2,300 lin. ft. concrete curb and gutter, 3,600 sq. yds. asphalt; Peoria St., 1,250 lin. ft. concrete curb and gutter, 1,960 sq. yds. asphalt; Rhodes Ave., 6,900 lin. ft. concrete curb and gutter, 10,430 sq. yds. asphalt; Sherman Ave., 1,200 lin. ft. concrete curb and gutter, 1,600 sq. yds. asphalt; St. Lawrence Ave., 6,400 lin. ft. concrete curb and gutter, 11,000 sq. yds. asphalt; 63d St., 3,200 lin. ft. sandstone curbing, 9,300 sq. yds. creosoted wood block; 35th St., 7,030 lin. ft. sandstone curbing, 9,300 sq. yds. creosoted wood block; 35th St., 7,030 lin. ft. sandstone curbing, 15,590 sq. yds. creosoted wood block; Washington Ave., 6,000 sq. yds. creosoted wood block; Ontario Ave. system, 8,960 lin. ft. concrete curb and gutter, 17,290 sq. yds. asphaltic macadam. The work includes sewer construction and adjustment, in Portland cement concrete foundation and sand cushion when specified. Specifications on file with John B. Hayes, Chief Clerk Paving Division.

Following bids were received by the Board of Local Improvements of Decatur, Ill., for the resurfacing of North Main and West North Sts.: North Main St.—Capital City Construction Co., Springfield, Ill., $30,301; S. S. Saxton Co., Frankfort, Ind., $28,344; Murray Construction Co. Knoxville, Tenn., $27,097 (on Trinidad asphalt); Murray Construction Co., $27,097 (on Bermudas asphalt); Murray Construction Co., $25,655 (on California asphalt); H. P. Streicher, Memphis, Tenn., $24,489. West North St.—Capital City Construction Co., $7,378; S. S. Saxton, $7,059; Murray Construction Co., $6,764 (Trinidad); Murray Construction Co., $6,764 (Bermudas); Murray Construction Co., $6,403 (California); H. P. Streicher, $6,004.

The Board of Local Improvements of East St. Louis, Ill., has adopted plans and specifications for the improvement of Missouri Ave. from 21st to 35th Sts., by paving with brick and sewering. City Engineer E. F. Harper has estimated the cost at $103,189.

The City Council of Belleville, Ill., has passed ordinances providing for the paving of four streets at an estimated cost of $104,924. The streets to be paved are Fourth, Fifth, Sixth and Seventh Sts. About 80,000 sq. yds. of paving will be laid.

The city of Champaign, Ill., contemplates laying brick pavement on Neil St., from Hill St. to the Big Four tracks, Fifth St., from the north limits to the south limits, East University Ave., from Market St., to Wright St., and Prospect Ave., from Washington, one-half of a mile north. The work will cost approximately $183,000.

The Board of Local Improvements of Rock Island, Ill., has passed a resolution for the paving of 20th St., from First to Fourth Ave., with creosoted wood block, and from Fourth Ave., south to Seventh with brick. H. M. Schriver is Mayor. L. D. Jeffries is City Engineer.

The Board of Local Improvements of Rockford, Ill., has passed a resolution for the paving of Harlem Ave., from the watering-tank to Auburn St., and two blocks on North Main St., south of the tank. The distance includes about a mile and a quarter and the cost will be $71,047. April 1 was set as the date for final hearing. The estimates of City Engineer Edmund Main is apportioned as follows: 7,570 cu. yds. of excavation at 40 cts. per yard, $3,028; 27,125 yds. brick pavement at $1.90 per sq. yd. $51,672; 9,294 lin. ft. cement curb at 22 cts per ft., $2,324; 12,450 lin. ft. cement curb and gutter at 50 cts per ft., $6,225; 50 crossing heads at $6, $300; storm water sewer, $5,000; court costs, engine, advertisement, inspection, etc., $2,500.

The City Council of Shelbyville, Ill., has definitely decided to make improvements which will cost near $60,000. The pavement to be laid will be similar to that on Main St. A public hearing was held March 28.

Approximately 15 blocks of the residence section of Harvard, Ill., will be paved this spring at an estimated cost of $39,100. The residence streets on which paving will be put in include the completion of East Brainard St., starting at Johnson St., to North Division, thence on Church St. to Garfield St., and a half block north and south on Garfield, covering a span of six blocks. An estimate of the total cost, including the cost of labor, material and other expenses, has been made and is given herewith. J. H. Vickers, president, Board of Local Improvements:

5,600 sq. yds. of brick pavement on a 4-in. broken stone Portland cement concrete foundation, 2 in. sand cushion and joints between the brick filled with bituminous cement complete, at $1.75 per sq. yd.	[illegible]
8,000 cu. yds. of earth excavation at $0.40 per cu. yd.	3,200
500 lin. ft. of concrete curb 6 in. thick and 30 in. in depth on 6 in. of gravel, at $0.40 per lin. ft.	200
9,690 lin. ft. concrete curb and gutter 6 in. in thickness with 18 in. gutter pan on 6 in. of gravel at $0.40 per lin. ft.	3,876
2,700 lin. ft. of 10 in. storm water sewer connection complete, at $0.50 per lin. ft.	1,620
350 lin. ft. of 6 in. sewer pipe, intersection drains complete, at $0.40 per lin. ft.	140
[illegible] furnished and set complete at $12 each	504
[illegible] intersection drain rings and grates furnished and set complete, each	
24 manholes and manhole rings and covers adjusted at $2.50 each	
For lawful costs and expenses attending the proceedings and the making and collecting the assessment therefor	
Total	

Indiana.

✣Bids will be received until 7 April 8, by Common Council, Attic the improvement of Park Ave. a St. S. Truman is City Engineer.

✣Bids will be received until 2 p.m., 15, by Commissioners of Madison ware Counties, Anderson, Ind., fo struction of a road on line betwee and Madison counties. J. B. Auditor of Madison County.

✣Bids will be received until 1 p.m. 8, by Board of Wells County Comiss Bluffton, Ind., for the constructi gravel roads in Harrison township streets in Harrison and Liberty tow in Poneto and for macadamized Harrison township. L. A. Wil County Auditor.

⊙The City Council of Kendall has awarded the contract for layin of paving to Childs & Sawyer.

City Engineer Aug. Pfafflin of Ind., has a profile map of planne ments to Lincoln Ave. The ma blocks between Canal St., and t Central tracks.

An election will be held in Mun ship, Muncie, Ind., on April 8, to vo gravel road improvements in the to

Iowa.

✣Bids will be received until A City Council, Eagle Grove, Ia., fo struction of street pavement.

✣Plans have been prepared by neer E. A. Steiner of Marshalltow the construction of about 33 block crete pavement, estimated to include yds. The work will include a conc dation of 5 ins., being part 1 cem sand and 5 gravel, and 23,000 lin. crete curb. The contracts will be le F. E. Northrup is City Solicitor.

⊙The City Council of Muscatine awarded the contract to the August Co. for the brick paving in Improve trict No. 29 and also for the placin crete alleys in Blocks 79, 145 and bids received for the various work follows: District No. 29—James Se 647; Independent Construction Co. James Horribin Co., $21,402; Norw Co., $21,912; Korneman Co., $21,3 79—James Selden, $803; Indepe $979; Korneman Co. $617; S. E. $658. Block 145—James Selden, $8 pendent Co., $993; S. E. Kinsley, $68 man Co., $624. Block No. 151—Jame $841; Independent Co., $1,006; S. E. $704; Korneman Co., $644.

The City Council of Vinton, Ia. structed City Attorney L. J. Ki draw up a resolution of necessity for the paving of Washington St., point where the paving now ends t of the street at the Tilford Academ

The City Council of Newton, Ia. dered 50 blocks of new paving for Bids will be asked immediately started by May 1.

⊙Following bids were received b of Creston, Ia., Theo. S. De Lay, C neer, on March 25, for the constr pavement during 1912: (1) Sta bituminous concrete with 2-in. wea face on a 4-in. concrete foundation, yds. (2) Bitulithic with 2-in. wearin on a 4-in base, 50,000 sq. yds. (3) B sand filler. (4) Brick with pitch f Brick block with sand filler. (6) Br with pitch filler. (7) Concrete alle 26,000 sq yds. (8) Extra for 5-in. stead of 4-in base, 3,700 sq. yds.; all brick block pavement calls for 50,000

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

er ent rattler; brick to be laid on 2-in. [illegible]

Bidder. Address.	Per yd.	Per yd	Per yd	[illegible]	[illegible]	Per yd	[illegible]
ghlin & Sons, Red Oak, Ia				$1.[illegible]	$1.[illegible]	$1.12	
provement Co., Racine, [illegible]							*.12½
[illegible]	1.63					1.[illegible]	
[illegible]		$1.84½	1.86			1.[illegible]	.10
[illegible]				[illegible]			.12
[illegible] Kans	1.58						.1[illegible]
[illegible]						1.2[illegible]	.11
[illegible]			1.75		1.8[illegible]		.11
ofing Co., Omaha, Neb..					1.9[illegible]		.12
tion Co., St. Louis, Mo.	1.73					1.3[illegible]	.23
& Hamilton, Shenandoah, [illegible]	1.59			1.76		1.2[illegible]	
ing Co., Omaha, Neb....		1.69	1.94	1.94		1.10	.12

ng bids were received at Creston, rch 25, Theo. S. De Lay, City En- the construction of curbs and gut- g 1912, to accompany paving: (1) [illegible] ccompany brick paving 6-in. x 6-in. [illegible] mbined curb and gutter to accom- paving 6-in x 6-in. curb with 6-in. ter. (3) 45,000 ft. straight curb ; all curb and combined curb and k is to be of 1:2:4 mixed, mono- ruction:

Address.	(1) Per ft.	(2) Per ft.	Per ft.
ghlin & Sons,* Red Oak, Ia............	$0.58		$0.31
provement Co., Racine, Wis...........		.66	
[illegible]		.68	.35
[illegible]		.69	.69	.38
[illegible] Neb	.64		
[illegible]		.73	.30
g Co., Topeka, Kans....................			.35
[illegible]		.68	.34
king Construction Co., Des Moines, Ia.	.69	.66	.35
[illegible]	.70	.70	.38
[illegible]	.63	.59	.30
alk Co., Decorah, Ia.........			.33
[illegible]		.64	.33
[illegible]	.56	.66	.53
ng Co., Omaha, Neb..................	.34	.62	.36

ds of Supervisors of Lee and Des nties, Ia., have under considera- ntinuation of the lake shore drive lississippi river from Keokuk, Ia., n, Ia., at an approximate cost of

Kansas.

ty Commissioners of Pittsburg, awarded the contract for the pav- alpa St., from Forest Ave., to obert Nesch at $1.42 per yd. and yd. for the excavation of dirt.

Commissioners of Pittsburg, Kan., ted a petition providing for the East Fourth St., from Elm St., imits.

Kentucky.

[illegible] Trustees, Price Sewell, Chairman, , for paving certain streets with r telford, including approximately ls. Plans and specifications are on W. S. Canning, City Engineer.

l be received until 7 p. m., April f City Council, Georgetown, Ky., struction of the streets hereinafter and for the construction of a pave- urb and gutter upon the streets and streets hereinafter named of the fol- modes of construction: Vitrified n concrete foundation; natural asphalt rete foundation; asphaltic concrete on foundation. The streets and parts ets to be improved are as follows: St., from the city limits on the west west side of Warrendale Ave.; Broad- , from the north side of Main St., to th side of Court St.; Court St., from side of Broadway St. to the east side rt alley; the street from the south side rt St., to the north side of Main St., ust east of the Courthouse and being rtion of said street lying just east of ewalk east of the Courthouse. Speci- s for each of the above modes of con- n are on file in the City Clerk's office. be accompanied by a certified check for $1,000. J. S. M[illegible], Mayor, J. H. Cleary, City Clerk.

Louisiana.

• [illegible] Bldg., New Orleans, La., has been awarded the contract by the Highway Department of the Board of State Engineers of Lousiana, 104 New Orleans Court Bldg., New Orleans, La., for the construction of a main public highway extending from New Iberia to Heanerette, Iberia Parish, La., a distance of 9½ miles. Petrolithic will be used with macadam and liquid asphalt binder. The contract price is [illegible]

Maryland.

✣Bids will be received until 1:30 p. m., April 10, by Mayor and City Council, Brunswick, Md., for laying macadam; approximately 14,000 sq. yds. of Tarvia or Texaco road asphalt filled macadam on part of Wenner St., High St., and part of Potomac Ave., and the building of such amount of concrete curb as may be necessary. Detailed plans, specifications and forms of proposals may be seen at the Mayor's office or by calling upon the Street Committee. Each bid must be accompanied by a certified check for $200, drawn payable to the Mayor and Council. Dr. A. G. Horine is Mayor.

Michigan.

✣Bids will be received early in May by the City of Holland, Mich., for the construction of 1½ miles of streets with bituminous pavement, estimated to cost $45,000. H. A. Naberhuis is City Engineer.

◉The Lake Shore Stone Co. of Milwaukee, Wis., has been awarded the contract by the Board of Muskegon County Road Commissioners, Muskegon, Mich., John B. Barlow, Clerk, for the furnishing of 11,000 cu. yds. of crushed lime stone f. o. b. cars at several points in the county at $1.41½ per cu. yd., being average price. The entire contract will amount to $15,655. The county will probably do work of building roads by day labor. Bids were opened March 23.

◉Harry Vander Veen, 610 Ashton Bldg., Grand Rapids, Mich., has been awarded the contract by the city of Benton Harbor, Mich., for the construction of 13,000 sq. yds. of asphaltic concrete on 5-in. cement concrete foundation and 6,000 lin. ft. of curb and gutter. The contract price is $1.25 per sq. yd. Bids were opened March 21 by B. Spaulding, City Clerk.

City Engineer H. E. Terry, of Flint, Mich., has been instructed by the Common Council to prepare plans and specifications for the construction of a pavement on East Eighth St., from Saginaw to Lapeer St.

The city of Detroit, Mich., has awarded contracts for the furnishing of brick during 1912 as follows: Wooster Shale Brick Co., $.88 per sq. yd. Deckman-Duty Brick Co. $.86; Alliance Clay Products Co., $.85; Nelsonville Brick Co., $.87; Bessemer Limestone Co., $.89; Metropolitan Brick Co., $.89; Detroit Vitrified Brick Co., $.83, and Townsend Brick Co., $.84.

Minnesota.

•The city of East Grand Forks, Minn., James Gorman, City Clerk, has awarded the contract for the paving of DeMers Ave., from Water St. to the Northern Pacific Railway Co.'s tracks to the General Contracting Co., 440 Temple Court, Minneapolis, Minn., for $46,340, itemized as follows: 3,200 ft. reset curb, $960; 1,850 ft. new kettle river curb, $1,480 450 ft. new circular granite curb, $563; 500 lbs. new cast iron castings, $23; 9 brick catch basins, $450; 3 inlets, $69; 640 ft. of 8 in. catch basin connections, $416; 100 yds. cement concrete, alley entrances, $160; 11,150 yds. sandstone pavement, concrete cement filler, $37,799; 890 yds. sandstone pavement on sand, cement filler, $2,741; 1,050 yds. concrete pavement in 8 ft. strip street car track area, $1,680.

City Clerk Harry Cheadle, of Duluth, Minn., will sell certificates of indebtedness for street improvements, amounting to $200,000.

The council committee on roads and bridges, Minneapolis, Minn., has voted in favor of the paving of Richfield road with creosoted blocks at a cost of approximately $27,000. The city sold permanent improvement bonds in the sum of $200,000 on March 28.

The Township Board of the town of Stuntz, Minn., has fixed the tax levy for the next year at $100,000 for road purposes and $20,000 for the general fund. A. Newberg is Chairman of the Board.

Mississippi.

Coahoma County, Miss., is to issue bonds in the sum of $50,000 to be used in the construction of roads and bridges. Clarksdale is the county seat.

Missouri.

◉The Rackliffe-Gibson Construction Co., was recently awarded the contract by the city of Springfield, Mo., for the paving of the National Blvd., with 38,848 sq. yds. of Hassam. The total cost approximates $68,055. The company also has the contract for the paving of Center St., and part of East Commercial St., which includes about 31,152 sq. yds. of pavement.

Following bids were received by City Engineer H. G. Horton, of Springfield, Mo., for street improvement, to be considered by the City Council April 9: Concrete curbing on both sides of the National Blvd. from Walnut St. to Turner St. (where curbing is not now in): Nicholas D'Onfro, $.30 per lin. ft.; William Bishop, $.34.

Hassam pavement (Class B) patented, on the National Blvd. from Walnut St. to Turner St.: The Rackliffe-Gibson Construction Co., $1.75 per sq. yd.

First class brick paving on Peach Alley from Walnut St. to Pickwick Ave.: J. C. Likes, $2.32 per sq. yd.; the Will F. Plummer Co., $2.28½.

First class brick paving on Olive St., from Jefferson St. to Benton Ave.: J. C. Likes, $2.29 per sq. yd. for paving and $.20 per lin. ft. for oak curbing; the Will F. Plummer Co., $2.17.

Concrete paving on Billings St. from Mt. Vernon St. to State St.: Nicholas D'Onfro, $1.25 per sq. yd.; Whittaker and Waddell, $1.25; J. A. Kerr, $1.28; Fox & Cornwall, $1.25; Jarrett-Richardson Paving Co., $1.32; Speer & Beacon, $1.34.

Asphaltic concrete paving on Lombard Ave., from Holland St. to King's highway: Jarrett-Richardson Paving Co., $1.60 per sq. yd.

Asphaltic concrete paving on Myrtle St. from Cherry St. to Monroe St.: Jarrett-Richardson Paving Co., $1.60 per sq. yd.

Concrete paving on Commercial St., from

✣ indicates work now open for bids. ◉ indicates a contract let recently.

Washington Ave. to Gold St.: Nicholas D'Onfro, $1.25 per sq. yd; J. A. Kerr Construction Co., $1.30; Fox & Cornwall, $1.32; Jarrett-Richardson Construction Co., $1.25; Speer & Beason, $1.35.

Asphaltic concrete paving on Belmont Ave., from Holland St. to King's highway: Jarrett-Richardson Paving Co., $1.60 per sq. yd.

Concrete curbing and gutter combined on both sides of Myrtle St. from Cherry St. to Monroe St. (where curbing and gutter is not now in): Nicholas D'Onfro, $.54 per lin. ft.; Fox & Cornwall, $.48; J. G. Ridenour, $.57; Jarrett-Richardson Paving Co., $.56; Speer & Beacon, $.58.

Concrete curbing and gutter combined on both sides of Calhoun St., from Benton Ave. to Clay St. (where curbing and gutter is not now in): Nicholas D'Onfro, $.52 per lin. ft.; Fox Z. Cornwall, $.52; J. G. Ridenour, $.57; Jarrett-Richardson Paving Co., $.58; J. S. Speer and C. B. Beacon, $60.

Concrete curbing on both sides of Webster St. from Boonville St. to St. Louis and San Francisco railroad (where curbing is not now in): J. Stahl, $.57½ per lin. ft., including excavation; Whittaker & Waddell, $.35½; J. A. Kerr & Co., $.37; Nicholas D'Onfro, $.70; Nicholas D'Onfro, $.35; Fox & Cornwall, $.36; J. G. Ridenour, $.37; Speer & Beacon, $.37½.

First class four-foot cement sidewalk on the west side of Freemont Ave., from George St. to Center St. (where walk is not now in): Nicholas D'Onfro $.52 per lin. ft.

First class four-foot cement sidewalk on the north side of Center St., from Clay St. to Freemont St. (where walk is not now in): J. G. Ridenour, $.70 per lin. ft.

According to advices from Monett, Mo., the Mt. Vernon special road district is planning to build 90 miles of macadamized road. Mt. Vernon Township is to vote March 25 on a proposition of issuing bonds to the amount of $50,000 for the purpose of building the road.

Nebraska.

Roscoe C. Ozman, City Clerk of Lincoln, Neb., will sell bonds April 20 in the sum of $37,300 for the purpose of paving: $2,000 for the paving in Paving District No. 72; $11,400 for the paving in Paving District No. 199; $14,900 for the paving in Paving District No. 204, and $9,000 for the paving in Re-Paving District No. 42.

New Jersey.

✣Bids will be received until noon, April 15, by Township Committee, E. D. Wilt, Chairman, Long Beach Township, at the office of I. H. Cramer, Cedar Run, N. J., for building a gravel road in the Township of Long Beach, beginning at the northeast line of the Borough of Beach Haven and extending north-eastward to the southwest line of the Borough of Surf City, a distance of 34,480 ft. or 6 53/000 miles.

✣Bids will be received until 8 p. m., April 15, by City Council, Sea Isle, N. J., for furnishing the necessary labor and materials for constructing macadam roadways and cement gutters to an amount not exceeding $20,000. R. L. Goff, Ocean City, is Engineer.

New York.

✣Bids will be received until 1 p. m., April 19, by State Superintendent of Public Works, Albany, N. Y., for the improvement of the following highways:

County.	Road No.	Approx. Length.
Albany	977	[illegible]
Allegany	945	1.18
Chautauqua	1011	4.70
Clinton	1008	1.28
Chenango	668	1.11
Cayuga	1016	7.96
Chemung	5207	7.18
Chemung and Schuyler	5208	12.47
Erie	991	4.64
Greene	998	6.27
Herkimer	5209	3.07
Herkimer	5170	1.35
Livingston	1010	0.98
Monroe	633	3.73
Monroe	1004	0.73
Orange and Ulster	5176	2.16
Orange	5210	6.78
Rensselaer	949	0.29
Rensselaer	5163	0.41
Rensselaer	980	[illegible]
Steuben	5211	8.16
Steuben	5212	3.94
Tompkins	1002	2.54
Tompkins	5213	1.43
Tompkins	5214	5.10
Tioga	5215	10.75
Wayne	997	1.99
Washington	803	8.23
Wyoming	975	2.01
Warren	5227	4.58

Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the Commission in Albany, N. Y., and also at the office of Division Engineer Spencer J. Stewart, Columbus Hall, Poughkeepsie, N. Y., for highways in the counties of Dutchess, Nassau, Orange, Putnam, Suffolk, Sullivan, Ulster and Westchester; at the office of Division Engineer Paul McLoud, Humane Bldg., Albany, N. Y., for highways in the counties of Albany, Clinton, Greene, Rensselaer, Saratoga, Schoharie, Warren and Washington; also at the office of Division Engineer James H. Sturdevant, Cleveland Bldg., Watertown, N. Y., for highways in the counties of Herkimen, Jefferson, Oneida and St. Lawrence; also at the office of Division Engineer Frederick Steele Strong, South Clinton and West Jefferson Sts., Syracuse, N. Y., for highways in the counties of Cayuga, Chenango, Cortland, Madison, Oswego and Wayne; also at the office of Division Engineer James P. Morrissey, 423 Cutler Bldg., Rochester, N. Y., for highways in the counties of Alleghany, Cattaraugus, Chautauqua, Erie, Livingston, Monroe, Niagara, Orleans and Wyoming; and also at the office of Division Engineer Perry Filkin, 901 Press Building, Binghamton, N. Y., for highways in the counties of Chemung, Delaware, Otsego, Schuyler, Steuben, Tioga and Tompkins. The especial attention of bidders is called to "Information for Proposers" on pages 6 and 7 of the specifications. Proposals for each highway must be presented in a separate sealed envelope endorsed on the outside with the name and number of the highway for which the proposal is made. Each proposal must be accompanied by a New York draft or certified check payable to the order of the State Commission of Highways for an amount equal to at least 5 per cent of the amount of the proposal, which such draft or check accompanies. This draft or check will be held by the Commission until the contract and bond are duly executed.

✣Bids will be received until 1 p. m., April 15, by D. W. Peck, Superintendent of Public Works, Albany, N. Y., for the improvement of the following highways:

County.	Road No.	Approx. Length.
Albany	978	1.35
Chenango	1074	0.08
Chenango	5200	7.61
Chautauqua	5201	1.48
Cattaraugus	695	1.21
Cattaraugus	697	2.27
Cortland	995	4.86
Delaware	983	1.56
Dutchess	1007	1.72
Erie	5197	2.84
Erie	986	[illegible]
Greene	993	0.46
Herkimer	5161	1.60
Jefferson	5175	0.41
Madison	955	0.43
Monroe	493-A	0.48
Monro and Orleans	588	2.03
Otsego	5202	1.94
Oneida	5001	1.06
Oswego	979	5.67
Putnam	5203	9.79
Rensselaer	765	1.10
Suffolk	1018	6.79
Steuben	1000	6.95
Steuben	5204	6.44
Saratoga	5205	5.38
St Lawrence	967	3.30
Tompkins	5206	1.74
Ulster	992	1.91
Wayne	994	3.46

✣Bids will be received until 1 p. m., April 17, by D. W. Peck, Superintendent of Public Works, Albany, N. Y., for the improvement of the following highways:

County.	Road No.	Approx. Length.
Albany	979	8.27
Chenango	1013	0.19
Chenango	5216	1.67
Chautauqua	1012	3.30
Chautauqua	5217	7.98
Cattaraugus	960	2.80
Cortland	996	2.25
Chemung	5218	4.37
Erie	517	[illegible]
Erie	[illegible]	[illegible]
Greene	516	[illegible]
Herkimer	467	[illegible]
Herkimer	521	[illegible]
Monroe	[illegible]	[illegible]
Monroe	574	[illegible]
Nassau	988	[illegible]
Niagara	5220	[illegible]
Oneida	5131	[illegible]
Oswego	5221	[illegible]
Rensselaer	981	[illegible]
Rensselaer	5222	[illegible]
St Lawrence	966	[illegible]
Schuyler	999	[illegible]
Schoharie	5197	[illegible]
Sullivan	[illegible]	[illegible]
Steuben	5224	[illegible]
Tompkins	1001	[illegible]
Tompkins	522	[illegible]
Ulster	371	[illegible]
Westchester	5226	[illegible]
Wayne	993	[illegible]

✣Bids will be received until 11 a. April 5, by Board of Contract & Supply, y, N. Y., for the labor, services and materials quired in grading, regulating, curb paving of Spring avenue from Pawl nue to the city line. Plans and specifications are on file with the City Engineer. J. Riley is Secretary of the Board.

⊙The Warner Quinlan Co., has been awarded the contract by the Board of Contract Supply of Syracuse, N. Y., for re-s streets where the guarantee has expired $28,755.

⊙Hagaman & White of Rochester, have been awarded the contract by the of Trustees of Geneseo, N. Y., for ing of Court and Bank Sts. with block and for the paving of F with vitrified brick. The contract $10,459. Bids were opened March 22

Mayor Edgerton of Rochester, N. recommended the passage of a bond i $850,000 for improving the city parks, lows:

Durand-Eastman Park
Genesee Valley Park
Highland Park
Seneca Park
Maplewood Park

For the improvement of other parks and playgrounds these are the estimate

Brown Square Playground
Front Street Playground
Pike's quarry
Webster Avenue Park
Cobb's Hill
Plymouth Avenue entrance to Genesee Valley Park
Armory Park
Carter Street Park

The citizens of Pulaski, N. Y., have the issuance of bonds in the sum of $15, the paving of the business section with connection with the state road passing through Pulaski from Syracuse to Watertown. The citizens also voted $2,000 by tax for the construction and repair of crushed stone roads the village. William J. Peach is President.

The Village Trustees of Youngstown, have called a special tax election for to vote on a proposition to pave 3½ each side of Main St., in connection with new state highway.

The Village Council of Danville, contemplates submitting a proposition taxpayers to bond the village to the amount of $30,000 or $40,000 for the making improvements on Main and Perine Sts.

The Long Island Electric Railway C which operates trolley cars from Jama Far Rockaway, will pave that part Rockaway turnpike that is in the Cedarhurst, L. I. David H. Weyant lage president.

North Carolina.

✣Bids will be received until 8 p. m., April 10, by Executive Board, Charlotte, N. C. for paving certain streets in the city. The work to be done consists of approximately 100 sq. yds. of paving, 42,000 cu. yds. of grading, 34,000 sq. yds. of cement sidewalks, 50,0 ft new curbing, 20,000 ft. old curbing reset and about 9 miles of sewers and drains. Bids will be received on bitulithic, sheet asphalt, bituminous macadam and double bond pavement. A certified check equal to 5 per cent of the amount of the bid and made payable to the Treasurer of the City of Charlotte will be

;ompany each bid. Joseph Firth is
er.
ll be received until 2 p. m., April
ement of date from April 1), by
[illegible]
secretary, Murphy, N. C., for
[illegible]
otla Road a distance of 4.7 miles.
submitted on one or both roads.
will require approximately 67 cu.
, 1,500 lin. ft. vitrified pipe, 600
masonry. Marble township will
at the same time. Plans and pro-
ile with G. W. Scott, Court House
eer.

ll be received until 8 p. m., April
utive Board, Charlotte, N. C., for
ons of certain streets. The work
[illegible]
paving, 42,000 cu. yds. of grading,
ls. of cement sidewalks, 50,000 ft.
, 20,000 ft. old curbing reset and
s of sewers and drains. Bids will
on bitulithic, sheet asphalt, bi-
acadam, and double-bond pave-
s may be seen and specifications
the office of Joseph Firth, city en-
[illegible]

Ohio.

ill be received until April 15 by
., for the construction of 60,000
tar top concrete pavement on cin-
tion; also cement curb. B. F.
, O., is engineer.

received until noon, April 10,
ncil, East Youngstown, O., for
of all sidewalks to be laid in
luring 1912. P. J. Carney is clerk.

ll be received until noon, April 9
Public Service, St. Bernard, O.,
ement of Church St. from Car-
to Clem Kruthaup's west line on
side and from Carthage Pike to
the north side by constructing
[illegible]
between the points above men-
by constructing the necessary
and furnishing necessary macad-
and specifications are on file with
, or H. A. Nunlist, city engineer,
ion Bldg., Cincinnati, O. W. J.

! be received until noon, April 17,
Licking County Commissioners,
for necessary labor and material
nstruction of road improvement as
ngineer's estimate No. 107—Grad-
ing and improving a part of
d Linnville road from a point
east from the corporation line
Newark to the National Pike, a
04 miles. Earth excavation,
s. Solid rock, 2,300 cu. yds.
700 cu. yds. Macadam, 3,909 cu.
[illegible]
and improving that part of the
and Centerburg road from the
rlington township northwester-
line of Burlington township, a
[illegible]
eyor.

e received until 11 a. m., April
of Cuyahoga County Commis-
and, O., for the improvement of
Road No. 2 from the east line
vnship to the county line in
ip. Plans and specifications are
rank R. Lander, county survey-
denhogen is clerk of the board.

be received until noon, April 6,
f Public Service, Ashtabula, O.,
labor and materials for the im-
Division St. from Joseph St. to
erein by constructing a sewer
ling to the plans and specifica-
said office. The work includes
20 lin. ft. of 12-in. sewer, 462
. sewer, 2 catch basins, 2 man-
tank and manhole combined, and
bor, material, branches and appurtenances, as shown by the plans and specifications or required by said improvement. John Mac Rae is clerk of the department.

✣Bids will be received until 1 p. m., April 10, by Board of Wood County Commissioners at the office of C. E. Stinebaugh, county auditor, Bowling Green, O., for the grading, draining and macadamizing and also applying tar binder and constructing earth road where provided for in the specifications of the fol- [illegible] Schramm et al., Andrew Hanely, Chas. H. Coy et al., Chas. Schumacher et al. and James Daum et al. E. F. Metzger is county surveyor.

⊙C. J. Chinnock of Warren, O., has been awarded the contract by the County Commissioners, Youngstown, O., for the construction [illegible] $13,500.

⊙The County Commissioners, Bowling Green, O., have awarded five stone road contracts as follows: Samuel Stearns Road—E. T. Reed, at $2.15 per yd. for stone, $.20 per yd. for grade, $.03½ per yd. for tile and $.12½ per gal. for tar binder; J. C. Recker Road—W. H. Jeakle, at $1.17 for stone, $.18 for grade and $.03½ for tile; W. F. Spiker Road—W. H. Jeakle, at $1.84½ for stone, $.17½ for grade and $.03½ for tile; Henry Siek Road—J. A. Westrick, at $1.89 for stone, $.18 for grade, $.03½ for tile and $.11½ for tar binder; J. W. Turley Road—J. E. Wixson, at $2.17 for stone, $.19 for grade, $.02 for tile and $.12 for tar binder.

⊙John C. Devine Co. of Alliance, O., has been awarded the contract by the Stark County Commissioners, Canton, O., for the paving of the Marlboro Road from Marlboro to the Lexington Township line, a distance of 1½ miles, for $30,614. The road will be 16 ft. wide. Bids were opened March 25 by J. H. McConnell, auditor.

Pennsylvania.

✣Bids will be received until 10:30 a. m., April 5, by City Controller, Municipal Hall, Pittsburgh, Pa., for grading, regrading, paving and repaving and otherwise improving with blockstone Warrington Ave. from Arlington Ave. to a point 34.69 ft. east of Mt. Olivet St.; grading, curbing and paving with blockstone Kingsboro St. from Haberton Ave. to Craighead St.; grading, curbing and paving with brick streets and branches laid out in the grounds of the University of Pittsburgh from Allequippa St. eastwardly from Center Ave. southwardly and from Berthoud St. eastwardly to connect with present improved street in the grounds of the University of Pittsburgh; grading, curbing and paving with asphalt Raleigh St. from Murdock St. to Wightman St.; grading, curbing and paving with brick and blockstone Glenwood Ave. from Johnston Ave. to Mansion St.

South Carolina.

✣Bids will be received until noon, April 12, by H. K. Gilbert, mayor, Florence, S. C., for furnishing said city one street sweeper, horse drawn, suitable for sweeping bitulithic pavement.

South Dakota.

✣Bids will be received until 8 p. m., April 8, by A. K. Thomas, city auditor, Rapid City, S. Dak., for the construction of cement sidewalks.

Tennessee.

✣Bids will be received until 2 p. m., April 24, by mayor and Board of Aldermen, McKenzie, Tenn., for the necessary grading, culvert work and graveling of certain streets. F. D. Walpole, McKenzie, Tenn., is recorder and C. H. Jenks, Union City, Tenn., is engineer.

An injunction has been granted a number of citizens of Overton County, Tenn., restraining County Judge J. R. Hogue from issuing $150,000 in bonds for good roads which were voted Feb. 28. Livingstone is the county seat.

The County Court, Memphis, Tenn., at the April meting will be asked to approve County Commissioners' plan to get a $300,000 loan and to divert surpluses in other funds to pay turnpike indebtedness and for the building of [illegible]

The citizens of Halls, Tenn., have voted the issuance of bonds in the sum of $15,000 for the improvement of the streets of the town.

Texas.

✣Bids will be received until 8 p. m., April 5, by City Council, Denison, 202 Main St., Denison, Texas, for paving that portion of East Main St. with brick lying between the east line of Crockett Ave. and the present end of brick pavement in the 100 block east of Main St. J. D. Yocom is city secretary.

The citizens of Corpus Christi, Tex., on March 25 voted the issuance of bonds in the sum of $150,000 for the paving of the city [illegible]

The County Commissioners, Greenville, Tex., have been petitioned to call an election to vote on the issuance of bonds in the sum of $400,000 for the building of 10 macadamized roads leading out of Greenville in various directions.

Virginia.

Bonds in the sum of $120,000 have been voted by the county of Culpeper, Va., for the construction of 30 miles of county roads. H. B. Smith, Culpeper, is county supervisor.

Plans have been prepared for the construction of 4 miles of macadam roads in the town of Culpeper, Va. Work will be started about June. W. S. Chapman is chairman of the Street Committee.

The Augusta County Board of Supervisors, Staunton, Va., has called an election for April 30 for the purpose of voting on the issuance of bonds in the sum of $1,000,000 for the construction of 260 miles of roads, principally water bound macadam on a clay foundation. W. I. Lee of Staunton, is Engineer.

Washington.

✣Bids will be received until April 6 by the Board of Whatcom County Commissioners, Bellingham, Wash., as mentioned in our last issue, for the construction of bituminous macadam or concrete pavement 16 ft. wide, and necessary culverts as follows: One mile of permanent road on the Northeast Diagonal, 1 mile on Northwest Diagonal, and 1½ miles on Nouksack-Sumas Road. The estimated cost is $50,800. Charles Lindberg, Bellingham, Wash., is engineer of county.

The City Council of Colfax, Wash., has been petitioned to pave two more streets in the south end of the city. Work is to be begun immediately on the paving of the south end of Main St. and the several other streets in the south end embodied in improvement district No. [illegible]

The Town Council of Goldendale, Wash., has employed Samuel C. Lancaster, who has had charge of the road work on Samuel Hill's Maryhill property, to supervise the street improvement work in Goldendale. Plans and specifications are now being prepared under the direction of Mr. Lancaster for macadam work on 52 blocks of streets. Bids will be asked immediately.

Wisconsin.

⊙[illegible] awarded the contract for the paving of Grand Ave. from Third St. to Fourth St. and one alley next summer at $6,853, in the city of Beloit. Vitrified brick will be used. Other bidders were: Western Improvement Co., Racine, Wis., $6,965; Fred Nelson, Racine, $6,964.

⊙Chris. Johnson of Oshkosh, Wis., has been awarded the contract by the city of Neenah, Wis., John Le Tournenx, City Engineer, for the paving of Wisconsin Ave., from Walnut St. to Park Ave., by grading and paving with sheet asphalt, concrete, or cement, asphalt block, sarcolithic, tar macadam or creosoted wood block, for which bids were opened March 23 and the contract awarded March 28. Mr. Johnson was low on the following: Creosote block, $43,922; tar macadam, $24,275, and asphaltic concrete, $26,013.

Canada.

⦿The Town Council of Welland, Ont., has awarded the contract for 38,362 sq. yds. of paving on Main St. from the Grand Trunk and Wabash to the Niagara, St. Catharines & Toronto electric railroad station on Muir St., from the canal bridge to the Michigan Central, Canadian Pacific and Toronto, Hamilton & Buffalo station, to C. H. Kaumeir of Port Huron, Mich., for $109,894. No. 1 Metropolitan brick will be used.

The recommendation for paving as local improvements, amounting to $700,000, of the following streets have passed the court of revision of Vancouver, B. C.: Dunsmuir, wood block, Howe to Burrard, $12,338; Beatty, wood block, Georgia to Smyths, $36,802; Hastings, wood block, Vernon to Victoria, $122,443; Robson, wood block, Bute to Denman, except vitrified brick from Jarvis to Card 448; Pender, wood block, Cambie to Carrall, except vitrified brick between Cambie and Abbott, $35,552; Davie, wood block, Granville to Richards, $15,255; lane between Granville and Howe, from Georgia to lane south of Pender, stone blocks, $11,943; lane between and Seymour, from Georgia to Dav blocks, $35,359; lane between Main a from Alexander to Prior, stone block

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

Preliminary plans have been completed by the Morgan Enginering Co., Goodwyn Institute Bldg., Memphis, Tenn., for the Tri-County Drainage District. The system will reclaim some 500,000 acres of land in Mississippi, Craighead and Poinsett counties, and will require some 600 miles of ditches. The matter is now before the courts.

California.

Report has been made to City Trustees of Sacramento on a plan by City Enginer Geo. N. Randle for raising the north levee, building a Sutterville levee and strengthening the levee below the old city of Sutterville. The improvement contemplates an expenditure of $250,000.

Illinois.

⦿Bids were opened March 23 by the Deer Creek Drainage District No. 3 for excavating 6,174 cu. yds. in cleaning and straightening of open ditch and for furnisihng and laying 1,300 ft. of 20 in. tile and 1,300 ft. of 18 in. tile. The contract was awarded to Carter Bros., Danville, Ill., at $2,600.

All bids received March 19 by the Hallock-Medina Drainage District of Peoria were rejected. The work called for a new channel for Hallock Hollow Creek, requiring 7,500 cu yds. of excavation, and for cleaning present channel of the creek and changing outlet of Crow Creek, about 3,000 cu. yds. of excavation being required. The Harman Engineering Co., Peoria, Ill., are the engineers.

Iowa.

✣Bids will be received until 1 p. m., April 12, by Board of Pocahontas Supervisors, Pocahontas, Ia., for the construction of nine sections of the Drainage Improvement District 41. Section No. 26 is open work, 2,900 ft.; side slope 1 to 1; average depth, 10.4 ft.; approximate yardage, 17,480 cu. yds. Section No. 25 is tile drain and is comprised of about 28,800 ft.; tile sizes, 8 to 30 ins. Sections 24, 27, 28, 31, 32, 35 and 36 are railroad crossings, and the time for commencement and completion of said sections shall be subject to further notice by the County Auditor. Section No. 26 is to be begun not later than May 1, 1912, and completed on or before August 1, 1912. Section No. 25 is to be commenced not later than August 1, 1912, and completed on or before August 1, 1913. Further information may be obtained of J. A. Terry, County Auditor.

Surveys are being made by George H. Armstrong, Drainage Engineer, Algona, Ia., for a $40,000 drain in Kossuth County, to be known as the Prairie Creek drain.

Louisiana.

⦿Stewart & McGinnis and M. L. Linnan, Baton Rough, La., have been awarded the contract for constructing two new levees on Red River in Rapids Parish, bids for which were opened March 28 by the Board of State Engineers at New Orleans. The contract includes the Cutoff Bayou levee, 75,000 cu. yds., at 14.95 cts., and the Wilson levee, 45,000 cu. yds., at 16.73 cts.

The Vinton Drainage District in Calcasieu Parish, Lake Charles, La., voted March 26 on issuing $106,000 of bonds.

The Police Jury of Vermillion Parish, Abbeville, La., has organized the Coulee De Jons Drainage District. A bond issue of $45,000 will be made for constructing the drainage system.

Minnesota.

✣Bids will be received until 10 a. m., May 9, by L. H. Slocum, county auditor, International Falls, Minn., for the construction of Judicial Ditch No. 3, including about 128,000 cu. yds. of excavation.

✣Bids will be received until 3 p. m., April 9, by J. P. Byhre, county auditor, Walker, Minn., for the construction of Judicial Ditch No. 1, including approximately 193,000 cu. yds. of excavation.

Missouri.

Bids will probably be asked the latter part of the year for the extensive drainage project of the Little River Drainage District in Cape Girardeau, Scott, Stoddard, Dunklin and New Madrid counties, Missouri. The work will involve the expenditure of about $5,000,000 and will call for the handling of some 40,000,000 cu. yds. of material. Wm. A. O'Brien, Himmelberger-Harrison Bldg., Cape Girardeau, Mo., is Chief Engineer.

Hearing will be held by the County Court of Marshall, Mo., on April 4, on the report recommending the construction of five miles of ditches for the Gilham Lake section. T. O. Stanley, Sedalia, Mo., is the engineer.

Montana.

✣Bids will be received until 2 p. m., April 15, by U. S. Reclamation Service, Huntley, Mont., for the excavation and back filling of drainage ditches in the vicinity of Ballantine and Newton, Mont. The work involves the excavation and backfilling of about 16,350 lin. ft. of trenches.

Nevada.

✣Bids will be received until 2 p. m., April 8, by U. S. Reclamation Service, Los Angeles, Cal., for furnishing electrical apparatus for Truckee-Carson project, Nev. F. H. Newell, Washington, D. C., is director.

Ohio.

✣Bids will be received until 10 a. m., April 23, by J. R. Schopp, County Surveyor, Lancaster, O., for the construction of the Hocking River improvement in Fairfield County, O. The work includes about 200,000 cu. yds. of excavation, 3,400 sq. yds. of sodding, three light-weight steel bridges, and other work of minor importance. Plans and profiles may be seen at the office of the County Surveyor. George J. Gearhart is County Auditor.

Tennessee.

The Obion Drainage and Levee District will probably call for bids in about three months for the reclamation of 245,000 acres of land, the work including 25 miles of open ditches and 55 miles of levee. W. C. Kelly, Union City, Tenn., is the engineer.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE.)

B. G. Covington of the St. Francis Levee Board is back in Memphis. B. G. states that owing to a disinclination to wet feet he thought it best to move the Levee Board office back to Memphis until the subsidence of high water. B. G. is confident that his levees will hold back the water and states that the only kind of levee the St. Francis knows how to build is the unbreakable sort.

Every time you meet Bill Walker, the well known Memphis concrete man, h hurry. Bill has numerous contract the city and is kept hustling atte them. He says that he is going to horses up in the stable and buy an au to help him go his rounds.

"Jeff Davis" Sims was in town rec expressed himself as being "almigh that he pulled out of the levee busine this winter hit us. He states that the we have had since November is e make any dirt mover shoot all his m then commit suicide. All the old ti remember "Old Man Jeff" as one of levee builders that ever dumped a He rolled up his pile and retired fr ness and can now take advantage of weather to laugh up his sleeve at tho to buck old Jupiter Pluvius.

At the next meeting of the Shelby Turnpike Commission, it is planned duce a measure providing for a $300 in order to carry on new work du coming season. The commissioners s there are not sufficient funds on hand plete necessary work and the deficit taken care of by this loan. Prospects be good for quite a lot of work.

The Corssett, Monticello & Northe road has been granted a charter to o Arkansas, and will build from Crem tion to Fountain Hill, thence to Cross route will cover about 50 miles and erse Ashley and Drew counties and o rich section of the country It is that the work will be open for inspect

On March 23 it was voted by th County Good Roads Association, whic Trenton, Tenn., to issue bonds in an half a million, to be used in road im ments. President J. J. Fuqua of Mila reports that extensive new work will during the coming season and that ev in Gibson county will be given a County Engineer St. George Richa back from the front a few days and that he is not satisfied with the progr made with Shelby County's portion Memphis to Bristol highway, but thi prospects are better now. Saint is hale and hearty and states that he is the jump in the interests of road impr

Jack Gordner is now in charge of Labor Agency here, succeeding B. F. who returned to St. Louis. Jack bear good name in Little Rock, his last stat has issued a cordial invitation to contractors to drop in and get acquai

J. A. Omberg, Jr., the chief enginee Memphis Compress Co., who is to b $1,000,000 plant in South Memphis, receiving and tabulating bids on the of the new project all last week, and position, he hopes, to make the award April 5. The grading will amount to mately 150,000 cu. yds. and for the will be a steam shovel proposition. the leading Memphis contractors have bids, and on account of the high wat expected that a vast number of teams available and that the work as a cons will go very cheaply. Jesse Nick Clavey, C. D. Smith, Mike Road

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

d, Lee McCanlis and [illegible] who are known to date to have put ition on the new work.

nsworth, who has done a great deal work in the Yazoo Delta, was in ist week renewing friendships with lys. Harry is looking fine, a little than usual, and says he is 'ust' t into the game once more. A dirt , always one, contends Harry.

orris, general superintendent of the & Mississippi Valley, states that his are hard at work on the plans for tion and preparation of foundation depot at Memphis and that within ear future invitations will be sent number of the larger construction is section. The grading work will roximately [illegible] moved and for the most part will hovel work.

pleasant visit with his family, Bill ssistant chief engineer of the Mis- lhoma & Gulf R. R., has returned to Okla., to resume his duties with his is busy locating a number of new h his road will build at once.

esent indications it looks as if the actors will have plenty of work this . Not so long since, the boys were moaning their fate because the Mis- River Commission had decided to f the money at its disposal for on revetment and mat work, to of the usual work on the huge retch along both sides of the big m Cairo to New Orleans. But the ted flood now about to reach its age will cause untold damage to es, even if large portions are not by crevasses occurring, and a vast amount of work [illegible] it is an ill wind that does not levee boys luck. The crest of the reach Memphis about [illegible] l then top the gauge at 42 feet or ng to the belief of old river men. ll be the highest water that ever tween the banks of the Mississippi. [illegible] ing this vast volume of water is folly; they can't do it in their present shape. Already one portion of the embankment has given way at Point Pleasans, Mo., and at the present writ- [illegible] crumbled and the mad waters rush headlong through a chain of small lakes into the St. Francis River. The volume of water thus going into the St. Francis River is going to flood the low lands lying in that valley, and according to levee engineers is going to show conclusively that the people along the latter river's banks must endeavor to protect them- [illegible] ture by building small embankments to protect the lands which are subject to overflow from water which finds its way into the St. Francis from the Mississippi either from that known as seip water or from the volume that can be expected from an unusual flood in the main stream. The town of Hickman, Ky., [illegible] the citizens of the little village, is battling hard to save the low places from what seems a certain break in the levee. Major Smith, in charge of the United States forces at Memphis, has riders out on his dikes with orders to shoot any one coming near the embankments without the proper countersign, fearing that the levees might be cut to save those below. Ben Covington of the St. Francis Levee Board realizes that he has the fight of his life on his hands, for his levees are known to be somewhat weak in places, especially at Pecan Point, where the old levee now hangs over the caving bank, and, should it break, will cause great damage in the territory near Marion, Ark., the same land, by the way, which was so seriously damaged [illegible] way in 1907. Major Dabney, in charge of the upper Yazoo levee, chartered a special train from the Illinois Central to rush teams and graders' outfits to his levee at Hollywood, Miss., where a break is expected if the levees do not give way above Memphis. While Major Woodruff of the United States forces at Vicksburg seems sanguine of his chain of dikes, Bill Stephenson, Lowrance Brothers and Henry McCarten, who are at work on the Atherton Loop, a new levee being built for protection of the present old one, think that the strain of water rushing down the valley will be too great for the rain soaked embankments and that only a miracle can save the farmers in that section of the country from a serious overflow. City Engineer Weatherford of Memphis is having his own troubles with the high water. His small levee in North Memphis has so far withstood the tremendous strain well, but according to Heiskell there is no telling how high the flood will go, and in order that he may not be caught napping is having thousands of bags of sand filled to reinforce his dikes when the crest of the rise reaches Memphis.

The employes of those outfits which have been forced to lay up on account of the high water have almost to a man been given employment by either the government or state levee boards as riders during the present flood. By riders is meant men who go along the levees day and night looking for miscreants who might cut the levee in order to protect land below. These men are empowered with the authority of a United States marshal and may shoot to kill any one who has no business on or about the big mounds. Pigs and cattle, strayed away from owners on account of the sudden flood, are shot at sight should they be found on or near the dikes, for they indent the soft dirt and oftimes cause weak spots to occur. The foremen and commissary clerks of the idle contractors can make from $150 to $200 per month during the high water in this fashion, and being in the game themselves and having the protection of their outfits at stake in many instances, they make the best sort of riders and as a rule are eagerly sought by the authorities in charge of the upkeep of the levees.

Washington.

City Commissioners of Spokane, Wash., are considering plans for draining Union Park. The estimated cost of an open ditch has been set at $24,000. Morton Macartney is City Engineer.

WATER-WORKS

Arkansas.

sting Engineer W. S. Merkle, 1005 nk of Commerce Bldg., St. Louis, preparing plans for the improvement aterworks and electric light systems s, Ark.

own Council of Foreman, Ark., has a committee to let contracts for llation of a waterworks system.

Packard, care McPherson Hotel, hia, Ark., who was recently granted ise to construct a waterworks sys- Benton, Ark., noted in our last issue, struct a steel tank and tower of llons, at a cost of $68,000, including s, etc.; also about 10 miles of sew- . Packard is not connected with the Speer & Dow, of Fort Smith, Ark., stated in our March 27 issue.

California.

of pipe lines and conduits for the ion of the Owens river water, to- with the cost of the same, have been d to the Public Service Commission Angeles, Cal., by Chief Engineer Wil- lholland, of the aqueduct. The cit- be served with water are Pasadena, Pasadena, Alhambra, Santa Monica, and smaller communities lying be- os Angeles and Crescent bay. The ne is estimated to cost $886,102.

Board of Trustees of Sacramento, considering the proposition of sink- isson in the bed of Sacramento river sh a supply of clear water to Sacra- and relieve the danger which is said ten the city intake from a change in the river current, due to the construction of the new railroad bridge. The cost is estimated at $30,000.

Florida.

Plans are being prepared by Consulting Engineers Whitaker & Hill, Forsyth Bldg., Atlanta, Ga., for the construction of a 2,000,000-gal. reservoir at the waterworks plant, Pensacola, Fla., estimated to cost $14,000. The work will be in charge of the Water and Gas Committee, D. Hugelman, Chairman.

Georgia.

The city of Buford, Ga., will let contracts in 30 to 60 days for the making of extensions to the water works system, for paving and for the building of a public school building. City Council is in charge.

Engineer J. L. Ludlow, of Winston-Salem, N. C., consulting engineer for the city of Columbus, Ga., has estimated the cost of the installation of a modern waterworks system at $435,000. The work would include a 5,000,000-gal. reservoir located on Factory Hill, north of the city. L. H. Chappell is Mayor.

The citizens of Carrollton, Ga., will vote on April 3 on the proposition of issuing bonds in the sum of $4,000 for making improvements and extensions to the waterworks.

Illinois.

✣Bids will be received until 1 p. m., April 20, by Board of Local Improvements, Hamilton, Ill., for furnishing and setting hydrants and hydrant branches and for a pump house, pumping plant and a steel tower and tank.

✣Bids will be received until 1 p. m., April 19, by Board of Local Improvements, Hamilton, Ill., for the construction of a water distribution pipe system and sewers. Official advertisement will be found elsewhere in this issue.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 13, for furnishing, delivering and erecting complete at the Lake View pumping station, Montrose Blvd. and Clarendon Av., all steam, water, blow off and exhaust piping, valves and fittings, with necessary drains and traps required to equip the temporary boiler plant and to connect this boiler plant with engine No. 1 and with two steam turbine units and two air pumps to be located in the engine room; also the furnishing, delivering and erecting of one open feed water heater of 1,000 H. P. capacity, two steam separators and blowoff basin; also the furnishing and placing of non-conducting covering on all steam, exhaust and feed water piping, valves, fittings, heater, steam separator and boilers; also the erection and connection of two boiler feed pumps and three stoker engines to be furnished on the premises by the city.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., until 11 a. m., April 10, for furnishing the materials, labor, etc., necessary to construct and lay water service pipes in the following streets: S. 43d Ct., W. 27th St. to W. 31st St., N. Hamilton Av., Wellington St., Barry Av., W. Huron St., Rockwell St. to Western Av., W. 105th St., Vincennes Road, Prospect Av., W. Ohio St., Western Av., Campbell Av., N. Sawyer Av., Foster Av. Balmoral Av., Sherman Av., 81st St., 82d St., Superior Av., 132d to 136th St.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 10, for furnishing and delivering to the water works shops, 1330 Indiana St., 2,850 brass union nipples, made up as follows: 1,250 ¾ in., 1,300 1 in., and 300 1½ in. The finished union nipples must consist of 80 to 84 parts copper, 5 to 9 parts tin, 8 to 10 parts zinc, and not over 2 per cent lead, all properly mixed, and weigh from 1 lb. to 2 lbs. 4 ozs., depending upon the size. Separate bids for each size of nipple must be submitted.

✣Bids will be received until April 13, by Board of Local Improvements, Moline, Ill., for the construction of a 6-in. water main in portions of 14th St. and 26th Ave., as noted under sewers.

The City Council of Woodstock, Ill., has decided to issue bonds in the sum of $10,000 for the purpose of providing funds for increasing the capacity, extending and improving the city waterworks. H. G. Fisher is City Clerk.

The Belleville, Ill., Water Supply Co., will begin at once to lay pipe in order to secure water from the Mississippi river at a point above East St. Louis, Ill. Charles Slocum is Superintendent.

Indiana.

⦿James B. Clow & Sons, of Chicago, Ill., have been awarded the contract by the Board of Public Works of Fort Wayne, Ind., for the furnishing the city waterworks department with 500 tons of pipe and the amount of special pipe necessary in the laying of that amount of tubing. The bid was $22.85 per ton for 300 tons of 12-in. pipe; $23 for 200 tons of 6-in. pipe, and $.02½ per lb. for special orders, with the privilege of increasing the entire order 25 per cent. The contract amounts to about $11,400.

The Sullivan County Water Co. has filed articles of incorporation with the Secretary of State at Indianapolis, Ind., for $75,000. The new company will install a waterworks in the city of Sullivan during this year. The incorporators are E. M. Kerlin, J. L. Ebner and T. Morrisey, of Vincennes, Ind.

Plans are being prepared by Consulting Engineers Burgess & Long of Columbus, O., for the installation of mechanical filters in the city of Columbus, Ind., at an estimated cost of $55,000. The work includes 1,000,000 gals. reinforced concrete sedimentation basin, 500,000 gals. reinforced concrete clear well, filter house and duplicate 4,000,000 gals. daily capacity low life pumps, etc. The water supply will be secured from the east fork of White River. An election will be held April 16 to vote on the proposition, and if favorable contracts will be let about May 15. Wm. H. Rights is City Engineer.

Iowa.

The citizens of Defiance, Ia., on March 25 voted to expend not to exceed $8,000 for the purpose of installing waterworks. Two plans are proposed. One is for water pressure from a tower built on cemetery hill. The other is an air pressure system with air tank stationed at pump house.

Kansas.

The city of Coffeyville, Kans., has sold bonds in the sum of $130,000 for the installation of a waterworks system.

The city of Gypsum, Kans., has retained Consulting Engineers Worley & Black of Kansas City, Mo., to prepare plans and specifications for the installation of a waterworks system. The system will cost from [illegible]

Massachusetts.

⦿Following bids were received by the Board [illegible] for the construction of the Hyde Park Pumping Station, contract being awarded to the lowest bidder: A. Varnerin Co., 101 Tremont St., Boston, $19,984; J. W. Bishop Co., 683 Atlan- [illegible] Co., Wellesley, Mass., $21,543; Louis B. Cadario, 15 Court Sq., Boston, $21,794; Conners Bros. Co., 157 Plain St., Lowell, $24,240; C. A. Dodge & Co., Erie & Albany Sts., Cambridge, $25,497; Woodbury & Leighton, 201 Devonshire St., Boston., $26,345; L. D. Wilcutt & Sons Co., 146 Summer St., Boston, $26,846; George E. Mitchell, 166 Devonshire St., Boston, $27,487; Coveney Bldg. Co., Hyde Park, Mass., $34,000.

Mississippi.

The Town Council of Crystal Springs, Miss., has given notice of intention to issue bonds in the sum of $10,000 for the purpose of liquidating outstanding indebtedness, and improving the electric light and waterworks plants.

The City Council of Yazoo City, Miss., has authorized the issuance of $30,000 worth of bonds for the purpose of installing water meters and for the general improvement of the water system.

Montana.

The city of Great Falls, Mont., W. H. Harrison, City Clerk, rejected all bids received March 25 for pipe and materials for the construction of a 12 in. water main from 2nd St. to 21st St., starting at 2nd St. and extending east on 3rd Ave., south to 6th St., thence north on 6th St. to 4th Ave., north, thence east on 4th Ave. to 21st St.; also the completion of the 8 in. supporting line of 21st St. from 4th Ave. north to 8th Ave. north, including about 358 tons of 8 in. cast iron pipe, class "C," 24 tons of 12 in. cast iron pipe, class "B," 12 12 in. gate valves, two 12x12 crosses.

Nebraska.

⦿According to advices from Dunbar, Neb., E. E. West has been awarded the contract for the installation of a new system of water supply at the county farm.

New Jersey.

✣Bids will be received until noon, April 23, by Quartermaster, Fort Hancock, N. J., for installing a water main.

New York.

✣Bids will be received until 3:30 p. m., April 15, by Common Council, Board of Contract & Supply, Yonkers, N. Y., for construction of two covered masonry filters, a clear water basin, pipes, gates, castings, venturi meters, indicating apparatus and screw pumps. J. V. Mahony is Secretary.

✣Bids will be received until 7:30 p. m., April 18, by Board of Public Works, Geneva, N. Y., for the construction of a 30-in. cast iron intake pipe, 730 ft. long and crib for the city. William S. Johnson, 101 Tremont St., Boston, Mass., is Engineer.

Consulting Engineer George A. Johnson, of Johnson & Fuller, 150 Nassau St., New York City, has been engaged by the Water Committee of Wellsville, N. Y., on the question of waterworks improvement at that place.

The Vulcan Rail & Construction Co., 17 N. Ninth St., Brooklyn, N. Y., on March 26 submitted the lowest bid to the Board of Water Supply of New York City for furnishing and delivering bronze ladders, steel gratings, wrought iron pipe railings and steel plates for the upper gate chamber of Ashokan Reservoir at Brown's station in the town of Olive, Ulster county. The bid was $[illegible]

North Carolina.

Plans are in preparation by Consulting Engineer William M. Piatt, of Durham, N. C., for the making of extensions to the waterworks system of Durham, estimated to cost $150,000. The work will include a 4,000,000-gal. high duty pumping engine, 5,000,000 filtration plant, boilers, centrifugal pumps, pipe, specials, valves, etc. The present source of supply is the river. No date for the letting of contracts has been set. J. C. Michie is Superintendent of the plant.

The town of Clinton, N. C., will shortly advertise for bids on waterworks and sewers and is now awaiting results from deep wells now being bored. The waterworks will consist of approximately 3½ miles [illegible] iron pipe 6 to 10-in. in diameter, hydrants, valves, pumping station, boilers, pumps, feed water heater, air lift, concrete reservoir [illegible] tower and tank. William M Piatt, [illegible] ham, N. C., is Consulting Engineer.

North Dakota.

Definite plans will be prepared after April 15 for the installation of a new waterworks system in the city of Beach, N. Dak., at an estimated cost of $25,000. The source of supply will be secured from wells. N. Reed is Mayor.

Ohio.

The Ohio State Board of Health has approved the plans of the city of Akron for municipal filtration plant and waterworks system.

⦿Gould & Mayback, Collinwood [illegible] Cleveland, O., have been awarded the contract by the village of Euclid, O., Id[illegible] Shoaff, Clerk, for furnishing the material and labor necessary for the improvement [illegible] clid road from 818.5 ft. westerly from center line of Chardon road to Upson road by constructing a 10-in. water main on [illegible] side, and a 10-in. water main on the [illegible] side of Euclid road, from the easterly [illegible] of Chardon road to the Upson road. The contract price is $23,765. The F. A. P[illegible] Engineering Co., Williamson Bldg., [illegible] land, O., is Engineer. Bids were opened March 25.

Oklahoma.

✣Bids will be received until 10 a. m., April 16, by Charles Wheeler, Jr., City Clerk, Muskogee, Okla., for furnishing 10 gate [illegible] Bids must be accompanied by a certified check for $200. Further information [illegible] obtained by the city clerk or Alexander Potter, 114 Liberty St., New York City, Consulting Engineer.

✣Bids will be received until 10 a. m., April 9, by City Council, Muskogee, Okla., [illegible] erection and construction of mechanical equipment for water purification plant and [illegible] h. p. boiler. Alexander Potter, 114 [illegible] St., New York, N. Y., is Engineer.

The city of Bigheart, Okla., plans [illegible] stallation of a waterworks system at an estimated cost of $12,000. E. E. Walton [illegible] President of the Board of Trustees.

Pennsylvania.

✣Bids will be received until April [illegible] Paul B. Noftsker, Secretary, Shippensburg, Pa., for repairing and lining reservoir. The banks of reservoir constructed about 2 years ago.

⦿The board of Water Commissioners [illegible] Reading, Pa., Edward Elbert, President, [illegible] awarded the following contracts for the furnishing of supplies to the water department for 1912-13; bids opened March 19: Item 1—Cast iron pipe, 179.46 net tons. 31,900 [illegible] bell and spigot castings, Standard Cast Iron Pipe & Foundry Co., $21.95 per ton and [illegible] per lb. Item 2—Water gates, 12 6 in., 3[illegible] 3 12 in., Darling Pump & Mfg. Co., $[illegible] and $26, respectively. Item 4—Corporation cocks, 360 ½ in., 60 ¾ in., 30 1 in., 10 [illegible] and 10 2 in., H. Mueller Mfg. Co., $.3[illegible] $.84, $2.74 and $4.73, respectively. Item [illegible] Scrap removal, Luria Bros & Co., 40,000 lbs. cast iron pipe, $210; 4,000 lbs., wrought iron pipe, $21; 50 lbs. copper, $6; 100 lbs. brass, $10; 100 lbs. rubber, $1; 50 lbs. vulcanized rubber, $.50; 100 lbs. rubber hose, $1. [illegible] —Removing old Bernhart main. [illegible] O'Rourke, 10,000 ft. of 10 in. pipe at [illegible] 924 ft. of 12 in. pipe at $.08; 738 ft. of [illegible] pipe tunnel, $.08; 738 ft. of 12 in. pipe [illegible] $.08; 250 cu. yds. of excavation at $.50.

South Carolina.

The citizens of Barnwell, S. C., will vote May 8 on the proposition to issue bonds [illegible] sum of $22,000 for the installation of [illegible] works and electric lights. Survey and plans will be prepared by T. B. McCrary of Atlanta, Ga. R. C. Kirkland is Mayor.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Texas.

will be received until 7 [illegible] 9, y City Council, Paris, Texas, E. H. Mayor, for pumping two wells [illegible] ction was held in [illegible] for the purpose of voting on the of bonds in the sum of $25,000 for rks improvements, and $20,000 for ing.

ommissioner Robert L. Jones, of Tex., in his annual report, makes ing recommendations for the water nt: Construction of brick building room purposes at an estimated cost construction of an underground nk for fuel oil at an estimated cost ; the purchase of 290 tons of 12-in. ; the extension of the present 20-in. the purchase of 500 tons of 8-in. use in various sections of the city.

izens of Dallas, Tex., voted April proposition of issuing bonds for the n of a water purification plant and purposes. No engineer has been se- B. Winslett is City Secretary.

Virginia.

ave been prepared for the construc- filtration plant in the city of Cul- , to cost from $6,000 to $8,000. The will not be let before July 15.

uart Water Co., of Stuart, Va., has orporated with a capital stock of construct a waterworks system. The

[illegible]

Wisconsin.

✣[illegible] 19, by Village Board, Independence, Wis., for furnishing the necessary labor and material for the construction of any or all of the following items: Wells, pump house, motor driven pump and discharge pipe line connecting with present water mains in said village, all in accordance with revised plans and specifications for the procuring of a new water supply by said village. Rvised plans and specifications may be seen either at the office of Jacob Jackson, Clerk of Independence, or by application to W. E. Miller, Engineer, Madison, Wis.

The City Council of Two Rivers, Wis., has appropriated $15,000 to enlarge the municipal water and light plant.

Canada.

✣Bids will be received until 5 p. m., April 10, by S. H. Kent, City Clerk, Hamilton, Ont., for the laying of a 48-in. steel intake pipe 2,200 feet in Lake Ontario from the Hamilton Waterworks Filtering Basins with gate house, crib, piling, etc. Also for the laying of a steel and concrete conduit from the Beach Pumping Station to the filtration basins, with gate house, piling, manholes, etc. Specification and forms of tender may be obtained from and plans are on file in the office of A. F. Macallum, City Engineer. Tenders will only be considered upon the forms supplied by the city, and must be sent by registered mail, in care of S. H. Kent, City Clerk, addressed to Geo. H. Lees, Esq., Mayor, Chairman Board of Control, Hamilton, Ontario.

⊙The Moose Jaw Construction Co., of Moose Jaw, Sask., has been awarded the contract for the construction of a reinforced concrete reservoir of 2,000,000-gals. capacity for $34,352. W. J. Francis & Co., Montreal, Que., are Engineers. Bids were opened March 18 by E. B. Bonnell, City Clerk.

⊙The City of Moose Jaw, Sask., E. B. Bonnell, City Clerk, has awarded the contract for supplying various valves and fittings for waterworks installation to Drummond, McCall & Co., of Montreal, Que., at $8,400. Bids were opened March 18.

The city of London, Ont., intends to carry out the following construction in the waterworks department, of which H. J. Glaubitz is General Superintendent: 11,000 ft. of 12-in. main extension at a cost of $30,000; two synchronous motors for artesian well pumping plant, one of 200 h. p., to drive existing gas engine turbine pump, and one of 100 h. p. to drive new compressor, including air compressor, $10,000; one low lift centrifugal pump and motor of 1,500,000 gals. per day capacity at Springbank pumping station. Bids have been received for most of the material. All construction work will be carried out entirely by the city force.

EWERAGE AND GARBAGE DISPOSAL

California.

[illegible] contracts for the construction of sewers in annexed sanitary dis- and 3 to F. H. Dahnke.

Council of San Diego, Calif., has s the date to hold the election for $680,000 in bonds to extend sewers, ins and make certain street improve- hich include the building and repair

Engineer of San Jose, Calif., Chas. er, has prepared plans and specifica- r the sewering of the Gardner Dis-

Board of Public Works of Los An- alif., has recommended to the City that that portion of the Arroyo de la storm sewer extending from Temple Melrose Ave. be constructed immedi-

rustees of the town of Etna, Siskiyou Calif., have retained Ned Duncan t as their engineer in the design [illegible] sewerage system [illegible] works to cost about $20,000

Connecticut.

s will be received until 4 p. m., April he city of Putnam, Conn., for the con- of 1,200 ft. of 12-in., 1,400 ft. of 3,000 ft. of 8-in. and 900 ft. of 6-in. 11 manholes, 8-in., and 53 manholes, orge M. Perry is City Engineer. C. E. r, Norwich, Conn., is Consulting Engi- oted February 29.

Florida.

City Council of Eustis, Fla., it is re- has retained Engineer W. P. Bullock sas City, Mo., to prepare plans and tions for the installation of a sewer It is contemplated to call an election bonds in the sum of $20,000 for the im- ent.

City Council of Orlando, Fla., has an election for April 23 for the pur- voting on the issuance of bonds in of $88,000 for a sewerage system.

Georgia.

ds will be received until 11 a. m., April 25, by Constructing Quartermaster, Fort Screven, Ga., for construction of a 150,000-gal. steel water tank with 75 ft. trestle complete.

Surveys are to be made at once for the construction of a new sewer system in Ocilla, Ga., by the J. B. McCrary Co., of Atlanta, Ga. It is not probable the contract for this work will be let before the first of 1913. J. J. Flandes is chairman of the Sanitary Committee.

Illinois.

✣Bids will be received until April 13 by Board of Local Improvements, Moline, Ill., for laying a 6-in. water main and an 8-in. sewer main in 14th St. from 26th to 25th Aves. and in 25th Ave. from 14th to 13th Sts.

✣Bids will be received until 2 p. m., April 10, by Board of Local Improvements, Lawrenceville, Ill., for the construction of an entire sewer system. Plans and specifications are on file with R. J. Benefiel, City Engineer, Lawrenceville, Ill. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 1 p. m., April 19, by Board of Local Improvements, Hamilton, Ill., for the construction of a system of sewers and water distribution pipe system. Official advertisement will be found elsewhere in this issue.

✣Bids will be received by the Town of Cicero until 8 o'clock p. m., April 8, for furnishing labor, materials, tools, etc., necessary to construct a tile pipe sewer in W. 26th St. according to plans and specifications on file at the office of the Board of Town Clerk. Jno. J. Forrest is Secretary of the Board. Cash or certified check for 10 per cent of bid must accompany proposal.

✣Bids will be received by the Board of Directors of the City of Chicago Municipal Tuberculosis Sanitarium until 11 a. m., April 16, for furnishing the tools, labor, materials, etc., necessary to construct the sewerage system as planned for the administration building and nurses' home at Bryn Mawr Ave. and 40th Ave. and for such other parts of the contract as plumbing, masonry, heating, etc. Plans and specifications on file at office of Frank E. Wing, 1514 Fort Dearborn Bldg., Chicago.

✣Bids will [illegible] Board [illegible] Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, until 11 a. m., April 10, for furnishing tools, labor, materials, etc., to construct brick and tile, pipe sewers in the following streets: Maplewood Ave., 665 lin. ft. 15 in., average depth 10.0 ft.; Maplewood Ave., 507 lin. ft. 12 in., average depth 8.0 ft.; E. 101st St., 160 ft. 12 in., 3.5 ft., 5 house drains 125 lin. ft. 6 in., 3.5 ft.; S. Ridgeway Ave., 640 lin. ft., 24 in. double invert, 10 ft., 660 ft., 18 in. 12 in., 9.0 ft.; W. 32nd St., 340 lin. ft., 18 in., double strength, 10.5 ft.; S. Hamlin Ave., 1,300 lin. ft. 12 in., 7.5 ft.; S. Hamilton Ave., 780 lin. ft. 12 in., 7½ ft., wing sewers 9 ft. 9 in., 7½ ft.; W. Kedzie Ave., 630 lin. ft. 15 in., 10.0 ft., 680 lin. ft. 12 in., 9 ft.; Millard Ave., 350 lin. ft. 12 in., 5½ ft.; S. Artesian Ave., 665 lin. ft. 15 in., 9½ ft., 507 lin. ft. 12 in., 7½ ft.; W. 43rd Pl., 150 lin. ft. 12 in., 6½ ft.; N. 50th Ave., 1,020 lin. ft. 30 in., double ring, 12½ ft., 340 lin. ft. 18 in. double strength, 12.0 ft.; Patterson Ave., 650 lin. ft. 15 in., 11.5 ft., 540 lin. ft. 12 in., 9.0 ft., 670 lin. ft. 12 in., 9.0 ft., 680 lin. ft. 12 in., 9.0 ft., 670 lin. ft. 12 in., 9.0 ft.; Waveland Ave., 670 lin. ft. 12 in., 9.0 ft., 650 lin. ft. 15 in., 10.0 ft., 540 lin. ft. 12 in., 10.0 ft., 680 lin. ft. 12 in., 9.0 ft., 670 lin. ft. 12 in., 9.0 ft.; Warwick Ave., 650 lin. ft. 15 in., 10.0 ft., 540 lin. ft. 12 in., 10.0 ft., 670 lin. ft. 12 in., 9.0 ft., 680 lin. ft. 12 in., 9.0 ft., 670 lin. ft. 12 in., 8½ ft.; S. Mozart St., 670 lin. ft. 15 in., 10½ ft., 670 lin. ft. 12 in., 9½ ft.; S. Francisco Ave., 670 lin. ft. 15 in., 10½ ft., 670 lin. ft. 12 in., 9½ ft.; S. Honore St., 1,340 lin. ft. 12 in., 8½ ft., 670 lin. ft. 15 in., 9½ ft.; W. 73rd St., 1,330 ft. 24 in., double invert, 11.0 ft.; S. Lincoln St., 1,340 lin. ft. 12 in., 8½ ft., 670 lin. ft. 15 in., 9.0 ft.; S. Winchester Ave., 1,340 lin. ft. 12 in., 8½ ft., 670 lin. ft. 15 in. 8½ ft.; S. Robey St., 1,340 lin. ft. 12 in., 8.0 ft., 670 lin. ft. 15 in., 8.0 ft.; Funk St., 1,400 lin. ft. 15 in. 9½ ft.; N. Walnut Ave., 1,030 lin. ft. 12 in., 8.0 ft. The work includes manhole and catch basin construction, according to specification on file at the office.

⊙The Board of Local Improvements of Galesburg, Ill., has let the contracts for the construction of two sewers to the O'Connor Trading & Construction Co. of Galesburg, at $9,425 and $887. The Sixth Ward sewer will drain Henderson St. from Main to Losey St., and Olive St., Lawrence Ave. and Hawkinson

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] The Waters St. sewer from Seminary to Cherry St.

The City Council of Rockford, Ill., has instructed City Attorney Smith to prepare an ordinance for a sewer system in the Southeast End, the estimated cost of the system being [illegible] Main is City Engineer.

Following are the lowest bids submitted to [illegible] Chicago, Ill., E. J. Glackin, Secretary, for constructing sewers in streets as shown. Prices are unit [illegible] Av., 67[illegible] lin. ft., 12 in., $1.23; Cullom Av., 675 lin. ft., 12 in., $1.30; Cuyler Av., 670 lin. ft., 12 in., $1.24; N. 45th Av., 670 lin. ft., 12 in., $1.27; [illegible] 310 lin. ft., 12 in., $[illegible]; Simon Ryan, contractor; MacFarlane Av., 980 lin. ft., 12 in., $1.29; 98th St., 480 lin. ft., 12 in.; Scully & Fosco, contractors; E. 119th St., 565 lin. ft., 12 in., $1.23; Perry Av., 310 lin. ft., 12 in., $1.07; N. Albany Av., 1,340 lin. ft. 12 in., $1.32; Simon Ryan; Jeffrey Av., 640 [illegible] 15 [illegible] $2.35; 670 lin. ft., 12 in., $2.00; Thos. Burke; N. 45th Av., 340 lin. ft., 15 in., $1.30; Humboldt Av., 670 lin. ft., 12 in., $1.20; S. May St., 620 lin. ft., 15 in., $1.59; Mich. Pontorelli; Pease Av., 660 lin. ft., 15 in., $1.35; 670 lin. ft., 12 in., $1.21; Thos. Burke; Bennett Av., 650 lin. ft., 18 in., double strength, $2.50; 670 lin. ft., 15 in., $1.45; 540 lin. ft., 12 in., $1.40; Thos. Burke; Paxton Av., 670 lin. ft., 18 in., double strength, $2.75; 660 lin. ft. 18 in., double strength, $2.25; 660 lin. ft. 15 in., $1.50; 500 lin. ft. 12 in., $1.39; Thos. Burke; Lincoln Parkway, 82 lin. ft., 3½ ft. double ring, $5.00; 600 lin. ft., 3.0 ft. double ring, $4.50; Lake Shore Drive, 904 lin. ft., 2½ ft. double ring, $4.00; 1,050 lin. ft., 2 ft. double ring, $3.00; 600 ft., 15 in., $1.75; 580 ft., 12 in., $1.75; wing sewers, 550 lin. ft., 15 in., $1.75; Chr. Malone; Roscoe St., 6[illegible] lin. ft., 3.0 double ring, $5.00; 1,240 lin. ft., 2 [illegible] ft. double ring, $2.55; N. California Av., 330 lin. ft., 2 ft. double invert, $2.25; 360 lin. ft., 1½ ft., double strength, $1.80; 380 lin. ft., 15 in., $1.50; 790 lin. ft., 12 in., $1.24; bulkhead, $1,000; De Vito Passarelli & Tirtelli.

Indiana.

⊙The Board of Public Works of Vincennes, Ind., has employed Consulting Engineer George W. Fuller of New York City to supervise the construction of the sewer system in Vincennes, the contract for which was recently awarded by the Vincennes Sewerage Association to the Stewart, Sheets Co. of Tiffin, O.

⊙The City Council of Decatur, Ind., has let the contract for the construction of the Merriman sewer in the south part of the city to Henry Stevens at $1,495.

A number of improvements are to be made in Kendallville, Ind., during the year at an estimated cost of $65,000. The municipal plant will be overhauled at an approximate cost of $35,000; North Main St. and the alleyway between Main and Orchard Sts. will be paved, and a sewer will be constructed in Railroad St., at a cost of $10,912.

⊙The Board of Public Works of Terre Haute, Ind., has awarded the following contracts for sewer construction. Second St. sewer, Hulman to Idaho, W. C. Dorsey, $919; Fourth St. sewer, Hulman to Idaho, W. C. Dorsey, $935; Seventh Ave., Third St. to Fourth, Sixth St. to Fourth, J. P. Welch, $432; Elm St., Locust to Hancock, W. C. Dorsey, $9,383; Eighth Ave., Lafayette Ave. to 12½, Bowen Construction Co., $2,520; 19th St., Poplar to Crawford, Bowen Construction Co., $[illegible]; [illegible] St., Spruce St. to Schaal Ave., Foulkes Construction Co., $5,558; Third Ave., Sixth to Fourth St., W. H. Roberts, Jr., $387; Fourth Ave., Fourth St. to second alley east, Luke Sweeney, $317; 13th St., Chestnut St. to Wabash Ave., Luke Sweeney, $1,195; Oakland Ave., Schaal Ave. to Wabash Ave., W. H. Roberts, Jr., $459; Home Ave., Schaal Ave. to Wabash Ave., W. H. Roberts, Jr., $703; 11th St., Elm to Spruce, J. P. Welch, $942; Ash St., 13th to 14th, W. H. Roberts, Jr., $688; Second St., Hulman to Washington Ave., Foulkes Construction Co., $2,860. The total cost of the sewer construction work, according to the lowest bids, is $2,877.

Iowa.

⊙Lewis & Leeder of Sioux City, Ia., have been awarded the contract by the City Council of Sioux City, Ia., for the construction of a storm water sewer in Jackson St. for $11,000. Paul J. Wells is City Clerk.

⊙Street & Steuck of Dubuque, Ia., have been awarded the contract by that city for the construction of an 8-in. tile pipe sanitary sewer in Queen St., from the present manhole in Queen St., northerly in Queen St., to a point opposite the center of Lot 46 A, Stafford's Add., requiring 970 lin. ft. of pipe and 5 manholes. The contract for the construction of an 8-in. tile pipe sewer in Kniest St., from Lincoln Ave. to the east line of Saunders' Sub., was awarded to the O'Farrell Contracting Co. of Dubuque. Bids on both sewers were opened March 21.

The City Council of Mason City, Ia., has taken steps to secure a site for the proposed sewage disposal plant on the north side of Lime Creek, opposte the outlet of the Willow Creek sewer.

Plans are on file in the City Clerk's office, Mason City, Ia., for the construction of 3,000 ft. of 8-in. pipe sewers, estimated to cost $4,000. The contract will be let about April 15. F. P. Wilson is City Engineer.

Following bids were received by the City Council of Ottumwa, Ia., for the construction of one and one-third miles of trunk sewerage of various dimensions, entailing a cost of approximately $120,000: Ballingall branch, lower section, 5 ft. in diameter, 550 ft. long, Charles Chilton, Ottumwa, $4,463; John W. Scott, Ottumwa, $4,885. Ballingall branch, lower section, 4 ft. in diameter, 735 ft. long, Charles Chilton, $5,476; John W. Scott, $5,145. Blake's branch extension drain, 350 ft. long, 8 ft. in diameter, to be of brick and stone, John W. Scott, $5,163.

The town of Reinbeck, Ia., will construct six miles of sewer this year at an estimated cost of from $40,000 to $50,000.

The annual budget for the city of Sioux Falls, Ia., includes from $13,000 to $18,000 for sewer work.

Kansas.

⊙The City Commissioners of Wichita, Kan., have awarded the contract for the construction of an inverted sewer on Third St., from the drainage canal to Lorraine Ave., to McGuire & Stanton of Leavenworth, Kan., at about $58,419. The brick will be laid for $1.64 per yd.; excavating will cost $0.30 per cu. yd., and hauled a distance of 1,300 ft.; $0.35 for dirt excavation conveyed not further than 2,600 ft., and $0.40 for excavated dirt transported over 2,600 ft.

⊙E. Eby of Wellington, Kans., has been awarded the contract by the city of Mulvane, Kans., for the construction of a sewer system at $9,865. The work will include trenching and laying about 16,000 lin. ft. of 8, 10, 12 and 15-in. pipe, constructing manholes, lampholes and flush tank. Bids were opened March 25 by Robert P. Syfer. L. C. Lawton, Newton, Kans., is Engineer.

Fred Tarry & Son of Leavenworth, Kan., submitted the lowest bid to Maj. G. G. Bailey, Constructing Quartermaster, Fort Leavenworth, Kans., for the construction of a sewer to the N. C. O. quarters. Bids were opened March 30.

Maryland.

✣Bids will be received until 11 a. m., April 17, by Board of Awards, Baltimore, Md., for the construction of sanitary lateral sewers in Districts 18 and 40-B. The work will include the following approximate quantities: District No. 18: 35,750 lin. ft. vitrified pipe sewer, 8 to 24 ins. in diameter; 2,250 lin. ft. 27 in. sewer, vitrified pipe or brick and cement; 21,000 lin. ft. vitrified pipe house connections. District No. 40-B: 33,000 lin. ft. vitrified pipe sewer, 8 to 12 ins. in diameter; 20,000 lin. ft. vitrified pipe house connections. H. W. Rodgers is Secretary of the Sewerage sion.

Chief Engineer Clavin W. Hendric of the Sewerage Commission of Baltimore, has submitted spcifications for $150,000 th of sanitary sewers and storm-water The largest contract provides for sewers in the district bounded by Place, Jones Falls, the Fifth Regiment and North Av. Another contract is f itary sewer in the territory bounded St., Jones falls, Frederick St., and C The storm-water drains are to be lo different sections of the city and will so as to keep that work ahead of paving to be done by the Paving Com

Michigan.

✣Bids will be received until 1.30, April 8, by Pontiac, Mich., for the cons of 15 sewers, a total of approximatel ft. C. L. Groesbeck is Clerk of the

⊙The City Council of Lansing, Mi awarded the contract for completi sewer on Herbert, Norman and Isbell Fitzpatrick, Fisher & Noyce for $24,4 original contract with John Algate at to $36,000.

Minnesota.

✣Bids will be received until April 8 city of Tracy, Minn., for the constru septic tank and sludge bed, estimated about $1,500. H. F. Blomquist, M Minn., is Engineer. L. J. Fitch, Tracy is official in charge of the work.

⊙Following bids were received by t Council of Duluth, Minn., for the c tion of the Woodland sanitary trunk lin from Austin St. to Lake Superior at 36t east, bids for which were opened Ma Hugh Steele, Duluth, $35,303, awarde tract; John Bergman, Duluth, $41,531 toret-Lawrence Co., Duluth, $37,973; Johnson, Duluth, $37,241; A. G. Osma luth, $38,678; P. McDonnell, Duluth, $4 George R. King, Duluth, $51,515; M gerald, Duluth, $46,291; Fraser & Da St. Paul, $45,571; O'Neil & Preston, St $57,846, and H. L. Bartlett, St. Paul, $4

The citizens of Cold Spring, Minn voted $4,000 for the construction of a and will shortly call for bids to constr same.

Missouri.

✣Bids will be received until 7 p. m., 5, by J. R. Dearmont, City Clerk, Moun Mo., for the construction of about 4,3 ft. of 10-in. sanitary sewer main and 1 holes, and 1,180 lin. ft. of 12-in. storm also 10 inlets and 3 manholes. Seitz-Pet Engineering Co., St. Joseph, Mo., are neers.

⊙Olson-Schmidt Construction Co. Joseph, Mo., has been awarded the c by the Board of Public Works of that c the construction of the South Park sewer from 6th and Atchison Sts., an erals to 22d and Commercial and 22d field Sts. The contract price is $15,000 were opened March 8.

Montana.

C. W. Swearengen of Missoula, Mont been engaged by the city of Lewistown, as consulting engineer for the new sew system.

New Jersey.

✣Bids will be received until 8 p. m., 15, by City Council, Sea Isle City, N. J. furnishing the necessary labor and ma for the construction of a reinforced co sewage treatment tank and appurtenance an intercepting sewer with manholes, ejectors, etc. R. L. Goff is Engineer, City, N. J.

✣Bids will be received until April 2 Common Council, Rahway, N. J., Fra Marsh, City Engineer, for the constructi sewers in Harrison and Whittier Sts., Co Place and Newton St.; in Scott Ave., and Monroe Sts.; in Main St. from Mo St. to Irving St. The approximate am

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] be [illegible] and material [illegible] as follows: 4,204 ft. [illegible] vitrified [illegible] ft. [illegible] vitrified pipe [illegible] vitified pipe; 1,476 ft. 6-in. laterals to [illegible] nes of Main St., as shown on plan, [illegible] sufficient number of 6-in. connec- [illegible] on plans; 27 [illegible] check for $500, payable [illegible] Common Council of the City of [illegible] accompany each bid. Plans and [illegible]s, contract and bond may be ex- [illegible] the office of the City Engineer after [illegible]

[illegible] g are the seven low bids received [illegible] the South Orange, N. J., Town- [illegible] ttee for the construction of sani- [illegible] Potter, 114 Liberty St., New York [illegible] sulting Engineer; (1) standing for [illegible] N. J.; (4) Cantrell Construction Co., [illegible] James Christie, New [illegible] awarded contract; (6) Claire D. [illegible] selip, L. I.; (7) Antonio Costa, [illegible] J. These sewers are to be con- [illegible] wet clay gravel. The specifica- [illegible]s work call for the construction [illegible] lly water-tight sewer. All joints [illegible] de with G-K. compound:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8 in. vit. pipe sewer, 10 to 12 ft. deep	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] in. vit. pipe sewer, 8 to 10 ft. deep	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.85
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
of B. M. sheeting left in place........	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	750.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2000.00
[illegible]	$13,489	$15,329	$1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] contract							

[illegible] of Public Works of Paterson, [illegible] rdered the construction of the [illegible] wers: Knickerbocker Ave., be- [illegible] n and Hazel Sts., through Hazel St., to Dakota St., to Gould Ave.; [illegible] between Carroll St. and Summer [illegible] ugh Summer St. from Harrison [illegible] s.; Martin St., between Oak St. St., and through Bond St. from [illegible] ver Sts.; Lawrence St., between [illegible] and Mercer St.; West 18th St., West 26th St. and West 28th [illegible] Litle Falls turnpike; Bur- [illegible] tween Hamburgh Ave. and Bel- [illegible] East 16th St., between Sixth and [illegible] s.; East 19th St., between Eighth [illegible] es.; East 25th St., from Lot No. [illegible] Ave. and along 21st Ave. to East [illegible] h Ave., between East 27th and [illegible] s.; Vernon Ave., between Crooks [illegible] Aves. and along Dundee [illegible] m Vernon to Trenton Aves.; [illegible] Ave., between Ryerson Ave. and [illegible] St.; Edmund St., between To- [illegible] and Hill St.; Harrison St., between [illegible] e. and East 18th St.

New York.

[illegible] will be received until 10 a. m., April [illegible] F. Howard, Secretary of the Board [illegible] Works, Corning, N. Y., for build- [illegible] and sanitary sewer extensions. Plans [illegible] le with W. O. Drake, Superintendent [illegible] ard.

[illegible] will be received until 4 p. m., April [illegible] ard of Contract and Supply, Bing- [illegible] N. Y., for the laying of vitrified pipe [illegible] a number of streets and avenues. [illegible] pkins is Clerk.

[illegible] will be received until 11 a. m., April [illegible] ard of Contract and Supply, Troy, [illegible] r the labor, services and materials re- [illegible] the construction of a public sewer, [illegible] necessary regulations and connec- [illegible] Fales Court, from Excelsior Ave. to [illegible] er Ave., in the city of Troy. Plans [illegible] fications are on file with the City En-

[illegible]

The Queens Topographical Bureau, New York City, has called for maps of Hollis, with a view to completing plans for the installation of a sewer system in that borough. The sewage will probably be disposed of in a new plant in South Jamaica

[illegible] L. I., to have a sewer system installed in that village and Inwood and Cedarhurst. The estimated cost of a disposal plant is placed at [illegible]

North Carolina.

⦿W. S. Stancill has been awarded the contract, according to advices from Charlotte, N. C., for the laying of the sewer lines through Colonial Heights, a suburb of Charlotte.

The town of Clinton, N. C., will shortly advertise for bids for the construction of several miles of pipe sewers from 8 to 12 in. in diameter, with manholes and automatic flush tanks. Plans have been prepared by Consulting Engineer William M. Piatt of Durham, N. C.

North Dakota.

✣Bids will be received until 5 p. m., April 8, by E. R. Orchard, City Auditor, Fargo, N. Dak., for furnishing all materials for the construction of a 12 in. lateral sewer on 8th St. south, extending from 9th Ave. S. to 10th Ave. S. in Sewer District No. 3.

Ohio.

✣Bids will be received until noon, April 6, by Director of Public Service, Hamilton, O., for furnishing the necessary labor and material for the construction of a storm sewer in Walnut St. from 7th to 9th St. Plans and specifications are on file at the office of the City Engineer. J. A. Holzberger is Clerk.

✣Bids will be received until noon, April 15, by Directors of Public Service, Lakewood, O., for the necessary labor and material for the construction of sewers in West Madison Ave., in the City of Lakewood. Bids will be received separately on the following sections: 1. From Rocky River to a point 120 ft. west of Bunts road. 2. From Highland Ave. to a point 120 ft. west of Bunts road, in accordance with the plans and specifications for such work now on file in the office of the Engineer at the City Hall, Lakewood, O., and at the office of Charles W. Root, C. E., 1030 Society for Savings Bldg., Cleveland, O. J. W. Chrisford is Director of Public Service.

It is reported that Louis A. Boulay of the firm of Smith & Boulay of Toledo, O., has been employed by the Town Council of Port Clinton, O., to prepare plans for the installa- [illegible]

Oklahoma.

An election was held in Oklahoma City, Okla., on April 2 for the purpose of voting on the issuance of bonds in the sum of $275,000 to extend the present main, sanitary and storm sewer system, and $56,000 for the purchase and erection of highway bridges and concrete arches where needed. Four sewer extensions are proposed, as follows: E. Noble main storm sewer, extending from 14th St. south on Santa Fe right of way to Canadian River; Blackwelder and Linwood mains, extending through Bell Vern and Linwood additions and emptying into the Canadian River near the water station; E. Ave. main, starting at 23d St. and Kate Ave., southeasterly to Fourth St., emptying into the Canadian River at Fouth, south of the Fair Grounds. The fourth proposed extension is a sanitary sewer in Capitol Hill to be known as College Hill main, starting at A and Walker Aves. in Capitol Hill and emptying in Canadian River at the treating plant, Ash and Western Aves. Plans and specifications for all these extensions were adopted by the City Commissioners

Oregon.

⦿The City Council of Portland, Ore., has let the contract for the construction of the East Stark St. trunk sewers, Nos. 1 and 2, to the Consolidated Contract Co. of Portland, at $61,582 for No. 1 and $109,679 for No. 2. No. 1 runs from the river to East 21st St. and No 2 from East 21st District to East 41st St. A district sewer in Eastmoreland was awarded to the Pacific Bridge Co. of Portland at $55,- [illegible]

Pennsylvania.

✣Bids will be received until 2 p. m., April 12, by Board of Trustees, S. W. Waters, Secretary, State Hospital for Insane, Warren, Pa., for constructing additions to the sanitary sewer system, a pumping plant and a disposal plant. The work briefly outlined is as follows: Laying 8,700 T. C. pipe sewers, sizes 8, 10, 12 ins.; constructing receiving well and pump house; furnishing 2 centrifugal pumps, driven by electric motors, capacity each 500 gals. per minute; laying 3,850 ft. 10-in. C. I. force main; constructing one disposal plant, consisting of settling tanks, sprinkling filter, chemical house and sludge filters. Plans and specifications may be seen at the office of the Steward in North Warren, Pa., or at the office of the engineers, or may be obtained by depositing $20 with the engineers, Albright & Mebus, 908 Land Title Bldg., Philadelphia.

✣Bids will be received until April 10 by the State Health Department, Harrisburg, Pa., for the construction of a sewer system at the State Sanitarium at Cresson. The work will include about 6,600 ft. of 8-in. terra cotta pipe sewer, sprinkling filter, contract bed, etc.

✣Bids will be received until 10:30 a. m., April 5, by city controller, Pittsburgh, Pa., for the construction of sewers in the following streets and alleys: Darlington road, from the present sewer at a point 700 ft. east of Murray Ave. to present sewer on Murray Ave., 18 in. pipe relief. Barn alley from a point about 360 ft. northwest of Morgan St. to present sewer on Morgan St., 12 in. pipe. Rebecca St., from crown north of Black St. to present sewer on Black St., 15 in. pipe with 9 in. pipe laterals. Jordan alley from a point about 60 ft. west of Evaline St. to present sewer on Jordan alley, at Winebiddle St., 12 in. pipe.

⦿The Borough Council of Old Forge, Pa., has let the contract for the installation of a system of sewers, for which new bids were opened March 21, to M. Stipp of Scranton, Pa., at $35,000. Other bids received were: William Brown & Co., $37,984; C. D. Snyder, $39,948; Flanagan & Son, $37,937; James Costa, $40,312; Ryan & Co., $38,996; Paglearieri Bros., $37,987.

South Dakota.

Engineer W. G. Potter of Chicago, Ill., has completed plans and specifications for the installation of a sewerage system for Aberdeen, S. Dak. The plans provide for a large sedimentation tank and a filtration bed, together with 10,000 ft. of sewer force mains. Bonds in the sum of $200,000 have been voted for this improvement. The plans were passed upon by Consulting Engineer W. S. Shields, Hartford Bldg., Chicago, Ill.

Texas.

The citizens of La Grange, Tex., on April 2 voted on the proposition to issue bonds in the sum of $17,000 for the installation of a modern sewerage system.

Prof. Geiseke of the Agricultural and Mechanical College, College Station, Tex., has been employed in an advisory capacity by the City Council of Huntsville, Tex., in regard to the water and sewerage system and the fire protection of the town.

Virginia.

The Town Council of Abingdon, Va., has employed Engineer W. M. Dunlap, former City Engineer of Roanoke, Va., to prepare plans for the installation of a complete sewer system. The system will cost approximately [illegible]

West Virginia.

✣Bids will be received until April 15, by V. Dunn, Mayor, Kingwood, W. Va., for the construction of about 25,000 lin. ft. of 8 to 12-in. sewer. The cost of the work is estimated at about $15,000.

Wisconsin.

✣Bids will be received until 2 p. m., April 4, by Board of Public Works, Oshkosh, Wis., for the construction of sewers in accordance with plans and specifications on file at the office of the board.

⊙The City Council of Kenosha, Wis., has awarded the following contracts for the construction of sewers: Superior St. from Salem Ave. to Avery St., 300 ft. 12 in. sewer, 630 ft. of 15 in. sewer, 3 manholes; Christ Johnson; total cost, $1,333. Bain Ave., from Salem Ave. to Avery Ave., 800 ft. of 12 in. sewer, 600 ft. 18 in. sewer, 6 manholes; Christ Johnson, Kenosha, $2,062. Milwaukee Ave. (formerly Union St.), 800 ft. 12 in. sewer, 4 manholes; Michael Steinbach, $980. Bain St., from Elizabeth St. to Prairie Ave., 280 ft. 24 in. sewer, 840 ft. 18 in. sewer, 4 manholes; Christ Johnson, $2,295. Superior St., from Avery St. north, 230 ft. 12 in. sewer, 610 ft. 15 in. sewer, 4 manholes; Andrew Thompson, Racine, $1,263. Pleasant St., from Selleck Ave. north, 500 ft. 12 in. sewer, 850 ft. 18 in. sewer, 5 manholes; Christ Johnson, $2,275. Fremont Ave., from Strong St. to Collins St., 1,450 ft. 24 in. sewer, 4 manholes; Reichert Construction Co., Racine, $3,675. Collins St., from tracks of Chicago & Northwestern Railway Co. to Pleasant St., 230 ft. 12 in. sewer, 610 ft. 15 in. sewer, 4 manholes; Christ Johnson, $1,749.

Canada.

✣Bids will be received until 8 p
17 by George Elliott, town clerk, [illegible]dbury,
Ont., for the following work in ac
with plans and specifications on file w
man & Power, Engineers, Mail Bldg.
Ont: Contract "A," main sewer, 8,
18 and 15 in.; Contract "B," sanitar
and force main; Contract "S," sewer
junctions.

•McKenzie & Thager have be
the contract by the City Commiss
Prince Albert, Sask., for supplying se
required by the city during 1912 at
Bids were opened March 16 by C. O
son, Secretary and Treasurer. The f
approximate quantities will be require

Size.	Standard length straight pipe	Y junctions.	Bends
24-in.	3,353 lin. ft.	137	
18-in.	1,770 lin. ft.	10	
15-in.	5,812 lin. ft.	160	
12-in.	3,121 lin. ft.	49	
10-in.	6,108 lin. ft.	171	
8-in.	21,327 lin. ft.	800	[illegible]
6-in.	3,000 lin. ft.	60	[illegible]
4-in.	6,000 lin. ft.		[illegible]

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ET

Arkansas.

✣Bids will be received until 2 p. m., April 30, by Secretary of Interior, Washington, D. C., for the erection and completion of a frame dwelling on the south side of Hot Springs Mountain reservation, Hot Springs, Ark.

California.

✣Bids are now being asked by the City of San Diego, Cal., for dredging and the construction of a municipal pier to cost $300,000, and for the purchase of a dredge. E. M. Capps is Harbor Engineer of San Diego.

The State Engineering Advisory Board has appointed J. B. Dutton & Co., San Francisco, as architects to draw plans for the construction of two new ferry buildings to adjoin the present ferry building at San Francisco. They are to be 325 ft. long each, and to cost $250,000 each.

City Trustees of Hermosa Beach, Cal., will call a bond election for the purpose of raising funds for a municipal pier to cost $60,000. Preliminary estimates have been presented by the Mercereau Bridge & Construction Co.

Connecticut.

✣Bids will be received until 3 p. m., April 16, by Capt. A. E. Waldron, U. S. Engineer, London, Conn., for dredging in Connecticut River below Hartford, Conn.

Bids as follows were received March 28 by Capt. A. E. Waldron, U. S. Engineer, New London, Conn., for completing Kelsey Point Breakwater, Harbor of Refuge, Duck Island, Conn.: (1) bid on class A stone, 170,000 tons, (2) bid on class B stone, 178,500 tons: The Breakwater Co., Philadelphia, Pa. (1), $1.11, (2) $1.01; E. S. Belden & Sons, Hartford, Conn. (1), $1.07; Estate of John Beattie, Leete Island, Conn. (1), $1.05 (recommended for acceptance; Maritime Dredging Co., New York, N. Y. (1), $1.29; (2) $1.23.

Delaware.

✣Bids will be received until 11 a. m., April 20, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for dredging harbor at Wilmington.

District of Columbia.

✣Bids will be received until 10:30 a. m., April 10, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 697: Chain, journal bearings, galvanized steel, sheet zinc, sheet copper, gaskets, solder, steel washers, vitrified sewer pipe, lead pipe, brass tubing, pipe fittings, valves, cocks, grease cups, wrenches, machetes, hammers, tool handles, corn brooms, hinges, files, paint brushes, galvanized buckets, water coolers, lantern globes, life preservers, hose, packing, leather washers, wool waste, emery cloth, railway flags, bunting, chamois skins, sponges, tag board, lime, gasoline, linseed oil, red lead, venetian red, yellow ochre and ivory black.

✣Bids will be received until 2 p. m., April 8, by Commissioners of the District of Columbia, Washington, D. C., for the construction of walls and steps at the intersection of Belmont and 15th Sts. N. W.

✣Bids will be received until April 5, at the office of Chief Signal Officer, Washington, D. C., for furnishing one carload bituminized fiber, Orangeburg, 3-in., socket joint, approximately 25,000 ft., including 20 gals. of coupling mixture.

✣Bids will be received until 3 p. m., May 2, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures, of the United States postoffice at Crowley, La. The building is to be of one story and mezzanine and has a ground area of approximately 5,100 sq. ft.; fireproof first floor; stone facing, and tile and copper roof. Drawings and specifications may be obtained from the custodian of site at Crowley, La.

✣Bids will be received until 3 p. m., May 4, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures, of the United States postoffice at Hillsboro, Tex. The building is to be approximately 4,350 sq. ft. in ground area; one story and mezzanine, faced with stone and granite to first floor with brick above, terra-cotta trimming and tile roof; the first floor only is of fireproof construction. Drawings and specifications may be obtained from the custodian of site at Hillsboro, Tex.

✣Bids will be received until 3 p. m., May 1, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the installation of a vacuum cleaning system in the United States postoffice at Oklahoma City, Okla.

✣Bids will be received until 3 p. m., May 7, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits, wiring, and interior lighting fixtures, of the United States postoffice at Olympia,
Wash. The building is to be appro
5,500 sq. ft. in ground area, two st
attic, with granite facing to first fl
stone or sandstone above, and tin r
first floor only is of fireproof cons
Drawings and specifications may be h
the Custodian of site at Olympia, Wa

Georgia.

✣Bids will be received until noon, A
by Board of Trustees, R. H. Powell,
ant Secy., Valdes Hotel, Valdosta,
the construction of two dormitory b
to be erected on the grounds of
Georgia Agricultural and Normal
Valdosta, Ga. Each bid for the cons
of the building must be accompanied
fied check in the amount of $3,000, a
bid for the installation of steam heati
with certified check for the amount
payable to C. R. Ashley, Treasurer.
ings and specifications may be seen
office of William A. Edwards, Archit
Chandler Bldg., Atlanta, Ga.

Illinois.

✣Bids will be received until 10
26, by Lt. Col. George A. Zinn, U.
gineer, Chicago, Ill., for dredging in th
met Harbor, Ill. Official advertiseme
be found elsewhere in this issue.

✣Bids will be received by Ray Palm
Electrician, Chicago, Ill., until 11 a. m.
5, for furnishing and delivering
mately 100 cast iron pedestals in ac
with plans and specifications on file
office.

✣Bids will be received by Ray
City Electrican, Chicago, Ill., until 11
April 13, for furnishing and delivering
Department of Electricity 80 fire alar
nal boxes according to specifications on
his office.

✣Bids will be received by Chas. F.
lich, Fire Marshal, Chicago, Ill., until A
10 a. m., for furnishing 20,000 gallons
oline according to specifications.

✣Bids will be received by Chas. F.
lich, Fire Marshal, Chicago, Ill., until 10
April 12, for furnishing the fire depa
with approximately 40,000 lin. ft. of 2
double jacket cotton rubber-lined fire
5,000 ft. of 2½ in. single jacket fire ho
5,000 ft. 3½ in. double jacket fire hos
cording to specifications on file at his

✣Bids will be received by L. E. Mc
Commissioner of Public Works, Chicag
until 11 a. m., April 6, for furnishing
Bureau of Engineering, all materials, la
tools, etc., necessary in constructing, e
and launching a floating pile driver, ex

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] boiler and smoke stack [illegible]. The hull is to be 25 [illegible] and 5 ft [illegible] deep [illegible] The bow [illegible] in. rake, and the stem end to be ke of 40°. Cash or crtified check ust accompany proposal.

[illegible] be received by [illegible] issner of Public Works, Chicago, Ill., [illegible] m. April [illegible] [illegible] velocity meters [illegible] and 10 [illegible] with their proposal a written de- [illegible] the meters [illegible] with such cross sections, drawings will indicate the general construc- of material and assembly of vari- [illegible] eatest width, total height and total [illegible] red to pass 100 cubic feet of water [illegible] on each size must be submitted.

[illegible] Council of Champaign [illegible] J. R. Cravath to draw plans and [illegible] em. Nat. M. Woodward is City [illegible]

[illegible] are the low bids submitted to eGann, Commissioner of Public hicago, Ill., for furnishing and de- the Bureau of Engineering, 1 30-ft. [illegible] ch fitted with engine capable of [illegible] lternate bid $1,485 [illegible]

[illegible] Commissioner of Public Works. Rolson was the lowest bidder at alendar month.

[illegible] Council of Chicago has approved nce providing for the construction in Harbor District No. 1, and f approving the bond issue for be voted on by the citizens at on. City Engineer John Ericson ge of the harbor work.

[illegible] the city of Springfield, Ill., includes ion of $50,000 for the purchase trucks.

Indiana.

will be received until 10 a. m., April rtermaster, Jeffersonville, Ind., for ous supplies.

will be received until 10:30 a. m., by Trustees of Monroe Township, ounty, Monrovia, Ind., for the con- of an 8-room brick school building. ay is a Trustee.

will be received until 10 a. m., May rd of Marion County Commission- napolis, Ind., for the construction of undry building at Marion County or Poor. W. T. Patton is Auditor n County.

Kansas.

ilure of natural gas supply has he Emporia (Kansas) Electric Light to the necessity of re-constructing ial gas plant. The engineering in- as been placed with Henry L. Lea, g Gas Engineer, Peoples Gas Build- ago. The preparation of plans and ons, the placing of contracts, super- construction and the placing of the plant in operation, will be [illegible] e direction of Mr. Lea. It is ex- at bids will be asked within two [illegible]

Louisiana.

ere opened Feb. 26 by Capt. T. H. U. S. Engineer, Dallas, Tex., for ing a dam at the foot of Caddo Lake, H. B. Thompson Co., Sharp Bldg., City, Mo., at $81,005 will probably be the contract.

Michigan.

✢[illegible] 11, by Lieut. Col. C. S. Riche, U. S. Engineer, 57 Park St., Grand Rapids, Mich., for building shore connections of breakwater and re- [illegible] Mich.

✢[illegible] 22, by Light House Inspector, Detroit, Mich., for the erection and completion of a reinforced concrete light and fog signal station and three steel towers at the Superior entry, Wis.

L. C. Hilding, Grand Rapids, Mich., at $8,456, was low bidder for straightening and deepening of Plaster Creek between Burton [illegible]

Missouri.

✢Edward Flad & Co., Engineers, Fullerton Building, St [illegible] plans and wil [illegible] brick building 80 ft. diameter, with reinforced [illegible] Brewing Association, St. Louis; estimated [illegible]

Bids as follows were received March 4 by Maj. Edward H. Schulz, U. S. Engineer, Kansas City, Mo., for constructing standard revetment at Waverly Bend, (1) standing for bid of DeWitt & Shobe, Glasgow, Mo.; (2) for bid of Rust, Swift & Co., St. Louis, Mo.; (3) for S. G. White & Co., Waverly, Mo., and (4) for J. W. McMurray Contracting Co., Kansas City, Mo.:

[illegible]

Material in place:

[illegible] .70

[illegible] .30

[illegible] 2.50

Montana.

✢Bids will be received by Board of Trustees, School District No. 1, Silver Bow County, Butte, Mont., for the complete construction of new Emerson School building and other improvements. A certified check for $1,500 must be filed with each bid. C. R. Hepkins is Chairman of the Board and T. Richards is Clerk.

✢Bids will be received until 8 p. m., April 9, by Board of Trustees, School District No. 1, Silver Bow County, Butte, Mont., for the plumbing, sewer connection and the heating and ventilating of the new Emerson Bldg. A certified check for $350 must be filed with each bid. Thomas Richards is Clerk.

Nebraska.

✢Bids will be received [illegible] 8, by Board of Regents, University of Nebraska, Lincoln, Neb., for the construction of a medical college laboratory building. J. S. Dales is Secretary of the Board.

New Jersey.

✢Bids will be received until 8 p. m., April 15, by Village Board of Trustees, South Orange, N. J., for furnishing the following machinery: 1st—Two horizontal, cross-compound, Meyer gear, crank and fly wheel air compressors, each to be capable of delivering 510 cu. ft. of free air per minute at a piston speed not to exceed 300 ft. against an air pressure of 75 pounds per sq. in., when supplied with a steam pressure of 125 lbs. per sq. in. at the throttle. 2nd—Two horizontal, triple expansion direct-acting, or two horizontal, cross-compound, Meyer gear, crank and fly wheel pumping engines, each having a capacity of 200 U. S. gallons per minute at a piston speed not to exceed 150 ft. per minute, and capable of delivering this quantity of water against a total water pressure of 120 lbs. per sq. in., when supplied with a steam pressure of 125 lbs. per sq. in. at the throttle. Air compressors and pumping engines to operate condensing; the Board supplying suitable condensing apparatus capable of maintaining a vacuum of 26 in. referred to a 30-in. barometer. A certified check for $1,000, or a surety [illegible] proposal. Michael Fitzsimmons is Village Clerk; John J. Boyd is Consulting Engineer.

Bids as follows, per cu. yd. scow measurement, were received March 21 by Col. Wm. T. Rossell, U. S. Engineer, New York City, for dredging in (1) Matawan Creek, (2) Raritan River, (3) South River, (4) Shoal Harbor and Compton Creek, and (5) Shrewsbury River, N. J.: Maritime Dredging Co., 80 Broad St., New York, N. Y., (1) $0.56, (2) [illegible] mended for rejection); John H. Gerrish, 8, New St., New York, N. Y. (recommended for acceptance), (1) $0.53, (2) $0.38½, (3) [illegible]

Manufacturers of Bayonne, N. J., whose plants are located along the Newark Bay shore, are working on a plan to extend the shore line a distance of 200 ft., by filling in the bay, as has been done at Constable Hook and at Greenville on the New York Bay shore. The plan provides for filling in the bay 200 ft. further than the present shore line, and the construction of piers to extend 200 ft. further, making 400 ft. from the present shore line, to deep water. The concerns interested include the F. W. Bonsall Lumber Co., at the foot of First St. and Newark Bay, and the Leolastic Works, at West 31st St. and Newark Bay.

A Philadelphia syndicate headed by Alfred E. Bush of Philadelphia is to have work started this month on the new $400,000 pleasure pier to be erected at New Jersey Ave., Atlantic City.

The American Dredging Co., Philadelphia, Pa., at 6.8 cts. per cu. yd. place measurement was low bidder March 8 for about 850,000 cu. yds. of dredging at Cold Springs Inlet three miles east of Cape May City, N. J., for the [illegible]

New York.

Surveys have been made and construction work will be started shortly on a 200-ft. $10,000 concrete dam, to be erected for the Newfane Basket Co. at Newfane, N. Y.

Ohio.

✢Bids will be received until noon, April 12, by Director of Public Service, Lorain, O., for furnishing the necessary labor and materials for the dredging of Black River approximately 170,000 cu. yds., according to plans and specifications on file in office of the Director. L. B. Johnson is Clerk.

The Board of Education of Hamilton, O., has determined to proceed with the construction of a new high school and also to build a new school in East Hamilton. The board will try and have the plans, specifications and estimate of cost completed in time to give the people a chance to vote on a bond issue at the May primary.

Oregon.

The Seattle Construction & Dry Dock Co., Seattle, Wash., was the low bidder at about $300,000 for constructing a sea-going suction dredge for the U. S. Government. This dredge is to operate in Coos Bay, and bids for it were opened last week at the Construction Quartermaster's office, Portland, Ore.

A plan is under consideration for the construction of a tunnel under Council Crest and a connecting subway tube under 15 blocks of the West Side to a point about the center of the business district of Portland. Property owners of the Tualatin Valley are interested in this project and plans are being formulated for financing it. Preliminary surveys have been made and the cost estimated at $3,000,000. C. E. Wickland, Portland, Ore., is interested.

Bids as follows were received March 5 by Col. Frederic V. Abbot, U. S. Engineer, Newport, R. I., for repairing breakwater at Harbor of Refuge at Point Judith, R. I., the contract requiring (1) resetting 1,130 tons of stone, (2) 15,000 tons new stone: E. S. Belden & Sons, Hartford, Conn., (1) $1.73; (2) $2.83; total $44,405. The Breakwater Co., Philadelphia, Pa., (1) $2.47; (2) $1.93; total $31,741.

Pennsylvania.

✣Bids will be received until 10:30 a. m., April 5, by City Controller, Pittsburg, Pa., for the construction of concrete retaining walls on 5th Ave., opposite Brenham St., and on Wylie Ave. at McClarren St.

✣Bids will be received until noon, April 9 by George W. Gerwig, Secretary, Board of Public Education of the School District of Pittsburg, Seventh Floor, Fulton Bldg., Pittsburg, Pa., for addition, alterations and repairs to the heating and ventilating system for Moorhead Public School. Edward Stotz is architect.

✣Bids will be received until April 8, by J. M. Murray, Borough Clerk, Glassport, Pa., for the following supplies: Two Anderson nozzles, 1 dozen house straps, 3 dozen spanners, 6 dozen gaskets, 1 dozen pairs boots, 1 dozen coats, 1 gallon sulphuric, 10 pounds bicarbonate, 1 plug wrench, 3 lanterns, 1,000 feet hose.

⊙Guy M. Gest, New York City, has been awarded a contract by the Metropolitan Electric Co. of Reading, Pa., for constructing an underground conduit system in that city. The work will call for the expenditure of about $1,000,000.

An ordinance has been introduced in the City Council of Philadelphia, Pa., appropriating $50,000 to the Department of Wharves, Docks and Ferries, for the purpose of preparing complete plans for the improvement of the river front.

South Dakota.

✣Bids will be received until 2 p. m., April 13, by C. F. Hauke, Acting Commissioner of Indian Affairs, Washington, D. C., for the material and labor necessary for the erection of a brick hospital addition to brick laundry, addition to brick mess hall and additions to two brick dormitories at the Pine Ridge School, S. Dak.

Tennessee.

✣Bids will be received until noon, April 22, by Maj. Clarke S. Smith, U. S. Engineer. Memphis, Tenn., for furnishing about 45,000 cords of brush poles for revetment work in 1st and 2d districts, Mississippi River.

Texas.

✣Bids will be received until noon, April 29, by Capt. T. H. Jackson, U. S. Engineer, Dallas, Texas, for furnishing about 4,000 cu. yds. of sand, delivered at Crockett, Texas.

✣Bids will be received until noon, April 30, by Capt. T. H. Jackson, U. S. Engineer, Dallas, Texas, for furnishing about 8,000 barrels American Portland cement for lock and dam at Hurricane Shoals, delivered at Crockett, Texas.

✣Bids will be received until noon, May 2, by Capt. T. H. Jackson, U. S. Engineer, Dallas, Texas, for one-man stone and crushed rock delivered at Crockett, Texas, on International and Great Northern Ry.

✣Bids will be received until May 1, by County Auditor, Galveston, Texas, for plans and specifications for an up-to-date, modern and strictly sanitary jail building, to be four stories in height to conform in architecture with that of annex building, to accommodate no less than 200 prisoners. Other required information will be given by the building committee when applied for. John Murch is County Auditor.

✣Bids will be received until 3 p. m., April 17, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the mechanical equipment, except gas piping and lighting fixtures of the U. S. Post Office at McKinney, Texas.

⊙The Gordon James Construction Co., San Antonio, Tex., has been awarded the contract at $86,665 for the erection of the new mess hall at A. & M. College, San Antonio.

⊙John Fields, Greenville, Tex., has been awarded the contract at about $80,000 for the construction of the administration building and two dormitories to be erected for Wesley College at Greenville.

⊙The Unit Construction Co., Liggett Bldg., St. Louis, Mo., has been awarded the contract for the buildings to be erected for a textile plant for the C. W. Post interests at Post, Garcia County. This plant is designed to take cotton direct from the fields, gin it, and make it into cloth.

⊙The Waxahachie Gas Co., of Waxahachie, Tex., has been incorporated under the laws of the State of Texas, with an authorized capital stock of $150,000, for the purpose of building a gas plant in the city of Waxahachie. This company was formed by Henry M. Wallace and associates, of Detroit, Mich., who have just completed a water gas plant at Temple, Tex., where gas was turned on Feb. 29th, 1912. The officers of the Waxahachie Gas Co. are: President, Henry M. Wallace; Vice-president, Raymond G. St. John; Secretary and Treasurer, William T. Utley. Contracts for the construction of the plant, complete, have been awarded to the United Gas Improvement Co., of Philadelphia, and to the Kerr Murray Manufacturing Co., of Fort Wayne, Ind. A 77,000-cu. ft. steel, double lift, storage holder and a relief holder will be erected, and a four-foot water gas set will be installed. The company holds a 30-year franchise, granted during the past six months, and authorizing the sale of gas at $1.50 per 1,000 cu. ft. Waxahachie is a city of about 10,000 people. Herbert L. St. John, formerly of Byllesby & Co., of Chicago, will be in charge of the construction work, as Engineer. George Buckingham will be Construction Foreman.

Washington.

✣Bids will be received until 2 p. m., April 25, by Commissioner of Indian Affairs, Washington, D. C., for furnishing necessary labor and material for the erection of a frame office and dairy barn at the Tulalip Indian School, Wash.

⊙George C. Dietrich & Co., Globe Block, Seattle, Wash., has been awarded a contract at about $25,000 for piling bulkheading and filling a section of Commercial St. in Anacortes, for that city.

The Pacific Light & Power Co., Los Angeles, Cal., has engineering work underway for its proposed new dam to be built across the Columbia River at the foot of Priest Rapids. It is estimated that the dam will cost about $8,000,000.

West Virginia.

✣Bids will be received until noon, April 8, by Secretary, Board of Education, Cairo, W. Va., for the construction of a reinforced concrete school building. C. W. Bates, Board of Trade Bldg., Wheeling, W. Va., is architect.

✣Bids will be received until 11 a. m. (eastern time), April 18, by Maj. F. W. Alstaetter, U. S. Engineer, Wheeling, W. Va., for furnishing and delivering 1 craneboat hull, No. 29; 2 deck flats, Nos. 30 and 31, and 1 fuel flat, No. 32, for Kanawha River, W. Va.

Patterson & McNeil, Coalwood, W. Va., have the contract for sinking two shafts for the Virginia Pocahontas Coal Co., at Coalwood. The shafts will be 610 ft. deep and work has already been started on them.

Canada.

✣Bids will be received until 11 a. m., April 9, by Chairman, Board of Control, Winnipeg, Man., for the supply of a 50 h. p. Gasoline Traction Engine, to be delivered f. o. b. City Yards, on or before May 15th. Specification and form of tender, together with conditions governing tenders as prescribed by By-law, may be obtained at the office of the City Engineer, 223 James avenue. M. Peterson, Secretary.

✣Bids will be received until noon, April 18, by James Chisholm & Son Architects, Winnipeg, Man., for the erection of Sparling Methodist Church and institut
corner of Elvin Ave. and Worth

✣Bids will be received until 10
April 10, by G. H. Lees, at the offi
Clerk, Hamilton, Ont., for furnishin
mately 6,500 concrete posts. E. L.
Engineer.

✣Bids will be received until noo
by A. S. Dawson, Chief Enginee
ment of Natural Resources, Canadi
Ry. Co., Calgary, Alt., for the conc
tures in about half of the area
the Eastern Section of the Compan
tion Block, Alta. Official advertise
be found elsewhere in this issue.

✣Bids will be received until 10 a.
3, by A. G. Willson, Chairman,
Home Committee, Welland, Ont., fo
to the home at Welland. T. L. Nicl
land, Ont., is Architect.

✣Bids will be received until 11 a.
18, by Chairman, Board of Contr
peg, Man., for supply of labor and
for erection of a machine shop a
yards, Ross Ave., and Tecumseh St.
son is Secretary.

✣Bids will be received until noo
by A. S. Dawson, Chief Engineer
partment of Natural Resources, Can
cific Ry. Co., Calgary, Alta., for
structures in about half of the area
ing the Eastern Section of the comp
gation block, Alberta. The work wi
the following approximate quantiti
cu. yds. of concrete; 1,200,000 lbs. r
steel. The quantities in individual
vary from 5 to 700 cu. yds.

⊙The Sinclair Construction Co., N
minster, B. C., at $171,000 has been
the contract for the first 6,500 ft.
the mouth of the Fraser River. Thi
is the first portion of the scheme
volves an expenditure of $1,500,00
the next three years.

Plans and specifications are being
by G. A. Keefer, Victoria, B. C., Resi
gineer of the Dominion Public Work
ment, for the construction of a br
2,500 ft. long, to be built westerly fro
Point, at Victoria. This is the first
the Victoria outer harbor work. Abou
000 will be expended.

The supplemental estimates of the
an Government for the coming fiscal
clude the following: $200,000 for
construction on the new Welland can
000 for French River waterway impro
being practically a beginning on the
Bay ship canal; $1,000,000 for Quebe
improvements; $100,000 for St. John
$1,000,000 for a Dominion Governme
ing in London, England; $300,000
Dominion buildings at Toronto; $50
a new departmental building at Ottaw

The following sums for river an
work in Ontario are provided in the
mental estimates of the Canadian
ment for the coming fiscal year: Be
construction of wharf (revote),
Beaverton harbor (improvements),
Belleville harbor (improvements),
Burlington, revetment wall, etc., $25,
bourg, extension of west pier, $25,000;
wood harbor (improvements), $75,00
erich harbor (improvements), $50,000;
ton harbor (improvements), $200,000;
dine, harbor at north end of north pi
000; Kingston harbor (improvements
000; Orillia, wharf, $4,000; Owen Sou
provements), $25,000; Parry Sound,
$25,000; Picnic Islands (improve
channel), $100,000; Picton harbor (dre
$19,000; Port Burwell (improvements
bor work), $50,000; Port Stanley harb
provements), $50,000; Rainy River (i
ments), $60,000; Sault Ste. Marie harb
provements), $150,000; Telegraph and
Islands (dredging), $40,000; Thornbu
bor (improvements), $29,000; Toronto
(improvements—further amount re
$17,000; Whitby harbor (improvements
000

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SEWER.

Ludington, Mich., March 21, 1912.

[illegible] of Public Works until April 20, 1:30 p. m., for the construction of [illegible]nately four thousand feet of pipe [illegible]f various sizes for the city of [illegible]n, Mich., according to the plans [illegible]ifications on file at the office of [illegible]

[illegible]oard reserves the right to reject all bids. Each bidder shall de- [illegible] f the City Treasurer, in the sum per cent of his proposal, but not n $50.00, to be forfeited to the Ludington in case he shall fail to to contract, in accordance with [illegible]sal, should his proposal be ac- y the Board of Public Works.

DEAN THOMPSON,
City Clerk.

ENGINEER OFFICE—Boston, [illegible] will be received here until 12 M., [illegible] 1912, and then publicly opened. [illegible] T. Col., Engrs.

ENGINEER OFFICE, CHICAGO. arch 26, 1912. Sealed proposals lging in Calumet Harbor, Ill., received here until 10 a. m., 1912. Information on applica- [illegible] ZINN [illegible]

TENDERS FOR CONCRETE CONSTRUCTION.

CANADIAN PACIFIC RAILWAY COMPANY.

[illegible]

SOURCES.

Sealed tenders, addressed to the undersigned and endorsed "Tenders for Concrete Structures," will be received up to noon of May 1, 1912. The work to be let includes the concrete structures in about half of the area comprising the Eastern Section of the Company's Irrigation Block, Alberta. Materials, except for [illegible] Company. Materials for forms and all labor must be furnished by the Contractor. The approximate quantities are: 15,000 cubic yards of concrete and 1,200,000 pounds of reinforcing steel. The quantities in individual structures vary from 5 cubic yards to 700 cubic yards.

Plans, specifications and full information will be furnished after April 1, 1912, on application to the undersigned. A deposit of $100.00 will be required before plans, etc., will be given out, which will be refunded on their return in good condition.

All proposals must be accompanied by a certified check, payable to the undersigned, for 5% of the amount of the tender, to be forfeited as liquidated damages should the bidder neglect or refuse to enter into a contract in the event that the work is awarded to him.

Proposals must be made on the standard form provided. Alterations thereto, interlineations or qualification of prices may invalidate the bid.

The right is reserved to reject any or all bids and to waive defects.

A. S. DAWSON,
Chief Engineer.

Calgary, Alberta, March 20, 1912.

DITCH CONSTRUCTION.

St. Paul, Minnesota, March 4, 1912.

Sealed proposals will be received at the office of the State Auditor, of the State of Minnesota, until 2 o'clock P. M., Tuesday, April 2nd, 1912, for the construction of the Mustinka River State Ditch, in Traverse County, Minnesota, involving the construction of about 13 miles of main outlet ditch, and the excavation of about 350,000 cubic yards of earth. The work is located from 1 to 10 miles from Wheaton, Traverse County, Minnesota.

This is an excellent floating dredge job, and is suitable for a 1½ ward machine. Excellent roads cross the line of the ditch at various points. For full particulars address

GEORGE A. RALPH,
State Drainage Engineer,
St. Paul, Minnesota.

Architects' and Builders'

periodicals appreciate the value of Tyrrell's Mill Buildings

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CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon**

WATER WORKS AND SEWER.

Hamilton, Illinois, March 29, 1912.

Sealed proposals will be received by the Board of Local Improvements of the City of Hamilton, Illinois, until one o'clock p. m., on the 19th day of April, 1912, for the following work:

1st. For a system of sewers, comprising approximately 1,200 lineal ft. of 15-in. sewer, 1,929 lineal ft. of 12-in. sewer, 7,445 lineal ft. of 10-in. sewer, and 8,581 lineal ft. of 8-in. sewer, together with the necessary manholes, flush tanks, etc.

2nd. For a Water Works distribution pipe system, comprising approximately 3,375 lineal ft. of 10-in. pipe, 12,435 lineal ft. of 8-in. pipe and 9,140 lineal ft. of 6-in. pipe, together with the necessary special castings, valves and valve boxes.

Sealed proposals will be received by the Board of Local Improvements of the City of Hamilton, Illinois, until one o'clock p. m., on the 20th day of April, 1912, for the following work:

1st. For furnishing and setting hydrants and hydrant branches, comprising approximately 46 4-in. hydrants with 4-in. hydrant branches and 10 5-in. hydrants with 6-in. hydrant branches.

2nd. For certain water works improvements to be divided into separate portions or items, as follows:

Item One: A Pump House.
Item Two: A Pumping Plant.
Item Three: A Steel Tower and Tank.

Separate contracts will be awarded for each of the four divisions above named and bids may be made upon any one or more of said divisions. Separate bids may also be made for any one or more of the three items in the fourth division.

Bids must be on blank forms furnished for that purpose and each bid must be accompanied by cash or by a certified check, made payable unconditionally to the order of the President of the Board of Local Improvements, in his official capacity, certified to by a responsible bank, the amount of said cash or check to be not less than 10% of the aggregate amount of the bid.

Payments for the work embraced in the 1st and 2nd divisions above named, will be made in cash or in local improvement bonds bearing interest at 5% per annum at the option of the City. Payments for the work embraced in the 3rd and 4th divisions above named, will be made in cash.

Plans and specifications are on file and blank forms of proposal may be obtained at the office of the City Clerk of Hamilton, Illinois, and at the office of L. P. Wolff, Consulting Engineer, St. Paul, Minnesota.

The right is reserved to reject any or all bids.

NEAL DOUGHERTY
President of the Board of Local Improvements.

HIRAM B. KINKADE,
Secretary of the Board of Local Improvements.

R. H. ATHEY,
Member of the Board of Local Improvements.

SEWER SYSTEM.

Notice is hereby given that the undersigned, the Board of Local Improvements of the City of Lawrenceville, Illinois, will receive sealed bids or proposals, until 2 o'clock, P. M., Wednesday the 10th day of April, A. D. 1912, at the City Council Chamber in the City Hall Building in the City of Lawrenceville, Illinois.

For the construction of the entire Sewer system in Sewer District Number Three (3) of said City, consisting of vitrified clay pipe sewer manholes, lampholes and all appurtenances, including all labor and material necessary to the completion of said work, according to the plans and specifications which are to be found at the Office of the City Engitimate of cost, $42,100.00.
Illinois.

Specifications and estimates of the proposed work, together with bidding blanks and instructions to bidders will be furnished upon application to said City Engineer.

All bids must be accompanied by cash or a check certified to by some responsible Bank, made payable to Carl Busse, President of the Board of Local Improvements, in a sum not less than ten (10%) per cent of the aggregate amount of the bid or proposal.

The Contractor shall be paid in Cash or in the Bonds of said district drawing Five (5%) per cent interest per annum, at the election of the Board of Local Improvements. All bids will be opened by said Board of Local Improvements of said City at 2 o'clock P. M., Wednesday, April 10th, A. D. 1912, in said City Council Chamber and said Board of Local Improvements reserves the right to reject any and all bids. Engineer's estimate of cost $42,100.00.

Dated at Lawrenceville, Illinois, this 27th day of March, A. D. 1912.

CARL BUSSE,
J. H. PHILLIPS,
A. M. FYFFE

Board of Local Improvements of the City of Lawrenceville, Illinois.

Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Nebraska, until 2 o'clock p. m., April 22, 1912, for the construction of an earth dam and auxiliary works, on the North Platte Project, about nine miles north of Minatare, Scottsbluff County Nebraska. The work involves the handling of about 840,000 cubic yards of material, of which 630,000 cubic yards is earthfill, 157,000 cubic yards gravelly material, 14,000 cubic yards unscreened gravel, 11,500 cubic yards screened gravel, 14,000 cubic yards concrete, and 12,000 cubic yards brule clay excavation, besides 45 acres of sod stripping, 600 feet of wells and casing, 3,200 linear feet of drains, and the handling and placing of 250,000 pounds of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Nebraska; 519 Commonwealth Building, Denver, Colorado, or Washington, D. C. F. H. NEWELL, Director.

U. S. ENGINEER OFFICE, Duluth, Minn., Mar. 5, 1912. Sealed proposals for furnishing and placing rock in the foundation embankment for the breakwater extension at Marquette, Mich., will be received here until noon April 5, 1912, and then publicly opened. Information on application. Francis R. Shunk, Lt. Col., Engrs.

SEWAGE DISPOSAL WORKS.

Sealed proposals will be received by the City Clerk of the City of Springfield, Missouri, at his office in the City Hall, until twelve o'clock, Noon, of Thursday, the 4th day of April, 1912, for the construction of the southern and northern sewage disposal works, in accordance with the plans and specifications approved by the City Council on the 15th day of March, 1912, which said plans and specifications are on file in the office of said City Clerk.

The southern sewage disposal works is designed to treat four million gallons daily. It embraces the construction of the grit chamber, two Imhoff tanks, five sprinkling filters equipped with mechanical distributors, two sludge beds and one final settling basin.

The northern sewage disposal works is designed to treat five hundred thousand gallons daily, and similar except that sprinkling nozzles are substituted for the mechanical distributors.

Proposals for each plant must be made separately. Proposals shall be accompanied by certified check for two and one-half per cent of the amount of the bid, made payable to the City of Springfield, Missouri, without condition.

The successful bidder to give bond in double the sum of his bid, conditioned for the faithful performance of the conditions of his contract, and conditioned further to hold said city harmless on account of any claims for damages made to or against it on account of any damages occasioned by the construction of said works.

Plans and specifications can be seen at the office of the City Clerk of Springfield, Missouri, or at the office of the consulting engineer, Alexander Potter, 114 Liberty Street, New York. It is provided that any bidder may, in addition to his bid for the construction of said disposal plants in accordance with the aforesaid plans and specifications, submit any plan of his own, or may propose any modification or alteration of said plans and specifications, or any part thereof, together with his bid for the construction of said plants in accordance with such modified or altered plans, such modification or alteration to be subject to the approval of the Consulting Engineer and the City Council.

The right is reserved to reject any and all bids.

By order of the City Council of the City of Springfield, Missouri.

ROBERT E. LEE, Mayor.
J. H. LANGSTON, City Clerk.
ALEXANDER POTTER,
Consulting Engineer.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE—Mitchell, Nebraska, March [illegible], 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Nebraska, until 5 o'clock p. m., April 10, 1912, for the construction of an embankment and spillway for an earth dam, on the North Platte Project, about nine miles north and one mile east of Scottsbluff, Scotts Bluff County, Nebraska. The work involves the handling of about 175,000 cubic yards of material, of which about one-tenth is brule clay. For particulars address the U. S. Reclamation Service, Mitchell, Nebraska, or 519 Commonwealth Building, Denver, Colorado. ANDREW WEISS, Project Engineer.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

W TER WORKS IMPROVEMENTS.

Holdenville, Oklahoma.

[illegible] in the City Hall, until 10 o'clock April 13th, 1912, for furnishing F. [illegible] R. R., three miles east of Holden- lahoma) the following material hinery to be used in the exten- [illegible] stem of Holdenville.

will be opened by the Mayor and oners the same day and bidders ed to be present and to submit the following items:

linear feet of ten (10) inch cast Class A, weight 57.1 pounds per [illegible]

pounds of lead.

gine generator set, consisting of [illegible] hree hundred volt, seventy-five (75) [illegible] l steam engine.

oard and instruments complete.

[illegible]

thern Cedar poles, 30 feet long, tops, with cross-arms, guys, sulators, etc.

ronze fitted horizontal turbine pacity six hundred and twenty- gallons per minute against a l of 112 feet, direct connected to P., 3 phase, 60 cycle, 2,300 volt [illegible]

2'x18' horizontal return tubular

[illegible] specifications will be on file fice of the City Clerk, or may be from the Consulting Engineers, & Harper, 920 Scarritt Bldg., ity, Mo.

[illegible] must be accompanied by rtified check of not less than five (5) r ent of the amount bid, made pay- to W. R. Scott, Commissioner of Fi- , a guarantee that the bidder re- g the award will enter into con- with the city and furnish satis- ry bond within ten days after the [illegible]

[illegible] r all bids, to waive any informality, to award the contracts as may be d to the best interests of the city.

WILLARD S. LEVAN
City Clerk.

[illegible] 1912.

PAVING.

ls will be received until noon, May 1, at the office of Board of Improve- Paving District, No. 7, city of Fort [illegible] t, for the repaving of Garrison ave- Specifications at office of City En- r. Approx. 35,000 yards.

PARTMENT OF THE INTERIOR. TED STATES RECLAMATION VICE—Washington, D. C., March 11. Sealed proposals will be received at office of the United States Reclama- Service, Los Angeles, California, un- o'clock p. m., April 8, 1912, for fur- ng electrical apparatus for Truckee- on Project, Nevada. For particulars ess the U. S. Reclamation Service, Federal Building, Los Angeles, Cali- a., or Washington, D. C. F. H. [illegible] Director.

CANADIAN PACIFIC RAILWAY COMPANY [illegible]

RESOURCES—IRRIGATION BRANCH.

TENDERS FOR STEEL HIGHWAY BRIDGES.

Sealed tenders, addressed to the undersigned, will be received up to noon of April 15th, 1912, for the design, manufacture and erection complete on piers to be provided by the Railway Company, of the following Steel Highway Bridges:

2 Bridges—span 125 feet.
[illegible]
[illegible]
9 Bridges—span 60 feet.

[illegible] and general instructions may be had on application to the undersigned. A deposit of $25 will be required before specifications will be given out, which will be returned on receipt of a bona fide tender.

Tenders will only be received from parties who can show a reasonable ac- [illegible] character, and that they have the facilities and plant necessary for work of such magnitude.

A certified cheque or cash deposit to the amount of 5 per cent of the tender must accompany all bids as a guarantee that the bidder will enter into a contract for the work should it be awarded to him and which will be forfeited as liquidated damages should the bidder default.

Cheques or deposits of the unsuccessful bidders will be returned within ten days after the award of the contract.

The right is reserved to the Company to reject any or all tenders and to waive defects.

A. S. DAWSON,
Chief Engineer.

Calgary, Alberta, March 1st, 1912.

WATER MAINS.

Bids will be received up to Apr. 11, 1912, for a system of water mains in the village of Morton Grove, Ill. Further particulars at the office of the undersigned. Bids to be forwarded to undersigned to be delivered to his office not [illegible]

[illegible]
Village Attorney.

167 W. Washington St.,
Chicago, Ill.

U. S. ENGINEER OFFICE—Little Rock, Ark., Jan. 31, 1912. Sealed proposals for constructing the two (2) steel hull, 24-inch pump dredges H. S. Taber and Robert McGregor will be received here until 12 o'clock noon, April 9, 1912, and then publicly opened. Information on application CLARKE S. SMITH, Major, Engrs.

The STARY
All Sizes
All Types
AUTOMATIC
FLUSH TANK SIPHON
For Flushing Sewers
[illegible]
F. STARY & SONS Cedar Rapids, Iowa

Proposal Advertising
—IN—
Engineering & Contracting Pays

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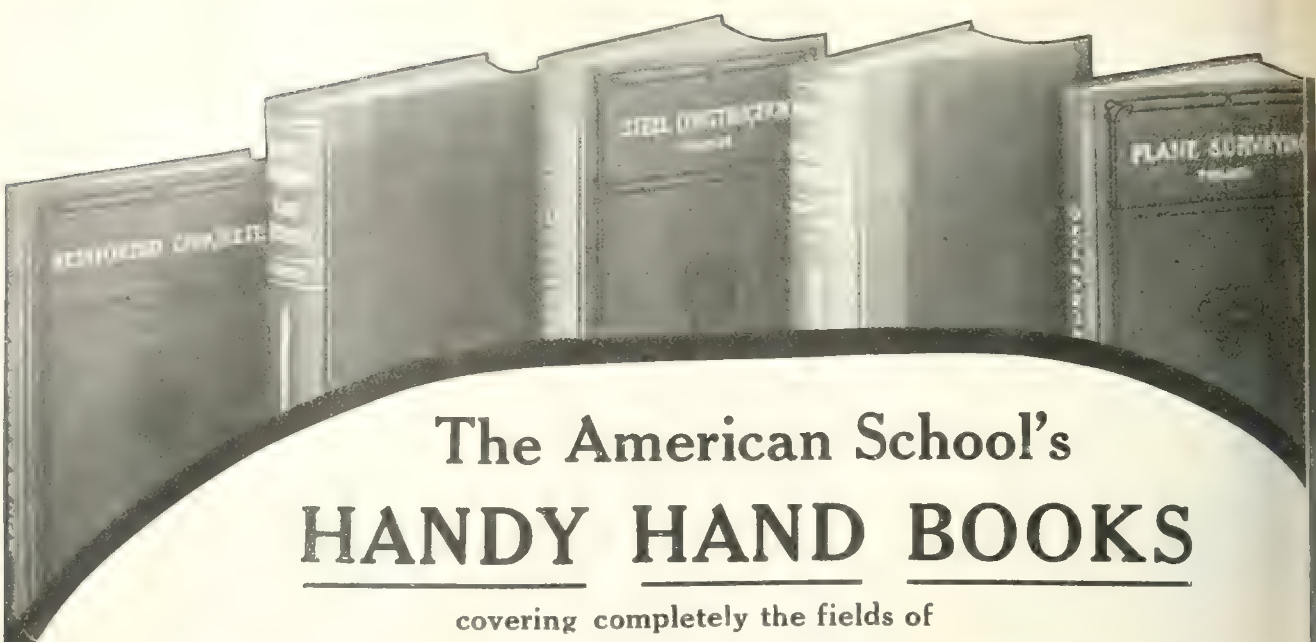
[illegible]
1 Tube Mill, with automatic screw feed, 7' diameter [illegible]
INDIANAPOLIS WATER CO - 113 Monument Place

Second Hand Locomotive Cranes For Sale
[illegible] Industrial Works, [illegible] M. C. B. cars, and outriggers. Schoen Steel wheels, two booms, [illegible]
W. S. Ramsay, 1418 Fourth St., Bay City, Mich.

WANTED
Experienced Cranesmen at once for Ditching Dredges in Ohio.
EDWARD BODETTE, Toledo, Ohio.

We specialize in River, Harbor, Canal and Submarine Rock Excavations.
Steam and Electric Railway Construction.
Hydraulic and Electrical Engineering.
Hydro-Electric and Water Power Development.
Irrigation, Reclamation and Drainage.
THE BRINDLEY COMPANY
CONTRACTING ENGINEERS
Whitehall Building, 17 Battery Place
NEW YORK

Proposal Advertising
—IN—
Engineering & Contracting Pays



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and to Methods and Cost of Construction

Published every W[illegible]

EDITORS: H. P. Gillette, C. S. Hill, [illegible]

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[illegible] Panama, Canal Zone and [illegible]

XVI. Volume No. 15.

April 10, 1912

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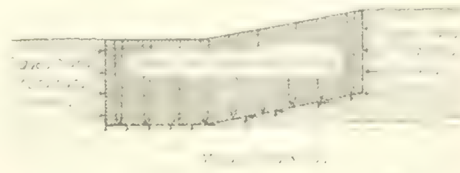
nforced Concrete Arch of Remarkable Span—Length and Design.

[illegible] common labor in Europe [illegible] st of materials a relatively larger [illegible] in America, of the [illegible] of oncrete structures. European en- gn carefully to save material. This he reasons why European rein- rete structures generally present a ceful appearance as compared with tures in the United States. Econ- materials is, however, not the only and perhaps is not even the principal rior the less massive reinforced con- ructures observed in Europe. Engi- re exhibit a greater confidence in l than do engineers in America. act value from the tensile strength. [illegible] he American engineer does not exact. inforced concrete work therefore fre- exhibits a boldness in design which almost hazardous to the person who hed only American examples. This is rly true of arch bridges. Few Amer- inforced concrete arches show any s in using the thin sections, long spans t arcs which are of the most com- urence in Continental Europe. An il- n is at hand in the general drawings d elsewhere in this issue of the arch over the Tiber at Rome.

Tiber arch has a span of a fraction 8 ft., and a rise of arc of one-tenth the This is the longest arch of concrete nstructed. In fact there are but few e arches in the world which come with- same class dimensionally. Of these, e in the United States: The Walnut ridge, 233 ft.; the Rocky River bridge, ; the Spokane bridge, 281 ft., and the rg bridge, 312 ft. The nearest in ngth to the Tiber bridge of concrete is the Auckland arch of 320 ft. span Zealand. The Tiber bridge is truly a ced concrete structure. None of the bridges named are, in at all the same of reinforced concrete. Their structural er is far more nearly that of the Cabin John Bridge or any other large masonry arch than it is that of the Tiber Bridge or any other true reinforced concrete arch. The Tiber Bridge is, therefore, unique as the only reinforced concrete arch having a span of the first magnitude among concrete arches.

The resisting sections of any of the concrete arches which are named above are readily denominated. For example the Auckland Bridge which is nearest in span length to the Tiber arch has two arch ribs with a cross section of 4¼x5½ ft. each, or a total compression area of 46¾ sq ft. The resisting section of the Tiber bridge, however, is difficult to measure. Considering the arch at the crown there are the arch ring 66 ft. wide and 8 ins. thick, the seven spandrel walls 1½ ft. high and 8 ins. thick, and the floor slab 66 ft. wide and 8 ins. thick. All these dimensions are approximate only, since published dimensions in sufficient detail for exactness are wanting, but they will do for general comparison. The total section of concrete at the crown in floor plate, arch ring and spandrels, is 95 sq. ft. Only a portion of this section can be considered to resist thrust. The arch ring having a section of something over 44 sq. ft. less, and some portion of the spandrel wall section may be assumed to take thrust. Considering the arch ring alone, its section, it will be observed, is nominally only slightly less than that of the two arch ribs of the Auckland Bridge; allowing for thickening of the slab to 11 ins. under the sidewalks of the Tiber Bridge, its ring section is fully that of the Auckland Bridge. The Tiber Bridge has a rise of only about one-third the rise of the Auckland Bridge and a correspondingly intensified crown thrust, and its greater boldness of design is evident.



It is, however, not the flat arc alone or its small thrust resisting section that is the bold feature of the Tiber Bridge design. This is the foundations. If the traditional requirements for arch bridge foundations mean anything the only argument in favor of the foundations for the Tiber Bridge is the unanswerable one that the bridge is sound and stable after a year and bids fair to endure in this condition. The exact character of these foundations is interesting to note.

The original soil on which the abutments are located consists of several layers of fairly compact clayey sand down to a depth of 14 to 19 ft. under which come "muddy sand of little consistency," clayey sand of little consistency," "clay without consistency," etc. In brief there was a 14 to 19 ft. crust of ordinarily compact sandy soil overlying mud to an undetermined depth. Over the area of each abutment 66x66 ft. were driven or sunk concrete pillars or piles, the longest of which was about 23 ft. These piles therefore penetrated the harder crust and a little into the underlying mud. The duty that these piles were designed to perform was to compact the soil as well as to transmit as bearing piles the weight of the masonry to the soil. In fact 24 of the 96 piles for each abutment were compacting piles solely—no masonry rested on them. Under the conditions, then, there was produced a foundation which may fairly be represented by the accompanying sketch. There was a pile compacted mass of sandy soil 66x66x23 ft. bounded on all sides by the same soil in its natural state of solidity and all resting on a deep bed of mud. This is virtually a floating foundation; even more truly one than any ever constructed in years past under a Chicago building, for Chicago clay is not mud on top, becomes harder as the depth increases and turns to hardpan resting on ledge rock.

American engineers have often been accused of designing recklessly, but this foundation for a 328-ft. masonry arch adopted by French engineers and formally approved by the Italian engineers under whose official service it was built makes the most daring of American designing appear ultra conservative. Most American engineers viewing the foundation plans would be likely to predict that Father Tiber would take El Ponte del Risorgimento to his bosom the minute the centers were struck if not sooner. Yet there are no signs of failure after a year and no indications that the bridge will not endure. There is, therefore, [illegible]

The Handicap Imposed on the Engineer Graduate of an "Agricultural College."

Several colleges in the United States offering regular four year courses of study in Civil Engineering are called Agricultural Colleges. For example the Oregon, Maryland, Michigan, North Dakota, and Kansas Agricultural Colleges all grant the degree of Bachelor of Science in Civil Engineering to graduates of that course. In every case there are several other full courses of study offered. The following statistics show the number of graduates in 1911, in each course of study offered in three of the institutions named.

Oregon Agricultural College.—Agriculture, 23; [illegible] Domestic Science [illegible] Civil Engineering, 18; Electrical Engineering, 10; Mechanical Engineering, 16; Mining Engineering, 9; Commercial, 21; and Pharmacy, 8. The total number of graduates was 12[illegible]

Maryland Agricultural College.—Agriculture, 3; Horticulture, 3; Biology, 1; Chemistry, 3; Civil Engineering, 5; and Mechanical Engineering, [illegible] Total, [illegible]

Michigan Agricultural College.—Agriculture, 40; Engineering (Civil, Electrical, Mechanical), 58; Home Economics, 26; Forestry, 21. Total, 145.

At Oregon 18.5 per cent, at Maryland 15 per cent, and at Michigan 27.5 per cent of the degrees conferred were in Agriculture.

These institutions were founded as, or soon became, Colleges of Agriculture and the Mechanic Arts. For years they have been misnamed.

To the engineer of experience it makes little difference what college he took his degree in, but the name of his college is of great importance to the inexperienced young man seeking his first position. The prospective employer usually wants to know what college the applicant attended. In many cases it is next to impossible for the applicant to prove that he graduated in Civil Engineering from an Agricultural College. The employer usually infers that the young man took a course in farm drainage as an incident in his course in Agriculture, and unless he knows the applicant personally, or is familiar with the courses of study offered in the institution, it is difficult if not imposible to prove to him that the applicant's engineering studies were carried any further. Thus the young graduate engineer has a heavy handicap imposed on him at the time when he is least able to carry it.

The institutions named are good ones. Their engineer graduates have attained high standing in the profession, after surmounting the early handicap imposed by the names of their colleges. It seems that the older engineer alumni of each of these institutions would confer a great favor on the new graduates by cooperating for the purpose of having the name of the college changed. A general name for the institution such as State College, instead of Agricultural College, would not alter the early standing of the graduates in agriculture, while it would be a great help to the students graduating in the other courses of study. A movement to have the names of these colleges changed should be undertaken by their alumni.

The Importance to the City and to the City Engineer of Complete and Accurate Engineer's Records.

The importance of complete and accurate engineer's records of all permanent municipal improvements has long been appreciated by engineers. It is one of the things which may safely be classed as common knowledge among engineers. It is also a well known fact that in trenching operations, even in our largest cities, pipe lines often are encountered which are not shown on the city records. Apparently then, although the importance of keeping full and accurate records of the location and nature of all improvements is well understood, such records often are not kept at all, or if kept, are inaccurate.

A reminder of the expense and confusion arising from the lack of proper engineer's records comes to us from a city of 20,000 population in a north central state. The present city engineer of that city has held the position for the past two years and recently made a report of the work of his department for that period. The report clearly shows the effect of the failure to keep adequate engineer's records in past years. We have selected a few comments of the present engineer on the conditions, in this regard, as he found them. The reader will appreciate the expense incurred by the city before the faults enumerated were corrected. The quotations follow:

> Sewer Records.—The sewer records are very incomplete and resort was made necessary to a complete survey in order to get the physical information, more particularly with respect to sizes and grade.
>
> Our sewer Y maps are somewhat incomplete and some of them are missing. All records of permits in the city offices have been investigated and a record made of connections to sewers, but we know of many houses that are connected to sewers that have no permit for the same, and no record that such connections have ever been made. This is an important thing to know, for the health of the city depends on its sewer system. Some time ago I was called to a residence in the Fifth ward wherein the sewer was out of order. The condition of the cellar beggars description. All the houses in the block were connected to a private sewer, supposed to be in the alley, but no one knew exactly where. No record is available showing where the sewer connects to the city sewer and I could find no responsible party who could give me any information. This is a condition that cannot do any good to the community and may result in lasting harm.
>
> Paving.—An investigation has bee determine the total amount of pav the city, including the date constr cost and total cost, length of time reasons for reconstruction, and pres tions. The records of this office shed light on any portions of these sul from other sources a table has been that at least covers part of this im formation.
>
> Maps.—This department has felt complete and accurate maps of the purposes, and I believe, and in some know, that serious errors have bee relying on maps that were unreliable. ister of deeds of this county has on plete set of all plats filed, but no copi maps and plats have been filed in This deficiency has been eliminated rect copy of these plats have been m of the City Engineer's records. All been brought to a standard size and pleted will be bound into book form and indexed.

Obviously the tax payers of the cit reference is made have been the on fer the greatest financial loss resul the necessity of eliminating the mentioned. While the annoyance these conditions may have been gre vidual citizens in some instances, financial loss to the individual citi ably has not been great in any case unnecessary in all cases. However, vidual who has experienced the gr resulting from the faulty engineer's the former engineer himself, now faults have been disclosed. He pro discredited man in the estimation of ent mayor and city council and succ as have read the present report. izens will insist that the disclosure faulty records constitutes a seriou the professional record of the form neer. All the hard and faithful wo for the city is probably now forgotte pletely overshadowed by his failure proper records of his work.

It is not unlikely that in past funds of the city engineer's departm normally insufficient to pay for the necessary to compile complete and records. That is not an unusual con our smaller cities. Probably the for neer, or engineers, found it difficult the design and construction of th works with the funds and help prov so felt justified in keeping rather i records. Whatever the extenuating stances may have been at the time was done, the citizen of today think the lack of proper records of the ment. It is always so, and for that r city engineer should seriously con advisability of compiling records done under his direction on his own ti out compensation, if the city is unab willing to provide funds for that pu ways providing, of course, that the is too timid to resign from the off proper funds for this work are de Any other course on his part is c cause him much embarrassment late he will surely suffer some loss of rep

GENERAL ARTICLES

Inspection of Waterproofing for Concrete Work.

Contributed by Jerome Cochran, C. E., formerly Designing Engineer, Trussed Concrete Steel Co., Detroit, Mich.

(Concluded from page 373.)

The series of articles on the inspection of concrete work, of which this is the seventh, has been planned in opposition to the general assumption on the part of writers that standards or methods of construction have been long ago established and have become knowledge. The first article on "Directions and Suggestions for the Inspection of Concrete Materials" appeared in this journal for Jan. 31, 1912; the second article, on "Proportioning and Mixing Concrete," appeared on Feb. 7, 1912; the third article, on "Inspection of Forms and Centering," appeared on Feb. 21, 1912; the fourth article, on "Inspection of Steel Reinforcement," appeared on Feb. 28, 1912; the fifth article, on "Inspection of Concreting," appeared on March 6 and 13, 1912, and the sixth article, on "Inspection of Surface Finishes for Concrete Work," appeared on March 20, 1912. The following article relates to the inspection of waterproofing for concrete work.

It is foreign to the purpose of this article to consider the designing of waterproofing systems, which presupposes that the designer is thoroughly familiar with the physical and chemical nature of the materials he proposes to employ, and their effect upon the concrete structure, etc., but simply to give such general and specific instructions as are necessary to insure proper and adequate inspection of waterproofing after the plans and tions are completed and the contract

Special Treatment of Surface— Surface.

Various methods of treating the su concrete have been employed to incr water-tightness. Long continued t will produce a dense condition suc found in a sidewalk, which is practic pervious to water. This method of t has already been discussed. Under of coating surfaces will be discussed a proof coatings applied to the surface concrete after it has set. Such coatin from a wash to a plaster. All surface treatment with waterproof have the disadvantage that they prevent hardening of the concrete as soon as installed, because no more moistur [illegible] interi r and it is [illegible] to further hardening.

PREPARATION OF SURFACE.

[illegible] plication of the waterproof coat- be prepared by chipping off their so that an entirely new surface The concrete surface should be chipped not more than two days e application of the waterproof efore applying the coating, it is hat the surface be clean and in dry, and a competent inspector see the conditions.

[illegible]

[illegible] surfaces [illegible] lication of common muriatic acid [illegible] strength of the solution depending ge of the wall; or the use of the erial may be deferred until the been completed. Allow the acid til it has exhausted itself, which at least ten minutes. A second f acid solution should be applied ving the first. A third coat [illegible] removed the skin of hardened

f *Unspent Acid.*—In case acid or ders have been employed, all un- hould be removed by rigid appli- hose, immediately after the acid is reached a satisfactory stage.

[illegible] d loosened material must be com- ved from the chipped surfaces, rubbing with stiff wire brushes, under good pressure, steam jet, able means. An absolutely clean ld be obtained, not further ahead g work than twenty-four hours.

ids.—All holes should be filled les with the waterproof concrete, les with waterproof mortar. A l must at all points be secured lerlying concrete.

[illegible]

plication of alternate coatings of alum solutions is probably the most thod of rendering set concrete This is the well-known Sylvester of making concrete impervious to d is applicable not only to concrete k and stone masonry surfaces. The p penetrate the pores of the ma- ng insoluble compounds which lation. This process has been nployed and is mainly adapted to he surfaces of tanks, conduits, and ter-carrying structures, to render

tions.—The proportions generally three-quarters (¾) of a pound of ne (1) gallon of water, and two (2) f alumn to one (1) gallon of water, stances to be perfectly dissolved in fore using. The proportions of the used in practice vary. Prof. I. O. his book on "Masonry Construc- 09 Edition, states that the soap solu- ade by dissolving 2.2 pounds of hard gallon of water, and the alum solu- issolving 1 pound of alum per gallon . The proportions first stated may l if better results are thereby secured.

[illegible] n must each be perfectly dissolved be-

ation of Coatings.—The concrete sur- uld be clean and dry before applying the washes, and the temperature of should not be less than 50° Fahr. at of application of the washes.

solutions should be applied with a soft sh, the soap solution boiling hot, and n solution at 60° to 70° Fahr. The ution is applied first, and should re- twenty-four hours, or until it is dry d, before applying the alum solution. coat should remain twenty-four hours he third coat (soap solution) is put other words, one wash should be put allowed to dry—usually for 24 hours—when the other is applied. This constitutes one treatment, and as many treatments may be given as necessary.

The solutions should be well rubbed in, but [illegible] plying the soap wash.

[illegible]

[illegible] or more washes of each solution should be applied, depending upon exposure, pressure, strength of solutions, and other local conditions. Two washes of each solution are said to be impervious to a head of 45 ft. of water, when mixed in the proportions first stated above. In some cases as many as six treatments have been employed. Prof. Baker states in his book on "Masonry Construction" that eight washes of each solution in the second proportions stated above have made leaky concrete impervious under a head of 100 feet.

[illegible]

Instead of using alum and soap as above, it is generally cheaper and more effective to substitute aluminium sulphate for the alum.

[illegible] of 5 lbs. of alum dissolved in 2 gallons of water, to which 1 lb. of concentrated lye has been added, has been successfully used on green concrete surfaces.

[illegible]

A wash composed of alum, lye and Portland cement has been used for making a water-tight lining for tanks and cisterns. This wash will prevent fungus growth or discoloration of surfaces covered with it.

Proportions.—A stock solution is prepared of 1 lb. of concentrated lye and 5 lbs. of alum dissolved in 2 gallons of water. One pint of this solution is stirred in a 12-gallon pail containing 10 lbs. of cement, with enough water added to well fill the bucket. Where a 1:2 facing mixture is used on the concrete, a 1 part stock to about 30 parts water will give good results.

[illegible]

Care must be taken to have every particle of alum and lye dissolved in the water used for the stock solution. Heating to near the boiling point will quickly insure this without injury to the mixture. After the addition of 10 lbs. of cement to 1 pint of the stock solution, enough water must be added to insure the mixture spreading easily and working well on the surface to be treated with a calcimine or white-wash brush, filling all the pores. The mixture will be found to be satisfactory when it lathers freely under the brush. The solution must be kept well stirred after the cement is added.

Application of Wash.—Much depends upon the condition of the surfaces to be coated with an alum, lye and cement wash. If the surfaces are too dry, they must be well sprinkled with a hose just ahead of the waterproofing wash. The wash should be applied while the concrete is still green, or within three or four days after placing. The wash should be applied on a cloudy day, or while the concrete is protected from the sun and while it is still moist; otherwise, too rapid evaporation of the water in the wash will leave the cement without the necessary moisture to set and leave it so that it can be brushed off. The wash should be applied as thin as practicable without running, rubbing it well into the surface with the brush. If the wash is applied too thick, it is liable to peel off. In a few hours the wash will withstand a water spray.

This method is not satisfactory for application on old work. It may, however, be applied. In such cases, if the surface is dry, it must be thoroughly wetted with a spray or brush before applying the mixture.

[illegible]

Grout Wash.—Portland cement grout is preferable to plaster for coating concrete wall surfaces. A thin mixture of neat cement spread on with a white-wash brush is quite effective, if thoroughly rubbed in. The surfaces should be well wetted with water before applying the wash. The grout should serve only to fill the small pits and pores in the concrete surface. Care must be taken to see that the workmen do not get a coat of the grout on similar to a skim coat of plaster, as that is liable to peel in cold weather. Two coats of grout wash will generally make ordinary concrete impermeable under a 10-ft head of water. The grout wash is most effective if it is put upon the water side of the concrete, if the wall is to be made impervious in both directions, both sides should be washed.

Other Washes.—There are several other materials that may be used as a wash for rendering concrete water-tight, but none of them is as cheap or as effective as the alum and soap or as the grout wash mentioned above. Among these are: alum alone, aluminium sulphate alone, wax, paraffine, resin, stearic acid, and oil emulsion.

Coating the surface with ordinary linseed oil paint until the paint ceases to be absorbed is sometimes used. There are two difficulties encountered in using an oil of this nature on concrete. First, linseed oil is an unstable compound, and does not have a very long life. Again, the oil coming in contact with the cement produces a soap which is soluble in water and is soon washed off.

Silicate of soda (liquid or soluble glass) is used to some extent for making building blocks waterproof. A solution is made with water, so strong that the water takes up all of the chemical that it will absorb. This solution is applied to the surface with a brush and well rubbed in. It answers the purpose very well, but is more expensive than the alum and soap or grout washes.

Waterproof Paints.—Numerous waterproof paints have been devised but very few of them are effective for long periods because the majority contain oils of some nature which are attacked by the alkali in the cent with the production of soluble soaps. These are washed away with every rainstorm and the surface soon becomes non-waterproof. Care must be taken in accepting these waterproofing paints without full knowledge of their nature and effects.

PARAFFINE PROCESS.

There are now on the market solutions of paraffine which are applied with brush and close the surface pores of concrete, thus preventing absorption of water and efflorescence. Pure paraffine wax installed with the application of heat is doubtless the most effective method of preventing ingress of moisture. The paraffine should be specially hardened to resist the sun's action.

Condition of Surface.—Surface to be treated should be smooth and free from all projections. Holes should be filled up. Surface to be clean and thoroughly dry, not only on surface but all the way in.

Application of Coating.—Paraffine should be applied to the surface hot with a brush, or if required by the engineer, the surface may first be treated with artificial heat and when sufficiently warm, melted, hot paraffine wax should be thoroughly rubbed in, filling all corners, recesses, etc.

Care must be taken to avoid an excessive use of paraffine which would give a glossy, oily appearance to the surface.

Experienced Workmen.—The hot paraffine should be applied by those specially equipped for and experienced in this kind of work. The workmen should at all times be under intelligent supervision.

[illegible]

Rich cement mortar mixtures offer considerable resistance to penetration by water and when well made may be used with a fair degree of success to waterproof ordinary concrete. A rich mortar plaster will reduce leakage, and may prevent it entirely, but it is questionable how far it will prove water-tight. A mortar plaster, however, may be made waterproof by the use of the alum and soap mixture or some of the proprietary compounds. To obtain a good result the greatest care must be exercised in mixing the waterproofed cement mortar plaster, a perfect bond of the plaster to the concrete and the fundamental principle of complete continuity must be rigidly enforced, as well as careful protection while the material is setting. All this requires assiduous, painstaking work. When [illegible] care, however, it repays [illegible] exercised.

Proportions of Plaster Coat.—The proportions of the plaster coat are usually 1 part Portland cement to 2 or 3 parts of sand.

Sylvester Mortar Coatings.—In this class of coatings the alum and soap are added to the mortar which is used as a plaster. To 1 part Portland cement and 2 parts sand add ¾ lb. of pulverized alum for each cubic foot of sand and mix these ingredients dry; then add the proper amount of water, in which has been dissolved ¾ lb. of hard soap to the gallon. The mortar must be mixed thoroughly.

Another recipe for such a mortar is given as follows: Powdered alum (1 per cent by weight) is thoroughly mixed with the dry cement and sand; and about 1 per cent of any potash soap (such as ordinary soft soap) is dissolved in the water used in mixing the mortar.

Thickness of Plaster Coat.—It is usual to apply a continuous coat, ⅝ in. thick, of waterproofed cement mortar plaster to vertical surfaces, and the same plaster 1 to 2 ins. thick on floors.

Preparation of Surface.—The difficulty with this method of waterproofing is to make the plaster stick. The surfaces must be thoroughly cleaned and roughened by steel brushes or equivalent before the coating is applied. Most failures with plastering occur because the surface is not absolutely clean. The plaster can usually be made to adhere if the concrete wall is thoroughly and repeatedly washed with water; but if the wall has a dense hard surface of nearly neat cement, it may be necessary to chip and wire broom the surface to remove the skin or glaze, or apply a solution of ordinary muriatic acid in water to dissolve out the cement and roughen the surface, followed by a thorough washing with water to remove the acid. A coat of ordinary whitewash, or a layer of laitance, or an almost invisible film of the oil or grease used in oiling forms, will keep the plastering from adhering unless they are carefully removed. No plaster should be placed on the walls thus treated until a competent inspector has passed on its condition.

When the surface has been properly prepared, the adhesion is so strong that the plaster can only with the greatest difficulty be separated from the wall.

Drenching Surfaces.—Just before the main mortar coating is to be applied, the properly prepared walls should be thoroughly drenched and soaked with water to its full absorbing capacity.

Slush Coating.—Before the wall shows marked signs of drying a "slush coating" should be applied. To prepare this, some of the mixed, ready-for-use coating may be thinned with water to the consistency of cream, or a coat of cement grout may be used. The slush coating should be applied with a palmetto, or an equally strong-fibred scrubbing brush, with a scouring effect, care to be exercised to fully cover, in this manner, the inner surfaces of all crevices and holes.

Sometimes the surface is cleaned and then covered with a coat of tar; and while the tar is still tacky, the plaster is put on. The tar should be mixed thick by boiling and should be applied very hot. It will then adhere to a very smooth surface. The tar could be used alone, if it were not for its color and if it did not become brittle by oxidation.

Scratch Coat.—Before the slush coating has dried, or while the tar is still tacky, the first application of the regularly mixed coating should be applied as a scratch coat, one-fourth to three-eighth inch thick, and pressure brought on the trowel to push the coating on, to form a uniform bearing. The scratch coat should be troweled with considerable pressure, and to a fairly good surface, and scratched before hardening.

Finishing Coat.—Upon the scratch coat, before its final setting, the finishing coat of sufficient thickness to obtain a total thickness of (say) five-eighths inch should be applied. The finishing coat should be pushed on hard and uniformly troweled and floated to a true surface, free from pits, pin holes, sagging cracks, projections, or other defects. The floating of the finished surface should be done from the bottom of the wall up. Special care must be exercised to apply this finish coat before the first coat has reached its final set. Several succeeding coats may be applied instead of one, until the desired thickness of mortar has been secured.

Applying Finishing Coat After Scratch Coat Has Set.—Should there be cause at any time to prevent applying the finishing coat before the scratch coat has already set, then the latter should be thoroughly rinsed and slush-coated before finishing coat is applied.

Removing Coating Which Has Become Set.—Any portion of the coating which should become set before it has been properly floated and finished should be entirely removed by chipping, and replaced with freshly mixed coating.

Joining One Day's Work to Another.—The joining of one day's work to a previously applied and hard set coating should be straight edges, cut at the time when the older work is being finished. To make the joining the edge should first be scraped with the edge of a trowel or scraper; slush-coating should then be scrubbed into this edge, and fresh, regularly mixed coating should be hard rubbed, back and forth, under the nose of a pointer trowel, into the preceding slush coat. This point should again be well packed when the floating and the finish troweling takes place. In all cases a continuous seal must be obtained.

Protection of Finishing Coat.—The finishing coat should be kept moist by spraying or otherwise, and protected from frost and sun while it is in the process of setting. If the wall is under water, the pressure should be relieved by drainage or by pumping until the plaster has set. In other words, an adequate drainage system including an emergency sump should be provided.

Test for Soundness.—When the work has thoroughly hardened (three to five days being allowed therefor), sounding with a light hammer over the fall should be resorted to by the inspector, to discover any loose or hollow portions. Any hollow or shelly places thus revealed should be entirely cut out with sharp steel points and replaced in the same manner as above described. The bond of the coating to floor or wall should at every point of contact be firm and sound.

ASPHALT COATING: BITUMINOUS PROCESS.

Asphalt is extensively used as a waterproofing material. It may be used alone or in combination with felt or other fabric, being applied to the surface or between two sections or layers of the concrete structure. The method of applying the asphalt directly to the concrete surface will now be considered. No special expert knowledge is needed for its application. Some judgment, however, must be used in selecting the asphalt to be used for waterproofing purposes.

Composition of Asphalt.—Asphalt should be of the best grade, free from coal tar or coal-tar products. It must not volatilize more than ½ of 1 per cent under a temperature of 300° Fahr. for 10 hours. It should not be affected by 20 per cent solution of ammonia; 35 per cent solution of hydrochloric acid; 25 per cent solution of sulphuric acid, nor by a saturated solution of sodium chloride. Asphalt should show no hydrolithic decomposition when subjected for a period of ten hours, to hourly immersion in water with alternate drying by warm air currents.

Range of Temperature.—Where asphalt coatings are used on surfaces exposed to the sun and frost attention must be given to the fact that a compound of different properties is required where the range of temperature is great than where this range is smaller. For example, asphalt should have a flow point of 212° Fahr. and a brittle point of 0° Fahr. when exposed directly to sun and frost as compared with (say) a flow point of 185° Fahr. and a brittle point of 0° Fahr. when covered from the direct action of sun and frost.

Condition of Surface.—All surfaces to be waterproofed must be in a condition fit to receive the same, namely, clean and dry.

Preparing Metal Surface.—Before applying asphalt to a metal surface, the metal [illegible] be cleaned of all rust, loose scale and [illegible] and if previously coated with oil must be burned off with benzine, or other suitable means. The metal surface must be warm [illegible] enable the asphalt to adhere to it and the warming is best accomplished by covering it with heated sand, which should be swept back as the hot asphalt is applied.

Preparing Concrete Surface.—The concrete surface must be properly prepared to receive the asphalt coating or else it will peel off. The asphalt must be applied when the surface of the concrete adjacent to it is dry, not superficially dry, but when the concrete is thoroughly set and the wall is dry for several inches in from the surface. Even then it is very difficult to make hot asphalt adhere to a concrete surface, however dry the surface may be, unless it is heated by artificial means. Hot asphalt laid on ordinary dry concrete will [illegible] adhere and can be rolled up like [illegible] after it is cool. By heating the surface of the concrete with hot sand before applying the asphalt, the latter may be caused to adhere to the same. If the concrete [illegible] cannot be made dry and warm, it should be first coated with asphalt reduced with [illegible] or with some other asphalt paint applied. It will generally be found preferable to [illegible] the asphalt cut with naphtha, applying it [illegible] painting or swabbing coat. This is particularly necessary for vertical surfaces.

It is difficult to make either cold or [illegible] asphalt adhere to the surface of concrete [illegible] mortar when the latter is covered with a film or skin of cement. To overcome [illegible] the surface should be covered with a finishing coat of mortar composed of one part Portland cement to one or two parts [illegible]. If this is not permissible the surface should be cleaned by chipping or with a sand [illegible].

No asphalt should be placed on the [illegible] thus treated until a competent inspector [illegible] passed on its condition.

Preparing Asphalt.—The asphalt should [illegible] heated in a suitable kettle to a temperature not exceeding 450° Fahr. Care must [illegible] not to prolong the heat to such an [illegible] to "pitch" the asphalt. Before the "[illegible]" point is reached the vapor from the [illegible] of a bluish tinge, which changes to a yellowish tinge after the danger point is [illegible]. If this occurs the material should be tempered by the addition of fresh asphalt. In case it should become necessary to hold the kettle for any length of time, a quantity of fresh asphalt should be put into the kettle and the fire banked or drawn. The asphalt [illegible] cooked sufficiently when a piece of [illegible] can be put in and withdrawn, the [illegible] clinging to it.

Application of Asphalt.—The first [illegible] should consist of a thin layer of hot asphalt thoroughly mopped over the prepared surface.

The second coat should consist of [illegible] ture of clean sand or limestone [illegible] and asphalt, in the proportions of [illegible] asphalt to three or four parts of dry [illegible] or screenings by volume. This coat should [illegible] thoroughly mixed in the kettle and [illegible] spread on the surface (or first coat) with warm smoothing irons, such as are [illegible] laying asphalt streets, and thoroughly tamped and pressed into place. The irons must not be hot enongh to burn the asphalt.

The finishing coat should consist [illegible] hot asphalt spread thinly and evenly [illegible] the entire surface, and sprinkled with washed roofing gravel, torpedo sand or stone screenings, to harden the top, especially when the coating is to be covered with earth or [illegible] stone, so that the asphalt coating will not [illegible] damaged.

The first coat should be allowed to set up before the second coat is applied. Coatings should be well rubbed in in corners and recesses and continuous throughout.

Thickness of Coating.—The entire coating should not be less than ½ in. thick [illegible] the thinnest place. The thickness of the coating depe d upon the character of the work ary from ½ in. to 2 ins.

Waterproofing Material—Membrane Method.

thod of making concrete waterists in surrounding the structure pervious shield or membrane which water away from the concrete. aking this is not a method of ren- crete impervious. The waterproof r shield consists of several, usually or more, thicknesses of waterproofing or elt cemented together with asphalt, tar.

GENERAL REQUIREMENTS.

Labor.—Every detail of the work areful attention and unless men this work are employed, materials sted and be of no benefit. In other waterproofing should be done only nced and expert laborers or water- A serious mistake is sometimes in ttempting to do the work with in- and inexperienced men.

Weather.—No waterproofing done when the temperature is be- ° ahr. Good work cannot be done in weather as the air chills the bitumen

f Paper or Felt.—The rolls of felt should be stored on end and on the side.

PREPARATION OF SURFACE.

paration of the surface to be water- that it will be perfectly smooth is

n of Surfaces.—All surfaces to be fed should be as smooth as possible be dry. All dirt and foreign mat- be removed before waterproofing Concrete must be allowed to et and all uneven surfaces leveled at of cement mortar. The sur- smoothed off with a trowel, if . No waterproofing should be placed faces thus treated until a competent s passed on its condition.

Heat for Drying Surfaces

situations where special diffi- untered in securing dryness on to be waterproofed, apparatus for ication of heat should be used if to expedite drying of the surfaces. od to be pursued should be in ac- with most approved usage as ap- the materials used. The concrete ve at least 48 hours to set before heat is applied.

System.—It is a difficult thing to material on a wall reeking with n adequate drainage system should ed and maintained at all times, until proofing is completed. It is abso- cessary to keep down the water If this is not done, the material is be pressed off the wall before the g masonry is placed. In the floor cessary, sumps with drainage chan- ld be provided, so that water may be by pumping in advance of the water-

nal Layer of Felt.—If for any rea- impracticable to have the concrete a layer of felt or treated fabric in to those called for in the specifica- uld first be laid against the surface, the upper surface of the felt or abric should be spread the first layer or asphaltum. This additional layer fabric should not be counted as one equired layers or plys. Asphalt cut htha as described above may be used f the additional layer of fabric.

Surfaces.—Metal surfaces should be clean, free from rust, loose scale, If previously coated with oil, same removed with benzine or other suit- ns.

COMPOSITION OF MATERIALS.

of waterproofing materials range dinary tar paper laid with coal tar asbestos or asphalted felt laid in

ar Pitch.—Soft coal-tar pitch should [illegible] Fahr., being a grade in which distillate oils, distilled therefrom, have a specific gravity of 1.105. If soft pitch is not obtainable, hard pitch may be used. Hard pitch may be made soft by adding dead oil in quantities not exceeding 1 of dead oil to 30 of hard pitch. Soft pitch, however, is more desirable.

Grade of Asphalt.—The asphalt used should be the best grade of Bermuda, Alcatraz, or lake asphalt, of equal quality.

Composition of Asphalt.—The following requirement for asphalt is that given in the specifications for the New York Subway [illegible] by Mr. Wm. Barclay Parsons, Chief Engineer.

"The asphalt shall be a natural asphalt or a mixture of natural asphalts, containing in its refined state not less than ninety-five (95) per cent of natural bitumen soluble in rectified carbon bisulphide or in chloroform. The remaining ingredients shall be such as not to exert an injurious effect on the work. Not less than two-thirds of the total bitumen shall be soluble in petroleum naphtha of seventy (70) degrees Baumé or in acetone. The asphalt shall not lose more than four (4) per cent of its weight when maintained for ten (10) hours at a temperature of three hundred (300) degrees Fahr.

Waterproofing Paper.—Tar paper is usually of short fiber, hard and brittle. The coal tar used as a saturant is sometimes refined to such a point in order to extract the various products which are more valuable for other purposes, that the coal tar left and used for saturation is practically nothing but a residuum of little value for any purpose. Tar paper should, therefore, be very carefully inspected before being used. To be efficient, a paper should not only be temporarily waterproof, but permanently waterproof. The stock from which the paper is made must be good. It should not be made from sweepings and refuse stock. No poor paper can permanently hold its waterproof qualities, for the waterproofing soon dries out, leaving a brittle and lifeless paper to crumble and rot away.

Use of Burlap.—Burlap or a similarly woven fabric is sometimes used with tar and asphalt to give them elasticity. Fundamentally the completely vegetable character of such material is objectionable for it is possessed of little durability when exposed to underground conditions. The fact that it is woven still further contributes to its unworthiness; for unlike a uniform fabric similar to felt or even paper its body consists of alternate material and interstices. If the asphalt or tar becomes cracked such material offers no additional protection.

Waterproofing Felts.—Felt used in waterproofing should be composed of asbestos or other equally non-perishable material. Wool is invaluable in a waterproofing felt, because of its superiority to other available materials as an absorbent of the saturating compounds used. Its percentage therefore determines the possible degree of saturation. The felt should contain an amount of wool equivalent to from a minimum of 20 to a maximum of about 30 per cent of the weight of the unsaturated fabric. A lesser amount would leave the felt inadequately waterproofed while a greater amount would so increase the relative amount of saturating compound as to decrease the strength. In other words, the proportion of wool should average about 25 per cent. The balance should be made up of such material as will best serve in combination with the wool and the saturant to form the most pliable, durable and waterproof fabric.

The felt should be properly treated with pitch, asphaltum or other suitable material. The saturating and coating compounds should be of a character capable of remaining plastic after long heating at a temperature of at least 250° Fahr. and the surface of the felt should not crack when bent double at ordinary temperature.

The saturating and coating compounds used in the felt must not only serve specifically as insulation against moisture, but it must remain unaffected by continued contact with water or dampness, even at high or low temperatures. The saturant must not deteriorate with age, and must be capable of resisting the chemical action of all ordinary agents which may be found in ground waters, escaping sewerage and the like, and permit the felt to remain permanently pliable. In its best form such a compound should be a combination of gums and mineral non-volatile oils insoluble in water. All injurious chemicals should be eliminated.

The felt should be capable of easy application. It should have a natural affinity for any mineral pitch, distillates of straight asphalt or straight coal tar, which may be employed for cementing the sheets of felt together, in the process of applying the work.

The weight of the wool felt before saturation should be from 5 to 7 lbs. to the square of 100 ft. When saturated and coated one side it should weigh roughly 12 to 14 lbs. per 100 sq. ft., while the weight of a similar area saturated and coated on both sides should range from about 14 to over 16 lbs.

LAYING WATERPROOF MATERIAL.

The waterproof sheet should be applied continuously over the whole surface to be treated. All surfaces to which waterproofing is to be applied should be made as smooth as possible; on these surfaces there should be spread either hot melted pitch or asphaltum (or other cementing material) in a thick layer of uniform thickness; on this layer of pitch or asphaltum should be laid the waterproofing fabric; this process should be repeated until such number of layers as may be required have been placed, and a final coat of pitch or asphaltum should then be applied.

Joints.—The layers of fabric should not be laid independently but shingled on consecutively. All joints should be broken properly at least 4 ins. on cross joints and 12 ins. on longitudinal, and at least 12 ins. lap left at corners to form good connections with adjoining sections. Special care must be taken that all joints are well broken and cemented together. A primary requirement with all waterproofing laid in layers of fabric is that the edges shall overlap so that as sheet after sheet is laid side by side these laps shall be uniform and the number of thicknesses be the same in all parts.

Spreading Pitch or Asphalt.—Each layer of pitch or asphaltum must completely and entirely cover the surface on which it is spread without cracks or blowholes or other imperfections. The compound should not be spread on for more than 9 sq. ft. of surface at a time, i. e., not more than 3 ft. in front of a roll of felt, which is 36 ins. wide. The mopping of the materials should be done quickly, uniformly, and thoroughly, while it is at the proper temperature.

Laying Fabric.—The pitch or asphaltum (or other cementing material), thoroughly heated, should be applied with a mop on the prepared surface, and the fabric immediately rolled over the surface. Where it is possible several rolls should be started at once and the cementing compound swabbed on the surface ahead so that there is the least possible loss of time in covering it with the fabric and pressing the same into position.

The first roll having been started and mopped, the second is placed so as to overlap the first by a width, depending upon the number of plies to be laid. For example, if the felt is 32 ins. wide and is laid 3-ply, the second roll should be lapped upon the first about 22 ins. or two-thirds of the width, or if it is to be laid 6-ply the lap of the second roll over the edge of the first should be about 26 ins., or five-sixths of the width. As soon as the second roll has been sufficiently unrolled (in the same general direction as the first), the third roll should be started so as to lap both of the others. This process with the corresponding mopping should be continued for the entire width of the surface which is to be covered. In no part of the work should fabric touch fabric, but be cemented with pitch or asphaltum. In fact, a primary requirement with all waterproofing laid in layers of fabric is that these sheets as they are successively laid shall be securely cemented to each other, that there shall be no air pockets causing separation of the sheets and no uncoated surfaces, the spaces between which might furnish channels for the passage of water.

The sheets should be applied vertically to the wall surfaces and these sheets should not be longer than can conveniently be handled

In connecting side wall with floor work, the layers of fabric on the sides should be carried down on the outside of the ends of the floor layer and a lap of at least 12 ins. should be allowed for same. Especial care must be taken with this detail.

In connecting side wall and roof work, the layers of fabric of the roof should be carried on the outside of the side wall layers and should lap at least 12 ins. Especial care must also be taken with this detail.

All corners should be reinforced with two extra pieces of felt snugly fitted into it, one between the second and third layer and one on top.

Carrying Waterproofing Against Sheet Piling.—In case tongue and grooved sheet piling is used for making and protecting the excavation and this piling has been treated with an efficient wood preservative, the waterproofing may be carried up against the sheet piling. The sheet piling should be given a thorough coat of hot pitch or asphaltum and all joints thoroughly filled before the first layer of fabric is placed thereon. Coppered carbolineum or other wood preservative may be used for protecting the sheet piling.

Connecting New to Old Work.—One of the difficulties in securing continuity with layers of fabric is encountered in the joining of new work to old. The laps become covered with dirt, cement mortar, water, etc. Before new work is added to old, the joints should be thoroughly cleaned of all foreign matter, such as cement mortar, or other substance which finds its way thereon, and coated with the cementing material. It is here that a competent inspector is needed, as workmen are often tempted to neglect this precaution. The new fabric should be made to stick smoothly and evenly over the entire joint area.

Number of Ply.—The "ply" in waterproofing—that is, the number of layers which cover all parts of the surface, varies from 2-ply to 10-ply. Four or five layers are usually sufficient for ordinary cases, although from 6 to 10 layers may be necessary for reservoirs and similar structures. The number of layers of fabric required depends upon the water pressure and the quality of the fabric. As many sheets or layers of fabric should be cemented or veneered together as the conditions require.

PROTECTION OF WATERPROOFING.

The application of the fabric and the pitch or asphaltum compound does not by any means complete the work. It is very important to carefully protect the waterproofing until it is completed and until the permanent protection is placed upon it.

After the waterproofing has been put into place, it should be properly protected against injury from any cause whatsoever, i. e.: Backfilling with earth; depositing concrete against same; laying brickwork or rubble against same; bulging of waterproofing from wall; cracking of same due to bulging; running of material due to heat; injury due to frost; injury due to gas from street mains; throwing tools, bricks, or other debris thereon; passing of men or wheelbarrows thereover.

Safety Coat of Mortar.—The layers of waterproofing fabric should be protected from injury by a layer of cement mortar (generally 1 in. thick) mixed in the proportion of 1 part Portland cement to 2 parts sand. This safety coat of mortar should be placed as soon as possible after the laying of the waterproofing, not exceeding 12 to 14 hours, or sooner if the engineer should so direct. Special care must be taken in laying the mortar not to break, tear, or in any way injure the layers of waterproofing fabric.

Failure Due to In[illegible] Coat.—Should the waterproofing be injured, owing to failure of placing the protective coat of cement mortar, which injury is caused by exposure to weather, bulging from masonry surface or puncturing from any cause, the contractor should be required to remedy the same at his own expense.

Placing Masonry Against Waterproofing.—The placing of concrete, brick or stone masonry against the waterproofing must receive careful attention on the part of the inspector, especially when the safety coat is omitted. The greatest care must be exercised that the waterproofing sheet is not punctured by sharp corners of brick or stone. In other words, care must be taken not to break, tear or injure in any way the outer surface of the pitch or asphaltum. Innumerable good jobs have been injured and even ruined by being punctured during this operation, especially when the backing is concrete. Sharp projecting stones coming in contact with the outer surface of the pitch or asphaltum will break a hole through the latter, which will admit water, making the source of such a leak extremely difficult to discover. It is always advisable where masonry comes in immediate contact with the waterproofing, to protect the latter with a safety-coat of cement mortar as mentioned above.

When brick work is placed against waterproofing on vertical walls, a slight space should be left for slushing in with mortar to avoid puncturing the outer surface of the pitch or asphaltum. The bricks should not be rammed up against the waterproofing sheet. It is advisable to use the safety coat as just mentioned.

Backfilling with Earth.—Protection of the waterproofing should not stop with placing the backfilling on same. Tamping against it should be forbidden, especially when the safety coat is omitted.

Water Pressure.—The work should be free from water pressure during the laying of the waterproofing, being relieved by draining, and pumping if necessary. An adequate drainage system, including an emergency sump, should always be provided for in the design.

Protection from Gas.—Care should be taken to prevent gas from coming in contact with the waterproofing. Asphaltic compounds have been seriously injured by gas escaping from the mains in the street.

Openings or Incisions in Waterproofing.—When openings or incisions in the waterproofing sheet are necessary, the inspector should see that such places are repaired in the most thorough manner.

Passages for Pipes, Etc.—Where a pipe has to run out through the waterproofing fabric, as in the case with sewers, water pipes, etc., the fabric should be wound around the pipe with great care. The pipe must first be thoroughly cleaned off so that the pitch or asphaltum will stick to it, and then after the fabric has been wound around the pipe, one or two flat iron bands about ⅛ in. thick should be bolted very tightly around the seal. All inwardly projecting fabric should be cut off and the seal scraped clean so that concrete will adhere to it. If there is any pitch or asphaltum between the concrete and the pipe, the seal will probably flow and perhaps leak. All pipe passages should be neatly pocketed and connections thoroughly made. Such places should not be covered up until the work has been examined by the inspector and found properly executed.

Repairing Waterproofing.—Any masonry that is found to leak at any time prior to the completion of the work should be cut out and the leak stopped by applying layers of fabric and cementing compound as described above. Each piece of fabric should be a little larger than the previous one. A layer is of no value unless it is larger than the one under it. Do not attempt to patch the seal while it is dirty, cold or damp; it can not be done properly.

The United States produced in 1911 $20,000,000,000 worth of manufactures, of which $1,000,000,000 worth were exported.

Methods of Patching and pairing Concrete.

The following summary of
patching and repairing concrete
clusions reached from a special in
by the Committee on Masonry of
ican Railway Engineering Associat
100 answers were received to the
The various methods may be d
follows:

(1) *Wet Method.*—The surface
concrete is thoroughly roughene
and drenched with water and co
a cement grout. Then the new
mixed to a sloppy consistency a
being held in place till set by for
quired.

From the reports received it a
many successes and many failures
lowed this method. Where it has
cessful, that result probably has b
painstaking care and expense being
in the preliminary cleaning an
wetting of the old concrete surfa
the new concrete is applied.

(2) *Moderately Dry Method*
face of the old concrete is thoroug
ened, cleaned and drenched with
powdered with cement or painted
ment grout—after which the new
applied and thoroughly tamped a
old surface. Generally, such patche
moist by sprinkling them with
several days.

The same comment applies here
wet method.

(3) *Dowel Method.*—This is a
of the two preceding methods and
ly used for other than horizontal
although it may be applied to the la
new concrete may have any consi
meet the particular conditions or
of the engineer in charge, but usual
wet concrete is used. This metho
drilling holes and setting dowels in t
concrete with projecting ends to en
the new concrete. Sometimes stee
metal fabric are connected to the
to further insure permanency of the

This method can be made unifo
cessful, but cannot always be applie
any considerable mass of new conc
be connected to old concrete this is
safe method to pursue.

(4) *Wedge Method.*—This me
cludes the cutting out of defective c
such a manner as to undercut the su
good concrete so that the new con
be held in place, when set, by the
the binding edges of the old concre

The difficulty of undercutting co
as to secure such edges is too great
this method applicable in ordinary c
except where a considerable depth
concrete is to be put in, such u
could not be successfully done, as
cannot be cut so as to leave sh
edges.

(5) *Cleaning With Steam.*—T
method of cleaning surfaces of old
preparatory to putting on a patch o
of cleaning the top of a rough conc
before applying the "finish coat."
face of the old concrete is brushed
as possible with stiff brushes and
over at least twice with a steam je
dinary piece of ½-in. gas pipe mak
satisfactory jet nozzle. This short
pipe is connected to a steam hose
can be readily moved about. The
supplied by the boilers of the mixer
ing engines. The steam will clean
the concrete surface, leaving it perf
so it is important to thoroughly dr
surface with water after cleaning w
In cold weather it is found advant
use hot water. Immediately after th
is thoroughly cleaned and drenched,
concrete is applied.

Excellent results have followed th
this method of cleaning, but it is
that the surface of the old concrete

ched with water after using the otherwise the new concrete will to the old.

ning With Acid.—This method [illegible] shing of the surface of the old con- a solution of hydrochloric (mu- of one part acid to two parts er which the surface must be care- thoroughly washed to remove all [illegible]

very commonly applied method of l concrete surfaces preparatory to v concrete against them, and, by nsidered the only safe one to use, where a "finish coat" is to be put e concrete base is set.

The following [illegible] ods of repairing defective or worn f concrete are presented:

ll cases the surface to be repaired e thoroughly cleaned of all loose ttance and dust and the clean, d concrete exposed to receive the bably the best method of cleaning s of a steam jet.

r cleaning, the surface to be re- st be thoroughly saturated with simply moistened, but so thorough- that the old concrete will not ab- from the new mortar or concrete tching. If possible, the surface should be kept covered with water for several hours.

(3) If the repair or patch is to be made on a vertical or sloping surface and is not to be more than 1½ ins. thick, the surface of the old concrete, while it is still wet, should be spattered or splashed with a cement grout, following this immediately with a fairly stiff plaster coat of mortar made of the same proportions of cement and sand as was used in the original concrete, but never richer than 1 cement to 2½ sand. This plaster coat should not be thicker than ½ in., and each coat should be forced into the surface, but not dragged with a trowel. The surface of each coat, except the final coat, should be "scratched" to give a bond for the next coat. This plastering should preferably begin at the top and progress downward, and only enough time be allowed to permit each coat to receive its initial set before the next coat is applied. The final coat should be finished with a wooden float and only enough water used to properly finish the surface. This patch should be kept damp and protected from sun or frost till fully set up.

(4) If the repair or patch or "finish coat" is to be made on a horizontal or nearly horizontal surface, the surface of the old concrete should be slushed and broomed with a thin cement group, following this immediately with a *wet* mortar made of 1 part cement and 2½ parts sand or granite screenings and of the full thickness required (not less than ½ in. thick, however). When this mortar begins to take its initial set, it should be floated or troweled to such a finish as may be desired.

(5) If the repair or patch is to be made on a vertical or sloping face and is to be more than 1½ ins. thick, it will be advisable to embed dowels into the old concrete, as deeply as the thickness of the proposed patch, and spaced sufficiently close together to firmly anchor the patch to the old concrete. The dowels must be wedged into the old concrete and it will be advisable to fasten wires, metal fabric or bars to the dowels, in the case of extensive patching, as an additional safeguard. The patching may then be done with mortar without forms, or with wet concrete supported by forms, depending upon the thickness and the extent of the patch.

(6) If the repair or patch is to be made on a horizontal or nearly horizontal face and of considerable thickness, dowels may be used, or the concrete may simply be reinforced by fabric or bars without using dowels—treating the patch as a block of masonry.

(7) Care must be taken not to have thin edges on patches. To avoid this, it may be necessary to cut out sound concrete around a place to be patched, so as to give deep edges to the patch. If possible, the edges should be undercut.

ARTH AND ROCK SECTION

of Sealing a Cofferdam with Crushed Rock and Grout.

[illegible]

Salle street traction tunnel now ap- mpletion in Chicago consists of cal tubes under the river section approach bores at each end form- and sections. The sinking of in the river section and the of the land sections have [illegible] in various articles in En- ONTRACTING. In making the con- tween the land and river sections, ms were built inclosing the connec- t each end of the river tubes a timber ilt on top of them, reaching 3 ft. vater surface. This formed a part rdam and the remaining part con- riestedt steel piling driven at each [illegible] tubes to form a pocket the land section and joining er crib on top of the tubes. The were about 17½ ft. square and the ling was 50 to 65 ft. in length, the [illegible] deep. As om of the tubes was rounded the sheet id not entirely close up to the tubes, the tubes were set in a trench exca- a dredge. To fill this cofferdam with uld involve danger of losing a large it through this hole as the weight as added. It was therefore decided to bottom with concrete. At first the e was deposited through the 50 ft. of by a tremie, but the report of the that the concrete was disintegrated this method to be abandoned.

substitute the bottom was covered with rock and grouted by the use of the naels compressed air mixer, which pre- had been used to mix and blow con- rough pipes into the arch forms of the tubes. Gas pipes 1½ ins. in diameter ent to the radius of the tunnel tubes, placed that they would discharge at distances underneath the tubes. Four e pipes were placed in each pocket and fastened in position by submarine div- addition to the bent pipes, each pocket ed twelve to fifteen 2-in. diameter equipped with well points, stripped of ting, at bottom ends, and placed so as bout 2 ft. above the bottom of the ex- n. The top end of all pipes was thread- attachment to the grouting machine. [illegible] over the bottom of the pocket and grout under a pressure varying from 35 to 100 lbs. per square inch was then forced through the pipes to fill the voids in the layer of stone.

In general the grout consisted of a mixture of about five bags of cement to one barrow of torpedo sand. All lumps, gravel, etc., which would clog the well points was removed from the cement and sand before mixing. The grout was thoroughly mixed before being put into the mixer. After placing the bottom course a second set of pipes and another layer of broken stone were placed and grouted as before. This process was continued until the desired height of concrete was obtained. This method made use of quite a large number of pipes, as it was impossible to remove them after the grouting was complete. The method used in the south cofferdam was similar to that used in the north, except that in the main section of the pockets only one set of pipes was used. After these had been put in position, the whole volume of broken stone was deposited. Grout was then forced through the pipes, and as the grouting continued, the pipes were worked up and down through the mass of stone until the voids were filled. This method appeared to be as successful as that used in the north dam, although about three hundred bags less of cement were used. During the operation of grouting, whenever the grout was flowing freely into the voids, the pressure was from 40 to 50 lbs. per square inch, but when the voids were practically filled, this pressure became 90 to 100 lbs. The operation at all times continued until no more grout could be forced into the pipes. After the concrete had sufficiently set, the remaining volume of the pockets was filled with clay; the north dam proved in all respects securely water tight, leaks were slight, and the water apparently flowed along the line of separation between the clay and the concrete. In the south dam one bad leak developed, the water apparently coming from the river underneath the concrete.

Methods and Progress Records of Driving the Laramie-Poudre Tunnel.

The Laramie-Poudre tunnel is a part of the system for supplying water to the Greeley-Poudre irrigation district, which comprises 125,000 acres of arid land in Weld county, Colorado. This article, which describes the tunnel construction, is abstracted from a paper by Burgis G. Coy, printed in the Proceedings of the American Society of Civil Engineers, volume 38, page 217.

The Greeley-Poudre system is naturally divided into two parts, the mountain or collection system and the plains or distributing system. The principal features of the mountain division are the east and west side collection ditches, 8 and 4½ miles long, respectively, on either side of the Laramie River. These intercept the flow of the numerous tributaries and divert it back to a reservoir known as tunnel reservoir, which lies in the bed of the river and from which the water is diverted by the Laramie-Poudre tunnel through Green Ridge into the Cache La Poudre River. Each of these collection ditches has a capacity of 275 cu. ft. per second where it discharges into the reservoir, and the capacity from there to the head is decreased in proportion to the water collected.

The cross section of the tunnel is 7½ ft. high and 9½ ft. wide; its slope is 1.7 per cent and its capacity is 800 cu. ft. per second. As it was anticipated that the corners would not break out square without extra drilling work, the dimensions were made large enough to give a minimum section of 62 sq. ft. and still leave quite an area in the corners, the cross section thus approaching nearer an ellipse than a rectangle of the given dimensions. As actually constructed, however, the section is nearly rectangular, thus giving a section considerably larger than the minimum required, with a corresponding increase in capacity.

The distributing system includes the main canal, diverting the water from the Cache La Poudre River, and the distributing laterals and several reservoirs. The aggregate length of canal and laterals is 300 miles and the storage capacity of all the reservoirs of the system aggregates 100,000 acre feet.

In September, 1909, the final location of the tunnel was begun by a party of five men. A base line, approximately 2,600 ft. long, was laid out in a level place in the Laramie River Valley, and a triangulation system was established from which the length and bearing of the tunnel were determined. Levels were run over the hill and bench marks were placed at each 100 ft. in elevation; these were subsequently checked by another man. The top of the hill is practically 1,000 ft. above the Laramie River and 1,500 ft. above the Poudre

River. A dense growth of jack pine and quaking asp covers the top of the hill, and a great deal of cutting was necessary in establishing the triangulation system and the tunnel line. The final line as first located required set-ups of the transit to get over the hill (Fig. 1), but later this was reduced to six when the permanent points were set.

The contract for the construction of the tunnel was let to Mr. J. M. McIlwee of Cripple Creek, who had made a record on the Cripple Creek drainage tunnel. The company agreed to put up and furnish the camps at each end, build a power plant, and furnish rails, pipes, cars, etc., and the contractor was to furnish his own drills, steel tools, etc. Mr. McIlwee moved to the site of the east portal on Nov. 25, 1909, established a temporary camp in tents, and erected a small steam compressor and boiler to use until the company could erect the permanent camps and power plant. Although the weather was extremely cold and the ground covered with snow most of the time, at the end of 30 days he was ready to work, and on Christmas day the first blow in the actual driving of the tunnel was struck at the east portal. A similar temporary camp and power plant were erected at the west portal, but being less accessible, especially at that season of the year, work was not started until nearly a month later. At the east portal 800 ft. of tunnel were driven with this temporary plant, but at the west portal not much tunnel proper was driven before the permanent plant was ready, most of the time having been spent in driving an incline to get down to the tunnel grade.

The contract for installing the power plant was awarded to the Hampson-Fielding Engineering Co. of Denver, Colo., which began operations about Dec. 1, 1909, and had the plant completed and ready for operation on March 15, 1910. All the buildings at both ends were erected by the company by force account.

All the supplies, machinery, and building material had to be freighted in from Fort Collins, Colo., to the east end, and from Laramie City, Wyo., to the west end. The distance from Fort Collins to the east portal is about 65 miles, and the distance is about the same from Laramie City to the west portal. The handling of all this material over mountain roads for such distances and in the dead of winter was no small accomplishment. Some of the road was newly built and was very rough. All traffic to the east portal had to go down Pingree Hill, where a descent of 1,260 ft. is made in 2.7 miles, with several pitches steeper than 20 per cent, and usually covered with ice and snow. Although as great a load as 11,000 lbs. was hauled on a wagon, there was no serious accident and but small loss of material. The price paid for freighting was $1.40 per 100 lbs. for the heavy machinery and $1.12½ for lighter stuff.

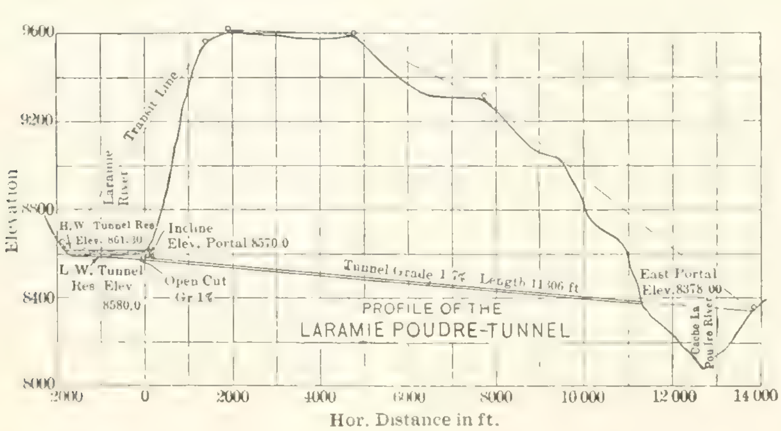


Fig. 1—Longitudinal Section Showing Laramie-Poudre Tunnel Location.

Plant.—The Poudre River, near the east portal of the tunnel, has a very steep grade and affords an excellent site for a power plant. This was taken advantage of for power for the main plant to drive the tunnel. A 10-ft. rock-filled crib dam was built across the river about 1½ miles above the tunnel site and from this a 22-in. wooden stave pipe leads down the river for 8,500 ft. to the power plant, where three Pelton wheels are operated under a static head of 278 ft.

A 48-in., single-nozzle wheel, with a maximum capacity of 130 h. p., running at 245 r. p. m., was used to drive an air compressor for operating the drills at the east end, being belted to a 72 by 16½-in. face pulley from a 40x16½-in. face driving pulley. The nozzle on this wheel was controlled by the pressure in the air receiver. The compressor was of the Ingersoll-Rand Imperial type 10 cross compound, 17x10x14 ins., having a capacity of 600 cu. ft. of free air per minute at 135 r. p. m., maintaining a pressure of 135 lbs. per square inch at the receiver. It was also equipped with an automatic unloading device controlled by the pressure of the air. A 10x3-ft. receiver was placed just outside the power house, and a similar receiver was placed inside the tunnel. The air line for the first 4,000 ft. from the receiver was 4 ins. in diameter, then 3 ins. for 300 ft., and 2 ins. for the remainder of the distance; it was reduced at the manifold to the ¾-in. air pipes for the drills.

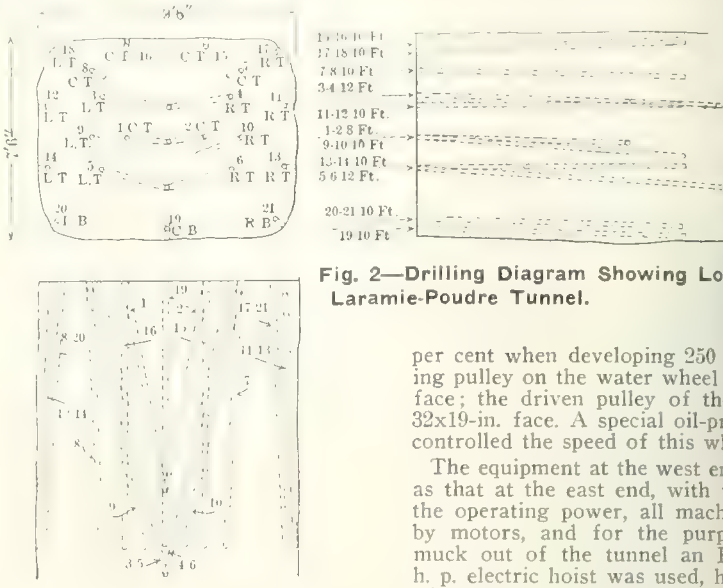


Fig. 2—Drilling Diagram Showing Locatior Ho Laramie-Poudre Tunnel.

A Connorsville blower, with a capacity of 13 cu. ft. per revolution, running at 225 r. p. m., was used for ventilating the tunnel, and required from 20 to 30 minutes to suck the gas out after each round was shot. This blower was operated by a 48-in. single-nozzle wheel, mounted on the blower shaft, and guaranteed to develop not less than 25 h. p. A 15-in. ventilating pipe was laid from the blower into the tunnel and within 100 ft. of the breast, and was extended as the work progressed.

For lighting purposes in both camps and for power for the west end, a 150-kw., General Electric, 3-phase, 60-cycle, 2,300-vol generat running at 600 r. p. m., was used. This was belted to a 48-in. water wheel, running at 245 r. p. m., operated by a 12-in. doue There were four nozzle tips, two 125 h. p. each, one for 90 and one f so that any two could be used in combinat as desired, giving an efficiency of per c when developing 210 h. p., normal l, and per cent when developing 250 h. p. The ing pulley on the water wheel was 8 face; the driven pulley of the gene 32x19-in. face. A special oil-pressur controlled the speed of this wheel.

The equipment at the west end was as that at the east end, with the ex the operating power, all machinery by motors, and for the purpose o muck out of the tunnel an F. M. h. p. electric hoist was used, having of 5,000 lbs. at a speed of 120 ft. The electricity for operating the pl west end was generated at the pla east end. The transmission line was weather-proofed copper wire 15,000 and reached an altitude of 9,600 ft. the mountains. At each end a 5-k former furnished current at 110 lighting the camp and at the west 150-kw. transformers furnished curr volts for operating the motors.

At both ends of the tunnel No. water drills were used up to July, 1 No. 8 drills were substituted. For th of supplying water for these drills, pipe was carried into the tunnel. At end the supply was obtained by gravit small creek which runs near the por water was run into a steel tank conne the compressed air line. When the full the inlet valve was closed and pressed air was turned into the tank the water through the pipe to the dril tanks were in use at each end, and one ing filled while the other was being With this system, freezing caused more trouble, but before the winter of 1910- the heading was advanced so far that could be moved into the tunnel, and th was taken from water running on t At the west end the same system was cept that water was pumped from the River into a wooden tank on the hillside above the portal, until the work was advanced so ta that steel tanks could be used inside the tunne

A No. 2 Leyner drill sharpener was sed the blacksmith shop at each end for sh and shanking the drill steel. At the the camp buildings included a com cook house and dining room, 28x80 f enough for 75 men; a two-story bunk 28x80 ft., containing 22 bed rooms, accommodating two men each, with a genera room, bath and wash rooms; a com and hospital, 22x38 ft., containing stor medicine room, doctor's bed room, ward and bath rooms; a two-stor building, 26x32 ft., containing five bed sitting room and office; a power hous ft., with a small room for the enginee store room for supplies; a blacksmit 24x24 ft.; a store house, 24x16 ft.; 12x14-ft. house tents for men who de have their families with them; and th powder houses, thaw houses, barns, a buildings. The buildings are all of lum are covered with ruberoid roofing, a kitchen, bunk house, and hospital are ing water and sewer connections. at the west portal is similar to that portal, except that the buildings are e same size, and are of logs with roofs. There is also a transformer addition to those already mentioned. grade of the tunnel is to the east, were much more favorable for k at the east end than at the west e it was necessary to haul all muck s well as to pump out the water en- The grade of the tunnel at the e hill at the west end is 15 ft. below the Laramie River and about 1,200 t from it. It was thought best to tunnel (Fig. 1) at the hill, where the was solid and water tight, and to part back toward the river after the ings had met. This part, being gla- sits of sand and gravel, contained ess water. The tunnel grade is about ow the surface at this point, and was an incline about 200 ft. long, start- the first rock formation showed at n of the hill. After the two headings nel was driven back from the foot of e toward the river as far as the for- as solid; the remainder was taken

was anticipated from the first that less water would be encountered at end, facilities for handling 700 gals. te were provided. A Byron Jackson, 5-in., centrifugal pump, direct con- 25-h. p., 3-phase, 440-volt induc- running at 900 r. p. m., was mount- k and kept on a side track at the to be taken down into the tunnel eded. A 5-in. spiral-riveted water as the tunnel advanced, to which uld be connected. It was never sary, however, to run this pump. good part of the time a small piston s in use. This was operated by com- from the main air line. A sump tation was blasted out at the side nnel, so that the pump would be out ay and safe from the flying muck, and p was set up and connected to the ne. When the sump filled up, the s operated until it was empty again. el progressed, new sumps were and the pump was moved nearer At the east end all the water y gravity.

—All the drilling was done with s mounted on a horizontal bar. s held in position by tightening it the walls of the tunnel with a jack- ith which one end was fitted. The bar le of a piece of 3-in. double-strength h a fixed shoe on one end and a screw her, and was easily handled and set machine men and their helpers. e holes were drilled with the ma- e the bar and some with them be- Two set-ups of the bar were required the entire round. The upper set-up lled from the top of the muck pile e muck was being cleared away; then was lowered and the lifters were put first two drills were used on the bar, r it was found that three could be much greater advantage. Rounds were from 10 ft. deep with 12-ft. cut holes, g a 10-ft. round, down to 7 ft. deep ft. holes, breaking a 7-ft. round.

e 2 is a diagram of the holes as drilled -ft. round by three drills on the bar, 21 holes to the round. The holes let- R. T. were drilled by the right-hand e on the top set-up. Those marked C. e drilled by the center machine on the -up, and those marked L. T. by the d machine; likewise those marked R. B., and L. B. were drilled by the re- machines on the bottom set-up. The were started 2⅛ ins. in diameter and ed at 1⅜ ins. It will be noted that each d but one hole to drill on the lower set- when one man was delayed in finishing er, the others blew out the holes already and loaded them ready to shoot.

ing.—The holes were fired in the order red in Fig. 2, each being fired independently of the others by fuses cut to such lengths as would explode them in the proper order. The pairs of holes, 1 and 2, 2 and 3, and 3 and 4, however, being joined or very close together, usually went at the same time, and gave better results when they did so.

The charge varied, both as to the strength and quantity of powder used, according to the depth of the holes and the quality of the rock, but a charge for a 10-ft. round in hard rock was about as follows: Seven sticks of 1¼x8-in., 100 per cent blasting gelatine were put in the bottom of each of the cut holes and tamped to within 2½ ft. of the collar of the hole with 60 per cent dynamite; the remaining holes were similarly loaded with 60 and 50 per cent dynamite. The wrapers were slit and the powder tamped until it filled the hole. German insoloid fuse was used and 5x California caps. Hole 21, being the last one fired, threw the muck away from that side of the tunnel, leaving room to operate the lever to tighten the screw in setting up the bar for the next round. Rounds were fixed as soon as ready and as soon as the smoke was cleared out, usually from 15 to 30 minutes, the drillers set up the bar for a new round and the muckers began loading the muck shot down.

Mucking.—The muck was loaded into cars by from four to six men using square-pointed shovels. Steel plate ⅜ in. thick were laid on the floor of the tunnel, extending back about 25 ft. from the breast, and were covered with enough muck to keep them in place while shooting. The muck fell on these plates and was easily shoveled from them. Steel cars of 18 cu. ft. capacity were used on a single track. A trip of empty cars was run up close to the muck pile and all but one were then tipped off the track to one side; the remaining car was loaded and pushed back past the empty cars, one of which was then put on the track and loaded in the same way. When all the cars in the trip were loaded they were pushed up as close to the muck pile as possible and an empty trip was run up close to them and tipped off the track; then the loaded trip was run out to the dump and a new trip was loaded as before.

At the east end the loaded cars ran out by gravity, and were hauled back by mules. At first one mule, handling a 5-car trip, was able to keep the muckers busy, but as the haul increased, two mules in tandem were used on 10-car trips. Two mules in this way were able to handle the muck until the tunnel was in about a mile, and there a siding, long enough to hold about 40 cars, was laid. At the siding the two mules left their empty trip and returned with a loaded one, another mule hauling the empty cars from the switch to the heading in 5-car trips and returning to the switch with a loaded trip. As the length beyond the siding increased, two mules and 10-car trips were substituted. The mules took the cars to the dump track, left them for the dump man to unload and arrange on another siding ready to go in, and returned with a trip already on this siding.

At the west end a mule hauled the empty cars and the hoisting cable to the breast and did the shifting there, but loaded cars were hauled out by the hoist, taking trips of twelve cars to the foot of the incline and three or four cars up the incline, where a man with another mule took them to the dump and returned the empty cars to the siding ready to go in again.

Dull steel was brought out on the loaded trip, left at the blacksmith shop as the trip went by, and sharp steel was taken in with the empty trip.

The track, with 18-in. gage and 16-lb. rails, was laid on the left side of the tunnel; the ventilating pipe, air and water lines were laid on the right side. As the ventilating pipe did not extend nearer the breast than 100 ft., this gave room to handle the cars.

Timbering.—The rock encountered was mostly a hard gray or red granite. Some soft seams were encountered, however, and where these ran in the direction of the tunnel, some timbering was necessary. In all, eighteen different stretches have been timbered, varying from 15 to 400 ft. in length and aggregating 985 ft. In most cases, however, the rock stood until the tunnel heading was far enough past to allow the timbering to be put in without interfering with the progress to any great extent. The timbering was of the ordinary square-set type, made from round logs and lagged with poles, all of which were cut from the hillsides near by. The pieces in the square sets varied from 9 to 18 ins. in diameter, and the spacing was from 3 to 8 ft., according to the quality of the rock supported. The timber used was fire-deadened red spruce, with an occasional stick of white spruce or lodge pole. It is the intention to line all these timbered places with concrete during the winter of 1911-12.

Progress.—The drillers, helpers, and muckers worked in the three 8-hour shifts of three drillers, two helpers, from four to six muckers, and one foreman. Drivers, blacksmiths, and power house men worked 12 hours. The wages paid were as follows: Drill runners, $4.50; helpers, $4; muckers, $3.50; blacksmiths, $4.50; drivers, $4.50, and foremen, $6. In addition to these wages a liberal bonus was given each month for fast work.

The total length of tunnel driven is 11,306 ft., and the progress for each month was as follows:

	East End Feet	West End Feet
[illegible]		
[illegible]		
February	315	...
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
October	413	28*
[illegible]	[illegible]	
[illegible]	[illegible]	
1911—		
[illegible]	[illegible]	
February	420	
March	653	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]

*Work was shut down at west end on October 4th.

†Headings met July 24th.

‡Work at west end under incline, but handled from east end.

§Work at west end under incline, completed August 8th.

This gives a monthly average of 308.7 ft. for 7 months at the west end and 473.7 ft. for 19 full months at the east end; 509.4 ft. per month for the 16 months during which the complete plant was operated and 525.2 ft. per month for the last year of work; 653 ft. in March, 1911, sets a new record in America for 1 month's work.

This remarkable record was due to the organization of the operating force, the friendly rivalry between the different shifts, and in no small measure to the efficiency of the power plant, which was operated for more than 16 months. The total time lost from all causes aggregated less than 24 hours.

On checking up after the connection was made the following errors were found: Alinement, 0.01 ft.; grade, 0.18 ft.; computed length between initial points 11,288.77 ft., measured length 11,288.20 ft., or an error of 0.57 ft. For the alinement three separate lines were run over the hill from the west to the east and the mean of these was run back through the tunnel for a center line of the east end work. Three different sets of levels were carried over the hill from the west to the east and the mean of these was assumed as the correct elevation from which to carry the elevation back through the tunnel. The measured distance through the tunnel is the mean of two measurements. The point at which the headings met was 8,937 ft. from the east portal and 2,351 ft. from the top of the incline at the west portal.

Mr. J. J. McIlwee, son of the contractor, was superintendent at the east end, and Mr. Walter Warner at the west end. Mr. D. W. Brunton, past president of the American Institute of Mining Engineers, was consulting engineer. Mr. Charles R. Hedke, M. Am. Soc. C. E., of Port Collins, was chief engineer until June, 1911, when he was superseded by Mr. L. L. Stimson of Greeley, Colo. The writer was resident engineer in charge of the tunnel, collection ditches, and reservoirs.

From the end of the solid formation on the west side an open cut extends to the river, a distance of 1,500 ft. The total quantity to be moved is about 35,000 cu. yds., the cuts ranging from 0 to 44 ft. This work is now under contract by Messrs. Ianson and Loesch of Fort Collins. The first 300 ft. next to the hill consists of gravel and boulders; many of the latter contain from 10 to 20 cu. yds. and require considerable blasting. This part of the work was sublet to a station gang of Swedes, who are doing the work by hand, using a track and cars drawn by a horse to handle the muck. The remainder of this cut is of gravel and clay and is being done by teams in the usual way.

The controlling works at the west end of the tunnel consist of a set of three steel gates, each with a 5 by 8-ft. opening. They are set in concrete in the usual way for river gates. It was originally planned to have a 50-ft. dam at the tunnel reservoir, giving a draw of 33 ft. through the tunnel, but for the present the dam will be only 26 ft. high, giving a draw of 9 ft., and the gates are put in the cut, near the high-water line.

At the east end of the tunnel the water will be discharged into a concrete box, 30 ft. square and 14 ft. deep. A concrete flume 30 ft. wide and 50 ft. long will draw the water from this box, leaving the lower 6 ft. of the box for a water cushion. After rating, the water will be released to run down the hillside to the Cache La Poudre River, about 1,200 ft. away and 300 ft. below the end of the tunnel.

Recent Examples of California Gold Dredges With Costs of Dredging.

A concise statement of practice in California in dredge construction for reclaiming gold from underwater gravels is taken from an elaborate paper by Mr. Charles Janin in the bulletin for March, 1912, of the American Institute of Mining Engineers. The paper also gives a table of costs which are of general interest in view of the increasing favor with which elevator dredges are being considered in America.

The modern California-type dredge, with close-connected buckets, spuds, and belt-conveyor for stacking tailings, was a gradual development through years of experimenting. This dredge embodies the ideas of successful operators, and it is generally conceded that dredge-construction and operating-methods in California are far ahead of those in any other country in the world. The dredges built in California cost from $25,000 to $265,000 each; a standard 8.5-cu. ft. boat costing from $150,000 to $175,000, according to conditions to be met in operation. With great improvements made in dredge-construction, and corresponding reduction in operating-costs, areas that were at first considered too low grade to be equipped with a dredge are being profitably worked.

California dredges vary in size from 3.5 to 15-cu. ft. buckets. In Alaska some dredges are equipped with buckets as small as 1.25 cu. ft. to dig shallow ground, and are reported to be working profitably. While electricity is the ideal power for operating dredges, steam has been successfully used on a number of installations, and experience has proved the merits of the gasoline and distillate-engine for this work. There seems little doubt but that the successful development of the gas-producer for the generating of electric power will prove an important factor in considering future dredging of gravel-areas in districts where electric power or water-power for the installation of hydro-electric plants is not at present available.

One of the largest gold-dredges operating in California, was put in commission at Hammonton, in Yuba River basin, Aug. 10, 1911. This dredge was built by the Yuba Construction Co., and is one of five practically similar dredges built by the same company this year. It required 820,000 ft. of lumber f th and housing the hull, its dimensio are 150x 58.5x12.5 ft., with an overhang of 5 ft. on each side, making 68.5 ft. total width of housing. The digging ladder is of plate-girder construction and designed dig 65 ft. below water-level, and is equipped with ninety 15-cu. ft. buckets arranged [illegible] connected line. The entire weig [illegible] digging-ladder and bucket-line [illegible] mately 700,000 lbs. The washing screen is of the revolving type, roller-driven and is 9 ft. in diameter by 50.5 ft. long and weighs 111,721 lbs. Two steel spuds are [illegible] weighing over 44 tons. The [illegible] winch has a double drum, and we [illegible] lbs. The swinging-winch consists [illegible] drums, and weighs 34,193 lbs. The stac hoist winch weighs 3,732 lbs. The gold- ing tables are of the double-bank type have an approximate riffle-area [illegible] ft. The tailings-sluices at the ste ca arranged to discharge the sand fro bles either close to the dredge or a distance behind. The conveyor stack 42 ins. wide and 275 ft. long, on sta ladder of the lattice-girder type, 14 ft. Nine motors are in use on the dredge, a total rated capacity of 1,072 h-p. The weight of hull and equipment is 4,68

Natoma No. 10 dredge, now [illegible] struction, is equipped with 15-cu. f bu and will have a steel hull, bei [illegible] dredge operating on a steel hull in Cal The hull will be 150x56x10.5 [illegible] have a total weight of 920,000 lbs. [illegible] be about one-half the weight of [illegible] hull to carry the same machinery and draft of the boat will be considerab [illegible] This boat will be in operation in A [illegible]

The machinery of some Californi [illegible] has been dismantled and moved [illegible] fields and installed on new dredg [illegible] estimated cost of dismantling the Sc [illegible] dredge which was equipped with [illegible] buckets, building a new hull, insta [illegible] chinery including a 28-mile haul, [illegible]

TABLE I—OPERATING COSTS OF CALIFORNIA GOLD DREDGES

Capacity of buckets	Time in commission	Working period for figures given	Actual working time: hours during working period[1]	Quantity handled	Average depth of gravel	—Operating Expenses, in Cts. per Cu. Yd.— Labor and material	Electric power	Water	Repairs	General	Taxes and insurance	Total expense	Remarks
Cu. ft.			Hrs.	Cu. yds.	Ft.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	
3	. . .	1 yr.	2,869	173,655	27.0	2.77	0.90	0.14	4.15	0.78	0.49	9.23	Difficult digging.[7]
3	5 yr. 9 mo.	1 yr.	7,216	478,882	26.9	2.03	0.69	.	3.28	0.63	0.37	7.00	Working under favorable conditio
3.5	7 yr.	1 yr.	.	395,316	55.0	2.83	1.53	0.228	1.74	1.32		7.67	
3.5	6 yr. 6 mo.	1 yr.	7,344	461,882	35.0	2.85	1.48	0.195	1.71	1.07		7.32	Compact gravel land subject to ov
4	9 yr.	1 yr.	7,057	484,587	20.6	1.83	0.89	0.31	2.58	0.65	0.26	6.52	Remodeled dredge, uneven bed places shallow.
5	6 yr.	1 yr.		481,184	25.0	3.28	1.46	0.39	2.97	1.52	. .	9.55	Difficult ground, in places cement
5	2 yr. 5 mo.	1 yr.		635,146	27.0	3.14	1.45	.	2.40	1.28	0.41	8.70	Difficult ground.
5	2 yr.	1 yr.		782,891	30.0	3.28	2.02	0.32	2.59	1.37	1.00	9.60	Difficult digging.
5	5 yr. 6 mo.	1 yr.	7,344	615,009	25.0	3.06	1.42	0.29	3.06	1.14	. . . .	8.98	Difficult digging.
5	4 yr. 6 mo.	1 yr.		812,355	36.0	2.30[2]	1.08		2.95		0.35	6.65	Medium gravel with considera much brush on top soil.
7	3 yr. 5 mo.	1 yr.	6,798	1,148,480	25.5	0.88	0.52	0.05	1.77	0.27	0.35	3.80	
5	2 yr. 5 mo.	1 yr.	6,490	2,148,802	29.9	0.82	0.49	0.03	1.89	0.27	0.16	3.64	Loose gravel, heavy overburden loam.
5	4 yr. 7 mo.	1 yr.	6,641	599,614	38.5	1.77	0.92	0.25	4.03[3]	0.47	0.23	7.67	Loose gravel, heavy overburden sand Difficult digging, working agai bank.
7	9 mo. 10 days	1 yr.	5,088	838,885	35.0	1.19	0.69		1.22	0.26	0.17	3.53	Difficult digging, gravel coarse [illegible] mented.[8]
7	1 yr.	1 yr.	6,313	1,114,605	27.6	1.21	0.62	0.03	1.81	0.29	0.11	4.07	Compact gravel.
7	3 yr. 9 mo.	1 yr.	6,390	1,033,694	26.5	1.08	0.64	0.14	2.69[4]	0.34	0.20	5.09	Compact gravel, heavy digging.
7	2 yr. 9 mo.	1 yr.	6,917	1,017,167	28.1	1.10	0.65	0.15	2.19[5]	0.28	0.14	4.51	Compact gravel, heavy digging.
7	5 yr.	1 yr.	6,352	935,322	33.4	1.26	0.85	0.06	3.06	0.31	0.34	5.88	Compact gravel.
7	3 yr.	1 yr.	6,700	1,194,146	27.5	1.05	0.58	.	2.78	0.32	0.37	5.10	Compact gravel.
7.5	2 yr. 11 mo.	2 yr. 11 mo.	13,464	3,458,229	27.9	0.27	0.41	. .	1.50	0.24	0.24	4.42[6]	Medium compact bench gravel.
7.5	9 mo. 6 days	9 mo. 6 days	5,582	944,879	28.9	0.95	0.58	.	1.30	0.27	0.39	3.55	Medium compact gravel with hea over burden.
7.5	2 yr. 6 mo.	1 yr.	6,402	1,369,844	70.2	0.99	0.77		1.95	0.45		4.16	Medium gravel overlain with h tailings.
7.5	2 yr. 6 mo.	1 yr.	6,900	1,281,351	67.8	1.09	0.98		2.01	0.45	.	4.53	Medium gravel overlain with hraul tailings.
8	6 mo.	6 mo.	3,162	583,927	42.5	1.69	0.59		1.14	0.28	0.22	3.92	Light gravel, dredge working again 10-f bank.
8	4 mo. 8 days	4 mo. 8 days	2,369	626,624	24.0	*	*	*	*	*	.	2.47	
9	5 mo.	5 mo.		580,310	51.0	*	*	*	*	*		4.98	Cemented gravel, difficult digging 20-f bank above water level.
13.5	8 mo.	8 mo.	4,478	1,803,201	19.0	1.02	0.47	.	0.60	0.12	0.09	2.30	Fine gravel, easy digging.

[1] Total possible time in year's work, 8,784 hours.
[2] Including general expense, management, etc.
[3] Heavy repair cost due to new tumbler, conveyor-belt, repairs to digging-ladder, screens, etc.
[4] Replacing tumbler-shafts, conveyor-belt, and new screen included in repairs.
[5] New steel spud and screen in repairs.
[6] Depreciation charges included in total expense.
[7] A 7-ft. dredge is now working this ground at a profit.
[8] This dredge successfully replaced an open-connected bucket-dredge which could not handle ground at a profit.
* Segregated costs not given.

[illegible] ver l [illegible] transmission l [illegible] lredge was put in operation in ınd dismantled in July, 1910. It l with 3.5-cu. ft. buckets. The being placed on a new hull and w bucket line of 4-cu. ft. buckets. f the installation has been esti- [illegible]

r-dredge has been successfully small areas at Oroville and else- does not meet with approval ge-operators in general, who con- efficiency of these boats, both [illegible] ıat of the standard type. These a low first-cost (about $25,000,) and are built with buckets of 2.5 cu. yds.' capacity. It is the dealers and some operators he following conditions there is [illegible] s somewhat shallow; (2) where f the ground is not sufficient to installation of a costly dredge; he material is of a rough char- ers, and stumps; (4) where the ıxed with more or less clay, as will relieve itself notwithsatnding ness of the material.

What seems to be a record in dredge-con- [illegible] the Julian Gold Mining & Dredging Co. on Osbourn creek, near Nome, Alaska. This dredge was constructed by the Union Construction Co., of San Francisco. The dredge was shipped from San Francisco on June 1 arriving at Nome June 13. On June 17 the company commenced hauling material, and on July 22 the dredge was completed and operations started. The dredge-hull is 30x [illegible] nected 2.75-cu. ft. buckets, and is designed to dig 14 ft. below water-level. Power is furnished by gasoline engines as follows: One 50-h.p. for digging ladder, winches, and screen; one 30 h.p. for pump; one 7 h.p. for lighting apparatus; a total of 87 h.p. Distillate costs at Nome 21 cts. per gallon. Operating expenses at present range from $110 to $125 per day, and the capacity of the dredge is from 1,000 to 1,300 cu. yds. per day, indicating an operating cost of from 10 to 11 cts. per cubic yard, exclusive of repairs. The cost of the dredge complete and in operation was $45,000.

The operating cost of dredging is always a matter of interest, but working costs cannot be fairly used in comparison unless uniform methods of determining them are employed, and also unless operating conditions are somewhat similar. As in other branches of the mining industry, it may also be said that the apparent operating cost is in a great measure a matter of bookkeeping. It is interesting to note the following average operating cost per cubic yard of the large companies working in California during 1910. The Yuba Construction Co., for the year ended Feb. 28, 1911, handled 13,970,728 cu. yds. at a total cost of 5.67 cts. per cubic yard. The Natomas Consolidated handled, for the year ended Dec. 31, 1910, a total of 15,989,525 cu. yds. at a total cost of 4.52 cts. per cu. yd., and during the six months ended June [illegible] total operating cost of 3.78 cts. per cubic yard. This company has put in commission during 1912 three dredges with buckets having a capacity of 15 cu. ft. These two boats are now satisfactorily handling ground that for a long time was considered too difficult for economical dredging. The gravel is deeper and more compact than any other in the district, and dredge No. 8 is handling ground containing much stiff clay. The Oroville Dredging, Ltd., for the year ended July 31, 1910, handled 5,661,612 cu. yds. at a total cost of 5.05 cts. per cubic yard.

ROADS AND STREETS SECTION

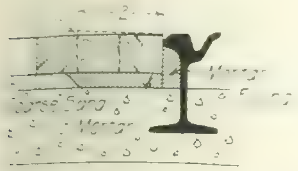
Creosoted Wood Block Pavements Chicago Loop District— A Review.

[illegible]

7 N. La Salle St., Chicago, Ill.

ıt of the widespread interest mani- e pavements recently laid in Chi- ıl business district and on account he numerous inquiries concerning t is possible that a review of the ct by the one under whose immeision the work was done would be nd at the same time would clear nts made rather obscure by some reat differences of opinion.

g, with the advent of the new city n, an entirely new Board of Loments was appointed. Of these ly the president had had previous n a similar capacity, and it is not rprising that under the circumstances med some rather distorted opinions eir first impressions on assuming of- ıe storm of protest over the nuisance by the exudation of tar from creo- lock pavements which reached them their friends, interested property and even the daily press demanded ate and decisive action. The new nt, in order to obtain some authoritatements as to the real reasons for the and the best means of obviating it, d to the commissioner of public works, ing that this official direct the city en- to make an exhaustive investigation port on the subject.



—Cross-Section of Pavement Just utside of Street Railway Track.

rdingly Mr. John Ericson, city engiıade "an examination of the method of wood paving blocks and the forms of ations under which creosoted block nts are constructed in this city, to dee whether the treatment of the blocks is proper and sufficient, and also as to whether the exuding of tar from the pavement under the heat of the sun may be avoided and whether the material used is controlled by an individual or combination and non-competitive."

In general Mr. Ericson's conclusions were "that pavements laid with blocks treated under the old forms of specifications or with creosote of a specific gravity of 1.08 or 1.09 are preferable to those treated with the heavy oil later specified . . .; that the 'bleeding' is caused principally by the use and excessive quantity of this heavy tar oil . . .," and "that the manufacture of both creosote and the heavy or 'special paving oil' seems to be limited to comparatively few concerns, which may or may not have formed combinations."

In justice to a number of other prominent engineers who have gone deeply into the subject it should be said that these same facts had on several occasions previously been pointed out. Mr. John B. Hittell, chief engineer of streets, has for several years urged a return to the use of the lighter oil and several of his assistants have maintained a similar attitude. According to Mr. S. Whinery in his report to the Commission on City Expenditures of the city of Chicago in August, 1910, this heavy oil "is not creosote oil at all in the recognized meaning of that term. It contains but a very small percentage of the antiseptic elements that have been heretofore considered the essential components of the creosote oil for timber preservation." He also points out that this heavy oil "is likely to exude in hot weather, covering the pavement with tar and making it very disagreeable and unsatisfactory in use." The Chicago Bureau of Public Efficiency in its report of last June reviews the experience of Indianapolis and says that though no trouble from exudation of tar was noted where the lighter oil had been used the opposite was the case with the heavy oil, and "from the beginning of its use there was trouble and annoyance caused by the exudation of tar."

In this same report Mr. Richard Lamb is quoted as saying: "The use of this pitch is unjustifiable in the light of engineering experience. Blocks treated with the 1.10 specific gravity oil often buckle and they rot in a few years. Creosoted blocks do not buckle and will not rot." In discussing a paper by Mr. P. E. Green on Chicago Paving Practice, presented before the American Society of Civil Engineers in October, 1909, Mr. Lamb says he "has built a number of kilns for drying lumber and has observed that when the heat is greater than 260° F. the wood is cooked and made brittle, the cells are broken down, and the wood is injured. If the strength and life of the wood are to be preserved these attributes of dead oil of coal tar which have to be heated excessively in order to inject them into the wood cannot be used." And goes on further to quote from a paper by Captain John C. Oakes, U. S. A., entitled "Difficulties in Practical Work of Creosoting Timber," who states that "an oil having a specific gravity as a whole of more than 1.07 should be looked upon with suspicion and investigated. Unless it is almost wholly lacking in the low boiling fractions, it possibly has some hard pitch or undistilled coal tar mixed with it."

Fig. 2—View Showing Method of Laying "Brow" Pavement.

Reviewing the monopoly feature of the heavy oil, Mr. Ericson's conclusion was mild compared with that of Mr. Whinery, who in the report previously mentioned states that the Chicago specifications call for an "oil that is now produced by but one firm and is therefore a monopoly." In this he is supported by the Chicago Bureau of Public Efficiency, whose report in a most vigorous discussion of the subject says "that there is a monopoly control of this high priced product, which has thus far seemed inferior to the cheaper oil, is recognized by unbiased students of the situation"; and also by Mr. Richard Lamb and many other authorities.

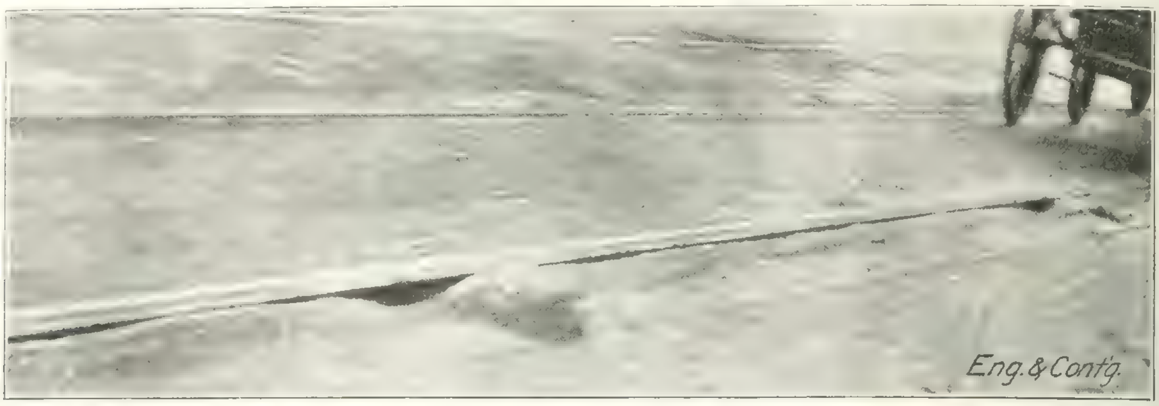


Fig. 3—View Showing Results of Improper Construction of "Brow" Pavement.

While the character of the preservative is undoubtedly of the greatest interest, the wood used is now receiving a large share of attention.

Experience in this country with woods suitable for paving blocks is rather limited and is confined largely to long leaf pine. Fortunately this wood is available over a very large area. Forest service circular No. 194, issued in January of this year, giving "the results obtained after four years of heavy traffic in a service test on wood paving blocks of various species laid in co-operation with the city of Minneapolis, Minn.," says the woods used "may be tentatively grouped in accordance with the results of this inspection in the order of their value for creosoted paving material as follows:

1. Long leaf pine.
2. Norway pine, white birch, tamarack, eastern hemlock.
3. Western larch.
4. Douglas fir.

In Chicago we have been confined almost exclusively to long leaf pine, though we have some tamarack and one black gum street, which was laid in the down town district last summer. This latter was very interesting from many points of view. The blocks had been treated the year before and stored over winter. Black gum is hard to handle at its best and is much inclined to warp. The storing of the blocks aggravated matters, and when they were delivered on the street the inspectors seemed disposed to reverse the operation of "culling" and to set about picking out the blocks that could be used. The pavers also complained loudly, as it was next to impossible to cut a block to fit decently in making closures. We finally gave up trying to cut the gum blocks and used pine wherever cutting became necessary. Congress street from Wabash avenue to Michigan boulevard between the Auditorium and Congress hotels was the street selected for trying the black gum. The street itself is misshapen due to the settlement of the Auditorium building, which has gone down some eighteen inches directly under the tower.

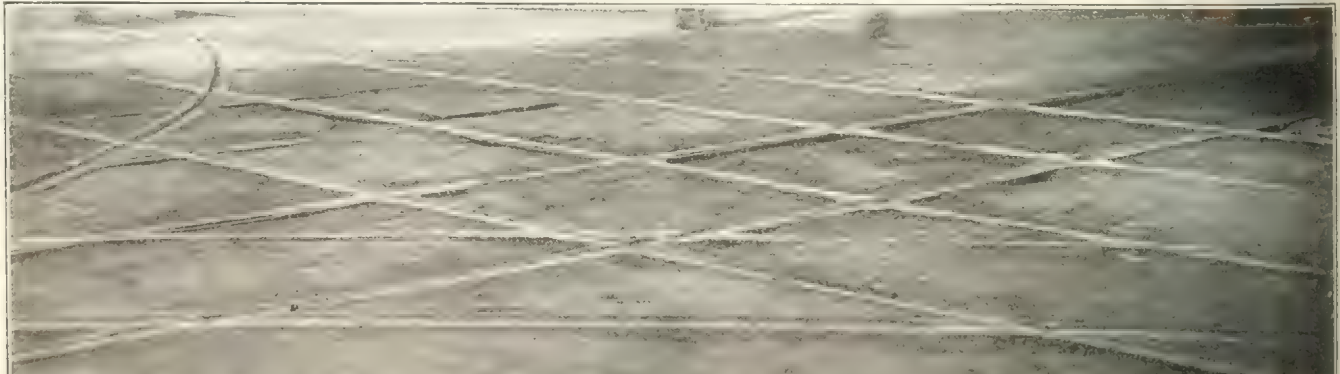


Fig. 4—View Showing Intersecting Car Tracks Paved with Creosoted Blocks.

We had until now always used transverse expansion joints, but we had also laid the blocks at an angle of from 45° to 67½° with the curb line, and though these transverse joints had been considered more or less objectionable they had never realy been very seriously so. The blocks in this case were laid at right angles to the curb, but unfortunately transverse expansion joints 1 in. wide were built every 25 ft. according to the common custom here. In a very short time the pavement started to bulge at every joint and very soon after it became necessary to do something to render the street passable. This experience convinced the writer of what he had previously believed—viz.: that transverse joints were wholly unnecessary and that when placed in a pavement similar to the one under observation they became a serious menace to the safety of those using the street.

Owing to a misunderstanding the writer was not informed when the repairs were made to the pavement, and in the absence of special instructions the paving inspector on the job followed his own ideas regarding the manner in which the fault was to be corrected. Only two or three rows of blocks on each side of the joints were taken up and relaid, and the expansion joint was replaced in the same manner as it had been originally made.

As was to be expected, the pavement again came up at every joint. This time the writer was present when the repairs were made. All blocks which had been disturbed by the expansion were removed. This meant that from 2 to 5 ft. on each side of every transverse joint and from 2 to 4 ft. along each gutter had to be taken up and relaid. The gum blocks were used as far as they would go and the balance was filled in with pine. In no case was a block less than 2 ins. in width or 5 ins. in length used. The blocks were fitted tightly together, eliminating all expansion joints, over the whole width of roadway except for 2 ins. along each curb line, which was left for a longitudinal expansion joint. This longitudinal joint was made with the utmost care and half filled with tar. It has been found that any little pebble or other solid in the joint will interfere with the free tion of the blocks and seriously affect the of the surface in the gutters unles before any damage is done. It is portant that the sand from the bed come up much higher than the bott blocks or be left any lower. In the the sand tips the blocks and in the tar finds its way under the blocks a to lift them up. No trouble has sinc oped in this pavement and after a re spection the writer is convinced th service may be expected from it.

One of the most important change manner of construction of these p during the past season was the substit "torpedo" or coarse sand for the cushion in lieu of the fine "bank" s viously used. Besides the advantage bility or holding its position under tr stead of pushing or waving the coar was found to drain very rapidly after been wet by rain or passing street sprinklers. This quality proved e valuable in enabling a more rapid pro of the work during a very wet seaso several consecutive days we had showers at short intervals and only suc was occasioned as was caused by the t tually lost when the workmen must cover, as the laying of the blocks pre immediately after the rain stopped.

Another unexpected advantage in thes coarse sand developed when the roll put on the blocks. The specifications for rolling with a 10-ton steam roller having a weight of 250 lbs. per inch of wheel. It was assumed that it wo unnecessary to specify a small roller the contractor would use one in self tion. The contractor on three of the tracts, however, elected to use only a road roller, having a weight on th wheels of something over 400 lbs. per i width. Because many blocks had been with a small drum roller when fine san been used as a bed it was now thoug many that with a large 3-wheeled rolle breakage would be excessive and even

This, however, was not at all the the contrary the breakage was negligible and the credit for this the coarse sand, which seemed to ly and firmly, thus permitting a ceive uniformly over its entire sur- ress developed by the roller. The s and firmness of the wearing sur- ned in this manner is remarkable. ng is an anlysis of a typical sample pedo" sand used:

Per cent
mesh per lineal inch sieve [illegible]
mesh per lineal inch sieve [illegible]
mesh per lineal inch sieve [illegible]
mesh per lineal inch sieve [illegible]
10 mesh per lineal inch sieve [illegible]

ifications for work in this district past year contained the following

along the street railway rails [illegible] manhole covers shall be laid flush [illegible] of cover and allow for settlement. After rolling, the a space of at least one foot adjoin- ilway rails and manhole covers shall up and relaid perfectly flush there- bed of mortar composed of one part ement to three parts sand, mixed sufficient water to moisten the mass.

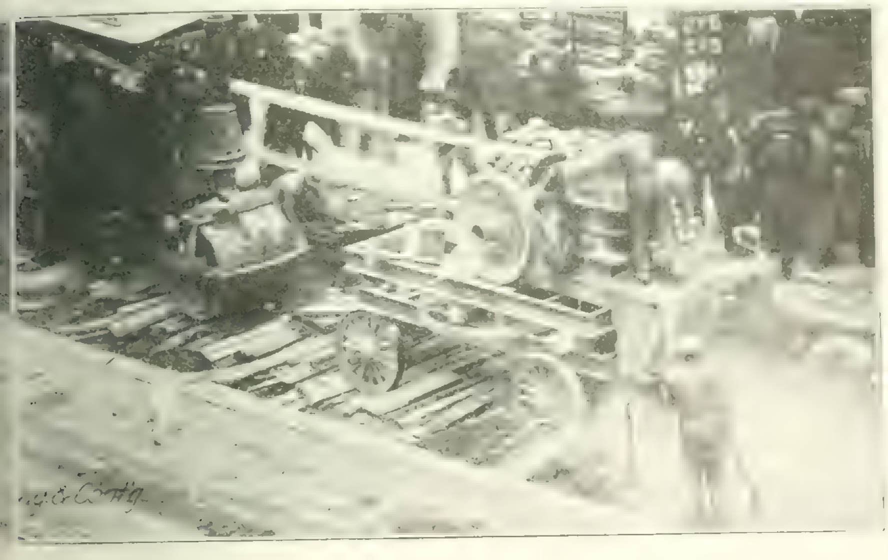


Fig. 5—Traveling Plant for Crushing Old Granite Blocks.

street from Clark street to La t was the first improvement of the l every effort was made to have the he very strictly in accordance with visions of the specifications relating nner of paving along street railway around manhole covers. This in- most strenuous campaign of educa- ng the contractors' men and the va- inspectors. The idea was new to l was also opposed to the opinion most of them. The common practice lay a pavement a little high in fset or counteract a probable future t. The disastrous effects of this re now very well recognized, and ntly been so fully discussed that the eed not be further treated here; but ne this work was done the writer had est difficulty in getting desired re- use the habit of doing the work in y was so strong that the men found npossible to break themselves.

1 shows the cross section of a por- one of these pavements just outside t railway tracks. The grading and were so done that the finished t would be 1 in. below the grade of f the rail at a distance of 1 ft. from g objection was made to this method n the plea that no matter how care- work was done the pavement was go down some under the action of nd that as this was the weak point avements usually fail something to ct this tendency should be done. It is hat wherever a pavement goes down something has to give. If the concrete is good and 8 ins. thick it can hardly be expected to fail under present traffic conditions as long as it has any protection at all in the shape of a wearing surface. Sand 1 in. thick after being once tamped is capable of very little further compression while confined. Wood blocks themselves show very little wear or compression during the time when the timber itself may be said to retain its "life" if they are properly supported both horizontally and vertically. What then is the reason some [illegible] ly from one of two causes. The sand is pushed out from under some of the blocks, allowing these to fall and raising those adjacent, or it is pumped out through the joints between the blocks by the combined action of water and vibration.

Proper drainage is absolutely essential to the life of any pavement and proper drainage is impossible when any of the material in the pavement is laid above a level or nearly level street railway track. Another pertinent observation in this connection is that if a pavement is laid as those described are laid it is at least a proper and adequate construction at the time it is built, and if for some reason a weak spot develops it is easily and effectually repaired, while if it is laid in the other manner (making some arbitrary allowance for settlement) it is never right at any time, can never be made right short of entire reconstruction, and automatically begins to get worse from the moment it is thrown open to traffic.

As it is quite possible through inadvertence or otherwise to get the shoulder or that part of the pavement half way between the curb and center too high, even though it meets perfectly the rail on the one hand and the proper gutter grade on the other, the writer has thought it best to provide for an inch drop in the first foot of pavement adjacent to the rail. This is not because a full inch is necessary or because a quarter or even an eighth of an inch wouldn't do. As a matter of fact it is the first sixteenth of an inch above the rail that does the damage because it reverses to that extent the flow of water. And then the trouble grows—it never diminishes. There are other reasons for making this requirement. It makes an "allowance" for unavoidable imperfections and makes it in the right direction. It allows too for the almost uncontrollable tendency to follow old customs. It is an insurance that water will be taken at least some distance from the rail or from the place where it does the most damage to where it will do the least. Finally it has the moral effect of impressing the men with the importance of their work and the high standard of excellence which will be demanded of them.

In order that the flow of sand or the pumping out of the bed along the rails and around manhole covers may be stopped mortar has been substituted for sand in those places. The mortar too provides an easier transition of traffic from the rigid iron or steel to the more or less resilient wood block bedded in sand. That this was required to be done in two separate operations instead of in one has caused some interest among those endeavoring to get better results and bitter opposition on the part of one contractor who maintained that as good work could be done in one operation and at a less cost. In this instance the moral effect previously alluded to of requiring the blocks to be taken up and relaid is more apparent and more important than any other consideration. It is gratifying to see the real interest and painstaking care developed in these men after they have once entered heartily into the spirit of the work.

Figure 2 shows some of this relaying in progress. The contractor whose work is here illustrated elected to make of it three operations instead of two. After preparing the sand bed, laying, rolling and culling the block, each row was tightened up by prying open with an iron bar the joint between the wood and granite blocks along the rail. Next, the blocks along the rail and around manhole covers were removed by a laborer and following him the best paver available relaid the blocks, making good, close fitting joints and taking care that no block less than 6 ins. in length was used. Next these same blocks were carefully removed and set up on the adjacent pavement in the order in which they were taken out, as shown in Fig. 2. The sand on the bed was then shoveled into a wheel barrow and there mixed with the proper amount of cement. Little or no water was added, depending on the dampness of the sand. Laborers replaced this mixture in the bed and the paver relaid the blocks with the greatest care for the surface obtained, as he did not now have any cutting or other fitting to do.

In general the method has been peculiarly successful and the writer believes it to be the best solution so far advanced of the difficulty of maintaining pavements along street railway tracks. Figure 3 illustrates the results of improper construction in the pavement of Madison street opposite the Hotel La Salle. The work on this street had been completed less than two years at the time the photograph was taken. The pavement in front of the federal building on Dearborn St. is over three years old and is still in practically perfect condition without having had any repairs. This work was done by the contractor who complained so loudly about requiring the blocks along the rails taken up and relaid, but to his credit be it said that when he found there was no other way out of it he set about doing the best work possible and with absolutely no attempt to in any way "skin the job." His work of last season was not in the "loop district," but his method was good and applicable anywhere. After laying, rolling and culling, the blocks along the rail were removed, mortar previously prepared was substituted for the sand bed and then finished with such a finishing tool as is used in cement floor or sidewalk work. This gave compression to the mortar bed and insured a very even surface to the pavement.

The use of granite blocks along the rails of the street railway tracks on streets otherwise paved with creosoted blocks opened up a heated argument during the year which deserves some comment in this discussion. When the contractor was ready to go into Clark street from Madison street to Van Buren street the writer ordered the granite block (brow stones) removed from along the rails. These stones are seen in place in Figs. 2 and 5. Legal notice was at the same time served upon the contractor that he would be prosecuted to the full extent by the railroad company if he made an attempt to disturb any of its property.

The ordinance under which the street improvement was made provided that the railroad company should pave its right of way with the same material. The city law department held, however, that inasmuch as the railroad company had been compelled to pave its right of way with granite blocks under the terms of a prior ordinance it would be unreasonable and oppressive to come now after two or three years and demand that the granits blocks be torn out and creosoted blocks substituted. At first blush one would naturally be inclined to agree with the law department and the railroad company, especially if one held stock in the latter. But on further consideration it seems as if there were something wrong somewhere. Why are property owners who are put to the expense of making a big modern improvement compelled to see it ruined in effect because of such an unfortunate combination of circumstances as this?

An effort was made by the Board of Local Improvements to get the railroad company to consent to paving the brow with creosoted blocks at this time on the promise that in future money enough would be provided in the assessment to cover the cost of such work. But the company was obdurate and refused to have the granite brow disturbed, even at the city's expense, on the ground that it would not undertake the maintenance of wood block.

One would think that a great street railroad company would have enough of public spirit or civic pride to cooperate with the city in making its most prominent streets a credit to all those who are striving for public progress. This was the first instance in which a decided stand was taken against the city on this point, the various companies having previously either accepted without comment or submitted to the requirements made. In this particular case the granite brow paving is miserably bad and varies from its proper elevation as much as 1½ ins. in either direction, which renders it absolutely impossible to lay the wood blocks in such a manner as to be serviceable or to even approximate a workmanlike connection with the granite. The elevation in this case for the surface of the new pavement was, however, taken in the same manner as on other streets—namely: 1 in. below the rail at a distance of 1 ft. from it. In relaying the blocks, though, they were fitted to the granite as it then existed. In this way it will be an easy matter to properly relay the brow pavement at any time.

The arguments advanced in favor of a granite brow pavement under such conditions as we have here seem to the writer to be fundamentally wrong. The laying of a creosoted block street in Chicago's business district is justified more on account of its noiselessness than for any other virtue. We have been able, on this feature alone, to repave many streets whose surfaces were otherwise serviceable. The courts (for we must get confirmation from them on a petition to levy a special assessment before we can proceed) have repeatedly held that the old granite block pavements it was sought to remove were no longer serviceable, though they still sustained the traffic and performed most of the functions of a pavement.

The question of noise in these streets and in similar streets in the larger cities of the country is a most serious matter. It strikes directly at the mental health and development of the nation. The hundreds of thousands of people of both sexes and of all ages that are daily toiling in the mammoth buildings along these streets and that are compelled to work in the midst of the never ending roar and din of traffic are not only weakening mentally and morally themselves but are contributing to a retrogression in the standard of strength in succeeding generations.

Returning to the claim that a granite brow can be maintained while one of wood can not, it can be demonstrated unquestionably to any unbiased observer who will make a careful comparison that this is untrue. It is admitted, however, that granite blocks will outlast wood blocks in brow pavements under some conditions, but they will not at once outlast and be more serviceable, especially when laid as is the custom here with a cement grout filler. The granite block pavements in the street railway right of way on some of our streets here have been a constant source of expense ever since they were laid and have on many occasions, by popping up from expansion, become very dangerous. This is not due to the granite blocks but to the manner in which they are handled. The granite brow pavement on this same street under discussion is a glaring example of what answers the purpose of the railroad company, but what can not except by stretch of the imagination be called serviceable.

It is idle, on the other hand, to contend that wood blocks cannot be made to stand up along street railway tracks. If one but considers the fact that in almost any pavement of this class long, unbroken stretches of brow paving exist and that the failures are confined to spots and short stretches, one must admit that a certain percentage at least stands up. Does it not logically follow then that if an appreciable amount of this paving is good the trouble lies rather in the handling than in the material itself? We have wood brow pavements that have stood much abuse and have remained practically perfect for seven or eight years and we have some that have not lasted six months. The writer believes he can point out the reason for failure in any of the cases he has known to exist.

Figure 4 shows some intersecting car tracks paved with creosoted block. This pavement and some others require renewal every few months because they are improperly laid, while at other intersections where similar conditions obtain the pavement shows no break after two years.

While the writer is perfectly willing to admit that these pavements leave room for some honest criticism, still they represent the results of his best efforts, under the existing circumstances, after 15 years of experience and study. He has endeavored here and previously to point out their defects and to suggest ways of avoiding mistakes in the future, and though most of the comments on the work have been flattering, yet—"unless some better methods are employed and more care is taken in laying creosoted wood block paving than has prevailed largely in the down town section of Chicago, this kind of paving will gain a degree of unpopularity not deserved," says a writer in a leading technical journal. The street paving experience of this critic seems to be confined to a more or less careful observation of results obtained in the district named and is an example of what may be expected from a necessarily superficial study by a man inexperienced in this class of work. The criticism itself is broad and sweeping, and is based on some misconceptions. The author illustrates by failures in parts of these pavements which were never intended to be permanent. Owing to the difficulties of getting its "special work" in the prosecution of what was probably the largest street railway reconstruction ever attempted, many of the pavements in the rights of way here were laid without foundation for the temporary accommodation of traffic pending the arrival of the shop work and permanent construction. They were not expected to last more than a few weeks.

As two public efficiency bureaus made complete investigations of the city's business during the time when these pavements were laid and as their reports were both in general complimentary on the results obtained, the writer believes that the criticism quoted is unfair and its scope absolutely so in view of the magnitude of the work.

A novel and interesting method of utilizing the old granite blocks existing in the street was introduced in connection with some of this work by William Kissack, the contractor. The old blocks, which were from 5 to 7 ins. in depth, were gathered up and piled on the outer edge of the sidewalks along the line of the improvement. After the street was graded a traveling plant shown in Fig. 5 was drawn in on the prepared subgrade. This plant consisted of a Reliance crusher mounted on a steel frame truck and Kelly Springfield gasoline road roller. The truck shown was designed for another purpose and was used here because it happened to be available. Any truck strong enough would have answered the purpose.

Besides operating the crusher the roller was used also to roll the subgrade. I was op- erated by gasoline and was smoke less and made relatively little noise.

The crusher cost $1,400 with truc cessories, and the roller $2,800. Th material was turned out at a cost o cts. per cubic yard; this amount in cost of removing the blocks fro pavement and piling them on the but does not include first cost or de of plant or interest on money inve cost of sand and crushed limestone on the street was $1.50 per cubic y cost of removing and disposing blocks by ordinary methods would have averaged $1.50 per cubic yard must be considered in connection w ing the granite blocks on the street deavoring to get comparative costs.

There is seldom a market for blocks. Sometimes, however, the road will haul them away if the loads them on to the cars and at rar vals some private paving job nearb secured where the blocks may be u crusher turned out 80 cu. yds. of sto cu. yds. of screenings a day, and repairs during the six weeks' time use on this work, with the exceptio new set of manganese steel jaws. Al cu. yds. of stone were crushed with of jaws, which cost $60 per pair. blocks furnished just about enough stone to make the required 8 ins. of (1—3—6 mix), but it was necessary amount of screenings or sand equa produced.

When this plant was first put in numerous complaints reached the city at one time the commissioner of publ ordered the work stopped. Several ences were held, demonstrations we and finally all officials satisfied themse the complaints of noise, dust, etc., we ly exaggerated and that on the othe most excellent concrete was resulti peated efforts failed to run down t plaintants and then it began to be str timated that the source of trouble la reduced sales of crushed stone. The was probably the best and strongest here in a street improvement—surely that ever came within the writer's ex —and was laid at a saving of about 5 square yard, including the amount grading.

All pavements this year, with the exc noted, were laid as follows: 8 ins. of base; 1 in. of coarse sand bed; 4 ins pine blocks, treated with 20 lbs. per cu of heavy oil; joints filled with heavy paving pitch with melting point of ab F.; no transverse expansion joints; lo nal joints 2 ins. wide, made with care, neither deeper or shallower th blocks and half filled with paving pitc of the blocks used were uniformly 8 length. There are many advantages t form length of block, such as amount of cutting and facilitating the ing of joints, and where it does not the price of the blocks to specify one l would be desirable to do so.

In discussing the relative merits and mortar for a bed for blocks the thinks that sand—coarse sand—has m vantages. It absorbs some of the s impact instead of transmitting it dir the foundation, thereby saving both th dation and the block. It facilitates d and thus mitigates against decay. It fies the making of repairs and in this renders it possible to have continuous the pavement, which would otherwise be closed while the mortar is taking its mortar bed around manhole covers an street railway rails has a peculiar f and is well adapted to such places. writer believes that to use mortar for throughout lessens the life of the pa This is paradoxical in view of the for but it is possible enough to do somet increase the life of the pavement in spot getting exceptional wear to a len low the average life of the balance.

Expansion of blocks gave no troubl

reosote oil was used and has been insignificance by proper construc- the heavy paving oil was used. The [illegible] in this regard lies in [illegible] sections either by the introduction rse expansion joints or giving an crown to the pavement. If care is each block bears firmly over its en- rice on another block or on some sistant plane surface and that the pressure due to the development of tresses remains normal to these urfaces, no trouble from buckling xpected, and this is especially true lighter or true creosote oil is used. rproofing qualities claimed for the do not seem to have worked out is now very generally conceded that ed with the true creosote oil treat- this agent develops in the wood a d affinity for moisture.

ns in these pavements are more to use of the explanations they ne- n for any real damage they do, as easily, quickly and cheaply repaired sually be avoided entirely.

s Involved in the Selection of Street Pavement.

ual cost of pavements, in most cities, he largest single items of the munic- ditures; the proper selection of the ial has much to do with determin- [illegible] The Bureau of Municipal Re- Cincinnati, O., has issued recently an report bearing upon the main prin- olved in the proper selection of a In the report, local data have been lustrate the application of the prin- his report was prepared by James and Rufus E. Miles, Engineer and respectively of the Bureau. An ab- the report follows:

ncipal kinds of pavement in use in are granite, creosoted wood blocks, halt, bitulithic, brick, boulder and All of these, except macadam and re now laid on a Portland cement oundation 6 ins. in thickness.

Considerations.—Good practice has at owing to their slipperiness, cer- nents shall not be used on grades or ceeding a certain amount. On ac- the topography of Cincinnati, this times proves a controlling factor. nual report of the Engineering De- for 1906, the following are suggested um permissible grades for the prin- [illegible] pavements:

	Per cent.
and asphalt	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

[illegible] of special hillside blocks, the al- [illegible] for brick may now be increased [illegible] binder as now frequently [illegible] adam becomes more slippery, and [illegible] permissible grade would be less ere shown.

ousness to street liquids is a neces- ary quality, as is also freedom from s or recesses, such as the joints in avement in which street offal may d decay. Freedom from dust is a rable element. The ease of cleaning important item, especially on the reets which are cleaned every day. streets the relative cost of cleaning ily be a determining factor in econ- impervious, smooth pavement un- y the modern high-pressure flushers bably hold first rank from the street and sanitary standpoint.

ty.—The most economical pavement nder any given conditions is that ll show the lowest average cost per ng the entire period of its existence. vement having a relatively high first , owing to its longer life or lower pairs, prove ultimately cheaper than in first cost. This principle of aver- al cost should be thoroughly under- it is fundamental in determining a economical paving policy for a city.

TABLE I.

Kind of Pavement	1908.	1909.	1910.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	.033
M[illegible]	[illegible]	332,511.01	328,232.34	.076

The average annual cost of a particular pavement may be defined as that amount of money which, if contributed annually, will, under the existing conditions, keep the street perpetually paved and repaired. The average annual cost is composed of three principal factors: 1. Average annual cost of repairs; 2, interest on the cost of the pavement; 3, annual charge on [illegible] and invested each year such that the pavement, when worn out, will have been completely paid for.

This average annual cost might be imagined as a rental. If the streets were laid and kept in repair under a continuous contract with a private corporation, the average annual cost, as above described, plus profits, would make up the rent demanded by the corporation. In the long run, the cost to the citizens under the present methods has to be figured in the same way.

In order to apply this principle to the selection of a pavement for a given street, certain exact data are necessary, such as the durability and cost of repairs of each kind of pavement under various conditions, especially those of traffic. As a matter of fact, the information of this character which is available in most cities is meager and fragmentary, due doubtless to the long period necessary for such an extended investigation and the lack of continuity of records through changing administrations.

Interest.—To determine the annual interest charge, the first cost of the various kinds of pavements must of course be known. A study of public records shows that the price per square yard in Cincinnati for the past four years for the various kinds of pavements has been approximately as follows:

Kind of Pavement.	Minimum.	Maximum.	Approx. average.
Granite	[illegible]	[illegible]	[illegible]
Wood b[illegible]	[illegible]	[illegible]	[illegible]
Bitulithic	2.14	3.22	2.65
Asphalt	1.81	2.62	2.30
Brick	1.86	2.50	2.25
Granitoid	1.54	[illegible]	2.10
Macadam	.66	1.30	.95
Boulder	[illegible]	[illegible]	[illegible]

The above prices include (a) Excavation equal to the total thickness of the pavement; (b) all consolidation of subgrade; (c) a 6-in. concrete foundation, and (d) furnishing and laying the surfacing complete above the foundation. The macadam is 12 ins. thick and has no concrete foundation; the boulder likewise has no concrete foundation. Inasmuch as a good Portland cement concrete foundation should outwear several surfacings, it will be necessary for the determination of the replacement fund to separate the cost of the foundation from that of the surfacing. The sum of $1 per square yard may be taken as a reasonable average price, including work and materials, for the concrete foundation; subtract this figure from the amounts above given and the difference will represent the average cost of the surfacings. Upon these costs the interest is calculated, the rate assumed being 4 per cent.

Repairs.—The average cost of repairs for individual pavements during their life is not locally available. However, it is known that the gross amount of money expended annually for several years past on each kind of pavement. From this and such available records as exist of the amount of each kind of pavement in use, a figure (Table I) for the average cost of local repairs per square yard per year can be obtained.

The gross expenditures in the first three columns are taken from the annual reports of the street repair department. In order to determine the last column, the most recent United States census report was used as a basis for the amount of each kind of pavement in use. No allowance is made for streets under guarantee. Particular attention is called to the high repair cost of macadam, especially as compared with brick. The annual cost of repairs to a Portland cement concrete foundation is assumed to be negligible.

Sinking Fund.—In determining the annual payment on account of the sinking fund, the two factors are the initial cost and the durability or length of life. The former has already been given. For the latter, the figure which is desired for each kind of surfacing should represent the average length of life under the average conditions to which it has been subjected in Cincinnati. Obviously this figure is not susceptible of exact determination. It is believed, however, that the figures given below are fair approximations.

Granite	[illegible]
Wood block	[illegible]
Bitulithic	[illegible]
Asphalt	[illegible]
Brick	[illegible]
Boulder	25 years
Macadam	[illegible]

**Cleveland and Columbus, with practically no macadam, spent annually on street repairs dur- [illegible] cinnati's average for the same period of $441,300.

††Particular attention is called to the general [illegible] It is quite impossible to arrive at any accurate [illegible] dependent on the amount of traffic, and particularly as the stone locally available is a com- [illegible] made here merely for the purpose of a definite comparison.

The life of the Portland cement concrete foundation is assumed to be 50 years. A variation from this figure of several years will make no material difference.

With the foregoing data as a basis, the annual amount of money required for the sinking fund is readily calculated by the use of standard tables.

Table II gives a summary of the foregoing data, on the basis of which is worked out the continuous annual expense per square yard for keeping paved and repaired each different kind of pavement under its actual local conditions:

From the application of this annual expense method, it is seen that the respective costs of granite, asphalt and macadam, under the actual conditions under which each has been used in Cincinnati, are not far apart, while brick is considerably lower. Boulder is disregarded, being considered obsolete for general use.

Lack of data on life and repairs makes figures for wood block and bitulithic uncertain, the latter having been first laid only about ten years ago.

Perhaps the most significant facts brought out by the above table are the relatively high

TABLE II

	Granite.	Wood block.	Bit.	Asphalt.	Brick.	Boulder.	Macad.
Underlying Data—							
First cost of surfacing	$2.70	$2.45	$1.65	$1.30	$1.25	$1.75	[illegible]
Assumed life	[illegible]	[illegible]		15 yrs.	15 yrs.	25 yrs.	[illegible] yrs.
Average Annual Cost of Surfacing—							
Interest at 4% on cost of surfacing	0.108	0.098	0.066	0.052	0.050	0.07	0.038
Average annual cost of repairs	0.026		[illegible]	[illegible]	0.012	0.033	0.076
Annual charge for sinking fund	[illegible]	[illegible]		0.063	0.060	0.041	0.100
Oiling or watering							0.04
Total, surfacing	0.197			0.188	0.122		
Average annual cost of foundation	[illegible]	[illegible]	0.046	0.046	0.046		
Total average annual cost per sq. yd.	0.243			0.234	0.168	0.144	

cost of macadam and the relatively low cost of brick, the macadam costing nearly 50 per cent in excess of brick. In comparing the above annual costs, the fact must not be lost sight of that the different classes of pavement are not, on the average, subjected to the same traffic conditions; e. g., macadam is used normally on streets of light traffic, and yet costs about the same as granite which is used on the heaviest traffic streets. Hence, if the macadam were replaced with a more permanent pavement, its comparative costliness would be more marked than shown above.

Should Interest on Repairs Be Included in the Total Annual Cost of a Pavement?

Sir:—I have been much interested in reading the leading editorial in your issue of March 20 in regard to pavement economics. Your article calls attention to many pertinent points, but there are several minor points to which I wish to refer.

You state that "if the weighted age is more than half the total life of the pavements, repairs and renewals may be large." This statement, it seems to the writer, would be true only when the curve of annual repair cost began at zero-life and was a straight line; inasmuch as such curves start later and are usually concave upwards, the weighted age would give a better approximation if it were somewhat greater than half the life. On the first example on the enclosed reprint, from the Municipal Journal and Engineer of Jan. 18, the average yearly expenditures for a 13-year life is $0.0276, which is the amount actually spent in approximately the ninth year. This, however, is probably an extreme case.

Again, in the example you worked out on page 312 of your paper you have failed entirely to take account of the item of interest in conjunction with the removal cost, which in a 20-year period is very considerable. It is true that with a 10-cent item it is small, but taken on a salvage value of a granite block pavement it might be very considerable. I believe a proper way to consider this is as shown on the marked portion of the reprint herewith.

The item of interest is nearly always neglected in connection with repair costs—i. e., no attention is paid to when the money for repairs was spent during the life of a pavement. In the second example worked out herewith, this was taken into consideration and it reduced the annual payment to cover repair costs approximately 25 per cent.

Very truly yours,
J. E. BARLOW,
Assoc. M. Am Soc. C. E.

Cincinnati, O., March 23, 1912.

[The main question raised by our correspondent is whether interest on repairs should be regarded as a part of the total annual cost of a pavement. Interest on repairs is never charged to any structure or machine, for to do so would not only greatly confuse the accounting, but would result in paying interest on parts of the first cost of the structure several times. To illustrate: Suppose all the ties of a railway are renewed every ten years. Suppose the railway as a plant were to have a life of 100 years. Then the ties would be renewed 10 times during that life and if, after each tie renewal, interest were charged upon the cost of the renewal, the resul that after the 90th year the annu charges would be made on 9 tim cost of the ties. While it may be a there is fundamentally no fallacy in an extreme procedure, provided are treated in the same manner, it that to do so would lead to confu confounded in the accounting recor to any plant.

It is infinitely simpler to regard pair as an annual expense which is t to the annual interest charge on th of the structure. We may, it is tru interest on the annual interest cost compound the interest for a term of we may calculate interest on the r thus compound the annual repair term of years. But what is gaine compounding? A pavement, like is part of a transportation plant life is usually unknowable—vide, t roads still in existence. The top of pavement may last only 25 years, b crete base may last ten centuries. the ledger account relating to any ment to be closed? Probably neve

Our correspondent refers to an a ten by him and published in the *Journal*, Jan. 18, 1912, giving a "met termining when it becomes more to renew a pavement than to conti pair it." The method there given rect. A correct solution of this econ lem will be found in the second Gillette's "Handbook of Cost Data, 33. A large part of our correspon teresting paper on the selection of is reprinted elsewhere in this issue.–

WATER SUPPLY, SEWERAGE AND SANITATION SECTI

The System of Recording Sanitary Sewer Notes in Use at Dayton, Ohio.

Contributed by F. O. Eichelberger, Engineer in Charge of Sewer Construction.

A very comprehensive yet concise system for maintaining a permanent record of sanitary sewer notes has recently been adopted by the Engineering Department of the City of Dayton, Ohio. The record contains all information of value to the sewer superintendents, municipal inspectors, city engineers and private plumbing contractors, such as the depth, location and size of street mains; the position and kind of openings left for house connections; the location of manholes, lampholes, flushtanks, etc.; and all information necessary to locate the house connections that have been made to the sewer.

The forms on which the complete data above mentioned are inscribed are printed on heavy ledger paper, size 21 ins. long by 11 ins. deep. When completed these forms are filed, loose leaf, in a Tatum Transfer Binder. Additions to and rearrangements of the sewer records are so often necessary that the loose leaf method of filing the data is both convenient and labor saving and by far superior to the bound volume. Fig. 1 shows a specimen form which has been filled out.

The left half of the form, which is to contain the notes referring to the depth and location of the street mains and the position and kind of openings left for house connections, is of course a record of the field notes of the engineer in charge of the construction of the sewer system. The right half of the page is reserved for the data pertaining to the house connections that have been made to the sewer and includes the location of the house connection at the curb line of the street, or at the property line if the main has been constructed through the alley in the rear of the properties; these locations are made by measurements from some definite or permanent object. The data on house connections also show the location of the end of the pipe line, if the same is not to be immediately connected to the soil pipe from the house or building; the depth of the house connection at the curb line or property line, as the case may be; the name of the plumber or contractor making the connection, the date the connection is made, and such special remarks as the engineer or inspector may deem necessary for future reference. All of these notes are taken by the sewer inspectors at the time inspections are made and are immediately entered in the permanent loose leaf record.

Referring back to the data on street mains, at the extreme left of the page is a column headed "Station." In this column, on every other line, are printed +25 + 50 + 75, then three blank lines on the second of which is inserted the station number. The space between each line is ¼ in. deep and represents a distance of 12½ ft. of sewer: there are 40 such spaces on each page, thus permitting a record of 500 ft. of sewer main to the page of the record. The station numerals and plusses indicate the points in the line of the sewer main at which the elevations designated in the next two columns have been taken.

In the next column, under the heading "Surface Elevation," are designated the surface elevations of the street or alley along, and immediately over, the line of the sewer main; these elevations being taken and recorded at intervals of 25 ft. The plotting of these notes will describe an accurate profile of the surface of the street should the same be needed for another purpose at some future time.

Under the heading "Grade Elevation" are designated the elevations of the flow line of the sewer pipe directly under and with relation to the surface elevations, thereby showing the depth of the sewer to be the difference between the surface elevation figures and the grade elevation figures.

Under the subhead or caption "Notes to Sewer Taps," and in a column headed "Y Branch," are given the measurements to the Y branches, manholes, lampholes and flushtanks. These measurements are taken from the stations recorded in the station column, the center of the outlet manhole being taken as Station 0 + 00. The measurements are recorded as nearly opposite the corr number as possible—that is a Y 356 ft. from the outlet manhole, or S would be recorded on a line opposi 3+50, while the manhole measurin from the outlet manhole is recorde station 2+75. The measurements to lampholes and flushtanks are dist from the Y measurements by the d opposite the measurement figures, su Manhole, 346.5 Lamphole and 350

The measurements recorded Branch" refer to the openings left f tions to the sub-drains, if such have stalled.

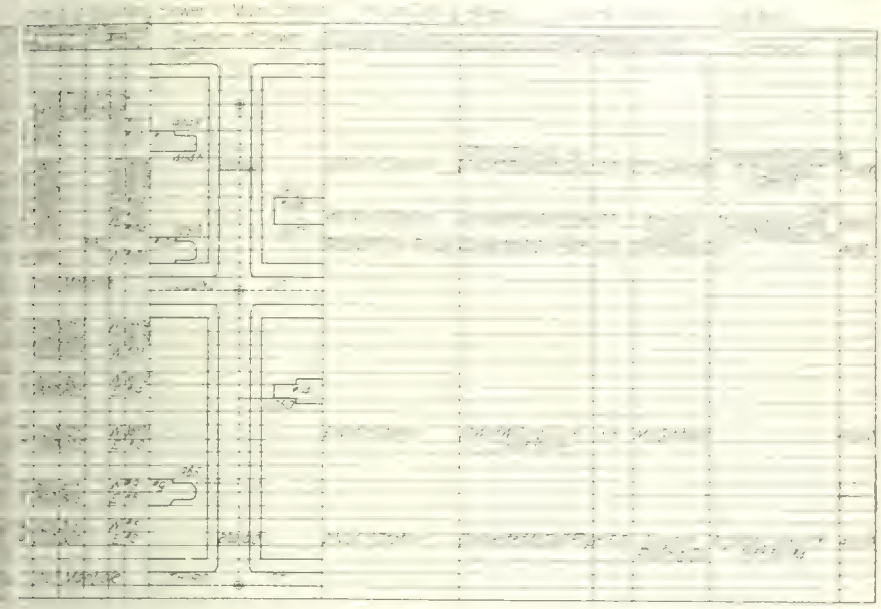
In making connections to the stree is very frequently inconvenient, a times impossible, to go to the "Y" that purpose; and in such instance tion is made by tapping the barrel o with a ferrule which we have had m cially for that purpose. Measure such taps are taken by the sewer ins the time these kind of taps are made recorded in the column marked "Fer on lines opposite their nearest sta bers. The direction in which the "Y ferrule is headed is noted in the marked "Direction," and recorded cardinal points of the compass.

In the next column, marked "Hou ber" or "Lot Number," is recorded t number or lot number to which con the street sewer has been made, or an opening has been left. The hous is distinguished from the lot numbe sign placed before the house number. number is used only when the lot proved by any buildings, the use of t number being always preferable.

Under "Diagram of Sewer" a roug or plan is made of the street or alley the sewer has been constructed, sho intersecting streets and alleys, and of houses and other buildings, wh been used as points of reference for "Y," "T," "Ferrules," etc. The po the sewer with reference to the curb property lines is shown on this plan, er of the pipe and the material struction, such as 8 in. vitrified

e blanks have been filled in com- y number of convenient arrange- of the pages can be made. Such ar- will be governed to a certain ex- al conditions. The city of Dayton sanitary sewer districts and the sewer is ivided by ten Manila division sheets. nal leather tabs bearing the number trict, beneath which the notes hat district are found. In the front k is maintained an index, arranged tical classification of the street a back of each name is recorded the page number where the notes be found. For sewers that have ructed in alleys the index is main- giving the names of the streets be- h the alley is located, such as First orth of; Second St., alley south of,

tem in the short time it has been has demonstrated conclusively its e and efficiency, and is saving the



g. 1—Specimen Loose Leaf Page Used in Recording Sanitary Sewer Records in Dayton, Ohio.

iderable expense. Sewer records erly kept in 50 small volumes, simi- engineer's field book, giving the he street mains, and nine large vol- ng the notes to house connections. information contained in these 59 an be recorded on 1,500 sheets of eaf record.

st of the Tatum binder, division index sheets and 1,000 record s $33.15. This is a little more than f one of the large volumes formerly

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vantages and Limitations of ar Reinforced Concrete Res- irs—Enlargement of Such Reservoir at Suffern, New York.

the past few years engineers have proper realization of the effect of ses in built up members of structural lting from deformations in the mem- fabrication and erection processes. danger from high local stresses ex- nforced concrete reservoir construc- the reinforcing is not placed accord- design on which the computations d, as is shown in a recent paper be- New England Water Works Associa- lexander Potter. The following ab- he paper also brings out the economy ular form of reservoir and describes the methods employed in enlarging the capacity of the reservoir in the water works system at Suffern, N. Y.

The economy in constructing service reservoirs for water works purposes circular in shape is not, in the opinion of the writer, appreciated as fully as it should be. The circular shape for small reservoirs is not only the safest type of construction from a structural standpoint, but permits also a more economical use of the structural materials. It is rare to note failures of circular reinforced concrete tanks other than those of badly leaking tanks due either to poor workmanship or poor design, or both.

One of the greatest advantages possessed by the circular section and not possessed by any other is the ability to increase economically the capacity of such a reservoir by simply increasing its depth. The ability thus to increase the capacity of a reservoir is of great importance in the design of water works improvements. It enables the designer to keep down the first cost of construction by building a reservoir of a size sufficient for the immediate needs. As the water consumption increases, it is possible to increase economically the capacity of the reservoir, and at the same time raise the water level to counteract the increasing frictional losses in the distribution system due to increased consumption.

The design of a circular reinforced concrete reservoir appears to be so very simple that the inexperienced designer is likely to create a structure of larger diameter than the application of the simple formula of tank design would seem to warrant. To him there appears to be no ostensible reason why a structure twice the size of one already built should not offer every evidence of strength and stability if designed in accordance with the formula for ring tension—a very misleading deduction. The secondary stresses, which in small structures are insignificant, and consequently are deemed of too little importance to have attention called to them, increase rapidly with the size of the structure and only too often limit the size to which any particular type of construction can be adapted. In a circular reinforced concrete tank, the writer has in mind the varying tension from point to point in the steel reinforcement due to the difficulty of obtaining a true circle in the field. In a small tank this is not so serious, as its effect upon the resultant stresses in the steel reinforcement is so slight. To make this point clear, some computations have been made by the writer based on the assumption that in the construction of this type, even with the best of care taken in the field, a variation of a half-inch in the middle ordinate of a 10 ft. chord is likely to occur. The results of these computations are given in Table I.

TABLE I—RANGE IN STRESS IN REINFORCING BARS DUE TO A VARIATION OF ½ IN. IN MIDORDINATE OF 10 FT. CHORD IN TANKS OF VARIOUS DIAMETERS

[illegible]	Variation in curvature due to variation of middle ordinate of 10 ft. chord.	Corresponding range in tension in reinforcement, [illegible] equals 14,000 lbs. per sq. in.
ft.	[illegible]	[illegible]
ft.	[illegible]	11,950 lbs.—19,100 lbs.
ft.	74.9—150.5	5,910 lbs.—21,100 lbs
ft.	120.2—632.0	5,820 lbs.—11,500 lbs.

Table I is not made to show accurately the variation in the tensile stresses of the steel reinforcement for the various diameters given; it does, however, give a fair idea of what may be expected in the variation of the ring tension in a circular structure. It points out the danger resulting from carelessness in constructing a circular reservoir more than 100 ft. in diameter. For reservoirs of large diameter, however, the economy resulting from the use of a circular section does not obtain to the same extent and consequently recourse to this type is not so frequent.

The writer's experience would tend to limit the working tension in the steel reinforcement to 14,000 lbs. per square inch in a small tank and to 12,000 lbs. per square inch for comparatively large tanks. A reduction in the allowable steel tension for large tanks is recommended because of the greater range in the ring tension present in the larger structure. It may even be advisable to reduce the allowable unit stresses below 12,000 lbs. per square inch to keep within safe limits the excessive local stresses which cannot be avoided.

The variation in the tension of the steel reinforcement from point to point, due to the varying curvature of the shell, makes the use of a reinforcing bar with mechanical bond advisable. The reinforcing bars for this reason should also be of as small a size as it is possible to handle economically in the field. A high carbon steel with an elastic limit of 50,000 lbs. per square inch can be used to great advantage.

Another difficulty to be considered in the design of a circular reservoir is the tendency to rupture along the line between the inside wall of the reservoir and the base, due to the expansion of the walls by internal water pressure and the consequent drawing away, as it were, from the base of the tank.

THE ENLARGEMENT OF THE RESERVOIR AT SUFFERN, N. Y.

A good example of increasing the capacity of a circular reservoir is the enlargement of the distribution reservoir for the village of Suffern, N. Y. This village takes its water supply from Anthrim Lake, formed by impounding a branch of the Ramapo River. The water is pumped from this lake to a distribution reservoir located on the side of a mountain to the north of the village, about 180 ft. above the average village datum. This distribution reservoir, built a number of years ago, is a circular tank 70 ft. in diameter and 10 ft. 6 ins. deep, sunk entirely into the ground. The walls forming the sides of the tank are 2 ft. thick, and both bottom and sides are constructed of plain concrete. This reservoir has a storage capacity of 266,000 gals. and cost approximately $4,000.

The recent growth of the village has made it advisable to double the capacity of this distribution reservoir. The old structure although massive leaked to a considerable extent, especially in the bottom. It was therefore decided to line the bottom of the tank at the same time that the sides were being raised. The reservoir was remodeled has an inside diameter of 69 ft. and holds approximately 20 ft. of water, giving a storage of 560,000 gals. The side walls of the old tank are lined on the inside with 6 ins. of reinforced concrete. Above the [illegible] ins., tapering to 8 ins. at the top.

The circumferential reinforcement consists of ⅝ in. square corrugated bars, possessing an elastic limit of 50,000 lbs. per square inch. These bars are so spaced that the average unit tensile stress in them does not exceed 14,000 lbs. per square inch.

In designing the lining for the old reservoir it was assumed that the reinforcement would only have to take care of the increased tension due to the additional depth of 10 ft. 6 in. This is a constant quantity with a full reservoir: consequently the spacing and size of the steel in the lining of the old reservoir is uniform. The existing wall is still relied upon to resist the hydrostatic pressure that it formerly did.

It is not very likely, because of the great daily fluctuation in the water level in this reservoir, that ice pressure will develop to such an extent as to over-stress seriously the reinforced concrete shell, and consequently, no provision has been made for such pressures.

The bottom lining is reinforced with ⅜ in. square corrugated bars, which have their ends hooked over the lowest reinforcing rings. Vertical ⅝ in. square bars, spaced 3 ft. centers, were used as vertical distributors. Each reinforcing ring is made up of six sections lapped 30 ins. and wired. The rings were also wired to the vertical reinforcement at every intersection.

The forms consisted on the inside of vertical sheathing extending the full height of the reservoir and of horizontal sheathing on the outside.

The thickness of the bottom lining varies from 3 ins. to 6 ins., so arranged as to offer better drainage than was obtained in the old tank.

The reservoir was completed on Oct. 12, 1911, and filled for the first time to its full depth on Nov. 11, 1911. No leaks whatever have thus far appeared. The only precaution to render the reservoir water-tight other than that of using a fairly wet concrete which was mixed in the proportion one part of cement to two parts of sand and four parts of ¾ in. broken trap rock was to wash the inside of the tank with a semi-liquid cement.

The writer wishes to call attention to the comparatively low cost of this work. An increase in the storage capacity of 294,000 gals. was obtained at a cost of $2,500, the contract price for this work. The location of the reservoir on a steep mountain slope about 180 ft. above the street level added considerable to the cost of hauling the structural material to the site and, consequently, to the contract price.

Announcement has been made that the Canadian Northern Ry. will this year build 1,053 miles of line in different parts of Canada. The program includes the completion of through lines from Montreal to Ottawa and from Sydenham to Ottawa, the latter linking up Toronto with Ottawa. Following is the program of construction in detail: Montreal to Hawkesbury, 58 miles; Ottawa to Ottawa River, 32 miles; west from Ruel, Ont., 100 miles, east from Port Arthur, 108 miles; branch lines and extensions in Alberta and Saskatchewan, 400 miles.

Progress Diagram and Distribution of Time of Force on Sewer Trenching by Machine.

Contributed by W. G. Kirchoffer, Consulting Engineer.

Recently an 8-in. sewer 5,270 ft. in length was laid at West Salem, Wis. The excavation was made in a sandy gravelly clay by the use of a Parson's trenching machine. Fig 1 shows the machine in operation. The trench averaged about 8 ft. deep. The total number of days' work put in on the job was 325¾, or an average of 61.8 days per 1,000 ft. of sewer. The trenching machine was operated 20 days out of the total 26 put in upon the work, or an average of 263½ ft. per day. The least distance made in a day was 20 ft. and the maximum distance was 550 ft. of completed sewer. There were five days in which the rate exceeded 400 ft. of sewer per day. The progress diagram is shown in Fig. 2.

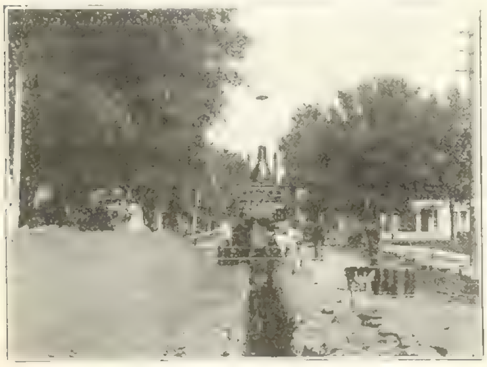


Fig. 1—View of Trenching Machine Excavating Sandy Clay at West Salem, Wis.

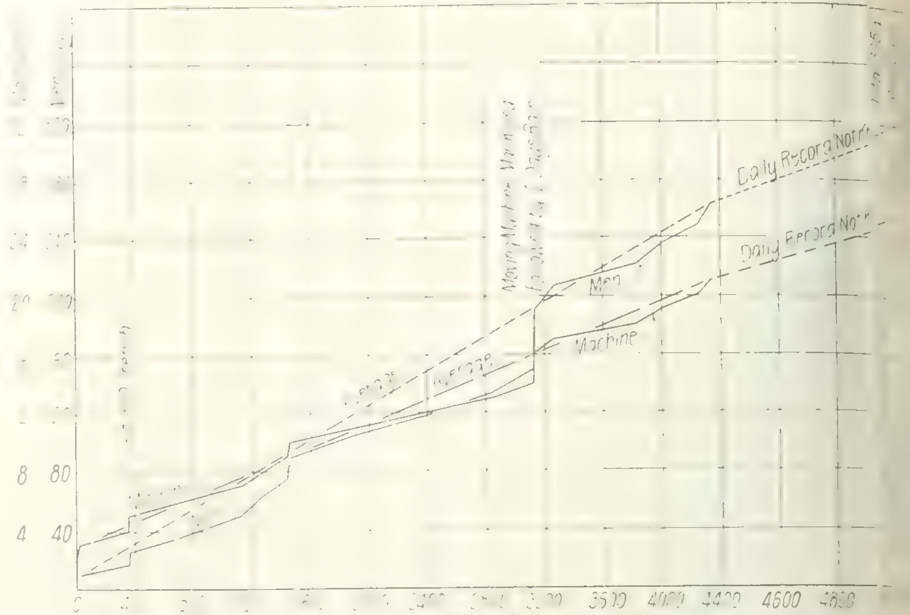


Fig. 2—Progress Diagram of Sewer Trenching by Machine at West Salem, Wis.

The labor put in upon the work was divided as follows in days per 1,000 ft. of sewer:

Contractor	1.932
Inspector	4.935
Pipe layer	4.317
Foreman	4.270
Engineer	4.79
Fireman	4.412
Team	3.417
Mason	3.75
Water boy	1.993
Common labor	26.04
Tamper	4.13

The greatest number of men employed in any one day was 16 and the smallest number was two. The man who was killed upon the work came in contact with some high tension wires in attempting to lift them over the excavator with a common broom stick when they were moving from one street to another.

This work was done under the supervision of W. G. Kirchoffer, consulting engineer, Madison, Wis. The contractor was F. E. Kaminski of Watertown, Wis.

$7,500 for a Non-Slipping Rubber Roadway.—An important announcement is to be made at the International Rubber Exposition which opens at the new Grand Central Palace, New York City, in September next. The above named sum has been subscribed by a number of gentlemen connected with the rubber industry, and is to be offered to the inventor or inventors who can suggest the best method of making rubber non-slipping for pavements, roads, etc., or for any use to which it may be put in all atmospheres and for all kinds of traffic. The idea is to divide the sum into three prizes.

Methods and Cost of Thawin Frozen Water Pipes in Chicago b Electricity During the Rece Severe Winter.

Frozen water pipes have been thawed for a number of years in Chica by Commonwealth Edison Company. his service has not been advertised and granted largely as a favor to the c and householders. The methods and costi ing out frozen pipes in this manr stated in a recent informal talk by M. Roper before the Western Society neers. At one time during the re severe winter the Commonwealth had a total of 18 gangs working o jobs, and were thawing out more service pipes each day.

The first calls for thawing out ser this winter came from a street wher had been opened in December, duri ing weather, and backfilled with frozen earth. Mr. Roper's descripti work follows:

The outfit used in this work is ve Previous experience had taught us t ply of current at about 55 volts wo out most of the water service pipes minutes and without injury to them mains. As none of our transformers nected for this pressure, we arrang duce the pressure by connecting tv formers in series on the primary an tiple on the secondary. These tra can then be used without any regul vices whatever, using the primary cu main switch. As the visible supply formers decreased rapidly, the last few fitted up for this work were equippe single transformer, the secondary co being altered inside the transformer deliver 55 or 110 volts. In a few ca water mains have been frozen up, a were thawed out by the applicatio volts.

The amount of current which flow water service pipes ranges between 300 amperes, depending upon the l the service pipe. The time required the water varies from five to fifteen In the case of the 6 in. water main of about 600 amperes thawed out the about one hour.

In thawing out the service pipes t of the building, or the city, has a plu hand who disconnects the service pi the house pipe at the building wa secondary wire is connected to the pipe and the other to the nearest

thawing out a street main the two sec-
tes are connected to the [illegible]
ends of the block where the main.

[illegible] feature in connection with the
rred on Monday, Feb. 19. Sunday,
is the warmest day we had in two
thermometer ranging above 50°.
ny people who had been all [illegible]
ter to run theretofore [illegible]
the pipes from freezing noted the thaw,
ed that the cold weather was over.
here was still 6 ft. of frost in the
the thaw which we had on Sun-
penetrate more than an inch or
he ground. As a result we received
per cent more orders for thawing
es on the day following the thaw
l received on any one day up to

[illegible] been a number of instances
e pipes have been thawed out a
and a smaller number where
en thawed out three times.

ost to the customers has averaged
and $15 each, which is much
n any other method of thawing out
when they are frozen between the
d the street main. To dig up the
[illegible] out the pipes would have
iderably more expensive, and in ad-
ld make the pipes more vulnerable
t, as was shown by our first few
such cases the earth, having been
freezing weather, could not be
perly in the ditch, consequently the
rated the loosely packed frozen
the trench far more quickly than
ave penetrated through the solid

Enomic Study of the Four Alter- Methods Considered for e Disposal of the Garbage, Rubbish and Ashes of Toronto.

II.

[illegible] abstract of the report of
Gregory on the disposal of the
he city of Toronto takes up the
two projects C and D. Projects
vere considered in our issue of
1912. The present abstract also
the relative advantages of the
ts considered, and the recommenda-
engineers as to choice of method
desirable, for Toronto conditions,

PROJECT C.

s project it is proposed that the gar-
bbish and ashes be collected separate-
the garbage be disposed of by the re-
process, grease and tankage being
ed, that all of the rubbish be inciner-
d that all of the ashes be removed to
and used for filling up and reclaiming

dering first the question of the dis-
f the rubbish, it is proposed that two
incinerators would be installed and
same locations proposed for the two
incinerators in Projects A. and B,
on property owned by the city at the
Market and on property which would
red by the city near Greenwood Ave.
Projects A and B it is suggested that
be redistricted so as to provide only
ain collection districts, namely, an
district and a western district.
two rubbish incinerators would, in
be similar to the two refuse in-
rs proposed under Project A, except
ey would be of much less capacity.
incinerator would have a net rated
y of burning 60 tons of rubbish per 24
and would be provided with two fur-
each capable of burning the above
t. While each furnice would thus be
of burning 60 tons of rubbish per 24
only one furnace would be in service at
ne, the other being held in reserve. No
mill would be provided and no power
would be produced. Electric current for lighting and operating the incinerator would be purchased from the Hydro-Electric Com- [illegible] on the property at each incinerator to provide for the removal of the clinker.

At each incinerator site a loading station would be built for the loading of garbage onto cars. The loading station would consist of a covered building through which a railroad sid- [illegible] cient length to receive two cars. The garbage wagons would be driven into the building and the cars loaded with garbage, either by dumping the garbage direct into the cars from the wagons or in some other manner, depending on whether the wagons would come in above the cars or on the same level as the railroad siding. For transporting the garbage from the loading stations to the reduction works, special cars built of steel and holding about 40 tons of garbage would be used. The body of the car would be semicircular and set on trunnions so that it could easily be turned to discharge the whole load at one operation.

It is proposed that the garbage reduction works be located about 10 miles east of the city and near the shore of Lake Ontario. A railroad spur would be built to connect the reduction works with the Grand Trunk Railway, and each night the loaded garbage cars would be transported to the reduction works, empty cars being left at the loading stations for receiving the garbage collected on the day following.

At the reduction works the garbage cars would be received in a covered unloading building in which the garbage would be dumped. It would then be loaded into a conveyor and transported to the digester building which contains the digesters in which the garbage is cooked, and also the presses for pressing the cooked material removed from the digesters. From the digester building the pressed tankage would be transported to a dryer building which contains the dryers in which the present tankage is dried. From the dryer building the dry tankage would go to the percolating building in which grease is extracted from the dry tankage by means of the naphtha process.

The liquids removed from the pressed tankage in the digester building would go to a grease separating and evaporating building, where the grease is drawn off and the remaining liquids evaporated down to a syrup. This syrup would then be mixed with the percolated tankage and the mixture dried, after which the tankage is ready for shipment. The grease would be stored in tanks and then either loaded into tank cars or into barrels depending on the method of transportation and point of destination.

The reduction works would have a net rated capacity of handling an average of 240 tons of garbage per day, but would have sufficient reserve to handle the maximum amount which might be expected in any one day. In addition to the buildings and equipment briefly mentioned heretofore, a power plant would be provided in which would be located the boilers for supplying steam and the pumps for supplying water to the various parts of the works. The equipment throughout would be operated by electricity, and the power would be purchased from the Hydro-Electric Commission, a power line being run from the city to the reduction works, as estimates which have been made indicate that it would be cheaper to thus secure power than to produce it at the works. An office would be provided and also a railroad track scale for weighing garbage received at the works and grease and tankage shipped from them.

The estimated cost of construction of the two 60-ton rubbish incinerators, without providing means for picking out the salable portions of the rubbish, but including land, fencing, railroad sidings and paving is $227,700. The estimated annual cost of operating the two rubbish incinerators including fixed charges when handling the rubbish from a population of 600,000 is [illegible], and when [illegible] the rubbish from a population of only 400,000, it is $41,580.

In Tables I, II and III are given, somewhat in detail, the estimated cost of construction of the two 60-ton rubbish incinerators and also the estimated annual cost of operation of the same when handling the rubbish from a population of 600,000 and from a population of 400,000 but without utilizing the salable part of the rubbish.

The estimated cost of construction of the two loading stations, of the garbage reduction works and of the power line from the city to the reduction works, including land, fencing, railroad sidings and paving is $538,200.

The estimated gross annual cost of operation of the two loading stations and reduction works including fixed charges when handling the garbage from a population of 600,000 is [illegible] which have been recovered from the garbage and the prices which have been received for the sale of the same at Cleveland and Columbus, Ohio, have been mentioned before. As a basis for estimating the receipts from the operation of reduction works at Toronto, it is assumed that, with the naphtha process, the amount of grease which would be recovered would be 3.5 per cent, and the dry tankage 15 per cent, of the weight of the garbage reduced. It is further assumed that the average price which would be received for grease would be 3.5 cts. per pound and for tankage $7 per ton. These figures are believed to be conservative. On this basis it is estimated that, with a population of 600,000, the receipts from the sale of grease and tankage would be $210,000 per annum, thus giving a total net annual income of $40,030. The estimated gross annual cost of operation of the loading stations and reduction works, including fixed charges, when handling the garbage from a population of 400,000 is $131,960 and the estimated receipts from the sale of grease and tankage $140,000, giving a total estimated net annual income of $8,040. In these estimates of the annual cost of operation freight charges for transporting the garbage to the reduction works have been included.

In Tables IV, V and VI are given, somewhat in detail, the estimated cost of construction of the two loading stations and of the reduction works, and also the estimated annual cost of operation of and income from the same when handling the garbage from a population of 600,000 and from a population of 400,000.

As this project involves not only the incineration of the rubbish but the reduction of the garbage, the previous estimates of the cost of construction and annual cost of operation of the two rubbish incinerators, of the two loading stations and of the reduction works must be combined in order to arrive at the total cost of construction and operation. Combining these estimates it is found that the total estimated cost of construction of the two 60-ton rubbish incinerators, of the two loading stations and of the reduction works is $765,900. The total estimated net annual cost of operation of these works with a population of 600,000, including fixed charges, is $7,150, and with a population of 400,000, it is $33,540.

PROJECT D.

Reduction of the Garbage and Incineration of the Rubbish With Utilization of the Salable Part of the Rubbish.—This project is similar to Project C, just described, except that the salable parts of the rubbish would be picked out and sold. The garbage rubbish and ashes would be collected separately. The garbage would be disposed of by the reduction process, grease and tankage being recovered. The rubbish would be delivered to incinerators where the salable material is picked out and the remaining portion burned. All of the ashes would be removed to dumps and used for filling up and reclaiming low land.

As was the case in Project C it is proposed that two rubbish incinerators would be installed and at the same locations. As in all the previous projects which have been considered it is suggested that the city be re-

TABLE I.—ESTIMATED COST OF CONSTRUCTION OF TWO 60-TON RUBBISH INCINERATORS FOR A POPULATION OF 600,000 WITHOUT UTILIZING THE SALABLE PART OF THE RUBBISH.

Net capacity of each incinerator (tons of rubbish per 24 hrs.) ... 60
Net capacity of two incinerators (tons of rubbish per 24 hrs.) ... 120

	Incinerator at cattle market.	Incinerator near Greenwood Av.
Land—		
At cattle market (owned by city)	....	
Near Greenwood Ave.	......	$ 8,540
Fence	$ 1,000	1,000
Railroad Siding—		
At cattle market	3,140	......
Near Greenwood Ave.	......	600
Paving	2,250	2,250
Incinerator—		
Building—		
Excavation	700	700
Foundations	3,500	3,500
Superstructure	11,250	11,250
Chimney	3,500	3,500
Equipment—		
Furnace	48,000	48,000
Storage hoppers	8,600	8,600
Cranes	7,000	7,000
Clinker hoist	1,000	1,000
Ventilating apparatus	1,060	1,060
Lavatory and locker house	2,000	2,000
Scale, scale house and office	3,000	3,000
	$ 96,000	$102,000
Engineering and Contingencies, 15 per cent	14,400	15,300
Total estimated cost	$110,400	$117,300

Grand total estimated cost $227,700.

TABLE II.—ESTIMATED ANNUAL COST OF OPERATION OF TWO 60-TON RUBBISH INCINERATORS WITH A POPULATION OF 600,000 WITHOUT UTILIZING THE SALEABLE PART OF THE RUBBISH.

Weight of rubbish burned at each incinerator annually, 15,000 tons; at two incinerators 30,000 tons. Average weight of rubbish burned at each incinerator daily, 50 tons; at two incerators 100 tons. Working days, 320.

		Total.	Per ton of rubbish handled.
One Incinerator—			
Supervision and weighmaster		$ 4,800	$0.320
Labor		7,680	0.512
Removal of clinker, 3,000 tons at 30 cts.		900	0.060
Power and light		360	0.024
Maintenance and repairs		1,060	0.071
Estimated annual cost of operation of one incinerator		$14,800	$0.987
Estimated annual cost of operation of second incinerator		14,800	0.987
		$29,600	$0.987
Fixed Charges—			
Interest 4 per cent on $227,700	$9,110		
Sinking fund 3.72 per cent on $227,700	8,470	17,580	0.586
Total estimated annual cost of operation		$47,180	$1.573

TABLE III.—ESTIMATED ANNUAL COST OF OPERATION OF TWO 60-TON RUBBISH INCINERATORS WITH A POPULATION OF 400,000, WITHOUT UTILIZING THE SALEABLE PART OF THE RUBBISH.

Weight of rubbish burned at each incinerator annually, 10,000 tons; at two incinerators 20,000 tons. Average weight of rubbish burned at one incinerator daily, 34 tons; at two incinerators 67 tons. Working days, 320.

		Total.	Per ton of rubbish handled.
One incinerator—			
Supervision and weighmaster		$ 3,600	$0.360
Labor		6,400	0.640
Removal of clinker, 2,000 tons at 30 cts.		600	0.060
Power and light		360	0.036
Maintenance and repairs		1,040	0.104
Estimated annual cost of operation of one incinerator		$12,000	$1.200
Estimated annual cost of operation of second incinerator		12,000	1.200
		$24,000	$1.200
Fixed charges—			
Interest 4 per cent on $227,700	$9,110		
Sinking fund 3.72 per cent on $227,700	8,470	17,580	0.879
Total estimated annual cost of operation		$41,580	$2.079

districted so as to provide only two main collection districts.

The two rubbish incinerators would be similar to those proposed under Project C except that each would have a net rated capacity of burning 40 tons of rubbish per 24 hours. Each incinerator would be provided with two furnaces, each capable of burning the above amount. In addition to the equipment required for incineration, additional equipment would be provided, as in Project C, for the sorting out and handling of the salable part of the rubbish. No clinker mills would be provided and no power produced, for the reason before stated, namely, that electric current for lighting and operating the incinerators can be purchased cheaper from the Hydro-Electric Commission than it could be produced at the works.

As in Project C a loading station, for the loading of garbage onto cars, would be built at each incinerator site similar to those proposed under Project C. The cars for transporting garbage from the loading stations to the reduction works would be the same as those previously described. A railroad siding would be built on the property for the loading of the garbage onto the cars and for the removal of the clinker from the incinerators.

The reduction works would be located at the site proposed under Project C, namely, about 10 miles east of the city and near the shore of Lake Ontario. The works would have the same average rated capacity, namely, 240 tons of garbage per day, and would be of the same size as those proposed under Project C. A description of these works will not be repeated here.

The estimated cost of construction of the two 40-ton rubbish incinerators, including means for sorting out and handling the salable part of the rubbish, and including land, fencing, railroad sidings and paving is $255,300.

The estimated gross annual cost of operation of the two incinerators, including fixed charges, when handling the rubbish from a population of 600,000 and including the cost of picking out and handling the salable part of the rubbish is $92,510. The recei the sale of the material picked out om the rubbish are estimated on the same b as in Project B, namely, $2.25 per ton o ubbish handled, or $67,500 per annum, thu giving a total estimated net annual cost of eration of $25,010. The estimated gross an al cost of operation of the two incinerators includ ing fixed charges, when handling th ubbis from a population of only 400,000 is $7 and the estimated receipts from the ale of material picked out from the rubbish 45,000

TABLE IV.—ESTIMATED COST OF CONSTRUCTION OF GARBAGE REDUCTION WORKS FOR A POPULATION OF 600,000.

Capacity of works, 240 tons of garbage per 24 hours.

Land—			
For cattle market loading station (owned by city)		....	
For Greenwood Ave. loading station		$ 8,540	
For railroad spur		3,600	
For reduction works		7,500	
			$ 19,640
Loading Stations—			
Cattle market		$23,260	
Greenwood Ave.		17,100	
			40,360
Garbage cars, 13 at $2,000			26,000
Power transmission lines			25,000
Railroad spur			6,000
Reduction Works—			
Grading and drainage		$ 6,000	
Railroad tracks		3,000	
Railroad track scale		3,100	
Water supply		10,500	
Garbage unloading, building and equipment		10,000	
Digester Building—			
Building	$27,000		
Equipment	50,700		
		77,700	
Grease separating and evaporating building—			
Building	$14,000		
Equipment	32,200		
		46,200	
Dryer building—			
Building	$26,000		
Equipment	33,000		
		59,000	
Percolating building—			
Building	$17,000		
Equipment	22,000		
		39,000	
Naphtha storage vault		5,500	
Power plant—			
Building	$19,000		
Chimney	5,000		
Equipment	64,000		
		88,000	
Office		3,000	
			351,000
			$468,000
Engineering and contingencies, 15 per cent			70,200
Total estimated cost of construction			$538,200

TABLE V.—ESTIMATED ANNUAL (31 O OPERATION AND INCOME FRO GAR BAGE REDUCTION WORKS WITH POP. ULATION OF 600,000.

Weight of garbage reduced annuall 60, tons; average weight of garbage reduc d 200 tons, 320 working days.

Operation—		Tota	pe
Labor at loading stations		$ 1,6	$0
Freight on garbage, 60,000 tons at 30 cts.		18,	
Reduction works—			
Supt. and clerk	$ 3,700		
Labor	41,260		
Electric current	3,600		
Coal, 18,000 tons at $2.35	42,300		
Naphtha, 30,000 gals., at $0.085	2,550		
Miscellaneous supplies	3,000		
Miscellaneous expenses	3,600		
Repairs and renewals	8,000		
Removal of ashes, 2,700 tons at 30 cts.	810		
		108,	
		$128,	
Fixed charges—			
Interest, 4 per cent on $538,200	$21,530		
Sinking fund 3.72 per cent on 538,200	20,020		
		41	
Total estimated gross annual cost of operation		$169,97	$2
Income From Sale of Product.			
Grease—			
3.5 per cent of 60,000 tons of garbage = 4,200,000 lbs. 4,200,000 lbs. at 3½ cts.		$147,00	$2
Tankage—			
15 per cent of 60,000 tons of garbage = 9,000 tons. 9,000 tons at $7		63,00	1
Total estimated gross annual income		$210,	
Total estimated net annual income		$40,	

TABLE VI.—ESTIMATED ANNUAL C OPERATION OF AND INCOME FROM GAR BAGE REDUCTION WORKS WITH POP ULATION OF 400,000.

Weight of garbage reduced annually, 0,00 tons; average weight of garbage reduced dai 133 tons; 320 working days.

Operation—		Total	
Labor at loading stations		$ 1,600	0.
Freight on garbage, 40,000 tons at 30 cts.		12,000	0.
Reduction works—			
Supt. and clerk	$ 3,700		
Labor	29,420		
Electric current	2,520		
Coal, 12,000 tons at $2.35	28,200		
Naphtha, 20,000 gals., at $0.085	1,700		
Miscellaneous supplies	3,000		
Miscellaneous expenses	2,730		
Repairs and renewals	5,000		
Removal of ashes, 1,800 tons at 30 cts.	540		
		76,81	
		$ 90,41	
Fixed charges—			
Interest, 4 per cent on $538,200	$21,530		
Sinking fund, 3.72 per cent on $538,200	20,020		
		41,55	
Total estimated gross annual cost of operation		$131,960	.29
Income From Sale of Product.			
Grease—			
3.5 per cent of 40,000 tons of garbage = 2,800,000 lbs. 2,800,000 lbs. at 3½ cts.		$ 98,000	45
Tankage—			
15 per cent of 40,000 tons of garbage = 6,000 tons. 6,000 tons at $7		42,000	
Total estimated gross annual income		$140,000	
Total estimated net annual income		$ 8,040	

total estimated net annual cost of $28,510.

Tables VII, VIII and IX are given, showing in detail, the estimated cost of construction of the two 40-ton rubbish incinerators and also the estimated annual cost of operation of the same when handling the rubbish from a population of 600,000 and from a population of 400,000 and with utilization of the salable part of the rubbish.

The estimated cost of construction of the loading stations, of the garbage reduction works, of the power line, etc., is the same as that in Project C, namely, $538,200. The estimated annual cost of operation and estimated annual income, with a population of 600,000 and with a population of 400,000, are the same as those in Project C and [illegible]

TABLE VII.—ESTIMATED COST OF CONSTRUCTION OF TWO 40-TON RUBBISH INCINERATORS FOR A POPULATION OF [illegible] WITH UTILIZATION OF THE SALABLE PART OF THE RUBBISH.

[illegible]

	Incinerator at Cattle Market.	Incinerator at Greenwood av.
[illegible]	[illegible]	[illegible]
[illegible]	1,250	1,250
[illegible] Market	[illegible]	
[illegible] Wood A[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	3,500	3,500
[illegible]	32,000	32,000
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible] equipment	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
ale house and office....	3,000	3,000
	$106,000	$116,000
and contingencies, t..................	15,900	17,400
nated cost.........	$121,900	$133,400

al estimated cost $255,300.

VIII.—ESTIMATED ANNUAL COST OF OPERATION OF AND INCOME FROM TWO 40-TON RUBBISH INCINERATORS, WITH A POPULATION OF 600,000, WITH UTILIZATION OF THE SALABLE PART OF THE RUBBISH.

t of rubbish delivered at each incinerator annually, 15,000 tons, at two incinerators 30,000 tons. Weight of rubbish burned at each incinerator annually 10,000 tons, at two annually, 20,000 tons. Average of rubbish delivered at each incinerator [illegible] at two incinerators daily [illegible] Average weight of rubbish burned at each [illegible] daily, 33 tons, at two incinerators [illegible] tons. 320 working days.

tion.	Total.	Per ton of Rubbish Handled.
[illegible] and weighmaster	[illegible]	[illegible]
[illegible]	25,920	1.728
al of clinkers, 2,000 tons [illegible]	[illegible]	[illegible]
light	1,080	0.072
ce and repairs......	4,000	0.267
ated annual cost of operation of one incinerator.....	$36,400	$2.427
ated annual cost of operation of second incinerator..	36,400	2.427
	$72,800	$2.427
harges—		
st. 4 per cent on [illegible] $10,210		
fund 3.72 per on $255,300..... 9,500		
	19,710	0.657
estimated gross annual of operation..	$92,510	$3.084
Income from Sale of Material		
handled, 30,000 tons at [illegible]	67,500	2.250
estimated net annual cost operation	$25,010	$0.834

Estimated gross annual cost of operation [illegible]

[illegible]

of the two loading stations and reduction works, including fixed charges....$131,960

[illegible]

Combining these estimates it is found that the total estimated cost of construction of the two 40-ton rubbish incinerators, including equipment for picking out and handling the salable portions of the rubbish, of the two loading stations and of the reduction works, complete, is $793,500. With a population of 400,000 the estimated net annual cost of operation of these works is $20,470, but with a population of 600,000, instead of a net cost of operation, there is an estimated net annual income of $15,020.

CONCLUSIONS.

It will be seen that while the projects for reducing garbage and incinerating rubbish require a much greater outlay for construction than the projects for incineration of garbage, rubbish and ashes, being $287,500 more without equipment for picking, and $301,200 more with such equipment, the annual cost of operation, due to the return from the sale of products, is very much less. Without picking over the rubbish, the annual cost of operation with a population of 600,000 is $117,790 less, and with picking it is $114,090 less, than the annual cost of incinerating together garbage, rubbish and ashes.

When we compare the cost of operation for a population of only 400,000 assuming for convenience that the first outlay is the same as for the larger population, we have the following annual cost: Incineration of garbage, rubbish and a portion of the ashes (a) without picking over rubbish, $102,540; (b) with picking over rubbish, $86,570. Reduction of garbage and incineration of rubbish (a) without picking over rubbish, $33,540; and (b) with picking over rubbish, $20,470 per year.

These estimates show that for a population of 400,000, without picking over the rubbish, the annual cost of operation for the reduction project is $69,000 less, and with picking it is $66,100 less, than the annual cost of incinerating both the garbage and the rubbish.

The above figures show conclusively that the project for incinerating both the garbage and rubbish of Toronto, in the near as well as the distant future, is materially more costly than the project for reducing the garbage and incinerating the rubbish. This circumstance as already said is due to the fact that the heat created by the incineration cannot be converted into electric power for the price paid directly for the Niagara power. It is also partly due to the absence of a market for the clinker, although even with such a market the balance still weighs greatly against the incineration of garbage and rubbish.

With reduction of the garbage and incineration of the rubbish, foregoing the profit to be derived from picking over the latter, the total outlay for construction would be $765,900 for a population of 600,000. The annual cost of operation, including fixed charges, would range from $33,540 at the beginning, for a population of 400,000 down to $7,150 for a population of 600,000. If the rubbish is picked over, the total outlay for construction would be $793,500. The annual cost of operation, including fixed charges, would range from $20,470 at the beginning for a population of 400,000 to an annual profit of $15,020 for a population of 600,000. The annual saving in expense derived from picking, therefore, ranges from $13,070 to $22,170.

In view of the facts above set forth the engineers found that for the City of Toronto the reduction process for converting the garbage into salable products, the incineration of the rubbish and the utilization of the ashes for filling land or for other purposes, is materially cheaper than incinerating both the garbage and rubbish, together with a sufficient heat for a complete incineration of the organic matter.

TABLE IX.—ESTIMATED ANNUAL COST OF OPERATION OF AND INCOME FROM TWO 40-TON RUBBISH INCINERATORS WITH A POPULATION OF 400,000, WITH UTILIZATION OF THE SALABLE PART OF THE RUBBISH.

Weight of rubbish delivered at each incinerator annually, 10,000 tons, at two incinerators annually 20,000 tons. Weight of rubbish burned [illegible] at two incinerators annually, 13,000 tons. Average weight of rubbish delivered at each incinerator daily, 34 tons, at two incinerators daily, 67 tons. Average weight of rubbish burned at each in[illegible] daily 44 tons. 320 working days.

Operation.	Total.	Per ton of Rubbish Handled.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Removal of clinker, 1,300 tons [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Estimated annual cost of operation of one incinerator	[illegible]	[illegible]
Estimated annual cost of operation of second incinerator.	26,900	2.690
	[illegible]	[illegible]
[illegible]		
[illegible]		
Sinking fund, 3.72 per cent on $255,300...... 9,500		
	19,710	0.985
Total estimated gross annual cost of operation..........	$73,510	$3.675
Income From Sale of Material.		
Rubbish handled, 20,000 tons at $2.25	45,000	2.250
Total estimated net annual cost of operation	$28,510	$1.425

RECOMMENDATION.

In Toronto the most material difference between the projects of incineration and reduction considered in the report, so far as the engineering aspects are concerned, is that of cost. The engineers, therefore, recommended the adoption of the project according to which the refuse must be separated into three parts to be separately collected, the garbage to be converted into salable products by the reduction process, the rubbish to be incinerated either without or with prior picking over, and the ashes to be disposed of by dumping onto low ground or for use in making road foundations.

Plans are being drawn by Junior United States Engineer R. B. Gillette, Jr., for the construction of the lock and dam at White Rock shoals in the Trinity River for the city of Dallas, Tex. The construction will be under the direction of Major Thomas H. Jackson and Capt. Ernest Graves. The work is to cost about $200,000. The lock and dam will be at mile 180, from the mouth of the river at Galveston Bay. The lift of the lock is to be 18 ft. The bottom of the lock is to be 79 ft. above mean low tide in the bay. The lock is to be of monolithic construction, its top at elevation 103 ft., or 24 ft. above the floor of the lock. The water level will rise to 97 ft. The lock length, over all, will be 239 ft. Its boat capacity will be 140 ft., at least. Its width is 50 ft. The distance from the river wall of the lock to the wing wall on the far side of the river is 200 ft. Of this distance 17 feet next the lock will be the drift chute, with bottom at 91 ft., a section that can be closed when the lock is in operation. There is a 4-ft. wall of concrete between this chute and the section of the dam whose concrete top will be at 89 ft. Another 4-ft. wall separates this 56-ft. section from the long section, 116 ft., to the wing wall. The wing wall is 40 ft. and there is a land wall to prevent washing or erosion by the floods. The Chamlin type of dam is to be used.

DRAINAGE AND IRRIGATION SECTION

The Irrigation System of the Southern Alberta Land Co., Ltd.

Contributed by Augustus H. [illegible], [illegible] M. Am. Soc. C. E., [illegible] and [illegible]

In the southeastern portion of the Province of Alberta, Canada, about 50 miles west of the city of Medicine Hat, a block of semi-arid bench land, half a million acres in extent, is being developed by a combination of Canadian and English capital, under the name of The Southern Alberta Land Co., Ltd. The rainfall of this portion of Alberta is about 11 ins. yearly, only a portion of which occurs during the growing period of crop development, and for this reason this land, until late years, had been thought fit only for grazing immense herds of cattle and horses. The rivers of this section of the country have abundant supply of water from their source in the Rockies above the snow line, but in that portion of their course within the prairie section of the country, their slope is slight, and their valleys narrow and deeply scored with side drainage, making the economic construction of a gravity canal system difficult if not impossible.

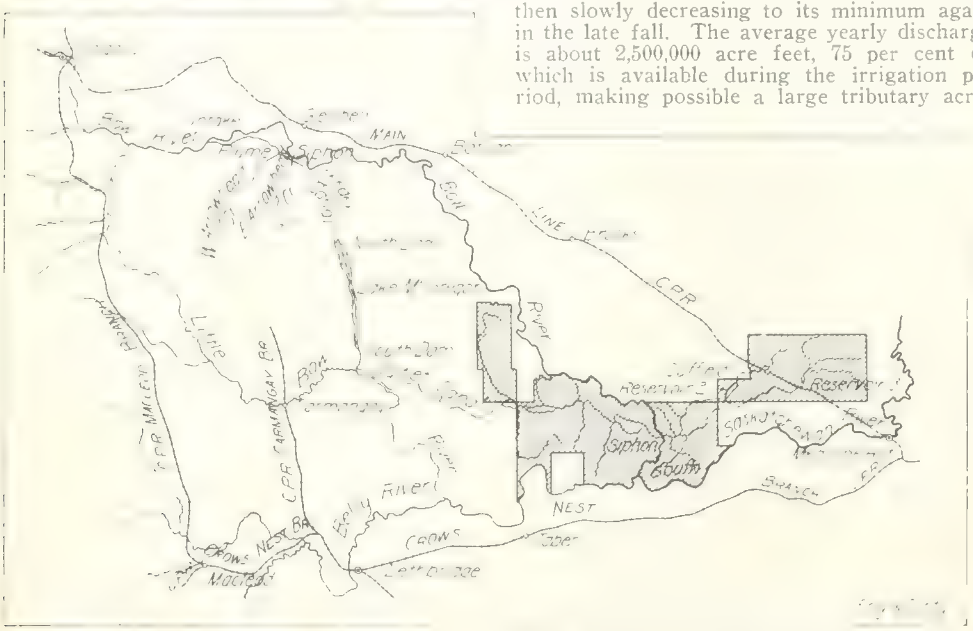


Fig. 1—Map Showing Irrigation System of the Southern Alberta Land Co.

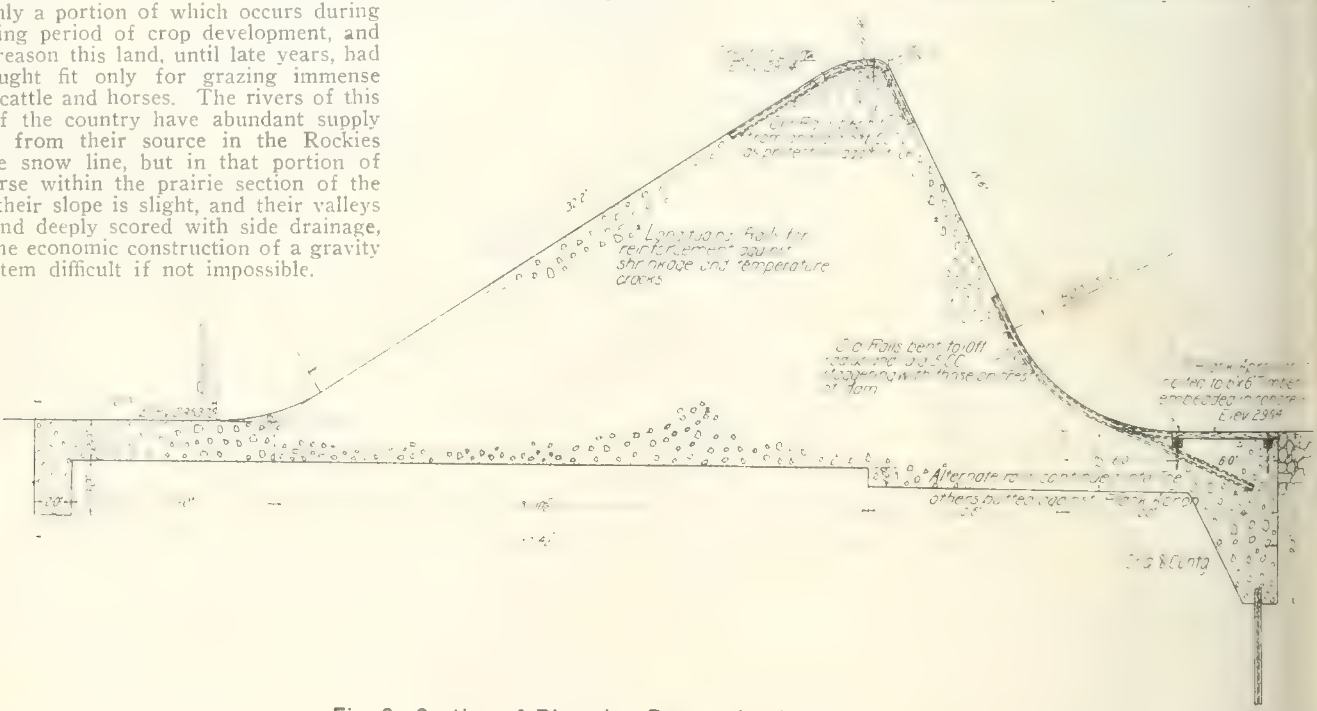

Longitudinal Rods for reinforcement against shrinkage and temperature cracks
C. C. Rails bent to 10 ft.
Elev 2954
60°
Alternate rails continue into the others butted against

Fig. 2—Section of Diversion Dam at Intake of Main Canal.

Owing to this obstacle to a gravity system, the original layout was for a pumping system taking water from the South Saskatchewan and irrigating the land on the east of the Bow River. This was abandoned on account of maintenance and operation charges, and the Bow River drainage was canvassed for a possible gravity location. The Bow River rises in two glacial lakes on the east slope of the Rockies, flows east and southerly, and at a point on the south boundary of the tract, joins with the Belly River to form the South Saskatchewan. Its glacial origin, combined with the influence of the lakes at its source, makes the discharge curve of this stream remarkably regular, rising from a minimum of 2,000 sec. ft. during the winter, to flood height of 50,000 sec. ft. sustained during June and July, and then slowly decreasing to its minimum again in the late fall. The average yearly discharge is about 2,500,000 acre feet, 75 per cent of which is available during the irrigation period, making possible a large tributary acreage. Only one other system of any size takes water from the Bow River, requiring a possible maximum of 1,200,000 acre feet, leaving therefore a comfortable margin for the 300,000 acres under this system.

TOPOGRAPHIC FEATURES.

The land to be irrigated lies on both sides of the Bow River, north of the Belly and Saskatchewan, and at an elevation of 250 ft. or more above them. East of the Bow the land slopes to the north and east, away from the steep banks of the Saskatchewan, while on the west side of the Bow it rises gradually to the foothills of the Rockies west of Calgary.

A suitable point for the canal i found about 45 miles southeast of C an elevation of 2,975. The Bow, at has a fall of 8 ft. to the mile, and is much shallower than in the lowe of the river. With a ruling grad in 5,000 the canal soon drew away river to the bench, following the eas the Blackfoot Indian Reserve from ward. About 50 miles east of the I the canal line turns southward int natural depression, glacial in origin long and from ½ to 2½ miles in wi bottom of this valley, nearly level f tire length, is 50 ft. below the canal at its northern end, and by the const a low dam at either end of this storage reservoir was obtained, of 36 feet capacity, the lower end of which 50 miles from the land to be watere

From the lower end of this res Lake McGregor, as it is called, the follows the slope of the valley for f then debouches into the valley of Bow River, a tributary of the Belly follows for ten miles, then emerges divide between the drainage of the Belly. This divide is a series of bro ing ridges interspersed with low sag are the determining points of the cation. The slope of the divide heavier than the ruling gradient of and it is necessary to dispose of 15 surplus grade. Nine drops will be co of which two, within the irrigable a be used to develop power for pumpi land otherwise inaccessible to a gravit

The irrigable area is split up by leys adding materially to the cost of ect. About 65 miles below Lake Mc low wide depression cuts through from the Bow to the Belly. The cana this valley about three miles south of per end at a point where it is 4,800 and 45 ft. below grade, hence its na Wide Valley. Twenty miles furt the canal the Bow River Valley is cross at this point the river is 200 ft. below grade. A wood stave pipe siphon will structed here, crossing the river prope pile and timber bridge 900 ft. long, whi serve also for a highway crossing.

DIVERSION DAM AND INTAKE.

The dam is in three sections; a concr version weir in the main channel, 530 ft.

art embankment 1,800 ft. long across son island; and a second weir, similar to rst nd 526 ft. long, across the minor [illegible] the main weir, thus acting as an [illegible] high water.

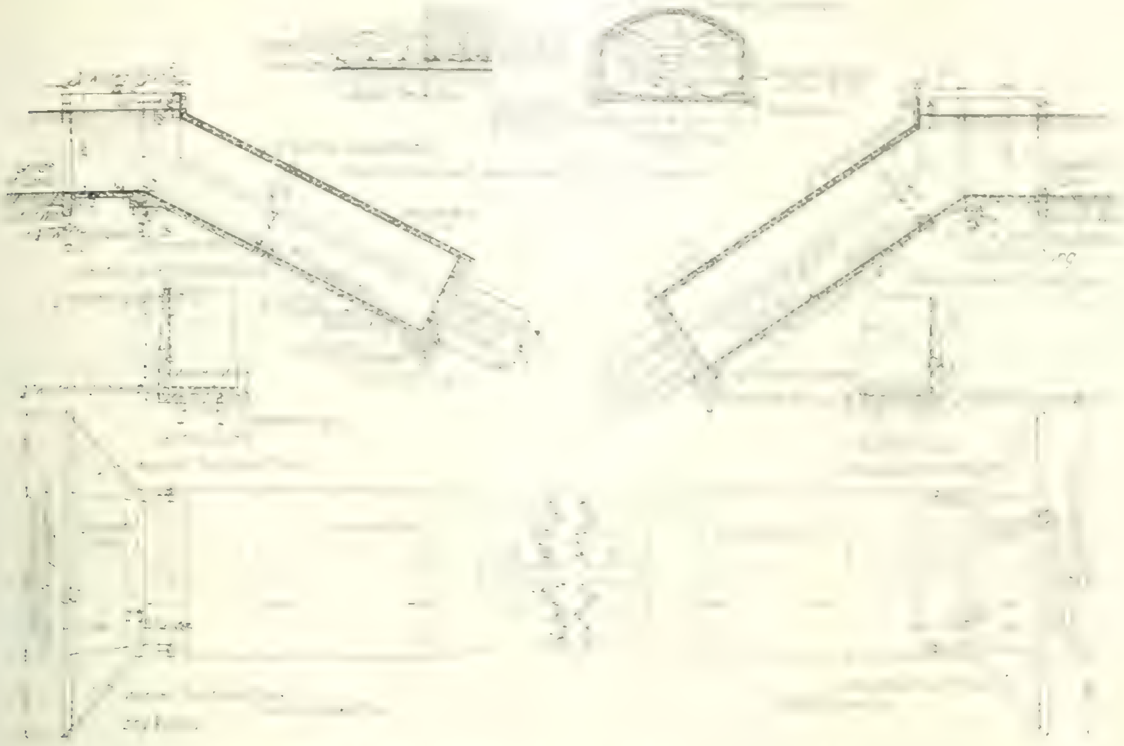


Fig. 3—Wood Stave Siphon Crossing East Arrowwood Creek.

th side, and built monolithic with ersion weir, are the intake gates g sluices. The intake gates, five in are Stoney sluices, 8x10 ft., set with 9 ft. below the crest of the main t they may discharge their full capacity to the canal even in the low stage ver. The scouring gates are similar n two in number, and set with their lower than the intake gates to carry s from the intake gates and if necesrain the pond back of the dam in low

oncrete dams are of gravity section, es of 2 to 1 upstream and ½ to 1 am, and rounded crest and cushion. tream and downstream toes are car- below the main foundations, and the tam toe is further safeguarded against ing by a cutoff of steel sheet piling refusal. Six strings of old rails d longitudinally through the dam and and toe are protected against ice rails imbedded in the surface on 5-ft. The concrete apron is overlaid with k driftbolted to timbers imbedded in rete, as a protection against ice im-

rth embankment on Johnson Island is h, with slopes 3 to 1 upstream, 2 to 1 am, and top width of 20 ft. The upope is riprapped with boulders grouted th concrete. The earth embankment, at the north end of the spill dam, top of the intake structure are all 10 the crest of the spill dam and 11 ft. at of the main diversion weir, providarge capacity of 110,000 sec. ft. As test flood recorded is 55,000 sec. ft. vides ample freeboard in the flood the river.

FEEDER CANAL.

the diversion dam to Lake McGregor, canal has a cross-sectional area of ft. and capacity of 1,035 sec. ft. The radient is 1 in 5,000, with additional all flume and siphon crossings. The miles is built along the foot of the nks, heavy excavation work, with but little classified material. In the fifth and sixth miles, in order to avoid returning to the steep cut banks, a section [illegible] ft. long is encountered, in which the cut runs from 40 to 64 ft. in depth. The excavation of the top of this cut was removed by teams working graders and wagons. The main part of the excavation was done, however, by two 70-ton Atlantic shovels and one 40-ton Marion, hauled in overland from the railroad at High River. Much loose rock, gumbo and water has been encountered, making excavation exceedingly difficult. To safeguard the canal section from sliding of the banks, it will be lined with concrete for 6,000 ft. The lining will consist of concrete side slabs, 8 ins. thick, held in place by cross struts, 20 ft. centers, at top and bottom of the slab.

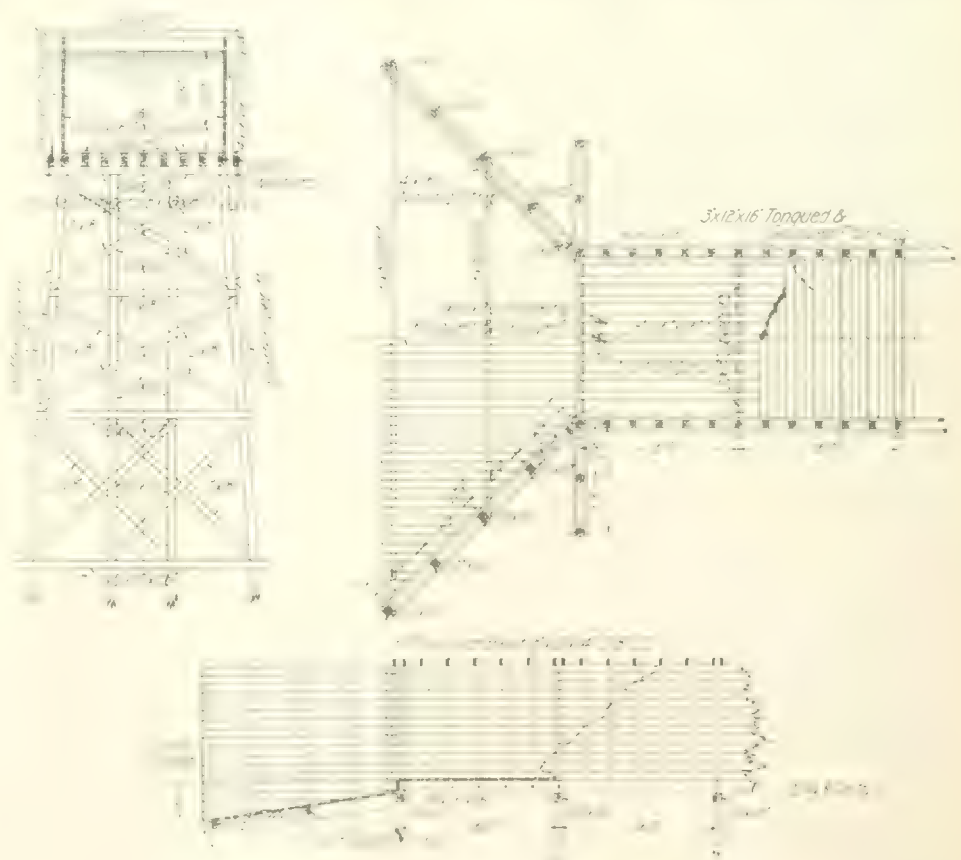


Fig. 4—Timber Flume Carrying Canal Across Coulees.

Below this cut little trouble was encountered except with side drainage. The smaller coulees were crossed by heavy fills, but the larger ones, six in number, required structures. West Arrowwood Creek, a small stream, dry part of the season, is crossed by a timber flume, 1,100 ft. long and 42 ft. in height to bed grade. The waterway is 16 ft. wide and 10 ft. deep, carried by 8x16 in. stringers on framed bents, 16 ft. centers. These in turn are erected on four wooden piles per bent. Bents are heavily cross-braced and alternate bents are towered to resist longitudinal stresses; 500,000 ft. B. M. of coast fir was required for this structure. In the twenty-first mile East Arrowwood Creek is crossed by a siphon, consisting of two 7.5 ft. wood stave pipes, 1,200 ft. long and under a maximum head of 135 ft. The intake and outlet are practically identical reinforced concrete structures, designed to increase and decrease the velocity of the water with the slightest possible loss of head. The sides of the valley are steep and of unstable material on account of which the footings of the concrete structures are carried to rock where possible and the pipes are carried up the sides of the valley on reinforced concrete cradles. The creek crossing proper is made by a framed structure set on concrete piers, carried to bed rock.

With a ruling gradient of 1 in 5,000, all side drainage is eliminated by the thirty-first mile and from this point to the lake the grade is increased, thereby reducing cost of canal excavation by reducing the section. Even with this expedient the lake is reached at an elevation well above the high water of 2,860 and in the last two miles of the canal a flight of drops will be built which can be eliminated if at any future date it seems necessary to increase the capacity of the lake.

LAKE McGREGOR.

The works necessary to convert Snake Valley, as it is locally called, into a storage reservoir, consist of earthen dams at either end; the North dam is 3,100 ft. long and 48 ft. in height, and the South dam is 1,900 ft. long and 46 ft. in height. These dams are 25 ft. wide on top, rise 10 ft. above high water level and have inner and outer slopes of 1½ to 1. The inner slopes are faced with riprap of boulders laid in concrete, which is well bonded into a heavy concrete footing, carried 6 ft. below the toe of the dam into the heavy clay of the foundations. At the South Dam are the controlling works for the outlet canal. These consist of two 5x10-ft. Stoney sluices set in a heavy reinforced concrete gate tower connecting to a segmental arched concrete outlet culvert, carrying water through the dam. Buttressed wing walls lead to and from the above structures, and are bonded thoroughly into the boulder riprap of the water face. The canal is also heavily riprapped for 250 ft. away from the outlet and concrete baffles are built into the floor of the outlet to reduce the velocity before entering the canal.

OUTLET CANAL.

The outlet canal follows the east side of Snake Valley for five miles, then turns sharply to the east, encountering the side walls of the valley of the Little Bow, upon whose steep side slopes it lies for eight miles. Within this section of the work much loose and solid rock was found making the location of a safe canal difficult and its construction costly in the extreme, one mile of this work having cost in the aggregate $120,000. To safeguard this section of the canal an automatic spillway is being built at mile six, so constructed that if the canal is overloaded at the lake, the excess will spill over at this point leaving the canal below with only its normal amount of water. At mile twelve a wasteway will be built to drain the canal in case of accident to the banks at any point below.

At mile 15 the canal turns away from the Little Bow and follows the north slope of the divide for 35 miles until it enters the Company land at mile 50. Between the Little Bow and Mile 39 there are seven drops. These water is passed through four trapezoidal weirs onto semi-circular concrete lips, which, breaking the force of the fall and reducing the thickness of the water sheet, discharge it quietly into the cushion below grade, whence it passes through baffles into the canal below. These drops are of 1,800 sec. ft. capacity and range from 8.7 to 15.8 ft. in height.

At mile 47 the first lateral takes 150 sec. ft. from the canal for the land in the southwest part of the tract and in the next three miles two laterals take out 300 sec. ft. for the block of land to the north and west, while between these headgates a second wasteway is being built to discharge into an old lakebed nearby.

MILE WIDE VALLEY FLUME.

From mile 50 to mile 64 the canal follows the south slope of the ridge which at this latter point flattens out and is broken by the wide shallow valley known as the Mile Wide Valley. The canal crosses this depression by a timber flume 4,800 ft. long and 45 ft. maximum height to bedgrade. The construction of this flume is similar to the West Arrowwood Flume, but the grade is heavier and the section smaller. The waterway is 16 ft. wide and 7.5 ft. deep, carried on 8x16-in. stringers, resting on framed bents at 20 ft. centers. Each bent is built on four concrete pedestals, 6 ft. in height, carried 4 ft. below ground surface to the solid gravel strata. The velocity in the canal above the flume is 2.9 ft. per second while the velocity in the flume itself will be 12.0 ft. per second. To increase the velocity to this figure will require 2.1 ft. velocity head, which will be allowed for in the entrance to the flume. To reduce this velocity at the downstream end will require the opposite action and this will be attained by aid of a check headgate at the east end of the flume.

BOW RIVER CROSSING.

For the next 15 miles, or until within four miles of the Bow River the canal follows the north slope of the divide, two drops being necessary to obtain supporting grade. These drops each 16 ft. in height, will be used to develop power which may be used for pumping water onto high land not available under the gravity system, or for any other industry which can use water power for six months in the year.

For three miles on each side of the river crossing the land is low, necessitating heavy double fills with flat slopes and easy curves. The yardage in these six miles is 800,000 cu. yds. which has been placed during the last season by 120 teams operating six graders and 50 wagons.

The crossing itself of the Bow V a wood stave siphon, consisting of pipe, 6,550 ft. long and under 180 ft. head. This will be laid in cut and the water edge, and will be carried river proper on a timber structure, pile bents 24 ft. apart, and protected action by breaker crib piers in the ri At the inlet and outlet ends, ther reinforced concrete structures to pr crease and reduce the velocity of t A blowoff will be built into the p lowest point to drain and clean the not in use.

EASTERN EXTENSION.

East of this crossing the main cana the ridge in a northeasterly directio mile 20 empties into Reservoir No. trolling and storage basin of 36,000 capacity. From this reservoir t branches, following both sides of a b ley extending eastward to the Sask River, and watering 90 per cent of between the two branches.

PROGRESS OF WORK.

The diversion dams, earth embank intake structure have been completed of $150,000 and water has been runn the dam since May, 1911. The feed involving 3,500,000 cu. yds. of exca practically complete except for the the Big Cut and the drops at Lake M The two dams at Lake McGregor h placed and riprapped, and the outlet completed. The outlet canal, 4,300,00 of excavation work, is 90 per cent c as far as the excavation is concerned structures will be built in the spring The Mile Wide Valley Flume and River Siphon are already under cons East of the Bow River the canal is c to Reservoir No. 2 and a large par lateral construction from this point is now under construction. The sys be completed in the next season an will be turned into the lake early in th

The intake works, East and West wood Crossings, flumes, spillways, Feeder Canal, and outlet from La Gregor were built by the Carter-Hal ger Co., Ltd., of Winnipeg. The earth the canals and dams is being done McArthur Co., Ltd., also of Winnip riprapping of the dams at Lake M the lining of the big cut, and the Mi Valley Flume are being built by force account under the direction of gineering department.

PERSONNEL.

Mr. James D. McGregor is Manag rector of the Southern Alberta Land Mr. Arthur M. Grace, M. Am. Soc. Chief Engineer, and has had charge preliminary and final surveys, and c tion of all the work since its begin 1906. The Upper Division, including from the intake to the South Dam, L Gregor, has been under the direct sup of Mr. Frank A. Wallace, as Princi sistant Engineer; and the writer, as Assistant Engineer, has had supervisio Lower Division, from the South Dam east limit of the company tract.

BRIDGES AND BUILDINGS SECTIO

The Reinforced Concrete Arch Bridge of 328-ft. Clear Span Over the River Tiber at Rome.

(STAFF ARTICLE.)

The longest and boldest reinforced concrete arch in the world has been completed across the River Tiber at Rome. This arch has a clear span of 328 ft. and a rise of 32.8 ft. It is not merely the long span and flat curve of the arch, however, which make the structure a bold one; the sections taking the thrust are exceedingly light and the abutments are carried on a construction which virtually amounts to a floating foundation. Complete details of the arch are not available but the last numbers of *Annales des Ponts et Chaussées* contains a general description which gives the following data.

The bridge over the Tiber, known as the Ponte del Risorgimento, was initiated under exceptional circumstances. To connect the two parts of the Exposition of 1911, located on opposite banks of the river, a temporary wooden bridge had been planned. The location of this structure was practically on the site where the new plan for the city of Rome called for a permanent masonry bridge. The municipal authorities, therefore, advanced a proposition to co-operate with the ex officials and substitute for the temporar a permanent structure of reinforced c After a consideration of several pl offer was made by the representative of the firm of Hennebique to construc gle span arch in time for the use of th sition for the sum of 1,250,000 lire, abo 000. This proposition was accepted 1909.

The bridge was designed by the e of the firm of Hennebique. As shown general view, Fig. 1, it consists of ring, carrying solid spandrel walls and zontal roadway platform flanked by ab

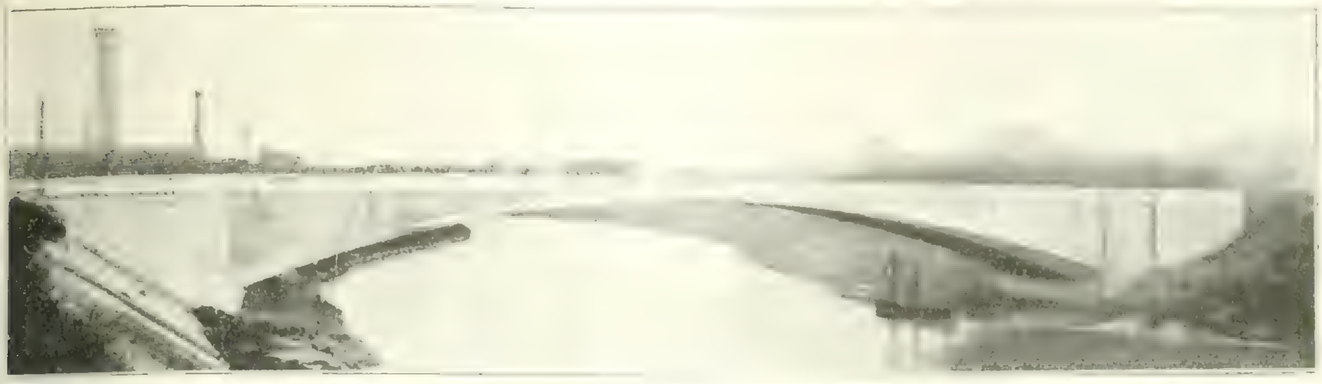


Fig. 1—The 328-ft. Span Reinforced Concrete Arch Bridge Over the River Tiber at Rome

tly solid masonry. As a matter of hown by the drawings of Fig. 2, the on is cellular throughout, the abut- a well as the arch span being made eries of longitudinal and transverse anged as is described further on. h of the bridge over all is 20 m. er 19.2 m. (63 ft.) between parapet up of a 13-m. (42.64 ft.) roadway 3.1-m. (10.17-ft.) sidewalks. The carries two electric railway tracks r the roadway platform are various her conduits.

gives the general structural details nd abutments. The arch ring is a ple, curved to a circular arc. It is 20 ins.) thick at the crown, and 50 cm. thick at the springing line where ged along the edge into a triangular ansverse beam, bearing against lon- diaphragms resting on a slab floor a slab rear wall. There are seven phragms and the arch ring carries ndrel walls which continue the dia- over the arch from abutment to abut- ore correctly, probably, the abutment ns are continuations of the spandrel he spandrel walls are all 20 cm. s.) thick and they are braced to- ansversely at intervals by thin ver- s as indicated by Fig. 2. The span- transverse walls carry a slab and tform which forms the bridge floor. or, walls and arch ring as described, einforced concrete and are further- molded together into a virtually c structure. From this statement arent that the arch thrust has a re- ction not merely of that of the thin , but in addition of some portion of drel walls. Virtually the structure by the end retaining walls, the outer walls, the arch ring and the roadway and subdivided by interior partitions, lar flat topped arch. This flat topped s at the ends on horizontal slabs sup- piles and abuts by means of the end walls against cellular abutments.

llular abutment construction is indi- Fig. 2. Each abutment consists of gitudinal vertical walls in line with rel walls of the arch and of a num- ansverse vertical walls, the two sets dividing it into rectangular compart- This cellular structure has no floor; he walls at each intersection rest on te pile or pier. Similar piles support footings of the arch ends. One abut- nstruction only is shown by Fig. 2; site abutment is similar except that footing is extended in front of the face to form an apron terminating -off wall of vertical concrete sheet This protection was deemed unneces- the side illustrated. Like the arch e abutment walls are reinforced.

f the notable features of the bridge undations. Borings on the two banks of the [illegible] sandy earth [illegible] less stable as the depth increased. The French article describes the lower layers as being of a *fluidité fangeuse,* which may be Englished in a fashion as "muddy fluidness." As a foundation for a 325-ft. arch bridge such material evidently offers little comfort to the designer and we believe that engineers will agree with us that its use as a foundation by the French designers of the arch was the boldest feature of their very bold work.

The system of construction adopted was one considerably used in France, known as the compressol system. Briefly it consists of forming holes in the soil by repeatedly dropping heavy pointed weights (conical or projectile shaped) until the required depth is reached. These holes are then filled gradually with concrete which is compacted by repeated drops of a heavy pear-shaped weight. The theory of the construction is not only that concrete piles or piers are formed but that the forming of the holes and the compacting of the concrete by heavy weights dropped from a height, solidifies the surrounding soil and increases greatly its bearing power. There were used for each abutment 96 piles, 72 of which were bearing piles under the walls of the abutment and 24 were intermediate piles employed solely to compact the soil. Altogether the volume of material forced into the soil by the means described was for the two abutment areas, 1,717 cubic meters. As the average depth to which the piles penetrated was 9 m. (29½ ft.), the volume of foundation compacted was (20x20x9m.) 2 = 10,800 cu. m., so that the additional material forced into the soil was 0.16 cu. m. per cubic meter.

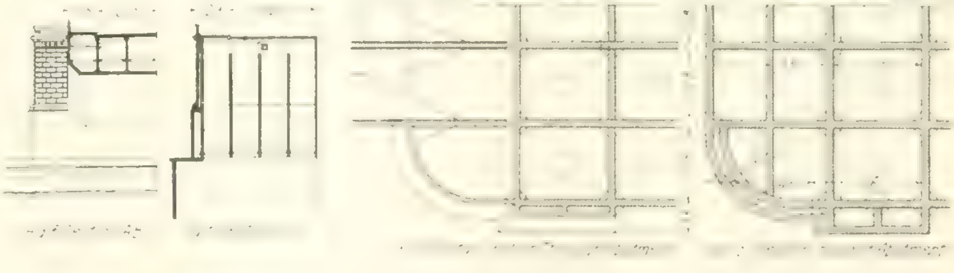


Fig. 2—General Structural Details of 328-ft. Reinforced Concrete Arch.

The concrete employed for the work was made of washed and screened gravel and both natural Portland cement and true Portland cement. The wall forms were made in panels and used over and over. The arch center was of special construction and will be described more in detail.

High water periods being frequent and severe in the Tiber, the falsework for the center had to be made stable against flood and drift. Provisions for navigation had also to be made. Eight pile piers were constructed at intervals across the river. Each pier consisted of a double row of eight piles capped with a reinforced concrete girder. From each girder there were erected eight concrete posts. These posts were braced together and from bent to bent by reinforced concrete struts. On top of each row of posts was set a wooden cup on wedges. These caps carried the joists and lagging boards. The choice of the construction described was determined first by the desire for a strong and rigid center and second by the fact that it could be constructed by the regular concrete workers. Its security against shock was demonstrated during construction by the collision of a vessel with one of the pile piers. This collision broke off the two end pairs of piles and left the concrete cap projecting cantilever-like. No deflection of the center resulted.

The record of progress of construction was in outline as follows: Work was begun driving sheet piling for the cut-off wall mentioned above on Dec. 18, 1909, and completed March 4, 1910. The construction of the centers followed and was completed in September, 1910. Meanwhile the compressol pile driving was begun and finished as shown at the left.

Construction of abutments began July 27, 1910, and of the arch Oct. 9, 1910; concreting proceeded continuously and was completed Feb. 25, 1911. The centers were struck beginning April 1 and ending April 11, 1911. The testing was begun April 17, 1911. From the date of beginning work to that of com-

	Begun.	Completed.
utment:		
rting piles	Jan. 2, 1910	June 8, 1910
acting piles	Sept. 20, 1910.	Oct. 11, 1910
tment:		
rting piles	[illegible]	[illegible]
pacting piles	Oct. 20, 1910	Dec. 17, 1910

pletion, the time elapsed was 15 [illegible] actual working time was 180 [illegible] 160 days were rain [illegible] and during [illegible] was frequently retarded by frost and floods.

An Investigation of Concrete Flat Floor Slabs Using Flexible Rubber Models.

The rapid introduction and development of flat slab floors of reinforced concrete is sufficient evidence of the great importance of this type of construction. In fact, the demands of owners and builders for flat slabs are so insistant, that, in spite of the lack of reliable methods of design, many acres of such floors are built every year. The insistence of this demand has led many engineers to advance theories of the structural action of flat slabs, and these theories yield perhaps the most striking contrasts and disagreements to be found in modern engineering practice. The reason for this is largely because the flat slab is an extreme example of redundant structure, and mathematical analyses of it have so far been based upon certain arbitrary assumptions which vary in the different analyses. The differences in these assumptions are so great that the practical applications of the theories founded upon them to flat slabs of reinforced concrete yield results varying by about 400 per cent. This variation leads one to class the flat slab as beyond the range of pure analysis and one must look to experimental engineering for a satisfactory solution of the problem. In a paper read at the recent convention of the National Association of Cement Users, Mr. Frank J. Trelease describes a study conducted under the direction of Mr. A. E. Lindau, Chief Engineer, Corrugated Bar Co., Buffalo, N. Y., to determine the nature and distribution of stresses in flat floor slabs. This paper follows:

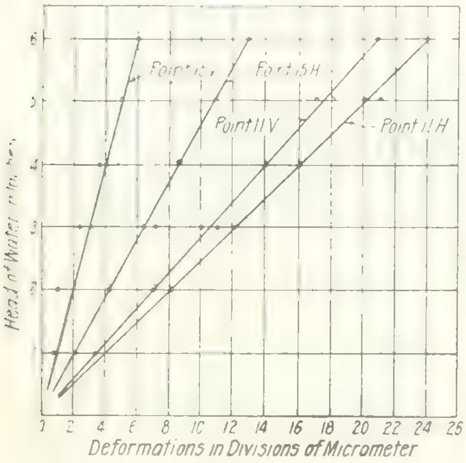


Fig. 1.

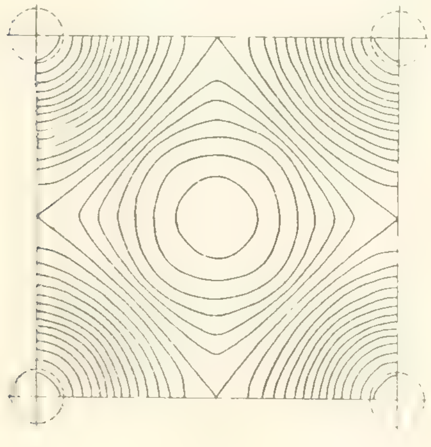


Fig. 2.

The usual load tests of completed structures may be dismissed at once as being entirely inadequate as a basis of design. In these tests as usually made, but one panel of a structure is loaded which does not give maximum stress conditions in a flat slab floor. Even if several panels be loaded and the test carried to destruction, it will at best only roughly indicate the stresses at the weakest point of the structure under the scheme of loading employed and cannot give any information as to the economy of the design.

A very recent and more adequate form of test on completed structures is that in which several panels of a building are loaded, not necessarily to destruction, and in which the actual elastic deformations of both steel and concrete are measured by extensometers. The results obtained in such a test would form a satisfactory basis for the design of similar structures if one could eliminate from the results the effects of tension in the concrete, arch action, annular slab action, and many other indeterminate factors, which enter largely into all tests of reinforced concrete. These effects are so indeterminate that they cannot be satisfactorily eliminated, thus rendering results of tests on completed structures a more or less unsatisfactory basis of design. The average engineer hesitates to count on these factors in designing, and even had he no personal objections to their use, none of the building laws or regulations will permit of any allowances being made for them.

It would seem then that for a satisfactory solution of the problem we must obtain an empirical analysis of the structural action of flat plates derived from experiments on plates of homogeneous material. Such an analysis could be then used in the design of flat slabs of reinforced concrete, using any desired combination of unit stresses and making such allowances for tension in the concrete, etc., that personal judgment or various building regulations might dictate.

A very interesting and exceedingly simple little experiment was made on a sheet of heavy cardboard fastened over twelve spools representing columns. By pressing the fingers on this little model at various points, much was learned as to the general action of flat plates. For instance, one could press upon the center of several panels and note that the surface of the model was convex upwards at right angles to the lines joining the columns and forming the sides of the panels, showing that tension in the top face existed at that point, although none of the systems of reinforcement then in use had any steel to resist these stresses.

The work most productive of results was a series of experiments on rubber models of flat slab floors. Rubber was chosen for the models as best fulfilling the requirements of reasonable homogeneity, low modulus of elasticity, and the ease with which all its physical properties could be determined in the laboratory.

A sheet of pure gum rubber was obtained and fixed on an air-tight box containing the proper columns to divide it into nine panels each 8 ins. square. The columns were 1.25 ins. in diameter. Load was applied by exhausting the air from the box with a water jet aspirator, and measured by a simple U-tube manometer.

FIRST SERIES.

In the first series of experiments the rubber plate used was 5/16 in. thick. At first the scope of this series was limited to the measurement of the shape of the elastic surface of the plate under stress. With this end in view, deflection readings were taken at numerous points in the various panels. In some cases these were taken at points only one-twentieth of the span apart. The values of these readings were then averaged, grouping those which through symmetry should be alike, and the results plotted. Equideflection lines were then drawn, giving contour maps of the surface.

Many interesting conclusions can be drawn from the deflection maps. They show at once the general nature and intensity of the stresses existing in the plate. They show beyond a doubt that tension exis upper face of the slab at right ang lines joining the columns and fo sides of the panel, being a maxim columns and decreasing to the mi the mid-point, although even this value of the tension in the top fa is approximately equal to the tension i the b tom face at the center of the panel Tensi in the top surface at the edge of

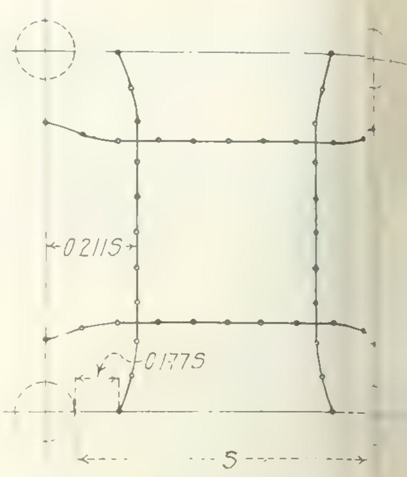


Fig. 3.

has never been provided for in the ing of flat slabs although the need been clearly pointed out time and ag formation of cracks in the concret cracks, which run from column t along the sides of the panel, have nearly every multiple panel load-test inforced concrete flat slab which made, and have even formed in sev under their dead weight only. It was the radii of curvature of the elasti could be accurately measured and th moments deduced from them. It w however, that results so obtained indefinite to be considered reliable.

It was evident that to obtain ex mation as to the distribution and of stresses existing in the plate it necessary to measure the actual e formation of the material caused stresses. This was attempted in ma by measuring distortion of squares the slab, by measuring cracks forme ter paris coatings and lines, and b forms of extensometers. After try devices it was decided to use a m fitted with an ocular micrometer and ure with it the deformations occurri gage length 0.5 in. long. The o crometer is a disc of glass, engrav fine scale, which is inserted in the The disc lies in the plane of t formed so that the engraved lines be upon the image itself, and its le be easily read. The absolute valu division of the scale depends upon t

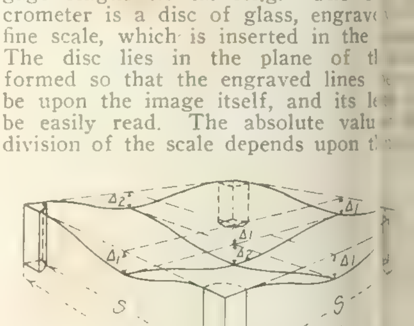


Fig. 4.

scope used, and was approximately in these experiments. The total about 1 40 in.

Several devices were tried for bri deformations occurring over the ga into the field of the micrometer. Af heavy tin foil was fastened at each he gage length by passing a fine ough it into the rubber. The points of these strips nearly touched at th

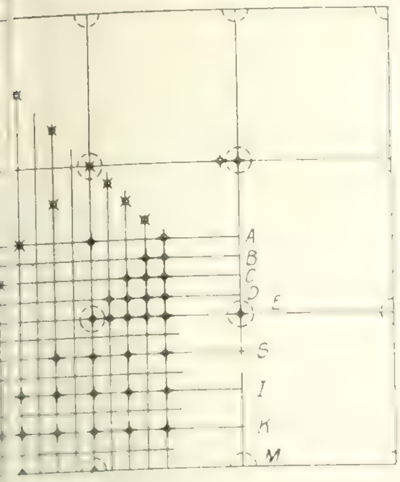


Fig. 5.

the gage length and the distance e them was measured under no load, en under the various loads employed. arrangement of tin foil strips was not ory, as readings taken with it were istent with each other, caused prob- slight play of the strips around the perhaps by the strips themselves the gage length shortened. y attempts, the following method l and found entirely satisfactory: e of very fine needle was placed the rubber at one end of the and at the other end was placed, piece of needle with the ex- d ground to a triangular shape and hed. A small strip of brass was a knife edge at one end, and at small conical depression was . The point of the first needle entered ression, and the knife edge was very the triangular end of the other needle. ance from the end of the strip to one

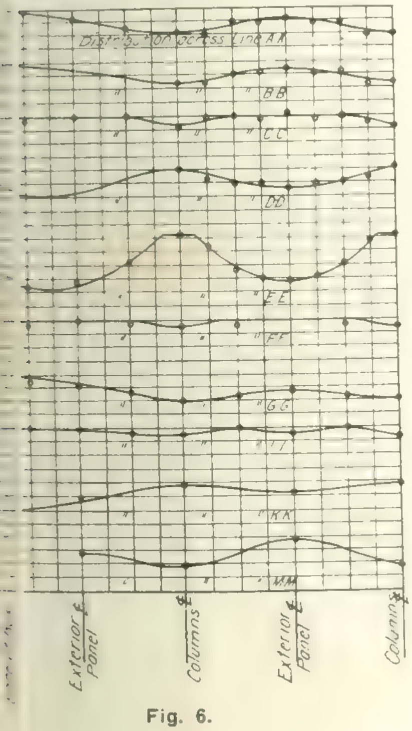


Fig. 6.

f the triangle was read very easily, arrangement gave perfect satisfaction. is first series, these extensometers were d on lines radiating from the columns, readings both along the lines and per- lar to them were obtained. Full results of these readings are not given, because it was found that the deformation at a given point increased more rapidly than the loads indicating catenary action or pure tension throughout the cross section of the plate. If such action existed, the tensile deformation read in the top fibers of the plate would be higher than the true values caused by bending, [illegible] formation of the top fibers would be less than they should be. To test for this, short columns were clamped on the top of the slab directly over these on the underside and the load reversed. This method of load reversal was too tedious to be adopted, and it was decided to use a thicker plate in the next series of experiments. Indeed the results obtained in the first series of experiments have been discarded in favor of those in the second series, and the first series has been regarded as merely preliminary and has served its purpose in enabling the many mechanical difficulties to be overcome, and in indicating many points to be covered.

In the second series of tests the apparatus used was the same as that employed in the first series, except that the rubber plate was 0.5 in. thick. This greater thickness was used because it was thought that the effect of catenary action would be less on a heavy plate than on the lighter one used in the first series. The correctness of this assumption was later proved by a series of readings of deformations at various points under different loads the equivalent to from 1 to 6 ins. of water which showed proportionality of deformation to load. The results of these readings are plotted in Fig. 1. The lack of catenary action was also confirmed by reversing the load and obtaining curves identical to those obtained under direct load.

Deflection readings were taken at points over the interior panel spaced one-tenth of the span apart. Figure 2 is a plan of the interior panel upon which have been plotted contour lines representing elastic deflections of 0.1 in. caused by a load equivalent to 5 ins. of water. Sections of the surface so defined were taken parallel to the sides of the panel, and the points of inflection plotted in Fig. 3. The lines joining these are lines of inflection for imaginary beams or strips parallel to the sides of the panel. These lines agree very well with the results obtained later from deformation readings.

Figure 4 is an exaggerated sketch of the elastic surface upon which have been marked coefficients for deflection. To apply these to flat slab floors, assume a strip of unit width along the side of the panel, and another along the center line of the panel at right angles to the first. Knowing the total load per square foot on the panel, as well as the effective depth and area of steel at the center of each strip, it is an easy matter to obtain the deflections. Instead of working out the values of the moment of inertia for these strips, one may follow the method described by Mr. Eli White in the "Engineering Record, Nov. 9, 1907."

The results of the first series of tests indicated that tensile reinforcement would have to be provided in the top of the slab at right angles to the lines forming the sides of the panel, and it was decided that a two-way system of reinforcement would be most adequate, both in providing this steel and in taking care of the stresses existing in other parts of the construction, and consequently the arrangement of the extensometers was as shown in Fig. 5. It will be seen from this figure that the deformations were read parallel to each side of the panel at points spaced one-eighth of the span apart, and so distributed that deformations in other portions of the plate were by the symmetry of the construction obtained from readings of these.

It was found that a load equivalent to 5 ins. of water gave deformations large enough to be easily read, and this load was therefore adopted. The extensometers at all points were read under no load, and again under load, the differences giving elastic deformations caused by the load. The load was applied and released time and again, as many as forty readings being taken on some of the critical points by each of two observers. The readings obtained at any given point agreed with one another to within a very few divisions of the micrometer. It will be seen upon inspection of Fig. 5 that two sets of curves may be plotted from these readings. One set will show moment diagrams for imaginary strips, the axes of which lie along the zero lines of the curves. Curves of the other set show the distribution of moment among various strips of this kind. Since a two-way system of reinforcement was to be used, it was decided to design each set of bars independently. For square panels the reinforcement would, of course, be the same in each direction. Figure 7 shows the moment curves for strips parallel to one side of the panels, while Fig. 6 shows distribution curves for these same strips. These two sets of curves can be combined to form a surface showing both moments and distribution for one set of strips.

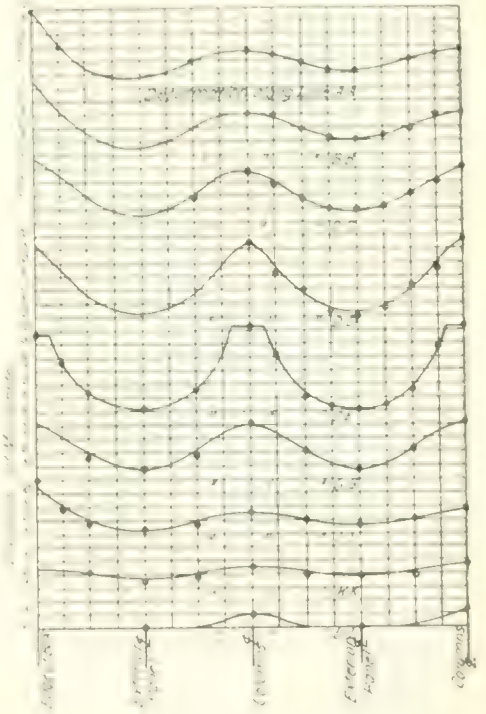


Fig. 7.

Figure 8 is a sketch showing the surface for the interior panel. In this figure the ordinates from the plane *A-B-C* to the surface are proportional to the deformations of the top fibre of the plate parallel to side *B-C* at the point at which the ordinate intersects the surface. Sections parallel to *B-C* will be the moment diagrams similar to those in Fig. 7, and sections parallel to *A-B* will be distribution curves similar to those in Fig. 6.

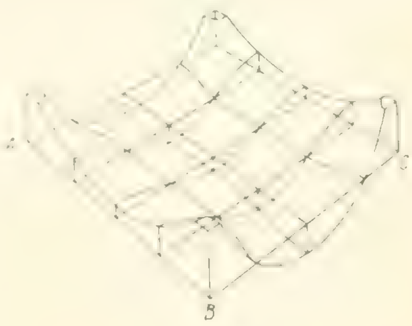


Fig. 8.

In Figs. 6 and 7 the ordinates to the curves are shown in terms of divisions of the micrometer. In order to co-ordinate divisions of the micrometer with bending moment, a strip of the rubber was cut from the plate, and the stress strain diagram shown in Fig. 9 obtained. Both the axial and lateral deformation of the strip were measured, from

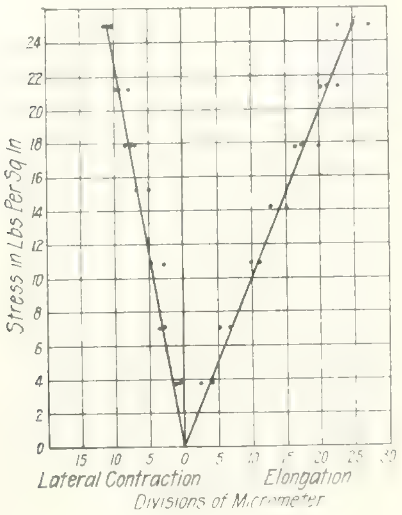


Fig. 9.

which the modulus of elasticity was found to be about 1,000 and Poisson's ratio about 0.44, one division of the micrometer showing a unit elongation of 0.001.

The value of one division of the micrometer in terms of bending moment was, however, obtained directly in the following manner: A strip of rubber cut from the plate was supported over two knife edges, and loaded as shown in Fig. 10. An extensometer exactly like those used on the plate was placed on top of the strip between the supports. Known weights were applied, and the accompanying deformations read. Figure 10 shows deformations so obtained, plotted against bending moments in inch pounds per inch width of strip. From this curve the moment equivalent of any number of divisions of the micrometer can be obtained. The unit load on the panel being known, together with the span, what might be termed the "gross bending moment" or $M = wS^2$ may be obtained. In this case the clear span

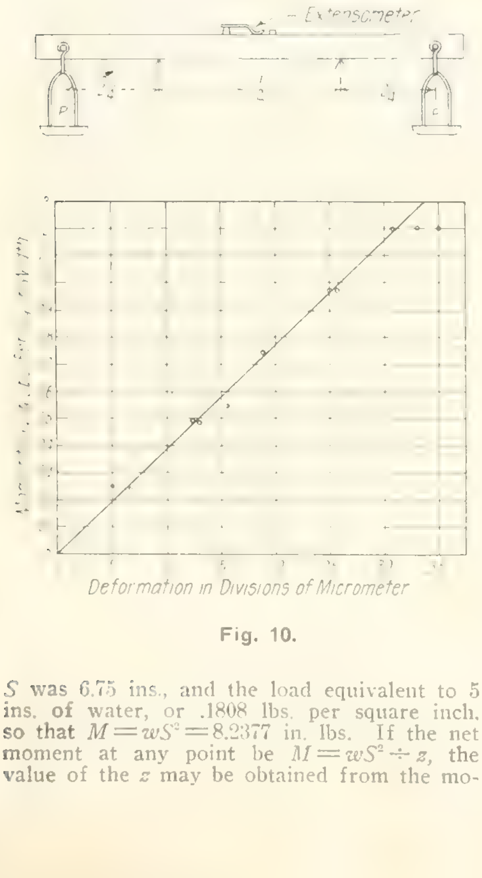


Fig. 10.

S was 6.75 ins., and the load equivalent to 5 ins. of water, or .1808 lbs. per square inch, so that $M = wS^2 = 8.2377$ in. lbs. If the net moment at any point be $M = wS^2 \div z$, the value of the z may be obtained from the moment curves in Fig. 7, and the calibration curve in Fig. 10. With S equal to the clear span from edge to edge of column heads, $z = 215 \div D$, where D is the ordinate to the moment curves in divisions of the micrometer. On Fig. 11 the moment expressions obtained in the above manner have been marked at the critical points.

Having now obtained our empirical analysis of the homogeneous plate we can proceed to its application to flat slabs of reinforced concrete. We may do so without hesitation because the whole history of the development of reinforced concrete has been made upon just such lines. We find that once we had solved the problem of internal stress, distribution in a concrete beam, we could safely use the equations for external moments which we had used for homogeneous beams and so on.

Here in our empirical analysis we have measured the components in two directions of the stresses existing in a homogeneous plate and shall supply steel in our concrete flat slab to resist these components where they show tensile stresses. In laying out the reinforcement a radical departure will be made from the old diagonal, or four-way, system, and the simpler and more adequate two-way system will be employed.

This two-way system of reinforcement has some advantages, one of which is that by using it, tensile steel is placed on top of the slab between the columns, which tends to prevent the formation of cracks extending from column to column, and stiffen the whole structure, giving all the advantages of continuous construction.

Another point in favor of the two-way system is that by its use the tensile steel over the columns is in but two layers and hence the effective depth at this critical point is greater than would be possible with systems in which four or more layers are used.

The moment factors used are based on the results of the experiments previously described. The distribution of these is shown in Fig. 12. To avoid confusion in the drawing, the moments for one set of reinforcement only are shown, those in the other direction being the same but turned through 90°. The numbers in the circles on the diagram are moment coefficients entering into the denominator of the moment equation, thus the moment at the center of the panel in the middle band is $M = wS^2 \div 40$, where w is the total live and dead load per square foot, S is the span in the feet and the 40 is the moment factor shown in the circle at this point. M is the moment in foot pounds per foot and is positive, requiring steel in the bottom of the slab as indicated by the heavy *dashed* arrow showing the direction of the steel. The moments at other critical points in the panel are obtained in the same way.

The distribution of these moments across the panel, that is, the widths of the strips or bands to which they apply, is shown by the sections at the bottom of Fig. 12, section X-X being at the edge of the slab. The heavy stepped line shows the practical distribution while the dashed curved line shows the actual distribution found in the tests.

The general method of procedure in designing a concrete flat slab in accordance with this method is to first find the areas of steel required in the different bands at the center line of the panel. These areas are supplied by rods of the proper size and spacing, every other one of which is bent up in the top at about the quarter point and extends over into the adjacent panels while the remainder are straight and extend about six inches past the edge of the panel. This arrangement gives the necessary amounts of steel, in both the top and bottom of the slab, except in the areas over the columns where the necessary extra steel in the top is supplied in the form of short straight bars, remembering that at these points the effective depth of the slab is increased. To avoid bunching the steel in the top of slab, a bent bar in one panel should be in line with a straight bar fr th panel.

The line of inflection may be fely taken at the fifth point of the clear sp or at the quarter point of the center to cer spacing of the columns, using the high val

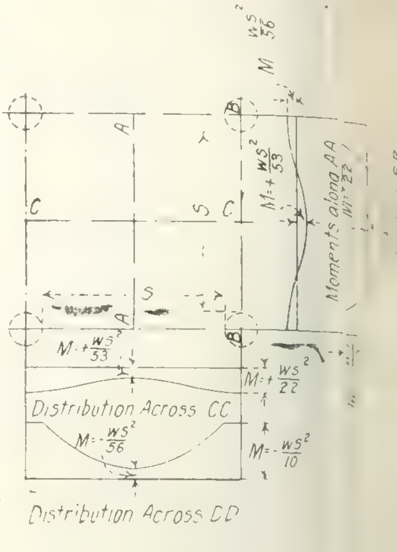


Fig. 11.

every case. The point of bend the b steel, and also the length of the tra sh rods in the top will be goverr by dimension.

In the end panels the area of tl steel pendicular to the wall should b increa by the usual 20 per cent. The siest to do this is to use round bars in e inte panels and square bars of the sa nom size and spacing in the end pan. In der to facilitate the placing of t steel will be found necessary to provid ght

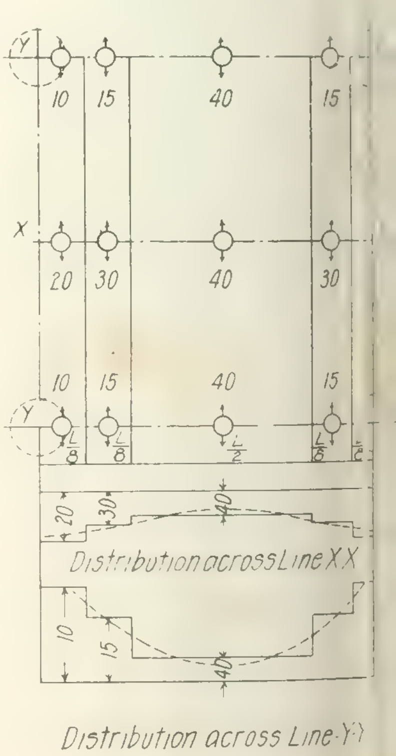


Fig. 12.

preferably ⅜-in. round, along the the panels so that they may be use port the bent bars. Of course, the bars may be figured as effective over the top of the column, and th some of the short bars used there

NEWS SECTION

Eitorial Comment Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

[illegible] Comment—The [illegible] Road Improvement [illegible] Lawyer-Survey[illegible] [illegible]

Doings the eek.

A [illegible] new railroad [illegible] work has been put [illegible] contract since our last issue, but bids on a number of the larger contracts are still in the hands of the railroad [illegible] The Erie R. R., at last advices, had [illegible]rded the contract for the construction [illegible] track between Meadville and Con[illegible] Meadville division. It is probable, [illegible], that this work will be placed this [illegible] No word has been received regarding [illegible]hern Pacific's Fernley & Lassen R. R. [illegible]a, but it is likely that these con[illegible]e let by the time this issue appears.

[illegible]y of railroad contracts let recently [illegible]g may be noted: Rinehart & Den[illegible]arlottesville, Va., for seven miles [illegible]rack work for the Richmond Belt [illegible] Atlantic Coast Line Ry., the con[illegible]sting of about 350,000 cu. yds. of [illegible],000 cu. yds. of concrete, laying [illegible] Winston Bros., Globe Bldg., Min[illegible]inn., for 60 miles of second track [illegible]e Chicago, St. Paul, Minneapolis [illegible]a Ry. between Truax and Northline, [illegible]illiam Oseman, Kinistino, Sask., for [illegible]truction of the first 50 mile section [illegible]dian Northern line from Prince [illegible]k., toward Hudson Bay; O'Rourke [illegible]ring Construction Co., 345 5th Ave., [illegible]rk City, at $913,352 for constructing [illegible] Route 5, of the Lexington Ave. Rapid [illegible] R. [illegible] New York City; [illegible] Yonkers, N. Y., at $49,559 for the [illegible] of an electric railway at the [illegible] State Hospital, Yorktown, N. Y.; [illegible] & Edinger, 109 E. 6th St., Los Ange[illegible] for constructing 175 miles of railroad [illegible]n Antonio for the San Antonio, Rock[illegible] Mexican R. R., a new line which is [illegible]anced by English capital; Clifton, Ap[illegible] [illegible] Bldg., Spokane, [illegible] and G. O. Foss & Co., Spokane, Wash., [illegible] sub-contracts for work on the We[illegible]th branch of the Great Northern [illegible]es Smith, Perkiomenville, Pa., for [illegible]r a trolley line from Skippach to [illegible]h, Pa.; G. W. Thompson, St. Louis, [illegible]r laying steel on main line of the In[illegible]nal & Great Northern R. R., between [illegible]orth and Houston.

[illegible] are now being asked on a number of [illegible] contracts. New work [illegible] this issue includes the construction [illegible]s of gravel and sand clay road for [illegible] County, Ala., and 40 to 48 miles of [illegible]nt rock roads and bridges for Pre[illegible] of Lamar County, Tex. Bids on the [illegible] County work are to be opened on May [illegible]ids on the Texas work will be opened [illegible]

[illegible] disastrous floods [illegible] the Mississippi [illegible] will make plenty of work for levee [illegible]tors. Press dispatches of Sunday [illegible]hat as a result of the two weeks flood, [illegible]uare miles of country are inundated, and [illegible]as been a property loss of $10,000,000. [illegible]od has caused great damage to existing [illegible] many of which will require rebuilding. [illegible] way of levee work now open for bids [illegible] the one of the Caddo Levee District. This work calls for about 750,000 cu. yds. of levee work in Caddo Parish, La. Bids on it will be opened April 24.

A number of good sized bridge contracts are now open for bids. Among the larger mentioned in this issue are the following: Construction of the foundations for two river piers for a county bridge for Cuyahoga County, Ohio, the estimated cost of the work being $300,000; construction of the steel superstructure of a highway bridge 889 ft. long over the Connecticut River at East Haddam, Conn., for the state of Connecticut; construction of a bridge for the city of Tampa, Fla., consisting of two 82 ft. reinforced concrete arch spans, and a one deck Scherzer rolling lift draw of two wings of 93 ft. span; construction of the sub and superstructure of a movable bridge over the Christiana River at 3rd St., Wilmington, Del.

Bids on a good sized government job were opened last week by the U. S. Engineer at Detroit, Mich. The work called for the construction of the east approach canal at Sault Ste Marie, Mich. The Great Lakes Dredge & Dock Co., Chicago, Ill., at $395,750, was the low bidder.

The Rhode Island State Harbor Improvement Commission has requested the Governor to submit to the people a $1,000,000 bond proposition, the money to be expended largely for a pier for the use of the Grand Trunk R. R. In addition to the sum proposed by the state, $300,000 is requested for the new municipal docks at Providence, the original appropriation of $450,000 being insufficient. About 3,000 lin. ft. of wharf is contemplated.

Road Improvement Plan.

The present agitation for the improvement of public roads has been responsible for much oratory and a tremendous amount of planning and figuring. Many of the plans advanced by public organizations have been impractical, others have been but temporary expedients, while still others will, or have already, resulted in the actual betterment of the roads. One of the most practical plans advanced recently for providing funds for highway construction is that of a highway association of Richmond, Va. This association is working to provide effective means for building a permanent highway between Richmond and Washington as a link in the proposed Quebec-Miami, Fla., road. In brief, the plan put forward is to form a stock corporation. The minimum capital stock is to be $10,000 and the maximum $150,000, the shares being $10 each. Each subscriber to the fund will receive stock in proportion to his subscription. All moneys so received are to be expended for public purposes and no private profit is possible under the plan. No officer but the secretary is to be compensated for his services. The most notable feature of the plan is to apply 20 per cent of the subscriptions to the maintenance of the highway when it is completed. It is planned that the association, co-operating with the various counties, can thus maintain the roads until some permanent pro[illegible] state or otherwise. This last feature of the plan is worthy of note. It too often happens that an association, a county or even a state will undertake extensive road building on a plan which can best be described by the following paraphrase of Patrick Henry's famous saying: "Millions for construction, but not one cent for maintenance."

Female Contractors.

A small city in New Mexico has female contractors [illegible] from a Des Moines, Ia., paper goes to show:

[illegible] which were not there when I was there before. [illegible] had secured the contract for laying these sidewalks and that one of these had been the superintendent of the public schools. I determined to see these two women who had nerve enough to do something that the men down there had not thought of. The one who had been superintendent of schools superintends the work and does the most of it herself. She is a very large woman. I do not know of any woman in Des Moines who is as large as she is, and it was a funny sight to see her down on her knees laying brick. She wears a short skirt and high boots and is an excellent workman. The other woman is the business member of the firm. She is a small woman, I would say a tiny woman. Both are Eastern women. These [illegible] and went to work. The former school teacher is the politician and she got the contract after the other one had made the specifications and named the price. This is not all that they do. They build houses. The larger one does the front or facade part of the buildings herself, and I never saw finer workmanship. She plans as she goes along. She builds the front part first, but the design is different from any other I ever saw and really more beautiful. These women are doing all the contract work in the city.

It would be interesting indeed to see one of the houses which "she plans as she goes along."

Lawyer-Surveyor.

A primary election was held in Illinois yesterday to select candidates for various state and county offices. Among the offices to be filled was that of county surveyor of Cook county. One of the candidates for the position, who, by the way, had the indorsement of several municipal associations and the support of some of the newspapers, was a lawyer, who had the further qualifications that "he has had experience in the office of county surveyor." Possibly the duties of the county surveyor of Cook county are such that they can be performed by a disciple of Blackstone. If this is the case, the duties of the position differs from those of similar positions elsewhere. Perhaps the pecuniary rewards differ also, which would explain the entrance of a member of the legal profession into the engineering field.

PERSONAL

Mr. J. Roy Pennell has been appointed Highway Engineer of Marion County, S. C.

Mr. Louis Wilputte, formerly connected with the business of H. Koppers at Joliet, Ill., has resigned.

Mr. Hutcheon, City Engineer of Guelph, Ont., has resigned. He is likely to be appointed Government Engineer to New Ontario.

Mr. E. B. Menuez has been appointed District Engineer for the middle district of the New York Central lines to succeed W. F. Dorrance, resigned.

Mr. W. J. O'Brien of New York has been appointed Engineer of Barge Canal Crossings of the New York Central R. R., with headquarters in Albany.

Mr. Paul Whitton, present Assistant Engineer to the Port of Seattle, has been appointed to succeed R. H. Thompson, who has resigned as Chief Engineer.

Mr. Ayliff has been engaged by the City of Fargo, N. D., as expert chemist for the new filtration plant. He has been at Lorain, Ohio, in charge of the filtration plant for the past five years.

Mr. F. X. Nikirk of San Jose has been appointed Town Engineer of Santa Clara to succeed the late Chas. E. Moore, and will begin at once on the construction of a new sewer system for the town.

Messrs. B. E. Grant, Geo. E. Leuth, H. E. Hudson, W. R. Mathews, A. J. Shafmeyer and C. O. Dowdell were successful in passing the recent civil service examination for Asst. Chief Engineer of Sewers of the Board of Local Improvements of the city of Chicago.

Mr. D. C. Tuttle, formerly with the Stone & Webster Engineering Corporation of Boston, and more recently of the Engineering Department of the Spring Valley Water Co. of San Francisco, has entered the firm of David Bixler & Co. Mr. Tuttle has been appointed Manager of the Machinery Department in charge of sales of their construction machinery and equipment in the States of California and Nevada.

Mr. W. D. Hines has been appointed Assistant Engineer of Bridges in the City of Baltimore. Mr. Hines was formerly Roads Engineer of Cecil County. He will take the place of Mr. James W. Ogier, who became Engineer of Bridges in succession to Mr. N. R. Alexander, recently appointed as Assistant to Harbor Engineer Lackey. Mr. Hines is a graduate of the City College and of Johns Hopkins University. He was connected with the City Commissioner's Department under Commissioner Smyrk, and since that time has held positions with the Southern Railway Co., the Western Maryland Ry., the Washington, Baltimore & Annapolis Electric Line and in the office of former Inspector of Buildings Preston. Mr. Ogier, who has been appointed Engineer of Bridges, has been connected with the City Engineer's Department since 1908. Mr. Christian Ramsler, a Chicago contractor, died suddenly on April 1 of heart disease.

INDUSTRIAL

The H. H. Meyer Co., 110 S. Howard street, Baltimore, Md., has taken on the agency for Chain Belt concrete mixers, Chain Belt concrete elevators and distributors. The Dominion Equipment Supply Co. of Winnipeg, Can., has opened a new plant at Vancouver, and will take on the agency for Chain Belt concrete machinery.

Mr. W. P. J. Dinsmoor, for several years manager of the Sullivan Machinery Co. at Denver, Colo., has been appointed manager of the Chicago sales office and will assume his new duties about May 1. Mr. Geo. W. Blackinton, associated with the general offices of the company at Chicago for several years as general sales engineer, will succeed Mr. Dinsmoor in charge of the Denver office.

The United States government has recently purchased from the Duff Manufacturing Co. of Pittsburg, Pa., a Duff-Bethlehem hydraulic jack capable of lifting a load of 500 tons. This jack is intended for use in the Washington navy yard. The American Bridge Co. has also placed an order for a large number of these 500-ton Duff-Bethlehem forged steel hydraulic jacks for use in connection with the erection of a large bridge at Kenova, W. Va.

CATALOGUES

De Laval Steam Turbine.—Paper, 6x9 ins., 117 pp. De Laval Steam Turbine Co., Trenton, N. J.

This catalog describes the multi-stage type turbine, giving illustrations and descriptions in detail, with a large amount of data useful to designers and purchasers.

Pillsbury Sprayer.—Paper, 6x9 ins., 4 pp. Walter Cressy, Gloucester, Mass.

This apparatus consists of a detachable device connecting with a specially designed steel tank wagon. The pamphlet describes the use of the sprayer for surface treatment, for the penetration method and in the layer method of construction.

Steam Tractor.—Paper, 8½x12 ins., 48 pp. J. I. Case Threshing Machine Co., Racine, Wis.

This catalog illustrates and describes traction engines and plows; prices and specifications are given.

Gas Tractor.—Paper, 8½x12 ins., 3 pp. J. I. Case Threshing Machine Co., Racine, Wis.

These pages illustrate and describe the Case 60-h. p. oil tractor and 40-h. p. gas tractor. Specifications and data are given as to the cost of engine haul as compared to team haul.

Belt Conveyors.—Paper, 6x9 ins., 24 pp. Webster Manufacturing Co., Tiffin, Ohio.

This catalog illustrates and describes the conveyor system for an elevator in Buffalo and describes the Perkins pivoted bucket carrier.

Universal Excavator.—Paper, 3½x6 ins., 6 pp. R. M. Gates, Sales Engineer, Cleveland, Ohio.

This folder describes and illustrates a machine adapted to the use of a clam shell, a dragline bucket or a steam shovel attachment.

Blaw House Forms.—Paper, 6x9 ins., 24 pp. Blaw Steel Centering Co., Westinghouse Bldg., Pittsburgh, Pa.

This catalog contains illustrated descriptions of the Blaw forms for constructing building walls. Line drawings are given showing the method of handling.

General Electric Review.—Paper, 8x10½ ins., 40 pp. General Electric Co., Schenectady, N. Y.

This is the April number of this review published by the General Electric Co. and contains a number of articles on electrical progress in the United States and foreign countries.

Dump Wagons.—Paper, 9x10½ ins., 16 pp. Studebaker Manufacturing Co., South Bend. Ind.

This catalog illustrates and describes the details of the Studebaker dump wagon. Specifications and prices are given.

Electrically Operated Brick Plants.—Paper, 8x10½ ins., 20 pp. General Electric Co., Schenectady, N. Y.

Bulletin No. 4929 is devoted to the application of electric motors for the operation of brick plants. In this bulletin is shown the electric motor as used in the various operations of brick manufacture. The bulletin contains a description of a representative plant electrically operated, and contains cost data relative to the operation.

Search Light Projectors.—Paper, 8x10½ ins., 24 pp. General Electric Co., Schenectady, N. Y.

Bulletin No. 4928 is devoted to commercial search light projectors. It describes the carbon arc projectors and also contains illustrations and descriptions of incandescent lamp search lights.

Arc Valve Tappet Rock Drill.—Paper, 6 [illegible] ins., 16 pp. Ingersoll-Rand Co., Easton, Penn.

This bulletin is descriptive of [illegible] tappet rock drills. These drills have an arc shaped valve which is moved on a circular seat by a rocking tappet, the [illegible] faces all being concentric with the rocker pin. The working pressure is on the back of the valve, forcing it to its seat so that wear, instead of inducing leakage, only improves the tightness of the working valve parts. The valve is moved by the piston through an intermediate tappet or rocker. This tappet swings on a pin and extends slightly into the cylinder bore, where it is moved by beveled shoulders on the piston sliding under it. An arm on the [illegible] carries a spring and plunger engaging the valve. The function of the spring is to hold the valve to its seat when there is no pressure on the drill. This arrangement of spring and plunger also acts as a valve in discharging water of condensation which may collect in the cylinder when steam is used. The catalog shows the parts of drill, also sectional views, and gives descriptive table of sizes and capacities.

Metal Flume.—Paper, 9x6 ins., [illegible] The Colorado-Ingot Iron Pipe [illegible] Co., Colorado Springs, Colo.

This catalog describes metal flumes and contains illustrations of installations of various western products.

Electric Fans.—Paper, 8¼x10½ ins., [illegible] pp. Fort Wayne Electric Works, Fort Wayne, Ind.

This catalog contains illustrations, descriptions, specifications and prices of [illegible] types of ventilating fans. This is Bulletin 1142.

Bulletin 1134, 8x10½ ins., 16 pp., issued by the same company, contains illustrations and descriptions of direct current motors and controlling rheostats.

Bulletin Index, 8x10½ ins., 4 pp., index, under date of January 15, 19[illegible], issued by the Fort Wayne Electric Works and supersedes indexes of all previous dates. It contains a list of subjects treated in the 141 bulletins issued by the [illegible] on electrical machinery.

Buckeye Trench Excavator.—Paper, 7¾x10¼ ins., 28 pp. Buckeye Traction Ditcher Co., Crystal St., Findlay, Ohio.

This is an interesting illustrated catalog with descriptions of the uses of the Buckeye Trench Excavator, the soils in which an excavator will work, the principles of the construction and operation of the excavator, widths to which trenches may be excavated, cost of operation, etc.

Another booklet accompanying the above catalog contains letters from users of the machine describing their work.

A third booklet, 11x9½ ins., 8 pp., contains reprints of articles on the methods and costs of trench excavation which have appeared in Engineering Contracting and Engineering Record.

"Clipper" Drills.—Paper, 8x11 ins., 4 pp. Loomis Machine Co., Tiffin, Ohio.

This is Bulletin "GT-24," describing the Clipper gasoline power traction machine, which is made in four sizes of capacities from 450 to 1,000 feet, using Manila cable tools. Illustrations and descriptions with price lists are given. Other bulletins illustrate the blast hole drilling machines and contain letters from users.

Pumps.—Paper, 10x7 ins., 48 pp. Luitwieler Pumping Engine Co., Rochester, N. Y.

This catalog contains useful information on pumping efficiency and describes with complete illustrations the Luitwieler non-pulsating pumps.

Channon's Review.—Paper, 6½x9 ins., 3[illegible] pp. H. Channon Co., Chicago, Ill.

This is the March issue of the [illegible] bulletin of the H. Channon Co. [illegible] covers contractors' supplies.

RAILWAYS, STEAM AND ELECTRIC

Arkansas.

nincering corps of the Ander[illegible] &
ver Ry. Co., J. S. Bell, Chief En-
ne Bluff, Ark., has started surveys of
sed route of the line to a point near
Grant County, where it will tap
[illegible] branch known as the Pi[illegible]
tern. The A. & S. R. Ry. now
Clio, a lumber town on the Cot-
Millersville, Cleveland County.
new standard gauge track is
the proposed extension will be
Stodmier, a station on the Ander-
Saline River Ry., 16 miles west of
The new line is to tap the Iron
branch at a point five miles east of

California.

be received until 2 p. m., May 8,
of Public Works, J. L. McCor-
ry, Hewes Bldg., San Francisco,
[illegible] delivering [illegible]
ter, California type motor cars.
four extra trucks complete with
and motors for the Geary Street

Belt Line & Terminal Co. has
[illegible]
tion papers have been taken out.
[illegible] of which $11,[illegible]
scribed. The company proposes
begin on the west side of the
River and to run through the town
n. A branch or intermediate line
t across the Northern Electric
foot of M St., entering Sacra-
ine one-mile in length. The line
connect with the Southern Pa-
lejo and Northern and the West-
lines in Sacramento. The incor-
the company are: W. A. Curtiss,
P. J. Harney, T. L. Enwright,
J. L. Mayden and W. Rennie.
ma & Coast Ry. Co., of Petalu-
ted recently with a capital stock
which $22,000 is subscribed, pro-
struct an 18-mile road from Lib-
Petaluma & Santa Rosa Ry., to
nd thence to a point on the coast
all in Sonoma County. The di-
J. E. Alexander, H. Levy, A. F.
d D. S. Hyde of San Francisco,
Ferguson of Santa Rosa.

piece of track up Kern County
ersfield and Fresno, which hereto-
n operated by the Santa Fe R. R.
Southern Pacific Co. under the
Sunset R. R. Co., has been incor-
tly by both roads under the name
set Ry. Co., with a capital of
The capital stock is fully paid up
ectors named are: A. G. Wells,
ver and C. N. Beal of the Santa
Company, and H. V. Platt and
of the Southern Pacific Railroad.

mento Valley West Side Electric
een incorporated with a capital
,000,000. This company proposes
tion of a line between Woodland
ff. Over 90 per cent of the right
been donated by land owners along
E. L. Sisson, Willowsa, Cal., is

rson & Bella Vista R. R., accord-
es from Anderson, is considering
[illegible] terminus from Bella Vista [illegible]
ng the Great Western Mining Co.,
r place, an all rail outlet for its

as follows were received March 27 by
rd of Public Works of San Francisco
construction of the municipal railroad
ry St. from Fifth Ave. to Kearny St.:
Boland & Ayer, $225,025; State Con-
n Co., $253,110; Mahoney Brothers,
: E. B. & A. L. Stone Co., $295,370; Healy-Tibbits Construction Co., $297,350; Contra Costa Construction Co., $321,640; Willett & Burr, $332,920; City Street Improvement Co., $314,458; Chadwick & Sykes, $349,790; Grant, Smith & Co., $361,770. The work calls for tearing up the old cable road and laying roadbed for an electric railway for a distance of 27,000 lin. ft. The rails and track supplies will be furnished by the city.

Rights of way for the proposed line of the recently incorporated Tidewater & Southern Traction Co. from Skaggs bridge to Kerman have been secured and officials of the company hope to have actual construction work started by the first of May. The route decided upon is straight north and south running from Skaggs bridge to Kerman, about one-quarter mile east of Madera Ave. J. H. Wallace, San Francisco, Calif., is Chief Engineer.

It is reported that the Western Pacific has under consideration the construction of a branch line from Doyle, Calif., to Alturas, via Susanville. The line will be approximately 40 miles in length, but it is intended, as soon as possible, to extend this branch easterly into Nevada and thence down to Gerlach on the main line, thus giving the railroad a branch of semi-circle shape, tapping its main line at two points, Doyle and Gerlach, and at the same time giving it a strong hold on the valley territory and traffic. T. J. Wyche, San Francisco, Calif., is Chief Engineer of the company.

Georgia.

Steps are being taken at West Point, Ga., to form a company to be known as the West Point Interurban & Great Eastern Ry. Co., for the purpose of building an electric railway from West Point to Washington, Ga., 150 miles. As projected the line will traverse the counties of Troup, Merriwether, Pike, Spalding, Butts, Morgan, Putnam, Jasper, Green, Talliaferro and Wilkes. It is the intention to touch Greenville or Harris City, Griffin, Jackson, Machen or Monticello, and Union Point.

Colorado.

Meeting of the stockholders of the Denver & Rio Grande R. R. will be held April 27 at Denver to ratify the bond issue of $25,000,000 authorized three weeks ago by the directors. Of this issue $10,000,000 will be marketed for immediate improvements. Out of this sum it is proposed to set aside $2,500,000 to acquire the obligations of the Western Pacific. A portion of it will be used by that road to apply on payment of first mortgage bond interest. The remainder is to be used for important improvements on the Western Pacific, including completion of a low grade line west of Salt Lake City. Chief among the improvements contemplated by the Rio Grande is a detour of 14 miles from Soldier Summit, Utah, to Tucker. This line will have a maximum grade of 2 per cent as against 4 per cent on the existing track. This detour, it is expected, will save about $400,000 per annum in operating expenses.

The Denver & International R. R., W. G. Smith, Denver, Colo., President and General Manager, plans the construction of a line to Fort Logan, where a connection will be made with the proposed diversion of the Littleton lines.

Idaho.

The Portneuf Development Co., recently incorporated with a capital stock of $600,000, is planning the construction of an electric railway from American Falls to the Rockland Valley, and is stated to have negotiations under way for the sale of bonds for the project. This is the proposed line mentioned a short time ago in these columns as being promoted by Judge A. Z. Watson, of Chicago. Judge Watson is one of the incorporators of the Development Co. A. Q. Campbell, Pocatello, Idaho, is also interested.

Preliminary construction work has been started for the extension of the line of the Caldwell Traction Co., W. R. Sebree, President, Caldwell, to Nampa Ferry. From there, later on, this road will be extended to Givens' hot springs on the Snake River.

Citizens of Idaho Falls have raised a bonus of $40,000 for a proposed electric railway from that place. H. S. Sewell, Idaho Falls, is the promoter.

Articles of incorporation have been filed by the Cambridge-Indian Valley Eastern R. R. Co., capitalized at $50,000 of which $17,500 has been subscribed. The company will construct a line from Cambridge, Idaho, to a point in Indian Valley, a distance of 15 miles. The cost of construction will be heavy, but the new road will tap a very rich fruit section and develop that particular section of the western part of the state. The directors are: D. K. Lindsay, J. I. Linder and W. E. Henke, all of Indian Valley; A. W. Gibson and R. E. Wilson, of Cambridge. The stockholders named are: C. K. Macey, J. I. Linder, S. K. Lindsay, Wilson & Devaney, Joe Madison, C. E. Schmetz, Cambridge Lumber Co., Stewart & Johnson, A. W. Gibson, Fred M. Jewell, W. D. Morey, Thomas Nelson, J. A. Hudelson, Marshall Lewis, H. M. Coon, H. T. Brown, Anderson Bros., A. J. Francis, W. E. Henke, L. A. Thompson, C. H. Shepherd, L. E. Elliott, T. A. Bell and A. M. Henke.

Illinois.

◉The Gould Construction Co., which has the contract for the construction of the Illinois Central shops at Centralia, Ill., has instructed its men to report for work at that place not later than April 20.

Citizens of Hillsboro have voted in favor of granting a franchise for the construction of the interurban from Hillsboro to Taylor Springs. The franchise is given to the Hillsboro Electric Ry. Co., which is composed of stockholders of the Hillsboro Electric Light & Power Co. of Hillsboro, Ill. The company will spend about $100,000 in equipping and constructing the line.

The Central Illinois Public Service Co., Mattoon, Ill., has been making estimates of the cost of extending its city line at Charleston to the fair grounds.

Engineering Department of the Chicago, Peoria & St. Louis Ry. has plans under way for a subway to be constructed at West Jefferson St., Springfield, Ill.

Officials of the Chicago, Milwaukee & St. Paul Ry. recently inspected the Toluca and Rutland Branch of the Chicago & Alton R. R., and rumors have arisen that the former road is considering purchasing the Toluca branch with a view to building a 60-mile extension south to reach the Central Illinois coal fields.

At an election held at Decatur, Ill., recently, it was voted to grant the Vandalia R. R. a franchise for crossing streets and to build a railroad yard and freight terminal station.

It is believed at Davis Junction, Ill., that the Chicago, Milwaukee & St. Paul R. R. will construct an extension from that place south to Steward connecting with its line to the coal fields.

Indiana.

The Indianapolis & Louisville Traction Ry. Co. has been incorporated with a capital stock of $1,200,000, the incorporators being: J. C. Chaplin, Pittsburgh, Pa.; B. B. Veech and W. E. English. This is probably a reorganization of the present Indianapolis & Louisville Traction Co., of Scottsburg, Ind.

Kentucky.

The Williamson & Pond Creek R. R. Co., of Ashland, has been chartered and proposes the construction of a 11-mile line from Will-

✣ indicates work now open for bids. ◉ indicates a contract let recently.

iamson, W. Va., up Pond Creek in Kentucky. This is probably a Norfolk & Western project and it foreshadows the entrance of this railroad to Kentucky coal fields. The incorporators include L. E. Johnson, Roanoke, Va., President of the Norfolk & Western R. R., and W. A. Ginn of Ashland, Ky.

According to an announcement reported to have been made following a meeting of the directors of the Carolina, Clinchfield & Ohio R. R., work will soon be started on the Elkhorn extension of the line from Dante, Va., to Elkhorn, Ky. This extension is to be 40 miles in length through a most difficult mountain country and will give a Clinchfield road connection with the Chesapeake and Ohio, affording it the outlet to the middle West contemplated in the original plans of the promoters. The extension will cost approximately $4,000,000 or $100,000 per mile. It is understood that financial arrangements for this work have been made. The Clinchfield road is now in operation from Spartanburg to Dante, a distance of nearly 300 miles. Ward Crosby, Johnson City, Tenn., is Chief Engineer.

Louisiana.

The New Orleans & North Eastern R. R. (Queen & Crescent Route, C. Dougherty, Chief Engineer, Cincinnati, O.) and the Frisco system, are planning the immediate expenditure of $900,000 for the completion of the joint terminals at New Orleans. Of this sum, about $700,000 is to be spent for the completion of the Chalmette slips along the Mississippi River, where ships will enter to load at the Frisco wharves. Another $200,000 will be spent in improvements on the Frisco warehouses above Chalmette.

The New Orleans, Fort Jackson & Grand Isle R. R., O. T. Maier, Vice-president, New Orleans, has applied to the Port Commissioners of New Orleans for space on which to install wharves on both the east and west sides of the river.

The survey of the proposed line of the New Iberia, Lafayette & Northwestern R. R. is, according to reports from Lafayette, La., completed to Eunice.

D. K. Jeffries, President, Southern Ry. & Navigation Co., which has under construction a line from Vidalia to Monterey, recently visited Vidalia, La., for the purpose of securing terminal facilities and making connection with the St. Louis, Iron Mountain & Southern at that point.

Maine.

The Portland Terminal Co., M. McDonald, General Manager, Portland, Me., a subsidiary of the Boston & Maine R. R., is planning the construction of improvements in Portland and Westbrook which will involve the expenditure of about $2,000,000. It is stated that all the freight business will be concentrated at Thompsons Point, where there will be a freight yard. A station will be built on Brighton Ave., Portland, and there will be a new double-track line of more than six miles through the Deering district.

Maryland.

It is reported that the Western Maryland R. R. is contemplating the construction of a new low grade freight line from Williamsport through Boonsboro to the main line of the road at Westminster, Md. No definite information has been obtained in regard to the matter as yet.

Minnesota.

Arrangements are reported to have been made in London to finance the proposed St. Paul-Rochester line of the St. Paul Southern Electricy Ry. Co., and it is stated that the plans for the line have been practically completed and that construction work will begin this spring. It is expected the line will be completed as far as Hastings by July. The Interurban Construction Co. of St. Paul, Minn., is back of this project. Interested in it are: Edward Feldhauser, St. Paul; Senator A. T. Stebbins, Rochester; John Heiner, Hastings; Mayor F. D. Seager, Cannon Falls; Otto Ackerman, Hastings; Senator Albert Shaller, Hastings.

The Duluth Street Ry. Co., Herbert Warren, General Manager, Duluth, will expend $200,000 to $300,000 this year for improvements. These will include the building of the 9th St. extension, the placing of new heavy type rails where streets will be paved, and the addition of 10 new double truck cars to its equipment.

It is stated that the Port Arthur, Duluth & Western Ry., a branch of the Canadian Northern, will be extended from Gunflint, its present terminus, to Ely.

The Minneapolis, St. Paul, Rochester & Dubuque Electric Traction Co., Albert Graber, Chief Engineer, International Bldg., Minneapolis, Minn., is planning the construction of 30 miles of new track for the present season.

Mississippi.

It is now stated that the Wausau Southern R. R., running southeast from Laurel into Greene County, a distance of about 30 miles, will be completed and in operation before May 1.

The Mississippi R. R. Co. has been incorporated, the incorporators being T. B. Brittingham of Madison, Wis.; G. C. Hixon of Chicago; J. M. Hixon of La Crosse, Miss.; F. J. Hughes of Electric Mills, Miss.; E. S. Bostick of Meridian; S. Eastland of Meridian; R. E. Wilbourne of Meridian, and W. E. Baskin, Meridian. According to the terms of the incorporators, the terminals of the road are as follows: "Beginning at the northwest corner of township 12, range 17, in Kemper county, thence southeastwardly 25 miles, crossing the main line of the Mobile & Ohio Railroad at Electric Mills in Kemper County; thence through said county about 15 or 20 miles to the state line between Mississippi and Alabama." The road is projected by capitalists, who have large quantities of hardwood and other timber in the interior of Kemper County, and is designed to give a better outlet for this.

The Meridian & Memphis Ry. Co., Meridian, Miss., is taking bids for the grading of 30 miles of its proposed line. This section extends from Meridian to Union, Miss., and work is to be started on or before May 1.

Missouri.

The Kansas City Ozark & Southern Ry. Co., J. B. Quigley, Chief Engineer, Ava, Mo., has completed location of one of its lines south from Ava and has located the site for a hydro-electric plant on the north fork of the White River. The company has purchased this site and is now making plans for the dam, etc. This plant will furnish power for operating all the lines it is proposed to build in this section; also power to operate the line now being operated by steam locomotives from Ava to Mansfield, Mo.

The Commercial Club of Warrensburg, Mo., has submitted a proposition to the officials of the Chicago & Alton R. R. Co., offering to guarantee the right of way and $1,000 per mile providing the company would build a 23-mile spur from Higginsville, Mo., to Warrensburg. E. L. Crugar, Chicago, Ill., is Assistant Chief Engineer.

Montana.

⊙Noon & Malberg and Walton & Nelson have secured subcontracts for work on the extension of the Butte, Anaconda & Pacific Ry. from Browns Spur to the Southern Cross Mine. Clifton, Applegate & Co., Anaconda, Mont., and Spokane, Wash., as noted previously, have the general contract, which includes 350,000 cu. yds. earth excavation, 150,000 cu. yds. rock excavation, 150,000 cu. yds. borrow embankment, and seven bridges ranging from 60 ft. to 175 ft. The work is composed mostly of station and team work and is to be rushed so that steel can be laid in the fall. Clifton, Applegate & Co. have some good team work not yet let.

⊙A. B. Bennett & Co., Helena, Mont., have been awarded a contract by the Montana Construction and Irrigation Co., mentioned in our last issue, for constructing the f t 25-mil section, from Three Forks to Rad burg, fo the Three Forks, Helena & Mad n Valle R. R.

The Gallatin Valley Electric Ry. o., Bozeman, Mont., is making arrangeme for improving its system at Bozeman.

Advices from Lewistown give e following information as to some of the ns of the Milwaukee with regard to its proj ed [illegible] It is said that while the survey for e Lewistown-Great Falls lines is practically ompleted and all engineering difficulties have een overcome, there are still many details o dispos of before actual construction can e starte and that this work is expected to be begu during the summer. It has been de ed, however, to proceed without delay to tend th Hilger branch from that point to rmells, distance of 11 miles north of Hil r and t build the line to Grass Range, a tance 35 miles, 20 miles of the grading w bein completed. These two extensio [illegible] started in advance of construction w k on th Lewistown-Great Falls line, but wil ot dela nor interfere in any way with [illegible] project.

New Jersey.

Articles have been filed with the ecretar of state of New Jersey at Trenton m ging th Mine Hill R. R. Co., the South East & lipsburg R. R. Co. of New Jerse ai South Easton & Phillipsburg R. . (Pennsylvania with the Lehigh & H sc Co. under the name of the Lehigh H River Ry. This is an absorption by t l & Hudson company of the other the railroads, which have a combined pi $180,000. The Lehigh & Hudson, der th merger, has a combined capital of ,700,00

New York.

⊙The O'Rourke Engineering Cotructio Co., 345 Fifth Ave., New York City, as bee awarded the contract at $912,352 for ec. 2, Route 5, of the Lexington Ave. Rap Trans R. R. in New York City. The work alls f the Canal St. station, Broadway-lexingto Ave. line and Canal street crosstow ine underneath. Bids were opened March 2. Th bidders on this work were as follow: (1) b ing bid for upper level, (2) bid f lowe level, and (3) total bid: O'Rourke gineer ing Construction Co., (1) upper le 779; (2) lower level, $119,572; (3) 91 F. L. Cranford, 177 Montague St., o (1) upper level, $844,592; (2) low $242,364; (3) $1,086,956. Empire En eerin Corp., 60 Wall St., New York City, (uppe level, $1,025,302; (2) lower level $300 1; (3 $1,325,461. J. F. Cogan Co., 280 B adwa New York City, (1) upper level, $ 54,08 (2) lower level, $318,210; (3) $1,372, non Contracting Co., 60 Wall St., N City, (1) upper level, $1,147,228; (l level, $409,689; (3) $1,556,917. John Flatiron Bldg., New York City, (uppe level, $1,387,307; (2) lower level, $332,3 ; (3 $1,719,731.

⊙Thomas O'Hern, Yonkers, N. Y., s bee awarded the contract by the State Co issio in Lunacy at $49,559 for the constr ion an electric railway at Mohansic State spita Yorktown, N. Y.

The Corning & Painted Post Street y. Co Corning, is considering extending it ine North Corning.

The Public Service Commission, F t District, New York City, has adopted the ne rapid transit routes which will be n led building the comprehensive dual sy m rapid transit extension which the Co issio has already approved, and which is no pend ing in the Board of Estimate and Ap rtion ment of New York City. This is the ysten which it is proposed to lease for oper ion t Interborough Rapid Transit Co. a th Brooklyn Rapid Transit Co. within t ir re spective spheres of development. T ne routes which have been sent to the B rd Estimate and Apportionment for its a rova are as follows: Route No. 35—The S nwa Tunnel-Times Square Extension Rout Th route begins at a point under 42nd neai

it the westerly terminus of the pres-
vay Tunnel Route and extends west-
r 42nd St. to the easterly side of 8th
No. 38—The 7th Ave. Extension
k St. Route. This route begins at
nder 7th Ave. near West 12th St.
nds southward under 7th Ave. and
sed extension of 7th Ave. and under
and its proposed extension to West
at Leonard St. This route will
t each end with the existing 7th and
Av Route, and is designed to make pos-
le t building of the proposed extension
the present subway from Times Square
ar own the west side of Manhattan to the
tter near which it will connect with a
w t nel or tunnels to Brooklyn. Route
The Whitehall St. East River-Mon-
et Route. This route begins in Mor-
Manhattan, near the intersection of
St., Trinity Pl. and Morris St.,
ay connect with the Broadway-Lex-
enue Subway or the 7th Ave. Ex-
the present subway, or both, and
r private property and Broadway to
St., under Whitehall St. to the
, under the East River to Montague
klyn, and under Montague St. to a
r near Court St., where connection
ade with other lines of the dual

North Dakota.

idland Continental R. R., projecting
line from Edgeley to Pempina, has
ict to A. J. Jackson, Jamestown, N.
the construction of its line into
H. H. Hurning, Edgeley, N.
hief Engineer.

Bros., St. Cloud, Minn., have moved
to Minot, N. Dak., for work on
Northern branch line.

en announced at Bismarck, N. Dak.,
racks of the Northern Pacific Ry.
extended beyond Stanton, N. Dak.,

Ohio.

nsylvania R. R. is reported to have
ne Ohio River & Western R. R.,
from Bellaire to Mill Run, Ohio,
f 111 miles, and has trackage right
altimore & Ohio into Zanesville.

Oklahoma.

skogee Electric Traction Co., Mus-
build an extension from the Broad-
uth on Seventh and thence across
estern section of the city.

Oregon.

h Oregon Electric Ry. Co., Railway Ex-
Bldg., Portland, Ore., has made a pre-
ry survey for rebuilding its main line
n Portland and Tualatin, and making it
r-grade route. The main idea in the
ge is to eliminate the heavy pull over
l, and to follow the west bank of
ette as nearly as possible. Under
ed scheme it will be necessary to
nel 600 ft. long through Elk Rock.
ew main line would leave the present
ar the Porter St. shops and rejoin the
line near Tualatin.

er & Co., subcontractors on the South-
cific line to Coos Bay, Ore., have com-
d grading operations westward from
e. This company has had perhaps 200
attered along twelve miles of right-of-
l winter, clearing the land for the grad-
ork with the settling of weather this
Power graders will be put to work as
as possible. Twohy Bros., Portland,
s, have made a good start
2,300-ft. tunnel at Noti Pass, and have
ted the transportation of ten wagon-
of compressor machinery, so that the
men may use air drills.

plementary articles of incorporation have
filed by the Valley & Siletz R. R. at
, Ore., providing for the construction
line from Independence to Newport. In
iginal articles the company proposed to
a railroad from the Upper Dam on the
amute River to Simpson. Under the
new plan this will give Portland a direct connection with Yaquina Bay on the West Side.

Pennsylvania.

⊙James M. Smith, Perkiomenville, Pa., has been awarded a contract for grading for the trolley line from Skippack to Lederach.

Surveys have been made for the proposed Geistown extension of the Johnstown Traction Co., E. M. du Pont, President, Johnstown, Pa. Practically all right of way has been secured and it is expected that the line will be completed this summer.

The Titusville Electric Traction Co., W. J. Smith, General Manager, Titusville, is understood to have completed plans for finishing its extension to Cambridge Springs. A considerable part of the grading is already completed; contracts for construction materials were placed last fall.

A syndicate, composed of Brown Brothers & Co., W. H. Newbold, Son & Co. and Robert Glendinning & Co., Philadelphia, which recently acquired the Citizens' Traction Co., of Venango County, Pa., has retained Day & Zimmerman, engineers, Philadelphia, as operating managers, to supervise proposed improvements and extensions.

The Susquehanna Railway, Light & Power Co., of 40 Wall St., New York City, has taken over the Columbian Power, Light & Railway Co. and its subsidiary companies, the Columbia & Montour Electric Ry. Co. and the Columbia Gas & Electric Co. The absorption affects directly about 30 miles of street railways, the electric light interest in Bloomsburg, Berwick and Danville and the gas business of Bloomsburg and Danville, as well as a number of small towns covered or about to be covered through subsidiary companies. It is announced that work will start in the near future on the extension of the electric lines eastwardly from Berwick to Wilkes-Barre, a distance of about 30 miles, meeting the lines of the same company who operate the Wilkes-Barre and Suburban lines, and westwardly from Danville to Sunbury, a distance of 13 miles.

Construction work is to be resumed in June on the 9-mile line of the Slippery Rock & Grove City Ry. About six miles of grading for this road have been completed. The road will be operated by gasoline motors. Capt. J. C. Barr, Grove City, Pa., is President.

The City Council of Somerset, Pa., has granted a franchise to the Baltimore & Ohio R. R. Co. to occupy parts of Pleasant St. in the construction of a second track for the Somerset & Cambria branch and it is believed that work between Rockwood and Johnstown will be started at once. A. M. Kingman, Cincinnati, O., is Engineer of Construction.

Eastern contractors will learn with regret of the death on March 26 of Wm. H. Mc Manus of 1510 Market St., Philadelphia. Mr. McManus kept in close touch with all the large construction work in the East and was well known to many contractors and engineers. He was about 60 years old.

South Carolina.

The Greenville, Spartanburg & Anderson Ry. (electric), projecting a line from Greenville to Spartanburg, is shortly to select its terminal site in the latter city, and will in the near future make a definite decision as to the route of the line. At a recent meeting of the directors and stockholders at Greenville, the following officers were elected: J. B. Duke, New York, president; W. S. Lee, Charlotte, vice-president; E. Thomason, Charlotte, treasurer and general manager; Thomas E. Hill, Anderson, secretary.

An ordinance has been introduced into the city council of Columbia, S. C., providing that the Southern Ry. be permitted to install spur tracks to the proposed buildings of the Gibbes Machinery Co. As proposed the spur will cross Gates and Wheat Sts.

Grading work is well along on the extension of the Roysten yards of the Southern Ry., three miles north of Columbia, and it is expected that this will be completed the latter part of the month. J. Davis Powell, Columbia, S. C., has the grading contract, which involves 25,000 cu. yds. of earth excavation and 25,000 cu. yds. of embankment. W. C. Powell, Columbia, S. C., and C. E. Teague, Columbia, have subcontracts. The masonry and trestle work is being done by the forces of the Southern Ry.

South Dakota.

The promoters of the projected Sioux City, Mitchell & Pierre R. R., mentioned in our last issue, have raised $1,500 for preliminary work. Theodore Quale, Blunt, S. Dak., and A. E. Hitchcock, Mitchell, S. Dak., are interested.

Tennessee.

The Murfreesboro Electric Ry. Co. has been chartered with a capital stock of $50,000 and proposes to build an interurban railroad from Clarksville to Nashville, via Springfield; from Nashville to Woodbury, via Murfreesboro, and from Nashville to Cornersville, via Lewisburg. The incorporators are: Richard T. Wilson, Joseph Frank, Robert L. Burch, T. Garland Tinsley and Albert T. Lee. J. L. Parkes, Murfreesboro, is manager.

Texas.

⊙Shattuck & Edinger, 109 E. 6th St., Los Angeles, Cal., according to advices from San Antonio, have been awarded the contract for constructing 175 miles of the new San Antonio, Rockport & Mexican R. R. The contract covers the construction work from San Antonio to Crowther, Crowther to Rockport and Rockport to Harbor Island. Under the contract work will be started at once and will be completed within 18 months from date.

⊙The Southern Traction Co., which proposes the construction of the interurban line from Dallas to Waco, 134 miles, has taken out its charter. The main office of the company is at Dallas and the capital stock is $7,500,000, of which $100,000 is certified paid in. On April 2 the company completed its organization, the following officers being elected: J. F. Strickland, president; Osce Goodwin, C. W. Hobson, J. Lee Penn, F. N. Drane and W. J. Neale, vice-presidents; Osce Goodwin, treasurer; H. I. Gahagan, assistant treasurer; James P. Griffin, secretary; W. H. Painter, assistant secretary; M. B. Templeton, general counsel. The executive committee is: J. F. Strickland, Dallas; T. J. Cole, Waxahachie; R. E. L. Saner, Dallas, and C. W. Hobson, Dallas. The contract for building the line has been awarded to the Southern Engineering & Construction Co., which was organized for this purpose. Luther M. Dean is Chief Engineer of the company, which has offices at 1316 Commerce St., Dallas.

⊙G. W. Thompson, St. Louis, Mo., has been awarded a contract amounting to about $100,000 for laying new 80-lb. steel on the main line of the International & Great Northern R. R., between Fort Worth and Houston.

The Commissioners' Court of Dallas County has granted a franchise to the Eastern Texas Traction Co., of which J. W. Crotty of Dallas is the active vice-president, to build an interurban across certain public roads in Dallas County.

Preliminary work is under way for the organization of a company for the purpose of building an interurban line from Dallas to Greenville, 54 miles. It is anonunced to be the intention of the promoters of the line to raise all of their capital locally. It is estimated that $2,000,000 will be required to construct and equip an electric line such as the one to Greenville, and it is claimed that already $400,000 of cash has been promised in stock of the company which it is proposed to form. J. B. Wilson, William Doran and Harry L. Slay, of Dallas, are interested.

A plan is under consideration for the building of five interurban lines out of Dallas. According to a prospectus issued by E. P. Turner and associates, of Dallas, the present company will be known as the North Texas Independent Interurban System. The proposed lines are as follows: Dallas & Western Interurban Ry., from Dallas to Fort Worth, by way of Irving, 33 miles. Dallas and North-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

western Interurban Railway, from Dallas to Denton and Gainesville, by way of Irving. Dallas and Southwestern Interurban Railway, from Dallas through Cement, Mansfield, Cleburne and Walnut Springs. Dallas and Southeastern Interurban Railway, from Dallas to Terrell, thence to Paris, Clarksville and Texarkana. Towns on the several lines are to be as follows: Dallas, Irving, Fort Worth, Farmers Branch, Denton, Grapevine, Gainesville, West Dallas, Cement, Mansfield, Lillian, Egan, Godley, Glenrose, Cleburne, Walnut Springs, Orphans' Home, Garland, Mesquite, New Hope, Heath, Chisholm, Terrell, Canton, Terrell, Kaufman, Tyler, Lone Oak, Sulphur Springs, Emory, Charleston, Paris, Clarksville and Texarkana. It is probable that the Terrell-Tyler line will be the first to be undertaken.

A movement has been started at Corpus Christi, backed by local capital, to build an interurban electric railway line around the bay front from Corpus Christi to Ward Island.

The Gulf, Texas & Western Ry., J. T. Witt, Dallas, Tex., Chief Engineer, has surveys under way for its proposed extension from Jacksboro to a connection with the Weatherford, Mineral Wells and Northwestern Railroad at some point near Salesville or Oran, in Palo Pinto County.

Proposition has been submitted to the citizens of Rio Grande City for the construction of a standard gage steam and motor railroad from Samfordyce to a point in Zapata county, passing entirely through this county and city and having direct connection with the St. Louis, Brownsville & Mexico Railroad at the terminal of the Brownsville and Samfordyce branch. The proposition was submitted by representatives of the San Benito & Rio Grande Valley Ry., which proposed to build and equip this line within one year and to begin active and continuous work of construction to completion upon Rio Grande City raising a bonus of $25,000 cash and right of way through the city and terminal grounds. E. E. McLellan San Benito, is Chief Engineer of the San Benito & Rio Grande Valley Ry.

Surveys for the entire line of the Quanah, Seymour, Dublin & Rockport R. R. will soon be completed. The promoters of the new line are negotiating with several other roads for trackage rights in order to give them a temporary through line between the two proposed terminal points as early as possible. The road will construct its own line from Quanah to Georgetown, where it will connect with the Missouri, Kansas and Texas and operate from that place into Austin over the latter's track. It will build a link between Austin and Lockhart, thirty miles, and will use the track of the San Antonio and Aransas Pass from that place to Luling. Bonuses are being raised to aid in the construction of the link between Luling and Rockport.

Preliminary arrangements are being made by C. J. Grainger, Palestine, Texas, for the construction of line through Huntsville and thence northwesterly.

It has been announced at Weatherford, Texas, that engineers of the Gulf, Texas & Western Ry. are running a line from Jacksboro to a point to intercept the road from Mineral Wells.

Surveyors of the San Antonio, Uvalde & Gulf R. R. have started work on the proposed Fowlerton extension from a point near Pleasanton to Fowlerton. A. R. Ponder, Crystal City, Texas, is Vice President of the road.

The citizens of Midway, Texas, are very anxious to secure the construction of a railroad through that place and a bonus is to be raised for the first company deciding to build via the town.

It is reported that Harvey Austin, San Antonio, Texas, is promoting the construction of a railroad from San Angelo to Kerrville, a distance of about 175 miles. The proposed line will connect with the San Antonio & Aransas Pass at this place, and by means of that line a new through railway route between San Antonio and San Angelo will be obtained. One of the most important towns on the route under consideration is Junction, and the people of that place have subscribed more than $25,000 as a bonus in aid of the project. The Santa Fe is reported to be back of the proposed road.

Utah.

The Ogden Rapid Transit Co., Ogden, is understood to have under consideration tentative plans for a number of extensions of its lines in the city. These plans are said to include the building of lines on 23rd and 27th Sts., parallel to the 22nd and 25th St. lines. It also has been reported that the company will complete its line on Wall Ave. and 24th St., thus finishing the business district and Union depot loop.

Ogden Rapid Transit Co., Jos. A. West, Chief Engineer, Ogden, Utah, expects to build a 7-mile extension from the Hermitage in Ogden Canon to Huntsville this season. The rights of way have been secured for this extension. The Logan Rapid Transit Co. also expects to build several miles of interurban lines in Cache Valley the present season connecting the valley towns with Logan, the county seat. Just how many miles will be built depends largely upon the readiness with which franchises and rights of way are obtained.

It is said that contracts have been let for the construction of a branch line connecting the Denver & Rio Grande R. R. at Thompsons, Utah, with the Ballard Coal fields. The American Fuel Co., Salt Lake City, Utah, as mentioned in our Feb. 20 issue, is interested in the proposition.

Vermont.

Frank O. Sinclair, Consulting Engineer, Burlington, Vt., has been working on plans for the new union station at Burlington for the committee representing the city.

Virginia.

⦿Rinehart & Dennis Co., Jefferson National Bank Bldg., Charlottesville, Va., has been awarded the contract for seven miles of double track work for the Richmond Belt Line of the Atlantic Coast Line Ry. The contract consists of about 350,000 cu. yds. of excavations, 4,000 cu. yds. of concrete and laying of track, etc. Two steam shovel outfits and concrete outfit will be placed on the work.

Washington.

⦿Subcontracts for work on the Wenatchee North branch of the Great Northern R. R. have been let to Clifton, Applegate & Co., 507 Hutton Bldg., Spokane, Wash., and G. O. Foss & Co., Spokane, Wash., by Guthrie, McDougall & Co., Portland, Ore., the general contractors. Foss & Co. secured five miles of work starting at Wenatchee and Clifton & Applegate secured four or five miles about 30 miles north of Wenatchee. Both subcontracts include a considerable amount of heavy work.

⦿Advices from St. Cloud, N. Dak., state that A. L. Riley of that city has been awarded a subcontract by Guthrie, McDougall & Co. for constructing a portion of the Great Northern line from Wenatchee, Wash.

The Chicago, Milwaukee & St. Paul Ry., which recently purchased Bellingham Bay & British Columbia R. R., according to advices from Spokane will extend the road to that city. It is stated that the road will cross the mountains through Cascade pass, coming down the east slope of the pass and following the Stehekin River, and coming thence eastwardly to Spokane.

The Olympia Terminal R. R. Co., organized by citizens of Olympia, has purchased from the Northern Pacific about five miles of partly graded right of way, which will be used in constructing a locally owned railroad south from the city to connect with the Oregon-Washington & Milwaukee lines. Dr. P. H. Carlyon, Olympia, is interested.

The Chicago, Milwaukee & Puget Sound Ry., E. O. Reeder, chief engineer, Seattle, is reported to have completed location work for its projected Beverly-Hanford branch and it is said that grading work will be started this month. This branch will extend between the Beverly crossing of the railroad on the Columbia river and Hanford, below Priest Rapids. It is estimated that the line will cost $1,000,000.

The Idaho & Washington Northern, W. C. Smith chief engineer, Spiri ho, is reported to be planning to soon on a 40-mile branch line from Deep creek to Northport.

Advices from Spokane, Wash., state farmers are promoting a scheme for construction of 15 miles of railroad from LaCrosse on the Oregon-Washington R. R. & Navigation Co. route to Dusty in Whitman County. The cost of the project would be, it is estimated, about $150,000.

Business men of Walla Walla, are making efforts to secure the construction of the Oregon-Washington Ry. & Navigation Co. shops at that place. At present the shops are at Starbuck.

Articles of incorporation have been filed at Olympa, Wash., for the Vancouve Co., capitalized at $10,000 and quarters at Seattle, Wash. Th proposes the construction of mon in British Columbia.

West Virginia.

The Morgantown & Dunkard Va J. Ami Martin General Manager, M W. Va., is reported to have made ress with its plans for extending railway to Blacksville. From the the road may be continued to Mou

Wisconsin.

⦿Winston Bros., Minneapolis, Mn. were recently awarded the contrac structing 90 miles of new line for t & Northwestern Ry. from Peori Girard, have also closed a contract Chicago, St. Paul, Minneapolis & Ca for building 60 miles of second track Truax and Northline, Wis. Wor started as soon as possible.

The Manitowoc & Northern Tra Thos. Higgins, President, Manitowo chased the material and will shortly construction work on a 1-mile ext Manitowoc.

Canada.

⦿Advices from Prince Albert, Sa that the Canadian Northern Ry. Co. contract for the construction of th miles of railway from Prince Albe Hudson Bay to William Osemun, Sask.

The Niagara Falls, St. Catharines Toronto Ry. Co., E. F. Seixas, General Manager, St. Catharines, Ont., has applied to the government for the right to build a brid the Welland canal at Killaly St., Hun This is the dividing line between borne and Humberstone. The inten extend the line east to Fort Erie, b least as far as Crystal Beach this ye

The Canadian Northern Ry., as our last issue, has preliminary wo way for its tunnel through Mount which it will gain an entrance to This will be a double track tunnel ab miles long and is to be built by the Tunnel & Terminal Construction Co sidiary of the C. N. Ry. The office of company are on St. James St., Montreal, S. P. Brown is Chief Engineer.

According to a statement of Donal Toronto, Vice-president of the Northern Ry., that company will build 1,053 miles of railway in differ of Canada. Included in this program the completion of through lines from to Ottawa, and from Sydenham to Ottawa, latter linking up Toronto with Ottaw lowing is the program of construction tail: Montreal to Hawkesbury, 58 mi tawa to Ottawa River, 32 miles; we Ruel, Ont., 100 miles, east from Port 108 miles; branch lines and extension berta and Saskatchewan, 400 miles; Columbia, 75 miles; Sydenham, Ont., tawa, 80 miles; relaying track on m

⁜ indicates work now open for bids. ⦿ indicates a contract let recently.

miles. Total mileage, 1,958. New company expects to construct 978 oad to complete the Transcontinental s mileage includes 350 miles from it of the Rockies to Lytton, B. C., iles along the north shore of Lake [illegible]

milton, Waterloo & Guelph Ry. Co. John Patterson, General Manager, Hamilton, Ont., has negotiations [illegible] for building its line into Hamilton. rstood that the company has about financial arrangements for beginork.

adian Northern Ry. has about comns for its new eastern entrance to including yards at Leaside and the North Toronto. The company has 00 acres of land at Leaside for a e and freight yards one mile in is also stated that the Canadian Ry. has decided on the erection, in [illegible] union station in North Toronto, and that the [illegible] preparation in Montreal.

[illegible] Wash., and associates in Eastern Canada, will [illegible] Groundhog Mountain district of British Columbia, 150 miles north of Hazelton. This railroad is planned to run from the forks of [illegible] the railroad, bunkers, etc.

Announcement has been made that the Canadian Northern Ry. will build carshops near Ottawa, Ont.

The Saskatoon & Hudson Bay Ry. Co., [illegible] toon, may have construction work started this fall. The company was incorporated last May by special act of parliament. The incorporators were Frank O. Fowler, of Winnipeg; Vivian T. Bartram, Toronto; C. O. Foss, St. John, N. B.; Howard Pardee, Philadelphia, and J. B. Craven, New York City. The cap- [illegible]

Mexico.

[illegible] Taylor, Director of Construction, City of Mexico, has awarded the contract for work on the Allende-San Carlos line to Gonzalez Trevino Bros., of Monterery, N. L., Mexico. The contract for the construction of 111 kilometers of line between Canitas and Kilometer 151.6 [illegible] meter branch line from Kilometer 151.6 to Sombrerete was let to the Sombrerete Construction Co., F. W. Johnston, President, Mexico City.

ROADS, STREETS AND PAVEMENTS

Alabama.

will be received until April 30, by unty Commissioners, Court House, la., for the construction of 5 miles oads, for which bids were rejected

vill be received until May 7, by lmore County Commissioners, We- ., for the construction of 18 miles nd sandy-clay roads. D. K. Caldis Engineer.

Arkansas.

[illegible] D. Ehrman, Secy. Paving District lena, Ark., for paving, guttering, cing culvert pipe and grading in An approximate estimate of the work to be done is as follows: Curb 400 lin. ft.; grading, 1,000 cu. yds.; , 1,000 lin. ft.; catch basins, 10; ra- rs, 220 lin. ft.; headers (stone or lin. ft.; cast iron, 2,000 pounds. vith 5-in. concrete foundation, 10,- Bids will be received on the following: Brick block paving, sand filled; paving, asphalt filled; [illegible] ock paving; sheet asphalt paving; bitu- he materials for the pavement will be after the bids are received and opened. contract awarded to the lowest and lder on the class of material selected. eck for $700 required. Plans and ns on file with the city clerk, C. R. , and with City Engineer L. R. Par-

Colorado.

city of Colorado Springs, Colo., plans penditure of about $300,000 for street during this year; also $50,000 for park [illegible]

Georgia.

ds will be received until 7:30 p. m., 15, by Mayor and Board of Aldermen, idge, Ga., for furnishing the necessary nd material for 22,000 sq. yds. of vitriick, wood block, bitulithic, granitoid or pavement. H. S. Jaudon Engineering tlanta, Ga., are Engineers.

ds will be received until 8 p. m., April Mayor and City Council, Brunswick, Ga., rnishing all material and labor and do- work of grading and paving with vitbrick Monk St., from Newcastle west ne steps, Gloucester St., from Union to stle, F St., from Newcastle to Bay, glethorpe St., from Monk to Gloucester, ing to the plans and specifications on the office of the City Engineer and Di- Public Works, copies of which will nished on application. There will be imately 11,000 sq. yds. of paving and in. ft. of granite curb. Bids must be accompanied by a certified check of 10 per cent of the bid, payable to W. B. Fain, City Treasurer. The successful bidder will be required to execute a bond to the sum of 30 per cent of his bid for the faithful performance of his contract. J. L. Zachry is City Engineer and Director of Public Works.

Idaho.

⦿The Ada County Commissioners, Boise, Ida., on April 2 awarded the contract for the construction of the concrete road from the city limits of Boise to the fair grounds, to join with that portion of the Boise-Meridian road completed last fall, to the Inland Empire Hassam Paving Co., of Spokane, Wash., at $14,187. The road is 5,100 ft. long, 20 ft. wide, and will be curbed its entire length and guard rails placed on either side. A. E. Fox will take charge of the engineering supervision of the work.

The Nampa Highway District Board of Trustees, Otto G. Reinhardt, President, Nampa, Ida., has outlined a campaign of good roads work that will put all of the principal highways in the district in condition. The plans include the building of a driveway around the entire city, a distance of 12 miles, and the building of a new road from 11th Ave. to the site of the state home for the feeble-minded north of the city. Approximately $11,000 will be expended.

Illinois.

✣Bids for the earthwork on the Mascoutah and Shiloch Valley road will be received by the Town Clerk of Mascoutah Township, at Mascoutah, Illinois, until 10 a. m., April 13, at which time they will be opened in the City Hall at Mascoutah, Illinois. Work to be done: The work to be done consists in the construction of earth approaches to the Silver Creek bridge, the embankment to be built from material taken from borrow pits alongside the embankment. The average height is 5 ft. and the width on top 24 ft. The total quantity of embankment is approximately 28,000 cu. yds. The soil is light clay. Work to be completed on or before October 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission which may be seen at the Town Clerk's office or may be obtained, upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received until April 15 by Board of Local Improvements, Peoria, Ill., for repaving Knoxville Ave., from Illinois Ave. to the north city limits. L. D. Jeffries is City Engineer.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., until 11 a. m., April 17, for furnishing labor and materials necessary to construct pavements in the following streets and alleys: 69th St., 8,000 lin. ft. sandstone curb, 17,280 sq. yds. brick; Union Park Ct., 1,885 lin. ft. sandstone curb, 3,470 sq. yds. brick; alley Tell St., 410 lin. ft. concrete curb, 330 sq. yds. brick; alley Clinton St., 700 lin. ft. concrete curb, 400 sq. yds. brick; alley Maxwell St., 700 lin. ft. wood curb, 600 sq. yds. brick; alley Van Buren St., 500 lin. ft. concrete curb, 300 sq. yds. brick; alley Eugenie St., 650 lin. ft. concrete curb, 470 sq. yds. brick; alley Belmont Av., 1,660 lin. ft. concrete curb, 1,270 sq. yds. brick; alley Kenmore Av., 1,690 lin. ft. concrete, 1,320 sq. yds. brick; alley Belden Av., 1,480 lin. ft. concrete curb, 1,200 sq. yds. brick; alley Indiana St., 600 lin. ft. concrete curb, 550 sq. yds. brick; alley Lincoln Av., 1,210 lin. ft. concrete curb, 960 sq. yds. brick; alley Center St., 1,420 lin. ft. concrete curb, 1,120 sq. yds. brick; alley Armour Av., 1,200 lin. ft. concrete curb, 700 sq. yds. brick; alley Champlain Av., 1,430 lin. ft. concrete curb, 1,120 sq. yds. brick; alley Hyde Park Blvd., 1,230 lin. ft. concrete curb, 1,060 sq. yds. brick; alley Harrison St., 1,400 lin. ft. wood curb, 1,200 sq. yds. brick; alley, first W. of Halsted St., 900 lin. ft. concrete curb, 1,300 sq. yds. brick; alley, 18th St., 850 lin. ft. concrete curb, 600 sq. yds brick; alley Congress St., 1,900 lin. ft. concrete curb, 1,500 sq. yds. brick; alley Van Buren St., 2,000 lin. ft. concrete curb, 1,600 sq. yds brick; alley Desplaines St., 400 lin. ft. concrete curb, 300 sq. yds. brick; alley Lytle St., etc., 500 lin. ft. concrete curb, 450 sq. yds. brick. The work includes 6-in. Portland cement concrete foundation, sand cushion excavation, sewer construction adjustment, etc.

⦿The city of Virden, Ill., has let the contract for the pavement around the public square to O. W. Eisenmeyer, of Granite City, Ill., at $26,511.

Following bids were submitted to the City Council of Decatur, Ill., for the paving of East William St., with brick: I. D. Lane, $1.73 per sq. yd.; Jansen & Zoller, $1.72 per sq. yd.; S. A. Tuttle, $1.71 per sq. yd.; Keyes & McNamara, $1.72 per sq. yd.; L. F. Hunt, $1.71 per sq. yd., and Allen & Alexander, $1.73 per [illegible]

City Engineer L. D. Jeffries, of Peoria, Ill., has estimated the cost of paving Peoria Ave. with brick a width of 25 ft., from Nebraska to Frye Ave., at $5,000, or $3.75 per front ft.

April 11 has been set by Judge Albert Akers in the Circuit Court, Quincy, Ill., as the date for the hearing on the legality of the paving ordinances recently passed by the City Council. J. Frank Garner is Mayor.

Citizens living along the east part of Ash and Oak Sts., Watseka, Ill., have asked to have the proposed new paving on those streets extended to the east city limits at Eighth St. An ordinance has already been passed for Oak St., from Second to Sixth.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

The City Council of Pekin, Ill., has adopted an ordinance providing for the paving of Broadway, from Eighth St. to the C. & A. tracks, with brick. John R. Seibert is City Engineer.

[illegible] dered the construction of a considerable amount of paving, estimated to cost $85,000.

The citizens of Edwardsville Township, Edwardsville, Ill., on April 2, it is reported, voted in favor of the construction of 22 miles of hard roads. It is planned to make the entire improvement at once and gives the Highway Commissioners authority to make a levy of $.80 on the $100 valuation for a period of five years to defray the cost. The amount to be constructed is a little less than one-third of the entire mileage in the township. The estimated cost of the improvement is $125,000.

Plans have been prepared by Engineer Arthur W. Hersey of Harvey, Ill., for the construction of most of 50,312 sq. yds. of vitrified brick pavement on an 8-in. limestone foundation, to cost about $150,000. Plain 6-in. curb will be laid with sand filler. The contracts will be let in May or June.

Plans have been prepared by James Anderson of Lake Forest, Ill., for the construction of 1½ miles of paving, estimated to cost $22,723. The work will include concrete pavement, cinder foundation and cement gutter and curb. The contract will be let in about 30 days.

Indiana.

✣Bids will be received until 10 a. m., April 10 by Board of Public Works, Indianapolis, Ind., for the following road improvement contracts: For improvement of Noble St., from S. property line Stevens St. to N. property line McCarty St., by grading and paving the roadway; for improvement of 36th St., from E. property line Illinois St. to W. property line Pennsylvania St., by grading and paving roadway; for the improvement of Gray St., from N. property line New York St. to S. property line Michigan St., by grading and paving the roadway; for the improvement of Reid Place, from S. curb line Prospect St. to a point 496 ft. S. of S. property line of Prospect St., by grading, graveling and rolling roadway; for the improvement of Kealing Ave., from N. property line New York St., to S. property line Michigan St., by grading, graveling and rolling the roadway; for the improvement of Grove St., from N. E. curb line Virginia Ave. to S. W. sidewalk of Hosbrook St., by grading and paving the sidewalks.

✣Bids will be received until 11 a. m., April 20, by Vigo County Commissioners, Terre Haute, Ind., for grading, draining and paving in Nevins and Prairie Creek and Linton Townships. N. G. Wallace is County Auditor.

⊙Jake Ackerman of LaPorte, Ind., and Ray Demass of Chesterton, Ind., have been awarded the contracts by the Board of Porter County Commissioners, Valparaiso, Ind., for the construction of gravel roads in Liberty and Jackson Townships. Bids were opened April 2 by C. A. Blachly, County Auditor.

⊙The Board of Adams County Commissioners, Decatur, Ind., has awarded the following contracts for the construction of macadamized roads in Washington, Monroe and Root Townships, for which bids were opened April 2 by H. S. Michaud, County Auditor: Merryman & Fugate, Monroe, Ind., M. F. Parrish road, $3.100; Erie Stone Co., Huntington, Ind., Oscie E. Tucker road, $3.599; Julius Hough, Decatur, Ind., A. R. Bell road, $7,987; Christ Musser, Monroe, Ind., Ernst Fuelling road, $[illegible]

⊙Smith, Douglas & Witt of Goshen, Ind., have been awarded the contract to do the cement and concrete work on the St. Joseph St. paving in Elkhart, Ind., the general contract for which is held by the Northern Indiana Construction Co., of Elkhart.

⊙The Board of Public Works of Indianapolis, Ind., on March 28, awarded the following contracts: Grading and graveling roadway of Northern Ave., from Senate to Cornelius, and curbing, John Arnold, $1.49 per lin. ft.; grading and graveling Concord St., from Michigan to Vermont, John Arnold, $.87 per lin. ft.; grading, graveling and curbing 30th St., from Fall Creek to College, American Construction Co., $1.75 per lin. ft.; grading, graveling and curbing Gray St., from 10th to Michigan, Abel Bros., $.96 per lin. ft.; cement walks on Ritter Ave., from Pleasant run to 10th St., Abel Bros., $.13½ per sq. ft.; grading and graveling roadway and grading walks of Ritter Ave., from Pleasant run to 10th St., Abel Bros., $1.11 per lin. ft.; constructing walks on Hosbrook St., from McCarty to Shelby St., Abel Bros., $.11 for walks and $.64 per lin. ft. for curb.

⊙The City Council of Bourbon, Ind., has awarded the contract for the laying of brick pavement on a 5-in. gravel, with a sand cushion of 2-ins., to J. J. Kelherer & Co., of Frankfort, Ind., at $1.27 per yd. Terre Haute brick will be used.

⊙Staples & Ackerman of South Bend, Ind., have been awarded the contract by the Board of County Commissioners, South Bend, for the construction of three miles of macadam on the Nace road at $13,480. Bids were opened April 1.

The contract for the construction of a pike road on the line between Spencer and Geneva Townships, for which bids were opened by the Board of Jennings County Commissioners, Vernon, Ind., on April 1, has not been awarded. M. N. Brogan is County Auditor.

⊙The Board of Marion County Commissioners, Indianapolis, Ind., has awarded the contract for furnishing a road grader for use on county highways to Kiger & Co., of Indianapolis. Bids were opened March 26.

No bids were received April 2 by the Board of White County Commissioners, Monticello, Ind., for the construction of a gravel and stone road in Cass Township. A. G. Fisher is County Auditor.

⊙Mathias Bellman, of Sunman, Ind., has been awarded the contract by the Dearborn County Commissioners, W. S. Fagely, County Auditor, for the construction of a macadam road in Jackson Township at $16,605. Bids were opened April 2.

⊙Albert Karsteter of Lawrenceburg, Ind., has been awarded the contract by the Board of Dearborn County Commissioners, Lawrenceburg, for the construction of public highways in Jackson and Clay Townships at $5,425. Bids were opened April 2 by W. S. Fagely, County Auditor.

⊙Wm. Mahoney of Greencastle, Ind., has been awarded the contract by the County Commissioners, La Fayette, Ind., for the construction of three gravel roads, as follows: Heisser Road, Shelby Township, $3,737; Boes Road, $4,247; Switzer Road, Shelby Township, $4,697. Eight bids were received. Bids were opened April 3 by Geo. W. Baxter County Auditor.

Following low bids were received by the Board of Public Works of Indianapolis, Ind., for the paving of Wallace St., between Washington and New York Sts.: Franck Lawson, brick, $2.40 per lin. ft., on each side of the street; American Construction Co., asphalt, $2.70 per lin. ft., on each side of the street.

Iowa.

⊙Dunnegan & Hamilton have been awarded the contract by the City Council of Corning, Ia., for the laying of brick pavement, approximating $39,000.

⊙Zitterell & Sullivan of Webster City, Ia., have been awarded the contract by that city, P. M. Banks, City Clerk, for the construction of 35,800 sq. yds. of asphaltic concrete pavement at $1.39 per sq. yd.; also for the construction of 27,300 lin. ft. of combined curb and gutter at $.44½ per lin. ft. C. H. Currie is City Engineer. Bids were opened April 3.

⊙J. W. Turner Improvement Co., Des Moines, Ia., has been awarded the contract by the Town Council of La Porte City, Ia., for the construction of 6,100 yds. of brick paving on a concrete base at $1.98 per yd. Bids were opened April 1 by G. E. Stebbens, Town Clerk. R. B. Slippy, 401-2 Marsh Pl. Bldg., Waterloo, Ia., is Engineer.

⊙G. Mancini of Florence, Nebr., at $1.18 per sq. yd., has been awarded the contract by the City Council of Newton, Ia., E. J. Finch, Clerk, for the construction of 40,0 sq. yds. of pavement, and Geo. M. King of Des Moines, Ia., at $.27 per cu. ft., for the construction of 25,000 cu. ft. of curbing. Bids w April 1.

The City Council of Albia, Ia., ha plans for additional paving, inclu 16½ blocks. The pavement will b with a concrete base in most instan

Kansas.

✣Bids will be received until 5 pm., April 18, by V. L. King, City Clerk, Atchison, Kan. for regrading, curbing and paving Division St. from Sixth St. to Maple St. The work will include approximately 3,100 cu. y of grading; 6,170 lin. ft. of concrete cu; 10,5 sq. yds. of pavement. Alternate b will received on concrete and brick ave Specifications and plans are on file with Engineer S. K. McCrary.

✣Bids will be received until 8 p. m., 24, by O. T. Jones, City Clerk, Pittsburg, for the construction of about 4,500 vitrified brick paving on a concrete base, asphalt filler. Specifications may be of the City Clerk. Official advertisement be found elsewhere in this issue.

Kentucky.

✣Bids will be received until A Town Trustees, Jackson, Ky., for struction of 13,000 sq. yds. of macad ford pavement. W. S. Canning is neer. Official advertisement will elsewhere in this issue.

The city of Hickman, Ky., is considering the matter of floating $15,000 worth of to be used in street paving.

Louisiana.

✣Bids will be received until 8 p. m., 16, by City of Crowley, La., R. J. City Clerk, for 27,000 sq. yds. of pav yds. excavation; 5,500 lin. ft. of curb

Maine.

The citizens of the town of York, recent meeting voted an appropriation 000 to build the state highway through Harbor.

Maryland.

✣Bids for the paving of sections of 20 streets, which have been arranged in following named contracts, will be received the Board of Awards, Baltimore, Md., until a. m., April 17: Contract No. 14—Sheet phalt or bituminous concrete over cobble 500 sq. yds; certified check, $1,500. No. 15—Sheet asphalt over cobble minous concrete over cobble, 37,98 680 sq yds. vitrified block; certif. $2,000. Contract No. 16—Sheet asphalt cobble and on a concrete base, 41,43 2,220 sq. yds. vitrified block, 120 sq. gian block, 1,500 sq. yds. wood block check, $2,000. Contract No. 17—Vitrified on concrete base, 15,400 sq. yds., 76 granite block; certified check, $1,000. Contract No. 18—Granite or wood block on concrete base, 7,800 sq. yds.; certified check, $1 0. The figures above represent the approximate quantities of the principal items appearing in the contract. Specifications and proposal sets be obtained upon application to the deposit of $5 will be required for each cation covering each contract, which refunded provided the bid is filed.

Massachusetts.

⊙The Department of Public Works of ton, Mass., L. K. Rourke, Commissioner awarded the contract for repairing stone sidewalks on any street within limits, for which bids were opened to Jeremiah J. Sullivan of Boston, as Less than 20 sq. ft., each job, $3; 20 and than 100 sq. ft., $.18 per sq. ft.; 100 and than 300 sq. ft., $.17 per sq. ft.; 300 and than 500 sq. ft., $.13 per sq. ft.; 500 and than 700 sq. ft., $.12 per sq. ft.; 700 and than 900 sq. ft., $.12 per sq. ft.; 900 sq. ft. over, $.12 per sq. ft.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ers at Westfield, Mass., will [illegible] munity at the April meeting to [illegible] cessary funds for a number of [illegible] improvements, including the [illegible] ite blocks on Depot Square [illegible] St., as far as Union St.

Michigan.

[illegible] & Sutherland of Ironwood, Mich., [illegible] awarded the contract by the Board [illegible] Road Commissioners, [illegible] S. Barber, Chairman, for the con[illegible] 15 miles of dirt road at [illegible] missioners also awarded a contract [illegible] Nichols at $21,48[illegible], three miles [illegible] Johnson & Kelley at $5,147, and re[illegible] bids received for the construction of [illegible] dirt road. [illegible] les the following approximate quan[illegible] 000 cu. yds. of dirt; 55,000 sqs. of [illegible] is Engineer. Bids were [illegible]

[illegible] Council of Mt. Clemens, [illegible] in favor of brick for the improve[illegible] North Gratiot Ave.

Minnesota.

[illegible] and Bridge Committee [illegible] mmissioners, St. Paul, Minn., has [illegible] tract for grading, claying and grav[illegible] and one-half miles of the Manomin [illegible] B Number, at $7,000. Other [illegible] warded were: Grading, claying and [illegible] he Portland road to D. W. Moore, [illegible] improving the New Brighton road [illegible] n Devine, at $1,500; improving the Lake road at $3,740, to William De[illegible] ving a section of the New Bright[illegible] J. Phillips, at [illegible]

Jergens of Deephaven, Minn., has [illegible] the contract by the Hennepin [illegible] mmissioners, Minneapolis, Minn., [illegible] kson, Auditor, for furnishing re[illegible] ontract number 5, road number 14 [illegible] Bids were opened April 1. The [illegible] ers at the same time awarded con[illegible] er 7 to Thomas Contracting Co., [illegible] g., Minneapolis. Bids for contract [illegible] were rejected.

[illegible] rd of Public Works of St. Paul, [illegible] rejected all bids received for the [illegible] Fifth St., from Broadway to Cedar [illegible] ha to St. Peter Sts.; also the bids [illegible] ving of Fourth St., from St. Peter [illegible] n Corners. Oscar Claussen is City [illegible]

paving committee of the City Council, [illegible] Minn., has ordered the [illegible] ing on Hennepin Ave., between [illegible] gton Ave. and High St., removed and [illegible] eet paved with creosoted wood blocks. [illegible] mmittee also ordered $143,000 worth of [illegible] gutter work, distributed as follows: [illegible] Second Ward, [illegible] Ward, $35,000; Fourth Ward, $10,000; [illegible] Ward, $1,000; Sixth Ward, $8,000; Sev[illegible] Eighth Ward, [illegible] Tenth Ward, [illegible] 12th Ward, [illegible] $7,000.

Mississippi.

Adams County Board of Supervisors, [illegible] z, Miss., on April 1, sanctioned a bond of $100,000 for good roads in the county. John F. Jenkins is Clerk of the Board.

[illegible] recent special meeting of the Yazoo [illegible] Board of Supervisors, Yazoo City, [illegible] it was decided to have Beats 3 and 5 [illegible] d by contract and to issue bonds for the [illegible] nt of the same. Bonds in the sum of [illegible] will probably be issued for the road [illegible] in Beat 3 which includes the city of [illegible] Beat 4 is located in the north end of [illegible] unty.

Missouri.

eron, McManus & Joyce, 6846 Clayton [illegible] St. Louis, have some fine short haul work to let west of Forest Park.

Nebraska.

ty Engineer Scott has furnished to the [illegible] Commissioners, Lincoln, Nebr., an es-

[illegible] concrete bridges, $1,250.

New Jersey.

✣Bids will be received until 7:45 p. m., April 11, by Streets and Highways Committee, Board of Village Trustees, South Orange, N. J., for the curbing and guttering with a monolithic concrete and cement curb and gutter, the relaying of bluestone sidewalks and the construction of concrete and cement sidewalks and the furnishing of such new bluestone flagging as may be required on both sides of Garfield place, between Richmond Ave. and Prospect St., and on both sides of Summit Ave., between Garfield Place and the village line. It is estimated that there will be approximately 2,600 lin. ft. of monolithic concrete and cement curb and gutter; 1,300 lin. ft. of bluestone sidewalks to be relaid; 892 lin. ft. of four-ft. concrete and cement sidewalks, and 185 lin. ft. of four-ft. bluestone flagging to be [illegible] may be seen and proposal blanks obtained at the office of Ira T. Redfern, the Village Engineer, on the second floor of the Taylor building, No. 11 South Orange Ave., South [illegible]

New York.

✣Bids will be received until 4 p. m., April 18, by Board of Public Works, Poughkeepsie, N. Y., for paving a portion of four streets amounting to about 11,000 sq. yds. of brick R. J. Shields is Clerk of the Board.

✣Bids will be received until 8 p m., April 16, by T. H. O'Neill, Mayor, Auburn, N. Y., for the construction of vitrified brick pavement in Franklin St., and an asphalt pavement in Lewis St. Further information may be had of the City Engineer. The approximate quantities for the work are as follows: Franklin St. —9,400 sq. yds. brick; 4,875 lin. ft. concrete combined curb and gutter, straight; 50 lin. ft. circular curb and gutter; 340 lin. ft. armored concrete curb and gutter, circular; 233 lin. ft. stone header; 200 sq. ft. concrete sidewalk; 900 sq. ft. of sidewalk relaid; 4 sewer manholes; 14 surface water inlets; 250 lin. ft. sewer; 250 sq. ft. concrete driveway. Lewis St.—2,890 sq. yds. asphalt; 2,160 lin. ft. concrete combined curb and gutter, straight; 60 lin. ft. curb and gutter, circular; 100 sq. ft. concrete sidewalk, 1,200 sq. ft. sidewalk relaid; 2 sewer manholes; 8 surface water inlets; 140 lin. ft. sewer; 300 sq. ft. concrete driveways.

North Carolina.

✣Bids will be received until 4 p. m., April 30, by Mayor and Commissioners of Roxboro, N. C., for improving streets. The work will consist of about 11,000 sq. yds. of bituminous macadam, 1,500 sq. yds. of concrete sidewalks, 6,000 lin. ft. of combined curb and gutter, and 16,000 cu. yds. of grading. Plans, profiles and specifications will be on file at the Town Hall at Roxboro, N. C., and at Engineer Gilbert C. White's office at Charlotte, N. C. No bid will be considered unless accompanied by a certified check for $500.

North Dakota.

⊙J. Rischard of Wahpeton, N. D., has been awarded the contract by the City Council of that city, Clark M. Olson, City Auditor, for the construction of various kinds of sidewalks, curbs, gutters and crossing. Bids were opened [illegible]

Ohio.

✣Bids will be received at the office of the Commissioners of Lake County, at Painesville, Ohio, until 10 a. m., April 25, for grading and paving with a bituminated concrete, the Madison Southern Road, in Madison Township, said County. Length, 7,465 ft., or 1.41 miles, width of pavement, 12 ft., estimated cost of construction, $9,788.35. A draft or certified check for $300 shall be deposited with each bid. The successful bidder shall be required to give bond for an amount equal to the contract price, for the faithful performance of the obligations within the contract. Date set for completion, August 1, 1912. Plans and specifications are on file in the offices of the County Commissioners and the State Highway Department. James R. Marker is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Mahoning County, at Youngstown, Ohio, until 10 a. m., April 26, for grading and improving with a waterbound macadam, Section No. 1 of the Ellsworth Center Easterly Road, Ellsworth Township, said County. Length 6,700 ft., or 1.27 miles, width of pavement 14 ft., estimated cost of construction, $12,098.19. A draft or certified check for $300 shall be deposited with each bid. The successful bidder shall be required to give bond for an amount equal to the contract price for the faithful performance of the obligations within the contract. Date set for completion August 1, 1912. Plans and specifications are on file in the offices of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Jefferson County, at Steubenville, Ohio, until 1 p. m., April 18, for grading and paving with a waterbound macadam, the New Somerset Road, in Knox Township, said County. Length, 14,106 ft., or 2.67 miles; width of pavement, 14 ft.; estimated cost of construction, $29,136.49. A draft or certified check for $300 shall be deposited with each bid. The successful bidder shall be required to give bond for an amount equal to the contract price, for the faithful performance of the obligations within the contract. Date set for completion, August 1, 1912. Plans and specifications are on file in the offices of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Mahoning County, at Youngstown, Ohio, until 10 a. m., April 26, for grading and improving with a waterbound macadam, Section No. 2 of the Ellsworth Center Easterly Road, in Ellsworth Township, said County. Length 6,802.5 ft., or 1.29 miles, width of pavement 14 ft., estimated cost of construction, $11,615.78. A draft or certified check for $300 shall be deposited with each bid. The successful bidder shall be required to give bond for an amount equal to the contract price for the faithful performance of the obligations within the contract. Date set for completion August 1, 1912. Plans and specifications are on file in the offices of the County Commissioners and the State Highway Department. James R. Marker is State Highway Commissioner.

✣Bids will be received until noon, April 26, by Board of Hamilton County Commissioners, Cincinnati, O., for the improvement under Specifications No. 297, of Fallis Road, from Union Cemetery Road to Rich Road, in Symmes Township. A bond for $1,000 must accompany each bid. Stanley Struble is President and Albert Reinhardt is Clerk of the Board.

⊙Fred Betzing of Cincinnati, O., has been awarded the contract by the Director of Public Service of St. Bernard, O., for the macadamizing of the roadway and constructing concrete curb and gutters on Langley Ave., at $4,137. Bids were opened March 30.

⊙The Board of Control of Wooster, O., John Johnston, Director of Public Service, has awarded the contract for the paving of a strip 1,300 ft. in length on High St., to George B. Herring & Son of Mansfield, O.

City Engineer Phil Weber of Canton, O., has estimated the cost of the proposed paving

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

of Aultman Ave., from ... to North Market St., at $27,415.

A petition has been circulated at ..., O., to have the proposition of repaving and improving the public square at a cost of $3,500 submitted to the electors.

The estimates for the proposed repaving of Eastern Ave., city of Cincinnati, O., show that the cost will be about $25,000. It is contemplated to re-use the best of the present granite blocks in repaving between the car tracks. Included in the improvement is the raising of the grade of the street in places so that the new street will be at a minimum of 65 ft. above low water mark in the Ohio River.

Oregon.

⊙The city of Salem, Ore., has awarded the contract to construct a Portland cement pavement on Center St., to the E. W. Geiger Construction Co., of Salem, Ore., at $23,532.

The City Council of Medford, Ore., has passed an ordinance ordering the pavement of the following streets: North Ivy St., from Sixth St. to Fourth; West 11th St., from Central Ave. to Oakdale; Newtown, from Dakota Ave. to 11th St., South Ivy, from Eighth St., to north line of Park addition; 10th St., from Oakdale to Holly St.; Bennett Ave. and 11th St., from Oakdale to Hamilton St., have been stricken from the list.

Following bids were received by the City Council of Roseburg, Ore., on March 20, for the laying of approximately 20,000 sq. yds. of pavement: Warren Construction Co., standard bitulithic, $2.25 per sq. yd., light bitulithic, $2.10 per sq. yd.; Pacific Coast Westrumite Co., westrumite pavement, $1.70 per sq. yd.; Clark & Henery Construction Co., standard asphalt, $1.65 per sq. yd., light asphalt, $1.48 per sq. yd., other proposals submitted by this firm on asphalt were $1.58, $1.65, $1.56, $1.73 and $1.83 per sq. yd.; Hillard & Maginnis, concrete, $1.25 per sq. yd.; Jeffry & Bufton, dolarway pavement, $1.35 per sq. yd.; August Kehrberger, concrete, $1.29 per sq. yd.; L. D. Pugh, concrete, $1.09 per sq. yd.

Pennsylvania.

The City Council of Erie, Pa., rejected all bids received for the paving of East Ave., from Fifth St. northwardly to Queen St., being considered too high. The bids averaged more than $1.61 per sq. yd. for asphalt and brick.

Rhode Island.

✣Bids will be received until noon, April 10, by State Board of Public Roads, Providence, R. I., for the construction of Sections of State highway in the following towns: Glocester, 4.9 miles; Coventry, 3.2 miles; East Providence, 3.7 miles; Warwick, 8.76 miles; Burrillville, 1.0 mile; South Kingstown, 4.4 miles; Exeter and Richmond, 3.9 miles; Johnston and Cranston, 2.0 miles; and for resurfacing sections of State highway in the following towns, Cranston and Warwick, 4.13 miles; Warwick, 4.0 miles; East Greenwich and North Kingstown, 5.2 miles; North Kingstown, 2.3 miles; North Kingstown and Narragansett, 5.4 miles; Cranston and Warwick, 6.0 miles; North Providence, Johnston, Smithfield and Glocester, 6.5 miles; Glocester, 5.0 miles; East Providence and Barrington, 5.5 miles; Warren and Bristol, 1.4 miles; Warren, 1.5 miles; Bristol, 1.3 miles; Tiverton, 3.7 miles; Middletown, 2.0 miles; South Kingstown, 1.3 miles; South Kingstown and Charlestown, 6.7 miles; Charlestown and Westerly, 5.5 miles.

South Dakota.

✣Bids will be received until noon, May 1, by F. G. Haven, County Clerk, Mellette, S. Dak., for the construction of 8 miles of road in [illegible] Township.

Tennessee.

⊙The Memphis Asphalt & Paving Co. has been awarded the contract for the improvement of Fourth St., between Union and Court Aves., city of Memphis, at $7,122.

Texas.

✣Bids will be received until [illegible], by L. S. Polk, City Secretary, Sweetwater, Texas, for the construction of about 60,000 sq. yds. of waterbound macadam street paving and 4,000 sq. yds. of asphalt macadam street paving in the city of Sweetwater, Texas, all bids to be submitted as follows: Each bidder must submit a price per square yard of water-bound macadam paving, a price per square yard of asphalt macadam paving and a price per cubic yard of grading. All bids shall be in accordance with the requirements of the specifications of the City Engineer. Specifications for such work may be obtained from A. O. Dreyer, City Engineer, Sweetwater, Texas. Each bill shall be accompanied by a certified check in the sum of $500.

✣Bids will be received until noon, May 21, by Board of Permanent Road Commissioners, W. F. Gill, Secretary, Paris, Tex., for the entire construction of 40 to 48 miles of permanent rock roads and bridges for Precinct 1, Lamar County, Texas. M. Hannah is Engineer. Official advertisement will be found elsewhere in this issue.

⊙The City Commission of Fort Worth, Tex., has awarded the contract for the paving of West First St. to R. S. Blome Co., for granitoid material. The Commission also awarded a contract to the General Construction Co., for the paving of North Main St. with brick at $1.97 per sq. yd. The latter contract will amount to approximately $80,000.

No bids were received on March 30 by Commissioners' Court, Dallas, Tex., for the construction of the Seagoville and Molloy bridge road, beginning at the Molloy bridge and extending in an easterly and westerly direction; the Hutchins bridge and Rylie road from Hutchins bridge in an easterly and westerly direction; the Wilmer bridge road, beginning at the Wilmer bridge and extending in an easterly and westerly direction. The work will be done by day labor. G. L. Fearn is County Auditor.

The city of Corpus Christi, Tex., will let contracts in about 60 days for the construction of 150 blocks of pavement, to be laid on a concrete foundation. The kind of pavement has not been selected. The work will be in charge of the Street Commissioner.

The Victoria County Commissioners, Victoria, Tex., have sold bonds in the sum of $200,000 for the construction of good roads in Victoria precinct to the Commerce Trust Co., of Kansas City, Mo.

The citizens of Corpus Christi, Tex., on March 25, it is reported, voted the issuance of bonds in the sum of $150,000 for the purpose of paving the city streets.

The Board of Municipal Commissioners, Dallas, Tex., has adopted the report of Street Commissioner Lee that Knight St. be graded from Cedar Springs Road to Dickason Ave., and that the City Secretary advertise for bids on the work. City Engineer J. M. Preston has estimated that 1,158 yds. of material will have to be removed at a cost of $290.

The Attorney General at Austin, Tex., has approved the $300,000 issue of good roads bonds made by Wharton County. Wharton is the county seat.

The City Council of San Angelo, Tex., has rejected all bids received for the purchase of $50,000 worth of street improvement bonds and has announced that bids would be received through 30 days' notice. This issue was ordered for pavement purposes by the voters two weeks ago.

Washington.

✣Bids will be received until 8 p. m., April 22, by Town of Cashmere, Wash., for the construction of cement walks and sewers.

Following bids were received March 29 by the Board of Public Works of Seattle, Wash., for paving work: Harvard Ave. N.: Nura Case, $7,936; Fenn & Breman, $8,109; S. Normile, $8,181; Sparger Concrete Co., $8,305; P. J. McHugh, $8,070. 4th Ave. S., asphalt top—P. J. McHugh, $29,869; Barber Asphalt ... $28,111. 20th Ave. N., concrete w... Asphalt Co., Henry Bldg., Seattle, ... H. Traphagen, $9,374; Fenn & Breman, ...; Krogh & Jessen, $9,442; Jenkins & ... 404; Elliott Construction Co., ...; Isedor & Co., Federal Bldg., Seattle, ...; De Flong & Heltborg, $10,009; A. Peter... & Co., $10,365; S. Lamping Co., ... Ave. N., concrete walks—DeFlong ... $871; Chas. G. Nixon, $868; Edg. C. Park... $835; D. H. Traphagen, $854; Krogh & Jessen, $896. Newport Ave. et al., concrete walks—Frasca & Coluscia, $10,494; Edg. C. Parks, $10,308; D. H. Traphagen, $9,397; DeFlong ... Heltborg, $9,454.

The City Council of Aberdeen, Wash., has ordered the paving of West Heron St., from K to M Sts., and portions of K and M Sts. to the Northern Pacific and other railroad property. The engineer's estimate of the improvement is $24,051.

The King County Commissioners, Seattle, Wash., have decided to make special ... surfaced roads, to be built in the future ... enough to include not only warrenite, ... phalt, brick and other surfaces.

The City Council of Pullman, Wash., has created an improvement district in the residence district of the city. Star Route Ave. and Montgomery St. are to be paved from the south end of Star Route Ave. to the state college campus.

Wisconsin.

⊙The City Council of Green Bay, Wis., ... awarded contracts aggregating $7,000 for asphalt paving work and one contract amounting to $13,500 to the White Construction ... Milwaukee, Wis. W. W. Reed is City Engineer.

⊙The City Council of Green Bay, Wis., ... awarded the contract for the construction ... asphalt pavements amounting to $7,000 and ... contract for tar macadam pavement amounting to $13,500, to the White Construction ... Milwaukee, Wis. Asphalt will be used ... top surface on Dousman, West Walnut, O... land, Shawano and the part of E. ... between Adams and Webster Ave. Tar macadam will be laid on Crooks St.

Bids were opened March 26 by the City ... Janesville, Wis., C. V. Kerch, City ... for constructing brick pavement ... Main St., Gund, Graham & Co., Freeport, ... being the low bidders at the following bid...

900 cu. yds. excavation...................
5,513 sq. yds. brick pavement...............
1,520 ft. combined cement curb and gutter
36 ft. brick protection curbing......
31 ft. stone protection curbing......
36 ft. protection curbing reset.......
860 sq. yds. brick pavement relaid...
900 sq. yds. new foundation ..

Wyoming.

✣Bids will be received until 10 a. ... by Maj. Amos W. Kimball, Qua... Fort D. A. Russell, Wyo., for repai... curbs and gutters.

Canada.

✣Bids will be received until noon April ... by W. Gorham, Secretary-Treasurer, Ru... Municipality of St. Paul, Man., at his office at Bird's Hall, for the draining and grading of: (1) East two-mile road from the south boundary of the Municipality to Bird's Hill; (2) the Hoddinott Road; (3) the 1st Main Road through Ward 3; (4) the West Main Road from north to south boundary of the Municipality. Plans and specifications of roads on the east side may be se... Municipal Office at Bird's Hill, an... Main Road on the west side at the ... Mr. T. H. Emes, or at the office of ... way Commissioner, Parliament Bldg., ... peg.

✣Bids will be received until 8 p. m., April 22, by H. W. Dixon, Secretary ... North Battleford, Sask., for contra... constructing 180,000 sq. ft. of concrete walks. Chipman & Power, Toronto ... nipeg, are Engineers.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

BRIDGES—STEEL AND CONCRETE

California.

Council of San Francisco, Calif., a resolution appropriating $[illegible] to build a bridge over the [illegible] Harrison St.

from San Francisco, Calif., state kland & Antioch R. R. Co. is plan- Secretary of War Stimson for a uild a $1,000,000 bridge across the Suisun Bay, popularly called the he Sacramento River. The bridge, length, will be of the vertical lift rding to plan, and will be of steel, concrete piers. The structure will m Black Diamond in Contra Costa r the town of Antioch, to Chipps Solano County. The bridge is not r steam trains, but will be used for s, vehicles and pedestrians. It is at the expense of the improvement ne in different proportions by the mpany, the counties of Solano and sta and Sacramento's civic and com-

Colorado.

ntract for the construction of a I-beam bridge on the State High- f the town of Hillrose in Morgan lo., has been awarded by the mmission to the Missouri Valley Iron Co., Leavenworth, Kan., at e work will include substructure

Connecticut.

[illegible] received until April [illegible] Haddam Bridge Commis- Purple, Chairman, East Haddam. onstructing the superstructure of ridge, 889 ft. long over the Con- er at East Haddam, Conn., for f Connecticut. The work includes tons of structural steel, with the chinery, safety gates, electric mo- rmers, etc. There will be one 461 span; one 3[illegible] ach spans. Boller, Hodge & Baird. y, New York City, are Consult- s. E. W. Bush in Chief Engineer.

Delaware.

l be received until noon, April 23. ourt, Wilmington, Del., for the substructures of a movable bridge ristiana River at Third St., Wil- l. Plans and specifications are on nty Engineer, Church Bldg., Wil- A certified check for $1,000 will be th bid. Official advertisement will sewhere in this issue..

Florida.

ll be received until noon, May 7, f Commissioners of Public Works, cKay, Chairman, Tampa, Fla., for the tion of steel and concrete highway over the Hillsboro River at LaFayette e structure will consists of two rein- concrete arch spans of 82 ft. clear span 93 ft. single deck Scherzer rolling lift ith two wings. A certified check for ayable to the board much be filed with d. Boller Hodge & Baird, 149 Broad- ew York City, N. Y., Consulting Engi- Official advertisement will be found re in this issue.

Board of County Commissioners, Jack- , Fla., received the following bids for struction of a steel concrete bridge 530 with 16 ft. roadway over Trout Creek Lem Turner Road: Converse Bridge hattanooga, Tenn., $20,000; Edwards uction Co., of Tampa, Fla., $19,757; a Bridge & Iron Co., Roanoke, Va., ; Southern Bridge Co., Birmingham, 23,134; Austin Bros., Atlanta, Ga., $21,- [illegible] Bridge Co., Macon, Ga., $2[illegible]

[illegible] W. C. Kienan & Co., Whitewater, Wis., two [illegible]

[illegible] West Palm Beach, Fla., have announced that a bridge will be constructed over the St. Lucie River at Stuart shortly. Plans for the work have already been completed

Idaho.

✣Bids will be received until 10 a. m., April [illegible] E. F. Crawford, Chairman, Boise, Idaho, for the construction of two reinforced concrete boxes across the Valley road and one set of abutments.

Illinois.

The Committee on Streets, Alleys and Bridges, Peoria, Ill., has reported favorably on the resolution of Mayor E. N. Woodruff providing for the construction of a viaduct over the railroad crossing at Bridge and Water Sts., and plans for the structure have been ordered drawn. The cost of the improvement is estimated at about $60,000. L. D. Jefferies is City Engineer.

The Common Council of Oshkosh, Wis., has voted in favor of employing the Scherzer Rolling Lift Bridge Co., Chicago, Ill., to prepare plans for the construction of a bridge to replace the present West Algona St. structure. The plans are to include both a bascule and swing bridge.

A petition is being circulated by H. J. Adkins, River St., Aurora, Ill., for presentation to the City Council asking for the construction of a bridge over the Fox River from Benton St. to Holbrook St.

Following is the low bid submitted to L. E. McGann, Commissioner of Public Works, Chicago, Ill., on April 3 for furnishing the labor, materials, etc., for making necessary pile repairs at the Rush St., Madison St., Adams St. and 12th St. bridges, furnishing and driving 22,500 lin. ft. white or burr oak piles, at 26½ cts., $5,962.50; 4,200 lin. ft. pile chain at 20 cts., $840; 1,200 lbs. boat spikes, at 3 cts., $36, 2,500 lin. ft. oak caps, wales or fenders, at 72 cts., $1,800; 200 lin. ft. old caps and waling removed, at 5 cts., $10.00; 200 old piles pulled, at $2.00, $400.00. Total $9,048. Walsh & Masterson, 105 N. Clark St., were low bidders.

Indiana.

✣Bids will be received until 10 a. m., April 15, by Hancock County Commissioners, Greenfield, Ind., for the construction of several county bridges. Lawrence Wood is County Auditor.

✣Bids will be received until 11 a. m., April 20, by Board of Vigo County Commissioners, Terre Haute, Ind., for the construction of a concrete bridge in Honey Creek Township. N. G. Wallace is County Auditor.

Board of Marion County Commissioners, Indianapolis, Ind., has been petitioned by the residents of Pike Township, asking that a bridge be constructed over Big Eagle Creek. No action was taken on the matter.

⊙The Board of County Commissioners, Fort Wayne, Ind., received the following bids for the construction of the bridge over the Maumee River at Coombs St.: W. H. Roney, Gary, Ind., stone-faced concrete, Grosvenor plan, $58,400; J. W. Turner, Des Moines, Ia., Grosvenor plan, $65,000; National Concrete Co., Indianapolis, own plans, $57,978; Hackedorn Engineering Co., Indianapolis, own plans, $59,977; George Jaap, Fort Wayne, Grosvenor plan, $59,000; Weatherhogg plan, $63,000; own plan, $56,464; county plan, $52,282; Lafayette Engineering Co., Lafayette, Ind., $61,500; Grosvenor plan, $63,000, and $61,000 on other plans; Herman Tapp Construction Co. (awarded contract), $56,430 Grosvenor plan; $56,390 Jaap plan; $56,015 county plans. Three bids on steel structure were received. One from the Attica Bridge Co., of Attica, Ind., $17,097, another from the Elkhart Bridge Co., $18,200, and the third from the National Concrete Co., [illegible]

⊙The Board of Jasper County Commissioners, Rensselaer, Ind., has awarded the contracts for the construction of five bridges as follows: One bridge to Attica Bridge Co., Attica, Ind., at $837; and four to F. M. Williams, Winamac, Ind., at the following prices: [illegible]

Iowa.

✣Bids will be received until 1 p. m., May 6, by Supervisors of Union County, Creston, Ia., for the construction of a 40 ft. bridge over the river at Creston, Ia. The structure will be of steel with concrete substructure and will have a 24-ft. roadway with walk on each side. Plans and specifications ready April 20 and on file with T. S. DeLay, County Surveyor, Creston, Ia.

⊙The contract for the construction of five concrete bridges in Marshall County has been awarded to the Capital City Construction Co., Des Moines, Ia., at $17,800. The work will include one structure of 3 60-ft. spans, and arch bridge and four 70-ft. single slab bridges.

The Illinois Central R. R. will take immediate steps toward the construction of a new bridge to replace the bridge near Lehigh, Ia., which was recently washed out.

Plans have been completed, it is said, for the construction of a bridge at Lansing, Ia., to cost about $100,000. L. Markwardt, Lansing, Ia., is Architect.

Kansas.

The Commissioners of Kingman County, Kingman, Kan., will soon construct a reinforced concrete bridge over the Ninnescah at the Main St. crossing to replace the old wooden structure at that point.

Kentucky.

The Commercial Club of Pineville, Ky., is advocating the construction of a 100 ft. bridge over the Cumberland River to the site of the proposed new railroad depot. The structure will be used for both pedestrians and ordinary traffic. Further information may be obtained of N. R. Patterson, Mayor.

Minnesota.

⊙The contract for the construction of a new bridge over the Red River at Oslo, Minn., has been awarded to the Continental Bridge Co. at $18,500.

⊙The Great Northern Bridge Co., Minneapolis, Minn., has been awarded the contract for the construction of a bridge at Cloquet, Minn.

At the annual town meeting, Hallock, Minn., it was voted to construct three new steel bridges. P. Lindahl is Clerk of the town.

Mississippi.

⊙The Harrison County Circuit Court, Gulfport, Miss., has awarded the contract for the construction of a bridge over the Biloxi River to Austin Bros., Atlanta, Ga., at $5,000.

⊙The Board of Supervisors, Batesville, Miss., has awarded the contract for the construction of three steel bridges to the Memphis Bridge Co., Memphis, Tenn., at $3,829.

Nebraska.

✣Bids will be received until April 30, by County Clerk, Blair, Nebr., for the construction of a bridge over the Elkhorn, River in Washington County about ½ mile west of Arlington. Bids will be considered on a 180-ft. steel bridge on concrete abutments or a 2-span concrete arch bridge, 180 ft. in length.

✣Bids will be received until April 23, by Keyapaha County Clerk, Springview, Nebr., it is said, for constructing two new bridges over the Niobrara River, to be known as the Carns Bridge and the McCulley bridge.

New Jersey.

Governor Wilson, Trenton, N. J., has signed the Leavitt free bridge bill. The measure authorizes the acquisition by the state of all bridges across the Delaware River between New Jersey and Pennsylvania and abolishes all tolls. This action must be concurred in by the state of Pennsylvania to become effective.

New York.

At a special meeting of the town board, Whitesboro, N. Y., a resolution was adopted urging Governor Dix to sign the bill authorizing an appropriation of $60,000 for the construction of a new bridge over the Erie Canal replacing the present railway bridge.

The Flushing Association, Brooklyn, N. Y., has approved the plan of the bridge to be erected over Main St., Flushing, by the Long Island R. R. The bridge will be of steel construction, masked with concrete. It will span the street and will have a clearance of 14 ft. The roadway will be 60 ft. It will cost in the neighborhood of $25,000. T. J. Carlisle, Jamaica, N. Y., is Principal Assistant Engineer of the railway.

North Carolina.

Commissioners of Mecklenburg, Charlotte, N. C., have decided to replace all structures washed out by the Stewart's Fork Creek and Crooked Creek with steel structures.

Ohio.

✤Bids will be received until 11 a. m., April 27, by Board of Cuyahoga County Commissioners, Cleveland, O., for furnishing the necessary labor and material for the construction of the foundation of the two river piers, estimated to cost $300,000, necessary for the construction of a county bridge to be known as the Detroit-Superior Bridge. J. F. Goldenbogen is Clerk of the Board.

✤Bids will be received until May 8 by Board of Ashtabula County Commissioners, Jefferson, O., for remodeling abutments; also plate girder with reinforced cement floor over Ashtabula Creek on Gulf Road.

✤Bids will be received until 11 a. m., April 30, by Board of Medina County Commissioners, Medina, O., for furnishing the necessary labor and material for the construction of the superstructure of a highway bridge on the Cleveland pike. The structure, which will be known as the Rocky River bridge, will be 65 ft. long and 16 ft. wide. L. E. Carver is County Auditor.

✤Bids will be received until 10 a. m., April 16, at the office of the County Auditor, Bryan, O., for the construction of bridge and abutments in Williams County.

⊙The Commissioners of Ashtabula County, Jefferson, O., have awarded the contract for fill approaches to bridge to Ward & Nims, Colebrook, O., at $1,035.

⊙Wade & Nims, Colebrook, O., have been awarded the contract by the County Commissioners, Jefferson, O., for making fills of approaches to a bridge on Pine St. in Jefferson Village. The contract price was $1,034. J. S. Matson is County Engineer.

An election will be held May 21 at Columbus, O., to submit to the voters the question of building a new viaduct at Third St. to connect the North and South sides of the city. Henry Maetzel is City Engineer.

Special Engineer C. L. Gates, who has been conducting an investigation for the city of Toledo, O., has declared unsafe the Erie St. bridges over Swan Creek and the Miami & Erie Canal and the Western Ave. bridge over Swan Creek. Immediate steps will be taken by the Department of Public Service toward the construction of new bridges.

Oklahoma.

Following a conference with the Santa Fe Ry. officials and the City Charter officers of Guthrie, Okla., it has been announced that work will begin shortly on the construction of the Cleveland Ave. viaduct over the Cottonwood River and the Santa Fe tracks. The city recently voted $47,000 for the purpose and the balance of the expense will be paid by the railway company.

Oregon.

✤Bids will be received until 10 a. m., April 17, by F. S. Fields, Multnomah County Clerk, Portland, Ore., for the erecting of the steel of the Troutdale bridge, furnishing the timbers and planking for the roadway and laying the same. Steel to be removed from cars before demurrage accrues. Plans and specifications can be seen at the office of the County Surveyor, at the Courthouse, Portland, Ore.

✤Bids will be received until 10 a. m., April 17, by F. S. Fields, Multnomah County Clerk, Portland, Ore., for furnishing the steel for a bridge over the Sandy River at Troutdale, Ore. The bridge consists of two 163-ft. riveted Prat trusses and one 39-ft. deck girder, 18-ft. roadway, steel railing and plank floor. Steel to be delivered at Troutdale, Ore., f. o. b. cars. Plans and specifications may be seen at the office of the County Surveyor at the courthouse. No bid will be considered unless accompanied by a certified check payable to the order of the County Court, for at least 5 per cent of the amount of the bid.

⊙Union Bridge & Construction Co., Kansas City, Mo., has been awarded the contracts by the Oregon Electric Ry. Co. to build three bridges on the extension from Salem to Eugene, Ore. The principal structure will span the Willamette River at Harrisburg and the second in size will be across the Santiam, the remainder of the contract being in connection with less important work. L. S. Stewart is President of the construction company.

Commissioners of Yamhill County, McMinnville, Ore., have decided upon the erection of a new steel bridge over the Yamhill River near Whiteson estimated to cost about $10,000.

Pennsylvania.

✤Bids will be received until 11 a. m., April 15, by Board of County Commissioners, West Chester, Pa., it is said, for constructing a stone arch highway bridge over White Clay creek at 3d St. in Avondale.

Business Men of the Lawrenceville, Pa., district have adopted a resolution favoring the site at 39th St. for the construction of the proposed bridge over the Junction Hollow from Liberty Ave. to Melwood St.

The State of Pennsylvania has been petitioned to take preliminary steps toward the reconstruction of two bridges, recently destroyed by floods. One structure is at Mahoning, Armstrong County, and the other at Falls, Wyoming County. After a consultation the State Highway Commissioner appointed viewers to inspect the sites.

Manager T. A. Wright of the Traction Co. and county officials at Wilkesbarre, Pa., recently held a conference in regard to the plans of the traction company to enlarge the Market St. bridge to accommodate a double track line. The cost of the improvement is estimated at $75,000.

New Jersey.

⊙The contracts for the construction of steel and concrete bridges over the Upper and Lower Raceways on Ellison St. at Paterson, N. J., have been awarded to F. A. Schwins, Jr., at $4,757 and the Lafayette Ave. bridge to G. W. Sasco at $2,744.

South Carolina.

The Seaboard Air Line Ry. Co. has submitted to the city of Greenwood, S. C., plans for the construction of the proposed steel and concrete bridge over the Seaboard cut. The cost of the work is estimated at about $4,000.

South Dakota.

⊙Ellerman & McLain Construction Co., Yankton, S. Dak., has been awarded the contract for the construction of a reinforced concrete bridge over Rhine Creek in Pine St. J. N. Summers, Yankton, S. Dak., is City Auditor. Bids were opened April 1.

Tennessee.

⊙Foster-Creighton-Gould Co., Nashville, Tenn., has the contract for the construction of the new Lewisburg & Northe bridge over the Cumberland Riv It will be 3,300 ft. long and 120 ft. hig consist of one 300-ft. span, three 2 ft. spa one 150-ft. span and two 115-ft. spans. It have a viaduct approach consisting of on ft. and one 40-ft. span. The foundation the bridge will be solid rock. It is estimated that the cost will be between $,000 and $600,000. More than 12,000 tons of structural steel will be used. This firm has also secured the contract for the erection of fift wo bridges on the same line between Nash and Birmingham.

Texas.

✤Bids will be received until noo May 21, by Board of Permanent Road Commissioners, Paris, Texas, for the construction of bri in connection with about 46 miles of pe nent rock road in Lamar County, Texas ficial advertisement will be found in this issue.

⊙The County Commissioners, F W Tex., have awarded the contract fo the struction of the bridge over Marin Cr 23d St. to the Tarrant Constructi (

An agreement has been reached tw M. Preston, City Engineer, Dallas, Tex Engineers of the Houston & Tex (R. R. whereby the company is to bid crete and steel bridge at the cro ng Pennsylvania Ave., providing a crosig the tracks for the street. Street Commiss Lee will recommend the railroad be lo go ahead with the work. The brid w 60 ft. long and will provide 12 ft. le over the street. It will be built wit co abutments and steel girders. The sec passes through a hole in the embankment, about 3-ft. clearance for vehicles. e ent expense will be borne by the railro.

Utah.

✤Bids will be received until 10 a. m., Ap 16, by County Commissioners, Salt Lake Utah, for the erection and completn girder bridge on concrete abutments n No. 15 east over Big Cottonwood r miles east of Murray. Margaret Zan Nitch is County Clerk.

Citizens of the West Side, Salt Lake Ci Utah, have petitioned the city to take st induce the Denver & Rio Grande construct a viaduct over its tracks on Seven South St. between Fifth and Sixth est S D. H. Blossom is City Engineer.

According to advices from Moa Grand County, voted almost unanimously favor of issuing bonds amounting to $50 the completion of the Grand River ldge

West Virginia.

✤Bids will be received until noon, p by Street Committee, of the City Grafton, W. Va., for the construct of concrete bridge on Yates Ave. o Creek in West Grafton.

The Lincoln Bridge Co. of Br chla W. Va., has been incorporated with capi stock of $25,000, and proposes to cotruct bridge across Guyandotte River in Linco County and charge toll, etc. The incr tors are J. F. Ridgley, R. L. O'Ne Rau., Sr., C. C. Becker, Huntington, a W. Conger, Oswego, N. Y.

Wisconsin.

Citizens of Duluth and West Dulut Min are strongly advocating the construct bridge by the county over St. Louis Fond du Lac, Wis.

Canada.

⊙L. J. Looby, Dublin, Ont., has bee war ed the contract for the constructi concrete bridges at $12,052.

The Government will guarantee $1,00 4 per cent bonds of the Valley Ry. C years to aid the construction of three One is to cross the Kennebeccasis nea Point; one to cross the St. John n Mistake, and the other to cross the S near Andover. The interest for t fifteen years will be paid by the domi

✤ indicates work now open for bids. ⊙ indicates a contract let recently.

...een announced by William M. Neill ... Board of Directors of the Burrard ... ter, Boundary Railway & Navigation ... ouver, B. C., that the company has ... sideration the construction [illegible]

[illegible] ernment [illegible]

[illegible] Control in an effort to secure the erection of the old superstructure of the Osborne St. bridge over the Assiniboine River at Arling- [illegible]

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arizona.

...ere opened March 28 by the A... ssociation, Phoenix, Ariz., for the ex- work on the new cross-cut canal ... 3½ miles from the ... [illegible] ... er house. Grant Brothers Construc- was awarded the contract. The work ...5,000 cu. yds. earth excavation, 10,000 [illegible] excavation, and 7,000 [illegible] excavation.

California.

...Nitmer, Denair, Cal., has been award- ...tract at $25,500 for the construction ... 5½, and changes in Lateral 7 for ...k Irrigation District, bids for which ... opened March 25 at Turlock. The ...ncludes the excavation of about 15 ... canal, about 463 cu. yds. reinforced ...86 cu. yds. plain concrete lining, 12 [illegible] ...ridges and 1 concrete-steel bridge.

Colorado.

...will be received until 10 a. m., April ... S. Reclamation Service, 408 Com- ... Bldg., Denver, Colo., for furnish- ... barrels of Portland cement, f. o. b. ...rks of bidder for shipment during ... of 1913 to 1916 inclusive. The es- ...quirements for each of the above ... as follows: 1913, 70,000 barrels; ...915, 85,000 barrels; 1916, 20,000 [illegible]

Georgia.

...Augusta, Ga., is considering means ...ting its waterfront from encroach- ...flood waters. A levee is proposed. ...ly a plan has been brought forward ...t a dam eight miles above the city. ...le that a $1,250,000 bond issue may

Idaho.

...ontracts for equipment for the Crane [illegible] Smith, Kerr ... ise, Idaho, and Toronto, Ont., are ...gineers, have been let as follows: The ...Chalmers Co. was awarded the contracts [illegible] equipment: Three ... open flume type hydraulic turbines, capa- ... developing 3,000 B. H. P. each under ...f 27 ft. at 164 R. P. M.; two single ...citer turbines, each capable of de- ...215 B. H. P. under a head of 27 ft. ... P. M.; 3 water wheel type A. C. ...ators, 3 phase, 60 cycle, 6,600 volts, 164 ... M.; two 125 volt, 120 kilowatt, 350 R. ..., compound wound exciters. The fol- ...g contracts were awarded the Westing- ... Electric & Manufacturing Co.: Three ... phase, 60 cycle, 6,600 volt, low tension ...000 volt high tension step up transform- ...three single phase, 60 cycle, 60,000 volt [illegible] 2,200 volt low tension step ... transformers. The following 3 phase, ... volt induction motors with squirrel cage ...daries and with complete starting equip- ... were also awarded to the Westinghouse ... Three 1,025 H. P., 865 R. P. M. motors; ...700 H. P., 700 R. P. M. motors; two 330 ..., 495 R. P. M. motors; two 255 H. P., ... R. P. M. motors

Illinois.

...ids were opened March 25 by the com- ...ioner of Richland Creek Drainage Dis- ... Belleville, Ill., for drainage work, the ...ract being awarded to R. A. Brown & Co., ...hington, Ind., at 10 cts. per cu. yd. The ... includes a main channel, 5 miles long, 18 ft. base, ½ to 1 slopes, 9 ft. average cut, re- [illegible]

⊙Contracts for work in Sub-district No. 4 of Pitman Drainage District No. 2, bids for which were opened March 30 at Waggoner, Ill., have been let as follows: Furnishing tile, Stoneware Pipe Co., East Alton, Ill., at $12,239; the Raymond Tile-Cement Co., Raymond, Ill., at $1,160; hauling tile, J. C. Hitchings, Harvel, Ill., at $1,337; outlet wall, Ward Rice, Waggoner, Ill., at $60. The contract for trenching and laying tile was not let and will be readvertised. J. W. Dappert, Taylorville, Ill., is the engineer.

⊙Carter Bros., Danville, Ill., have been awarded the contract at 10 cts. per cu. yd. for the construction of open ditches for the Clark Drainage District of Emma Township, the work calling for 65,000 cu. yds. of excavation. Bids were opened April 2 at Carmi, Ill.

Iowa.

✣Bids will be received until noon, April 12, by G. H. Getty, Boone County Auditor, Boone, Ia., for the construction of County Drain No. 94. The cost of the work is estimated at $16,777. H. [illegible]

Louisiana.

✣Bids will be received until Monday, April 24, by the Commissioners of Caddo Levee District, S. N. Kerley, Secretary, Shreveport, La., for the construction of the following levee work in Caddo Parish, La., Red River, right bank: Blanton bluff to Peru plantation: Section No. 1—From about Station 43 to about Station 53, and from about Station 73 to about Station 169 plus 25. New levee and enlargement. Approximate contents, 105,000 cu. yds. Deposit required, $375. Bond required, $5,300. Section No. 2—From about Station 169 plus 25 to about Station 295. Enlargement. Approximate contents, 90,000 cu. yds. Deposit required, $300. Bond required, $4,500. Section No. 3—From about Station 295 to about Station 375 plus 75. New levee and enlargement. Approximate contents, 90,000 cu. yds. Deposit required, $300. Bond required, $4,500. Section No. 4—From about Station 375 plus 75 to about Station 505 plus 25. Enlargement. Approximate contents, 150,000 cu. yds. Deposit required, $450. Bond required, $7,500. Section No. 5—From about Station 505 plus 25 to about Station 560 plus 35. Enlargement. Approximate contents, 115,000 cu. yds. Deposit required, $350. Bond required, $5,800. Section No. 6—From about Station 560 plus 35 to about Station 681 plus 50. Enlargement. Approximate contents, 120,000 cu. yds. Deposit required, $375. Bond required, $6,000. Section No. 7—From about Station 681 plus 50 to about Station 823 plus 75. Enlargement. Approximate contents, 115,000 cu. yds. Deposit required, $350. Bond required, $5,800. Section No. 8—From about Station 823 plus 75 to about Station 899 plus 25, and from about Station 958 plus 30 to about Station 985 plus 60. New levee and enlargement. Approximate contents, 115,000 cu. yds. Deposit required, $350. Bond required, $5,800. Proposals will be received on any one or more sections separately, or on the entire work as a whole.

⊙The Vermilion Bay Co. of Avery Island has awarded a contract to John Anderson of Gulfport, Miss., for dredging 12 miles of navigable canal from the mouth of Deep Bayou, in Vermilion Bay, La., to Belle Isle, La. The approximate cost is $40,000.

Vinton Drainage District No. 1 of Calcasieu Parish, Lake Charles, La., has voted to issue $106,000 of bonds for drainage work. The district embraces lands north, south, east and west of Vinton, extending as far westward as the Sabine River, almost opposite Orange, Texas, and eastward to Sulphur, about 10 miles west of Lake Charles, and southward it extends to the intercoastal canal

Minnesota.

⊙Forrestal & Feyen, Scandinavian Bank Bldg., St Paul, Minn., have been awarded the contract at $21,860 for constructing the Mustinka River State Ditch in Traverse County, Minn., bids for which were opened April 2 by the State Auditor, at St. Paul. The work includes the excavation of the ditch which is 12 miles long from 30 to 40 ft. wide at base, 8 to 16 ft. deep, contains 350,000 cu. yds. Work will probably be increased to 500,000 yds. Ditch follows channel of river. Work will be done with 1½ or 2-yard floating dredge.

⊙Bids were opened April 3 by H. P. Edwards, County Auditor, Fairmont, Minn., for the construction of Judicial Ditch No. 12, contract for the tile work being let to Chris Axelsen, Clear Lake, Ia., and contract for the open work let to Chas. Sutcliff, Litchfield, Minn., at 7.88 cts. per cu. yd. The work includes 64,965 cu. yds. of earth to be removed; bottom width of ditch, 10 ft.; slope, ½ to 1; length, 7.22 miles; deepest cut, 11.8 ft.; also 13,650 ft. 6-in. tile, 4.9 ft. av. depth, 8.4 max. depth; 32,855 ft. 8-in. tile, 5.7 ft. av. depth, 10.5 max. depth; 30,713 ft. 10-in. tile, 6.1 ft. av. depth, 1.1 max. depth; 9,771 ft. 12-in. tile, 5.9 ft. av. depth; 9.9 max. depth; 3,500 ft. 14-in. tile, 7.8 ft. av. depth, 10.1 max. depth; 4,500 ft. 16-in. tile, 6.4 ft. av. depth, 8.6 max. depth; 13,813 ft. 22-in. tile, 8.5 ft. av. depth, 13.7 max. depth; 6,282 ft. 24-in. tile, 8 ft. av. depth, 10.7 max. depth. Starting point of open ditch is about 1½ miles from Guckeen on the C. & N. W. R. R. Average haul for tile is about 3¾ miles from Guckeen. Soil is black loam, with clay subsoil.

⊙Bids were opened April 4 by J. C. Herrin, County Auditor, Blue Earth, Minn., for the construction of Judicial Ditch No. 12, contracts being let as follows: Chas. Sutcliff, Litchfield, Minn., $5,184; tile work, Chris. Axelsen, Clear Lake, Ia., $36,400. Contract for cleaning Judicial Ditch No. 2 was let to Chas. Sutcliff at $900.

Montana.

Engineering details of the Milk River project of the U. S. Reclamation Service will be considered this month by the Board of Advisory Engineers, and it is probable that work upon all three divisions will be started this year. The total cost of this project will be about $7,000,000. It involves the storage of water in the two St. Mary's lakes in the northwestern corner of Montana and the diversion of the stored water from the St. Mary's drainage basin that now discharges into the Hudson Bay to the Milk River drainage basin, by a canal 27 miles long. The lands to be irrigated are located between Havre and the confluence of the Milk River with the Missouri River about 25 miles east of Glasgow. Upwards of 250,000 acres of land will be covered by the canals constructed in the Milk River Valley by the reclamation service. The entire tract to be reclaimed is traversed by the Great Northern Ry. The total distance traveled by the water from St. Mary's lakes to the end of the canal below Glasgow is a little more than 500 miles The project naturally divides itself into three grand divisions. The Chinook division, extending below Havre to the Dodson dam, with division headquarters at Chinook. The [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] Vandalia dam, with [illegible] and also project headquarters at Malta. G. O Sanford, Malta, Mont., is Project Engineer.

Ohio.

✣Bids will [illegible] 23, by Board of Fairfield County Commissioners, at the office of J. R. Shoop, County Surveyor, Lancaster, O., for work and materials of the Hocking River improvement. G. J. Gearhart is County Auditor.

Oregon.

Condemnation proceedings are now underway in the Federal Courts to secure the final rights of way for the second unit of the Klamath irrigation project of the U. S. Reclamation. All right of way, except in two cases, has been secured. The necessity of getting the required title in all of the right of way grants in connection with the second unit may mean some little delay. This unit is to furnish water to Poe Valley and a stretch of territory in the Klamath Valley in the vicinity of Stukel Mountain.

Tennessee.

⊙N. C. McGinnis, Bement, Ill., has been awarded the contract for the construction of a drainage canal in Big Muddy Creek bottom, in the southern portion of McNairy County. Approximate specifications call for a canal system 7½ miles long; width, top, 23 ft.; bottom, 8 ft., depth, 7 ft. The owner land through which it passes are h right of way. The contractors wi m 700 cu. yds. of dirt.

Texas.

✣Bids will be received until 2 m 16, by Commissioners, Grand lls, War County Drainage District, Gran alls, Tex for the construction of a drain system. Bonds amounting to $33,000 have een is- for the work. A. H. Dunlap is Engineer.

Washington.

The City of Toppenish, Wash., [illegible] a municipal irrigation system.

WATER-WORKS

Alabama.

The town of Haleyville, Ala., is considering the question of issuing bonds for waterworks and street lights. The Commercial Club is co-operating with the Town Commissioners.

California.

The Mount Shasta Aqueduct Co., has been incorporated in San Francisco, Cal., with a capital stock of $10,000,000, by C. E. Sheets, Oakland; Thomas H. Laine, Berkeley; W. H. Hawkins, J. B. Kennedy and C. H. McDonagh, San Francisco. The company has a scheme for supplying pure mountain water to San Francisco, Oakland, Alameda, Berkeley, Point Richmond and the towns in Contra Costa, Solano, Yolo, Colusa, Glenn, Tehama, and Shasta Counties. It proposes to build an aqueduct from McCloud River, in Siskiyou County, to San Francisco, a distance of more than 300 miles. The surveys made last summer indicated a route along the west side of the Sacramento Valley, several miles west of the Southern Pacific R. R

Colorado.

The citizens of Gunnison, Colo., on April 2 voted the issuance of bonds in the sum of $70,000 for the installation of a waterworks. E. M. Nourse is Mayor.

The citizens of Milliken, Colo., on April 2 voted the issuance of bonds in the sum of $15,000 for the installation of a waterworks system. R. M. Benton is Mayor.

The citizens of Ridgway, Colo., on April 2 voted the issuance of bonds in the sum of $30,000 for the purchase and improvement of the present waterworks system. C. M. Stanwood is City Clerk. J. B. Culver is Mayor.

The citizens of DeBeque, Colo., on April 2 voted the issuance of bonds in the sum of $20,000 for the purchase of a mountain water supply. Lambert Sandenberg is Mayor.

The City Council of Trinidad, Colo., has sold bonds amounting to $360,000, known as water refunding bonds, to the First National Bank of New York City.

Florida.

✣Bids will be received until noon, April 16, by Water & Gas Committee, D. Kugelman, Chairman, Pensacola, Fla., for the construction of a reinforced concrete reservoir. Specifications are on file with the Water Department.

An election will be held in Fort Meade, Fla., on April 16 for the purpose of voting on the issuance of bonds in the sum of $39,000 for the installation of a waterworks system and for the construction of sewers.

Georgia.

The City Council of Valdosta, Ga., has laid plans for the issuance of $100,000 worth of bonds for the enlargement of the water system, street paving and the extension of the city hall. It is estimated that about $400,000 will be needed for the extension of the system.

Idaho.

The Mountview Water Co., of Holbrook, Oneida County, Ida., has been incorporated with a capital stock of $10,000. The incorporators are: John M., John K., Loren D., Joseph W., and Gilbert S. Haws.

Illinois.

✣Bids will be received until 2 p. m., April 26, by Lieut. Col. G. W. Burr, Ordnance Department, Rock Island, Ill., for the erection of a filtration plant at Rock Island Arsenal, Ill.

✣Bids will be received until noon, May 3, by J. R. McAndrews, Constructing Quartermaster, Fort Sheridan, Ill., for furnishing and installing a pressure filtration plant, pumps and motors and a hot air heating system in the present pumping station building at Fort Sheridan.

✣Bids will be received until 1 p. m., April 25, by Village of Ashton, Ill., for the construction of a water works system including well, pumping station, elevated reservoir, water mains, fire hydrants, etc., for a complete system. Aetna Engineering Bureau, 17 N. LaSalle St., Chicago, Ill., are Engineers. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 4:30 p. m., April 24, by T. H. Keys, Clerk, Normal, Ill., for a deep well, pumping machinery, concrete reservoir and station building. Plans and specifications are on file with the clerk.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 18th, for furnishing labor, materials, tools, etc., necessary to construct and erect complete, at the Lake View Pumping Station, Montrose Ave. and Clarendon Ave., on a foundation prepared by the city, a temporary boiler house, an elevator tower, ash hopper, and hopper house, including structural steel corrugated iron, railroad track, ventilators, etc., exclusive of smoke stack and flues, elevator machinery cage, guides, etc., and machinery platform. Estimated quantities, 140,000 lbs. structural steel and iron.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 18th, for furnishing labor, appliances, etc., necessary to remove to the temporary boiler house at the Lake View Pumping Station, Montrose Ave. and Clarendon Ave., 3 180-h. p. Babcock & Wilcox water tube boiler, 1 500-h. p. Freeman water tube boiler with Green chain grate stoker from lighting plant at Rice St. and Lincoln St., 2 250-h. p. Scotch marine boilers with Hawley Down Draft Furnaces from old Lake View Pumping Station. Cash or certified check for $100 must accompany proposal.

The citizens of Rankin, Ill., at a recent election voted against the proposition to install a system of waterworks.

Following are the low bids submitted to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering boiler and furnace tubes, 312 charcoal iron boiler tubes, $1,076.40; 32 charcoal iron stay tubes (screwed ends), $298.88; [illegible] Down Draft furnace tubes (screwed [illegible] $396.20; furnishing labor, tools, etc., n[illegible] to remove old boiler tubes and stall ne[illegible] tubes in two boilers, $400. Jno. M r & S[illegible] 349 W. Illinois St., was low bidder.

Following are the low bids sub[illegible] L. E. McGann, Commissioner [illegible] Works, Chicago, Ill., for furnishing [illegible] materials, appliances necessary to [illegible] design and erect a vertical triple [illegible] pump, driven by direct connect[illegible] triple expansion condensing engi[illegible] appurtenances auxiliaries and [illegible] Bethlehem Steel Co., 122 S. Mich[illegible] $89,900; Nordberg Mfg. Co., Milwaukee, $92,000; Allis-Chalmers Co., 122 S. Michigan Ave., Chicago, $115,000.

Following is the lowest bid submitted [illegible] furnishing the City of Chicago wit[illegible] of pig lead and delivering same [illegible] 150 tons Avers Ave. and Wabansia [illegible] yard (A), 2354 S. Ashland Ave., [illegible] (B), 150 tons, 104th St. and Ste[illegible] pipe yard (E), 200 tons. Gardiner [illegible] 1364 W. Lake St., $4.44 per cwt. [illegible] Gann is Commissioner of Public Works.

Following are the low bids submitted [illegible] L. E. McGann, Commissioner of Public Works, Chicago, Ill., on April 1st, for furnishing and delivering labor, materials, [illegible] necessary to design, construct and erect [illegible] mains, valves and venturimeters at the La[illegible] View Pumping Station, Montrose [illegible] Clarendon Ave. W. A. Kock, $20,[illegible]; W[illegible] Dowdle Co., 9 S. LaSalle St., $22,[illegible]; [illegible] Chalmers Co., Milwaukee, Wis., $24,[illegible] All[illegible] Chalmers Co. have been recommend for [illegible] award.

Indiana.

The Sullivan County Water Co., has [illegible] incorporated according to advices from Su[illegible] van, Ind., with a capital stock of $7,[illegible]00, [illegible] E. M. Kerlin, J. L. Ebner and T. M[illegible]rise[illegible] directors. The company will supply water [illegible] the City of Sullivan, which will be secur[illegible] from driven wells in the Wabash bottoms [illegible] miles west of the city.

The Board of Public Works and [illegible] Board of Park Commissioners of South Bend, In[illegible] recently held a meeting to discuss the location of the proposed waterworks reservoir [illegible] which plans and specifications were prepar[illegible] by Consulting Engineers Burns & McDonn[illegible] Scarritt Bldg., Kansas City, Mo. It prob[illegible] ble the reservoir will be located just south [illegible] the Leeper park pumping station.

Iowa.

✣Bids will be received until 10 a. [illegible] Ap[illegible] 15, by City Clerk, Sioux City, Ia., for build[illegible] concrete foundation for pump at city water works, Main St. station. Specifications are [illegible] file at the office of the City Engineer. G[illegible] Healy is Supt. of Parks and Public [illegible]

⊙The city of Donnelson, Ia., has [illegible] the contract for the installation of w[illegible] works system for which bids were [illegible] March 28 to the Des Moines Bridge [illegible] Co., Des Moines, Ia., itemized as [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

& lams, Centerville, Ia., Consulting En- [illegible] 490 ft. 8-in. c. i. pipe laid, $89 [illegible] 6-in. c. i. pipe laid, $69; 3,750 ft [illegible] pipe laid, $49; 15 hydrants with [illegible] l each; one 8-in. valve and box, $20; valves and box, $15 each; four 4-in. [illegible] box, $11 each; 1,220 lbs [illegible] ½ per lb.; 40,000-gal. tank on 80-ft. [illegible] 125; 40,000-gal. tank on 90-ft. tower, [illegible] 000-gal. tank on 90 ft. tower, $2,7 [illegible] lders on the works were: [illegible] n Co., Des Moines; C. W. Roland, nes; W. D. Lovell, Minneapolis, ck Island Bridge & Iron Co., Rock I.; Chicago Bridge & Construction [illegible] and A. M. Peatman, [illegible]

Kansas.

lland Engineering & Construction Scott, Kans., has been retained to ins and specifications and construct l water plant for Moran, Kans., to [illegible] mately $10,000. Testing [illegible] [illegible] work is now under w[illegible]

Kentucky.

rd of Public Works of Louisville, granted a franchise to the Peaslee- , to lay an 8-in. water main across between 14th and 15th Sts. The be used to supply the plant with perate an automatic sprinkler for of fire.

Maryland.

ng bids were received March 6 by of Awards of Baltimore, Md., for r Department, Ezra B. Whitman, ineer, for the construction of Lock , the contract being awarded on King-Ganey Contracting Co., of City at, at $374,884; (1) standing C. B. Clark & Co., Baltimore, Md., Ganey Co., New York City, (3) Co., Alta Vista, Va., (4) T. J. Contracting Co., Mt. Vernon, N. sher & Carozza, Baltimore, Md., (6) spie Co., New York, (7) James Co., New York City, (8) J. F. New York City, (9) Sanford & Baltimore, (10) Maryland Dredg- ltimore, (11) B. F. Sweeten & Son, (12) W. M. Kefauver Co., Balti-

Louisiana.

Consulting Engineer N. A. Kramer, Magnolia, Miss., has prepared plans for the con- [illegible] gan City, La., estimated to cost between $7 [illegible] contracts will be let in two or three weeks.

Massachusetts.

Commissioner of Public Works L. K. Rourke of Boston, Mass., has petitioned the Metropolitan Park Commission for permission to erect and maintain a pumping station in connection with the high pressure water system of the Boston Fire Department, to be located on the Charles River Basin land at the foot of Otter St.

Michigan.

The Board of Public Works of Norway, Mich., has instructed the City Engineer to furnish plans and specifications for a 4-in. iron pipe line from the end of the city system to the cemetery line. This line was recently petitioned for by the Board of Health of Norway Township.

Minnesota.

⊙The Village Water & Light Commission of Bagley, Minn., has let the contract for the construction of a 50,000-gal. flat bottom steel tank to the Minneapolis Steel & Machinery Co. of Minneapolis at $2,130. The tank is to replace the wooden water tank which was destroyed by fire.

The City Council of Red Lake Falls, Minn., recently conferred with J. A. Childs, Asst. Engineer with the State Board of Health, on the waterworks proposition. The Council proposes to ask the citizens to vote on the issuance of bonds in the near future to install a system.

Consulting Engineer C. S. Burns of the firm of Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., has made his report to the City Council of Virginia, Minn., on the value of the Virginia Electric Power & Water Co. plant. The appraised valuation of the plant is placed at $579,512. The company recently offered to sell its plant to the city for $550,000.

The Village Council of Cuyuna, Minn., will sell bonds April 30 in the sum of $15,000 which were voted by the citizens on March 12, for the purpose of constructing and maintaining a system of waterworks, with necessary water supplies. Ed. Gustad is Village President.

Mississippi.

According to advices from Vicksburg, Miss., Charles A. Zilker of New Orleans, La., president of the Delta Ice & Cold Storage Co., has secured an option on the Vicksburg waterworks plant and will make the city a proposition to take over and operate the plant, provided he is given a 50-year franchise. This plant was recently offered to the city for $350,000. M. O. Crumpler is Manager.

Missouri.

✣Bids will be received until noon, April 12, by Board of Public Improvements, St. Louis, Mo., for furnishing general and detail drawings, constructing and erecting in place at High Service Station No. 2, Bissell's Point, two high duty triple expansion crank and fly wheel pumping engines, of a capacity of 20,000,000 gals. each in 24 hours, with all valves, piping and appurtenances necessary in accordance with plans and specifications approved by the Board.

⊙The American Contracting Co., 5018 S. Grand Ave., St. Louis, Mo., has been awarded the contract by the Board of Public Improvements of that city, J. C. Travilla, President, for letting No. 10,453 at $9,521, for making excavations, hauling and laying complete, in accordance with specifications, about 4,870 ft. of 36-in. water pipe, 30 ft. of 12-in. water pipe, 162 ft. of 6-in. water pipe, 50 cu. yds. rock excavation removed, 100 lbs. of wrought iron straps and bands furnished, 6 fire hy- [illegible]

Montana.

✣The voters of Shelby, Mont., on April 1 voted the issuance of bonds in the sum of $22,000 for the construction of a municipally owned water system. The Town Council will order at once an issue of warrants in the sum of $18,000 for the same purpose. The money will be available for use May 1, at which time bids will be opened by the Town Clerk in public for the construction of the system. Plans and specifications will be sent to bidders whose names are on file with City Engineer J. E. Nolan April 15. The approximate quantities are: 3,000 ft. 8-in. steel pipe; 27,000

		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] and for all pumping		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
xcav. for foundation..	12,660 cu. yds.	.85	.90	.72	.70	1.43	.50	1.05	2.90	1.10	.80	1.50	2.00
k excav. for founda..	7,800 cu. yds.	1.50	1.30	1.05	1.00	1.63	1.50	1.40	2.90	1.56	1.20	2.00	3.00
excav. for founda..	17,000 cu. yds.	2.20	1.30	1.45	1.75	2.00	2.00	1.75	2.90	1.90	2.40	3.50	4.00
[illegible] for cut-off drain trenches..........	4,600 cu. yds.	4.50	4.00	3.75	4.00	3.71	3.00	3.50	4.50	6.30	6.90	7.00	20.00
[illegible] in rock of con cte	300 lin. ft.	.50	.30	1.00	.50	1.00	.60	2.80	.30	.30	.80	1.00	1.00
and plac. cement grout.	1,000 bags cement	1.00	1.00	1.00	.50	1.00	1.30	4.20	1.00	.75	1.00	2.50	1.00
[illegible] wrought iron for grouting............	150 lin. ft.	.40	.20	.50	.30	.25	.30	2.10	.15	.15	1.00	.50	.20
and plac. 12-in. vit. pipe ins	750 lin. ft.	.50	.50	.65	.50	1.00	.50	.84	.50	.50	.70	.50	.50
and plac. 6-in. vit. pipe ins	1,570 lin. ft.	.30	.30	.35	.30	.75	.30	.35	.35	.35	.40	.35	.20
and placing gravel und drains	300 cu. yds.	2.00	2.50	2.50	1.75	2.00	2.00	2.80	2.50	2.50	1.80	2.50	2.00
and plac. porous concrete block drain...........	1,970 lin. ft.	.55	.50	.65	.75	1.30	.50	1.12	2.00	1.00	1.00	.75	1.00
mass concrete in cut-off ll and dam................	17,100 cu. yds.	4.75	5.75	6.35	5.75	5.50	7.00	6.37	6.50	7.35	6.00	5.75	6.40
5 mass concrete in dam. aining wall and wing walls	24,500 cu. yds.	4.25	5.00	5.45	5.00	4.74	5.75	6.37	6.00	7.00	5.00	5.50	5.90
concrete around conduit.	336 cu. yds.	9.50	8.00	6.95	8.00	14.40	8.00	8.40	7.50	15.00	10.00	7.00	7.00
and timber bridge over [illegible] of dam. incl. piers.													
ing 60-in. cast iron pipe	144 lin. ft.	4.00	2.60	2.35	3.00	5.00	7.00	14.00	6.00	10.00	10.00	5.00	20.00
[illegible]	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
60-in. sluice gates and purt. in back of dam......	6	215.00	50.00	125.00	75.00	100.00	50.00	210.00	60.00	200.00	200.00	100.00	75.00
and plac. gratings for -in. sluice gates, 6 gratings	2,940 cu. yds.	6.00	6.50	7.25	6.75	7.65	10.00	9.10	7.00	7.65	10.00	12.00	20.00
concrete in gate house bstructure	140 lin. ft.	3.00	2.60	1.75	2.50	4.50	8.00	11.20	5.00	7.00	9.00	3.00	18.00
ing 48-in. c. i. pipe for erflow	21,000 lbs.	.03	.04	.0275	.025	.04	.06	.042	.05	.03	.04	.05	.05
and plac. steel reinforc- g bars	190 lin. ft.	2.00	1.30	.75	1.00	3.50	3.00	4.20	4.00	5.00	3.00	3.00	12.00
-in. c. i. drain pipe ..	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] drain sluice gates	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
rectangular sluice gates [illegible] in gate house [illegible]	[illegible]												
al days		300	400	300	450	300	300	350	375	400	400	500	300
al		$367,908	$374,884	$383,416	$387,516	$410,147	$414,595	$443,644	$453,772	$492,510	$499,551	$562,374	$625,611
e at $75 per day..........		$ 22,500	$ 30,000	$ 22,500	$ 33,750	$ 22,500	$ 22,500	$ 26,250	$ 28,125	$ 30,000	$ 30,000	$ 37,500	$ 22,500
Grand total		$390,408	$404,884	$405,916	$421,266	$432,647	$437,095	$469,894	$481,897	$522,510	$529,551	$599,874	$648,111

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] wood pipe, 13,000 [illegible] hydrants, 4,000 [illegible] 5,500 lbs. of fittings, tees, ells, crosses, etc., for wooden pipe; [illegible] tank; digging 43,000 ft. of trench, six ft. deep [illegible] pump, [illegible] valves.

The Libby, Mont., Waterworks, Electric Light & Power Co., plans to spend in the neighborhood of $7,000 during the spring and summer improving their plant. Among the improvements will be the erection of a standpipe on South Libby Hill, the putting of additional iron bands on the main pipe line from the dam to the power house and the improving [illegible]

New Jersey.

✣[illegible] advertisement) by Board of Water Commissioners, Atlantic City, N. J., for one 10,000,000-gal. horizontal or vertical condensing steam turbine engine and centrifugal pump. L. Van Gilder is Engineer.

The construction of a filter plant is being considered by the City Council of Woodbury, N. J. A plan has been suggested to the Council which calls for the acquiring of what is known as Matlock Hill, in the center of the city, boring wells and erecting a standpipe, and at the same time prepare for the erection of a municipal lighting plant in the same place.

The Grey Rock Artesian Water Co., of Trenton, N. J., has been incorporated with a capital stock of $25,000 to build reservoirs, sink wells, etc. The incorporators are: A. H. Ashton, J. B. Garrison, M. L. Ashton and R. A. Garrison, all of Trenton.

New York.

⦿The International Steam Pump Co., on April 1, was awarded the contract by the Board of Contract & Supply of Yonkers, N. Y., James V. Mahony, Secretary, for furnishing and installing one 10,000,000-gal. high-duty pumping engine and appurtenances at $21,000. Bids were opened March 25.

⦿Harrison & Boice, 220 Broadway, New York City, at $182,153, has been awarded the contract by the Board of Water Supply, 165 Broadway, New York, for the construction of the Wallkill Blowoff, including about 7,000 ft. of concrete conduit, 7 ft. inside diameter, about 80 ft. of cut and cover aqueduct, a blowoff chamber and necessary castings for valve and aqueduct. The work is located 1½ miles northeast and southwest respectively of Gardiner and New Hurley Stations on the Wallkill Valley R. R., Ulster County. Bids were opened April 2 by J. P. Morrissey, Secretary.

Mayor Otto Pfaff of Oneida, N. Y., on April 4 declared his intention of calling a special election to vote on a proposition to vote $10,000 for water main extensions. Charles Fitzgerald is Superintendent of Public Works.

Oklahoma.

✣Bids will be received until 10 a. m., April 13, by W. S. Levan, City Clerk, Holdenville, Okla., for furnishing f. o. b. cars at Waterworks Spur (on C., R. I. & P. R. R., three miles from Holdenville) following for waterworks extension, etc.: 15,000 lin. ft. 10-in. cast-iron pipe, class A, weight 57.1 lbs. per lin. ft.; 20,000 lbs. lead; engine generator set, consisting of 3-phase 60-cycle 2,300-volt 75-K. V. A. generator, direct connected to horizontal steam engine; switchboards and instruments complete; 45,000 lin. ft. No. 6 waterproof copper wire; 130 Northern cedar poles, 30 ft. long, 6-in. tops, with cross-arms, guys, braces, insulators, etc.; bronze fitted horizontal turbine pump, capacity 625 gals. per minute against total head of 112 ft., direct connected to 35-horse-power 3-phase 60-cycle 2,300-volt meter, with auto-starter; 72-in. by 18 ft. horizontal return-tubular boiler; complete specifications on file at office of Clerk and obtainable from Consulting Engineers, Goodwin & Harper, 920 Scarritt Bldg., Kansas City, Mo.

✣Bids will be received up to 1 p. m., on April 18 by the City of Stillwater, Okla., for the construction of an open caisson well approximately 25 ft. in diameter and 55 ft. in depth. Plans and specifications are on file in office of the Commissioner of Revenue & Accounting of said city, and in the office of The Benham Engineering Co., Consulting & Supervising Engineers, 812-13-14 American National Bank Bldg., Oklahoma City, Okla.

The town of Perkins, Okla., has employed the Benham Engineering Co., Consulting Engineers, 812-13-14 American Nat. Bank Bldg., Oklahoma City, Okla., to draw plans and specifications for a water works system. Bonds in the amount of $25,000 have been voted for this purpose.

The Nagal Engineering Co. of Muskogee, Okla., has been retained by the Idabel Light & Fuel Co., Idabel, Okla., to prepare plans for the making of extensions to the waterworks system for which bonds in the sum of $35,000 were recently voted.

Oregon.

✣Bids will be received until 7 p. m., April 16, by J. N. Sievers, City Recorder, Gladstone, Ore., for furnishing material and constructing portions of a waterworks system for the City of Gladstone. Bids will be received separately, or as a whole for the following subdivisions of the system: (1) For ditching and back filling complete. (2) For wood pipe and fittings installed, complete. (3) For reservoir complete. Plans and specifications, forms of contract and proposal, may be obtained upon application at the office of Cross & Hammond, Beaver Bldg., Oregon City, Ore.; the City Engineer, at Gladstone, Ore.; or of C. A. Williams, Chairman, Fire and Water Committee, No. 229 Labbe Bldg., Portland, Ore.

Pennsylvania.

✣Bids will be received until 11 a. m., April 13, by Department of Public Works, J. G. Armstrong, Director, Pittsburg, Pa., for the inspecting and testing of the rising main and appurtenances for the Mission St. Pumping Station, Contract No. 1-N, Bureau of Water. The inspecting and testing shall be done on the following items for furnishing and laying of rising main and appurtenances, Contract No. 1-L: Item No. 3: 30-in. steel pipe and appurtenances, 9/16-in. thick, 3,200 lin. ft. Item No. 4: 30-in. steel pipe and appurtenances, 7/16-in. thick, 2,000 lin. ft. Item No. 7: Cast steel specials, 20.5 tons. Blank forms upon which to make the proposal can be secured in the Contract Office of the Department of Public Works, Room 432 Oliver Bldg., Pittsburg, Penn. Each proposal shall be accompanied by a bond for $300.

✣Bids will be received until 7 p. m., April 24, by Frank C. Rowe, Secy., Board of Commissioners, Hanover Township, 727 Hazel Ave., Hanover Township, Pa., for furnishing 50 water plugs and water for same in the township for a period of 10 years.

✣Bids will be received until noon, April 15, by Morris L. Cooke, Director of Public Works, Philadelphia, Pa., for Contract No. 183—Concrete mixer for Queen Lane. Contract No. 184—Pitometer sets with recording devices for water waste survey work, and two permanent pitometer sets with recording devices for Queen Lane filters. Contract No. 185—Hypochlorate of lime. Contract No. 186—For furnishing one oxy-acetylene welding and cutting outfit. Contract No. 187—For furnishing cast iron pipe and delivering same on city streets. Contract No. 188—For furnishing and delivering pig lead. Contract No. 189—Structural steel, bolts, nuts, etc., for trestle at Shawmont pumping station. Contract No. 190—48-in. x 36-in. x 12-ft. planer for city shop. Contract No. 191—Hauling ashes from pumping stations for the remainder of the year. Contract No. 162—Office building for First Survey District. Specifications, drawings and blank forms upon which bids must be made can be obtained from the Chief of the Bureau of Water, 701 City Hall, to whom all communications should be addressed.

⦿M. O'Herron & Co., Pittsburgh, Pa., have been awarded the contract by Joseph Armstrong, Director of Public Works, Pittsburgh, for the construction of a 30-in. steel rising main from Mission St. P. station [illegible] Bids were opened Febr. 28. Pro[illegible] the construction of a reservoir [illegible] Township will not be asked for un[illegible] time in May.

South Dakota.

⦿The city of Madison, S. Dak., h[illegible] let the contract for furnishing one 600-gal. [illegible]mp and 60 h. p. Remington oil engine, and o[illegible] 400-gal pump and 40-h. p. Westinghouse mot[illegible], to the Deane Steam Pump Co., at $7,254.

The citizens of Lake Preston, S. D., at a recent election voted the issuance of bonds in the sum of $5,000 for the making of extensions to the waterworks system.

According to advices from Bancr[illegible] S. D., C. O. Dill of that town has purchas[illegible] a controlling interest in the local waterw[illegible]ks system and will make extensive improv[illegible]ents [illegible] the system.

Texas.

⦿The Board of City Commissioners of [illegible]veston, Tex., has awarded the contract [illegible] the repairs in the submerged water ma[illegible] tween the concrete piers of the [illegible] causeway to Isaac Heffron at $3,[illegible] contract calls for the furnishing of [illegible] ment, tools and appliances and superin[illegible] work. The city is to furnish all cast-[illegible] sleeves, lead or leadite and hemp f[illegible] joints and will pay weekly all emp[illegible] laborers employed on the work.

Providing the bond issue to be vot[illegible] by the citizens of Dallas, Tex., car[illegible] intended to erect a $12,500 pumping station [illegible] Oak Cliff. The station will be located [illegible] caster Ave., near the end of Zang's Bl[illegible] provements contemplated by the W[illegible] partment will necessitate the expend[illegible] approximately $240,000. Of this am[illegible] proximately $40,000 is to be used to [illegible] cost of a new pump at Turtle Cree[illegible] so that there may be conserved muc[illegible] water which now goes to waste by [illegible] over the dam at flood seasons, and [illegible] for a purification plant to filter and p[illegible] of the water run through the presen[illegible] and render it potable.

The citizens of Dallas, Tex., on [illegible] voted the issuance of bonds in the [illegible] $400,000 for waterworks improvemen[illegible]

Engineer James F. Brook of Palesti[illegible] engaged jointly by the City Council of P[illegible] Tex., and the Pecos Commercial Club [illegible] pare preliminary plans and estimate [illegible] tem of soft water for Pecos, has comp[illegible] his work and reported that the cost [illegible] system would be $84,870 complete and [illegible] would serve a city of 13,488 people, fu[illegible]ishing each person 50 gals. of water per day.

The City Council of Sherman, T[illegible] called a bond election for April 27 [illegible] purpose of voting bonds to the am[illegible] $40,000 for improvements to the wat[illegible] system and sewerage system. The wat[illegible] improvements will cost about $30,000.

The City Council of Cleburne, Tex., [illegible] took over the waterworks plant of t[illegible] for a consideration of $128,000. Impro[illegible] are to be made that will cost approx[illegible] $50,000. Plans are now being prepared

The citizens of Sulphur Springs, T[illegible] April 2 voted the issuance of bonds [illegible] sum of $30,000 for improving the wate[illegible] by constructing a pipe line two miles [illegible] White Oak Creek and the building o[illegible] tion. C. W. Higgins is City Secretary.

Washington.

✣Bids will be received until April [illegible] City Clerk A. J. O'Connor, Brewster, [illegible] for the construction of a water system [illegible] cal deep well, triplex pump, concrete [illegible] house and reservoir and laying about 6[illegible] of mains. Specifications are on file w[illegible] Clerk.

Otto Emmer and W. J. Stredwick of [illegible] Wash., have purchased the Eltopia city [illegible] works from A. R. Hamilton.

The City of Centralia, Wash., will vo[illegible] 7 on the proposition of installing a [illegible] water system, estimated to cost $250,00[illegible]

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] gates, screens, [illegible]
[illegible] r and the acquiring or building of [illegible] system. [illegible] anley Macomber is City Engineer. [illegible]

West Virginia.

[illegible] purchase the plant and holdings of water company of that city.

Wisconsin.

[illegible]

Wyoming.

[illegible] have been awarded the contract by that city, James J. Winthrow, City Clerk, for the construction of 8,000 ft. of 4-in. cast iron water [illegible]

Canada.

✣[illegible]

Contract "A"—Labor laying water mains and [illegible] for and erecting water tower. Contract "D"—Furnishing cast iron water pipes and special castings. Coatract "E"—Furnishing fire hy- [illegible] on main outfall sewer. Contract "S"—Furnishing sewer pipes and junctions. Contract [illegible] pipe. Tenders will shortly be called for power house, machinery, and sewage disposal works, plans and specifications may be seen at the office of Chipman & Power, Engineers, Toron- [illegible]

SEWERAGE AND GARBAGE DISPOSAL

Arkansas.

Council of Clarendon, Ark., has [illegible] rably on its proposition of es- [illegible] id the other for water.

California.

ll be received fron [illegible] until 3 p. m., y Board of Public Works, San Calif., for the construction of sew- purtenances in Golden Gate Park Ave., from Lincolnway to Cabrillo [illegible] McCormick is Secretary of the

ent has been started in Oak Park, Calif., for a bond issue to in- r system in that part of the city, [illegible]

Colorado.

Board of Health, Denver, Colo., l a rule that all garbage from hos- sanatoriums receiving and treating [illegible]

District of Columbia.

ll be received until 11 a. m., April M. Smith, Acting Chief of Bureau id Docks, U. S. Navy Department, D. C., for garbage crematories yards, Puget Sound, Wash., and ı., and the naval training station, sco, Calif.

Florida.

s will be received until 3 p. m., May oard of Commissioners, State Institu- Florida, at the Governor's office, Talla- Fla., for a receiving hospital building Florida Hospital for Insane. G. T. ld is Secretary, Tallahassee, Fla.

Illinois.

[illegible] ity of Alton, Ill., for the construction Bellview Ave., sewer. J. E. Schwab Engineer.

J. Schmidt of Silvis, Ill., has been d the contract by the Village Board of ace for sewer and watermain extension st Ave., from Fifth St., west to War- rossing at $2,590. T. W. Crawford is ent of the Board.

T. Bartlett of Evanston, Ill., has been d the contract by the Board of Local ements of Galva, Ill., J. J. Lord, Mayor, rnishing the necessary labor and ma- for the construction of sanitary sewers st iron water mains at $1,409 for sewers .386 for water mains. The work will 594 ft. of 8-in. sewer; 2,040 ft. of 6-in. 9 brick manholes and 1 combination [illegible] pe, 5 double nozzle fire hydrants and valves with boxes. W. S. Shields Co., Hartford Bldg., Chicago, is Engineer. ere opened April 1.

e following contracts for constructing [illegible] Local Improvements, Chicago, Ill., E. J. Glackin, Secy.: Belle Plaine Ave., Cullom Ave., Cuyler Ave., N. 45th Ave., LaFayette Ave., Simon Ryan; MacFarlane Ave., Thos. Burke; E. 98th St., Scully & Fosco; E. 119th St., Simon Ryan; Perry St., N. 45th Ave., Simon Ryan; N. Albany Ave., Angelo Mancini; Jeffrey Ave., Pease Ave., Bennett Ave., Paxton Ave., Thos. Burke; S. May St., M. Pontorelli; Lincoln Park Blvd., Lake Shore Drive, E. Oak St., M. J. McNamara; Roscoe St., De Vito Passarelli & Tertelli.

L. E. & B. S. Craine, 11th St., Murphysboro, Ill., have been awarded the contract by the Board of Local Improvements of that city for the construction of the East Side sewer system at $42,455. The work includes 26,000 cu. yds. of excavation in trenches of an average cut of 10 ft.; 11,615 ft. of 8-in. vitrified pipe; 2,304 ft. of 10-in. pipe; 1,682 ft. of 12-in. pipe; 1,050 ft. of 18-in. pipe; 11,894 ft. of 22-in. pipe; 300 ft. of 8-in. iron pipe; 300 ft. of 22-in. iron pipe; 71 manholes and 9 automatic siphon flush tanks; 6 cu. yds. of concrete in outlet. Most of the work is in very unstable earth with a great deal of quick sand. Bids were opened April 1. Ralph A. Rollo is City Engineer.

The city of Plano, Ill., contemplates the installation of a sewer system.

The Board of Local Improvements of Sandwich, Ill., F. S. Mosher, President, has adopted a resolution providing for the installation of a system of sanitary sewers, to include 3,410 ft. of 18-in. tile pipe, 270 ft. of 15-in. tile pipe, 2,450 ft. of 12-in. tile pipe, 5,110 ft. of 10-in. tile pipe, 31,985 ft. of 8-in. tile pipe, 4,000 ft. of 6-in. tile pipe, 145 manholes, 13 flush tanks, 552 ft. of 12-in. tile outlet drain, 1 sewage tank, 6 sand filters, sludge bed, etc. The estimated cost is $50,000.

Iowa.

⦿The City Council of Carroll, Ia., has let the contract for the construction of storm water sewers to M. Jensen of Newell, Ia., at $5,150, and the contract for making sewer and water connections to R. J. Hamilton of Carroll at $0.45 per ft.

⦿The City Council of Muscatine, Ia., has awarded the contract for the construction of a sewer along Grandview Ave., in South Muscatine to D. E. Keeler & Co., of Davenport, Ia., at $1,329.

The City Council of De Witt, Ia., contemplates the installation of a sewerage system.

The City Council of Dubuque, Ia., intends to construct an 8-in. tile pipe sanitary sewer in Ashbury St., from the intersection of Delhi St. to St. Ambrose St., thence in St. Ambrose St. to Willow St., to Rosedale Ave., thence in Rosedale Ave. to present sewer at angle in said avenue first west of Alta Vista St. The City Engineer has estimated that it will require 5,100 lin. ft. of pipe, 20 manholes and one drop manhole and will cost the abutting property owners $5,500.

Kansas.

✣Bids will be received until 5 p. m., April [illegible] for the construction of pipe sewer in Sewer District No. 6. The work will include approximately 23,300 lin. ft. of tile sewer ranging in size from 6-in. to 12-in. and in depth from 5 to 25 ft.; 640 Y. junctions; 49 manholes; 57 lampholes. Plans and specifications are on file with S. K. McCrary, City Engineer.

✣Bids will be received until 7:30 p. m., April 17, by City Clerk, G. E. Strauchon, Ottawa, Kan., for furnishing and installing a garbage incinerator or crematory of 5, 10 or 15 tons capacity per 24 hrs. C. S. Pugh is City Engineer, and W. T. Wood is Mayor.

⦿Mayor Walter W. Minick and the City Commissioners of Wichita, Kan., have awarded approximately $60,000 worth of public contracts. Contracts were let for the construction of an inverted sewer on Third St., from the drainage canal to Lorraine Ave. The total amount of the contracts was about $58,419, and the bulk of the work was awarded to McGuire & Stanton of Leavenworth, Kans., at $50,248. Other contracts were: A. T. Buckridge, putting in coping at $2,579; W. M. Blake, building retaining walls and constructing sidewalks and outlets, $5,591.

The State Board of Health and engineers of the state university will install an electric sewage disposal plant at El Dorado, Kan. The plant is to handle 300,000 gals. of sewage per day. W. C. Hoad is State Sanitary and Water Engineer.

Maryland.

⦿B. F. Sweeten & Sons, Caroline & Madison Streets, Baltimore, Md., have been awarded by the Board of Awards of that city the construction of lateral sewers in district No. 17. The work will include the following approximate quantities: 14,000 lin. ft. of vitrified pipe sewer, 8-ins. to 15-ins. in diameter; 10,000 lin. ft. of vitrified pipe house connec- [illegible]

Massachusetts.

✣Bids will be received until 3 p. m., April 18, by Board of Sewage Disposal Commissioners, 352 Main St., Fitchburg, Mass., for constructing Section 1, of the main intercepting sewer, covering the following work: 902 lin. ft. of earth excavation and building 48-in. sewer; 180 lin. ft. of 24-in. tile and reinforced concrete sewer; 5,081 lin. ft. of trench and laying 30-in. cast iron pipe; 1 siphon chamber at junction of 48-in. sewer and 30-in. cast iron pipe, also necessary manholes and incidental work. A certified check for $2,500 must be filed with each bid. D. A. Hartwell is Chief Engineer.

The City Council of Boston, Mass., has passed an order appropriating by loan $400,000 for the construction of sewerage works within the watershed of the Charles River Basin.

The proposition to raise $100,000 for a new sewage system was voted in favor of at a meeting of citizens of Amesbury, Mass., on April 1. The sewer commissioners are Charles H. Prescott, John P. Titcomb and T. F. Lynes.

The Board of Trade of South Deerfield,

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Mass., is agitating the installation of a sewer system. F. W. Farquhar of the firm of Warren, Chapman & Farquhar of New York city, has estimated the cost of a gravity system at $[illegible]

Michigan.

✣Bids will be received until 1:30 p. m., April 20, by Board of Public Works, Ludington, Mich., for the construction of approximately 4,000 ft. of pipe sewers of various sizes for the city. Dean Thompson is City Clerk.

Minnesota.

⊙The City Council of Albert Lea, Minn., has awarded the contract for the construction of lateral sewer No. 7 to Illstrup & Olson of Minneapolis, Minn., for $12,981. Other bidders were: Lars Overn, St. Peter, $15,300; A. L. Jones, Sioux Falls, $14,215; Greene Bros., Albert Lea, $13,101; Haggert Construction Co., Fargo, N. Dak., $13,250; Pastoret, Lawrence Co., Duluth, Minn., $13,150, and E. T. Sikes, Minneapolis, $13,354.

Missouri.

⊙The Board of Public Works of St. Joseph, Mo., has awarded the contract for the building of the Lower Whitehead branch sewer in Atchison St., from Sixth to Fifth to the Land Construction Co., at $27,487.

Montana.

The city of Bozeman, Mont., will shortly vote on the proposition to issue bonds in the sum of $40,000 for the installation of a sewage system. The plant will consist of a settling tank, an automatic arrangement for introducing the chloride of lime solution into the sewage, a storage tank for holding the sewage for an hour to allow the chemical to act, and a discharge line to carry the product to the East Gallatin River. Carl C. Widdener is City Engineer.

The citizens of Lewistown, Mont., will vote April 11 on the proposition of issuing bonds in the sum of $60,000 for sewer system.

New Jersey.

According to advices from Ocean Grove, N. J., the proposition to raise $30,000 for a sewage disposal plant was carried at the special election in the West Grove district of Neptune township. A further sum of $5,000 for maintenance was voted. Jacob Stiles, Wellington Pharo and Peter F. Dodd of West Grove were chosen as the first Board of Sewer Commissioners.

New York.

✣Bids will be received until 10 a. m., April 30, by Municipal Board, Newark, N. Y., for furnishing material and performing labor for a sewage disposal plant for the village. The sewer disposal plant consists of two Imhoff tanks operated by electrical pumps and automatic machinery. Plans and specifications will be on file at the office of the Municipal Board. J. E. Wiser is Clerk.

✣Bids will be received until 10 a. m., April 30, by Municipal Board of Newark, N. Y., for the construction of a system of sanitary sewers for the village. The work will embrace the trenching and laying about 100,000 lin. ft. of 6-8-10-12 and 18-in. vitrified sewer pipe; constructing manholes, lampholes and flush tanks. Plans and specifications will be on file at the office of the Municipal Board. J. E. Wiser is Clerk of the Board.

✣Bids will be received until 10 a. m., April 30, by Municipal Board, Newark, N. Y., for the construction of a siphon under the Barge Canal. Plans and specifications are on file at the office of the Board. J. E. Wiser is Clerk.

⊙The Board of Contract and Supply of Rochester, N. Y., has awarded the contract for the construction of a new sewage disposal system, known as Contract No. 5, to Ripton & Murphy at $41,698.

⊙Maurice E. Connolly, President of the Borough of Queens, New York City, has awarded the following contracts for sewer work in Long Island City, Ridgewood, Richmond Hill and the Rockaways, aggregating $156,044: Temporary sewer for the Rockaways, plan No. 6, and appurtenances for the purpose of abating a nuisance and to prevent damage to property in Wave Crest Ave., which comprises Wave Crest; in Bay Ave., from Dickerson Ave., to Wave Crest Ave.; in Atlantic Ave., from Channel Ave. to Wave Crest Ave.; in Cedar Ave., from Wave Crest Ave. to Atlantic, 4,245 ft. of 10-in. cast iron force main in Cedar Ave., from Wave Crest Ave. to Franklin Ave., from Cedar Ave. to Cornega Ave., J. H. Holmes, $26,337; sewer in Hamilton Ave., from Jamaica Ave. to Ashland St., Richmond Hill; in Ashland St., from Hamilton Ave. to Birch, and in Birch from St. Ann's Ave. to Hillside Ave., lowest bidder, Joseph Sigretto, $30,163. In Troutman St., from Brooklyn line to Metropolitan Ave., and in Metropolitan Ave. from Troutman St. to Starr, Ridgewood, McFarlane Contracting Co., $25,065. In Brevoort St., from Jamaica Ave. to Metropolitan Ave.; Joseph L. Sigretto & Co., $13,273. In Jamaica Ave., from Greenwood Ave. to North Vine St., Richmond Hill; J. H. Holmes, $28,047. In Newton road, Long Island City, from 13th Ave. to 18th Ave.; Frank St., $2,322. In Hancock St., in Webster Ave., to the corner north of Pierce Ave., Long Island City, and in Washington and Pierce Aves., from Hancock St. to the boulevard; Gabriel Hill, $14,146. In Flushing Ave., from Metropolitan Ave. to Atlantic St., Maspeth; Newmann & Carey Co., $14,804. In Sunswick St., Long Island City, from Wilbur to Paynton; Clancy & Van Alst, $1,095. In Hopkins St., Long Island City, from Taylor St. to Clark; Clancy & Van Alst, $606. Receiving basin southeast corner 14th St. and the boulevard, Long Island City, Gabriel Hill, $180.

The officials of Elmira, N. Y., have been notified by Dr. Eugene Porter, State Health Commissioner, to begin within a short time the installation of sewage disposal plants. Mayor Daniel Sheehan has estimated that a plant on either side of the river will cost $200,000.

Mayor Cornelius F. Burns of Albany, N. Y., has notified the members of the Board of Contract & Supply that he has signed the resolution providing for a 24-in. sewer in Lincoln Ave., Troy.

The Village Board of Sloan, N. Y., contemplates the installation of a sewerage system. Percy Lansdowne is Village Attorney.

City Engineer E. W. Sayles of Watertown, N. Y., has completed his maps and specifications for the North Side trunk sewer, for which surveys have been made by his staff during the past few months. The plans call for a sewer 9,585 ft. long of either concrete pipe or hollow clay block. The taxpayers will shortly be asked to vote on the appropriation of $65,000 for the improvement. Plans are to be submitted to the State Board of Health for approval.

Ohio.

✣Bids will be received until noon, April 19, by Department of Public Service, Cambridge, O., for the construction of 5,400 ft. of 8 and 10-in. vitrified pipe sewer, including manholes and flush tanks. Plans and specifications are now on file.

⊙Shannon & Wilderson of Orrville, O., have been awarded the contract by the city of Andover, O., F. A. Woodard, Clerk, for furnishing the necessary labor and material for the construction of a sewage disposal works at $11,995. B. F. Hewitt, Jefferson, O., is Engineer. Bids were opened March 25.

⊙The Department of Public Service of Cincinnati, O., has awarded the contract for sewering Boudinot Ave., north of Werk Road and Lischer Ave., to Thomas Maloney at $5,218; also the contract for a sewer in Boudinot Ave., between Montana Ave., and Mozart Ave., and in Urwiler Ave. to Joseph J. Brown at $3,364.

The city of Cambridge, O., will receive bids about June 15 on 6,000 ft. of 8-in. 10-in. and 12-in. vitrified pipe sewers; also on a sewage ejector plant and ½ mile of vitrified brick pavement. Karl M. Cosgrove is City Engineer.

John Dempsey, 5130 Carthage ve., Nor wood, O., has been awarded the ontract b the Director of Public Works of Bern O., for the improvement of Lang Ave., constructing an 8-in. vitrified pipe wer fr Mitchell Ave., to Delmar Ave., at 910. were opened March 30. W. J. Vo r is Cl

A number of improvement ass iations Dayton, O., recently held a meetin to dis needed improvements of suburbs, ief am which was the proposed constru ion of storm sewer through Dry Hollow o preven flooding of territory in the West ide. The estimated cost is $150,000.

City Engineer Phil Weber of inton, has estimated the cost of the p posed tension of the Shriver's run culver or Li St. storm sewer from its presen ending East Tenth to East North St., at 9,000 city plans to continue the culvert rom North St. to Lawrence Ave., a stanc about 2,000 ft., next year. The st entire improvement will be close $1 it is estimated.

Oklahoma.

✣Bids will be received until 10 m., Apri 16, by Charles Wheeler, Jr., City rk kogee, Okla., for furnishing the labor and material for the constr tion sanitary sewer in District No. 79. check for $500 must be filed wit T. P. Clonts is City Engineer.

✣Bids will be received until 10 April 12, by City Auditor, Tulsa, Ol construction of sanitary sewers in we trict No. 26. T. C. Hughes is City En

The citizens of Oklahoma City, Ok April 2, it is reported, voted the iua bonds in the sum of $275,000 for the x of main, sanitary and storm sewers erection of highway bridges and c arches where needed.

Pennsylvania.

✣Bids will be received until 2 p. m., 12, by Board of Trustees, S. W Secy., State Hospital for the Insan W Pa., for additions to the sanitary sys tem, a pumping plant and disposal work briefly outlined is as follow 8,700 T. C. pipe sewers, sizes 8, Constructing receiving well and pu Furnishing 2 centrifugal pumps, electric motors, capacity each 500 al minute. Laying 3,850 ft. 10-in. CI main. Constructing one disposal p sisting of settling tanks, sprinkl chemical house and sludge filters. specifications may be seen at the off Steward in North Warren, Pa., office of the engineers, or may be ob ined depositing $20 with the engineers, Mebus, 908 Land Title building, Ph

✣Bids will be received until Ap Borough Council, West Hazleton, a. the construction of a 768-ft. flume ing the sewage from the Green Ri across the cave-ins into the Cranber

The Pennsylvania Department Pub Health, Samuel Dixon, Commissio granted a permit to the town of Cor use the public waters of Hare Creek the installation of a new sewage syst Pla prepared by City Engineer Nevin Dix call for an expenditure of $50,000 wi out cost of a disposal plant. The plant must completed by July 1, 1915.

The Board of Public Works of Yk recently held a meeting with Mayo to consider plans for the selection gineer to prepare date for the comp ion the sewer system. An appropriation $1 is allowed in the 1912 city budget for posed survey and other work to be

An ordinance has been introduce City Council of New Castle, Pa., for an increase in the indebtedness city by a bond issue of $75,000 to tak the construction of storm sewers alre templated and for the necessary exte the sanitary sewer system in the Ward.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

South Dakota.

ard of Commissioners of Sioux S. Dak., has let the contract for the ruc n of a sewerage system to Dear- & J kson of Cedar Rapids, Ia., at $168,- S. B. Howe is City Engineer. L. P. Paul, Minn., is Consulting En-

Tennessee.

Bids will be received until noon, April 11, M. Douglass, City Clerk, Memphis, f the construction of one or more [illegible] for the city of Memphis. s are on file with D. C. Newton, ing Commissioner.

e Board of Public Works of Nashville, rejected all bids received for the ruc n of the Wilson Spring branch om Wilson spring to Fourth Ave., al Demonbreun St. The work will the city force under the direction engineer.

Texas.

ns of Nacogdoches, Tex., at a re- voted the issuance of bonds in $65,000 for an electric light plant, l street paving.

ns of Dallas on April 2 voted the bonds in the sum of $100,000 for and laying of sanitary sewers.

Virginia.

[illegible] for the installation of a water- werage system in Colonial Beach, timated cost of $37,000. The sew- will cost about $20,000 and the about $17,000. Contracts will be [illegible] al Beach is official in charge.

Washington.

✣Bids will be received until 8 p. m., April 22, by town of Cashmere, for the construction of sewers and cement walks. S. H. Andrews is Clerk of Cashmere, Wash.

The City Council of Pomeroy, Wash., has employed Robert Dieck of Portland, Ore., as engineer in the construction of a sewer system.

Plans have been prepared by Thos. Allman, Civil Engineer, for the construction of a sewer system in Cathlamet, Wash., estimated to cost $1,200. The contract will be let in May or June.

West Virginia.

⦿Arnot Davies has been awarded the contract by the Board of Commissioners of Huntington, W. Va., for the construction of 12-in. lateral sewer in alley between Rookwood and 9th Ave., at $1 per ft. Bids were opened April 1 by J. Coon, Commissioner of Streets.

Wisconsin.

⦿Johnson & Theander of Marinette, Wis., have been awarded the contract by the city of Marinette, A. L. Hillis, City Engineer, for the construction of a 36-in. 2-ring brick sewer at $11,901. The work includes 1,543 lin. ft., of 36-in. sewer with foundation and inlet. Bids were opened April 3.

Canada.

✣Bids will be received until noon, April 19, by City Commissioners, Saskatoon, Sask., for furnishing approximately 41,400 lin. ft. of concrete sewer pipe, varying in size from 5-in. to 24-in. and the necessary Y's, T's, etc. G. T. Clark is City Engineer, Saskatoon, Sask.

✣Bids will be received about May 1, by City of Point Grey, B. C., for the Ward Three and Ward Five sewerage schemes.

✣Bids will be received until 8 p. m., April 30, by H. W. Dixon, Secretary-Treasurer, North Battleford, Sask., for Contract A, for labor, laying water mains and sewers; Contract B, for construction of power house. Chipman & Power, Winnipeg, and Toronto, Ont., are Engineers.

✣Bids will be received until noon, April 19 by City Commissioners, Saskatoon, Sask., for furnishing approximately 41,400 lin. ft. of concrete sewer pipe, varying in size from 5 to 24-in. and including necessary Ys, Ts, etc. Further information may be obtained of George T. Clark, City Engineer.

✣Bids will be received until 6 p. m., April 30, by City Commissioners, Edmonton, Alta., for the construction of a reinforced concrete tunnel sewer. Plans and specifications are on file with the city engineer.

⦿The City Council of Point Grey, B. C., has awarded the contract for the construction of a sewer system in the Eburne district to Kibler Roseneath at $92,000.

⦿The City Council of Vancouver, B. C., has awarded the contract for the construction of the Balaclava trunk sewer to Palmer Bros., & Henning of Vancouver for $89,071. Other bidders were: Graff Construction Co. of Seattle, Wash., $89,069, and Romano Pinto Co., $87,105.

⦿The municipal engineer of Point Grey, B. C., and Consulting Engineers Cleveland & Cameron, 506 Winch Bldg., Vancouver, B. C., have awarded a contract for the work on the Point Grey sewage scheme to Ledingham & Cooper, Carter-Cotton Bldg., Seattle, Wash., [illegible] for this work.

UILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

i will be received until 11 a. m., April ommon Council, San Diego, Calif., for abor and materials for the con- f a suction dredger for the city. t is City Clerk.

dard American Dredging Co., San al., has been awarded a contract r the Huntington concession for Los Angeles. The contract pro- at approximately 1,400,000 cu. yds. of all be used in filling the concession and making the fill approximately 413,000 d of earth be dredged from the channel e west side of the concession.

or Engineer E. M. Capps, San Diego, pared specifications for a pile driver sed by the city at a cost not to

ity of San Francisco has voted bonds um of $8,800,000 for the establishment vic center, the construction of a city l other public buildings. M. Mansen, rket St., is City Engineer, and Alfred ey, 995 Market St., is City Architect.

Delaware.

s will be received until 11 a. m., April Maj. R. R. Raymond, U. S. Engineer, gton, Del., as noted in our last issue, dging harbor at Wilmington, Del. For rposes of this contract the harbor is into three sections. Section No. 1 ex- rom the 21-ft. depth in the Delaware to the mouth of the Brandywine a channel length of about 2½ miles. In ction the width on the bottom will be and the depth 21 ft. at mean low water. No. 2 extends from the mouth of the wine River to the B. & O. R. R. bridge, nel length of about 2 miles. In this sec- e width on the bottom will be 200 ft., e depth 21 ft. at mean low water. Sec- o. 3 extends from the B. & O. R. R. to the P., B. & W. R. R. cut-off bridge No. 4, a channel length of about 3,400 ft. In this section the depth will be 21 ft. to the upper end of the pulp works wharf, thence diminishing to a depth of 10 ft. at the P., B. & W. R. R. cut-off bridge No. 4. The width on the bottom will be 200 ft. The approximate yardage in sections 1, 2 and 3 is respectively as follows: 446,999, 281,115 and 162,700, measured in place. These quantities include material removed in making side slopes. The material is believed to be mud, clay, sand and gravel.

Bids as follows were received April 1 by Maj. R. R. Raymond, U. S. Engineer, Wilmington, for about 30,000 cu. yds. dredging in Murderkill River, Del.: River & Harbor Improvement Co., Philadelphia, Pa., 11 cts. per cu. yd.; Rickards Dredging Co., Philadelphia, Pa., 11.8 cts. per cu. yd.

District of Columbia.

✣Bids will be received until noon, April 17, by W. Crozier, Brig Gen., U. S. A., Chief of Ordnance, Washington, D. C., for furnishing 12 sets, except trunnion hoops more or less of steel forgings for 12-in. mortar, Model 1912, to be tempered and annealed.

✣Bids will be received until 10:30 a. m., April 27, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 698 material for steel cylinders, rivets, steel reinforcement bars, babbitt metal, bolster truck springs, pipe wrenches, cable hangers, fire hose, heating boilers, hot-water service heaters, sanitary fixtures, cast-iron pipe and fittings, steel pipe and fittings, brads, pipe and fittings, lead bends and P traps, valves, cocks, lumber, untreated piles and artificial vermilion.

✣Bids will be received until 11 a. m., May 6, by Capt. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 701 blasting caps, detonators, safety fuse, insulating tape, and lead wire.

✣Bids will be received until 10:30 a. m., May 6, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 700 dynamite.

✣Bids will be received until 10:30 a. m., April 15, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under canal circular No. 699: Boat spikes, poultry netting, portable forges, paint brushes, scythes, mess kit spoons, asbestos packing, rubber belting, wool waste, magnesia pipe covering, railway flats, coal tar, beeswax, calcium carbide, asbestos cement, muriatic acid, linseed oil, library paste, scratch pads and long leaf yellow pine lumber.

✣Bids will be received until 2 p. m., May 13, by Joseph E. Ralph, Director, Bureau of Engraving and Printing, Washington, D. C., for furnishing brass castings and iron castings for washing wetting cloths during the fiscal year beginning July 1, 1912.

✣Bids will be received until 11:30 a. m., April 12, at the office of the Chief Signal Officer, Washington, D. C., for furnishing four miles of cable, type 324, 20 pair submarine paper insulated, in accordance with specifications 427C and seven miles do type 321, 10 pair in accordance with specifications 427-C.

Florida.

✣Bids will be received until noon, May 2, by Capt. J. R. Slattery, U. S. Engineer, Jacksonville, Fla., for the motor survey launch Capt. J. J. Meyler.

Georgia.

J. B. Pound, President of the Hotel Ansley Investment Co., 817 Forsyth Bldg., Atlanta, Ga., has just awarded the contract for the erection of the structural reinforced concrete skeleton for the new Hotel Ansley to the Southern Ferro Concrete Co., Charles Loridans, President, Atlanta, Ga. The building will be a total of 15 stories in height, the base-

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

ment floor, one floor at [illegible] and 13 stories above the [illegible] The building is approximately [illegible] in dimensions. The hotel [illegible] most up-to-date buildings [illegible] South. It will have 306 guest rooms, each room to have a private bath, [illegible] of the accessories that go [illegible] up a modern hotel. The St. Johns Construction Co., to whom the contract for the general work has been awarded, are now taking sub-bids for the construction of the general work, and the contracts for this work will be let within a few weeks. Their offices are at 817 Forsyth Bldg., Atlanta, Ga. The approximate cost is $750,000, and the architect is Capt. Brinton B. Davis, Louisville, Ky.

Illinois.

✣Bids will be received until 10 a. m., April 26, by Lieut. Col. George A. Zinn., U. S. Engineer, Chicago, Ill., for dredging in Calumet Harbor, Ill.

✣Bids will be received until 11 a. m., April 18, by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering lap welded special charcoal, iron boiler tubes and seamless steel, Hawley down draft furnace tubes in the following quantities and sizes: Charcoal iron tubes, 120; 12 ft. long, outside diameter 3 ins., thickness B. W. G. 10, 280, 12½ ft. long, 3½ in. O. D. 10, 110, 12 ft. 4½ ins. long, 3½ in.; O. D. 9, 40, 16 ft. long, 4 ins. O. D., 10, 20, 18 ft. long, 4 ins., 9, 150, 18 ft. long, 4 ins., O. D., 10; iron stay tubes, 28, 12 ft. 7 ins. long, 3½ ins. O. D. 8 threaded, 28, 11 ft. 8 ins. long, 3 in. O. D. 8 threaded, seamless steel tubes, 500, 5 ft. 1¾ ins. long, 2⅜ lin O. D., 6 plain, 20, 5 ft. 2 in., [illegible] threaded, 50 ft. 3½ ins. long, [illegible] threaded, 20, 5 ft. 4 ins., 2⅜ ins., 6 threaded Cash or certified check for $500 [illegible] pany proposal.

⦿F. J. McCarthy, Davenport, Ia., has been awarded the contract at $23,858 for the construction of a concrete tunnel for steam pipes at the Bartonville asylum for the state board of administration.

Louisiana.

✣Bids will be received until 11 a. m., April 30, by Lieut. L. H. Beach, U. S. Engineer, New Orleans, La., for furnishing and delivering stone at South Pass and Southwest Pass, Mississippi.

✣Bids will be received until noon, April 25, for the erection of any one of or all of four 2-story and basement brick school buildings at Lake Charles, La. Favrot & Livadais, Ltd., 839 Gravier St., New Orleans, La., are Architects. E. S. Jenkins, Lake Charles, La., is Superintendent.

Massachusetts.

✣Bids will be received until 11 a. m., May 4, by W. M. Smith, Acting Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for one officer's quarters at the navy yard, Boston, Mass.

✣Bids will be received until 2 p. m., April 12, by Board of Harbor and Land Commissioners, Boston, Mass., for dredging of about 20,000 cu. yds,. of material to enlarge the basin at the town landing at a depth of 12 ft. at mean low water and dredge a 60-ft. channel into the pond at a depth of 6 ft. at mean low water. The dredged material is to be deposited on the marsh south of the town landing.

✣Bids will be received until 2 p. m., April 12, by Board of Harbor and Land Commissioners, Boston, Mass., for building up and strengthening of the outer ends of both jetties at the entrance to Cuttyhunk Harbor. It is estimated that about 1,300 tons of stone will be required.

✣Bids will be received until 2 p. m., April 12, by Board of Harbor and Land Commissioners, Boston, Mass., for the work to be done in the dredging of about 16,000 cu. yds. of material to straighten and widen the entrance channel. All dredging to be to the depth of 6 ft. at mean low water.

✣Bids will be received until 2 p. m., April 12, by Board of Harbor and Land Commissioners, Boston, Mass., for the work of building up and strengthening of about 800 ft. of the existing breakwater at Cherry Island Bar in the town of Revere. It is estimated that about 2,500 tons of stone will be required.

Michigan.

✣Bids will be received until 4 p. m., April 22, by Board of Education, Lansing, Mich., for the erection and completion of school building at the corner of Genesee and Butler Sts., Lansing, Mich. Dr. Charles G. Jenkins is Chairman of the Board.

✣Bids will be received until 3 p. m., April 22, by Gardner S. Williams, Consulting Engineer, Ann Arbor, Mich., for the construction of a reinforced concrete and brick power house, reinforced concrete multiple arch spillway, earth embankment and tail race excavation for the Barton plant of the Eastern Michigan Edison Co. near Ann Arbor, Mich. The approximate quantities of the principal items will be: 12,000 cu. yds. earth excavation, 50,000 cu. yds. earth embankment, 4,500 cu. yds. concrete, 70 tons reinforcing steel. Official advertisement will be found elsewhere in this issue.

Mississippi.

✣Bids will be received until 2 p. m., April 22, by T. P. Scott, Secretary Building Committee, at the Governor's office, Jackson, Miss., for the steam heating and power plant, electric lighting plant, electric wiring, plumbing and sewerage for the Mississippi Normal College at Hattiesburg, Miss. For plans and specifications apply to R. H. Hunt, architect, Chattanooga, Tenn.

Missouri.

✣Bids will be received until noon, May 4, by Maj. E. H. Schulz, U. S. Engineer, Kansas City, Mo., for the construction of about 14,000 ft. of standard revetment on the Missouri River about 215 miles below Kansas City and at and below Rutland, Mo. Official advertisement will be found elsewhere in this issue.

New Jersey.

✣Bids will be received from 3:30 until 4 p. m., by Board of Police Commissioners, Newark, N. J., for furnishing two motor power combination patrol wagons and one automobile. J. M. Cox is Secy. of the Board.

✣Bids will be received between 4 and 4:15 p. m., April 16, by Board of Education, Newark, N. J., R. D. Argue, Secy., for the construction complete of the Miller St. school house addition.

✣Bids will be received until April 12, for the erection of a schoolhouse in Caldwell, N. J. Plans and specifications may be obtained of Ernest E. Twist, News Bldg., Passaic, N. J.

New York.

✣Bids will be received until 3 p. m., May 1, by C. D. Stearns, Commodore, U. S. N. Inspector Third District, Tompkinsville, N. Y., for furnishing 17 lenses for the light house service.

✣Bids will be received until 1:30 p. m., April 11, by M. Gary Zalinski, Deputy Quartermaster General, New York City, for furnishing six propeller blades for the U. S army transport Warren. Proposal No. 305.

✣Bids will be received until 11 a. m., May 2, by Chief Quartermaster, Governors Island, N. Y., for constructing, plumbing, heating and lighting ferry house at that place.

Ohio.

✣Bids will be received until noon, April 30, by Board of Hospital Commissioners, E. L. Kennedy, Clerk, Cincinnati, O., for furnishing necessary labor and material for erecting 25 elevators for 18 buildings composing the Main Group of the New General Hospital.

Oregon.

✣Bids will be received until April 13, by F. S. Fields, Multnomah County Clerk, Portland, Ore., for an automobile for the county to be not less than 30 h.p., seats for two.

✣Bids will be received until 10 a. m. 11, by Multnomah County Clerk, F. S. Portland, Ore., for one 5-ton auto the county.

Pennsylvania.

✣Bids will be received until noon, by Chairman of Building Committee office of T. E. Billquist, Architect, 34 Ave., Pittsburg, Pa., for plain and rei concrete, stone work, brick work, st steel work, ornamental metal work, she work, roofing, carpenter work, painti glazing for one industrial shop build Pennsylvania Training School, Mc Washington Co., Pa.

✣Bids will be received until 10 a. m. 13, by Shade Tree Commission at th of the City Controller, Pittsburgh, the following: 1,500 ft. of galvanize fencing, height 68 ins.; crimped wire, mesh; cables No. 12½, pickets No. 9, barbed wire, 400 locust or cedar posts, 500 ft. ornamental fence, 1 single pos 12 ft. opening with gate, 1 single gat iron tree boxes.

✣Bids will be received until noon, A for the construction of sewage disposa at the Pennsylvania State Sanatoriu Tuberculosis near Cresson, Cambria Pa. Specifications and plans may be o of S. G. Dixon, Commissioner of Harrisburg, Pa., by depositing a check

South Dakota.

✣Bids will be received until 10 a. m. 22, by Regents of Education, F. W. Secy, Elk Point, S. Dak., for the erect a new wing to the central building Northern Normal and Industrial sch Aberdeen.

Texas.

✣Bids will be received until 10 a. m. 15, by Board of Regents, State Normal Board, Austin, Tex., for the erection reinforced concrete manual arts building brick walls and plumbing and wiring same, to be erected at San Marcos, Tex. tified check of $500 payable to F. M. B president of the board, must accompan bid for the erection of the building an each bid for plumbing and wiring the Bids should be addressed to F. M. president State Normal School Regents, Austin, Tex.

Washington.

✣Bids will be received until 11 a. m. 27, by W. M. Smith, Acting Chief of of Yards and Docks, Navy Department, ington, D. C., for two 100-kilowatt moto erator sets and controlling panels at the yard, Puget Sound, Wash.

West Virginia.

✣Bids will be received until 11 a. m. ern time), April 30, by Maj. F. W. Altsta U. S. Engineer, Wheeling, W. Va., for structing and delivering sternwheel ga boat Grantsville.

✣Bids will be received until 11 a. m. ern time), April 27, by Maj. F. W. Altsta U. S. Engineer, Wheeling, W. Va., fo construction of two 2-story seven-room lockkeeper houses at Dam No. 28, Ohio near Huntington, W. Va.

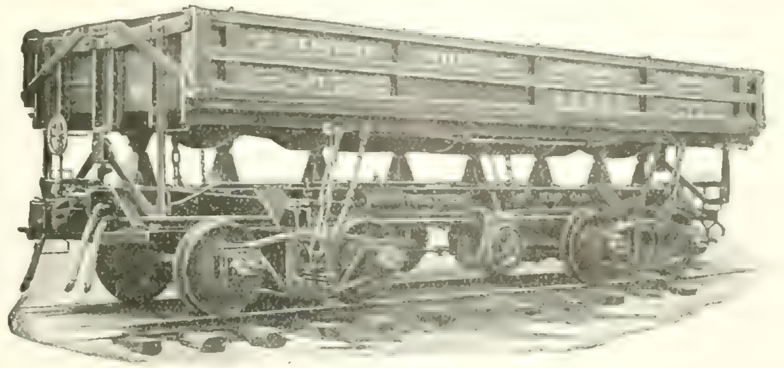
Canada.

✣Bids will be received until noon, Apr by Symons & Rae, Superintending Archi 15 Toronto St., Toronto, Ont., for all required in the erection of St. Alban's thedral, Toronto.

✣Bids will be received until 8 p. m. 15, by H. W. Dixon, Secretary-Treas North Battleford, Sask., for Contract furnishing and erecting boiler; contract furnishing and erecting 750-h.p. steam er and accessories; contract "K," furnishing erecting 500-k.w. generator and equip Chipman & Power, Winnipeg and Toronto Engineers.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Whenever You Require A Big Dump Car There Is No Other That Equals A "Western"



INVESTIGATE any big earth moving proposition where records for rapidity and economy have been made and you are pretty certain to find that a large percentage of the material was handled in Western Dump Cars.

The reason is,—greatest experience and largest facilities in dump car building has enabled the Western Dump Cars to be developed to highest efficiency.

This superiority is eminently illustrated in the Western Air Dump Car.

It's the logical car for trestle filling, raising grades, widening road beds for double-tracking and for ballasting because it saves practically all the cost of unloading.

It dumps and rights the car instantaneously, so that there is not only least work in dumping but the discharge is accomplished in shortest time, which is an important consideration on a busy main track.

Moreover, each car can be dumped separately from either side, alternate cars can be dumped from alternate sides or the entire train can be dumped at one time requiring only one man in the operation in addition to the engineer and fireman.

A prominent railroad has compiled statistics to prove that the cost of handling material with Western Air Dump Cars was only half as great as with flat cars and scrapers and 25 per cent less than with old style A-frame side dump cars.

Western Air Dump Cars also possess all of the Western improvements of having a 47 degree dumping angle, best chilled wheels conforming to the Master Car Builders' specifications, automatic side doors pivoted in such manner that as the bed is tilted the doors are thrust outward and upward from the load, so that no part of the load as it moves is thrown against the door, removing the tendency to derail the car, to which other side dump cars are subjected.

Western Air Dump Cars are made in 12, 16, 20 and 30 yard capacities, level full, and are frequently loaded to 25 per cent more than these capacities.

Let us give you the records of leading railroads showing that no other car equals the economy of the Western Air Dump Car.

Write for our general catalog of earth and stone handling machinery showing the largest line of dump cars made by any concern.

Western Wheeled Scraper Co.

Aurora, Illinois, U. S. A.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

TAMPA BRIDGE.

Contractors experienced in bridge construction are invited to tender sealed bids for the construction of a highway bridge to be built in the City of Tampa, Florida, carrying Lafayette street over the Hillsboro River, in accordance with the detail drawings and specifications on file in the office of the Board of Commissioners of Public Works of Tampa, Fla., and hereinafter referred to as the Board, and also in the office of the Consulting Engineers, Messrs. Boller, Hodge and Baird, 149 Broadway, New York City.

Bids will be received by the Board at their office in the City of Tampa, Fla., not later than noon of Wednesday, May 7, 1912.

A certified check for $5,000, made payable to the Board, must accompany each bid. Such check will be returned to the unsuccessful bidder immediately after the bids are opened, and to the successful bidder, unless he fails to execute the contract within ten days after such contract is awarded to him.

A bond satisfactory to the Board for the sum of 25 per cent of the contract price will be required.

All bids must be made on form of proposal, which with the contract, specifications, and bond, can be obtained on application to the Clerk of the Board.

Bidders can secure a set of all drawings for this work by depositing $10 with the Clerk of the Board, which deposit will be returned on the return of the drawings.

The above work covers two reinforced concrete earth spans of 82 feet clear span, one deck Scherzer rolling lift draw, of two wings of 93 feet span, and concrete retaining walls for the approach to this structure.

The City of Tampa reserves the right to reject any and all bids.

CITY OF TAMPA,
By D. B. McKAY, Chairman Board of Commissioners of Public Work.
Attest: ALLEN THOMAS, Clerk.
BOLLER, HODGE & BAIRD,
Consulting Engineers.

BRIDGE.

Separate sealed proposals for the super- and sub-structures of a movable bridge crossing the Christiana River at Third Street, Wilmington, Delaware, will be received at the Levy Court Room, in the Court House, Wilmington, Del., until 12 o'clock noon on the 23rd day of April, 1912, at which time all bids received will be publicly opened and read.

Plans, specifications, form of proposals and instructions to bidders are on file in the office of the County Engineer, Church Bldg., Wilmington, Del., and the County Engineer will furnish contractors complete sets upon the receipt of $10.00 for each set. Bidders will be required to enclose a certified check or acceptable bond to the amount of one thousand ($1,000.00) dollars with their bids as a guarantee of good faith, and the successful bidder will be required to give a bond for one-half the amount of the cost of the work.

The Levy Court reserves the right to reject any and all bids.

S. J. DENNISON,
Chairman Bridge Committee.

POWER HOUSE AND DAM.

Sealed proposals will be received at the office of Gardner S. Williams, Consulting Engineer, Ann Arbor, Mich., until 3 o'clock p. m., on April 22, 1912, and then opened, for —

The construction of a reinforced concrete and brick power house, reinforced concrete multiple arch spillway, earth embankment and tail race excavation for the Barton plant of the Eastern Michigan Edison Company near Ann Arbor, Mich.

The approximate quantities of the principal items will be:

12,000 cu. yds. earth excavation.
50,000 cu. yds. earth embankment.
4,500 cu. yds. concrete.
70 tons reinforcing steel.

Those bidders desiring plans and specifications for use at their offices may obtain the same by depositing with the undersigned a certified check for twenty-five ($25.00) dollars, of which twenty ($20.00) dollars will be refunded upon the return of the said plans and specifications in good order.

Plans and specifications may be inspected and information obtained at the office of the undersigned.

GARDNER S. WILLIAMS,
Consulting Engineer.
Ann Arbor, Mich

WATERWORKS SYSTEM.

Notice is hereby given that the Village of Ashton, Lee County, Illinois, will on the 25th day of April, A. D. 1912, at the hour of 1 o'clock p. m., at the Village Hall, in said village, receive bids for the construction of a waterworks system for said village, including well, pumping station, elevated reservoir, water mains, fire hydrants, etc., being for a complete system to be constructed in said Village of Ashton, in acordance with plans and specifications heretofore adopted by the Village Board of said village, and on file in the office of the Village Clerk, where the same may be seen and inspected by any person wishing to bid thereon, together with instructions to such bidders.

All bids to be accompanied by cash or certified check for ten per cent (10%) of the amount bid.

The Board reserves the right to reject any or all bids.

Dated at Ashton, Ill., this 1st day of April, A. D. 1912.

SAM'L T. ZELLER, JR.,
President.
Attest: H. C. NELSON, Village Clerk.

Plans and specifications may also be seen at the office of the Aetna Engineering Bureau, 17 N. La Salle St., Chicago.

PAVING.

Pittsburg, Kans.

Sealed proposals will be received at the office of the City Clerk up to 8 o'clock p. m., Wednesday, April 24, 1912, for the construction of about 4,500 sq. yds. of vitrified brick paving on a concrete base with asphalt filler.

Specifications and proposal blanks may be obtained at the office of the City Clerk. Samples of brick must accompany bids.

The right is reserved to reject any or all bids.

O. T. JONES, City Clerk.

PUBLIC HIGHWAYS.

Sealed bids will be received at Par Tex., up to noon, Tuesday, May 21, 191 for the entire construction of 40 to miles permanent rock roads and bridg for Precinct 1, Lamar County, Texas. D tailed plans, profiles and specifications w be on file on and after April 20, 191 Printed copies of contract, specificatior bond, general instructions and form tender will be furnished on deposit of $5. to insure safe retudn of same.

The Board reserves the right to acce that bid which appears most advant geous to them, and also to reject any a all bids or parts of bids. Address

BOARD OF PERMANENT ROA
COMMISSIONERS.
W. F. GILL, Secretary.
M. HANNAH, Engineer.

SEWER SYSTEM.

Notice is hereby given that the unde signed, the Board of Local Improvemen of the City of Lawrenceville, Illinois, wi receive sealed bids or proposals, unt 2 o'clock, P. M., Wednesday the 10t day of April, A. D. 1912, at the Cit Council Chamber in the City Hall Buil ing in the City of Lawrenceville, Illi nois.

For the construction of the entir Sewer system in Sewer District Numbe Three (3) of said City, consisting o vitrified clay pipe sewer manholes, lamp holes and all appurtenances, includin all labor and material necessary to th completion of said work, according t the plans and specifications which are t be found at the Office of the City Engi timate of cost, $42,100.00. Illinois.

Specifications and estimates of th proposed work, together with biddin blanks and instructions to bidders wi be furnished upon application to sai City Engineer.

All bids must be accompanied by cas or a check certified to by some responsible Bank, made payable to Carl Busse President of the Board of Local Improvements, in a sum not less than ten (10%) per cent of the aggregate amount of the bid or proposal.

The Contractor shall be paid in Cash or in the Bonds of said district drawing Five (5%) per cent interest per annum, at the election of the Board of Local Improvements. All bids will be opened by said Board of Local Improvements of said City at 2 o'clock P. M., Wednesday, April 10th, A. D. 1912, in said City Council Chamber and said Board of Local Improvements reserves the right to reject any and all bids. Engineer's estimate of cost $42,100.00.

Dated at Lawrenceville, Illinois, this 27th day of March, A. D. 1912.

CARL BUSSE,
J. H. PHILLIPS,
A. M. FYFFE.
Board of Local Improvements of the City of Lawrenceville, Illinois.

U. S ENGINEER OFFICE, CHICAGO, ILL., March 26, 1912. Sealed proposals for dredging in Calumet Harbor, Ill., will be received here until 10 a. m., April 26, 1912. Information on application. GEO. A. ZINN, Lt. Col., Engrs.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

ENDERS FOR CONCRETE CONSTRUCTION.

ADIAN PACIFIC RAILWAY COMPANY.

ARTMENT OF NATURAL RESOURCES.

led tenders, addressed to the under- l and endorsed "Tenders for Concre Structures," will be received up to n of May 1, 1912. The work to be let ludes the concrete structures in about [illegible] Alberta. Materials, except for [illegible] actor. The approximate quanti- re: 15,000 cubic yards of concrete 200,000 pounds of reinforcing steel. uantities in individual structures from 5 cubic yards to 700 cubic is

lans, specifications and full informa- will be furnished after April 1, 1912. application to the undersigned. A de- of $100.00 will be required before etc., will be given out, which will refunded on their return in good con- on.

ll proposals must be accompanied by ertified check, payable to the under- ned, for 5% of the amount of the der, to be forfeited as liquidated dam- es should the bidder neglect or refuse enter into a contract in the event that work is awarded to him.

roposals must be made on the stand- l form provided. Alterations thereto, erlineations or qualification of prices y invalidate the bid.

he right is reserved to reject any or bids and to waive defects.

A. S. DAWSON,
Chief Engineer.

Calgary, Alberta, March 20, 1912.

U. S. ENGINEER OFFICE, Kansas ty, Mo., April 4, 1912.—Sealed proposals r the construction of about 14,000 ft. of ndard revetment on the Missouri ver, about 215 miles below Kansas City, d at and below Rutland, Mo., will be ceived at this office until 12 o'clock on, May 4, 1912, and then publicly ened. Information on application. ED- ARD H. SCHULZ, Major, Engrs.

STREET PAVING.

Jackson, Ky.

Proposals will be received by the under- gned until 1 o'clock, the 20th day of pril, 1912, for paving certain streets with acadam or Telford. The work will em- ace furnishing and laying approximate- 13,000 sq. yds. of paving.

Plans, specifications and general infor- ation may be obtained from the office the City Engineer.

The right is reserved to reject any or l bids.

BOARD OF TRUSTEES, TOWN OF JACKSON.
PRICE SEWELL, Chairman.
W. S. CANNING, City Engineer.

U. S. ENGINEER OFFICE—Boston, ass., Mar. 18, 1912. Sealed proposals or rock excavation in Boston Harbor, ass., will be received here until 12 M., pril 17, 1912, and then publicly opened. nformation on application. FREDERIC . ABBOT, Col., Engrs.

WATER WORKS AND SEWER.

Hamilton, Illinois, March 29, 1912.

Sealed proposals will be received by the Board of Local Improvements of the City of Hamilton, Illinois, until one o'clock p. m., on the 19th day of April, 1912, for the following work:

1st. For a system of sewers, comprising approximately 1,200 lineal ft. of 15-in. sewer, 1,929 lineal ft. of 12-in. sewer, 7,445 lineal ft. of 10-in. sewer and 8,581 lineal ft. of 8-in. sewer, together with the necessary manholes, flush tanks, etc.

2nd. For a Water Works distribution pipe system, comprising approximately 3,375 lineal ft. of 10-in. pipe, 12,435 lineal ft. of 8-in. pipe and 9,140 lineal ft. of 6-in. pipe, together with the necessary special castings, valves and valve boxes.

Sealed proposals will be received by the Board of Local Improvements of the City of Hamilton, Illinois, until one o'clock p. m., on the 20th day of April, 1912, for the following work:

1st. For furnishing and setting hydrants and hydrant branches, comprising approximately 46 4-in. hydrants with 4-in. hydrant branches and 10 5-in. hydrants with 6-in. hydrant branches.

2nd. For certain water works improvements to be divided into separate portions or items, as follows:

Item One: A Pump House.
Item Two: A Pumping Plant.
Item Three: A Steel Tower and Tank.

Separate contracts will be awarded for each of the four divisions above named and bids may be made upon any one or more of said divisions. Separate bids may also be made for any one or more of the three items in the fourth division.

Bids must be on blank forms furnished for that purpose and each bid must be accompanied by cash or by a certified check, made payable unconditionally to the order of the President of the Board of Local Improvements, in his official capacity, certified to by a responsible bank, the amount of said cash or check to be not less than 10% of the aggregate amount of the bid.

Payments for the work embraced in the 1st and 2nd divisions above named, will be made in cash or in local improvement bonds bearing interest at 5% per annum at the option of the City. Payments for the work embraced in the 3rd and 4th divisions above named, will be made in cash.

Plans and specifications are on file and blank forms of proposal may be obtained at the office of the City Clerk of Hamilton, Illinois, and at the office of L. P. Wolff, Consulting Engineer, St. Paul, Minnesota.

The right is reserved to reject any or all bids.

NEAL DOUGHERTY,
President of the Board of Local Improvements.
HIRAM B. KINKADE,
Secretary of the Board of Local Improvements.
R. H. ATHEY,
Member of the Board of Local Improvements.

PAVING.

Bids will be received until noon, May 1, 1912, at the office of Board of Improvement Paving District, No. 7, city of Fort Smith, Arkansas, No. 9½ North Sixth street, for the repaving of Garrison avenue. Specifications at office of City Engineer. Approx. 35,000 yards.

WATER MAINS.

Bids will be received up to Apr. 11, 1912, for a system of water mains in the village of Morton Grove, Ill. Further particulars at the office of the undersigned. Bids to be forwarded to undersigned to be delivered to his office not later than 1 P. M. that day.

JULIUS H. GEWEKE,
Village Attorney.
167 W. Washington St.,
Chicago, Ill.

Sealed proposals will be received at the office of the United States Reclamation Service, Mitchell, Nebraska, until 2 o'clock p. m., April 22, 1912, for the construction of an earth dam and auxiliary works, on the North Platte Project, about nine miles north of Minatare, Scottsbluff County Nebraska. The work involves the handling of about 840,000 cubic yards of material, of which 630,000 cubic yards is earthfill, 157,000 cubic yards gravelly material, 14,000 cubic yards unscreened gravel, 11,500 cubic yards screened gravel, 14,000 cubic yards concrete, and 12,000 cubic yards brule clay excavation, besides 45 acres of sod stripping, 600 feet of wells and casing, 3,200 linear feet of drains, and the handling and placing of 250,000 pounds of reinforcing steel. For particulars address the United States Reclamation Service, Mitchell, Nebraska; 519 Commonwealth Building, Denver, Colorado, or Washington, D. C. F. H. NEWELL, Director.

U. S. ENGINEER OFFICE, GALVESTON, TEXAS, April 18, 1912.—SEALED PROPOSALS for derdging the Houston Ship Channel, will be received at this office until 12 m., May 15, 1912, and then publicly opened. Information on application. EARL J. BROWN, Major, Engrs.

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of
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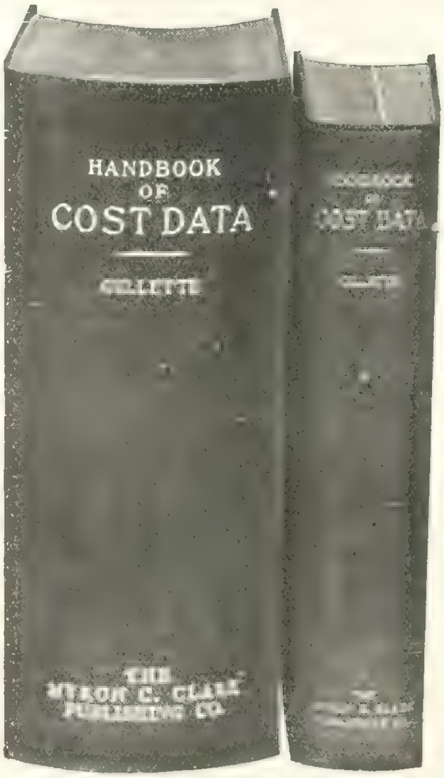

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Devoted to the Economics of Civil Engineering Design and to Methods and Cost of Construction

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[illegible]od Engineering Societies Defend [illegible]mbers from Unjust Accusation [illegible]f Professional Malfeasance?

[illegible] an engineering society a[illegible] [illegible]ligation to defend a member charged [illegible]th professional malfeasance? Every [illegible]ng society records constitutionally its [illegible] remove from membership any mem[illegible]y of professional malfeasanace. Its [illegible] thus to keep its membership purged [illegible]en to question. Indeed, it is under [illegible]ligation to its members and to the [illegible]ering profession to see that the honor [illegible]mbership is kept unsullied. Is there also [illegible] obligation of the society to guard [illegible]ously its membership by defending a [illegible]er unjustly or mistakenly charged with [illegible] acts, which, if true, would [illegible]t cause for his expulsion from the so[illegible] This inquiry is suggested anew by [illegible]ecent action of the Illinois Society of [illegible]eers and Surveyors in the case of Mr. [illegible] Elliott, formerly Chief of Drainage In[illegible]ations, U. S. Department of Agriculture. [illegible]e in February Mr. Elliott was summarily [illegible]ssed from office. The reason given for [illegible]action was that he "had certified and [illegible]nted false accounts, knowing them to [illegible]lse, on which the Government had paid [illegible]noney." Hearings which continued sev[illegible] [illegible] followed the accusation, and some [illegible]ays ago indictment was returned against [illegible]Elliott on the charges. Stated thus boldly [illegible]ircumstance has a rather vicious aspect. [illegible]official announcements made by the De[illegible]nent Solicitor have, however, been couched [illegible]rms no more considerate. One naturally [illegible] what the crime was which subjected an [illegible]eer of prominence in his field and having [illegible]viously honorable record to treatment so [illegible]ic.

[illegible]iefly, the facts seem to have been these: [illegible]une, 1909, the Bureau of Drainage In[illegible]gations, of which Mr. Elliott was chief, [illegible]d that there was not remaining of the [illegible]s appropriated for the year ending June [illegible] 1909, sufficient money to complete the [illegible] work in progress. The additional money [illegible]ed amounted to about $500. It was not [illegible]ible under the law to make the expenditure from the appropriation for the succeeding fiscal year, which appropriation became available on July 1, 1909. In order that the work in hand might not be discontinued it was arranged with citizens interested in the work that they should advance from their own funds the money needed and should be reimbursed from the 1910 appropriation by receiving appointments which should last until the pay equaled the sum advanced but which should call for no services. Mr. Elliott, with his office engineer and to the knowledge of the Accountant of the Department, was responsible for this arrangement.

It is to be noted that no person concerned in the transaction described profited by his action to the extent of one penny of Government money. Neither was the Government a loser by one penny by the transaction. On the contrary, there is no doubt that the Government profited by the action, because it prevented interruption and possibly postponement of the work of the bureau. The crime, then, consisted, it seems, in violating a statute defining the manner in which accounts should be kept, with the result that some Government funds intended to be spent in July were spent in June.

We may leave the decision as to the veniality of this crime to our readers. Likewise, they may safely be left to judge of the manner of its punishment. For the present we are concerned only in noting the action taken by the Illinois Society of Engineers and Surveyors in defense of a member—Mr. C. G. Elliott. That the effort will be futile we have very little doubt, but this is not the whole matter. An effort has been made. The Society has recognized a moral obligation to defend a member from what it considers to be a false charge of professional malfeasance. Doubtless sympathy begot of close friendship is more responsible for the action in this particular instance than obedience to an accepted doctrine of society procedure, but ought not the action portend the time when the reverse will be true?

In the past our engineering societies have been little more than clearing houses for technical papers and discussions. This has been natural. In performing this duty they have done a most valuable work. There should be, moreover, no cessation of effort in this work. Instead, the question is, ought not the engineering society to have other functions? Should not membership in its ranks strengthen the individual against attack on his professional life, should it not strengthen his hand in contention for his professional rights?

The Dearth of Test Records of the Bearing Power of Soils.

Two records of tests of the bearing power of Chicago soils are described elsewhere in this issue. One of the tests recorded is stated to have been the first obtained for Chicago hardpan. Therefore, though the hardpan underlying the clay bed on which Chicago is built has been used, and safely used, for years to carry the foundations of heavy buildings, no actual determination by test of its bearing power had been made until within a few months. Doubtless were one to seek records of bearing power of Chicago clay similar to the one published also in this issue they would be found quite scant. It is natural enough that the case should be as described and at the same time it is rather disappointing that it is. First and last there must have been a number of tests made on Chicago clay particularly, to determine the foundation loads it would carry. At least it would not seem credible that Chicago architects had continued all these years to design foundation areas in every case on general assumptions of safe bearing power of the soils on which they were repeatedly erecting heavy structures. Yet at the recent meeting of the Western Society of Engineers, held to discuss the bearing power of Chicago foundation soils, there were presented only the two records of tests, which we publish in this issue.

The conditions existing in Chicago in the matter of available test records of bearing power of local soils are probably not much better in any other large American city. Tests, if they have been made, have rarely been placed on record. It is regrettable that this is the fact, not so much because there is any substantial hazard in relying on general assumptions of bearing power, but because it

[illegible]

The Possibility of Destructive Expansion in Timber Flumes.

[illegible] this issue indicates a possible danger which irrigators and other users of water who frequently employ such flumes should have in mind. It appears from the description of the failure that the flume was a rectangular open top trough mounted on mud sills at the ends and on trestle bents between ends. The flume sides and bottom were boards laid longitudinally. All lumber used had been stacked in the open air during part of a summer and one full winter. Expansion was due to the longitudinal swelling of the sheeting boards through absorption of moisture. It amounted in the case of one 800-ft. flume to 0.75 ft. or 0.083 ft. per 100 ft. In case of the 4,70 which failed, direct measurement w ticable, but the expansion was wreck 800 ft. of structure. The acc an unusual one and it is important the lesson it teaches. Where longitud ing is used some provision is necessa the longitudinal stresses due to exp the sheeting due to soaking. Th adequate bracing of the trestle fro bent or the introduction of expansio

GENERAL ARTICLES

Science of Management—The Law of Unit Cost Reports.

III.

A *unit cost* is the cost of a unit of work, service or product; such as the cost of a ton-mile of hauling, the cost of a kilowatt-hour of electricity, the cost of a cubic yard of concrete.

Engineers and contractors are so accustomed to express costs in units of this sort that it is hard for them to realize that there are classes of men to whom the idea of using unit costs at all is almost a novelty. Ask the ordinary city politician what is the unit cost of teaching children in the public schools, and he will be in deep water at once. Going higher in the scale of public administration, inquire of a state governor how the unit cost of tax collecting in his state compares with that in other states, and again there will be a look of non-comprehension. In general, unit costs of performing the various functions of government are not known. Few have been even casually investigated and those only within very recent years. We look in vain in books on political economy for discussion of any of the unit costs of government.

But we need not confine ourselves to the most notoriously uneconomic branch of human effort—political administration—in order to be convinced that the practice of expressing costs in units is far from being universal. The average small merchant usually has little or nothing in his accounting system that indicates perception of the managerial advantage to be secured by expressing his selling costs in units of goods sold. Likewise the vast majority of plumbers, job-printers, blacksmiths, house builders, farmers, etc., have next to no knowledge of unit costs that relate to their own specialties.

On the other hand, in striking contrast are the large industrial corporations, not one of which exists without some sort of unit cost analysis and periodical reporting thereof. The units that they use are often crude and far from satisfactory to one who understands more scientific methods. But a unit cost of some kind is better than none at all for judging efficiency. The ton-mile and the train-mile may both be unsatisfactory units by which to denote costs of freight transportation, yet ton-mile and train-mile costs are infinitely better than mere statements of monthly or other periodic costs not reduced to any such units.

In the evolution of scientific cost analysis five kinds of units were successively developed.

1. Time units.
2. Sale units.
3. Dimension units.
4. Work units.
5. Formula units.

The *time unit* of cost is the cost per unit of time, as the day, week, month or year. All interest costs and most depreciation costs are time costs. Many other "fixed costs," such as rent, supervision, etc., are time costs; that is, they are a function of time rather than of output. Hence time units will always remain useful as measurers of certain costs of production.

Where the number of production units is practically a constant—as the weekly car-miles of a street railway system—the time unit of operating cost may be of great value in contrasting one week's, month's or year's cost with another. But it is not commonly the case that the number of units of product is the constant per unit of time. Indeed, wide fluctuations in production frequently occur. Therefore it early became the practice to express costs in terms of sale units.

A *sale unit* is the unit of product in which selling prices are expressed; as, the ton of pig iron, the cubic yard of concrete, the kilowatt hour of electricity, etc.

While the sale unit of cost is still more commonly used than any other, with the possible exception of the time unit, and while the sale unit possesses merit, it is a very imperfect criterion for judging the cost of many products. Thus, the cost of excavation expressed only in the sale unit of the cubic yard means next to nothing unless accompanied by a statement of many local conditions. The length of haul may, and often does, become a far more important cost element in earthwork than all other items combined. Then the sale unit (the cubic yard) ceases to have much significance as a cost unit when taken merely by itself.

The sale unit of freight transportation was originally the ton-mile. Here, too, we have an imperfect unit in which to measure all transportation costs. Railway track maintenance cost is less a function of the ton-mile than of the car-mile, and most of such maintenance is not a function of either. Ties, for example, decay as fast in an unused track as in a used track. Perception of such facts led to the adoption of two kinds of cost units that are quite independent of sale units; (1) dimension units, and (2) work units.

A *dimension unit* is a unit of length, area or volume. Thus, the mile of track may be used as a length unit in which to express the cost of track maintenance. Thus, the square yard of concrete surface may be used as an area unit in which to express the cost of forms or molds. Thus, the cubic foot of building content may be used as a volume unit of building cost.

Obviously a volume unit is convertible to a weight unit if the specific gravity and voids of the material are known. Hence we shall include weight units when we speak of volume units in this discussion.

In selecting dimension units that are better criteria of costs than sale units, the instinctive aim is to choose a dimension unit that shall directly measure the approximate amount of labor required to produce the unit. The next step in the evolution of cost units was to do with more scientific precision that that had been done by instinct, that is to select for cost units those that were more truly measurers of the labor required in their production. These we shall call work units.

A *work unit* is a unit that directly measures the approximate cost of labor involved in its production.

If all work were done without tools, or with tools of perfect efficiency and costless in themselves, then the ideal work unit would be the foot-pound or some multiple thereof. In other words the work unit would be the product of some weight (or force) and the distance through which the weight (or force) moves. Even though this ideal work unit is rarely a perfect measure of labor costs, it is always well to have in mind the ideal when selecting a work unit for practical use. Thus, in selecting a work unit for hauling portation costs, one should be ch will be approximately a function o multiplied by tractive resistance. Th fulfills this condition better than the ti for example. Yet the car-mile, the and the ton-mile are rather crud transportation units, and are destin supplemented, if not displaced, by will more closely approximate the performed.

We have come now to the latest dev in unit cost analysis, namely the for as we shall designate it.

A *formula unit* is a composite cost u up of simple cost units, each of whi ures approximately or exactly the c certain part of the total.

Nearly every satisfactory formula composite of the three classes of u we have discussed, namely: (1) Ti (2) dimension units, and (3) work formula unit may be itself a sale u may be some arbitrary unit that mere to sum up all the sub-units of a given of a multiplicity of kinds. It may cubic yard of masonry, or it may b arbitrary unit. In all cases, however, mula unit is one susceptible of expr the left-hand x of an equation in w right-hand member contains all the that respectively measure the corre costs with approximate correctness.

Thus,

$$x = a + b + c$$

Here x is the formula unit cost w example, may be the cost of a cubic excavation. Then a may be expressed of a time unit, and may include certa costs; b may be expressed in terms of sion unit, such as the yard; c may be e in terms of a work unit, such as the of haul.

No matter what cost unit is adopted, comparison of unit costs in totals and totals is one of the most fruitful m discovering wastes and of awaken managerial mind to the possibilities of costs by change of men, change of change of machines, etc. To do this, u for each period should be divided i units, and either tabulated or plotted matically, or both. The diagram is more striking in its presentation of co tions than is the table, but the diagr be too bulky for convenient use, and o objectionable.

To make a table more effective f parative purposes, it is a common expe express sub-unit costs as percentages total unit cost. This is often very illum Not only does a percentage show the importance of a sub-unit cost, but a in percentages at different periods is noted.

A restaurant keeper stated recently writer that when the cost of liquors so ing a month exceeded 40 per cent of the from the sales, he was quite certain tha or wastes were occurring. In like ma the cost of butter for a given month e a certain percentage of the total food c that month, he was reasonably certai butter was being wasted or stolen, pound prices paid for the butter were p too high.

The cost of certain sub-units is often

cost of other sub-units or of the ost, or of the total income, so that ns of percentages, as above outlined, ry instructive.

stated, the cost of one sub-unit is unction of another sub-unit cost, g up or down in unison. Frequently, he functional relation is such that sub-unit cost goes up another sub- goes down. Thus, a moderate in- cost of management usually results ase in the cost of the direct labor. n increase in plant costs is usually d by a decrease in direct labor manager who is fully informed as methods, will study the quantita- n between sub-unit costs that cary ne to the other. If the quantitative n can be established, it can be ex- he equation that gives the "formula Then it becomes possible to apply of mathematics to this unit cost nd solve for a minimum unit cost. [illegible] all [illegible]

ns of the application of differential solving for minimum unit costs will our issues of Jan. 4 and Jan. 25. he first named issue the problem d the most economic span for a ridge spans over a river. In the d issue the problem was to deter- nost economic diameter of water water is to be pumped any con- stance.

gerial law of unit cost reports may d thus:

[illegible] *med and materials used in its* [illegible] *as to give formula unit of total*

o secure the greatest results from [illegible] unit costs, experiments nade to establish the functional the sub-unit costs to one another. lations can be expressed quantita- mes a simple matter to solve for total unit cost, insofar as such a n be secured by relative changes in f the sub-units themselves. While is usually exceedingly fruitful as reducing the total unit cost, the ing of formula unit costs is itself ulus to cost reduction and to the [illegible] to better the [illegible]

ce" will often cause variations in unit d the natural effort to account for tion in the records may lead to most liscoveries. Without records of "chance" results would ordinarily ticed.

st records can be used to show the efficiency of all men and particularly who direct the work of subordinates. nt foremen and superintendents are iscovered" much more certainly and usly than is possible in the absence of st records. Incompetence is likewise l before serious losses occur.

gh it is generally conceded that unit orts lead to economics, it is a rather ble fact that relatively little effort is expended by managers in perfecting ping systems and in deducing formula ts. If it is difficult to measure the of units of output of an individual or ng, the difficulty is often made the ex- r not attempting to surmount it. So re managers to avoid such difficulties re is scarcely a field of human effort here greater harvests await the reaper ains than to be found in this very unit cost reporting. The average r is content with securing cost records ery general character, and usually ex- in units that are not formula units, r words in units that are such as to next to nothing except to the man who e cost records himself, and that usually ittle enough to him.

general failure to secure records of work done in terms of units that truly measure the work is largely accountable for the failure to pay men in proportion to their output, and this, in turn, is the secret of much of the inefficiency that managers blame upon their employes, when, in truth, the blame should rest upon the blamers.

In a subsequent issue we shall discuss the law of maximum "output factor."

Action of the Illinois Society of Engineers and Surveyors on the Case of C. G. Elliott, Formerly Chief of Drainage Investigation.

A protest [illegible] Society of Engineers and Surveyors against the summary dismissal from office of Mr. C. G. Elliott, formerly Chief of Drainage Investigations, U. S. Department of Agriculture. This protest is embodied in the form of a letter sent to President Taft and Secretary of Agriculture, the Hon. James Wilson. This letter was as follows:

[illegible] in the summary discharge of Mr. C. G. Elliott, chief of drainage investigations.

Mr. Elliott is well known in this society (of which he is an honored member) and through the central states and the west, both for his practical work in drainage engineering and for his investigation of the general subject of land [illegible] an engineer and expert there is no question. Of his integrity [illegible] the public interest we consider that there is no question.

We [illegible] action of the department was based, and we cannot believe that the department has acted [illegible] on Mr. Elliott.

We desire to see Mr. Elliott reinstated and reparation made him, so far as reparation can be made after this attack upon his integrity. Also that any investigation shall be conducted in a competent, impartial and fair-minded manner, and not left to those who may have unworthy personal or political motives for avoiding a fair and full hearing.

Respectfully,
JACOB A. HARMAN
Pres. (Peoria, Ill.).
E. E. R. TRATMAN
Secretary

Cost of Roosevelt and Morena Dams.—At the time of publication of the article on the construction of the Morena dam—ENGINEERING & CONTRACTING, Nov. 15, 1911—the work was not completed and costs were not given. Mr. O'Shaughnessy has, however, in subsequent discussion published in the proceedings of the American Society of Civil Engineers been able to give an approximate estimate of the cost of the Morena rock fill dam which compares very favorably with that for a masonry dam such as the Roosevelt dam, in Arizona, which closely resembles the Morena dam in size. The table following will show the comparison.

	Roosevelt dam.	Morena dam.
Height of dam, ft	[illegible]	[illegible]
Thickness of base, ft.......	170	300
Thickness of top, ft........	16	16
Crest length, ft	[illegible]	[illegible]
Contents, cu. yds	[illegible]	[illegible]
Time for building	[illegible]	[illegible]
Cost	[illegible]	[illegible]

Albany Society of Civil Engineers.—The next regular meeting of the Albany Society of Civil Engineers will be held in the banquet hall at Keeler's Hotel, Maiden Lane, on Monday evening, April 22, 1912. Mr. T. Kennard Thomson, Mem. Am. Soc. C. E., Consulting Engineer of New York City, who has put in the foundations for several of the tallest buildings in New York, will deliver an illustrated lecture on Caisson Foundations.

The Appraisal of Water Rights.

In an appraisal and rate-making report made to the Everett (Wash.) Railway, Light & Water Co., by Mr. Halbert P. Gillette, M. Am. Soc. C. E., the determination of the value of the water rights owned by the company is discussed at some length. The report formed one of the company's exhibits in a recent hearing before the Washington Public Service Commission, the hearing being for the purpose of establishing the value of the company's property as a basis for regulating the rates charged for water and for electricity.

Everett is a city of 25,000 population. The water is secured from a number of creeks, carried by gravity to a pumping station in the city and pumped into a ten million gallon reservoir. No other source of adequate water supply exists near the city, except the Suahamish River, whose water is contaminated. About eighteen miles from the city is a small river of pure mountain water that might be used.

For a clearer understanding of the "real estate method" used by Mr. Gillette in appraising the water rights, we give first an abstract of his general discussion of land values, and then follow with his discussion of the water right values.

Land Valuation.—For the purpose of ascertaining the value of lands owned and leased by this company, four real estate exuerts were employed. They were instructed to estimate the land values without regard to the excessive prices that must actually be paid for land bought for railway right of way, for watersheds, etc. In other words, they were to apply no public utility factor. By *public utility factor* is meant the factor by which ordinary land values must be multiplied to obtain the price actually paid by a public utility company.

It is well established that a railway usually pays for country right of way about two or three times the value of the land when that value is based on its use for farming purposes, or the like. In case a railway pays three times the farming value of the land, the public utility factor is three.

It is also well established that lands purchased to acquire water rights, whether for power purposes, or for irrigation, or for city water supply, can not ordinarily be purchased without paying a considerable excess above the normal value of the land. Hence, a public utility factor must be applied to the normal value of watershed land.

The location of a railway can usually be shifted if the owners of land attempt to get too great a public utility factor. A public utility corporation seeking to acquire watershed or riparian rights is generally more at the mercy of the land owners than is a railway, for it is usually less feasible to obtain other equivalent watersheds than to obtain other equivalent rights of way. This would tend to make the public utility factor for watershed lands higher than for rights of way. On the other hand, watershed areas are larger than right of way areas, which often has a tendency to reduce the public utility factor on watershed land, thus offsetting the other advantages in the purchase of rights of way. In determining public utility factors for such estimates, it must be remembered that developed farm land will usually have a larger factor than wild land. Likewise, land adjacent to a city will usually have a larger factor. Hence, land of a small watershed adjacent to a city will ordinarily have a larger public utility factor than land of a large watershed more remote from a city.

Under the geenral head of land values should fall easements and lease values of leased land.

Easements need not be discussed in this case, since they are relatively insignificant unless we assign a value to the easement rights under which the water mains, street railway, etc., of this company were placed on the land now used as streets. In case of a condemnation of this plant for municipal ownership, these easement rights would probably possess very considerable value, since they render the franchise an exclusive franchise, insofar as a large part of the plant is [illegible] for rate making purposes it is doubtful whether the value of these particular easements is an element to be considered. I have, therefore, omitted this easement value from this appraisal.

A long time lease of land often possesses great value. If the term of the lease is very long and if the annual rentals under the lease are inconsiderable, the ownership of the lease may be practically equivalent to the ownership of the land; hence the value of the lease may be almost equal to the value of the land. In any given case the method of ascertaining the value of a lease is briefly as follows:

Appraise the value of the leased land and of the improvements on it. Estimate the total annual interest return, taxes and depreciation on the land and its improvements. The difference between this annual total and the actual rental paid under the lease will give an annual sum, which, if divided by the rate of interest (i. e., capitalized), will give the value of a perpetual lease. If the lease is not perpetual, then determine its present value by deducting from the value of a perpetual lease a sum of money which, at compound interest, will amount to the value of a perpetual lease if the money is compounded over a term of years equal to the remaining life of the lease.

Other than leases of watersheds and water rights, this company has no leases whose value need be considered. The value of these watershed and water right leases is discussed below.

WATER RIGHT VALUATION BY REAL ESTATE METHOD.

As previously stated, this company owns and leases watersheds and owns rights to divert waters to supply the city of Everett with water. We may classify this property as follows:

(1) Watershed land that is owned by the company.

(2) Rights to use all the water from watersheds.

(a) So long as used to supply Everett; and

(b) For a limited term of years.

(3) Diversion rights, or rights to divert water from lands lying below the intakes of supply pipe lines. It is important to keep distinctly in mind the difference between these three classes of property.

I have had real estate experts appraise all the watershed land owned by the company, also all the watershed land leased by the company. They have appraised the land at its normal value for agricultural or other purposes, and without regard to the value of water rights or other public utility value. As stated above, this normal land value must be multiplied by a public utility factor.

Once the normal value of the land and the public utility factor are established, it is easy to calculate the minimum value of the water rights. To illustrate, suppose the normal value of the land of the watershed is $160,000, and suppose the public utility factor is 2½, then we have: $160,000 × 2½ = $400,000, of which $160,000 is the sum paid for the land, and $240,000 is the sum paid for the water rights.

Hence, the difference between the public utility factor (2½ in this example) and unity (1) is a factor (1½ in this example) that when multiplied by the normal land value ($160,000 in this example), gives the minimum value of the water rights ($240,000 in this example). I say *minimum* value, because it may readily transpire that, after a water right is purchased, the purchaser may be able to develop a greater value than is represented by his purchase price. To illustrate: An irrigation company might purchase land and water rights, paying therefore an amount involving a public utility factor of 2. Subsequently the irrigation company might so use the water as to develop far greater value than the public utility factor would indicate. This, in fact, has been done again and again in irrigable parts of the country. So, while the public utility factor gives a measure of the value of water rights, it serves only to give a measure of minimum value. However, in the case now under discussion, I regard the minimum value thus deduced as being a reasonable value. I take this view because there are other watersheds available, which, if they had been used for supplying Everett with water would have involved an expense not essentially different from that incurred by the use of the present watershed.

These other watersheds are more remote from Everett, and what would have been saved in acquiring water rights and in pumping would have been fully offset by the interest and depreciation charges on the larger service pipe lines and other larger items of investment.

In making such a comparison as that just indicated, it is essential that an appraiser consider the two sources of water supply (the existing source and the other available source) not merely from the present viewpoint but in connection with the history of the existing city and its water supply plant. The question is not what we would do today if we were building a new plant but what a man of good judgment would have done 19 years ago and during the subsequent years. Had the owners of the existing water works gone to such a source of supply as Sultan River or Canyon Creek (18 to 20 miles distant), they would have incurred an expense of fully $500,000 and probably more, to bring a water supply to Everett. While such a supply would have come by gravity, and would consequently have saved the pumping cost of the present supply, there is no period of time during the last 19 years when it would not have been more economic to use the supply from the sources now used by the company. Therefore, it was good business judgment that dictated the original selection of the present supply.

Now, if it could be shown that the present supply must soon be abandoned, it follows logically that the company must be recouped for such a loss, since such an abandonment of the watershed would be entirely analagous to the abandonment of a pump or other piece of machinery that has become too small for economic service because of the growth of community. In other words, the development expense or going value (which is discussed below) would be increased by the value of the existing water rights should the existing watershed be abandoned. Had the city itself owned the water works from the inception, there is no doubt that it would have pursued the same course that has been pursued by the company in securing and using the present water supply. Were the city now to abandon that supply, it would suffer a loss—an outlay of capital—which it could not escape, and which would have to be met by the citizens of Everett. The company is the agent of the city—both in fact and in the eyes of the law—and as such agent it is morally and legally entitled to be recouped for every reasonable development expense and every reasonable depreciation expense, whether the depreciation is that of a pump or of a watershed. It seems clear, then, that it is a matter of no financial moment in this appraisal whether or not the existing watershed will continue to serve the city for years to come, since, if it be now assigned a short future life, the loss in plant value will be exactly offset by the increase in development expense or going value. However, I shall discuss this question of probable future life of the watershed later, after the subject of appraised value of water rights has been disposed of.

We have seen that the cost of water rights can be scientifically deduced if we know the value of the watershed land and the public utility factor to be applied to it. In this manner I have deduced the value of water rights owned and of water rights held by the company under perpetual easement.

Water rights held under limited lease have been deduced in similar manner, and the value of the limited lease rights has been calculated in accordance with the rule above given in the discussion of "Land Valuation."

DIVERSION RIGHTS.

Thus far, this discussion of water right values has involved only the values arising from ownership or lease of water on watersheds above the headworks or intakes of supply pipes. We come now to another class of water rights, namely, the diversion the rights to divert water from lan below the headworks or intakes o pipes.

Diversion rights may be of val though very little land is adjacent stream below the point of diversion water may have a value for mill which is entirely independent of its farming purposes. The minimum diversion rights may be calculated in ner similar to that above outlined f lating watershed rights; but the calc rendered more difficult because it is n easy to estimate the width of the strip that must be purchased to acquire the rights.

It happens that this company rece quired the rights to divert three creek ly, Morgan's, Davis and Larimer Cre periods of 15 to 25 years. For this right the company paid about $10, this basis a perpetual diversion righ have cost about $14,000; and, since a 400,000 gallons of minimum flow per d thus acquired, these diversion rights co $10,000 per million gallons of minimu flow. On this basis, the diversion ri Woods Creek would cost about $25,000 are, at present, no other diversion r be considered, for the watersheds of Pigeon Creeks below the intakes are o the company.

Through the ownership of a perpetu ment, the company owns the diversio of Woods Creek.

WATERSHED VALUATION BY THE COM METHOD.

It has just been shown how the m value of a watershed may be de what may be termed the real estate There is a second method that can be which may be termed the comparative of deducing values of watershed.

The comparative method is best ex by an example. Suppose the headwor supply pipe line of watershed *A* is est to cost $100,000 *exclusive of land.* S the headworks, supply pipe line *and l* watershed *B* is estimated to cost $150,00 sume first that the annual cost of maint (including depreciation) is the same fo *A* and *B*. Then it follows logically that shed *A* is not worth more than $150,000 $100,000, or $50,000; for if the owner of shed *A* were to attempt to charge mor $50,000 for the land, it would be chea buy the land and build the supply pip required for watershed *B*.

Where the annual maintenance expen the supply lines of two watersheds, *A* are equal, the problem is exceedingly as above explained; but it usually h that one watershed, as *B*, will be farth tant from a city than another watershed. In that case the annual maintenaance c the supply pipe lines should be estimate *A* and for *B*, and this annual mainte cost should be "capitalized" by dividing the rate per cent of interest. The capit maintenance cost thus calculated shou added to the pipe line cost in each cas *A* and for *B*. In general, all annual ope expenses, maintenance, pumping, etc., s be "capitalized" in this manner and add the plant costs to secure the *total capit cost* of each system. The general rule, is this: From the total capitalized co water supply from watershed *B* (including of its land and water rights) deduct the capitalized cost of water supply from w shed *A* (excluding cost of its land and rights); and the difference thus found be the maximum sum that a purchaser w pay for the land and water rights of w shed *A*.

I have applied this rule to the problem under consideration, and I deduce that value of the present Everett water s (land and water rights) is approxim $417,000, as compared with $361,100 de by multiplying the appraised value of the w shed land by a public utility factor of as previously explained.

Watershed *A* in this case is the pr

that supplies Everett with water B is Canyon Creek, which is prob- ext most economically available pure water for Everett. Mr. J. L. had made a survey and detailed esti- cost of securing water from Can- prior to my appraisal of the Everett Light and Water Co. property, and le two estimates of cost of the Can- project, one based on a supply of gals. daily and the other on a sup- 000,000 gals. daily, the latter being nely the present supply. I concur Mr. Stannard in his unit prices of con- but would add to his [illegible] about 19 per cent for financial costs, terest during construction, broker- business management, etc., which do in his estimate.

with him in believing that if the eek supply were used, reservoirs 20,000,000 gals. capacity would be to safeguard the city in case the were washed out where it crosses elsewhere, as recently happened attle supply. There is now one servoir of 10,000,000 gals. capacity ust completed at a cost of $100,000 ld provide another if the Canyon ly were used.

cost of the land, pipe lines, etc., yon Creek supply is conservatively $715,000 (as shown below) for a daily service, and the annual (repairs and depreciation) would $10,000, which capitalized at 7 per capitalized maintenance cost of aking a total cost of $858,000 for Creek supply (watershed B).

cost of headworks, supply pipe, ng plant of the existing water sup- is about $191,000, exclusive of and and water rights. The pump- se is about $11,000 yearly and the e expense would be about $6,500 otal annual operating expense of hich capitalized at 7 per cent gives operating cost of about $250,000, tal cost of $441,000 for the existing rshed A) exclusive of watershed, water rights. Hence a prospective would not pay to exceed $858,000 1,000, or $417,000 for the watershed ights of the present Everett sup- ver, he would pay nearly that sum, n, for, as I have shown elsewhere, re such as to warrant belief that f Everett must double in size before ent watershed will be outgrown, and, h inclusion of available creeks, Everett ile in size without outgrowing the ailable water supply.

not introduced the cost of meters ove problem, for I have used the costs of two supplies (A and B) practically identical; hence if one e metered, the other (B) would have etered, unless larger pipe lines were B. If the present supply (A) were and the Canyon Creek supply (B) metered, the larger consumption of the unmetered supply (B) would inexpedient to build a pipe line that rry less than 10,000,000 or 12,000,000 y, and this larger pipe line, Mr. Stan- imates, would cost about $240,000 n the 6,000,000 gals. daily supply line, uld fully offset the first cost and d maintenance of meters required for nt supply.

this deduction it appears clear that parative method—comparing the cost ing water supply lines with the cost anyon Creek supply—leads to a value $417,000 for the watershed and water f the existing supply.

it might be argued that if the value watershed and water rights of the ex- ater supply is thus based upon an of the cost of the next most avail- ply (Canyon Creek), and if that sup- lf involves buying a watershed, we t escaped considering certain real es- ues as a basis of calculating other ate values. Fortunately, however, two-thirds of the watershed of the Canyon Creek supply lies [illegible] it will not have to be acquired by purchase. The remaining third of the watershed, or about 10,000 acres, can be acquired for about $10 an [illegible] Stannard's estimate. This is certainly a conservative estimate, and the cost might readily run considerably above $10 an acre, in which case we should have a higher cost for the Canyon Creek supply than I have used in the preceding estimate [illegible] difference between the cost of the present supply and the Canyon Creek supply. In brief, the $417,000 value of the present watershed deduced by the comparative method would be increased were the $10 an acre price for the Canyon Creek watershed exceeded, which seems likely. But even if the 10,000 acres of the Canyon Creek watershed were secured entirely free of cost, it would result in decreasing the $417,000 by only $100,000; so that, at the lowest, the comparative method leads to a value of $317,000 for the watershed and water rights of the present Everett supply.

The following is a tabulated statement of the estimated cost of the two supplies, the present supply (A) and the Canyon Creek supply (B):

PRESENT SUPPLY SYSTEM (A)

(6,000,000 gals. daily.)

Headworks	[illegible]
Supply lines	[illegible]
Filtration tank	[illegible]
Pumping machinery	[illegible]
Pump house	[illegible]
Total	[illegible]
Overhead cost, 20 per cent	[illegible]
Real estate for pump house	[illegible]
Total plant excluding watershed	[illegible]
Yearly operating and maintenance (including depreciation), $17,500 capitalized at 7 per cent	[illegible]
Total capitalized cost	[illegible]

CANYON CREEK SUPPLY SYSTEM (B)

(6,500,000 gals. daily.)

Watershed rights, 10,000 acres at $10 [illegible]	[illegible]
Right-of-way for pipe line (estimated)	[illegible]
Headworks, pipe line, etc.	357,430
Total	[illegible]
Overhead cost, 20 per cent	[illegible]
Total	[illegible]
Reservoir, 10,000,000 gals.	[illegible]
	[illegible]
Yearly maintenance (including depreciation), $10,000, capitalized at 7 per cent.	142,857
Total capitalized cost	[illegible]
Total capitalized cost of Canyon Creek (B)	[illegible]
Total capitalized cost of present plant (A)	[illegible]
Difference in favor of (A)	[illegible]

While the Canyon Creek supply is the next most available supply of water that needs no filtering, there is still another available source of supply, but one that would require filtering. I refer to the Snohomish River. The Snohomish River is brackish, due to tides, for about 13 miles above Everett, hence a filter plant would involve the use of a supply pipe line of almost as great length and cost as the supply pipe lines of the present system. The pumping cost would be greater, due to a higher lift and to the long supply line through which pumping would be necessitated. The cost records in a large number of eastern cities (see my Handbook of Cost Data, second edition, pages 736 to 766) show that filtered water costs about $10 per million gallons, including operating expenses and interest (interest at 5 per cent). But since a higher interest rate prevails here, since taxes must be added, and since wages are higher here, I estimate that the cost for Everett would be about 20 per cent higher than in the East, or $12 per million gallons, filtered. Since the fixed charges constitute nearly all the cost of slow sand filtration, it follows that the average daily cost would not be less than $12 multiplied by the maximum daily consumption (5 million gallons) or, say, $60 per day for Everett. This is equivalent to $22,000 annual cost of filtering water for Everett under existing conditions. If we capitalize this $22,000 at 7 per cent, we have $22,000 ÷ 0.07 = $314,300. This $314,300 is the capitalized cost of filtering water from a river, no part of whose watershed need be purchased; and, since the intake, supply lines, etc., for a filtered supply from the Snohomish River would approximately equal in cost the present supply lines and headworks, it may be seen that we have in this $314,300 the basis for another application of the comparative method of ascertaining the value of the watershed of the present supply system. Due to the fact that the Snohomish River is subject to heavy floods, it would not be safe to operate a filter plant using its waters without providing a 10,000,000-gal. reservoir in addition to the present one, which would cost $100,000. Adding this $100,000 to the $314,000 (the total capitalized cost of filtering) we have $414,000 as approximately the sum by which the Snohomish River filtering cost would exceed the total capitalized cost of the present supply, and therefore as the measure of the value of the present watersheds and water rights of the Everett Railway, Light & Water Company. I have not considered the cost of meters, for if meters were installed in one case (present supply) they would be installed in the other case (Snohomish River supply) and the difference in capitalized cost of the two systems would not be changed thereby.

In "capitalizing" operating expenses, I have used 7 per cent, which I assume to be the rate of interest for bare capital in large quantities in this state; and I do not use the "fair return" rate on a business investment which would be fully 2 per cent higher. The investor is concerned only with the interest rate in figuring actual costs.

A lower rate of interest than 7 per cent would result in higher capitalized cost of the Canyon Creek supply, and a correspondingly higher value for the present watershed as deduced by the comparative method.

While the comparative method gives "replacement cost" rather than "reproduction cost" of the existing plant and therefore is not without objectionable features, still, in case of disagreement among real estate experts as to land values and public utility factors, the comparative method offers an excellent means of checking the accuracy of estimates made by the real estate method. It will be interesting now to compare the results secured by the two methods:

VALUE OF WATERSHED AND WATER RIGHTS OF EVERETT RAILWAY, LIGHT & WATER COMPANY.

By real estate method, using factor of 2½	$361,100
By comparative method Canyon Creek as basis	417,000
By comparative method Snohomish River as basis	414,000

The comparative method, it will be seen, yields a somewhat higher value than the real estate method, using the land values established by Messrs. Duryee, Westland, Lucas and McRae, and using a public utility factor of 2½.

In the case where the Snohomish River is used as a supply, the comparative method is entirely free from any estimates as to real estate values. In the case of the Canyon Creek supply, the comparative method yields a value that cannot possibly be less than $317,000 when all watershed land is considered as costing nothing, so that we at least have a minimum value deduced in that case without any consideration of land values. The comparative method, therefore, indicates very closely that the watershed value of $361,100 established by the real estate method is approximately correct.

LIFE OF WATERSHED AND REASONS FOR NOT DEPRECIATING VALUE OF WATER RIGHTS.

In a preceding section of this report, I touched upon the subject of the probable useful life of the present watershed. It was there pointed out that the life of the water supply has no bearing upon the appraised value of the property of this company if we are to include its value as a going concern. The U. S. Supreme Court has repeatedly held that a going concern value must be given to a company, whether for rate making or for condemnation of its property for public use. Since there is no logical way of estimating the going value, save by [illegible] of building up the existing business, and since the reasonable deficits below a fair return constitute the only provable measure of the cost of building up the business, it follows that every sort of reasonable depreciation suffered by the property must be regarded as adding to the cost of building up the business, unless such depreciation has been offset by surpluses above a fair return. This fact will be rendered more clear below, in the course of the discussion of "Development Expense or Going Value." I have had to anticipate that discussion at this point, otherwise it might not be apparent that the probable future life of the present water supply has no effect whatsoever upon the total appraised value of this company's property, including its going value or development expense.

In order to prognosticate the probable future investment needed to supply Everett with potable water, it is essential that we give careful study to the quantity and quality of the supply. To this end I have secured the assistance of two civil engineers of experience and standing in this state, Mr. J. L. Stannard, hydraulic engineer, and Mr. E. J. McCaustland, professor of civil engineering at the University of Washington and consulting engineer to the State Board of Health.

Mr. Stannard's study of the question of adequacy of the present water supply makes it clear that, by the installation of domestic meters, the peak load consumption of water need not exceed 125 gals. per capita for any 24 hour day in the year, and will probably be less. According to the 1910 U. S. census, Everett had a population of 25,000. That the population has not increased since 1910 is shown by the stationary condition of post office receipts, bank clearances, number of names in the city directory, etc. Besides which, it is noteworthy that the number of customers using water has actually decreased during the last 18 months, and the receipts from the water department have correspondingly fallen. From these facts it is evident that, by metering the domestic consumption, the peak load would not exceed 25,000 x 125 = 3,125,000 gals. per day. Without meters the city has consumed as high as 5,000,000 gals. in a summer day. Most of this excessive consumption has been due to waste of water in lawn sprinkling and the like, which waste the use of meters will eliminate.

In order further to curtail this waste, and particularly to meet conditions prior to the installation of domestic meters, I would suggest the following expedient: Divide the residence parts of the city into three districts, and permit lawn sprinkling and other irrigation only two days of the week in each district. This will serve to secure one-third as much hourly consumption of water due to sprinkling and irrigation as has existed in the past. On the other hand, it need not curtail the total amount of water used for the irrigation of any lawn, for it will be possible to water the lawn a greater number of hours during the two days of the week. The whole object of this two day restriction would be to cut down the peak load on the pumps, and to conserve the existing supply of 5,700,000 gals. per day.

In the irrigation of farm lands it is always the custom to limit each farmer to the use of water on certain days, thus preventing a high "peak load" from occurring. The same rational use of water for lawn sprinkling will give the same satisfaction to the citizens of Everett as to the farmers who use water for irrigation.

Except during the months of July and August, the citizens of Everett consume 100 gals. per capita per day. During July and August they often use 200 gals. per capita per day. By dividing the city into three sprinkling or irrigation districts, it should be possible to reduce the peak load to 133 gals. per capita per day. In that event, even without meters, it would require only 25,000 × 133 = 3,325,000 gals. per day, so that the present supply of 5,700,000 gals. would serve a population of 41,000 people, or 65 per cent more than the present population. If meters are used, there is not doubt that water wastes can be so reduced that the present supply will serve double the present population.

The present supply is derived from five creeks, and there are several more available in the present watershed, so that one can now see, within easy reach, enough water to supply a city of 75,000 people. For many years to come, therefore, the present supply will be ample, provided only that it be properly conserved.

It is of great importance to every water user in Everett that the present supply be conserved, for as soon as it shall prove inadequate an expense of more than half a million dollars—probably nearer three-quarters of a million—must be incurred to get water from Sultan River or Canyon Creek. Whether the company is forced to make this additional investment or whether the city does it under a municipal ownership plan, the water users of Everett will ultimately have to foot the bill.

In this connection it may be well that the waters of Sultan River and yon Creek are "hard," and will good as the present supply for dom in washing or for commercial use boilers. Even when the time comes th is brought to Everett from other sou those at present used, it is probable present supply will find a market for cial use.

Passing now to the quality of the supply, I concur with Prof. McCaust Mr. Stannard in the belief that the immediate danger of contamination on Pigeon Creek No. 1. I also con them in advising that the present s treated with hypochlorite of lime o whenever the time arrives that conta seems to be imminent. It will be expensive to filter the water than Sultan River or Canyon Creek fo supply.

When, due to the growth of th time comes that a new supply must it is probable that the value of the w land now owned by this company enhanced to such a degree that the then be sold for enough to wipe ou present watershed and water right This watershed land lies near enoug erett to insure a rise in value prop to the growth of the city.

To sum up, we have the following why the present water rights shoul given a depreciated value in any app

1. If a depreciated value is give water rights, then the going value or ment expense will be increased acc so that the total value of the plant going business will not be altered.

2. The rate of future growth of is problematical, but, since the presen can be so used as to serve double the population, and, with available addi the supply, will serve triple the present tion, the depreciation in the value of t rights is now so slight as to be im even if Everett continues the growth of the past 10 years.

3. Due to its excellent character f purposes and for other uses it seems that there will always be a good ma the water from the present sources of

4. With the growth of Everett th be a corresponding increase in value watershed land owned by this compan increment in land value is practically to offset any possible depreciation i rights as fast as such depreciation ma

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EARTH AND ROCK SECTIO

Methods and Costs of Constructing Two Rock Tunnels Under the Erie Canal for the Buffalo, N. Y., Water Works.

Contributed by C. H. Hollingsworth, Superintendent for the Contractors.

I.

The new water supply for the city of Buffalo is obtained from an intake in Lake Erie about 6,700 ft. from shore and from which a tunnel leads to the new pumping station at the foot of Porter Ave. From here a smaller tunnel runs to the old pumping station under land belonging to the city and diagonally under the Erie Canal.* From the new pumping station four 60-in. mains lead to the water tower, reservoir, distributing mains, etc. Two of these mains run up Jersey St. and two up Porter Ave. and to get to the main part of the city all four are obliged to cross the Erie Canal a short distance from the pumping station.

Studies were made by the engineers of the Department of Public Works for the crossing of the canal and it was found to be impracticable to use the Jersey St. highway bridge for the mains, as it was an old bridge and too light to support the large mains in addition to the increasing traffic. At the same time there was not sufficient room on it for the mains even if it should be strengthened. At the Porter Ave. bridge there was no room for the mains and as this is practically a parkway bridge it was also considered inadvisable to spoil its appearance by laying the pipes across it. It was therefore decided to carry the mains under the Erie Canal in tunnels.

After a conference with the State Department of Public Works, which controls the Erie Canal, it was found that it would first be necessary to keep the roof of the tunnels at least 12 ft. below the present canal bottom and second that the work would have to be carried on during the winter season, when navigation was closed, owing to the fact that the tow paths would be obstructed during the work. The Buffalo Dredging Co. was the low bidder for the two tunnels. The contract was awarded to that company on Dec. 10, 1910, and the work was started the next day.

The water level in the canal is about Elev. 572.77, while the bottom of the canal is Elev. 560.90, giving 12 ft. of water in the section over the tunnels. At the point wh tunnels cross the canal there is a tow each side about 15 ft. wide and ab above water level. From the tow ground slopes upward on about a 1 to to a height of about 30 ft. above wat In order to shorten the tunnels were located as near the canal as pr and in the case of both shafts at Port and the west shaft at Jersey St., this them on the slope above mentioned, them very difficult to timber and to The east shaft at Jersey St. was loca worse position than the other three. by Fig. 2 there is a retaining wall, through the center of the shaft locatio lel with the tunnel line, and joining retaining wall which formed the west the shaft excavation. Therefore the of the ground in the south half of th was about 10 ft. higher than that in th half and in addition a small house clea northeast corner of the shaft by only

Plant. In starting operations the were numbered, beginning at the west Ave. shaft. The west shaft was No. east shaft No. 2 and at Jersey St. th shaft was No. 3 and the east shaft No

It was decided to use compressed ai

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*The construction of [illegible] tunnels [illegible] described in Engineering & Contracting for [illegible] and 24, 1910.

ed by the same company in the [illegible] intake tunnel, and [illegible] and the New York [illegible]. A 5-in. air line was laid to shafts rter Ave. and a 5-in. branch run [illegible] Jersey St. At Shaft 1 motive type boiler was set up, a [illegible] and a dry house [illegible] this point also was built [illegible] n Porter Ave. and Jersey St. the [illegible] was placed. At Shaft [illegible] rs were installed, besides the derricks. At Shaft 3 a [illegible] stalled, a stiff leg derrick erected as built a dry house, electrician's tween Jersey St. and Porter Ave. or storing and thawing dynamite [illegible] See Fig. [illegible] to haul excavated material from the the dump at the foot of Porter ese teams belonged to the company, stabled in a remote part of the city, vas considered economy to build a d have them on the work, as they herwise be obliged to be on the road me going to and coming from work, xtra teams were needed, especially at would be impossible to get them.

ft 4 there was no plant excepting the nd hoists. All hoisting engines were n by steam, but were piped for com- air to be used in emergencies. The part of the pumps were also run by d exhausted into the sumps.

lacksmith shop was equipped with an ill sharpener, a compressed air ham- e heating furnace, forge, etc. The p was equipped with a drill tripod for rills after they had been repaired.

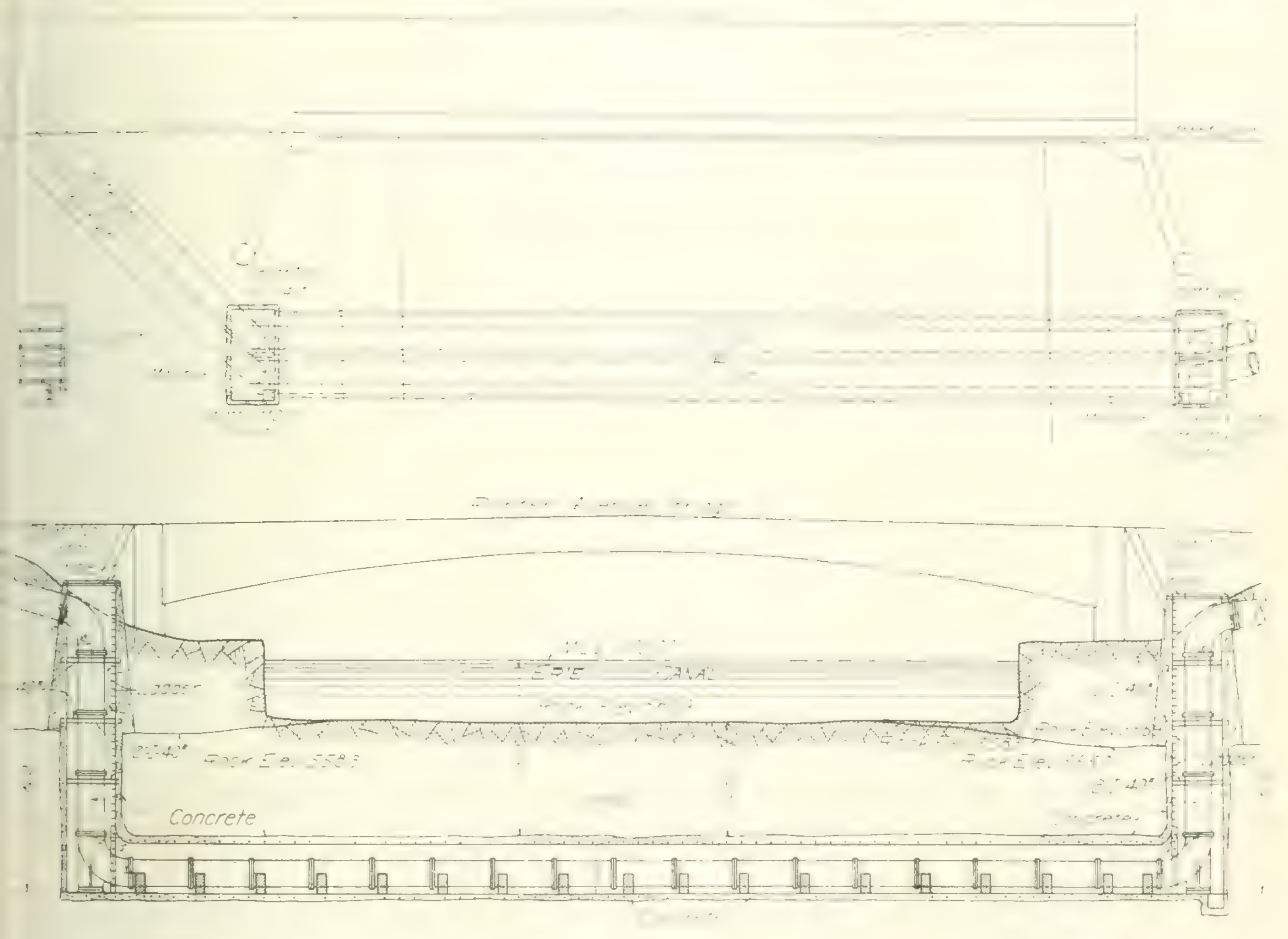


Fig. 1—Plan and Section Showing Shafts and Tunnel at Porter Ave. Bridge, Buffalo Water Works.

At Shaft [illegible] 16 ft. below the surface and 2-in. sheeting was used, it being driven as the excavation progressed, while at shafts 1 and 2 the rock surface [illegible] was found to be 24 ft. below, and sheet piling was driven ahead of the excavation after the shafts had been shaped up and excavated level with [illegible] piling. It was made of three thicknesses of [illegible] the results were so remarkably bad that steel sheet piling was used for Shaft 1.

Shaft [illegible] more trouble in getting it to rock than the other three. First of all the wooden sheet piling drove in all sorts of peculiar shapes and decreased the space inside it to about 3 ft. less than it should have been. Some of the piles did not penetrate more than 6 or 8 ft., which was just down to the water level; some of them spread out when small cobble stones were struck. There were scarcely a dozen all told that kept in their proper positions and drove anywhere near their full length of 18 ft. In addition to that there were two old drains running into the canal through the shaft location and the water working back around these, after they had been plugged, gave a lot of trouble. It was found necessary to start new 3-in tongue and groove sheeting 12 ft. long inside the sheet piling after a depth of about 9 ft. had been reached and later a 4 ft. set was started below this before rock was reached. In spite of all precautions the shaft was flooded out a dozen times. To crown all, when rock was finally reached, the water pressure blew a 3-in. slab off the top of the rock and large quantities of water came up through various seams. As the timbering was in such a bad condition the concrete lining was placed in the shaft from the rock surface up above water level. After this had set three small chambers of about 2 cu. ft. each were dug out of the rock and covered over with boards and burlap. Through this cover a hole was left and an 8-in. pipe set around the hole. Down through these 8-in. pipes the pump suctions were dropped and then a 30-in. concrete floor was placed covering the bottom of the entire shaft. After it had set for several days the pump suctions were withdrawn from the 8-in. pipes and caps with 2-in. connections screwed on their tops. See Fig. 3. Grout was then forced in through these 2-in. connections and allowed to set for several days. Then the concrete floor was drilled and blasted out and the shaft sinking in rock was started.

At shaft 1 very little difficulty was experienced except for the fact that the rock was [illegible] and the steel sheeting was therefore short. However, a set of 6-ft. sheathing of 2-in. matched lumber reached from the bottom of the steel sheeting to the rock. Considerable water came in at the rock surface and good clean gravel and sand were encountered the entire depth of 24 ft., while directly across the canal at Shaft 2 the gravel ran only a short distance, after which quicksand, marl, hard pan, and then quicksand again were found.

At Shaft 3 the material encountered was clean gray sand running into quicksand at the bottom and a great deal of water was found coming in on the rock surface. At Shaft 4 the material was nearly all a stiff red clay and this was the dryest shaft of the four.

In sinking the shafts in the soft ground the forces were worked three 8-hour shifts with a foreman at each shaft on each shift and a timber foreman and timber gang to look after two shafts on each shift. The shafts were [illegible] were [illegible] rock. [illegible] were timbered practically alike and as follows: The sets were spaced 4 ft. apart and each set was composed of a 12x14-in. ranger along each side of the shaft and made up of two 16-ft. lengths. Across each end was a 12x14-in. brace driven out against the sheeting and across the center of the shaft were two 12x12-in. braces about 12 ins. apart. A 12x12-in. corner brace was placed in each corner, with a 3x12-in. plank running from it to the center brace, and spiked on the face of the ranger, while a second 3x12-in. plank was spiked on the face of the end braces between the toes of the corner braces. In the corner a 3x12-in. plank cleat about 2 ft. long was spiked on the ranger to hold the end braces in place until the corner braces were in. The sets were laced together by 2x12-in. planks spiked vertically on the faces of the rangers and end braces and on each side of the center braces. Spacing blocks or posts 4 ft. long of 12x12-in. timber were placed in each corner and under the center braces between the rangers. See Figs. 4 and 6. As the ground was mostly quicksand and always wet, it was essential that no movement be allowed to occur, as all four shafts were almost under bridge abutments, so the braces were driven home with a 4,000-lb. pile hammer swung on the hook of the derrick. When rock was encountered all loose spalls and pieces were removed and the sheeting was driven down firmly to a solid bearing on the rock, while oakum was driven into all cracks and 1-in. boards nailed over it.

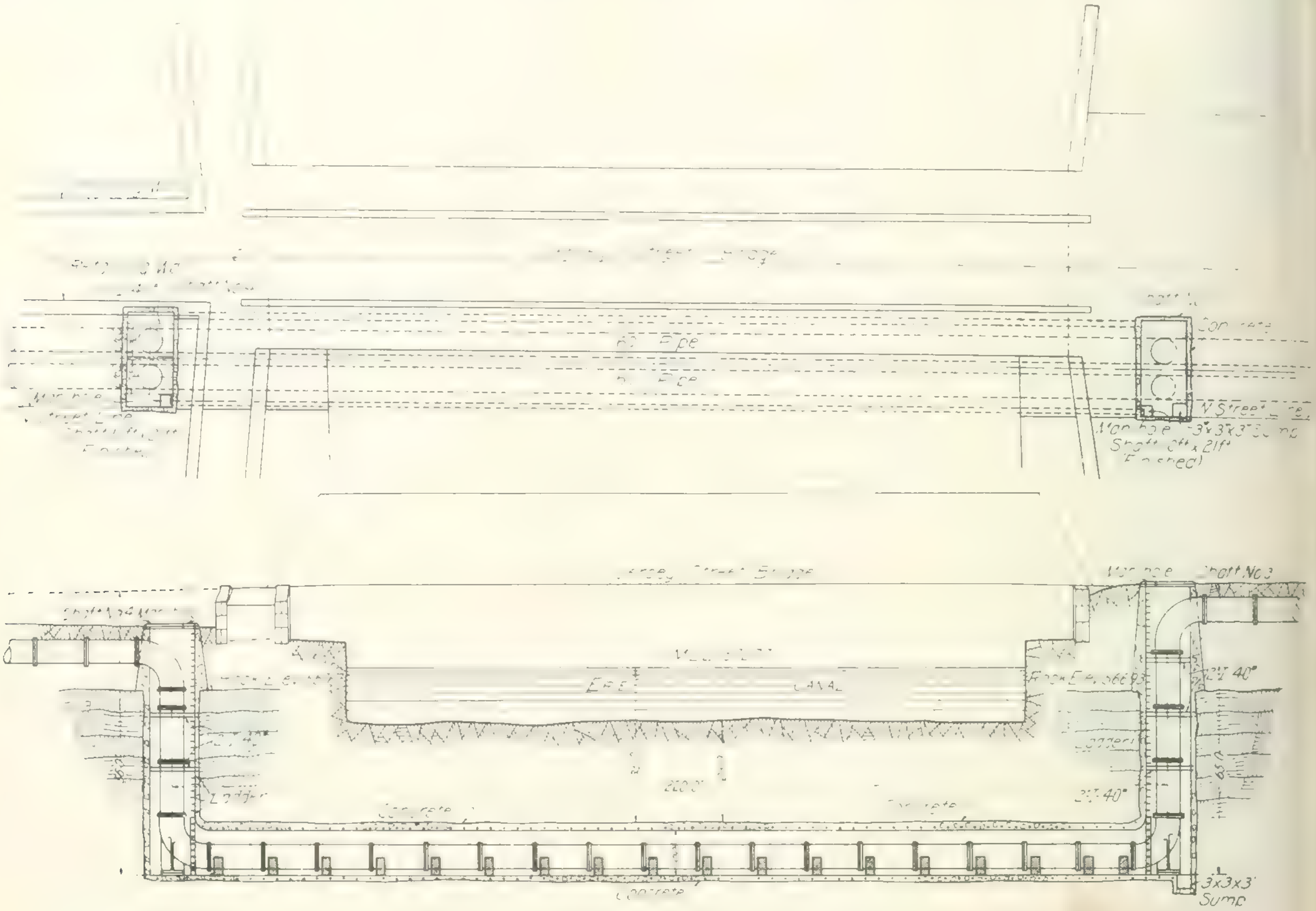
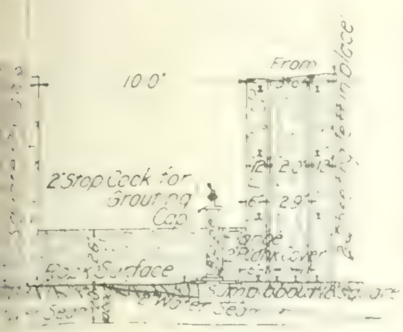


Fig. 2—Plan and Section Showing Shafts and Tunnel at Jersey Street Bridge, Buffalo Water Works.

On starting the rock excavation in the shafts the plan was to have one drilling shift of 8 hours to drill and shoot one round every 24 hours, and two mucking shifts of 8 hours each. While it was found that, with the class of men obtainable, this schedule could be easily carried out under ordinary circumstances, in this case the enormous amount of water encountered made it impossible to do so. As the rock work in each shaft was different from that in the others and as each one had its own assortment of trouble, I will briefly describe the work on each one.

Shaft 3.—This shaft at Jersey St. was the first one started in rock. The surface of the rock under the quicksand was smooth and level, but was full of seams, and the first shot broke it back badly under the bottom of the sheeting, which had to be redriven. The second shot shaped the shaft up fairly well and with very little water except what came in along the rock surface. The dimensions of the shaft in rock were 12x23 ft. The holes were placed as shown by Fig. 7. The drill gang of five runners and five helpers and a foreman, one top man, nipper and signal man came on at 8 a. m., drilled the 27 holes and fired the cut holes before 4 p. m., and if possible fired the next round also. At 4 p. m. a muck gang came on, consisting of a foreman, ten muckers, signal man and two top men or dumpers, besides a drill runner and helper, whose duty was to finish shooting. The remaining holes were fired at lunch time (8 p. m., at midnight and at lunch time of the 12 o'clock shift, which was at 4 a. m. The 12 to 8 o'clock shift was made up exactly the same as the 4 to 12 o'clock shift. No trouble was experienced in drilling the 27 8-ft. holes and shooting part of them in the eight hours, although the rock was fairly hard and there was no trouble in getting the rest of the holes fired and in mucking out, in the 16 hours, making a progress of from 6 to 7 ft. per day. After three days of this, however, the progress came to an abrupt halt. One of the drill holes struck a water seam that spouted water at considerable pressure. This seam was struck with a 4-ft. steel. Six holes were drilled down to it around the outside of the shaft and these were fitted with 2-in. nipples with stopcocks screwed on their tops. Grout was then forced in through a 2-in. hose. About 6 batches, each consisting of 1 sack of cement and 1 sack of sand, were forced into each hole. Then the operation was repeated until the holes were full. After the cement had set for a few days new holes were put down between the ones which had been grouted and three other seams between 6 and 10 f were discovered. These were groute time, but the rock surface under the bo the sheeting had started to break up o the action of the frost, and as Shaf fair to be an easier job it was decided crete Shaft 3 as far as sunk and d tunnel from Shaft 4 and then finish partly by raising and partly by sinkin cordingly, holes were drilled about 1 around the sides of Shaft 3. Into the the ends of reinforcing rods were The rods were then bent upward and tal reinforcing wired to them. See The forms were put up and the concr ing put in up to about water level in th The concrete was not allowed to rest rock bottom, but rested on boards whi [illegible] up from the rock and wh later removed, leaving the lining clear of the rock bottom. When the had been driven under Shaft 3, two rou 10-ft. holes were drilled from below an or three short rounds were drilled an from the top, breaking through after t rious seams were grouted. The depth shaft was 16 ft. in earth on one side on the other, and 52 ft. in rock. In the of this shaft is a permanent sump, 3x3 lined with concrete. This was excavate the tunnel and the shaft were complete

Shaft 1.—This shaft at Porter Ave. w in rock and was sunk with the least trou any. The progress was slow, however, averaged one water seam about every 8 depth. Added to this was the fact t house, with people living in it, abutted a the corner of the shaft and there wer tories on the other side of the street, very few holes could be fired at one Some of the water seams at this shaft considerable water, but were so clos neat cement mixed in a thin grout woul the seam, with half a batch, near the leaving the rest of the seam open. seams were filled with dirt and broken These we cleaned out by turning the f pressure on one hole and opening the ciers alternately, thus blowing out the hen shooting, this shaft was covered timbers made up into shutters about 6 ft a 16 ft. long, so that one length would



3-Details of Temporary Concrete Bot- n . Rock Surface in Shaft 2 to Stop nflow of Water from Seams.

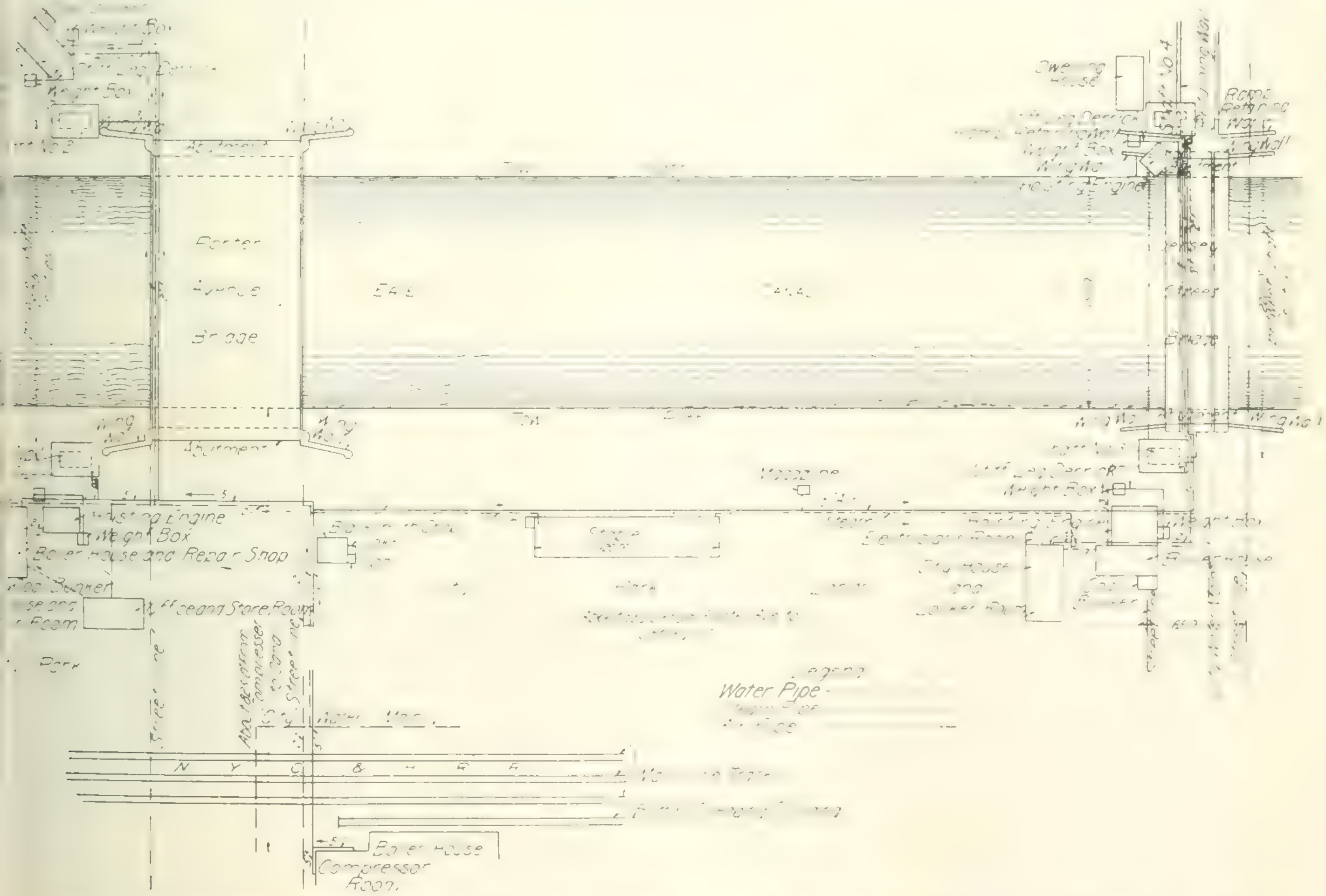
[illegible] half. When this shaft had reached ted grade it was found that there [illegible] only 2 ft. above the grade unnel roof, so the shaft was sunk an and a temporary sump excavated sinking this shaft, as in all the he cut holes were drilled at one end t to be under the center braces. The Shaft 4 was 14 ft. in earth on the si and 24 ft. on the high side and 50 ft.

1.—The shaft at Porter Ave. was the aft on which rock excavation was und was one of the slowest in sinking. s owing to the large amount of water ered. As before stated, the material rock was a fine, clean gravel which water through freely and there was no stopping this water excepting to stop cavation and concrete the shaft from rock surface up to water level. This plan could not very well be carried out, as either Shaft 1 or Shaft 2 had to be used as a working shaft for the tunnel, and Shaft 2 was much worse than Shaft 1, since the sides behind the sheeting were caving. Therefore as the work had to be completed by April 15, the sinking in rock at Shaft 1 was started in spite of the water. The latter, although plentiful, did very little harm until the first two shots [illegible] enough so that the water running over the edge of the rock drenched the men and froze on the machines, hose and everything else. It [illegible] shaft was [illegible] shore of the lake, and I have seen their clothes frozen on them so that they could scarcely get out of the bucket after coming on top. Canvas was tried to keep the water from flying all over the shaft and was a par[illegible] of the pieces tied back to the sheeting. The water followed the canvas down and as the bottom of it was kept within a few feet of the bottom there was not much water splashed out in the middle of the shaft.

A water seam was struck about 4 ft. below the rock surface which proved troublesome. The opening of the seam was not large enough to admit much grout and consequently the latter did not stop the water and when the seam was cut with the shaft sinking it yielded a considerable flow with no chance to stop it. Four other similar seams were encountered and when a point about 2 ft. below the tunnel roof grade was reached a large water bearing seam was struck. This took the grout freely and the flow was stopped. However, because of the location of this seam and also because the rock surface was much lower than expected the tunnel grade was lowered 12 ft. and the shaft was finally sunk to the new grade. In this shaft as in Shaft 3 at Jersey St., there is a small permanent concreted sump 3 ft. square and 3 ft. deep. In excavating this sump it was discovered that there was another water seam about 5 ft. below the grade of the bottom of the tunnel.

Fig. 4—Plan of Shaft 1, Showing System of Timbering in Soft Ground.

This shaft was 24 ft. in earth on the low side, 32 ft. on the high side and 46 ft. in rock. It was sunk to 62 ft. below water level.



5—General Plan Showing Layout of Plant for Construction of Tunnels Under the Erie Canal for the Buffalo Water Works.

Shaft 2.—This shaft was sunk from the top only 14 ft. in rock, and the remaining portion was taken out from the bottom after the tun-

[illegible] ed an 8 ft. round hole was drilled through this concrete and into the rock. As this concrete lining had been placed in the shaft from the rock surface up to water level, the trim- [illegible]

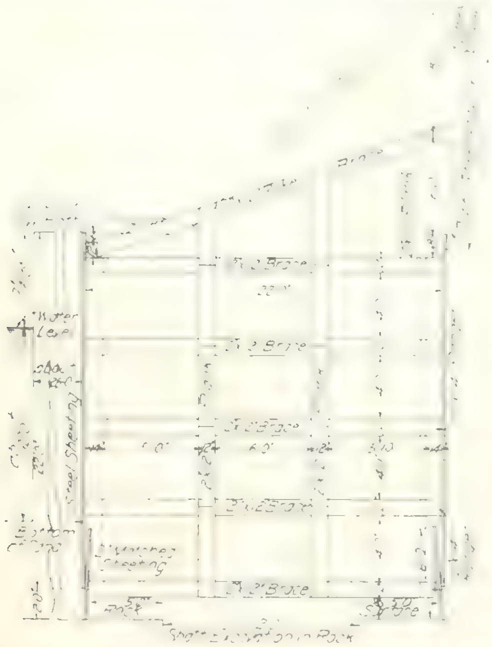


Fig 6—Cross Section Showing Timbering in Soft Ground.

the concrete and slanting outwards so that when they were bottomed they were slightly outside the excavation line. This left a prism of rock to be removed under the concrete walls, but this was easily done, as the surface rock was quite seamy. The bottom 10 ft. of the concrete walls was reinforced with old rails, they being placed in two lines and lapping at the corners. The first set of four lines was directly on the rock and every 2 ft. vertically there was a set with 1 in. square rods as vertical reinforcement. In taking out the shaft from the bottom the muck was allowed to remain piled up within 8 or 10 ft. of the roof, with just an opening from the tunnel to get up the machines, etc. Columns were set up on the muck pile and jacked up to the roof and the machines mounted on arms on these columns. Several water seams were encountered and grouted. Some of them gave considerable trouble, as they would not take grout no matter how thin it was mixed, but at the same time flowed sufficiently to require considerable pumping. This shaft was 32 ft. in earth on the high side, 24 ft. on the low side and 46 ft. in rock.

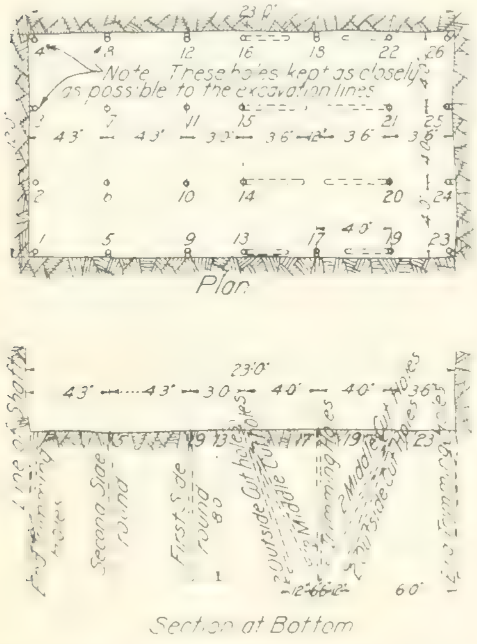


Fig. 7—Spacing of Holes for Blasting in Shafts.

Holes 13, 14, 15, 16, 19, 20, 21 and 22 = cut holes — 1st shot.
Holes 17 and 18 = trimming holes — 1st shot.
Holes 9, 10, 11 and 12 = 1st side round—2d shot.
Holes 23, 24, 25 and 26 = end trimming holes —2d shot.
Holes 5, 6, 7 and 8 = 2d side round — 3d shot.
Holes 1, 2, 3 and 4 = end trimming holes = 4th shot.

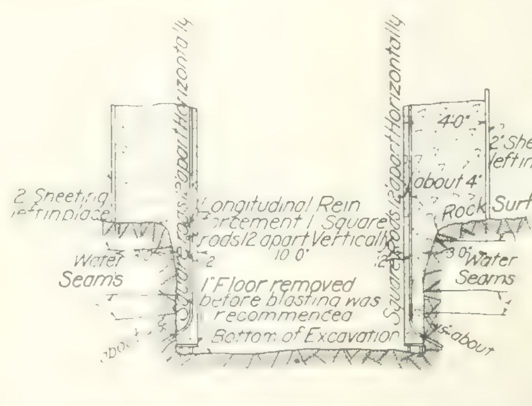

Square Rods 2 apart Horizontally
Square Rods 2 apart Horizontally
4.0'
2' Sheeting left in place
about 4"
Rock Surface
2' Sheeting left in place
Longitudinal Reinforcement 1' Square rods 12 apart Vertically
10.0'
Water Seams
Water Seams
1' Floor removed before blasting was recommenced
Bottom of Excavation
about
about

Fig. 8—Method of Concreting Shaft 3, with Excavation Partially Completed—to Water from Seams and Rock Surface.

(To be continued.)

Results of Tests on Chicago Hardpan at a Depth of Fifty-one Feet Below Lake Level.

Hardpan and rock underlie the clay bed on which a large portion of the city of Chicago is located. Deep building foundations generally are carried down to one of these materials, the standard construction being wood curbed circular wells excavated down through the clay bed and filled with concrete. No tests are recorded as having been made on the bearing power of Chicago hardpan, despite its frequent use as a foundation bed, until the construction of the Cook County Hospital was undertaken. The tests made for this building are, therefore, of unique interest and we give them here from a discussion before the Western Society of Engineers, by Mr. Frank A. Randall, Chief Engineer for Morey, Newgard & Co., who are engineers for the work. The following is an abstract of Mr. Randall's discussion:

The preliminary borings were made 6 ins. in diameter for about 30 ft. in depth and 3 ins. for the balance of the depth. These borings show below yellow clay a thick stratum of "soft sticky clay" down to about 37 ft. below ground level, with solid blue clay running into "hard clay and gravel" down to hardpan at an average of about 47 ft. below ground at the south end and 56 ft. below ground level under the main building. The main building is about 550 ft. long by 70 ft. deep, and has four pavilions, 40 ft. by 200 ft., projecting from the rear. The ground area covers about 75,000 sq. ft. Rock was shown according to the borings at elevations —67 and —89.5 in two cases, but the latter figure was assumed to be the more reliable. Because of the great difference in cost between caissons to hardpan and to rock and the size of the loads to be carried, it was decided to use hardpan caissons, provided the test showed a satisfactory layer of hardpan, with rock in the same relative location as in the preliminary borings. Bids were received also for pile foundations, but as the prices for these amounted to some $13,000 more than those for caissons, the latter were used. The caissons tested were carried on down after the test to determine the thickness of the hardpan stratum and the depth to rock. The hardpan was found to be from 15 to 20 ft. in depth, w hard clay and gravel beneath, and rock wa found at elevation —90, below ground level.

The test was made in caisson No. 1 which was 4 ft. 3 ins. in diameter and 64.7 below ground level, or at an elevation of — Chicago City Datum.

The apparatus consisted of a load platform, extra bearing plate, wedges, 12 steel tape, straight edge, carpenter's lev form scale, 13 tons of pig iron an with drum for raising and lowering The apparatus as used is shown on the

The timber loading platform consist central post 12x12 ins., with two 8x crosswise at the top and covered wi planking (see Fig. 1). The post w with a steel plate 12x12 sq ins. thick The extra bearing p a steel plate 12x12x2 ins., and beneath the loading platform, rest rectly on the hardpan. Four wedges we to steady the platform, loosely pla shown in the sketch (see Fig. 2).

The steel rod, 2 ins. in diameter an 12 ft. long, sat in a babbitted hole, deep, in center of the platform. upper end of this rod the steel tape tached. The rod projected up throu pig iron and thus permitted the tape unfastened while pig iron was being into well. The tape was an ordina tape, graduated to feet and inches.

The straight edge was as shown in and was found perfect when tested re-versal of the carpenter's level, which latter was of more than ordinary sensitiven and accuracy. The platform scale was ca from the hospital and was found cor checking same against known Thirteen tons of pig iron was on ha only about twelve tons of this was us this amount being considered sufficient by

Fig. 1—View of Load Platform for T Bearing Power of Soil at the Bottom the Caisson.

cerned. The tripod was of ordinary con tion, such as was used on the work f cavating and filling wells.

Procedure.—Water had been standing

[illegible] several days and this water was [illegible] Friday morning, on [illegible] it [illegible] necessary to deepen well [illegible] in order to remove earth [illegible] b[illegible]n softened by the standing water.

[illegible] about 18 ins. square was [illegible] ter[illegible]f the bottom of the well and the bottom [illegible] cefully cleaned and leveled. The extra [illegible] plate was then set, leveled and cen[illegible] this hole. It had been intended to [illegible] the central hole in a wooden box of [illegible]les, to be backed up with concrete and [illegible] keep all water out of hole, but water [illegible]d in from above directly into hole, [illegible]h had to be abandoned.

[illegible] 30 p. m. (Friday) a start was made at [illegible] the platform, but [illegible] platform had to be rotated so that [illegible]uld clear lugs in rings of lagging. [illegible]n was not in place until 7:25 p. m. [illegible] was raised and dropped several [illegible] bearing plate in order to force out [illegible] as possible of the earth which had [illegible]d off into hole.

[illegible] lowered and placed. The pigs were [illegible] ers and headers radiating toward [illegible] bonded together in addition by [illegible]es of wood as deemed necessary. [illegible]n was placed closer than 1½ ins. [illegible]ging, the pile when completed being [illegible] in diameter and a little over 12 [illegible]

[illegible] readings were taken at intervals, the [illegible] being as follows: A permanent bench [illegible]stablished upon water table of pres[illegible]l building, within 4 ft. 7 ins. of the [illegible] well. Elevation of B. M. = +17.49 [illegible] This was leveled across from the [illegible] the tape by means of straight edge [illegible]ape to the nearest 1/16 in.

[illegible]dings taken were as shown in the [illegible]

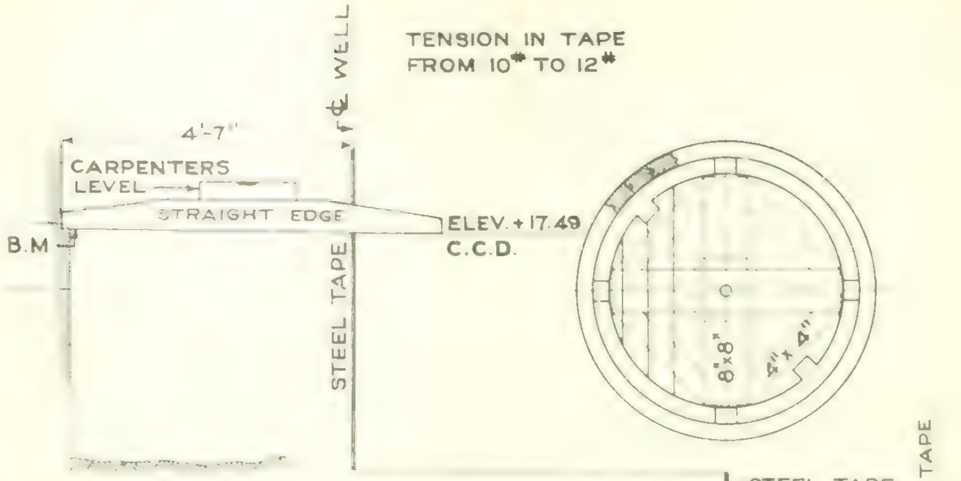
	Load.	Reading. Ft. Ins.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]ll tested was a very wet one, due [illegible]t that two sewers, 6 and 9 ins. in diameter, were cut into in sinking. This well was the wettest one encountered. From about 12 ft. to 14 ft. of water stood in the well during test.

When the platform and bearing plate were removed it was noted that ⅛ in. of compressed earth adhered to top of loose bearing plate.

The caissons were designed for 14,000 lbs. per square foot at top of caisson and were belled twice the diameter of the shaft. Considering hardpan at 60 ft. below the surface, the unit designing load on the latter is about 13,300 lbs. per square foot, or about one-half of the test load. The test load was applied to 1 sq. ft., while the area of the well was about 16 sq. ft. It is not known how much bearing value of the hardpan is increased when the caisson is completed and the well completely filled, but it must be a very material increase. The results indicate that the hard pan stratum will carry the load designed for with safety. Doubtless a portion of the settlement was due to the compression of the loose soil which sloughed in at platform was being lowered.

The test was conducted by Morey, Newgard & Co., under the personal supervision of the author. The W. J. Newman Company, contractors for the caissons, supplied labor and material. The total cost of the test was $400.



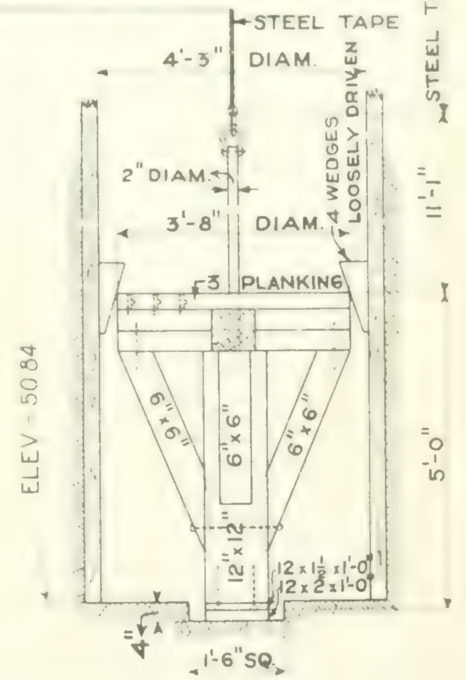


Fig. 2—Details of Apparatus for Testing Hardpan in the Caisson.

ROADS AND STREETS SECTION

[illegible]ction of Concrete Sidewalk, Curb and Gutter Construction.

[illegible]uted by Jerome Cochran, C. E., Formerly [illegible]esigning Engineer, Trussed Concrete Steel Co., Detroit, Mich.

[illegible] series of articles on the inspection of [illegible]te work, of which this is the eighth, [illegible]en planned in opposition to the general [illegible]ption on the part of writers that stan[illegible] or methods of construction have been [illegible]go established and have become com[illegible]knowledge. The first article on "Direc[illegible] and Suggestions for the Inspection of [illegible]ete Materials" appeared in this journal [illegible]an. 31, 1912; the second article on "Pro[illegible]ning and Mixing Concrete" appeared on [illegible]7, 1912; the third article on "Inspection [illegible]orms and Centering" appeared on Feb. [illegible]12; the fourth article on "Inspection of [illegible] Reinforcement" appeared on Feb. 28, [illegible] the fifth article on "Inspection of Con[illegible]g" appeared on Mar. 6 and 13, 1912; [illegible]ixth article on "Inspection of Surface [illegible]hes for Concrete Work" appeared on [illegible] 20, 1912; and the seventh article on [illegible]ection of Waterproofing for Concrete [illegible]" appeared on April 3 and 10, 1912. The [illegible]ing article relates to the inspection of [illegible]ete sidewalk, curb and gutter construction.

There are certain rules that must be observed in concrete sidewalk, curb and gutter construction, and success depends entirely upon how much attention is given to same. Many sidewalks, curbs and gutters are built which, sooner or later, become more or less defective. While defects may be found in concrete sidewalks, curbs and gutters, it is probable that these defects may be traced to the contractor or inspector, owing to the lack of knowledge of the materials used in construction; to inexperience; or to neglect in appreciating the importance of minor details. The cause of these defects will be pointed out and a means by which they may be avoided suggested.

Concrete Sidewalks.

Concrete sidewalk construction is a task for experienced and skillful workmen which is often undertaken by unskilled and inexperienced workmen. Its inspection demands close attention to many small structural details which have been proved essential to good workmanship and to the skill and honesty of the men doing the work. Defective work frequently results from failure on the part of the builder or the inspector, to appreciate the importance of watching, closely these smaller details, which are considered by some as of minor importance. The necessary qualifications for the construction of sound and lasting work are good materials, proper methods and careful workmanship. Failure to provide these will often result in disappointment. Poor workmanship and neglect of correct principles of construction are responsible for practically all failures that occur in this class of work. Failures which can be positively charged to poor materials are few, though frequently materials are used which could be improved by a more careful and intelligent selection, without adding to the cost of the work.

It is not uncommon to hear, as an argument to prove proper workmanship in a defective walk, that the same workmen had laid satisfactory walks by the same methods. Simply because one job was laid without any regard to proper method of construction and is satisfactory, is no argument that the same can be repeated, as the conditions vary in every case. The weather condition at the time a walk is constructed has a marked effect upon its behavior, and is not always the same, so that a walk placed on a damp, cloudy day has a better chance than when it is hot and dry, and no precautions are taken to prevent the work drying out too fast. The drainage and foundation of the work may be entirely different, and the gravel used may be more evenly proportioned, as in no quarry or pit does it run the same entirely throughout.

Designation of Concrete Sidewalks.—Sidewalks composed of Portland cement, sand and broken stone or gravel in the base, and Portland cement and sand or granite screenings (or other screenings) in the wearing surface are variously called: "Artificial Flags," "Artificial Stone Flagging," "Artificial Stone Sidewalks," "Artificial Walks," "Cement Concrete Sidewalks," "Cement Sidewalks," "Cement Walks," "Concrete Sidewalks," "Concrete Walks," "Granolithic Cement Concrete Sidewalks," "Granolithic Sidewalks," "Granolithic Walks," "Portland Cement Concrete Sidewalks," "Portland Cement Flag Stonewalks," and "Portland Cement Sidewalks."

The styles of construction, however, vary less than the names by which Portland cement concrete sidewalks are designated.

GENERAL REQUIREMENTS.

Thickness of Walk.—The thickness of the walk should be determined by the location, the amount of travel, and danger of being broken by heavy bodies falling on it, or by frost.

Business front walks should not be less than 4 inches thick and may be 6 inches thick with profit. The top coat or wearing surface of business walks should not be less than 1¼ inches thick, and for driveways subjected to excessive wear, the wearing surface should be at least 1½ inches thick, preferably 2 inches thick.

In residence districts the wearing surface should not be less than 1 inch thick and the thickness over all for different widths of walks should be as follows:

4 feet wide should be 3½ ins. thick.
4½ feet wide should be 3½ ins. thick.
5 feet wide should be 4 ins. thick.
6 feet wide should be 4½ ins. thick.
7 feet wide should be 5 ins. thick.

All other widths less than the above should be 3½ inches thick at the center and at the edges 3 inches thick.

Size of Blocks.—The size and shape of blocks or flagstones into which a walk is divided are governed largely by the width of the walk, the local practice and personal tastes. Blocks nearly but not quite square have a better appearance than those which are distinctly oblong. The slabs should not contain over 36 square feet of surface, and should not be over 6 feet in any one direction without being reinforced.

Slope of Walk.—To prevent water from lying on the sidewalk, it must not be level, but slant or "grade" a little to one side, so that rain-water will drain off. If the sidewalk has not a considerable longitudinal slope, it should be given a transverse slope of about a quarter (¼) of an inch to the foot to provide for draining the surface. Some cities build their walks with a slope of about ⅜ inch to the foot toward the gutter.

Curving Upper Surface of Walk for Drainage.—The straight edge, employed to level the surface of the walk, may be cut in an oval form, pressing the surface concrete into a convex form, and thus providing a surface from which all water will easily drain. The height of the center should not be too great or it will make it unpleasant to walk upon same, if the walk is narrow, yet must be high enough to readily allow the water to drain off. This method of draining the upper surface of sidewalks is very seldom used, it being much better to slope the walk as mentioned above. There are two principle objections to laying sidewalks with a crown, one being that one-half the drainage is on the wrong side, i. e., away from the curb or gutter; and the other being that they are particularly ugly at points of intersection on account of the hollow left. A crown on a crosswalk, however, if not too high, is very desirable and preferably it should be very slight in the center of the walk and rather steep at each side, where the road material banks up against it.

CONCRETE MATERIALS.

The selection of materials is the first consideration and is an important matter. Great care must be exercised in the selection of the various materials used in the construction of concrete sidewalks, for if any defective material is used, it will be bound, like poor workmanship, to show in a short time.

Cement.—Only the most uniform, sound, strong, slow-setting Portland cement should be used, one that has been manufactured and known for a number of years and that has become recognized as a standard for sidewalks. Rosendale and other forms of natural cement, as well as Pussolan cement, are not suitable for this work, the former because of its low strength and inability to resist abrasion, and the latter because in work above ground it is weakened by the action of the atmosphere. Nothing can take the place of standard Portland cement, and care must be taken to secure a good grade. The cement should comply with the Standard Specifications for Portland Cement of the Am. Soc. for Testing Materials, adopted June, 1904, together with subsequent changes and amendments.

Many attempts have been made to use natural cement for the concrete base of the walk and Portland cement for only the finishing coat or wearing surface. This practice, however, is not to be commended, owing to a tendency for the two to separate. This is probably due to the fact that the Portland cement mortar was put upon the base before the base was set and the difference in the amount of contraction of the two concretes, while setting, prevented a union being formed.

Sand.—The sand must be clean and coarse, graded in size from medium to coarse grains, free from dust, loam, or other foreign matter. At least 75 per cent of a sand should be retained on a 40-mesh sieve, with the particles well distributed between that size and the size passing a 4-mesh sieve, with an increasing proportion on the coarser sieves. Avoid the use of sand that is too fine.

Limestone Screenings.—The use of limestone screenings in sidewalk concrete is not advisable. While limestone screenings may prove a success in concrete used in foundations and underground work, they have not shown the same efficiency in sidewalk concrete where they were exposed to the elements and to extremes of heat and cold. Limestone expands on receiving moisture and contracts in drying, and this action will cause hair cracks.

Broken Stone.—Broken stone for concrete should be a good hard stone, giving many angles in the fracture, and that will not be affected by the weather. It should be screened dry through a 1¼-inch mesh and be retained on a ¼-inch mesh. It should be free from dust, dirt, or other foreign substance.

Gravel.—If gravel is used, it must be washed river or beach gravel, free from clay, loam, dust or other foreign matter, and varying in sizes from that retained on a ¼-inch mesh to the largest passed by a 1¼-inch mesh.

Unscreened Gravel.—If unscreened gravel is used, it should be clean, hard and contain no particles larger than 1¼ inches. The proportion of fine and coarse particles must be determined and corrected to agree with the requirements for broken stone concrete.

Grit Screenings or Crusher Dust.—These are for the wearing surface and should be of crushed quartz, granite or other hard, tough stone, free from all foreign matter, and crushed so that the largest piece will pass through a sieve of ¼-inch mesh, the particles graded in size from fine to coarse, the crusher dust to contain not over 25 per cent of fine dust.

Sand does not make as good a wearing surface as broken stone or gravel screenings.

Water.—Water should be reasonably clean, free from oil, acid and alkalis. Clear rain or irver water is best, since water from wells or springs oftentimes contains acid or other deleterious matter. Water should be fresh and free from earth, dirt or sewage. A soft water, clean and clear, used not too cold, will give the best results.

Boards.—All material used in the work should be placed on clean boards, a the inspector should reject any not so iced.

Material From Old Concrete Walk—Wh old concrete walks are torn up ing the progress of the work, the contracto is sometimes permitted to recrush the co ete and use it in the base of the new wal

GRADING FOUNDATION.

The sidewalk should be excavated nd graded to the depth and width show on t drawing having reference thereto, ncluding all wings and crossings, as show on plan, and to the levels given on the grou by the engineer. The site should be carefu y staked off, running the lines such a dist ce apart that the distance between them is a ut 4 ins wider than it is desired to make t finished walk. The grading must be smc hly and neatly done, all large stones, bowlds, r sods and rubbish of every descrip n b removed from the grade, and the e re w must be made to conform fully to and the grade of the walk when fi he is well to do the excavating and fi g time before the concrete is put in, t s ing thorough setting.

Depth Below Grade of Walk; S—The excavation should be made to the b previously determined upon. It is ot sible here to state exactly what the ep excavation should be as it depends o climate and the nature of the grou, deeper in localities where heavy fr s or where the ground is soft than i li were there are no frosts. In the fo er the excavation may have to be car d depth of 12 inches or more, where the latter from 4 to 6 inches may be ffi The sub-grade should have a slop t the curb of not less than ½ inch pe fo

Excavations.—In places where cutti is essary to bring the sidewalk to the e grade, no plow should be used bel three inches above the surface to vic sub-grade is to be graded. The na three inches should be carefully d se with picks or other hand tools. The ex tion should be kept free from wate

Consolidation of Trenches, Etc.—Alre or excavations that have been mad f in connection with sewers, private d n or water pipes, telephone or electi pipes or conduits, etc., and which n thoroughly settled, should be opene ou refilled, in six-inch layers of gravel r earth, well tamped, and watered if es until solid.

Defective Places.—All soft, boggy, defective places encountered in exca ti elsewhere, should be wholly remove o depth and extent as may be necess y all depressions filled with suitable fi g terial (preferably gravel), which s ul thoroughly compacted by flooding a t ing in layers not exceeding six ines thickness.

Boulders, Trees, Etc.—All boulder stone rocks, stumps, roots of trees, walls obstructions found upon the line should be removed. Trees should n be in jured, cut down or otherwise disturb excep by order of the engineer. Roots which are not removed, but which tiguous to the line and grade of or in any way interfere therewith, s ul properly trimmed and cut away. Any e moved should be grubbed for the enti widt of the sidewalk and also its roots it ris above the level of the sub-grade. Lar are sometimes covered with earthe w pipes.

The heaving and throwing of w often attributed to tree roots growin to under the walks, is more often the r lt o the movement of the earth caus swaying of nearby trees, especially lar Roots, however, do grow close to crete walk, as they find moisture th elm and maple roots should be look a especially, as they are likely to cause t mos trouble.

Surplus Material Required by Ci— lumber, stone flagging, dirt, or other m e of value arising from the work or a f, should not be thrown away, wasterwise disposed of, without the enwritten sanction. The [illegible] s that the above mentioned surplus are conveyed and deposited in such may be directed by the [illegible] r of the excavated material is piled sides of the walk, except by the n permission.

Material Not Required [illegible] rplus materials are not required by the inspector should see that they [illegible] not to cause a nuisance, injury or nce to the city or to public or pri-

[illegible] roper level of sub-grade should be with suitable material, solidified by

f Cuts.—In cutting, the contractor required to excavate for a sufficient ive a slope of 1½ horizontal to m a point one foot from the

lls.—When the sub-grade occurs on ration requires very careful at- [illegible] roperly made fills. The material in case of a fill should be good upper portion of the fill should layers not to exceed 6 inches in [illegible] tamping. In no case should a ted in layers exceeding 10 inches The fill should be flooded with er to thoroughly settle it. Care to see that fills are thoroughly d are free from large stones or terials.

f all fills should extend at least yond the walk on each side. If ow they wash or cave down so ge of the sidewalk slab is left to tip or break down under load. s can be attributed to fills having too narrow and then left un-

f the fill should be given a slope ½, so that it will not slip away. ranular materials are used, the be banked with sod or clay. le sidewalk should be constructed ankment until the same has sufled to afford a stable foundation. ment must be made proof against l out.

Areas, Window Openings, Stop Etc.—In excavating for foundaewalks, care must be taken not the window openings, areas, coal s, lamp posts, hydrants, or water ock boxes, down pipes or other appliances that may be in, or e present walk, and care must also to prevent material of any descripling into the stop-cock boxes, or in injuring or affecting them so as to with their proper working. Wher- und necessary to cut or alter prior driveways, they should be replaced in a satisfactory manner.

f Removing Existing Walk.—The or should be required to remove existks in small sections only, sufficient to the day's work, and so as to interthe business of the street as little At the close of each day's work ould be left in such a state as to fect safety to the public. Lamps be provided wherever necessary, and nces it may be advisable to enclose s of the walks by barricades.

PREPARATION OF SUB-BASE.

the sub-grade prepared as above and nspection and acceptance of the same, be placed the sub-base.

ness of Sub-base.—The thickness of -base may vary from nothing to twelve In localities unaffected by frost and soil sufficiently porous to carry off water, the sub-base may be omitted and the concrete laid upon natural ground excavated to the required depth; but in clay soil in northern climates, twelve inches of sub-base may be required. An average thickness for a sub-base is 4 to 6 inches, although in warm climates, if the ground is firm and well drained, the sub-base may only be 2 or 3 inches thick or omitted altogether as stated above.

Materials for Sub-base.—The materials for a sub-base, where such is required, should be clean, hard cinders, slag, broken stone, coarse sand, gravel, broken bricks or other similar materials. In order to make it more porous, broken stone or gravel should be screened. Whatever material is employed it should be of such a character that it will withstand tamping without crushing to an extent that will prevent proper drainage. The best material for this sub-base is broken stone varying in size from ½ inch to 3 inches. Steam cinders, however, are more commonly used, on account of being cheaper than broken stone. Care must be taken to eliminate the fine material from the cinders. Shells are sometimes used.

[illegible] ever material is employed it should be evenly spread upon the sub-grade, should extend at least two inches beyond the edges of the walk and should be thoroughly rammed so as to present a firm and unyielding surface. This is a part of sidewalk work which is often neglected. Stone should be sledged and lighter materials tamped with iron tamper. The common practice of filling excavations or trenches by shoveling cinders, etc., from wagon without evening, etc., and often allowing it to be used for walk (path through middle) for some time before it is used is very objectionable, and has proven ruinous to many walks otherwise well made. A heavy iron roller should be used and the cinders, etc., kept evenly tamped when put in. It is not so much that they are tamped hard as that they are even (edges and middle alike). Care must be taken to see that the top of the sub-base is made smooth and to grade. The writer would suggest that where broken brick and cinders are used that in addition to tamping them thoroughly that they be covered with a layer of sand in order to prevent opposite action in expansion from freezing.

The finished sub-base should be kept at least fifty feet in advance of the placing of any concrete.

Wet Material.—While compacting the sub-base the material should be thoroughly wet and should be in that condition when the concrete is deposited. Cinders or sand must be thoroughly wet when being rammed. Enough water should remain in the sub-base to render the surface as moist as the concrete base at the time the latter is laid, or if the work has been delayed, the sub-base should be sprinkled with water as required. If the sub-base is too dry it will absorb from the base the water necessary for the perfect hardening of the concrete.

Drainage.—The sub-base must have good drainage otherwise it may be a menace to the walk. If it is more porous than the retaining soil, it will naturally drain this soil and will offer sufficient drainage, but in some soils and under some conditions, additional drainage is necessary. If the water is not able to escape into the sewer or elsewhere, it will accumulate in the sub-base, and may be frozen and heave the walk. Therefore, in soil where the sub-base and the natural drainage cannot take care of the water, other drainage should be provided. The best means of supplying this additional drainage will depend somewhat upon the available outlets, etc. An excellent plan sometimes adopted is to lay at intervals of twenty or twenty-five feet a blind stone drain, about 10x12 inches, from the walk foundation to the foundation of the curb. Tile drain may also be provided at suitable points to carry off any water which may collect in the sub-base or under the concrete base. A line of three-inch diameter round, butt-jointed, hard-burned drain tile may be used for this purpose, the outlet or discharge for the drain being connected with the street inlets, or in the absence of street inlets by such other arrangements as may be prescribed by the engineer.

It is most important that the sub-base be well drained to prevent the accumulation of water under the walk, otherwise the walk will be heaved up by frost in the winter; and if it does not crack, will at least be thrown out of position when the soil again settles. Upheaval by frost is obviated by providing proper under drainage.

All openings in curbings for outlets into the gutter for cross-drains should be made by a competent stone cutter, and any curbstone defaced or broken in this operation should be replaced.

Protection of Sub-base.—No walking on or driving across the prepared sub-base should be permitted. In case this is unavoidable, cross-boards should be placed on the sub-base and plank laid lengthwise on these to prevent packing of one portion more than another, where the walk is much used.

FORMS.

After the foundation or the top of the sub-base has been brought to the proper distance below the grade stakes, forms are placed for the walk, being of such shape and dimensions as may be required.

Material for Forms.—When wooden forms are used they should be free from warp and of sufficient strength to resist springing out of shape. They should consist of 2-inch scantling set on edge, and in width being the height of the thickness of the walk (concrete and mortar top). As the minimum thickness of a concrete sidewalk in successful practice is four inches, 2x4-inch scantlings may be used. Where the walk is to be five inches thick a one-inch piece, nailed to the top of the 2x4-inch scantlings solves the problem. Surfaced lumber has advantages, but its use is not necessary.

Where curves are desired in the walk, narrow boards are used instead of the scantlings. Thin strips of metal, however, will be found more convenient in forming curved lines.

Cross scantlings are put in at regular distances and at right angles with the side forms. These are used in dividing the walk into equal sized blocks. Ready-made metal cross-forms or parting strips of special patented type are now on the market. Metal cross-forms should be about ¼ inch thick, with stiffeners on the ends and top, if necessary. They should be of a depth to correspond to the thickness of the proposed walk, and should extend full width of the walk and be set at right angles to the side forms. They should be left in place until the wearing surface is floated.

Where forms are used for the second time they should be cleaned from all particles of dirt and mortar that may be clinging to them.

Alignment and Level of Forms.—Forms should be placed in the manner necessary to outline both external edges of the walk accurately, the top of the frames being located to coincide with the established grade of the walk. Care must be taken to maintain a good alignment. The top edges of the forms must be true to grade as they serve as templates for finishing the walk.

Staking of Forms.—The forms must be well staked to the established lines and grades, the stakes being sufficiently close so that no bulging can occur when the concrete is tamped into place. Stakes are generally driven along on the outside of forms every 5 or 6 feet. Forms are sometimes held in place by means of stakes driven on each side, those on the outside being much the stronger. As the work of laying the concrete advances, the small stakes on the inside of the frames are removed. Generally the nailing of stakes to forms is not necessary. If forms are held in place by nailing through the supporting stakes into the scantling, these nails should not be driven "home" in order that they may be easily pulled to release the forms when the work is completed.

Where thin ceiling stuff or sheet iron is sprung for curves, special care must be taken to hold them in place, so they will not crowd between stakes in tamping.

[illegible] which the concrete is being deposited, a shovelful or two of concrete being sufficient to hold the cross-frame firmly until the concrete is tamped into position. If the special metal cross-frames mentioned above are used, fewer stakes will be needed for the forms, for when the cross-form is keyed into position, it holds the forms in their proper relative position.

Providing for Surface Drainage of Walk.—Forms on one side should be a little lower than the other to provide proper drainage for the surface of the walk. The grade should, of course, be in the direction towards the curb or in the direction of the gutter. A rise of a ¼ inch per foot will be sufficient in most cases to properly drain the walk from rain water.

Spacing of Forms.—All forms must be so spaced that the inside measurements are exactly those of the "blocks" being molded. The side forms should be marked to show where joints are to come, care being taken that the marks defining a joint are exactly opposite each other on the two scantlings. If wooden cross-forms are used they should be placed so that the face against which the concrete is placed is in line with the marks indicating positions of joints.

Strips at Curbing.—Suitable strips, where there is no curbing, should be set to hold the concrete, and these strips should not be removed until permission is given. As soon as they are removed, earth should be tamped against the edges of the walk.

Wetting Forms.—All forms should be thoroughly wetted before any material is deposited against them. This is of value in preventing the wood absorbing too much of the moisture from the concrete that is placed next to the form.

Removal of Forms.—Forms should be left in place until the concrete or mortar has set.

CONCRETE BASE OF WALK.

The base of the walk consists of a layer of concrete deposited on the foundation or sub-base and carrying a surface layer of wearing coat of cement mortar. Its functions are to furnish a solid foundation for the wearing surface and to give transverse strength to the walk, transmitting the pressure uniformly to the foundation or sub-base.

Proportions.—Materials for concrete should be proportioned according to the voids in the aggregate, which varies with different materials. The concrete may be mixed in proportions of 1 part Portland cement, 2 or 3 parts coarse, clean sand, and 4 or 6 parts broken stone or gravel, depending entirely upon the strength of the work required and the nature of the sand and broken stone or gravel. If the ground is firm and the sub-base well rammed in place and properly drained, great strength will not be required of the concrete, which may, in such cases, be mixed in about the proportions 1:3:6.

Thickness of Concrete Base.—The concrete base should not be less than three inches thick. Four inches is much better and is recommended for general use in sidewalks, while in some cases five or six inches are required.

Mixing.—All proportions should be obtained by actual measurement in boxes, and no material should be used which has not been thus measured. The concrete may be mixed either by hand or machine, as described by the writer in ENGINEERING & CONTRACTING, Feb. 7, 1912, page 149. The concrete should be mixed to such a consistency that when rammed, the mass will not shake like jelly, but will, when struck, compact within the area of the face of the rammer without displacing the material laterally. In other words, the concrete should be just short of quaking. Mixing is frequently neglected in sidewalk work and it must be carefully watched. An excess of water must be avoided. It is not practicable to use as wet concrete in sidewalk construction as in some other classes of work. The top coating should have much more water than the lower layer and be of such a consistency as to work well under a trowel. The concrete should not be mixed in larger quantities than is required for immediate use.

Size of Batch to Be Mixed at One Time.—The size of a batch of concrete should be governed by the speed with which it can be mixed and deposited. A batch should not be made that is larger than can be placed within thirty minutes' time or less, generally not over a cubic yard. Some specifications state that only one barrel of cement shall be used to a batch. The quicker the concrete is placed, tamped and surfaced, the greater the chances of success; for on hot, quick-drying days the mortar often begins its initial set even before the half-hour period.

Retempering.—One of the common mistakes made by inexperienced workers is to mix too large a batch at one time; and then when the mortar has begun to set before it could be placed, to attempt to remix or retemper same. Under no circumstances should this be done, as once concrete or mortar has taken its initial set, or began the hardening or drying out process, the addition of water or mixing will not delay this process. Any remixing of concrete after hardening has begun will generally weaken it to such an extent as to make it unsatisfactory. The saving which may result from the use of a portion of a batch of concrete which is retempered will not justify the introduction of uncertainties into the work. Retempered concrete should not be used. Any concrete left over at quitting time should be wasted.

Transporting Concrete.—In transporting concrete, care must be taken to prevent loss of material in any way. Wheelbarrows must not be overloaded. Loss of any surplus water in the mixture may rob it of a portion of the cement carried in suspension.

Placing Base Concrete.—The concrete should be deposited within the forms on a sub-base previously wet and tamped into final position as soon as possible. The surface of the concrete should be brought to a plane parallel to the proposed finished surface of the walk, and at a distance below it equal to the thickness of the wearing surface. To insure this the concrete should be struck with a straight edge, long enough to span the walk and notched out at the ends so that when placed on the side forms the straight edge will define the correct grade of the base.

The concrete should be dumped, not thrown or dropped from a height, as this tends to separate the stone from the mortar. No concrete should be placed upon a dry sub-grade. If this precaution is not taken it is certain that the porous material, absorbing a considerable quantity of water, will rob the concrete of much of the moisture it needs for proper crystallization and curing.

Tamping Base.—The concrete should be thoroughly tamped or rammed until water appears on the surface. If the concrete quakes it is an indication that too much water was used in the mixing. The concrete should be compressed sufficiently by the tamping to give the right depth for the wearing surface. The straight edge or gage mentioned above should clear the concrete at all points. In ramming, care must be taken not to disturb the forms.

Concrete may be tamped with iron-shod rammers, seven inches square, and weighing about twenty pounds. For tamping next the forms, the makers of cement working tools offer a lighter rammer with square face at one end and blunt, chisel-shaped tamper at the other.

The tamping should be as thoroughly done at edges and corners as in the center of the slab. Particular care must be taken that the concrete base is well rammed and consolidated along the outer edges. Concrete that has begun to set before ramming is completed should be removed from the work.

Preserving Joints in Base.—The concrete is now cut into blocks exactly corresponding to the proposed blocks in the wearing surface. There are several methods employed for dividing walks into blocks. One is to place a wooden cross-form along the walk at regular distances and at right angles with the side forms to correspond with marks previously made on the forms. After the co[illegible] section has been thoroughly tampe[illegible] form should be removed, togeth[illegible] stakes that support it. Against th[illegible] made bare, clay or loam mortar m[illegible] tered (¼ inch thick), or paper [illegible] inch thick may be placed; or agai[illegible] may be placed a steel divider 6 [illegible] and ¼ inch thick. The perpendic[illegible] the new concrete slab must be ca[illegible] served, the next slab be tamped [illegible] clay, loam, mortar, paper, felt [illegible] divider, as the case may be. If [illegible] vider is used it should be remove[illegible] tapping, leaving the joint dividin[illegible] open; if paper is used the part [illegible] above the concrete should be trimm[illegible] shears; if clay is used no furthe[illegible] is necessary. If desired the sla[illegible] tamped directly against each other

Ready-made metal cross-forms [illegible] strips of special patented type m[illegible] instead of the steel divider menti[illegible] In this case, the metal cross-forn[illegible] position until the adjoining slab is [illegible] plete with wearing surface, being [illegible] as the slabs are reeciving their fin[illegible] and the groover run over the space [illegible] it has been removed. If preferre[illegible] cross-form may be removed after t[illegible] for next block is in place and befor[illegible] ing surface is placed.

Another practice which was com[illegible] ber of years ago is to lay altern[illegible] entirely independent of each oth[illegible] the first set is completed, the alte[illegible] tions are filled. Some recent speci[illegible] the writer's possession still speci[illegible] "blocks" shall be laid alternately [illegible] of 2x4 inches or 2x5 inches dresse[illegible] held in place by stakes and brace[illegible] tar paper being placed in the joint [illegible] them requires that no adjoining blo[illegible] laid within six hours of each other, [illegible] quirement is also made that whe[illegible] splitting off or other defects occur [illegible] pleting the entire block or divisio[illegible] replaced with a new block or d[illegible] patching being allowed.

Sometimes a long stretch of co[illegible] the base is placed and a straight e[illegible] across the walk in line with the [illegible] viously made on the side forms to [illegible] joints, and with a spade or speci[illegible] concrete base is cut entire through [illegible] base. The joint in the base is then [illegible] clean sand. This practice is not to [illegible] mended, and especially when dep[illegible] placed upon cutting through both t[illegible] base at the same time. Results o[illegible] of construction are to be seen in [illegible] of places.

Do not allow the joints to become [illegible] cement after being made, thus de[illegible] purpose for which they were made

Avoid Fractional Slabs.—A part [illegible] or block should never be molded and [illegible] after having stood long enough to [illegible] set. Any concrete left over after [illegible] slab should either be mixed in wit[illegible] batch, if this is to follow in a very [illegible] or it should be discarded. The [illegible] should see that fractional slabs ar[illegible] otherwise a crack will probably oc[illegible] wearing surface above the line o[illegible] between adjacent batches. The con[illegible] be tamped against the cross-form [illegible] when placing of concrete is resum[illegible] start from a vertical joint between [illegible] slabs as mentioned above. Under n[illegible] stances should a section of the ba[illegible] partially completed to be finished [illegible] next batch or left until the next da[illegible]

Expansion Joints.—Expansion joi[illegible] be constructed as specified. The u[illegible] tice is to provide expansion joints a[illegible] mately every 50 feet and at all street [illegible] returns. The expansion joints shou[illegible] through the entire thickness of the [illegible] proper.

The concrete base should not be a[illegible] bear directly against any solid body [illegible] curb, area step, or coping, wall of [illegible] lamp-post, telegraph or telephone p[illegible] hole rim, etc., but leave the same [illegible] wee the blocks themselves (generally ¼ [illegible] changes. This space can be con- [illegible] or felt. It is sometimes specified ar space of not less than ½ inch ft between the back of the curbing such fixtures) and the abutting ends lewalks for the full depth of the s space being filled with approved [illegible]

Base.—Workmen must not be per- walk on the base before the top laid, as it is positive to place more reign matter upon same, and thus ak spot in the work. Care must be to prevent sand or any other mate- being dropped on the concrete, and nting a proper union with the wear- e. Where sand or dust gets on the ust be carefully removed before ıg surface is applied.

[illegible]

as a few of the blocks of concrete been laid, the top dressing or wear- should be applied immediately, and of the blocks have set. The lack n between the base and wearing one of the most frequent causes of concrete sidewalks. The preparation ation of the wearing surface re- ch care if satisfactory results are [illegible]

s.—The wearing surface should be he same first-class Portland cement base. Not more than one brand should be permitted to be used in g surface in front of any property reet block, as the case may be. Ei- or fine crushed rock, or a mixture , may be used to form the mortar. coarse sand or fine gravel is used gregate. If crushed rock is used it f a texture such as granite or trap. break into cubical, rather than flat ted fragments. Hard, clean sand, will usually answer. The aggregate screened through a quarter-inch there should not be a large pro- f very fine material. It is of the portance to see that the sand is free from any trace of loam, as ıin to make "soft spots" which soon [illegible]

ons.—Customary proportions are 1 ortland cement to 1 or 2 parts of gate. If mortar richer than 1:1 is t is likely to check or crack in setting, ıg the appearance of the walk. The does not recommend mortar richer 1½ mixture. It is better to avoid a variation between the richness of aring surface and that used in the base. mixture of cement and sand is some- employed, but this is not a mix suffi- rich for walks subject to the average [illegible]

wearing surface may be obtained by e (1) part of Portland cement, one ne-half (1½) parts of coarse sand and ınd one-half (2½) parts of pebbles or granite or other approved stone as lected, screened to pass ½-in. and l on ¼-in. screen. Where both fine aggregates are used in the mixture [illegible] en a 1:2:4 concrete with Portland cem- and or stone screenings and crushed or ned gravel may be used, screened in roportions stated above.

ickness of Wearing Surface.—The thick- of the wearing surface varies in practice ½ to 1 inch. Usual thickness is about nch. The thickness of the wearing sur- however, is governed by the service to n the walk is put. Business districts re- greater thicknesses than residential dis- [illegible]

xing.—The materials should be very ex- proportioned, so as to give a uniform . All proportions should be obtained by al measurement in boxes, and no mate- should be used which has not been thus measured. The mixing should be done in suitable boxes or upon tight platforms. The materials should be thoroughly mixed by turning [illegible] then be added in a fine spray and the mass [illegible] be. An excess of water in the mixing is likely to crack the finishing mortar, due to great shrinkage.

[illegible] consistency required will depend upon whether the top mortar is to be floated or is to be tamped. If the top mortar is to be placed by floating under straight edge it should be mixed wet enough to "float" readily. A mushy consistency about like mortar used by a mason in laying brick is about right. If the mortar is mixed too stiff it cannot be readily leveled off with a straight edge, and if too thin it takes longer to dry out ready for finishing and is apt to result in sandy spots or to cause pock marks. If the top mortar is to be tamped down with the base, the consistency should be such as to permit of thorough tamping and allowing a film of moisture to appear on the surface.

Placing Top Mortar.—The top mortar should be placed immediately after the base is tamped into position. This may be done by floating or by tamping. The most common way of placing the top mortar is to float it, by making the mixture very thin, and then spread it regularly, and work it down with a straightedge until the surface is a true plane flush with the top edges of the forms. The mortar should be spread heavily on the surface of the concrete by means of a trowel, care being taken that no air spaces are covered, and that the trowel is run along sides so that the edges will become dense. The trowel should not be used to smooth the mortar top, but take a straight edge, the back of the concrete straight edge will do, if straight; with this resting on the side forms stroke the mortar off even. In holding straight edge slightly slanting it will pack the mortar some.

Another method is to apply the mortar to the base, mixed with less water, so as to be stiff, and spread evenly and somewhat deeper than the final wearing surface. The mortar should then be tamped with a light rammer and beaten with a wooden batten to break any air cells and make the mortar finish perfectly solid. The surface should then be struck off with a straight edge bearing on the top of the side forms. Some hollows or rough places will remain, and the straight edge should be run over a second or perhaps a third time, a small amount of rather moist mortar, made from thoroughly screened sand, having been first applied to such places. Care must be taken to see that all low spots are brought to proper grade. A top mortar put on in this manner can be finished with much less delay than can the floated top mortar.

[illegible] *Mortar.*—The writer is of the opinion that at least seventy-five per cent of all sidewalk men put in their concrete base, and especially the top mortar or wearing surface entirely too wet. It is not uncommon to hear, as an argument, that by so doing the top mortar bonds better with the concrete base, but as a matter of fact this reason is fallacious. On the other hand a mortar top is very likely to show a different degree of construction in setting from the concrete base, and when it is troweled in finishing, neat cement is flushed on the top and forms a thin, brittle surface that is very apt to scale off in time. Besides this, if the mortar has been mixed too thin (as it generally is when it is to be floated), the finishers have to wait around until the surface is dry enough for finishing or surreptitiously sprinkle dry cement on it to take up the superfluous moisture. The surface should be finished before any portion of the particles commence to crystallize. To disturb these particles by troweling a half hour later is apt to cause hair-cracks and crazing.

The writer would suggest that the top mortar be put on with only a little water in it and then tamp it thoroughly until moisture appears on the surface, making it possible to finish in the usual way. If the mixture is of the proper consistency and the top properly applied, a more perfect bond between the top and base is assured. The tamping gives a dense, close-grained top. There is also much less danger against checking and crazing. It is frequently argued that tamping the top mortar adds to the cost of the work, but the writer is of the opinion that it is cheaper to pay for a little more tamping than to have finishers waiting around for the surface to dry out, especially when they are drawing extra pay after quitting time.

[illegible] tar top or wearing surface may be obtained by using a base concrete rich in cement and tamping it until the mortar rises to the top. This method does not produce as perfect a surface as is secured by using a separate coat of mortar as mentioned above, but for many walks can be employed. Considerable time is [illegible] as fast as the workmen cover same, without the necessity of going back to put on the wearing surface.

In placing a walk of this construction the base mixture is well heaped above the forms and then tamped to grade. The usual tamping may be followed by a special tamper which will assist in forcing the coarse stone from the surface and in bringing mortar to the top. This tamper is made by bending a piece of strap-iron and bolting it together to form a square of about 9 inches on the side, and then short cross-bars are bolted to this at about ¾ inch apart, inside the square. Four pieces of iron rod are then bolted to the four corners of tamper and brought up to a handle for operating same. This tamper can be made very easily by any blacksmith. The cross-bars assist in forcing the large stone, etc., down into the mass, and in bringing the fine particles to the surface. The surface should then be leveled and smoothed by straight-edge and finished in the usual way.

To Avoid Loose Tops or Wearing Surface.—It is of the utmost importance that the mortar top be applied before the concrete base has begun to set, and it must not be applied to a portion of a block and then some time allowed to elapse before applying the remainder. The placing of the top mortar must receive the closest attention in order that it may be properly bonded to the concrete base. A hollow sound produced in walking over a concrete sidewalk is an almost infallible sign of a poor bond between the top mortar and the concrete base, which eventually will result in the breaking up or cracking of the surface finish over the concrete, greatly disfiguring the walk. Loose mortar tops are usually caused by the drying out and the setting-up of the concrete before the top surface is placed and then failure to take the proper precautions to prepare the concrete surface for the mortar top. The sooner the top mortar can be applied after concreting, the more thoroughly it is pressed down (preferably tamped) into the concrete base and the rougher the surface is, the better will be the bond between the two materials. It cannot be too strongly insisted that the top mortar be applied as quickly as possible after the concrete base has been tamped into position. It is frequently specified that the top finishing of concrete sidewalks shall follow immediately the concreting of the base, or be delayed not more than 30 minutes. Freezing of work done in cold weather will cause loose tops.

Care must be exercised to prevent sand or any other material from being dropped on the concrete base, and thus preventing a proper union with the wearing surface. Sometimes the base is permitted to become dusty and dirty, both by the dust being blown from the street and from careless workmen walking over the fresh concrete. Where sand or any other material falls upon the base it should be cleaned off, and a coating of neat cement and water applied in a thin wash. Top finishing mortar will not adhere well to smooth, dry, unclean, oily or dusty surfaces. If the concrete has begun to dry it should be wetted just before applying the top mortar.

Do not use a base of one brand of cement and a top surface of another; the different quality of the cement, difference in time of setting or hardening, contraction, expansion, etc., often causes top to crack from base.

[illegible] Mortar [illegible] Hardened [illegible]

Where the work upon the top surface has been unavoidably delayed until the concrete in the base has set or hardened, or where it is desirable to place a new top mortar on an old base, special means must be employed to insure perfect adhesion between the top and base. Two methods of bonding with success are:

(1) Care must be taken to remove all loose, inert or foreign material from the concrete base before any attempt at bonding the new work is made. The old concrete should be roughened up, swept and thoroughly washed with water. The base should then be rewashed with a dilute solution of muriatic acid or with an acid wash, such as "Ransomite." The acid wash loosens up any dust, dirt, woody matter or other foreign substances that may be present or embedded in the concrete, cutting slightly the surface film on the concrete, producing a surface not unlike that of coarse sand-paper, an excellent one for the adhesion of the top mortar. After the acid wash has worked, it must be removed as far as possible by thorough washing until every trace of acid and dirt is removed before applying the top finish. Any remaining traces of acid may be detected by tasting the water left on the surface. The top mortar should now be applied to the wet surface in the usual way. When the acid wash is not used on the concrete base, other means of preparing the surface may be resorted to, but probably with not so good results. The following method, however, has proved quite successful:

(2) The surface of the base should be thoroughly wet with water, and with a stiff broom or wire brush all dirt and loose material scrubbed from same. By a vigorous use of the wire brush (if the surface being treated will permit of it) the aggregate in the base can be uncovered; that is, the film of cement over same scrubbed or brushed off where it has not thoroughly set or hardened. By removing this film of cement (similar to the acid treatment mentioned above), the new concrete can have every chance to bond with the base. After the concrete has been sufficiently brushed it should be again washed with water and grouted with thin cement mortar. The top mortar should now be applied in the usual way before the grout has dried.

Placing top mortar on hardened base concrete should be permitted only in case of absolute necessity. The surface of the concrete in any case should be rough and all dust, dirt, oil, grease, embedded sawdust, woody matter, locomotive cinders, etc., removed, before any attempt at bonding top mortar to hardened base is made. After the surface has been properly prepared by either method mentioned above, the top mortar should be applied in the usual way. If considered necessary the acid wash treatment may be followed up by flushing the base with thin grout and this followed up immediately with the top finish. Mortar that fails to show a proper bond after it has been allowed sufficient time should be taken up and replaced with new mortar of the proper quality.

Should it become necessary to delay the placing of the top mortar after several blocks or slabs have been laid, the work may be saved by the following treatment: Immediately after laying and while still soft, roughen the concrete base with a wire brush, thus producing to some extent a surface similar to that obtained by the use of an acid wash as mentioned above, thereby saving a great amount of labor later on when the concrete is hard and unresponsive. If this brushing is done carefully and without appreciably disturbing the concrete while green the results will usually be satisfactory to a certain extent, although it may become necessary to resort to one or the other of the above mentioned methods of securing a good bond.

Surface Treatment.—After the top mortar has been pressed heavily onto the concrete base and the surface struck off with a straightedge as mentioned above, the character of the desired surface decides the next step. The usual practice is to float the surface, first with a wooden float and afterwards with a metal float or plasterer's trowel, the operation being similar to that of plastering a wall. The floating of the surface, however, is a point on which there are many opinions. Some prefer the use of a wooden or cork float entirely, while others prefer a glassy finish produced by the vigorous use of a steel trowel. The exact time at which the surface should be floated depends upon the setting of the cement, and must be determined by the builder. Considerable skill is required in troweling to prevent the formation of hair-cracks by overtroweling, and to insure a surface which will not wear easily as a result of insufficient troweling. No finishing should be done after dark.

Steel Trowel Finish.—While a steel trowel is universally employed in finishing the flat surface of walks, yet its use must not be carried to an excess. The general tendency when a steel trowel is employed is to use it too much, and over-troweling flushes neat cement to the surface and forms a thin, hard coating that seems al right at first, but which afterwards scales off. In other words, excessive troweling will form a film of clear cement over the surface of the work, and in drying this contracts, and results in crazing or hair cracks. Furthermore the use of a steel trowel gives a glossy, streaked and cheap appearance to a sidewalk, which is neither good looking nor practical. Also a surface that is too smooth is not to be desired in walks, for the reason that when wet they are very slippery, and besides the smooth finish shows every little blemish and variation in color. There is constant danger of slipping on a glassy finish to a walk, especially if there is any considerable grade to it.

Wooden Trowel Finish.—A good finish can be obtained by using a wooden or cork float, such as plasterers use, finishing with a revolving motion in the floating. The floating must not be done too heavily so as to shove the mortar, but slightly, so as to compact the surface, and at the same time give it an even, unmarked appearance. The wooden trowel finish is specially suited to severe northern climates, as it prevents pedestrians from slipping. It is growing in popularity, and certainly has many points in its favor.

Brush Finish.—Another finish to the surface is known as the brush finish, which is had by stroking in one direction with a moistened whitewash brush applied after the wooden float. The result is a good, even surface on which there is no danger of slipping and which in appearance is equal to the best natural stone.

Special Tool Finishes.—Another method is to indent the surface. A small imprint or dot roller is used, the surface of which is covered with pointed studs that, in passing, indent the surface, giving it the appearance of having been bushammered. The flags or slabs after being trued up are marked all over, with the exception of a border of about an inch in width along the edges, with the roller.

Other Finishes.—When a rough surface is desired, the top is smoothed down and then some coarse, clean sand sifted over it. The troweler goes lightly over the surface to partially imbed the sand. Another method is to float the top coat, and then lay a piece of leather or rubber down onto the mortar. The sheet of leather or rubber is then peeled off the cement, leaving a roughened surface.

Precautions to Be Observed in Using Floats, Etc.—In using floats, tooth rollers, groovers, etc., it is important to frequently wet the tool, so that it will not catch in the cement finish. In case such should happen, or the tool slip while handling, some cement should be instantly dusted on the damaged part and sprinkled lightly with water, and the float or trowel used to finish smooth again, and the tooling or surfacing continued. If the top surface is worked too long with the float, the cement is brought to the surface, robbing the next lower layer of its cement and resulting in scaling.

Dusting Top Finish.—Dusting the surface of the top finish, after placing, with dry material to absorb any free water that may have collected, should not be resorted to unless absolutely necessary. Even then, it should not be done with dry cement alone but with the same proportions of dry ingredients as the top finish itself, which are usually about one part of Portland cement to two parts of sand. Dusting of any kind is, as a rule, detrimental to the wearing qualities of the surface, producing indentations, pock marks and other defects. If the proper amount of water is used in the mixing in the first place, dusting willl be unnecessary. The application of neat cement to the surface in order to hasten hardening should be absolutely prohibited under all circumstances. It will cause the finished top to have a mottled appearance, or small hair cracks, owing to the dry cement forming little balls of neat cement or mortar when coming in contact with the water and on being troweled out will show spots and hair cracks.

A mixture of hydrated lime and marble dust, in the proportions of 1:2, is sometimes used as an aid in correcting the detrimental effect of flushing too much cement to the surface by the action of the steel trowel.

It is the practice of some workers to apply a dry mixture to the surface of the top mortar in finishing in order to produce a white color. This is to be done by bringing the surface, with the steel trowel, to a perfectly even plane, and then by lightly sprinkling the surface with white Portland cement and marble dust, mixed in about equal parts and applied with a sieve, then finishing with the trowel again. Another mixture is to employ one of white Portland cement, hydrated lime, and marble dust or white sand, mixed in the proportions of 1:1:2, and sprinkled lightly over the surface with the aid of a sieve, then finishing with the steel trowel.

Conditions Governing Shade or Color of Walk.—A sidewalk finish frequently presents a patchy or unsightly appearance. In fact, it is not such an easy matter to secure a uniform shade or color throughout the walk. The lack of uniformity of shade or color in the same walk is much more noticeable than the lack of uniformity of shade or color in adjoining walks. The variations in the shade or color of a finished walk are usually due to one or more of the nine well-known causes which may be summed up as follows:

1. Variations in the nature of the cement and sand or stone screenings.
2. Lack of uniformity in the amount of cement and sand in each batch of mortar.
3. Insufficient mixing in any or all batches of mortar.
4. Consistency of the mortar.
5. Amount of troweling.
6. Character of the finishing tool used.
7. Time which elapses between placing and finishing the top.
8. Weather conditions and temperature.
9. Treatment and protection which the work receives during the first 48 hours after completion.

Different materials will give different results. No change in the brand or quality of cement should be made while laying the top mortar. Different brands of cement may give different colors to the finished walk. If more than one brand is used the colors must be such as not to show marked variations in appearance of the walk. All sand should be of a bright, uniform color. No sand should be used which contains small particles of coal or lignite. The water used in mixing the mortar should be free from iron or other impurities that tend to discolor the mortar. Although the builder may be so fortunate as to always obtain the same grade of materials, he will still find that uniform results are equally dependent upon proper methods of mixing and applying the top mortar and careful workmanship.

Lack of uniformity in the amounts of

in each batch will cause [illegible] the exposed surfaces of mortar. [illegible] or should make certain that the speci- portions are accurately and uniformly l to.

ar should be thoroughly mixed and [illegible] l to look raw when deposited on the e base. If the mortar is not uniformly the surface will be irregularly colored ill contain pitted and honey-combed Variable proportions of water should [illegible]

tar mixed dry gives a darker [illegible] wet one.

pposite sides of a street [illegible] itly appear to be of different shades, result of half of it being finished from le, while the other half was finished opposite side.

character of the finishing tool used in ng the surface will affect the color or the walk. A steel trowel gives a ish than a wooden trowel or float. ie top mortar is allowed to become too ter being floated, and then finished with l trowel, it is apt to contain blotches remain indefinitely.

ther and temperature conditions some- ffect the color or shade of a walk. The has observed walks, which had been laid in the late fall or spring, of two differ- ades, according to whether they were sunshine or shadow. Walks affected manner, however, usually bleach out e, but until this occurs, the appearance walk is not pleasing. Of course such ons are beyond the builder's control. riter simply mentioned this to show how ve a sidewalk finish is to the treatment ives.

alk allowed to harden under a wet sand ng tends to bleach out lighter in color ne which is exposed to the air during rdening period. Fresh manure placed ery green top mortar to protect the walk freezing is very apt to discolor the walk. water dripping from tarpaulins or paper for covering will cause a non-uniform and streaks in a walk.

Wearing Surfaces.—The wearing e is frequently colored, or some squares ft the natural cement color and alter- quares of a different color, so as to give rast and avoid a sameness in the side- If a colored surface is desired, the col- matter should be mixed with the whole top mortar. For the most permanent naturally colored aggregate should be yed. When colored sand or other ma- is not available, artificial coloring matter be employed to give the desired shade. use artificial coloring matter containing grease or acids for they lessen the th of the cement. Only those coloring ials should be used which consist of the s of the various elements, since the salts able to disintegrate. The disadvantage ploying artificially colored mortars is the hat they cannot be assured to hold the shade for all time. In fact, most color- ubstances are bleached by the cement re of short life.

following proportions are suggested, nounts named being added to a bag of nd cement, containing about 95 pounds:

ck, 2 lbs. Excelsior carbon black.
e, 5 lbs. Prussian blue.
l, 8 lbs. Raw iron oxide.
w or bluff, 9 lbs. Ordinary yellow
[illegible]

dry mineral colors, mixed in propor- of 2 to 10 per cent of the cement, give s approaching the color used. The col- matter should always be mixed with the ement, and the two in turn mixed with and before adding water. In mixing the dients, the greatest care and exactitude ssential. If improperly mixed, the surface t to be spotty. For a further discussion ie introduction of coloring matter into ar, see the writer's article on Concrete ce Fnishes in this journal for March 20, page 325.

rking for Blocking Wearing Surface.—e might possibly be some chance for argument regarding the proper surface treatment which a walk should receive, but certainly the marking of the wearing surface into blocks will not permit of any. Preserving joints in the concrete base of walk has already been mentioned. These are the real [illegible] should always occur over them. Care must be taken to see that the top mortar is cut entirely through on exact line above the joints in the base. This may be done by a trowel working along a straight-edge, after which the edges are rounded off with a special tool called a jointer, having a thin shallow tongue. In cutting the top mortar, the trowel should be held to cut, and thus avoiding dragging and tearing the edges. Special tools may be had for cutting through the mortar and rounding the edges of the joint at one operation. The marking is sometimes done by means of a chalk line stretched between the ends of the desired mark. This line is then pressed into the soft mortar with a small trowel, and being removed, leaves the mark. A trowel or special tool is then used to cut the mortar through to the base, following the mark made by the chalk line, and the joint finished by a grooving tool, which leaves a rounded edge. It cannot be too strongly insisted that the marking of the wearing coat into blocks should be directly over the block joints in the base. If this is not done the mortar or top surface will check across even with the lower joint, thus impairing the work. More walks are disfigured by failure to provide proper joints than by any other cause. The inspector must see that the marking is done with a tool which cuts clear through to the base. Joints must be continuous to prevent cracks from running into adjacent slabs.

Finishing Edges of Walk.—A trowel should be run along side forms as far as finished, cutting about 1 inch deep, and held in such a way as to crowd the mortar back from the form about ⅛ inch. The edges of the walk are now finished by placing a quarter round tool into the trowel cut, and sliding the same along the side form for the whole length finished, repeating the operation on the other side. Care must be taken to press only hard enough to make an even and straight furrowed edge. The edges are generally rounded off to a curve of about ½-in. radius. An edging trowel, which is a small float with one of its edges curved, gives a good finish. The outer edges are sometimes beveled.

Workmanship.—The finished surface should be hard and dense, and free from any defects of workmanship, such as depressions, elevations, etc., and should conform to the proper grades. The finished walk should show an even, true surface free from sags, humps, pits or other defects. When a straight-edge five (5) feet in length is laid upon the surface at any point, except at grade changes, the surface should at no point vary more than one-quarter of an inch from the true edge of the straight-edge.

Before the final release of the work all concrete sidewalks should be carefully inspected and sounded for defects, and any hollow or otherwise defective blocks should be cut. Relaying of top course only should not, as a rule, be permitted.

CARE AND PROTECTION.

After the surface has been finished the walk is left to harden. Care must be taken to protect it from the elements and traffic until it has set.

Protection from Rain.—The finished walk must be protected from the direct impact of rain while it is still soft. Rain falling on soft mortar washes and pits the surface, making it rough and unsightly. Any covering that will prevent the direct impact and wash of the rain on the green mortar is satisfactory. This can be accomplished by covering with roofing paper or canvas.

Protection from Sun and Wind.—The surface coat must be protected from the hot sun, after placing, to prevent too rapid drying, which weakens the mortar and causes hair checking. A strong, warm wind blowing over top finish mortar while soft is very apt to check it.

Various methods of protecting sidewalks from too rapid drying are available. Some builders employ sand as a protection, placing it where the walk is hard enough so as not to injure same, removing it when the walk is thoroughly hardened or fully cured. The sand should be of sufficient depth, generally ½-inch will answer, and should be wet thoroughly with a rose nozzle as often as may be necessary. Sawdust, shavings, straw, grass, cloth, paper, etc., are other means of covering that may be adopted. Freshly cut grass answers very well when it can be had, though anything that will absorb water and can be sprinkled without removing can be used.

Curing Sidewalks.—Do not put water on the sidewalk until it has set hard, usually after 12 or 18 hours; then it becomes very necessary to keep the walk wet thoroughly and continuously for as long a time as economy will permit. Too much importance cannot be attached to the curing of walks, as in the rapid drying days the set or hardening of the concrete will be unduly hastened, with a decrease in the strength of the work. The surface should be covered with any of the coverings mentioned above for at least the first twelve hours on such days, and then, by wetting the work well twice a day for several days, the material will be given a fair chance to attain its maximum strength and durability. Concrete sidewalks after setting up, can hardly have too much water, provided the water is not dashed on while the surface is hot from exposure to the sun nor while still too soft to resist the washing action of the water. Water is a very important element in the curing of all cement work. Sidewalks should be kept covered for a week, and constantly wet. It should not be allowed to dry for a moment at any time during the first week.

Protection from Traffic or Accident.—Special care must be taken to protect the walk at night. It should be fenced off so that animals may not walk over it while still fresh. This applies especially to dogs and cats, which have disfigured many an otherwise good walk. These barricades should be at least three feet high, at each end of the walk. On the sides of walk the same or other kind of sufficient barricade should be used to protect the walk from injury and guard the public against accident. All barricades should be properly protected by red lights at night. If necessary keep a man in charge to keep animals and persons from walking over the newly laid walk.

The walk may be opened to light travel after about four days, but it is better to remain covered with damp sand, grass, etc., for a week.

Protection from Frost.—Sidewalks should not be constructed during cold weather unless unavoidable. Where work is placed in freezing weather, the surface can be covered with sand, and upon this manure can be placed with a covering of canvas or tar paper to prevent the rain or snow falling on the manure, and thus leaching through to the concrete. Fresh manure must never be applied directly to the walk, or the mortar surface will be discolored by the manure, as well as injured by the ammonia in same. If construction in freezing weather is unavoidable the rules given previously by the writer for concreting in freezing weather should be followed. See ENGINEERING & CONTRACTING, March 13, 1912, page 301. In freezing weather the same precautions as to heating the aggregate, etc., are necessary as in other classes of concrete work. The covering should remain on walks laid in freezing weather for at least three weeks.

CLEANING UP AFTER COMPLETION OF WORK.

Cleaning Up.—After the walk has been completed the street in front of same should be cleaned of all surplus material, cement, sand, broken stone or gravel, barrels, etc., used in its construction.

Grading.—The slopes and parks should be graded to conform to walk and curb grades (or to lines indicated on the plan) and dressed with fine earth, raked and left smooth. Grading on the curb side of the walk should generally be about [illegible] walk, and not less than [illegible] to the foot fall towards the curb or gutter. On the property side of the walk the ground should be graded [illegible] at least [illegible] not lower than the walk; this will insure the frost throwing the sidewalk alike on both sides.

Sodding.—[illegible] may be sodded with blue grass sod, free from weeds. All joints should be broken in laying and the sod laid to a uniform and even surface. The sodding should be kept sprinkled until such time as the entire improvement may be accepted. If the lawns are already in grass, they should be left in proper condition and any unnecessary damage should be repaired.

Seeding.—Parks may be sowed with white clover seed of good quality, using one pound of seed for each three hundred (300) square feet.

Concrete Curbs and Gutters.

Closely connected with concrete sidewalk construction is the matter of providing concrete curb and gutter. Most of the general and specific instructions to be followed in inspecting concrete sidewalks, as stated above, are applicable to either concrete curb or combined curb and gutter construction.

Concrete Materials.—The cement should comply with the Standard Specifications for Portland cement of the American Society for Testing Materials, adopted June, 1904, together with subsequent changes and amendments.

The sand, broken stone or gravel, and water for concrete should conform to the requirements stated for sidewalks. It is sometimes specified that no gravel greater than one inch in diameter shall be used. The inspector will, of course, be governed by the specification requirement as to the size of aggregate.

Sub-Grade.—The excavation should be made to the sub-grade previously determined upon. The necessary grading for preparing the base or sub-grade, and compacting it to render it suitable for curb and gutter construction, should be carefully done. It is sometimes required that sufficient grading be done in each case to leave a backing of at least five feet in width back of, and on a level with, the top of the curb, such filling being compacted and sloped down to a solid base on a slant of one and one-half to one.

All soft, boggy, spongy, or defective places should be removed and all depressions filled with suitable filling material, which should be thoroughly compacted by flooding and tamping in layers not exceeding six inches in thickness.

When the sub-grade occurs on fills exceeding one foot in thickness its preparation requires very careful attention. In all cases, fills must be thoroughly compacted.

Sub-Base.—Upon the sub-grade prepared as above and after inspection and acceptance of the same, should be placed a foundation of compacted coarse sand, cinders or other suitable material as mentioned for sidewalks, of not less than six inches in depth, such sand, cinders, etc., to be free from earthy and other objectionable materials. The sub-base may consist of a layer of broken stone six inches thick, or six to twelve inches of cinders thoroughly rammed.

The preparation of the foundation should be similar to that required for a sidewalk, care being taken that the sub-base be thoroughly drained, the drainage system being connected with sewers or other drains as may be indicated on the plans.

Forms.—After the foundation or the top of the sub-base has been brought to the proper distance below the grade stakes, forms are placed for the curb or the combined curb and gutter, being of such shape and dimensions as may be required.

The material for forms should be dressed on the edges and on the side next the concrete and should be set securely so that the curbing and guttering, when completed, will conform accurately to line and grade.

At least once in every one hundred and fifty (150) feet, expansion joints should be provided. These joints to be constructed as specified or as may be required by the engineer.

Body of Curb or Combined Curb and Gutter.—Materials for the concrete body of curb or combined curb and gutter should be proportioned according to the voids in the aggregates, not exceeding 1 part Portland cement to 8 parts fine and coarse aggregates. When the voids are not determined, the concrete should be composed of 1 part Portland cement, 3 parts fine aggregate and 5 parts coarse aggregate.

Materials should be mixed wet enough to produce a concrete of such a consistency that it will flush readily under a light tamping and which can be handled without causi[illegible] aration of the coarse aggregate [illegible] mortar.

A layer of concrete should be de[illegible]site the top of the gutter form and ta[illegible] width of the gutter, to a surface all [illegible] which should be at least the thickne[illegible] wearing surface below the finished s[illegible] the gutter. Concrete placed for [illegible] should be tamped and the remaind[illegible] concrete placed and tamped to perm[illegible] application of the required wearing surface to the face and top of the curb.

In constructing curb or combined curb and gutter, particular attention must be given to have all templets perpendicular between the stones. All stones should be of uniform length of about six (6) feet, and should be separated from each other by sheet steel templets made to conform with the shape of the curb or combined curb and gutter, which are then removed after the cement has sufficien[illegible]

Finishing or Wearing Surface.—I[illegible]ly after the completion of the body [illegible] and before the cement therein has ha[illegible] set, the finishing or wearing surfac[illegible] be added.

The mortar for the finishing surfac[illegible] be composed of 1 part Portland cem[illegible] not more than 2 parts of fine granite [illegible] slag screenings of a size not excee[illegible] of ordinary coarse bank sand and wh[illegible] be free from all foreign materials. [illegible] sistency of the mortar should be such [illegible] not require tamping, but which can [illegible] spread into position.

Wearing surface on the gutter an[illegible] top and face of the curb should be [illegible] ¾-inch thick.

Edge of the curb on the street side [illegible] intersection of the curb and gutter s[illegible] rounded to radius of about 1½ ins., [illegible] edges to have a radius of about ½ i[illegible]

All exposed surfaces should be [illegible] finished by troweling to a smooth a[illegible] finish, and must be left free from irr[illegible] ties and depressions. Any spalling [illegible] ting off whatever of the finished [illegible] either at the joints or in the body [illegible] section, should be sufficient cause for rejection. No patching of any character [illegible] be allowed.

Protection.—When completed, the [illegible] gutter should be kept moist and protected from traffic for at least a week.

WATER SUPPLY, SEWERAGE AND SANITATION SECTIO

The Life and Economic Use of Steel Water Pipe.

During recent appraisals of two water works systems by one of the editors of *Engineering and Contracting,* question arose as to the probable life of steel water pipes. The editor secured sections of such pipe of various ages, up to 20 years, taken from the mains in the process of tapping for service connections. He also conferred with the managers of the two water companies as to their experience with leaks, and as to methods of prolonging the life of steel pipes. It is our purpose briefly to outline the results of this investigation, which took place in the cities of Everett and South Bellingham, Wash.

In both cities steel pipe of the Metheson and Converse types had been used extensively by the privately built and owned water works, and with results that had proved economic over a period of about 20 years. In each of these cities there is steel pipe in such good condition that, so far as can be seen, a total life of 40 years or more might be secured. It is true that in certain soils, a life of 20 or 25 years seems to be the limit for thin steel pipe, particularly if it has not been properly coated or if the coating has been scraped off in spots before laying. It is also true that in the alkaline soils of certain arid states, the life of steel pipe may be less than 20 years. But the fact that impressed the editor very forcibly was the undoubted durability of well coated seamless steel pipe—a durability that extends, under ordinary soil conditions, far beyond the period of years commonly assigned by engineers to any steel pipe.

The editor is not prepared to say positively that riveted steel pipe is less durable than seamless (lap-weld or lock-bar) steel pipe, but he would not be surprised were it found that riveted pipe has a shorter life because small leakages of water tend to rust it out along the riveted joints. The manager of the Fairhaven Water & Power Co., of South Bellingham, Wash., believes this to be a fact from his experience with certain riveted pipe, but he is not certain that the shorter life of that pipe may not have been due to use of a poor pipe dip. Incidentally, it may be added, be believes in both calamine and pitch coatings over the steel.

The manager of the water department of the Everett Railway, Light & Water Co. does not regard the calamine coating as essential, but is very positive that every water company should dip the pipe just before laying it. He also re-dips all pipe that is taken up at any time. A description of his pipe dipping apparatus, and the methods and cost of dipping, was published in our issue of Dec. 13, 1911.

As a result of the examination of the seamless steel pipe in the two cities just [illegible]amed the editor estimated that a life of 3[illegible] y[illegible] could readily be secured under the co[illegible] existing in those cities, and this he [illegible] to be a conservative estimate.

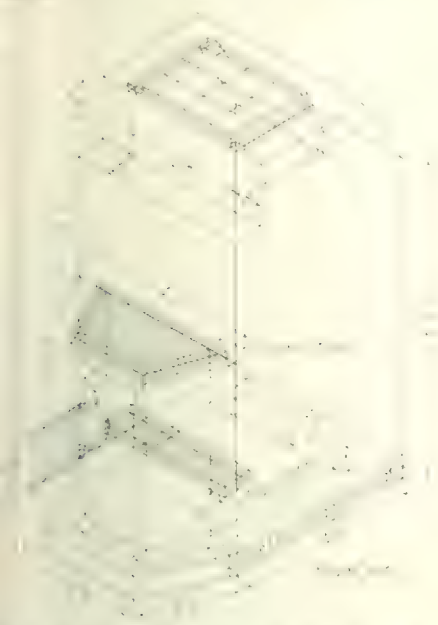
There is one feature about the life [illegible] pipe that is almost always overlooked [illegible] neers who have not themselves been co[illegible] with water companies that have use[illegible] such pipe. We refer to the replacing of [illegible] sizes by larger sizes of pipe, to prov[illegible] the growth of the community. Few Ameri[illegible] towns or cities are without large a[illegible] sparsely built up or sparse tenanted p[illegible] If a 4-in. or 6-in. main is laid in [illegible] districts, it is likely to become inadequa[illegible] before the life of the pipe or even the [illegible] the pipe coating has expired. Hence [illegible] 12 years, a small main is likely to be ta[illegible] relaid elsewhere, and a larger main sub[illegible] for the small one. When this is done, [illegible] pipe should be re-dipped, for, by so [illegible] there is no good reason why it may [illegible] forever.

Seamless steel pipe, it seems to [illegible] worthy of much more extended use [illegible] has received in the past. It is unquest[illegible] long enough lived for economic use in a[illegible] ing community, and there is strong reas[illegible] for believing that its life is very much [illegible] than has been commonly supposed by en[illegible] and water works managers.

The New Sewer Standards of Richmond, Va.—Dimensions of Trenches—Instructions to Inspectors.

[illegible] Allen J. Saville [illegible] Engineer.

[illegible] of Richmond has been [illegible] sewer work for the past two [illegible] ll continue this work during the present



1—Standard Brick Catch Basin, Richmond, Va.

[illegible] in sewer bonds. The standard plans herewith we e drawn up for the pur- mproving the quality of the work and ite uniformity in construction on the contracts in different parts of the [illegible]

Basins.—The new type of catch basin. standard in Richmond, is shown in [illegible] The old style basin had the trap are in plan, and the cover and arch were made of old pieces of flagging. [illegible] f this kind were set on green brick- [illegible]

[illegible] however, the shape of the trap was [illegible] This reduced the size of the cover ecessary, and also improved the work- [illegible] gn the opening in the curb was changed, ng made longer and flatter to eliminate sudden dip in the curb made necessary the old design. The excavation for the w basin is 9 cu. yds., and 1,850 brick are quired in its construction.

n Figs. 2 and 3 the design of the forms [illegible] center and also facilitates the removal of [illegible] four ¼-in. round iron rods placed as shown on the design of the forms in Fig. 3.

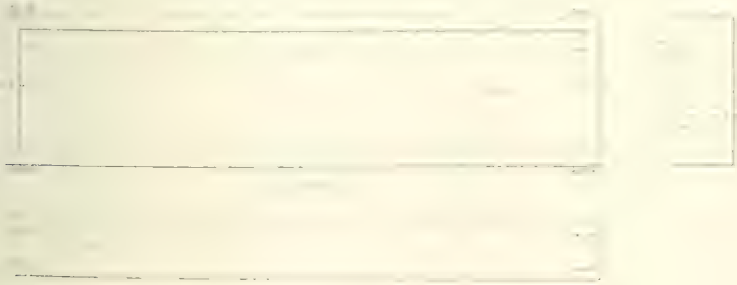


Fig. 3—Details of Form for Reinforced Concrete Trap Slab for Catch Basin.

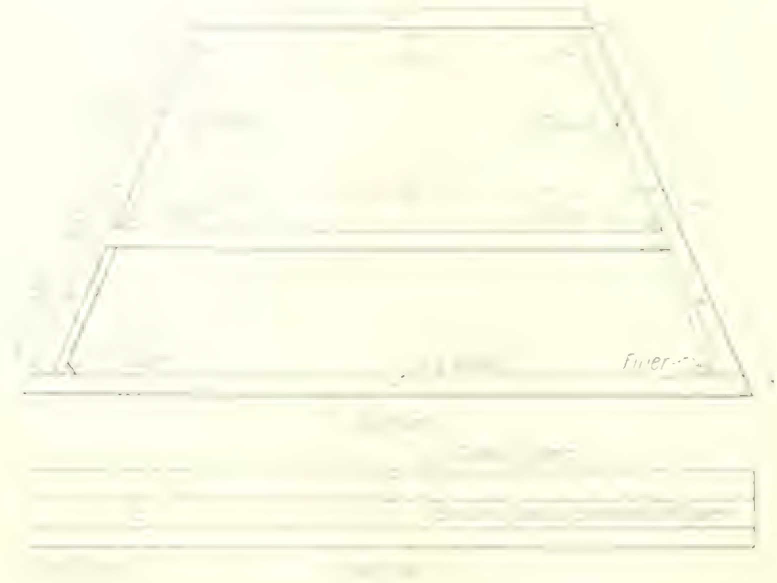


Fig. 2—Plan and Elevation of Form for Reinforced Concrete Cover Slab for Catch Basin.

These forms have been in use for some time and have been found to work very well. The wire in the cover slab is put in to strengthen the concrete to withstand handling. It is not necessary for the slab to be reinforced to carry a load. The frame shown in [illegible] high. The bottom boards are screwed to the lower half and dowel pins are fixed in the bottom half and work loose in the top half so that it can be removed. The dowels are iron. Screws are used in the form in place of nails. The form shown in Fig. 3 is not provided with a bottom. Holes for the insertion of reinforcing rods are made in both ends of the form, and the sides are hooked to the ends, so that the whole form can be taken down.

The standard brick manhole for pipe sewers is shown in Fig. 4. The standard manholes for brick sewers have walls similar to those shown in Fig. 4. For circular brick sewers, 3 ft. in diameter, the manhole walls are 8 ins. thick and contain 110 bricks per foot of height above the top of the sewer bore. These manholes are 3 ft. in inside diameter at the bottom and 2 ft. at the top. [illegible] manholes on egg-shaped brick sewers are the same in size as those just described.

The dimensions of trenches excavated for brick sewers are shown in Fig. 5. The dimensions allowed for trenches for pipe sewers are given in Table I.

[illegible]

The instructions to inspectors here given are not intended to cover the whole subject of inspection, but serve to call the inspector's [illegible] looked after, and prescribe the method of keeping records and notes.

[illegible]

[illegible] the ticket.

[illegible]

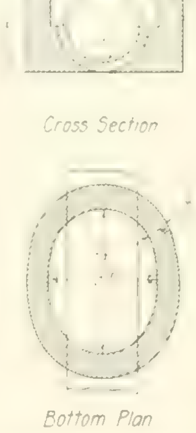


Fig. 4—Standard Brick Manhole for Pipe Sewer, Richmond, Va.

the work. Hubs to be located from nearest stack and elevation referred to some permanent datum or noted either depth below top nearest stack or below a corner stone.

TABLE I—DIMENSIONS AL[illegible] FOR PIPE SEWER TRENCHES

Size. Ins.	Cut below 10 ft. Top. Ft.	Bot. Ft.	Av. Ft	Cut from 10 ft. to 15 ft. Top. Ft.	Bot. Ft.	Av. Ft.	Cut from 15 ft. to 20 ft. Top Ft.	Bot. Ft.	Av. Ft.
6 ins..	2.0	2.0	2.0	3.0	2.0	2.5		...	
[illegible]	[illegible]	2.0	2.0	3.0	2.0	2.5	[illegible]	2.0	3.0
15 ins..	2.5	[illegible]	[illegible]	3.5	2.5	3.0	[illegible]	2.5	3.5
18 ins..	[illegible]	[illegible]	[illegible]	4.25	2.75	3.5	4.75	2.75	[illegible]
[illegible]	3.0	3.0	[illegible]	[illegible]	3.0	3.75	5.0	3.0	4.0
24 ins..	3.4	3.4	[illegible]	[illegible]	3.4	4.0	5.4	3.4	[illegible]

[illegible] corner or other permanent marker.

(3) Stacks.—Locate from corner streets, note depth and size of sewer between stacks. Show on sketch by circle.

(4) House Connections.—Locate on sketch as accurately as possible by measurements from the corner stone or street line to the first connection and then the measurements between each connection until the next corner stone is reached. Take every precaution to get these located accurately. Measurements to tenths.

(5) Brick Sewers.—Size, location in street, whether center or not.

(6) Pipe Sewers.—Same as brick,

(7) Records for Estimates.—Number of cubic yards of excavation for the main sewer and for all connections, for basins and hubs, must be kept in detail and as accurately as possible, using widths of ditch as given on standard and depths as measured in the field. If there are very many house connections on a block, it is better to take an average connection and use this all the way through that block, provided there is not much variation in the ground. Ditches to be all figured as cut square in the bottom.

(8) Number of Bricks.—Bricks are paid for by the M. per actual count. Records must therefore be kept of all brickwork in detail. The number of bricks in a brick sewer per foot, one and a half rings being one foot, should be counted frequently and an average made for each size on a job. See standard sheets for bricks in stacks and basins.

(9) The number of feet of each size pipe received daily and the number of feet laid each day should be kept.

(10) Number of barrels of cement received should be kept and the number of barrels used per M. bricks should be kept approximately. The following record should be kept of cement: Date ordered, hour ordered, number of barrels ordered, date received, hour received, number of barrels received, number on tickets.

[illegible] OF CONSTRUCTION ESPECIALLY TO BE LOOKED AFTER.

(1) Basins.—Basins to be built according to drawings. See that basin is plastered on the inside up to the water line. Bats can be used in basins provided they are not smaller than ½ brick. Every fourth or fifth course must be whole brick laid as headers. Basins must be square with the street and the walls built straight and true. Bricks for basins to be up to specifications for bricks in sewers. Wherever the grades have been determined, the basins shall be built to grade. If basin is built in gutter before street is cleared up it should be boarded up to keep out loose dirt until street is cleaned up.

(2) Stacks.—Stacks to be built to drawings. On pipe sewers, stacks in bottom to be 4x3 ft. top 2 ft. circular. On brick sewers 3 ft. circular at sewer and 2 ft. circular at casting. Wherever practicable the castings shall be set on the finished grade of the street. It must never be set very high on traveled roadways, however.

(3) House Connections.—All to be laid as single connections on all pipe lines. Connections to be put in for every house and for all vacant lots unless shown otherwise on drawings. Where it is practicable the inspector is to find out from owners on line of sewer as to where they wish their connection. Connection to be 7 ft. deep at property line below finished grade if surface grade permits. In laying pipe be careful to see that no cement is left inside of pipe at the joints. See that connections are properly stopped up at end. Grade either to be given or whole length to be cut out to grade before any pipe is laid. Connections are given a sweep of about 10 ft. in ordinary streets; that is, Y is put in 10 ft. further down the sewer than the point of connection on property line. See that no dirt gets in pipe and be very careful to see that the cement does not squeeze out on the inside of the pipe, producing obstructions.

(4) Brick Sewers.—Bricks must conform to specifications. If they do not, make the contractor haul them away from the job. Bricks must be thoroughly wet before laying. No bats to be used in sewers on any excuse except for making joints. Arch to be tamped up to crown before drawing centers. Line and grade both must be carefully given. In case invert is cut too large or caves in, the sewer must be backed up with good material before arch is turned. Notice clause in specifications about racking back where brickwork ends. All joints must be carefully made and the arch keyed up before centers are moved. Centers must either be renewed before mortar has taken initial set or left in until mortar has taken hard set. Keep the courses straight in the whole sewer. Do not allow bricks to be laid with large joints and then pointed up or flushed. Notice specifications as to size of joint.

(5) Pipe sewers must be laid absolutely straight between stacks. Ditch must be wide enough in the bottom to allow workman to get his arm around under pipe to put cement in joint. Joints must be covered with cement all the way around. Packing to be put in as far around as can possibly get it, starting at top. Not less than 25 ft. of pipe shall be laid at one time, except by special permission from the engineer in charge. All joints in a section to be laid first without cementing any pipe, then straightened out and packed and then cemented. Test all pipe that comes on job by tapping it with small rock. If pipe rings it is all right, but if it sounds dull then look for the crack and send it back. Tamp dirt to one foot above pipe and do it very carefully, seeing that dirt gets under the pipe. Cement on joints should be beveled off from bell and not wiped straight down.

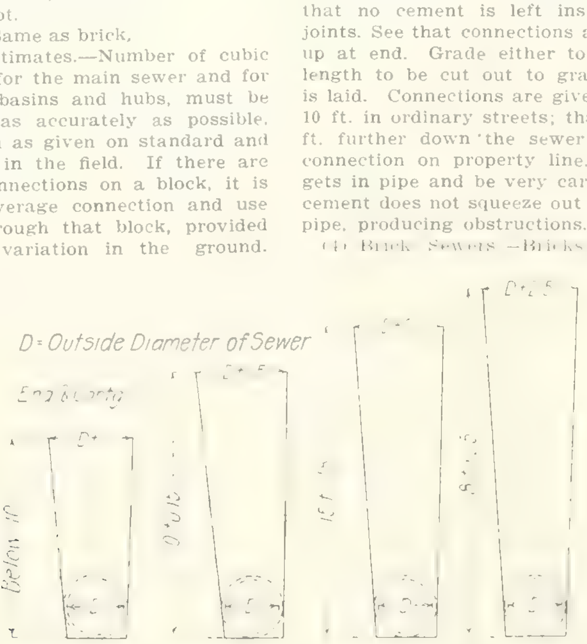


Fig. 5—Dimensions of Trenches Allowed for Brick Sewers, Richmond, Va.

(6) Before leaving a job the inspec open up the stacks and inspect the sew that it is clean and in working order a a written report to that effect to the en charge. If possible water must be run upper end and allowed to run until th sewer is in operation and washed out.

(7) A written report must be sent i conclusion of the job, giving a list of etc., left over and its location.

(8) Inspectors must be on the job at times Their hours are the same as those of tractor who is doing the work.

Method of Thawing Out a Frozen Water Main, Submerged in Salt Water, By Electricity.

The 6-in. water main, 1,700 ft. which connects North Brother Isla the Borough of Bronx, New York came frozen during the very cold we the early part of February. The co diseases and tuberculosis divisions of hospital are located on this island, quently the water famine caused by th ing of the supply main caused keen Water was carried to the island for days in water carts and barrels on bo a Government water boat finally was in this service.

On the single previous occasion, De 1892, when this same main froze, all to thaw it out in place failed, and it be taken up and relaid. On March year, the New York Edison Co. un to thaw out the main. The effort was ful, although a continuous application tric current to the frozen main for fi and nights was required to thaw it ou conditions were unfavorable to thawin the salt water does not freeze until a te ture of 27° F. is reached. Freezing at the shore of the island, where th emerged from the water. Freezing point stopped the flow of water in line, and the entire submerged portic rapidly became frozen.

A shack was erected on the islan for use as a temporary substation. A four 100 K. W. transformers was in to drop the line voltage of 2,000 down volts. This electrical pressure was in the first effort to thaw out the main.

Both ends of the frozen main were and electrical connections were made submerged portion. The current was on on the morning of March 7, ab amperes and 200 volts being used a Pumps were installed on the island pressure of 80 lbs. was maintained main. During the evening of the 7th th rent was increased to 1,000 ampere March 8th the current averaged 1,300 a but had no effect on the ice. Early afternoon of the 8th steam began to issu the severed end on the Bronx shore. 9th the current was increased to 1,500 a and the voltage was increased to temporary substation being enlarged a two more 100 K. W. transformers installe At 11 a. m. on the 10th the current was up to 1,600 amperes and the voltage to 368 T hours later the current was increased t amperes. This current was maintaine constantly until 6 a. m. of March 12th, water started to flow out of the Bro end of the pipe. Within a short time the after the flow of water through the pipe that it was entirely thawed out. Th cold salt water flowing over the pipe made it sary to use 36 times as much heat to out the pipe line as the same quantity ice on land would have required. Within 24 after the ice thawed out the water sup of the island was resumed.

Preliminary work has been started f a mile tunnel through Mount Royal at Mo Que., by which the Canadian Northern R will enter the city.

Sp ifications for the Manufacture, esting, Dimensions, and Laying of Plain Concrete Sewer Pipe, Kansas City, Mo.

[illegible] wer pipe has been drawn by Mr. L. R. [illegible] ty Engineer of Kansas City, Mo. The itions are published herewith. With rmission of Mr. Ash, we invite our manufacturers of concrete pipe, engi- contractors, and others who may be ed, to discuss these specifications crit- ica. It is probable that the ational Asso- cia n of Cement Users will appoint a com- to recommend a standard set of speci- [illegible] ar or two. A full discussion at this ll assist such a committee materially undertakes to formulate standard tions. The importance to all users of e pipe of having recommended stand- ifications, well considered before they red for adoption, is obvious. There- is hoped that the accompanying speci- s may be used as a basis for a careful ation of the various problems arising nanufacture and use of concrete sewer

Kansas City specifications are similar in use in the Borough of Brooklyn, rk City, where the long and successful concrete sewer pipe calls for a defer- nsideration of the governing specifica- The Kansas City specifications differ se in force in Brooklyn in the mat- hape and size of bell, form of inside [illegible]

[illegible] s is incorporated in the Kansas City [illegible] t graded to the size of the pipe. The izes undoubtedly will meet this re- nt without trouble but, in Mr. Ash's ion, it is very doubtful in sizes below 12 This test probably will be eliminated or ly changed in future specifications in Kansas City. The points of differ- re enumerated, between these two tions, should be taken up in the dis-

Kansas City specifications, which apply rete pipe, ranging in size from 6 ins. 4 ins. internal diameter, follow:

MANUFACTURE.

ll pipe must be the product of approved ories, and the Board of Public Works re- es the right to reject the entire product any pipe works whenever, in its opinion, [illegible] of manufacture are such as not guarantee uniform results, or where the erials used are such as to produce an in- or pipe, as indicated by repeated failure to fy the tests under these specifications.

[illegible] pipe shall be machine made. [illegible] must be of the best quality, [illegible] tland cement, fulfilling all of the require- its heretofore mentioned in these specifica-

[illegible] 12 ins. in diameter and under shall [illegible] of concrete composed of one part cement wo and one-half parts of clean Kaw River [illegible] Pipe of larger diameter than 12 ins. be made of a mixture of one part of ent to two and one-half parts of clean Kaw sand, or a mixture composed of one t of cement, one part of clean Kaw River [illegible] and two parts of hard stone.

f a mixture involving the use of stone is [illegible] samples of the stone must be sub- ted to the City Engineer and approved him before the manufacture of the pipe started.

ll materials used in the manufacture, the cess of manufacture, and the marking and ing of pipe shall be subject to inspection at factory.

ethods of molding, trimming and season- pipe shall be left to the discretion of the nufacturer, but as furnished for the work shall be without warps, cracks, or imperfec- [illegible] pressed on the outer surface as identification [illegible] broken from the spigot end deeper than the depth of the bell or longer at any point than one-half the diameter of the pipe; nor which has a piece broken from the bell end if the fracture extends into the body of the pipe or is longer at any point than one-half the diameter of the pipe.

TESTS.

When required, the contractor shall deliver at the point indicated by the city engineer one [illegible] pipe to be laid under the contract. This pipe is for testing purposes and shall be selected by the engineer and marked by him on the line of the work for identification when tests are made, and shall be delivered by the contractor without special compensation for the same.

The tests to which the pipe may be subjected are as follows:

External Crushing Test.—When supported upon a bed of thoroughly compacted sand of such dimensions and in such manner that an even bearing is provided throughout the whole length, but without appreciable displacement of sand at the sides, the various sizes of pipe shall withstand the following pressures applied at the crown uniformly along a line 1 in. in width and extending the whole length of the pipe, exclusive of the bell.

Diameter.	Lbs. per lin. ft.
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] ins.	[illegible]
18 ins.	1,450
[illegible]	[illegible]
[illegible]	[illegible]

Drop Weight Test.—Pipe, supported on a dry sand bed 2 ins. deep, shall withstand without cracking the impact from two blows of a cast-iron ball weighing 10 lbs., falling 18 ins. This test may be applied on the line of the work before the pipe is placed in trench.

Hydrostatic Test.—Untreated pipe shall show no percolation up to 10 lbs. per sq. in., and shall resist fracture at 33 lbs. per sq. in. internal pressure.

When any pipe is broken it shall appear homogeneous, being entirely free from cracks or voids, and generally uniform, showing pieces of fractured stone firmly imbedded in the mortar.

DIMENSIONS.

When sizes of pipes are given, they shall mean the interior diameter.

All pipes shall be of the following [illegible] thicknesses and the diameters shall not vary more than 3 per cent from those specified.

Diameter.	Wall thickness, ins.
6-in.	¾
[illegible]	[illegible]
[illegible]	[illegible]
12-in.	1¼
15-in.	1½
18-in.	1¾
[illegible]	[illegible]
[illegible]	[illegible]

Pipes [illegible] be true and straight. Each straight pipe having a branch or connection molded thereon shall not be less than 2 ft. or more than 3 ft. long; plain pipe shall be in length not shorter than 2 ft. nor longer than 3 ft.

The hubs of all cement pipe shall be of the self-centering type, and there shall be left an annular space to permit of the making of a layer of cement mortar at least ½ in. thickness between the hub and spigot.

Pipes having 6-in. spurs formed thereon for house connection shall be furnished and laid at such points as are indicated on the drawings.

LAYING.

Previous to being lowered into the trench each pipe shall be carefully inspected, and those not meeting the foregoing specifications shall be rejected and either destroyed or removed from the work. All lumps or excrescences on the ends of each pipe shall be removed before it is lowered into the trench. No pipe shall be laid except in the presence of the agent of the Board of Public Works, and he may order the removal and relaying of any pipe not so laid. No sewers shall be laid within 10 ft. of the excavating or 40 ft. of the blasting. Pipes having any defects which do not cause their rejection shall be so [illegible] sewer, and if the bell or spigot be broken, the defective place must be liberally covered with neat cement mortar, reinforced with a pipe or pipe ring, if the Board of Public Works so direct.

The pipes and specials shall be so laid in the trench that after the sewer is completed the interior surface thereof shall accurately conform to the grades and alignment fixed and given by the Board of Public Works. All adjustment to line and grade of pipes laid directly upon the bottom must be done by scraping away or filling in the earth under the body of the pipe, and not by blocking or wedging up. Before laying, the interior of the bell shall be wiped smooth and clean, and the hub and spigot thoroughly wet, and the annular space shall be free from dirt, stones and water.

The mortar shall be laid in the collar in such a manner that when the spigot end is driven into the collar the mortar will fill the annular space between the spigot and the limbs. Mortar is then to be wiped around the inside of the joint to fill any vacancies which may be left.

Special care must be taken properly to fill with mortar the annular space at the bottom and sides as well as at the top of the joints. After such space has been filled the cement having been compacted with a wooden or iron calking tool, a neat finish shall be given to the joints by the further application of a similar mortar to the face of the hub so as to form a continuous and evenly beveled surface from the exterior of said hub to the exterior of the spigot all around. All water must be kept out of the bell-hole during the laying, or else such bell-hole must be completely filled with cement mortar specified or with concrete (for which mortar or concrete no extra compensation will be allowed). The interior of the joint shall be wiped clean of cement by a wad made of a sack filled with hay, large enough tightly to fill the pipe and attached to a rod or cord, which shall at all times be kept in the sewer and pulled ahead past each joint as soon as cemented. The mortar used shall be composed of one part cement to one part of sand and wet to a thick paste.

As soon as the cementing of any joint has been completed the bell-hole under the hub must carefully and compactly be filled with sand, loam or fine earth, so as to hold the exterior mortar finish of said joint securely in its place.

While the pipes and specials are being laid in each section between manholes or other permanent openings, light from the remote end of the section shall remain constantly in plain view throughout the entire length of such section or division.

Pipes with 6-in. spurs for house connection shall be furnished and laid where shown on the plans. Each spur and junction piece shall be closed with a disk of earthenware, or cement. The cost of spurs and junctions, or Y's, will be included in the price per lineal foot for pipe sewers.

A competition for the best plans and specifications for small concrete residences is to be held by the Blaw Steel Centering Company, Westinghouse Building, Pittsburgh, Pa., and prizes will be given to the successful contestants. The designs will be in the hands of the company by May 15. They will select ten which in their opinion possess the greatest merit and will submit these to Prof. A. D. F. Hamlin of Columbia University for final selection of the most meritorious. The competition will not be conducted under the rules of the American Institute of Architects, and will be open to all. Following the award of the prizes the plans of the successful contestants will be published in a booklet.

The Installation of Water Meters as a Means of Making an Ample Supply of Water Sufficient—Experience of Elgin, Ill.

Our secondary cities as well as the larger cities, often are confronted with the necessity of making a choice between securing an additional supply of water and getting along with the old supply. When a city finds its supply insufficient to its needs the first impulse usually is to plan for, and often secure, an additional supply. However, an increasing number of cities are turning to the water meter as a means of making the old supply sufficient. The experience of Elgin, Ill., in this matter is typical. Mr. R. R. Parkin, chief engineer of the Elgin water works, presented a paper before the recent convention of the Illinois Water Supply Association in which figures were given to show the effect of water meters on the consumption of water. The following matter is based on Mr. Parkin's paper:

About six years ago we installed four large wells and connected them with what is known as the shaft and tunnel system. Using this system we soon found that to meet the demand of our growing city we either had to install more wells to meet these demands or mix the artesian with river water. We were for a time compelled to do this, against the wishes of many, in order that our people could use all the water they wanted, as before, upon what is known as the "unfair" or "flat" rate. During this time we commenced to consider the advisability of installing more wells, and various other methods of getting away from using river water entirely were figured out. More wells were considered the best location of same was carefully gone over, and, finally, after considering all propositions, we took up the meter question. The expense of going after more water was considered, also the cost of metering all consumers was taken into consideration, and finally a meter ordinance was presented and passed. Meters are now being installed at the rate of about 500 to 600 each year. In addition, all new consumers are metered as they are made.

Table I shows the number of services from 1902 to 1911, inclusive, the number of services metered, the percentage of services metered, the total yearly pumpage and the yearly consumption per service, the total yearly income and the income per service.

As will be seen from the table, the first real impetus was given to the installation of meters in 1907. During that year the pumpage was reduced over 100,000,000 gals. from the amount used in 1906. The revenue increased $7,723.73 over that in 1906. The meters installed in 1907 were upon all business blocks, also on all public services, including public cemetery, school houses, fire stations, drinking fountains, public parks and street sprinkling cars. All public uses are metered in Elgin.

During 1908 the meter rates were reduced for domestic consumers from $6 to $5 minimum. General rates in some classes were also placed on the downward scale, which reduced the receipts somewhat.

In 1911 with 4,845 services, of which 3,200 were metered, 759,000,000 gals. were pumped. This amount exceeded the total pumpage for 1902 by only 34,000,000 gals., although the number of services had increased from 3,263 to 4,845. The net revenue for 1911 exceeded that of 1902 by $24,839.38, although the amount of water pumped was about equal in the two years.

The meters installed in Elgin have more than fulfilled the most sanguine expectations of the water department officials. Had the city continued up to the present time with the flat rate, many times the amount expended on meters would have been appropriated for filters, settling basins, new machinery and building.

Our water users are more than satisfied with the service. Very few have been compelled to install meters and then only where the department found violations in the use of water. The city furnished all meters, except those using in excess of 10,000 cu. ft. per quarter. The consumers pay for the installation only. The meters are read in three divisions every three months by one man. This work does not occupy his entire time. For valid reasons consumers may have their meters read each month.

By the use of meters water users soon find that to waste water is unprofitable. The livery and garage keeper shuts off the water after washing his vehicle instead of throwing the hose upon the floor to run for hours, in most cases without a nozzle. Automatic sprinklers are no longer allowed to remain stationary for hours for cooling or ornamental purposes. Repairs are more quickly made when the user finds his bill has doubled. In most instances he acknowledges the leak and states that he had little knowledge of the amount of water wasting through so small an aperture. In fact, inspection is reduced to a science by the meter. This relieves the department of many unpleasant duties connected with inspecting private premises.

TABLE I. WATER SUPPLY STATISTICS OF ELGIN, ILL., SHOWING EFFECT OF WATER METERS ON WATER CONSUMPTION AND REVENUE.

Year.	Number of services.	Number of metered services.	Percentage of services metered.	Total yearly pumpage Gals.	Yearly consumption per service Gals.	Total yearly income.	Income per service.
1902	3,263	210	6.4	[illegible]	222,000	$30,013.68	[illegible]
1903	[illegible]	[illegible]	[illegible]	730,000,000	210,500	33,308.39	[illegible]
1904	[illegible]	[illegible]	6.6	[illegible]	228,400	34,620.25	9.20
1905	3,795	[illegible]	6.9	730,000,000	192,500	36,200.47	9.54
1906	3,923	[illegible]	7.3	[illegible]	[illegible]	39,022.33	[illegible]
1907	4,030	1,170	29.1	[illegible]	[illegible]	[illegible]	11.60
1908	4,195			[illegible]	199,000	49,159.66	11.72
1909	4,420	2,223	50.3	[illegible]	169,500	49,159.34	11.12
1910	[illegible]	2,728	[illegible]	[illegible]	169,200	53,687.63	11.53
1911	4,845	3,200	66.1	759,000,000	156,800	54,853.06	11.32

Sewerage Statistics—Census Report on Sewers and Sewage Disposal in Cities of Over 30,000 Population in 1909.

A preliminary statement of a special report on sewers and sewage disposal in cities of over 30,000 population in the United States in 1909, was issued March 30 by Director Durand of the Bureau of the Census, Department of Commerce and Labor. The statistics were prepared under the direction of Le Grand Powers, chief statistician for agriculture, and are subject to revision later. This report forms a part of the annual report on the Statistics of Cities, which in each year take up some one subject for special study. It will deal principally with physical or general statistics.

The Supervisory Authority.—In 145 of the 158 cities covered by the report, the sewers and highways are under boards, departments, services, etc., usually having some such designation as "Board of Public Works," "Board of Public Service," "Engineering Department," or "Engineer's Department." The head of such boards or departments is generally designated superintendent, consulting engineer, or city engineer. In only 12 cities were the sewers under a department apparently distinct from that regulating highways. In more than 100 of the cities, the board of public works or supervisory authority had charge of all the sanitary or highway services carried on as municipal activities. The health department supervised or had supervisory control of refuse collection and disposal in 52 cities.

Mileage of Sewers.—The mileage of sewers classified by kind of system and construction material is shown for 157 of the 158 cities covered by the investigation. No report was obtained for Atlantic City, N. J., where the sewer system is owned by a private [illegible]tion.

The cities reporting had, exclusive [illegible] and catch-basin connections, 25,011.2 [illegible]les of sewers, of which 18,361.5 miles were [illegible]signed for conveying both domestic sewage a[illegible] storm water, 5,258.3 miles for domestic sew[illegible] only and 211.4 miles for storm wat[illegible] only. Between 1907 and 1909 there was a la[illegible]r percentage of increase in the mileage of [illegible]nitary sewers or those designed to convey [illegible]mestic sewage only than in the mileage of al[illegible] sewers combined. This was due principally [illegible]o the building of sanitary sewers in the [illegible]es of western states of light rainfall, wh[illegible] quently no provision is made for carr[illegible]ng storm water by means of closed sewer[illegible] The total mileage of sewers is clas[illegible]ed construction material, as follows:

Stone
Brick
Brick and concrete..
Brick and stone.
Concrete
Reinforced concrete.
Vitrified pipe........
Cement pipe
All other ....

Of the total mileage of sewers, 11 3[illegible] 44 per cent, were reported by the 16 [illegible]es over 300,000 population. The followin[illegible] each had more than 1,000 miles of [illegible] New York, 1,907.9 miles; Chicago, 1,83[illegible] Philadelphia, 1,185.1 miles.

The report shows other facts besid[illegible] age, as well as the total maintenance [illegible] eration expenses for 1909 and the expe[illegible] 1,000 population served by the sewer [illegible] and per mile of sewer.

The average cost of sewer service p[illegible] population served for all cities makin[illegible] plete reports was $290.90. Individua[illegible] show large variations from these figure[illegible] highest costs were reported for [illegible] Mass., $1,358.45; New Orleans, $1,214[illegible] Sacramento, $965.71. The high cost i[illegible] cities is caused by the necessity of [illegible] pumping or purifying their sewage, or [illegible]

The average cost of maintenance and [illegible] tion of sewers per mile of sewer was [illegible] Cities with a high cost on this basis wer[illegible] more, $1,174.20; New York, $739.14 [illegible] Francisco, $716.16; Woonsocket, $651.1[illegible] boken, $592.36; Providence, $575.74; a[illegible] ramento, $520.72.

Flushing and Cleaning of Sewers and [illegible] Basins.—Detailed information is given [illegible] the flushing and cleaning of sewers and ca[illegible] basins. Practically all cities employed m[illegible] less flushing in connection with the op[illegible] of their sewer systems. Nearly all flu[illegible]ed a portion of their system by means of h[illegible] attached to fire hydrants, but 65 made use [illegible] tomatic flush tanks installed in their [illegible] and 14 had one or more portable flush [illegible] Many cities avoided practically all clea[illegible] sewers by means of continual flushing.

Nearly all cities did some cleaning [illegible] ers, but only 77 reported the gross [illegible] cleaned. Some cities reported absolu[illegible] cleaning of sewers. Many others report[illegible] that where stoppages occurred in the system [illegible] were dislodged by means of jointed ro[illegible] then the sections of the system where [illegible] stoppages had occurred were th[illegible] flushed. The cost of cleaning per m[illegible] sewer for those cities reporting the cost [illegible] from $2.25 for Salt Lake City to $406. for Chicago.

Volume of Sewage.—The volume of [illegible] reported for many cities was an estima[illegible] in some cities the estimate was based up[illegible] sewage pumped or purified, or upon thei[illegible] measurements. The average daily dis[illegible]rge of sewage per capita of the estimated p[illegible]ulation served by the system for all cities [illegible]ing reports was 164 gallons. Included i[illegible] that amount is a large volume of storm or [illegible] water, water from factories, and water u[illegible] flushing the sewers.

Each of the three following cities repo[illegible] daily contribution by factories of more [illegible] 20,000,000 gals.: Cleveland, 21,000,000 [illegible] Indianapolis, 37,500,000 gals.; Pat[illegible] 22,000,000 gals. Two-thirds of the tota[illegible] for Paterson was reported as being [illegible] from factories.

nsive of storm water and waste [illegible] s and basing computations [illegible] accurate estimates of sewage, [illegible] is arrived at that for many cities the [illegible] daily discharge of domestic [illegible] much, if any, in excess of 75 gals. This n is of interest principally in comparison with similar figures for [illegible] or which the average daily flow of [illegible] is about 25 gals. per capita [illegible] 34 gals. In the construction of [illegible] of sewers for the city of Edinburgh mbined estimate of sewage and rainfall [illegible] gals. per head per day. [illegible] ison it is apparent that there is a much se of water for domestic purposes in the United States than in those of itain.

[illegible] of the 158 cities of over [illegible] umped sewage. Of these, only 11 re- mpage of more than 50 per cent of sewage of the city.

[illegible] Sewage. Only 19 [illegible] e purification of any portion of their [illegible] only 8 purified [illegible]

[illegible] socket, 100 per cent.

[illegible] portion of the total were: New York, St. [illegible] Akron, Altoona, Pawtucket, Canton, Little [illegible]

Some of these cities used settling or septic tanks for a partial purification of the sewage before it flowed onto the sand filter beds. Of the 19 cities, 4 reported the use of 48 chemical precipitation tanks, 6 the use of 16 septic tanks and 5 the use of 14 settling tanks. Of the [illegible] 222 sand filter beds, 2 cities (Columbus, Ohio, and Reading, Pa.) the use of 6 sprinkling beds and Auburn, N. Y., the use of 4 contact beds.

The cost per million gallons of sewage treated on the sand filter beds varied from $1.71 for Altoona, Pa., to $119.74 for Pawtucket, R. I.

The per cent of suspended solids removed [illegible] sand filter beds varied from 60 per cent for New Britain, Conn., to 100 per cent for Worcester, Mass. The percentage of suspended solids removed reported for other cities is [illegible] Pawtucket, 85; and Woonsocket, 88. These percentages are much larger than those reported for Columbus, Ohio, 18, and Reading, Pa., 50, by means of sprinkling filter beds.

Several other cities than the 19 here reported are planning for the purification of all of their sewage within the near future. Among these are Waterbury, Conn., and Baltimore, Md., whose systems will be in operation within a short time. Auburn, N. Y., expects soon also to be purifying all its sewage.

RAINAGE AND IRRIGATION SECTION

mber Flume Simply Designed for asy Construction by Unintelligent Labor.

T flume illustrated in the accompanying is of interest because of the design Two flumes, over 800 ft. long and , and one 400 ft. long and 5x4 ft., uired to be built for the Santa Rita o., in Colombia, South America, and ve carpenters with peon helpers were All framing had, therefore, to be so that measuring and thinking unnecessary by the carpenters. The lected to meet the conditions and the od of constructing the flume are de- d in "Engineering and Mining Journal" r. R. D. O. Johnson. An abstract of Mr. on's article follows:

boards were all 1½ ins. thick and 12½ ng, making the flume boxes average 12 length. The bottom of each box of the er flume was made up of one 12-in. and two 10-in. boards, each side of two boards and one 8-in. board making nine s for each box. The number and di- ions of the boards varied in a few in- es to accommodate narrower boards were more convenient and economical t. Since it cost as much to edge and to e a 6-in. board as it did a 12-in. board, se of narrower boards was not frequently

boards were sawed by hand, the sawyers ing in pairs. The sawyers were at first t day's pay, but it soon became evident the lumber would cost $40 per M. It s pays to put the peon on contract where ble. As the peon knows nothing of the urement of lumber by the board-foot and as it appeared a hopeless task to ex- it to him another method had to be de- . The work of the best pair of sawyers taken as a guide and a schedule of prices worked out for each size of board or r needed. These prices were calculated cost of $18 per M, the prices being a l amount higher for the thin and narrow ds and a small amount less for the large ds and timbers. This scale of prices was mpanied by simple specifications as to the of timber acceptable, full dimensions, edges, worm holes, rotten spots, etc.

ntracts were given to each pair of saw- for a limited number of boards and tim- on the basis of the specifications and schedule. Each sawyer was charged 25 gold per day for his board, the cost to company being somewhat below this e. It was found desirable to give small racts rather than large ones. Boards inspected each day and a record of the work of each pair of sawyers kept. Failure to keep to the specifications was met with the penalty of severe docking. The prices were found in practice to be about right as, on the contracts, the better sawyers could make about 50 per cent more than the ruling day's pay for sawyers, and the poorer ones were either eliminated or had to be content with less than the ruling rate.

In searching for bunches of good trees, so that the cost in time and labor in handling the logs would be less, the sawyers would sometimes go to great distances from the sites of the flumes, making the cost of collecting boards excessive.

To obviate this difficulty a price of from 1 to 3 cts. a board, depending upon the size, was added to the contract price and the sawyers were required to deliver their boards at the flume site. All boards were brought to dimensions and edged at a price of 5 cts. per board. The boards were not tongued and grooved, reliance for the tightness of the flumes being placed on careful edging. As the boards were finished they were marked and distributed along the lines of the flumes. As the woods were full of small and fairly straight trees, it was determined to make the frames out of the round timber without even going to the trouble and expense of taking off the bark. The accompanying cross-section of the flume shows the frame, the parts of which are of much more ample diameter than the working stresses would ordinarily require, but the timber was plentiful and the large diameters made up for the mark and the weakening due to the cutting out of crooks and bends. Miter boxes were used to cut the sills, caps, posts and braces to reduce the cutting to mere mechanical operations.

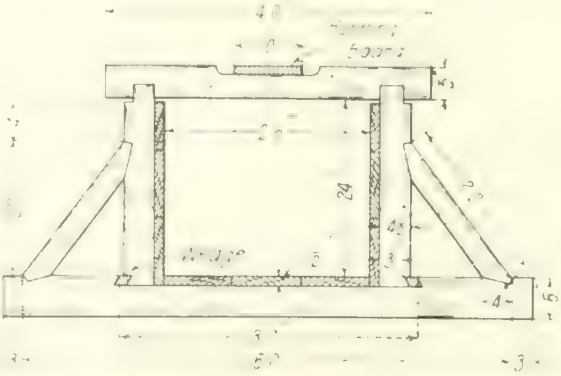


Fig. 1—Cross-Section of Timber Flume Built by Columbian Native Labor.

The sills, caps and braces were cut on contract, sills 6 cts., caps 3 cts. and braces 1 ct. each. The cutting of the posts required the combined labor of three carpenters and was not given out on contract. The wedges were made from 1½-in. hardwood boards, 10 ins. wide, and sawed into 12-in. lengths. These short sections were inserted in the wedge miter box, welded tightly, and sawed. Each 12-in. section makes four wedges, two rights and two lefts. For the total number of wedges the labor of one carpenter for six days was required.

As the sills were completed they were laid out upon the shelf excavated to receive the flume, lined up carefully, spaced and given the proper inclination on the curves. When all the boards had been sized and edged and all parts of the frames formed up and distributed along the line of the flume, four native carpenters and four helpers (peons) laid the flume at the rate of 120 ft. per day. The process was as follows:

The ends of the boards of a box were carefully fitted to the end of the preceding box already laid, the lower side boards were then spiked to the outer bottom boards; the bottom as a whole was then carefully adjusted to the centers of the sills, the posts set up and the wedges started. The center bottom board was then spiked to the sills, the lower side boards spiked to the posts, the caps placed and spiked and the wedges driven up hard. The outer bottom boards were then spiked to the sills and the braces driven into their recesses in the sills and posts and spiked. The posts were not spiked to the sills, so that the wedges could be driven up later if it appeared desirable to do so. The necessary sequence of the operations involved in laying the flume was carefully explained to the carpenters and, with a little practice, they acquired the "swing" [illegible] work thereafter moved off at a sati- [illegible] rate. Little calking of the flume was found necessary. Although ½x3-in. battens were provided, few were used. Exclusive of the work of excavating the shelf and on the two trestles on the line, the cost of the smaller of the two flumes was 45 cts. per running foot.

A Diagram for Converting Square Feet Into Acres in Irrigation and Drainage Work.

The accompanying diagram was devised and extensively used by Mr. H. P. Strough, Civil Engineer, San Mateo, Cal., while in the service of the Sacramento Valley Irrigation Co. Briefly the diagram is a combined table and scale for converting square feet of area into acres. It is used for example as follows:

PROBLEM.

Convert 2,164,230 sq. ft. into acres. In the table the nearest number to 2,164,230 is 2,134,440, which equals 49 acres. The remainder (2,164,230 — 2,134,440) is 29,790, opposite 29,800 in lower scale read .684 acres. Adding (49 + .684) we get 49.684 acres.

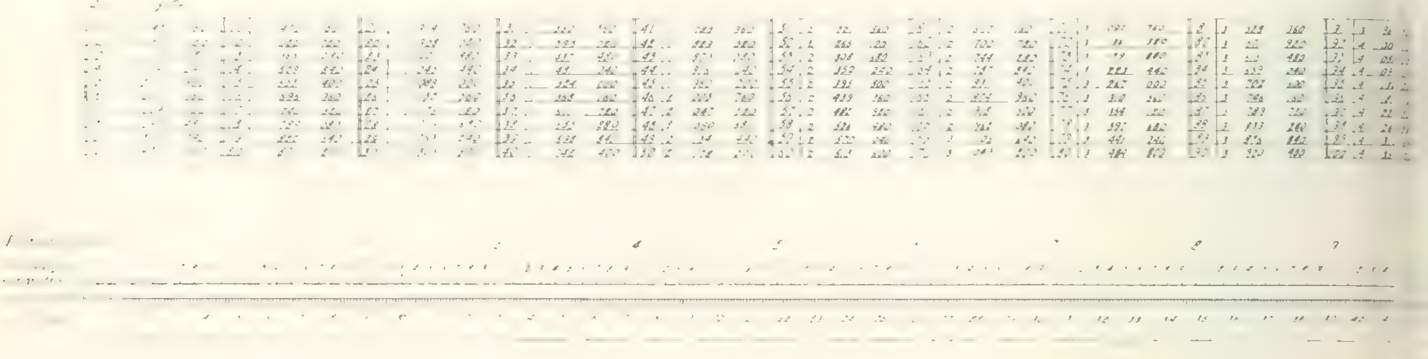


Diagram for Converting Square Feet Into Acres.

Any area from zero up may be converted by this table and scale and the result will be accurate up to the third place of decimals.

Longitudinal Expansion in Timber Flumes.

Several timber flumes constructed in 1910 in the Boise Basin, Idaho, have shown marked longitudinal expansions. The causes of this expansion and its remedy are discussed by Mr. Godfrey Spirling in a paper before the American Metallurgical Society from which we abstract as follows:

The flumes were built for the Centerville Mining & Milling Co., by contractors who had erected many similar structures in these placer-mining districts and it is particularly interesting that those built by the Centerville Co. were the first recalled wherein the expansion in a direction parallel to the grain was so marked as to be measurable and productive of such large stresses as to be more or less directly traceable to the failure of the higher portion of a long flume.

Experiments by the Forest Service at its various timber-testing stations indicate that the shrinkage of wood in a direction parallel to the grain is very small, and seems to be considered negligible. F. Roth writes: (Timber Forestry, Bull. No. 10) "Since only an insignificant longitudinal shrinkage takes place (being commonly less than 0.1 in. per 100), the change in volume in drying is about equal to the sum of the radial and tangential shrinkage." That the shrinkage was appreciable in certain species of western soft woods has been brought to the writer's attention at various times by timber constructors. The cases referred to here, however, are the most marked, and measurable expansion, rather than shrinkage was manifested.

A smaller straight flume 800 ft. in length showed an expansion of 0.75 ft., as measured from the movement of the mud sills at both ends, to which the last length of flume boards were spiked. This gives 0.083 per cent expansion.

The timber for the flume box was logged and sawed during the months of July and August, 1910, from mature western yellow pine, and piled with drying strips in the sun. The timber selected was reasonably free from knots and sap-wood and contained little pitch wood. The flume was built about Sept. 1; rains occurred in October and heavy snow fall, thawing and freezing, drying and soaking alternated during the winter until water was turned into the flume April 1. The expansion was measured after water had been in the flume one week and did not change appreciably thereafter.

The boards in the flume box were laid while dry, longitudinally, fitting tightly, end to end, and it can be assumed that the measured expansion very nearly represents that due to soaking and resoaking from air-seasoned condition to the saturation point. Had there been no opposing force to the free expansion of the timber, the measured expansion would represent the sum of expansion due to soaking and the thermal expansion. The latter at an average daily variation of the atmospheric temperature of 30° F. would amount to about 0.1 ft. in 800 ft. of pine timber. Since the daily variation of temperature of the flume timber was about the same as that of the water which was nearly constant through the day, the thermal expansion can be neglected.

One of the forces opposing the free expansion of the flume was the resistance of the mud sills at either end set in firm soil about 2 ft. below the surface of the ground, with a retaining power of about 2 tons per square foot; this would create a compressive stress in the flume box of about 75 lbs. per square inch. Another opposing force was the resistance to longitudinal movement offered by the flume bents. These were built of square, sawed timbers, set on sills without anchors and without longitudinal diagonal bracing. On these bents the flume box was spiked. After expansion, these bents, near the ends of the flume, leaned toward the flume ends visibly. These bents offered perhaps less resistance to the expansion than that offered by the mud sills at either end. The total force generated by the expanding wood it is impossible to ascertain closely. It was certainly greater than the sum of these two opposing forces and continued to increase up to the saturation point. If we affect an analogy between the compressive stresses generated in a block of wood with its ends held fixed, and tending to expand, due to added moisture, to a block of wood under compression, we can assume that the attempted deformation due to moisture is proportional to unit stress generated. Taking 1,060,000 as the elastic modulas (Tremann, "Effect of Moisture on Wood," Forestry Bull. No. 70) for resoaked pine wood,

$$\frac{S}{0.00083} = 1{,}060{,}000. \quad S = 870 \text{ lbs. per square}$$

inch, this would represent the maximum unit compressive stress due to resoaking to the saturation point.

The main flume, 4,700 ft. long, was built during September, 1910, of similar material to the small flume. It was also subjected to the same exposure and water was turned in at the same time.

The movement of the mud sills at either end of this flume did not appear more marked than that of the shorter flume. B[illegible] partly in curves, the compressive fo[illegible] in flume box due to soaking had the effect [illegible] lifting the inner posts of bents on curves [illegible] actually did lift these posts from th[illegible] curves of the lower part of the flu[illegible] as high as 36 ft. were observed in that [illegible] dition carrying the entire load on [illegible] posts of the bents.

The dead load per bent of 16 ft. calculate[illegible] from weights taken from dimensio[illegible] of th[illegible] flume was 3,600 lbs. and the live l[illegible]d of [illegible] second feet, the capacity of the flu[illegible] with cross-sectional area of 2.67 sq. ft. [illegible] 2,66[illegible] lbs. per 16 ft. bent. The total dea[illegible] and liv[illegible] load was 6,265 lbs.

The distance from center of ben[illegible] to foo[illegible] of post for a 36-ft. bent was 8.5 ft. Then b[illegible] resolution let P equal the radial fo[illegible] actin[illegible] at each bent at the flume box le[illegible]. P=

$$\frac{6{,}265 \times 8.5}{36} = 1{,}480 \text{ lbs. sufficient t[illegible]}$$

ner post of a 36-ft. bent.

The radius of the curve at this [illegible] 425 ft., the central angle for a 16-ft. [illegible] 2° 10′, tangential deflection was 1° [illegible] fore, the compressive stress in the f[illegible] necessary to create this force [illegible]

$$\frac{P}{\text{Cos. } 1^\circ\ 5'} = \frac{1{,}480 \text{ lbs}}{.0184} = 78{,}200 \text{ lbs.}$$

The cross sectional area of the flume b[illegible] is 80 sq. ins., giving a unit compress[illegible] stre[illegible] of 980 lbs. per square inch, or 110 per cent [illegible] the unit stress arrived at in the smal[illegible] flum[illegible] and is, therefore, in close agreeme[illegible] ther[illegible] with. The actual stress in the flume box, a[illegible] lowing for resistance caused by th[illegible] ben[illegible] which had no longitudinal diagonal bracin[illegible] either, did not likely exceed 1,100 lbs. p[illegible] square inch. Some buckling, but no[illegible] was observed in the flume box of eit[illegible]r [illegible] or small flume.

The relatively small expansion not[illegible] at t[illegible] ends of this long flume is accounte[illegible] for [illegible] being thrown into the curves. It app[illegible]rs her[illegible] that the stresses generated by expan[illegible]g tim[illegible] ber, due to moisture, approxima[illegible] tho[illegible] created in timber under compression[illegible]

These flumes were built for plac[illegible] minin[illegible] purposes where the comparatively s[illegible]rt li[illegible] required and the lower first cost wi[illegible]h [illegible] maintenance was an economy and [illegible] justified the type of construction use[illegible] [illegible] these features were obtained, criticis[illegible] [illegible] be made of the details of framing [illegible] instance, no longitudinal diagonal bra[illegible]g wa[illegible] employed—only longitudinal ties an[illegible] s[illegible] from bent to bent were used. In t[illegible] (apparently an oversight) they wer[illegible] di[illegible] tinued at one bent joint near the en[illegible] o[illegible] highest part of the flume. It was at [illegible] where the outer post buckled in the re[illegible] of the missing strut and all the joints [illegible] level bucked and failed in the same [illegible] wrecking about 800 ft. of flume fr[illegible] 95 ft. high. The upper joints of be[illegible] flume box, dropped vertically and wer[illegible] from 6 to 8 ft. into the ground.

It appears then that the wrecking of [illegible] flume was caused primarily by the e[illegible] of the wood box due to soaking. T[illegible]

…rces possible from that source wer… and failure occurred at the weak point … design. This experience shows that … provision for expansion of timber … be made where expansion parallel with …

[illegible] to engineers; nothing definite having come to the [illegible]

In rebuilding the wrecked flume, an expansion joint allowing 6 ins. of longitudinal movement was used at the ends of curves, also a space of ½ in. was left between the ends of boards in the flume boxes.

TEAM AND ELECTRIC RAILWAY SECTION

of Locomotive Repairs, Renewals and Depreciation.

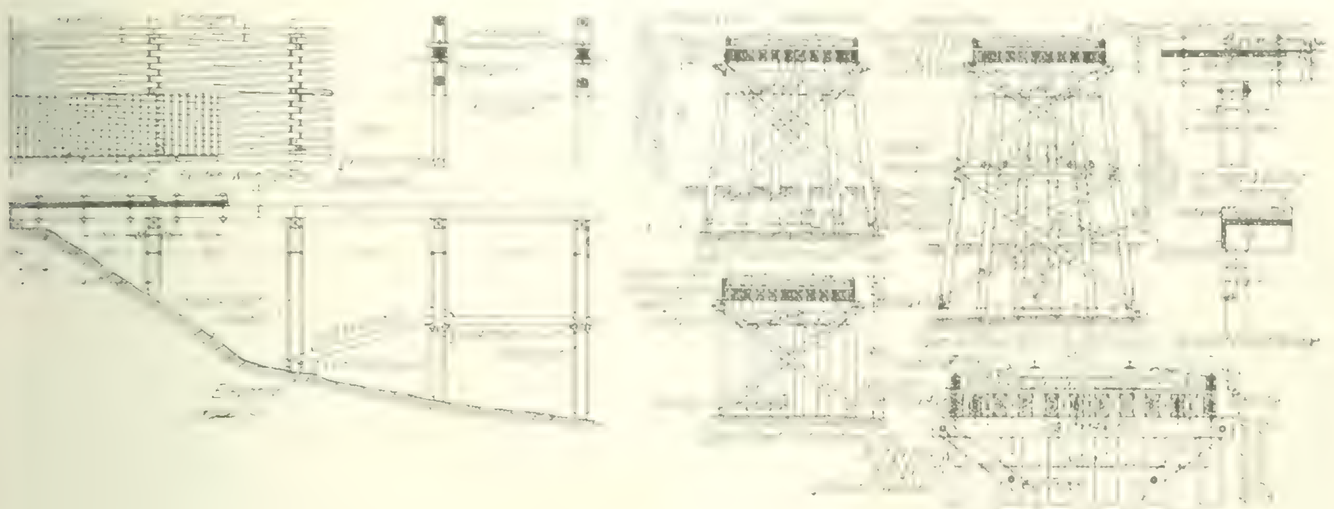
…menting the article and table in our … March 20, 1912, giving the costs of … freight cars per car mile, we pub… with the costs of locomotive repairs … wals and depreciation. The table … extended from one published in the … and Engineering Review," which … the totals for the various items. … in the table here computed the unit … ie figures, except the totals, are cal… slide rule and are accurate to with… of 1 cent per mile run.

…—SHOWING COST PER MILE RUN … LOCOMOTIVE REPAIRS, RENEWALS … DEPRECIATION ON [illegible] RAILROADS … 1.

	Total miles run.	Repairs per mile Cents.	Renewals per mile Cents.	Depreciation per mile Cents.	Total.
& S. F..	47,060,848	13.44	.01	1.50	14.95
L..ne	20,[illegible]	6.44	.01	.60	7.11
Ohio..	63,708,403	9.03	.07	.96	10.06
[illegible]	31,870,282	6.78	.07	.99	[illegible]
of N.J.	12,643,323	8.64	.02	1.67	10.33
[illegible]	19,[illegible]	9.39	.04	.70	10.13
& Alton..	[illegible],327,555	11.32	.00	.34	11.66
N. W....	[illegible]2,418,503	7.08	.02	.57	7.67
& Q....	48,079,561	7.10	.43	2.68	10.21
& St. P..	45,961,742	7.14	.00	.43	[illegible]
I. & P....	41,972,762	9.47		.08	9.55
& W...	[illegible],019,521	7.66	.01	1.77	9.44
	[illegible],833,271	10.07	.04	.83	10.94
	28,098,160	9.40	.00	2.61	12.01
..l....	[illegible]	10.61	.01	.79	11.31
ral..	[illegible],150,061	5.78	.03	.50	9.31
	[illegible],249,785	8.78	.02	1.15	9.95
St. L....	[illegible],264,219	8.89	.32	.42	[illegible]
& H. R.	[illegible],540,204	7.47	1.13		[illegible]
N.H. & H.	30,[illegible]	7.91	.02	[illegible]	8.10
West.	23,323,395	8.26	.01	1.52	7.79
	30,180,346	7.51	.01	2.65	10.17
ania .	[illegible],207,231	11.09		[illegible]	12.06
& Read..	25,462,073	10.48	.75		11.23
& S. F..	[illegible],425,651	9.50	.04	.10	[illegible]
	40,112,861	11.43	.54		11.97
	42,141,667	8.53	.05	.86	9.44
L. & W.	[illegible]2,830,808	8.93	...	.32	9.25
Pacific...	22,564,917	12.17	.01		12.18
ash	21,770,774	9.52		.64	10.16

Standard Ballasted Deck Wooden Trestle of the Chicago, Rock Island & Pacific Railway.

The Chicago, Rock Island & Pacific Railway uses a ballasted deck wooden trestle which is similar to those used by other roads, but has features peculiar to itself. The trestle is illustrated in the accompanying drawings. The two outside stringers are laid to butt together on the caps, but the other nine stringers are laid so that they do not butt together at the center of the cap; instead they are laid so that the ends are side by side and bear on the full width of the cap. This arrangement throws the stringers out of parallel with the center line of the track, but has the advantage of securing greater bearing surface and of making it unnecessary to cut the timbers to exact lengths. The bridge is designed for Coopers E-55 loading. The dead load is carried by eleven stringers and the live load by nine stringers. This maximum load on each bent is 36,800 lbs. dead load and 150,000 lbs. live load, or a total of 186,800 lbs. The stringers are covered with 3x12-in. plank laid transversely. As the timbers are all creosoted, [illegible] to slick endways and to overcome this the plank covering is spiked to those stringers. The bents are spaced 15 ft. on centers so that the full length of a 16 ft. stringer can be utilized and have full bearing on each 12-in. cap. For bents 15 ft. in height and less the piles are set vertically, but for all bridges higher than 15 ft. battered piles are used. The spacing of the piles is given in the table below for heights of trestle between 16 and 30 ft. The letters *a*, *b* and *c* refer to those on the drawing.



Standard Ballasted Wooden Deck Trestle, C., R. I. & P. Ry.

TABLE I.—SPACING OF PILES AT GROUND LINE.

Height of trestle. Ft.	Dist. a. Ft.	Ins.	Dist. b. Ft.	Ins.	Dist. c. Ft.	Ins.
16	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE II.—BILL OF MATERIAL FOR ONE PILE BENT. PILES NOT INCLUDED.

Base of rail to ground.	Caps, 12"x14"x16' No. req'd.	Sash and Sway Braces. 16'	18'	[illegible]	[illegible]	24'	26'	Timber, ft. B.M. Total.	Wrought Iron ¾" ϕ Bolts.—No. required			¾"x2' Drift bolts	Cast-iron St. C. I. Wash. Pat. R-923 No. req'd	Total weight W.-I. in lbs.	Total weight C.-I. in lbs.
6' or less	1							[illegible]						18	
[illegible]								[illegible]		12		6	[illegible]	51	18
[illegible]								[illegible]		[illegible]		6	[illegible]	51	18
9								[illegible]		12		6	24	51	18
10	1							[illegible]		12		6	24	51	18
11								314		12		6	24	51	18
[illegible]	1							314		12		6	24	[illegible]	18
13								[illegible]		12		6	24	51	18
14								324		12		6	24	51	18
15								324		12		6	[illegible]	[illegible]	18
16								334		12		6	24	51	18
17								334		12		6	24	51	18
18								334		12		6	24	51	18
19								344		12		6	24	[illegible]	18
[illegible]								[illegible]		12		6	24	51	18
21								354		12		[illegible]	[illegible]		18
22								[illegible]	6	18		6	60	101	45
[illegible]								514	[illegible]	18	[illegible]	[illegible]	60	101	45
24								[illegible]	6	18	[illegible]	[illegible]	60	101	[illegible]
25								524	[illegible]	18	[illegible]	[illegible]	60	101	[illegible]
[illegible]								524	[illegible]	18	[illegible]	[illegible]	[illegible]	101	45
[illegible]								524	6	18	[illegible]	[illegible]	60	101	45
[illegible]								534	6	18	[illegible]	[illegible]	60	101	45
29								534	6	[illegible]	[illegible]	6	60	101	45
30	1							534	6	[illegible]	[illegible]	6	60	101	45

All piles, caps, stringers, floor planks and guard rails are creosoted. When this is done in the field all timbers are framed before treatment, it being the intention to have no cutting of timber done after treatment, except boring holes, sawing off piles and cutting outside stringers to required length. Whenever cutting is necessary the new surface is coated with heavy coal tar creosote, heated to a liquid condition and applied while hot. After the piles have been cut off to required height the tops are coated with coal tar creosote in the same way. Piles which project beyond the edge of the cap are not chamferred. When holes are bored in treated timber these are filled with coal tar creosote before the bolts are put in. Unused holes are filled with creosoted plugs, and track spikes used during erection only are pulled and the hole remaining is filled with a creosoted plug the full depth of the hole.

Bills of material for this trestle a in Tables II and III.

TABLE III.—BILL OF MATERIAL FOR DECK.
(Does not include track material.)

	Timber						Wrought Iron								
No. of spans	Total length		No. of stringers [illegible]	Guard rail No. of pieces, 6"x8"x16'	Planking,* No. of pieces, 3"x10"x14'	Total No. ft. B.M. required	Bolts [illegible]	Fill [illegible]	Drift bolt, [illegible]	[illegible] steel wire spikes	[illegible] steel wire spikes	Cast iron, [illegible] Washers [illegible]	Total weight wrought iron in lbs.	Total weight cast [illegible]	Total weight [illegible] in lbs.
1	16'	0"	11	2	20	2,706	6	6	6	[illegible]	164	12	63		
2	31'	2"	22	4	38	5,342	12	12	12	8	324	24	126		
3	46'	2"	33	6	56	7,978	18	18	18	16	484	36	189		
4	61'	2"	44	8	74	10,614	24	24	24	21	644	48	252		
[illegible]	76'	2"		10	92	13,250	30	30	30	32	804	60	315		
For each additional span add	15'	2"	11	2	18	2,636	6	6	6	8	160	12	63		

BRIDGES AND BUILDINGS SECTIO

Deduction of a Formula for the Most Economic Span of Timber Trestles.

In our issue of Jan. 4, 1911, we gave a deduction of a formula for finding the most economic span for a series of steel bridge spans resting on piers. We shall now give a similar deduction for timber trestle spans.

The calculation for timber trestle spans differs mainly from that for steel spans in that the masonry piers for steel spans have a much longer life than that of the steel spans, whereas the bents of a trestle usually have a life that is the same as that of the stringers or beams. The economic effect of a life of masonry piers that is longer than the life of the supported steel spans is fully discussed in our issue of Jan. 4, 1911, and need not be repeated here. In the same article it was shown that the cost of the floor system does not enter as a factor in the problem of most economic steel span. Similarly, of course, the cost of the "deck" of a railway trestle or the cost of the floor plank of a highway trestle does not enter the problem before us.

Let

C = total cost (in dollars) of beams or stringers in a span.

c = cost of beams per lin. ft. of trestle.

K = total cost of a bent.

k = cost of bents per lin. ft. of trestle.

y = combined cost of beams and bents per lin. ft. of trestle.

W = total safe load (dead and live) in lbs. at center of a span.

F = constant for any given kind of timber = 70 for southern yellow pine.

b = aggregate breadth, in inches, of beams in a span.

d = depth of beam, in inches.

L = length of span, in feet.

M = number of 1,000 ft. B. M. of beams in a span.

p = price (in place) per M. of timber in beams, in dollars.

$$(1)\quad C = p\,M$$

$$(2)\quad c = \frac{p\,M}{L}.$$

$$(3)\quad k = \frac{K}{L}$$

$$(4)\quad y = c + k = \frac{p\,M}{L} + \frac{K}{L}$$

$$(5)\quad W = \frac{F\,b\,d^2}{L}.$$ (See theoretical mechanics).

$$(6)\quad b\,d = \frac{W\,L}{F\,d}.$$

$$(7)\quad M = \frac{b\,d\,L}{12{,}000}.$$

$$(8)\quad b\,d = \frac{12{,}000\,M}{L}$$

Combining (6) and (8)

$$(9)\quad \frac{W\,L}{F\,d} = \frac{12{,}000\,M}{L}$$

$$(10)\quad M = \frac{W\,L^2}{12{,}000\,F\,d}.$$

Substituting in (4).

$$(11)\quad y = \frac{p\,W\,L}{12{,}000\,F\,d} + \frac{K}{L}.$$

To solve for a minimum unit cost (y), differentiate and place the first differential coefficient equal to zero.

$$(12)\quad d\,y = \frac{p\,W\,d\,L}{12{,}000\,F\,d} - \frac{K\,d\,L}{L}.$$

$$(13)\quad \frac{d\,y}{d\,L} = \frac{p\,W}{12{,}000\,F\,d} - \frac{K}{L^2} = 0.$$

$$(14)\quad K = \frac{p\,W\,L^2}{12{,}000\,F\,d}.$$

Substituting value of M (see eq. 10) in eq. (14).

$$(15)\quad K = p\,M.$$

But by eq. (1), $p\,M = C$, hence

$$(16)\quad K = C.$$

Hence the most economic trestle span is secured when the cost of a single bent equals the cost of all the beams or stringers in a single span.

To arrive at a formula that will give the length of the most economic span directly, solve for L in e. (14). Then:

$$(17)\quad L^2 = \frac{12{,}000\,K\,F\,d}{p\,W}$$

$$(18)\quad L = \sqrt{\frac{12{,}000\,K\,F\,d}{p\,W}} = 110\sqrt{\frac{K\,F\,d}{p\,W}}$$

nearly. Equation (18) is the desired formula by which to determine the most economic span for a timber trestle.

It will be observed that the first step in solving for L in eq. (18) is the determination of the cost (K) of a bent. It will also be noted that K is assumed not to be affected by the length of the spans between bents, which is essentially true in all ordinary railway and wagon trestles, for the posts are commonly made of some standard cross-section (as 12x12 ins.) regardless of the height of the bents, and so large a factor of safety is used for the posts that the number of posts in a bent is not altered by ordinary changes in the spacing of the bents; that is, in the span of the beams. If, however, change is made in the amount of timber in the bents because of increased live load per bent due to longer spans, then (as shown in our issue of Jan. 4, 1911), although there is an increase of material in the posts per bent, there is no in the total material of all the post whole trestle. In other words, chang amount of material in posts of a ben ing from increased spans cause no ch the material in all the posts per li bridge; hence we must confine our a in solving for K, to such costs of a remain unaffected by changes in sp bents.

For any given type of trestle and the cost per bent (K) is mainly a fur the height of the bent and the price o in place. Hence the economic span approximately as the square root height of average bent in the trestle. a point that is seldom given enough eration by designers of trestles.

The ordinary limitations as to com length (L) and depths (d) of timbe do not permit any great refinement in for the most economic span in trestl on the Pacific coast, where very l large timbers are available at low cos designers can use eq. (18) to great ad The writer has seen any number o road and railway trestles on the Paci that were uneconomically designed, ap because "standard designs" worked eastern conditions had been adopted. way trestles with bents spaced 16 ft. a far from being economic in a countr timbers 30 ft. long are available and yet a 16 ft. spacing of bents is often wagon road trestles, merely becaus "standard." Standard designs are savers when standard conditions e otherwise standard designs are fr causes of great waste of money.

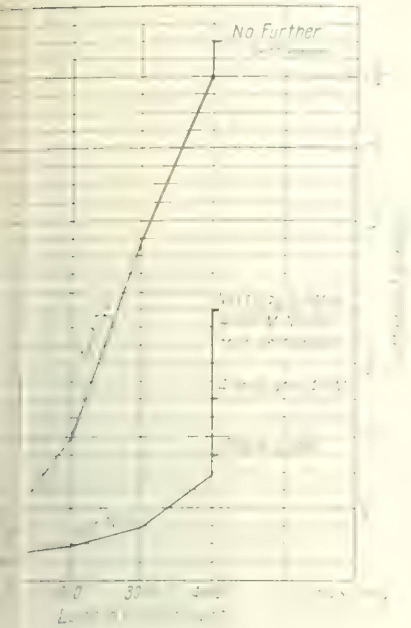
Equation (18) makes it evident tha the spacing of bents is decided u average height of bents should be det It also shows that the unit price (p) o is an important factor when the unit timber in the beams exceeds that in t as often happens where very long be required.

The safe center load (W) should o include the load of the beams and d this is readily allowed for by reme that a uniformly distributed load is effect to half as great a center loa beam.

Equation (18) contains the elemen depth of beam; d is usually made as possible, having regard to commercial timber and the effect of d upon the u of timber (p). In any given market t tion of p to d (the depth) and L (the of beams can be determined and expr the form of an equation, so that the p thus determined can be substitute (18), thus permitting a direct solutio problem without resorting to the method of successive approximations.

ult of Tests of Bearing Power of Mist Blue Clay Underlying Chicago.

ther careful bearing tests [illegible] le recently on site of the Federal in Chicago. The results of these



m Showing Results of Tests of ng Power of Moist Blue Clay.

given a discussion by Mr. Edwin a meeting of the Western Society

nings were made in the concrete he basement building, about 8 ft. the soil excavated for a depth of ure a bearing on the original clay never been disturbed.

[illegible] ks 2 ft. long. These planks were laid together so as to give a bearing of 4 This grillage was built up about a foot [illegible] upon which the load of pig iron was placed.

The settlement was taken by means of a wye level and rod. Readings were taken as soon as each load was put on and then again after giving an hour for settlement. If no further settlement had occurred a larger load was placed upon the plank. If the settlement had increased readings were taken until they showed that the settlement had ceased.

The elevation above city datum of the street opposite this test was 14 ft. and the elevation of the clay upon which the test was made was 0. The lateral distance between the tests was 150 ft.

The results of the tests are given by the accompanying diagram.

Tests to Ascertain the Transverse Strength of Nailed Joints.

Tests to ascertain the transverse holding power in pine lumber of 9-in. spikes and in particular to find the permissible loads on a nailed joint to be used at the lower corner of a corncrib flume, were recently made at the laboratories of the University of Toronto. As the type of joint illustrated is of common occurrence in timberwork these tests have a wider interest than the work which was of immediate concern. We, therefore, abstract the results from an article in "Applied Science" by J. H. Thornley:

These characteristics of any timber joint which are of great importance are:

(1) Relation of elastic limit to ultimate load.

(2) Extreme permanent deflection possible without lessening of ultimate strength. This point is of prime importance, since, owing to the inequalities in size of commercial lumber, more particularly in unplaned material and to unavoidable inaccuracies in work fabricated by carpenters, joints are often called upon to undergo very considerable deflections before the theoretical distribution of loads occurs.

(3) Effect of moisture and frost. The present test would have no bearing upon this point.

Method of Test.—The specimen was made by nailing together three pieces of 4x8 in., 4x10 in., 3½x8 in., or various combinations of these sizes, as shown in Fig. 2. Figure 3 shows the nailing used for the most of the tests.

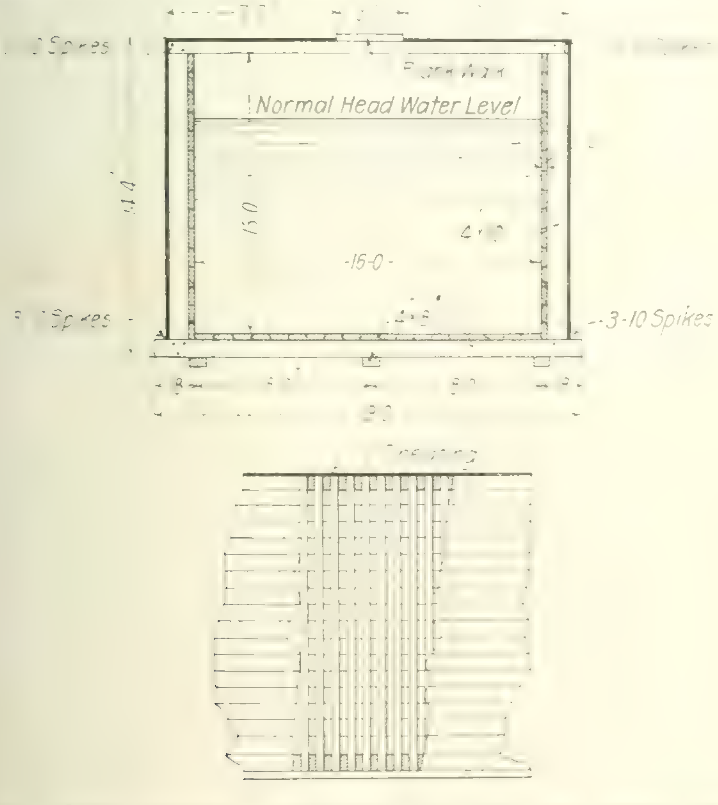


Fig. 1—Sketch Showing Construction of Flume with Nailed Joints.

Figure 1 shows the nailed joint used in the flume. Referring to Fig. 2 a ½-in. steel plate was used to distribute the load applied to the end of the vertical 4x8 in. piece. The load was applied by a universal head of the ball [illegible] are shown and a wedge-shaped piece of steel

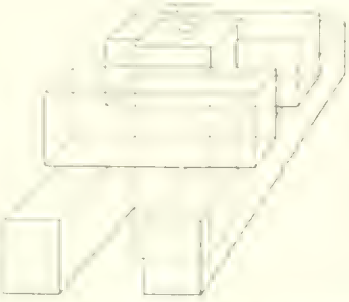


Fig. 2—Sketch Showing Method of Testing Nailed Joints.

was attached to the upper or moveable-head of a 100-ton testing machine.

Notes on Results of Experiment.—To design a well proportioned joint it was necessary first to ascertain the laws governing the holding power of a 9-in. spike in cases where the failure took place by drawing of the spikes, that is, to find the value of one spike, and second to find the limiting number of spikes which would develop their full load (that is, would not cause failure by splitting) in a joint made up of 4x8-in. pieces. The 8-in. dimension was fixed by the load on the side of the flume under consideration. Table I gives the results in detail.

Specimens Nos. 1, 2, and 3 were made with 4x10-in. used as cross pieces (failure by cracking would occur in the cross pieces if at all) and with two, three and four nails per piece respectively. In every case the failure of the joint took place in the nails, and since the results were quite uniform (1580, 1590, 1570 average per nail respectively) it may reasonably be concluded that the values would hold for 9-in. spikes in pine regardless of the dimensions of the timbers.

In experiments Nos. 4 and 5 the number of nails was as before, but the timbers were reduced from 4x10-in. to 3½x8-in. Failure occurred at a much lower value per nail than with the 4x10-in., which would suggest a failure of the timbers, this was in agreement with the observations.

In experiments Nos. 6 and 7 the nailing was as before, but the timbers were of an intermediate size 4x8-in. Failure occurred at about the same average load per nail as in experiments Nos. 1, 2 and 3, but while in No. 6 failure occurred by breaking of the timbers, in No. 7 the failure was due to bending and drawing of the nails. The proportioning of nails to timber was, therefore, about correct.

Omitting experiment No. 8 and averaging the values of a 9-in. spike as found in the remaining four experiments where failure took place by drawing of the spikes and using [illegible]

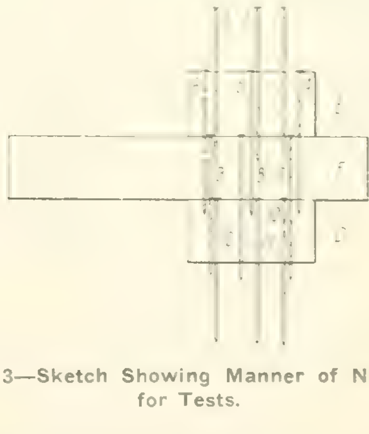


Fig. 3—Sketch Showing Manner of Nailing for Tests.

TABLE I.—RESULTS OF TESTS FOR STRENGTH OF NAILED JOINTS

DESCRIPTION OF SPECIMEN												
Number	CONSTRUCTION See Fig.	METHOD OF NAILING See Fig.	REMARKS ON LUMBER USED	Load in pounds at which first signs of failure were noted	Load in pounds at ultimate failure	Number of 100% effective nails equivalent to nailing as used. Equation Ult. L. grip 1-3 length	Number of 100% effective nails equivalent to holding as used. Equation Ult. L. grip 1-3 length constant	Observed average ultimate load in pounds per 9 in. spike 100% effective grip. Equation L. 1-3 length	Observed average ultimate load in pounds per 9 in. spike 100% effective grip. Equation Ult. L. = 1-3 length constant	Calculated ultimate load per 9 in. spike 100% effective. Equation. Ult. L. = 3 Cd².	Calculated load elastic limit in pounds. Equation El. L. Cd² x No. nails. No consideration taken length grip.	REMARKS
1.—D. & E.: 4 in. x 10 in. F: 4 in. x 8 in.		8 NAILS 2 to each piece of specimen.	Pine rough. Fairly dry. Material fair.	[illegible]	[illegible]	5⅓	[illegible]	[illegible]	1,580	1,540	6,160	The values of the joint values as governed by
2.—D. & E.: 4 in. x 10 in. F: 4 in. x 8 in.		12 NAILS 3 to each piece of specimen.	Pine rough. Fairly dry. Good condition.	14,000	15,960	[illegible]	10	1,990	1,590	1,540	9,240	The values obtained values of the joint as by the nails for in failure resulted from ing and bending of th
3.—D. & E.: 4 in. x 10 in. F: 4 in. x 8 in.		16 NAILS 4 to each piece of specimen.	Pine rough. Fairly dry. Good condition.	19,000	21,000	10⅔	[illegible]	[illegible]	1,570	1,540	12,320	The values observed values of the joint as by the nails, for in failure took place b ing and bending of th
4.—D. E. & F.: 4 in. x 8 in.		12 NAILS 3 to each piece of specimen.	Pine planed. Fairly dry. Fair condition.	12,000	[illegible]	10	12⅔	1,600	1,320	1,540	9,240	The values obtained values of the joint as by the wood, for in failure resulted from ing of the nails of the tered "E" in Fig. 3
5.—D. E. & F.: 4 in. x 8 in.		8 NAILS 2 to each piece of specimen.	Pine planed. Fairly dry. Weather cracked.	[illegible]	11,570	6⅔	[illegible]	1,750	1,440	1,540	6,160	Failure as in No. 4.
6.—D. E. & F.: 4 in. x 8 in.		12 NAILS 3 to each piece of specimen.	Pine rough. Fairly dry. Fair condition.	14,400	16,350	[illegible]	10	[illegible]	1,630	1,540	9,240	The values obtained values of the joint as by the wood, for in failure resulted from ing of the nails of the tered "E" in Fig. 3.
7.—D. E. & F.: 4 in. x 8 in.		12 NAILS 3 to each piece of specimen.	Pine rough. Fairly dry. Fair condition.	— —	16,000	[illegible]	10	2,000	1,600	1,540	9,240	The values of the join values as governed by since in this case failu ed from the drawin nails, therefore 1,60 the holding power of th
8.—D. E. & F.: 4 in. x 8 in.		9 NAILS 3 nails with 1 in. hold omitted.	Pine rough. Fairly dry. Extra good material.	13,000	16,500	7	[illegible]	2,360	2,060	1,540	6,930	The results from this as will be noted, show agreement with the ot retical values or with served values of the en specimens. This is in part at least, a re extra good lumber us included as showing a limiting maximum valu nails.

NOTE:—Observations of Elastic Limit Load were entirely unsatisfactory, since the specimens showed large permanent deflections the first 25% or less of the load, but even when the specimen had been stressed almost to the point of failure with corresponding deflect an inch or more the load could be released and again brought about above the previous high point without causing any material increase or tion beyond that which had resulted from the first loading.

grip in inches
———— const., we get 1,570 as ul
⅓ total length
timate load value in shear of 9-in. spike in pine, as against a theoretical value of 1,540 lbs. The greatest divergence of a single experiment from the average was 60 lbs.

Conclusions.—(1) The accepted permissible deflection value of 1-16 in., that is, deflection which can be caused without weakening the joint, is altogether too small. Joints tested to deflections of an inch and more seemed to be in no way weakened. This is a very strong point in favor of the nailed timber joint.

(2) No satisfactory results were obtained regarding the relation of elastic limit to ultimate load. The percentage relation of elastic limit to ultimate load would depend on the definition assumed of elastic limit, but for practical purposes there can be no doubt that it is at least 50 per cent.

(3) The relation stated between the strength of a joint and the number of nails used, that is, that strength of joint is proportional to number of nails and entirely independent of arrangement of nails where failure does not occur by cracking of the timbers, was entirely borne out by the experimental results. Various arrangements of the nails were tried, the nails of almost every specimen being differently spaced, but as will be noted, no material difference in holding power resulted.

Steam Shovel Record.—At the Chino Copper Co., Santa Rita, N. M., during the month of January, 1912, a model 91 Marion Steam Shovel equipped with a 3½ yd. dipper loaded 101,547 cu. yds. of material, says the Mining and Scientific Press, in 59 shifts. Of this material, 88,172 cu. yds. were rock and 13,375 cu. yds. were earth.

The work for the shovel was complicated, as part of the material was waste and part of it was ore, some of the ore having to be sent to the ore dumps over a haul of 4,500 ft., having a total of 225° curvature with adverse grades up to 4.3 per cent, while the other portions of the ore had to be loaded in 50-ton ore cars for the mill. Out of a possible 590 hours, the shovel was actually loading 505.56 hours, or at the rate of 200.8 cu. yds. per loading hour. The conditions were not especially favorable for work during the month. The shovel was served by two trains only, and was somewhat handicapped through having only 12-yd. cars instead of 18-yd. cars. The shovel crews and the train crews, however, took the dee terest in the work and used their h the best advantage to prevent any The actual cost for labor and supp this shovel for January was 12.84 cubic yard for stripping, and 9.33 ton for loading ore.

New Swiss Railway Tunnel.— of the Swiss railways passing fr to Olten there is a tunnel 8,187 ft. in known as the Hanentein tunnel. proposed to shorten the distance line 369 ft. at the cost of an entire tunnel 26,098 ft. in length. The however, will be but 56 ft. pe whereas the grade on the old li ft. per mile, and the summit of t tunnel will be 361 ft. lower than th mit of the present tunnel.

Rapid Caisson Sinking.—At the phone Building in New York City a of 35 ft. 4¼ ins. x 38 ft. 2 ins. was sunk by the pneumatic process. Its reinforced concrete and was sunk t below the level of the street in thr a half days. The contractors a O'Rourke Engineering & Constructi

NEWS SECTION

itorial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

[illegible]
Roads, Streets and Pavements.

Doings the eek.

A number of good sized railroad construction jobs have come up for letting since our last issue. Chief of these is the work of improving the alignment and double tracking from Aber- S. Dak., for the Chicago, Mil- St. Paul Ry. Bids on this work were April 12, but at this writing the con- not been let. Another good job probably come up shortly is the sion of the Carolina, Clinchfield & from Dante, Va., to Elkhorn City, extension runs through a rough will be an expensive proposition. Service Commission of New York calling for bids on another section dway-Lexington Ave. subway. This Lexington Ave. north 129th sses under the Harlem River by tun- will be 3,176 ft. long.

g the raliroad construction contracts are the following: A. Bennett Co., nt., subcontract from the Montana n & Irrigation Co., for grading for the Three Forks, Helena & Madi- R. R., and Allen & Rankin, Three t., subcontract for grading for 10½ bove railroad; Karner Bros. Co., Bldg., Dallas, Tex., for grading for le line of the new Southern Trac- Dallas; Holbrook, Cabot & Rollins eacon St., Boston, Mass., for con- new 10-mile line from Hinsdale, N. tleboro, Vt., for the Boston & Maine work including a bridge over the River and much heavy construc- B. Swift & Co., Chicago, Ill., for a erecting shop, 75-ft. transfer table foun- and extension to rod and wheel shop Virginia Ry. at Princeton, W. Va.; the Construction Co., Davenport, Ia., for nes of double track betterment work for icago, Milwaukee & St. Paul Ry. be- Cambridge and Huxley, Ia.; Bates, Bor- Ayer, Oakland, Cal., at $225,025, for the ion of the Geary St. municipal electric r the city of San Francisco; Keasil n Co., Tacoma, Wash., for the 3- ction from Old Town to Rushton of the Defiance line of the Northern Pacific; nard Engineering Co., New York City, pleting the removal of Tunnel Moun- Glen Okono, Pa., for the Central R. R. Jersey, also for removing a hill g a bridge for the Lehigh Valley R. R.; Oklahoma City, Okla., and Hillsboro, or grading from Waxahachie to Waco Southern Traction Co.'s line. The fol- have secured subcontracts from Win- Bros. Co. for work on the Chicago & western Ry. extension in Illinois: s & Murphy, Minneapolis, team work Peoria south; Fisher & McDonald, cu. yds., near Green Valley, Ill.; Conn uction Co., Boone, Ia., 120,000 cu. yds. work near Sweetwater, Ill.; Palmer & steam shovel work near Springfield; T. sser, 500,000 cu. yds. of steam shovel near Currin, Ill.

way construction continues to offer opportunities for contractors. The New State Highway Commissioners are open- s this week on a considerable amount of work, and the Pennsylvania Highway Commissioner is preparing to call for bids on some large contracts. The commissioners of St. Lucie county, Fla., have just awarded a $181,000 contract for the construction of hard surface roads, and the County Road Commission of Monroe county, Tenn., is calling for bids for grading about 160 miles of road in the county.

In the way of drainage work about the biggest job of the past week appears to be the one on which the directors of the Beaver Bayou Drainage District of Phillips county, Ark., are now taking bids. The work calls for the following floating dredge ditches: Johnson Bayou ditch, 307,000 cu. yds.; Lick Creek ditch, 539,000 cu. yds.; Beaver Bayou ditch, 675,000 cu. yds.; Hillside ditch, 85,000 cu. yds.

The Canadian Public Works Department is planning on making a beginning this year on the construction of the new Welland Canal, and has issued instructions for the preparation of detailed plans and specifications. The government has already provided $200,000 for beginning work, and it is reported that it is possible that bids may be asked in June. The total cost of the canal will be about $45,000,000 and probably $10,000,000 will be appropriated in next year's estimates. Another big job on which the Canadian government is now calling for bids calls for the construction of the new St. Lawrence drydock, which is to be located either at Quebec or Levis. Tenders close on July 2. The successful bidder will receive a 3½ per cent subsidy for 35 years on $5,000,000. The dimensions of the drydock will be 1,150 ft. long, 137 ft. wide and 37 ft. deep.

Arrangements are reported to have been completed with a syndicate of French and Belgian capitalists for building a $2,000,000 dry dock at Sault Ste. Marie, Ont.

Mining by Contract.

A system by which a satisfactory condition of relations between miners and mine owners has been maintained for over half a century is of interest. In the copper and tin mining district of Cornwall, England, there has not been a strike for over 50 years. With the exception of the company superintendents and clerks the entire labor in these mines is performed under contracts with groups of miners. These contracts are bid for at an open auction, which is held on the day the previous contracts expire. A few days before the auction is to be held the company superintendents examine the mine to determine what new operations shall be carried on under the new contracts, the term of which is usually two months. Each piece of work to be auctioned is specified in a book, and opposite each item is marked the rate which in the superintendent's estimate will be a fair remuneration for the work. The auction is held in the open air. One of the superintendents of the mine reads the rules and conditions on which the work is to be taken, which includes fines for neglect or idleness. Then he offers the different classes of work for sale. The first bid is always high, but they fall lower and lower until the competition ceases and the work is awarded to lowest bidder. This man gives his name to the superintendent and the names of the three or four men who are to work with him [illegible] are registered in the selling book and the transaction closed. In this way all of the work is auctioned off. Sometimes the men agree among themselves not to bid less than a certain sum for some piece of work. In such case the low bidder is not given the work, but instead he is allowed the first option of taking it at the superintendent's price. If he declines, all the other bidders have the option of taking it, and if none takes it the superintendents must reset their price. By this system trivial contentions are avoided and the price of labor adjusts itself to the satisfaction of the employers and the employes.

Sabotage.

A new and sinister term has been introduced in this country in labor wars. The Industrial Workers of the World, a new labor organization, which is now conducting a strike among the forces of the contractors on the Canadian Northern Ry. in British Columbia, according to [illegible] advocating sabotage, a form of industrial warfare propagated by the French syndicalists. In the British Columbia strike the leaders are said to be endeavoring to make clear to the idle men that a more successful campaign can be conducted in the construction camps and in the tunnels and cuts and on the dumps than outside in the strike camps. They explain that the costly machinery of the contractors is fully in the hands of the workers and that it is the easiest thing in the world to see that some important bolts disappear mysteriously, that some nuts rattle off and the machinery be allowed to shake itself to pieces. It is easy to have a stove upset some night in a camp and the camp go up in smoke; it is easy to have a blast go off at the wrong time and in the wrong place; rock slides and caveins can be caused with a little ingenuity, and the blame can be traced to no one. Meanwhile the men will be back at work, drawing their regular pay, but the bosses, harassed by repeated accidents and goaded to despair by the resulting delay, will be forced to grant the demands of the men. This then is sabotage, the practice of which would make men stoop to any crime, even murder, to gain their ends.

Commission Rule at Des Moines.

Advocates of the partisan and spoils idea of city government will find some satisfaction in the results of the recent election in Des Moines, Ia. This city for a number of years has been operated under the most advanced commission plan. At the last election the old line politicians made a vigorous and systematic campaign, and as a result, of the five commissioners now in office, only two are of the right sort. Two are spoilsmen and the third is a machine man. When the voters place commission government in the hands of politicians the administration is likely to be even worse than under the ordinary form of city government. The commission plan offers the opportunity for non-partisan, economical and efficient municipal administration. If the citizens do not take advantage of the opportunity, it is their fault, not the fault of the plan.

PERSONAL

Mr. John Criswell, inspector for the highway department at Harrisburg, Pa., has resigned.

Mr. Walter Nickol has been made assistant city engineer and sealer of weights and measure for the city of Marinette, Wis.

Mr. Albert P. Haines has been appointed roads engineer in charge of the construction of roads for the city of Fort Worth, Tex.

Mr. Wm. Watson McIntire, a member of the sewerage commission of the city of Baltimore, Md., died suddenly at Baltimore at the age of 62 years.

Mr. Douglas P. LeFevre has been appointed county road engineer of Cumberland county. Mr. James P. Gaffney has been appointed city engineer of Cumberland, Md.

Mr. H. M. Waite has been appointed city engineer of Cincinnati, O., succeeding Mr. H. F. Shipley, who has entered private practice. Mr. Waite was formerly superintendent of the Sea Board Air Line Ry. at Birmingham, Ala.

Mr. N. P. Turner has resigned as chief engineer of the Cuba R. R. to enter the practice of general engineering and exploration work in the West Indies and Central and South America. His offices are at Hotel Camaguey, Camaguey, Cuba.

Mr. H. P. Hayes has been appointed as road engineer for the county of Tarrant, Tex. He will plan a system of roads and supervise their construction. Mr. Hayes has been connected with the city engineering department at Dallas for several years.

Mr. Wm. M. Dunlap, who has been acting as City Engineer of Bristol, Va., has been made City Engineer and will also serve as purchasing agent and building inspector. Work will soon be commenced under his direction on an extension of the sewer system.

Mr. Wm. Sullivan, former street commissioner of Youngstown, O., has resigned as superintendent for the contractor, John Grady, on the construction of the East Youngstown sewer system. He is contemplating, it is reported, entering into the business of contracting.

Mr. J. G. Schillinger, engineer of maintenance of way of the Cleveland-Indianapolis division of the Big Four R. R., has been appointed chief engineer of the Rutland R. R. Mr. Paul Hamilton, former engineer of the Cincinnati division, has succeeded Mr. J. G. Schillinger as engineer of maintenance of way.

Mr. Chas. F. Grainger has been re-elected president of the Board of Water Works of Louisville, Ky., at the annual meeting of the water company. Mr. Theodore A. Leisen has been appointed chief engineer and superintendent of the water company of Louisville and Mr. C. M. Duke assistant chief engineer.

Mr. A. S. More, engineer of the Cairo division of the Big Four, has been transferred to the Cincinnati division. Mr. W. C. Kegler, engineer of the Michigan division, succeeds Mr. More, and Mr. C. W. Cochran, former assistant engineer on the Cleveland division, has been appointed engineer of maintenance of way for the Michigan division. These appointments are now in effect.

Mr. James R. Maxwell, a noted civil engineer of Newark, N. J., died on April 7 at his home at the age of 67 years. He retired from actual work about ten years ago. He had been a contributor to engineering magazines. Mr. Maxwell was at one time engaged on the construction of the Peruvian Central R. R., which runs from Callao to Oroya, crossing the Andes at an elevation of 15,665 ft., the highest altitude reached by any standard gage railroad in the world. He was also engaged on the construction of a number of western railroads in the United States.

Mr. John A. Bensel, state engineer of New York, on March 25 delivered an illustrated lecture on "The Construction and Maintenance of the State Roads of New York" before the graduate students in high engineering at Columbia University.

Mr. John F. Hammond, M. Am. Soc. C. E., for six years past connected with Hammond & Sloane, Inc., of New York City, has resigned as president and director of that company and, having purchased the company's water works, sewer and pavement plant, will continue the business along these lines. His offices are at 123 Oak St., Richmond Hill, Queen's County, New York City.

Mr. S. A. Freshney, general manager Board of Public Works, Grand Rapids, Mich., has resigned and his resignation will take effect on May 1, although Mr. Freshney has agreed to give part of his time to the city until the first of July. In accepting the resignation last week the committee paid Mr. Freshney a high tribute for his efficiency and faithful service. He is not ready at the present time to announce his future plans.

INDUSTRIAL

The Strauss Bascule Bridge Co. has moved its offices from 608 Monroe building, Chicago, to 104 S. Michigan Ave., Chicago.

The corporate name of the North American Metaline Co., manufacturers of oilless bearings for pulley blocks, wire rope sheeves, etc., etc., has been changed to the Metaline Co.

The H. Koppers Co. has succeeded to the business of H. Koppers of Joliet, Ill., manufacturer of by-product coke and gas ovens, and will shortly have general offices in the Mallers building, s. e. corner of Madison St. and Wabash Ave., Chicago, Ill.

T. F. Stroud & Co., manufacturers of contractors' supplies, Omaha, Neb., have already started to rebuild their plant, which was damaged by fire on April 5. The company is now prepared to make immediate shipments of elevating graders, dump wagons and repairs of all kinds.

Mr. Charles W. Denniston, formerly representing the products of the Mack Manufacturing Co., 2032 Land Title building, Philadelphia, Pa., in New York state, has terminated his connection with that company. The interests of the Mack Co. in New York state will be handled hereafter by Mr. E. H. Goodrich.

CATALOGUES

Universal Cement.—Paper, 6x9 ins., 16 pp. Universal Portland Cement Co., Chicago-Pittsburgh.

This is the monthly bulletin for February containing articles relative to concrete construction.

Paving and Roads.—Paper, 5½x8¾ ins., 16 pp. The Texas Co., 17 Battery Place, New York City.

This is the February bulletin of the company which is published in the interest of good roads, and contains useful illustrated articles regarding the use of Texico in road construction.

Pedestal Piles.—Paper, 7x9 ins., 16 pp. MacArthur Concrete Pile & Foundation Co., 11 Pine St., New York City.

This bulletin, entitled "Some Structures Supported by Pedestal Piles," is a supplement to the company's last book, "The Pedestal Pile," which was mentioned some time ago. The book contains illustrations and brief descriptions of construction work and buildings where these piles are placed.

All Metal Silo.—Paper, 6x9 ins., 32 H. W. Harry Mfg. Co., Kan Mo.

This catalog contains illustration scriptions of silos and culverts construction.

Gas Tractors.—Paper, 3½x6 ins., 12 Traction Company, Minneapol

This booklet contains reports done with the Big Four "30" trac gine during the season of 1911 with tions of the work.

American Steel Fence Posts.—Pap 3½x6 ins., 32 pp. The American Stee Wire Company, Chicago.

Illustrates and describes the ga anized steel fencing and posts and shows t methods of constructing fences with terial.

Gisholt Boring Mill.—Paper, 7½x 2 pp. Gisholt Machine Co., Wis.

This is a page for the loose le log of the Gisholt Company, whi trates and describes the Gisholt 36 ing mill.

Contractors' Plant.—Paper, 6½x9 pp. G. L. Steubner Iron Works St., Long Island City, N. Y.

This is price-list No. 555 and illustrations and descriptions of buckets, industrial railway eq screens, wheel barrows, etc. Ta sizes, capacities, etc., are given.

Wizard Rock Drills.—Paper, 6½x pp. McKiernan-Terry Drill Broadway, New York City.

This booklet illustrates and desc new cushion device for increasing t of the down stroke of the piston drills. This cushion device is also the company's steam pile hammers.

Locomotive Cranes.—Paper, 9x12¼ pp. Industrial Works, Bay Cit

This catalog illustrates and desc comotive cranes, orange peel and gra ets. Gives line drawings showing c diagrams for various sizes of loc cranes and gives illustrations show work upon which these machines ha engaged.

Traction Engines.—Paper, 11x9¼ pp. Port Huron Engine & T Co., Port Huron, Mich.

This is the 1912 catalog of th Port Huron line, which contains comple illustrations and descriptions of the trac engines and other machinery. Specif of single simple, single compou double compound traction engi given.

Electric Hoists.—Paper, 6x9 ins., 8 Brown Hoisting Machinery Co. land, Ohio.

This catalog illustrates and d tramrail systems, trolleys and hoists for industrial plants and f struction service. The illustrations drawings show the details of cons and cover a number of installations plete prices are given.

Barco Pipe Joints.—Paper, 5½x8 pp. Barco Brass & Joint Co., 230 ferson St., Chicago, Ill.

This catalog contains complete tions and descriptions of Barco joints, which consist of three metall and two non-metallic gaskets surrou universal ball joint. Illustratio shown of the joints in use and lin ings and price lists are given.

Hauling Machinery.—Paper, 8½x11 The Avery Company, Peoria, Il

This is the new 1912 catalog of ing and hauling machinery. Contai trations and descriptions of the types of traction engines manufact the Avery Company. Reports from ers of Avery single steam engines average of 1,137 lbs. of coal for work. A new gas tractor and ga trucks are also described.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

nderstood that the receiver recently d for the Missouri & North Arkan- will ask the court to authorize an receiver's certificates for the purpose g some needed improvements and ing ew equipment.

California.

Barland & Ayer, Oakland, Cal., have rded the contract at $225,925 for the n of the Geary St. municipal rail- m Kearney St. to 5th Ave., for the of an Franciso. The work calls for tear- old cable road and laying roadbed lectric railway for a distance of 27,000 The rails and track supplies will be by the city.

erside-Redlands Interurban Ry. Co., recently with a capital stock of $2.- which $50,000 is paid in, proposes te electric railway lines in Riverside, s. San Jacinto and Hemet. The direc- the new corporation are William S. and Maurice Salzman of Los Ange- E. Dinsmore. Charles E. Johnson Smith of Riverside. Peloubet and are among the principal stockholders thern California Utilities Co., which led its articles of incorporation, and es appear as well as incorporators of any recently organized to build an railway between San Diego and Riv-

Cutting, Richmond, Cal., has ap- the County Supervisors for the sale of a franchise for an electric rail- ough the town of Pullman and along rtion of Cutting boulevard lying out- ity limits of Richmond. It is un- d that the franchise is being sought for R. R. is being sought, which is plan- extend its Berkeley suburban lines Richmond.

). Goode, Glendale, Cal., has been a franchise for an electric railway lendale to Griffith Park. The line will ut two miles long and construction probably be started at once.

Woods, Leesville, Cal., has placed an t work on the construction of the Co- arysville branch of the Northern Elec-

Arnold, Martinez, Calif., an engineer, rted to have asked the Board of Super- and Trustees of the town for a fran- o construct a steam railroad along the roads and streets of the town from yton Chemical Works to Muir Station ambra Valley connecting at Peyton with uthern Pacific and at Muir with the Fe, making a belt line for the big manu- ing plants and for the proposed Asso- Oil refinery near the city.

City Trustees, Sacramento, Calif., have an ordinance granting the Western a 20-year franchise to construct a between P. and Q. Sts. on the Sacra- River. The cost of the improvement imated at about $30,000. W. J. Calvin, mento, Calif., is Division Engineer.

Colorado.

Chamber of Commerce, Denver, Colo., ppointed a committee of twelve to join an Juan Congress in an effort to induce enver & Rio Grande Railroad to broad- its tracks from Denver into the San Country in the southwestern part of the

Georgia.

e McRae, Jacksonville & Northern Ry., cting a line from Jacksonville to McRae, iles, and from McRae to Dublin, 40 miles, ompleted surveys and has secured $50,000 nstruction capital. Time for awarding ruction contracts has not been decided. The first section to be built will be from Jacksonville to McRae. Max L. McRae, McRae, Ga., is president, and W. J. Clarke, Helena, Ga., is chief engineer.

Ap[illegible] for the Atlanta & Macon Ry. Co., which proposes the construction of an interurban line between Atlanta and Macon, via Jonesboro, Griffin and Forsyth. It is stated that construction work will be started shortly. Among those interested in this project are: Kenneth [illegible], of Chicago, Ill.; [illegible], of New York; W. G. Sheehan, of Chicago, Ill.; S. Bullard, of Chicago, Ill.; H. N. Randolph, of Atlanta, Ga.; Hugh M. Scott, of Atlanta, Ga.; Robert S. Parker, of Atlanta, Ga.; Howard R. Stewart, of New York; W. J. Massee, President the Central Georgia Power Co., of Macon, Ga.; S. Grantland, of Griffin, Ga., and W. G. Kincaid, of Griffin, Ga.

Illinois.

⊙Advices from Peoria, Ill., state that crews are being organized by W. O. Newell and E. L. Green of the Hoy & Elzy Construction Co., St. Paul, Minn., which has a subcontract from Winston Bros. for building the section of the Northwestern's Peoria-Girard line, from Kickapoo River to Pekin Bend across the bottoms, east of Bartonville and South Bartonville. They already have crew No. 1 encamped near the Acme plant and expect to work five different crews on the job, or about eighty men. The work will be done with steam shovels and dredges, and they expect to finish it during the present summer.

It is rumored that the Michigan Central has under consideration the construction of a line connecting with the Chicago & Northwestern and the Burlington at Aurora. As proposed the new line will be built from Rockdale, a suburb of Joliet, Ill., to Aurora. The work, it is said, will also include the construction of a 20-stall round house at Joliet.

The Tri City Ry. Co., Davenport, Ia., is understood to be planning the expenditure of about $100,000 this year for improvements at East Moline. These are said to include the laying of double tracks on 3d Ave., from 1st to 7th St., and on 7th St., from 3d to 1st Ave.; laying of a stub track in State St. to provide car service for employes of the factories north of the railroad tracks, and the installation of a large motor generator to furnish power for the street car line.

The Illinois Central Electric Ry. Co., L. W. Martin, President, Canton, Ill., is considering extending its Canton-St. David line to Lewistown.

E. E. Headley & Son have completed their work on Illinois Southern R. R. at Salem, Ill., and are moving their outfit to Centralia, Ill., where they will begin work on the Illinois Central Yards.

The Rochelle, Oregon & DeKalb Electric Ry. Co. has been incorporated with a capital stock of $2,500, and principal office at Chicago, and proposes to construct and operate a railway from Rochelle, Ill., to Freeport and Oregon, Ill. The incorporators and first board of directors are John W. Bissell, Maurice E. Burr, Charles Aaron, Earl R. Burton and Robert J. Scott, all of Chicago, Ill.

The Chicago & Interurban Ry. Co. has been formed to take over the electric lines in the Pullman and Whiting districts of Chicago and adjoining territory. The intention is ultimately to combine these properties into a new interurban system for the development of the territory which these lines serve. The board of directors includes Ira L. Cobe, Samuel Insull of Chicago, F. M. Busby and C. M. Mattison.

The directors of the Chicago, Milwaukee & St. Paul Ry. Co. have authorized a new issue of 4½ per cent convertible debenture bonds, which will be offered to stockholders, both preferred and common at par, in the proportion of 15 per cent of their shareholdings. This will call for a total of $34,893,466 of the new debentures. The bonds can be converted into common stock at par at any time between June 1, 1917, and June 1, 1922. All of the money realized from the sale of the new debentures will be expended for improvements and equipment for the St. Paul's old line. A considerable amount of double track and branch mileage has already been contracted for.

Iowa.

It is said that the removal of the Chicago Rock Island & Pacific headquarters to Des Moines, Ia., involves the enlargement of the round house facilities.

H. O. Garst, Engineer, who made the survey of the proposed Cainsville-Trenton-Chillicothe R. R. from Cainsville to Trenton, Ia., and south, has started work at Chillicothe on the line north.

Kansas.

⊙Rights of way have been secured for the construction of the proposed railroad between Wichita, Kan., and Benkleman, Nebr., and the contract for grading let to the Pikeway Construction Co. E. W. Moses, Great Bend, Kan., is President of the railroad company.

Engineers are surveying for the construction of a spur from the Santa Fe line at the Western Salt Plant, Hutchinson, Kan., to the State Fair Grounds. F. C. Fox, Armarillo, Tex., is General Manager of the Western lines of the Santa Fe.

Louisiana.

Citizens of Shreveport, La., have voted to grant the local traction company a franchise to build an electric line to the Cedar Grove factory addition, three miles south of the city.

Advices from St. Martinville, La., state that at the recent election it was voted to levy a 5-mill tax for 10 years in favor of the New Iberia, Lafayette Northwestern R. R.

Maine.

The Portland Terminal Co., as previously noted in these columns, is planning some extensive improvement work at Portland. The company proposes to divert one of its main lines in the city of Portland for a distance of about 5½ miles and to build a large freight yard in the city. The cost of the two items will exceed $2,000,000. Theo. L. Dunn, Portland, Me., is chief engineer of the Portland Terminal Co.

Maryland.

✣Bids will be received until 11 a. m., April 17, by the Board of Awards, Baltimore, Md., for furnishing relaying rail with necessary splice bars for about 7,000 lin. ft. of single track. The weight of the rail is to be not less than 56 lbs. nor more than 70 lbs. Specifications may be obtained from Ezra B. Whitman, Water Engineer, City Hall, Baltimore, Md.

A report is current that the Pennsylvania R. R. has purchased the Chesapeake R. R., running from Washington to Chesapeake Beach, on the shore of the bay. It is said that the property had been taken over by the New York banking houses of F. J. Loseman & Co., and that the bankers are acting for the Pennsylvania R. R. in taking the property out of the hands of the Moffat estate. The purchase price is said to be $850,000. It has been known for some time that the Pennsylvania R. R. has had plans for building a line to Drum Point and it is possible that the Chesapeake line may be connected up at Upper Marlboro with the Pope's Creek branch and the extension south made from there.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Massachusetts.

The town of Norwell, Mass., has voted to buy land for right of way in order to secure an extension of the Hanover branch of the New York, New Haven & Hartford R. R. from Hanover station to Greenbush and the South Shore division.

Committee of the State Legislature has voted to report favorably the bill petitioned for by the New England Investment and Securities Co. which will allow the New York, New Haven & Hartford R. R. to acquire the street railway lines of southwestern Massachusetts. The New England Investment & Securities Co. is a voluntary association acting for the New Haven road and holding certain street railway companies in Massachusetts. The bill it fathers would authorize the New Haven road to acquire and consolidate directly or indirectly the Springfield street railway company and various lines running into Worcester, and through the authority of these companies to unite physically with the Berkshire Street Ry. Co., thus giving the New Haven road the control of all street railway lines in southwestern Massachusetts west of the eastern line of the city of Worcester. The Boston & Worcester line, therefore, is not included. The bill provides for a capital of not the Southern Pacific R. R., which is planmore than $20,000,000, of which $5,000,000 is to go for extensions of new lines along the Connecticut valley.

Michigan.

Engineers of the Port Huron & Northern Ry. are reported to have started on the preliminary work of the proposed line into the Thumb district of Michigan. It is necessary for the company to secure ten franchises. They already have seven of these and they predict little trouble in obtaining the remaining three, which are from the cities of Croswell and Sandusky and the township of Watertown. It is anticipated that these franchises will be acquired within a short time. The railway will in all probability be completed by November 1, to Lexington, and December 1, to Croswell. W. H. Goodson, Detroit, Mich., is Secretary of the Company.

It is reported that the Michigan Central Railroad Co. is planning the construction of a third track between Detroit, Mich., and Toledo, O., and also the construction of three new roundhouses. W. H. Sellew, Detroit, Mich., is Principal Assistant Engineer.

Minnesota.

It is anticipated that the Chicago, St. Paul, Minneapolis & Omaha Ry. will make heavy improvements and extensions in the Duluth, Minn., yards during the coming season. C. W. Johnson, St. Paul, Minn., is Chief Engineer of the road.

It is rumored at Deerwood, Minn., that F. J. Egan, Chief Engineer of the Cuyuna Northern Ry., is preparing plans for the construction of two branch lines from Deerwood, one to Ironton and the other along the south range to Brainerd and Barrows. Nothing definite is available as yet.

Duluth and the Iron Country.

BY PETER F. MEAGHER.

⊙The Winston-Dear Co., steam shovel contractor, has started its operations on its big steam shovel job at the Buffalo and Susquehannah Mine, Hibbing, Minn., and in a very short while will have five steam shovels in operation on this job. It has been reported that the company has been awarded an additional 1,000,000 cu. yds. It has already stripped about 5,500,000 cu. yds. on this work.

⊙Hugh Steele, who was awarded recently a $35,000 sewer contract by the city of Duluth, was a caller and stated that he had already started on this work and would complete the same as rapidly as possible.

⊙P. MacDonald and H. L. Bartlett, contractors, left for a trip to Canada, where they will bid on some work. Mr. Bartlett reports that he has been awarded a large sewer contract in Alberta, amounting to about $150,000.

Gill Haggart, president of the Haggart Construction Co. of St. Paul, Minn., was a visitor at this office last week. They have some sewer work in the city of St. Paul and are going to start on the same immediately. Mr. Haggart stated that the outlook for business in his line looked very bright for the coming season.

A. J. Perrin of Carl Hall & Co., railroad contractors, returned from a trip to Michigan, where they bid on some work, but they were not successful in getting it. They are in the market for some railroad work and can be addressed care of this office.

Guy Bergen, the new representative for the Taylor Iron and Steel Co., manufacturers of Tisco steel, spent a few days here with us recently. Mr. Bergen is going to make his headquarters in this territory and judging from the progress that he has already made, we have no doubt he will be successful.

W. F. Lawrence of the Pastoret-Lawrence Co., is at present in St. Paul making arrangements to start their sewer job that they have in that city. They intend to put a large force of men on this contract and complete same as soon as possible.

Edward Foley of Foley Brothers, contractors in St. Paul, was in the city this week and when talking to the writer stated that his firm had a great deal of work under way at the present time.

Business at the head of the lakes and vicinity is opening up rapidly, and the outlook for construction work for the coming season is looking better than ever. The stripping contractors at the iron mines are starting up their operations, and quite a few steam shovels have been started by the mining companies. Labor is fairly plentiful here now, but do not think that it will be so very long.

Missouri.

The Grand View Railroad Co. of St. Louis, successor to the Montesano & Southern Ry. Co., which proposed to build a line to Montesano, has been granted an additional franchise to run on Fanny Ave., Carondelet township, St. Louis county, thus giving the road connections with the southern terminus of the Broadway line and connections with the Bellefontaine. It is expected that by May 1 the Grand View Co. will have cars running as far as Continental, St. Louis county. George W. Baumhoff, St. Louis, Mo., is secretary of the new line.

The Kansas City, Clay County & St. Joseph Interurban Ry. (now under construction) has applied to the county court at Kansas City for permission to enter the city over what is known as the 11th St. extension—a piece of road 300 ft. in length, between the south city limits and the Burnes road. Construction work has been resumed on the interurban between St. Joseph and Kansas City. At last reports there were three grading gangs at work between St. Joseph and the Thomas Ashton place. One gang is grading the hill on 11th St. between Garfield Ave. and Lake Blvd. An 8-ft. cut, 30 ft. wide, is being made. A concrete bridge over the Sparta road, a half mile north of the Ashton place, is about finished. Material, including ties and rails, is being delivered and work is being pushed all along the line.

Surveys have been made for a proposed interurban line from Fillmore to Savannah, a distance of 14 miles. C. W. Spicer, Fillmore, Mo., is interested.

The receivers of the Kansas City, Mexico & Orient Ry. have completed an inspection trip of the property of the company in the United States. The engineers of the receivers are now preparing their report, upon which probably depends to a large extent the future arrangements for financing and completing the system. The report will be submitted to the reorganization committee, which is composed of a number of British and American financiers. The reorganization committee, it is reported, contemplates an issue of $30,000,000 in underlying bonds to retire the indebtedness of the road, end the receivership and build the road in its entirety. The bonds it is thought can be disposed of abroad. The reorganization committee probably will receive th from its experts within 30 days.

The North & South R. R. Associa., incorporated under the laws of Arizo, has been granted a license to do business Missouri. The main office in Missouri to at Hermann, Gasconade county. John Wilson is president and A. I. Beall secretary. These two officers and John Tonge, Fr Berkeley, R. E. Francis and E. Klein constitute the board of directors. The corporat was formed for the purpose of constructir a line of railroad from the Gulf of Mexico Canada, with branch lines to Omaha, Duh and other cities, the main line to be know as the Louisiana Purchase R. R.

St. Louis Items.

BY A. B. KOENIG.

✣The Board of Public Improveme has set April 26 as the date for receiving ds $184,999 worth of street improvemen work. The most important piece of downtow w provided for is the paving of Locus str with wood blocks between Fourth an teenth. The streets and estimated cos re follows: Asphalt—Osceola, between Br and Virginia, $25,328. Brick—John, Eleventh and Von Phul, $2,696; Ga between Pennsylvania and Minnesota, Grace, between Gravois and Fairview, Newhouse, between Blair and Nin $3,940; Shaw, between Tower Gro King's Highway, $33,897; Arsenal, fro L isiana to Grand, $9,354; Cherokee, California and Nebraska, $4,389; Mo tween 2d and Broadway, $4,040; Nort ket, between Broadway and 15th, Wood Blocks—Delmar, between Skin city limits, $8,312; Delmar, between Red and Skinker, $16,117; Locust, from 4th $16,410; Olive, from Channing to Grand

⊙The Walsh Construction Co., Dav Ia., secured six miles of double track ment work on the Chicago, Milwauke Paul Railroad between Cambridge an ley, Ia. This is a steam-shovel proposi

⊙J. W. McMurry Contracting Co., Bldg., Kansas City, Mo., were awar contract by the Government for putt 1,300 lin. ft. of revetment work on th souri River near Waverly, Mo. They buy a small tow boat to be used in towi and willow brush for this work.

⊙Contracts that call for the expendi $2,000,000 or more by the southern Gou have just been let to J. W. Thompson Louis. One of the contracts calls for t ing of the new 80-lb. steel on the main the International & Great Northern Fort Worth and Houston and another f lasting material between New Orlea Marshall, Texas. More than a million of gravel will be used in the work, and come from the Profit Island plant Thompson. In addition to this w Thompson is now building a station the Texas & Pacific at El Paso to cost another at Marshall to cost $50,000 a for the International & Great North Laredo to cost $60,000. He is also con ing a round house at Marshall at a c $40,000.

Costello Bros., Claypool Bldg., Indian Ind., have one nice piece of team work Wabash Railroad that they will sub quantities to suit outfits. Free transpo for outfits and labor.

Cameron, McManus & Joyce have star their big grading job in the west part city. They have some fine short haul work to let. Address them 6846 Clayton St. Louis, Mo. They also have 200,000 side borrow work to let near Mason Ci

O. T. Dunlap has 10,000 yds. of gradi street work to sublet at Edwardsville, Il

The J. A. Ware Construction Co. and & Riley have resumed work on the ne Louis, Columbia & Waterloo electric line Columbia, Ill.

The Board of Park Commissioners of Ea Louis, Ill., last week accepted from the of Local Improvements an ordinance f building of the "north boulevard," the fi

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ries boulevards and parks to be laid out ne residence part of the city. The will skirt the northern residence e city. It will be about two miles cost is estimated at approximately

man is going to be in charge of a stello Bros.' work on the Wabash Taylorville, Ill.

ias. Grant was the first contractor starting he new Wabash double track work in ois. Charley had his outfit on the job and ork three days after getting the contract.

ne Louis, Creve Coeur & Western Ry. which is to operate a line from the inter- on the Olive St. road and United Rail- Cs tracks in University City to Studt's Creve Coeur Lake, was granted a rsi ry franchise by the St. Louis County new company headed by persons ex- nce in electric lines, has taken the rights iginal company, whose stockholders e farmers living on the Olive St. old company, of which William F. Creve Coeur was the president, pro- first franchise in 1909. Pfister application for the new franchise st week. It is thought plans for the n of the new company will soon be

Lawrence is now chief engineer of Building Co. at Fort Worth, Texas.

as been quite a change in the labor in the past two weeks. Previous there was lots of labor, but the this class has been the greatest in St. Louis, caused by hurry up calls different cities to save them from Labor is very scarce here right now until some of these men that are flood protection and levee work

is Traction System is promoting a nect Quincy with its Bloomington- ch, it is said. It plans to build the ria via Macomb, Littleton, Rush- storia, Lewiston and Canton. The ial associations of the various cities assistance.

ting of the East St. Louis, Ill., Board Improvements last week, City Engineer arper was instructed to submit plans pifications for the improvement of 11th St. Clair Ave. to Lake Ave. A pub- ng on the improvement of Missouri s postponed because the East St. Louis urban Street Car Company, which is part of the expense, has not yet pro- franchise from the City Council to s in the avenue. The improvement of West Broadway and 1st, 2d and 3d discussed, but no definite plans were

sets of plans for the proposed new rks system at Anna for the State Hos- re presented to the State Board of tration at Springfield, Ill., on April 4 ey H. Maury of Peoria. The board sider the plans. One scheme, that rec- ed by Maury, calls for a reservoir sys- ated five miles from the hospital. It uilt at a cost of $104,305. The second ls for a series of wells and will entail $1[illegible]

Commissioner Edward E. Wall, before the St. Louis League of Elec- terest at the City Club, advocated the of a new St. Louis waterworks, and d its cost would approximate $20,- He said if economy were used in sumption of water throughout the city ight possibly the present waterworks would suffice for 10 or 15 years.

Wabash receivers have awarded con- or steel rails aggregating 36,000 tons, delivered between April and Septem- his will provide for relaying 70 miles n line and constructing 180 miles of track over various portions of the sys- specified in the report recently filed in eral Court. The new rails will be 90- the contracts are distributed as fol- Sixteen thousand tons to the Lacka- Steel Company of Buffalo, 5,000 tons to the Indiana Steel Works at Gary, and 15,000 tons to the Illinois Steel Company at Chicago. A dispatch from New York states that Bernard M. Baruch will succeed the late Edwin H[illegible] Committee of the Wabash. He is probably the largest holder, aside from the Gould estate, of Wabash first refunding and extension bonds.

Bert Lawrence, Engineer of the Walsh Con[illegible] the stand the Mayor of a town out west has taken for law enforcement. It seems that the ordinance of the town specified that no saloon should be nearer than 300 ft. from a church. In order to enforce the law the Mayor gave them three days to move the church.

Richard K. Papin of R. K. Papin & Co., with offices in the Pierce Bldg., is one of the hustling supply men we meet everywhere these days.

More than $1,000,000 will be spent by Alton, Ill., manufacturing companies in 1912, according to present plans, in making additions and improvements to their plants. The Illinois Glass Co., will spend $700,000; the Western Cartridge Co. will build a large addition; the milling companies, Beall Bros., shovel manufacturers, and the Alton Brick Co. are among the big institutions planning large expenditures.

A. C. Stansill, representing the Kilbourne & Jacobs Mfg. Co. of Columbus, O., came in and got acquainted; business good.

Joyce Bros. & Bagwell, Mason City, Ill., have a lot of side borrow work on the Northwestern extension near Springfield, Ill., to let. R. F. Haupt, their bookkeeper, informs us that they can use one machine outfit, also three 12 to 15 team outfits for wheeler work.

W. J. Harris, Centralia, Ill., wants a 15-team outfit for wheeler work.

L. E. Wooten, General Manager of the Wm. J. Oliver Mfg. Co. of Knoxville, Tenn., spent a few days here looking over the situation. Wooten reports business improving. He made several nice sales here.

Winston Bros. have let all of the team work on the Northwestern extension from Peoria south to Cravens & Murphy of Minneapolis.

Earl Cravens, of Cravens & Murphy, informs us that they have 150,000 yards of machine scraper work on the Northwestern Railroad near Athens, Ill., to sublet in quantities to suit outfits. They have opened an office in Athens, where Mr. Cravens will be pleased to show contractors over the work.

Fisher & McDonald got in on 175,000 yards of the Northwestern work near Green Valley, Ill.

Alex. McGavock is going to do 200,000 yards of team work on the Northwestern Railroad near Mason City, Ill.

The Conn Construction Co. of Boone, Ia., secured 120,000 yards of team work on the Northwestern Railway near Sweetwater, Ill.

Palmer & Young got in on a fine steam-shovel job on the Northwestern Railroad near Springfield, Ill.

T. L. Rosser has taken 500,000 yards of Winston Bros.' steam-shovel work on the Northwestern Railroad near Currin Ill.

W. E. Tench & Co., 3090 West Grand Boul., Detroit, Mich., have 25 miles of side work on the Wabash Railroad in Michigan to sublet at attractive prices. Free transportation for labor and outfits over the Wabash Railroad to and from work.

Montana.

⊙The Montana Construction & Irrigation Co., Three Forks, Mont., which has the contract for constructing the Three Forks, Helena & Madison Valley R. R., as noted in our April 3 issue, has sublet contracts to the following: A. B. Bennett Co., Toston, Mont.; Secs. 1 to 15 inclusive; Allen & Rankin, Three Forks, Mont., Secs. 16 to 23 inclusive, and a 2½ mile spur to the Keating Gold Mining Co.'s mines. The work will include 150,000 cu. yds. earth excavation, 50,000 cu. yds. rock excavation, 250,000 cu. yds. embankment, and 600 lin. ft. pile trestles. Allen & Keating will sublet 100,000 cu. yds. of fresno and machine work.

New Jersey.

The State Public Utility Commission has approved the application of the Trenton & Mercer County Traction Co., Trenton, N. J., for permission to issue $100,000 of bonds for improvement work.

New York.

✣Bids for the construction of Section 14 of the Broadway-Lexington avenue subway will be opened May 7 at noon by the Public Service Commission, Travis H. Whitney, secretary, 154 Nassau St., New York city. Section 14 lies in Lexington Ave. north of 129th St., Manhattan, and passes under the Harlem River by tunnels and through The Bronx to East 135th St. and Park Ave., where the line divides into two branches, the west branch continuing to and up Jerome Ave. to Woodlawn Road and the east branch continuing to 138th St., through that street, Southern Blvd. and Westchester Ave. to Pelham Bay Park. Section 14 ends just north of the point of division. The subway in this section will be a four track railroad which will pass under the Harlem River in four tubes, which may be either of steel or cast iron, contractors being permitted to bid upon each type. The section is 3,176 ft. long. When this contract shall have been let, all that part of the Lexington Ave. subway north of 53d St. up to 157th St. in The Bronx will be under construction, as well as most of the line south of 40th St. The section between 40th and 53d Sts., which will include the connection with the Grand Central Station of the New York Central & Hudson River R. R., as well as two or three sections in downtown Manhattan, still remain to be awarded. Plans for these sections are being revised and they will soon be put up for bidding.

The Black River Traction Co., Watertown, N. Y., has secured the necessary rails and will shortly begin work double tracking its line on State street at Watertown.

The State Public Service Commission has granted the applications of the New York Central & Hudson River R. R. Co. to buy the stock of the Rome, Watertown & Ogdensburg at $128 a share, plus dividends accrued to the date of the purchase, and also to buy 11,030 shares of the stock of the Utica & Black River at $180 a share, plus dividends accrued. The commission also authorized the Central to issue $16,429,000 of its 30-year 4 per cent debentures to make the purchases. The capital stock of the Rome, Watertown & Ogdensburg outstanding amounts to $1,000,000. The Central now will own the entire stock of the Utica & Black River, which amounts to 22,230 shares.

It is believed as a result of the refusal of the New York Public Service Commission to allow the transfer to the New York Central of the majority of the New-York, Ontario & Western stock, the New York, New Haven & Hartford R. R. Co., which controls the Ontario & Western, will carry out its plan as soon as possible of a northward extension of the New York, Westchester & Boston. The latter suburban line out of New York City will be opened early in May from the Bronx to New Rochelle and probably during the early summer to White Plains and its other terminals. The northward extension from White Plains will be to a point at or near Brewsters Station, N. Y., connecting with the Ontario & Western by way of the Poughkeepsie bridge system.

Important steps were taken during the week toward the carrying out of the dual plan of subway extension adopted by the Public Service Commission of New York city and approved by the transit committee of the Board of Estimate and Apportionment. Governor Dix signed the Wagner bill, amending the rapid transit act so as to permit the city authorities to enter into contracts with the Interborough Rapid Transit Co. and the Brooklyn Rapid Transit Co. for the equipment and operation of the proposed lines. Following this action by the governor, the commission instructed its counsel to prepare forms for the proposed contracts with these companies em-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

bodying the terms for construction, equipment and operation submitted by the companies in their respective propositions. After these forms are prepared, they will be submitted for discussion at a public hearing, after which they will be put in permanent form for approval by the commission and the Board of Estimate and Apportionment. These operating contracts will cover the Broadway-Lexington avenue subway in Manhattan and The Bronx, now under construction, the Brooklyn loop subway in Manhattan and the Fourth avenue subway in Brooklyn, which are nearly completed, the extension of the existing subway from Times square south through Seventh avenue and other streets to the Battery and thence by tunnel to Brooklyn, the proposed Broadway subway for the Brooklyn Rapid Transit Co. with a new tunnel to Brooklyn and the various branches of both systems in The Bronx, Brooklyn and Queens. Counsel was also directed to embody in such contracts provisions for the immediate operation of the Steinway tunnel connecting 42d street, Manhattan, with Long Island City, and for the immediate operation of other lines as soon as they are completed.

The governor having signed the bill carrying appropriation for the elimination of grade crossings, the Public Service Commission for the first district, 154 Nassau St., New York city, will have $350,000 available for this year as the state's contribution to such expense. Elimination work is paid for one-half by the railroad company, one-quarter by the city and one-quarter by the state, so that this appropriation will provide for work costing $1,400,000. There is now $2,000,000 worth of such work under way under orders previously issued by the commission and there are proceedings sufficiently advanced to allow immediate action upon the allotment of the new money. The bulk of it will be spent in the elimination of crossings on the Long Island R. R. in the borough of Queens. The total number of grade crossings, both public and private, within the city is 488, of which 205 are in Queens, 117 in Richmond, 103 in Manhattan, 58 in Brooklyn and 5 in The Bronx. The work already ordered will reduce this total by 48, of which 32 are in Queens, 10 in Brooklyn, 4 in The Bronx and 2 in Richmond. Between 30 and 40 more crossings will be covered by the elimination work to be ordered under this year's appropriation. The grade crossings in Manhattan are largely the streets crossing the New York Central R. R. down the west side of the city, and as the removal of these tracks from the surface has by law been made the subject of special negotiation between the company and the city, they are not included in grade crossing orders issued by the commission. Until the Public Service Commission began active prosecution of this work elimination of grade crossings in New York city lagged for many years. For ten years prior to 1907, the year in which the Public Service Commission was created, the state of New York made total appropriations for this purpose aggregating $1,475,000, but of the entire amount only $9,720 was expended in New York city. The commission has urged upon the legislature the need of forwarding this work and each year makes a formal request for an appropriation by the state. Its last request was for $1,000,000 for the year 1912, but only $350,000 was allowed.

North Carolina.

Plans are under way, it is said, for the construction of the branch of the Winston-Salem Southbound R. R. from the main line in Southside into Salem up Tar Branch to the new freight house to be erected at a point near the Salem Iron Works. E. B. Pleasants, Wilmington, N. C., is Chief Engineer of the company.

North Dakota.

Siems & Co., contractors on the Northern Pacific line to Stanton, N. Dak., have established a camp at a point near Fort Clark, N. Dak., and will resume work at once on the extension. It is hoped to have steel laid within 30 days.

Officials of the Northern Pacific hope to have tracklaying completed by July 1 on the branch line from Pingree to Wilton, N. Dak.

The Great Northern R. R., A. H. Hogeland, chief engineer, St. Paul, Minn., has placed parties in the field to locate the final route of the air line from New Richford to the Montana state line. It is understood that construction work is to begin at once. The new line will shorten the coast run about 75 miles and will be used for through passenger and mail trains exclusively.

Ohio.

An English syndicate represented by Leslie M. Shaw, New York City, is reported to have negotiations under way for the purchase of the Toledo, Port Clinton & Lakeside Electric R. R., which is now operating 46 miles of line.

It is reported that the Chesapeake & Ohio, which last year made a complete resurvey of its line from Cincinnati, O., to Chicago, will rebuild portions of the system and reballast the entire line.

The State Public Utilities Commission has authorized the Cincinnati, Hamilton & Dayton Ry., W. C. Loree, general manager, Cincinnati, O., to issue $1,559,000 of bonds for improvements. The bonds are to be pledged to the Baltimore & Ohio R. R., which is to advance the money. Of this amount $27,000 is to be spent at Dayton for yards and tracks, $117,000 at Toledo for yards and tracks, $112,000 for dock facilities at Rosford, $62,000 for completing double track between Hamilton and Dayton, $43,000 for changing grades at Swanders and $179,000 for constructing a bridge over the Scioto River.

The sale of the Detroit, Toledo & Iron Ry., which was to have been held April 9, has been postponed until October. It is understood that the postponement of the sale was made for the reason that there are several reorganization projects on foot and that it would not be advisable at this time to offer the road at public bidding. It is said that steps are being taken in New York City for the reorganization of the company upon a good working basis and that it was intended, if the deal is consummated, to improve the line and build a cut-off on the southern end by which the heavy grades and sharp curves would be eliminated.

Oklahoma.

The St. Louis, Bartlesville & Pacific Ry. Co. has made a proposition to the citizens of Buffalo, in Harper county, to extend the proposed line west from Alva to Buffalo for a bonus of $75,000, to be raised throughout Harper county. The company was chartered three years ago to build west from Joplin, Mo., across the northern boundary of Oklahoma, striking Miami, Bartlesville, Pawhuska, Ponca City, Pond Creek, Cherokee and Alva.

Representatives of the Texas Traction Co., Dallas, Tex., have been investigating conditions at Ardmore and also looking into the topography of the country with the view of a probable extension of the company's line into Ardmore. The extension, which the company is contemplating, will be from Sherman to Whitesboro, Gainesville and Ardmore. Another proposed route is from Sherman to Durant, Okla., thence west to Ardmore. It is also understood that the company will take steps looking to the damming of the Washita River and using the power thus obtained for motive purposes.

Oregon.

The following committee of Medford citizens has been appointed to investigate a proposition to build a railroad from Medford to the Blue Ledge Mine: Colonel Touvelle, J. D. Bell, Dr. J. F. Reddy, W. H. Gore and Mayor W. H. Canon.

The Errol Heights Ry. Co. has completed surveys and has secured the capital for a 1-mile street railway to be built on Knapp Ave. and E. 32d St., at Portland, Ore. C. W. Hodson, 269 Washington St., Portland, is president of the company.

Articles of incorporation were filed at Salem, Ore., recently by the Pine Timber Co., which proposes among other projects struction of two small railroads, rating from the Southern Pacific station a Rogue River, formerly Woodville, up bot Evans and Elk Creeks. The lines will fo w the Creek grades as nearly as possible. company is capitalized at $100,000 principal offices at Medford, Ore.

D. Lewis, Portland, Ore., who has e contract for the construction of the posed railway from the North Bank road White Salmon at the top of the bluff, is paring to start active work. The citizens White Salmon have subscribed $12,000 toward the work, which will cost about $50,000.

Pennsylvania.

⊙The Leonard Engineering Co., N York City, has been awarded a contract by e Central R. R. of New Jersey, for compl ng the removal of Tunnel mountain at Glen On The Leonard Co. has also been award a tract by the Lehigh Valley R. R. t en the long, high knoll opposite the Lehig V station at Glen Onoko, and to erect br across the Lehigh River there.

Prospects are encouraging for the ust tion of the projected Manatawany R. is a proposed 9-mile independent railw, f a junction with both the Reading an P sylvania Rys., at Douglassville, Berk C ty, Pa., to some rich iron ore depos trolled by the Bessemer Steel Ore o Berks County, northerly from the po tioned. A preliminary, but not fixed, ca of the line has been made, but actual ust tion is not likely to be undertaken unti ore has been blocked out to warrant i A Lehman, C. E., 506 Walnut St., Phil el Pa., is interested.

Applications for charters for the sh ton Traction Co. and the East Wa Traction Co. are to be made this mont T companies propose the construction ot railways in Washington county. Ch Caldwell, John W. Warrick, I. E. Pa Vowell and Frank McKinley, all of sh ton, are interested.

The Pittsburgh Rys. Co., 435 Six Pittsburgh, Pa., is considering exten g Allenport & Roscoe Street Ry., whic is extension of the Charleroi line, from to California this summer. This is a st of about three miles.

The Philadelphia & Garrettford St Upper Darby, Pa., has been granted n trance into Media by way of State St. h part of a route planned for the Phil el & West Chester Traction Co.'s Medi xtension, the western terminus of which w be at 69th and Market Sts., Philadelphia.

The authorities of Muhlenberg Co e Allentown, have requested of the offi s the Lehigh Valley Transit Co., Allent n extend its trolley line on Chew stree a mile, past the college grounds, in co with the paving of that thorough ar 17th St. to 23d St.

The Western Maryland Ry., H. R Pr chief engineer, Baltimore, Md., has co let resurveys for the extension of its ei yards at York, Pa.

The Pennsylvania R. R. is contempla g expenditure of about $6,500,000 for ch roadbeds and in the construction of ne ings in the vicinity of Pittsburgh. W already been started on some of the i rovements, while others have been author d by the board of directors. Three freight tion will be erected in Pittsburgh, and a $1 railroad yard built on the gravity plan ill located near the city on a site not y m public. A number of grade crossings ar be eliminated. Besides those in the vic ty Pittsburgh grade crossings in Johnstow M rellsville, New Florence and Manor ll abolished at a cost of $575,000.

South Dakota.

Surveys have been made and right of now being secured for the proposed ct line from Belle Fourche to Spearfish, This company has been organized by Moodie, Bruce Sebastian, Fred S. Har a

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

iba, all of Belle Fourche. The pro- ute follows the Redwater River and valleys. A. D. Wilson, Deadwood, surveys.

hicago & Northwestern Ry., according t, is to have grading work started or the completion of its line between and Carter. It is understood that l be begun at Jordan and be continued west from that point.

hicago, Milwaukee & St. Paul Ry., M. ime, district engineer, Minneapolis, proposes to improve alignment and rack from Aberdeen to Summit. 70 dverse grades will be reduced to 0.5 cent. Contractors examined the work 9 and bids were received on April 12. are being prepared by the Chicago, ee & Puget Sound R. R. for the con- of a 15-stall addition to the new se at Aberdeen, S. Dak. The cost ork is estimated at $75,000.

Tennessee.

ashville Railway & Light Co., Nash s applied to the county court at e for permission to extend the West to Bell Meade and the Gallatin Pike t Inglewood.

elieved that work will be started this by the New Orleans, Mobile & Chi- R. on the proposed line from Middle- ... to Lexington, in order to provide connection from New Orleans to Chi- W. F. Owen, Mobile, Ala., is Presi- General Manager of the company.

umberland Valley & Interstate Elec- Co., incorporated two weeks ago capital stock of $50,000, proposes the tion of a line from Gallatin, Tenn., to d, Ky.; also out to the Cumberland rom Gallatin. Two routes are con- The first is from Gallatin to by the way of Dixon Springs and on to Stanford. The other route is allatin to Westmoreland to Hartsville, te to Stanford. The incorporators are Brown, Gallatin; Judge S. M. Young, Springs; M. L. Wright, Hartsville; W. , Gallatin; W. G. Schamberger, Galla- dge William Hall, Gallatin; Will B. Gallatin; F. Burnley, Willard; Ed S. Enon College.

Texas.

nty Commissioners at Fort Worth have a franchise to a stock company, head- Rev. Lee R. Scarborough of the South- Baptist Seminary, Fort Worth, for tallation and operation of a street car m the terminus of the Hemphill street the seminary. A gasoline motor e used. The contract for the con- n work, which will cost about $17,500, J. Hodge. The line will be long.

Key, Oklahoma City, has secured a for grading from Waxahachie to for the Dallas-Waco Interurban line. l make his construction headquarters at

rner Bros. Co., Dallas, Tex., has warded a subcontract by the Southern ering & Construction Co. for grading for the projected line of the Southern on Co., mentioned in our last issue. This y projects a 134 mile interurban line allas to Waco.

ty Council of Yoakum has granted a franchise to E. B. Carruth, J. W. and associates to erect and maintain and e a street car system and to lay a pipe conduct natural or artificial gas to all of the city.

State Railroad Commission has ordered red $220,000 bonds of Houston & Brazos R. R. Co., covering 24 miles from An- Velasco.

Fort Worth, Mineral Wells & North- n R. R. Co., recently organized with a stock of $100,000, proposes the con- on of an interurban electric line between Worth and Mineral Wells, a distance of 60 miles. It is planned to ultimately ex- he line west to Roswell, N. M. The directors [illegible] and Paul Hurley of Fort Worth and James A. Watkins of Little Rock, Ark.

Steps are being taken to secure the construction of an interurban from Beeville to La Grange. It is reported that $100,000 has already been subscribed and that a charter will be taken out shortly. C. J. von Rosenberg of La Grange, C. F. Hellmuth of Beeville and C. F. Krolle of Industry are interested.

It is believed that steps will be taken shortly by the Pecos Valley Southern Ry. for the extension of the line from Toyahvale at the foot of the Davis Mountains in Jeff Davis County, Texas, to Fort Davis. The proposition is that the three counties of Reeves, Jeff Davis and Presidio should take $400,000 worth of preferred stock in the railroad, at 75 cents on the dollar and give in addition a cash bonus of $175,000. Part of the stock is to be raised in the city of Pecos, which recently gave $100,000 to secure the original 45-mile line now in operation. W. L. Carwile, Dallas, Texas, is President of the company.

Surveys are under way for the construction of the proposed railroad between Comfort and Brownwood, Texas, connecting with the San Antonia & Arkansas Pass at Comfort and entering San Antonio over that line. A connection will be made with the Frisco at Brownwood. It is hoped by the citizens of Fredericksburg, who subscribed a bonus of $200,000, that the line will be in operation by October 1.

The Board of Municipal Commissioners, Dallas, Texas, has passed an ordinance granting the Houston & Texas Central Railroad permission to build a switch track across Hall, Flora and Cochran Sts.

The Crystal City & Uvalde R. R. Co. has amended its charter providing for the construction of a new line from San Antonio to a point near the Live Oak County line, through Bexar and Atascosa counties, sixty miles, and from a point on this line to Fowlerton, Lasalle County, 45 miles. The capital stock of the road was increased from $125,000 to $230,000. The amendment was voted at a meeting of the directors of the road held in Crystal City. The amendment is signed by J. E. Franklin, as president of the road; M. E. Leming, A. R. Byrd, E. J. Buckingham, A. R. Pender, E. R. Byrd, Carl F. Green, William Byrd, Jr.

Reports from Orange, Texas, state that engineers running the second survey for the extension of the Orange & Northwestern R. R. from Newton to Hemphill, have reached a point 18 miles above the first city and have already realized a great saving of distance as well as cost. Nothing definite has been secured concerning the time for starting construction work. L. Miller, Orange, Texas, is President of the company.

Utah.

Advices from Ogden, Utah, state that work has been resumed on the Ogden-Lucin cutoff after a suspension of activities for several weks. About 150 men are employed and two ballast trains are on the work.

It is reported that the Western Pacific Ry. is contemplating the expenditure of about $1,250,000 for the completion of the low grade line known as Arnold's Loop, 145 miles west of Salt Lake, Utah, in the construction of shops at Sacramento, Calif., and in the establishment of a ferry service on San Francisco Bay. T. J. Wyche, San Francisco, Calif., is Chief Engineer.

Board of Commissioners, Salt Lake City, Utah, has passed an ordinance granting to the Oregon Short Line R. R. Co., its successors and assigns, a franchise and right of way to construct a spur track upon and across the east side of Third St., between First South and South Temple Sts.

Vermont.

⦿Holbrook, Cabot & Rollins Corp., 6 Beacon St., Boston, Mass., has been awarded the contract by the Boston & Maine R. R. for constructing a new line from Hinsdale, N. H., to Brattleboro, Vt. This line is being built to avoid the use of the Grand Trunk tracks from South Vernon to Brattleboro. It will be eight or ten miles long and will involve some heavy work. The construction of a bridge over the Connecticut River will be required.

The State Public Service Commission has authorized the Clarendon & Pittsfield R. R. Co., E. C. Partridge, president, Proctor, Vt., to increase its capital stock in the sum of $70,000 for the purpose of obtaining funds to pay for the roadbed, rolling stock and all other property of the Pittsford & Rutland R. R. Co. and the Brandon & West Rutland R. R. Co., which it has purchased, and for the purpose of raising funds to extend its line and improve its roadbed and equipment.

Virginia.

The Norfolk Southern R. R., F. L. Nicholson, chief engineer, Norfolk, Va., has acquired a large acreage at West Munden, near South Norfolk, on which it will erect new shops. It is stated that about $500,000 will be expended and that work will begin within two months.

It looks now as though the Carolina, Clinchfield & Ohio Ry., Ward Crosby, chief engineer, Johnson City, Tenn., would be ready in the near future to let contracts for the 40 mile extension from Dante, Va., to Elkhorn City, Ky. This extension will traverse a rough and mountainous country. It is understood that the work will be let in 2-mile sections.

The Richmond & Rappahannock River Ry. Co. has been chartered wtih an authorized capital stock of $300,000. This company has acquired the right and franchises of the Richmond, Urbanna & Peninsula Ry, and propose to build a line of railroad between Richmond and Urbanna, on the Rappahannock, an estimated distance of 60 miles. The officers of the company are: Colenel Joseph E. Willard of Fairfax, president; Charles L. Ruffin of Burnsville, N. C., vice-president; R. B. Campbell of Richmond, secretary and treasurer, and O. E. Parrish, assistant secretary and treasurer. The directors are: Joseph E. Willard, Fairfax; A. M. Gover, A. R. Holladay, Thomas P. Bryan, R. N. Pollard, Christopher Manning, Jr., and Clyde W. Saunders, all of Richmond.

Washington.

⦿The Keasil Construction Co., Tacoma, Wash., has been awarded the contract for constructing the 3-mile section from Old Town to Ruston, of the Point Defiance line of the Northern Pacific. Bids on this work were opened several weeks ago. It is the last of the contracts for this line, and involves much side hill work.

⦿Andrew Peterson, Pioneer Bldg., Seattle, Wash., has been awarded a contract covering two miles of grading on the line of the Lake Burien Street Ry. Co. from Seattle to Lake Burien. The Lake Burien Street Ry. Co. has also awarded a contract to Fox & Co., Seattle, for 1,700 ft. of trestle work on this line.

The Northern Pacific Ry. officials have filed their acceptance of the grade separation ordinance with the City Council of Spokane, Wash. The ordinance calls for the commencement of the work by October 1, 1912, and its completion within three years. The estimated cost of grade separation ranges from $3,000,000 to $3,500,000. The Council will now take up for consideration S. P. & S. connection franchise applied for by the Northern Pacific recently.

A conference was recently held by officials of the Canadian Pacific Ry. and the Chicago, Milwaukee & Puget Sound at Bellingham, Wash., in regard to the probable extension of the Bellingham Bay & British Columbia R. R., which was recently purchased by the Milwaukee. It now seems probable that the latter company will build from Everett to Bellingham, thereby affording the Milwaukee and Harriman system's entrance to Bellingham and Vancouver, B. C., and the Canadian Pacific an entrance to Tacoma and Seattle over the Milwaukee's coast line. The Canadian Pacific will be used between Sumas and Vancouver. The Canadian Pacific now reaches Bellingham over the Bellingham Bay Road.

✣ indicates work now open for bids. • indicates a contract let recently.

West Virginia.

George L. Carter, president of the Virginia-Pocahontas Coal Co., Coalwood, W. Va., is planning the construction of a 5 mile railway line to connect Coalwood and Caretta. This line will connect the plants of the company at the above mentioned places.

⦿The Virginia Ry. Co., H. Fernstrom, chief engineer, Norfolk, Va., will ask bids in a few days for a 10-stall addition to the round house and for a lavatory and office building at Princeton, W. Va. Contracts for a 12-bay erecting shop, 75 ft. transfer table foundation and 100 ft. extension to rod and wheel shop have been awarded to Geo. B. Swift & Co. of Chicago, Ill. Contract for one 200-ton crane for the erecting shop, one 30-ton crane for the extension mentioned above as a boiler and tank shop, and one 20-ton crane for the erecting shop has been awarded to Niles-Bement Pond Co.

Wisconsin.

⦿Winston Bros. Co., Globe Bldg., Minneapolis, Minn., as noted in our last issue, has been awarded the contract for 60 miles of second track and revision work on the Omaha road from Truax to Northline, Wis. This is comparatively light work, and altogether will not exceed 1,500,000 cu. yds., of which only a very small per cent is classified material. Winston Bros. will do most of this work with their own outfits.

Engineers working in the vicinity of Summit and Elcho, Wis., gives rise to the report that the Chicago & Northwestern Ry. is preparing to eliminate the steep grade at Summit Lake.

Wyoming.

Work is to be resumed about May 1, laying track on the Chicago, Burlington & Quincy Ry. Company's new line through Big Horn Basin to Powder River, Wyo. About 80 miles of track remains to be laid to complete the line to a connection with the Chicago & Northwestern. George W. Holdredge, Omaha, Nebr., is General Manager of the system.

Canada.

A syndicate of United States and Canadian capitalists, represented by Joseph Choate, Jr., New York City, has secured a 30-year franchise to build radial railways throughout Manitoba. This is the syndicate which will also take over the $25,000,000 street railway property of Mackenzie & Mann in Winnipeg.

Farmers of Iron Springs and the District are endeavoring to have wor on the proposed Suffield-Kipp branc Canadian Pacific. It is possible that of grade will be completed this yea laying of steel is doubtful.

The Canadian government is to cal shortly for the second section of the Bay Ry. This section will be 100 m the contract having already been aw J. D. McArthur for the first sectio miles from Las Pas to Thicket Port decision has yet been made for the as between Nelson and Churchill, former port is the more likely to be owing to the shorter route.

The franchises and all of the asse Ottawa & St. Lawrence Ry. and th Lanark Ry. have been purchased Morden & Co. of Toronto, Ont. T will run south from Ottawa to M thence westerly along the St. Lawren to Brickville, then north through P Lanark to Arnprior, then following wa River to Ottawa, a total distanc miles. The road will be bonded at $2 mile, and it is understood that pa shortly leave for London, England, tiate the sale of this bond issue.

BRIDGES—STEEL AND CONCRETE

California.

The Board of Orange County Supervisors, Santa Ana, Calif., are contemplating the construction of about 12 new bridges during the coming season and the matter of issuing bonds will probably be submitted to the voters May 14. The expenditure of $4,000 has already been authorized for building a bridge across the Santiago Creek at Tustin avenue, between Tustin and Orange, and $1,800 for building a bridge across the Santa Ana River at West Seventeenth St., between Santa Ana and Garden Grove.

Advices from Los Angeles, Calif., state that Ivory B. Noble, County Engineer, has prepared plans and specifications for the construction of a reinforced concrete highway bridge over the Los Angeles River at Lankershim Ave. The structure as proposed will consist of seven 42-ft. and two 21-ft. spans. The abutments will be 21 ft. each with concrete retaining walls extending up the stream, and footings will be built on four piles which are to be driven to refusal point. The bridge will be built with expansion joints and will have concrete posts, galvanized iron hand railings and asphalted roadway 21 ft. wide.

The officials of Los Angeles County, Los Angeles, Calif., have filed condemnation proceedings against Charles B. Scoville to secure the land necessary for the erection of the Arroyo Seco bridge. The cost of the new structure is estimated at $600,000.

Connecticut.

⦿Advices from East Haddam, Conn., state that the contract for the substructure for the new state draw bridge across the Connecticut River between Haddam and East Haddam has been let by the Commissioners in charge to Holbrook, Cabot & Rollins, Boston, Mass.

Delaware.

⦿The Levy Court of Kent County, Dover, Del., awarded the contract for the construction of a new bridge at Dupont station connecting the public roads to the Luten Bridge Co., York, Pa., at $997.

Plans have been drawn by C. G. Fisher for the construction of a concrete and steel bridge near Harrington, Del., and submitted with the specifications to the Levy Court, Dover, Del. J. P. Carmean is Levy Court Commissioner.

Florida.

Board of Duval County Commissioners, Jacksonville, Fla., has granted permission to John S. Collins, to build a bridge over Biscayne Bay at a point north of the incorporate limits of the city of Miami.

Georgia.

✣Bids will be received until 2 p. m., May 3, by Bartow County Commissioners, Cartersville, Ga., for the construction of a 216-ft. single span bridge over Etowah River at Milam bridge site. The structure will be of steel and will have a 16 ft. roadway. Bids will be received also for the construction of a 38 ft. concrete bridge over Little Pumpkin Vine Creek and a 48 ft. concrete bridge over Pine Log Creek. Both concrete structures will have 48-ft. roadways.

✣Bids are being received by the Board of County Commissioners, Marietta, Ga., it is reported, for furnishing Cobb County a 12-ton road roller and for the construction of a concrete bridge over Noonday Creek on Bell's Ferry road in Gritter district. The structure will have a truss span of 60 ft. and one I beam span of 30 ft. and a 16 ft. roadway.

Idaho.

✣Bids will be received until 10 a. m., April 19, by Board of Ada County Commissioners, Boise, Idaho, for the construction of 10 bridges located as follows: Bridge No. 1—Over Dry Creek, one mile north of Eagle, 30-ft. I beam. Bridge No. 2—Over Farmers' Union, two miles north of Eagle, between sections 32 and 33, township 5 north, range 1 east, 24-ft. I beam. Bridge No. 3—Over Farmers' Union in section 32, township 5 north, range 1 east, 24-ft. I beam. Bridge No. 4—Over Willow Creek, between sections 8 and 9, township 5 north, range 1 west, 32-ft. I beam. Bridge No. 5—Over Ridenbaugh, between sections 17 and 18, township 3 north, range 2 east, 32-ft. I beam. Bridge No. 6—Over Ridenbaugh, between sections 21 and 22, township 3 north, range 1 east, 30-ft. I beam. Bridge No. 7—Over Ridenbaugh, north of Perkins, 30-ft. I beam. Bridge No. 8—Over Ridenbaugh, between sections 20 and 21, township 3 north, range 1 east, 30-ft. I beam. Bridge No. 9—Over Ridenbaugh, in section 24, township 3 north, range 1 west, 24-ft. I beam. Bridge No. 10—Over the west channel of the Boise River on the Meridian road west of the Main street bridge, 95-ft. steel. E. F. Crawford is Chairman and Stephen Utter is Clerk of the Board.

It is reported that the Municipal Council, Idaho Falls, Idaho, is contemplating the construction of a new bridge over Crow at Elm St. to replace the present which was recently condemned.

The Commercial Club, Lewiston, taking active steps to secure the con of a bridge over the Clearwater Rive place. It is hoped to raise about $4 the improvement, by a city bond is individual donations from farmers a dents outside the city benefited by t ture.

City Council of Sand Point, Idaho, structed the city engineer to prepare the construction of a new bridge River at Bridge St.

Plans have been prepared by J. Sand Point, Idaho, Engineer, for t struction of a 444-ft. pile trestle bri Sand Creek at Bridge St. in Sand Po ho. The structure will have a 16-ft. and 8-ft. walk and will be floored w timber. The cost of the improveme timated at $3,500. Bids will be receiv May 1.

Illinois.

⦿The contract for the construction inforced concrete bridge in Pecatonica ship, Winnebago County, Ill., has to W. H. Shons, Freeport, Ill., at $13, structure will consist of four 55-ft. sp an 18-ft. roadway. J. S. Tarbert, Pe Ill., is Town Clerk. Bids for the wo opened April [illegible]

⦿E. F[illegible]ack, Springfield, Ill., ha awarded the contract for the construct bridge over the Bluffs Ditch and Cran in Schuyler County, Ill., at $3,750. Th ture will be 180 ft. long.

⦿The contract for the concrete cons on the new Grand Trunk bridge at B Mich., has been let to George B. Swif 189 W. Madison St., Chicago, Ill. T tract calls for eight concrete piers, abutments, two of the eight piers bei piers for the draw spans. The bridge 1,300 feet long and it is to be strictly road bridge. The concrete work is to ished about the latter part of August. Garner, Black Rock, N. Y., is Engi charge of the work.

Plans have been prepared by H Cochrane, Consulting Engineers, Kans. Mo., for the construction of the viad proach to the lower free bridge at Ill. One plan is for a viaduct ending lower side of Washington St., and th

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

proach ending at the lower side between Adams and Washington St. [illegible] is City Engineer

decided at a recent meeting [illegible] the Peoria & Pekin. Ry. [illegible] a new bridge over the [illegible] the near future. [illegible] Engineer

Indiana.

will be received until May 7 [illegible] Knox County Commissioners, Vin- [illegible] for the construction [illegible] J. T. Scott is County Auditor.

will be received until May [illegible] Jackson County Commissioners, [illegible] Ind., for the construction of four [illegible] W. Wacker is County Auditor.

will be received until 1 p. m., May [illegible] of Jasper County Commissioners, Ind., for the construction of two [illegible] P. Hammond is County Auditor.

will be received until April [illegible] County Commissioners, Huntington, the construction of two large One of the bridges will span the River in section 33 of Lancaster [illegible] other will be located at Clark [illegible]kle over the Wabash River. Both will be of steel in single spans built same plan as the Briant St. bridge [illegible]

Wabash County Board of Commis- Wabash, Ind., awarded the contract [illegible] on the Wabash St. bridge to Wil- rt and George Todd, at $4,996.

ard of Gibson County Commission- on, Ind., has awarded the contracts struction of three new bridges to [illegible] at a total bid of $2,200. The e built are the Keg Creek bridge nceton-Oakland City road, the Mil- bridge in Patoka Township; the lge in Union Township.

ard of Warrick County Commis- neville, Ind., has let the contract construction of 49 concrete bridges to ennes Bridge Co., Vincennes, Ind., at

Elkhart County Board, Elkhart, Ind., ed bridge requisitions for appropria- r two structures in Bauge Township [illegible] one in Olive for $1,000, ork for $1,800; one in Middlebury for o in Jackson Township for $800 and

Commissioners of Wabash County, Ind., have granted the petition asking construction of a new 200-ft. bridge Wabash River to replace the one re- ashed out by floods at Beldon, Ind.

issioners of Kosciusko County, War- d., have made appropriations for the tion of 12 new bridges in that County ws: Neff bridge, Jefferson Township, erts, Scott, $350; Ulrey, Wayne $324; Monroe, $286.69; Ludlow, Turkey 90; Wiley, Monroe, $341; Graff, $285.63; Jones, Clay, $298.76; Paxton, [illegible] Henwood, Tippecanoe [illegible] Brumbaugh, Van Buren, $565.20; Harrison, $220; superstructures, $90.

Iowa.

have been completed by officials of the Great Western Ry., for the construc- a modern steel bridge over the Des river above the town of Lehigh, Ia., ce the old structure recently destroyed high water and ice. The structure will t 300 ft. long and will have two con- butments and one pier.

proposed by the City Council of Du- Ia., to construct a viaduct over the Central tracks at Rockdale. C. H. artner is City Engineer.

Kansas.

will be received until noon, April [illegible] the office of the County Clerk in the House at Jetmore, Kansas, for one to be built in Sterling Township, Hodgeman County. A deposit of $50.00 must accompany each bid. Orwell Bridge: Reinforced [illegible] ft. clear spans, 66.6 ft. over all, with an 18-ft. clear roadway. Estimated amount of concrete in superstructure 70.3 cu. yds.; estimated amount of steel in superstructure 6,309 lbs.; and 131 cu. yds. of plain concrete masonry in the two abutments and two piers. The abutments and piers are 11 ft 3 ins. high. The excavation for the foundations will be in a sandy clay and the footings are to be carried 3 ft. 6 ins. below bed of stream and wood piling will probably have to be used. It is seven miles to the Atchison, Topeka & Santa Fe Railroad station at Hanston. Sand is available one mile south of the bridge site. Light stripping will be necessary to get the best sand in the pit. No charge has been made heretofore for sand from this pit. Rock in rubble size can be delivered at the bridge site for approximately $2 per cubic yard. Cost of crushing would be extra. Plans and specifications are on file with the County Clerk and copies of the same may be had by mailing $1 to the State Engineer, Manhattan, Kansas.

Louisiana.

✣Bids will be received until May 1, by Police Jury Madison Parish at the office of A. L. Slack, Secretary, Tallulah, La., for the construction of the following bridges: First—Over Willow Bayou on the road leading north from Tallulah, 80-ft. span. Second—Over Panther Lake on the road leading north from Waverly, 64-ft. span. Third—Over Suck Bayou south of Waverly, 120-ft. span. Fourth—Over Little Fork south of Waverly. Fifth—Over a slough just north of Quebec Station, 45-ft. span. Said bridges to have concrete abutments and to be capable of sustaining the weight of a 20-ton traction engine. Roadway 12 ft. Engineers to furnish their own plans.

Massachusetts.

✣Bids will be received until noon, April 24, by Weymouth Back River Bridge Commission, at the office of the Harbor and Land Commissioners, 131 State House, Boston, Mass., for the construction of the superstructure for a highway bridge across Weymouth Back river in the towns of Weymouth and Hingham, consisting of three fixed spans and one double leaf Scherzerdraw span.

It is planned to replace the old bridge on Tremont St. at Castle Square, Boston, Mass., with a modern structure. It will be built by the Boston & Albany Railroad, which will pay the largest part of the cost, while the Boston Elevated will pay a part of the cost. The city does not pay anything as Tremont St. is an old thoroughfare, which was there before the railroad and requires a bridge merely because of the railroad. The new bridge will have plate girders to support transverse steel beams encased in concrete, forming a solid steel surface, on which pavement is to be laid. The plans were presented to the Railroad Commission by Woodward Hudson, counsel for the Boston & Albany, and were explained by F. B. Freeman, Chief Engineer, Boston, Mass.

Advices from Holyoke, Mass., state that the bridges on Cabot St., will not be built this season unless the parties interested pay their proportionate share of the cost. T. J. MacCarthy is City Engineer.

Michigan.

✣Bids will be received until noon, May 5, by C. L. Miller, City Clerk, Kalamazoo, Mich., for the construction of a reinforced concrete bridge over the Kalamazoo River at Mill St. The structure will have three 59-ft. 6-in. spans with 20-ft. roadway and two 5-ft. walks. Plans and specifications are on file with the City Engineer, H. A. Johnson. A certified check for $1,000 must be filed with each bid

Minnesota.

It has been announced by K. Oustad, City Bridge Engineer, Minneapolis, Minn., that test borings made to locate suitable foundations for bridge piers in the Mississippi resulted in the location of bed rock at the extreme lower end of Nicollet Island. It is hoped to have work started on the sub-structure of the proposed bridge within a month.

Montana.

⦿The Security Bridge Co., Billings, Mont., has been awarded the contract for the construction of three steel bridges as follows: One over the Yellowstone River at Miles City for $63,800; another across the Yellowstone at Fallon for $68,000, and a third across Powder River, near its junction with the Yellowstone, for $34,600.

Nebraska.

✣Bids will be received until noon, May 14, 1912, at the County Clerk's Office in Platte County, Columbus, Neb., for the construction of one bridge across the Loup River, located about half a mile south of the town of Monroe. Bids will be received for the above bridge as follows: Monroe Bridge: One high truss steel bridge across the main channel composed of six 136-ft. 6-in. spans with concrete piers and abutments, all as per plans and specifications, and one 80-ft. low truss steel span across the north channel with concrete abutments, all as per plans and specifications. All bids must be sealed and accompanied by cash deposit or certified check for $1,000, all certified checks to be made payable to Mr. John Graf, County Clerk of Platte County. Bids will be publicly opened at the County Clerk's Office in Columbus, Nebraska, at one o'clock p. m., May 14, 1912. Copy of plans and specifications may be had upon application and payment of $5.00 at the office of the State Engineer, D. D. Price, Lincoln, Neb.

✣Bids will be received until May 7 (postponed from April 23) by Keyapaha County Clerk, Springview, Nebr., for the construction of two new bridges over the Niobrara River between Rock and Keyapaha Counties to be known as Carns bridge and McCulley bridge. D. D. Price is State Engineer, Lincoln, Nebr.

It is reported that the Commissioners of Dodge County, Fremont, Nebr., have appropriated $40,000 for repairs to a wagon bridge over the river recently damaged by high water.

Commissioners of Douglas County, Omaha, Nebr., are planning to build a new bridge over the Elkhorn River on Military Road to replace the $6,000 steel structure recently destroyed by highwater. The old bridge was 200 ft. in length.

Commissioners of Saunders County, Wahoo, Nebr., have peittioned for state aid in replacing 26 bridges washed out by recent floods. The state enginering department will take immediate steps toward preparing plans. D. D. Price is State Engineer, Omaha, Nebr.

New York.

⦿The Board of Public Works, Poughkeepsie, N. Y., has awarded the contract for the construction of steel and concrete covering and bridge work over the Fallkill at Clinton Square to Charles Mitchell, at $5,161. There were two other bidders, Morgan & Fiedler, whose bid was $5,702.19, and the Torrington Building Company, whose bid was $7,260.62. The entire open space between the present bridges will be covered and a small park formed on top.

At a special meeting of the Town Board of Riga, N. Y., the Supervisor was authorized to sign an agreement with the New York Central Railroad Co., for a new bridge known as No. 723 to carry the Buffalo road over the tracks one-half mile west of Churchville.

In connection with the change of highway leading west from Clyde, N. Y., to Lock Berlin a new bridge will probably be erected over the trolley road at Lang's cut.

Plans and specifications are being prepared by J. H. Giles, City Engineer, Binghamton, N. Y., for the construction of repairs to the Washington St. bridge. The work will include replanking the roadway.

The following bids were received April 9 by the City of Oswego, N. Y., for the construction of the proposed highway bridge over the hydraulic canal at the foot of East Mohawk St: United Construction Co., $1,623; Climax Road Machine Co., submitted four bids ranging from $1,373 to $1,464; Groton Bridge C two bids, $1,294 and $1,898.

North Dakota.

The Board of Billings County Commissioners, Medora, N. Dak., has decided upon the construction of a highway bridge over the Little Missouri at Marmath. Plans are now being prepared by the State Engineering Department.

Ohio.

⊙The contract for the construction of a new bridge over the canal at the Grand Blvd., Hamilton, O., has been awarded to Al S. Fox, Dayton, O., at $9,927.

⊙Bids were opened March 30 by Board of Cuyahoga County Commissioners, Cleveland, O., for the construction of seven bridges and contracts awarded as follows: Bridge per Report 2913, Harry Nicholas, Brecksville R. F D. No. 2, at $932; Bridge per Report 2914, Harry Nicholas, Brecksville, R. F. D. No. 2, at $561; Bridge per Report 2915, to H. R. Henderson, Chagrin Falls, at $248; Bridge per Report 2016, to J. T. Kelley, 1521 Clark Ave., Cleveland, at $275; Bridge per Report 2018, to H. R. Danfort, Chagrin Falls, at $587; Bridge per Report 2917, to the Advance Construction Co., 1244 Norwood Road, Cleveland, O., at $2,448; Bridge per Report 2921, to Advance Construction Co., at $130. J. F. Goldenbogen is County Clerk.

⊙The Board of Wood County Commissioners, Bowling Green, O., has awarded the contract for the construction of a concrete bridge over Grassy Creek 2,430 ft. north of the S. E. corner of the River Tract 81 in Ross Township to Carl Finch, Bowling Green, O., at $2,123. C. E. Stinebaugh is County Auditor.

⊙The Wood County Stone & Construction Co., Bowling Green, O., has been awarded the contract by the Board of Wood County Commissioners, Bowling Green, for the construction of a concrete bridge 210 ft. south of the S. E. corner of the River Tract 81 in Perrysburg Township. The contract price was $1,896. C. E. Stinebaugh is County Auditor.

A delegation of Union Township citizens recently conferred with the Board of Commissioners, Scioto County, Portsmouth, O., urging the construction of repairs to the bridge over Brush Creek at Freestone.

Oklahoma.

The proposition to issue bonds for the construction of bridges in Oklahoma City, Okla., was not voted upon and will probably be postponed until fall. G. E. Blackwelder is Commissioner of public works.

The Santa Fe is contemplating the construction of a viaduct at Guthrie, Okla., and plans and specifications for the work will probably be submitted to the Corporation Commission, Oklahoma City, Okla., in the near future. J. E. Love is Chairman of the Commission.

Oregon.

⊙The Bridge and Lighting Committee of the Executive Board, Portland, Ore., has awarded the contract for installing lights on the Morrison St. bridge to the Northwest Electric Engineering Co., at $3,837, and similar contracts on the Hawthorne Ave. and Burnside Bridges to the West Coast Engineering Co., at $6,410 and $3,047 respectively.

The contract for furnishing two steel bridges one to span Swale Creek east of Centerville and Alder Creek one mile north of Alderdale, Klickitot County, Wash., to the Columbia Bridge Co., Portland, Ore., at $4,000.

Members of the Rose City Park Improvement League, Portland, Ore., are advocating the removal of the present narrow bridge over the Willamette River on Burnside St., and the construction of a wide double-deck bridge. Walter Seaberg is a member of the Improvement League.

Pennsylvania.

✣Bids will be received until 10 a. m., April 24, by D. K. Hoch, County Controller, Reading, Pa., for the repair of Flannery's bridge which crosses the Monocacy Creek in Amity Township on the road leading from Monocacy Station to Flannery's Mill.

✣Bids will be received until 10 a. m., April 22, by D. K. Hoch, County Controller, Reading, Pa., for the erection of a reinforced concrete bridge over the Irish Creek in Center Township, Berks County, Pa., to be known as Centreport Bridge.

✣Bids will be received until 10 a. m., April 24, by D. K. Hoch, County Controller, Reading, Pa., for the following described lumber to be used for reflooring the Lancaster Ave. bridge: 15 pieces 6-in. x 6-in. x 12 ft. long; 36 pieces 3-in. x 4-in. x 15 ft. long; 12 pieces 3-in. x 12-in. x 14 ft. long; 155 pieces 3-in. x 12-in. x 17 ft. long; 16 pieces 3-in x 12-in. x 17 ft. long; 10,744 ft. board measure plank 2 ins. thick, 8½ ft. long, from 4 to 8 ins. in width; 36,620 ft. board measure plank, 3 ins. thick, 11 ft. long, and from 8 ins. up in width. All lumber must be either white or chestnut oak, free from sap and bark and full on all edges and must be delivered at the bridge as required by the Bridge Inspector. All bids must be accompanied with a certified check equal to 10% of the aggregate amount of the bid.

✣Bids will be received until 10 a. m., April 22, by D. K. Hoch, County Controller, Reading, Pa., for the erection of a reinforced concrete arch bridge over the Iron Stone Creek in Douglas Township, Berks County, Pa.

⊙The York Bridge Co., York, Pa., has been awarded the contract by the Montgomery County Commissioners, Norristown, Pa., for the construction of a new bridge over the Schuylkill Canal at DeKalb St., Bridgeport, Pa. The new canal bridge will be constructed of plate girder. It will be 10 ft. wider than the bridge that at present spans the canal. The floor of the new bridge will be of concrete. Work will begin immediately upon the new structure. The Commissioners also awarded the contract for widening the bridge across the Gulf Creek at Bird-in-Hand to James Smith, whose bid was $6.92 cu. yd. It is estimated that the cost of widening this bridge in accordance with the width of the roadway will be $3,000.

Bridge viewers are selecting a site for the construction of a bridge over the river at Falls and profiles of the proposed sites on the east side of the river have been submitted to the County officials at Wilkesbarre, Pa.

M. C. Kennedy, Vice President and General Superintendent of the Cumberland Valley Railroad, Chambersburg, Pa., in his annual report recommends the construction of a new bridge over the Susquehanna River between Lemoyne and Harrisburg, Pa. It is reported that the expense of constructing a bridge, according to the style planned by the engineers, will be $400,000. New bridges will be erected also at other points over the Potomac River for which the interstate commerce commission has given the Cumberland Valley Railroad permission to create a reserve fund of $15,427.08 each month for the period of three years from January 1, 1911.

South Dakota.

✣Bids will be received until 8 p. m., May 6, by Leroy C. Eastman, City Auditor, Hot Springs, S. Dak., for making the necessary repairs and alterations on the Soldiers' Home bridges, situated on the Southwest side of the Home Grounds to make said bridges safe for travel of all public conveyances.

At an election held in Pennington County, S. Dak., it was voted to issue bonds amounting to $50,000 for the construction of two bridges over the Cheyenne River at Wasta and the other at Creston. General plan and profile for the Wasta structure may be obtained of James Hartgering, City Engineer, Rapid City, S Dak. S. H. Lea, Pierre, S. Dak., is State Engineer.

An ordinance is now before the people on referendum providing that the Chicago, Minneapolis, St. Paul & Omaha R. R. build a viaduct over its tracks at Grange Ave., Sioux Falls, S. Dak. The proposition of raising the grade of that avenue for the structu voted on at the coming election.

Tennessee.

The County Court at a recent me ng held at Shelbyville, Tenn., appointed a Br e Committee to solicit bids for the const tion of two bridges, one over Sugar Creel and the other over Wartrace Creek.

At a recent meeting of the Sulliva County Court, Blountville, Tenn., $14,000 w appropriated out of the sinking fund for he construction of a bridge over the Hols Ri at Yoakley's Ferry, also $4,500 ot of the ordinary fund for the construction o brid over the Holston River at Shady rd. committee was appointed by the cou to for bids for the construction of bri across Holston River at the end o We Pike to be known as the Webb and lop bridge and to cost $7,000.

The Humphreys County Court, av Tenn., has voted $3,000 for the const tic a bridge over Hurricane Creek near cE

Texas.

⊙The City Commissioners of Dalla T have let the contract for the construc on concrete bridge over Peak Branch a Ex tion and Parry Aves. to B. T. Dav ar M. Davis at $6,850. The structure ll vide for a double track of the stree ai system and approaches to the Se Grounds.

⊙The Spence-Howe Construction ., Port Arthur, Texas, has been awarded the on by the Pleasure Pier Co., Port Ar ır, the construction of a bascule bridge e canal at that place. The contract p e $29,300.

Virginia.

✣Bids will be received until May by cahontas County Commissioners, Mal Va., for the construction of several ri C. J. McCarty is County Clerk.

A committee of citizens in the vi it Pineville have submitted to the Br County Supervisors, Powhattan, Va. a for the construction of a $25,000 bri e the James River at Michaux Ferry. T C ty is asked to pay $8,000 toward the provement.

The Tidewater Council No. 30, has dopted resolutions favoring the constructio t bridge now being considered to give e and Norfolk, Va., a physical connec n

Washington.

✣Bids will be received until 11 a. April 22, by W. J. Roberts, State Highway mn sioner, Olympia, Wash., for the con u of two steel highway bridges, one at V land, over North Fork of the Lewi R and the other near Mt. Vernon over th River.

Canada.

✣Bids will be received until noo A 30, by City Commissioners, Moose Ja for the construction of a reinforced subway under the Canadian Pacific R pany's tracks on 11th Ave. Plans and cations may be obtained of the City E

✣Bids will be received until noon, by Frank Barber, C. E., 57 Adelaide S Toronto, Ont., for the construction crete abutments and concrete floors following bridges: Malton Bridge, o Mimico Creek on the town line betw Counties of York and Peel near the vi Malton, for the Counties of York a North Woodbridge Bridge, over the River, on the County Road in the T of Vaughan near the Village of Woo for the County of York. Cockburn's over the Humber River, on the road lots 15 and 16, Con 7, in the Town Vaughan, in the County of York, Township of Vaughan.

Plans have been prepared by the Vancouver, B. C., for the constructio viaduct over the Canadian Pacific track Harris to Georgia St

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ROADS, STREETS AND PAVEMENTS

Alabama.

ity Commissioners of Birmingham, awarded the following contracts nstruction of about 50,000 sq. yds. of ing. McCartin Paving & Construc aving 19th St., north from 6th Ave., lle Ave., 26th St., north from 8th 5th Ave., and 12th Ave. to 32d St. with Norwood Ave., with Standard alt, including about 30,000 sq. yds., sq. yd.; Southern Asphalt & Con o., for paving 30th St., south from Ave. to Highland Ave. and 26th from Avenue H to Madison Ave., alt-concrete, including about 15,000 at $1.[illegible] per sq. yd.; C. M. Burk for paving one block of Avalon two coats of binder macadam, in ut 5,000 sq. yds., at $0.88 per sq. yd. Carretson & Co., 1150 Brown-Mark ingham, Ala., have been awarded act by the city of Booneville, Miss., [illegible], for the construction of l. ft. of concrete sidewalks; also 5,000 grading and excavating at $8,200 ks and approximately $15,000 for Bids were opened April 11.

Southern Fuel & Material Co. has the contract by the Board of Mobile County, Mobile, Ala., for t f 76,986 tons of gravel at $1.08 per 981 tons of chert at $1.85 per ton, point in the county. Bids ened April 8. C. L. Strange, Room 11, Bldg., Mobile, is County Engineer.

missioners of Talladega County, Ala., rejected all bids received ing grading and surfacing approximately 1½ miles of the Marlinsville road. The work was cost $8,000. W. S. Keller, Mont State Highway Engineer.

California.

contract for the improvements of the of 12th St., from Santa Clara St. to nando St., in the city of San Jose, been awarded to the Ransome-Crum at $.17 per sq. ft., for paving, $.30 ft. for curbing, and $.17 per sq. ft. ers.

Delaware.

Levy Court at Wilmington, Del., has the following contracts for building the roads for which bids were opened March: John F. O'Neil, West Chester ft. wide, 1⅓ miles long, $16,132; Pat Mundy, Pike's Creek road, 12 ft. wide, long, $27,000; Patrick J. Mundy, Mar , Philadelphia and Baltimore turnpipe of a mile long, $7,429.

Florida.

s will be received until 10 a. m., May 8, rd of Duval County Commissioners, ville, Fla., for furnishing one 7-ton tan ad roller. Gail L. Barnard is County

ls will be received until 10 a. m., April Board of Duval County Commissioners, ville, Fla., for the clearing and grad Steele Ave. on the Mayport road to the C. W. Ellis is chairman of the Board L. Barnard is County Engineer.

ls will be received until 8 p. m., May 7, Council, Palatka, Fla., for furnishing ry labor and material for the construc 52,000 sq. yds of street pavement. hen gravel and mound shell to be used. Stallings is City Engineer.

th & Maule of Titusville, Fla., have varded the contract by the Commission St. Lucie County, Fort Pierce, Fla., for onstruction of hard-surface roads, and docks at $181,000, for which bids ened April 9. The work includes the following: 100,000 cu. yds. of excavation and embankment, 90,000 cu. yds. of hard-surface material, 700 lin. ft. of trestle bridges, two docks also 75,000 cu. yds. of embankment. D. D. & C. M. Rogers, Fort Pierce, are Engineers.

Georgia.

✣Bids will be received until 7:30 p. m., May 15 (extension of date), for furnishing the necessary labor and material for the construction of 22,000 sq. yds. of vitrified brick, wood block, bitulithic, granitoid or asphalt pavement. [illegible] Callahan, Mayor, Bainbridge, Ga. Jaudon Engineering Co., Atlanta and Savannah, Ga., Engineer.

✣Bids are being received by Board of Cobb County Commissioners, Marietta, Ga., it is reported for furnishing a 12-ton road roller.

✣The City Council of Atlanta, Ga., is receiving bids for the paving of Marietta St., between Tabernacle Place and North Ave., on either side with asphaltic macadam and between the car tracks with wood blocks.

Idaho.

Shoshone County Commissioner Charles E. Lightner, Wallace, Ida., has advanced a proposition for road building in the county and favors the issue of $1,000,000 in bonds to build permanent roads.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 25, for furnishing and delivering f. o. b. shops 200 hand carts for use of the Bureau of Streets, according to plans and specifications on file at Room 406, City Hall.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., April 25, for furnishing and delivering f. o. b. city asphalt plant, 3,500 tons (approximately) of asphalt surface mixture and 2,000 tons of asphaltic concrete binder, according to plans and specifications on file at office, Room 406, City Hall. Cash or certified check for $500 must accompany proposal.

✣Bids will be received until 8 p. m., April 24, by Board of Local Improvements, Collinsville, Ill., for the construction of Paving District No. 3, including the following approximate quantities: 6,650 cu. yds of excavation; 13,850 sq. yds. of vitrified brick on 4-in. concrete foundation; 7,400 lin. ft. of granitoid combination curb and gutter; 2,850 lin. ft. of vitrified pipe 12 to 24 in. in diameter, in place; 12 brick catch basins; 6 manholes. A certified check for 10 per cent of the amount bid must be filed with each bid. A. C. Powell is engineer of the board.

✣Bids will be received until 3 p. m., April 25, by Board of Local Improvements, Sycamore, Ill., for the construction of 10,759 sq. yds. of brick pavement on gravel foundation on State St. and Washington Place; also 6,453 lin. ft. of concrete curb and gutter and 3,700 cu. yds. of earth excavation; 14 storm water inlets. Further information may be obtained of J. F. Betty, City Clerk, or Walter M. Hay, City Engineer, Sycamore, Ill.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., until 11 a. m., April 24, for furnishing the labor, materials, etc., necessary to construct pavements in the following streets and alleys. E. J. Glackin is secretary of the board: Halsted St. system, 3,520 lin. ft. concrete curb and gutter, 6,200 sq. yds. asphalt; 36th St., 1,800 lin. ft. concrete curb and gutter, 2,320 sq. yds. asphalt; Stewart Av., 4,200 lin. ft. sandstone curbing, 8,710 sq. yds. asphaltic macadam; Southport Av., 5,000 lin. ft. sandstone curbing (5 in. x 30 in.), 9,350 sq. yds. asphaltic macadam; 77th St., 3,220 lin. ft. concrete curb and gutter, 4,110 sq. yds. asphalt; Marshfield Av., 650 lin. ft. concrete curb and gutter, 760 sq. yds. asphalt; May St., w. ½, 350 lin. ft. concrete curb and gutter, 950 sq. yds. asphalt; Hillock St. 3,900 lin. ft. concrete curb and gutter, 8,000 sq. yds. asphalt; 56th St., 4,300 lin. ft. concrete curb and gutter, 6,780 sq. yds. asphalt; 50th St., 6,070 sq. yds. gravel concrete curb and gutter, 9,230 sq. yds. asphalt; 44th Ct., 6,625 lin. ft. concrete curb and gutter, 9,540 sq. yds. asphalt; 43d Av., 5,300 lin. ft. concrete curb and gutter, 8,400 sq. yds. asphalt; alley Calumet Av., etc., 1,540 lin. ft. concrete curb, 1,480 sq. yds. brick; alley, Oakwood Blvd., etc., 1,800 lin. ft. concrete curb, 1,410 sq. yds. brick; alley, Jackson Blvd., etc., 800 lin. ft. concrete curb, 500 sq. yds. granite block; alley, Calumet Av., etc., 1,000 lin. ft. concrete curb, 800 sq. yds. brick; alley, Eugenie St., 1,200 lin. ft. concrete curb, 950 sq. yds. brick. The work includes granite, concrete combined curb and gutter unless otherwise specified; 6 in. Portland cement concrete foundation, manhole and catch basin construction and adjustment, iron grates, covers, etc. Jno. B. Hayes is Chief Clerk in charge of profiles and specifications.

⦿The Board of Local Improvements of Decatur, Ill., has rejected all bids received for the paving of East William St. It awarded the contract for resurfacing of North Main St., and West North St., with asphalt to H. P. Streicher of Memphis, Tenn., at $24,489 and $6,013 respectively.

⦿Wm. F. and James P. Lodge of Monticello, Ind., have been awarded the contract by the Board of Local Improvements of Bement, Ill., for grading, paving and curbing Rodman St., for $16,634. Bids were opened April 6 by W. J. Day, President of the Board.

⦿The Board of Local Improvements of Chicago Heights, Ill., has awarded the following contracts for paving work: McGavock Bros. Construction Co., Chicago Heights and Beloit, Wis., paving West End Ave., from the Michigan Central tracks to Main St., with Marion brick, $24,226; Chicago Heights Coal Co., for paving Forest Ave. and Circle Court with asphalt macadam at $4,350; also for the paving of West 21st St., from Chicago Road to Euclid Ave., with asphalt macadam at $4,883. Other bids received on the work were: West End Ave., Chicago Heights Coal Co., $26,229; Pronger & Fletcher, $27,341, and James Cape & Sons Co., $26,598; Forest Ave., Pronger & Fletcher, $4,469; Otto Jaeger, $4,543, and McGavock Bros., $4,450; West 21st St., Pronger & Fletcher, $4,980; McGavock Bros., $5,160.

An engineer of the Illinois State Highway Commission has inspected 12th St., from the city limits of Rock Island, Ill., to the entrance of Chippiannock Cemetery, and the Center Station road, from 9th to 12th St. It is proposed to improve these roads with asphalt. A. N. Johnson is State Engineer.

Amboy Township, Amboy, Ill., at a recent election voted a tax levy at the rate of $.30 on each $100 of the assessed valuation of all taxable property each year for five years, for the purpose of constructing roads. J. E. Lewis is Town Clerk.

The Board of Local Improvements of Aurora, Ill., has decided on the paving of Grand Ave., from Walnut St. to Illinois Ave., with asphalt. The work will be done this summer.

Citizens of Monmouth, Ill., are considering another paving district, being South D St., between Broadway and 4th Ave., including also West 1st Ave., between B and D Sts.

The City Council of Bloomington, Ill., has under consideration the paving of the following portions of streets with brick pavement: Washington St., from East to the Illinois Central R. R. tracks; Morris Ave., from Washington to Wood St.; Center St., from Miller to Stewart St.; Clay St., from State to Mercer Ave.; Woodlawn, from Grove to Clay St.; Vale St., from Grove to Clay St.; Mercer Ave.,

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

from Grove to Clay St.; Taylor St., from Vale to Mercer Ave.; Morris Ave., from Chestnut to Seminary Ave.; Seminary Ave., from Morris Ave. to the C. & A. tracks; Taylor St., from Allin St. to Morris Ave.; Robinson St., from Grove to Clay Sts.; Clayton St., from Bell to Miller Sts.; Clinton St., from Clay to Lincoln Sts.; Phoenix Ave., from Franklin Ave. to Fell Ave.; Emerson St., from Franklin Ave. to Fell Ave.; Clinton St., from Chestnut to Monroe Sts.; West Market St., from Center to Howard to either widen or resurface pavement.

Citizens of Milford Township, Iroquois County, Ill., are agitating the construction of a mile or more of brick highway in that township, extending north and south from the town of Milford.

Following are the low bids received by the Board of Local Improvements, Chicago, Ill., for furnishing materials, labor, etc., necessary to construct pavements in the following streets: 3,840 lin. ft. concrete curb and gutter at 65 cts, 7,700 sq. yds. asphalt at $2, total $19,035, The American Asphalt Paving Co., 133 W. Washington St.; Blanche St., 1,740 lin. ft. concrete curb and gutter, 64 cts., 2,730 sq. yds. asphalt $2.16, total $7,438, Parker-Washington Co., 133 W. Washington St.; Cornelia Ave., 4,900 lin. ft. concrete curb and gutter at 65 cts., 7,730 sq. yds. asphalt $1.97, total $20,069, The American Asphalt Paving Co.; Dickens Ave., 2,340 lin. ft. concrete curb and gutter at 64 cts, 3,700 sq. yds. asphalt at $2.12, total $1,018, Parker Washington Co.; Diversey Ct., 2,400 lin. ft. concrete curb and gutter at 60 cts., 4,550 sq. yds. asphalt at $2.18, total $9,598, American Asphalt Paving Co.; 88th St., 1,360 lin. ft. concrete curb and gutter at 65 cts., 2,150 sq. yds. asphalt at $2.16, total $6,196, Parker Washington Co.; Ems St., 2,015 lin. ft. concrete curb and gutter at 64 cts., 3,000 sq. yds. asphalt at $2.03, total $6,090, Parker Washington Co.; 14th Pl., 2,550 lin. ft. concrete curb and gutter at 65 cts., 4,900 sq. yds. asphalt at $2.05, total $12,678, R. F. Conway Co., 133 W. Washington St.; 42d Ave., 12,500 lin. ft. concrete curb and gutter at 65 cts., 20,300 sq. yds. asphalt at $2.04, total $53,277, Standard Paving Co., 1101 S. 48th Ave.; 51st Ave., 2,755 lin. ft. concrete curb and gutter at 60 cts, 4,550 sq. yds. asphalt at $2.18, total $12,646, Standard Paving Co.; 53d Ct., 4,665 lin. ft. concrete curb and gutter at 65 cts., 7,215 sq. yds. asphalt at $2.09, total $15,079, The American Asphalt Paving Co.; Frankfort St., 1,995 lin. ft. concrete curb and gutter at 64 cts., 2,975 sq. yds. asphalt at $2.05, total $7,970, Parker Washington Co.; Francisco St., 1,300 lin. ft. concrete curb and gutter at 65 cts., 2,110 sq. yds. asphalt at $1.98, total $5,611, R. F. Conway Co.; Haynes Ave., 2,700 lin. ft. concrete curb and gutter at 65 cts., 4,100 sq. yds. asphalt $2.05, total $11,285, R. F. Conway Co.; Hollywood Ave., 380 lin. ft. concrete curb and gutter at 65 cts., 540 sq. yds. asphalt at $2.01, total $1,750, Barber Asphalt Co., 133 W. Washington St.; Houston Ave., 5,190 sq. yds. asphalt at 65 cts., 13,500 sq. yds. asphalt at $2.06, total $27,810, Parker Washington Co.; Leavitt St., 1,400 lin. ft. concrete curb and gutter at 65 cts., 2,300 sq. yds. asphalt at $1.94, total $6,495, The American Asphalt Paving Co.; Lincoln St., 1,130 lin. ft. concrete curb and gutter at 65 cts., 2,170 sq. yds. asphalt at $2.03, total $6,076, The American Asphalt Paving Co.; Paulina St., 2,220 lin. ft. concrete curb and gutter at 60 cts., 4,450 sq. yds. asphalt at $2.09, total $11,267, Parker Washington Co.; E. ½ Robey St., 1,290 lin. ft. concrete curb and gutter at 60 cts., 2,020 sq. yds. asphalt at $2.02, total $5,641, The American Asphalt Paving Co.; 25th St., 1,350 lin. ft. concrete curb and gutter at 65 cts., 2,170 sq. yds. asphalt at $2.03, total $6,076, The American Asphalt Paving Co.; N. ½ 37th St., 2,330 lin. ft. concrete curb and gutter at 65 cts., 3,820 sq. yds. asphalt at $1.97, total $10,201, The American Asphalt Paving Co.; Wrightwood Ave., 3,040 lin. ft. concrete curb and gutter at 65 cts, 5,000 sq. yds. asphalt at $2.06, total $14,144, The American Asphalt Paving Co.; Belden Ave. system, 6,195 lin. ft. concrete curb and gutter at 65 cts, 9,495 sq. yds. asphalt at $2.10, total $19,939, The American Asphalt Paving Co.; Belden Ave., system, 6,195 lin. ft. concrete curb and gutter at 65 cts., 9,495 sq. yds. asphalt at $2.10, total $19,939, The American Asphalt Paving Co.; Washington Ave., 6,710 lin. ft. concrete curb and gutter at 61 cts, 10,020 sq. yds. asphalt at $2.10, total $27,752, Parker Washington Co.; Central Park Ave. system, 33,890 lin. ft. concrete curb and gutter at 65 cts., 52,360 sq. yds. asphalt at $2.06, total $142,541, R. F. Conway Co. Total bid includes sidewalk construction, 6 in. Portland cement concrete foundation, manhole and catch basin construction and adjustment, iron grates, covers, leds, etc. Bids opened April 3.

Plans have been prepared by Engineer John C. Gibson of Duquoin, Ill., for the construction of 37,262 sq. yds. of vitrified brick pavement in that city at an estimated cost of $84.785. The work will include concrete base on a 2-in. sand cushion. sandstone and marginal curb, and grout filler covered with ½ sand. A hearing upon this improvement will be held April 27. E. E. Jacobs, H. Alber and J. H. Gregory are in charge of the work.

Plans have been prepared by Engineer John R. Seibert, 422 Court St., Pekin, Ill., for the construction of 32,520 sq. yds. of brick pavement in Margaret and Elizabeth St. District. The work will include concrete foundation, 3,425 reset curb, 9,900 new concrete curb, cement grout, 10,700 cu. yds. of excavation. The Council passed upon the improvement April 15.

Plans have been prepared by John R. Seibert, 422 Court St., or 329 Elizabeth St., Pekin, Ill., for the construction of 13,770 sq. yds. of brick pavement on Broadway St., at an estimated cost of $27,059. The work will include concrete foundation, 8,300 ft. of curb, bituminous filler and 4,590 cu. yds. of excavation.

Indiana.

✣Bids will be received until 10 a. m., April 19, by Board of Public Works, Indianapolis, Ind., for the following contracts: For the improvement of the First Alley west of Delaware St., from the south property line of 32d St. to the north property line of 30th St., by grading and paving the roadway; for the improvement of Brookville Ave., from the north property line of Washington St. to the south property line of New York St., by grading graveling and rolling the roadway; for the improvement of Minnesota St., from the east property line of Shelby St. to the west property line of Churchman Ave., by grading, graveling and rolling the roadway; for the improvement of Ruckle St., from the south property line of 30th St. to the north property line of Fall Creek Boulevard, by grading and paving the roadway; for the improvement of Minnesota St., from the east property line of Shelby St., to the west curb line of Churchman Ave., north side, and from east end of bridge over Pleasant Run to east curb line of State Ave., south side, by grading and paving the sidewalks; for the improvment of Woodland Drive, from the north curb line of Washington St. to the south property line of Ohio St., by grading, graveling and rolling the roadway.

✣Bids will be received until 7 p. m., April 23, by Board of Public Works, Monticello, Ind., for a brick pavement in Broadway St.; cement sidewalks and gutter and crushed stone pavement in Market St.; brick pavement in alley; sewer in alley. W. J. Gridley is City Clerk.

✣Bids will be received until 11 a. m., May 21, by Board of Benton and Tippecanoe County Commissioners, Fowler, Ind., for the construction of a gravel road on the line between said counties. Lemuel Shipman is Auditor of Benton County, Fowler, Ind.

✣Bids will be received until 10 a. m., May 7, by Board of Montgomery County Commissioners, Crawfordsville, Ind., for the grading, draining and paving the M. C. Graves et al., road in Coal Creek Township. Luther Long is chairman of the Board and B. R. Engle is County Auditor.

✣Bids will be received until 11:30 a. m., May 7, by Board of Clay County Commissioners. Brazil, Ind., for the construction of a road on the line between Jackson Sugar Ridge and Washington Townships. Edgar St is Clay County Auditor.

✣Bids will be received until 10 a. m. May 7 by Board of Cass County Commissioners, I gansport, Ind., for the construction of a in Eel Township. J. F. Wallace Auditor

✣Bids will be received until 1 p. m. May 7, by Board of Wabash County Commissioners, Wabash, Ind., for the construction of road gravel or macadam, in Chester Daniel Showalter is County Auditor.

✣Bids will be received until May 7, Commissioners of Knox County, Vincennes, Ind., for the construction of four roads. John T. Scott is County Auditor.

✣Bids will be received until 10 a. m. May 7, by Board of Howard County Commissioners, Kokomo, Ind., for the construction of gravel road in Liberty Township and one one between Taylor, Howard and Center Townships. A. B. Easterling is County Auditor.

✣Bids will be received until 2 p. m. by Board of Monroe County Commissioners, Bloomington, Ind., for the construct stone road in Salt Creek Township. Blakely is County Auditor.

✣Bids will be received until 1:30 p. 6, by Board of Washington County Commissioners, Salem, Ind., for the construction roads in Vernon and Howard Townsh Frank S. Munkelt is County Auditor.

✣Bids will be received until 1 p. 6, by Board of Benton County Commissioners, Fowler, Ind., for the construction roads in Parish Grove Township and Grant Township. Lemuel Shipman is County Auditor.

✣Bids will be received until 2 p. m. by Board of Rush County Commissioners, Rushville, Ind., for the construction adam road in Rushville Township, J is County Auditor.

✣Bids will be received until 1 p. m., by Board of Jennings County Commission Vernon, Ind., for the construction of road in Geneva Township. M. W. Brai County Auditor.

✣Bids will be received until 1 p. m., by Board of Switzerland County Commissi ers, Vevay, Ind., for the constructio highway in Pleasant Township. Scc bertson is County Auditor.

✣Bids will be received until 1 p. m., by Board of Decatur County Commis Greensburg, Ind., for the constructio free macadam road in Sand Creek Towsl L. W. Sands is County Auditor.

✣Bids will be received until 2 p. m., by Board of Newton County Commis Kentland, Ind., for the construction macadamized roads in Lake Township Bringham is County Auditor.

✣Bids will be received until 10 a. m., by Board of Tipton County Commis Tipton, Ind., for the construction of a road in Cicero Township. H. J. Tranbaer County Auditor.

✣Bids will be received until noon, by Board of Miami County Commis Peru, Ind., for the construction of r Peru and Jackson Townships. Frank Elheny is County Auditor.

✣Bids will be received until 2 p. m., by Board of Grant County Commiss Marion, Ind., for the construction of a and stone road in Pleasant Township. Kimball is County Auditor.

✣Bids will be received until 2 p. m., by Board of Blackford County Comm ers, Hartford, Ind., for the constructio macadam road on the line dividing H and Jackson Townships; also macadam Washington Township. James Cronin, County Auditor.

✣Bids will be received until 10 a. m., 24, by Board of Public Works, Indianapolis, Ind., for the following contracts: For the improvement of Fletcher Ave., from east property line State Ave. to west property St. Paul St., by grading and paving the way; for the improvement of first alley of Pratt St., from west property line Ave. to east property line of first alley

Ave, by grading and paving the for the improvement of Goode Ave., from southwest property line Uni- e. to northeast property line Beech- e., by curbing outer edges of road- the improvement of Goode Ave., from southwest property line of d Ave., by grading and paving side the improvement of Kealing Ave., th sidewalk of Washington St. to walk of New York St., by grading ng the sidewalks; for the improvement of Kealing Ave., from north prop- Washington St. to south property line k St., by grading and paving the for the improvement of Westmore- , west side, from south property line to north property line second alley 10th St., by grading and paving the

Board of [illegible] Logansport, Ind., J. E. Wallace, awarded the following contracts at erm: Crane Road No. 1, to Hyman r, Logansport; Crane Road No. 2, McHale, Logansport; concrete work ds, Burnettsville, Ind., and Walter ogansport; Kredone bridge floors to li, Logansport.

man & Ferguson have been awarded ict by the Board of Crawford County oners, English, Ind., for the grading, and paving with stone, etc., of roads Run Township at $5,965. Bid April 1.

Kittrick and Anthony Englehart of Ind., have been awarded the con- Board of Davies County Commis- shington, Ind., for the construc- gravel and macadam roads in [illegible] The Commissioners [illegible] a road in Washington Township to [illegible] of Washington, Ind. Bid April 6.

tern Construction Co. is the prob- or for the paving, grading, curb- ring of Baltimore St., in Michi- Bids were opened April 2. City Engineer.

rd of Wells County Commission- Ind., awarded the following con- road work for which bids were pril 8 by L. A. Williamson, Auditor: rth, Bluffton, macadamize Bend St., rles Henley, Bluffton, Poneto St., , $7,732; James R. Crosbie, Bluff- Road, $2,174; J. n. graveling Stogill Road, $3,620.

Council of Fort Wayne, Ind., has contracts for the construction of the city as follows: Grace Con- , Fort Wayne, for paving the fol- ts with asphalt: Butler St., from o Lafayette, Kinnaird Ave., South from Organ Ave. to Creighton Harrison St., from the alley south St. to Butler; Brooks Construction paving Walnut St., from Fairfield Mine St., with Bessemer block, and St., from Superior St. to the Trent- with vitrified block; Moerllering for paving 4th St. from Clinton with Metropolitan block. Lane, from Main to Pearl, and n, from Main to Superior, with ck. Bids for the paving of Lake Maumee Ave, from Walton Ave. to St., are still under consideration.

Board of Public Works of Vincennes, warded the contracts for the im- t of Lyndale Ave., from 2d St. to the aute road and for the improvement of St., from 1st St. to 11th St., to the Construction Co., of Terre Haute. th streets are to be improved with walks and stone curbing. The item- ls of the successful contractor are: Ave.—Walks $.09 per sq. ft., curbing lin. ft., alley crossings $.10 per sq. las St.—Walks $.10 per sq. ft.; $.44 ft. for curbing, $.15 per sq. ft. for alley s.

ring will be held at 10 a. m., April Board of Public Works, Logansport, Ind., [illegible] Ave., [illegible] the south branch of the Wabash River to the south line of Mildred St., by grading and paving the roadway with granite block, cement concrete, brick or wooden block, laid on a 5-in. gravel or broken stone concrete foundation, from curb line to curb line, to an uni- [illegible] curbs, including the space occupied by gutters and the necessary marginal finish, cement curbing or cement curb and gutter combined, all as shown on plans in accordance with the profiles, details and specifications on file in the office of the Department of the Board of Public Works of the city. The cost of the work is estimated at about $40,000. H. H. Thompson is City Engineer.

Following bids were received by the City Council of Goshen, Ind., for the construction of vitrified brick pavement on Pike and 1st Sts.: W. W. Hatch & Sons—Combination concrete curb and gutter, $.35 per lin. ft.; stone curb, $.50; circular stone curbing, $1.38; Metropolitan brick, per sq. yd, $1.31; Deckman Duty, $1.31; Terre Haute, $1.30½; Hocking Valley, $1.31; Postom, $1.31; paving on concrete foundation, $1.63, asphalt filler, $.19; tar filler, $.02; sand filler, $.01; cement filling $.07; excavating, $.25 per cu. yd.; catch basins, $14; man holes, $30; catch basins and man holes reset, $2; $.20 extra for crushed stone with concrete. Cement walks, $14 per sq. ft. Smith, Douglas & Witt, Goshen—Cement walk, $.15 per sq. ft.; concrete curb, $.22; combination curb and gutter, $.44; stone curb, $.52; Bessemer brick, $1.86; Hocking Valley, $1.84; Metropolitan, $1.86; Postom, $1.53; brick on concrete foundation, $1.95; catch basins, $21.50; manholes, $40; reset, $5; crushed stone, $.22 additional. Henry Cripe, Goshen—Curb and gutter, $.34; cement walk, $.10; stone curb, $.50; circular stone curb, $1.40; Metropolitan brick, $1.47; Bessemer brick, $1.48; Postom, $1.46; Hocking Valley, $1.48; concrete foundation, $.38; asphalt filler, $.20; tar filler $.09; sand filler, $.02; cement filler, $.07; excavating, $.25; catch basins, $18; manholes, $35; reset, $3; $.20 additional for crushed stone.

City Engineer August Pfafflin of Evansville, Ind., has submitted his report to the Board of Public Works on the petitions for the improvement of Linwood Ave., from Monroe Ave. to Green River Road, Oakley St., from Pennsylvania to Illinois St., and West Illinois St., from 9th Ave. to St. Joseph Ave. The cost is estimated at $11,276 for Linwood, $44,878 for Oakley St., and $21,300 for West Illinois St.

The City Council of Shelbyville, Ind., has voted in favor of the paving of South 1st St. with vitrified brick on a cement foundation and asphalt cushion.

The City Council of Connersville, Ind., contemplates paving the following streets this year: Eastern Ave., from 1st to 11th St.; Central Ave., now partly paved with brick, from the stone bridge over the canal north to Virginia Ave., north; Western Ave., from 3d St. to the present brick pavement at 6th St.; Washington St., from 5th to 7th St.; Grand Ave., from the present brick section between 6th and 7th Sts. to the south line of the city cemetery. The cross streets on which it is proposed to place paving are 4th, 5th and 7th Sts., from Eastern Ave. to Western Ave.

City Engineer Henry W. Klausmann of Indianapolis, Ind., has prepared plans and specifications for the paving of Madison Ave., from the Pennsylvania R. R. tracks to Raymond St. The estimated cost, based on wood block paving, is $37,408.

Petitions for the paving of Park Place Sts., from the Myers Road on the east to the Alexandria pike on the north, and also for the improvement of Cincinnati Ave. and Wheeler Ave., under the three-mile road law, have been presented to the City Council of Anderson, Ind.

City Engineer H. H. [illegible]nsport, Ind., has completed plans and specifications for paving Burlington Ave. with brick. The estimated cost is placed at $38,000.

Iowa.

✣Bids will be received until 7:30 p. m., April 30, by City Clerk, New Hampton, Ia., for the construction of about 10,000 sq. yds. of cement concrete pavement and about 9,200 lin. ft. of curbing.

⦿The City Council of Marshalltown, Ia., has let the contract for the construction of 33½ blocks, or about 48,500 sq. yds. of concrete paving to Elzy & Carlson of Marshalltown at $1.08 per sq. yd. Other bidders were: J. S. McLaughlin & Sons, Red Oak., Ia.; F. K. Hahn, Cedar Rapids, Ia.; Lytton & Reinkling Construction Co., Des Moines, Ia., and Dearborn & Jackson, Cedar Rapids, Ia.

⦿The City Council of Eagle Grove, Ia., has awarded the contract for the placing of asphaltic concrete paving to the Des Moines Asphalt Co., Des Moines, Ia., at $1.37 8/10 per sq. yd., and the contract for the construction of curbs and gutters to C. H. Atkinson, Watertown, S. Dak., at $.49. Bids were opened April 18.

The City Council of Mason City, Ia., has passed a resolution of necessity for the paving of East 5th St.

The Polk County, Ia., surveyors will survey the road between Des Moines and Ankeny in order to make plans for the permanent improvement of that thoroughfare. It is probable that the road will be paved with brick or cement.

The City Council of New Hampton, Ia., has voted to pave Broadway, from Main St. to the Milwaukee depot.

Kansas.

✣Bids will be received until 8:30 a. m., April 22, by City Clerk, Abilene, Kan., for the construction of 2½ miles of brick, asphalt, concrete, asphaltic concrete, sarcolithic or Hassam pavement and curb and gutter. Kenyon Riddle is City Engineer.

The City Council of McPherson, Kan., has passed an ordinance providing for the paving of Kansas Ave., from past the Rock Island R. R. through and past the Union Pacific and Missouri Pacific Ry.

Louisiana.

The DeSoto Police Jury, Mansfield, La., has decided to complete the road to the Sabine Parish line, and to complete the road to Logansport, and to build a road from Mansfield to the Red River Parish line.

The City Council of Lake Charles, La., has adopted an ordinance providing for paving five of the principal streets of the city; North Ryan, Broad, Kirby, Pujo, Hodges and Division. Bids will be asked for and work started early in May. Wood block, bitulithic, asphalt and brick will be used.

Maryland.

✣Bids will be received until April 24, by Board of Awards, Baltimore, Md., for paving Mason and Jenkins alleys, between Preston and Hoffman Sts. The work will be done under Contract No. 19 and will include 880 sq. yds. of vitrified block; 600 lin. ft. of concrete curb; 180 cu. yds. of grading. A certified check for $200 must be filed with each bid. Charles A. Edel is secretary of the Paving Commission.

Massachusetts.

The town of Westfield, Mass., will let contracts in July or August for the construction of 4,900 sq. yds. of granite block pavement, and 860 ft. of concrete curb. The pavement will be laid on concrete foundation with cement and sand filler. John L. Hyde is Town Engineer.

Michigan.

The Common Council of Flint, Mich., has passed a resolution declaring the construction of a pavement on Williams St. to be a necessary public improvement and instructing the City Engineer, H. E. Terry, to prepare plans and specifications for the work.

The citizens of Ottawa County, Mich., at a recent election voted the issuance of bonds in the sum of $600,000 for the construction of good roads. Grand Haven is the county seat.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Marshall Township, Marshall, Mich., has voted to accept an offer made by F. A. Stuart of Marshall to build four miles of gravel road from Marshall, one-half the expense to be borne by him and the other half by the township.

The citizens of Hastings, Mich., at a recent election voted to bond the city for a mile and one-half of paving.

Minnesota.

✣Bids will be received until 8 p. m., April 23, by A. M. Childs, City Clerk, Crookston, Minn., for furnishing the city a new 10-ton gasoline road roller and also an 8-ton gasoline road roller, f. o. b. car at Crookston.

✣Bids will be received until 2 p. m., April 23, by Polk County Board, Crookston, Minn., for doing road work on the state road on line between the towns of Gentilly and Kertsonville. The estimated cost of the work is $2,000. S. Steenerson is Assistant State's Engineer, St. Paul, Minn.

⊙Fielding & Sheplin, St. Paul, Minn., have been awarded the contract by the City Commissioners of Saskatoon, Sask., James Clinkskill, Commissioner, for the laying of sandstone block pavement on 5-in. concrete base. The contract price is $117,810. George T. Clark is City Engineer. Bids were opened April 6.

The construction of 21 miles of macadam road, for which bids were asked by Joseph Winczewski, County Auditor, Winona, Minn., until April 9, were to have been built under the Elwell law. The law is to be tested in the State Supreme Court, which will be argued May 6 and 7. If the law is held constitutional the work will probably be readvertised.

The Hennepin County Commissioners, Minneapolis, Minn., have instructed County Surveyor Frank Haycock to prepare plans and specifications for improvements to be made upon nine county roads by the commissioners. Work upon the roads will be completed this summer, at an approximate cost of $37,000. The roads are: Minneapolis to Watertown, Minneapolis to Shakopee, Rockford, 6th Ave. N. extension, Bass Lake and Crow River, Fort Snelling and Shakopee, Penn Ave., Independence and Minneapolis to Monticello.

The Stuntz Township Board, consisting of A. Newberg, chairman; and Supervisors J. B. Connors and A. P. Silliman, has mapped out a road building program which will necessitate the expenditure of $90,000. A road engineer will probably be employed. Stuntz Township is located in St. Louis County, of which Duluth, Minn., is the county seat.

Mississippi.

✣Bids will be received until 2 p. m., May 7, by Good Roads Commission of Supervisor's District No. 4, Monroe County, Miss., for the purchase of about 52,000 cu. yds. of rock and gravel for surfacing 26 miles of public highway in that district. The longest haul is 5 miles and average haul is 2½ miles. Plans and specifications may be obtained at the office of the Commission Clerk, P. O. Box 115, Aberdeen, Miss.

At a recent election the voters of Kosciusko, Miss., authorized the Board of Aldermen to issue sidewalk and street bonds in the sum of $30,000.

Missouri.

✣Bids will be received until April 26, by Board of Public Improvement, St. Louis, Mo., for paving a number of streets. The estimated cost of the work is as follows: Asphalt—Osceola, between Broadway and Virginia, $25,328. Brick—John, between 11th and Von Phul, $2,696; Gasconade, between Pennsylvania and Minnesota, $4,009; Grace, between Gravois and Fairview, $10,310; Newhouse, between Blair and 19th, $3,940; Shaw, between Tower Grove and King's Highway, $33,897; Arsenal, from Louisiana to Grand, $9,354; Cherokee, between California and Nebraska, $4,389; Mound, between 2d and Broadway, $4,040; North Market, between Broadway and 15th, $37,263. Wood Blocks—Delmar, between Skinker and city limits, $8,312; Delmar, between Rosedale and Skinker, $16,117; Locust, from 4th to 13th, $16,410; Olive, from Channing to Grand, $8,934.

⊙The Metropolitan Paving Co. has been awarded the contract by the Board of Public Works of St. Joseph, Mo., to pave 20th St., Messanie to Olive, with asphalt-macadam, at $1.35 per sq. yd.

The City Council of Hannibal, Mo., has passed resolutions for paving two streets with Hassam pavement, Broadway and Main Sts., to a point 215 ft. easterly from the east curb line of 1st St., and Center St., from Main St. to 5th St.

The Harg Road District, Fulton, Mo., on April 6, voted the issuance of bonds in the sum of $20,000 for the improvement of the Fulton gravel road on the cross state highway. The Harg district joins the Columbia district on the east and extends to the Callaway County line. About five miles of cross state highway is in the district. Dr. W. P. Dysart, M. A. Turner and W. E. Crews are commissioners.

New Jersey.

⊙The city of Paterson, N. J., H. J. Harder, City Engineer, has awarded the following contracts for permanently improved streets in the city: Carroll St., wood block, Mack Bros., 512 W. 53d St., New York City, $13,633; Clay St., Dolarway, Mack Bros., $24,194; Ellison St., extension, and Spruce St., Geo. F. Brackett, Ridgewood, N. J., granite block, $17,914; Main St., Mack Bros., wood block, $7,020; Market St., granite block, Mack Bros., $35,142; Mill St., Geo. F. Brackett, granite block, $10,137.

⊙O'Gara & Maguire, 238 Washington St., Newark, N. J., have been awarded the contract for the grading, flagging and curbing of a number of streets in the city of Newark, N. J., at $6,488. Bids were received April 1 by W. C. Van Dwyne, 52 Grove St., Bloomfield, N. J., Engineer.

New York.

✣Bids will be received until 10:30 a. m., April 23, by Cyrus C. Miller, President of the Borough of Bronx, New York City, for regulating, grading, setting curbstones, flagging sidewalks, laying crosswalks, building approaches and erecting fences where necessary in Corlear Ave., from 230th St. to 240th St., together with all work incidental thereto. The Engineer's estimate of the work is as follows: 1,500 cu. yds. of earth excavation; 500 cu. yds. of rock excavation; 55,500 cu. yds. of filling; 4,760 lin. ft. of new curb; 18,850 sq. ft. of new bluestone flagging; 1,010 sq. ft. of new bridgestone; 4,050 cu. yds. of dry rubble masonry; 200 lin. ft. of vitrified pipe, 12 ins. in diameter; 15,000 ft. (B. M.) timber and lumber; 4,100 lin. ft. of guard rail; sinkage, shrinkage and settlement. The time allowed for the completion of the work will be 225 working days. The amount of security required will be $15,000.

✣Bids will be received until 11 a. m., April 24, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for six improvement contracts, the largest being No. 1, for regulating and repaving with asphalt block on present concrete foundation the roadway of Bushwick Ave., from Montrose Ave. to McKibbin St., and from Flushing Ave. to Arion Pl. The Engineer's estimate is as follows: 4,960 sq. yds. asphalt block pavement, outside railroad area (5 years' maintenance); 830 sq. yds. asphalt block pavement, within railroad area (no maintenance); 10 cu. yds. concrete outside railroad area; 10 cu. yds. concrete within railroad area; 210 lin. ft. granite heading stones set in concrete. Time allowed 40 working days. Security required $4,000.

⊙The Board of Trustees of Geneseo, N. Y., has awarded the contract for the construction of the new road on Court and Bank Sts., in the village, to Hagaman & White of Rochester, N. Y., at $10,459. Other bidders were Schrader & Hicks Construction Co., $11,378 and Lawrence Leonard, Geneseo, $11,266. William D. Shepard is Village Clerk. Fred C. Lyon, Consulting Engineer.

⊙The Town Council of Olean, N. Y., [illegible] let the contract for the paving of [illegible] St., from State to North Union St., [illegible] D. [illegible] Dugan at $20,318.

⊙The Board of Public Works of Niagara Falls, N. Y., has awarded the contract for the paving of Whirlpool St. to H. P. Burgard, Buffalo, N. Y., at $45,800 on asphalt block.

An appropriation of $17,630 has been voted by the Warren County Supervisors [illegible] La[illegible] George, N. Y., for the county's share of the construction of the Chestertown-Hague road, 6.36 miles. This road will extend from Chestertown through Starbuckville and H[illegible] con to the southeast shore of Brant Lake, [illegible] ing at the dividing line between the towns [illegible] Horicon and Hague. The total cost will [illegible] $82,700.

North Dakota.

Following bids were received April [illegible] by [illegible] R. Orchard, City Auditor, Fargo, N. Dak., [illegible] the construction of approximately [illegible] yds. of pavement in the 3d Ward, [illegible] plans and specifications were prepared by [illegible] Engineer F. L. Anders; (1) standing for [illegible] of S. Birch & Sons, (2) James Kennedy, [illegible] Warren Bros., and (4) O. C. Chapi[illegible]

	(1)	(2)	
Cement concrete	$1.30	$1.30	[illegible]
Bituminous concrete	1.42	1.64	[illegible]
Sheet asphalt	1.82	1.85	[illegible]
Bitulithic	2.10	1.90	[illegible]
Brick	2.32	2.40	[illegible]
Creosote wood block,			
Creosote wood block, "A"	2.40	2.55	[illegible]
Creosote wood block, "B"	....	2.40	
Dolarway	....	.....	[illegible]

Ohio.

✣Bids will be received until noon, M[illegible] (readvertisement, bids received Ap[illegible] jected), by G. A. Boeckling, president and [illegible] eral manager, Cedar Point Resort C[illegible] Point, O., for the construction of [illegible] miles of paved roadway from the Hu[illegible] to the resort. A certified check for $3[illegible] be filed with each bid.

✣Bids will be received at the office [illegible] Commissioners of Guernsey Count[illegible] bridge, Ohio, until 10 a. m., April 19, [illegible] ing and paving with brick for hea[illegible] highways the Stubenville Road Pet. N[illegible] Cambridge Township, said county. Le[illegible] 5,280 ft. or 1.00 miles. Width of pa[illegible] 14 ft. Estimated cost of construction, $[illegible] A draft or certified check for $300 sh[illegible] posited with each bid. The successful bi[illegible] shall be required to give bond for an [illegible] equal to the contract price, for the [illegible] performance of the obligations within [illegible] tract. Date set for completion, Augus[illegible] Plans and specification are on file in [illegible] of the County Commissioners and [illegible] Highway Department. The State [illegible] Commissioner reserves the right to r[illegible] and all bids. James R. Marker, Colum[illegible] State Highway Commissioner.

✣Bids will be received at the offic[illegible] Commissioners of Coshocton County, [illegible] ton, Ohio, until 10 a. m., April 22, [illegible] grading and constructing with a wa[illegible] macadam having bituminous surface t[illegible] the Walhonding and New Gilford R[illegible] No. 356, in New Castle and Perry T[illegible] said county. Length 12,505 ft. or 2.[illegible] Width of pavement, 12 ft. Estimated cost [illegible] construction, $13,986.06. A draft or [illegible] check for $300 shall be deposited w[illegible] bid. The successful bidder shall be re[illegible] give bond for an amount equal to [illegible] tract price, for the faithful perform[illegible] the obligations within the contract. [illegible] for completion, August 1, 1912. Al[illegible] bids will be considered for the con[illegible] of the above mentioned road by pavin[illegible] bituminous bounded macadam. Estim[illegible] of construction, $16,320.34. Plans ar[illegible] fications are on file in the office of the [illegible] Commissioners and the State High[illegible] partment. The State Highway Comm[illegible] reserves the right to reject any and [illegible] James R. Marker, Columbus, O., Stat[illegible] way Commissioner.

✣Bids will be received at the offic[illegible] Commissioners of Carroll county, [illegible] Carrollton, Ohio, until 9 a. m. [illegible] grading and paving with for medium traffic the Stubenville and in Center Township, said county. ft., or 1.33 miles. Width of pave- t. Estimated cost of construction, A draft or certified check for be deposited with each bid. The bidder will be required to give bond ount equal to the contract price. for completion, August 1, 1912. Plans specifications are on file in the office of oun Commissioners and the State Highway Department. The State Highway Comone reserves the right to reject any and ids. James R. Marker, Columbus, O., is Highway Commissioner.

will be received at the office of the ers of Wyandot county, Upper Ohio, until 10 a. m., April 23, for l constructing with a water-bound he Uncapher Road, Pet. No. 406, in township, said county. Length, 2 miles. Width of pavement, ted cost of construction, $12,76[illegible] certified check for $300 shall be ith each bid. The successful bidder ired to give bond for an amount contract price. Date set for comgust 1, 1912. Plans and specifican file in the office of the county ers and the State Highway De- The state highway commissioner right to reject any and all bids. arker, Columbus, O., is state high- [illegible]

ll be received at the office of the ers of Guernsey county, Cambridge, 0 a. m., April 19, 1912, for grading with brick for heavy traffic high- Newcomerstown Road, Pet. No. 252, ge township, said county. Length, 1 mile. Width of pavement, 14 ft. of construction, $14,947. A tified check for $300 shall be de- each bid. The successful bidder required to give bond for an amount contract price for the faithful perf the obligation within the contract. completion, August 1, 1912. Plans ations are on file in the office of the nissioners and the State Highway The state highway commissioner right to reject any and all bids. arker, Columbus, O., state highway er.

ll be received at the office of the oners of Morrow county, Mt. Gilead, til 10 a. m., April 24, for grading and ing with a water-bound macadam bituminous surface treatment, the on Road, Pet. No. 365, in Cardington ead townships, said county. Length, ft. or 2.95 miles. Width of pavement, Estimated cost of construction, A draft or certified check for $300 deposited with each bid. The success- shall be required to give bond for nt equal to the contract price for the performance of the obligations within ract. Date set for completion, August Alternative bids will be considered construction of the above mentioned paving with a water-bound macadam a gravel base and a bituminous surface nt. Estimated cost of construction, 15. Plans and specifications are on file ffice of the county commissioners and ite Highway Department. The state commissioner reserves the right to reand all bids. James R. Marker is ighway commissioner, Columbus, O.

ls will be received at the office of the sioners of Carroll county, at Carrollton, until 9 a. m., April 27, for grading and with brick for medium traffic the Peg road, Pet. No. 413, in Center and townships, said county. Length 5,500 1.04 miles. Width of pavement 14 ft. ted cost of construction, $17,215.50. A r certified check for $300 shall be de- with each bid. The successful bidder required to give bond for an amount o the contract price. Date set for com- August 1, 1912. Plans and specifica- [illegible] commissioners and the State Highway Department. The state highway commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is state highway commissioner.

✣Bids will be received at the office of the commissioners of Vinton county, at McArthur, Ohio, until noon, April 17, 1912, for grading and constructing with a water-bound macadam the McArthur-Hamden Road in Elk and Clinton townships, said county. Length, 17,080 ft., or 3.24 miles. Width of pavement, 12 ft. Estimated cost of construction, $21,389.83. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 1, 1912. Plans and specifications are on file in the office of the county commissioners and the State Highway Department. The state highway commission reserves the right to reject any and all bids. James R. Marker, Columbus, O., state highway commissioner.

⊙The Franklin County Commissioners, Columbus, O., recently awarded the following contracts for the building of 11 miles of waterbound macadam road, totaling $68,997; Vogelberg & Walls, Cole Road, two miles in Brown and Prairie Townships, $9,982; Jewett & Keys, Kenny Road, 3¾ miles in Clinton and Perry Townships, $26,677; J. N. Snouffer, Scioto and Mudsock Road, 4½ miles, $29,030; W. O. Jewett, one-half mile of the Hart Road in Norwich Township, $3,311.

⊙Lambert & Wirt of Delaware, O., have been awarded the contract by the Department of Public Service of Galion, O., for the placing of brick pavement on concrete base on Atwood and East Railroad Sts. Bids [illegible] March 30.

⊙Wm. H. Reed, East Youngstown, O., has been awarded the contract by the Village Council of that place, for the construction of all sidewalks in 1912 at $.107 per sq. ft. Approximately 5 miles of sidewalks will be laid during the year. Bids were opened April 10.

⊙The contract for the macadamizing of North Main St., from Howard Run to Bell Ave., has been awarded by Director Joseph Oehlschlager of Findlay, O., to the Hancock Stone Co. Work will be started at once and to be completed by July 1.

City Engineer Samuel Harper of Portsmouth, O., is surveying a proposed sidewalk improvement on the west side of the Chillicothe pike, from the N. & W. road north to Kinney Lane.

The City Council of Findlay, O., has passed an ordinance to pave Center St. and McManness Ave., and to issue $9,570 in bonds to pay for the improvement. City Engineer Harry A. Glathart has estimated the cost of the proposed paving of the west side of South Main St., at $8,939. A. B. Crozier is City Auditor.

The City Council of Canton, O., has passed resolutions providing for the paving of South Wells St. and Meyers Court, and instructed City Engineer Phil Weber to prepare plans and estimate the cost of the improvements.

The citizens of Bryan, O., at a recent election voted the issuance of bonds in the sum of $60,000 to pay the village's share of the proposed paving. About $175,000 will be secured for the construction of more than five miles of streets.

The Gurnsey County Commissioners, Cambridge, O., have adopted a resolution for grading, curbing and paving with brick what is known as the Newcomerstown road in Cambridge Township for a distance of one mile. The width of the pavement is to be 14 ft., and the estimated cost of construction is $14,947. The board also adopted one for improving one mile of what is known as the Steubenville road, Cambridge Township, estimated to cost $15,646.

Oregon.

R. S. B[illegible], Ore., will sell bonds April 29 in the sum of $50,000 for paving work.

The City Council of Portland, Ore., has formed three improvement districts in Westmoreland in which hard surface pavements will probably be laid this year. The districts are East 17th, estimated by City Engineer Tom Hurlburt to cost $66,000; East 19th, estimated to cost $58,000, and East 21st, estimated at $47,000. Bids for the work have been received as follows: Independent Paving Co., $45,665, $51,164 and $47,920, respectively.

Pennsylvania..

An ordinance authorizing contracts for about $238,000 worth of street repaving has been presented in the City Council of Pittsburgh, Pa., by Director Joseph G. Armstrong. The proposed pavements would be laid on the following streets: Penn Ave., from a point near 15th St. to a point near 29th, $30,000; Penn Ave., north side, from Lexington Ave to city line and from Braddock Ave. to city line, $9,500. Fifth Ave., Shady Ave. to Penn Ave., $23,000. Ellsworth Ave., north side, from a point near Colonial place to College Ave.; south side, from Ivy St. to a point near College Ave; south side, from Clyde St. to a point near Colonial Place, $25,000. Liberty Ave., north side, from 23d St. to a point near 28th, $9,500. Wilkins Ave., from 5th Ave. to the top of the hill, $9,500. Ohio St., from Federal St. to a point near Cedar Ave., $20,000. Perrysville Ave., from a point near Butler St. to Taggart, $21,000. Selby alley, from South 9th St. to South 10th, $1,700. Pretense (formerly Pine) St., from South 9th to South 10th St., $1,600. Sandusky (formerly 7th) St., from Liberty to Penn, $3,200. South 25th St., from Sidney St. to the Pittsburgh & Lake Erie R. R., $10,800. Devon road and Reynton lane, $4.200. West Carson, from Main, $2,500. Thomas Boul., from Linden to Dallas, $10,000. 9th, from Penn to Liberty, $2,500. South 25th, from Harcums to Mary, $1,700. Fox alley, from South 19th to South 20th, $2,200. South 18th, from Fox to Wharton, $1,700. South Sixteenth, from Mary to P., V. & C. R. R., $2,700. Webster, from Kirkpatrick to Francis, $10,000. Elm, from Wylie to Franklin, $2,300. 23d, from Smallman to Liberty, $3,500. Colwell, from Vine to Dinwiddie, $7,200. Locust, from Van Braam to Pride, $6,700. Merriman, from South 17th to South 18th, $3,000. Lincoln, from Agnew to city line, $13,100.

Citizens of Lehighton, Pa., are urging the Town Council to take immediate steps towards paving the streets regardless of cost.

The Reading Transit Co. plans the construction of approximately $16,000 worth of street paving in Norristown, Pa., within the next six months.

Tennessee.

✣Bids will be received until 1 p. m., April 24, by Monroe County Road Commissioners, Madisonville, Tenn., for grading about 160 miles of road in Monroe County. Plans and specifications are on file at the office of the Engineer, Madisonville, Tenn.

⊙T. J. Martin of Dover, Tenn., has been awarded the contract by G. S. Bingham, Asst. Quartermaster, Jeffersonville, Ind., for repairs to roadway and guttering at Fort Donelson National Cemetery, Dover. The contract price is $570. Bids were opened March 27.

The Sullivan County Court, Blountville, Tenn., has made an appropriation that guarantees the construction of a highway from Birstol to Kingsports. The citizens of Bristol and Kingsport have contributed $8,000 toward the work.

The citizens of Athens, Tenn., will vote April 20 on the proposition to issue bonds in the sum of $20,000, the proceeds from the sale of which are to be used for retiring the city's floating indebtedness and for street improvement work. The improvements will consist of paving with brick or asphalt and cement sidewalks for an additional 10 miles to those already laid.

Texas.

✣Bids will be received until [illegible] p. m., April 25, by Commissioners' Court, Anderson County, W. H. Harding, judge, Palestine, Texas, for grading, draining and surfacing 10 sand clay roads of a total length of about 40 miles.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

⦿The City Commission of Fort Worth, Tex., has awarded the contract for the paving of North Main St., from North Third St. to the Cotton Belt railroad, to the General Construction Co. Thurber brick will be used.

⦿The Dallas County Commissioners' Court, Dallas, Tex., has awarded a contract to W. T. Strong for gravel to be used on the Eagle Ford road. The contract calls for the deliv[illegible] miles at $1.15 per 36 cu. ft.

⦿The Tiffin Crushed Stone Co. has been awarded the contract by the County Commissioners' Court, Dallas, Tex., for the furnishing of from 12,000 to 30,000 cu. yds. of crushed limestone, 2,240 lbs. being considered a yd., at $.56 per yd. The freight rate included will bring the price to approximately $1.30 per gross ton, or yd. J. F. Witt is County Engineer. Bids were opened March 30.

Precinct No. 2 of Bastrop County, Tex., on April 2 voted the issuance of bonds in the sum of $100,000 for the construction of good roads. Bastrop is the county seat.

The citizens of Terrell, Tex., at a recent election voted the issuance of bonds in the sum of $20,000 for street improvements.

The City Council of Taylor, Tex., has called an election for April 30 for the purpose of having the citizens vote on the issuance of bonds in the sum of $25,000 for permanent street improvements, the paving of Maine and intersecting business streets.

The City Council of Temple, Tex., had adopted a resolution providing for the pavement of Adams Ave. from First to Main St. with vitrified brick. The city's portion will cost about $1,800.

Utah.

The City Commission of Logan, Utah, has created Paving District No. 21, embracing about 94 blocks and covering a large portion of the city.

The Weber County commissioners, Ogden, Utah, have instructed County Surveyor Ralph Corlew to prepare at once a detailed survey of the proposed change in the county road at North Ogden and report on its feasibility and approximate cost. The proposed change will eliminate the heavy grade on the North Ogden hill. It is the intention of the commission to macadamize the new road, which will be three rods wide.

The engineers of the State Road Commission of Utah have resurveyed the state road for the purpose of building a 50 ft. highway through the city of Nephi instead of the regular width of 34 ft. The city is planning to curb the portion of the new road through the business section of town.

Virginia.

✣Bids will be received until noon, April 20, by Committee on Streets and Sewers, at the office of H. L. Shaner, city engineer, Lynchburg, Va., for paving certain streets. The principal items of work to be done are as follows: 25,000 cu. yds. excavation, 37,000 sq. yds. granite rubble stone pavement and 22,000 lin. ft. granite curb. Specifications and forms of proposals can be obtained at the office of the city engineer, Lynchburg, Va.

Washington.

✣Bids will be received until 3 p. m., May 1, by J. R. Pitman, town clerk, Goldendale, Wash., for furnishing labor and material for grading, curbing, parking and paving streets and constructing storm sewers.

⦿Mills Bros. have been awarded the contract by the Thurston County commissioners, Olympia, Wash., for building and improving permanent highway No 2, east of Olympia, at $3,081 for the state's portion of the work, and for the county's part, from stations 83 to 110, 22 cts. per yard for excavating 2,900 yds; and force account the same as on state's portion, which was $6 for man and team, $2.75 for man alone and $4 for foreman. On the state's portion they will receive 3 cts. per yard for an estimated overhaul of 15,000 yds. and in addition will receive $3 for grubbing stumps of 12 to 36 ins., $4 for 36 to 50 ins. and $6 for over the latter size.

⦿The Board of Public Works of Seattle, Wash., has awarded the following contracts for paving and sidewalk work: Concrete walks on Newport Ave. et al., D. H. Traphagen, $9,397; surfacing Fourth Ave. S., with asphalt, Barber Asphalt Co., $28,141; concrete walks on 20th Ave., N. E., et al., Carl Isidor & Co., $9,328; paving, etc., Harvard Ave., N., Xura Case, $7,936; concrete walks on 25th Ave., N., Edgar C. Parks, $836; grading 37th Pl., Robt. J. Barter.

⦿Commissioner of Public Works Owen Woods of Tacoma, Wash., has awarded the contract for the extension of Jefferson Ave. to Center St., from South 27th St., to John Huntington & Co. at $49,500.

Following bids were received April 6 by the Whatcom County Commissioners, Bellingham, Wash., Chas. Lindberg, Engineer in Charge, for the construction of pavement 16 ft. wide and necessary culverts, as follows: (1) being bid of Independent Asphalt Co., (2) Independent Asphalt Co., and (3) Hardy Construction Co.: (1) North West Diagonal Road, from westerly side of city limits of Bellingham, Warrenite paving, 1 mile, 6-in. top, $18,609; (2) North East Diagonal Road from easterly side of city limits of Bellingham, concrete paving, 1 mile, 5-in. base and 1-in. top, $14,444; (3) Nouksack-Sumas Road from westerly side of town of Sumas, concrete paving, 1½ miles, 6-in. straight concrete, $19,072.

The City Council of Spokane, Wash., has ordered the paving of Ash St., Broadway to Northwest Blvd. The cost of the improvement will range from $38,470 for asphalt macadam to $75,170 for wood blocks. D. C. Coates is commissioner of public works.

Plans and specifications have been approved by the Board of Public Works of Seattle, Wash., for the following improvement work: Concrete walks on N. 82d St., et al., estimated at $11,000, including 8,810 sq. yds., and 16,000 ft. of crosswalks; paving 37th Ave. N., including 5,643 ft. of curb and 7,588 sq. yds. of paving, estimated at $26,000; grading West 51st St., et al., including 55,000 cu. yds. of earthwork, 22,000 cu. yds. of embankment, 142,000 ft. of curb and 16,000 ft. of box drains, estimated at $29,000; concrete walks on N. 80th St., et al., including 11,144 sq. yds. of walk, 23,000 ft. of alley concrete, crossing 48 sq. yds., estimated at $14,000; paving Jackson St., et al., 1,735 ft. of curb, 5,675 sq. yds. of paving, 1,582 sq. yds. concrete walls, estimated at $25,000.

City Engineer A. H. Dimock of Seattle, Wash., has been instructed by the City Council to prepare plans and specifications for an improvement that will reduce the grade of 12th Ave. S. from 8½ to 6 per cent between Weller and Judkins Sts. The cost of the work is estimated at $50,000.

Plans are under way in the Whatcom County engineer's office, Bellingham, Wash., to begin the survey of the road between Deming and Heisler's on the Deming tr thought the survey will be finish latter part of this month.

The Board of Public Works Wash., has been petitioned for th ment of Hoyt Ave. from Wall St., Ave. and Wall St from Colby Aves., by paving with asphalt and c walks.

Wisconsin.

⦿G. H. Stanchfield, Fond du Lac been awarded the contract by the cit kesha, Wis., M. R. Butler, City En the construction of bituminous ma concrete curb and gutter at $43,926. will include 12,443 cu. yds. of grad ft. of concrete curb and gutter, 32,4 of bituminous macadam, 1,868 sq. yd and 355 ft. of storm sewer. Bids w April 8.

Following bids were received Apr City Council of Du Pere, Wis., for of Main Ave., Fourth St. and Fifth Sts., contract to be let within a f G. H. Stanchfield & Co. of Oshkosh 1—Curb and gutter, 50 cts. per run concrete pavement, $1.40½ per sq. y macadam, poured process, $1.39. J Curb and gutter, $.51; concrete, $1 macadam, $1.44. Job No. 3—Curb a $.51, $1.44; asphalt macadam, $1.4 Weber Construction Co. of Oconom 1—Curb and gutter, $.52; concrete, phalt macadam, $1.62. No. 2—Curb ter, $.52; concrete, $1.48; asphalt $1.65. No. 3—Curb and gutter, $.52 $1.48; asphalt macadam, $1.65. W struction Co. of Milwaukee: No. 1— gutter, $.45; sheet asphalt 1½ in $1.72; 2 in. surface, $1.82; asphaltic $1.49. Same figures on job No. 2 a Fred Eul of Menasha: No. 1—Curb ter, $.53; sheet asphalt, 1½ in. surfa concrete, $1.46. No. 2—Curb and gu sheet asphalt, $1.95; concrete, $1.41. Curb and gutter, $.52; sheet asph concrete, $1.45. McGrath Constructi Green Bay: No. 1—Curb and gutter, phaltic concrete, $1.44; concrete, $1 phaltic macadam, $1.29. No. 2—Curb ter, $.50; asphaltic concrete, $1.52; $1.42; asphaltic macadam, $1.37. Curb and gutter, $.50; asphaltic $1.52; concrete, $1.42; asphaltic $1.32.

Canada.

⦿The Buffalo Steam Roller Co., B Y., has been awarded the contrac Board of Control of Winnipeg, Peterson, Secy., for furnishing on Buffalo Pitts double drive tandem roller at $3,053. Bids were opened

⦿The Board of Control of Winnipe M. Peterson, Secy., awarded the contracts for the supplying of asphalt by the city during 1912, for which b opened March 20: Alloway & C Winnipeg, 2,500 to 3,000 tons of re phalt at $21.60 net ton; 700 tons of fluxing oil at $21.85 net ton; Canadi eral Rubber Co., Winnipeg, 1,200 to 1 of asphalt cement at $23.50 net ton.

⦿The Waterous Engine Works, Ltd ville, Ont., has been awarded the co the city of Vernon, B. C., D. G. T Clerk, for supplying and delivering ton road roller at $3,250. Bids were April 1.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

✣Bids will be received from 1 until 3 p. m., April 25, by Directors of Beaver Bayou Drainage District, Phillips County, at the rooms of the Board of Trade, Solomon Bldg., Helena, Ark., for the following described floating dredge ditches: Johnson Bayou ditch, 625 stations, 307,000 cu. yds.; Lick Creek ditch, 340 stations, 539,000 cu. yds.; Beaver Bayou ditch, 840 stations, 675,000 cu. yds.; Hillside ditch, 250 stations, 85,000 cu. yds. Maps, profiles, etc., may be obtained of C. B. Bailey, Wynne, Ark., Consulting Engineer. J. A. Gussiner, Helena, Ark., is Resident Engineer.

⦿Bids were opened April 9 by C. B engineer, Levee District No. 4, Wynn for about 442,000 cu. yds. of levee w contract being awarded to A. V. Wills Paragould, Ark., at 15.99 cts. per cu. y work is designed as floating dredge w the average section of the levee is as

7 ft.; height 7 ft.; slopes, 2:1. The gth is about 21 miles and the work the west side of Dunklin County and sied to prevent the overflow of the St. River.

Georgia.

pt is to be made shortly to the city of Augusta, Ga., on the proposed ntioned in our last issue. As soon as rt is received it is planned to call an to vote a $1,000,000 bond issue for the on of the city against floods.

Iowa.

B will be received until noon, April 19, Frk McSpaden, Hampton, Ia., for the tion of Drainage District Sub. No. 6 ict No. 6. The work will be let in six

B will be received until noon, April 19, k McSpaden, Franklin County Audimpton, Ia., for the construction of e District No. 20, in two sections.

B will be received until noon, April 19, k McSpaden, Franklin County Audimpton, Ia., for the construction of District No. 21 in two sections. G. , Clarion, Ia., is Engineer.

will be received until noon, April 19, McSpaden, Franklin County Audimpton, Ia., for the construction of District No. 23, in two sections. hem, Clarion, Ia., is Engineer.

Kentucky.

ill be received until 10 a. m., May 7, f Fiscal Court, Jefferson County, Ky., for the construction of Mill h and extension of Pond Creek F. Crecelius, 403 Equitable Bldg., Ky., is Civil Engineer.

Louisiana.

ice jury of Avoyelles Parish, J. B. President, Marksville, La., has vo drainage districts, one the Avorainage District No. 4, comprising tern the Second, Fourth and Fifth Wards parish, and the Bordelonville Drainage , in the Sixth Ward of Avoyelles.

Michigan.

ls will be received until April 25, by E. lman, Commisioner of Drains, Gratiot , Ithaca, Mich., for cleaning out 404.4 f No. 152 drain in Emerson Twp., Co. The bottom width is 4 ft. and erage about 1.5 ft. in depth of cleaning he upper 441.36 rods of this drain will at this time as a tile job of which ods will be 18 in., 194.36 rods of 12 in. 4 rods of 8 in. The most of the tile will in an open drain, the maximum cut bottom of old drain being 3 ft. and will e not to exceed 25 ft. The furnishing tile will be let as a separate contract. cil Committee of Saginaw, Mich., has d favorably on the plan for extending ly line ditch on the east from the Pere ette south tracks, its present ending, to er, a distance of about 1,500 ft. The ted cost is $2,000. H. H. Eymer is City er.

Minnesota.

ds will be received until 10 a. m. April W. H. Holz, County Auditor, St. Peter, for the construction of Ditch No. 3, in- 3,051 cu. yds.; also for Ditch No. 52, ng 7,704 cu. yds. The estimated cost $1,204.

ds will be received until 1 p. m., May 7 P. Edwards, County Auditor, Fairmont, for the construction of Judicial Ditch of Martin County, all tiled requiring: ft. of 20-in. tile, average depth, 8.2 ft., um depth 11.16 ft. 3,400 ft. of 18-in. verage depth 7.4 ft., maximum depth 9 000 ft. of 16-in. tile, average depth 6.7 ximum depth 8.64 ft. 4,200 ft. of 15-in. verage depth 7 ft., maximum depth 8.69 0 ft. of 14-in. tile, average depth 5.8 ft., um depth 5.96 ft. 2,800 ft. of 12-in. tile, e depth 6.5 ft., maximum depth 8.80 200 ft. of 10-in. tile, average depth 5.1 ft., maximum depth 7.59 ft. 11,650 ft. of 8-in. tile, average depth 4.9 ft., maximum depth 8.24 ft. 1,600 ft. of 6-in. tile, average depth 5.1 ft., maximum depth 6.68 ft. The average haul for tile is about two miles; nearest railroad station Granada, on C. M. & St. P. R. R. Soil is mostly black loam with clay sub-soil. Clay tile specified. Bids to be accompanied by certified check, payable to H. P. Edwards, County Auditor.

✣Bids will be received until 10 a. m., April 20, by John Kelley, County Auditor, Luverne, Minn., for the construction of Judicial ditch No. 2, including 14,000 lin. ft. of 10 to 42-in. tile and estimated to cost complete $37,482; also several laterals and branches to cost over [illegible]

✣Bids will be received until 10 a. m., May 9, by L. H. Slocum, County Auditor, International Falls, Minn., for the construction of Judicial ditch No. 3, which will be 23 miles long and will include 28,000 cu. yds. of earth excavation. The cost of the work is estimated at about $28,000 or $29,000.

⦿Bids were opened April 9 by A. D. McKellar, County Auditor, Jackson, Minn., for constructing Judicial Ditch No. 13, contracts being let as follows: Andrew Rydeen, Windom, Minn., 194,692 cu. yds. excavation at $16,671; Sam Christensen, Garner, Ia., 313,275 ft. of tile work and 26 retaining walls at $72,000.

⦿Contract for constructing Judicial Ditch No. 1, bids for which were opened April 9 at Walker, Minn., has been awarded to the Kohler Contracting Co., Little Falls, Minn., at $21,595. The work involves the excavation of about 193,000 cu. yds. of earth, the clearing of about 61 acres of right of way, and leveling of about 5 miles of roads. It consists of about 5¾ miles of main and lateral ditches and the straightening and dredging out of about 9 miles of the channel of the Willow River. It is located from 3 to 7 miles from the villages of Remer, Cass County, and Shovel Lake, Aitken County, on the Minneapolis, St. Paul & Saulte Ste. Marie Ry.

The Commissioners of Marshall County, Warren, Minn., have sold $247,000 of bonds, the proceeds of which will be used for 5 drainage ditches in the county.

Nebraska.

Final hearings are to be held April 23 on the assessments for the work of constructing a drainage system for Johnson County Drainage District No. 1. It is probable that contracts for the work will be let this summer. About 30 miles of open ditches, requiring 1,240,000 cu. yds. of excavation, will be constructed. E. D. Howe, Table Rock, Neb., is the engineer.

Bids as follows were received April 10 by the U. S. Reclamation Service, Andrew Weis, project engineer, Mitchell, Neb., for the construction of an embankment and spillway for an earth dam on the North Platte project about nine miles north and one mile east of Scottsbluff, Neb., (1) standing for bid of Kilpatrick Bros. & Collins, [illegible] (2) bid of Luttjohann & Folks, Topeka, Kan.; (3) F. W. Lamoreaux, Omaha, Neb.; (4) W. O. & S. B. Morrison, Denver, [illegible] J. L. Wilkens, Scottsbluff, [illegible] W. L. [illegible], Merrill, Neb.

	(1)	(2)	(3)	(4)	(5)	(6)
Spillway excavation [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Spillway excavation [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Spillway excavation [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] embankment [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

North Carolina.

✣Bids will be received until noon, April 30, by Board of Drainage Commissioners of Muddy Creek Drainage District, Kenansville, N. C., for the construction of a drainage canal in Muddy Creek Drainage District near Chinquapin, N. C., Duplin county. The proposed canal will be about 9.54 miles long and will include 240,000 cu. yds. J. L. Becton, Wilmington, N. C., is Engineer.

Oklahoma.

The Pottawatomie County Commissioners, Tecumseh, Okla., have appointed a board of viewers as the first step in the plan toward reclaiming approximately 15,000 acres of waste land along Salt Creek, in the southeastern part of the county. It is proposed to straighten the channel of the stream.

Oregon.

⦿L. F. Gerdetz, Portland, Ore., has been awarded the contract for constructing a concrete dam across the Deschutes River at Deschutes, for the Central Oregon Irrigation Co. Mr. Gerdetz has also been awarded the contract for constructing the first 2 miles of the north canal for the company.

Memphis, Tenn., and Vicinity.

[illegible]

Geo. T. Weathers is about town mingling with the boys who are doing nothing on account of high water. George has his crack outfit in a place of safety and feels no uneasiness on account of the flood.

Martin Jennings, who fought so hard on the Atherton loop in Louisiana to hold out against seepage water, has at last thrown up the sponge and moved his outfit to a place of safety, stating that he will not be able to do any work until the water recedes very considerably.

George Lowrance at Transylvania managed to get in a pretty good estimate last month, but is fearful of the results for the month of April. George has had remarkably good success with his present Louisiana contract and had it not been for the high water would have been ready for more work by the end of this month.

Henry McCarten and Bill Stephenson, whose outfits have been hard at work trying to build up the Atherton loop before the flood waters reached that section of the country, have given up the struggle and placed their outfits at the disposal of President McClellan of the Louisiana State Levee Board on force account work.

Helgason Brothers, the two hustling Vicksburg levee contractors, have given their teams and laborers over temporarily to the United States forces near Vicksburg, where they are being used to make a fight to save the levees in the lower district. Tom Helgason is personally in charge of a big force of men and moves from place to place keeping sacks ready for weak spots.

There is no trouble now for any able bodied man to get work in this section. In fact the government and state levee boards have been seriously handicapped by not being able to secure a sufficient force to keep up the hard fight which has been waged so relentlessly against the oncoming waters. The government pays $1.50 per day for "sackers," with free board and lodging. The St. Francis Levee Board has been paying as high as $1.75 and board and quarters, and then was not able to get nearly enough help. It is estimated by one engineer that fully 5,000 men are now hard at work on the levees. Mayor Crump of Memphis was the recipient of much praise last Saturday when he put out a drag net and conscripted all the idle men about town and forced them to board the government steamer for the Arkansas levees, where all are hard at work now.

Jim McClavey is in town and chafing under the enforced idleness. Jim is such a busy man when in camp that he does not know how to take it easy. But Jim has been squinting his right eye on some city work about to come up and says he may slip in a bid on same.

J. A. Omberg, Jr., chief engineer of the Memphis Compress and Storage Co., which firm recently asked for bids on 150,000 cu. yds. of work in the southern part of Memphis, has not as yet made public the result of the letting.

[illegible] the water [illegible] property to be graded and that it may be a [illegible] done; therefore he sees no necessity of making the award for the time being. The contract for the steel and concrete work, involving perhaps a million dollars, is also in status quo.

Stanton Palmer of the Roach-Manigan Paving Co. was in Memphis last week shaking hands with all the paving boys at the Peabody and left later for Chicago in the interest of his firm. Stant says the paving outlook in the southwest is really exceptionally bright for this season and he advises all the pavers to whet a sharp point on their pencils and be ready to go to the south.

W. S. Ely, who is the southern representative of the Barber Asphalt Co., was in Memphis for a day looking over the local situation. Walter was not much encouraged over the prospects for asphalt this year in Memphis, for the city engineer, in his list of streets to be paved with that material, has reduced the number to about three, with a possible four—all, though, small contracts. Mayor Crump has curtailed the street appropriation for 1912, and the fact that the Barber company raised the price for asphalt in Memphis is one of the reasons given by the city engineer for not including more streets of this material. But Walter thinks that there will be more than enough work in the south and southwest this season to compensate for the loss of Memphis.

H. P. Streicher, a well known Memphis paving contractor, has secured some nice street contracts in Decatur, Ill., and Toledo, O., and will perhaps not be a bidder on the batch of streets to be let in Memphis in the near future. Streicher has completed all his Memphis jobs.

Much interest in this section was taken in the meeting of the National Drainage Congress, which was held at New Orleans April 10-13. The following acted as delegates from Memphis: S. M. Neely, Harry N. Pharr, Lem Banks, E. A. Morgan, W. E. Ayres, Bolton Smith, P. R. Freidel, S. B. Anderson, J. W. Falls, Jr., J. M. Dockery, O. N. Killough, D. H. Crump, B. G. Compton, H. D. Tomlinson, Jas. F. Hunter, L. K. Salsbury, C. B. Dudley, Frank May, B. G. Lee, W. G. Thomas, E. C. Newman, H. J. Johnson, T.. H. Tutwiler, Foster Hume and Chas E. Sessions. Mr. Killough is president of the St. Francis Levee Board and is thoroughly familiar with all the different phases of levee construction and drainage projects. Mr. Tomlinson is secretary of this board and is also an authority on drainage. Mr. Pharr and Mr. Ayres are prominent drainage engineers, while all the delegates are prominent men and able to care for the best interests of the community.

Citizens of Lexington, Tenn., are jubilant over the news that the Frisco is contemplating the building of a line from Middleton, Tenn., to Lexington, which will be a part of their New Orleans to Chicago road. Col. H. E. Graper, president of the Citizens' Bank at Lexington, states that the last issue of Frisco bonds is intended to construct this line, in connection with quite a large quantity of other improvements which the Frisco intends doing

It is stated that the Gibson County Good Roads Association will immediately take steps to vote bonds providing for the improvement of roads in Gibson county, running from Humbolt, Tenn., as one center point and Milan as another center. Although a motion before the county court there providing for the graveling and other improvement of roads in Gibson county was defeated, officials think that it will be possible to form several road districts, which can then issue bonds in the sections which desire these improvements. The country near Milan and Humbolt is solid in demanding improvements, while in quite a large area the people are vigorously opposing such a movement.

Vice President W. L. Park, Chief Engineer A. S. Baldwin and General Superintendent S. S. Morris of the Illinois Central R. R. were visitors to the big Huntington levee loop at Moore, Miss., last week, where Roach & Stansell are throwing up a protection embankment which will serve to keep the waters from the I. C. and Y. & M. V. tracks. Later the party came to Memphis. All seemed well pleased with the work near Moore. General Superintendent Morris stated that water was interfering considerably with operation of some of the southern lines; in addition service in the north of Memphis had to be discontinued and the trains from St. Louis, Chicago and Louisville detoured through the South Dionagal of the I. C. No doubt when the flood recedes from the I. C. lines in Mississippi it will be found that several branches will have to be practically rebuilt.

The Southern Bitulithic Co. on last Saturday completed its Memphis contract and for the present will lay up the plant, which has been in use on Manassas street. George Ingram secured a small contract for his firm in Helena, Ark., which he expects to start as soon as the high water permits work being done in the little town in Arkansas.

Alley Bartee of the Roach-Manigan Paving Co., a large Memphis concern, left last week for Helena to prepare to get in brick for his firm's contracts in the latter city. Alley says he will not attempt the actual work of preparing foundation for some weeks to come, on account of the ground at Helena being filled with seepage water from the river, but it is his intention to unload the brick and sewer pipe, distribute it properly on the streets and be in readiness to go right ahead with the work when conditions permit.

Several of the railroads which enter Memphis from the west and whose tracks just across the river from this city are now flooded with a twelve mile an hour current dashing over the rails, are preparing to put steam shovels in and make the necessary repairs as soon as the water permits. Those roads which to date have cast about for available equipment are the Iron Mountain, the Rock Island and the Frisco. Probably the Cotton Belt's rails are not seriously damaged, but considerable work will be necessary on the others' tracks before trains can be run. The work will be emergency contracts and contractors look for same to bring a good big price. It is thought a month must elapse before anything in this connection can be done. The L. & N. may have to do a little work in the city of Memphis, where a great portion of its tracks have been under water for about two weeks.

At the request of Tennessee repres atives who called on President Taft with a request that he get the United States engineer to devise some good plan for the protectio of the low lands of the city of Memphis fro overflow, General Bixby, chief of engine telegraphed to Major Clarke S. Smith, U S. engineer at Memphis, to make an inve gation of the local conditions and send in hi report with any suggestions he saw fit t make. Major Smith in company with Mayor Crump and City Engineer Weatherford, ha gone over the situation and the major's. r ort is expected within a few days. Prior to t s government investigation City Engineer ather-ford had made tentative plans for a s tem of huge culverts over the Bayou Gayoso, rough which stream most of the high water fr Mississippi backs up, and each culvert a be about 51 ft. in height, higher than any flood could reach. It is not k Major Smith will concur in this p something will be done at once, for has been hurt more than any one ca the recent overflow of her low land citizens of this good town will not see name and valuable property again danger it has been this year. It is probable plan devised cannot be carried throug cost less than $1,000,000; in fact, so engineers have plans which will be ev expensive. It is the intention of fathers to try to get the government this expense, inasmuch as the Memph is caused by the building of high levee Arkansas shore. But should Uncle fuse, then the city will no doubt raise issue to take care of the emergency work will be started at once. It loo much as though Major Smith is going ommend a levee about the low parts of and provide a flood gate at Wolf River does this, several of the levee boys work and all of the big levee cons firms will be bidders of the propositio will be one of the largest single cont be let in this section perhaps this seaso

Texas.

The Corpus Christi Reservoir & Irr Co., W. A. Fitch, President, Corpus Tex., expect to begin active constructi within 60 to 90 days on its Tule Lak voir proposition.

Final surveys are to be made shor it is expected that bids will be taken for draining 3,270 acres of land in son County, Tex., for the Port Arth & Irrigation Co. The work will inclu 25 miles of open ditches and a pumpin and will cost $60,000 to $70,000. J. F ken, Beaumont, Tex., is engineer.

Canada.

The Canadian Public Works Dep Ottawa, Ont., has issued instructions preparation of detailed plans and speci for beginning work on the new Wellan The government has already provided for beginning work, and it is reported is possible that bids may be asked i The total cost of the canal will be abo 000,000 and probably $10,000,000 will be priated in next year's estimates.

WATER-WORKS

Alabama.

✣Bids will be received until noon, April 22, by city of Fayette, Ala., for furnishing material and labor for the construction of water works system and sewers. E. B. Kay, Tuscaloosa, Ala., is engineer.

Engineer Edgar B. Kay of Tuscaloosa, Ala., is preparing plans for the making of improvements to the water supply of the city of Mobile, Ala.

Illinois.

✣Bids will be received until 2 p. m., May 1, by Village Clerk J. S. Archer, Compton, Ill., for the construction of a steel water tower and tank. A certified check for $100 must be filed with each bid. Official advertisement will be found elsewhere in this issue. Edward Byrne, LaSalle, Ill., is Engineer.

✣Bids were received as follows on April 10 by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering to the water meter shops 1330 Indiana Ave., brass union nipples as follows: 1,250 ¾ in., 10 oz., nipple, 6 oz. nut, 38 cts. each; 1,300, 1 in., 12 oz., nipple, 7 oz. nut, 42 cts. each; 300 1½ in., 22 oz. nipple, 14 oz. union nut, each. Fidelity Brass Manufacturing W. Monroe St.

✣Bids will be received by the Board cal Improvements, Chicago, Ill., until 1 April 24, for furnishing the materials etc., necessary to construct water pipes following streets: Addison St., 2,012 li in., 3 fire hydrants, 1 valve basin; Ell 605 lin. ft. 6 in., 2 hydrants; 41st Pl., ft., 6 in., 2 fire hydrants; Iowa St., 496 6 in., 1 fire hydrant; E. 101st St., 335 li in.; W. 114th St., 335 lin. ft., 8 in., 1

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

S[illegible]ngfield Ave., 670 lin. ft., [illegible] ant; 38th St., 254 lin. ft., 6 in., 1 fire [illegible] Winchester Ave., 670 lin. ft., 6 in., [illegible] ants; S. Harding Ave., 1,382 lin. ft., [illegible] hydrants; Hayes Ave., 1,040 lin. ft., [illegible] hydrants; Hermitage Ave., [illegible] ft., 8 in., 4 fire hydrants; [illegible] lin. ft., 8 in.; S. Rockwell St., 2,570 lin. [illegible] fire hydrants; Vernon Ave., 1,365 [illegible] 4 fire hydrants; Vincennes Ave., [illegible] 8 in., 4 fire hydrants; [illegible] ls lin. ft., 6 in., 3 fire hydrants; West [illegible] 2,275 lin. ft., [illegible] 1,340 lin. ft., 8 [illegible]

[illegible] are the low bids received by L. E. [illegible] mmissioner of Public Works, Chi[illegible] or furnishing and delivering 500 [illegible] and Wabansia Ave., 150 tons; pipe [illegible] 04th St. and Stewart Ave., 200 tons [illegible] Metal Co., 1364 W. Lake St., $4.44

[illegible] are the low bids received by L. E. [illegible] mmissioner of Public Works, Chi[illegible] April 6, for furnishing and deliv[illegible] water works shops, 1330 Indiana [illegible] y water meters of a current type: [illegible] ters, $51 each; 25 4 in. meters, $102 [illegible] meters, $204 each. [illegible] 118 N. La Salle St.

Indiana.

[illegible] will be received until 10 a. m., April [illegible] ard of Public Works, Logansport, [illegible] with reinforced concrete piers, [illegible] and bridge floor for use of the [illegible] department. The cost of the work [illegible] gineer.

Iowa.

[illegible] be received until 8 p. m., April [illegible] ouncil, Cherokee, Ia., for furnish[illegible] ng as extensions to the water sys[illegible] of 6-in. cast iron pipe, 1,600 ft. of [illegible] n pipe, also necessary valves, fire [illegible] William S[illegible]

[illegible] s of Centerville, Ia., have voted [illegible] waterworks system. [illegible] shortly to make [illegible] ments by putting in the new reservoir [illegible] on branch and providing a supply of

Kansas.

[illegible] ers employed by the City Council [illegible] ngton, Kans., to report on the feasi[illegible] securing a water supply for the city [illegible] mitted their report. It has been found [illegible] upply cannot be obtained nearer than [illegible] oms of the Arkansas river, 15 miles [illegible] The cost of a pumping plant and pipe [illegible] estimated at $200,000 if wood pipes [illegible] and $300,000 if pipes are of cast iron.

[illegible] ity Commissioners of Topeka, Kans., [illegible] proved a plan to extend water mains [illegible] Ninth St., from Western Ave., to [illegible] St.

Kentucky.

[illegible] ity Council of Fulton, Ky., has sold [illegible] mounting to $25,000, known as the [illegible] orks refunding bonds, to the Mercan[illegible] st Co., of St. Louis, Mo.

Louisiana.

[illegible] and specifications are to be prepared [illegible] neer H. W. Wright of Winnfield, La., [illegible] installation of a water work system [illegible] ewerage system in Mansfield, La.

Massachusetts.

[illegible] s will be received until 7:30 p. m., [illegible] 8, by Board of Public Works, 425 [illegible] ay, Everett, Mass., for supplying 200 [illegible] of 6-in. cast iron water pipe, 380 lbs. [illegible] gth; 84 lengths of 14-in. cast iron [illegible] pipe, 1,310 lbs. per length; 83 lengths of [illegible] cast iron water pipe, 1,610 lbs. per [illegible] 3 14x6 tees, 1 14x10 tee, 18 6x6 tees, 4 [illegible] said board. William Walker is chairman of the board.

• [illegible] Mass., have awarded contracts for the sea[illegible] Works, gateway, $1,925; Lead Lined Iron Pipe Co., of Wakefield, furnishing lead-lined iron [illegible] constructing shelter house at Ashley ponds, $1[illegible] part of special castings, $227; J. & W. Jolly, furnishing part of special castings, $466; Builders' Iron Foundry, Providence, R. I., split sleeves, $77; Pratt & Cady Co., Hartford, Ct., gate valves, $319; also for brass goods, $296; Paper City Brass Foundry, brass plugs, $.18 per lb. for old stock and $.21 for new stock; Hitchcock Supply Co., Springfield, galvanized iron pipe, $99 for Reading wrought iron and $85 for steel.

• [illegible] been awarded the contract by the borough of Foxboro, Mass., for construction cast iron pipe in the eastern and central sections at $5,320. Frank L. Fuller, 12 Peart St., Boston, is Engineer.

At the annual fire district meeting, Chester, Mass., an appropriation of $500 was made to employ competent authority to advise on the proposition of obtaining additional water supply. John A. Smithies is Clerk.

Following bids were received April 4 by the Special Water Committee, Springfield, Mass., for the laying of water pipes in and about the center of the city. Three sections of piping were bid upon, sections 5 and 6 being for the center of the city and section 7 to run to the Ashley reservoir: Section 5—Crowe & Walsh of Pittsfield, $8,229; Antonio Lambo of Waterbury, Ct., $9,492; Edward B. Robert of Boston, $10,724; Peirson Engineering and Construction Co., of Hartford, Ct., $11,186; Golden & Allen of Schenectady, N. Y., $11,258; John E. Palmer of Boston, $11,670; W. S. Bryne of Boston, $11,758; Cordner & Montague of Springfield, 11,776; M. L. Camarco of Lee, $12,030; Michael Russo of Boston, $13,175; R. H. Newell of Uxbridge, $13,506; Joseph Long & Co. of Loeminster, $14,012. Section 6—Crowe & Walsh of Pittsfield, $12,486; Pierson Engineering and Construction Co., $15,270; Edward B. Roberts, $16,206; W. B. Bryne, $16,803; M. L. Camargo, $17,053; Golden & Allen, $17,072; John E. Palmer, $17,500; Michael Russo, $18,577; R. H. Newell Co., $22,983. Section 7 — Simpson-Corbins Co. of New York, . $9,874; W. B. Bryne, $10,922; Pierson Engineering and Construction Co., $11,963; Golden & Allen, $11,225; Cordner & Montague, $12,177; M. L. Camarco, $12,440; John E. Palmer, $12,598; R. H. Newell, $12,747; Joseph Long & Co., $12,892.

Michigan.

✣Bids will be received until noon, May 6, by C. L. Miller, City Clerk, Kalamazoo, Mich., for the construction of two steel tanks 36 ft. in diameter and 70 ft. high. A certified check for $600 must be filed with each bid.

The Board of Public Works of Grand Rapids, Mich., is advertising for bids on the first of the materials needed in the making of extensions to the waterworks system, for which bonds in the sum of $100,000 were recently voted.

The citizens of Gladstone, Mich., at a recent election voted against the issuance of bonds in the sum of $10,000 for the installation of sewerage.

The Board of Trade of Saginaw, Mich., has presented a new project for water improvement to the Common Council in the form of a proposal to go to Saginaw bay for a pure water supply for the city at an estimated cost of $1,346,000 for the plant itself, including a conduit from the bay to the city and $181,000 additional for connecting up both sides with the new system. A detailed report has been presented by Engineer Gardner S. Williams, of Ann Arbor, Mich. The detailed estimated cost is as follows:

[illegible]	[illegible]
	$11.90
[illegible]	[illegible]
Delivery of pipe, 22,000 tons at $1.....	22,000
[illegible]	[illegible]
[illegible] vision	75,000
	[illegible]
Saginaw Pumping Station	
[illegible]	[illegible]
[illegible] switchboard and connections, erected [illegible]	[illegible]
[illegible] vision	6,000
	[illegible]
[illegible]	[illegible]
Site, connections and incidentals.....	5,000
Contingencies, engineering and supervision	5,000
	[illegible]
[illegible]	[illegible]

Minnesota

State Geologist N. H. Winchell has inspected the different artesian wells of the city of Moorhead, Minn., and will make a report of his findings. Upon this report will depend whether the city shall install a new water system, which was decided upon by the city officials some time ago.

The superintendent of the waterworks of Chisholm, Minn., has submitted his report to the Water, Light, Power & Building Commission, recommending necessary changes and improvements in the plant, the principal ones being the rearrangement and enlargement of the pumping station; raising the height of the building two stories, including on the second floor a laboratory and office; a concrete smokestack and a hoziront al triple expansion, direct acting pump; surface condenser and air pump having a capacity of 1,000,000 gals per day, filter unit and a well of 100,000 gals. capacity.

Mississippi.

The town of Sumner, Miss., will probably issue bonds in the sum of $22,500 for a water works, sewer system and electric light plant.

Missouri.

Water Commissioner Edward E. Wall, of St. Louis, Mo., is advocating the building of a new waterworks in the city, and estimates its cost at $20,000,000. The Commissioner suggests that the plant be located on the Missouri river, near St. Charles, which station would supply the western and southern districts of St. Louis.

Nebraska.

The City Council of David City, Neb., has decided to extend the water mains some 8,000 ft. One line will run west of the Burlington track. The work will require three car loads of 4-in. pipe.

New Jersey.

✣Bids will be received until 8:30 p. m., April 30, by City Council, South Amboy, N. J., for the construction of a steel water tank panied by a certified check for $100. Richard M. Mack is City Clerk.

New York.

✣Bids will be received until noon, May 2, by Board of Water Commissioners, Jamestown N. Y., for furnishing all labor and materials for the construction of a 5,000,000-gal. reinforced concrete covered reservoir, in accordance with plans and specifications on file in the office of the Board of Water Commissioners, Jamestown, New York, and at the office of Chester & Fleming, engineers, Union Bank Building, Pittsburgh, Pennsylvania. Each proposal must be accompanied by a certified check for $1,000, made payable to City Treasurer, Jamestown, N. Y.

✣Bids will be received until noon, May 2, by Board of Water Commissioners, Jamestown, N. Y., for furnishing approximately 275 lengths of 24-in. and 235 lengths of 16-in. cast iron pipe and specials also separate proposals for hauling and laying same, in accordance with plans and specifications on file at the office of the Board of Water Commissioners, Jamestown, N. Y., and at the office of Chester & Fleming, Engineers, Union Bank Building, Pittsburgh, Pennsylvania. Each proposal must be accompanied by a certified check for $1,000, made payable to City Treasurer, Jamestown.

✣Bids will be received until April 24, by Clifford A. McDonald, Village Clerk, Middleport, N. Y., for the construction complete municipal water system, including about eight miles cast iron pipe, pumping stations, pumps, stand pipe and appurtenances; also for construction complete municipal sewer system including about six miles pipe sewers, treatment works and appurtenances. Charles Hopkins, 349 Cutler Bldg., Rochester, N. Y., is Engineer.

The citizens of La Salle, N. Y., at a recent election voted to purchase the plant of the La Salle Water Co., for a consideration of $30,000. The city plans to expend approximately $20,000 on improvements. Fred Brooks is village president.

North Carolina.

The Polk County Water Co., of Tryon, N. C., has been incorporated with a capital stock of $5,000 to supply water for the town of Tryon. The incorporators are: W. E. Strong, F. P. Bacon, J. Foster Searles, G. H. Holmes and others.

Oklahoma.

⦿The City Commissioners of Muskogee, Okla., have awarded the contracts for the building of the new filtration plant at the water station as follows: F. P. McCormack, solution and mixing tank and substructure, $4,095; Weathers & Kearne, superstructure, lump sum $6,100. The superstructure will be built of brick and the solution and mixing tanks of concrete.

Oregon.

The city of Woodburn, Ore., took over the water plant at present operating in the city during the first week of April for a consideration of $9,650. The plant was formerly owned by R. K. Page. Work has commenced on the construction of a 110-ft. structural steel tower with a 60,000-gal. conical steel tank which will be completed within 90 days. The Council has ordered the purchase of more than a mile of additional mains and work on extensions will commence at once. The city will expend $10,000 for betterments and extensions.

Pennsylvania.

State Health Commissioner Samuel Dixon has approved plans of the Gettysburg Water Co., Gettysburg, Pa., for a mechanical filtration plant which will not only furnish pure water to the borough, but also the supply for the camp sites. The company will secure its supply from Marsh Run.

South Dakota.

✣Bids will be received until 8 p. m., May 6, by N. H. Jensen, city auditor, Mitchell, S. Dak., for digging, casing and connecting an artesian well complete with appurtenances.

✣Bids will be received until noon, May 6, by M. T. Woods, city auditor, Mobridge, S. Dak., for furnishing and erecting a steel tower and tank of 100,000 gals. capacity, to be at a height of not less than 100 ft. above the top of foundations. A certified check for $1,000 must be filed with each bid.

⦿Deane Steam Pump Co., has been awarded the contract by the city of Madison, S. Dak., for furnishing a pumping outfit at $7,254. The work includes one 600-gal. pump direct connection to 60 H. P. Remington oil engine and one 400-gal. pump and 40 H. P. Westinghouse motor. Bids were opened April 4.

Easton & Wells of Aberdeen, S. Dak., have been retained by the town of Bowdle, S. Dak., to supervise the installation of a water works system. The improvements consist of a reservoir, standpipe, power plant and water mains.

An election was held in Bruce, S. Dak., on April 16, for the purpose of voting on the proposition of installing a municipal water works system.

Tennessee.

Plans and specifications have practically been completed by Engineer R. C. Huston, Exchange Bldg., Memphis, Tenn., for the installation of a water works system in Tiptonville, Tenn.

Texas.

⦿Briggs-Weace & Co., have been awarded the contract by the city of Paris, Tex., for furnishing one Duplex 12x14x12 air compressor to pump five wells at $1,639. Bids were opened April 9.

The citizens of Terrell, Tex., at a recent election voted the issuance of bonds in the sum of $25,000 for the waterworks improvements.

Chief Water Engineer J. M. Bassett of Dallas, Tex., has prepared the specifications for the 36,000,000-gal. pumping engine the city is to secure for Bachman pumping station. The engine and its installation, it is estimated, will cost about $40,000. The pump is to have about a 45-ft. lifting power, 36-in. intake and will discharge into Bachman.

The City Council of M'Allen, Tex., has granted a franchise to Colonel A. L. Strang of El Campo to put in an up-to-date waterworks system. The contract has been let and work begins at once.

The City Commission of Abilene, Tex., has decided to order an election for the purpose of determining whether bonds should be issued for $10,000 to purchase additional fire equipment for the city; also bonds for $7,000 for the erection of a city crematory. An auto-engine will probably be purchased.

The Port Lavaca Manufacturing Co., has been incorporated at Port Lavaca, Tex., with a capital stock of $50,000. Arrangements are under way to put in a complete system of waterworks for the town. The officers are: Willett Wilson, President; W. E. Sh President; H. C. Innis, Secretary, a Shell, General Manager.

The sum of $2,000 has been subs Frankston, Tex., for an electric light terworks plant for that town.

The city of Sherman, Tex., will mal extensions to its sewer system and wate works system at an estimated cost of $40,0 to be done by day labor. P. C. Thurmon is city engineer. B. C. Kreager, secretary.

West Virginia.

The citizens of Parkersburg, W. at a recent election voted the issuance of the sum of $100,000 for the construct 4,000,000-gal. reservoir, estimated $40,000, and for pipe line, estimated $25,000; also for larger mains in the district, estimated at $65,000.

Wisconsin.

✣Bids will be received until 7 p. 25. by Robert Luchsinger, Village Cler ville, Wis., for furnishing 8,700 ft. of 4-in. cast iron pipe class B; 4,800 spe ings; 14 hydrants; 7, 6 and 8-in. va 7 valve boxes f. o. b. cars Bellevill will also be received for the above included with the work of laying th building a 14x50 ft. concrete stand the drilling of a 12-in. well 200 ft. dee and specifications may be seen at th office or at the office of W. G. Ki Engineer, Madison, Wis.

⦿The Wausau Iron Works, Wausa has been awarded the contract by the Commissioner, Shawano, Wis., O. gand, County Clerk, for the erection 000-gal. steel tank and a 80-ft. steel County Insane Asylum. The contra is $2,394. W. G. Kirchofer, Madison, Engineer. Bids were opened April 4.

The ciitzens of Janesville, Wis., hav to buy the plant of the Janesville Wa and operate it as a municipal owned

The Common Council of Two River has appropriated $15,000 to enlarge th cipal water and light plant and has contract aggregating $17,000 for pavin

The citizens of Horicon, Wis., on voted the issuance of bonds for the tion of a system of waterworks.

Wyoming.

⦿The City Council of Sheridan, W , has awarded the contract for the construc 7,685 ft. of water mains at points wit city to Walsh & Patterson at $7,018. bidders were: F. D. Lovell, $8,324; Wilcox, $7,880; A. C. Evans, $7,213; A. Harker, $7,816 and Cox Bosen, $8,

Canada.

The Board of Control of Toronto, O, has recommended to the City Council that pe mental wells be sunk on the island with to ascertaining the feasibility of a sys artesian wells for the water supply o A sum of $5,000 will probably be set as that purpose.

Wyoming.

The citizens of Torrington, Wyo., w May 14 on the proposition to issue b the sum of $30,000 for the installatio of a water works and sewerage system.

The citizens of Manchester, Wyo., w April 27 on the proposition of issuing amount of $8,000 for a water works system.

SEWERAGE AND GARBAGE DISPOSA

Alabama.

✣Bids will be received until noon, April 22, by City of Fayette, Ala., for necessary labor and material for the construction of system of sewers and water works. J. E. Chandler is Mayor, and Edgar B. Kay, Tuscaloosa, Ala., is Chief Engineer.

Arkansas.

⦿Commissioners of Sewer District No. 15, Pine Bluff, Ark., have awarded the contract for the construction of the sewer to Robinson Bros., at $6,800.

California.

The Board of Public Works of San cisco, Cal., has recommended to the visors that $30,000 be set aside out sewer bond fund of 1904 for reconst the sewer in Oak St., between Stany Cole, so as to relieve the overflow fr

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

sewer in front of the Park Hospital.

atives from the cities of Whitti[illegible] Lordsburg, Claremont, Glendora, Covina, Cal., recently met in the l city for the purpose of ascer- hether or not the building of a outfall for the joint use of the cities San Gabriel river to the sea, is rect. A permanent organization with Mayor L. L. [illegible], President, and Arthur [illegible] as Secretary. It is said the sewer will range between [illegible]

ary plans for a sewerage system rdner District, segregated into sec- that the work can be done under ntracts, have been submitted by er F. W. McCarton to the Mayor Council of San Jose, Cal.

Colorado.

vill be received until 11 a. m., y Board of Public Works, Denver, furnishing all labor and materials cting sewers, manholes, inlets and es in Part "A" of Subdistrict No. West and South Side Sanitary [illegible] Read is President.

Connecticut.

trossci Co., Hartford, Conn., has ed the contract by the city of Put- , for the construction of 1,200 ft. 400 ft. of 10-in., 13,000 ft. of 8-in., in., 11 4-in. manholes and 53 8-in. The contract price is $11,273. Bids April 10. George M. Perry [illegible] ineer. C. E. Chandler, Norwich, nsulting Engineer.

Delaware.

y Council of Wilmington, Del., has agreement with the Directors of and Sewer Department whereby will provide for a bond issue of proceeds to be turned over to the Sewer Department to be used as wer fund.

Georgia.

Commissioner Shelby Smith, At- , has notified the City Council of At- at the county is ready to begin work on the extension of the following wers, for which the city will furnish erial and the county the labor: High- e. sewer, McDaniel St. sewer, Butler r, and the intercepting sewer on Proc- k. In connection with this work the just awarded a contract to the R. O. ll Coal Co., for furnishing 100,000 of cement at $.98 per barrel.

ys are about to be started for the of extensions to the sewer system of ah, Ga., to include extensions of house and storm sewerage systems within ative limits.

Idaho.

s will be received until 5 p. m., April Board of Public Works, Boise, Idaho, construction of sewers in Lateral District No. 11, including approxi- 40,561 lin. ft., with necessary Ys, man- nd flush tanks. Bids will be received cement and vitrified clay pipe. A cer- check for $1,000 must be filed with d. Plans and specifications are on file G. Eagleson, City Engineer.

ds will be received until 5 p. m., April Board of Public Works, Boise, Idaho, construction of sewers in [illegible] District No. 2, approximating 11,126 feet, with necessary "Ys," manholes, sh tanks, as provided for by Ordinance 003. Bids will be received on both and vitrified clay pipe. A certified for $1,000 must be filed with each bid. Eagleson is City Engineer.

nes Kennedy, of Fargo, N. Dak., has warded the contract by the City Council catello, Idaho, for the construction of r system, divided into six districts, at $70,000. [illegible] mated quantities in the various districts follow: First district—2,523 ft. of 10-in. pipe; 3,006 feet of 8-in. pipe; 14 manholes and one combined manhole and flush tank. Second district—1,050 ft. of 6-in. pipe; 4,728 ft. of 8-in. pipe; 13 manholes; one lamphole, and three combined manholes and flush tanks. Third district—720 ft. of 10 in. pipe; 3,497 ft. of 8-in. pipe; 11 manholes, and two combined manholes and flush tanks. Fourth district—792 ft. of 10 in. pipe; 3,995 ft. of 8-in pipe and fourteen manholes. Fifth district—5,050 ft. of 8-in. pipe; 12 manholes and two combined manholes and flush tanks. Sixth district—4,933 ft. of 8-in pipe; 12 manholes; one combined manhole and flush tank, and one lamp hole

Illinois.

✣Bids are being received, it is reported, by City Council of Elgin, Ill., for the improvement of the water course in the W. J. Kimball plat for West Elgin. The improvement will be an extension of the west side sewer system.

✣All bids received April 10 for the construction of the sewer system in Sewer District No. 3, at Lawrenceville, Ill., were rejected, the lowest being $48,588. New bids will be received by Board of Local Improvements, Lawrenceville, Ill., until 2 p. m., April 24. J. O. Martin is City Attorney and R. J. Benefiel is City Engineer.

◉J. S. Vyer, of Normal, Ill., has been awarded the contract for the sewer which is to be laid in connection with the new training school building at the university at Normal. The work includes 10,068 ft. of sewer.

Following are the lowest bids submitted to the Board of Local Improvements, Chicago, Ill., E. J. Glackin, secretary, for furnishing materials, labor, etc., necessary to construct sewers in the streets as follows. 43d Pl., 150 lin. ft. 12 in., 87.5 cts.; Hamilton Ave., 780 lin. ft. 12 in., $1.265. Wing sewers, 90 lin. ft. 9 in., $1.25; Millard Ave., 350 lin. ft. 12 in., $1.05; E. 101st St., 160 lin. ft. 12 in., 67 cts. House drains, 125 lin. ft. 6 in., 17 cts.; Artesian Ave., 665 lin. ft. 15 in., $130,507 lin. ft. 12 in., $1.20. Al. Nortordonato, S. Francisco Ave., 670 lin. ft. 15 in., $1.35; 670 lin. ft. 12 in., $1.25. S. Maplewood Ave., 665 lin. ft. 15 in., $1.30; 507 lin. ft. 12 in., $1.20. Mozart St., 670 lin. ft. 15 in., $1.35; 670 lin. ft. 12 in.. $1.20; the Ryan Co., Stock Exchange Bldg., total, $6,430. Frink St., 400 lin. ft. 15 in., $1.26. Walnut St., 1,030 lin. ft. 12 in., $1.08; Louis Scully, total, $1,936. Ridgeway Ave., 640 lin. ft. 24 in. double ring brick, $2.85. Ridgeway Ave., 660 lin. ft. 12 in., $1.24. W. 32d St., 340 lin. ft. 18 in., $1.80. Hamlin Ave., 1,300 lin. ft. 12 in., $1.24; total, $4,961; Camimi Roberts. N. 50th Ave., 1,020 lin. ft. 2½ ft. double ring, $3.80; 340 lin. ft. 18 in., $1.70. Patterson Ave., 650 lin. ft. 15 in.. $1.34; 3,160 lin. ft. 12 in., $1.19. Waveland Ave., 650 lin. ft. 15 in., $1.34; 2,560 lin. ft. 12 in., $1.19. Warwick Ave.. 650 lin. ft. 15 in., $1.34; 2,560 lin ft. 12 in., $1.19; total, $16,206; P. J. McNulty. W. 73d St., 1,330 lin. ft. 2 ft. brick. double invert, $2.78. Honore St., 1,340 lin. ft. 15 in., $1.24; 670 lin. ft. 15 in., $1.26. Lincoln St., 1,340 lin. ft. 12 in., $1.18; 670 lin. ft. 15 in., $1.26. Winchester Ave., 1,340 lin. ft. 12 in., $118; 670 lin. ft. 15 in., $126 S. Robey St., 1,340 lin. ft. 12 in., $1.18; 670 lin. ft. 15 in., $1.23; Mal. Murphy, $13,459. Bids opened April 10. The contracts have not been awarded.

The Board of Local Improvements of Moline, Ill., has decided upon an improvement for that territory lying between 10th and 17th Aves., and 26th and 31st St. The system will be known as the 27th St. sewer and water system. Preliminary hearing will be held April 20.

Engineer E. O. Hills has presented plats to the City Council of Sterling, Ill., for the various sewer systems of the city.

Henry Rees has been awarded the contract for the construction of the Oak St. sewer in Quincy, Ill., at $4,725.

Plans have been prepared by the W. S. Shields Co., Hartford Bldg., Chicago, Ill., for the construction of a new sewer system in Sandwich, Ill., estimated to cost $44,000. The Board of Local Improvements is at present in charge of the work.

Plans and specifications for the installation of a sewer system in the city of Plano, Ill., have been prepared and are on file in the office of C. A. Darnell. The cost of the system is estimated at $43,000.

The Board of Local Improvements of Jacksonville, Ill., is considering the construction of a sewer in South Mauvaisterre St., from College Ave., south to Brook.

The Board of Local Improvements of Lawrenceville, Ill., has rejected all bids received April 10 for the construction of a complete sewer system owing to bids being about 15 per cent above estimate. R. J. Benefiel is City Engineer.

Indiana.

✣Bids will be received until 10 a. m., April 22, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in the alley west of Meridian St. from alley north of Minnesota St. to Minnesota St.

✣Bids will be received until 10 a. m., April 22, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in Rural St. from Glen Drive to the Belt Railway tracks.

✣Bids will be received until 10 a. m., April 22, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in Oxford St., from Glen Drive to Roosevelt Ave.

✣Bids will be received until 10 a. m., April 22, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in Parker Ave., from Glen Drive to Roosevelt Ave.

✣Bids will be received until 10 a. m., April 22, by Board of Public Works, Indianapolis, Ind., for the construction of a local sewer in Linwood Ave., from Michigan to Byram St.

◉The Board of Public Works of Evansville, Ind., has awarded the following contracts for sewer work: John L. Newman, sewer in Columbia St., west from 12th Ave., for three blocks, sewer in block 81, Archer Addition, between Baker and Harriet and Michigan and Virginia Sts., and in the alley in block 2, Shanklin enlargement, between Michigan and Franklin Sts.; West Side Construction Co., sewers in Fifth St., between Division and Ingle, and in block 2, Forrest Park, in the rear of Harriet St., between Nevada and Cleveland Sts.; Meguiar Contracting Co., sewer in an alley between Seventh and Eighth and Cherry and Oak Sts.

Aug. Schneider is the probable contractor for the construction of about 1,200 ft. of 10-in. and 12-in. sewer pipe in Baltimore St., Michigan City, Ind., for which bids were opened April 2. Bids have been taken under advisement. H. M. Miles is City Engineer.

Preliminary plans for the construction of the Bowman Creek trunk sewer have been completed and presented to the Board of Public Works of South Bend, Ind.

Iowa.

✣Bids will be received until 1 p. m., April 22, by City Clerk G. J. Gittinger, Chariton, Ia., for the extension of the sewer ending at Park Ave., to Ashland Ave. The work will include about 450 ft. of 24-in. No. 1 salt glazed vitrified sewer pipe.

✣Bids will be received until 8 p. m., April 18, by O. P. Geiger, City Recorder, Dubuque, Ia., for the construction of an 8-in tile pipe sanitary sewer, including 5,100 lin. ft. of tile pipe and 20 manholes and 1 drop manhole.

✣Bids will be received until 2 p. m., April 23, by City Council at the office of City Clerk W. H. Conrey, Knoxville, Ia., for the necessary labor and material for the construction of sewers and subdrains. Hall & Adams, Centerville, Ia., are Engineers. A certified check for $750 must be filed with each bid.

◉The City Council of Ottumwa, Ia., has awarded the contract for the construction of the Ballingall branch sewer of the Charles Chilton, and the contract for the building of the Blake branch to John W. Scott.

✣ indicates work now open for bids. ◉ indicates a contract let recently.

The City Council of Sioux City, Ia., has ordered the laying of [illegible] storm water sewer [illegible] Marshall Ave., South Alice St., Dodge Ave., South Rustin Ave., Washington Ave., and South Irene St. The Council also adopted a resolution providing for a sanitary sewer in Helen Ave.

The engineering department of Des Moines, Ia., has recommended an expenditure of $100,000 to replace the 5-ft. sewers now in service on East and West First Sts., with 10-ft. sewers. [illegible] is City Engineer.

Louisiana.

⦿The Great Southern Lumber Co., Bogalusa, La., C. R. Howard, Chief Engineer, has awarded the contract for the construction of a sanitary sewer system in Bogalusa to Hamilton Johnson of Jackson, Miss., at a bid of $6,940 when material is furnished by contractor and $4,025 when material is furnished by the company.

The Board of Sewerage Commissioners of the First Sewerage District, Opelousas, La., has awarded bonds in the sum of $40,000, issued by the district, to the Interstate Trust & Banking Co., of New Orleans. Bids for the construction of the sewerage system will shortly be called.

Maine.

The Town Board of Wells, Me., has postponed the matter of installing sewers in the town for an indefinite period. William S. Wells is Chairman of the Sewer Committee.

Maryland.

Following bids were received by the Board of Awards of Baltimore, Md., on Sanitary Contract No. 86, covering lateral sewers in District No. 17; Calvin W. Hendricks, Chief Engineer of the Sewerage Commission: B. F. Sweeten & Son, Baltimore, $92,424; D. M. Andrew & Co., Baltimore, $104,460; Ryan & Reilly, Baltimore, $108,391; Whiting-Turner Construction Co., Baltimore, $110,116; James Ferry & Son, Pittsburgh, Pa., $114,457.

Massachusetts.

The Board of Health of Chicopee, Mass., has entered a protest to the State Board of Health against the proposal of the Finance Committee of Springfield, Mass., to connect the East Springfield sewer with the Chicopee river. The officials of Springfield contemplate turning the sewerage into the river at some distance from the Stevens-Duryea plant instead of having it built to empty into the Garden brook sewer near the Hampden paint works. Engineer George N. Merrill drew plans showing that by the former method the sewer could be built at a cost of not more than $30,000, whereas it would cost in the vicinity of $70,000 or $80,000 to have it enter the Garden brook sewer.

Loan orders have been passed by the City Council of Boston, Mass., for $175,000 for sewer in the South End and $150,000 for other sewers; also $300,000 for the making of highways.

The Selectmen of Westfield, Mass., have awarded the contract for furnishing 8,000 ft. of sewer pipe to Mosely & Maschin at 77 per cent off the list price minus a cash discount of 2 per cent if the pipe was paid for within 30 days.

Michigan.

⦿Knig & Austin, of Petoskey, Mich., have been awarded the contract to construct the Lake St. sewer, preparatory to laying pavement in Petoskey.

⦿John Lennane has been awarded the contract by the city of Pontiac, Mich., C. L. Groesbeck, City Clerk, for the construction of 14 lateral sewers having a total length of 12,200 ft., at $17,882. Bids were opened April 8.

The citizens of Escanaba, Mich., at a recent election voted the issuance of bonds in the sum of $80,000 for the installation of sewerage.

Minnesota.

City Engineer Wilson of Duluth, Minn., has completed specifications for storm sewer construction for this year amounting to $87,735. The following sewers are recommended for construction; 58th Ave. East, Lake Superior to Glenwood St., $9,044; 11th Ave., East, Sixth St. to Eighth St. (ordered built 1911), $6,001; Glenwood St., 54th to 58th Ave. East, $1,000; 11th alley, Miller's Creek to 100 ft. east of 24th Ave. West, $546; 18th Ave. East, Seventh to Eighth Sts., $1,059.

Missouri.

✤Bids will be received until Noon, April 19, by Board of Public Improvements, St. Louis, Mo., for the construction of Gratiot Joint District sewer and branches in the district. Plans and specifications may be obtained at the office of the board. The works will include the following approximate quantities. Brick and Portland Cement Mortar Sewers: 1,325 ft. of 7-ft. inside diameter, 1,185 ft. of 5-ft. inside diameter. 766 ft. of 36-in.x54-in. inside diameter. 980 ft. of 34-in.x51-in. inside dimensions. 216 ft. of 32-in.x48-in. inside dimensions. 912 ft. of 30-in.x45-in. inside dimensions. 374 ft. of 28-in.x42-in. inside dimensions. 67 ft. of 26-in.x39-in. inside dimensions. Pipe Sewer: 520 ft. of 12-in. inside diameter. With manholes, junction chambers and all other appurtenances. Deposit required, $2,100.

⦿The Board of Public Works of Kansas City, Mo., has let a contract to Brown Bros. for the construction of a sewer in District No. 3 of Westport, which extends from 33d to 40th Sts., from Jefferson to Main Sts., at $17,052. The sewer will be constructed of plain concrete, in sizes from 10 to 24-ins.

⦿The J. C. Likes Construction Co., of Des Moines, Ia., has been awarded the contract by the City Council of Springfield, Mo., for the construction of the southern and northern sewerage disposal works for which bonds in the sum of $100,000 were authorized. The contract price is $69,315. Alexander Potter, 114 Liberty St., New York City, is Consulting Engineer. Bids were opened April 4.

The proposed municipal improvements of Maplewood (P. O. St. Louis, Mo.), including a sewer system to connect with that of St. Louis, were considered at a recent meeting of the Maplewood Business Men's Association and the Maplewood Civic League. Dr. J. P. Marshall is President of the Association.

Nebraska.

⦿The City Council of Superior, Neb., has awarded the contract for the construction of sewers in Sewer District No. 2 to the Kelly Construction Co., of St. Joe, Mo., at $13,161. Other bids were: Meeker & Mahaffey, Lincoln, Neb., $14,031; Inter Mountain Bridge & Construction Co., Tecumseh, Neb., $13,434; F. S. Dobson, Lincoln, $13,171; Haley & Rice, St. Joe, $13,964; Midwest Engineering Co., $13,059 and Skylbrother Co., St. Joe, Mo., $13,928.

⦿The city of Fullerton, Neb., has let the contract for the installation of a new sewer system to the Midwest Engineering Co., of Omaha, Neb. Bruce & Standevin, 432 Bee Bldg., Omaha, are engineers.

The city clerk of Schuyler, Neb., will shortly call for bids for a sewer system, estimated to cost $60,000. Bruce & Standevin, Bee Bldg., Omaha, Neb., engineers.

New Jersey.

✤Bids will be received until 8:30 p. m., April 30, by City Council, South Amboy, N. J., for the construction of the Machanicsville section of the Sanitary sewer system of the city of South Amboy, N. J. Richard M. Mack is City Clerk. A certified check for $500 must be filed with each bid.

New York.

⦿Thomas L. Crane, 121 Jay St., Schenectady, N. Y., has been awarded the contract by the village of Hobart, N. Y., W. J. H. Robinson, Clerk, for the construction of sewer and disposal works at $20,304. Bids were opened March 25.

⦿The Board of Contract & Supply of Binghamton, N. Y., has awarded four contracts to George Serafini of that city for the construction of sewer, aggregating $15,000, and another contract to S. Flannagan & S struction Co., at $7,297.

⦿The Board of Contract & Supply N. Y., has awarded the contracts [illegible] structing sewers in Central and Kinloch to Golden & Allen of that city at $1,6 [illegible] sewer in Central Ave., and $ similar sewer in Kinloch Ave.

The Board of Estimate & Apport of Rochester, N. Y., has voted to $1,000,000 for sewerage disposal purp

State Health Commissioner Dr. Eu Porter, of New York, has asked the ficials of Corning, N. Y., to submit plans for the establishment of a sewera [illegible] plant upon the site purchase purpose some time ago by the Board [illegible] Works.

The city of Syracuse, N. Y., has pra secured all right of way for a sewer in the Hayden tract in the Ninth Wa

Dr. Eugene Porter, State Health C sioner, has again urged the city offic Corning, N. Y., to install sewage plants. The Board of Public Works years ago purchased a site for the plant upon which it was proposed to plant costing between $40,000 and $50,0 liam O. Drake is Superintendent of Works. Frederick A. Ellison is Mayo

Ohio.

✤Bids will be received until [illegible] 24, by Director of Public Service, Ash O., for necessary labor and materia the improvement of Division St., fro seph St. to the angle therein by const a sewer therein, according to the pla specifications on file in said office. includes approximately 20 lin. ft. sewer, 462 lin. ft. of [illegible] basins, 2 manholes, 1 flush tank and combined. John Mac Rae is [illegible] department.

✤Bids will be received until noon, A by Director of Public Service, Cincinna for the construction of main and latera ers and drains with their appurtenan Halstead St., from Straight St. to A St.; Hukill alley from Eliza St., to M lin St.; right of way along the Miami an Canal from Addison St. to Straight St.; alley from Dixon St. to its southern nus; Kottman St. from Halstead St., to and Erie Canal. Plans, specifications blank proposals can be obtained at the of the Chief Engineer of the Departm Public Service. Each proposal must companied by a bond in the sum of $2,0 a certified check. M. J. Keefe is Clerk Department of Public Service.

⦿Frank J. Davis & Sons have been aw the contract by the city of Hamilton, O., Weaver, City Engineer, for the constr of the Walnut St. storm sewer at $705. work includes 360 ft. 18-in pipe, 360 ft. pipe, 350 ft. 12-in pipe, 10 inlet basins an manholes. Bids were opened April

Property owners on Summit St. hav titioned the City Council of Kent, O., sanitary sewer to extend from Willow South Water St., to connect with the at that point which leads to the river.

The citizens of Reading, O., have vote issuance of bonds in the sum of $35,000 construction of a sanitary sewerage syst

The Sinking Fund Trustees of Cinci O., have purchased $25,000 worth of the 000 bond issue authorized by the City cil to defray the cost of the plans for th stallation of the sewer system. Enginee F. Layman and Frank Farley, of Cinci will make the surveys.

By the decision of the Supreme C making the Bense act valid, the city of Clinton, O., will be compelled to constr new sewer system or arrange a disposal for its present system which has its outl the river and along the lake front. The C cil has been notified by the State Boar Health to make plans for a different sys

Engineer French has presented plans sanitary sewer on South Lundy St., bet Etna St., and a point 550 ft. north to the

✤ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] Salem, O. [illegible] The sewer committee [illegible] the building [illegible] East Green St. from a point [illegible] St. to Jennings Ave. Plans [illegible] specifications will be prepared [illegible]

Oklahoma.

[illegible] Council of Bartlesville, Okla. [illegible] ordinance creating a new sewer district [illegible] instructing the city engineer to prepare [illegible] and specifications.

Oregon.

[illegible] ty of Carlton, Ore., has awarded the [illegible] the installation of a sewer [illegible] James Kennedy, of Forge [illegible]

[illegible] Engineer Tom Hurlburt of Portland [illegible] prepared plans for the territory [illegible] from the Rose City Park territory, [illegible] North Mount [illegible] and [illegible] prepared two separate sewer [illegible] One will have its outlet by way of [illegible] Gulch, which will cover Rose City [illegible] the other district will drain into the [illegible] River by way of East Stark St. [illegible] r system will cover the territory east [illegible] to E. 52nd St., south to Kinzel Park and up the east slope of [illegible] to the crest of the elevation [illegible] south of the O. W. R. [illegible] The Sullivan Gulch system is north [illegible] W. R. & N. It is probable that the [illegible] sewer system will [illegible]

Pennsylvania.

[illegible] own Council of Olyphant, Pa., has [illegible] he contract for the new Third Ward [illegible] Scranton, Pa.

Delaware County, Pa., towns lying just beyond the Philadelphia city limits are considering plans for constructing a trunk sewer that will afford drainage facilities to most of the boroughs in the Darby Creek watersheds. The towns that would use this sewer are Clifton Heights, Aldan, Collingdale, Yeadon, Darby and suburban sections in Upper Darby Township. The end of this drainage system would be a disposal plant near Darby. Civil Engineer Albert F. Damon, Jr., Darby, Pa., estimates that the trunk sewer would cost about $40,000. The Clifton Heights Civic Association will endeavor to have a bill passed by the next legislature authorizing the proposed drainage system.

South Dakota.

[illegible] Mi[illegible] passed a resolution providing for the construction of an extension of the lateral sewers in District No. 3. N. H. Jensen is City Auditor. A. E. Hitchcock is Mayor.

Texas.

F. W. Johnson, President of the Pecos Land Co., has made application to the Mayor and City Council of Pecos, Tex., for a 50-year franchise to construct throughout the city of Pecos a sanitary sewerage system, with option [illegible]

Utah.

A mass meeting was recently held in Garland, Utah, for the purpose of considering the matter of bonding the town for funds for the [illegible] W. E. Grover is President of the Town Board.

Virginia.

The City Council of Bristol, Va., has ordered sewers laid to the extent of $3,600. Sewers will be constructed on Vernon, Winston, Edmonds and Goodson Sts., and Highland, Fairmount and Commonwealth Aves. William M. [illegible]

Washington.

◉Commissioner of Public Works Owen Woods, of Tacoma, Wash., has awarded the contract for the construction of the Indian addition sewer, serving the Rogers school, to John Gallucia at $23,000.

The City Council of Anacortes, Wash., contemplates constructing a trunk line sewer along M Ave., as far south as 20th St., and run laterals up the various cross streets so as to include practically all of the Queen Anne hill section of the city.

Green & Co., Civil Engineers, Spokane, Wash., are making surveys of the town of Ontario, Ore., for the purpose of establishing correct corners, intersections, etc., and for the purpose of laying out proper sewer districts, giving grades for streets, sidewalks, etc.

Wisconsin.

◉The City Council of Marinette, Wis., has awarded the contract for the making of an extension of the Bangs and Currie St. sewer to Johnson & Teander, of that city, at $11,901. Other bidders were the Hackworthy Construction Co., $14,784 and John Striffler, $1[illegible]

UILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Arizona.

[illegible] received until 2 p. m., May 11, [illegible] issioner of Indian Affairs, Washing- [illegible] for furnishing the necessary labor [illegible] ial for the construction of a stone [illegible] se at the Western Navajo Indian [illegible]

Arkansas.

[illegible] received until May [illegible] mmissioners, Little Rock, Ark., for [illegible] nstruction of a new county court house [illegible] laski county. George P. Mann, Little [illegible] Architect.

California.

[illegible] Board of Fire Commissioners, D. R. [illegible] iff, secretary, 64 Eddy St., San Fran- [illegible] Cal., has asked the Supervisors for a [illegible] t allowance of $2,616,303 for next year. [illegible] ich amount $1,012,426 is to permit of the [illegible] tution of motor driven apparatus for [illegible] d style horse-driven engines, carts and [illegible]

Connecticut.

[illegible] as follows were received April 12, by [illegible] A. E. Waldron, U. S. Engineer, New [illegible] n, Conn., for about 40,000 cu. yds. of [illegible] ing in Pawcatuck River, R. I. and Con- [illegible] ut: John H. Gerrish, Boston, Mass., [illegible]: J. S. Packard Dredging Co., Provi- [illegible] R. I. (recommended for acceptance), [illegible] A. Scott Co., Inc., New [illegible] n, Conn., $0.33; Charles M. Cole, Fall [illegible]

District of Columbia.

[illegible] received until 10:30 a. m., May [illegible] Maj. F. C. Boggs, General Purchasing [illegible] r, Isthmian Canal Commission, Washing- [illegible] D. C., for furnishing under Canal circular [illegible] wheels.

[illegible] ls will be received until 10:30 a. m., April [illegible] y Maj. F. C. Boggs, General Purchasing [illegible] er, Isthmian Canal Commission, Wash- [illegible] n, D. C., for furnishing under Canal Cir- [illegible] 702, Chain, Steel Wire, Cold Chisels, [illegible] Pliers, Wrenches, Washers, Nuts, Nails, Tacks, Files, Sheet Copper, Solder, Shovels, Hammer Handles, Truck Handles, Corn Brooms, Paint Brushes, Galvanized Buckets, Water Coolers, Hose Couplings, Padlocks, Steel Tapes, Hose, Packing, Gaskets, Twine, Oakum, Rawhide Lacing, Sponges, Cotton Bunting, Railway Flags, Roofing Felt, Vitrified Promenade, Tile, Fire Brick, Fire Clay, Gold Leaf, Metal Polish, Soap, Candles, Silica Wash, Lye, Borax, Lard, Oil, Japan Drier Paints, White Zinc, and Turpentine.

Florida.

✣Bids will be received until 3 p. m., May 6, by Board of Commissioners of State Institutions, Tallahassee, Fla., for the construction of a receiving hospital building at the Florida Hospital for Insane. G. T. Whitfield, Tallahassee, Fla., is Secretary.

Georgia.

✣Bids will be received until noon, April 20, by Board of Fire Master, Fire Department, Atlanta, Ga., for the erection and completion of a one story fire station. Morgan & Dillon, Grant Bld., are Architects.

Idaho.

✣Bids will be received until 8 p. m., April 30, by C. H. McQuown, Clerk, Buhl, Idaho, for the construction of a public school building. Gates Bros., Twin Falls, Idaho, are Architects.

Iowa.

✣Bids will be received until 5 p. m., May 9, by Board of Directors of the Independent School District, Sioux City, Ia., for the remodeling of, building additions to, and installing heating systems and plumbing in the following named school buildings in said Independent School District, to-wit: Hunt building and Webster building. All bids must be in strict accordance with plans and specifications prepared by F. E. Colby, Architect, which may be seen at his office in Sioux City, after April 20, 1912. Bids will be received for all work on either building or on separate parts of the same. A certified check must accompany each bid equal to five per cent of the amount of said bid. T. C. Prescott is Secretary Independent School District of Sioux City.

Louisiana.

✣Bids will be received until 11 a. m., April 30, by Lieut. Col. Lansing H. Beach, U. S. Engineer, New Orleans, La., for furnishing and delivering stone at South Pass and Southwest Pass, Mississippi River.

Michigan.

✣Bids will be received until 2 p. m., April 24, by Lighthouse Inspector, Detroit, Mich., for placing reinforced concrete caissons and completing the foundation piers for lights 1, 2, 3 and 4, Detroit River.

Bids were opened April 2 by Col. C. McD. Townsend, U. S. Engineer, Detroit, Mich., for the construction by the East Approach Canal at Sault Ste. Marie, the Great Lakes Dredge & Dock Co., Chicago, Ill., at $395,750 being the low bidder. The work to be done is to excavate the new navigation channels at the east end of St. Marys Falls Canal, including the removal of piers and cofferdams, prepare the foundations for and build new canal walls and piers for the Poe and new locks, remove the cofferdam at west end of new canal, and furnish all the labor, plant and supplies necessary to perform the required work. The following estimate of materials and work is approximate only:

Excavation, Class A, [illegible]	[illegible]
Excavation, Class B, [illegible]	[illegible]
Foundation filling, [illegible]	[illegible]
Crib framing and placing, timber, cu. ft.	616,000
Backfilling, cu. yds.	87,000
Concrete (exclusive of cement), cu. yds.	16,000
[illegible] and delivering, bbls.	[illegible]

Bids as follows per ton of 2,000 lbs. were received April 5 by Lt. Col. F. R. Shunk, U. S. Engineer, Duluth, Minn: For furnishing and placing rock in the foundation embankment for the breakwater extension at Marquette, Mich: T. L. Duxocher, Sault Ste. Marie, Mich., $1.11 (recommended for acceptance); Great Lakes Dredge & Dock Co., Chicago, Ill.,

✣ indicates work now open for bids. ◉ indicates a contract let recently.

$1.60, Powell & Mitchell, Marquette, Mich., $1.44.

Minnesota.

✣Bids will be received until N[illegible] 9, by Lt. Col. Francis R. Shunk, U. S. Engineer, Duluth, Minn., for dredging at Superior Entry, Duluth, Superior Harbor. Official advertisement will be found elsewhere in this issue.

Mississippi.

⦿The Southern Paper Co., B. F. Reists, manager, Pascagoula, Miss., has awarded the contract for the large paper and pulp mill to be erected on the banks of the Escatawpa River, one mile north of Laine, to the Lackawanna Bridge Co. The work of erecting the plant will commence about May 1, and it is expected to be in operation by Jan. 1 next. It will take over 15,000 tons of brick, steel and cement to build the plant, and the Louisville & Nashville R. R. is now preparing to build a spur track from Laine to the mills.

Montana.

✣Bids will be received until 3 p. m., May 17, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for an electric passenger elevator in the U. S. post office and court house at Great Falls, Mont.

Nebraska.

⦿The Rasmussen-Kyle Construction Co., Omaha, has been awarded the constructing of a 5-story and basement factory building at 15th and Leavenworth St., Omaha, for Egerss-O'Flyng Co. Building will be of brick, heavy mill construction and will have several elevators. Estimated cost is $60,000. J. P. Guth, 516 Paxton Block, Omaha, is the architect.

New Hampshire.

✣Bids will be received until 11 a. m., May 11, by H. R. Stanford, Chief of Bureau of Yards and Docks, U. S. Navy Department, Washington, D. C., for installing three electric passenger elevators: one in the naval hospital, Chelsea, Mass.; one in the naval hospital, Newport, R. I.; one in the naval hospital, Portsmouth, N. H.

New Jersey.

⦿The Hennebique Construction Co., Philadelphia, Pa., has been awarded the contract for construction of a concrete ocean pier costing $300,000, to be built on the site of the original Young's Pier, in Atlantic City, N. J. The pier will be 2,200 ft. long and 162.6 feet wide and will contain a long promenade, music pavilion and ocean dance hall. It will be built for a syndicate composed of New York and Atlantic City men, and headed by H. F. Stevens of New York and H. Harris, an Atlantic City real estate broker.

E. F. Fonder, Land Title Bldg., Philadelphia, Pa., at $86,700, was low bidder for the construction of a pier in front of the new immigrant station at Gloucester City, N. J., for the U. S. Government. The pier is to be 400 ft. long and 300 ft. wide.

New York.

✣Bids will be received until noon, May 8, by Col. S. W. Roessler, U. S. Engineer, New York City, for dredging in Newtown Creek, N. Y. The work consists in the excavation of a channel extending from a point about 400 ft. below the Meeker Ave. bridge to the Grand Street bridge, and through the English Kills to the Metropolitan Ave. bridge, a total length, both branches included, of about 1.75 miles. The bottom width will be 90 ft., with increased width at the bends and the depth 18 ft. at mean low water. The total estimated quantity of material to be removed to complete the work is 228,000 cu. yds., scow measurement. The amount of money available for payment of contractors' estimates is about $24,000. The material to be removed is estimated to be 75 per cent or more of recently deposited mud, and the rest sand and gravel.

✣Bids will be received until 11 a. m., May 2, by Dr. H. H. Stebbins, President of the Board of Managers, New York State Custodial Asylum, Newark, N. Y., for two new 150-h.p. boilers at the asylum in Newark.

⦿Lupfer & Remick, Buffalo, N. Y., have been awarded the contract at $49,600 for rebuilding the Buffalo breakwater north end light station.

The Buffalo Dredging Co., Buffalo, N. Y., at $147,823 was low bidder March 25 for building the wing wall of a ship lock at the front of Bridge St., Buffalo, for the U. S. Government. The work includes the construction of 1,260 ft. of concrete superstructure.

Ohio.

✣Bids will be received until Noon, April 30, by Board of Education, Toledo, O., for labor and material necessary for the completion of the Jessup W. Scott High School. Official advertisement will be found elsewhere in this issue. G. L. McKesson is Director of Schools.

✣Bids will be received until noon, May 6, by Board of Education, Cincinnati, O., for the furnishing of necessary labor and materials for the construction of a new school building on the Fifteenth District School lot, corner of Clifton and Main St. Garber & Woodward, 906 Andrews Bldg., Cincinnati, O., are Architects.

✣Bids will be received until noon, May 6, by Board of Education. C. W. Handman, Business Manager, Cincinnati, O., for furnishing all materials and doing all work necessary to complete certain alterations and additions to school buildings, in accordance with plans and specifications on file in the office of C. W. Handman, No. 511 West Court St. in the city of Cincinnati, Ohio.

✣Bids will be received until noon, May 6, by Board of Education, C. W. Handman, Business Manager, Cincinnati, O., for furnishing all materials and doing all the work necessary to complete the grading and parking of the lot surrounding the building known as the Hyde Park Public School, located on the northwest corner of Observatory Ave. and Edwards road, Hyde Park, Cincinnati, Ohio, in accordance with drawings and specifications on file in the office of C. W. Handman, No. 511 West Court St., in said City of Cincinnati.

Oklahoma.

✣Bids will be received until 3 p. m., May 18, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for an electric passenger elevator in the U. S. post office, Oklahoma City, Okla.

Pennsylvania.

✣Bids will be received until 4 p. m., April 24, by the School Board of Oakmont, W. G. Bermont, Secy., at the office of George H. Schwan, Architect, 1307 Peoples Bldg., Pittsburg, Pa., for the heating, ventilating school building and boiler house at Fifth and E. Sts., Oakmont, Pa.

Scofield Engineering Co., Arcade Bldg., Philadelphia, Pa., has been retained as Consulting Engineers by The Harwood Electric Co. for the power house extension at Harwood, Pa., and the sub-station reconstruction at Hazleton, Pa. Plans are in progress and contracts will be awarded soon.

Rhode Island.

The State Harbor Improvement Commission, Providence, R. I., has requested Gov. Pothier to submit to the people a $1,000,000 bond proposition, the money to be expended largely for an extensive pier for the use of the Grand Trunk R. R. In addition to the sum proposed by the State, $300,000 is requested for the new municipal docks, the original appropriation of $450,000 being insufficient. About 3,000 lin. ft. of wharf is contemplated, and the Grand Trunk has suggested leasing a part of this.

Texas.

✣Bids will be received until Noon, May 15, by Maj. E. I. Brown U. S. Engineer Galveston, Texas, for dredging the Houston Ship Channel.

⦿The Bailey-Mills Co., Victoria, Tex., has been awarded the contract to erect the new courthouse and jail of Jim Wells County, Tex., at Alice, the county seat. The courthouse and jail will each be two stories and constructed of stone and pressed brick. The contract price of the building is $61,700.

Utah.

✣Bids will be received until 10 a. m., April 29 by M. Z. Witcher, County Clerk, Salt Lake City, Utah, for furnishing the necessary labor and material for installing an electric elevator and electric dumb waiter for an infirmary and hospital building at the Salt Lake County Hospital at 12th South and State Sts.

Virginia.

✣Bids will be received until 3 p. m., May 13, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for two electric passenger elevators, two hydraulic lifts and pumping plant in the re[illegible]structing of the U. S. Post Office, Court House and Custom House at Richmond, Va.

Washington.

⦿The Puget Sound Bridge & Dredging [illegible] Seattle, Wash., has been awarded the contract at 14 cts. per cu. yd. for dredging Olympia Harbor, Olympia, Wash., for the U. S. Government. Bids for the work were opened March 6, the estimated cost being $[illegible],000.

The Port of Seattle Commission, [illegible] Whitton, Engineer, Seattle, has started condemnation suit against the Great Northern et al., for the acquirement of land at [illegible] Cove as a site for the lumber dock and [illegible] house. The commission has $1,000,000 [illegible] on the land and dock. The latter will [illegible] $500,000.

Canada.

✣Bids will be received until 2 p. m., April 23, by D. C. McNab, Deputy Minister, Department of Railways, Telegraphs and Telephones, Regina, Sask., for construction of the following long distance telephone lines: N[illegible] Watrous, Lanigan-Wynyard, Glenavon-[illegible]matre, Kipling-Kennedy-Langbank, Prince Albert-Melfort, Bredenbury-Manitoba Boundary, Biggar-Scott-Wilkie, Humboldt-Canora, Ro[illegible]town-Kindersley, Weyburn-Forward, Swift Current-Gull Lake, Saskatoon-Bulyea, Battleford-Lloydminister, Yorkton-Canora, Lanigan-Saskatoon. Specifications governing same may be seen at the office of the Department's Engineer.

✣Bids will be received until noon, April 23, by Board of Control, G. R. Geary, Chairman, Toronto, Ont., for the supply of one c[illegible] batch mixer of not less than 14 cu. ft. capac[illegible] loose material, to be mounted on street railway trucks of 4 ft. 10⅞ in. gauge. Specimens and form of tender may be obtained on application to the Department of Railways and Bridges, City Engineer's office, Toronto.

⦿The British North American Construction Co., Vancouver, B. C., has been awarded a contract at about $260,000 for the prelim[illegible] work on the construction of the dry dock and wharves at Prince Rupert, B. C., for the Grand Trunk Pacific Ry. This preliminary work calls for a large amount of creosoted piling and mill-work construction. Following [illegible] completion of this work contracts will [illegible] for building the steel and reinforced dry d[illegible] and wharf building, which will involve [illegible] expenditure of an additional $1,250,000.

Mexico.

The Mexican Government has granted a concession permitting the establishment of a new port in the Gulf of California, about 40 miles south of the Arizona boundary line at Yuma. The concessionaires, who are represented in the City of Mexico by Dr. [illegible] J. Hone of Sonora, propose to start a large farm colony on both sides of the gulf.

Enrique Schoendube, City of Mexico, h[illegible] petitioned the Department of Fomento [illegible] permission to use the waters of the El [illegible] River in Valle de Bravo, State of Mexico. The petitioner asks the right to use 5,000 liters per second.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

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CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

GRADING AND PAVING.

Sealed proposals endorsed with the title of the work will be received at the office of the City Auditor of the City of Mitchell, S. D., up till 8 o'clock p. m., on the 9th day of May, 1912, for the grading and paving of the following streets and avenues with reinforced concrete pavement:

Main St. from Railroad St. to within 1½ ft. of the Chicago, St. Paul, Minneapolis & Omaha Ry. Co.'s track, 2,969 lin. ft. approximately 19,2[illegible] sq. yds.

First Ave., 2nd Ave., 3rd Ave., 4th Ave. and 5th Ave. from the east line of the alley between Main and Rowley Sts., east to the west line of the alley between Main and Lawler Sts., approximately 284 lin. ft. or 1,326 sq. yds. on each of the said avenues.

A separate bid for each street and avenue above named must be made and no bids will be considered unless so made.

All work is to be done in accordance with the plans and specifications now on file in the office of the City Engineer of said city.

A deposit of $5 will be required from each contractor for each copy of plans and specifications furnished him. Deposit fee will be returned upon the return of the said copy of plans and specifications together with the receipt given.

All bids must be accompanied by a certified check upon some solvent bank in the city of Mitchell, or a draft made payable to the city treasurer of said city in the sum of 5 per cent of the amount of the bids, to insure the signing of the contracts and the furnishing of proper and acceptable bonds in the amount of 40 per cent of contract prices within ten days from the time of notification of the award of the contract.

The City Council reserves the right to reject any or all bids.

By order of the City Council. Dated at Mitchell this 10th day of April, 1912.

N. H. JENSEN.
City Auditor.

PUBLIC HIGHWAYS.

Sealed bids will be received at Paris, Tex., up to noon, Tuesday, May 21, 1912, for the entire construction of 40 to 48 miles permanent rock roads and bridges for Precinct 1, Lamar County, Texas. Detailed plans, profiles and specifications will be on file on and after April 20, 1912. Printed copies of contract, specifications, bond, general instructions and form of tender will be furnished on deposit of $5.00 to insure safe retudn of same.

The Board reserves the right to accept that bid which appears most advantageous to them, and also to reject any and all bids or parts of bids. Address

BOARD OF PERMANENT ROAD COMMISSIONERS.
W. F. GILL, Secretary.
M. HANNAH, Engineer.

U. S. ENGINEER OFFICE, GALVESTON, TEXAS, April 18, 1912.—SEALED PROPOSALS for derdging the Houston Ship Channel, will be received at this office until 12 m., May 15, 1912, and then publicly opened. Information on application. EARL J. BROWN, Major, Engrs.

LATERAL SEWERS.

Sealed proposals will be received at the office of the City Auditor of the city of Mitchell, S. D., up till 8 o'clock p. m. on the 9th day of May, 1912, for the construction of lateral sewers, including labor and material, in said city of Mitchell, as follows:

Branch "P," Sewer District No. 3—Approximately 1,508 ft. 8 in. pipe, 4 manholes.

Branch "U," Sewer District No. 2—Approximately 595 ft. 9 in. pipe and 732 ft. 10 in. pipe, 3 manholes.

Branch "W," on boundary line between Sewer Districts Nos. 2 and 3—Approximately 410 ft. of 10 in. pipe, 1 manhole.

Branch "X," Sewer District No. 4—Approximately 732 ft. 8 in. and 183 ft. 10 in. pipe, 3 manholes.

All complete and connected with existing sewers.

All work to be done in accordance with plans and specifications on file in the office of the City Engineer.

All bids must be accompanied by a certified check upon some solvent bank in the city of Mitchell, or a draft made payable to the treasurer of said city, in the sum of 5 per cent of the amount of bid to insure the signing of the contract and furnishing of proper and acceptable bond in the amount of 40 per cent of contract price within eight days from time of notification of the award of said contract.

The city reserves the right to reject any or all bids.

By order of the City Council. Dated at Mitchell this 10th day of April, 1912.

N. H. JENSEN.
City Auditor.

STEEL WATER TOWER AND TANK.

Sealed proposals are invited and will be received at the office of the Village Clerk, Compton, Illinois, until 2 o'clock, p.m., May 1, 1912, for the construction of a steel water tower and tank.

Bids must be accompanied by a certified check in the sum of One Hundred dollars ($100.00) to be forfeited to the Village of Compton should the bidder refuse or neglect to enter into a contract in the event that the work be awarded to him.

Proposals must be made on a standard form which may be obtained from the Village Clerk. For further information address J. S. Archer, Village Clerk.

The right is reserved to reject any and all bids.

CHARLES BRADSHAW.
President Village Board, Compton, Ill.

U. S. ENGINEER OFFICE, Kansas City, Mo., April 4, 1912.—Sealed proposals for the construction of about 14,000 ft. of standard revetment on the Missouri River, about 215 miles below Kansas City, and at and below Rutland, Mo., will be received at this office until 12 o'clock noon, May 4, 1912, and then publicly opened. Information on application. EDWARD H. SCHULZ, Major, Engrs.

U. S. ENGINEER OFFICE, CHICAGO, ILL., March 26, 1912. Sealed proposals for dredging in Calumet Harbor, Ill., will be received here until 10 a. m., April 26, 1912. Information on application. GEO. A. ZINN, Lt. Col., Engrs.

WATER-MAINS.

Sealed proposals, endorsed with the title of the work, will be received at th office of the City Auditor of the City of Mitchell, South Dakota, up till 8 o'clock p. m., on the 9th day of May, 1912, fo furnishing the material for and laying approximately 2,410 feet of 4-inch water main, 3,580 feet of 6-inch water-main and 1,510 feet of 10-inch water-main. Al with appurtenances including valves and fire hydrants, and also for 37 four, six and eight-inch valves to be placed on old mains.

All work to be done in accordance with the plans and specifications now on file in the office of the City Engineer of said city.

A deposit of $5.00 will be required from each contractor for each copy of the plans and specifications furnished him Deposit fee will be returned upon the return of the said copy of plans and specifications together with the receipt given.

All bids must be accompanied by a draft or a certified check upon some solvent bank in the City of Mitchell, S. D., in the sum of five per cent of the amount of bid, to insure the signing of the contract and the furnishing of a proper and acceptable bond in the amount of forty per cent of the contract price within ten days from the time of notification of the award of the contract.

The City Council, reserves the right to reject any or all bids or to reject either part of the proposal or bid.

By order of the City Council. Dated at Mitchell this 10th day of April, 1912.

N. H. JENSEN.
City Auditor.

SCHOOL BUILDING.

The Board of Education, Toledo, Ohio, is to receive bids until 12 o'clock noon, the 30th day of April, 1912, for the labor and material necessary for the completion of the Jessup W. Scott High School. The work includes the following items, which may be bid upon either separately or as a whole: Excavation; Stone Work; Water-proofing, damp-proofing and asphalt floors; Architectural Iron; Lathing and Plastering; Carpenter Work; Glass and Glazing; Brick Work; Concrete; Structural Steel; Sheet Metal; Marble, Tile and Terrazzo; Painting and Finishing; Hardware; Vacuum Cleaning. Additional information will be furnished upon request.

BOARD OF EDUCATION.
Geo. L. McKasson.
Director of Schools.

PAVING.

Pittsburg, Kans.

Sealed proposals will be received at the office of the City Clerk up to 8 o'clock p. m., Wednesday, April 24, 1912, for the construction of about 4,500 sq. yds. of vitrified brick paving on a concrete base with asphalt filler.

Specifications and proposal blanks may be obtained at the office of the City Clerk. Samples of brick must accompany bids.

The right is reserved to reject any or all bids.

O. T. JONES, City Clerk.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

TAMPA BRIDGE.

[illegible] invited to tender [illegible] the construction of a [illegible] ge to be built in the City of Tampa, da, carrying Lafayette street over Hillsboro River, in accordance with etail drawings and specifications on [illegible] office of the Board of [illegible] Public Works of Tampa [illegible] and hereinafter referred to as the I. and also in the office of the Consulting Engineers, Messrs. Boller, Hodge Baird, 149 Broadway, New York City. [illegible] received by the [illegible] the City of Tampa [illegible] noon of Wednesday [illegible]

ertified check for $5.000, made payo the Board, must accompany each I. Such check will be returned to the successful bidder immediately after e bids are opened, and to the successbidder, unless he fails to execute the ntract within ten days after such con- is awarded to him.

bond satisfactory to the Board for sum of 25 per cent of the contract will be required.

All bids must be made on form of prosal, which with the contract, specificans, and bond, can be obtained on application to the Clerk of the Board.

[illegible] secure a set of all [illegible] the Clerk of the Board, which deposit will be returned on the return of the drawings.

The above work covers two reinforced concrete earth spans of 82 feet clear span, one deck Scherzer rolling lift draw, of two wings of 93 feet span, and concrete retaining walls for the approach to this structure.

The City of Tampa reserves the right to reject any and all bids.

CITY OF TAMPA,
By D. B. McKAY, Chairman Board of Commissioners of Public Work.
Attest: ALLEN THOMAS, Clerk.
[illegible]
Consulting Engineers.

RELAYING RAILS.

[illegible] for Furnishing Relaying Rails," addressed to the Board of Awards of Baltimore City, will be received at the Office of the City Register, City Hall, Baltimore, Md., until eleven (11) o'clock a. m., Wednesday, April 17, 1912, for the furnishing of relaying tee rail with necessary splice bars, for about seven thousand (7,000) lineal feet of single track. The weight of the rail shall not be less than 56 pounds or more than 70 pounds per lineal yard.

[illegible] Baltimore, Md.

All proposals must be accompanied by a certified check of the bidder for two hundred and fifty ($250) dollars, drawn on a clearing-house bank to the order of the [illegible] to reject any or all bids, or any part of any bid.

[illegible]
Water Engineer.

Approved April 1, 1912.
[illegible]

[illegible] Minn., April 9, 1912. Sealed proposals for dredging at Superior Entry, Duluth-Superior Harbor, will be received at this office until noon, May 9, 1912, and then publicly opened. Information on application. FRANCIS R. SHUNK, LT., Col., [illegible]

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All Types **FLUSH TANK SIPHON**
[illegible]
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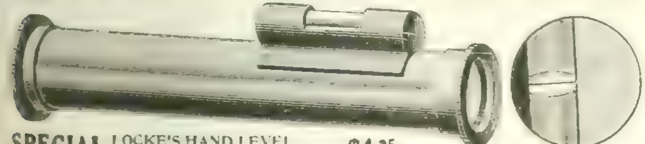

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Railroad Location Surveys and Estimates

By F. LAVIS, M. Am. Soc. C. E.
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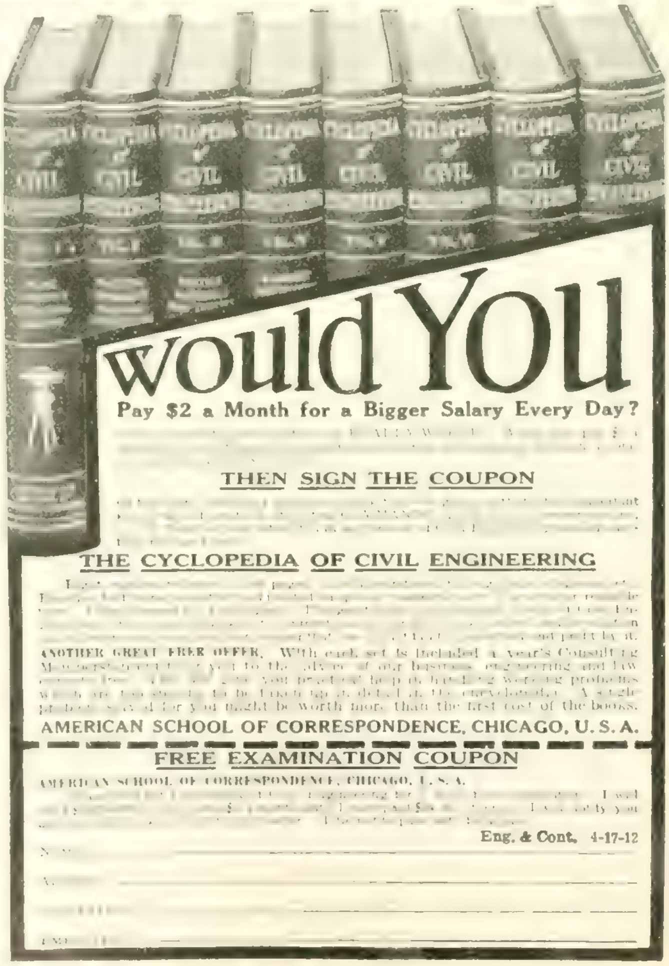

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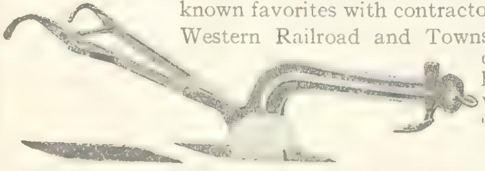

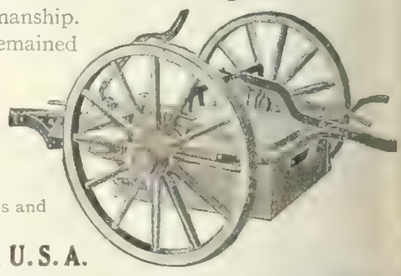

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ressional Report on "Scientific gement" Contrasted with the Navy Department Records of the Cost of Battleships.

ths a committee of the House sentatives has been investigating the stem of "scientific management." nittee's report is almost a humorous nt. It is replete with expressions that view of the politician who is more with gaining the approval of labor n with quibbling for cost data. ult of its "investigation" of the effi- workmen in the employ of the gov- the committee finds:

> is some loafing or soldiering among orkmen has been shown by the tes- your committee, but it is not nor does it occur in numerous instances with the total number employed.

tatement has been greeted with satis- all Socialists and by many labor , for it suits their theory that the ent should pay high wages for small [illegible]

eport also receives the cordial ap- of Engineering News. The editors ews say:

> ms to us to agree admirably with the of scientific management which have sented editorially in these columns."

ef, "scientific management" is damned nt praise by the congressional commit- the most essential feature of the Tay- stem of "scientific management"—the te payment—is rejected because it men. Probably some more ladylike of coaxing workmen to work would ceived a hearty endorsement.

committee approves of standardizing of doing work, and believe that it to systematize by "routing," etc. But its protest at the suggestion that a ystem of payment be introduced, for uld lead to slighting the quality in increase the quantity of output, and an might work himself into "the position of a beast of burden which is required to go on from day to day performing a given task."

If the report of the committee had contained some comparative unit costs to prove its contentions, it would have merited perusal. But, as usual with politicians, there is a strong affinity for platitudes and generalities, and an equally strong aversion for data. Some of the most convincing data lay near at hand, but these the committee ignored. We refer to the costs of building the battleships "New York" and "Texas."

The "New York" and the "Texas" are twin ships, begun at the same time and now nearing completion. The "New York," according to the latest estimate of the Navy Department, will cost $7,200,000. The "Texas" will cost $5,830,000, and will be finished before the "New York." These facts, it would seem, should be interesting even to a congressional committee that alleges as its object the investigation of "scientific management."

The "Texas" is being built by contract, and at a cost of about $1,400,000 less than the cost of the "New York," which is a government day labor job. Let us assume that two-thirds the cost of the "Texas," or $3,890,000, is represented by materials and items other than labor. Let us assume that the government can buy the materials, etc., as cheaply as the ship building contractors. In that case the difference between $7,200,000 and $3,890,000, or $3,310,000, is the cost of labor on the "New York," as compared with $1,940,000 for labor on the "Texas."

We give these figures merely as an illustration, but they will serve to indicate that there must be a striking labor inefficiency in the building of the "New York" by government workmen. Furthermore, it is likely that the $7,200,000 includes no allowance for interest on plant, little or nothing for plant obsolescence, and certainly nothing for taxes, which if added in would serve still more to widen the difference between the cost by day labor and by contract.

The most important single law of the science of management (we are not now speaking of Taylor's system of "scientific management," which is a much narrower term) is the law that announces the fact that payments for work must be in proportion to performance, if there is to be maximum production and maximum economy. This law is observed, at least in a large degree, when work is done by contract. It is observed only on the slightest degree when work is done by the ordinary day labor methods in vogue in the Navy Department. We need look no farther for an explanation of most of the difference in cost between the "New York" and the "Texas."

It seems to us that it is time that those who deny the existence of a science of management shall at least use scientific methods to prove their contention. All science is founded on data. The science of management is founded on cost data. Its proponents have again and again produced comparative unit costs to prove the truth of certain managerial principles or laws. Its opponents have produced what? Platitudes.

Comparative Life of Steel Barges and Creosoted Timber Barges.

Two articles on construction barges for improvement work on the Mississippi River are published in a succeeding section of this issue. These articles indicate differences in opinion and present some discrepancies in statements which are of interest. The practice of the past has been to build these construction barges of timber. Of late years treated timber has been used mostly. Recently designs have been prepared and contracts let for a number of steel barges. The purpose of this change is stated as follows:

> The steel barge has been adopted in conjunction with the creosoted lumber barge with a view to testing the durability of each, as well as costs of repairs. The steel barges cost about $9,300 each, have a capacity of about 400 tons, and estimated life of over 20 years. The creosoted wood barges cost about half as much as the steel barges, their capacity is about the same, but their probable length of life has not yet been determined, although it will probably be over 10 years.

The size of barges referred to in this quotation is that standard on the lower Mississippi work. A discrepancy, it will be seen, apparently exists between the life assumed in the above quotation for creosoted wood barges and that assumed in the computations [illegible] Mr. Hageboeck. Mr. Hageboeck records an age of twelve years for creosoted yellow pine barges which are now in use and states them to be in so well preserved a condition that a further life of ten years may safely be anticipated. He also gives to steel barges a probable life of 25 years. Granting the steel barge a life twice as great as that of a creosoted timber barge there is fair justification for its present trial. If, however, the comparative life figures given by Mr. Hageboeck are reasonably accurate then we must admit that his conclusion is correct that the creosoted timber barge is the more economic. It should be possible to get more closely to definite conclusions in this matter.

A Useful Series of Tests on the Permeability of Concrete.

The properties of concrete which contribute to its impermeability have been frequently studied by means of laboratory tests and a fair working knowledge of the ones to be sought is had. The tests here described furnish contributory data. They also indicate that some modification of current opinion may be necessary. For example, it is indicated that great impermeability does not depend merely upon the quantity of cement used in proportion to aggregate but also upon the ratio of course to fine particles in the aggregate. This is not a new discovery, but its emphasis by these new tests is useful because concrete workers while habitually resorting to an increase in the proportion of cement to aggregate to get water tight work infrequently make use of the equally effective carefully grading the aggregate. arises largely from the greater task ing the aggregate. An extra bag per batch means very little extra wo screening and remixing of a gravel run stone so as to secure accura means considerable labor and troubl there is little doubt, cement is add the grading of the aggregate would At all times when the highest possib of impermeability is wanted gradin aggregate must go with the use cement. There are others of the te which we summarize which merit and the article should be read ca cement users. In a succeeding issue publish a summary of a far more series of tests on waterproofing c for concrete.

GENERAL ARTICLES

Science of Management; the Law of Maximum "Output Factor."

IV.

The *output factor* of a plant or machine is the percentage obtained by dividing its actual output during a given period of time by its capacity output during that period.

Output factor is a general term that corresponds to the more specific term "load factor." Thus, if an electric generator having a 1,000 kilowatt capacity actually generates only 6,000 kilowatt-hours of current in 24 hours, its "load factor," or output factor, for the day is 25 per cent, for its daily capacity is 24,000 K.W.H., which is four times the actual output.

The *peak output* is the maximum output that occurs at any moment. It corresponds to the "peak load."

A high output factor may be secured in two ways: (1) By reducing the relative size of the peak output, and concurrently reducing the capacity of the plant. (2) By increasing the output of the plant during the periods between the "peaks."

One of the greatest economic problems submitted to a scientific manager is the problem of increasing the output factor of his plant, not only in toto but in uno. A few illustrations will serve to indicate the nature of the problem and the methods of solving it.

The peak output of a water works system usually occurs in the summer time, and during the late afternoon, for then the greatest amount of lawn sprinkling occurs. The manager of a water works may reduce the peak output by metering all users who have lawns or he may divide the city into, say, three districts and permit the residents of each district to sprinkle lawns on but two prescribed days of the week. The first of these two plans results in actual reduction in the total consumption of water, while the second plan reduces the peak output by distributing the consumption more uniformly.

Large plants that serve a great variety and number of customers ordinarily have higher output factors—and less pronounced "peaks" —than small plants that serve a few customers. This is one of the fundamental reasons why there is so pronounced a tendency for small industrial organizations to consolidate. On the other hand, a high load factor may often be secured by not seeking a diversity of business, but by confining the business to one or two special lines. This is well illustrated by the success of many manufacturers who make only one article, but keep their plants busy making that article in large numbers.

Many kinds of business—perhaps most kinds—have rush hours, peak loads, that seem unavoidable, yet a resourceful manager can frequently devise ways of raising the output factor even in such cases. An excellent example of such resourcefulness is to be found in the comparatively recent action of Theodore N. Vail, president of the Western Union Telegraph Co., who introduced the "night letter." By offering to telegraph 50 words by night at the day rate charged for 10 words, the output factor of the telegraph lines was greatly increased.

The output factor of certain ocean cables is about 25 per cent, and it is now proposed to increase it greatly by a very low rate for "delayed delivery" of messages.

Mr. Vail's plan is, in general, but a new application of a very old principle, namely, the selling of a product at lower than normal rates provided the product is taken by the purchaser at "off peak" times. Every large merchant has used this scheme to increase sales at times when sales would normally be small. Post-Christmas and mid-summer bargains are offered for the purpose of increasing the output factor of a store, as well as to reduce stocks that may go out of style. Coal is sold in summer at lower rates than in winter, for the purpose of increasing the output factors of the coal mines and of the coal merchants' plants.

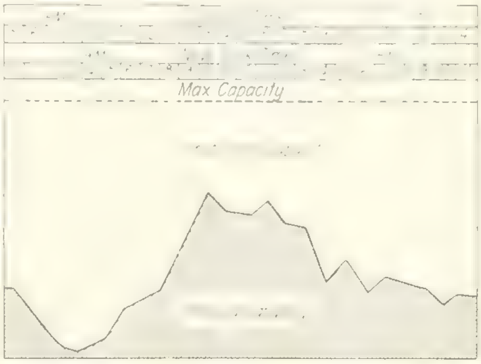


Diagram Showing Hourly Load on Certain Marine Cable Lines.

Electric power is frequently sold at exceedingly low rates if taken in large quantities at "off peak" times. The latest improvement in electric cookers involves the use of a heat reservoir that receives practically all its heat at "off peak" times.

In order to fill freight cars that would otherwise travel empty, exceptionally low rates are made. So long as such a rate is somewhat more than enough to cover the cost of handling the additional freight business, it is usually good managerial policy to put into effect a rate that will create the added traffic. Similarly the load factor of passenger cars is often increased by low excursion rates, as well as by commutation rates.

The output factor of American steel mills is increased by selling steel in foreign markets at prices below those secured in home markets. This practice has been condemned by shallow politicians, who have pointed to it as evidence of exorbitant profits secu steel sales in American markets. Si criticism has been aimed by the sa of politicians at railways for charg rates higher than the minimum re both instances sight is lost of the f very low rate is usually made for th of securing business that could no tained otherwise, and that it is sc nomics to offer such low rates if th to cover the cost of the additional even though the low rates are not to bear any considerable amount of costs.

From a consideration of such ins the foregoing, induction leads us t lowing generalization, which may the law of maximum output factor

Wherever the number of units of an entire plant, or any part there during successive periods of time, nomic to effect any increase in t factor that can be secured at a co less than the added gross income der the increased number of units of ou

A partial recognition of this law in the advice: Get additional any price that will more than c *added* cost.

No railway manager needs be this is a law of paramount importa there is a vast army of business have failed to see the great possibil an application of this law offers. Th manager charges against each unit o all the overhead expense, and refus his product unless he can get more unit cost thus estimated. This often a lower output factor and higher uni

Simple as are the means usually a increase the output factor, still there plants—probably none of any co magnitude—where the output factor such as to yield the greatest annual curable. Often it takes courage, a Vail's experiment with the "night l attempt to increase the output facto greater output factor may be secure expense of a smaller annual profit. larly if existing rates are reduced off peak times.

Often it requires some originality methods of profitably increasing a factor. The street railway manager conceived the idea of building an am park at the end of a previously un line was an inventor of a most s method of increasing the output fact street railway plant.

While few managers have failed t nize, in a general way, that it is high able to secure a greater output fa many have ever plotted the output their plants. Nothing serves better clear the economic advantage of a factor that approximates 100 per cent plot the actual output, or "load," (or fractions thereof) and by days.

ewi a curve showing the hourly load on marine cable lines, taken from [illegible] the February issue of the *World's* [illegible] This curve shows a startling wast[illegible] capacity; but a similar curve for the steam or electric railway is even more ng in its disclosure of plant waste.

ly should output curves be plotted nt taken as a whole, but for every f the plant, including every employe of employes whose output can be [illegible] Frequently many undreamed will thus be flashed upon the mana- r's ion. As a corollary, therefore, to the maximum output factor, we have this ction:

[illegible] *d of every important element of the* [illegible]

f the actual output is expressed as a of the capacity output, the eco- gnificance of an existing low output n not escape attention.

rage American freight car averages miles daily throughout the year, and ge freight locomotive averages more than double that mileage. If urves were plotted for all cars and s, and if managerial brains of high e concentrated upon the problem of the mileage traveled by rolling can doubt that this mileage "out- r" would be greatly increased? In private owners of fast freight cars this very thing, and have pointed for railway companies to follow.

n western retail store the output factor en greatly increased by offering dis- [illegible] rtain dull shopping hours every day. [illegible] sists in giving twice the usual num- ding stamps" prior to 11 a. m. daily. rs, when properly advertised, have to increase business at times of the ien clerks would otherwise be almost [illegible]

the methods most commonly used e the output factor are these:

[illegible]

rage of the product during periods nsumption.

prices for the product at "off s—at times of partial or entire idle-

tematic rotation of service to vari- s of patrons.

rking two or three shifts of men 24-hour day.

(Extra advertising to attract customers et hours, days or seasons.

Use of meters to curtail waste and re- ks."

tion to these common and rather al methods there are almost innumer- specific methods of increasing output s. Ingenuity of a high order is fre- y shown by managers who devise spe- [illegible]

[illegible] s the *general* output without changing lation of the "peaks" to the "valleys" is ow under discussion, let us consider a f the ingenious methods that have been d to increase the output factor.

"rotation of crops" has been called the st single discovery ever made in the art riculture. Prior to the discovery that a hat has become "exhausted" for one sort getation is not "exhausted" for all sorts. s the custom to have about one-third of farm always lying fallow. The output r of farm land was raised from 66⅔ per to 100 per cent by the rotation of crops.

ingenious contractor it was who con- d the idea of using an extra wagon on haul work, so that while men were load- e extra wagon a team was not kept wait- Thus, at scarcely any added cost, the t factor of the teams was considerably [illegible]

rmally the output factor of teams does much exceed 50 per cent at best, for they with loads only in one direction and n with empty wagons. On a long haul job a certain contractor who was hauling cement from a railway station to the site of a dam made a handsome profit by purchasing some standing trees near the dam. These he cut and hauled to the railway station in wagons that would otherwise have returned empty. It may be said that no ingenuity, but merely common sense, was used in this case. Ingenuity, however, is usually little more than an application of a "common sense" not commonly shown by most men. Another contractor doubled the output factor of a snatch team by the use of an "endless rope" passing around pulleys at the top and bottom of an incline. By this device the "snatch team" worked both ways—going up and going down—in a manner analogous to the use of a double drum hoisting engine with a main rope and a tail rope.

The rotating brush of a carpet sweeper serves to eliminate the idle time that occurs in moving the ordinary hand broom on the back stroke, and thus practically doubles the output factor of a person engaged in sweeping.

Since there are many classes of work that are now done by reciprocating motion, wherein the tool does no work half the time, it is well to bear in mind the following principle:

Convert reciprocal motion to rotary motion, if by so doing the output factor can be doubled [illegible] *cost.*

In the cases of the carpet sweeper and of the lawn mower, the added cost of securing continuous work is nominal. Similiar attempts have been made in certain other hand operated machines with less success, for it often happens that the work is so heavy when continuous motion is secured that two men are required where formerly one sufficed. There may then be an actual loss of efficiency, due to the frictional losses of the machinery alone. Thus, a manual rowing machine could readily be made that would replace the reciprocating action of the oar by the rotating action of a screw propeller driven by hand, but with questionable advantage.

Elimination of useless motions, or of motions through excessive distances, is one of the managerial expedients by which the output factor of workmen is increased. A useless or excessively long motion is the equivalent of idle time. This phase of the science of management is so important as to deserve special consideration in a separate article.

Plant idleness due to breakdowns is frequently the cause of a low output factor. The tendency is to underestimate the loss from such delays. The mere cost of repairing broken parts is usually nothing compared with the cost of an idle plant. Even though manganese steel wearing parts cost many fold as much as ordinary steel parts, it is generally economic to use manganese steel for parts subject to rapid wear if they become the cause of plant idleness. In estimating the cost of plant breakdowns, add to the cost of the repairs the cost of the idle time of the men and machines during the repairs. If this were the universal practice, duplicate parts, and even entire duplicate machines, would be more frequently provided, and more money would be expended in securing parts having a longer life. The best managers require that a complete record be kept of the duration of every delay caused by breakdowns, so that the true output curve of each machine can be plotted.

Breakages are not the only causes of serious chasms in an output curve. Delays frequently occur through lack of co-ordination of different gangs of men. Materials may not arrive when needed. All such delays should be similarly recorded and their aggregate cost should be estimated.

This leads us to the following enlargement of the generalization as to the plotting of output curves:

Plot output curves so as to show not only normal but recurrent abnormal variations; then calculate the periodic cost of the reduced output due to the abnormal decreases in output, and expend anything less than this periodic cost to keep the output curve normal.

We have merely sketched in a rough way the scientific solution of the problems involved in securing a maximum output factor. The ramifications of the subject are innumerable. Fortunately the general principles to apply are simple and few in number. The economic results that flow from their application are so striking as to preclude forgetting the principles once they have been tested in practice.

In a subsequent issue we shall discuss the law of competitive design.

Steel Barges for Mississippi River Improvement Work.

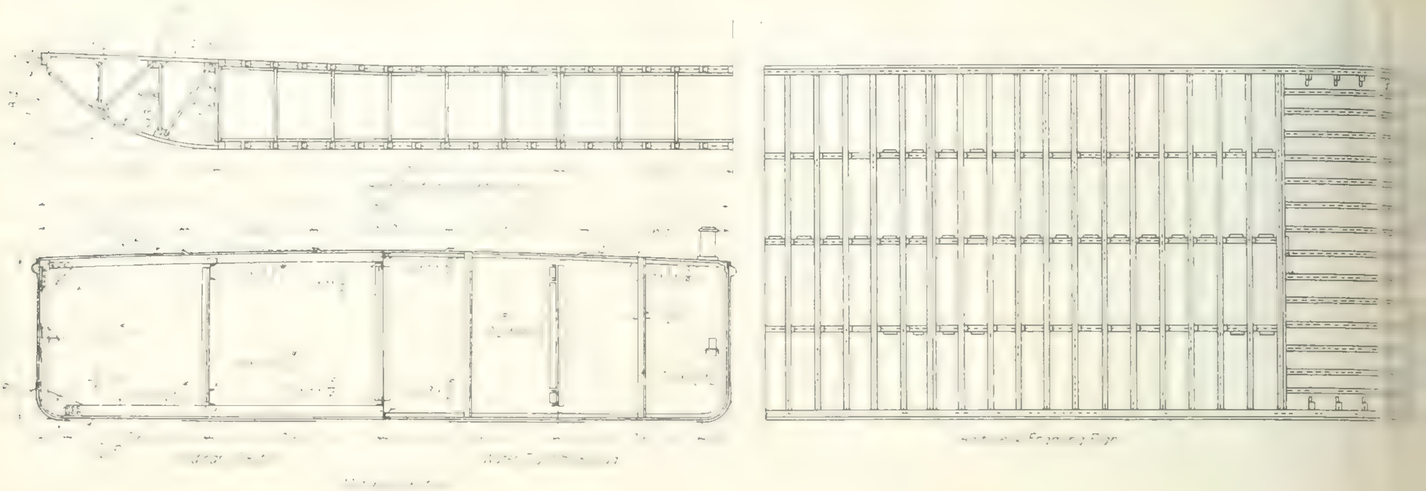
The accompanying illustration shows the design of a steel barge, 14 of which have recently been placed in commission on government work in the First and Second Mississippi River Districts. The steel barges are built by the American Bridge Co. at a cost of $9,300 each. They have a capacity of 400 tons and their estimated life is over 20 years. The specifications to which these barges are built are given below. They describe clearly the details of the design. The barges were designed under the direction of Maj. Clarke S. Smith, Corps of Engineers, U. S. A. The barges are 120 ft. long, 30 ft. beam, 7 ft. 4 ins. in depth of hold at center and 7 ft. at the sides.

[illegible] throughout, flat bottomed, with rounded knuckles, wall sided, symmetrical about the center line, with a rake 15 ft. long, a sheer 12 in. high at each end, and a crown of beam of 4 ins. Transverse framing lines shall be spaced uniformly 30 ins. They are to be numbered consecutively from 0 to 48. There shall be four continuous, transverse, water-tight bulkheads, one non-water-tight longitudinal plate bulkhead over the center line, and two symmetrically disposed longitudinal stiffening trusses. There shall be framing throughout the entire sides—all dead flat. The deck and floor framing shall be transversal, and over the rakes the deck and floor framing shall be longitudinal.

Hull.—All plating shall be laid in longitudinal strakes with single riveted lap seams and double riveted, butt strapped ends. Rivets shall be ⅝ in. diameter. Single riveted laps shall be 2¼ ins. wide, butt straps not less than 7¾ ins. wide and 1-16 in. thicker than the thickest of plates joined. Outboard edges of all plates shall be properly beveled, and calked with a round-nosed calking tool. All rivet holes in hull and deck plating, except the outboard row of deck rivets, upon each side, shall be countersunk on the outboard side. Ruling length of plates shall be not less than 20 ft., except the knuckle strake, which may be 10 ft. Butts shall be shifted not less than 5 ft. in adjoining strakes, well distributed, accurately planned, and fitted metal to metal and well calked. Bottom plating shall be in five strakes of 5-16 in. plates laid in and out, the keel strake being an inboard strake. Liners shall be worked between floor beams and outboard strakes, with proper spaces left at ends for limber holes. Knuckle strakes shall be ⅜ in. plates. Sides shall be each in one strake, of 5-16 in. plates. Deck shall be five strakes of ¼-in. plates, laid with inboard plates overlapping outboard plates. Plates may be jogged at laps, or tapered liners may be used. Side and deck plates shall entirely cover gunwale angles and be beveled at edges to about 45° angles. Similar construction shall obtain at the ends of the barges.

Bulkheads.—Transverse, four in number, one each on frames 6, 18, 30 and 42, shall be thoroughly water-tight, continuous from side to side of barge, built of 10.2 lbs. plates, with double riveted, lapped, vertical seams. Those on frames 18 and 30 shall each be stiffened with four 3½x2½x¼ in. vertical angles, one in middle of each space adjoining the longitudinal trusses. A 3x3x⅜ in. bounding angle shall connect bulkhead to hull plating, be jogged around the gunwale angles and, when cut, be spliced with an angle splice bar.

Longitudinal.—One non-water-tight, placed over center line, extending from frame 6 to frame 42, built intercostally to transverse bulkheads, of 10.2 lb. plates. Seams, if any, shall be lapped, vertical ones double riveted, horizontal ones single riveted. Plates shall be notched for deck and floor beams, extend from bottom plating to deck plating and secured to [illegible]



Standard Steel Barge for Mississippi River Improvement Work.

[illegible] top and one bottom 3x3x5-16 in. continuous [illegible] spectively, and be secured to them at each [illegible] stiffeners of 3½x2½x¼ in. angle, of the length between horizontal flanges of top and bottom [illegible] one on each side of the bulkhead, at each alternate frame. Connections of the bents to the [illegible] shall [illegible] of each intersection, extending between bounding angles of transverse bulkheads.

Longitudinal Trusses.—Two in number, one on each side of, and parallel to, center lines, shall be 7 ft. 6 in. therefrom. Each shall ex- [illegible] 42 and work intercostally to transverse bulkheads. Each sep- [illegible] by 13.75 lb. channel top chord, and similar bottom chord, connected and braced with 3x3x5-16 in. angle lattice members, constructed of one stanchion at each alternate frame and one diagonal brace in each space so defined, alternating in direction of inclination. A 5-16 in. vertical plate 24 in. wide shall, at each end, extend from bottom plating to deck plating, secured each by a 3x3x5-16 in. angle, and to the transverse bulkhead by the end stanchion, which shall here be 3½x3x5-16 in. and doubled. In each frame space adjoining the end space, a 24x12x5-16 in. plate and a 3x3x5-16 in. angle at top, and a 24x13x5-16 in. plate and a 3x3x5-16 in. angle at bottom will further secure the respective chords to the skin plating. A 5x3x⅜ in. angle clip 5 in. long with two ¾ in. rivets in each leg will secure each chord to its adjacent deck or floor beam at each crossing of same.

Deck Beams.—One at each frame line between lines 6 and 42, except where transverse bulkheads occur, shall consist of a continuous 6 in. by 10.5 lb. channel, 29 ft. 4 in. long, cambered [illegible] 4 in. at crown of deck.

Side Frames.—One at each frame line, except where transverse bulkheads occur, shall consist of a 4x3x5-16 in. angle, extending from the gunwale angle down around the bilge and ending on dead flat 10 in. inboard of the outer end of the floor beam, and on the rakes at the outboard rake frame. Each will be stiffened at the knuckles by a 5-16 in. plate futtock and at the gunwale by a ¼ in. plate knee, securing to transverse framing members where such exist. In rake spaces, plate knees will each be secured to deck by a 3x3x5-16 in. angle.

Floor Beams.—One at each frame line between lines 6 and 42, except where transverse bulkheads occur, shall consist of a 7 in. by 12.25 lb. [illegible]

Rake Frames.—Fourteen over each rake, spaced approximately 24 inches. Each shall consist of both a top and bottom chord of 4x3x5-16 in. angle, connected and braced by three 3x3x5-16 in. angle stanchions, two 3x3x5-16 in. angle diagonal braces [illegible] plate [illegible] in. wide adjoining head plate and secured to it by a 3x3x⅜ in. angle. All connections of web members to each other and to chords shall be [illegible] plate gussets.

Head Plates.—One at each end of barge, of ⅜ in. plate, extending between, and secured to, the corner castings. It shall be 14¾ in. wide at middle, have bottom line straight, and top conform to crown of deck. Connections shall be a 3x3x⅜ in. angle to deck plating, and a 6x⅜ in. plate, bent to conform to parts joined, to rake plating.

Riveting.—Except where otherwise specified or the nature of the work demands a different size, all rivets shall be ⅝ in. diameter, with pitch of 2½ in. in water-tight work and 5 in. in framing, etc. Machine driven rivets shall be not less than ¾ in. diameter. All double riveting shall be chain fashion. No rivet shall be nearer than its own diameter to the edge of any piece through which it passes. Rivets shall completely fill their respective holes and in water-tight work heads shall be laid up. All rivets shall be thoroughly tested and those showing any sign of looseness shall be cut out. All holes shall be regularly and accurately spaced, opposite each other in adjoining surfaces, and punched from the faying sides. Heavy drifting will not be allowed. Holes not lining up fair shall be reamed or drilled fair and normal to the surface and such rivets used as will completely fill the enlarged holes. Machine driving will be used wherever practical. Minimum depth of countersink three-quarters of thickness of plate. Rivets not completely filling their respective countersinks will be rejected. Points of rivets on outside of hull shall be flush or slightly convex. Depressed points will not be tolerated and plates much battered in riveting will be rejected. Not less than 4 rivets shall be driven in each connection of futtocks, frame gussets, etc.

Butt Straps, Angle Splices, Etc.—Butt straps shall be 1-16 in. thicker than the thickest of the plates joined and of width not less than called for by Rules of American Bureau of Shipping. Butting ends shall be accurately fitted metal to metal. Angle splice bars shall be fitted into the bosom of the bars joined and have their legs co-terminus in width with them. Their net cross-section shall be not less than that of the bars joined. On each side of the splice, the total cross-section of the connecting rivets shall be not less than 10 per cent in excess of the net cross-section of the bars joined and the minimum number of rivets, four.

Side Stringers.—Upon each side a stringer of 5 in. by 9 lb. channel shall be placed with its face 3 ft. 6 in. above floor molding line and secured to each side frame by a 5x3x⅜ in. angle clip with two ¾ in. rivets in each leg. It shall extend from model portion to model portion of rakes, work intercostally to transverse bulkheads and secure to them by two angle clips on each side of bulkhead.

Gunwale Angles.—Upon each side of barge, one 3½x3½x5-16 in. angle shall extend the entire side, reeve through the transve
heads, have butts closely fitted metal
and spliced with angle bars.

Nosing.—The nosing shall be of
Section M-33-17.75 lb. corrugated plat
convenient swaged to a depth of 3⅛
width of 5 in. with the corrugation fi
[illegible] mortar of 1 to 1 Portland cement
of the best qualities. It shall extend u
side, from corner casting to corner cas
secured to them. Across the ends, th
shall extend from corner casting to cor
ing and be secured to them. It shall be
angular cross-section, conform to the
the head plate, have a ⅜ in. face plat
by 8.2 lb. Z bar lower member, a 3x3
angle top angle and a [illegible] in. top plat
will overlap the deck. It shall be fi
mortar, as above specified.

Kevels.—Shall be steel castings, one
end of the barge. General dimensions, 5
10 in. wide, 7 in. high, with minimum t
of part ¾ in. Each shall have a de
forcing plate ⅜ in. thick, of ample a
shall be secured by 8 close-fitting turn
of ⅞ in. diameter.

Ladders.—A steel ladder shall be
each hatch, having rungs ¾ in. diame
12 ins. long, spaced about 4½ ins. cl
tance from, and riveted to, the adjoini
head, by means of properly bent ends.

Hatches.—There shall be ten hatche
as indicated, each furnished with a
of steel, cast in one piece, and a cover
steel, hinged to coaming, and properly
down, all being made water-tight. A c
grating will also be provided for eac

Pumps.—Each barge shall be furnis
two good pine or poplar pumps, coal bo
5x5 in. inside measurement, and long
to pump over hatch coamings.

Towing Bitts.—Shall be steel casti
at each end, with twin posts and two
side with single posts. All posts sh
in. outside diameter and 6½ in. inside d
Overall dimensions, for double posted
ft. 1 in. long, 11 ins. wide, 1 ft. 4 ins.
single bitts 1 ft. 2½ in. long, 11 in. w
4 in. high. Each shall have a deck rei
plate ⅜ in. thick and of angle area, a
be secured in place by 1 in. countersun
8 to each double posted bitt and 4
single one.

Corner Castings.—At each corner
barge a substantial steel casting shall
into the hull, forming the corner, and
the nosings shall end and secure.

Material and Workmanship.—The be
ity of materials and workmanship will
quired in each and every part of the w
under these specifications. All plate, c
bars and angles shall be of soft open
steel. Tensile strength desired, 60,000
per square inch. Minimum qualities s
Ultimate strength, 58,000 pounds per
inch; elastic limit, over half of
strength; elongation, 25 per cent in 8

area of fracture, 40 per [illegible] cold upon self, 180 degrees [illegible] gn of fracture on outside of [illegible] s shall in addition, be [illegible] without signs of cracks [illegible] ll be of the best quality of rivet steel. strength 48,000 to 58,000 pounds per [illegible] with minimum qualities [illegible] half of ultimate strength, elongation [illegible] t in ten diameters. Long rivets must [illegible] cold upon self, that [illegible] ving cold into the head, [illegible] of fracture. Steel castings shall be true smooth, well finished, free from blow ther imperfections and of the following qualities: Ultimate strength, 60,- s per square inch; elastic limit, one- timate strength; elongation in two per cent; reduction of area of frac- per cent. The number of [illegible] any materials shall be as directed tracting officer, but at least one test [illegible] each and every [illegible] metal is furnished. Rolled [illegible] ordered by weight. A variation [illegible] per cent above or below specified all be sufficient cause for rejection. lates shall be ordered by weight, tions for variations in weight, those [illegible] Carnegie Hand-book, 1903. All other plates shall be or- gage, with allowances for thickness ght, those given on page 222, above- d-book, and each plate gaged at each corners.

-All roller material shall be thor- completely covered with one coat [illegible] linseed oil, immediately [illegible] at, and before shipment from, the

mparative Costs of Repairs to es of Treated and Untreated nbers: Cost of Timber and Steel Barges Compared.

[illegible] costs of repairs to barges [illegible] treated and untreated timber [illegible] paper presented to the American [illegible] servers' Association, by Mr. A. E. [illegible] United States Inspector at Rock [illegible] Some 200 barges are now [illegible] river improvement work in the land District, and records of the main- costs of these barges, which are all of [illegible] 100x20x4 ft. 7 ins. [illegible] last 20 years. The comparative costs Mr. Hageboeck are, therefore, based ually comprehensive records. In con- with the data and discussion which fol- reader will be interested in the arti- Mr. Charles S. Durham, Principal As- U. S. Engineer, which was published issue of Oct. 18, 1911. General plans ndard barge are published in Mr. Dur- rticle. An abstract of Mr. Hageboeck's ollows:

nstructing light draft barges it has been icy to use pressure creosoted fir, as fir obtained in long lengths at a reasonable ong timbers are especially desirable in onstruction, as they reduce to a mini- e number of gunwale joints which are the first to cause trouble by leaking. being cheaper in cost, both before and reosoting, the fir is lighter, resulting in [illegible] but 9 ins. for a standard barge 100x 7 ins.

[illegible] Treatment Used [illegible] Barge n.—The first creosoted barges used in ntry were built in 1900 of pressure yellow pine by the New Orleans office U. S. Engineer Corps. These barges day in a perfect state of preservation, all probability will be used for 10 to 12 longer. The cost of repairs has been and the results so satisfactory that no ted barges are now built by that office. Rock Island District formerly used the ank treatment. The penetration was superficial, but the cost is only 5 per the total cost of a fir barge. Last fall iter inspected a large number of these ges built in 1908, and in no case was [illegible] timbers, while in a [illegible] of cases the un- [illegible] of decay. It is, therefore evident that the small cost of this treatment will pay good [illegible] heart surfaces is usually superficial. With Short Leaf and Loblolly pine it has been [illegible] saturate the sap that it often costs more than a 10-lb. pressure treatment. For treating barge timbers the pressure treatment has, in the opinion of the writer, a number of advantages that make it a far more economical treatment. First, from a treating standpoint, it is possible to treat either green or seasoned lumber. Second, the exact quantity of oil injected can be ascertained by the temperature and gage readings. Third, the entire treatment can be regulated to meet the requirements of each particular charge. Fourth, it is possible to plug the ends of the timbers and thereby retard the absorption of moisture. Fifth, the pentration of oil is far more uniform. The last two factors tend to eliminate the so-called "working" of the timbers. This is an important item in barge construction, as it is a well-known fact that a barge built of green, untreated lumber will usually cause trouble from leaking, due to the subsequent shrinkage of the timber as it dries, and the consequent opening of the seams and loosening of the oakum. Even after the lumber has once become dry it readily absorbs moisture during a wet period, and again gives it up during a dry period, and as a result an untreated barge is re-calked every year after its fourth or fifth year in service. The pressure treatment has largely eliminated this re-calking and so materially reduced the cost of repairs.

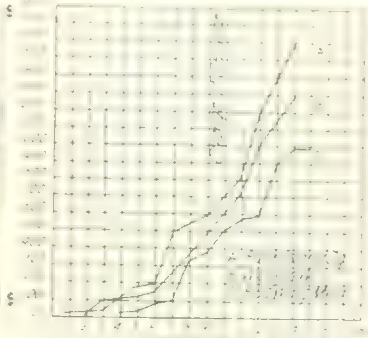


Fig. 1. Diagram Showing Average Cost of Repairs and Life for Untreated Douglas Fir Barges at Three Points on the Mississippi River.

[illegible] On the Mississippi River, between St. Paul and St. Louis, untreated yellow pine has been used but little, and the writer has been unable to obtain any accurate records of its lasting qualities. It is generally believed that unless timber, practically free from sap is obtained, its life would be exceedingly short. On the Lower Mississippi River a yellow pine untreated barge containing a minimum proportion of sappy timber is past economical repairs at the end of ten years.

Life of Pressure-Treated Yellow Pine Barges.—Pressure-treated yellow pine barges have been used on the lower river for twelve years. These barges are today in a perfect state of preservation, and without doubt are good for an additional life of ten years. It has been found necessary to re-calk the barges after two years' service, but otherwise the repairs have been small, and but little further re-calking seems necessary during the life of the barge. One reason given for this re-calking is that the creosote oil acts on the oakum and "burns" it out. As a matter of fact, however, the lumber in these barges was treated while in a green condition, and, in the opinion of the writer, the real necessity for re-calking is due to the subsequent shrinkage of the timber and consequent opening of the seams and loosening of the oakum.

On the Lower Mississippi River, where there is always a good stage of water, light draft is not a controlling factor, and so barges 120x30x6 ft. and larger are in general use. The original cost of these untreated yellow pine barges, built in the early 90's, was about $3,000; the cost of repairs during the life of 10 years averaged $2,006.61 per barge. The original cost of similar barges built of pressure creosoted yellow pine was $4,000; the cost of repairs on 10 barges averaged $557.35. The total cost of the untreated barge was $5,100, for which nothing remained at the end of 10 years to show for this expenditure. The total cost of the creosoted barge during nine years [illegible] praised at $3,600, remains on hand. Table I shows the comparative annual cost per barge:

[illegible]

	Untreated	Creosoted
[illegible]	[illegible]	[illegible]
	10 yrs. old	9 yrs. old
[illegible]	$[illegible]	$[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	$[illegible]
[illegible]		[illegible]
Total cost of untreated barge [illegible]	[illegible]	
Total cost of creosoted barge [illegible]		[illegible]
Annual cost per barge.......	510.00	106.00
[illegible] creosoted barge		[illegible]

[illegible] *Cost of Repairs.*—With few exceptions the necessity for repairs to an untreated barge are due to decay and not to mechanical abrasions. Ordinarily the decks of barges used for rock transportation will first decay on the bottom side at the points of crossing other timbers, and in this weakened condition are easily broken.

It has been necessary to replace plank originally 2½ ins. thick, which after eight years of service were 2⅜ in. thick, because of their decayed condition, and not because of wear. It is not uncommon to find evidence of decay on untreated barges after three years of service.

The repair costs used in Fig. 1 have been obtained from the plant records of the U. S. Engineer office at Rock Island, Ill., covering Douglas fir barges in use for the past twenty years in connection with the work of improving the Upper Mississippi River, between St. Paul and St. Louis. In the past untreated fir barges were kept in service 10 to 17 years, the average life being 15 years. The diagram is intended to show the usual cost of repairs from year to year during the life of an untreated Douglas fir barge. New barges are, as a rule, used for rip-rap rock transportation, this service requiring a substantial craft. From the diagram it will be noted that during the sixth and seventh years the barges required extensive repairs, the cost ranging from $200 to $300 per barge; that with repairs costing about $75 per year they continued in hard service to the tenth or twelfth year; that they then required large repairs and had to be taken from rock work and placed in the brush carrying service, which is much less severe on account of the large decrease in weight per cubic foot of load. From this time on to the end the cost of repairs per barge is largely increased; and it is debatable whether it would not be fully as economical to abandon the barge at about the tenth to twelfth year.

Life of Pressure-Treated Douglas Fir Barges and Cost of Repairs.—It seems safe to estimate the life of creosoted fir barges at 20 years, since untreated barges have given an average life of 15 years. The major portion of the repairs on an untreated barge are for calking and repairs to deck, rake and gunwale joints on account of decay. As the present tendency is to air season the fir before treatment, it seems natural to believe that the barges will give a long service without recalking, as was the case of the creosoted barges used on the lower river, as cited above. As an additional precaution it is thought ad-

TABLE II.—COMPARATIVE COST OF LIGHT DRAFT BARGES BUILT OF VARIOUS KINDS OF MATERIAL. SIZE 100 FT. × 20 FT. × 4 FT. 7 INS.

Items	Douglas Fir Untreated. [illegible] life.	Douglas Fir Treated. 10 lbs. 20 yrs. life.	Yellow Pine Untreated. 15 yrs life.	Yellow Pine Treated. 14 lbs. 22 yrs. life.	Steel. 25 yrs life.
Original cost	$1,200	$1,500	$1,300	$1,650	$4,000
[illegible]	1,094	400	1,094	700	400
Interest at 5% on cost	900	1,500	975	1,815	5,000
Interest at 5% on repairs	341	125	341	125	125
Total cost	$3,535	$3,525	$3,710	$4,290	$9,525
Yearly cost per barge	$ 236	$ 177	$ 247	$ 195	$ 381
Yearly savings in favor of creosoted fir barge	$ 59	..	$ 70	$ 18	$ 204

visable to protect the creosoted deck with a 1-in. wearing surface of untreated material. The repairs to the deck are, therefore, confined to the occasional relaying of this protection.

Table II for timber barges is based on Government freight rates on timber, and so, for commercial comparison, $10 per barge should be added to the yearly cost.

The yearly costs show the following relative order for economical barge construction: Creosoted Fir, Creosoted Yellow Pine, Untreated Fir, Untreated Yellow Pine and Steel.

It will be noted that the annual cost of a steel barge is twice that of either a fir or pine creosoted barge. The average cost of repairs on 31 fir barges used on the Upper Mississippi River was $1,094 per barge during an average life of 15 years. The original cost of an untreated barge built today would be approximately $1,200. On this basis, with interest at 5 per cent, the cost per untreated fir barge per year would be $236, as compared with $177 yearly cost for a creosoted fir barge, or a difference of $59 per year in favor of the creosoted barge.

The figure for interest on repairs was obtained in this way: First, the average cost per year for repairs on 31 average untreated barges was obtained, and the interest figured from the time the repairs were made until the barge was condemned. The figure for interest on repairs of the creosoted barges was obtained by proportion.

Conclusions.—The original cost of a steel barge with interest on the investment is not compensated for, by the added life, compared with a creosoted barge. The cost of repairs on an untreated barge and its short life of real hard service makes the annual cost, including interest, 25 per cent more than for the pressure creosoted barge. The pressure creosoted yellow pine barge and the pressure creosoted Douglas fir barge have respective fields depending upon the working conditions; on the Lower Mississippi, where there is always a good stage of water, the creosoted yellow pine will probably be more desirable, but for light draft and use on the Upper Mississippi the pressure creosoted fir will be far more economical.

Fir is a difficult wood to treat; and time is required to obtain good results, and the open-tank treatment will not give as economical results as the pressure process. Comparing the probable life of treated fir and treated pine, irrespective of the purpose for which it is to be used, treated pine is preferable. But for barge construction for work on the Upper Mississippi the creosoted fir is cheaper in first cost, both before and after creosoting; it makes a lighter draft barge, resulting in an increased capacity, and so is more economical.

Permeability Tests of Mortars and Concretes of Different Proportions.

Contributory information on the proportion of mortars and concrete which influence permeability is given by a series of tests conducted under the direction of Rudolph J. Wigg and R. H. Bates of the Bureau of Standards. The results of these tests are published in Bulletin No. 3 of the Bureau, from which we extract the following:

The tests were made on 1:2, 1:4, 1:6, and 1:8 mortars and on 1:2:4, 1:3:6, and 1:4:8 concretes. The cement was a "typical" Portland and the aggregates had the physical properties shown in Table I. The test pieces were circular disks which were for the mortar and the concrete of fine aggregates 7½ ins. in diameter and 1 in., 2 ins. and 3 ins. thick and for the concrete of coarse aggregate 18 ins. in diameter and 6 ins. thick.

Apparatus.—The testing apparatus is shown diagrammatically by Fig. 1. Figure 2 is a section showing the test piece and holder. In Fig. 2, *A A* are rubber washers of 5-in. inside diameter and 8 ins. outside diameter; *B B* are cast-iron top and bottom sections of the holder; *C* is the test piece 7½ ins. in diameter and 1, 2 or 3 ins. thick and is retained in corresponding short-length sections of wrought-iron pipe; *D* is the retainer in which the water passing through the test piece is caught.

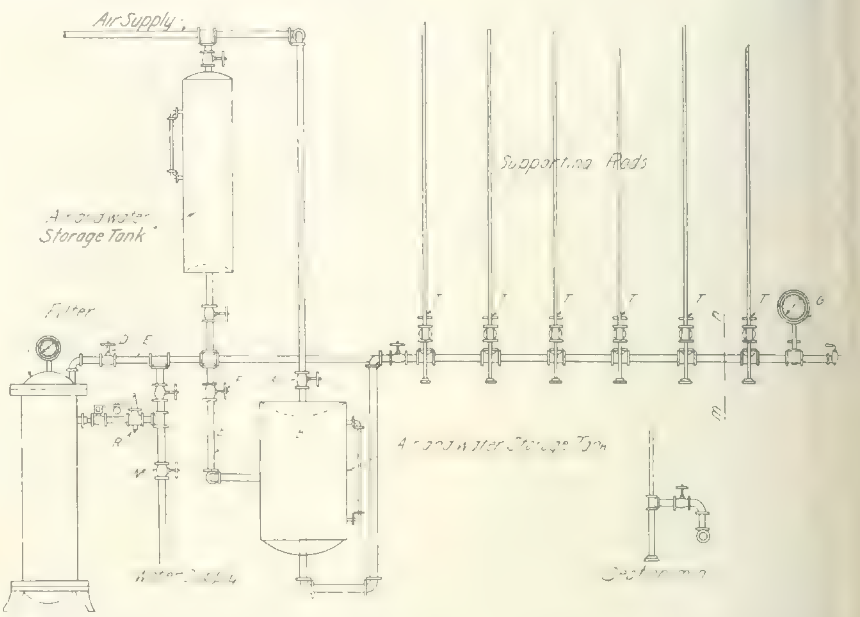


Fig. 1. Diagram Showing Arrangement of Apparatus for Permeability Tests.

Proportions.—The proportions of the constituent materials of the mortar or concrete were assumed according to volume measure, but since the actual quantity of sand or stone in a given volume is largely dependent upon its relative dryness and the method employed in filling the measure, it was deemed advisable to convert volume measurements into weight measurements. The weight of the cement was assumed as 100 lbs. per cubic foot and the weight per cubic foot of the sand and stone used was determined. The sand was taken directly from the storage bin without previous drying and contained an appreciable amount of moisture, for which a correction was made in the volume weights. A part of this weight was made up of moisture present in the sand and stone. This determination of the moisture was made each day, using a 300-gram sample from the material taken from the bin. The weight of the sand or stone required was increased by the percentage of moisture found to be present and the quantity of water to be added to produce a mixture of normal consistency was correspondingly decreased.

Consistency.—The two consistencies used, designated as "damp" and "quaking," were determined for each kind of mixture previous to making the test pieces, and are defined as follows:

A mortar or concrete of damp consistency contains only sufficient water to hold the particles together when made into a ball in the hands and the ball held between the thumb and finger. The water could not be brought to the surface by troweling. This quantity of water was recorded as a percentage of the total weight of the dry material and was used for making all test pieces of the same materials and proportions.

A mortar or concrete of quaking consistency contained all the water it would hold and permit of molding into a ball in the hands and holding between the thumb and finger. Water could easily be brought to the surface under the pressure of the trowel.

TABLE I.—PHYSICAL PROPERTIES OF SANDS AND STONES.

Name	Meramec River sand.	Bank torpedo sand.	Slag sand.	Beach sand.	Beach sand.	Limestone.
Register No.	1	2	3	4	5	6
Location	Drake, Mo.	Chicago, Ill.	Chicago, Ill.	Nombre de Dios, Panama.	Quango Beach, Panama.	Porto Bello, Panama.
Specific gravity	2.597	.....	2.440	2.727	2.505	2.594
Weight in lbs. per cu. ft.	100.6	119.9	82.9	105.6	91.0	102.1
Percentage of voids	37.9	26.9	45.3	37.92	41.72	36.90
Fineness in percentage passing sieve						
200	0.20	0.70	0.60	.....	.....	....
100	1.30	1.30	1.40	1.50	1.50	1.90
80	2.60	2.10	2.10	10.00	10.00	3.40
50	13.90	7.30	5.80	18.00	31.50	4.34
40	37.00	14.50	11.40	28.00	46.50	4.90
30	64.00	28.80	24.00	45.00	62.00	5.85
20	81.70	45.20	45.40	64.00	72.00	7.00
10	97.00	72.10	84.30	97.00	86.00	10.00
¼	100.00	100.00	100.00	100.00	100.00	19.00
½	...	.....	...	....	......	30.50
¾	....	..	.	..	....	47.00
1	.	.	..	.	....	59.00
1¼	.		..	..	.....	81.00
1½	.		....	..	....	89.00
1¾	.		...	...	.....	96.50
2	.		.		....	98.00
2½	.		.	.	....	100.00

fixi.—The materials were weighed. The l sand were spread on the mixing le all the cement spread evenly on top. h materials were mixed thoroughly dry turning with the trowel for about two mins. crater was then made in the center, which the proper percentage of clean ter is poured; the materials on the outer ge being turned into the crater with the of trowel. As soon as the water was orbed the materials were kneaded for about minutes. The materials for the 18-in. diamr by-in. thick test pieces were mixed on sorbent floor with a shovel in a siminer.

g.—Three test pieces were molded m ch batch. The iron molds in which permeability test pieces were molded were from wrought-iron well casing, 7½ ins. in met, in sections 1, 2 and 3 ins. in length. c inner surfaces of the molds were wetted placed on a zinc top pallet board and the a or concrete pressed firmly into the th the fingers, care being taken to uniform pressure in molding all test he material was piled up and comve the level of the molds and struck the edge of a trowel. The 1-in. ls ere filled in one, the 2-in. in two, and three operations.

lds for the 18-in. diameter test pieces l about one-fourth full and tamped times with a 13 lb. peet shaped are being taken to cover the entire This operation was repeated until was filled, when it was leveled off plasterer's trowel. Twenty-four hours r olding, the top and bottom surfaces of se est pieces were brushed with a wire sh which removed any neat cement which ve been drawn to the surface in molding s making the entire test piece approxiel homogeneous.

—All test pieces were placed in a et for the first 24 hours, after which ability test pieces were removed pallet board and stored on shelves mp room until tested. The iron re allowed to remain on the permet pieces until the testing was come All test pieces in the damp room were l with water at regular intervals three h 24 hours.

—Permeability test pieces were t from the damp room on the morning day they were to be tested and both es were brushed with a stiff wire brush attempt to remove any surface "skin" ment drawn to the surface in molding. was accomplished only with difficulty in cases. They were then placed in the ece holders as shown in Fig. 2, a 3/16-in. ubber gasket being placed between each cast-iron plates and the test piece. The ctions of the holder were drawn tightly er with the bolts as shown, care being to draw up evenly on opposite sides. older with test piece was then connected pipe rack by means of a union. After rly assembling and connecting all of the ieces, the valve *M* (Fig. 1) was opened, ting water through the regulating valve the filter, thence through the pipe *E* to *B*. When the water reached a mark as ted on the gage it was shut off and air ted through the valve *A*, which was when the pressure gage *G* registered (9.1 kilograms). The pet cocks on the iece holders were opened and valve *T* pened until all air was exhausted the chamber on the upper surface of the iece and water flowed from the pet cock. pet cocks were then closed and the valve ened full, thus exposing 126.68 square meters (19.64 sq. ins.) of the upper surof the test piece to the full water pressure lbs. per square inch (1.4 kilograms per e centimeter), which was arbitrarily n for all permeability tests and is equivto a hydrostatic head of 46.2 ft. As the started the regulating valve *R* was set he air cushion in the tank *B* assisted in ying the pressure and preventing varia- The flow was caught for a period of minute in a glass graduate or large cali-d retainer, dependent upon the quantity passing, at the end of the 10th, 30th, and 60th minute and each succeeding hour until the seventh when the water was turned off and the test piece removed. In some cases the test was continued for several days, a reading being taken every 24 hours, and some test pieces were subjected to a retest at a later period. The 18-in. diameter concrete permeability test pieces were tested in most cases for periods of 10, 30, 60 and 120 minutes, and 24 and 48-hour periods under the same or increased pressure.

Results.—In some cases considerable variation is shown in three apparently similar test pieces, but as a whole the results are fairly concordant. It is regrettable that the limited equipment would not permit retesting the mortars which were impermeable under the 1.405 kilograms per square centimeter (20 lbs. per sq. in.) pressure under a greater pressure in order to show their relative values. A summary of the results is given below:

In nearly every case the mortars 26 weeks old are less permeable than those 8 weeks old, which in turn were less permeable than those 4 weeks old.

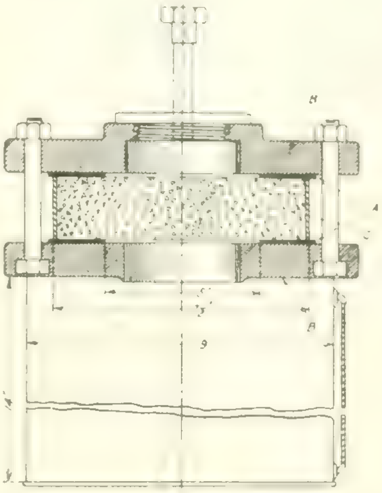


Fig. 2. Test Piece Holders with Test Piece in Position.

The richer the mixture in cement the less permeable was the mortar.

The quaking consistency was less permeable than the damp consistency.

The quantity of water passing decreases with the continuation of the flow.

The permeability was approximately the same for similar mortars whether in a 1, 2, or 3-in. thickness of test piece.

The coarse sand mortar was more permeable than the finer grain sand mortar.

The permeability of the mortar decreased with its age.

The quantity of water passing decreased with the continuation of flow.

The concretes richest in cement were least permeable.

The permeability of the concrete decreased with its age.

The concrete showed very slight or no decrease in the quantity of water passing, with the continuation of the flow.

The 3-in. thickness of test piece is slightly less permeable than the 2-in., which might be expected considering the size of the aggregate.

The retested test pieces showed practically the same relative decrease in permeability as corresponding mortars of the same age which had not been previously tested.

Concretes made with sand No. 4 were slightly more permeable than those made with stand No. 5, which contained the greatest percentage of fine material.

The same proportion, 1 to ½ to 5 parts, respectively, of cement, sand, and stone was the most impermeable with both sands.

These tests showed that the permeability of concrete was not dependent entirely on the quantity of cement used in proportion to the total aggregate but depended also upon the ratio of coarse aggregate to fine aggregate. In the case of sand No. 4, the 1 to 1½ to 7½ proportion was decidedly more impermeable than the 1 to 2 to 4 proportion, although the former contains considerably less cement in proportion to aggregate.

The richer the mixture the more impervious the mortar. The permeability of the mortars decreases rapidly with age. The 1-5 and the 1-6 mortars were as impermeable at 22 weeks as the 1-2 mortar was at 2 weeks. The value of troweling the surface is shown by these results.

Record for 70-Ton Steam Shovel.—On March 14 a 70 ton Bucyrus shovel at Panama loaded 290 small Western dump cars, containing a total of 2,900 cu. yds. of material, in the working day of eight hours. During this period the shovel was delayed one hour and 50 mins. waiting for cars.

This is the highest daily output for a 70 ton shovel since the commencement of operations by the United States.

Elevator for Cars or Concrete.—To facilitate the placing of concrete in the cellular approach wall at the upper end of Pedro Miguel Lock at Panama an elevator has been erected at the outer end of the wall, on the axis of the centre, to raise containers of concrete from the level of the ground as high as the final level of the wall. The elevator consists of a framework of heavy timbers, forming a shaft 6 ft. by 7 ft. 4 ins., and rising to a height of about 60 ft. above ground, in which a platform is raised and lowered by a small steel cable, operating over a drum moved by a 20 h.p., two cylinder upright air driven engine, set on the ground about 12 ft. from the side of the wall. The platform carries a ½ cu. yd. Decauville dump car, running on an 18 in. track, and at a height of about 12 ft. above the present levels of the cellular forms a track is extended on trestle work from the elevator shaft, so that the cars may be wheeled along and dumped into chutes leading to the forms. The concrete is placed in the cars at the bottom of the shaft from a ½ cu. yd. portable mixer, which is supplied from conveniently located stock piles of rock and sand and cars of cement. The mixer rested on the 30 ft. solid section of wall at the outer end till that was raised to 24 ft. above base, but above such a height it will be more feasible to use the elevator than to carry the ingredients up steep inclines to a mixer high above ground.

Sanitation in Berlin, Germany.—Consul General Thackara characterizes as admirable the system of sewage disposal now in use in Berlin.

No sewage is discharged into the river or canals that pass through the city. It is all pumped through large pipes to the city sewage farms, located within a few miles to the North and South of Berlin. The farms have an area of about 40,000 acres, of which about 6,200 acres are leased to farmers and the remainder cultivated by the municipal authorities.

While the city administration supervises the cleaning of the streets, the disposal of the sweepings and refuse gathered is left to various contractors. Some of these concerns have purchased barren and unproductive land to be used as dumping grounds, and as the garbage contains principally sand and horse manure, it is exceedingly valuable as a fertilizer and filler for such lands.

By law and by municipal police regulations, householders are obliged to provide for the removal of the waste from their buildings. For this purpose they have formed an association that includes most of the owners in Berlin. This association has made a contract for 30 years, 21 of which are still to run, with a limited liability company, which was formed for the purpose of disposing of household and other waste. They have erected a building for the purpose of handling the garbage, disinfecting it, and separating the different articles, such as metal, rags and bones.

EARTH AND ROCK SECTIO

A "Caterpillar Tractor" for Hauling Over Soft Ground.

A [illegible] carried [illegible] per [illegible] line motor and has been in actual use about eight years, chiefly in the West and South. It is called the "Holt Caterpillar Tractor."

The chief feature of the tractor is the platform wheel shown by Fig. 1. Two sprocket wheels, supported by the frame, serve to carry an endless track consisting of cast steel rails cut in short lengths and linked together with manganese steel pins. To the bases of these rails steel shoes are fastened which transmit the weight of the machine to the ground. These shoes are made in 16, 24 and 30-in. widths so that the bearing per unit area may be suited to the condition of the ground. The widest plates (30 ins.) give the bearing of 1½ lbs. per square inch, and the 16 in. plates lessen the bearing area so that the weight per square inch is increased to 8 lbs. For very soft ground the shoes may be provided with projecting cleats which increase their bearing surface.

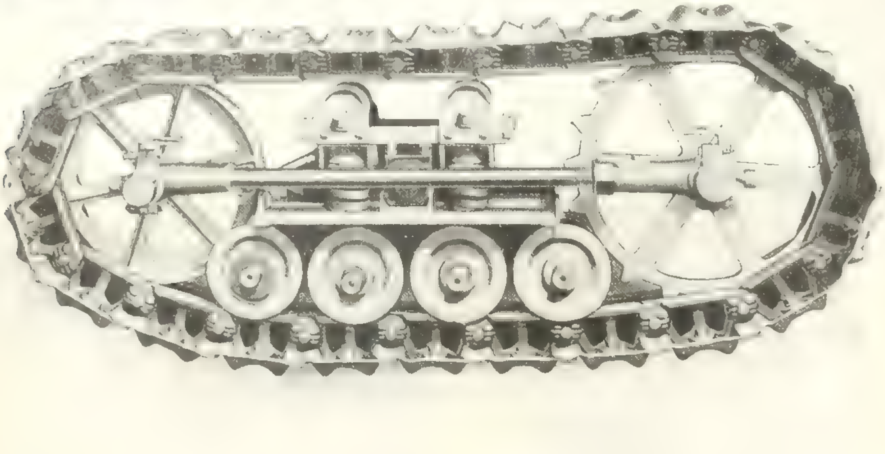


Fig. 1. "Platform Wheel" of a Holt Caterpillar Tractor.

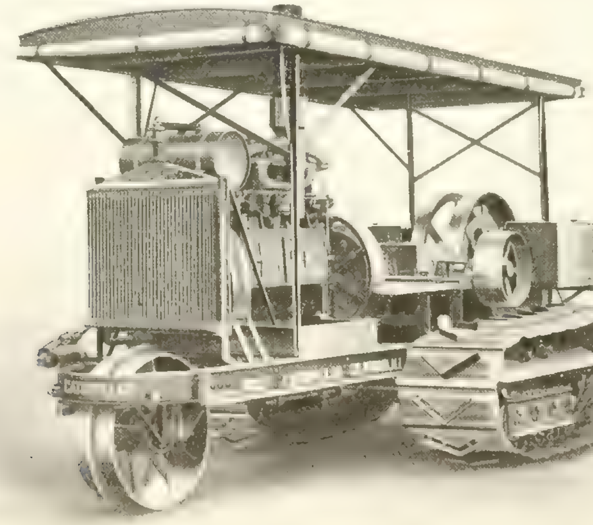


Fig. 2. View of Caterpillar Tractor with the 30-in. Plates Attached to "Platform Wheel."

The four small wheels shown by Fig. 1 support the weight of the machine upon the rails. These wheels are of semi-steel with a chilled face and run on roller bearings. It will be seen that this platform wheel arrangement is a device for laying its own track in front of the wheels and picking up the track after the wheels pass over it.

A general view of the tractor is shown by Fig. 2. The machine is 18 ft. long, over all, and weighs about 9 tons. The 45 hp. motor, when traveling at a speed of 2⅛ miles per hour, is capable of pulling a load equal to that which can be pulled by 30 horses. The machine can turn in a 30-ft. circle.

This tractor will haul trains of wagons for construction work, road machines and elevating graders, gang plows, etc., over roads on which the ordinary tractor cannot be worked. It is particularly adapted to the hauling of plows and in this task has shown some remarkable records of earth broken up. Mr. D. H. Nelson of Pendleton, Ore., states that 960 acres were plowed in 32 days to a depth of 8 or 9 ins. This was done at a cost of 47 cts. per acre, or more than 20 cu. yds. were loosened for 1 ct. A machine owned by J. J. Hicky of Thornton, Cal., has plowed 3,000 acres in two seasons and the repair costs have amounted to $425.

The tractor described is manufactured by the Holt Manufacturing Co., and the Holt Caterpillar Co., whose New York offices are at 50 Church St.

Cost of Diamond Drilling and Depreciation of Diamonds.

In calculating the costs of diamond lling the mistake is often made of not consering the depreciation of the value per carat the diamonds used, in addition to the deprϵation due to actual wear. A further mista may be made in estimating the time required drill a hole by records giving the rate of drillg per hour. These points are taken up in an ticle by Mr. Albert E. Hall, in the School of lines Quarterly of Columbia University, and data are given to show the cost of drillu and the theoretical and actual speeds of dmond drilling at Porcupine, Ontario. The folwing is an abstract of the paper:

In any discussion of this subject, i must be realized at the outset that local conio play a large part. For example, consi t water for the drills: In one case a dr w set close to a spring, so that the co w very small; in another case the water d be obtained from a lake 2,000 ft. dista pump could not be used, as the water fr an injector was installed. The cost i th case, where two drills were using the ate was 35 cts. per foot of hole, and hadne been but one drill the cost would have bn cts. per foot. These two cases illustra ex tremes in the procuring of water, and silar variations are to be found in other item: N fair comparison of costs can be made, er fore, unless all the conditions are knowi

The price of carbons varies widely, quotations must be known to be able to m pare costs at different periods. The foll table gives the cost of carbons at inta since 1875:

PRICE OF CARBONS PER CARAT

1875	$[illegible]
1893-4	
1896	[illegible]
1897-8	[illegible]
Bortz	
1899-1900	
1901	[illegible]
1903	
1906	
1908-9	[illegible]
1910, 1 to 1¼ K	
1¼ to 2 K	
2 to 3 K	
Bortz, 1 to 1¼ K	
Bortz, 1¼ to 2 K	
Bortz, 2 to 3 K	

A machine whose operating cost per fo i 1893 was $0.75 might appear to have e doing work cheaper than another which a cost of $3 per foot in 1910. Assumin th consumption of carbons to be the same, w ever, such is not the case, as may be se b the proportion, $15 : $60 : : $0.75 : $3, into consideration the advancing price of ar bons.

In our drilling operations at Porcupine m machine made 900 ft. of hole in 26 wo days, the last of which we have re d The work was done in two ten-hour shift day. The rock was schistose, containing q veins and stringers. The inclination of h hole was 54°, while the formation dippe a 73° in the opposite direction. Following r the itemized costs per foot:

Management and diamond setting	
Illumination (kerosene lamps)	
Coal	[illegible]
Lumber	
Casing pipe	[illegible]
Freight	[illegible]
Blank bits	
Core barrel and shell	[illegible]
Labor: Runners, $100 per month.	
Firemen, $2.75 per day.	[illegible]
Core checkers, $2.75 per day	[illegible]
Wear of carbons	
Water	
Depreciation of plant	[illegible]
Depreciation of carbons	[illegible]
Total	$[illegible]

In the case of another drill working in e same formation and under the same conditi s, the costs, based on 1,163 ft. of hole drille n 34 working days, amounted to $1.566 per ft. This includes the sinking of a stand-pipe a

TABLE I. [illegible]

[illegible]

1.0 11.0 26.75

17.5 35.0

f 30 ft., which took three days. Coal per ton laid down at the drill.

engineers and drill owners lose sight [illegible] ght stones of 2½ carats, at $85 per [illegible] to $680. Many operators stop here, the item to wear of carbons. This [illegible] iece, and hence their value per carat reciated, in addition to the actual loss [illegible] at. their total value is $840; this leaves [illegible] $180, which must be charged to depre-

[illegible] p one of these machines. The shed t for winter service, and was fairly [illegible]

[illegible]

r. nails, tar paper, etc.....$40.00

checkers at $2.75.......... 12.80

93.63

[illegible]

data in the following tables refer to rilled in schistose rock with quartz veins [illegible], and were bored at an angle of 54°. [illegible]

e first half of Table I shows what the l would be if all the time were con- d in drilling; the figures in the second half rom actual observation, whence the time red for handling the rods and for making [illegible]

e following comparison relates to two [illegible]

SHIFT NO. 1.

[illegible]

drilling with 3 ft. of core in the barrel

[illegible]

-11:16—Washing hole and starting.

[illegible]

-12:00—Repairing engine.

- 1:00—Dinner.

[illegible]

- 5:28—Repairing gears.

- 6:22—Pulling rods.

rods up at end of shaft.

SHIFT NO. 2.

th of hole, 1,155 ft.

[illegible]

ted drilling with 1 ft. of core in barrel.

- 8:36—Drilling.

[illegible]

ed of drill changed to 700 r. p. m.

[illegible]

8-10:33—Drilling.

3-10:36—Running back feed.

6-10:53—Drilling.

3-11:10—Adding 5 ft. of rod, testing and adsting blocking twice.

0-11:35—Repairing engine.

5-12:35—Dinner.

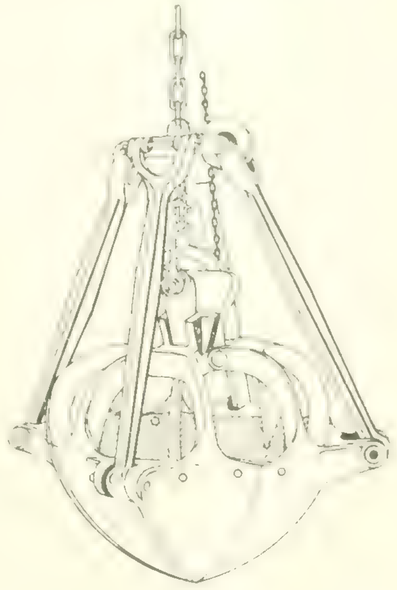
5- 1:30—Pulling rods.

e was stopped at this point.

Contrary to expectations, holes dipping with formation seem to give better core than se that dip across the formation. In the t case, the recovery is 95 to 100 per cent, ile in the second case it is between 90 and 95 per cent. In drilling parallel to the dip single pieces of core 10 ft. long have been obtained with a core barrel 10½ ft. in length.

An Orange Peel Bucket Made of Cast Steel with Arms Integral with Blades.

The accompanying sketch shows an excavator bucket of the orange peel type, which is notable in having the blades and hinge arms integral, or cast in one piece. This construction does away with all rivets where projecting heads are subject to wear. Also the blades are made of cast steel, which further increases their resistance against wear. Another feature is the design of the crown rigging so that three sizes of blades can be attached, giving with one crown rigging, for example, a ¾ cu. yd., a 1 cu. yd., and a 1¼ cu. yd. bucket. The crown rigging, like the blades, is made of cast steel. A feature that will be noticed is the design of the lever arms with a forked head, giving double bearings and a wide hinge at the top to reduce wear and pressure alinement in opening and closing the blades. The forked lever arms hinge to a curb steel center block which is designed so as not to bind, thus permitting the bucket to hang centrally in every position. All bearings are bushed with steel tubing which is easy to keep in stock and cut to make new bushings as they are needed. The makers claim that a set of bushings can thus be changed in an hour or two. They also point to the rugged construction as giving great strength and durability. The makers are the Industrial Supply & Equipment Co., Philadelphia, Pa.



View of Cast Steel Orange Peel Bucket.

Current Practice in Blasting and Dredging Rock Under Water.

Eight reports on high removal dredges and means for removing rock under water are reviewed by W. L. Saunders, President Ingersoll-Rand Co., in a general report to the Twelfth International Congress of Navigation. The following conclusions may be drawn from this review:

The type or design of dredge that may be employed is governed by the surrounding conditions in which it works.

Generally considered, where the scene of operation is open water and excavating light material, such as mud or sand, suction dredges with a drag suction, or elevator dredges, may be employed to the greatest advantage.

Where the situation is confined, as between and around docks and in narrow channels, the grab or clamshell and the dipper dredge are better adapted for the purpose.

In classifying the types in accordance with their effectiveness in the different classes of material, it would appear that the Fruhling system has developed the greatest efficiency in excavating mud and fine sand. This efficiency is due to the design and action of the suction head which, it is stated, will under certain favorable conditions, excavate a semi-fluid mass of a consistency from 80 to 90 per cent solid. It is stated that the average cost, all charges included, over a full season's work, has reached the low point of nine-tenths of one cent per cubic yard.

[illegible] revolving cutter heads at the mouth of the suction pipe, have proven most effective.

In hard clays, the elevator and dipper dredges give the best results.

The very hard, indurated clays, shales, soft rock formations and hard-pans, are excavated most economically by elevator dredges. This refers to dredging without previous blasting.

Rock that has been broken is most economically dredged by the elevator type or the dipper type of dredge. Where the rock is broken by breakers of the Lobnitz type and where the depth of each breaking is limited to 2 or 3 ft., the elevator dredge, owing to its ability to dredge closer to a given grade, is more effective. Where rock is drilled and blasted, the rock being broken in large pieces and the depth of the cut or broken masses of rock more than 3 ft., the dipper dredge will demonstrate superior economy. This does not apply to excavations in depths of 35 ft. or more, as the dipper dredges, owing to their mechanical design, lose their effectiveness beyond certain depths.

From a great amount of data available, it would appear that drilling and blasting by the American method is the most rapid and economical means of preparing the harder rocks for dredging where the depth of rock to be removed is greater than 2 ft. in depth. When the rock to be removed is less than 2 ft. in depth, the Lobnitz type of crusher attains greater economy as a means of breaking rock. This depth of 2 ft. may be increased in thinly stratified rock or in rock that shatters easily.

The discussion and data in which these conclusions are based, follow:

During the last few years the design of dredging machines has undergone a marked change. This change has been toward increasing the output of dredges by constructing dredges of greater power and larger size. The tendency of these improvements is well illustrated in that great suction dredge built for use on the Mersey; this dredge, aptly named the "Leviathan," has a rated capacity to excavate the enormous quantity of 10,000 cu. yds. in 50 minutes. Other examples of radical improvement in design and efficiency are those dredges built on the Fruhling system, whereby the proportion of solids excavated has been so much increased in hydraulic dredges. The elevator dredge recently built in Scotland for the Panama Canal, with buckets of 2 cu. yds. capacity each, and the larger dipper dredges in America with buckets up to 15 cu. yds. in capacity, are other examples of this trend towards increased size and capacity.

It is found from the standpoint of an investment, where the amount of material to be excavated justifies it, that the lessened cost per cubic yard excavated, due to the decrease in the cost of management, labor, fuel and maintenance, more than compensates for the great outlay necessary to construct these larger machines. The increasing use of cast steel has been a great factor in the improvement of dredges. This is especially evident where manganese steel has replaced the softer steels in bucket mouths, pin connections and other parts exposed to great wear.

In the United States, until very recently, the elevator dredge has not been regarded with favor. It was generally regarded by our engineers as a machine adapted to soft material, and more costly to build and maintain than the suction, dipper or grab dredge. The performance of elevator dredges on the Panama Canal, which are rebuilt machines of the French regime, has gone far to establish, through their economy of output, their many advantages; as is evidenced by the purchase of a large machine of this type in Scotland, for use on the canal.

In Canada the elevator type had been in favor and use even before the dipper dredge had been developed. It is now being recognized that in hard material, such as hard-pan and indurated clay, where the formation is not hard enough to justify the use of explosives under water, the elevator type is more efficient than the dipper type. This was demonstrated on the St. Lawrence River in excavating a water-power canal through indurated clay. In this instance dipper dredges of the most powerful design failed, and were replaced by an elevator dredge which completed the excavation in a satisfactory manner.

The dipper dredge, on the other hand, has its advantages over the elevator type under many conditions, and under certain circumstances (as in the construction of canals) is complementary to it. Reference will later be made to these conditions.

COMPARISON OF DIPPER AND ELEVATOR DREDGES.

Where the elevator type has great width of channel in which to maneuver or breast from side to side while working, it may be operated to advantage. But where the channel way is restricted in width, or where part of the width of the channel must always be clear for navigation, or where the excavating is to be performed in confined places, such as between docks, the dipper dredge can be used to greater advantage.

To move or breast the elevator dredge as required in excavating, necessitates the use of cables or chains attached to anchors placed outside of the channels. These cables must be slacked and the dredge stopped working while vessels are passing. In narrow channels with high banks, as in canals, if the lead of the breasting cables is too far ahead or too far astern, the maneuvering of the dredge is impeded; and in consequence the anchors must be moved forward frequently as the dredge advances. Where the sides of the channel, owing to the nature of the formation, require to be sloped as a precaution against the material falling or flowing into the excavated channel, the process of forming this slope is to raise or lower the buckets of the elevator dredge as the machine is breasting over the portion to be sloped. This is a slow process and the resulting slope is not always satisfactory. The delays and consequent loss of time due to passing vessels, the moving of anchors and the difficulties in forming slopes, are, owing to its design, avoided by the dipper type of dredge. Where it is required to form an embankment parallel to a channel that is being excavated, this may be done by a dipper dredge excavating from the channel and depositing the material in the embankment.

Owing to the above mentioned and other advantages possessed by the dipper type, the Montreal Harbor Commissioners, who were operating powerful elevator dredges in improving the Harbor of Montreal, removed the elevator type machines to the lower broad reaches of the river and placed dipper dredges on the harbor works.

It appears as established that for continuous excavation to great depths in tidal waters and where large quantities of hard material are to be removed, the elevator type has demonstrated its superiority over the dipper type.

HYDRAULIC DREDGES.

Large hydraulic dredges, fitted with cutter heads of the proper design and driven by sufficient power, are increasingly being used in excavating that class of materials which but a few years ago, it was considered could be economically dredged only by elevator dredges. In this design of dredge the cutter head is no longer considered merely as an agitator, to stir up and mix the material with the water so that it will flow readily into the suction pipe. The cutter is in its action comparable with the buckets of a dredge, in that it cuts and forces the material into the suction pipe. In effect, the cutter head performs the dredging action and the flowing water in the suction pipe transports the dredged materials.

A notable machine of this type, of a rated capacity of 1,000,000 cu. yds. per month, the property of the Public Works Department of Canada, was successfully excavating stiff blue clay and boulders in the lower St. Lawrence River and discharging the spoil 4,000 ft. away. The suction pipe was 36 ins. in diameter and it was stated that boulders measuring a half cubic yard or more pass readily through the pump and pipe line.

ELEVATOR DREDGES FOR HARD MATERIAL.

As the suction or hydraulic dredge is being developed to meet conditions that formerly were considered as the particular field of the elevator or ladder dredge, the ladder dredge is being developed to dredge materials that formerly could be excavated only after having been loosened by the use of explosives; such as indurated clay, cemented gravels, certain difficult hard-pans containing boulders, coral formations, and the softer rocks and stratas. Dredges of this type, of 350 H. P., for use in the North Sea, are described in the Report of R. Blumcke, Director of the Ship Building & Machine Works Co. (Ltd.) of Mannheim. A ladder dredge, electrically driven, has been excavating successfully in indurated clay. This dredge was built by the Bucyrus Co., South Milwaukee.

The unusual conditions this machine is designed to meet and the difficulties it is overcoming both as regards the hard material excavated and its disposal ashore, merit a short description. The electric power for operating this dredge is provided from the hydro-electric plant for which this dredge is enlarging the power canal.

The conditions which this dredge was designed to meet include excessively hard digging, combined with delivery to a distant spoil area, over banks as much as 64 ft. in height. The work consists of deepening and widening a power canal about three miles long, leading from the St. Lawrence River, with a head of about 40 ft. At the time the dredge was installed, the depth of the water in the canal was from 15 to 20 ft., it having been found impossible to complete the excavation to the 40 ft. depth originally intended, with the machinery then available. To overcome this difficulty this dredge, therefore, was designed to dig 42 ft. in depth. The material consists of a matrix of a very hard, indurated clay, carrying granite boulders of all sizes. Boulders from 2 ft. to 3 ft. in diameter are frequently split by the bucket teeth and come up in pieces.

The dredge selected for the work is of a close-connected elevator type, delivering the material ashore by means of a 24-in. centrifugal pump and pipe line similar to those used on an ordinary hydraulic dredge. The entire dredge is electrically driven, using three phase, 60-cycle current, delivered to the dredge at 2,080 volts. The digging buckets are driven by two variable speed motors, 300 H. P. each.

The material is dumped into a revolving screen driven by an independent 50 H. P. motor located over the pump intake. This screen is 6 ft. in diameter and 36 ft. long, made up of cast steel segments with holes about 10 ins. square. The dredged material is tumbled into the screen and all that can be broken up by this process goes through and down into the pump. The large boulders are rejected and go out through the screen to a stone scow alongside. The screen is placed diagonally across the deck so that the lower end can project over this scow and deliver the stones without rehandling.

The main pump is an unlined type driven by 1,000 H. P. motor, which frequently runs with an overload. The discharge pipe runs out through the stern of the dredge through a floating discharge line to the foot of the bank and is thence taken up the high bank at an angle of about 10°, and over to the spoil grounds. The length of the pipe line is sometimes as much as 2,600 ft., at times transporting material consisting largely of boulders. The capacity of each bucket is 12 cu. ft. Both hood and bucket are nickel chrome st[illegible] ings. The hood is provided with spe[illegible] heat-treated nickel chrome steel teeth wh[illegible] can be renewed when broken. The diggi[illegible] is excessively hard and for that reason [illegible]t was necessary to design the machinery w[illegible] gre[illegible] weight and strength.

COMPARISON OF DIPPER AND ELEVATOR [illegible] FOR ROCK.

The single bucket or dipper dre[illegible] has proven an economical and efficient ma[illegible]ine in excavating blasted rock. The large si[illegible] of the bucket and the situation of the bucket [illegible]elative to the rock being excavated have bee[illegible] actors in its efficiency.

The more modern and powerful dr[illegible]ges of this type carry buckets that measure [illegible]rom [illegible] to 15 cu. yds. The position of the [illegible]redge relative to the face or excavation is s[illegible]h th[illegible] the face is always in front of the bu[illegible]et an[illegible] the bucket is operated from the botto[illegible] of th[illegible] face upward.

When rock is drilled and blasted a[illegible] wh[illegible] the quantity of rock to be removed is la[illegible] masses, as in large channel improvem[illegible]ts, [illegible] bottom of all the drill holes are appro[illegible] on the same level. When these h[illegible]s [illegible] charged with dynamite and explode[illegible] a[illegible] certain level, at an elevation above th[illegible] of the hole (dependent upon the dist[illegible]ce holes are spaced apart and the de[illegible] are drilled below the required grade) [illegible] is broken in small pieces; above this [illegible] the pieces are large to very large.

The bucket of the dredge enters the [illegible] broken rock at the level where the [illegible] most shattered, and is hoisted up thr[illegible] rock and under the larger and heavie[illegible] above. Owing to the great size of the [illegible] very large masses may be dredged and [illegible] through the bucket. This ability to [illegible] large masses permits of the drill hol[illegible] being spaced farther apart, thus lowering t[illegible] average feet of drilling per cubic yard of [illegible]tion and also the amount of explosive [illegible] yard. The cost of drilling and explosi[illegible] is [illegible] greatest charge in submarine rock exc[illegible]

Elevator or ladder dredges, owing [illegible] small size of their buckets, require the [illegible] be broken into smaller pieces, accom[illegible] to the bucket. If the pieces are too la[illegible] are rolled in front of, or fall behind t[illegible] bu[illegible]ets or are forced to the side of the [illegible] To remove these large stones entails t[illegible] cost of divers or a grab dredge. T[illegible] orange peel or clam shell dredges h[illegible] proved economical in removing large [illegible] of rock for the reason that the rock [illegible] to be thoroughly disturbed and shaken [illegible] surface to permit the grab to pene[illegible] or catch the broken rock. To obtain th[illegible] finely broken or disturbed condition of the r[illegible] surface entails the use of unnecessaril[illegible] great quantities of explosive. Where the [illegible] well broken there is still great unc[illegible] as the amount lifted each time the [illegible] hoisted is dependent upon the uncertain[illegible] of dropping upon material arranged [illegible] form that the grab may penetrate an[illegible] or catch a load. The grab has not the [illegible]sitive manner of working of either the di[illegible] or elevator dredge.

On small, disconnected masses of r[illegible] grab dredge, because of its compa[illegible] cheap cost of construction, may be empl[illegible]ed to advantage.

[illegible]ALL DREDGE WORK VS. BLASTING AND [illegible]

The Bermuda Government has [illegible] placed in commission an elevator dre[illegible] signed to excavate the coral formation [illegible] previous blasting. This dredge is s[illegible] pelling, having twin screws, each actu[illegible] 500 H. P. engines. The engines are [illegible] ranged as to permit of either set bei[illegible] to operate the dredging machinery. [illegible] drilling machinery is fitted to the hull [illegible] that, in the event of an exceptionall[illegible] vein being encountered, it may be drill[illegible] blasted.

It appears as still an open question [illegible] it is more economical in the softer rock [illegible] as corals, soft limestones, tufas, etc., t[illegible] large dredges of great power to excavat[illegible] out blasting, or to use a lighter and les[illegible] dredge, and loosen or break the material e of explosives, or of rock breakers of the type.

ase of using powerful machines with- ting, there is always great strain and both hull and machinery, [illegible] lepreciation. The question then is this depreciation costs more than the nd blasting, or whether the increased s that would be dredged in the same f time when the material has been p by explosives, would compensate st of drilling and blasting.

st for drilling and explosives in the rmation in the Atlantic entrance of na Canal, is given in Mr. William- ort as 08.7 cts. per cubic yard, but it that the drilling was performed by an d drilling apparatus consisting of s or drop drills mounted on a scow. r drop drills will strike about 75 minute with a force approximating Steam-actuated percussion drills of rine pattern strike 250 to 275 blows ite with a force estimated at 2,500 ie ratio of effective work or depth drilled would probably be directly as er delivered by each type. It is there- ir to assume, as the cost of drilling is test charge in submarine operations of e, that had a modern drilling plant d for this particular purpose been used, [illegible] have been much less.

DRILL BOATS.

design of drilling machines and vessels use in this country consists of a scow that stands up n the [illegible] upon four mechanically-controlled olumns, one at each corner of the The drills are steam-operated percus- ills, similar in action and design to the steam or air operated drills used on pt that the cylinders are of much e, the piston diameter being from ins. in the best practice; and in tripod the drills are carried on mov- el towers. These towers run on tracks side of the vessel; vertical leads on owers overhang the side of the vessel rovide guides for the drill cylinders. guides are usually from 15 to 30 ft. in determine the range of feed of the that is, the drill may be raised or low- rough this range vertically while drill- The drill feed is controlled by hydraulic rs having a stroke the full length of the by long screws operated by small steam s, or by a gravity system. In the grav- tem of feed, the drill cylinder is bolted face of a cast iron block of about 4,000 eight. This block runs in guides and is and lowered by means of a cable lead- a steam hoisting engine on the founda- f the tower. These towers traverse the of the vessel and are moved by steam raulic power. Improvements in the long, -operated, feed and transverse movement towers are the principal factors that led to the high development of effi- and economy in the American method.

idal waters, where there is a wide range e and fall in the water level, the steel s are replaced by a structural steel col- upon which the drill, drill guides and nechanism are mounted. The lower end s column rests on the rock. The column d in position by guides which permit ver- novement of the barge as the water level es through tidal action or wave motion. guides which form the housing of the column are carried on a track running in rection of the length of the vessel. This ruction of mounting drills upon columns g on the rock avoids any motion of the being transmitted to the drill or its tings.

e four main spuds or columns which rt the barge while the drills are in oper- are each raised by a pair of independent es geared to a rack on each spud.

en the drills are working these spuds eing forced down and the barge is raised the height of normal flotation. The t above flotation that is required may aintained by the automatic regulation of the steam pressure in the engines of each spud gear. As an example: When the combined power of the different engines is sufficient to raise the hull 18 ins. above normal flotation, and no farther, a condition of equilibrium has been established. As these engines are under a constant steam pressure, any increase or decrease in the load will cause the engines to overhaul against the steam pressure, or start up because of the steam pressure. This condition of increase or decrease in the load is established by the fall or rise of the water in which the vessel floats.

Drill boats designed on the above general principles, mounting from one to five drills, have given results in speed and economy of operation that compare favorably with the methods used in drilling and blasting operations on land. In fact, drills of the submarine type with long, power-operated feeds and mounted on self-propelling carriages are being employed on land operations with marked success.

A study of the requirements essential to a submarine drill indicate that great lifting and striking power in combination with an ability to deliver the greatest number of blows in the shortest time, and a strong, rugged construction, are the fundamental qualities to be looked for.

The slow-acting well or drop drill does not meet these conditions. The various types of electrically operated devices have not yet demonstrated their efficiency. The rotary boring machines have proved too delicate and not sufficiently adaptable to the unavoidable motion of the working platform or barge. The steam-actuated percussion drills with the drill steel forming an extension of the piston rod have so far proven the most effective and durable device and in this country are accepted as the standard.

DRILLING AND BLASTING IN ST. LAWRENCE RIVER

The most difficult and notable piece of submarine rock work that has been undertaken on this continent was the excavation of a channel through the Galops Rapids on the St. Lawrence River. This work throughout was carried on by using drill barges and dipper dredges. It was considered impracticable to use elevator dredges as the current was so swift and the cross current so strong. The main difficulties encountered were holding the vessels in position while in operation and towing away the vessels containing the dredged rock. Tug boats were tried, but sufficient power and speed could not be developed in a vessel of manageable size to tow even the smallest practicable size of hopper barge in the turbulent and swift-running water of the rapids, the changing cross currents adding to the difficulties. A system of haulage by wire cable controlled by winding engines was adopted and found most satisfactory and economical in operation.

The ship channel of the St. Lawrence River through the Galops Rapids was executed by The Gilbert Brothers Engineering Co., Montreal, Contractors. The contract price was $8.40 per cubic yard. The work consisted of the removal of a very hard limestone bed rock by the submarine drilling and blasting process to form a channel 17 ft. deep and 200 ft. wide. The Galops Rapids commence about 7 miles below Prescott, Ontario, extending about 1½ miles down stream. The Rapids are caused by a ledge of limestone 7,800 ft. in width, extending the width of the river at this point. The boundary between Canada and the United States runs through and in the direction of the channel.

The Rapids, with a current of from 8 to 12 miles an hour, are broken and turbulent white water producing strong eddies, cross currents and breakers. The length of the channel was 3,300 ft. The aggregate length of shoals to be worked over was 1,800 ft.

The drilling plant consisted of one drill boat designed to meet the conditions. This boat carried four 5-in. drills, was fitted with four 20x20-in. power-controlled spuds and gear, and drums for handling five 1¼-in. breasting chains, one leading up stream and two over either side. These chains were attached to anchors of 15 to 20 cwt. each.

To maintain the drill boat in the fixed position essential to the operation of drills; to adapt the spud and breasting gear to the rapid maneuvering of the vessel in shifting position to avoid the large timber rafts shooting the rapids; to obtain competent workmen who would risk the evident dangers of the situation; these were some of the preliminary difficulties to overcome. Owing to mechanical and other modifications that were found to be necessary to better adapt the plant to the conditions, the first season's operations resulted in but little work having been performed.

Because of the unusual and difficult circumstances under which the drilling was carried on, the cost of operation was greatly increased. Holes were drilled and blasted in batches of four. Loading and blasting, shifting the vessel for blasting and setting used a large proportion of time. As the depth of water in a rapid will not increase to the same extent as that to which the bottom is lowered, and as the slope or inclination of grade has to be provided for, to place and set up the vessel in position with the required accuracy, took much time that would otherwise be employed in drilling.

To insure the precision of position of the drill boat, instrument men were posted ashore at ranges or targets to indicate the exact position required; from soundings taken aboard, an engineer marked the depth of holes in each position. Accuracy in placing the drill boat and in keeping records was maintained throughout the work.

The drill boat was built with four slots or wells in the hull, 20 ft. long by 18 ins. by the depth of the hull, these wells being forward of amidships. The drilling was done through these wells. The drill frames carrying steel drill spuds with pipe guides for the drill bars, were capable of being traversed for the length of the wells, permitting a number of holes to be drilled by each drill without shifting the position of the vessel. It was found more expeditious to keep the drills in a fixed position.

Wire cables were tied as breasting lines, but it was found that the force of the current caused the wires to become foul of the rocks. In shifting position it frequently occurred that the cables became disentangled from the rock, causing a sudden slacking of the cable; this permitted the vessel to sheer, either breaking the cable or endangering the vessel. In the event of the vessel getting crossways of the current with the cables holding, the inevitable result would be to capsize the vessel or break the cables. The breasting gear was so arranged, in case of the vessel sheering dangerously, that all side cables or chains were let go and allowed to run free.

To obviate fouling on the bottom and to do away with the shock when the wire cables became taut, 1¼-in. chain weighing 84 lbs. per fathom and tested to 44 tons breaking strain was substituted for the wire. The chain, while more cumbersome to handle owing to its greater weight, was less subject to the effect of the current, was less severe on the breasting gear, and the weight of the bight gave a certain amount of spring or elasticity. The cost of operating the drill boat was as follows:

Labor (12-hour day)	
1 Captain, $100 and board, $12	$ 112
4 Drillers, $75 and board, $12	348
4 Helpers, $30 and board, $12	168
1 Fireman, $30 and board, $12	42
1 Machinist, $65 and board, $12	77
1 Smith, $70 and board, $12	82
1 Helper, $30 and board, $12	42
1 Blaster, $60 and board, $12	72
1 Helper, $35 and board, $12	47
1 Cook, $30 and board, $12	42
17	$1,032
Coal, 60 tons per month, $4.00	$ 240
Oil and waste	40
Smith's coal	15
Steel, iron and smith's supplies	52
Total	$ 347
Labor, fuel, etc., per month	$1,379
Cost per drill hour	$1.105

The average depth of drilling per hour per drill was 2.25 ft.

The cost per foot of drilling was 4.91 cts.

The depth of cutting was from nothing to 11 ft.

The average cut was [illegible] ft.

The holes were spaced to average 20 sq. ft. per foot of drilling.

The drills averaged 1.66 cu. yds. per hour.

[illegible] lbs. of 75 per cent [illegible] per cubic yard.

The cost of operating for the entire work, drilling, dredging, maintenance, etc., was divided in the following proportion:

	Pct.
Salaries and [illegible]	[illegible]
Traveling and [illegible]	[illegible]
Fuel	[illegible]
Explosives	[illegible]
General repair [illegible]	[illegible]
Towing	[illegible]
Interest and de[illegible]	[illegible]
Miscellaneous [illegible] accidents, law [illegible] and [illegible] expense	[illegible]
	100

The total cost of drilling, blasting and dredging the channel was $277,724.81; the total revenue was $629,113.60, and the cost per cubic yard was $3.71.

Allowance was made for quantities excavated below the grade line specified, it being impossible under the circumstances to carry on the work with the same accuracy as in calm water.

The general rule observed in drilling and blasting this rock was to drill below grade to a depth equal to half the distance the holes were apart, holes never being spaced more than 6 ft. centers. The weight of dynamite used was equivalent to 1 lb. of nitro-glycerine per cubic yard of rock, measuring from the bottom of the hole. The above rule produced most satisfactory results. Any points that may have been found above grade in dredging could invariably be accounted for by reference to the record, a bad shot or missfire usually being indicated.

The rock formation was a very hard limestone in heavy strata, from 20 to 30 ins. The amount of excavation paid for below grade amounted to 25 per cent of the total.

Referring to the manner of working dredges in the currents of the rapids of the Danube and the advantages obtained by working the dredges in the direction of the current or down-stream, there is presented an opportunity of illustrating and comparing the difference in method when employing elevator dredges and dipper dredges, under similar conditions of current.

In the Galops Rapids, dipper dredges (American type) were employed. The dredges worked down-stream or in the direction of the current, as in the Danube work, but for a very different reason.

The dipper dredge, owing to its mechanical action, permits of the forming of a dam of the excavated material up to approximately the water surface. This dam is formed in front of the dredger for the width of the channel. The dredge is excavating this dam and at the same time shifting the dam down stream, but always maintaining the same size of dam. The amount of dredging will correspond to the distance the dam has been moved down stream, as the dredging is from the bottom up and the coarser or larger rock is always kept on top. This dam lessened the current above the dam and caused slack water below the dam where the drill barge operated.

The dredge had four spuds, one at each corner, and two 1¼-in. chains over either side and 1½-in. chain leading up-stream from the bow. The chain cables were for the purpose of maintaining the dredger in position while dredging and moving from one position to another. The spuds alone were inadequate to resist the force of the current.

This manner of working and carrying the dam ahead increased the output of the dredge; and owing to the decrease it caused in the speed of the current, permitted the most rapid and safe movement of the vessel except when towards the outer ends of the dams where the current was of its original velocity.

COMPARISON OF DRILL BOATS AND ROCK BREAKER

A comparison of performance of the different machines used for breaking rock would seem to indicate that the greatest efficiency and economy per cubic yard of rock broken may be obtained by two systems; by the use of rock crushers of the Lobnitz type and by the use of submarine drills of the Ingersoll-Rand type, mounted on a drill barge with power-actuated gear throughout, as in the American method. These two methods show their greatest efficiency under different conditions, as follows: The Lobnitz type, in shallow cutting where the rock is thinly stratified or will shatter easily. The drill barge in all rock where the depth of rock to be removed is three feet or more.

The following figures of performance indicate the comparative costs of operating by different methods. The conditions existing at Blyth, England, and on the St. Mary's River, Michigan, form a fair basis of comparisons. The data on the performance of the Lobnitz breakers and the drop drills is taken from a paper by Mr. John Watt Sanderman before the Institute of Civil Engineers, London, 1907. The drill boat using percussion drills of the Ingersoll-Rand type was of the standard American design as used in the Great Lakes.

The average quantity of blasted rock removed by one dredge (elevator type) per day of 24 hours and allowing for all stoppages, is 158 cu. yds.; and of that broken by the rock breaker, 182 cu. yds. The average number of days per annum worked by the dredges is 227. The cost per cubic yard of dredging blasted rock is 2s. 6d. The cost per cubic yard of dredging rock broken by rock cutter is 2s 2d. Allowing 4 per cent for interest and 2½ per cent for depreciation on £19,000, the cost of a dredge (as they are well maintained), the additional cost per cubic yard would be 8s 2d. for blasted rock and 7s. 1d. for rock broken by rock breaker.

The drilling and blasting at Blyth was carried out by means of a barge having six drop or well drills which were lifted by steam power through a cable and guided by hand. The average quantity of rock drilled and blasted per week by means of one barge was 488 cu. yds., and the average cost of drilling and blasting was about 3s. per cubic yard. The comparative cost of rock removal under the two systems is as follows:

	s.	d.
Drilling and blasting rock, per cu. yd.	3	0
Dredging same 2s. 6d. 8s. 2d.	3	2.2
Total	6	2.2
Breaking rock by rock breaker	1	2.5
Dredging same 2s. 2d. 7s. 1d.	2	9.1
Total	3	11.6

Difference in cost per cubic yard in favor of the removal of rock by means of rock breaker, 2s. 2.6d., and this saving on 500,000 cu. yds., £54,166.

Comparative cost of breaking a friable sandstone by the Lobnitz system as used at Blyth and a five-frame drill boat working in St. Mary's River, Michigan:

Cost of Lobnitz breaker £6,800	$33,048.00
Cost of five-frame drill boat	35,000.00

Lobnitz Breaker.—Cost of operating one week, night and day:

	£	s	d	
Wages	16	1	6	
Coal, stores and water	6	10	7	
Cost of repairs	22	0	0	
Total	44	1	1	$216.75

Working day and night for one week at an operating cost of $216.75 and breaking 908 cu. yds., the cost would be 23.8 cts. per cubic yard.

Five Frame Drill Boat mounting five 6½-in. Ingersoll-Rand submarine drills working one shift of 11 hours:

Cost of operation:	
Wages	56.93
Dynamite	16[illegible]
Coal and supplies	[illegible]
Total	[illegible]

In one shift of eleven hours at a [illegible] $228.38, the drill boat blasted 1,280 [illegible] above grade, which equals 17.84 cts. per [illegible] yard. In this comparison no allowan[illegible] been made for interest, depreciation [illegible] ance in either case.

With the Lobnitz machine, 2 ft. 6 i[illegible] the depth of cutting attainable before [illegible] ing. The drill boat was drilling 7-ft. [illegible] The work of the drill boat per hour w[illegible] cu. yds., and of the Lobnitz machi[illegible] cu. yds.

COMPARATIVE COST OF OPERATI[illegible] DAY

Lobnitz machine	$[illegible] or 23.8 cts. pe[illegible]
Drill boat	$228.38 or 17.84 cts. per[illegible]

The working conditions and the sa[illegible] formation on the St. Mary's River, Mi[illegible] and of the Blyth improvement, may [illegible] sumed as presenting the same features [illegible] fair basis of comparison of the different [illegible] ods of rock breaking. Prices given [illegible] cents per cubic yard.

The cost per cubic yard of drilling [illegible] blasting, using Ingersoll-Rand submarin[illegible] was 17.84 cents + 1.40 = 19.24 per cubic [illegible]

Drilling and blasting by drop drill a[illegible] at Blyth, 72.9 per cubic yard.

Breaking rock by rock-breaker, as u[illegible] Blyth, 1s. 2.5d., 29.3 per cubic yard.

Saving in cost by use of Ingersol[illegible] drills compared with drop drills, $268.[illegible]

Saving in cost by use of Ingersol[illegible] drills as compared with rock breaker, $[illegible]

The reduction of cost (15%) in dr[illegible] material broken by the rock breaker a[illegible] pared to blasting does not apply to the [illegible] comparison. The reduction is due to th[illegible] terial being broken smaller and adap[illegible] the buckets of ladder dredgers. These [illegible] ets are probably of from 8 to 18 cu. ft. [illegible] dipper dredgers employed on the St. [illegible] River have buckets of 6 cu. yds.

The submarine rock removal operati[illegible] Black Rock Harbor, Buffalo, have been [illegible] large scale, and every endeavor has been [illegible] regardless of cost, to provide the most e[illegible] means of breaking the rock. These [illegible] have been in progress for a number of [illegible] Facts and figures are available on the per[illegible] ance on this work of two modern five-[illegible] drill boats. These boats represent the [illegible] best practice. Figures are also availa[illegible] the performance of two rock crushe[illegible]

TABLE I.—LOBNITZ ROCK BREAKERS OPERATING IN BLACK ROCK HARBOR, BUFFALO, N. Y.

Name of Breaker	–Tonawanda– Season of 1907	April-Aug., 1908.	Total.	Tuscar[illegible] Season of 1907	Apr.-Aug. 1908	To[illegible]
Total time in commission, days of 24 hrs. each						
Days of 24 hrs. each on which some work was actually done	253	110.5	[illegible]	23[illegible]	8[illegible]	
Proportion of latter time actually worked, per cent.	150.5	110.5	261	[illegible]	87	
Contractor's estimate of rock crushed, cu. yds. pace measured	32	7[illegible]	[illegible]	43	7[illegible]	[illegible]
Average per day of attempted work, cu. yds.	10,451	[illegible]	27,276	12,738	12,6[illegible]	
Average depth of holes, ft	69.1	152	103 [illegible]	80.9	14[illegible]	

Average cost of operating 24 hrs. day	
Average cost per cu. yd.	

TABLE II.—FIVE FRAME DRILL [illegible] USING FIVE 6½-IN. INGERSOLL-R[illegible] DRILLS, BLACK ROCK HARBOR BUFFALO.

Drill holes 9 ft. 9 ins. average depth	
Cubic yards drilled and blasted	14,450
Linear feet drilled	15,224
Linear feet per shift of 11 hrs.	293
Cubic yards per shift	278
Cost of dynamite per cu. yd.	[illegible]
Cost of drilling and blasting per cu. yd.	42.[illegible]
Interest and depreciation at 2% per month on plant value, $40,000, per cu. yd.	5.[illegible]
Total cost including depreciation, etc.	48.[illegible]
Drill holes 3 ft. 6 in average depth	
Cubic yards drilled and blasted	333
Linear feet drilled	3,480
Linear feet drilled per shift	154½
Cubic yards per shift	1[illegible]
Cost of dynamite per cu. yd	36.[illegible]
Cost of drilling and blasting per cu. yd.	453.[illegible]
Interest and depreciation at 2% per month on plant value, $40,000, per cu. yd.	104 [illegible]
Total cost	557 [illegible]

rk. The rams used were of 15 t[illegible] nd every effort was made t[illegible] less of these machines. The conditions hich both types of machines worked t'y similar. The rock formatio[illegible] ard limestone, carrying veins of flint. r attention is directed to the very gmentation in the cost of drilling and [illegible] is accounted for by the decreased ratio in cubic yards blasted to foot of drilling and the proportion of the depths of each hole that is below grade. This below grade is non-productive; and in addition the holes must be spaced much closer together, which means added time in moving and shifting drills and vessel. It is this condition where shallow cutting is to be performed that gives the advantage to the rock cutter in the cost per cubic yard. The daily output of the drill is much greater than that of the breaker, and where time is a consideration either as applied to the capacity of the dredging plant, or to the undertaking as a whole, this factor must be taken into account.

OADS AND STREETS SECTION

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Measurements of Brick Pavements.

Bureau of Standards of the U. S. De- [illegible] Commerce and Labor, in the per- of its regular functions pertaining igation tests of structural material, gurated tests on paving brick in place vements. The tests are intended to [illegible] the [illegible] found under service conditions, meas- strains which are developed in the s themselves and from the deforma- ge of the stresses or loads which are Some preliminary work was done go at Indianapolis, and has since been at Cleveland. The work in these s been directed toward acquiring data relations of the street car tracks to nent, and upon the effect of varia- temperature in stressing the pave- e accompanying description of these the results obtained have been ex- [illegible] paper by James G. Hew[illegible] physicist, Bureau of Standards, at annual convention of the National lanufacturers' Association, Chicago, [illegible]

sts on the relations of the street car the pavements consisted of measur- lastic depression of the track under ghts of cars and acquiring informa- [illegible] on the adjacent pave- The elastic depressions of the rails sured on different types of track, among the number, places where rigidity was likely to prevail.

eral, it was found that the vertical vement of street car tracks, that is, rence in level of the rails between a nd unloaded state, is greater than can llowed by a monolithic pavement with- he formation of cracks alongside the Occasionally track in the very best tion may not display excessive depres- but the uncertaintly of maintaining such te renders it hazardous to make a bond en the pavement and the track.

ere is, in addition to the momentary elas- pression, a bodily settlement of the track ting from insufficient support of the road- Such settlement, when it occurs, involves rmanent depression altogether too great onsider in connection with those lesser ments which are now being described. bodily settlement of the car track, how- is a feature which can not be left un- ioned. Cases are so flagrant, at times, a good pavement can hardly be made use y reason of the ruts of the trolley tracks. these tests the means employed in the rvations, that is, sensitive levelling appar- were such that the presence of a trolley could be detected by the depression which used even in the pavement at a distance ft. from the track in the direction of the walk. Such an observation was made on laid pavement in which a tar filler had used, and substantially at that distance a cement filler, or from 10 to 12 ft. away. the intersection of two streets, where no ley tracks were present, the depression ed by the weight of a man was detected distance of 12 ft. This observation was le at a place where the hollow rumbling nds of passing vehicles indicated the pave- nt did not rest upon the sand cushion or ndation. It was noticed that the pave- nt at the crown of the street responded re promptly in respect to change of level to a load coming upon it from the other side rather than along the center line of the street.

Pavements are elastic, as the properties of the individual brick and cement filler would indicate, but the amount of transverse bending which a brick or a cement grouted pavement will endure without cracking is very limited in its extent. This is particularly the case when the material is strained in tension. A wider elastic range prevails for compression loads, substantially in the ratio of the compressive to the tensile strengths, or from ten to one or more.

Concerning the effects of changes in temperature on the integrity of pavements, data were acquired by the method of strain measurements. Gaged lengths of 20 ins. were established in the pavement in number exceeding 300. It has been found feasible to measure these gaged lengths with an accuracy, commonly, to the nearest ten thousandth of an inch. In this manner thermal changes may be followed very closely.

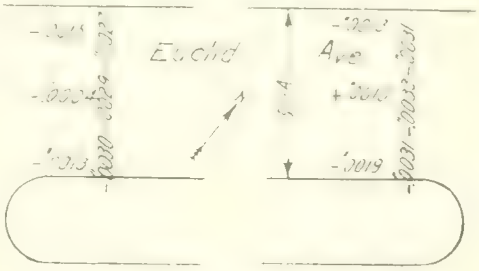


Fig. 1. Results of Observations on Euclid Ave.

Gaged lengths were located at the sides and at the middle of the street, in both crosswise and logitudinal directions. During the time in which these strain measurements have been in progress a range of pavement temperatures of 66° F. has been experienced. Figure 1 illustrates some of the results which have been obtained, those here entered referring to measurements on Euclid Ave. on a section of the pavement just east of University Circle, Cleveland.

In general the expansions or contractions of the crosswise gaged lengths proceeded with greater regularity than the longitudinal movements. Modifying conditions influenced the longitudinal movements and a drop in temperature yielded results which showed normal contraction on some gaged lengths, on others a very slight change, while certain of the measured lengths, those spanning cracks in the pavement, were longer at the lower temperatures.

It was found that transverse cracks which open with a drop in temperature do not always entirely close again, but displayed a tendency to progressively increase in width. Probably that result was due to fine particles of sand and abraided material of the pavement lodging in the open fissures. A repetition of the process caused a progressive lengthening of the pavement. During a period of 52 days, one set of measurements showed the combined effect of decrease in temperature and progressive increase in width of crack amounted to .0395, practically four hundredths of an inch. This occurred on a pavement which had been laid about four months. The crosswise gaged lengths on the same street, and during the same period of time, contracted regularly with lowering of temperature, the maximum amount observed being .0039.

A number of earlier determinations on the co-efficient of expansion of building brick gave a value in the vicinity of .0000040 per degree F. This value seems to fit the present tests fairly well. The observed changes were somewhat less than called for by the above value of the co-efficient, but the actual range in temperature of the brick was not ascertained with precision. Surface temperatures of the brick work were used, and not unlikely the range in mean temperature was less than the recorded amount.

Taking the observations as they were made, the contraction of the 40 ft. roadway of Euclid Ave., for a range in temperature of 100° F., was .1043 and .1101 in., respectively, at two sections of the roadway. The contraction called for on the basis of the above mentioned value of the co-efficient would be .1920 in. That is the total amount, one-half of which might be considered as affecting each side.

During sunny days the temperature of the pavement naturally goes considerably higher than the temperature of the air a few feet above it. Observations on this feature showed a difference of 38° on one occasion. The temperature of the air was, on the day in question, 64°, 4 ft. above the pavement. On the pavement, in the shadow of the curb, it was 69°. In a freshly drilled pocket for a reference pin, on the sunny side of the street, the temperature was 85°, while in the sun, at the angle of the pavement and curb, the thermometer rose to 102°.

In the laying of a cement grouted pavement a critical period is encountered at the very outset, during which care must be exercised just as in every cement structure, in order to avoid the formation of incipient cracks before the cement grout has had time to set and acquire strength. On account of the excess of water used in making grout the setting is much retarded, and several days may elapse before a substantial degree of hardness is acquired.

During this period the pavement should remain at a constant temperature, if it were possible, day and night. A drop of 20° calls for a contraction of about one-tenth of an inch in a length of 100 ft. It is a fortunate circumstance in laying a pavement when a minimum range in temperature is experienced during the first 48 to 96 hours after grouting. Incipient cracks have been developed at a very early period following the grouting, resulting in injury to the street, even before it was opened to traffic. Hot, sunny days, followed by cool nights, are menacing to freshly grouted pavements.

Transverse cracks have been started, which ultimately extended across the street, by the influence of the end joints of the edge stones against which the pavement was laid. The usual manner of laying pavements, with joints broken in one direction only, affords favorable paths for cracks, once started, to extend from curb to curb.

Recently an opportunity was furnished for inspection of the streets of the city of Panama, where brick pavements, cement filled, have been laid from five to six years. The pavements were without expansion joints at the sides. There are no street car tracks in Panama. The pavements are in very fine condition. In one place only were cracks of any kind noticed.

At Panama the temperature is quite high throughout the year, and while the nights are cool, still the drop in temperature is not great. It is believed that equable thermal conditions have contributed toward maintaining the integrity of these pavements, and that pavements in southern climates should in general be aided by the smaller range in temperatures over those experienced in northern climates.

In conclusion, the results now available point to the undesirability of bonding the pavements with street car tracks, excepting, possibly, those of the very best construction. Cracks parallel to and adjacent to the tracks are likely to develop if the pavement is called upon to follow the usual elastic depression of the rails. Obviously there can be no lateral thrust to the pavement if the rails are left free to depress.

The strain measurements show that transverse expansions and contractions proceed with greater regularity than longitudinal movements. A progressive change in length or creep of a portion of the pavement is due to alternate changes of temperature, open cracks being partly filled with abraided material and prevented from closing when a rise in temperature occurs.

Cautionary warning is found in the behavior of pavements which have developed transverse cracks in the early stages after grouting. At this time exposure to a wide range in temperature is undesirable.

Pavements are probably benefited by a certain amount of compressive stress in a longitudinal direction. Transverse cracks will be kept closed so far as possible, and if the compressive stress is not excessive, spalling would not be induced. The open ends of paved streets, having no buttresses to take the thrust, may be expected to develop transverse cracks.

The minimum amount of crowning necessary to turn the water is advantageous to enable the pavement to resist compressive stresses without causing rupture during spells of sudden heating. Bends and reversed curves in streets are disadvantageous to the pavements.

Prepared Filler Method of Constructing Bituminous Macadam.

Two methods have been used commonly in the construction of bituminous macadam—the penetration method or the mixing method. A third method, known as the prepared filler method, has also been used. This last method is new in this country. The following description of it is taken from a bulletin of the United States Office of Public Roads, prepared by Charles H. Hoyt, Superintendent of Construction in that office:

The actual construction is carried out very much the same as the plain water-bound macadam is built; that is, the foundation course is exactly the same as for a plain macadam. Then the top-course stone, varying in sizes from ¾ in. to 2 ins., is spread evenly to a depth of 3 or 4 ins., as may be specified for the depth of the top course while loose. The next step, and while the top-course stones are still loose, is to apply a layer of prepared filler spread evenly over them to a thickness equal to about four-tenths to five-tenths the depth of the layer of loose stone.

The prepared filler is made in the following way: To 1 volume of stone chips or pea gravel, varying in sizes from ⅛ to ¾ in., are added about 40 per cent by volume of clean, sharp sand and from 10 to 15 per cent (by volume of the stone chips or gravel) of bituminous binder, which may be of any kind or quality that would be used by the penetration or mixing methods, although it would probably be of no advantage to use by this method the lightest grades of those binders that are specified for the penetration method. The stone chips or pea gravel, sand, and bituminous binder are heated or not as may be required to secure a uniform mixture, and then they are thoroughly mixed together either on a board with shovels or in a machine mixer. After the layer of prepared filler has been spread over the top course of stone, it is then worked down into that course with rakes, or by harrowing with a light steel spike-toothed harrow the teeth of which are about ½ in. square, set close together, and about 3 ins. in depth. The harrowing should continue only until the top-course stone begins to appear through the layer of the prepared filler, and then the surface is rolled with a 10-ton roller until it is firm. More of the prepared filler may be sprinkled over the surface to cover bare spots as the rolling progresses, and, if desired after the first rolling has been finished, a surface coat about ¾ in. in thickness of the prepared filler may be applied and the surface rerolled.

Two sections of road—one 50 ft. long, the other 75 ft. long and 16 ft. wide—were built by this method under the supervision of Mr. Hoyt in September, 1910, at Ithaca, N. Y., on East Ave., passing Cornell University campus. On the 50-ft. section, after the first rolling had been finished, a paint coat of about ½ gal. of oil asphalt per sq. yd. was applied and covered with stone chips. On the 75-ft. section a surface coat about ¾ in. thick of the prepared filler was applied as described above. An oil asphalt binder was used for the 50-ft. section and a cut-back oil asphalt was used for the 75-ft. section. These two sections are now (January, 1912) in excellent condition. By using the proportions of materials stated for the prepared filler—that is, 1 volume of the stone chips or gravel, 40 per cent of sand, and 10 per cent of bituminous binder, there are required for a layer 1 in. thick over 1 sq. yd. of road surface the following amounts of material: 0.028 cu. yd. of chips, 0.0112 cu. yd. of sand, 0.0028 cu. yd. of bitumen, or 0.567 gal. per sq. yd. If 15 per cent of bitumen is used, then 0.85 gal. per sq. yd. is required. Assuming that a layer 2 ins. in depth of the prepared filler is used, the 10 per cent filler will require 1.134 gals. of bitumen per sq. yd. of road surface, and the 15 per cent filler will require 1.7 gals. of bitumen per sq. yd. The sand is used to serve a twofold purpose, one of which is to fill a part of the voids, and the other, which is the principal reason for its use, is to control the consistency of the mixture so that it can be manipulated freely. The amount of sand required can be determined by a few trials and will vary with the kind and amount of binder used. It is better to harrow or rake the prepared filler into the top course as soon after the filler is spread as possible; however, no difficulty was experienced in harrowing in a section of the filler that had lain two hours after it was spread. Some advantages of the prepared filler method are: (1) The amount of stone that is required to be heated is about one-half or less than the amount required to be heated by the mixing method, thus reducing cost and saving time over the all-mixing method. (2) The amount of bitumen required is less than by the penetration method. The amount used can be well controlled and but very little wasted. (3) The prepared filled can be applied evenly, and when worked into the top course it fills the voids and thus makes the surface comparatively solid and durable. (4) The manipulation of the prepared filler is rapid and convenient. The heating and mixing can all be done at one place, such as the crusher site, and the prepared filler hauled to the road where it is to be applied. (5) The prepared filler can be spread practically as well as dry screenings, and thus it is an economical and practical method of applying the bituminous binder, and the results obtained are a solid and substantial road.

Garbage Collection in Berlin.—In every building in Berlin, Germany, large sheet iron tanks or buckets are placed. The daily refuse is thrown into these tanks, which are capable of holding 100 or 200 lbs. of ashes and garbage, and which close with a lid. The ashes and garbage are placed in separate receptacles. On certain mornings of the week the tanks are collected by wagons accompanied by three or four men. A chain elevator is arranged so that a bucket can be placed upon a shelf on the side of the wagon and then raised and dumped into the wagon.

A New Method of Making a Durable "Brow" Pavement.

One of the causes of the high cost of maintaining street car tracks in cities is the most constant expense of repairing the pavement along the rails—the "brow." Under the load of passing car wheels, the rails bend and ties compress slightly, but enough to cause a movement of the pavement as far out as the ends of the cross-ties. It is [illegible] though slight, motion that tends to disintegrate the "brow" pavement. The disintegration often occurs in a surprisingly short time, particularly where there is much wet weather or where streets are frequently sprinkled or flushed, for the water that penetrates the sand cushion beneath a block pavement (stone, brick or wood) is pumped up again by the passing wheels and brings the sand cushion to the surface.

In our issue of April 10, we published an article by Mr. W. W. Marr, Am. Soc. [illegible], giving an excellent solution of the problem of making a "brow" more permanent. We agree with Mr. Marr in the belief that he has given "the best solution so far advanced, of the difficulty of maintaining pavements along street railway tracks."

Mr. Marr's method of constructing a "brow" is as follows:

(1) Give the concrete base a side slope of 1 in. in the first 12 ins. outside the rail.

(2) Upon the concrete base lay a sand cushion, and upon this lay creosoted wood blocks to form the "brow."

(3) Roll and tighten up the blocks, then remove both the "brow" blocks and the sand cushion, carefully laying the blocks opposite the places they were taken from.

(4) Mix the sand cushion with cement, forming a very dry 1:3 mortar, and put the mortar back on the concrete. Also place a similar mortar filling between the web of the rail and the wood blocks.

(5) Relay the wood blocks in the "brow."

It seems desirable to smooth and [illegible] the mortar with a finishing tool such as is used in cement wall work.

This method of construction has been in use in Chicago for three years with excellent results, and creosoted wood blocks in the "brow" thus laid are smooth and superior to "brows" of granite blocks, certainly in freedom from noise and probably also in durability. Even where wood blocks were not as carefully laid in the "brow" as described above, there are many streets where they are in perfect condition after 7 or 8 years of hard service. In other places wood block "brows" laid in the old way on sand cushions, have gone to pieces in 6 months.

The mortar bed, very careful laying, secured by relaying, a pronounced side slope, and the use of creosoted wood blocks constitute the combination that is believed to give the most durable "brow" pavement yet devised.

Experience of the South Park Comission, Chicago, with Bituminous Material in Road Work.

The commissioners of the South Park system of Chicago have under their control about 60 miles of drives, including various boulevards and park drives. The traffic over these drives varies from a maximum of [illegible] vehicles per 24 hours, of which 4,000 are heavily loaded teams, which extreme condition occurs in the northern end of Michigan Ave., down to a minimum of a few hundred vehicles on the more remote boulevards, which carry no through traffic. The comparatively few miles of boulevard in the down town district carrying the heavy down town traffic, such as the northern end of Michigan Ave. and Jackson St., have long been paved in a substantial way, and will not be considered here. Of the 60 miles of drives in the system, 90 per cent is paved either with plain water-bound macadam or a bituminous wearing surface supported on macadam. The water-bound macadam surfaces are being maintained in a usable condition with as little cost as practicable until such time as they can bituminous wearing surface. The traffic on the principal park drives and boulevards through the residential at an average distance of 6 or 7 om the center of the city, amounts 3,000 to 5,000 vehicles per 24 hours, ge fair weather, but this may be decreased during bad weather condi- greatly increased on Sundays and during fine weather. As traffic is con- cluded, at least 75 per cent of the ve- re automobiles, but, on the numerous ing streets, the general traffic moves ed across the boulevards, and must ad'd to the foregoing figures and reck- considering the effects of traffic pavement surfaces.

e informal discussion on Road Con- and Maintenance, held last January, auspices of the American Society Engineers, Mr. Linn White, chief of South Park Commission, de- experiences of the commission in f bituminous materials on the above park road system. This portion cussion was reprinted in the Pro- f the Society, Vol. XXXVIII, No. 3, m which has been taken the matter ticle

5 bituminous treatment for preserv- mecadam surfaces was begun, in an ental way at first, but, under the com- ly dense traffic conditions, experience idly gained. The emulsions and light which were tried were quickly aban- ause of constant complaint from s about the resulting sloppy, disagree- nditions of the drives, as well as the of these materials to add much, if nding value to the surface. Most of cadam was of limestone, of none too quality, which wore and disintegrated under the increasing traffic, and re- nething of more positive cementing an could be obtained from the lighter bituminous material. The first ap- cess was with Tarvia of the grade l sold as "A." In the first experi- he tar was applied to the completed and ed surfaces of the macadam and cov- a top dressing of limestone screen- securing a well-defined cushion coat ch penetration as good luck might

and 1907, 200,000 sq. yds. in the rk System were surfaced in this t an average cost of 5.7 cts. per sq. the bituminous surface alone, and 19.5 r sq. yd. including the necessary re- f the macadam and the addition, ases, of variable quantities of new The quantity of bituminous material as from ⅓ to ½ gal. per sq. yd. The were variable and not always encour- [illegible] was seen what or had an excess of fine material in position, the penetration was indiffer- nd the surface scaled off, sometimes a few weeks. The first improvement use clean limestone chips for the top and the next was to finish up the so that there would be plenty of voids to secure penetration. In 1907, cessity and means of securing penetra- beginning to be understood, and rk of this year was much more success- n that of 1906.

first section of work done in Chicago, ing what are now recognized as correct ation methods, was in August, 1907, on an Ave. from 41st to 42d Sts. Here ed a specially prepared grade of Tarvia, ut 1.20 gravity at 60° F., corresponding at was soon afterward put on the mar- Tarvia "X." The quantity used was per sq. yd., and the cost was approxi- 31 cts. per sq. yd., including 1½ in. w stone. This produced a fairly sub- l surface, but it was torn up in 1909 of carrying through a uniform ment. It was not worn out after 2 of service, but had developed some dis- ated spots, and had the fault of bleeding the hot summer sun, leaving it sticky hot and glassy when cold. If pro had been made for a somewhat deeper penetration, or if more fine material had been rolled in when first constructed, so that there would not have been as much bituminous material near the surface, this condition might have been improved

Other materials than Tarvia were used for penetration work, principally oils with heavy asphaltic contents requiring about 200° of heat for application. One section of Grand Boulevard surfaced in this way with California maltha of 1 gal. per sq. yd., at a cost of 23 cts. per sq. yd., without the use of any new stone except the top dressing of stone chips, waved and rutted so badly under traffic as to be at times almost impassable. Repeated rolling, with a liberal application of screenings, failed to cure the defect, and the road was torn up in 1909. An analysis of the trouble indicates that it was due to insufficient penetration in the old and dirty macadam, and to the presence of too much fine mineral matter. On a layer of clean coarse stone the results would undoubtedly have been more satisfactory.

In 1908, about 200,000 sq. yds. of penetration work were laid, 10,000 sq. yds. being laid by the mixing method, following some previous small experiments. Some of the penetration work of 1907 was given a second coat of Tarvia of about ⅓ gal. per sq. yd., which had the effect of adding a cushion coat without securing any penetration except where the surface was disintegrated. A second and even a third coat may be added with success, if there is a substantial structure of sound stone beneath; otherwise a shifting, unreliable surface will be obtained. Of the penetration work done in 1907 and 1908, amounting to 350,000 sq. yds., there remains in use about 100,000 sq. yds., of which 34,000 sq. yds. will have to be replaced with a new surface in 1912. None of the 1905 and 1906 work remains, and none of the 1907 and 1908 penetration work on street intersections, where miscellaneous traffic crosses the boulevards. All the 100,000 sq. yds. mentioned as being still in service, is where traffic is restricted and is principally rubber-tired.

As previously stated, in 1908 the first surfacing was done by the mixing method, amounting to about 10,000 sq. yds. No satisfactory machinery seemed to be available for mixing, unless standard asphalt paving plants were considered, and hand-mixing was recognized as being too expensive and slow. At the beginning of the season of 1909, there was on the market a portable plant manufactured by the Link Belt Co., of Chicago, which embodied all the essential parts of an asphalt paving plant mounted on one truck. The South Park Commissioners purchased two of these plants, which have been kept in use during the seasons of 1909-10-11, and, up to date, about 435,000 sq. yds. of mixed bituminous wearing surface have been laid with them, principally on the old macadam. A comparatively small amount has been laid on a new macadam base, but the method of construction was the same. The methods of doing the work have progressed from experiment to experience, and from experience to what may be considered established practice, in a process of evolution somewhat similar to that previously described for the pouring and penetration methods. More attention is now given to preparing the base with a coarse, open, and grainy top, into which the surfacing mixture may be forced. In the earlier work the macadam surface was left comparatively smooth, and dependence was placed on the composition of the mixture and the stability of the binder to prevent the shifting of the surface.

The bituminous wearing course in most of the work has been made 2 ins. thick, in some 1½ in., and in a small quantity about 1 in. The later conclusions are that a comparatively thin and completely waterproof wearing surface, with a strong, coarse layer of stone keying it to the macadam base and giving lateral stability, is the most logical, economical and successful construction, the layer of coarse stone corersponding somewhat to the binder course in sheet-asphalt pavements. The thickness of the wearing surface may be varied in the judgment of the engineer to meet the stress of traffic and amount of money available.

Careful records of cost have been kept and may be concisely stated as follows:

	Labor.	[illegible] supplies.	Total.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
1 in. thick....	0.12	0.20	0.32

These figures do not include the preparation of the base, overhead charges, or interest and depreciation. The same is true of any other figures of cost mentioned. The cost of labor and supplies in Chicago probably does not vary materially from that in any other large city in the United States, and the costs given above are based on the following average prices of materials used in the wearing surface:

[illegible]

The bituminous cements used have been asphaltic compounds, natural asphalts, and, to a limited extent, refined tar of from 1.20 to 1.29 gravity at 60° F.

All the surfacing done by the mixing method during the past 4 years, beginning with 1908, is giving good service with less than one-half of 1 per cent of repairs up to date. Some weaknesses of construction have developed at certain points where the stress of traffic has been the greatest, and have caused the small amount of repairs referred to. On some of the earlier pieces of work, surface cracks or checks have appeared, but it is believed that the better methods of construction, particularly the use of the coarse, open-stone base, have to a large extent overcome this tendency. The two other Park Commissions in Chicago, the West Park Commission and the Lincoln Park Commission, have adopted the same methods for surfacing macadam, and are using the same machinery for mixing and preparing the material. Altogether, there has been laid in Chicago by the three Park Boards nearly 1,000,000 sq. yds. by the mixing method.

In its meetings of the last three years the organization of City Officials for Standardizing Paving Specifications has adopted specifications for work of this class, under the name of "Bituminous Concrete," based principally on Chicago practice.

In conclusion, it may be said that the additional cost of surfacing by the mixing method over first-class construction by the penetration method is so slight, and the advantages of uniform results and longer service attained are so considerable, that every municipality should look carefully into it before deciding on the inferior method. It is probably true that it should not supersede the penetration method in all cases, but where there is a growing traffic, urban, suburban, or interurban, it will be the better method of construction.

Current Practice in Fixing Pavement Crowns.

[illegible]
Am. Soc. C. E., 21 Park Row, New York City

In a recent investigation made by the writer for the Department of Public Works, Borough of Manhattaan, New York City, to ascertain the current practice in fixing crowns for pavements in cities of the United States which have a population of more than 30,000 the following conditions were disclosed.

Methods Used to Ascertain Height.—More than one-half the cities with which communication was had, 112 in all, determine the height or amount of crown in the field, suiting it to local conditions of kind of pavement, grade, differing heights or curbs and degree of repair in which the street is kept. It is customary to assign a rise of a number of inches to the street width, this rise being proportioned to the before mentioned conditions, the usual practice being to decrease the crown as the grade increases. The crown for asphalt, bitulithic or other smooth monolithic pavements was given as follows:

Maximum $\frac{W}{[illegible]}$ minimum $\frac{W}{100}$ and average $\frac{W}{67}$

On a roadway width of 30 ft. this indicates a variation between the [illegible] 6 ins., the average being 5¼ ins.

The formula devised by the late Andrew Rosewater, City Engineer [illegible] one most employed to fix crowns. It has as factors the roadway width and grade and decreases the crown as the grade is increased. Its wide use is probably due to the publicity which it has received and to the principle, pretty generally recognized by highway engineers, that the crown should decrease to accord with increased grade. The formula is as follows:

[illegible]

P = per cent grade.

The cities of Baltimore, Spokane, Dubuque, Allentown and others modify the formula to suit local conditions. Seventeen different formulas were found in use, some of them being complicated and of limited application. The rules devised by Mr. George C. Warren are very simple, practical and easy to apply. He recommends for asphalt and other smooth pavements a crown of 1 in. for each 6 ft. of width, to be used on grades under 2 per cent. On car track streets the width to be used is that between rail and curb. For grades between 2 and 4 per cent one-half the crown is to be provided and above 4 per cent one-third.

The amount of crown is in some cities affected by the summits which are made in the gutters. These have the effect of decreasing the crown and a greater average is therefore necessary to meet the drainage conditions.

Methods of Producing Crown.—The parabolic form of curve is preferred in 36 out of 76 cities in which a preference was stated. The probabilities are that a larger percentage use it, its popularity being due to the very simple manner in which the ordinates are determined. Six cities use a circular curve and two use a parabolic one but raise or "peak" the middle third of the roadway from ½ to 1 in. in a roadway width of 32 ft. Mr. George C. Warren gives the following rule: "Provide one-third the fall between crown and the quarter and two thirds between the quarter and curb." By this rule more fall is provided for the middle of the street and less for the gutters.

Most of the formulas given by the city engineers are too intricate for use by the foremen and others who actually set the stakes or marks in the street. Some have worked out tables for different street widths, grades, etc., but at times unusual conditions are encountered which make them of little use and a ready rule desirable. The engineer is frequently limited as to time and the work has to be done at once. Some of the formulas are very limited in their application and a thorough knowledge of their limitations is essential to a proper use.

No such criticism will apply to Mr. Warren's rule, which seems to be unique in its completeness and the facility with which it may be applied.

Variation of Crown with Grade.—Out of [illegible] cities, 57 per cent stated that the crown was decreased as the per cent of grade increased. No doubt more cities would so proportion the crown were it not that a number are flat and find no need for it. The consensus of opinion and the practice seem to favor such a decrease. Seven formulas out of eleven recognize grade as a factor.

Effect of Car Tracks on Crown.—Out of 96 replies, 73 stated that the tracks were set level and 23 stated that the outer rails on tangents are placed from ¼ to 1 in. lower, dependent apparently on the crown and curb heights. The sides of a car track street were stated to be treated as separate roadways. The preference seems to be in favor of placing the rails on the curve of the crown in order to facilitate to some extent the drainage, but objection to this is no doubt met on the part of the railroad companies on account of the increased wear on wheels and rails. The fact that surface drainage of the railroad area must be taken care of by the railway company possibly tends to make grading receive less attention by the average city engineer than it otherwise would. That the appearance of the street is improved by a slight drop of the outer rails, say ½ in., will probably be conceded, especially where groo are used.

Where streets of differing widths ters and rails are necessarily at same vati the crown must be carefully adjusted, meet the conditions, and rules are difficult apply. Where a different kind of pavemen s laid within the track area to that withc, such as brick and asphalt or bitulithic, the ugges-tion has been made that the area utside the tracks be made to slope toward e rail in order to prevent water from follo ng th joint of the two kinds of pavements.

Conclusions.—No one form of cur seems to be suitable for roadway surface of all widths for the reason that a wide adway requires more fall in its middle thir to get rid of the water rapidly. It would em to be possible to establish a standard each width of street, kind of pavement an grade the rate of fall between the quarter and quarter points and center or gutters the governing factor. At no place sho exceed 4 per cent.

The amount of crown given by th R water formula and its various modi at seems to be too great for average co it in urban streets, lightly traveled, whe pavement is kept in good repair.

Too much emphasis cannot be give o importance of making traffic records tas tain the amount of wear in a given tin u a given load and to determine the de repair in which the pavement is kept d consequent crown required.

Owing to the fact that pavement rface are being perfected more each year t smoother surfaces result, it would a ar if the crowns for the various kinds pa ments should approach the same value Br pavements with grouted joints are n so as to require the same, or less ac effort than asphalt, and stone block pa are beginning to be laid with clos and smooth surfaces which approach th br That all jointed pavements should ec more crown than the monolithic, due th roughness, will be conceded, but with e proved construction the difference betw n two should be smaller than heretofor

WATER SUPPLY, SEWERAGE AND SANITATION SECTIC

Methods and Cost of Flushing Sewers.

The importance of flushing sewers in which self-cleansing velocities do not exist is becoming more widely appreciated. In past years some excellent studies have been made to determine the required amount of flushing water, the effective range of the flushing wave, and the frequency of flushing. Very little has been published heretofore on the cost of flushing sewers by the various methods in common use. The present article, which is based on information supplied this journal by the Merritt Hydraulics Co. of New York City, comprises an economic study of sewer flushing.

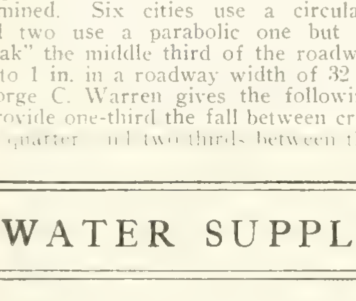


Fig. 1. Merritt Flush Tank with Type M Siphon, for Automatic Flushing—Fitted with Merritt Regulator.

METHODS AND APPARATUS FOR FLUSHING SEWERS

Flushing consists of admitting a sudden rush of water at a high velocity into the sewer. This can be secured by collecting water in a manhole or tank and then suddenly admitting it to the sewer by (a) opening a valve, (b) removing a plug, etc., or (c) breaking an air seal or lock in a siphon. Filling and discharging the tank may be done automatically, semi-automatically, or by hand.

In the case of very large sewers, the sewage itself may be used instead of water from an outside source. Here a plug or gate is put in the outlet and the incoming sewage allowed to dam up in the bottom of the tank or manhole. When a small head has been accumulated it is allowed to flow down the sewer. This method of flushing has several drawbacks. (a) The unsanitary character of the work. (b) the high cost for labor. (c) the time required for the sewage to accumulate, and (d) since the head can be built up it is limited by the grade of the inlet sewer, a low flushing velocity. As a result flushing with accumulated sewage is only employed on mains of large size.

Hand Flushing.—In flushing by hand, several methods of filling can be used: (1) By means of a water cart; (2) by a hose connection to a hydrant; (3) by a permanent connection from the water main.

A stopper is placed in the outlet of the manhole or tank and if it is not a dead end of a sewer a stopper is also placed in the inlet.

When the tank or manhole has been filled by the water from the cart, from the connection to the hydrant or water main, it is shut off, the plug or similar contrivance removed from the sewer and the water allowed to flush it out.

[illegible] and Semi-Automatic Flushing.—In flushing by means of automatic apparatus, water is fed to the tank by a servi pipe fitted with an appliance for regulat th rate of feed, and discharged by some m

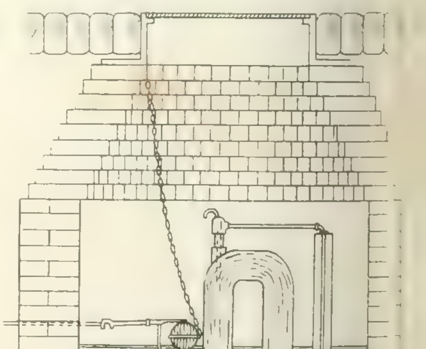
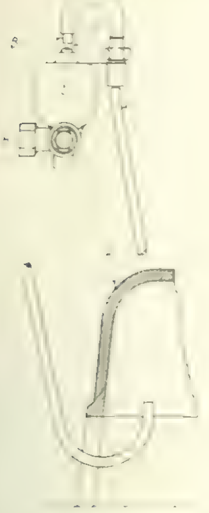


Fig. 2. Merritt Semi-Automatic Flush ank —Fitted with Merritt Semi-Automat Cut-off Valve.

siphon, which flushes when the wat has reached a predetermined level in the ank The operation of the siphon is entirely uto-matic. The water may be fed to the t n a continuous stream of such volume th the [illegible] and discharges entirely automatically [illegible] termined intervals of 24 to 48 hours. [illegible] else the water may be fed only [illegible] that flushing occurs at any frequency [illegible]

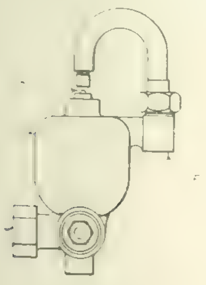


g. The Moise Regulator for Controlling Ra of Feed to Automatic Flush Tanks.

In the first case a regulator con- feed to the desired rate, and in the [illegible] vice designed to permit the filling [illegible] follows automatically, and at the [illegible] name implies with automatic flush tanks or at all is required. With the use of t-off valve to permit semi- automatic labor is necessary but it is merely [illegible] inhole cover.

lerritt flush tank which is suitable either tomatic or semi-automatic flushing, when [illegible] cut-off valve, is shown in Fig. 1. installation shown the flush tank is ed with a Merritt regulator and there- is automatic. A semi-automatic flush [illegible] is shown in Fig. 2.

Moise regulator which is used to control ite of feed to automatic tanks and to it waste of water by too frequent flush- shown in Fig. 3. This device also in- air into the bell K, of the siphon, to in- eliable discharge when the flushing level ched. This prevents weeping and drib- Water enters at H. E is the mud- C the nozzle of the injector discharg- ater to B into which it carries the air



4. The Merritt Water Regulator for Automatic Flushing.

pped in passing the air gap. The water air are fed together through the pipe F, inating under the bell of the siphon.

e Merritt water regulator for controlling of flush water to tanks with overhead or ted type siphons, gives automatic flushing redetermined intervals. This regulator is n in Fig. 4. In this figure J is the inlet water, E is the mud-drum, C the orifice controlling the flow, and F is the point at [illegible]

The Merritt semi-automatic cut-off valve, for operating flush tanks at any frequency, is shown in Fig. 5. This device can be installed in existing manholes without extra excavation. This device forms the semi-automatic flush tnak shown in Fig. 2. The operation of the [illegible]

At the start the float is in the position shown in Fig. 5 by solid lines, that is, extended to the right. In this position the weight of the [illegible] ant passes a hook through a hole in the manhole cover, lifts up on the chain, and swings the float over to the position shown by dotted lines. This opens the feed valve and admits water to the tank

The water entering the tank gradually fills it and, in rising carries the ball float to intermediate positions. The water rises until the ball float passes beyond the point of dead center. The float is counterweighted and as the discharge occurs the ball float falls with the water level. When the water is all discharged the float has resumed its original position and remains there until it is again lifted by hand by means of the chains. As the siphons are entirely automatic, the semi-automatic tank may be operated automatically by hooking up the chain of the cut-off valve, thus securing continuous feed.

[illegible]

Three items go to make up the cost of sewer flushing: (1) Cost of water; (2) cost of labor; (3) fixed charges against the apparatus.

Items 1 and 2 are independent of the fre-

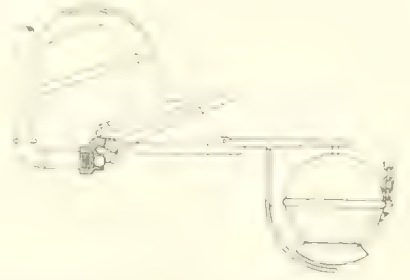


Fig. 5. Merritt Semi-Automatic Cut-off Valve for Operating Flush Tanks at Any Frequency.

quency of flushing, that is, whether flushing is performed once a day or once a month, the cost per flush for water and for labor are practically the same. This is not true of item 3. The fixed charges on the apparatus include interest on the money invested and sinking fund. The charge per flush, therefore, is governed by the frequency with which flushing is performed, the interest on sewer bonds and local conditions.

Assume a case where water costs 3 cents per 1,000 gals., and that the amount of flushing water required is 333 gals., so that the cost per flush for water is one cent. This is an extremely low cost for water. This figure can be assumed here, however, as the same cost will be taken in each method of flushing. Where the apparatus used for flushing wastes water, as for instance, where poorly operating automatic tanks discharge 2 or 3, or more, times a day, where once every 2 or 3 days would be sufficient, the money value of the water wasted will add up to a large amount in a year.

Flushing With Water Cart.—Two men with a water cart can flush about 20 tanks per day and the cost for labor is as follows:

2 men at [illegible]	$[illegible]
2 horses [illegible]	[illegible]
Total per day	$[illegible]
Labor per flush	[illegible]
Water per flush	[illegible]
Total cost per flush	[illegible]

To this must be added the fixed charges against the apparatus used for flushing. As we are only making a comparative study and [illegible] required in all the methods considered, we can eliminate charges on that investment. The charges against the investment on water carts

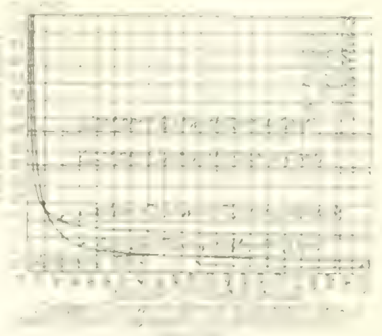


Fig. 6. Cost per Flush, at Various Frequencies per Year, with Different Types of Flushing Apparatus.

is included in the cost for horse and cart, which is considered as rental.

[illegible] labor to handle about 20 tanks would be:

[illegible]	$[illegible]
[illegible]	[illegible]
Total per day	$6.00
Total labor per flush	[illegible]
Water per flush	.01 ct.
Total cost per flush	[illegible]

[illegible] manholes or tanks with hand flap valves that may be operated in a day, depends largely on their distance from one another, on the time required to fill them and on the rapidity with which the attendant removes and replaces manhole covers, etc. A special report on the time taken to operate flushing manholes in a large city in the south is summarized by Table 1. As shown, one man flushed 44 tanks in one day.

Assume as an average, that one man with a horse and wagon can attend about 40 tanks daily. In many cases a horse and wagon might not be used, the attendant walking or riding bicycle from tank to tank. However, as it will be assumed that a horse and wagon are also employed with the semi-automatic tank in the analysis following, it is consistent to set down that item here. The cost per flush would then be made up of the following items:

1 man	$[illegible]
1 horse and wagon	[illegible]
Total labor per day	$[illegible]
Cost for labor per flush	[illegible]
Cost for water	[illegible]
Cost per flush exclusive of fixed charges	11 cts.

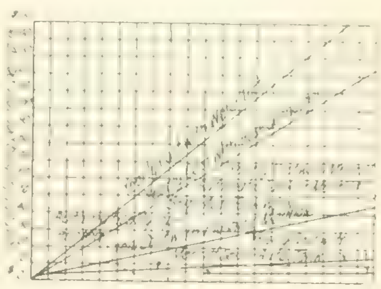


Fig. 7. Cost of Flushing per Year per Tank, with Various Types of Flushing Apparatus and at Various Frequencies of Flushing.

To this must be added the fixed charges on the investment for the water connection and the lift valve. Assuming $15 as the first cost for the water connection and flap valve, the fixed charges at 10 per cent = $1.50 per year. The fixed charge per flush depends upon the frequence of flushing. We will first consider a frequency of 365 flushes per year. The cost per flush for various frequences from 1

TABLE I.

Tank	[illegible]	[illegible]	3	4	[illegible]	6	7	8	9	10
Time	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.52	8.03	8.09	8.16	8.21
Tank	[illegible]	[illegible]	13	14	[illegible]	16	17	18	19	20
Time	[illegible]	[illegible]	8.36	[illegible]	[illegible]	9.15	9.25	9.35	9.40	9.45
Tank	21	22	23	24	25	26	27	28	29	30
Time	9.54	9.59	10.03	10.12	10.18	10.21	10.40	10.43	11.00	1.00
Tank	31	[illegible]	33	34	35	36	37	38	39	40
Time	[illegible]	1.27	1.32	[illegible]	[illegible]	2.10	2.35	2.45	3.02	[illegible]
Tank	41	42	43	44						
Time	3.30	3.45	4.00	4.20		Reports to Office.				

to 365 times per year is given by Table II and Figs. 6 and 7.

TABLE II. COST OF FLUSHING IN CENTS PER FLUSH, WHEN FLUSHING AT FREQUENCIES FROM 1 TO 365 TIMES A YEAR

Number of flushes per year	Hand-operated.*	Automatic.*	Cost per flush with flushing manhole.	Cost per flush with hose connections.	Cost per flush with cart.
	cents.	cents.	cents.	cents.	cents.
1	303.00	....	261.0	31.0	41.0
25	15.00	....	17.0	31.0	41.0
50	9.00	....	14.0	31.0	41.0
100	6.00	....	12.5	31.0	41.0
150	5.00	....	12.00	31.0	41.0
200	4.50	2.50	11.75	31.0	41.0
250	4.20	2.20	11.60	31.0	41.0
300	4.00	2.00	11.50	31.0	41.0
365	3.82	1.82	11.41	31.0	41.0

*Cost per flush with semi-automatic tank.

For flushing 365 times a year the fixed charge is $=\frac{\$1.50}{365}=$ .41 cents and the complete cost is as follows:

Labor per flush........................10.00 cts.
Water per flush........................1.00 cts.
Fixed charges .... .41 cts.

Total cost per flush (flushing 365 times per year) ....11.41 cts.

Automatic Flush Tanks.—With this method, the cost of water per flush is as before, one cent. The cost for labor is zero. The fixed charges on the flushing siphon are dependent upon its first cost, the life of the apparatus and the value of money. The investment for a Merritt automatic siphon and Moise or Merritt regulator as installed would be about $30. Setting down yearly fixed charges at 10 per cent as before, we have the fixed charge per tank as $3.00 and for flushing 365 times per year, .82 cents per flush. The total cost per flush is then:

Labor .... .00 cts.
Water ....1.00 cts.
Fixed charges .... .82 cts.

1.82 cts.

Table III summarizes the cost of various methods of flushing at a frequency of 365 times a year.

TABLE III.—COST OF FLUSHING, IN CENTS PER FLUSH, AT A FREQUENCY OF 365 TIMES A YEAR.

Method of flushing.	Water cost per flush.	Fixed charges* per flush. 365 flushes per year.	Labor cost per flush.	Total cost per flush.
	cents.	cents.	cents.	cents.
Water cart..............	1	0	40.0	41.0
Hose connection......	1	0	30.0	31.0
Flushing manhole ..	1	.41	10.0	11.41
Automatic flush tank	1	.82	0	1.82

*For purpose of comparison fixed charges against the masonry tank or manhole can be neglected and with the flushing manhole and automatic tank, 10 per cent of the cost of the apparatus are set down for interest sinking fund and maintenance.

Semi-Automatic Flush Tanks.—We have now to consider the cases where flushing is required less frequently, once or twice a week or less. Under these circumstances, the semi-automatic tank is the most economical method of flushing. Furthermore, this type of tank can be used when desired, as a full automatic tank, flushing at frequent periods or less frequently, the only labor required for flushing in this manner being the pulling of a chain from the outside of the manhole.

The cost for water is again, one cent per flush. As to labor, a man with a horse and buggy, costing in all $4 per day, can pull the chain and set off 200 tanks which would be only five times as many flushes as was assumed with the ordinary flushing manhole. This would make the cost for labor per flush 2 cents. The number of semi automatic tanks that can be operated in a day by one man, are dependent, as was the case with the flushing manhole, on the distance between tanks and the time consumed in operating the tank itself. With the semi-automatic tank, the time required to pull up the chain is but a fraction of a minute, as contrasted to the time required to remove a manhole cover, turn on the water, wait till the tank fills, open the flap valve and discharge the tank and replace the cover, as is the case with flushing manholes.

To the cost of 2 cents per flush for labor, must be added as before the fixed charges against the apparatus. The first cost of the semi-automatic tank over and above the first cost of masonry may be set down, as was the case with the automatic tank, at $30 at 10 per cent, so that the fixed charge is $3 per year. The fixed charges *per flush* depend upon the number of times per year the tanks are operated. If set off only once, it will be $3 and adding in the cost of the labor and water, the total cost will be 303 cents. If it is set off 52 times a year, the fixed charges will be 5.77 cents and adding water and labor, the total cost will be 8.77.

In the first column of Table II is set down the number of times per year flushing is performed. Corresponding to these frequencies, are set down the various costs per flush. The second column gives the cost with the Merritt semi-automatic tank; when flushing less frequency than 200 times a year the tank is hand operated and at frequencies greater than 200, the tank is operated either automatically or by hand, the cost by both methods being given. The cost with flushing manhole and other methods is also given.

Or we may show the same data by Figs. 6 and 7 which further illustrate the relative cost of the various methods of flushing. In Fig. 6 the cost *per flush* in cents is plotted against frequency while in Fig. 7 the total *yearly* cost for flushing by various methods is plotted against frequency.

Under practically all conditions either the full automatic or semi-automatic tank is the most economical means of sewer flushing. These figures of course are subject to market price of labor in any particular locality. They indicate, however, that where flushing is to be performed more than 15 to 20 times and less frequently than 200 times a year, the semi-automatic tank is the most economical apparatus to use. For flushing at intervals of every 48 or 24 hours or more frequently the full automatic tank is adaptable, and is the most economical.

Experiments on the Purification of Water by Storage at London, England.

In a recent report based on the studies of Dr. A. C. Houston of the Metropolitan Water Board of London, conclusions are drawn regarding the comparative vitality of cultivated and uncultivated typhoid bacilli in raw Thames River water. The fact, previously announced by Dr. Houston, is confirmed that typhoid bacilli which have been isolated fr n a case of typhoid and grown in artificial media in the laboratory have greater vitalit than typhoid bacilli which have not been us cultivated, but which are taken from the odies o excreta of typhoid patients or typho carriers. In thirteen experiments with the u ltivated typhoid bacilli the bacilli could not e found in the infected water after one we in nine experiments, and after two weeks in three experiments, and after three weel in one experiment. Yet the same microbes fter cultivation usually lived for over five wks. This information is abstracted from the view of Dr. Houston's studies by *The Su* eyor, of London.

It should be noted that the prese experiments were conducted under conditi s which are more nearly related to the actu case of the London supply than were those eviously made. In order to anticipate the bjection that indoor experiments are artificial and that there is considerable difference in war stirred in partially filled stoppered bottles d stored in an open reservoir of mai m gallons capacity, two open galvan d tanks, each capable of holding 35 were used in the open air for the u of the experiment. The tanks were ec raw river water, and were carefull wat and guarded, the bacilli were added an water was stirred thoroughly befor sa were taken.

It appears that the chief value of tese experiments is to prove that where the pcess of storage will eliminate *cultivated* typh within a given period, the same peric w more than sufficient for the eliminati of the typhoid bacilli likely to be present in he raw water, and that in making deducti s from such experiments a certain factor of afety is allowed.

TEMPERATURE AS AFFECTING PURIFI STORAGE.

The vitality of typhoid bacilli in *ra* Thames water at different temperatures is c sidered in the report. It is evident that thi has an important bearing on the water sup ques tion, seeing that large quantities of ter ar drawn from the river at flood tim in th winter, when the water is most hi ly pol luted owing to the washings from the rainag area and when the temperature is lo

It has been found that the effect of w temperatures is to lengthen consider y th period during which the typhoid ba li sur vive in the water. The fact is gene lly ac cepted that when a large number of typhoi bacilli are added to water there ours a initial drop in their numbers, usuall withi the first week. It has been found in e present experiment that the effect of low mpera tures is to delay this initial drop conse At temperatures of 50° F. and upw ds drop takes place within the first wk, from one to two weeks are needed abo 41° F., and between two to three eks about 32° F. We may therefore concl e th the efficiency of the storage reservoir is le in winter than in the summer—a mos mpor tant point. Five weeks' storage at 32° . pr duced the same result as two weeks' stora at 64.4° F., namely, the reduction of fr n ov 100,000 typhoid bacilli to 3.

The critical months as regards tem ratu are December, January and Februar 39° F. These are the months when large volumes of water are usually ta n in our storage reservoirs, and the river ter apt to be most impure. These facts s w enormous importance of adequate stor tention is drawn to the fact that the ru erning the abstraction of river water e u deniably lax. River water should not l rec lessly taken into storage, irrespective of current quality. It is shown by exampl giv that this thing is done. The lesson portion of the report is that the value age does not justify the Water Boar n laxing vigilant control over the qu y water taken into its storage reservoi the other hand, it is probably impos le exclude all water which is of a low s nda owing to the enormous quantity requi use; and this is the reason why Dr. H later on in the report recommends pr p an coagulation for the worst water be- it iters the reservoirs.

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onic Considerations Affecting the Selection of Pumping Units or Water Works Service.

cmon criticism of the design of water [illegible] is that [illegible] and steam engineering problems in the design have been overshadowed the problems of civil and sanitary engineer- [illegible] instances the point [illegible] ten, since unwise selections of pump- un., for water works purposes. often are he economic considerations which ience the choice of pumps, for this ently were brought out in a paper s S. Hill before the Municipal En- the City of New York. Mr. Hill the design of pumping stations in ty, but his discussion of pumps ven in the present abstract. In a of this journal the points brought e to boilers and steam piping will

Fig. 1. Diagrammatic Classification of Pumps for Water Works Service.

[illegible] engines for water supply age discharge may be divided into the neral classes, Reciprocating and Cen- A general classification of these wn in Fig. 1.

of Type.—In designing a pumping of the most difficult problems is n of the most economical type of g engine, best suited to the immediate conditions. By most economical the pest in first cost is not meant, nor giving the highest efficiency. An ical mean lies between these two limits. termination of this mean involves the st of pumping. It is customary in vorks plants to report the cost of pump- sed on station operating expenses, in- attendance, coal, oil, fuel, repairs, etc., interest and sinking fund charges, to- with the depreciation on the plant, are as important when considering the conomical type of engine to select. It ot necessarily follow that the engine e highest duty is the least costly to for the reason that the fixed charges sufficiently great to offset the reduced operation resulting from fuel saved.

[illegible] TRIAL [illegible] PERFORMANCE.

trial duty performance of steam driven sing pumping engines, on the basis of unds duty per 1,000 lbs. of dry steam, ollows:

l. triple expansion, crank and [illegible]	14[illegible] 180
ntal, cross compound, crank and [illegible]	110 to 1[illegible]
ntal, duplex, direct-acting, triple	75 to 110
ntal, duplex, direct-acting, com- [illegible]	[illegible]
[illegible]en, centrifugal pumps	7[illegible] to [illegible]
[illegible]iven, centrifugal pumps	7[illegible] to 9[illegible]

y engineers place too much value upon al engine duty. Engine duty represents he efficiency of the engine. This is one [illegible] cost of pumping. The effe[illegible]veness of the remainder of the plant is [illegible] equal consequence. [illegible] economical as a unit in th[illegible] consumption of coal, while the station duty is relatively low. The total cost of pumping may be high, though the station duty is excellent and the cost of pumping based on pumping station expense is low, as a result of using costly engines of high efficiency when not warranted and thereby unduly increasing fixed cost. Sight must not be lost of the fact that the cost of coal, which is the item chiefly affected by high engine duties is, in most cases, but 30 to 45 per cent of the total operating cost and a much lower per cent of the entire cost of pumping. It is obvious therefore that conclusions based on operating expense only may be misleading.

Duty is the measure of efficiency usually used in considering pumping plants or pumping machinery, and it is the ratio of work done to the energy expended in doing it. The terms generally employed at present are foot-pounds duty per 1,000 lbs. of steam or per 1,000,000 heat units. Formerly it was used on foot-pounds per 100 lbs. of coal. If the last named basis is used, the plant efficiency is also included and it may be correctly termed the station duty. It embraces boilers, steam pipes, feed pumps, heaters, etc., which have not necessarily any relation to the individual efficiency of the pump. It is the commercial test to be used in daily operation. It expresses the efficiency of the plant as a whole.

The duty of the same engine will, of course, vary materially with the service to be rendered. Under constant load and high head, the duty of reciprocating engines is the greatest. A variable, or intermittent load materially reduces the efficiency of any engine, and hence under these conditions high efficiencies are not warranted by the saving in cost to be effected. The effect of a variable load upon the steam consumption of a simple non-condensing engine may be illustrated as follows: The steam consumption per indicated horse power, at the rated horse power (120) of the engine in question, is about 27 lbs., whereas, at ⅓ load, or 40 h.p., the steam consumption amounts to 64 lbs. per i.h.p. Also the total steam consumed per hour increases only from 2,600 lbs., at ⅓ load, to 3,300 lbs. at full load.

The cost of coal can be determined from the following formulas:

Where the guaranteed duty of an engine is known, and when duty is expressed in foot-pounds per 1,000 lbs. of steam, then pounds of

steam per i.h.p. = [illegible]

$$\frac{\text{Duty}}{33{,}000\times 1{,}000}$$

$$\frac{1{,}980{,}000{,}000}{\text{Duty}}$$

The steam consumption corresponding to various duties may also be obtained from Table I (from Hague).

$$\text{The annual cost of fuel} = \frac{S\times \text{i.h.p.}\times T\times C}{E\times 2{,}000}.$$

In which S = pounds of steam used by the pumping engine per h.p. per hour;
i.h.p. = average indicated horse power developed;
T = number of hours during the year pumping is required;
C = cost of coal in dollars per ton of 2,000 lbs.;
E = evaporation factor of the boiler which equals approximately 8 lbs. of water evaporated per pound of ordinary good bituminous coal.

To the cost of coal thus determined there should be added, say, 4 to 6 per cent interest, on the cost of the engine, 8 to 10 per cent for repairs, depreciation, etc., and 1 to 2 per cent refunding sinking fund. No really reliable figures on the cost of pumping engines can be given. Such figures vary with the type, size, head pumped against, steam pressure, as well as with supply and demand and the cost of materials.

If an engineer is in doubt as to the type of pumping engine needed for a special situation, bids on the types that are to be considered should be obtained, and from the prices thus obtained a decision may be made.

In order, therefore, to fix upon the cheapest unit for a particular case it is necessary to consider the following elements: (*a.*) The first cost of engine; (*b.*) the cost of foundations; (*c.*) the cost of land; (*d.*) the cost of building required to house the engine; (*e.*) the efficiency of the engine; (*f.*) the cost of the boilers necessary to supply steam to the engine; (*g.*) cost of coal per ton; (*h.*) the cost of maintenance and repairs, lubricants and waste; (*i.*) the cost of any other elements which may be affected by the type of engine selected.

It frequently occurs that the cost of foundations for one type of engine are considerably more than for another, and, similarly, the cost of the building required to house a certain type of engine will be greater than for another. The engine to be purchased, therefore, should be charged or credited with these costs in order to accurately fix upon the total fixed charge involved.

A vertical type of engine of the same capacity occupies less floor space than a horizontal, and where land is extremely high, a big saving may be effected in floor space, and hence in initial cost, by installing this type of engine. For vertical engines, however, the sub-foundations are usually heavier and more costly than those required for the horizontal type. This is especially true where the materials encountered make foundation work expensive. If these costs are weighed, the results might show greater economy in the horizontal engine. For horizontal engines the condenser can usually be placed in the discharge line in such a manner as to reduce the basement required to a minimum. The height of a building re-

TABLE I. — BOILER HORSEPOWER REQUIRED FOR EACH PUMP HORSEPOWER, COUNTING 10 SQ. FT. OF HEATING SURFACE FOR EACH BOILER HORSEPOWER, FOR THE FOLLOWING DUTIES OF ENGINES

Duty in ft. lbs. per 1,000 lbs. steam.	Lbs. of steam per hour per pump h.p.	Boiler h.p. per pump h.p.
40,000,000	49.50	1.63
50,000,000	39.60	1.32
60,000,000	33.00	1.10
70,000,000	28.38	0.94
80,000,000	24.75	0.83
90,000,000	22.00	0.74
100,000,000	19.80	0.66
110,000,000	18.00	0.60
115,000,000	17.21	0.57
120,000,000	16.50	0.55
125,000,000	15.80	0.52
130,000,000	15.20	0.51
135,000,000	14.66	0.49
140,000,000	14.14	0.47
145,000,000	13.65	0.46
150,000,000	13.20	0.44
155,000,000	12.77	0.43
160,000,000	12.37	0.41
165,000,000	12.00	0.40
170,000,000	11.65	0.39
[illegible]	[illegible]	[illegible]
180,000,000	11.00	0.37
185,000,000	10.70	0.36
190,000,000	10.42	0.35
195,000,000	10.01	0.34
200,000,000	9.90	0.33

quired for vertical engines [illegible] horizontal, and, although the [illegible] pied by the horizontal type is greater than for the vertical, the difference in the height of the buildings and basements will sometimes make the station for a vertical equipment more costly than for the horizontal type.

The lower the efficiency of the engine, the larger the boiler plant required to furnish steam. This is exemplified by Table I. The added cost of boiler power required for engines with lower efficiency should be charged to this type of unit. As engines of low efficiency require a greater amount of steam, it sometimes happens that the cost of steam piping is enhanced when they are specified for use.

The prevailing price for coal has a decided influence upon the type of engine to be selected. Where coal is cheap it is evident that greater efficiency will produce a smaller proportionate saving than where coal is high.

For handling small quantities of water, the item of fuel usually becomes a secondary consideration, so far as the selection of type of pump is concerned, and the pump which is lowest in first cost, in most cases, will be found to have the field unchallenged. The capacity of the plant, in which the fuel saving to be effected by higher efficiency warrants the purchase of high priced machinery, depends largely upon the price of coal, as well as other local considerations, and although there has been some effort to fix an arbitrary point at which it pays to go into high duty engines, it is only possible to do so by careful estimate.

The cost of maintenance, including attendance and repairs, is frequently greater for engines of the highest economy than for units of lower efficiency, see Table II. This table gives a tabulation of the cost of an entire station in detail, with three types of engines, including the installation of superheaters and economizers, together with an electric light plant. In this case land is not included, because the property had already been purchased, but the table indicates the relative first cost of the plant equipment.

This table also gives the total cost of the station above the basement floor, as indicated in its upper portion, together with an estimate of the operating expenses and fixed charges for the three styles of equipment. The result of this tabulation shows a saving of approximately $190,000 upon the first cost of installation in favor of the horizontal cross compound type of engine, as compared with the vertical triple, and a saving of $15,000 per year, including interest, fixed charges and operating expenses, in favor of the same type of engine.

In presenting this table, it is not to be understood to indicate any preference for a particular style of engine. The tables are given as a method of determining upon the best type of engine to select. Local conditions, in the particular estimate presented, worked out in favor of the horizontal cross compound type, although, generally speaking, in stations for large municipalities, the vertical triple expansion type of engine is found to be more economical to install, notwithstanding the fact that the first cost is greater than for other types of engines. Other factors than the economical value of the pumping unit, must be considered in making a selection. One type or another of pump may be best suited to the local conditions.

TABLE II.—ESTIMATE OF COST OF CONSTRUCTION AND YEARLY COST OF PUMPING, FOR PUMPING STATIONS WITH THREE TYPES OF PUMPING ENGINES.

	Type of Pumping Engines		
Items.	Horizontal cross compound	Horizontal triple expansion	Vertical triple expansion
Cost of construction			
Engines (four)	$237,000	$304,000	$425,000
Engine foundations..	8,500	12,600	.
Boilers and foundations required for complete station	45,000	41,500	41,500
Superheater	11,000	11,000	11,000
Economizer .	16,000	16,000	16,000
Chimney (radial brick).	10,000	10,000	10,000
Buildings required for complete station......	60,000	72,000	72,600
Centrifugal pumps..	18,000	18,000	18,000
Four valve engines for centrifugal pumps . .	24,500	24,500	24,500
Foundations for centrifugal pump and engines	1,000	1,000	1,000
Generators, engine switchboard and foundations	20,300	20,300	20,800
Steam piping	10,000	10,000	10,000
*Total cost of station..	$461,300	$540,900	$650,400
Yearly cost of pumping			
Fuel	$ 90,000	$ 85,000	$ 80,000
Wages .	20,000	20,000	20,000
Repairs to machinery...	5,400	6,300	8,100
Supplies, oil and waste	5,000	5,500	5,500
Interest and depreciation	39,200	46,000	55,300
Refunding sinking fund.	13,950	16,350	19,670
Total yearly cost of pumping .	$173,550	$179,150	$188,570

*Above basement floor, not including subfoundation, suction intake, discharge piping.

CENTRIFUGAL PUMPS.

The recent improvements in design in centrifugal pumps, their greater efficiency and low first cost, have brought them prominently to the notice of the engineer. Like most other designs of pumping machinery, centrifugal pumps adapt themselves better to some conditions of service than to others. A pump of this type finds itself in many cases in competition with the best forms of vertical triple expansion, or horizontal, cross compound pump, at least when proposed for large units, and while the latter types are capable of giving a better efficiency, the centrifugal pump is in many instances the best form of pump to install. If, however, the centrifugal pump is to give the most economical results, and at the same time permit of moderate first cost, it is necessary that the pump should run at the highest possible speed consistent with safety and low maintenance charges and that the capacity of the pump and the head should be in a suitable ratio.

In regard to the first point, the most important factor limiting the number of revolutions in the turbine type of centrifugal pump, is the quality of the water passing through the pump. If the water is clean, a high speed may be selected, with every advantage so far as the pump is concerned. Should there, however, be a large percentage of grit in the water, then, of course, the speed of the turbine should be as moderate as possible in order to prolong the life of the internal parts of the pump.

Where dirty water is to be handled the volute type of centrifugal pump is probably better adapted for service. There are fewer short bends and less friction in the volute type than in the turbine, and where conditions admit of the pump being placed close to the water supply, the volute centrifugal is possibly the more economical to install, although some may disagree with this view.

In either the turbine or volute type of centrifugal pump as the quantity increases so the efficiency will increase, and where the head is greatly in excess of the quantity, the reciprocating pump will generally give the best results. Each case, however, must be considered on its merits, for there are many instances in which the low first cost, economy of space, low cost of up-keep and general convenience of arrangement of the volute or turbine types of centrifugal pump will give them a distinct preference over the reciprocating type.

The difference between the turbine and the volute types of pump is that diffusion vanes are used in the turbine pump. The diffusion vanes are so formed as to provide gradually enlarging passages from the periphery of the impeller to the volute, or discharge chamber, the purpose of these passages being to receive the water without shock as it leaves the impeller and to allow it to slow down gradually as it approaches the volute chamber, converting the velocity head into pressure head. There is no fixed policy with regard to the use of diffusion vanes. Some designers prefer them and some prefer the volute type without diffusion vanes. Diffusion vanes are accurate only when the pump is operated at [illegible] rated head and speed. If any change [illegible] either the capacity, head, or speed of [illegible] pump is made, the diffusion vanes become [illegible] efficient for they then to some extent obstruct the passage of the water. In order that the [illegible] fusion vanes may be efficient [illegible] ing edges must be very sharp and [illegible] proximity to the revolving vanes of the impeller and this results in rapid [illegible] both diffusion vanes and impeller [illegible] liquid to be handled is gritty or dirty. [illegible] the centrifugal pump to be installed is to [illegible] subjected to great variations in load, it [illegible] probable that the volute type will work best under all conditions, although there is some difference of opinion on this score.

It may be well to mention here the adaptability of electrically driven centrifugal pumps to small pumping stations where electric power may be cheaply obtained. Turbine centrifugal pumps make a compact and [illegible] unit. There are many locations where [illegible] are required for occasional service, for instance in fire service stations [illegible] centrifugal pumps may be used [illegible] advantage.

The centrifugal pump has a large [illegible] idly widening field, but until its efficiency [illegible] improved so as to remove its present [illegible] in economy it can hardly be expected [illegible] place the reciprocating pump in general [illegible] works service. It is true, however, that the difference in maintenance, [illegible] valve renewals and sustained efficiency [illegible] interest on low first cost is [illegible] centrifugal is in many cases on [illegible] reciprocating pumps for water-works [illegible]

In brief, the field of the centrifugal [illegible] is chiefly in handling large quantities [illegible] at low heads, and usually it can [illegible] sidered for high heads when the [illegible] water to be handled is relatively [illegible] be more explicit, in small plants.

With regard to the choice or adaptation [illegible] engines of the reciprocating type for [illegible] lar services, enough has been [illegible] outline which precedes to indicate [illegible] gines giving low duty and those with [illegible] duty are usually found to yield [illegible] cost for pumping, but in the selection [illegible] type of engine the study of the [illegible] should take into consideration the [illegible] ation [illegible] and, in no circumstances, the [illegible] duty. [illegible] should also be borne in mind that no water- works pumping station does any engine operate at its full normal capacity 100 per cent of [illegible] time. Therefore, in apportioning the charges for or against any one type of engine, [illegible] estimate should be made of just what [illegible] centage of the time and at what average [illegible] or average percentage of its normal rate, [illegible] pump which is selected will be call[ed] [illegible] work during its lifetime. This element [illegible] sideration is often eliminated from [illegible] which are frequently based upon the [illegible] assumption that the pump, once set [illegible] going to run right along at full [illegible] it is relegated to the scrap heap [illegible] especially important, as the efficiency [illegible] engine at half-load is very much less [illegible] when running at its rated capacity, and [illegible] the theoretical engine duty obtained [illegible] is really not a true measure of the results which will be obtained in actual [illegible] Moreover, as the quantity of coal used [illegible] some proportion to the hours [illegible] the amount of coal saved by high efficiency is necessarily reduced with shorter hours [illegible] hence the reduction in operating cost is [illegible] sened and there is a smaller sum available [illegible] offset the increased interest charges [illegible] usually accompany high duty machines.

The stand-by losses reduce the [illegible] materially where the pump is operated [illegible] portion of each day, and it may be said, [illegible] erally, that it hardly pays to go in the [illegible] expensive forms of pumping machinery [illegible] the engine is to be run at a fraction of [illegible] rated capacity, or where it is to operate only a portion of each day.

This brings a common error in the [illegible] of water-works pumping stations. [illegible] to take the maximum total pump[illegible] required, subdivide this into pump[ing] units ity. That is to say, if there are [illegible] will usually develop, however. livision of these units into dif- will allow each unit to be operated apacity, and far more economical n the consumption of coal will would be otherwise possible. In s, it is good practice to give due n to the load factor on the sta- e daily load curve, or the hourly [illegible] little figuring will show that by an subdivision of the units, the sta- worked at its maximum efficiency proportion of the day.

ults of the Water Waste Survey in ukee, Wis.—Conclusions and Recommendations—Increased Meterage Desirable.

summer of 1911 an investiga- loss and waste of water in Mil- made by Roy Palmer and W. The results of the investigation. [illegible] ently issued by the Bureau of d Efficiency. The portions of of general interest are here pre-

ters.—The results obtained from s on meters of about ¾ inch s, made by the Superintendent of Division, showed the average slip meters of the piston type to be t, and the average against 1,955 eters 0.6 per cent. The plunger had been in service from 15 to 23 time the tests were made and had been out for repairs within years. The disc meters had ice about 10 years and had not repairs within the last five years. lue for slip of meters based on [illegible] as these meters were the oldest ce (having been chosen consecu- respect to age of installation be- the oldest one on record), this be larger than the actual. On this test 1 per cent would be a apply to meters throughout the

[illegible] observations made in the typi- investigated, it is assumed that s the average metered consump- cent public consumption, and 1 sessment consumption. Thus 77 the total supply is accounted for, ent is lost or unaccounted for.

able amount of this 17 per cent for public use can be charged to r unnecessary consumption. For ex- ie ten horse troughs measured showed ge daily consumption of 15,300 gals. te sufficient to allow two horses to s. in two and one-half minutes l the consumption for 24 hours 500 gals. Of the 2,500 gals. per 24 ed in one bubbling drinking fountain not over 150 or 200 gals. were actu- [illegible] s were controlled by spring cocks so flow was cut off automatically when use the consumption should be kept 500 gals. or less per day.

bly the most unreasonable use of wa- d in the sections surveyed was that City Hall fountain. This fountain of a circular row of jets which spray ver a cluster of stones, and a sur- g trough from which horses are wa- The circular row of jets, or orna- part of the fountain, showed by test ment, with pail and watch, a daily ption of 108,000 gals., while the con- n of the trough alone, based on the quired to fill it, was 54,000 gals. per [illegible] changed so that the same water used for ornamentation would supply the trough as well, [illegible] ent. The entire consumption could thus probably [illegible] day for both uses, without impairing the ornamental effect desired.

[illegible] plied, as an example, the reduction which could be made by controlling horse troughs to an average consumption of 3,500 gals., bub- [illegible] This would reduce the so-called public con- [illegible] of the total consumption of the district.

That waste wherever found should be stopped, if possible, is generally considered a basic economic principle. However, if the reduction of waste is accomplished at a greater expense than the saving produced, such waste should be allowed to exist or more efficient means of elimination used. For example, if a thorough campaign were entered into which finally brought about the elimination of practically all of this waste of water at a considerable outlay of expense, and the system were allowed to lapse into an equally bad condition within a limited period of years, it would be hard to say whether the effort and expense involved were justified; whereas, if, on the other hand, the locating and eliminating of waste were carried on systematically, and the best methods established locally there would be a great saving to the city during and after the work of elimination, as the waste could be kept low by checking up the different districts from year to year at a small expense.

Should a thorough survey and investigation be made to determine the waste throughout the city, it would probably disclose the fact that most of the unaccounted-for consumption is due to defective mains and service pipes located on the street side of the meter and that the remainder results from the misuse of unmetered and unrecorded connections.

The saving to the city in stopping the waste from mains and service pipes while large, would not be as great per 1,000 gals. as through the metering of the unmetered services, as the revenue paid the city at 6 cts. per 1,000 gals. is at a much higher rate than could be credited to any saving of water now lost through water mains.

The value per 1,000 gals., which could be credited to water main leakage would consist of the actual cost of pumping and distributing the water to the location of leakage, including a fair interest on the necessary investment involved and a properly applied depreciation of the pumping and distribution system.

No fair estimate can be made of the actual cost of delivering 1,000 gals. of water to the average consumer in Milwaukee until the interest on the investment and the depreciation of the system are known. An inventory of the pumping and distribution systems will give figures from which these charges can be made.

The following conclusions are drawn from the facts and figures presented in the report:

1.—That the actual pumpage or consumption of the Milwaukee Water Works system cannot be accurately determined without the use or installation of some indicating or recording meter for checking the slippage of all pumps periodically throughout the year.

2.—That the slippage tests made during the summer of 1911 showed the average reported pumpage at the time the tests were made to be about 9½ per cent in excess of the actual pumpage and that the slippage varied from 1 per cent to 41 per cent on the different pumps.

3.—That although most of the slippage was due to defective hard rubber valves and valve seats which had been badly worn by sand, the station engineers cannot be held directly responsible for this slippage as the city pumping stations are not equipped with the necessary equipment for checking the condition of the pumps.

4.—That there is a loss of approximately 23 per cent of the total consumption in Milwaukee's distribution system due to underground leakage or to illegal use.

5.—That the amount of water used for public purposes is excessive and should be metered and regulated.

6.—That a smaller income to the city is derived per 1,000 gals. from owners of hydraulic elevators and private consumers under the assessment plan than from metered customers, due to the misuse and waste of water.

7.—That the opportunity for illegal use is materially increased by not making the metering of automatic sprinkler services compulsory.

[illegible] freely distributed for the use of individuals [illegible]

9.—That although the engineering and water distribution departments have tried to efficiently maintain the system, the water waste in the distribution system has increased faster during the last two years, due to underground leakage and illegal use, than at any time in the history of Milwaukee.

It has been repeatedly shown from the operation and maintenance statistics of other water systems that while large savings can be made by inspecting and forcing repairs on unmetered premises, the total net saving accomplished after all necessary inspections are made does not warrant the expenditure and effort. It is believed that if the methods listed below for reducing the waste of water are properly executed by an organization similar to the one making the preliminary survey, the immediate saving to the city will more than take care of the expense involved and at the same time will gradually place the distribution system in an efficient operating condition.

It is impossible to state what the total yearly saving to Milwaukee would be if this underground waste were eliminated as the data at hand are insufficient for the determination of the amount of reduction which would be made in the various items of yearly expense of operating the Milwaukee Water Works, or the accrued value to the system due to the increase in its capacity with respect to the ultimate number of consumers.

Such items as expense of coal, station operation and maintenance and the capacity of intake, pipes and feeder mains are involved. Feeder mains are pipes of 16 inch diameter or more. The increase in capacity of smaller sized mains cannot be rightly credited to such a saving. The reduction in coal consumption would, however, be in nearly direct proportion to the water saving which would mean a saving of over $5,000 per year, in coal alone, if a leakage amounting to 15 per cent of all the water pumped during the year 1910 could be stopped.

This amount alone would cover the yearly expense of a good waste survey organization to carry on efficient work in locating bad territories and tracing down trouble. An additional fund would have to be available for bearing the increased maintenance expense required for correcting the defects as they were located.

Following are the recommendations and methods to be adopted for reducing water wastes throughout the city:

1.—That the Common Council pass an ordiance requiring that all private water consumers, including those being supplied under the assessment plan, for elevator service, and for automatic sprinkler purposes, be supplied through approved meters only. The metering of sprinkling systems is thoroughly treated in another publication of the bureau.

It might be stated at this point, however, that the principal source from which illegal use would occur would be through the un- [illegible] tems. Meters should be installed on all such connections and charges made for all registered water which cannot be shown to have been used for fire protection.

The method of computing the water consumed by elevators as used in many places at the present time, which is based on the lineal feet of travel and the displacement of the plungers, is a very poor and inefficient one. The indicators can be very readily tampered with, are often out of repair, and do not in any way make good to the city for the slip or losses which often occur in this type of equipment. For these reasons this method of measurement for hydraulic elevators should be discontinued, and modern plunger or disc meters installed in each elevator service.

The results of inspections made in parts of District No. 1 showed many leaky fixtures in assessment places. Some fixtures allowed water to flow continuously without any apparent effort on the consumer's part to stop such leakage. Assessment plan consumers save their ice bills at the expense of the city by letting water run continuously during the hot days on perishable foods. Metering will check this misuse of water.

2.—That the Common Council pass an ordinance placing the ownership and maintenance of service pipes upon the city or establishing better standards of service pipe construction and inspection by the city to insure the proper installation of the very best materials at a reasonable expense.

3.—That the Common Council pass an ordinance requiring the metering of all public services, including parks, public buildings, fountains and drinking troughs so as to regulate their useful consumption.

The evidence of useless consumption through various forms of public supply as demonstrated by measurements taken on horse troughs, City Hall fountain and bubblers, shows that a very material saving can be brought about through more careful supervision of this form of consumption.

Meters installed on these services would indicate at once where the supply is excessive and would enable the water department to maintain a supervision of such consumption, and keep it within reasonable limits. This addition of meters would enable a water waste survey to be made at minimum cost and would be an advance towards a system from which an accurate determination of the distribution of the total supply could be obtained.

4.—That the Water Works so distribute hydrant wrenches to individuals and corporations as to assure the city a fair income from such use and protection against their misuse.

The use of hydrant wrenches by contractors, corporations and private concerns means a great deal of expense to the city in increased maintenance and repairs to hydrants, and should be abolished when possible. Some other means should be devised to furnish water for the purposes that are now supplied in this manner, so that the use of hydrant wrenches will be ultimately eliminated except for use by the city water and fire departments.

5.—That all newly laid mains be tested by means of some such equipment as a small portable gasoline engine and pu
tight connections under high pr
placing them in service

6.—That the city purchase n
meters or recording meters to
larly to check the slippage of
pumps so that the pumping stat
will show, when sent to the Ci
office, the slip of the pumps
and the actual number of ga
each day. These meters with
log sheet, which is recommende
report of the bureau, will help
engineers to keep the slip low a
City Engineer to know the con
pumps at all times so that the
for consumption and losses can
figured. When the fire sprinkle
sessment plan services, hydra
and public consumption services
the unaccounted-for consumpti
tically reduced to an item of
loss in the distribution system.

It is believed that the city sho
the most practical operating met
slippage tests and at the same
to use the instruments through
months on water survery work

7.—That an appropriation
made to continue the water
work with an organization of
laborers similar to the one tha
the preliminary survey. The redu
ter losses and other beneficial r
city which have been described i
will make the expenditure a pra
ment.

DRAINAGE AND IRRIGATION SECTI

Culvert Practice in Road Building in Connection with Drainage Ditching in Minnesota.

Utilizing the ditch spoil banks for constructing roads is a feature of land drainage practiced in Minnesota. Figure 1 is a view showing a lateral ditch with a finished road grade alongside. The construction of roads in this manner involves the placing of culverts ahead of the dredge which is digging the ditch. If this were not done the road embankment would have to be cut through for every culvert installed. In a paper before the Minnesota Society of Surveyors and Engineers Mr. W. R. Hoag, Chief Engineer, Judicial Drainage District No. 11, gives some data on the practice of this district in culvert work which is of value. Extracts from Mr. Hoag's paper follow:

The work on No. 11 for the approaching season involves the following of two floating dredges and three walking machines whose combined capacity is about two miles of ditch per day, calling for about three culverts. As these small patches of work are scattered over a large territory (occasioning a 15 or 20-mile drive, from one to the other over indifferent roads or no road at all), there is need of a good pair of drivers.

We are now advertising for bids to install these culverts, which call for a lump sum per culvert for hauling the culvert from the field station, placing it, and back filling up to the natural surface and a price per yard for the earth work involved in making the roadbed continuous with connecting roadway. The object of putting this part of the work under contract was to lighten the duties of the Engineering Department as well as to simplify the incidental accounts. We are hoping to place this work with the same sub-contractor, employed by the general contractor to prepare the roadbed. These two pieces of work are closely related, and I believe usually should be put into the contract for leveling the roads whether this is called for in the general ditching contract, or is a separate contract.

The following are the specifications for culverts for use on Judicial District No. 11 for 1912:

(A) All of the culverts shall be of a kind known as corrugated metal culverts, or modifications thereof, to be approved by the Engineer, and must conform to the following requirements.

(B) All metal sheets shall be the best product of reputable mills, to be approved by the Engineer.

(C) Each sheet shall be stenciled by the mill showing the mill at which the plate was rolled and the kind or trade name of metal and shall be stenciled by the mill with the size of the plate and the gauge of the plate.

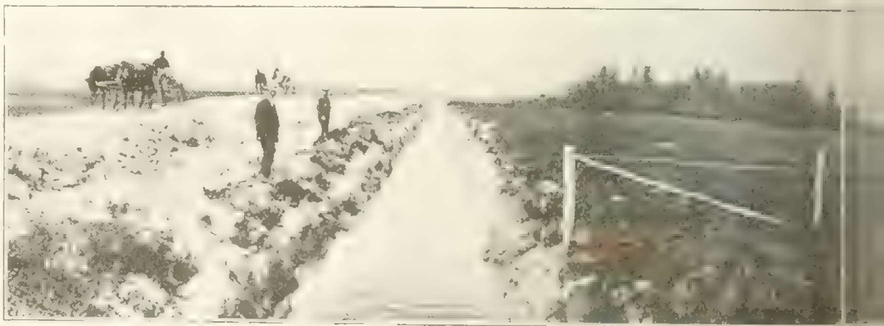

Fig. 1. View of Drainage Ditch with Road Grade Constructed from Spoil Ba
Drainage District No. 11, Minnesota.

(D) Culverts of 48, 60 and 72 ins. diameter shall be made from sheets of No. 12 U. S. Standard gauge.

(E) Culverts of 36 and 42 ins. diameter shall be made from sheets of No. 13 gauge U. S. Standard.

(F) Culverts of 24 and 30 ins. diameter shall be made from sheets of No. 14 U. S. Standard gauge.

(G) Culverts of 12, 15 and 18 ins. diameter shall be made from sheets of No. 16 U. S. Standard gauge.

(H) The following lengths of sheets shall be used for the different diameters of pipes, with 1 in. overlap for joints:

For 12-in. diameter of pipe use sheet 39 ins. long.
For 15-in. diameter of pipe use sheet 48 ins. long.
For 18-in. diameter of pipe use sheet 58 ins. long.
For 24-in. diameter of pipe use sheet 76 ins. long.
For 30-in. diameter of pipe use sheet 96 ins. long.
For 36-in. diameter pipe use sheet 115 ins. long.
For 42-in. diameter pipe use sheet
For 48-in. diameter of pipe use
ins. long.
For 60-in. diameter of pipe use
ins. long.
For 72-in. diameter of pipe use
ins. long.

RIVETS AND SPACING

(I) All rivets used in the const
culverts shall be of a metal appr
Engineer and shall be of 5/16 in.
¾ in. length in culverts of No. 12 g

(J) For culverts made of sheets
than No. 12 gauge stock the rivets
in. diameter and of ⅜ in. length.

(K) All circumferential rivetin
spaced not greater than 10 ins.
center, and all such joints shall be s

(L) Circumferential joints shall
greater distances than 2 ft. apar
along the axis of the culvert.

(M) In all longitudinal joints
placed at each corrugation or ab
apart.

(N) No fractional part of a foot
for in the length of a culvert.

OTHER STYLES OF CULVERT

(O) In case of culverts of othe
styles than that known as corrug
culverts the bidder shall have at
sample of 12-in culvert showing
sign of culvert as to every detail.

[illegible] OF RIVET AND OTHER [illegible]

bidder shall accompany his bid with [illegible] with the bidder's [illegible] kind of metal shall be so represented.

[illegible] letter and referred to in the bid.

[illegible]

freest inspection shall be permitted o from the sheets in stock to the fin- and any unsatisfactory material lp discovered at any time during n of the culverts shall result in of all culverts showing such de- uld any defects appear within a e placing of the culvert all ex- ir or renewal as ordered by the l be paid for by said contractor.

[illegible]

erts shall be delivered and sorted follows:

er of Section ....., T....., R.....

erts shall be delivered to the points d in the case of the failure of the have them so delivered and as- [illegible] 1912, the Engineer shall purchase, if and have delivered and sorted, all cted for but not so delivered and l cost and expense incident thereto ged to the contractor and be de- he amount due the contractor.

ard of the contract to which these relate shall be made within five e date of the opening of bids or after as the Engineer shall have nination and report on the relative [illegible]

Two Illustrations of Drainage Ditching Practice in Siberia.

[illegible]

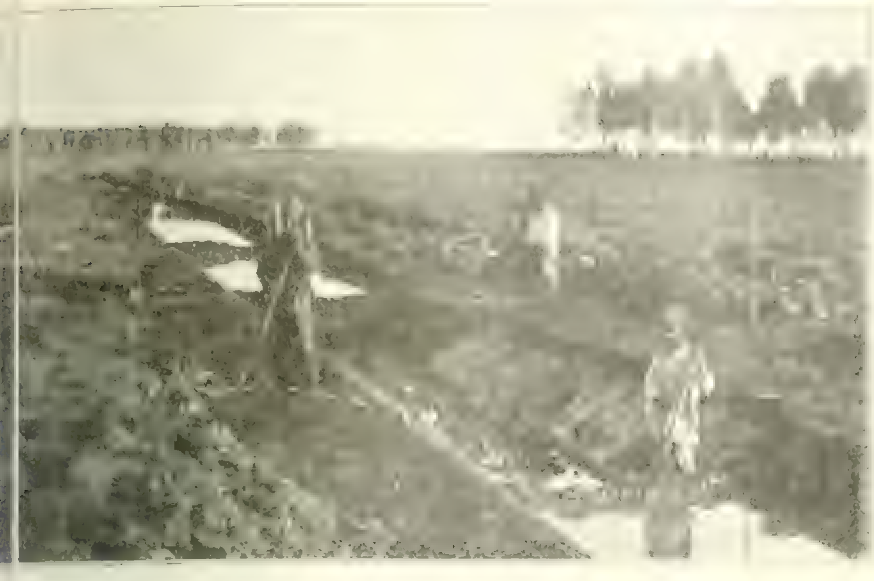

Fig. 1. Digging a Drainage Ditch in Eastern Siberia.

of the editors of this journal and the two views of Siberian drainage ditching which we publish here must tell their own story. So far as the landscape indicates these views might have been secured in southern Minnesota instead of in eastern Siberia. Indeed the people whose pictures appear are not, in these days of civilized Indians and automobilists, [illegible] however, is that of another practice than is familiar to the readers of this journal. A note on the back of the photograph from which the view Fig. 1 is reproduced states that these ditches are 600 miles from a rail- [illegible] machinery is available. The ditches are very good examples of open ditches, being neat in appearance and excellent in alinement and [illegible] of handling the water indicated by Fig. 1 is interesting. By digging the ditch in sections with thin dams of the natural soil left between the accumulation of water does not flood the work in progress at any time, while the removal of the dams with the long handled shovels being used makes a continuous ditch of the consecutive sections. In the second view, Fig. 2, there is shown an interesting timber "drop" at a change in ditch grade and size.

We are indebted for the views described to Mr. W. R. Hoag, Chief Engineer, Judicial Drainage District No. 11, in Marshall and Beltrami counties, Minnesota.

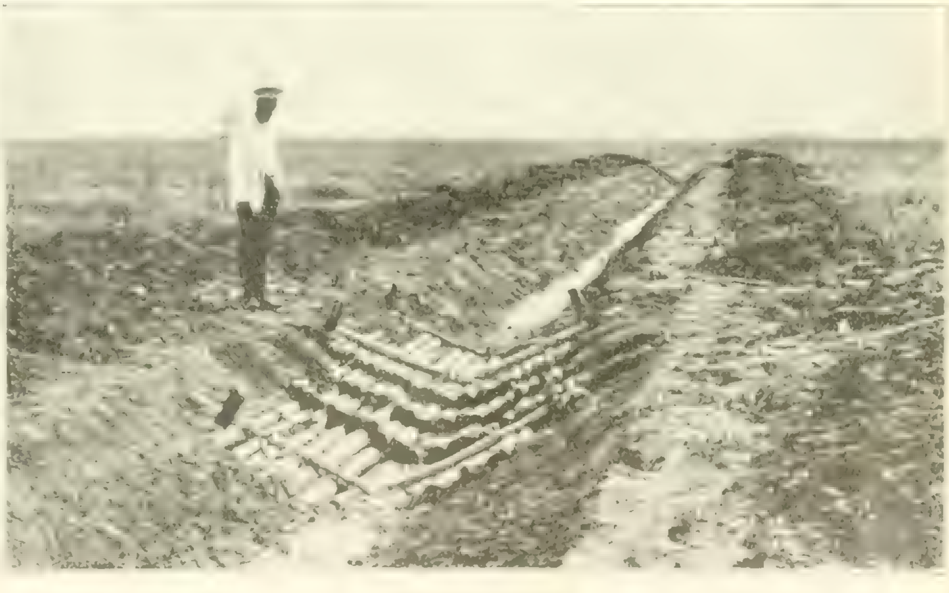

Fig. 2. Timber Drop in a Siberian Drainage Ditch.

The La Salle Street River Tunnel.—The tunnel under the Chicago River at La Salle St., which has been described in former issues of this journal, is practically completed, and it is thought that it will be ready for use by May. 1. The laying of rails is moving along rapidly and the approach entrances are nearly completed. As a precautionary measure only one line will run through the tunnel until the motormen become accustomed to the grades. The design and construction of the tunnel presented several interesting and difficult engineering problems.

RIDGES AND BUILDINGS SECTION

vantages of Suspended Centering for Arch Erection.

[illegible] H. G. Tyrrell, Consulting [illegible]gineer, Evanston, Ill.

ethod of erecting arches without timrs underneath is not new, for it was [illegible] England more than a [illegible] possesses so many advantages [illegible] little used, that attention is called to important factor in economic con-

ethod was first proposed in 1812 by inguished English engineer, Mr. Telford, who made plans for bridging Menai Straits with a single 500-ft. cast iron arch. He proposed erecting voussoirs on centers supported by a system of guy ropes or suspenders from frames 50 ft. high on the abutments, the estimated cost of this bridge being £127,300. During the same year, a proposed method of erecting arches without false work was published by John Isaac Hawkins, who claimed priority over all others for the invention. In 1825 Mr. John Seaward published a plan for bridging the Thames at London with a single cast iron arch of 600 ft., his plan being similar excepting in the erection, to that proposed for the same place in 1801 by Thomas Telford. The successive voussoirs were to be guyed back to shore by rods attached to temporary towers on the abutments.

In 1847, Mr. I. Brunel proposed spanning Menai Straits at Bangor with two cast iron arches of 350 ft. each, 105 ft. above high water, and a similar 350-ft. arch 20 ft. above high water over the Straits at Conway, and he developed a method of erecting them by cantilevering the voussoirs out symmetrically from the piers, with corresponding arch blocks at each side, held together over the piers with rods. The plan necessitated the use of half arches or anchor arms at the ends to balance the cantilever arms over the water, and showed that [illegible] at the [illegible] od was an exposition of cantilever erection, and yet [illegible] the arch [illegible] of the piers by tension rods. About the same time Mr. Stephenson proposed spanning Menai Straits with two cast iron arches of 450 ft., to be erected by the method outlined in 1812 by Mr. Telford and some years later by Mr. Seaward. A modification of these methods was put into [illegible] bridge over the Mississippi River at St. Louis.

In recent years similar erection methods have been used for several concrete bridges in America, including those at Belvidere, Ill., (1906), with four spans of 81 ft., and two bridges in Virginia in 1909 at Portsmouth and Richmond, with spans of 53 and 50 ft. respectively. In the year 1910 Mr. Charles Worthington published a method of erecting a great steel arch with the unprecedented span of 1,800 ft. over the St. Lawrence River at Quebec, by suspending the successive voussoirs from cables, and when all would come to their approximate position, they would be lowered to their bearings.

Other erection methods with centering completely or partially suspended have occasionally been used in Europe. Professor J. Melan when designing the Laibach bridge, attached the timber centering to the lattice reinforcing girders which were 7 ft. apart, in order partially to relieve the timber centering of some of its dead load. Somewhat similar methods were more recently used for the Alexander III metal arch at Paris.

Pile and Timber Centering.—Timber centering for arches of stone and concrete have long been made in the most rigid manner, the object being to avoid any possibility of settlement or deformation which would alter the line of pressure in the arch ring. Much greater expense has therefore been incurred on the centering for bridges of masonry than of steel. Great care was also needed in the planning and operating of devices for removing the timber after the masonry was completed, the most common practice being to block the centers up on wedges or boxes filled with sand. Radial bents were used for the Piney Creek Bridge at 16th St., Washington, and after the bridge was completed, the bents could be revolved down onto the ground. Another rather doubtful plan used on small work, is to make the centering supports of small sizes and slender, only strong enough to support their load when well braced together. To lower the timber lagging deck, the bracing between the supports is removed, which allows the support to bend or buckle enough to make the timber work easily removable.

Objection to Ground Supports.—The objections to pile and timber centering supported from the ground are many, the most serious one being that the timber so greatly obstructs the water way as to be in constant danger of destruction. In times of freshets, it is a certain collector of drift and debris, and when enough accumulates to form a dam, a washout is probable. It may also be destroyed by fire, ignited from adjoining buildings, engines or smoke stacks, or even through the carelessness of workmen, and as these temporary works are often not insured, the loss cannot be recovered.

The financial loss from a washout includes not only the loss of the timber work itself, but also such portions of the superstructure as are not self supporting at the time, which may amount to nearly the whole cost or value of the bridge, and generally the whole superstructure is lost. The danger in floods increases with each bridge, for the floating timber washed away from one bridge may accumulate to such an extent against another one lower down stream as to cause it to fail, and the amount of floatage may finally be so great as to carry away everything in its course.

Timber centering, especially on large work, takes a lot of time to build, and after the job is finished it is difficult and expensive to remove. Piles must either be pulled out or sawed off far enough below water to form no obstruction. Pile pulling is liable to loosen the subsoil so much as to cause scour or danger of settlement of the piers, and if the foundations are damaged the whole bridge is in peril. Centering with underneath supports is dangerous also for highway bridges over railway cuttings, for the timber may too greatly diminish the safe headroom over trains. A case of this kind recently came to the attention of the writer when inspecting a concrete arch highway bridge over several lines of railway at Pasadena, Cal. It was temporarily supported on timber work, and there was not only insufficient space between the tracks for substantial supports, but the timber that was used was a menace to trains, especially those with flat cars widely loaded.

The difficulty in removing timber centers is also an objection to them. Temporary supports on wedges or sand boxes are the best, but sand will sometimes fail to work unless it be wholly of clean large grains. Any such foreign material, as loam or clay, or even a soft or poor quality of sand, will cause the sand to stick, and prevent it from running from the sand boxes under the arch supports. The objection to timber centering supported from below is constantly increasing on account of the rising cost of timber and the difficulty of getting it in reasonable time, for as the cost of centers becomes greater, it is more difficult for the best class of permanent bridges to compete with temporary ones of steel which need less false work. Large spans proportioned for heavy loads are generally preferable to short and light ones, but the need of heavy and expensive timber centers may make their cost prohibitive. This was the case with the proposed great Hudson Memorial Bridge at New York, with a span of 703 ft., where the load on the foundations would have exceeded 2 tons per square foot over the whole area beneath the bridge. Indeed, in many cases high class concrete bridges are absolutely impossible of construction, if dependence must be placed on pile and timber falsework. Deep gorges, or rapid rivers subject to frequent freshets and heavy floods of ice and drift, can be spanned only by cantilevers, or suspensions, unless centers for a concrete arch can be supported overhead. And yet many places, such as rocky gorges with solid, unresisting walls for skew backs and abundance of stone, are the most naturally inviting for a masonry arch. It appears, therefore, that the need of pile and timber centers is a constant hindrance and drawback to progress in bridge building, and to the best and most permanent class of work. The fine large concrete bridge recently placed over the Delaware River, near Portland, Pa., would have been an utter impossibility if piles and timber work were the only means of supporting the centers, for the river at the site has a rapid current and much floating material and a clear waterway was imperative.

Ground supports for concrete bridges are lacking, also, because of their liability to settlement and distortion through shrinkage of the timber. Stone and monolithic concrete arches are assumed to have rigid supports, but any movement of the centers is liable to alter conditions. The great arch at Walnut Lane, Philadelphia, the centers for which settled 3¾ ins., was a cause of much anxiety, even though the safety of the arch may not have been greatly threatened. In this case the timber was stressed at too high a unit value, for in another bridge of nearly the same size, over the Sitter River in Switzerland, where the timber was stressed to only half the unit, the settlement of falsework under load was only 1¼ ins. It should in any case be firm enough so monolithic concrete ribs will not be destroyed with cracks.

Cost of Pile and Timber Centering.—Timber centering is frequently one of the largest cost items in concrete bridges. In the Walnut Lane bridge it amounted to no less than $13.80 per cubic yard of concrete. This expense item increases very rapidly with the span and height. For smaller and lower bridges it may not exceed $2 to $3 per cubic yard, but even that is large enough. The
cost of falsework on the Conne
Bridge at Washington D. C
on which there was a salvag
and the cost of framing the
per M. ft. B. M. Falsework
River bridge in Switzerland,
of 259 ft. and deck 261 ft. ab
would have been in America

Need for Something Better.—
something better and less exper
fore, evident, and this need
creasing with the rising cost
that each year makes conditio
continue using pile and timbe
high cost would tend ultimat
permanent bridges in preferen
ones, and in a short time wh
of structural timber is exhauste
must eventually be found.

Steel arch centers have lat
on two or more large America
some measure of success.
this purpose are said to have
sidered, though not used, by
Bush, for the Paulins Kill co
which is 1,100 ft. long and
the same year (1909) Mr. Bus
into execution on a large b
Delaware, Lackawanna & Wes
the Delaware River, near Portl
complete sets of three-hinged
used, so that two concrete s
erected at the same time. Th
passage way for flood water a
was so great a peril as to make
impossible. About the same tin
J. Watson used three-hinged s
ters for the twin ribs of the 28
Rocky River, near Cleveland,
found to be less expensive tha
falsework was first placed f
two ribs, and after it was finis
was lowered and moved
building the other rib, as
done with the combination tim
falsework of the Walnut L
Philadelphia. For the Rocky
the cost of metal falsework w
deducting $7,000 for portions of
were afterwards used in the per
and $2,500 for the salvage va
mainder, the net cost of the
only $17,200.

Suspended Centering.—Suspe
tering consists of a lagging
by vertical hangers from overh
by members radiating from th
porary towers on the abutment
of these two methods, and f
about 100 ft., cables can be f
ends to timbers buried in the
dimension of all parts can be
puted in the office, and the e
each vertical suspender marke
ing, so that when the parts ar
supported lagging deck will be
The framing may be made of st
wood pieces formed to the d
the intrados.

To facilitate erection of the t
it is convenient to hang smal
each suspension joint of the
make the length of hangers s
the lagging deck is in its prop
suspended signals will lie in a
and can be checked by a man w
builder's level. Suspenders a
made of rods ½ to ⅞ in. diam
buckles for adjustment, and to
is fastened pieces of gaspipe 2
eter, which carry the longitu
supporting the lagging. Th
other approaches should be b
arch, so they may be used as s
cable towers. Concrete arche
a solid monolith, for when the
ter is in position, concrete may
for the arches, laying it prefera
voussoirs. When it has ass
position, the joints between the
be filled with a rich concrete
and in 48 hours after the co
placed, the centers can be lowe
over to an adjoining position.
is self supporting, the whole r

[illegible] lowered or removed, and the [illegible] completed according to [illegible] braced together as [illegible]

[illegible] Suspended Centering.—[illegible] eath metal arch ribs are, there is for improvement, and the greatest [illegible] doubtless result from the [illegible] centering as [illegible] elford and his contemporaries from [illegible]. By this method, centers can be [illegible] from overhead cable, or they can [illegible] ht frames guyed to shore by rods [illegible] diating from the top of temporary [illegible] the abutments, as proposed by Mr. [illegible] of these methods [illegible] em, have the advantage of leaving space beneath the bridge open and [illegible] of flood water and drift [illegible] quickly [illegible] at small [illegible] r the completion of one bridge [illegible] d centers can be removed and [illegible] ble over deep cataracts, like Niag- [illegible] ubject to heavy floods and drift. [illegible] decided advantage also over [illegible] uttings, where supports under- [illegible] e an obstruction to trains.

[illegible] rts are easily put in place, and [illegible] on metal towers with adjustable [illegible] g them suitable for various posi- [illegible] ns. The ease with which the [illegible] lowered is one of the greatest [illegible] se, they may be raised and used [illegible] for the delivery of material [illegible] ning parts of the bridge, or they [illegible] the cables can be accomplished [illegible] turnbuckles on the cables or in [illegible] uspenders, and when the whole [illegible] the cables can be taken down, [illegible] spools, and shipped to another [illegible] kind of centering is especially [illegible] ribbed concrete arches, where [illegible] ver for the other one, but it [illegible] sed for arches with solid slabs. [illegible] lvantage of suspended centering [illegible] te bridges are made possible in [illegible] they would otherwise be pro- [illegible] Alexander III [illegible] bridge at Paris, river obstruction [illegible] permitted, and the centers were [illegible] ported from above. With cable [illegible] concrete arches are no longer [illegible] hic but in alternate voussoirs, [illegible] s tend to balance each other. [illegible] are made of previously moulded members, the advantage of suspended [illegible] is increased for the pieces can then [illegible] directly from the cables with few [illegible] ath supports.

[illegible] Forms.—In concrete building [illegible] forms are sometimes one-half [illegible] cost. Continuous efforts have [illegible] made to reduce this cost as [illegible] ssible, and forms have occasionally [illegible] e of concrete, which can be set in [illegible] then filled with other concrete, the [illegible] the shell and center forming [illegible] n completed. This plan was used [illegible] ns in the Bush Terminal Building. [illegible] ious to that one some buildings in [illegible] Tiles have been similarly used and [illegible] n is especially suitable for columns [illegible] purely compression members. Ad- [illegible] metal forms are also used, in which [illegible] number of similar or duplicate parts [illegible] st. The cost of forms is also reduced [illegible] tions are separately moulded and al- [illegible] harden before erecting. Many of the [illegible] ation bridges over streets through the [illegible] vanston, Illinois, were made in this [illegible] span slab bridges were moulded in a yard equipped with concrete ma- [illegible] and the bridges were then shipped on [illegible] heir permanent site, where they were [illegible] and placed in position.

[illegible] advantage of experience in building [illegible] ion, it will be seen that the cost of [illegible] n be similarly reduced for concrete [illegible] For not only can suspended center- timber work, but previous [illegible] when cast solid would be excessive [illegible] erected first, which can be filled solid with other concrete when in place. A convenient method is to cast such shells in sections 5 to 6 ft. long, weighing not over 2,000 lbs., with open tops, and sides and bottom 2 to 4 ins. thick. A fairly rich mixture should be used for these shells, of about one part of cement with three of fine aggregate. Adjustable steel moulds are convenient for this purpose as in building construction, and a large number of pieces can be cast in a short time, and at small cost. Short sections of gas pipe can be cast into the sections to receive dowel pins for joining them together. Holes can be left in the sides and bottom of the sections for lifting them, which can afterwards be filled. The sections can then be placed in position by an overhead cableway, working simultaneously from each end, and when they are suspended in their correct positions they may be lowered till the joints come to a bearing. The inside of the shell can then be filled with concrete reinforced with rods, thus forming solid arch ribs. The center can then be removed and a superstructure erected with floor supported on spandrel walls or columns. In building construction the strength of the concrete forms or shells is usually not considered as resisting compression. But since it evidently must take a portion of the stress, there is then an extra factor of safety. In one case where suspended centering and separately moulded members were used, a saving of thirty per cent was claimed over a corresponding bridge with solid filling erected on pile and timber false work.

Vitrified Paving Brick.—The National [illegible] recently has issued a pamphlet relating to vitrified paving brick. It is fully and attractively illustrated. The quantity of this paving material now in use in American cities is shown. These brick are manufactured from the less refractory fire clays and shales. No two deposits of these shales or clays are exactly alike, says the pamphlet. They do not burn alike as to color or amount of heat required. The raw materials must receive slightly different treatment at each factory.

A Diagram for Determining Weights of 3/8-in. Steel Plates.

[illegible]

In taking off weights of steel structures, I have found that by using the accompanying diagram considerable time can be saved in getting the weights of the various sizes of lateral and other small plates.

Ordinarily the weight of a steel structure is found by taking the weights of the main members and adding a certain per cent for details, but when a weight with a fair degree of accuracy is required, the weights of all small plates can be taken from the diagram, saving numerous calculations or references to steel hand books. In this case a very small percentage is added for details, thereby de- [illegible]

[illegible] 1728 [illegible] inches. This is the equation of the curves shown on the diagram. The figures on the various curves represent the weight of a plate whose dimensions intersect on the curve. In case the intersection falls between two curves, the weight can be interpolated.

Example.—Find weight of a 3/8-in. steel plate 11½ ins. wide and 18½ ins. long. Under "width in inches" find 11½ ins. and read across to the right to the intersection of the length 18½ ins., which is marked "X" on the diagram. This point falls very nearly half way between the curves marked "20" and "25," thus giving the weight of about 22½ lbs. The actual weight of this plate by calculation [illegible] 1728 [illegible] lbs., which is about ½ of 1 per cent more than the value taken from the curve.

Other weight diagrams can be made up for the most common thicknesses, or else one diagram will do for all, by multiplying the weight found on the diagram by the proper ratio.

The Novo contractor's pumping outfits, manufactured by the Novo Engine Co., of Lansing, Mich., are widely used for draining trenches, etc. The pumps have large water ways which adapts them to service where muddy water is handled.

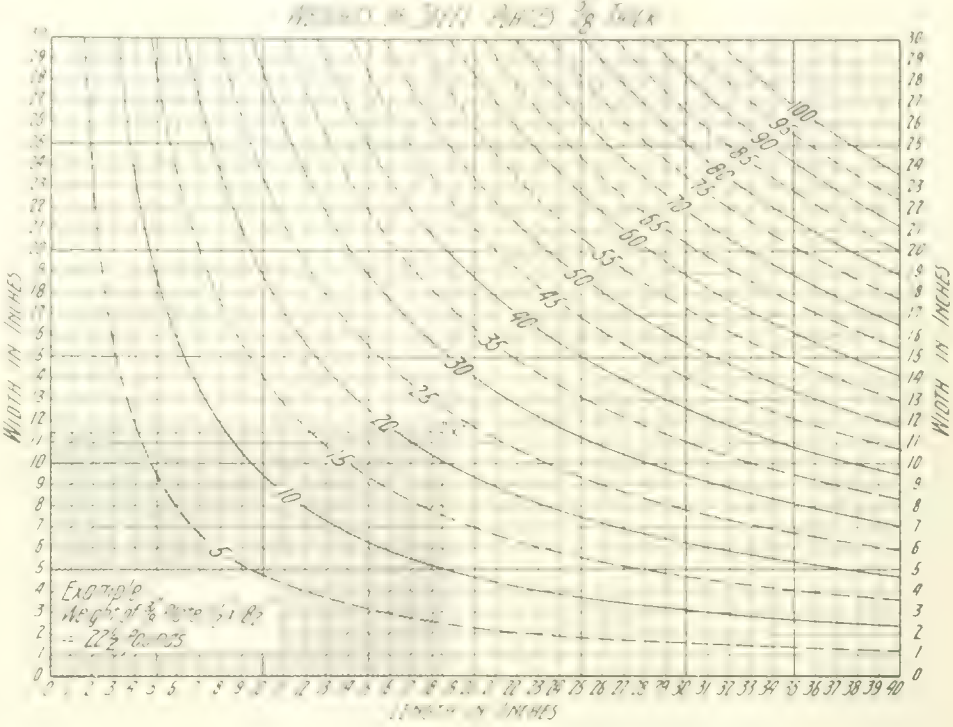

Diagram for Determining Weights of 3/8-in. Steel Plates.

STEAM AND ELECTRIC RAILWAY SECTIO

The Merits and Demerits of Reinforced Concrete Tanks for Railway Water Service.

Reinforced concrete does not compare favorably on the bases of cost and tightness with wood and steel as a tank material for railway water service. This fact, we may assume from the recent report of the Committee on Water Service of the American Railway Engineering Association, accounts largely for the inconsiderable use by railways of reinforced concrete tanks. This committee report is a suggestive one to those interested in the development of reinforced concrete and we publish it nearly in full as follows:

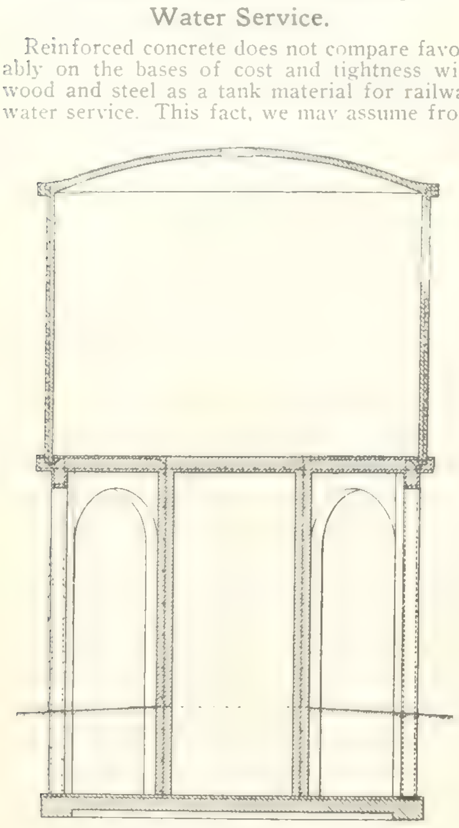

Fig. 1. Suggested General Plan for a Reinforced Concrete Substructure and a Reinforced Concrete Water Tank.

Reinforced concrete tanks have been built either as standpipes or as elevated tanks on concrete towers. The advantages are: (1) Low maintenance cost; (2) great durability. This may be true only of well-designed, well-built and water-tight tanks.

The disadvantages are: (1) Innovation in railway service; (2) imperfections in materials and workmanship; (3) greater first cost; (4) porosity of the concrete; (5) shrinkage of the concrete; (6) stretch of the concrete; (7) difficulty of waterproofing; (8) effect of frost on saturated concrete; (9) ugliness; and (10) immovability.

Objection No. 1 will be removed in time if the concrete tank develops sufficient merit; No. 2 is more incidental than fundamental, but the making of a strictly uniform high-grade monolithic concrete construction without local imperfections is difficult and requires highly efficient workmanship, and No. 3 may be justified by the advantages named. It can be shown in some cases that a reinforced concrete tank costs less than a steel tank of like capacity, but in such cases the design is probably sparing in the use of steel and concrete. A thin shell and a high stress in the steel are liable to result in a leaky tank. Generally, when the stress in the steel is low enough and the tank shell thick enough to insure against leakage, the cost of a reinforced concrete tank will be greater than that of a steel tank.

Objection No. 4 is the root of much of the trouble with the concrete tank. It is not an insurmountable difficulty. Careful selection and grading of sand and stone, liberal use of cement, complete and uniform mixing and proper placing will make a concrete impervious under the pressures required for railway water service. Serious leaks will be due to local imperfections rather than to porosity if the tank has been well-designed and constructed of a proper grade of concrete.

Objection No. 5 is a more fundamental difficulty. Shrinkage of concrete in setting is inevitable and it is increased by the large proportion of cement required in water tank construction. This frequently produces cracks, especially along the joints between successive courses of concrete. Careful and proper making of the joints and judicious steel reinforcement are necessary to prevent serious shrinkage cracks. The steel dam mentioned in the accompanying general specifications is a desirable thing in the joints when the concrete in the first half of the joint has hardened before the concrete in the second half is placed.

Objection No. 6 is a serious difficulty in the shell of the tank due to elasticity of the steel reinforcement and its stretch under the water load. Any concrete, however dense and impervious in its unstrained condition, can be stretched beyond its breaking strength and fine cracks through which water will flow under pressure may be opened therein by stressing the steel within the elastic limit of the latter. If the tank could be maintained constantly full of water the moderate leakage due to such stretch would generally stop through deposits of suspended matter from the filtering water. In some cases this would be assisted by chemical precipitation. But, under general service conditions, there is a wide fluctuation of pressure and the elastic recovery of the steel as the pressure drops appears to break down the plugging action of the leakage above indicated in those cases where the steel is stretched materially beyond the breaking point of the concrete.

Herein appears to lie a formidable handicap of the concrete tank as a competitor of the steel tank on the basis of cost. The effectual remedy appears to be the combination of that low stress in the steel with that increased thickness of the shell which will limit the stretch of the concrete so that cracks permitting the filtration of water will not be opened. That increases the cost of concrete and steel, making the latter approach the cost of steel in a steel tank.

Your committee is of the opinion that the ultimate stress of the steel without assistance from the tensile strength of the concrete should not exceed 10,000 lbs. per sq. in, and that the minimum thickness in inches of the concrete at any point should be such that when the total tensile stress due to water load at that point is diminished by 3,000 times the sectional area in sq. ins. of the steel at that point, the remaining water load will stress the concrete at that point 300 lbs. per sq. in., provided that in no case shall the thickness of concrete be less than 4 ins. Your committee does not say that concrete will not break under a tensile stress of 300 lbs. per sq. in., although experiments indicate that concrete of the high grade required for tank construction may have an ultimate tensile strength of 400 to 500 lbs. per sq. in.

This specification as to thickness of concrete is an arbitrary one intended to secure a minimum and reasonable thickness somewhat in excess of the thickness of concrete in tanks already constructed in which the stress in the steel has been 12,000 lbs. or more per sq. in., resulting in some leakage. The primary object is to secure a minimum thickness of wall in which tension cracks, if any, will be localized and minute and through which it would be difficult for water to pass. The size and the arrangement of the reinforcing rods have an important bearing on the minimum permissible thickness of concrete. The shrinkage of the concrete around large rods in thin wall is liable to crack the concrete.

The trouble from stretch of the c crete raises the question as to the practicab y of designing a tank shell to be in comp sion. This could be accomplished by build the shell as a series of short, flat, abutting rch convex to the center of the tank with e reinforcing steel supported by exterior liste forming the abutments of the arches, indi cated in the suggested plan and elevati of a section of concrete tank shell designe o be in compression appearing on the accom ying drawing, showing a general plan and ne section for a suggested concrete st pi The radius of the arches may readily pr portioned to make the total compres n the concrete equal to the total tensior steel. The reinforcing rods between th il ters may be covered by metal lath and me plaster. The density and impervious s the concrete in the arches would be in as by the water load. The polygonal forn tank with its recessed panels would br monotony of a plain cylinder and give t ta an improved appearance. Doubtless dil ilt would arise in the execution of such a si but without going into details, the sug sti is offered for what it is worth.

Objection No. 7 arises from 4, 5 and 7 problem is to find some foreign su which, when incorporated with the c will close the percentage of voids fou in the best grade of concrete, or, when to the surface, will be impervious and crack or peel off. In either case the is aggravated and the waterproofing nullified by the shrinking and stretchin concrete unless the latter is properl re forced against shrinkage and stretch. ar in service prove that it is practicable t concrete impervious under ordinar ta pressures by proper selection, gradi mixing of materials. Soap and alum porated with the concrete in the mak a applied as washes to the surface are p the best proved and most efficient mater effective waterproofing of concrete.

Objection No. 8 is a danger which ll eliminated by successful solution of a proofing. Since the latter will requir base a very dense concrete, the qua water passing through the latter wil small that the action of frost can hav lit or no effect on such close grained and a cally dry concrete. It is a fact, howev ti in our northern latitudes much disinte ti of porous concrete on the water line o ab and streams due to the annual effect frost season is apparent.

Ugliness is a sin chargeable to some lway structures other than water tanks. Per ps a little additional homeliness is not unp io

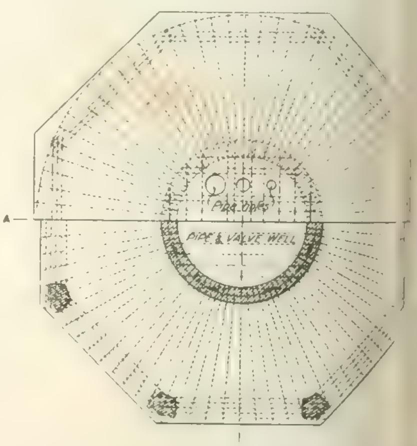

Fig. 2. Half Foundation and Half Dec Plan of Substructure for Water Tan

by the grace of utility. M
rete, especially a form-marked,
d, leaky efflorescent tank shell pos-
k of beauty which is not hidden b
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el tank can be and such tanks are
m place to place to meet changing
ts of railway water supply. Dis-
new and better water supplies some-
changes in locations of tanks de-
concrete tank should be located
ose points where there is no proba-
ange.
ing the obvious merits of the con-
this committee sees no reason why
gaged in permanent reconstructions
vater supplies should not favorably
beginning in reinforced concrete
ruction. Water-tightness is the im-
oblem. The stability of this form
tion is well established.
ting concrete tanks are practically
. Generally, leakage is immaterial
and objectionable principally as a
appearance and a possible danger
frost. It is more often the result
perfections, bad joints, and a thin
high stress in the steel than poros-
rmeability in a proper grade of con-

ven amount of available storage and
[illegible]
osal of sludge, the standpipe is
more economical than a tank on
notwithstanding it is practicable to
ncrete tower 20 ft. high including
t an expense less than the cost
ation and lower 20 ft. of a con-
e. This refers to railway serv-
ntities of water required only at
vations, the concrete tower may
more economical than the standpipe.
struction of the concrete tank on the
ubstructure would not differ mate-
that of the concrete standpipe, and
specifications for the latter may
nerally to the former.
structure may also be used for sup-
nks of wood or steel. Its general
sists of an octagonal foundation slab
onal deck slab, the latter being
the reinforced columns and the
pe and valve well resting on the
n. The plan shows the general ar-
the reinforcement. The founda-
ributes the load under its entire
s the unit load low and is favorable
m settlement, if any. On a rock
n this slab may be omitted. The
ell serves for enclosing and frost-
the piping and valves, helps to sup-
deck and makes the entire sub and
cture stable against wind pressure
ssistance from the surrounding col-
he plan contemplates a substructure
than 20 ft. high above the ground,
case the columns require no lateral
In the construction of the substruc-
ordinary approved building loads,
materials and workmanship for rein-
ncrete are acceptable and sufficient.
tion of waterproofing does not enter
is desired to make the deck slab the
the tank when the latter is made of

general plans are submitted, not as
ich should be adopted, but as sug-
for a number of good designs which
made.

ABBREVIATED SPECIFICATIONS.

ation.—In earth, excavation for the
n should be as deep as the lowest
e. In rock, only the excavation for
e box should be carried below the
frost. In earth, the bottom of the
ns should be thoroughly tamped. If
will not sustain the total load, in-
wind pressure, without material or un-
tlement, the foundation should be sup-
n piles of the number, size and arrangement as determined by the engineer. Such piles should conform to the specifications of this association for piling as selected by the engineer.

Foundation.—The foundation should be monolithic concrete of the form and dimensions as shown. If the depth of frost is excessive the foundation may be carried on broken rock uniformly compacted in the bottom of the excavation. The top of the foundation should be above the surface of the ground.

Concrete.—The concrete in the floor, shell and roof shall be a thoroughly uniform and dense mixture of cement, sand, stone and water, made and laid in accordance with the specifications of this association for reinforced concrete. The volume of the sand shall be in excess of the voids in the stone. The volume of the cement shall be in excess of the voids in the evenly mixed sand and stone. The excess of sand and cement shall be such as will give the greatest attainable density in the concrete. The volume of water shall be sufficient to give the concrete a fluidity that will cause it to flow and mold itself into the forms readily and completely. An unnecessary quantity of water shall not be used. The engineer shall determine the above specified voids and proportions.

In the foundation, the concrete shall be mixed in the proportions specified by the engineer and it shall fulfill the requirements of the specifications for concrete of this association. The concrete should preferably be mixed by batch mixing machines. The method used shall yied a complete and even mixture. All dirt and foreign matter shall be excluded from all materials, concrete and stages of the work.

The concrete, after mixing, shall be poured and worked into final position in the forms before its initial set is complete, and it shall not thereafter be disturbed. As it is thus placed, it shall be thoroughly worked throughout by flat thin bladed tools in a manner that will eliminate all voids and air pockets and produce unbroken mortar faces against all forms and secure perfect contact with every part of all reinforcing rods therein.

Joints.—The surface of concrete in joints should be free of laitance and all foreign matter and should be rough, fresh, clean and wet when concrete is laid thereon. The surface should be covered with a heavy coat of grout or mortar immediately in advance of placing concrete thereon. The surface should be thoroughly tooled, scrubbed and washed preparatory to the application of grout and concrete. The new concrete should be worked into complete contact with the old concrete. Muriatic acid or equivalent may be used as a help to the tooling and scrubbing, but all of the concrete penetrated by the acid should be entirely removed.

A metal dam of non-corrosive metal like copper should be inserted in the concrete joints intended to prevent the passage of water. The metal should be driven edgewise into the first half of the joint to a depth equal to half the width of the metal before the initial set of the concrete is complete. The contact between the concrete and the metal should be complete and perfect. The edges of the metal should be turned over 90° for anchorage. Joints in the metal dam should be lapped at the ends in a manner that will secure water-tight joints. This specification for joints does not necessarily and preferably may not apply to the joint between the floor and the foundation.

Forms.—The concrete forms should be made of dressed and matched lumber or of metal. They should be accurately made and erected, be water-tight, and should have ample strength and rigidity to prevent bending and warping under the load and action of the concrete. They should be erected in such manner as will permit the concrete to be poured and worked as above specified.

Reinforcement.—The concrete shall be reinforced by metal rods of the kind, form, size, number and arrangement as shown. They shall be maintained in required position as they are buried in the concrete, at which time they shall be free from dirt, paint, oil, grease and scale. Splices in a line of rolls shall be lapped far enough to develop the full strength of each rod. Throughout the splice, the ends of the rods making it shall be far enough apart to develop maximum total adhesion of the concrete. Unnecessary splicing shall be avoided. No splice shall be opposite a splice in an adjacent line of rods. The rods shall be metal rods, plain or deformed. Their tensile strength shall be not less than 50,000 lbs. per sq. in. Their elastic limit shall be not less than 30,000 lbs. per sq. in. Their ductility shall be such that any rod can be bent 180° on a radius equal to 2 diameters or sides of the rod without sign of fracture.

Stresses.—Assuming the metal rods to carry the water pressure and other stresses without aid from the tensile strength of the concrete, the stress per sq. in. in the rods should not exceed 10,000 lbs. Vertical reinforcement in the shell, between the shell and the foundation and across joints in the concrete should be ample to prevent opening of cracks in the concrete. Reinforcement in all necessary directions should be ample to prevent as far as practicable the opening of cracks in the concrete due to its shrinkage in setting and to its stretching under the water load. The minimum thickness in inches of concrete at any point should be such that when the water load in pounds at that point is diminished by 3,000 times the sectional area in sq. ins. of the metal reinforcement at that point, the remaining water load will stress the concrete not more than 300 lbs. per sq. in. at that point, provided that in no case shall the thickness be less than 4 ins.

Loading.—The weight of water should be assumed to be 63 lbs. per cu. ft. Wind pressure, acting in any direction, should be assumed to be, in pounds, 30 times the product of the height by two-thirds of the diameter of the tank in feet.

Waterproofing.—A uniformly dense mixture of concrete as herein specified should be the primary expedient to secure water-tight concrete. This may be supplemented by mixing with the concrete some form of waterproofing compound of proved efficiency or by washing the concrete surface therewith, or by both. The engineer shall select the waterproofing material and determine the proper proportions and methods of application. Waterproofing by the application of rich cement mortar may be acceptable if the foregoing specification for making joints in concrete work is complied with.

Waterway Required at Culverts for Drainage Areas in Eastern Kansas.

A new waterway formula based on abnormal conditions of run-off in eastern Kansas, was presented in a paper by W. C. Hoad, Engineer, Division of Water and Sewerage, Kansas State Board of Health, Lawrence, Kan., read before the Kansas Engineering Society at its convention in January. In the territory named, which might properly include most of Missouri and eastern Oklahoma the downpour rate over limited areas is very heavy. Observation for a number of years has shown many failures of culverts in this territory because of the use of formulas which, while perhaps well enough suited to other conditions, were not suited to the conditions here. These statements explain the wide difference between the new formula and those by Professor Talbott and the Chicago, Burlington & Quincy Ry. with which it is compared in the table and diagram given here. Mr. Hoad's paper follows:

The principal factors that combine to determine the maximum rate at which flood waters will be delivered at a culvert may be stated in the following terms:

(1) The size of the drainage area tributary to the culvert.

(2) The maximum depth of rainfall for a period of time approximately equal to that required for the concentration at the culvert of run-off water from all parts of the drainage area.

(3) The character of the drainage area so far as this may affect the ratio of the rate of run-off to the rate of rainfall; for example,

the permeability [illegible] and the slope of its surface and [illegible] of the vegetation upon it.

The relation of the size of the drainage area to the run-off is obviously a simple ratio; the other two factors remaining the same, the run-off is proportional to the drainage area.

The ratio of the maximum run-off rate to the corresponding rainfall depends upon so many unrelated variables that any general mathematical expression for it is out of the question. For a restricted area, however, over which ordinary conditions of soil, topography, climate, and the like, are tolerably uniform, a value may be assigned to this factor which will yield approximately correct results.

Evidently, a proper combination of factors (2) and (3) should furnish an expression for the rate of surface run-off per unit of area, for drainage areas of different sizes. The rainfall rate for which culverts in this section should be designed may be represented by the rainfall formula,*

$$I = \frac{240}{20+t} \qquad (I)$$

in which I = the intensity or rate of rainfall, in inches per hour, for the time, *t* in minutes.

For ordinary drainage areas the time, *t*, may be represented by the expression $24 + 0.92\sqrt{A}$; while the ratio of the maximum run-off rate to the average rainfall rate during the period of concentration may be assumed to be 0.45. Substituting these values in equation (I), and considering that an inch per hour of rainfall over the area of an acre is practically equivalent to a cubic foot per second, produces the run-off formula

$$Q' = \frac{118}{48+\sqrt{A}} \qquad (II)$$

in which Q' = the run-off, in cubic feet per second per acre, and A = the drainage area in acres.

This formula is believed to be sufficient to provide for all floods in eastern Kansas, on drainage areas small enough to be covered by a single storm, except in the case of extreme and unusual storms occurring perhaps once in a generation. For use farther west, where the soil is more permeable and the topography less abrupt, a coefficient of 0.75 or 0.50 or even less should be applied.

The allowable velocity of the water in passing through the culvert may be taken as

$$V = \frac{720}{50+\sqrt{A}} \qquad (III)$$

This formula gives velocities ranging from 7 ft. per second in the case of small culverts to 12 ft. per second in the case of the largest culverts considered under this discussion. It has been a common practice in designing railroad culverts to assume a velocity of 10 ft. per second, irrespective of the size of the culvert. Apparently the thought has been that in the case of the smaller openings the water could be allowed to head up back of the embankment sufficiently to permit the assumed velocity to be attained; while in the case of the larger openings it was unwise to assume a velocity higher than 10 ft. per second as a standard because of the prevalence of timber trestles. There is no good reason, however, why a somewhat higher velocity than 10 ft. per second may not be attained under unfavorable conditions for the time of maximum discharge in large masonry culverts with wing walls and paved floors. Under favorable conditions, as where the stream has emerged from its drainage area among the hills and is pursuing a sluggish course across a wide, flat bottom, a somewhat smaller velocity than that given by equation (III) should be assumed.

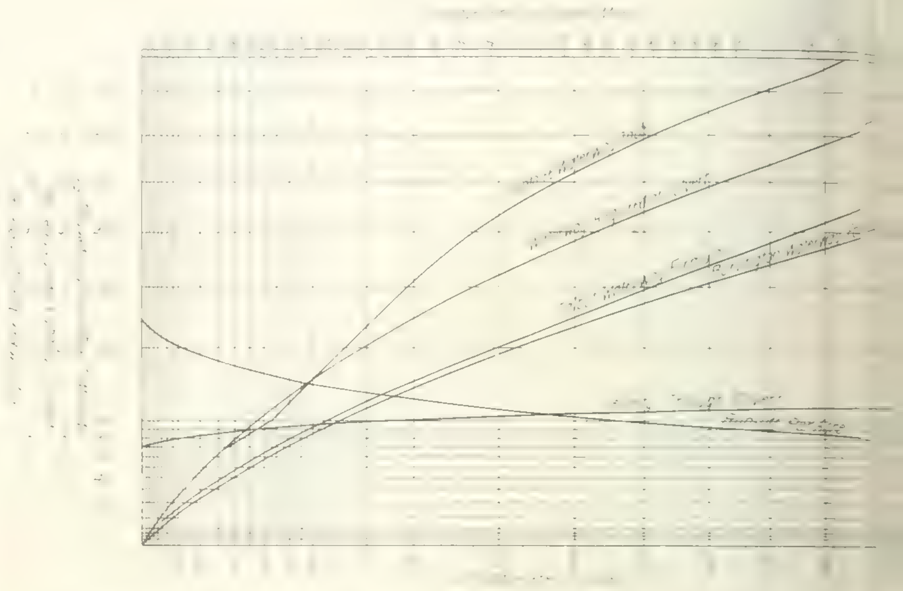
In the accompanying Table I are given, for different drainage areas expressed both in acres and in square miles, the maximum run-off rate, in cubic feet per second per acre, as determined by equation (II); the maximum run-off, in cubic feet per second; the velocity through the culvert opening at time of maximum discharge as determined by (III), and, finally, the waterway required, as determined by dividing the maximum run-off by the velocity.

The quantities given in columns [illegible] and [illegible] are also shown graphically by three heavy curves in the accompanying diagram. The horizontal scale is the same for each of these curves, the areas being indicated in acres at the bottom of the diagram and in square miles at the top. The vertical scales of the three curves are all different, but are indicated at the left [illegible] diagram.

The three lighter lines of the diagram represent waterway areas as determined by formulas already used to some extent in this section. One of these is from the Santa Fe Ry. Co.'s table of waterways required in Missouri and Eastern Kansas and Oklahoma. This table is perhaps more known and used than any other in this vicinity. The waterway areas are based upon an assumed velocity through the culvert of 10 ft. per second. Another curve is from the Burlington Ry. Co.'s formula,† Waterway

$$\text{area} = \frac{300\,M}{3+2\sqrt{M}},$$

M being the drainage area in square miles. In this formula as in the Santa Fe table, the velocity is assumed at 10 ft. per second. The third curve is from the formula proposed by Professor Talbot,‡ Waterway area = C [illegible] A [illegible] represents the drainage area, in acres, and C is a coefficient varying from about 1 for steep country to 0.4 or 0.5 for rolling country. A value of 0.5 was used in computing the ordinates of the curve shown in the diagram.



Comparison of Waterway Areas for Culverts Required by Different Formulas

TABLE I.—WATERWAY AREAS

1	2	3	4	5	6
Drainage area, acres	Drainage area, square miles	Maximum run-off rate per acre	Maximum run-off rate for entire drainage area	Velocity through culvert	Waterway area required
A	M	$\frac{118}{48+\sqrt{A}}$	$\frac{118A}{48+\sqrt{A}}$	$\frac{720}{50+\sqrt{A}}$	[illegible]
1	.002	2.41	2.4	7.10	0.3
2	.003	2.39	4.8	7.15	0.7
3	.005	2.37	7.1	7.18	1.0
4	.008	2.35	9.4	7.24	1.3
7	.011	2.33	16.3	7.28	2.2
10	.016	2.31	23.1	7.33	3.2
15	.023	2.28	34.2	7.41	4.6
20	.031	2.26	45.2	7.46	6.1
30	.047	2.21	66.3	7.57	8.8
40	.063	2.17	87.0	7.65	11.4
60	.094	2.12	127.2	7.79	16.3
80	.125	2.08	166.0	7.90	20.0
100	.156	2.04	203.9	8.00	25.4
120	.188	2.00	240.4	8.08	29.8
140	.219	1.97	276.1	8.16	33.8
160	.25	1.95	311.4	8.22	37.9
180	.28	1.92	346.4	8.28	41.8
200	.31	1.90	380.0	8.34	[illegible]
220	.34	1.88	413.5	7.60	49.2
240	.38	1.86	446.4	8.47	52.7
260	.41	1.84	479.0	8.50	56.3
280	.44	1.82	510.6	8.55	59.7
300	.47	1.81	541.8	8.60	63.0
350	.55	1.77	620	8.70	71.3
400	.62	1.74	695	8.80	79.0
450	.70	1.71	768	8.89	86.3
500	.78	1.68	839	8.97	93.5
550	.86	1.65	910	9.04	100.7
600	.94	1.63	978	9.11	107.3
650	1.02	1.61	1,043	9.18	113.6
700	1.09	1.59	1,110	9.24	120.3
750	1.17	1.57	1,172	9.30	126.0
800	1.25	1.55	1,236	9.36	132.2
900	1.41	1.51	1,361	9.45	144.2
1,000	1.56	1.48	1,482	9.54	155.6
1,100	1.72	1.45	1,598	9.63	166.1
1,200	1.88	1.43	1,714	9.72	176.4
1,300	2.03	1.40	1,826	9.80	186.4
1,400	2.19	1.38	1,935	9.87	196.0
1,500	2.34	1.36	2,046	9.94	206.0
1,600	2.50	1.34	2,147	10.00	214.7
1,700	2.66	1.32	2,246	10.06	223.4
1,800	2.81	1.31	2,348	10.12	232.0
1,900	2.97	1.29	2,450	10.18	240.4
2,000	3.13	1.27	2,546	10.23	248.6
2,200	3.44	1.24	2,740	10.32	265.6
2,400	[illegible]	1.22	[illegible]	10.42	280.0
2,600	4.07	1.19	[illegible]	10.50	295.4
2,800	4.38	1.17	[illegible]	10.58	309.4
3,000	4.69	1.15	3,448	10.65	323.6
3,200	5.00	1.13	3,612	10.73	336.4
3,400	5.31	1.11	3,774	10.80	349.0
3,600	5.63	[illegible]	[illegible]	10.86	362.0
3,800	5.94	1.07	[illegible]	10.92	[illegible]
4,000	6.25	1.06	4,246	10.98	386
4,500	[illegible]	1.02	[illegible]	11.10	[illegible]
5,000	7.81	1.00	4,970	11.22	442
5,500	[illegible]	[illegible]	5,310	11.33	468
6,000	[illegible]	[illegible]	5,650	11.43	494
6,500	10.17	.92	[illegible]	11.52	[illegible]
7,000	10.94	.90	6,276	11.60	[illegible]
7,500	11.72	.88	6,578	[illegible]	563
8,000	12.50	.86	6,872	11.75	[illegible]
8,500	13.29	.84	7,164	11.82	[illegible]
9,000	14.08	.83	7,446	11.88	[illegible]
9,500	14.86	.81	7,715	11.94	[illegible]
10,000	15.63	[illegible]	[illegible]	[illegible]	[illegible]

SUMMARY

The proposed run-off formula, $\frac{118}{48+\sqrt{A}}$, is based upon a rainfall [illegible] and is strictly applicable only to areas small enough so that all parts may be covered simultaneously by heavy downpours. For drainage areas too large to be covered equally by a single downpour the formula gives results too large.

The formula is suitable for rolling country subject to heavy downpours such as the eastern half of Kansas.

The velocities through the culverts given in the table and shown by the curves in the diagram are suitable for use except where the conditions are distinctly unfavorable to permit these velocities to be attained. The culvert should be adequately protected against being clogged by brush or other debris.

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*Trans. Am. Soc. C. E., Vol. 58, p. 49[illegible]

†Journal Western Soc. C. E., Vol.

‡Journal Western Soc. C. E., Vol.

NEWS SECTION

Editorial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

[illegible]

oings o he V ek.

[illegible] pears to have been very little doing. Developments of [illegible] of the larger railroads are [illegible] It is probable that both of these ne across with contracts in June. hore & Michigan Southern R. R. led its differences with the city [illegible] provement work planned in that nta Fe System has also author- struction of 100 miles of second Coast Line during the ensuing [illegible] work mapped out for the pres- l that it is only a question of it will be placed under contract. ontracts noted above one is the gnment and double track for the waukee & St. Paul Ry. between Aberdeen, S. Dak. Morris, Shep- erty, 401 Globe Bldg., St. Paul, i this work. The other contract ond track work between Meadville Pa., for the Erie. Ferguson & o., Brookville, Pa., secured Sec- is work. Robert Grace Contract- veland, O., secured Section B., illespie Co., 50 Church St., New C, secured Section C. The Erie R. wise planning the letting of con- double track work on other portions In fact it is understood that bids for that portion of its line west n, Ind No word has been re- ding the award of contracts for Lassen line of the Southern Pa- rnia, nor of the Grand Trunk Massachusetts. Bids on both these were taken some weeks ago.

three of the largest highway con- this year have been opened by [illegible] e bids received on April 15 and 17 und elsewhere in this issue. Bids [illegible] Texas and more are to come in ture. These Texas contracts are l in sufficiently large sections to igger contractors.

of drainage work about the larg- [illegible] ssue appears to be the one in Posey Indiana. This work calls for the [illegible] f dirt and the clearing of about s of right of way.

ere opened last week by the U. S. at Boston, Mass., for an extensive vation job in Boston Harbor. The for the removal of 78,792 cu. yds. low bidder was the Great Lakes Dock Co., 1148 Oliver Bldg., Bos- ., at $7.50 per cu. yd.

The City of St Paul is taking steps looking to the relocating of the river channel at that place. A preliminary survey has been made and a report submitted to the River and Harbor Commission of the city of St. Paul for this work. According to the preliminary estimate the work of changing the channel [illegible]

Locating the Incinerator.

[illegible] the few American cities [illegible] At Pasadena this method proved objectionable to the health authorities of the county, so it was decided to build an incinerator, and the people voted bonds for that purpose. The city council secured a location in the manufacturing section of the city, but there [illegible] site and a vigorous demand that it be put outside of the city. But whenever the authorities sought to locate it outside of the city, they were met with a flock of injunctions. Two other sites were finally obtained and an unofficial ballot was taken by the people on the question of location. The site originally selected by the city authorities was not only the winner, but it had more than six times as many votes as the two other cites combined. All of which goes to show that even as delicate and difficult a matter as the location of a garbage incinerator can be properly and satisfactorily settled by the people if they are given a chance to act.

New Jersey Road Work.

The series of road bills approved by Governor Wil- [illegible] the state of New Jersey eventually 1,500 miles of state highways and make radical changes in the method of dealing with these roads. The establishment of the system of state highways is placed in the hands of the State Highway Commission, Edwin A. Stevens, State Road Commissioner, and by one of the bills the State Treasurer is added to this Commission. House 293, the most important of the measures by Assemblyman Whyte, provides that the State highway system shall include roads, or parts of them, as now are, or will form, main-traveled highways of reasonably direct route between the county seats, existing improved highways being chief lines of travel between seaside resorts and the large centers of population, other roads which naturally would be a part of a State system, and the Ocean boulevard and the Delaware River drive. The State road commissioner is to prepare and submit to the State Road Commission a map of the proposed highway system. After making necessary modifications the commission is to adopt the mapped road system as the State highway system. The new law provides that in taking over any road as a part of the State system the commission shall be guided by the character and the amount of travel thereon, its consequent relative importance in the system and with due regard to the mileage of roads heretofore improved in each county and to the burden of maintenance and repair costs therein, which it is the intent of the act to relieve. The State system is not to exceed 1,500 miles of highways. Whenever a road, or portion thereof, is taken over by the State its further improvement, maintenance and repair shall be at the expense of the State. Another of the new Whyte laws provides for the permanent improvement of non-State highways, the work to be done under the control of the boards of freeholders, and the State to pay forty per cent of the cost. Under the old law the State paid only one-third the cost.

Luck.

[illegible] tractors is proverbial, but it is seldom, indeed, that a run of good luck sticks as closely as it did in the case of a contracting firm at Scranton. These contractors have the contract for constructing about 1,100 ft. of tunnel sewer for the city of Scranton, Pa. A couple of weeks ago they struck a coal vein and took out enough coal along the line of the tunnel to supply their own homes and several of their employes. A few days later they struck a worked out mine chamber which saved them the trouble and expense of blasting through rock. This chamber was 30 ft. long and ran in the direction the sewer tunnel was being driven, so that all the contractors had to do was to blast a couple of feet from the floor. Last week the contractors struck another vein of coal, which also ran in the right direction. It is estimated that about 1,000 tons of coal will have to be removed from the sewer's path. If this luck continues the city officials will begin to regret that they didn't sell the privilege for doing the work instead of paying the contractors $20,000 for it.

Job Wanted.

Of course the following letter, which appeared in a New England newspaper, is a fake, but nevertheless it pretty accurately sets forth the way the average day la- [illegible]

> [illegible] I see som mor man smokin pip, takin it kinda [illegible] for frank Has. down by ton hal i se mor man an waggin, all waitin for frank has. bi gosh, look lak pretty good job. i use to be waiter [illegible] rite of, so i can work on dos prospac hill job. i tankt hay ot to bild good sidwalk up dat street [illegible]
>
> respectfol yours
>
> [illegible]
>
> rivdal street.

PERSONAL

Dr. Hoyer has been selected as chairman of the Sewer Commission of the city of Middleport, N. Y.

Mr. Arthur Kramer of Florence, Pa., has been appointed pipe inspector at Philadelphia by the government.

Mr. H. F. Howe has been appointed chief engineer of the Guayaquil R. R., with headquarters at Huigra, Ecuador.

Mr. John Dickey Culbertson, second vice president and treasurer of the National Tube Company, died suddenly on March 13 at Pittsburg, Pa.

Mr. W. O. Galbreath has been appointed engineer maintenance of way of the Missouri & North Arkansas Ry., with office at Eureka Springs, Ark.

Col. Geo. W. F. Vernon has been recommended to fill the vacancy on the Sewerage Commission of Baltimore caused by the death of Mr. Wm. W. McIntyre.

Mr. Ralph Modjeska of Chicago delivered an address on April 15 before the Engineers' Society of Pennsylvania at Harrisburg on the subject "Famous European Bridges."

Mr. E. B. Minuez, formerly engineer of grade crossings of the New York Central & Hudson River R. R., has been appointed district engineer of the middle district, with office at Albany, N. Y.

Mr. W. D. Northern, formerly with the Leonard Construction Company of Chicago, has been appointed as superintendent of construction of the new filtration plant and reservoirs for the city of Aberdeen, S. Dak.

Mr. J. C. Holden has been appointed division engineer of the Manitoba division of the Canadian Pacific at Winnipeg, Manitoba. He was formerly assistant engineer of that division. He is succeeded by Mr. C. H. Fox.

Mr. Mackie, who has been acting as engineer in charge of sewer construction for the city of Cranbrooke, B. C., has been elected resident engineer for the city of Swift Current. He will be succeeded by Mr. A. A. McLintock.

Mr. Henry C. Nutt has resigned as fourth vice president and general manager of the western division of the Northern Pacific Ry. and has accepted the office of general manager of the Salt Lake route. He will assume charge on May 1.

Mr. G. W. Yellott, former county commissioner of Baltimore county, Maryland, has been unanimously elected chairman of the Good Roads Commission named in the bill passed by the legislature calling for a bond issue of $1,500,000 for the improvement of roads of the county.

Mr. E. F. Lawrence of Portland, Oregon, has been elected president of the Architectural League of the Pacific coast. The other officers are: Mr. John Bakewell, vice president, San Francisco; Mr. M. L. Whitehouse, secretary, Portland, and Mr. Myron Hunt, treasurer, Los Angeles.

Mr. E. Stanley Terhune, Newark, N. J., has relinquished his position in the sewer commission office at Batavia, N. Y., and will go to Newark to take charge of similar work. The city of Newark will put in a complete sanitary sewer system with 20 miles of sewers and an Imhoff disposal plant.

Mr. W. W. Gaffin, for a number of years connected with the Chicago & Northwestern Ry. as division engineer, has resigned his position and will enter into the contracting business with Mr. F. Gehri of Janesville, Wis., under the firm name of Gaffin & Gehri. Their headquarters are in Fond du Lac, Wis.

Mr. H. C. Phillips, formerly chief engineer of the Atchison, Topeka & Santa Fe Ry. coast lines at Los Angeles, Cal., has been appointed chief engineer of the entire Santa Fe system. This is a new position. Mr. Phillips' office is at Chicago. Mr. G. W. Harris, formerly engineer of construction of the Coleman-Lubbock cut-off of the Santa Fe, succeeds Mr. Phillips.

Mr. E. G. Connette, formerly vice president and general manager of the Syracuse Rapid Transit R. R., has been apointed to the position of general manager of the enlarged Brooklyn Rapid Transit railroad system at a salary of $14,000 a year. Mr. Connette has demonstrated great ability in handling traction situations and problems.

Mr. E. C. Hawkins, chief engineer of the Copper River & Northwestern R. R., died April 9 at the age of 52 years. He was a graduate of Rensselaer Polytechnic Institute and has been engaged for a number of years on railway construction in the West. He was in charge of the first railway constructed in Alaska. He built the White Pass & Yukon and the Copper River & Northwestern railways.

Mr. J. C. Orrell, formerly engineer in charge of the construction of immigration station on the Cooper River for the United States government, has resigned to accept a position as engineer with the water works department of Chicago. Mr. Orrell has been connected with the erection of a number of important federal buildings. Mr. Frank Crawford has been recommended for appointment to succeed Mr. Orrell.

Mr. A. J. Hammond, an engineer who made the report on the construction of the southwest land tunnel of Chicago for the Merriam commission which investigated the city expenditures on that construction, has been appointed city bridge engineer by Mayor Harrison. The former bridge engineer, Mr. Thos. G. Pihlfeldt, has been bridge engineer for a number of years, and was one of the few city officials who was not arraigned by the Merriam commission during its investigation into the city affairs.

CIVIL SERVICE EXAMINATIONS.

The State Civil Service Commission of Albany, N. Y., will hold its examinations on May 18, 1912, for the following positions: Axman, chainman, and inspector of telegraphs and telephones.

The State Civil Service Commission of Illinois at Springfield announces civil service examination to be held in Chicago on May 17, 1912, to fill present and future vacancies in the department of factory inspection. These positions include the following: General inspector, electrical, ventilation, mechanical, and structural iron work. Applications must be on file in Springfield prior to May 10. Blanks may be obtained from W. R. Robinson, chief examiner.

The United States Civil Service Commission announces that the receipt of applications for the examination for chief irrigation engineer in the Indian Irrigation Service will close on May 1, 1912.

INDUSTRIAL

The Columbia Chemical Co., Barberton, O., is to use Taylor Stokers in connection with its soda ash drying furnace.

Mr. Walter B. Snow, Publicity Engineer, has still further increased his office facilities by the occupancy of Rooms 421 to 426 at 170 Summer St., Boston, Mass.

Universal Portland cement was sold last month to the Wayne County (Michigan) Road Commissioners for 40 miles of all-concrete pavement to be constructed this spring. This will take about 100,000 bbls. in all.

The Raymond Concrete Pile Co. of New York and Chicago has been awarded the contract for placing the concrete piles for the foundations of improvements to the plant of the American Stopper Company at Dwight & Verona Sts., Brooklyn, N. Y.; N. M. Loney, Engineer.

The Robb Engineering Co., Ltd., has recently sold vertical boilers to B. F. Elwell Glue Co., Rockport, Mass.; Walter W. Field & Co., Inc., Cambridge, Mass.; J. W. Buzwell, Salisbury, Mass.; C. F Hathaway & So Cambridge, Mass.; Mystic Rubber Co., W. Medford, Mass.

The American Engineering Co., b der of the Taylor Stokers, report recent les as follows: The Quincy Market & Col Storage Co., Boston, Mass., 4 stokers, to b applied to 350 hp. Stirling boilers at their pla at Sargents' wharf; the Solvay Process C 8 stokers; the Minetto-Meriden Co., Mi to, N. Y., a stoker with extension grate f a 500 hp. Wiches boiler; New York Ed n Co., 34 stokers with extension grates; t Salem Electric Light Co., Salem, Mass., stokers with extension grates; the Weymou Light & Power Co., East Weymouth, Mas, 2 stokers for 400 hp. B. & W. boilers; t Troy Laundering Co., Columbus, O., on stoker with extension grate for a 250 hp. & W boiler; the Edward Ford Plate G s Co., Rossford, O., 2 stokers with extensi grates for 300 hp. Stirling boilers; the New Y k, New Haven & Hartford Electric Light C Cedar Hill Power House, New Haven, Con 2 stokers for 500 hp. Bigelow-Hornsby bo rs; the Firestone Tire & Rubber Co., Akr 1 stoker for 600 hp. Stirling boiler; the ic Electric Light & Power Co., Chicop Mass., 4 stokers for 229 hp. H. R. T boilers.

CATALOGU S

Horse Collars.—Card, 13½x9½ ir Foster, Helmreich, Wagner arness Co., Kansas City, Mo.

This card illustrates and desc be seamless roll top collar with no ip to injure the horse, with buck stitch without rivets and with billet ar c sewed with half-inch thong. The o collar is made for teams with ext h collar leather and the No. 556 is m e extra large pad for heavy dray tea first collar has a draft of about 17 s. the second about 18½ ins.

Koehring Mixers.—Paper, 6x9 ins. 80 pp. Koehring Machine Co., Mi aukee, Wis.

This catalog illustrates and desc es Koehring Mixer and all its acc Complete details are given. A p ion o the catalog is devoted to bar cut s and benders. Another portion is de ed t specifications, tables and line dra gs o all types of mixers. Illustrations ar shown of installations in various classes work. The catalog is very complete.

Coltrin Mixers.—Paper, 6x9 ins., 36 pp. The Knickerbocker Co., Jackso Mich. This catalog gives complete illu at and descriptions of the Coltrin mixe w is built to combine the best fea es i batch and continuous types, and is vide with an accurate automatic appar s fo proportioning of materials and ti ng mixing. The illustrations show th detail of all parts of the machine, as wel as th various types of machines as as mbled. Illustrations of installations on ariou work are shown, together with lett from users of the machines.

Mill Apparatus.—Paper, 3½x6 ins Pawling & Harnischfeger Co., ilwaukee, Wis.

This booklet illustrates P. & H appa ratus for steel mills, rolling mill foun dries, etc. It also contains illustr d de scriptions of grab buckets, charg ma chines, monorail systems and mill nes.

Boiler Tube Corrosion.—Paper, 8½ ins., 12 pp. The National Tube Co Pitts burgh, Pa.

N. T. C. Bulletin No. 4 contains n ab stract from the Journal of the A rica Society of Naval Engineers on t cor rosion of boiler tubes, giving a sum ry o corrosion tests of wrought iron an stee with illustrations.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

M Blount, Union Springs, Ala., Presi- of ie Birmingham & Southern R. R., [illegible] a few days ago for the [illegible] [illegible] miles of new line between [illegible] ar Electric in Elmore County.

Alaska.

bil has been introduced in the U. S. iding for the construction of 1,000 road in Alaska by the government. nent of natural resources and to pply of coal for the navy are the rposes of the bill. The bill pro- e creation of the Alaskan Railway composed of five members to be y the president. The commission president in determining the route and in having it constructed.

Arkansas.

[illegible] Hardy, Ark., are [illegible] o the proposition under consideration ttle Rock Board of Trade to con- ilroad north to connect with a [illegible] Missouri & North Arkansas It has been suggested that the m Little Rock north to Hardy, n, Floral, Victor, Cushman and [illegible]

Arizona.

ern Pacific Ry., J. D. Mathews, gineer, Tucson, Ariz., has prepared stimates for an underpass to be at 10th St. and Toole Ave., in

California.

being taken to organize a com- struct an electric car line at Au- nect the Auburn depot with the St. depot. The cost of the line is $30,000. It is proposed to apply ise on May 6. G. B. Herrington, nterested.

rom Lakeport state that R. D. cial agent of the Clear Lake Ry., ng constructed from Hopland to is been authorized to close a con- San Francisco firm for the com- he road. It is expected that the e completed before the summer n closes.

[illegible] has under consideration the con- a branch line from Doyle, Cal., ia Susanville, we are advised that [illegible]

e for the construction of electric in Redwood and vicinity has been to Edward F. Fitzpatrick. The first nstructed will be from the busi- of Redwood City to the foothills dside and Portola districts. The cific is believed to be backing

L. Philips, Los Angeles, Cal., is project involving the construc- ncline railway from the foot of go to the summit, a distance of A new type of mechanical device sed for operating the cars.

entatives of the Tidewater & South- R., which is planning to extend its line resno to Bakersfield, recently visited Cal., through which the line will pass. purpose of taking up with the Board e the matter of securing rights of way er aid from the citizens.

acramento Valley West Side Electric of Willows, is meeting with good suc- securing the right of way for its pro- ine. The company has recently or- survey from Woodland via Dixon to on the Sacramento River, touching the he Oakland, Antioch & Eastern electric line. The distance from Woodland to the point of connection with the Oakland line is about 33 miles. A new survey in Colusa County for a branch has been ordered also. It will run from Williams to Colusa. It will touch the Northern Electric in Colusa, the Vallejo Northern in Woodland and the Oakland and Antioch near Rio Vista.

Colorado.

A project is under consideration for the construction of an interurban line from Rocky Ford, Colo. H. L. Pierce, Boston, Mass., is interested.

The Oklahoma Land & Colonization Co. has about secured all right of way for a railroad in the vicinity of Moffet, Colo., and is ready to take up the matter of equipment and material. A rail of about 45 lbs. will be used The rolling stock will be steam for freight and motor car for passenger traffic. Lewis A. Coler, Moffat, Colo., is Chief Engineer.

Delaware.

The Wilmington & Southern Traction Co., New Castle, Del., is making good progress in securing its right of way for an extension from Rose Hill to Wilmington.

Florida.

The route for the projected line of the Memphis & Gulf R. R. is understood to have been practically decided on, and it is believed that construction work may be started by June 1. Work will probably be started at both Medidian and Jacksonville, Fla. C. D. Smith & Co., 630 Exchange Bldg., Memphis, Tenn., have the contract for the engineering and construction work for this railroad.

Georgia.

The Georgia Coast & Piedmont R. R., a standard gage 90-mile steam road, has plans well along for extending its line from Darien to Brunswick, Ga. An extension from Collins to Vidalia is also under consideration. A de Sola Mendes, Darien, Ga., is General Manager.

The Flemington, Hinesville & Western R. R. has secured the right of way from McIntosh to Hinesville for its projected railroad, and in planning to have construction started at an early date. It is hoped to complete the line to Hinesville by July 1. J. B. Way and L. E. Stafford, Flemington, Ga., are directors.

Idaho.

The Southern Idaho Light, Heat & Power Co., owner of the two interurban lines running out of Boise has engineers in the field for an extension from Caldwell to Ontario and Weiser. The engineering work is in charge of the Cleveland Construction Co., Cleveland, O., with branch office at Boise. R. L. Ewing is engineer in charge.

The Albion-Marshfield R. R. Co., Ltd., will resume work on its 9 miles of line from Albion, the county seat of Cassia county, to a connection at Marshfield, Idaho, a station on the Salt Lake & Idaho R. R., now building from Salt Lake to Burley, Idaho. Albion is at present without railroad facilities, and aside from being the county seat, has a state normal school, mines, agricultural and fruit raising. Location surveys will be made at once and right of way secured. The board of directors include T. E. Harper, president; C. A. Dumas, vice-president; G. A. Axline, secy.; A. Lounsbury, treas.; Sam Perrins, Tom Price, Louis A. Bauman, all of Albion, Idaho; W. C. Calvert, Burley, Idaho, is chief engineer.

Grading work for the Salt Lake & Idaho R. R., has been completed for the entire 65 miles from Burley to Kelton Summit, near the Utah line. The steel is now in the storage yards at Burley, and track laying will be started shortly.

Illinois.

The Chicago & Joliet Electric Ry. Co., J. R. Blackwell, General Manager, Joliet, is planning to begin work about May 1 on a number of extensions and improvements to the traction system at Joliet. Orders have been placed for 800 tons of rails, 5,000 steel ties and 25,000 wooden ties.

The Rochelle, Oregon & De Kalk Electric Ry. Co., the incorporation of which was mentioned in our last issue, has its main office at 21 East Van Buren St., Chicago, Ill. According to the articles, which are for 50 years' duration, the company proposes to build and operate an electric railway from Rochelle to Oregon and Freeport, with a branch to Dixon, Sterling and Morrison; from Rochelle to De Kalb and from Rochelle to Ottawa. The incorporators and the first board of directors are: John W. Bissell of Chicago; Maurice E. Burr, Chicago; Charles Aaron, Chicago; Earl R. Burton, Elgin, and Robert J. Scott, Chicago.

The Conn Construction Co. has secured subcontract for about eight miles of work at Greenview, Ill., on the new Peoria branch of the Chicago & Northwestern Ry. The company can use some small outfits, as it has some very good side work. This will be let in whole or will be stationed out.

The Chesapeake & Ohio R. R. has a number of improvements in view for placing its Chicago line in first-class shape. An expenditure of about $2,000,000 will probably be made, but it is likely that this sum will be spent gradually.

The St. Louis, Springfield & Peoria R. R., with principal offices in Champaign, has certified to the Secretary of State to an increase of capital stock from $6,050,000 to $7,850,000. The road is a portion of the Illinois Traction System.

At a recent meeting of the board of directors Chicago & Eastern Illinois (Frisco system) railway it was decided that $2,000,000 should be expended in improvements along the lines of the company between Chicago and St. Louis during the coming year. The proposed improvements include the installation of 15,000 tons of 100-pound rails and a new passenger station at Danville, Ill. Proposed double track work will practically complete double track improvement on the Chicago & Eastern Illinois line between Chicago and St. Louis. New Yards will be built near West Frankfort and at Cypress, Ill. W. J. Jackson, Chicago, Ill., is vice president and general manager of the railroad.

Indiana.

The Erie R. R. is understood to have taken bids on the double tracking of its lines west of Huntington, Ind., about 100 miles.

The city of Decatur, Ind., has voted to grant the Vandalia Railroad permission to construct 6 new tracks through a portion of the city, and the company has decided to make an expenditure of about $100,000 for the improvements. S. C. Scott, Pittsburgh, Pa., is Assistant to the President.

The Lake Erie & Western Ry. Co. will, providing the city of Muncie, Ind., grants permission to add to its switching facilities, build a new freight station. W. G. Atwood, Indianapolis, Ind., is Chief Engineer of the road.

Iowa.

The Cedar Rapids & Iowa City Railway & Light Co. has completed surveys for its proposed new interurban line between Cedar Rapids and Mt. Vernon, and it is probable that construction work will be put under way this spring. Wm. G. Dows, Cedar Rapids, Ia., is President.

Work on the proposed railroad from Bassett, Ia., to Springview will be commenced May 1. People in that vicinity have subscribed $85,000 toward the project.

Kansas.

The city of [illegible] has voted bonds in the sum of $20,000 for the Salina [illegible] Northern R. R., a proposed interurban line from Osborne to Salina. It is stated that every township and town through which the line will run have voted bonds at a rate of about $2,000 to aid the road.

Louisiana.

The Erath Sugar Co., Erath, La., has secured the right of way and will have work started at once on a standard gage railroad running six miles north of Erath.

It is reported that the Frisco will build into Lake Charles this year from De Quincy or Kinder.

Maryland.

It has been announced by Governor Goldsborough, Annapolis, Md., that he will sign bills by which voters of Anne Arundel and Calvert counties will decide at the next election whether the commissioners shall indorse bonds of the Baltimore & Virginia R. R. Co. to build the proposed Drum Point railroad. If the vote in Anne Arundel county is favorable the county will indorse $200,000 of bonds while Calvert county will indorse $100,000.

Massachusetts.

The Boston & Albany R. R. (New York Central Lines) is to expend about $250,000 for a new station at Pittsfield, Mass. Plans for the station are now being prepared. About $25,000 of the above sum will be expended for trackage changes.

Michigan.

The Business Men's League of Mt. Clemens, Mich., will co-operate with the Pontiac, Mich., Commercial Club with a view to securing the construction of a branch line of the Michigan Central Ry. between the two cities. J. A. Henk is Secretary of the Mt. Clemens body.

The City Council of Grand Rapids, Mich., has decided to act favorably on the petition of the Grand Rapids & Indiana R. R. Co. for permission to construct a spur track east from South Division street almost to East street, along the north side of Cottage Grove avenue. E. H. Barnes, Grand Rapids, Mich., is Chief Engineer of the company.

Officials of the Ann Arbor Railroad have practically assured the City Council of Owosso, Mich., that the new shops of the company will be located at that place. K. A. Gohring is Superintendent, Owosso, Mich.

Minnesota.

Advices from Spooner, Minn., state work will be started this summer on the proposed railroad line connecting International Falls and Thief River Falls. The project is said to be backed by the Backus-Brooks interests.

It is reported that the Great Northern Ry. Co. is planning to relay its line between Evansville and Barnesville, Minn., with 90-lb. steel.

The Backus-Brooks Co., Andrus Bldg., Minneapolis, Minn., it is said, will assume full charge of the Minneapolis & Rainy River R. R. on May 1. The announcement of the purchase of the property from the Weyerhaeuser interest was announced some time ago.

Mississippi.

Good progress is being made with the promotion work for the proposed interurban line from Greenwood, Miss., to Itta Bena. Capitalists of Greenwood are interested in this project.

A committee representing the Commercial Club of Yazoo City, Miss., has agreed to have the city subscribe a $50,000 bonus and secure necessary right-of-way and terminal points at both ends of the line and all stations en route in order to secure the proposed railroad from Yazoo City to Carthage. It is hoped that the new line will be in operation by Jan. 1, 1914.

Soliciting committees of the Meridian, Miss. Board of Trade have succeeded in raising all but $2,000 of the required bonus necessary for the construction of the Meridian & Deep Water Railroad from Meridian to Union, Miss.

It is understood that the New Orleans, Clinton & Birmingham Railroad, recently incorporated, is planning the construction of a line from Edenborn Station on the Louisiana Ry. & Navigation line to Clinton, and surveys have already been completed to Natchez. Residents of the country through which the proposed line will pass are asked to vote a 5-mill tax to aid the project.

Missouri.

⊙The Kansas City Terminal Ry. Co., John V. Hanna, Chief Engineer, Kansas City, in connection with its terminal work has awarded a contract to O'Hagan & Lake of Aurora, Ill., covering concrete work between Broadway and State Line. The work consists of building the Southwest Boulevard, Summit St. and 25th St. subways and the construction of retaining walls at various locations between the points mentioned. The approximate amount involved is $200,000, and time for completion about 15 months.

Montana.

The Flathead Interurban Ry., Kalispell, Mont., is completing arrangements for right of way from the end of the grade to the city limits, and for a crossing with the Great Northern railway, preparatory to the resumption of construction work.

It has been announced that 14 miles of right-of-way has been secured for the extension of the Gilmore & Pittsburg R. R. from Dillon to Twin Bridges, Mont. It is now said that no grading contracts will be let, however, until the route is permanently located. T. H. Bacon, Armstead, Mont., is Chief Engineer.

Nebraska.

The Missouri Pacific Ry., E. F. Mitchell, Chief Engineer, St. Louis, Mo., at the commencement of the next fiscal year, June 1, will probably begin construction on extensive improvements to its Omaha terminal and to its Omaha and Kansas City line. It is reported that something like $6,000,000 will be expended in this work, which will include a new and enlarged freight terminal, 24-stall round house and double tracked line for Omaha, heavily ballasted and rebuilt line to Kansas City, and extensive improvements on the "Low" line leading to Louisville and points in central Nebraska.

New Jersey.

The Public Service Corporation of New Jersey, Thomas N. McCarter, President, Newark, has acquired the Riverside Traction Co., operating a line from Riverton to Trenton, and the Elizabeth & Trenton Railroad Co., which owns the uncompleted railroad formerly owned by the Trenton and New Brunswick R. R., and the New Jersey Short Line R. R., extending from Trenton to Elizabeth, of which that section between Trenton and New Brunswick is in operation. The sum of $800,000 has been raised, to be secured by the bonds of the Riverside Traction Co., for the enlargement and extension of that property, and $1,000,000 has been raised, to be secured by bonds of the Elizabeth & Trenton R. R., to complete that property through from Trenton to Elizabeth.

New York.

The New York Central & Hudson River R. R. is understood to be planning the expenditure of $2,000,000 this year for betterment work between Fishkill Landing and Albany.

It is probable that the East Side Improvement Society, Oswego, N. Y., will be successful in securing the location of the terminal of the Syracuse, Lake Shore & Northern Ry. on the east side of the city.

The Freeport R. R. Co., Freeport, N. Y., recently incorporated with a capital stock of $20,000, proposes to construct a 1½-mile street railway line at Freeport. The directors of the company are T. P. C. Forbes, Solani M. Lamb, Alice D. Forbes, Eleanore [illegible] Stephen P. Pettit, William Forbes, [illegible] Mayer, Sarah J. Fisher and M. A. [illegible] Freeport.

The Sullivan County R. R. Co. [illegible] York City has been incorporated with a capital stock of $200,000. The incorporators are W. Kohler, Jeffersonville, N. Y., L. [illegible] and H. B. Mingle, New York City.

A citizens' committee at Cana[illegible] raised about $5,000 toward securing a spur from the Lehigh Valley R. R. [illegible] road has agreed to furnish the [illegible] ties for the road, the cost of which is estimated at $14,000. Grading, labor and other expenses will cost $9,000. A. P. F[illegible], Canastota, N. Y., is Secretary of the committee.

The Syracuse Rapid Transit Co., E. [illegible] ton, General Manager, Syracuse, N. Y., [illegible] considering a proposition to extend the Walnut Ave. line through University [illegible] Irving Ave., past the main entrance to the University stadium, terminating at a [illegible] which will give street car service to the [illegible] nor Tract section.

North Carolina.

The Virginian & Eastern Carolina [illegible] has surveys under way for a new line [illegible] North Carolina. J. M. Turner, 56 G[illegible] St., Augusta, Ga., is President.

At a meeting of the stockholders [illegible] Kinston Terminal Co., Kinston, N. C., the Board of Directors were elected and [illegible] of incorporation signed. The authorized [illegible] ital of the company is $50,000, and is [illegible] posed to build a line from Kinston [illegible] lands.

Ohio.

The City Council of Toledo has passed [illegible] ordinance for the vacation of Junction [illegible] and it will now be possible for the La[illegible] & Michigan Southern Ry., Samuel [illegible] Chief Engineer, Cleveland, Ohio, [illegible] work in the near future on extensive [illegible] provements in Toledo. These, it is understood, will cost the company $2,500,000. It [illegible] that they will soon be put underway.

The Republic Railway & Light Co. [illegible] town, Ohio, is planning extensive improvements to its properties. Some reports [illegible] it that an expenditure of $5,000,000 [illegible] 1916 is proposed, and that of this sum $2,[illegible] 000 will be spent this year. It is stated [illegible] between $1,500,000 and $1,600,000 will [illegible] utilized for the erection of a large [illegible] house either at Ellwood City, Pa., where the Mahoning system recently absorbed the Pennsylvania power plant, or at Lowellville. The remainder of the $2,000,000 will be used [illegible] new power equipment, rolling stock and the improvement of the West Federal St. barns at Youngstown.

The Ohio Electric Ry. Co., Cincinnati, has announced its intention of building new street car lines in Hamilton this summer, providing Council grants the franchise. One extension will be the connection of [illegible] Main St. line with the North B. at [illegible] St. bridge and the other from [illegible] the baseball park to Parrish Ave.

The directors of the Springfield and Xenia Ry. Co. have approved the preliminary su[illegible] for an extension to Dayton from Y[illegible] Springs and have authorized Martin Ackerman, General Manager, Springfield, O., to proceed with details preliminary to construction.

The State Public Utilities Commission has granted permission to the North Rand[illegible] road Co. to issue $150,000 in bonds [illegible] 000 in stock at par for the purpose [illegible] ing a branch line from Miles Ave., [illegible] land, to the new race track near Ran[illegible] miles. The new line, which will be in [illegible] extension of the Miles Ave. line to the race grounds, is projected by members [illegible] race track association, among whom a[illegible] Devereaux, H. A. Watterson and [illegible] Cannon of Cleveland.

The Bluffton Stone Co., Bluffton, [illegible], has been awarded a contract for stone [illegible] ballasting the Lake Erie & Western [illegible] the ew York Central lines from Lima to

Oklahoma.

[illegible]
[illegible] that the headquarters of construcbe located at Guymon, Okla., and ffices of The Brindley Co., 17 Bat- [illegible] ontract, will be established there.

of McAlester, Okla., have ap- [illegible]

Oregon.

is under consideration for the conf an electric railroad from Eugene Grove, and already right of way ie to Creswell, 10½ miles, has been Business men of Eugene are inter is proposition, which will be sub- [illegible] construction of a line. P. E. Eugene, Ore., is interested.

n, ranchers, landowners and busi n central Crook county, Ore., have $100,000 for the purpose of inducegon Trunk line to build a branch lius, or some similarly well-situatto Prineville, Ore., tapping the l Crooked River valleys.

& Co., sub-contractors of Twohy commenced grading work within nits of Eugene, Ore., on the prohern Pacific line from Eugene to

Pennsylvania.

rie R. R. has awarded the contracts track work between Meadville and to the following: Section "A," & Edmondson Co. of Brookville, n "B," Robert Grace Contracting eland, O.; Section "C," T. A. Gil f 50 Church St., New York City. vill involve the expenditure of over

tstown & Phoenixville Ry. Co. has surveys and has secured the capital nstruction of a 6-mile line from Spring City. The work will be Railway Building & Operating Co., Title Bldg., Philadelphia, Pa.

nbersburg, Greencastle & Waynest Ry. Co., Waynesboro, Pa., is to started shortly on the extension of m Highfield to Blue Ridge Sumight of way for this extension has

st Penn Traction Co., J. L. Fritsch, eer, Connellsville, Pa., has started surveys for a connecting link beilles and Irwin.

ading on the new extension of the Le- New England R. R., from Danielsville aqua, Pa., have practically been comby the contractors and the company is ying the steel. So far the rails have id from Andreas to Frantz's. All of [illegible] except the largest one, that over the River at Lehigh Gap, which is 110 ft. Rapid progress is also being made on nd it will be completed by the time the y has the tracks laid along the rest of e. From present indications regular can be started over the extension by the middle of June.

ons are being secured on right of way 8 or 10 mile line in the Indian Creek The line will be constructed primarily e development of coal lands owned by B. Zimmerman, Somerset, Pa., presif the Quemahoning Coal Co.

South Dakota.

rris, Shepard & Dougherty, 801 Globe St. Paul, Minn., have been awarded the ct for change of alignment and double for the Chicago, Milwaukee & St. Paul tween Summit and Aberdeen.

[illegible] Mills, President, Sioux [illegible] S. Dak., is [illegible] in Sioux Falls

Tennessee.

[illegible] tered early in April, proposes the construction of a 52-mile line, the route taking in Nashville, Murfreesboro and Woodbury, Tenn. Surveys for the line have not been made. R. T. Wilson, Nashville, Tenn., is President.

There is a report, which cannot be confirmed at this time, that the Atchison, Topeka & Santa Fe Ry. is planning to enter Memphis over its own rails. The plan, as outlined, in- [illegible] new lines from Memphis to the gulf, the route of which is already planned. It will enter the city from the south, passing through White Station and crossing the Speedway near South Orleans St. It is further stated that negotiations have been opened looking to the purchase of the old union depot site near Walker Ave. and Wellington St., for terminals. This ground is near that purchased by the Rock Island railroad, and will place the two systems close together in regard to handling business in and out of Memphis. It is known that the Santa Fe has made attempts to buy the Missouri & North Arkansas railroad from David R. Francis and John Scullins of St. Louis. A difference in price prevented the consummation of the deal. Now that the M. & N. A. is in a receiver's hands, negotiations have been re-opened, it is said, with fair chances of closing for the property.

Texas.

Engineers of the Stone & Webster Engineering Corporation, which controls the Dallas Consolidated Ry. Co. of Dallas, are making a re-survey of the right of way for a proposed interurban line from Dallas to Terrell.

Citizens of Rio Grande City have raised the $25,000 bonus for securing the construction of an extension of the San Benito & Rio Grande Valley R. R., S. H. Robertson, President, San Benito, Tex., from Sam Fordyce to Rio Grande.

Grading has been completed on the connecting line between the Marshal & East Texas R. R. and the Port Bolivar Road, and rails will be laid as soon as possible. The junction of the two roads will be at Jamestown, about 3 miles north of Ashland, Texas.

The Knox Lumber Co., Knox City, Texas, has completed surveys between Bronson, Texas, and Hempstead, and estimates are now being made of the cost of constructing a railroad line.

Engineers of the Quanah, Seymour, Dublin & Rockport Ry. Co., recently completed a preliminary survey for the construction of a line to Leesville, Texas. L. E. Walker, Austin, Texas, is President of the railroad.

Kennedy Bros. & Meller, who have the contract for grading the San Antonio, Uvalde & Gulf Railroad from Fowlerton to a point near Pleasanton, Tex., have shipped their outfit from Muskogee, Okla., to Fowlerton, and will commence work immediately. The equipment includes 140 head of draft horses and mules.

It is reported that the Brownwood North & South R. R. Co. (Frisco line) has filed an amendment with the Secretary of State, Austin, Texas, increasing their capital stock from $30,000 to $225,000 to cover the cost of an extension to the 17-mile line, north of the present terminus at May, Texas.

Utah.

It is reported that work will be started shortly on the Oregon Short Line Ballard-Logan cutoff in Cache county, Utah. The new cutoff will avoid the present loops by way of Wendon and Wellsville. Carl Stradley, Salt Lake City, Utah, is General Manager of the company.

Surveyors under the employ of Jesse Knight, Provo, Utah, have started preliminary work at Helper, on a branch line from the Denver & Rio Grande to the coal beds near Provo.

Virginia.

The Richmond & Rappahannock River Ry. Co., mentioned in our last issue, has begun surveys for the proposed line from Richmond to the Rappahannock. The main line of the road is to be about 50 miles in length between Fair Oaks and Urbanna, or about 60 miles, counting that part of the line already constructed into Richmond. Charles L. Ruffin of Burnsville, N. C., vice president of the company, is in charge of the engineering work.

Vermont.

The stockholders of the Burlington Traction Co., Elias Lyman, President, Burlington, Vt., have voted to issue bonds to the amount of $500,000 for the purchase of the Vergennes Power Co.'s holdings at Vergennes, Vt., and for the extension and improvement of the road. The Vergennes plant will cost $200,000 and the balance will be placed in the treasury to meet bonds and make improvements.

Representatives of the New York, New Haven & Hartford R. R. and the Grand Trunk Ry. have signed the formal agreement settling the long-pending controversy at Brattleboro, Vt. Under this agreement the railroads will expend more than $300,000 for improvements at Brattleboro. These include a $58,000 union station just south of Bridge St. and west of the present tracks; an overpass from the south of the Main St. bridge across the tracks and thence across the Connecticut bridge at a 5 per cent grade; the straightening of Vernon St. and the reduction of its grade to practically nothing; the construction of a freight yard for the control of Vermont west of the main tracks on a level with Vernon St.

Washington.

◉Philip Morrison, Seattle, Wash., has secured a sub-contract for grading and road work on the Wenatchee-Pateros branch line of the Northern Pacific Ry.

The Olympic Terminal Ry. Co. has completed surveys and has secured the capital for the construction of its projected 10-mile line between Olympia and the Point Defiance Line. The date for awarding construction contract has not been determined. P. H. Carlyon, Olympia, Wash., is President.

The Oregon-Washington Railway & Navigation Co., G. W. Boschke, Assistant General Manager, Portland, Ore., has in view a number of improvements to be made in Tacoma within the next two years in preparation for the rapid handling of freight on the opening of Tenino-Tacoma water grade branch of the Port Townsend Southern Railway. These improvements will call for an expenditure of about $2,000,000.

Wisconsin.

The Chicago Short Line R. R. Co. of Lancaster, Wis., has been incorporated with a capital stock of $25,000 and proposes to construct an electric road from Lancaster to Chicago via Platteville, Darlington and Shellsburg. The incorporators include A. H. Patch, F. G. Wettmore and Alexander Robinson.

West Virginia.

Press dispatches quote Frank Trumbull, chairman of the Board of Directors of the Chesapeake & Ohio R. R. as stating that a number of short branch lines will be built by the C. & O. into the West Virginia coal fields this year.

The Hart Construction Co. has completed its contract for straightening out curves on the Baltimore & Ohio R. R. between Patterson's creek and Okonoko, and the outfit has been shipped to the 4-mile job on the Norfolk & Western.

Canada.

The Kingston & Pembroke Ry., G. G. Hare, Engineer, Kingston, Ont., is to improve its roadbed between Kingston and Renfrew this summer. About $205,000 is to be expended.

Grading work is to be started early in May for the projected line of the Edmonton, Dunvegan & British Columbia Ry., and it is planned to lay the steel this year for 100

✣ indicates work now open for bids. ◉ indicates a contract let recently.

miles of this road. Contracts for this amount of rails have already been placed with American firms. A number of additional contracts are to be awarded this month. J. D. MacArthur, the railroad contractor, Winnipeg, Man., is President of this road.

⊙The Carter, Halls, Aldinger Co., Winnipeg, Man., has been awarded the contract for concrete, substructures, excavation, etc., for overhead bridges and subway at Edmonton, Alberta, for its Canadian Pacific Ry. Bids for this work were opened Feb. 18.

The Canadian Government wi consider shortly the proposition of the Ca dian Pacific to bore a tunnel under the y of Ottawa between the Central and Uni stations, thereby utilizing a portion of canal.

BRIDGES—STEEL AND CONCRETE

Alabama.

An engineering commitee, representing all the lines entering Birmingham, Ala., held a meeting April 23 to select a subcommittee of experts who shall consider with the city engineer the grade crossing problem in Birmingham. Walter G. Kirkpatrick is City Engineer.

California.

⊙The Board of Glenn County Supervisors, Willows, Calif., has awarded the contract for the construction of the Briscoe Creek bridge to F. L. Seamann, Redding, Calif., at $3,924. The structure will be of reinforced concrete.

⊙The contract for the construction of a 100-ft. steel truss bridge over Soquel Creek in Santa Cruz County has been awarded to Nelson Mosher, Santa Cruz, Calif., at his bid of $4,865. A. M. Baldwin, Santa Cruz, Calif., is County Surveyor.

⊙The Supervisors of San Bernardino County, San Bernardino, Calif., have awarded the contract for the construction of four concrete bridges over West Twin Creek at different points on the Waterman Canyon road to Charles Lefler, San Bernardino, Calif., at $2,100 and $9.45 per yd. of additional concrete.

⊙Board of San Bernardino County Supervisors, San Bernardino, Calif., has awarded the contract for the construction of a 250-ft. span bridge over the Mojave River to the Joliet Bridge & Iron Co., Joliet, Ill., at $11,620. J. S. Bright, Jr., is County Surveyor.

The Mercereau Bridge & Construction Co., Pacific Electric Bldg., Los Angeles, Calif., will probably be awarded the contract for the construction of a 1,460-ft. concrete arch bridge at Pasadena, Calif. The structure will have a 28-ft. roadway and two 5-ft. walks. The company's bid was $187,700. H. Dyer is City Clerk.

Colorado.

✣Bids will be received until 10:30 A. M., May 6, by Board of Las Animas County Commissioners, Trinidad, Colo., for the construction of a 46-ft. span bridge, 13 ft. high, from the center of the arroya or channel, said bridge to be located three-fourths of a mile north of the north line of City of Trinidad. Bridge to be a steel span with concrete floor or an all concrete bridge. County will furnish reinforcing steel to contractor at Trinidad, Colo. Bids on concrete to be by the cubic yard, bidders to furnish plans and specifications. G. F. Harlan is Chairman of the Board.

District of Columbia.

Advices from Washington, D. C., state that the senate committee has reported favorably on the appropriation of $25,000 for the construction of a bridge over the Snake River south of Jackson Lake, Idaho.

A bill has been introduced into the Senate, Washington, D. C., authorizing the Great Northern Ry. Co. to construct a bridge over the Yellowstone River in Dawson county.

Idaho.

The City Council of Lewiston, Idaho, will call a special election for the purpose of voting on the proposition to issue $100,000 of bonds for the construction of a steel bridge over the Clear water bridge. D. C. Wrighter is City Engineer.

Illinois.

✣Bids will be received up to 10:30 a. m., May 16, at the City Hall, Mascoutah, Ill., for one new reinforced concrete, slab superstructure, partly on old stone abutments and partly on a new reinforced concrete wall, to be built in the City of Mascoutah, St. Clair County. Geo. H. Liebig, City Clerk, Mascoutah, Ill. East North Street Bridge:—Span, 11 to 12 ft.; length, about 140 ft. Total concrete, about 102 cu. yds.; reinforcing steel, about 12,934 lbs. All material to be shipped in. Old stone walls to be used to support the superstructure, with the exception of about 72 ft. of new reinforced concrete wall. Total height, about 10½ ft. Work to be completed on or before July 16, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received up to 2 p. m., May 4, at the Town Clerk's office, Orion, Illinois, for 4 reinforced concrete bridges and one pipe culvert to be built in Western Township, Henry County. F. L. Anerson, Town Clerk, Orion, Ill. The materials for all of these bridges must be shipped in. Estimated total concrete in all bridges and pipe culvert, 220.8 cu. yds.; reinforcing steel, 11,787 lbs. It is said that gravel F. O. B. nearest railroad station will cost about 95 cents per ton. Low water flow for the Samuelson, Swanson, Miller and McDonald bridges and Edwards pipe culvert, respectively, is as follows: 6 ins. deep and 2 ft. wide; 6 ins. deep and 4 ft. wide; 6 ins. deep and 2 ft. wide. The span and height of the existing bridges are as follows: 5x8-ft. stone arch; 10x6-ft. wood; 8x9-ft. wood; 18-in. tile; 12-in. tile. Work to be completed on or before August 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received up to 2 p. m., April 27, at the Supervisor's room, Court House, Ottawa, Illinois, for two reinforced concrete bridges, to be built in Otter Creek Township, LaSalle County. Frank Birtwell, Town Clerk, R. F. D. No. 6, Streator, Ill. Badger Bridge:—Span, 30 ft.; height 12 ft.; roadway, 16 ft.; wings, 12 ft. Estimated concrete, 91.2 cu. yds.; reinforcing steel, 9,548 lbs. Nearest railroad station, Kernan, on the A., T. & S. F. railroad, 2¼ miles. Materials to be shipped in. Low water flow, dry; high water, about 6 ft. deep and 30 ft. wide. Stream bed silt. Foundations to be carried about 3½ ft. below stream bed. Old bridge 23 ft., steel truss, on piles with good approaches; total length, about 48 ft.; average excavation, about 9 ft. Henry Bridge:—Span, 50 ft.; height, 14 ft.; roaway, 16 ft.; wings, 14 ft. Estimated concrete, 159.1 cu. yds.; reinforcing steel, 21,993 lbs. Nearest railroad station, Kernan, on the A., T. & S. F. railroad, ¾ of a mile. Materials to be shipped in. Low water flow, depth about 6 ins.; width 20 ft.; high water flow, depth, 6 ft. Stream bed gravelly clay. Foundations to be carried about 3½ ft. below stream bed. Old steel truss on stone piers with wood approaches; length, about 65 ft. Average excavation, about 7 ft. Work to be completed on or before September 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received up to 2 m., 27, at the People's Bank, Golden, for one reinforced concrete bridge to be lt in Northeast Township, Adams Cou Tenhaeff, Town Clerk, Laprairie, Bridge:—Span 25 ft.; roadway, 16 18 ft.; wings, 22 ft. Estimated tot of concrete in structure, 113.3 c reinforcing steel, 11,925 lbs. Near station, LaPrairie, on the C., B. & Concrete materials to be shipped i gravel F. O. B. LaPrairie about $1. Quality not known. Low water 1½ ft. deep and 15 ft. wide; high ate about 11 ft. deep. Stream bed gravel bridge 25-ft. I-beam steel legs, b stone walls. Excavation to be ca 2 ft. below stream bed. Work t pleted on or before July 1, detailed information may be h examination of the plans a tions prepared by the Illinois Commission, which may be seen a Clerk's office or may be obtained plication in writing, from the Illino Commission, Springfield, Illinois.

At a special meeting of the Boar men, Aurora, Ill., the new ordinar proposed new concrete bridge at St. and the resolution calling a sp tion April 30 to vote on the is $100,000 of bonds for the improve passed. No action was taken on St. bridge proposition. M. J. Tar Engineer.

Indiana.

✣Bids will be received until 10 m 24, by Board of Tippecanoe Count sioners, Lafayette, Ind., for the c of the following respective bridg Ferry Bridge, Jewettsport Bridg Baxter is County Auditor.

✣Bids will be received until 10 m., 11, by Board of Switzerland Count sioners, Vevay, Ind., for the const bridge over Lower Indian Creek c vay-Madison road. Scott Culbertso ty Auditor.

⊙The contract for the constru bridge over the White River at Hay between Dubois and Martin counti let to the Vincennes Bridge Co., Ind., at $17,944.

The Board of County Com Youngstown, Ind., has instructed t Surveyor to prepare plans for the c of a bridge over Mill Creek in township in the Shield Road.

Iowa.

✣Bids will be received until 10 m 1, by Board of Grundy County S Grundy Center, Ia., for the const a bridge in that county. As pr structure will be of steel with con abutments and wings or a reinf crete arch bridge. E. G. Ensminger Co Auditor.

✣Bids will be received until noo Ju by Board of Hardin County Super dora, Ia., for the construction of a s across the Iowa River in the City Iowa, the length of bridge to be fr to 1,100 ft. Height to be 50 to 70 way to be 20 ft. wide and floor to crete, live load 100 pounds to the sq Profile of location and soundings a in the office of E. L. Marriage, Co itor at Eldora, Iowa.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

The oard of Hardin County Supervisors, I.., has instructed C. L. [illegible] Auditor, to advertise for plans [illegible] ions for the construction of the pro- 00-ft. bridge over the Iowa River. ed the structure will be of steel with e floor.

atter of paving the Grand Avenue ll be taken up by the city of Des I., this spring. The work, it is es- will require an expenditure of about J. W. Budd is City Engineer.

[illegible] Committee of the [illegible] Board, Waterloo, Ia., has [illegible] over the Elkhorn River at Winslow t will be necessary to build another extend over the additional 40 ft. of ashed out by the stream.

Kansas.

ssioners of Riley and Pottawatomie at a recent meeting at Manhattan, cted all bids received for the con- f a bridge at Cleburne. Plans and ns will be altered and work read-

Mississippi.

will be received until noon, May 6, ery clerk, Warren County, Vicks- s., for building a wooden bridge on 42, near the J. L. Hinston place, nce with plans and specifications on the clerk.

ard of Lamar County Supervisors, ss., has awarded the contract for the n of a steel and concrete bridge k Creek on the Hattiesburg and d to the Memphis Bridge Co., Mem- n., at $1,075.

Missouri.

[illegible] ny, Mo., has purchased steel for ction of 16 new bridges and erec- e structures will be commenced at

ard of Public Improvements, St. o., after viewing the Union Ave. ssing of the outer Terminal Belt unced that it will be the first cross- eliminated in the general movement y that body. It is proposed to build structure at an estimated cost of [illegible]

Nebraska.

pecial election held at Sutherland, ently it was voted to issue bonds onstruction of a bridge over the tte River north of Sutherland. The f the structure is estimated at about

Board of Gage County Supervisors, Nebr., has voted to construct a con- ge on Scott St., south of the Wit- ldition providing the city will agree e-half the cost. A. J. Pethoud is [illegible]

New Jersey.

[illegible] received until 3 p. m. [illegible] Board of Chosen Freeholders of Hud- ounty, N. J., Walter O'Mara, Jersey N. J., for the Hudson Ave. approach to n Three of the Fourteenth St. Viaduct he construction of a Retaining Wall on esterly side of Sections Two and Three Fourteenth St. Viaduct, West Hoboken. Jersey, according to plans and specifica-

ices from Trenton, N. J., state that Gov n, in accordance with the provisions of e Joint Resolution No. 4, introduced by or Johnson, has filed with the secretary ate the names of five persons to act with mission appointed by the Governor of York to investigate the feasibility of con- ing a bridge across the Hudson River cting New York and New Jersey. The tion was amended before it finally d, which will enable the commissions to into consideration also the construction tunnel under the river. The persons ap- ed by the Governor to serve on the New mmission are Victor L. M[illegible] saic; W. H. Noyes, Ber[illegible]; George Limouze, [illegible] Hudson.

Bids will be received at once by the Passaic County Freeholders Paterson, N. J., for the completion of the Rutherford Ave bridge over the Passaic river

New Mexico.

Commissioners of Santa Fe County, Santa Fe, New Mexico, recently viewed the proposed site for the construction of the bridge over the Rio Grande River and work will be started on the improvement shortly.

New York.

Bids will be received until 11 a. m. ,May 20, by J. G. Warren, Col., U. S. Engineers, Buffalo, N. Y., for furnishing and constructing a Strauss Bascule steel bridge with concrete pier and abutments over Black Rock Harbor at Ferry St., Buffalo.

North Carolina.

✣Bids will be received until 11 a. m., April 29, by J. P. Goodwin, County Supervisor, Greenville, N. C., for the construction of three new steel bridges, one at Taylors Station, one at Log Shoals and another at a point near Pelham and Batesville

✣Bids will be received, it is reported, by the town of North Wilkesboro, N. C., for a 125-ft. single track steel bridge on steel columns. W. Bullis is Town Clerk.

North Dakota.

The Board of Stark County Commissioners, Dickinson, N. Dak., recently inspected the bridge over the Antelope Creek at Shipley crossing and decided to replace the wrecked structure with a new 90-ft. span.

Ohio.

✣Bids will be received until noon, May 10, by Board of Hamilton County Commissioners, Cincinnati, O., for constructing under Specification No. 304, concrete bridge and fill at the intersection of McCormack Road and Columbia Road in Columbia township. Albert Reinhardt is Clerk of the Board.

✣Bids will be received until 11 a. m., May 6, by Board of Mahoning County Commissioners, Youngstown, O., for the necessary labor and material for the construction of abutments for new bridge over Mill Creek on the Shields road in Boardman township, Mahoning County, O., I. M. Hogg is County Auditor.

✣Bids will be received until 10 a. m., May 7, at the office of Putnam County Auditor, Ottawa, O., for the construction complete of a bridge across the Auglaize on the Putnam-Paulding County line.

⦿The contract for the construction of a reinforced concrete bridge over Whetstone Creek, near Mt. Gilead, O., has been awarded to the Hackedorn Contracting Co., Indianapolis, Ind., at $7,329. Clifton Sipe, Mt. Gilead, O., is County Auditor. Bids for the work were opened April 17.

⦿The Brookville Bridge Co., Brookville, O., has been awarded the contract for the construction of bridge in Williams County at $2,120. Bids were opened April 16. Other bridge contracts were let as follows: M. N. Harmon, 2 bridges, Bryan, O.; Mengerink Bros., 6 bridges, Napoleon, O.; Albrink & Harper, 8 bridges, Napoleon, O.; R. J. Smith, 2 bridges, Edgerton, O.; Rare & Smith, 1 bridge, Edgerton, O.

⦿The Board of Columbiana County Commissioners, Lisbon, O., has awarded the contract for the construction of the superstructure of a steel bridge in Middleton township to the Central Concrete & Construction Co., Canton, O., at $1,377. The substructure went to T. A. Richardson, Negley, O., at $1,465. Bids were opened April 15. P. R. Walker is Commissioners' clerk

⦿Wm. McDowell & Son, 10319 Miles Ave., Cleveland, O., have been awarded the con- [illegible] missioners, J. F. Goldenbogen, Clerk, Cleveland, for the construction of bridge work per Report No. 2919 rebuilding bridge. McCracken Road, Bedford Township. Bids were opened April 17.

A meeting was recently held at the office of U. S. Engineer Jervey, Government Bldg., Cincinnati, O., on the proposition to construct a bridge over the Ohio River between Owensboro, Ky., and Rockport, Ind. The Owensboro & Rockport Bridge & Terminal Co. has already submitted plans for the work.

[illegible] bridges by M. J. Bahin, City Engineer, Springfield, O., the following repairs will be made on seven of the structures: Replank West Pleasant St. bridge; replank east side Lagonda bridge; fix roadway of bridge over race in Water St.; paint bridge in Burnett road; fix cement posts at Bechtle Ave. bridge; place guard rails at Plum St. bridge; cover open culvert at Harrison and Sunset; relay sidewalk at Lowry Ave. bridge over Pennsylvania tracks.

The Park Commission, Youngstown, O., has decided to reject all bids received for the construction of a concrete dam and four bridges in Lincoln Park. The work will be readvertised.

The Commissioners of Franklin County, Columbus, O., have been petitioned for the construction of a new bridge at Kings Ave.

Director of Public Service, Toledo, O., has communicated with the officials of the Wheeling & Lake Erie Railroad in order to secure the construction of new bridges over the tracks at LaGrange and Elm St.

Oklahoma.

The Board of Chickasaw County Supervisors has decided upon an expenditure of $12,000 for the construction of new bridges during the coming summer. Seven structures will be of concrete and will cost $7,000 and three will be of steel, one having a 100-ft. span and the other two 60-ft. spans. The steel structures will cost $5,000.

A delegation of farmers residing in the vicinity of Newcastle, about 15 miles south of Oklahoma City, Okla., has asked the cooperation of the Chamber of Commerce of Oklahoma City, in a movement looking to the erection of a wagon bridge over the South Canadian River at a point directly south of Oklahoma City and northeast of Newcastle. An estimate of the cost will be prepared soon

Oregon.

It was decided at the last meeting of the joint bridge committee of the Vancouver and Portland commercial clubs to have plans prepared for the proposed Pacific Highway bridge over the Columbia River by Ralph Modjeski, Chicago, Ill.

Pennsylvania.

⦿The Board of Chester County Commissioners, West Chester, Pa., has awarded the contract for the construction of a stone arch bridge at Avondale to D. F. O'Connell & Son, Avondale, Pa., at $2,399. Bids were opened April 15. John Parker is Clerk of the Board.

The County Commissioners and Controller, Wilkesbarre, Pa., recently held a conference with Engineer Schofield and representatives of the Penn Bridge Co. and bridge contractors, relative to the status of the new bridge under the recent decision of Judge Fuller, compelling the approach to cross the tracks of the D. L. & W. above grade. This change will necessitate an additional expenditure of $75,000.

✣Bids will be received until 10:30 a. m., April 29, at the office of the City Controller, Pittsburgh, Pa., for altering steel columns bracing West Side Belt R. R. bridge over South Main St. (improvement of streets in West End Flood District). W. A. Magee is Mayor of Pittsburgh, Pa.

The Philadelphia and Easton Electric Ry. Co., Doylestown, Pa., is planning to build a bridge across the Lehigh River to connect with the Northampton Traction's line, in order to compete with the Lehigh Valley Transit Co.

Board of Dauphin County Commissioners, Harrisburg, Pa., received the following bids for the construction of a concrete twin-arch bridge over Clark's Creek, 4 miles northeast of Dauphin: Ferro Concrete Company, con-

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

crete bridge, $3,649; Nelson Meredith Company, concrete, $2,989, stone, $2,794; G. W. Ensign, stone, $4,468.50; Stucker Brothers, concrete, $3,444; Otto Paving and Construction Company, concrete, $5,240, and stone, $5,310; William Wagman & Bros., stone, $3,386; J. H. Kramer, stone, $5,683; G. A. & F. M. Wagman, concrete, $3,880.

The following bids have been received by the borough of Monessen, Monessen, Pa., for the construction of a reinforced concrete bridge, for which Chester & Fleming, Union Bank Bldg., Pittsburg, Pa., are consulting engineers, (1) standing for bridge complete, (2) for extra earth excavation per cu. yd., (3) for extra rock excavation per cu. yd., (4) extra concrete per cu. yd., (5) for complete using local steel, (6) time: L. J. Mensch, (1) $53,350, (2) $1.50, (3) $2.50, (4) $7.50, (5) $68,350, (6) 180 days; H. C. Brooks Co., (1) $57,000, (2) $1.50, (3) $3.00, (4) $8.00, (6) 150 days; Bowman Bros., (1) $59,500, (2) $1.00, (3) $1.50 (4) $12.00, (5) $59,500, (6) 150 days; Nicola Bldg. Co., (1) $52,329, (2) $.50, (3) $1.00, (4) $5.00, (5) $52,329, (6) 120 days; C. B. Clark Co., (1) $51,000, (2) $1.25, (3) $3.00, (4) $7.50, (5) $51,000, (6) 150 days; Cullen Friestedt Co., (1) $66,727, (2) $.85, (3) $2.25, (4) $7.40, (5) $66,277, (6) 120 days.

The County Court, West Chester, Pa., has appointed viewers to inspect the proposed sites for the construction of two bridges for which petitions were recently filed. One structure is planned for Chester Creek in Thornbury township and the other for Darby Creek in Upper Darby township.

The Bridge Committee of the City Council, Wilkesbarre, Pa., has received the following bids for repairing the South St. bridge: MacCallum Supply Co., Wilkesbarre, $28,900; Penn Bridge Co., represented in this city by Thomas W. Haines, $24,995, less $396 allowed for old materials, C. N. Neeld Construction Co., Pittsburg, $13,711 less $250; The Sax & Abbott Construction Co., of Philadelphia, submitted a bid for an entirely new bridge, $45,000. B. H. Finch is City Engineer.

Plans have been prepared by City Engineer, Franz Engstrom, Altoona, Pa., for the construction of the proposed 7th St. bridge. The structure will provide for street car traffic and the trolley company will pay $25,000 of the cost.

Following the approval of the Viewers, the Grand Jury and the Court, the County Commissioners, Ebensburg, Pa., have decided to call for bids shortly for the construction of a new bridge over Solomon's run at Von Lunen St. in Dale.

It has been announced by the Harrisburg Park Commission, Harrisburg, Pa., that the construction of the proposed bridge over Spring Creek will not be taken up during the present year. C. Grant Forrer, P. O. Box 672, Harrisburg, Pa., is Secretary of the commission.

Tennessee.

⊙The Nashville Stone & Adamant Co., Nashville, Tenn., has been awarded the contract for the construction of three concrete bridges in Athens, Ala. The longest structure will be about 50 ft. in length.

Committees of Davidson and Robertson Counties, Tenn., recently inspected the proposed site of the bridge to be erected over Sycamore Creek connecting the two counties. The Davidson County Court, Nashville, Tenn., has appropriated $4,000 for the structure while Robertson County Court at Springfield, Tenn., appropriated $3,500.

The Henry County Court, Paris, Tenn., has authorized the reconstruction of numerous bridges washed out and destroyed by the recent floods. The County Judge has been instructed to issue warrant for the payment of them when approved by the County Supervisor of roads.

Texas.

⊙The Guadalupe County Commissioners' Court, Seguin, Texas, has let a contract to the Missouri Bridge & Iron Co., East St. Louis, Ill., for the construction of a 173-ft. span bridge over the Guadalupe River at Miller bridge. The contract price was $6,400. The work must be completed within 110 days.

The Commissioners' Court of Taylor County, Abilene, Texas, has ordered the construction of two steel bridges at Abilene at once.

At a recently held election at Canutillo, Texas, it was voted to issue bonds amounting to $7,000 for the construction of bridges at Montoya and Vinton, Texas.

The matter of constructing a bridge over the Little White Oak Bayou on Montgomery Ave., Houston, Texas, is under consideration by the Commissioners of Harris County and a committee of citizens. At first it was believed that a creosoted wooden bridge would be adequate, but it was suggested later that if the county expected to make the expenditure at all it had as well put in a concrete bridge and have the expense ended for all time. The estimates will show the bridge to cost between $12,000 and $18,000. It is planned to build a 300-ft. bridge and to fill in the approach gullies on either side for a considerable distance.

Virginia.

✣Bids will be received until noon, May 1, Circuit Court, Spottsylvania, C. H., Va., for the construction of a steel bridge Po River in Spottsylvania County, miles from Fredericksburg, on the P. Ry. The structure will be about 2 ins. long and will have a 12-ft. with wooden flooring. The substruct be of concrete and stone and sand ma cured at the site. The substructure include tearing out old bends. P. St. son, Richmond, Va., is State Highw missioner. Blueprints of plans may cured at the office of Childrey, Sun Richmond, Va., at a cost of $.50.

Washington.

Advices from Tacoma, Wash., state Oregon-Washington Railway & N Co. will erect a steel bridge at 15t cost $296,000. Plans are already and bids for the work will be taken is said. G. T. Forsyth, Portland, Engineer of Bridges of the railroad

West Virginia.

✣Bids will be received until May Brooke County Court, K. C. Brashea Wellsburg, W. Va., for the constru two bridges, one over Buffalo Creek Brooms Fording and the other over Creek near Hollidays Cove. Separ for stone and concrete abutments wi ceived. Bids for bridge may be sep include the abutments. Bids will als ceived for all concrete bridges. Pl specifications at County Clerk's office.

Canada.

✣Bids will be received until noon, by City Commissioners, Saskatoon, S furnishing the necessary labor and for the construction of the superstru the 23d St. subway. Further informat be obtained of W. L. MacKenzie. Bri gineer of the Canadian Northern Ry. peg, Man., or of George T. Clark, Ci neer, Saskatoon, Sask.

⊙The following contracts have bee the construction of bridges in West township, Ontario: Black bridge, Ailsa Craig, 115-ft. span with a 16- way. Steel work awarded to the Bridge Company with a tender of $2, crete work to Charles Ferguson, of $2,470. Scott's and Adelaide town line former 50-ft. and latter 45-ft. span, e a 16-ft. roadway. Steel contract aw A. Hill & Co., Mitchell, at $1,640, crete work to R. Waltham, Kerwood, Selbee bridge, span of 45 ft. with roadway. Steel work awarded to A Co., Mitchell, at $695, and concrete R. Hutchinson at $780.

ROADS, STREETS AND PAVEMENTS

Alabama.

⊙George A. Muths and Dr. H. P. Rockwell have been awarded the contract by the City Commission of Mobile, Ala., for the paving of Government St., from the city limits to Fulton road with Dolarway pavement. The street car tracks will be parked and the roadway on each side will be 19 ft. wide.

⊙The Mobile County Board of Revenue and the Road Commissioners, Mobile, Ala., have awarded to the Southern Fuel & Material Co., the contract to supply material consisting of chert and clean gravel, for the construction of 40 miles of road. The contract price is $1.08 per ton for gravel and $1.85 per ton for chert. The material will be mixed in proportion of 75 per cent gravel and 25 per cent chert. It is estimated that 140,000 tons will be necessary and will amount to $177,800. C. L. Strange is County Engineer.

Plans and specifications are being prepared in the engineering department of the city of Mobile, Ala., for a considerable amount of street paving which has been ordered by the City Commission.

Arkansas.

✣Bids will be received until 2 p. m., May 15, by Board of Improvement, Paving District No. 29, Pine Bluff, Ark., C. M. Philpot, Chairman, for laying approximately 25,500 sq. yds. of bituminous wearing surface on old gravel roadway. Plans and specifications by Wm. J. Parkes, C. E., Citizens' Bank Bldg., Pine Bluff, Ark. Construction under supervision of F. R. Allen, City Engr.

⊙Shelby & Bateman have been awarded the contract by the Board of Commissioners of Improvement District No. 192 (West Seventh St.), Little Rock, Ark., for grading, draining, curbing and paving with wood block approximately 16,900 sq. yds. of West Seventh St., at $40,881. Ford & McCree, Little Rock, are Engineers. Bids were opened March 25.

Georgia.

⊙The West Construction Co., Chattanooga, Tenn., has been awarded the contract by the City Council and Mayor of Elberton, Ga., for furnishing the labor and material for the following work: 25,000 sq. bituminous macadam street paving, yds. of concrete gutters. The contra is $1.35 per sq. yd. H. S. Jaudon E ing Co., Savannah, Ga., Engineers. B opened April 9.

The Mayor and City Council of Br Ga., have rejected all bids received for furnishing all material and la doing the work of grading and pavi vitrified brick Monk St., from Newcas to stone steps, Gloucester St., from Newcastle, F St., from Newcastle and Oglethorpe St., from Monk to Gl The work would include approximatel sq. yds. of paving and 1,700 lin. ft. of curb. J. L. Zachry is City Engineer rector of Public Works.

The citizens of Cedartown, Ga., a cent election voted the issuance of b the sum of $20,000 for the purpose of the business section of the city. It is to let the contract at once. Wood bl probably be used.

✣ indicates work now open for bids, ⊙ indicates a contract let recently.

Idaho.

[illegible] the central square of the town.

[illegible] have installed in the city this year, of paving in the business district 75,000; 10 miles of water mains to [illegible] 16 and 18 miles of street grading, d 15 miles of cement sidewalk and cost $150,000. The Council will special bond election about June 1, voters of the city whether or not lesire of a majority of them to have done this year. Date is being pre- City Engineer R. J. Wood of the ngineering Co. J. B. Congdon of J. W. Bailey of Baker City, have [illegible]

Illinois.

will be received until about May 2. f Local Improvements, Lewistown, [illegible] trified brick paving on a concrete ller-Coult Co., Chemical Bldg., St. , Engineers.

will be received until 2 p. m., April ard of Local Improvements, Aurora. e construction of 18,380 sq. yds. of vement and 13,610 lin. ft. of com- and gutter. M. J. Tarble is City Official advertisement will be found in this issue.

Martin of Belleville, Ill., has been he contract by the Town Clerk of Township, at Mascoutah, Ill., for ruction of earth approaches to the ek bridge, the embankment to be material taken from borrow pits the embankment. The contract $.23 per cu. yd. The total quantity ankment is approximately 28,000 cu. he soil is light clay. Bids were opened

Thompson, 108 German Fire Ins. ria, Ill., has been awarded the con- he Board of Local Improvements of for re-paving Knoxville Ave., from Ave., to the north city limits at $33,- he work includes 17,500 sq. yds. of new ment and grout filler, 12,000 ft. of rb and 5-in. concrete foundation. opened April 15.

ity Council of Champaign, Ill. has contract for the laying of approxi- 1,200,000 bricks to J. W. Stipes & Co. St., between Washington and Green e alley between Clark and University will be paved.

e Board of Local Improvements of Ill., has awarded the contracts for ving of 12th St., between Broadway and and York St., between 10th and 12th, to Rees at $10,325 and $7,500 respectively.

Engineer Claude James of Mattoon, s prepared statistics for the laying of te pavement in Dodge Grove cemetery. ork to be begun about June 1. The ent will be 16 ft. wide, and will cover ain streets, the north and south thor- are and the principal cross street, mak- out 4,000 sq. yds. in all. J. E. Miller is intendent.

s are on file in City Engineer L. L. r's office, Belleville, Ill., for the paving ckroad. The road will be paved from outhern tracks to Edgemont, where it onnect with the contemplated East St. paving now under way. The plans le for brick pavement.

Board of Local Improvements of Peo- ll., has instructed City Engineer Leonard ffries to prepare estimates for the pav- f two blocks of California Ave. A hear- as held April 22 on the Brotherson St. vement, estimated by the engineer to $7,741.

e citizens of Sterling, Ill., on April 16 the issuance of bonds for the paving venue B and Fourth St.

petition has been presented to the Board [illegible] for the paving of D St., [illegible] West First Ave., [illegible]

The City Council of Champaign, Ill., has passed an ordinance providing for the paving of Prospect Ave. Plans and specifications for the improvement have been prepared by the City Engineer.

Following are the low bids received by the [illegible] J. Glackin secretary, for furnishing the materials, labor, etc., necessary to construct pave- [illegible] sq. yds. macadam, (8 in. slag, 4 in. granite top), $1 12; total, $13,762.10; Reinaker Construction Co., 9 South La Salle St. Central St., 6,230 lin. ft. concrete curb and gutter, 64 cts.; 9,790 sq. yds. asphalt, $2 23; total, $29,140, R. F. Conway Co., 133 West Washington St. Cortez St., 1,465 lin. ft. concrete curb and gutter; 2,075 sq. yds. asphalt, $2.27; total, $6,123; Parker-Washington Co., 133 West Washington St. Emerald Ave., 1,240 lin. ft. concrete curb and gutter; 1,820 sq. yds. asphalt, $2.09; total, $4,971. Forrestville Ave., 870 lin. ft. gravel concrete curb and gutter, 60 cts.; 1,850 sq. yds. asphalt, $2 02; total, $4,798; R. F. Conway Co. 41st St., 675 lin. ft. sandstone curbing; 1,560 sq. yds. No. 2 granite block, $2 76; total, $5,585; the Ryan Co., 31 North La Salle St. 56th St., 1,262 lin. ft. concrete curb and gutter, 60 cts.; 2,550 sq. yds. creosoted wood block, $3,042; total, $9,065; Ready & Callahan Co., 133 West Washington St. Green St., 1,250 lin. ft. concrete curb and gutter, 65 cts.; 1,960 sq. yds asphalt, $2.19; total, $5,647; American Asphalt Paving Co., 133 West Washington St. Home St., 3,570 lin. ft. concrete curb and gutter, 65 cts.; 5,430 sq. yds. asphalt, $2; total, $14,151; R. F. Conway Co. Huron St., 2,465 lin. ft. concrete curb and gutter, 65 cts; 3,690 sq. yds. asphalt, $2.15; total, $10,346; Parker-Washington Co. Lake St., 3,960 lin. ft. concrete curb and gutter; 6,660 sq yds. brick, $1.95; total, $12,987; J. A. Sackley Co., 133 West Washington St. Laurence Ave., 9,750 lin. ft. sandstone curbing (5x30 in.), 65 cts.; 14,990 sq. yds. creosoted wood block, $3.23; total, $58,187; the Ryan Co. La Salle St., 710 lin. ft. concrete curb and gutter, 65 cts.; 1,230 sq. yds. asphalt, $2.10; total, $3,488; R. F. Conway Co. Leavitt St., 2,845 lin. ft. concrete curb and gutter, 65 cts.; 4,800 sq. yds. asphaltic [illegible] $1.08; total, $8,710; J. A. Sackley Co. Madison Ave., 4,610 lin. ft. concrete curb and gutter, 55 cts.; 6,900 sq. yds. creosoted wood blocks, $3,092; total, $25,068; Ready & Callahan Co. Melrose St., 9,900 lin. ft. concrete curb and gutter, 65 cts.; 16,000 sq. yds. asphalt, $2.02; total, $32,320; American Asphalt Paving Co. Melrose St., 4,900 lin. ft. concrete curb and gutter, 65 cts.; 7,680 sq. yds. asphalt, $2 07; total, $20,646; American Asphalt Paving Co. 19th St., 2,300 lin. ft. concrete curb and gutter, 65 cts.; 3,600 sq. yds. asphalt, $2.04; R. F. Conway Co. Peoria St., 1,250 lin. ft. concrete curb and gutter, 65 cts.; 1,960 sq. yds. asphalt, $2 19; total, $5,647; American Asphalt Paving Co. Rhodes Ave., 6,900 lin. ft. concrete curb and gutter, 65 cts.; 10,430 sq. yds. asphalt, $2.02; total, $28,427; R. F. Conway Co. Sherman Ave., 1,200 lin. ft. concrete curb and gutter, 70 cts.; 1,600 sq. yds asphalt, $2.18; total, $3,488; Parker-Washington Co. St. Laurence Ave., 6,400 lin. ft. concrete curb and gutter; 11,000 sq. yds. asphalt, $2 03; total, $29,202; American Asphalt Paving Co. 63d St., 3,200 lin. ft. sandstone curbing (5x30 in.), 65 cts.; 9,300 sq. yds. creosoted wood blocks, $3 18; total, $3,325; the Ryan Co. 35th St., 7,030 lin. ft concrete curb and gutter, 68 cts; 15,590 sq. yds. creosoted wood blocks, $3.09; total, $60,028; Ready & Callahan. Washington Ave., 6,000 sq. yds. creosoted wood blocks, $19,101; Ready & Callahan Co. Ontario Ave. system, 8,960 lin. ft. concrete curb and gutter, 65 cts.; 17,290 sq. yds. asphaltic macadam, $1.27; total, $21,985; Calumet Coal and Teaming Co., 9022 Calumet Ave. The work includes a granite concrete curb and gutter unless otherwise specified, manhole and catch basin construction and adjustment, 6 in. Portland cement concrete foundation and preparation of subgrade. Bids opened April 10. The contracts have not been awarded.

Indiana.

✣Bids will be received until May 6, by town of Winamac, Ind., for paving Logan St., including about 8,418 sq. yds. The cost of the work is estimated at about $17,840. C. E. Paul is Surveyor. J. M. Ney is City Clerk.

✣Bids will be received until 10 a. m., May 6, by Board of Commissioners, Clark County, Jeffersonville, Ind., for grading, draining and covering with crushed stone Midway Boulevard. G. W. Stoner is County Auditor.

✣Bids will be received until 1 p. m., May 6, by Board of Ripley County Commissioners, Versailles, Ind., for the construction of a macadamized road in Shelby township. J. Francis Lochard is County Auditor.

✣Bids will be received until 2 p. m., May 7, by Board of Grant County Commissioners, Marion, Ind., for the construction of a stone road on line between Pleasant and Richland townships. E. H. Kimball is County Auditor.

✣Bids will be received until 2 p. m., May 7, by Board of Orange County Commissioners, Paoli, Ind., for the construction of a gravel road in Northeast township. A. B. Ham is County Auditor.

✣Bids will be received until 1 p. m., May 7, by Board of Lawrence County Commissioners, Bedford, Ind., for the construction of 10 gravel or macadamized roads. E. W. Edwards is County Auditor.

✣Bids will be received until noon, May 7, by Board of Morgan County Commissioners, Martinsville, Ind., for the construction of gravel roads in Ashland and Washington townships. J. S. Whitaker is County Auditor.

✣Bids will be received until 10 a. m., May 8, by Board of Cass and Pulaski County Commissioners, Logansport, Ind., for the construction of a road on line between said counties. J. E. Wallace is Auditor of Cass County, Logansport, Ind.

✣Bids will be received until 10 a. m., May 8, by Board of Tippecanoe County Commissioners, Lafayette, Ind., for the construction of two gravel roads. G. W. Baxter is County Auditor.

✣Bids will be received until noon, May 8, by Board of Lake County Commissioners, Crown Point, Ind., for the construction of four gravel roads in North township. C. A. Johnson is County Auditor.

✣Bids will be received until 10 a. m., May 11, by Board of Switzerland County Commissioners, Vevay, Ind., for the construction of gravel road in Jefferson township. Scott Culbertson is County Auditor.

✣Bids will be received until 10 a. m., May 2, by Board of Marion County Comissioners, Indianapolis, Ind., for furnishing 205 carloads of crushed stone for highways of Marion County; also for 200,000 gals. of road oil to be used on highways. W. T. Patton is County Auditor.

⦿The Madison County Commissioners, Joel B. Benefiel, Auditor, Anderson, Ind., have awarded the following contract for road work for which bids were received April 15: Madison Construction Co., Anderson, Cal Miller Road, $3,990; W. H. Bingaman Road, $1,060; A. D. Moffett Road, $1,100; Frank Fath Road, $750; Benjamin L. Ele Road, $800; Wm. O'Brien Road, $875; W. H. Cavan Road, $800; C. R. Bull Road, $3,195; Mason & Moreland, Alexandria, Ind., A. B. Summers Road, $1,827; Busby & Coy, Anderson, A. S. Busby Road, $5,873; Ryan & Son, Anderson, Wm. C. Scott Road (county line road), $7,450.

Propositions are before the City Council of Newcastle, Ind., to pave South 11th, South 15th, Grand Ave., Indiana Ave., Livery St., South 14th, Race St., Central Ave., West Broad, Church and Plum Sts., a total of about three miles. It is estimated that the improvement will cost $125,000. A. W. Wright is City Engineer.

The Board of Public Works of Logansport, Ind., has passed a resolution for the paving of Burlington Ave. Specifications prepared by City Engineer H. H. Thompson designate

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] brick, vitrified brick, sheet asphalt and brick as the material. Bids are to be asked shortly and it is hoped to start construction work by the last week in May.

The Board of Clark County Commissioners, Jeffersonville, Ind., has appointed Henry J. Lutz of Charlestown, Ind., to act as civil engineer in the construction of 43 miles of gravel roads in that township.

The Board of Public Works of Fort Wayne, Ind., has adopted resolutions for the improvement of 11 streets, and ordered plans for cement sidewalks on both sides of Ewing St., from Jefferson to Main St.

Iowa.

✣Bids will be received until May 14, by City Council, Clinton, Ia., for paving Fifth Ave. between Second and Fifth Sts. Charles Rensche is City Clerk.

✣Bids will be received until 9 a. m., May 1, by City Council at the office of Henry Sussing, City Clerk, Des Moines, Ia., for paving with sheet asphalt consisting of 1-in. binder course with one and one-half-in. wearing surface upon 5 inches of Portland cement concrete, East Thirteenth St., from the north line of Grand Ave. to the south line of Walker St.; Walker St., from the east line of East Twelfth St. to the west line of East Thirteenth St. court. About 8,423 sq. yds. of paving, more or less. Work to begin on or before the 10th day of May, 1912, and to be completed on or before the 1st day of July, 1912.

⦿As stated in our last issue the contract for the construction of approximately 48,500 sq. yds. of concrete pavement in Marshalltown, Ia., has been awarded to Elzy & Carlson of Marshalltown. Six ins. of concrete will be placed under the street railway ties and the ties filled in between, making a concrete thickness of 12 ins. The bids received are shown in the following table:

Contractors	Concrete paving per sq yd.	Paving street car track.	Curbing per lineal foot.	Extra excavating per cu. yd.
Elzy & Carlson	[illegible]	$1.77	$0.30	$0.28
J. S. McLaughlin & Sons, Red Oak	1.13½	2.24	.28	.30
F. K. Hahn, Cedar Rapids	1.16½	1.90	.2[illegible]	[illegible]
Lytton & Reinkling, Constr. Co., Des Moines	1.2[illegible]	2.26	[illegible]	.39
Dearborn & Jackson, Cedar Rapids	1.24	2.25	.31½	.35

The City Council of Iowa City, Ia., has decided upon the improvement of additional streets by paving, as follows: Governor St., between College and Bowery; Gilbert St., between Market and Brown; Bowery St., between Summit and Clerk; four blocks on Linn St.; two block on Burlington St., and eight or ten alleys. City Engineer J. C. Watkins has estimated the cost of the work at from $50,000 to $60,000.

The Commercial Club of Missouri Valley, Ia., has started a movement to have the business streets paved. A committee has been named to investigate the paving proposition and report on the same.

The City Council of Clarinda, Ia., has ordered the paving of Washington St., from U. P. church to the M. E. church; then 18th St., north to State and west on State to the Lon Green corner.

Kansas.

✣Bids will be received until 3 p. m., May 7, by City of Manhattan, Kan., O. E. Noble, Engineer, for the improvement of the following streets and avenues: Eleventh St., including 9,251 sq. yds. asphaltic concrete pavement; 3,310 cu. yds. earth excavation (1,500 ft. free haul); 2,107 lin. ft. 18-in. concrete gutter; 90 lin. ft. 36-in. concrete gutter; 60 lin. ft. 48-in. concrete gutter; 4,712 lin. ft. 8-in. curb and 18-in. gutter; 461 lin. ft. 3-in. oak headers and posts; 3 inverted siphons and catch basins. Fifth St., including 4,470 sq. yds. asphaltic concrete pavement; 1,400 cu. yds. of earth excavation (1,500 ft. free haul); 1,152 lin. ft. 18-in. concrete gutter; 1,470 lin. ft. 8-in. curb and 18-in. gutter; 96 lin. ft. 3-in. oak headers and posts. Bluemont Ave., including 11,106 sq. yds. of brick pavement; 397 lin. ft. 36-in. concrete gutter; 5,950 lin. ft. 8-in. curb and 18-in. gutter; 127 lin. ft. 18-in. concrete gutter; 366 lin. ft. 3-in. oak headers and posts; 5,553 cu. yds. of earth excavation (1,500 ft. free haul). Fourth St., including 3,987 sq. yds. of brick pavement; 1,455 lin.ft. 8-in. curb and 18-in. gutter; 480 lin. ft. 18-in. concrete gutter; 72 lin. ft. 3-in. oak headers and posts; 1,330 cu. yds. of earth excavation (1,500 ft. free haul). Moro St., 2,688 sq. yds. brick pavement; 1,800 cu. yds. earth excavation (1,500 ft. free haul); 177 lin. ft. 18-in. concrete gutter; 1,639 lin. ft. 8-in. curb and 18-in. gutter; 90 lin. ft. 36-in. concrete gutter; 141 lin. ft. 3-in. oak headers and posts; 1 inverted siphon and catch-basins.

Louisiana.

A delegation from Clinton, La., recently appeared before the East Baton Rouge Police Jury, Baton Rouge, La., and asked that a special election be called in Wards 5, 7, 9 and 10 for the purpose of allowing the people to vote a tax of 5 mills for 10 years for the construction of the Clinton and Birmingham road, which is to be run from Clinton to Edenborn, via Greenwell Springs.

The city of Crowley, La., R. J. Boudreaux, City Clerk, has rejected all bids received April 16 for the construction of 27,000 sq. yds. of paving, 5,000 yds. of excavation, and 500 lin. ft. of curbing. The work will be readvertised.

Massachusetts.

✣Bids will be received until 8:30 p. m., May 1, by Board of Selectmen, Odd Fellows' Bldg., North Attleboro, Mass., for laying brick pavement on Washington St. Specifications may be obtained of the Superintendent, Savings Bank Bldg., North Attleboro.

✣Bids will be received until 2:30 p. m., April 27, by A. T. Treadway, Authorized Committee, Stockbridge, Mass., for the construction of a road including 20,000 sq. yds. Each bid must be accompanied by a certified check for $500 payable to the Town. Barnes & Spaulding, Pittsfield, Mass., are Engineers.

⦿The Hassam Paving Co., of Worcester, Mass., was recently awarded a contract by the Long Island Motor Parkway Co., William K. Vanderbilt, Jr., President, for the construction of 14 miles of roadway on Long Island with Hassam concrete paving. The road runs from Lake Success on Long Island to Mineola and Garden City.

⦿The Board of Public Works of Holyoke, Mass., on April 12 awarded the contract for furnishing 90 per cent asphalt road oil to the Standard Oil Co., at $.08¾ per gal. Other bids were received from the Indian Refining Co.; the Gulf Refining Co.; the Texas Co.; the Asphalts Products Co., and the Barrett Mfg. Co.

Minnesota.

The City Council of Hibbing, Minn., has decided to pave Pine St., from First to Fourth Aves., and Third Ave., practically its entire length. Material has not been selected.

Mississippi.

The City Council of Greenwood, Miss., has adopted a resolution giving notice of its purpose to issue $70,000 bonds for street paving. W. S. Allen of Greenville has been selected as engineer.

The Board of Supervisors of District No. 1, Madison County, Miss., will sell $50,000 worth of bonds in May to improve the roads in that district. Canton is the county seat.

The city of Jackson, Miss., will issue an additional $90,000 for street paving and to refund outstanding indebtedness.

Missouri.

✣Bids will be received until noon, April 26, by Board of Public Improvements, St. Louis, Mo., for the reconstruction of Market St., from Broadway to Mound St., from Second St. to Br Cherokee St., from California to N Ave.; Arsenal St., from Louisiana Grande Ave. Bids also will be recei improving Delmare Blvd., from Skinne to the western city limits; Shaw Av Tower Grove Ave. to Kingshighway Newhouse Ave., from Blair Ave. to Grace Ave., from Gravois Ave., to F Ave.; Gasconade St., from Pennsylv Minnesota Ave.; John Ave., from 11t Von Phul St.; Osceola St., from Broa Virginia Ave.; Delmar Blvd., from F to Skinner Road. W. T. Findly is S of the Board.

✣Bids will be received until noon, by Board of Public Improvements, St. Mo., for the improvement under Lett 474, of Russell Place between Park and Hartford St. W. T. Findly is S of the Board.

The Board of Public Works of St. Mo., recently sent a petition to City F David L. Lawlor for the paving of St., 28th to 30th, with Hassam paveme

Montana.

✣Bids will be received until May City Council and Mayor, Helena, Mo furnishing the city one 12-ton steam

New Jersey.

✣Bids will be received until 3 p. m. 2, by Board of Chosen Freeholders, County, Jersey City, N. J., for the i ment of a portion of the Newark T at the westerly approach of the Hac River bridge, Hudson County, N. J. O'Mara is Clerk of the Board.

✣Bids will be received until 8 p. m., by Town Council, Irvington, N. J., fo ing, curbing and paving Maple Av Springfield Ave., southerly to May S work will embrace furnishing and la 10-in. telford pavement with an aspha er; constructing three-ft. brick gutter concrete foundation; furnishing and new quarry-cut curbing in concrete; re ing and resetting old curbing in concr a small amount of excavation. Plans fications and general information may tained at the office of town clerk M. man, in the town hall, or at the office town engineer, 1091 Clinton Ave., Irv N. J.

New York.

⦿The Board of Contract & Sup Rochester, N. Y., Frank X. Pifer, Cle awarded the contract for treating cer the city streets with calcium chlorid dust preventative, to F. X. Yeoman 45/100 per sq. yd. The total amount is

The city officials of Ogdensburg, and the officials of the street railwa perfected plans with the State Highw partment for paving work to be done the coming summer. The street railwa tion, between the tracks and several each side, will be constructed under a ent contract from the remaining port the streets. It is proposed to pave up tracks with brick and between the rail bithulithic. G. E. Van Kennen is Ma

NEW YORK STATE ROAD BIDS.

The following bids were received A by the State Commission of Highwa bany, for the improvement of public ways by State aid:

East Berne-Glyckman's Church, Roa 978, Albany County, 4.35 miles—J. J. Schenectady, $48,883; F. & F. Murphy, kill, $48,557; John E. Delee, Troy, $ Jos. Walker Cons. Co., Albany, $49,012; ard Hopkins, Troy, $48,974; H. F. K Albany, $51,485; Harvey B. Sproul, Pe $42,737; Pusso & Parker, Albany, $ Shaughnessey Cons. Co., Albany, $43,

McDonough-Hamlet, Road No. 1,014 nango County, 0.08 miles—John H. G Albany, $1,404.

Nineveh-Afton, Road No. 5,300, Bro Chenango Counties, 5.62 miles—Guy V. D acuse, $130,500; P. H. Mur[illegible] est $122,123; Walter K. Hassen [illegible] 28,645.

n City, Road No. 5001, Chau[illegible] y, 1.48 miles—Dunkirk Cons. Co., 56,536; Thos. Mahoney Co., James- 71; Niagara Cons. Co., Elmira, mer M. Love & Son, Corry, Pa., rie Cons. Co., Buffalo, $58,209; rn Cons. Co., Franklin, Pa., $58,-

to-Cattaraugus, Road No. 695, Cattarau- , 1.21 miles—Erie Cons. Co., Buf- 8; McNerner Cons. Co., Canton,

t Otto, Part 2, Road No. 697, Cat- unty, 2.27 miles—McNerner Cons. Pa., $19,671; Erie Cons. Co., Buf-

henango, Road No. 995, Cortland [illegible] Kitton & Murphy, R[illegible] Monroe Roads Co., P[illegible] Hendrickson-McCabe Cons. Co., Hen- 47,760; Conroy Nickedorf, Oneida, hn Johnson Cons. Co., Buffalo, ames Anderson, Albany, $49,969; [illegible] Syracuse, [illegible]

Broadwell, Road No. 345, [illegible] miles—Herlihy Cons. [illegible] $22,012; Lane Cons. Co., Meriden 5; John H. Gordon, Albany, $20,-

-Indian Pond, Road No. 1,007, unty, 2.72 miles—Samuel Beckin, ,281; Harvey B. Sproul, Peekskill, [illegible] Construction Co., M[illegible] 743; De Graaf & Hogeboom, K[illegible] 2; Suffolk Cons. Co., Huntington,

Falls-Buffalo, Part 5, Road No. Co., 2.84 miles—Niagara Cons. Co., 673; Miller & Knickenburg, Buf- ; John W. Landol, $65,310; Mos- ners, Buffalo, $68,803; Frank L. ffalo, $68,616; Dollard & Heerin, 235; Louis H. Gipp, Buffalo, $67,- ons. Co., Buffalo, $64,363.

Village, Road No. 939, Erie 5 miles—Frank L. Cohen, Buffalo, iagara Cons. Co., Elmira, $89,936; rn Cons. Co., Franklin, Pa., $88,- ons. Co., Buffalo, $86,706; Mosier , Buffalo, $86,117; Pat. Mulderry, 442; Dollard & Heeran, Albany, Fitzwater & Terry, Waterville, $82,- urley & Lyon, Fredonia, $79,346; itzgerald & Co., Fredonia, $77,251; hnson Cons. Co., Buffalo, $84,739; Knickenburg, Buffalo, $94,389.

Hamlet, Road No. 954, Greene Coun- miles—Catskill Supply Co., Catskill,

Village, Road No. 5,161, Herkimer 1.51 miles—Alfred Museo, Frankfort, Warron Bros. Co., Boston, Mass.,

River, Road No. 5,175, Jefferson 0.41 miles; Semper Bros., Watertown, M. R. Clock & Co., Watertown, $7,262.

nango Village-Seneca Turnpike, Road , Madison County, 0.43 miles—Conroy, , Oneida, $6,692.

ey Hill, Road 493A, Monroe County, le.—Monroe Roads Co., Pittsford,

oe-Orleans County Line, Road 588, & Orleans Cos., 2:08 miles.—Hend- McCabe Con. Co., Spencerport, $21,- osier & Summers, Buffalo, $21,474; ne Bros., Spencerport, $18,633; Falls Fletcher, Rochester, $25,955; Akin- ailey & Donaldson, Rochester, $21,279; & Clossen, Albion, $10,092; Greenfield Co., Hornell, $20,091; Thos. Grady & chester, $19,308; Wood & Tompkins, $20,363; Schroeder, Hicks Cons. Co., ter, $21,438.

illa Village, Road 5202, Otsego Coun- miles.—Harvey B. Sproul, Peekskill, ; Hollington Co., Troy, $39,428; West- ons. Co., Herkimer, $39,894.

ski-Williamstown, Road 972, Oswego , 5.67 miles.—P. H. Murray, Rochester, $52,111; Guy V. Dickensen, Syracuse, $51,120; Thos. Grady, Rochester, $49,961; Falk & Menzies, Buffalo, $57,090; Fran. S. Sparato, Syracuse, $61,742; Semper Bros., Watertown, $55,355; James Anderson, Albany, $61,730; Spellman, Oliver Co., Chateaugay, $56,733; Burns Bros. & Haley, Watertown, $61,193; Dale Engineering Co., Utica, $55,989.

Yorkville Village, Road 5091, Oneida County, 1.06 miles.—Warren Bros., Boston, Mass., [illegible]

Brewster-Patterson, Road 5203, Putnam County, 9.80 miles.—Harvey B. Sproul, Peekskill, $150,300; Schunnemunk Cons. Co., Highland Mills, $187,151; Frank G. Fowler Cons. Co., Mt. Kisco, $162,461; James E. Martin, [illegible]

Wynantskill-DeForestville, Winter St., Road 765, Rens. Co., 4.10 miles.—Wm. A. Patterson, Albany, $33,362; Thos. Carr, Troy, $36,646; County Cons. Co., Troy, $33,581; E. L. Grimes Co., Troy, $36,198; Harvey B. [illegible] Walch, Pittsfield, Mass., $35,363.

Coram-Patchogue, Road 1018, Suffolk Co., 6.79 miles.—McDonough Cons. Co., Mt. Vernon, $74,596; Suffolk Cons. Co., Huntington, $73,335; Clifford, Booth & Weston, Jamaica, $83,474; Dunbar Cons. Co., New York city, $81,999; Henry J. Mullen, Jamaica, $87,149; Frank J. Gallagher, Brooklyn, $74,815; Chas. V. Platt, Pt. Jefferson, $78,793; Amos D. Bridges & Sons, Hazardville, Conn., $81,916; Robt. W. Smith, New York City, $91,496.

Big Creek, Part 3, Rood 1000, Steuben Co., 6.95 miles.—McDougall Cons. Co., Hornell, $62,485; Fred E. Ellis, Melrose, Mass., $75,428; Peter F. Connelly, Boston, Mass., $60,453; T. J. Gill Co., Binghamton, $80,496.

Bath-Avoca, Road 5204, Steuben Co., 6.37 miles.—Shaughnessey Cons. Co., Albany, $36,219; Herlihy Cons. Co., Glens Falls, $40,316; Hollington Co., Troy, $37,672; Atlanta Cons. Co., Atlanta, $34,728; Greenfield Cons. Co., Hornell, $36,408; Fred E. Ellis, Melrose, Mass., $33,125.

Stillwater-Schuylerville, Part 1, Road 5205, Saratoga Co., 5.38 miles.—James Anderson, Albany, $73,483; Harlihy Cons. Co., Glens Falls, $62,693; Ed. G. Fox, Saratoga, $60,488.

Norwood-Norfolk, Road 967, St. Lawrence Co., 2.30 miles.—Jas. Anderson, Albany, $31,397; Spellman, Oliver Co., Chateaugay, $29,961; Semper Bros., Watertown, $31,996; Burns Bros. & Haley, Watertown, $35,022.

Trumansburg Village, Road 5206, Tompkins Co., 1.54 miles.—Murray & Ford, Elmira, $39,242; Niagara Cons. Co., Buffalo, $42,311; Erie Cons. Co., Buffalo, $50,843; Wm. Hazard, Trumansburg, $41,016; Dollard & Heeran, Albany, $38,838.

Kingston-Ellenville, Part 4, Road 352, Ulster Co., 1.91 miles.—Jos. Walker Cons. Co., Albany, $22,597; Halleck & Angle, Newburg, $19,966; De Graaf & Hogeboom, Kingston, $19,960; Suffolk Cons. Co., Huntington, $22,322; L. L. Melius, New York City, $22,502; F. D. Van Wagenan, Rondout, $24,933; Harvey B. Sproul, Inc., Peekskill, $20,829; Schunnemunk Cons. Co., Highland Mills, $20,482.

The Following bids were received April 17 by the State Commission of Highways, Albany:

Road No. 979, Feura Bush-Indian Fields, Albany Co., 8.27 miles.—James Anderson, Albany, $93,075; J. & T. Murphy, Cobleskill, $86,905; Lane Const. Co., Meriden, Conn., $96,411; P. H Murray, Rochester, $92,061; Ruddy & Saunders, Troy, $82,825; J. W. Whalen, Whitehall, $100,315; Harvey B. Sproul, Peekskill, $98,529; Herlihy Contr. Co., Glens Falls, $81,406; Shaughnessy Const. Co., Albany, $82,893; Jos. Walker Const. Co., Albany, $98,055.

Road No. 1013, Plymouth-Hamlet, Chenango County, 0.19 mile.—M. D. Windsor, Guilford, $3,241; E. D. Baker, Binghamton, $3,051.

Road No. 5216, Bainbridge-Unadilla, Chenango County, 1.07 miles.—Harvey B. Sproul, Peekskille, $14,173; Conroy & Nixdorf, Oneida, $15,091; Hollington Co., Troy, $15,374; Newport Const. Co., Herkimer, $13,485.

Road No. 1012, [illegible] Part 2, Chautauqua County, 3.30 miles.—Haywood & Goggert,, Fredonia, $51,291; Dunkirk Const. Co., Dunkirk, $55,855; Erie Contr. Co., Buffalo, $52,035; Schroeder-Hicks Contr. Co., Rochester, $53,640; Kerwin Const. Co., Albany, $48,960; Frank L. Cohen, Buffalo, $58,219; Northwestern Const. Co., Franklin, Pa., $52,046.

Road No. 5217, Jamestown-Bemis Point, Chautauqua County, 7.96 miles.—Thomas Mahoney, Jamestown, $182,289; Niagara Const. Co., Buffalo, $222,166; Dunkirk Const. Co., Dunkirk, $175,495; Busch & Percival, Buffalo, $179,873; Northwestern Const. Co., Franklin, Pa., $176,729; Frank L. Cohen, Buffalo, $168,663; Herly & Lyne, Fredonia, $174,865; Thos. Fitzgerald Co., Fredonia, $167,857; Erie Contr. Co., Buffalo, $156,313.

Road No. 960, Rutledge-Leon, Cattaraugus County, 2.80 miles.—Frank L. Cohen, Buffalo, $37,353

Road No. 996, Cortland-Groton, Part 2, Cortland Country, 2.25 miles—Amos D. Bridges Sons, Hazardville, Conn., $25,506; Conroy & Nixdorf, Oneida, $23,575; John Johnson Co., Buffalo, $23,508; Jos. McCormack, E. Providence, R. I., $23,668; Monroe Roads Co., Pittsford, N. Y., $24,087; M. D. Windsor, Guilford, $20,608; Nathan E. Young, Windsor, $21,598; John H. Gordon, Albany, $22,601; Greenfield Const. Co., Hornell, $22,732.

Road No. 5,218, Lewman-Waverly, Part 2, Chemung County, 4.27 miles—E. Whalen, Tonawanda, Pa., $45,794; Murray & Ford, Elmira, $43,003; Herlihy Constr. Co., Glens Falls, $40,828; T. H. Gill Co., Binghamton, $41,135; Fred E. Eilis, Melrose, Mass., $46,871; Hollington Co., Troy, $40,712; Schunnemunk Const. Co., Highland Mills, $40,380; Coughlin & Lowman, Watkins, $40.065; Peter Connolly, Boston, Mas., $40.675.

Road No. 5,172, Niagara Falls-Buffalo, Part 4, Erie County, 2.92 miles—Niagara Const. Co., Buffalo, $66,648; Frank L. Cohen, Buffalo, $66,758; Mosier & Summers, Buffalo, $74,125; Louis H. Gipp, Buffalo, $67,700; Dollard & Heeran, Albany, $66,820; Herly & Lyne, Fredonia, $68,411; Erie Contr. Co., Buffalo, $64,993.

Road No. 990, Angola Village, Erie County, 1.03 miles—John Johnson Co., Buffalo, $36,271; Elmer L. Love & Sons, Corry, Pa., $38,485; Frank L. Cohen, Buffalo, $34,619; Fred J. Mumm, Buffalo $40,999; Mosier & Summers, Buffalo, $36,723; Erie Contr. Co., Buffalo, $36,044; Hurley & Lyne, Fredonia, $33,594; Patk. Mulderry, Albany, $34,556; Thos. Mahoney, Jamestown, $35,895; F. W. Hamilton, Rochester, $40,271; Thos. Fitzgerald, Fredonia, $34,396; Dollard & Heeran, Albany, $36,275; Frontier Contr. Co., Buffalo, $36,970.

Road No. 5,166, Saugerties-Catskill, Part 2, Greene County, 3.87 miles—Russo & Parker, Hudson, $46,583; John F. Donovan, Saugerties, $49,796; S. B. VanWegenen, Rondout, $54,522; Harvey B. Sproul, Peekskill, $48,478.

Road No. 467, Newport-Norway-Cold-Brook, Herkimer County, 6.92 miles—F. W. Bergin Co., Newport, N. Y., $82,459; Newport Const. Co., Newport, N. Y., $74,828.

Road No. 5,219, Ilion-Frankfort, Herkimer County, 2.47 miles—L. L. Melius, N. Y. City, $104,069; Albert Musso, Frankfort, $98,041; Aetna Eng. & Con. Co., Herkimer, $103,363; Warren Brothers, Boston, Mass., $100,625.

Road No. 575, Rush-Honeoye Falls, Monroe County, 4.08 miles—Monroe Roads Co., Pittsford, $41,811; Schroeder-Hicks Contr. Co., Rochester, $42,825.

Road No. 574, Fairport-Nine Mile Point, Monroe County, 11.41 miles—A. J. Rockwood, Rochester, $239,164; Erie Contr. Co., Buffalo, $203,576; Julius Frederick, Rochester, $199,159; Whitmore, Rauber & Vicinus, Rochester, $239,745.

Road No. 988, New Hyde Park-Great Neck, Nassau County, 0.35 Miles—Suffolk Contr. Co., Huntington, $6,332; W. P. McDonald, Mt. Vernon, $4,905; Henry P. Mullen, Jamaica, $5,467; W. J. Cashman, Rosden, $4,379; Andros Bros., Mineola, $6,013.

Road No. 5,220, Niagara Falls-Buffalo, Niagara Co., 4.87 miles—Mosier & Summers, Buffalo, $110,305; Public Service Contr. Co., Buffalo, $112,845; Frank L. Cohen, Buffalo, $105,-[illegible] Contr. Co., Buffalo, $105,386; Niagara Const. Co., Buffalo, $111,783; Dollard & Heeran, Albany, $109,076.

Road No. 5,131, Rome City, Oneida County, 1.20 miles—Aetna Eng. & Contr. Co., Herkimer, $45,722; Warren Bros., Boston, Mass., $[illegible]

Road No. 5,221, Union Square-Pulaski, Part 2, Oswego County, 4.69 miles—Mosier & Summers, Buffalo, $68,713; Semper Bros., Watertown, $57,922; Conroy & Nixdorf, Oneida, $72,959; Spellman Oliver Co., Chateaugay, $67,357; Chas. D. McConnell, Syracuse, $77,-285; Jas. Anderson, Albany, $68,930; Dalen Eng. Co., Utica, $74,105; John H. Weidman, Syracuse, $61,256; Aetna Eng. Cont. Co., Utica, $68,945.

Road No. 981, DeFreestville-Couse, Rensselaer County, 3.14 miles—Arnold & Sherrill, Albany, $34,470; Crowe & Walsh, Pittsfield, Mass., $37,030; Thomas H. Karr, Troy, $50,-456; County Const. Co., Troy, $36,282; Aiken Const. Co., Troy, $38,099.

Road No. 5,222, Cropseyville-Grafton, Rensselaer County, 5.93 miles—Richard Hopkins, Troy, $84,870; Ruddy & Saunders, Troy, $81,-974; Thos. H. Karr, Troy, $95,078; Snead & Wilson, Brown's Station, $68,800.

Road No. 966, Madrid-Waddington, Part 2, St. Lawrence County, 4.04 miles—Semper Brothers, Watertown, $39,898; Herlihy Contr. Co., Glens Falls, $37,685; Burns Bros. & Haley, Watertown, $35,803; Burr C. Miller, Wilkesbarre, Pa., $39,956; Spellman-Oliver Co., Chateaugay, $41,401; James Anderson, Albany, $41,364.

Road No. 999, Montour Falls-Alpine, Part 2, Schuyler County, 6.68 miles—Coleman Brothers, Boston, Mass., $67,312; Coughlin & Lowman, Watkins, $65,562.

Road No. 5,195, Vrooman-Howes Cave, Schoharie County, 5.05 miles—Walter E. Hassam, Worcester, Mass., $102,128; Aetna Eng. & Contr. Co., Herkimer, N. Y., $101,689.

Road No. 5,223, Liberty-County Line, Part 1, Sullivan County, 8.54 miles—Merritt Const. Co., Tuckahoe, $124,850.

Road No. 5,224, Campbell-Bath, Steuben County, 9.43 miles—Thomas H. Gill, Binghamton, $85,330; Fred E. Ellis, Melrose, Mass., $89,650; Jas. Anderson, Albany, $86,-769; M. J. Cowhig, Albany, $80,707; Shaughnessy Cons. Co., Albany, $71,709.

Road No. 1,001, Enfield Center-Ithaca, Tompkins County, 6.45 miles—Wm. Hazzard, Trumansburg, $62,797; Richard Hopkins, Troy, $58,761; Thomas H. Gill, Binghamton, $63,801; Patk. Connely, Ithaca, $57,338.

Road No. 5,225, Varna Crossing, Tompkins County, 0.53 miles—Jos. McCormack, E. Providence, R. I., $18,990; Pat. Connely, Ithaca, $13,481; Wm. Hazzard, Trumansburg, $13,-238; Alfred Gaffy, Syracuse, $16,109; Elmer D. Baker, Binghamton, $13,598; T. H. Gill Co., Binghamton, $14,153; Monroe Roads Co., Pittsford, $15,741; Burt Burns, Honeoye Falls, $14,298.

Road No. 351, Highland-Gardiner, Part 2, Ulster County, 7.80 miles.—Suffolk Contr. Co., Huntington, $84,206; McDougall Contr. Co., Hornell, $83,241; Harvey B. Sproul, Peekskill, $77,388; S. B. VanWagenen, Rondout, $78,-546; DeGraff & Hogeboom, Kingston, $70,932; Schunnemunk Contr. Co., Highland Falls, $84,-238; L. L. Melius, N. Y. City, $93,616; Jas. E. Martin, Pokeepsie, $100,595.

Road No. 5226, White Plains-Rye Lake, Part 2, Westchester County, 7.01 miles.—White & Colligan, Purchase, $98,076; Malloy & Murray, Yonkers, $108,484; Wm. F. McCabe Co., White Plains, $107,644; Schunnemunk Con. Co., Highland Falls, $81,828; Saml. Beskin, Inc., Fishkill, $90,521; Wm. P. McDonald Co., Mt. Vernon, $79,324.

Road No. 993, Manchester-Palmyra, Part 2, Wayne County, 1.20 miles.—Geo. W. Chambers, Rochester, $14,296; Aiken, Bailey & Donaldson, Rochester, $10,743; Monroe Roads Co., Pittsfield, $10,180.

North Carolina.

✣Bids will be received until May 6, it is reported, by W. L. Wiggs, General Supervisor of Roads, Wake County, Raleigh, N. C., for the construction of 1 mile of macadam road with binder 12 to 16 ft. roadway.

◉Abee, Huggins & Fry, of Hickory, N. C., have been awarded the contract by the Murphy Township Highway Commission, M. L. Mauney, Secy., Murphy, N. C., for the grading and draining of Valley River road for a distance of 7½ miles and the Notla Road a distance of 4.7 miles. The contract price is $.22½ per cu. yd., unclassified. The work will require 67,000 cu. yds. of grading, 1,500 lin. ft. of vitrified pipe, 600 cu. yds. of masonry. Bids were opened April 15. C. E. Wood is Supt. of Roads of the Township. G. W. Scott, Courthouse Bldg., is Engineer.

Bids were opened April 10 by the city of Charlotte, N. C., Joseph Firth, City Engineer, for the construction of 161,000 sq. yds. of pavement, the bids received being as follows: (1) standing for bid of Atlantic Bitulithic Co., Richmond, Va., (2) for bids of West Construction Co., Chattanooga, Tenn., (3) for alternate bid of West Construction Co., (4) for bid of Kelley Bros., Portsmouth, O., (5) alternate bid of Kelley Bros., (6) for bid of Porter & Boyd, Charlotte, N. C., (7) for bid of Warner-Quinlan Asphalt Co., Syracuse, N. Y., (8) alternate bid of Warner-Quinlan Asphalt Co., (9) bid of Johnston, Porter & Peck, Charlotte, N. C., (10) T. J. McGuire, Norfolk, Va., (11) Southern Paving Construction Co., Chattanooga, Tenn.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bitulithic, 161,007 sq. yds.	$[illegible]	$1.10	$1.26						
Sheet asphalt, 161,007 sq. yds.		[illegible]	[illegible]				$1.79	$1.74	
Asphalt, paint coat method 161,007 sq. yds.		[illegible]	1.49				1.67	1.64	
Bituminous macadam, mixing method:									
New stone, 161,007 sq. yds.	[illegible]			1.27	1.25	1.30			
Old stone, 161,007 sq. yds.	1.16	1.10	1.00	1.15	1.13	1.20			
On concrete base, 161,007 sq. yds.	1.51	1.35	1.25	1.46	1.44	1.45			
Special bituminous macadam on concrete base, 161,007 sq. yds.	1.68	1.39	1.25						
Bituminous macadam, penetration method:									
New stone, 161,007 sq. yds.	1.26			1.25	1.23	1.15			[illegible]
Old stone, 161,007 sq. yds.	.96			1.13	1.11	1.00			1.05
On concrete base, 161,007 sq. yds.	1.31			1.44	1.42	1.35			
Double bond pavement, 161,007 sq. yds.	1.48	1.24	1.14						
Asphaltic concrete on concrete, 161,007 sq. yds.	1.48	1.43	1.29				1.59	1.54	
Grading, 12,341 cu. yds.	[illegible]	.40	.49	[illegible]	[illegible]	.55	.50	[illegible]	.40
Setting old curb, 21,411 lin. ft.	.07	.10	.10	.07	.07	.10	.30	.30	.15
Setting new curb	.07	.10	.10	.15	.15	.10	.30	.10	.15
18-in. concrete curb, 63,799 lin. ft.	.36	.27	.27	.36	.36	.32	.30	.30	.15
6-in. tile	.17	.15	.15	.20	.20	.15	.25	.25	

Bids were received April 10 by the Executive Board, Charlotte, N. C., Joseph Firth, City Engineer, for the construction of 34,424 sq. yds. of cement sidewalks, 21,411 ft. of old curb reset, and approximately 70,000 ft. of new curb; F. J. McGuire, $33,391, walks; Propst Contracting Co., $52,926, walks and curbing; West Construction Co., $52,725, walks and curbing; Porter & Boyd, $60,350, walks and curbing; J. W. Haas, $51,733, walks and curbing, and The S. Monroe Sons Co., $64,979, walks and curbing.

The City Council of Bryan, O., has employed Consulting Engineer Smith & Boulay of Toledo, O., to prepare plans and specifications for the construction of the proposed street paving for which bonds in the sum of $60,000 have been voted. The entire cost of the improvement is estimated at $175,000.

The City Council of Zanesville, O., has decided that Main St. should be repaved, and a resolution to issue $7,818 in bonds to pay for the city's share of the improvement was passed. The total cost of the repaving, which will extend from the "Y" bridge to Greenwood Ave., is estimated at $18,000.

A petition for the repaving of Summit St., from Cherry to Monroe Sts., has been filed in the City Council of Toledo, O. G. W. Tonson is City Engineer.

Ohio.

✣Bids will be received until 11 a. m., April 24, by Board of Cuyahoga County Commissioners, Cleveland, O., for furnishing the necessary labor and material for the repair of North Ridge Road, Wooster Road, Berea Road, Prospect Road, Lorain Road, State Aid Road, Brecksville and Euclid Roads. J. F. Goldenbogen is Clerk of the Board.

✣Bids will be received at the office of Commissioners of Hocking County, at L Ohio, until noon, May 1, 1912, for grading paving with concrete Section Number the Logan-Enterprise road in Falls Towns said County. Length 8,400 ft. or 1.59 m Width of pavement, 14 ft. Estimated cos construction, $14,153.10. A draft or cert check for $300.00 shall be deposited with bid. The successful bidder will be require give bond for an amount equal to the cont price. Date set for completion, Augus 1912. Alternative bids will be considered r ling and paving with brick for me traffic highway the above mentioned Estimated cost of construction $19,516. ternative bids will also be considered for g ing and construction with a waterbound adam the above mentioned road. Estim cost of construction $13,946. Plans and sp fications are on file in the office of the Co Commissioners and the State Highway partment. The State Highway Commissi reserves the right to reject any and all James R. Marker, Columbus, O., State H way, Commissioner.

✣Bids will be received at the office of Commissioners of Fairfield County at caster, Ohio, until 10 a. m., May 4, 1912, grading and paving with a waterbound adam the Lancaster-Newark road in Wa Township, said County. Length 22,616.5 f 4.28 miles. Width of pavement, 12 ft. mated cost of construction, $28,887. A or certified check for $300 shall be depo with each bid. The successful bidder w required to give bond for an amount eq the contract price. Date set for compl August 1, 1912. Plans and specification on file in the office of the County Co sioners and the State Highway Depart The State Highway Commissioner res the right to reject any and all bids. Jam Marker, Columbus, O., is State Hig Commissioner.

✣Bids will be received at the office o Commissioners of Clinton County, at mington, Ohio., until noon, May 2, for ing and paving with waterbound macada Wilmington-Xenia road in Union Town said County. Length 20,750.4 ft. or miles. Width of pavement, 14 ft. Estim cost of construction, $23,142. A draft o tified check for $300 shall be deposited each bid. The successful bidder will b quired to give bond for an amount equ the contract price. Date set for compl August 1, 1912. Plans and specification on file in the office of the County Co sioners and the State Highway Depart The State Highway Commissioner res the right to reject any and all bids. Jam Marker, Columbus, O., is State Highway missioner.

✣Bids will be received at the office o Commissioners of Summit County, at A Ohio, until 1 p. m., May 7, for grading paving with bituminated concrete the road in Copley and Bath Townships, county. Length 12,546.2 ft. or 2.38 Width of pavement 14 ft. Estimated co construction $18,423. A draft or cer check for $300 shall be deposited with

✣ indicates work now open for bids. ◉ indicates a contract let recently.

ccessful bidder will be required
for an amount equal to the con-
Date set for completion August
ns and specifications are on file
of the County Commissioners and
ighway Department. The State
mmissioner reserves the right to
nd all bids. James R. Marker,
., is State Highway Commis-

l be received at the office of the
rs of Ross County, at Chillicothe,
oon, May 6, for grading and pav-
uminated concrete the Frankfort
oto Township said county. Length
1.31 miles. Width of pavement
ated cost of construction $12,879.
certified check for $300 shall be
th each bid. The successful bid-
required to give bond for an
l to the contract price. Date set
on, August 1, 1912. Plans and
are on file in the office of the
missioners and the State High-
ment. The State Highway Com-
serves the right to reject any and
mes R. Marker, Columbus, O., is
vay Commissioner.

l be received at the office of the
rs of Miami County, at Tr
noon, May 3, for grading and
waterbound macadam the Piqua-
Section No. 1 in Washington
d county. Length 9,800 ft. or
Width of pavement 16 ft. Esti-
f construction $15,348. Alterna-
ll also be considered for grading
with a bituminous surface treated
macadam the above mentioned
nated cost of construction $16,566.
certified check for $300 shall be
ith each bid. The successful bid-
required to give bond for an
l to the contract price. Date set
ion August 1, 1912. Plans and
s are on file in the office of the
mmissioners and the State High-
tment. The State Highway Com-
serves the right to reject any and
ames R. Marker, Columbus, O., is
way Commissioner.

veland Trinidad Paving Co., Cleve-
as been awarded the contract by
of Cuyahoga County Commission-
and, for the improvement of Cen-
Road No. 2 in Dover Township at
or concrete curb or stone curb.
ers were: M. E. Kavanaugh, $153,-
ete curb, and $156,059, stone curb;
Paving & Construction Co., $155,-
ete curb and, $155,192, stone curb.
opened April 17 by J. F. Goden-
rk

Enterprise Paving & Construction
land, O., has been awarded the con-
he Board of Cuyahoga County Com-
, Cleveland, for the changes in the
ent of North Woodland Road No.
ck and common Medina block pave-
illside block pavement between vari-
ns at $44,241. Bids were opened
y J. F. Goldenbogen, Clerk.

Moran of Cincinnati, O., has been
he contract by the Director of Pub-
, St. Bernard, O., for the improve-
Church St., from Carthage Pike to
ithaup's west line on the south side
Carthage Pike to Tower Ave., on
side by constructing cement curbs
rs on both sides of Church st., be-
points above mentioned, and by
ng the necessary drains, etc., and
necessary macadam. The contract
1,563. Bids were opened April 9.

ill be received at the office of the
oners of Champaign County, at
Ohio, until noon, April 30, for grad-
paving with a waterbound macadam
na and St. Paris Road in Urbana
said county. Length 5,280 ft. of
Width of pavement 14 ft. Estimated
onstruction $9,757. A draft or cer-
ck for $300 shall be deposited with
The successful bidder will be re-

quired to give bond for an amount equal to the contract price. Date set for completion, [illegible] on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

Oregon.

✣Bids will be received until May 1 by E. L. Davidson, City Recorder, Oswego, Ore., for the construction, including excavation, of cement sidewalks.

✣Bids are being received by the city of Willamina, Ore., for the construction of approximately 800 lin. ft. of concrete paving and curbing; also approximately 3,000 ft. of macadam street improvements. R. W. Jones, McMinnville, Ore., is Engineer. Further information may be obtained of the City Recorder.

⊙The street committee of the City Council, Portland, Ore., has awarded the following contracts for street improvements: East 46th St. from Belmont to East Stark, grading and concrete curbs and walks, Beehill Bros., $1,587. East 19th St. from Sandy to Pacific, grading and concrete curbs and walks, Bechill Bros., $1,941. 62d Ave., southeast, from 62d to 69th Sts., grading and concrete curbs and walks, Carter Bros., $4,646. East Market St. from East 37th to East 39th Sts., asphalt pavement, Oregon Independent Paving Co., $4,408. East Clay St., asphalt pavement, Oregon Independent Paving Co., $2,411. East 38th St. from Hawthorne Ave. to Market St., asphalt pavement, Oregon Independent Paving Co., $2,572. East 49th St. district, asphalt pavement, Oregon Independent Paving Co., $17,331. 50th Ave., southeast district, grading and concrete curbs and walks, Carter Bros., $6,277. East 50th St. from Division to Powell, grading and concrete curbs and walks, Jeffery & Bufton, $7,409. East 65th St. from Davis to Flanders, grading and concrete curbs and walks, Carter Bros., $886. Webster St. from Union Ave. to East 11th St., grading and concrete curbs and walks, Hilliard & Maginnis, $5,901. East 7th St. from Holladay to San Rafael, grading and concrete curbs and walks, Oregon Independent Paving Co., $1,048. East Ash St. from East 80th to East 82d, grading and concrete curbs and walks, Oregon Independent Paving Co., $880. 36th Ave., southeast, grading and concrete curbs and walks, Oregon Independent Paving Co., $1,556. East 68th St. from East Glisan to East Davis, grading and concrete curbs and walks, Carter Bros., $1,521. East 67th St. from East Glisan to East Davis, grading and concrete curbs and walks, Jeffrey & Bufton, $1,397.

The city of Medford, Ore., will probably lay about 50,000 sq. yds. of pavement during the season of 1912 at an estimated cost of $125,000. The work will include asphalt pavement, asphaltic concrete, combined concrete curb and gutter, etc. Part of this work has already been awarded to Clark & Henery Construction Co., of Oakland, Cal. E. T. Foss is City Recorder.

Following bids were received April 11 by the City Council of Portland, Ore., for street improvements: Corbett St. from Julia to Nebraska, gravel bitulithic. Concrete—Jeeery & Bufton, $29,091. Morrison St. from Chapman to Stout, macadam pavement—Oregon Independent Paving Co., $2,223. East 13th St. from Miller to Bidewell, grading and concrete curbs and walks—Oregon Independent Paving Co., $668. Junior St. from East 29th to East 27th, grading and concrete curbs and walks—Oregon Independent Paving Co., $875. Hyde St. from East Ninth to East Tenth, grading and concrete curbs and walks—Bechill Brothers, $939. East 25th St. from Tibbetts to Powell, grading and concrete curbs and walks—Stevens & White, $1,622. East 26th St. from Division to East Sherman, asphalt pavement—Oregon Independent Paving Co., $3,452. Oregon St. from East 28th to East 29th, asphalt pavement—Oregon Independent Paving Co., $1,586. East 29th St. from Hancock to Tillamook, grading and concrete curbs and walks—Bechill Brothers, $337. McClellan St. from Brandon to Fenwick, concrete pavement—Elwood Wiles, $6,368. Willis Blvd. from Brandon to Fenwick, concrete pavement —Montague-O'Reilly Co., $6,617; Elwood Wiles, $6,658. Farragut St. from Aubrey to Patton, concrete pavement—Oregon Independent Paving Co., $10,170. Hancock St. from Grand Ave. to East Eighth, macadam pavement -Crawford & Co., $11,103. Chatham St. from Lombard to Farragut, concrete pavement—Oregon Independent Paving Co., $3,136. Greenwich St. from Lombard to Russett, concrete pavement—Elwood Wiles, $844. Schofield St. from Delaware to Patton, concrete pavement—Elwood Wiles, $16,056. Emerson St. from East Ninth to East 13th, grading and concrete curbs and walks—Kibbe-Welton Co., $2,571. Watt St. from Delaware to Patton, concrete pavement—Elwood Wiles, $13,245. East 43rd St. from Hawthorne to Mallory, grading and concrete curbs and walks—Oregon Independent Paving Co., $1,536. East 43rd St. from Hawthorne to East Main, grading and concrete curbs and walks—Bechill Bros., $658. Russett St. from Derby to Patton, concrete pavement—Montague-O'Reilley Co., $5,555. 41st St. from 60th to 43rd Aves., Southeast, grading and concrete curbs and walks—Joplin & Meeks, $5,282. East Burnside St. from East 82nd to East 90th, grading and concrete curbs and walks—Joplin & Meeks, $4,469. Villard Ave. from Portland to Lombard, grading and concrete curbs and walks—Kibbe-Welton Co., $6,098. Terry St. from Aubrey to Patton, concrete pavement—Oregon Independent Paving Co., $9,755. Fairbanks St. from Thurman to Vaughn, asphalt pavement—Oregon Independent Paving Co., $2,578. East 53rd St. from Hawthorne to East Taylor, Hassam pavement—Oregon Hassam Paving Co., $8,136.

Road Superintendent J. L. Lambirth and Surveyor C. M. Collier of Lane County, Eugene, Ore., have started surveys for macadamizing 15 miles of roads. The intention is to let the work by contract, if suitable bids can be received. The Commissioners have mapped out a good-roads campaign whereby it is planned to hard-surface the 1,500 miles of road in the county.

Pennsylvania.

✣Bids will be received and awards made, by the Department of Public Works, Philadelphia, Pa., some time before July 1, for the execution of contracts for street cleaning, collection of garbage and gasoline lighting, for the year 1913. Specifications are in course of preparation. The procedure of previous years will be materially altered. Wherever possible the contracts will be so subdivided as to permit of a contractor bidding on one or more districts. Time between advertising specifications and opening bids, three weeks. Street Cleaning: Includes not only actual street cleaning, but the removal of ashes and household waste. The total value of all contracts for 1912 is $1,500,000, divided into eight districts. Unit for 1913 will probable vary from $75,000 to $150,000. Garbage: Includes the removal and disposal of garbage from all parts of the city, either by utilization or reduction process. Contract for 1912 was let at an expense to the city of $278,000. Advertising may begin as early as June 1st. Gasoline Lighting: The city owns the poles, contractor furnishes tops and all necessary materials and attendance for upwards of 19,000 lamps, located mainly in alleys and outlying sections of the city. The price per lamp for 1912 is $28. For additional posts $7.50 each. Prospective bidders should watch for further announcements. Morris Llewellyn Cooke, Director Department of Public Works, Philadelphia.

✣Bids will be received until 10:30 a. m., April 29, at the office of City Controller, Municipal Hall, Pittsburgh, Pa., for the following street improvements: Repaving with block stone—Penn Ave., from Fifteenth St. to a point near Twenty-seventh St.; Liberty Ave., north side of street, from Twenty-third St. to a point near Twenty-eighth St.; Selby alley, from South Ninth St. to a point near South Tenth St.; South Twenty-fifth St., from Sydney St., to a point near P. & L. E. R. R.; West Carson St., from Steuben St. to a point near South Main St.; Wilkins Ave., from Fifth Ave. southwardly to top of hill. Repaving with brick—Pretense alley, from a point near South Ninth St. to South Tenth St. Repaving with asphalt—Penn Ave., from Lexington Ave. on south side and Braddock Ave. on north side to City line; Fifth Ave., from a point near Shady Ave. to Penn Ave.; Ellsworth Ave., on north side, from Colonial place to point near College Ave. to south side, from Ivy St., to a point near College Ave. and from Clyde St. to a point near Colonial place; Perrysville Ave., from a point about 80 ft. west of Cutler St. to Taggart St. Repaving with creosoted wood block—Ohio St., from Federal St. to Cedar Ave.; Sandusky (formerly Seventh) St., from Liberty Ave. to Penn Ave. Grading, paving and curbing with brick—Loretta St., from Greenfield Ave. to Frank St.; Merriman alley, from South Twentieth St. to South Twenty-first St. Concrete retaining walls—Metcalf St., near Strauss St.; Paulowna St., near Thirty-third St.; Elliott St., east of Planet St.; West Carson St., from Tabor St. to Florein St. (G. P. & C., of West Carson St., from Thirty-sixth and Fortieth ward lines to Chartiers Creek).

Texas.

✣Bids will be received until noon, April 30, by W. D. Lacey, County Judge, Leon County, Centerville, Texas, for the construction of a sand-clay road from Centerville to Concord, a distance of 10½ miles. Forms of proposals, copies of plans and specifications and instructions to bidders may be seen at the courthouse, Centerville, Tex., or a complete set of same will be mailed by the County Judge to any contractor upon receipt of $5, which will be returned when plans are returned. Each bid must be accompanied by a certified check for the sum of $500 on any responsible bank in Texas, payable to W. D. Lacey, County Judge, Leon County. Road District No. 1 Leon County, reserves the right to reject any or all bids. W. D. Lacey, County Judge, Centerville, Leon Co., Tex.; J. Gibbons Brown, Consulting Engineer, Houston, Tex.

⊙The $75,000 road bonds issued by the Lewisville road district, Denton County, Tex., have been turned over to their purchaser and the construction contract let to O. E. Cobb of Lewisville, Tex., at $6,500 a mile for the rock-macadam roads and $2,395 a mile for the gravel-surfaced roads. It is expected to build between 28 and 30 miles of road in the district, most of it gravel, the rock-macadam roads being through Elm bottom east of Lewisville.

⊙The City Council of Pecos, Tex., has awarded the contract for putting in a drainage system in the business and semi-residential district to C. W. Clayton of Pecos. The contract calls for the laying of 4,500 ft. of drainage tiling and accessories. The Council is also considering the granting of a franchise to F. W. Johnson for the putting in of a sewerage system.

The City Council of Terrell, Tex., is about to ask for bids for the construction of concrete sidewalks on North Catherice St., South Rockwall Ave., and other residence streets.

A special election is to be held in Van Zandt County, Tex., on May 4, to determine whether or not a road tax of $.15 on $100 shall be levied for road improvements. Canton is the county seat.

The Hunt County Commissioners' Court, Greenville, Tex., has called a special election for May 25 to decide whether or not the Commissioners' Court shall issue bonds to the amount of $400,000 for the purpose of building good roads in Precinct No. 1, in the center of which Greenville is located. If the proposition carries at least 10 macadamized roads will be built leading out from Greenville in various directions.

Virginia.

✣Bids will be received until noon, May 1, by Hanover County Clerk, Hanover, Va., for the construction of about 1¼ miles of gravel road between the Henrico county line and Carneal's store in Hanover County. P. St. J. Wilson, Richmond, Va., is State Highway Commissioner.

The citizens of Stafford County, Fredericksburg, Va., county seat, on April 18 voted the issuance of bonds in the sum of $100,000 for the construction and improvement of roads.

The Street Committee of the City Council of Richmond, Va., has decided to have Broad St. paved with a smooth pavement instead of brick block, cobblestone, granite and other types of pavement. Bids will shortly be asked on this work.

Washington.

✣Bids will be received until 2 p. m., April 30, by Board of King County Commissioners, Seattle, Wash., for the necessary material and labor (Jap or Chinese labor not allowed) for the construction of Permanent Highway No. 2a. The work consists of the clearing right of way 60 ft. wide, grubbing constructing roadway and graveling from Station 245+00 to Station 527+00. Length of improvement 18,200 ft. Plans and specifications may be secured of the County Engineer by depositing $5. O. A. Case is Clerk of the Board.

✣Bids will be received until May 1, by City of Aberdeen, Wash., for the paving of E St. with asphalt or bitulithic on 6-in. concrete base. The work will include 700 cu. yds. of excavation; 7,300 sq. yds. of pavement; 1,070 lin. ft. of armored curb and 2,670 lin. ft. of plain. Charles W. Ewart, City Engineer, is in charge of the work.

⊙McGuire Bros., Anacortes, Wash., have been awarded the contract by J. M. Shields, County Auditor, Olympia, Wash., for the hard surfacing of portion of State Aid Road No. 82, known as Fidalgo Bay State Aid road, at approximately $15,000. All bids received at the same time, April 2, for the construction of a portion of Asplund road, in Section 9, Township 34, N. R. east, have been rejected.

⊙The contract for constructing State Aid Road No. 2 in Skagit County, Wash., has been awarded by the Commissioners, Mt. Vernon, to McGuire & Roach for about $15,000. The road will be built of macadam and crushed rock.

A committee of citizens of Leavenworth, Wash., is at work investigating paving materials with a view to submitting the best kind of pavement to the City Council. It is proposed to pave the business section of the city.

Bids will be asked by the city of Wenatchee, Wash., some time during May for the paving of Walker and Spokane Sts at an estimated cost of $18,000.

The city of Pullman, Wash., will construct from 16 to 20 blocks of pavement this year. K. Bean is City Engineer. M. D.
official in charge.

Wisconsin.

⊙J. Rasmussenson Co., Oshkosh,
reported to have been awarded the
by the City Council of Portage, Wis.,
construction of brick paving with
on Wisconsin, DeWitt and Oneida
$1.48 per sq. yd. Other bidders wer
Harding Co., Racine, Wis., $1.49½, a
Bartlett, Watertown, Wis., $1.53.

⊙The County Highway Committee
Wagener, Chairman, Sturgeon Bay,
ceived the following bids for the fu
of crushed stone to be laid down at
ous points in the county where road
be macadamized this year: Baileys H
Thos. Carmody bids $.85 and Nick
$.85 per cu. yd. of rock. Both bids
jected and new bids asked for. B
Thos. Carmody bids $.90 per cu. y
tract awarded. Egg Harbor—Thos.
bids $.55; August Moeller bid on N
$.60, on No. 2 $.65. Mr. Carmody gra
contract. Gardner—Thos. Carmody
Albert Carbody bid $.69 and Mike
$.58 and $.60 on the two jobs.
awarded to Mr. Gerlach. Gibralta
Carmody bid $.60. Contract awarded
sonport—Thos. Carmody bid $.90 a
Herbst $.90. Both bids rejected and
asked for. Nasewaupee—Thos. Car
$.64 and Albert Carmody bid on the th
as follows: (1) $.58, (2) $.58, (3) $
vastopol. Five jobs bid on. Thos.
bid $.60 on No. 3; Aug. Moeller bid
lows: (1) $.65, (2) $.65, (4) $.60,
Bids were accepted for the various
above. Sturgeon Bay town—Thos. Ca
$.80; August Moeller, $.65. Contract
to the latter.

The City Council of Superior, W
under consideration the paving of Tow
from Third St. to 16th St.; also the
of Ogden Ave. from Third to Belk
City Engineer E. B. Banks has prepar
and specifications for the improvemen
latter street, calling for asphalt weari
face. The cost is estimated between
and $30,000. It is also proposed to
following: Ogden Ave., from Belknap
St.; Cumming, Baxter, Grand and
Aves.; Becker and Nettleton Aves.

The County Highway Committee,
Wagener, Chairman, Sturgeon Bay, W
a special meeting April 23 to consider
ceived from the following for the fur
of road-making machinery, includi
roller, and possibly a complete road-
outfit: Austin Western Co., Ltd., (
Ill.; Good Roads Machinery Co., Fort
Ind.; Huber Roller Co., Green Bay,
Kelly-Springfield Co., Springfield, O.

Canada.

✣Bids will be received until 4 p.
29, by Frank Ness, Sec. Treas., Mun
of Assiniboia, Kirkfield Park, P
Charles, Man., for the construction o
manent pavement 24 feet wide on th
side of Portage Ave., extending fr
western limits of the City of Winnipeg
western limit of Lot 20, St. James.
tender must be accompanied with a
check for 5 per cent of the amount of
Plans and specifications may be seen
Engineer's office at the Municipal H
Charles.

IRRIGATION, DRAINAGE, LEVEES AND CANAL

Alabama.

Bids as follows were received April 8 by the U. S. Reclamation Service, Los Angeles, Cal., for furnishing electrical apparatus (specifications 298) for the Truckee-Carson project, (1) being bid on Item 1 for each, (2) bid on Item 2 each, (3) bid on Item 3 each, (4) bid on Item 4: Pittsburg Transformer Co., Pittsburg, Pa., (1) $525, (2) $408; Crocker-Wheeler Electric Co., Ampere, N. J., (1) $545, (2) $436.66; Moloney Electric Co., St. Louis, Mo., (1) $605, (2) $420; Allis-Chalmers Co., Los Angeles, Cal., (1) $636.66, (2) $476.66, (3) $945, (4) $805; Westinghouse E. & M. Co. Los Angeles, Cal., (1) $666.66, (2) $483.33; (3) $967, (4) $772; Wagner Elec. Mfg. Co., St. Louis, Mo., (1) $734, (2) $525;
Electric Co., Schenectady, N. Y., (1
(2) $412.33, (3) $1,237, (4) $945.
Johns-Manville Co., Los Angeles, Ca
$1,700.

Colorado.

D. G. Gordon, Denver, Colo., at $2,4
low bidder for constructing the new

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

n ge system at the U. S. Recruit Depot, gan, Colo., and will [illegible] ard the contract. The other bidders follows: J. E. Maloney, [illegible] $2,671; J. S. Schwartz, [illegible] Colo., $2,828; C. S. Lamie Co., Den o., $2,985; J. E. Kiefer Plumbing Co., Colo., $3,250; Peter O'Brien Con n Co., Denver, Colo., $3,300; Dennis Denver, Colo., $3,477; Dempsey Con Co., Pueblo, Colo., [illegible] n, Denver, Colo., $4,260.

Florida.

ds received April 9 by the commission St. Lucie county, Fort Pierce, Fla., for ing 700 ft. docks were rejected. D. M. Rogers, Fort Pierce, Fla., are [illegible]

Indiana.

will be received until 2 p. m., April J. Johnson, County Surveyor, Mount Ind., for the construction of about 45 dredge ditch work. T. J. Johnson is n Commissioner, Mt. Vernon, Ind. dvertisement will be found elsewhere [illegible]

will be received until 11 a. m., April homas J. Wilson, Construction Com , Valparaiso, Ind., for the construc he Kellar Ditch, located in Porter rte counties. The ditch will be 13 , all main ditch, bottom width 6 to th 6 to 9 ft., requiring 141,321 cu. vation. Ten miles, containing 119,- [illegible] m and sand. Nearest railroad LaCrosse, 1 mile from beginning of posit of $500 required with bids. chfield, Engineer, Valparaiso.

Iowa.

will be received until 2 p. m., May 3, of Kossuth County Supervisors, Al for the drainage improvement com ,535 ft. of tile ranging from 6 to verage haul is 6 miles. B. E. Nor nty Auditor.

will be received until noon, April 25, etty, Boone County Auditor, Boone, construction of County Drain No. rdance with plans and specifications at the office of the auditor. The cost work is estimated at [illegible] ers, Boone, Ia., is Engineer.

will be received April 25 [illegible] A. Batman, County Auditor, Nevada, the necessary labor and material for nstruction of Drainage Districts Nos. 46 and 47.

ntracts for constructing Joint Ditch bids for which were opened April 16 , Ia., have been let as follows: work, Geo. W. McCarter, Warsaw, furnishing tile, Spencer Cement Tile pencer, Ia.; tile construction work, A. hweppe, St. James, Minn. The work s 15,000 ft. of open ditch and approxi 108,182 cu. yds. of excavation, also the ng tile work: 17,100 ft. of 6-in. tile, t. of 7-in. tile, 36,600 ft. of 8-in. tile, t. of 9-in. tile, 33,550 ft. of 10-in. tile, ft. of 12-in. tile, 12,900 ft. of 14-in. tile, 5,875 ft. of 15-in. tile, 10,800 ft. of 16-in. tile, 8,200 ft. of 18 in. tile, 11,700 ft. of 20-in. tile, 11,300 ft. of 22-in. tile, 9,250 ft. of 24-in. tile, 800 ft. of 28 in. tile, 1,300 ft. of 30-in. tile, and 1,500 ft. of 32-in. tile.

Michigan.

✣Bids will be received until 8 p. m., April 25, by Board of Public Works, E. H. Christ, President, Grand Rapids, Mich., for furnishing the labor and material for excavating and constructing a new channel for Coldbrook Creek from the present channel in Highland Park easterly to near Emerald Ave., including the construction of sections of concrete culvert, the protection of the open channel, the construction of retaining walls, wing walls, and embankments, the extension of storm sewers, changes in drainage and water mains and other incidental work in connection therewith, according to the plans and specifications on file at the office of the board. The cost of the work is estimated at $28,000.

The Western Land Securities Co., St. Paul, Minn., is planning to reclaim a large area of marsh lands in Luce county, east of Newberry. It is proposed to lower the Taquamenaw Falls several feet and dredge and straighten the channel of the Taquamenaw River.

Minnesota.

Preliminary survey has been made and a report submitted to the River and Harbor Commission of the city of St. Paul for the proposed location of the new river channel. According to the preliminary estimate the work of changing the channel would cost $2,192,331, and would require over 4,226,000 cu. yds. of excavation. Oscar Claussen is city engineer of St. Paul.

Nevada.

✣[illegible] S. Reclamation Service, Fallon, Nev., for furnishing, f. o. b. cars shipping point, the following: One bucket elevator, 66 ft. center to center, capacity 300 cu. ft. of fine, dry sand per hour; 1 bucket elevator for Portland cement, 44 ft. center to center, capacity 200 cu. ft. per hour; 1 12-in. belt conveyor, 95 ft. center to center, with 25-ft. vertical rise, capacity 200 cu. ft. per hour; 1 conical or cylindrical revolving gravel screen, 36 by 60 ins.; 1 pair right and left cast-iron quadrant gate reciprocating fenders, and 1 8-in. spiral conveyor, complete. For further information address [illegible]

North Carolina.

⊙The Eastern Dredging Co., Greensboro, N. C., has been awarded the contract at 6.2 cts. per cu. yd. for constructing 14½ miles of 20 to 30 ft. wide canal, requiring 290,000 cu. yds. of excavation, for Wayne County Drainage District No. 1. Bids were opened April 3 at Goldsboro, N. C.

Memphis, Tenn., and Vicinity.

[illegible]

The following account of the work of levee contractors in trying to prevent damage during the recent floods in the Mississippi River was received from our Memphis correspondent too late for insertion in our last issue:

While the newspapers have told of the suffering and damage caused by the breaking of levees, they have failed to state the gallant part played by so many levee contractors in the attempt to hold the mighty river and the unselfish way in which they devoted their whole time and risked their outfits to keep intact the line of embankment, when each break might mean an abundance of new work later in the season. Capt. Pat McCadden was placed in charge of the St. Francis Levee Board embankments and a force of 750 men and two steamboats were assigned him. For a week he worked night and day, snatching only such food and sleep as were necessary, and even refused to move his personal outfit from behind the levee because by so doing the men would have no place to sleep. When Wilson levee broke, his tents and equipment were washed away and he only managed to save his mules by a bare few minutes. All the Lowrance boys took off their coats and spent many sleepless nights and days of hard work trying to save the Greenville levee district. Mike Roach left his office and many business interests to go to the big Huntington Loop dike and there personally took charge of a number of men, including all the farm hands in that territory. Henry McCarten and Bill Stephenson were fighting hard for the Tensas levees when Lake Village gave way. While some of their equipment and canvas has been lost, it is believed that all live stock has been saved. Martin Jennings and George Lowrance kept up a gallant fight near Transylvania, La., trying to save the little town and had it not been for the Lake Village crevass they too would have been victorious. Then the Helgason boys in the Vicksburg territory, L. C. Dulaney and Contractor Foote in the Greenville district, Bobbitt in the lower section, all fought with a vim and unselfish thought to save the levees near them and one and all deserve that credit which is due men of their stamp who fight for a principle in the face of grave danger, when the abandonment of the fight might mean their ultimate profit and certainly their present safety.

Texas.

Specifications, profiles, etc., have been completed for the drainage system for Drainage District No. 4 of Matagorda county. This district comprises between 39,000 and 40,000 acres. The amount of the bonds voted was $103,669. H. Black, Markham, and E. N. Gustafson are the engineers.

Plans have been completed by B. F. Hoyt, C. E., Kingsville, for a proposed dam to be erected southeast of Kingsville for irrigation purposes. The dam will be about 1¼ miles wide and will conserve water for about 35,000 acres of land.

Canada.

✣Bids will be received until noon, May 15, by A. S. Dawson, Chief Engineer, Canadian Pacific Ry., Department_ of Natural Resources, Calgary, Alta., for timber structures in about half the area of the area of the Eastern Section of the Company's Irrigation Block in Alberta. Approximate quantities are 4,250,000 ft. B. M. of timber and 80,000 cu. yds. of excavation. All construction materials will be furnished by the Railway Company. Plans, specifications and full information will be furnished on application. A deposit of $50.00 will be required before plans, etc., will be given out.

WATER-WORKS

Alabama.

city of Haleyville, Ala., is planning stallation of a waterworks system to etween $8,000 and $10,000. The work nclude tank, piping, pumps and en Water supply will be secured from s or well. The date for letting con has not been decided upon. M. S. is City Clerk.

Arizona.

The city of Prescott, Ariz., contemplates purchasing the waterworks plant at present in operation from the Banning Creek Co.

The city of Tucson, Ariz., is considering the building of a reservoir out in the hills. It is planned to be 200 ft. in diameter and 30 ft. in depth, with a capacity of 7,000,000 gals., and an estimated cost of $110,000. To remove the sand from the pipes in the city [illegible] estimated, $30,000.

Colorado.

✣Bids will be received until 8 p. m., April 25, by S. R. Rigg, Town Clerk, Westminster, Colo., for the construction of a waterworks system. A certified check for $1,000 payable to Town Treasurer, must be filed with each bid. Plans and specifications [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

O'Brian Construction Co., 403-406 Nassau Block, Denver, Colo., for the sum of $5.

The town Board of Johnstown, Colo., has decided on building a $20,000 waterworks system by constructing a reservoir three miles west of the city, filling it with Big Thompson river water and building a pipe line to the town. The proposition will be submitted to a vote of taxpayers.

The citizens of De Beque, Colo., at a recent election voted the issuance of bonds in the sum of $20,000 for the installation of a waterworks system. The work will include a pumping plant, reservoir and about two miles of pipe lines. The water supply will be secured from the Grand River. It is thought that the contract will be let in about 30 days. Engineer has not been chosen. Lambert Sternberg is Mayor.

The citizens of Cedaredge, Colo., have voted the issuance of bonds in the sum of $40,000 for the building of a gravity system of waterworks. The plant will eventually be extended to cover the Surface Creek valley. J. C. Rowbotham is Mayor.

Florida.

The Water & Gas Committee, D. Kugelman, Chairman, Pensacola, Fla., has rejected all bids received April 16 for the construction of a reinforced concrete reservoir on account of the preparation of plans.

Georgia.

✣Bids will be received until 5 p. m., May 15, by Mayor and Council, Sylvester, Ga., for the construction of a partial sewerage system and waterworks improvements. Waterworks improvements consist of 1 compound steam Duplex air compressor, 1 Westinghouse direct-air compressor, brick pumproom additions; furnishing and laying 4,650 ft. 6-in. C. I. pipe, with valves, hydrants and special fittings. Sewerage system embraces approximately 3 miles, sizes ranging from 8-in. to 12-in., with one Septic tank. Work will be let as a whole to one contractor. Bids will be received for sewerage system and waterworks improvements separately and for both. Certified check required for 5 per cent of amount of bid. Plans and specifications may be seen at either the office of the City Clerk or the Engineers. A. H. Pinson, Mayor; R. B. Pollard, City Clerk; the J. B. McCrary Co., Engineers, Atlanta, Ga.

✣Bids will be received until 11 a. m., May 3, by City Council, Baxley, Ga., for furnishing 900 ft. and 1,100 ft. of 8 and 6 in. cast iron pipe and fittings; for constructing reservoir; for furnishing one boiler; for furnishing feed-water heater; for furnishing one triplex and one boiler-feed pump; for furnishing one air compressor; for installing machinery, complete, including switchboard; for furnishing and installing electric line work; for furnishing poles; for furnishing generator, exciter, switchboard, series transformer and transformers; for furnishing engine, and for erection of power house. Specifications may be obtained from and plans seen at the office of the Consulting Engineer. Each bid must be accompanied by a certified check for 5 per cent of the total of bids. Wade H. Watson, Mayor; H. J. Parker, Clerk; Wm. W. Lyon, Consulting Engineer, 305 Duval Bldg., Jacksonville, Fla.

The City Council of LaGrange, Ga., will ask the State Legislature to allow the voters of the city to pass on a bond issue of $215,000 including $150,000 for waterworks plant, $15,000 for additional public school facilities, and $50,000 for municipal gas plant.

Idaho.

✣Bids will be received until May 5, by F. C. Miller, City Clerk, Salmon, Idaho, for the construction of a new 120,000 gal. reservoir and 4 miles of extensions to the system. Plans and specifications are on file with A. C. Merritt, Engineer, Salmon, Idaho. The cost of the work is estimated at about $27,000.

The City Council of Weiser, Ida., plans the construction of 10 miles of water mains at an estimated cost of $90,000. Data is being prepared by City Engineer R. J. Wood of the Weiser Engineering Co.

The Village Board of Burley, Ida., has had prepared ordinance calling an election for voting upon the question of bonding for $85,000 to extend the electric lighting and power system, and put in waterworks and sewers.

Illinois.

✣Bids will be received until 8 p. m., April 25, by H. H. Dilg., Secy. of Board, Morton Grove, Ill., for water mains at that place. Edgar Rossiter, County Bldg., and J. H. Geweke, 167 W. Washington St., Chicago, Ill., will supply further information. Official advertisement will be found elsewhere in this issue.

⊙The Murray Iron Works Co., Burlington, Ia., has been awarded the contract by the Fire & Water Committee, C. W. Snyder, Chairman, Canton, Ill., for the construction and erection upon foundation at the Ave. D pumping station in the city of Canton, of a pumping engine of the Meyer valve gear type, compound condensing, high duty flywheel type. The contract price is $4,175. Bids were opened April 16.

The Village Council of Avon, Ill., has granted a franchise to the Avon Milling & Mfg. Co. to maintain a waterworks system in the village for a period of 20 years.

Indiana.

✣Bids will be received until 3 p. m., May 9, by Board of Public Works, South Bend, Ind., for furnishing two water tube boilers including appurtenances. Specifications are on file at the office of W. S. Moore, City Engineer. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Engineers.

✣Bids will be received until 3 p. m., May 6, by Board of Public Works, South Bend, Ind., for furnishing and erecting two 5,000,000-gal. corliss cross compound pumping engines and necessary feed pumps, drainage pumps and other auxiliaries; also two 8,000,000-gal. low service pumps in the water works station, South Bend, Ind. Specifications are on file with W. S. Moore, City Engineer. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., Consulting Engineers.

Iowa.

⊙The Town Council of Donnellson, Ia., has awarded a contract for the installation of a waterworks system to the Des Moines Bridge & Iron Works, Des Moines, Ia., at $6,291. The work includes a 50,000-gal. tank, tower and pipe line. Other bidders were: Cook Construction Co., Des Moines, $6,610; C. W. Roland, Des Moines, $6,395; W. D. Lovell, Minneapolis, Minn., $6,687, and Rock Island Bridge & Iron Co., and A. M. Peatman, Centerville, $6,823.

Louisiana.

The Sewerage & Water Board of New Orleans, La., has authorized extensions of water mains into the area bounded by Melpomene, Erato, Claiborne and Galvez Sts. Extensions are to be made by the property owners.

Massachusetts.

⊙The Department of Public Works of Boston, Mass., has awarded the contract to Ferguson & Kelly for laying water pipe on various streets in city proper, Charlestown, South Boston, East Boston, Roxbury and Brighton for $10,110. Other bidders were: M. De Sisto & Co., $10,900; John T. Shea, Jr., $13,330; Hugh McNulty, $15,960; D. E. Lynch, $19,350; Coleman Bros., $22,220.

Michigan.

The Board of Public Works of Grand Rapids, Mich., has approved the plans for the widening, deepening and straightening of Coldbrook Creek and will soon ask for bids on the work. City Engineer L. D. Cutcheon has estimated the cost of the work at $28,000.

Minnesota.

An election will be held in Red L Falls, Minn., on May 14, for the purp of voting on the question of issuing bo in the sum of $25,000 for the installatio a waterworks system. The water sup will be secured from wells.

Mississippi.

The town of Tutwiler, Miss., will is $13,500 of bonds for sewerage and w

The town of Sumber, Miss., will hold election May 6 to see whether $22,500 s be issued to build waterworks and s erage.

The City Council of Crystal Spri Miss,. will sell bonds at its May meetin the sum of $10,000 to improve the light water plant.

The City of Yazoo City, Miss., will bonds in May in the sum of $30,000 to prove the water and light plant.

Missouri.

✣Bids will be received until May 1, city of Pleasant Hill, Mo., it is repor for a 65,000 gal. tank on tower, pumphc with foundation, brick construction, 200 G. P. M. pumps, 20 h. p. motor, 20 h oil engine, 35 ft. well concrete, 16 ft. acr Rollins & Westover, Kansas City, Mo., Engineers.

Montana.

✣Bids will be received until May 29, Town Council, Shelby, Mont., for the c struction of a municipal water works syst Plans and specifications will be sent to ders whose names are on file with City E neer J. E. Nolan. The approximate quanti are: 3,000 ft. 8-in. steel pipe; 27,000 ft. 8 wood pipe; 13,000 ft. 6-in. wood pipe; 20 drants; 4,000 ft. of 2½-in. fire hose; 5,500 of fittings, tees, ells, crosses, etc., for woo pipe; one 100,000-gal. wood water tank; ging 43,000 ft. of trench, 6 ftl deep and ins. wide; one 20-h. p. engine and pump; 8-in. gate valves; 30 6-in. gate valves.

Nebraska.

✣Bids will be received until 8 p. m., M 1, by T. B. Myers, City Clerk, David C Nebr., for furnishing 8,000 ft. or more 4-in. standard cast iron water pipe of Cl B; also for the usual specials or fitti for said pipe. Bids are for the mate f. o. b. David City.

⊙The York Water Co., York, Nebr., awarded the contract for the construct of the foundation for the new wa tower to Jacob Zieg of York at $775.

⊙The Katz Construction Co., Oma Nebr., has been awarded the contract the city of Rosalie, Nebr., for the insta tion of a complete waterworks system $7,690. The work includes 1½-in. ma elevated tank, station bldg., oil engi wells and pump. Grant & Letton, 401 & M. Bldg., Lincoln, Neb., are Consult Engineers. Bids were opened April 16.

The City Council of Hastings, Nebr., taking steps to have a reservoir built the city water plant.

New Jersey.

✣Bids will be received until 8:30 p. April 29, by Township Committee of the tov ship of Union, at Odd Fellows' Hall, Vai Brook Ave., Lyndhurst, N. J., for the d tribution of approximately 35,000 ft. of pi special hydrants, valves, etc., and laying a placing the same. Bowe & Wessels, 237 P erson Ave., East Rutherford, N. J., are En neers. J. F. Woods is Township Clerk.

⊙Dravo-Doyle Co., Arcade Bldg., Philad phia, Pa., has been awarded the contract the Water Department of Atlantic City, N. for furnishing and installing one 10,000,0 gal. turbine driven centrifugal pump at $9,9 Bids were opened April 19.

New York.

✣Bids will be received until May 2, Board of Water Commissioners, Jam town, N. Y., for constructing a reinforc

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

te covered reservoir and [illegible] supply mains, in accordance with ind specifications prepared by Ches- Fleming, Consulting Engineers, Pitts- Pa. Plans and specifications can be ed at the Waterworks office in James- r at the office of the Engineers in rgh

✣ ls will be received until 11 a. m., May Board of Water Supply, J. P. Morris- cy., 165 Broadway, New York City, borings on and near the site of the ed Silver Lake reservoir, situated [illegible] mile west [illegible] 2 miles by trolley [illegible] Staten Island, Borough of Richmond, York City

⊙ lly Mfg. Co., Buffalo, N. Y., has been l the contract by the Board of Pub- provements of St. Louis, Mo., for ing general and detail drawings, con- g and erecting in place at High Ser- ation No. 2, Bissell's Point, two high [illegible] expansion crank and [illegible] g engines, of a capacity of 20,000,000 [illegible] 24 hours, [illegible] and appurtenances necessary in ac- e with plans and specifications ap- by the Board. The contract price 79. Bids were opened April 12.

Board of Public Works of Oneida, has asked the Common Council to special election to raise [illegible] ain extensions. George Tibbitts is [illegible]

Oklahoma.

City Council of Pawhuska, Okla., rded to Kennedy & Fleming, con- and consulting engineers of Okla- ity, Okla., the contract for equip- l machinery in extensive improve- r the city waterworks and electric nt. The contract includes three essure boilers, two Corliss engines, 00,000-gal. motor driven centrifugal nd auxiliaries.

Ludlow Valve Co. has been award- ontract by the city of Muskogee, Charles Wheeler, Jr., for furnishing te valves. Alexander Potter, 114 Lib- St., New York City, is Consulting [illegible]

ge C. Priestley of Bartlesville, Okla., purchased the Bartlesville Light & r Co. plant and plans the installation modern filtration plant.

. J. Merkle & Co., of Kansas City, Mo., been awarded the contract by the city oldenville, Okla., W. S. Levan, City , for furnishing f. o. b. cars at Water- s Spur (on C., R. I. & P. R. R., three from Holdenville), following for rworks extension, etc.: 15,000 lin. ft. cast iron pipe, class A, weight 57.1 er lin. ft.; 20,000 lbs. lead; engine gen- r set, consisting of 3-phase 60-cycle volt 75-K. V. A. generator, direct con- d to horizontal steam engine; switch- ds and instruments complete; 45,000 ft. No. 6 waterproof copper wire; 130 hern cedar poles, 30 ft. long, 6-in. tops, cross-arms, guys, braces, insulators, bronze fitted horizontal turbine pump, city 625 gals. per minute against total of 112 ft., direct connected to 35 h. p. ase 60-cycle 2,300-volt meter, with auto-starter; 72-in. by 18 ft. horizontal return-tubular boiler. Consulting Engineers, Goodwin & Harper, 920 Scarritt Bldg., Kansas City, Mo. The contract price is [illegible]

Oregon.

⊙The Water Board of Portland, Ore., has awarded the contract for furnishing the city with 400 fire hydrants to the Phoenix Iron Works of Portland at $14,600, and the contract for furnishing the board with 139 sleeves and valves to M. L. Kline at $3,011; also to Zimmerman, Wells, Brown Co., for furnishing the electric pumps and motors for the Palatine pumping station at $2,458, and the contract for constructing the Palatine standpipe to the Willamette Iron Works for $3,902, and the pipe from Fulton Park to the standpipe to Crane Co., at [illegible]

The city of Medford, Ore., has under consideration the making of extensions to the waterworks system. E. T. Foss is City Recorder.

Pennsylvania.

✣ [illegible] 17, by Commissioners of Waterworks, Erie, Pa., for the construction of a filter plant, settling basin, piping, coagulent house and superstructure, pumping station, low service pumping machinery, water tube boilers, stokers and superheaters. All bids shall be made upon the blank forms contained in the pamphlet with instructions to bidders, contract, specifications, etc., to be obtained at the office of the Commissioners, City Hall, Erie, Pa., or from the Engineers, Chester & Fleming, Union Bank Bldg., Pittsburgh, Pa.

Plans for the installation of a water purification plant in Gettysburg, Pa., for the town and for the camp site and battlefield, have been approved by State Health Commissioner Samuel Dixon.

South Carolina.

The City Council of Columbia, S. C., has authorized the Water Department to advertise for bids for the construction of a new coagulating basin at the plant. The basin will require approximately 1,000 yds. of concrete and will necessitate the excavation of about 8,200 yds. of dirt. The head house for tanks, apparatus and wareroom will be 24x70 ft., and will be equipped with 24-in. cast iron pipe and valves. Plans are being prepared by City Engineer F. C. Wyse. Bids will be asked by G. H. White, master mechanic at the plant.

South Dakota.

The citizens of Yankton, S. Dak., at a recent election voted the issuance of bonds in the sum of $60,000 for the waterworks system. Charles P. Edmunds is City Commissioner.

The citizens of Centerville, S. Dak., at a recent election voted against the proposition to change the water meter system.

Texas.

Specifications have been completed by Waterworks Engineer J. M. Bassett of Dallas, Tex., for the 36,000,000-gal. centrifugal pump which is to be installed at Bachman reservoir to pump water into the reservoir from the Trinity River when in flood stage It is proposed to enlarge the present plant and put in engines and boilers.

According to reports from San Angelo, Tex., announcements were received from C. W. Hobbs of New York City that the plant and holdings of the San Angelo Water, Light & Power Co., have been purchased by A. E. Fitkin & Co., of New York City, for a consideration of $400,000.

The citizens of Irene, Tex., have formed a stock company for the purpose of establishing a waterworks system for the town.

Washington.

✣ [illegible] 8, by town of Wapato, Wash., for the furnishing of all materials and labor necessary for the construction of the distributing system of the municipal water works. The work will consist of the furnishing and lay- [illegible] banded wood pipe, sizes four to 10-in., 27 hydrants, with specials, gate valves, etc. Bids must be accompanied by a certified check for 5 per cent of the amount bid, the check to be forfeited in case the bidder to whom the work is awarded fails to enter into a contract. Payments for the work will be in cash, 75 per cent monthly. Profiles and specifications for this work may be had by reputable bidders on application to the City Engineer. W. G. Ellington, Town Clerk; D. R. Redman, City Engineer, Toppenish, Wash

A special election has been called to vote on the construction of a new water system in Index, Wash., on April 27. Water will be brought from Deer Creek, one mile west, by gravity

Wisconsin.

✣Bids will be received until 10:30 a. m., May 15, by Department of Public Works, Milwaukee, Wis., for necessary labor and material for the construction of water works tunnel 12 ft. in diameter, for a distance of approximately 4,000 ft. out into and under Lake Michigan, from a point on the lake shore on the center line of Linwood Ave. extended; one lake shaft, including connections and steel cylinders; one shore shaft, including 2 gate wells and all connections, and approximately 150 cu. yds. of rock excavation, according to plans and specification. Official advertisement will be found elsewhere in this issue.

Canada.

The Windsor Water Commission, Windsor, Ont., has voted to purchase a new pump for the city pumping station. Joseph Martin is Commissioner.

The citizens of New Westminster, B. C., have voted a by-law to the extent of $400,000 for the following civic work and building: Street improvement, $250,000; water extension, $40,000; electric light extension, $25,000; fire apparatus purchase, $14,000; exhibition, $20,000; bunkers, etc., $6,000.

⊙Patrick Kilrenny, Ltd., Moose Jaw, Sask., has been awarded the contract by the City Commissioners of Moose Jaw for the installation of approximately three miles of 8-in. sewer mains and 6-in. water mains complete with house junctions, hydrants, valves, etc., at $19,545. Bids were opened March 29.

SEWERAGE AND GARBAGE DISPOSAL

Alabama.

he Board of Commissioners of Birming- , Ala., will erect a garbage and refuse in- rator at 63rd St. and Fourth Ave. Plans Valter G. Kirkpatrick, City Engineer.

California.

The Board of Public Works of Los An- s, Cal., has awarded the contract for the construction of the Hollywood main sewer to P. A. & C. H. Howard for $347,957.

⊙The Board of Public Works of Los Angeles, Cal., has awarded the contract for the construction of a sewer in Alameda St., from Shearer to Third, to Peter Grbovach at $16,669.

⊙The Board of Public Works of San Francisco, Cal., J. L. McCormick, Secy., has awarded the contract for the construction of sewers and appurtenances in Golden Gate Park and 48th Ave., from Lincoln Way to Cabrillo St., to the Consolidated Construction Co., Hearst Bldg., San Francisco, at $140,853. Bids were opened April 10.

⊙Chamberlain, Williamson & Chamberlain have been awarded the contract by the city of Anaheim, Cal., Edward B. Lewitt, City [illegible] the Outfall sewer at $3,040. Bids were opened March 28.

Engineer Abbey has reported to the City Trustees of Taft, Cal., that it will cost $20,- [illegible]

The Outfall Sewer Commission was recently organized in Los Angeles, Cal., by representatives of 15 cities of San Gabriel Valley, for the purpose of building the joint outfall which has been proposed by the Inter-City Commission. The officers elected were John D. Reavis, President; Robert Jordan, Vice President; C. W. Rhodes, Treasurer; F. H. Olmstead of the firm of Olmstead & Gillelen, Wright & Callender Bldg., Consulting Engineers, Los Angeles, Engineer.

[illegible] April [illegible] $43,000 for the installation of a garbage incinerator and sewer outfall extension.

Colorado.

[illegible] ing the sewer system.

Connecticut.

Specifications for the construction of the East End trunk sewer have been submitted to the City Council of Bridgeport, Conn., by City Engineer Alfred H. Terry, and bids for its construction will be asked for immediately. The sewer will extend along Read St., through private land to Radel St.; then to Florence Ave., to Connecticut Ave., to Bishop Ave., and Barnum Ave.; then westerly on Barnum Ave. to Mill Hill Ave. The pipes vary in size from 24-in. to 10x15 ins.

Georgia.

✣[illegible] April [illegible] by City Council, Augusta, Ga., for furnishing all labor and materials and constructing approximately 3,700 lin. ft. of brick sewer, 36 to 54 ins. in diameter, with manholes, catch basins, etc. Also at the same time there will be received proposals for furnishing labor and material and constructing all pipe sewers, 8 to 24 ins. in diameter, which may from time to time be ordered by the City Council during the year 1912. The brick sewers and pipe sewers will be considered separate contracts. Cash or certified check for $250 must accompany each bid as a guarantee of good faith. The successful bidder will be required to give bond as called for in the specifications. Nisbet Wingfield is City Engineer and Commissioner of Public Works.

The city of Augusta, Ga., is asking for bids on the Central Ave. sewer, the largest to be let this year. The sewer will be of brick, and from 3 to 6½ ft. in diameter. It will connect up with the present sewer that has been put down on a part of Central Ave., and will extend to the intersection of 15th St. and the Wrightsboro road, a distance of about 3,700 ft. There has been $20,000 set aside for this sewer.

Idaho.

The City Council of Weiser, Ida., plans the construction of 8 miles of sewer this year at an estimated cost of $70,000. Data is being prepared by City Engineer R. J. Wood of the Weiser Engineering Co.

Illinois.

✣Bids will be received until 7:30 p. m., April 25, by President R. W. McInnes, Board of Local Improvements, Belvidere, Ill., for the extension of the sanitary sewer system.

✣Bids will be received until 1 p. m., April 30, by Board of Local Improvements, Hamilton, Ill., for the construction of sewers. H. B. Kinkade is Secy. of the Board. Official advertisement wil be found elsewhere in this issue.

⊙Vae Wolf, Alton, Ill., has been awarded the contract by that city for the construction of the Bellview Ave. and Summit St. sewer at $2,220. The work includes 6, 8, 10, 12 and 15-in. sewers and 8 manholes and 6 catch-basins. J. E. Schwaab is City Engineer. Bids were opened April 15.

⊙The City Council of Elgin, Ill., has awarded the contract to the Illinois Hydraulic Construction Co. for the building of a sewer through the Carlisle property on Highland Ave., west of Crystal St., as an outlet for the sewer for $1,275.

⊙H. C. Gass has been awarded the contract by the City Council of Belleville, Ill., for the construction of the Crystal Palace sewer at $8,356. This sewer will drain that section of the city in the Fourth Ward lying back of the defunct Busch Glass Works and adjacent thereto, including Crystal Palace and Roosevelt Heights, and joining the Main St. sewer by the route of Busch Ave.

⊙J. E. & B. S. Craine of Carbondale and Murphysboro, Ill., have been awarded the contract by the City Council of Murphysboro for the construction of the east side sewer at about $12,000.

Indiana.

The Board of Public Works of LaFayette, Ind., has adopted specifications for the construction of a sewer on 26th St., from South St. to Ferry, and a sewer on 24th St., from Ferry to the Rossville road.

Preliminary resolutions for six sewers and the assessment roll for the Chapin Park sewerage system have been approved by the Board of Public Works of South Bend, Ind. The Chapin Park system will embrace drains on Partage, Angella, Woodward and Blaine Aves. and McCartney St. The preliminary action affects proposed improvements on the following streets: Sample St. between Webster and Olive; Ford between Kosciuszko and Olive; Allen from Michigan Ave. to Van Buren; College from Fassnacht Ave. to 20 ft. north of Michigan Ave.; Johnson from Michigan to Vassar Ave., and Miner St. from Notre Dame to Eddy.

The Board of Public Works of South Bend, Ind., has adopted resolutions for the construction of the Bowman Creek sewer. The sewer, which is to cost approximately $150,000, is to be situated in the southeast part of the city, and will be one of the principal trunk sewers. W. S. Moore is City Engineer.

Iowa.

✣Bids will be received until 8 p. m., May 6, by Chairman Street Committee, City Council, Ottumwa, Ia., for furnishing the necessary labor and material for the construction of certain trunk and main sewers in the city. J. F. Brady is City Engineer.

✣Bids will be received until 7:30 p. m., May 13, by Town of Reinbeck, Ia., for the construction of 6 miles of 8 to 15-in. sanitary sewers and disposal plant. A certified check for $500 must be filed with each bid. R. B. Ferguson is Town Clerk and the Iowa Engineering Co., Clinton, Ia., are Engineers.

✣Bids will be received until 7:30 p. m., May 13, by R. B. Ferguson, Town Clerk, Reinbeck, Ia., for the construction of a sanitary sewer system for said Town. Approximate quantities are as follows: A.—Disposal Plant, Outlet, Accessories and Connections, as follows: 1 Cement Concrete Bulkhead (8 cu. yds.). 1 Cement Concrete Septic Tank. 2,400 ft. 15-in. vitrified sewer pipe (bulkhead to Grundy Ave.). 48 ft. 16-in. cast iron pipe. 1 Concrete or brick manhole. B.—Sewer Pipe Lines and Accessories. Lateral Sewers. 1,850 ft. 12-in. vitrified sewer pipe. 7,300 ft. 10-in. vitrified sewer pipe. 19,200 ft. 8-in. vitrified sewer pipe. 39 Concrete or Brick manholes. 25 Concrete or Brick flush tanks. 96 ft. 12-in. cast iron pipe. Bids will be received for the separate divisions. Bids will also be received for 6,500 ft. 4-in. cast iron pipe. 15 hydrants, for water works extension. Check for $250. Iowa Engineering Co., Clinton, Ia., are the engineers.

Objections to the proposed sanitary sewer in the eastern part of Iowa City, Ia., have been withdrawn and the City Council has ordered the improvement. The estimated cost is $16,675. City Engineer J. C. Watkins has submitted plans and specifications for a sewer to run from Dubuque to the Iowa river, on Lafayette St., estimated to cost $1,145

Kansas.

⊙H. B. Derr of Oklahoma City, [illegible]a., has been awarded the contract by the ci[illegible] of Atchison, Kans., V. L. King, Clerk, fo[illegible]e construction of a pipe sewer in Sewer D[illegible]ict No. 6 for $20,537. The work will incl[illegible] 23,3[illegible] lin. ft. of tile sewer ranging in size [illegible] to 12-in., and in depth from 5 to 2[illegible] Y injunctions; 49 manholes; 57 [illegible] S. K. McCrary is City Engineer. [illegible] opened April 18.

Louisiana.

The City Council of New Iberia, [illegible]a., h[illegible] adopted a resolution providing for th[illegible]nstallation of a sanitary sewerage system.

Massachusetts.

⊙The Public Works Department o[illegible] Bos[illegible] Mass., has awarded a contract to [illegible] Regan for sewerage works in Col [illegible] between Chestnut Hill Ave. and p[illegible] easterly, Brighton, for $2,350.

⊙The Department of Public Work[illegible] [illegible]ton, Mass., has awarded a contract [illegible]th[illegible] H. Wood Lumber Co., for furnish[illegible] 63,000 ft. of spruce lumber for use [illegible] Concord St. sewerage works at $26. [illegible] ft.

Contracts will be let at once by t[illegible] ci[illegible] Amesbury, Mass., for the installat[illegible] complete sewer system, estimated [illegible] $150,000. The estimated cost of the [illegible] be done at this time is $100,000. M[illegible] & Woodfall, 15 Court Square, Bost[illegible] are Engineers.

Michigan.

✣Bids will be received until 8 p. [illegible] 25, by Board of Public Works, Gran[illegible] Mich., for transporting and erectin[illegible] piping, motors, transformers and [illegible] the East Side Sewage Pumping st[illegible] the city of Grand Rapids. E. H. [illegible] President of the Board.

⊙John Lennane of Detroit, Mich., [illegible] awarded the contract by the City Com[illegible] of Pontiac, Mich., for the constructi[illegible] sewers at $17,882. The sewers to [illegible]structed and the amount of each bi[illegible] follows: Mechanic St. from [illegible] westerly, $4[illegible]; Perry St. from [illegible] Chamberlain, $443; Palmer St. from [illegible] Lake Ave. to Stout and on Stout to [illegible] $897; Pinegrove Ave. from Johnson [illegible]ence, $499; Willow Ave. from Jo[illegible] Wisner St., $947; Chandler Ave. fr[illegible] dock to Meriva St., $279; Poplar A[illegible] Baldwin St. to P. O. & N. tracks, $9[illegible] Pike St. from Franklin Blvd. to [illegible] hill, $461; Maple St. from Wessen S[illegible] Line tracks, $381; Jessie St. from [illegible] Foot and on Foot to Sanford St. [illegible] Green St. from Orchard Lake Ave. [illegible] Clay Ave., $989; Orchard Lake A[illegible] Palmer to Johnson Ave., $2,420; Mt. [illegible] St. from Union to Douglass, $847; [illegible] Pike St. from Douglass St. to a p[illegible] Paddock St., $600.

The Town Council of Howell, Mi[illegible] passed a resolution requesting Consul[illegible]gineers Riggs & Sherman, The Nasby [illegible] O., to revise their former plans for [illegible] system to conform with present requ[illegible]m[illegible] in consideration of the fact that a p[illegible] the necessary system had already b[illegible]structed at a cost of about $6,000.

The city of Detroit, Mich., has [illegible] $200,000 for the installation of a new [illegible]cinerator system.

The City Council of Lansing, Mich [illegible]structed City Engineer H. A. Sparks [illegible] plans for a sewer to be constructed [illegible] Franklin Ave. between Seymour and [illegible] Sts.

T. C. Brooks & Son of Jackson, Mi[illegible] been awarded the contract for the [illegible]tion of about three miles of distric[illegible] in Shelbina, Mo., at $12,923.

Minnesota.

✣The contract for the constructi[illegible] septic tank and sludge bed, for [illegible] were opened April 18 by Lester [illegible] City Recorder, Tracy, Minn., has [illegible]

New [illegible] Ma[illegible] City Council of Minneapolis, Minn., [illegible] ment Machinery Co., 107 Vinton St., [illegible]

[illegible] f Mankato, Minn., for the construc- [illegible] Construction Co., $11,150; E. T. [illegible] Paul, $11,591; G. S. Redmon, Pipe- [illegible]nn., $11,601; John McCall, Mankato, L. Overn, St. Peter, $10,221; A. I. [illegible]ux Falls, S. Dak., $11,538; Joseph [illegible]r, Mankato, $10,731; Mankato Lime [illegible]t Co., $11,271; Dearborn & Jackson, [illegible]pids, Ia., $9,910, and Charles M. Mas- [illegible]kato, $12,872.

[illegible]ngineer Andrew Rinker of Minneap- [illegible] between 22nd and 23rd Sts.

Missouri.

[illegible] will be received until noon, April 26, [illegible] of Public Improvements, St. Louis, [illegible] the construction of sewers in Glaise [illegible]ver District No. 5, under Letting No. [illegible] follows: Brick and Portland cement [illegible]wers: 126 ft. of 40-in. x 60-in. in- [illegible]nsions; 475 ft. of 34-in. x 51-in. in- [illegible]nsions; 188 ft. of 32-in. x 48-in. in- [illegible]sions; 330 ft. of 30-in. x 45-in. in- [illegible]nsions; 604 ft. of 24-in. x 36-in. in- [illegible]nsions. Vitrified clay pipe sewers: [illegible]f 24-in. inside diameter; 415 ft. of [illegible]le diameter; 2,220 ft. of 18-in. inside [illegible] 1,420 ft. of 15-in. inside diameter; [illegible]f 12-in. inside diameter. With sewer [illegible]holes, and all other appurtenances. [illegible]quired, $912. W. T. Findly is Sec-

[illegible]ity Council of Mound City, Mo., has [illegible] the contract for the construction of [illegible]rs for which Seitz-Peterman Engi- [illegible]o., St. Joseph, Mo., are Engineers, [illegible]lbred Construction Co. of St. Joseph [illegible] Other bidders were: J. V. Dewey, [illegible], $5,790; Olson, Schmidt Construc- [illegible] St. Joseph, $4,886; Dunnegan & [illegible] Shenandoah, Ia., $4,935; Kelley Con- [illegible]

Montana.

[illegible]ty Council of Lewistown, Mont., has [illegible]20 as the date for the sale of bonds [illegible] nt., is Consulting Engineer.

New Jersey.

[illegible] are being asked, it is reported, by [illegible]n Iron Works, Camden, N. J., for [illegible] n and 530 ft. of 15-in. vitrified sewer from a point in their works to present [illegible] in depth. Specifications of the work [illegible]en to those applying to Camden Iron [illegible]

[illegible] Passaic Valley Sewerage Commission- [illegible] Bldg., Clinton St., Newark, N. J., [illegible]onstruction of Section 15 of the Intercepting Sewer, in the city of Pas- [illegible]nd Acquackanonk Township. Particu- [illegible]hat may enable the contractor to judge [illegible] character of the work are given below: [illegible]ximate quantities—Section 15: 3,445 lin. [illegible]-in. concrete sewer in trench, from about [illegible] to about 35 ft. in depth; 1,080 lin. ft. [illegible] concrete sewer in tunnel; 2,750 lin. ft. [illegible] concrete sewer in tunnel; 4,500 cu. yds [illegible]and cement concrete in trench; 6,200 cu. Portland cement concrete in tunnel; 200 [illegible]ds. brick masonry in manholes; 1,500 cu. [illegible]rock excavation in trench. Drawings, [illegible] of contract, specifications and form of [illegible]sal may be obtained at the commission- [illegible]ffice from Wm. M. Brown, Chief of En- [illegible]rs. John S. Gibson is Clerk.

[illegible]e city of Camden, N. J., A. L. Sayers, Street Commissioner, intends to construct the following sewers or drains in and along Viola St. from Fillmore St. to Sixth St.; North Fifth St. from Erie St. to Byron St., and east on Byron St. from Fifth St. to Sixth St.

New York.

City Engineer John A. Giles of Bingham- [illegible] be taken for the proposed Sixth Ward trunk sewer, which will run from Homer St. through private lands to the outlet of the pres- [illegible]

The Common Council of Watertown, N. Y., [illegible] construct a 10-in. sewer in Ann St.

Following bids were received by the Board of Contract & Supply of Rochester, N. Y., Frank X. Pifer, Clerk, on April 10 for Contract No. 6 of the Sewage Disposal System: Whitmore, Rauber & Vicinus, $137,778; William H. Sours, 2d, $162,832.50; Schroeder-Hicks Contracting Co., $148,378; Thomas Holahan, $144,683; Ripton & Murphy, $153,529; Jacob Almeroth, $123,900. This contract is from Dakes Corners, where the East Side Boulevard strikes Hudson Ave., in Irondequoit, a distance of 9,000 ft., to the disposal plant, and there will be no tunneling.

North Carolina.

⊙The Board of Public Improvements of Charlotte, N. C., has awarded the contract for the construction of nine miles of drains and sewers to Dabbs & Myers of Meridian, Miss., at $37,884.

⊙The Board of Public Improvements of Charlotte, N. C., has awarded the contract for the construction of 34,000 sq. yds. of cement sidewalk to J. W. Haas of Charlotte at $51,733.

Following bids were received April 10 by the Executive Board, Charlotte, N. C., Joseph Firth, City Engineer, for the construction of about 9 miles of sewers and drains, including 8, 12, 15, 18, 20 and 24-in. sewer pipe, 112 manholes, 19 flush tanks and 245 inlets. Dabbs & Myers, $37,884; Sullivan, Long & Haggerty, $41,797; James M. Ferry & Sons, $55,760; Porter & Boyd, $47,025, and The S. Monroe Sons Co., $54,842.

North Dakota.

✣Bids will be received until 5 p. m., April 25, by E. R. Orchard, City Auditor, Fargo, N. Dak., for furnishing the necessary labor and material for the construction of a 12-in. vitrified pipe sewer.

City Engineer T. R. Atkinson of Bismark, N. Dak., is preparing plans for the extension of the sewer on Broadway between Main and West Park Sts.

Ohio.

✣Bids will be received until noon, April 24, by Director of Public Service, M. H. Turner, Ashtabula, O., for the improvement of Pine St. by constructing a sewer therein. John MacRae is Clerk of the Department.

✣Bids will be received until noon, April 29, by Director of Public Service, Springfield, O., for furnishing the necessary labor and material for the construction of a storm water sewer in North St. from Indian Run to Jackson St.

⊙Contracts for the construction of storm sewers on Neal Ave., from Old Orchard to Rockwood; Hillcrest, from Stillwater west, and Miami Chapel road, from Broadway to Essex, city of Dayton, O., have been awarded to Boyd & Cook at $2,869.

The City Council of Mansfield, O., has adopted a resolution declaring it necessary to improve the third, fourth and fifth sewer districts by the construction of a new 12-in. siphon line from Strawberry alley to the sanitory plant to take the place of the present 8-in. siphon line. The estimated cost is $12,000.

The City Council of Lancaster, O., has passed an ordinance providing for the construction of sewer and curb laterals on Perry St., etc.

The city engineer of Steubenville, O., has estimated the construction of the proposed sewer and other improvements in Wellsley Ave., at $15,000, and the proposed sewer on South Third St., at $610.

The City Council of Urbana, O., has authorized the construction of 14.04 miles of sanitary sewers for which surveys and estimates of cost have been prepared by City Engineer Cary Pratt. The total cost of the work is placed at $90,901. Bids will probably be asked within a short time and, it is thought, construction work started this summer.

The city of Coshocton, O., is planning to build a sewage disposal plant and pumping station at an estimated cost of $100,000, to comply with the provisions of the new Benz law.

Oklahoma.

⊙The city of Muskogee, Okla., has awarded the contract for furnishing the necessary labor and material for the construction of a sanitary sewer in District No. 79 to the Heman Construction Co., of that city. Bids were opened April 16 by Charles Wheeler, Jr., City Clerk.

Oregon.

The citizens of Eugene, Ore., at a recent election voted the issuance of bonds in the sum of $200,000 for the construction of a sewer system.

The city of Medford, Ore., has under consideration extensions to the sewer systems. E. T. Foss is City Recorder.

Pennsylvania.

✣Bids will be received and awards made by the Department of Public Works, Philadelphia, Pa., for garbage disposal in the city as noted under Roads and Streets in this issue. Morris Llewellyn Cooke is Director of the Department.

✣Bids will be received until 10:30 a. m., April 29, at the office of the City Controller, Pittsburgh, Pa., for the construction of sewers in the following streets and avenues: Stebbins St., from the northeast line of Berkshire Ave. to present sewer crossing Stebbins St. at a point about 90 ft. west of Berkshire Ave., 12-in. pipe. Crosby Ave., north sidewalk, from Realty Ave. to present sewer on Limasco Ave., 8-in. pipe. Butler St. from present sewers at Forty-sixth St. to present sewer on Forty-eighth St., 30-in. pipe relief. W. A. Magee is Mayor.

⊙P. F. Scholl & Co., of Reading, Pa., have been awarded the contract by the Board of Trustees, S. W. Waters, Secy., State Hospital for the Insane, Warren, Pa., for additions to a sanitary sewer system, a pumping plant and disposal plant at $37,300. The work briefly outlined is as follows: Laying 8,700 T. C. pipe sewers, sizes 8, 10 and 12 ins. Constructing receiving well and pump house; furnishing 2 centrifugal pumps, driven by electric motors, capacity each 500 gals. per minute; laying 3,850 ft. of 10-in. C. I. force main; constructing one disposal plant, consisting of settling tanks, sprinkling filter, chemical house and sludge filters. Albright & Mebus, 908 Land Title Bldg., Philadelphia, are Engineers. Bids were opened April 12.

The Pennsylvania State Health Commission, Samuel Dixon, Commissioner, has approved the plans for the new sewage disposal plant at the North Warren State Hospital for the Insane. The estimated cost is $40,000. Construction work will be undertaken this summer.

State Health Commissioner Samuel Dixon has approved the plans for the installation of a sewage disposal system in the city of Corry, Pa.

South Dakota.

⊙The City Council of Aberdeen, S. Dak., has awarded the contract for the excavation of the sewage disposal plant and the sidetrack on the M. & St. L. railroad to Schile Bros. of Aberdeen at $.20 per cu. yd. The work includes 8,000 cu. yds. of material. The contract will amount to about $1,600.

Texas.

⊙The City Commissioners of Dallas, Tex., have awarded the contract for the construction of the Houston St. storm sewer to Mueller & West at $1,390.

Virginia.

✣Bids will be received [illegible] 30, by W. L. Craft, City Clerk, Roanoke, Va., for the construction of a sewer to accommodate property on the north side of Kirk Ave. s. e., between 13th and 15th Sts., and the south side of Campbell Ave., between 13th and 15th Sts. Also for the construction of storm drain through Highland Park, beginning at Park St. and 11th Ave., thence west through the park. A certified check for the sum of $50 for each contract must accompany each bid. F. L. Gibboney is City Engineer.

Washington.

✣Bids will be received until 11 a. m., May 11, by Bureau of Yards & Docks, U. S Navy Department, Washington, D. C., for [illegible] crematories at navy yards, Puget Sound, Wash., and Norfolk, Va., and naval training station, San Francisco, Calif. W. M. Smith is Acting Chief of the Bureau.

The City Council of Newport, Wash., has let the contract to the Weile Engineering Co., of Spokane, Wash., to survey all the ungraded streets of the town and prepare a survey for a sanitary sewer system and estimate the cost.

Wisconsin.

◉The Common Council of Oshkosh, Wis., has awarded the contracts for the construction of several sewers as follows: Robert Doyle, laying a sewer in Harrison St., from Nevada St. southwesterly to the summit; J. Rasmussen & Sons Co., a sewer in 11th St., from Stringham Creek west to Georgia St. in Georgia St. from 11th St. to 12th St., and in 12th St. from Georgia St. to the summit; August H. Strey, a sewer in 8th St., from Ohio St. west to summit; J. R[illegible] Sons Co., constructing an extension [illegible] Stringham Creek storm and sanitary sewer from its present terminus to 9th St[illegible]

The Board of Public Works of [illegible] Wis., has decided to let contract for the construction of a complete system under the contract. It is thought that about 28 per[illegible] its share of the cost could be saved [illegible] way.

Canada.

The contract for the following w[illegible] in accordance with plans and specificatio[illegible] on file with Chipman & Powers, Engine[illegible] Mail Bldg., Toronto, Ont., for which [illegible] were opened April 17 by George Elliott, T[illegible] Clerk of Sudbury, Ont., has not as yet be[illegible] awarded: Contract "A," main sewer 8.5 ft. [illegible] 18 and 15 in.; Contract "B," san[illegible] and force main; Contract "S," se[illegible] and junctions.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ET

Alabama.

✣Bids will be received until 11 a. m., May 18, by Maj. [illegible] Flagler, U. S. Engineer, Mobile, Ala., for building three lock tenders' houses, etc., at Locks Nos. 10, 11 and 12, Black Warrior River, Ala.

Arkansas.

✣Bids will be received until 10 a. m., May 6, by Board of Public Affairs, Fort Smith, Ark., for the following equipment: Motor [illegible] patrol wagon; horse patrol wagon; signal system for police force. [illegible] is Chairman of the Board.

California.

The Harbor Commission of Los Angeles has directed Harbor Engineers Homer Hamlin and E. D. Vincent to prepare plans for solid quay wall construction at the southern end of the Huntington Concession, where a slip 300 ft. wide and about 1,200 ft. long will be established. On each side of this slip will be provided two piers, each of which will be of adequate width and 1,200 ft. long. The plans will provide for reinforced concrete wharves, modern warehouses, depressed railroad tracks, electrically operated traveling cranes for the expeditious handling of freight at the wharves and a passenger staion to be located upon one of the piers. The improvement will cost about $1,250,000.

Bids were opened April 11 by Lt. Col. Thos. H. Rees, U. S. engineer, San Francisco, for dredging channel across flats, San Pablo Bay to mouth of Petaluma Creek, Cal., N. R. Harris, 23 California St., San Francisco, at 9.94 cts. per cubic yard, being the probable successful bidder on the work.

Colorado.

✣Bids will be received until May 10, by Capt. F. F. Faissell, Quartermaster, Fort Logan, Colo., for furnishing 2,000 ft. lawn hose, ¾-in. with couplings in 50 ft. lengths, 6 lawn mowers, 12 hose nozzles and 24 lawn sprinklers.

Connecticut.

✣Bids will be received until 2 p. m., June 7, by Capt. A. E. Waldron, U. S. Engineer, New London, Conn., for furnishing and installing an internal combustion engine plant at El Fraile, Island, P. I.

Bids were opened April 16 by Capt. A. E. Waldron, U. S. engineer, New London, Conn., for dredging in the Connecticut River below Hartford, Conn., the bid of the Hartford & New York Transportation Co., Hartford, Conn., at 11 cts. per cubic yard, being recommended for acceptance. It is estimated that the dredging will amount to 90,000 cu. yds.

Delaware.

Bids as follow were received April 15 by Maj. R. R. Raymond, U. S. engineer, Wilmington, Del., for dredging in Appoquinimink River, Delaware: River & Harbor Improvement Co., Philadelphia, Pa., 16 cts. per cu. yd.; the Richards Dredging Co., Philadelphia, Pa., 30 cts. per cu. yd.

District of Columbia.

✣Bids will be received until 3 p. m., May 29, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for an electric passenger elevator in the U. S. Post Office, Lander, Wyo.

✣Bids will be received until 3 p. m., May 24, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and lighting fixtures, of the United States Post Office at Bonham, Tex. The building is non-fireproof; one story and basement, of approximately 4,230 sq. ft. ground area; brick faced with stone trimmings, and is to be constructed in accordance with drawings and specifications, copies of which may be obtained from the custodian of the site at Bonham, Tex., or at the discretion of the Supervising Architect.

✣Bids will be received until 3 p. m., May 22, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for drilling an artesian well at the U. S. Post Office, Minneapolis, Minn.

✣Bids will be received until 3 p. m., May 21, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures, of the United States Post Office at Alameda, Cal. The building is one story and basement, and has a ground area of approximately 6,100 sq. ft.; fireproof construction throughout except roof; stone facing; tile and tin roof. Drawings and specifications may be obtained from the custodian of site at Alameda, Cal., or at the discretion of the Supervising Architect.

✣Bids will be received until 3 p. m., May 25, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures, of the United States Post Office at West Point, Miss. The building to be one story and basement, of approximately 4,160 sq. ft. ground area, brick faced, with stone and terra cotta trimming and tile roof. Copies of the drawings and specifications may be obtained from the office of the custodian of the site at West Point, Miss., or at the discretion of the Supervising Architect.

✣Bids will be received until 3 p. m., May 27, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating appar[illegible] tric conduits and wiring, and lightin[illegible] of the United States Post Office [illegible] Mass. The building is one story [illegible] ment and has a ground area of appr[illegible] 4,750 sq. ft.; fireproof construct[illegible] roof; stone and granite facings [illegible] and specifications may be obtained [illegible] custodian of site at Westfield, Ma[illegible] the discretion of the Supervising Ar[illegible]

✣Bids will be received until 10 [illegible] April 29, by Maj. F. C. Boggs, Gen[illegible] chasing Officer, Isthmian Canal [illegible] sion, Washington, D. C., for [illegible] under Canal Circular 704: Car[illegible] wrought iron and steel pipe, cast [illegible] and fittings, lead gaskets, gate va[illegible] hydrants, asbestos gaskets, rubber [illegible] hammers, wooden tie plugs, stee[illegible] canvas, paper, cardboard, linen t[illegible] asphaltum varnish.

✣Bids will be received until 10 a[illegible] May 20, by Maj. F. C. Boggs, Gen[illegible] chasing Officer, Isthmian Canal [illegible] sion, Washington, D. C., for f[illegible] transformer room equipment for [illegible] ma Canal Locks.

Florida.

✣Bids will be received until no[illegible] 15, by Capt. J. R. Slattery, U. S. E[illegible] Jacksonville, Fla., for constructio[illegible] motor survey launch Captain J. J. [illegible]

Georgia.

✣Bids will be received until noon [illegible] by Mayor and City Council, Manche[illegible] for the construction of lighting pla[illegible] plete. Plans and specifications are [illegible] with James S. Peters, City Clerk, a[illegible] McCrary Co., Atlanta, Ga., Engineer[illegible]

Citizens of Clarke County (Ath[illegible] county seat) have voted to issue $2[illegible] bonds for a new courthouse and jail.

Bids will be received until 3 p. m., [illegible] by Board of Fire Masters, Fire Deptm[illegible] Atlanta, Ga., for combined automati[illegible] automatic and manual fire alarm [illegible] central office equipment, including ca[illegible] and areal line work for the city.

Illinois.

✣Bids will be received until 7 p. [illegible] May 13, by Village of Odell, Ill., for ad[illegible] pumping equipment. A. W. Joe[illegible] is President of the Board of Trustee[illegible]

✣Bids will be received until noo[illegible] May 1, by J. R. McAndrews, Quarte[illegible] Fort Sheridan, Ill., for furnishing and [illegible] ering at Fort Sheridan, Ill., a switc[illegible] transformers, meters and miscellane[illegible] sortment of electrical supplies.

✣Bids will be received by L. E. M[illegible] Commissioner of Public Works, [illegible] Ill., until 11 a. m., April 30, for fu[illegible] labor, materials, etc., necessary t[illegible]

✣ indicates work now open for bids. ◉ indicates a contract let recently.

liver and erect a steel smoke
in diameter and 115 ft. high, on
is erected at the Lake View
station, Montrose and Clarendon

ill be received by L. E. McGann
ner of Public Works, Chicago,
April 30, for furnishing and erect-
temprary steam piping, including wa-
heat, steam separators, pipe fittings,
necessary to connect up N
engine and two 600 hp turbines
th temporary boiler plant at the
V v pumping station. Cash or certi-
for $500 must accompany pro-

ll be received by Charles F. Sey
marshal, Chicago, Ill., for fur-
[illegible] required by the department
balance of the year, bids opened

ll be received by Charles F. Sey-
marshal, Chicago, Ill., until 11
2, for furnishing the department
ngths 4-in. suction hose, 10 ft. 6
10 lengths 5-in. suction hose, 11
lengths 4½ suction hose, 11 ft.
or certified check for $200 must
proposal.

ill be received by Mr. Ray Pal-
Electrician, Chicago, Ill., until 11
l 29, for furnishing and deliver-
Department of Electricity 40,000
6 B. & S. gauge rubber insulated
[illegible] light cable, No. 19 B.
paper insulated lead-covered fire
as follow: 26,450 lin. ft., 5 pair,
of 10 pair, 14,265 ft. of 15 pair,
pair, 22,325 ft., 50 pair, 600 ft. of
70 3 in. by 4 in. 25 ft. steel poles,
4-in., 30 ft. steel poles. Cash or
eck for 5 per cent of total bid
npany proposal.

is the lowest bid received by
[illegible] Commissioner of Public
ago, Ill., for furnishing all mate-
tools, etc., necessary to construct,
liver a floating pile driver, exclu-
gine, boiler, smokestack, pulley
which will be furnished by the
ected in place by the contractor,
& Connell Dredge & Dock Co., 5
St., $4,200. Bids opened April 6.

Iowa.

ll be received until 5 p. m., May 9,
f Directors of the Independent
rict, Sioux City, Ia., for the re-
f building additions to and instal-
systems and plumbing in the Hunt
[illegible] buildings. F. E. Colby, Sioux
is Architect. T. C. Prescott is Sec-
the District.

will be received until 2 p. m., May
mmissioner of Fisheries, Depart-
mmerce and Labor, Washington,
for the construction of a biological
ry at the Fairport, Ia., biological

Louisiana.

will be received until noon, April 25,
[illegible] of any one or of all of four
[illegible] brick school buildings
Charles, La. Plans and specifica-
be seen at the office of F. S.
Supt., Lake Charles, La., or at the
Favrot & Livaudais, Ltd., Architects,
ier St., New Orleans, La.

will be received until 3 p. m., May
mes Knox Taylor, Supervising Archi-
easury Department, Washington, D.
an electric passenger elevator in the
st Office and Court House, Shreve-

s will be received until 2 p. m., May 9,
H. Turner, Secy., Columbia, La., for
struction of a school building in ac-
e with plans and specifications pre-
by X. A. Kramer, Magnolia, Miss.

Dock Board of New Orleans is plan-
construction of a new wharf 1,500 ft.
long and 210 ft. wide to extend from the lower end of the Dumser wharf, at Elmira St. The wharf will cost about $500,000 and plans for it will be prepared by A. C. Bell, New Orleans, engineer for the board.

Maryland.

✣Bids will be received until 1 p. m., May 15, by Lieut. Col. W. C. Langfitt, U. S. Engineer, Baltimore, Md., for dredging in Wicomico River, Md.

⊙The Board of Awards of Baltimore, Md., has awarded the contract to the Maryland Dredging Co., Baltimore, for dredging in connection with the commercial wharf and recreation pier at the foot of Broadway. Between [illegible] are to be taken out at 38 cts. a cubic yard.

Maine.

Bids per ton as follows were received by the U. S. engineer at Portland, Me., for the construction of breakwaters at Isles of Shoals, Me., and N. H., the estimated quantity required being 31,000 tons: The Breakwater Co., Philadelphia, Pa., $1.83; P. H. Doyen Co., Portland, Me., $1.08; Rowe Brothers Co., Richmond, Me., $1.23; E. S. Belden & Sons, Hartford, Conn., $1.43; Pigeon Hill Granite Co., Rockport, Mass., 83 cts.

Massachusetts.

The Easthampton Gas Co., Easthampton, Mass., is to petition the State Gas and Electric Light Commissioners for permission to increase its capital stock by $100,000, the proceeds to be used for equipment of plant.

Bids per cubic yard as follows were received April 17 by Col. Frederic V. Abbot, U. S. engineer, Boston, Mass., for rock excavation in Boston Harbor, the estimated quantity to be removed being 78,792 cu. yds.: Great Lakes Dredge & Dock Co., 1148 Oliver Bldg., Boston, Mass., $7.50; Morris & Cumings Dredging Co., 17 State St., New York, N. Y., $23.30; John B. Breymann, Toledo, O., $10.50; Daly & Hannan Dredging Co., Ogdensburg, N. Y., $8.87; Eugene Breymann, Toledo, O., $8.33 1-3; the Buffalo Dredging Co., Buffalo, N. Y., $7.60; Arthur E. Breymann, Toledo, $9.80.

The town of Manchester, Mass., has appropriated $11,000 for dredging the harbor. Of this $6,000 will go to the state, while the state will add $9,000 more to cut a new channel across Glasshead flats, 100 ft. wide on the bottom and with 6 ft. of water at mean low tide.

Michigan.

Bids were opened April 18 by Lt. Col. C. S. Riche, U. S. engineer, Grand Rapids, for the extension of piers at South Haven, Mich., Burk, Smith & Nelson, Muskegon, Mich., at $93,685, being the low bidders and probable successful contractors. The work includes dredging and placing oak and hemlock timber, bolts and stone.

Greiling Bros. Co., Green Bay, Wis., at $12,840, was the low bidder April 18 for dredging at South Haven, Manistee and Arcadia harbors, Mich., for the U. S. government. This bid has been recommended for acceptance.

Minnesota.

✣Bids will be received until noon, May 9, by Lieut.-Col. Francis R. Shunk, Duluth, Minn., for dredging at Superior entry, Duluth-Superior Harbor.

Missouri.

✣Bids will be received until noon, May 4, by Maj. E. H. Schulz, U. S. Engineer, Kansas City, Mo., for the construction of 14,000 ft. of standard revetment on the Missouri River, about 215 miles below Kansas City, and at and below Rutland, Mo.

✣Bids will be received until noon, May 22, by Maj. E. H. Schulz, U. S. Engineer, Kansas City, Mo., for the construction of 12,000 lin. ft. of standard revetment on Missouri River, about 31 miles below Kansas City and 3 miles below Missouri City, Mo.

New Jersey.

✣Bids will be received until 8 p. m., April 29, by Board of Education of Summit, N. J., for the erection and completion of a 4-room school building located on the north side of Morris Ave. Plans and specifications are on file with Cady & Krug, 69 Union Place, Summit, N. J.

✣Bids will be received until 8 p. m., April 29, by the Board of Education, Lincoln school, De Forest Ave., Summit, N. J., for the erection and completion of a 4-room school building at the north side of Morris Ave.

✣Bids will be received until 8 p. m., April 27, by Board of Education, J. Wallace Higgins, District Clerk, Roselle Park, N. J., for the construction of fireproof primary school building, to be build at Roselle Park, in accordance with plans and specifications for the same, prepared by Pierce & Bickford, architects, 118-120 Lake street, Elmira, N. Y. Plans and specifications are now on file at the High School building (Robert Gordon, chairman Building Committee), and at the office of the architects. Bids will be received upon general contract, plumbing and electric wiring.

New York.

✣Bids will be received until 2 p. m., May 1, by S. I. Kimball, General Superintendent Life Saving Service, Treasury Department, Washington, D. C., for the construction of a new building at the Moriches Life Saving Station, Long Island, N. Y.

✣Bids will be received until 10 a. m., May 7, by Constructing Quartermaster, Captain J. C. McArthur, Fort Slocum, N. Y., for furnishing and installing equipment at the fort for coal handling.

⊙The Durolithic Co., Buffalo, N. Y., has been awarded the contract at $133,486 for the construction of the new cattle building at the state fair grounds at Syracuse, N. Y. The building will be 386x362 ft. over all and will have a floor space of 90,200 sq. ft. It will be built of concrete, brick and steel with slate roof.

Ohio.

✣Bids will be received until 2 p. m., May 16, by Lieut.-Col. H. Jervey, U. S. Engineer, Cincinnati, Ohio, for hire of four dredging plants, each consisting of one dredge, one towboat and two dump scows.

✣Bids will be received until noon, May 6, by Board of Education, C. W. Handman, Business Manager, 511 West Court St., Cincinnati, Ohio, for furnishing the necessary labor and material for certain alterations and additions to a number of school buildings throughout the city.

Bids as follows were received April 9 by Maj. John C. Oakes, U. S. Engineer, Cincinnati, O., for reconstructing in concrete, the top of Dam No. 8, Muskingum River, at Eagleport, O., (1) standing for bid of G. T. Fogle & Co., St. Albans, W. Va.; (2) for bid of Clifton Bros., Zanesville, O.; (3) bid of J. A. Swingle & Co., Zanesville, O.; (4) bid of James Skene & Sons Co., Huntington, W. Va.

	(1)	(2)	(3)	(4)
Excavation, 5,000 cu. yds.	$0.80	$0.70	$0.71	$0.[illegible]
Concrete, 5,515 cu. yds.	4.65	3.70	4.75	[illegible]
Cement, 5,600 bbls.	1.40	1.30	1.32	1.70
Filling, [illegible] lin. ft.	.36	.40	.48	[illegible]
Timber, 75,000 ft. B.M.	49.00	56.00	80.00	102.90
Grand totals	42,960	37,385	45,688	51,142

Emory & Eisenbrey, chemical engineers, 2 South 15th St., Philadelphia, Pa., are receiving bids for the new plant of the North American Chemical Co. at Urbana, O. The building is to be two story construction, 117x32 ft., with engine and boiler room and shipping sheds separate. Bids are being asked both on reinforced concrete and brick construction, also on the necessary equipment, 100 h. p. slide valve engine, two 125 h. p. boilers, pulverizers, conveying machinery, etc.

Oregon.

Preliminary plans will probably be completed early in May for the proposed improvement of

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

the harbor at Astoria. The plans will provide for a system of wharves with slips between Tongue Point and Fort Stevens, including the portions of Young's Bay, Young's River and Lewis and Clark River, where the harbor line has been established. The whole section will contain 19 lineal miles of docks. P. P. Whitham is port engineer of Astoria.

D. P. Donovan, Payette, Idaho, has filed an application with the state engineer at Salem, Ore., for 1,200 cu. second ft. from the Clackamas River between Oregon City and Portland. It is presumed he intends to develop power for use in Portland, as the application says that it will be used for power, manufacturing and municipal purposes. According to application the cost of developing power will be $1,250,000. It is intended to develop 15,000 h. p. and construct two pipe lines 5¼ miles long.

Pennsylvania.

✣Bids will be received until 11 a. m., May 11, by Bureau of Yards and Docks, U. S. Navy Department, Washington, D. C., for a pile and reinforced concrete pier at the navy yard, Philadelphia, Pa.

The People's Light, Heat & Power Co. of Shenendoah and Mahanoy City, Pa., is to reconstruct the present Mahanoy City generating station into a large sub-station. Plans and specifications by the Scofield Engineering Co., Consulting Engineers, Arcade Bldg., Philadelphia, are in progress and construction will be started soon.

Plans and specifications are being prepared by the Scofield Engineering Co., Arcade building, Philadelphia, Pa., for a substation to be built at Freeland, Luzerne County, Pa., by the Hazleton Electric Light & Power Co., of Hazleton, Pa. Contracts will be awarded soon.

The Philadelphia & Reading Ry., Wm. Hunter, chief engineer, Philadelphia, Pa., is planning to improve its piers at Port Richmond, Philadelphia. It is proposed to enlarge Pier No. 18, and to install machinery for handling coal.

Texas.

✣Bids will be received until April 28 by Trustees of the Colored Carnegia Library, Houston, Tex., for the construction of a 2-story brick and stone building. Plans and specifications are on file at the office of the Orgen Real Estate Office, 409½ Milam St.

✣Bids will be received until 4 p. m., May 1, by Shiner School Board, Louis Trautwein, President, Shiner, Texas, for the construction of a 2-story brick school house. Stephenson & Heldenfels, Beeville, Texas, are Architects.

✣Bids will be received until noon, May 13, by D. C. Smith, Jr., City Controller, Houston, Tex., for the construction of a 2-story and basement addition for the colored high school. A. Delisle, Levy Bldg., Houston, Tex., is Architect.

It now seems probable that construction work will soon be under way on the rebuilding of the dam across the Colorado River at Austin. The City Water & Power Co., Hartford, Conn., on April 9, secured a permit to do business in Texas and in particular to "carry out and fulfill in all respects the terms of the contract made between the city of Austin, Texas, and William D. Johnson of Hartford, Conn., under date of Sept. 18, 1911, which provides for an enlarged, more efficient and economical water, light and power plant for the city of Austin." The concern is capitalized at $200,000. Its Texas headquarters will be located at Austin, with Frank S. Taylor, the engineer in charge of the rebuilding plans, as the state agent.

Wisconsin.

✣[illegible] by Board of County Supervisors, Milwaukee, Wis., for necessary labor and material for installation of the heating and ventilating system for the Milwaukee County School of Agriculture and Domestic Economy in the town of Wauwatosa in accordance with plans and specifications. Martin Plehn is County Clerk, Milwaukee, Wis.

Canada.

✣Bids will be received until noon, April 30, by C. O. Davidson, Secretary-Treasurer, Public School Board, Prince Albert, Sask., separately and bulk for the various works in connection with the construction of two 4-room brick schools to be erected at Prince Albert.

✣Bids will be received until 5 p. m., May 1, by J. R. Dennis, Secy.-Treas., Weston, Ont., for the different trades for the erection of a high school at that place. Munro & Mead, [illegible] Kingston Road, [illegible] Architects.

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CALLS FOR BIDS

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LATERAL SEWERS.

Sealed proposals will be received at the office of the City Auditor of the city of Mitchell, S. D., up till 8 o'clock p. m. on the 9th day of May, 1912, for the construction of lateral sewers, including labor and material, in said city of Mitchell, as follows:

Branch "P," Sewer District No. 3—Approximately 1,508 ft. 8 in. pipe, 4 manholes.

Branch "U," Sewer District No. 2—Approximately 595 ft. 9 in. pipe and 732 ft. 10 in. pipe, 3 manholes.

Branch "W," on boundary line between Sewer Districts Nos. 2 and 3—Approximately 410 ft. of 10 in. pipe, 1 manhole.

Branch "X," Sewer District No. 4—Approximately 732 ft. 8 in. and 183 ft. 10 in. pipe, 3 manholes.

All complete and connected with existing sewers.

All work to be done in accordance with plans and specifications on file in the office of the City Engineer.

All bids must be accompanied by a certified check upon some solvent bank in the city of Mitchell, or a draft made payable to the treasurer of said city, in the sum of 5 per cent of the amount of bid to insure the signing of the contract and furnishing of proper and acceptable bond in the amount of 40 per cent of contract price within eight days from time of notification of the award of said contract.

The city reserves the right to reject any or all bids.

By order of the City Council. Dated at Mitchell this 10th day of April, 1912.

N. H. JENSEN,
City Auditor.

STEEL WATER TOWER AND TANK.

Sealed proposals are invited and will be received at the office of the Village Clerk, Compton, Illinois, until 2 o'clock, p. m., May 10, 1912, for the construction of a steel water tower and tank.

Bids must be accompanied by a certified check in the sum of One Hundred dollars ($100.00) to be forfeited to the Village of Compton should the bidder refuse or neglect to enter into a contract in the event that the work be awarded to him.

Proposals must be made on a standard form which may be obtained from the Village Clerk. For further information address J. S. Archer, Village Clerk.

The right is reserved to reject any and all bids.

CHARLES BRADSHAW,
President Village Board, Compton, Ill.

U. S. ENGINEER OFFICE, Kansas City, Mo., April 4, 1912.—Sealed proposals for the construction of about 14,000 ft. of standard revetment on the Missouri River, about 215 miles below Kansas City, and at and below Rutland, Mo., will be received at this office until 12 o'clock noon, May 4, 1912, and then publicly opened. Information on application. EDWARD H. SCHULZ, Major, Engrs.

U. S ENGINEER OFFICE, CHICAGO, ILL., March 26, 1912. Sealed proposals for dredging in Calumet Harbor, Ill., will be received here until 10 a. m., April 26, 1912. Information on application. GEO. A. ZINN, Lt. Col., Engrs.

TAMPA BRIDGE.

Contractors experienced in bridge construction are invited to tender sealed bids for the construction of a highway bridge to be built in the City of Tampa, Florida, carrying Lafayette street over the Hillsboro River, in accordance with the detail drawings and specifications on file in the office of the Board of Commissioners of Public Works of Tampa, Fla., and hereinafter referred to as the Board, and also in the office of the Consulting Engineers, Messrs. Boller, Hodge and Baird, 149 Broadway, New York City.

Bids will be received by the Board at their office in the City of Tampa, Fla., not later than noon of Wednesday, May 7, 1912.

A certified check for $5,000, made payable to the Board, must accompany each bid. Such check will be returned to the unsuccessful bidder immediately after the bids are opened, and to the successful bidder, unless he fails to execute the contract within ten days after such contract is awarded to him.

A bond satisfactory to the Board for the sum of 25 per cent of the contract price will be required.

All bids must be made on form of proposal, which with the contract, specifications, and bond, can be obtained on application to the Clerk of the Board.

Bidders can secure a set of all drawings for this work by depositing $10 with the Clerk of the Board, which deposit will be returned on the return of the drawings.

The above work covers two reinforced concrete earth spans of 82 feet clear span, one deck Scherzer rolling lift draw, of two wings of 93 feet span, and concrete retaining walls for the approach to this structure.

The City of Tampa reserves the right to reject any and all bids.

CITY OF TAMPA,
By D. B. McKAY, Chairman Board of Commissioners of Public Work.
Attest: ALLEN THOMAS, Clerk.
BOLLER, HODGE & BAIRD,
Consulting Engineers.

PUBLIC HIGHWAYS.

Sealed bids will be received at Paris, Tex., up to noon, Tuesday, May 21, 1912, for the entire construction of 40 to 48 miles permanent rock roads and bridges for Precinct 1, Lamar County, Texas. Detailed plans, profiles and specifications will be on file on and after April 20, 1912. Printed copies of contract, specifications, bond, general instructions and form of tender will be furnished on deposit of $5.00 to insure safe retudn of same.

The Board reserves the right to accept that bid which appears most advantageous to them, and also to reject any and all bids or parts of bids. Address

BOARD OF PERMANENT ROAD COMMISSIONERS.
W. F. GILL, Secretary.
M. HANNAH, Engineer.

U. S. ENGINEER OFFICE, GALVESTON, TEXAS, April 18, 1912.—SEALED PROPOSALS for derdging the Houston Ship Channel, will be received at this office until 12 m., May 15, 1912, and then publicly opened. Information on application. EARL J. BROWN, Major, Engrs.

WATER-MAINS.

Sealed proposals, endorsed with ti tle of the work, will be received the office of the City Auditor of the C of Mitchell, South Dakota, up till 8 lock p. m., on the 9th day of May, 19 for furnishing the material for and ying approximately 2,410 feet of 4-inch ter-main, 3,580 feet of 6-inch water-ma and 1,510 feet of 10-inch water-main All with appurtenances including valv and fire hydrants, and also for 37 fou six and eight-inch valves to be plac on old mains.

All work to be done in accordanc with the plans and specifications now fil in the office of the City Engineer said city.

A deposit of $5.00 will be require from each contractor for each copy th plans and specifications furnished Deposit fee will be returned upon t return of the said copy of plans and ec fications together with the receipt

All bids must be accompanied draft or a certified check upon som solvent bank in the City of Mitchell, D in the sum of five per cent of the amount of bid, to insure the signing of the con tract and the furnishing of a prope an acceptable bond in the amount of per cent of the contract price with te days from the time of notification th award of the contract.

The City Council, reserves the rig to reject any or all bids or to reject her part of the proposal or bid.

By order of the City Council. Dat Mitchell this 10th day of April, 191

N. H. JENS
City A

DREDGE DITCH WORK

Bids will be received by Thom J Johnson, County Surveyor, at his fic in the city of Mount Vernon, Indian u to two (2) o'clock p. m., of the tw ty ninth (29) day of April, 1912, for the struction of about forty-five (45) mi dredge ditch work.

The said work consists of the of about one and one-fourth millio cubic yards of dirt; and the clearir of of about eleven hundred (1,100) acr of right of way. The said work to be old by the cubic yard, and the bid per ya t include the clearing off of the rig o way. Specifications for said work m b had by applying to the above named n ty surveyor

WATER MAINS.

Contract for the water mains in ton Grove will be let April 25th at o'clock p. m. Further information m be had at the office of Henry H. Dilg, of Bd., Morton Grove.; Edgar Ros County Building, and J. H. Geweke 6 W. Washington St., Chicago, Ill.

U. S. ENGINEER OFFICE, K City, Mo., April 22, 1912.—Sealed pro als for constructing about 12,000 f of standard revetment on Missouri R about 31 miles below Kansas City, a miles below Missouri City, Mo., wi be received at this office until 12 noon, 22, 1912, and then publicly opened. formation on application. EDWAR H. SCHULZ, Major, Engineers.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. Copy received until Monday noon.

SEWER.

[illegible]

Clerk of said City.

[illegible]

al ft. of 15-inch sewer, 1,929 lineal 12-inch sewer, 7,445 lineal ft. of sewer, and 8,581 lineal ft. of 8-inch [illegible]

[illegible] improvements and will not be con- [illegible]

l to by some reliable bank, pay- the order of the President of said [illegible] city, for not less than 10 per cent aggregate of said proposal or bid [illegible] or in local improvement bonds interest at the rate of 5 per cent um at the option of said City. proposals or bids shall be opened, [illegible] Council chamber in the City Hall City of Hamilton, Illinois, at the [illegible]

ight is reserved to reject any and [illegible]

[illegible]

v of the Board of Local Improve- [illegible]

R. HATHEY,
of the Board of Local Improve- [illegible]

[illegible] City of Milwaukee.

Water Works Tunnel.

f the Department of Public Works, Milwaukee, April 15, 1912.

l proposals will be received at this [illegible] lock a. m., for furnishing all ma- and doing all the work necessary [illegible] twelve (12) feet in diameter, for a of approximately four thousand [illegible] n, from a point on the lake shore enter line of Linwood avenue ex- one lake shaft, including connec- nd steel cylinders; one shore shaft luding two (2) gate wells and all con- ctions, and approximately one hundred d fifty (150) cubic yards of rock ex- vation, according to plans and specifi- tions on file in this office.

Bidders will submit separate figures for ing the following branches of the work: [illegible] of the work, based upon the estimated antities given in the specifications:

First—A price per lineal foot of shore [illegible]

[illegible] with all connections [illegible] excavation

Fifth—A price per lineal foot of tunnel [illegible] brick in ring of tunnel [illegible]

1st day of May, 1914, failing in which the contractor shall pay the city of Milwaukee as liquidated damages the sum of fifteen hundred ($1,500.00) dollars for each and every day's delay in completing the contract.

Bonds required in the penal sum of $90,000.00, or in lieu thereof the bidder may deposit with the Commissioner of [illegible] money or certified check [illegible] local bondsmen or a surety company authorized to do business in Wisconsin will be required, said bond to be approved by the City Attorney as to form and execution before being presented with bid to the Commissioner of Public Works. All bids must be stated in writing and in figures.

All moneys deposited will be returned to unsuccessful bidders on award of contract and to successful bidder when contract is entered into.

The Commissioner of Public Works reserves the right to reject any or all bids.

Bidders are required to submit with their proposals the method they intend to adopt in carrying out this work.

Plans and specifications will be furnished to prospective bidders on the receipt of $10.00 as a guarantee for their safe return.

Signed,

[illegible]
Commissioner of Public Works.
Countersigned, April 15, 1912.
C. P. DIETZ,
Comptroller.

PAVING.

Aurora, Illinois.

Sealed proposals will be received by the [illegible] o'clock, p. m., Friday, April 26th, for the [illegible] asphalt pavement and 13,610 lin. ft. of [illegible] braces five different improvements, and separate bids must be considered on each.

[illegible]
City Engineer.

U. S. ENGINEER OFFICE—Duluth, Minn., April 9, 1912. Sealed proposals for dredging at Superior Entry, Duluth-Superior Harbor, will be received at this office until noon, May 9, 1912, and then publicly opened. Information on application. FRANCIS R. SHUNK, LT., Col., Engrs.

GRADING AND PAVING.

[illegible] title of the work, will be received at the office of the City Auditor of the City of Mitchell, S. D., up till 8 o'clock p. m., [illegible] streets and avenues with reinforced concrete pavement.

Main St. from Railroad St. to within [illegible] lin. ft., approximately 19,251 sq. yds.

First Ave., 2nd Ave., 3rd Ave., 4th [illegible] of the alley between Main and Rowley Sts., east to the west line of the alley [illegible] mately 284 lin. ft. or 1,326 sq. yds. on each of the said avenues.

A separate bid for each street and avenue above named must be made and no bids will be considered unless so made.

All work is to be done in accordance with the plans and specifications now on file in the office of the City Engineer of said city.

A deposit of $5 will be required from each contractor for each copy of plans and specifications furnished him. Deposit fee will be returned upon the return of the said copy of plans and specifications together with the receipt given.

All bids must be accompanied by a certified check upon some solvent bank [illegible] payable to the city treasurer of said city in the sum of 5 per cent of the amount of the bids, to insure the signing of the contracts and the furnishing of proper and acceptable bonds in the amount of 40 per cent of contract prices within ten days from the time of notification of the award of the contract.

The City Council reserves the right to reject any or all bids.

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City Auditor.

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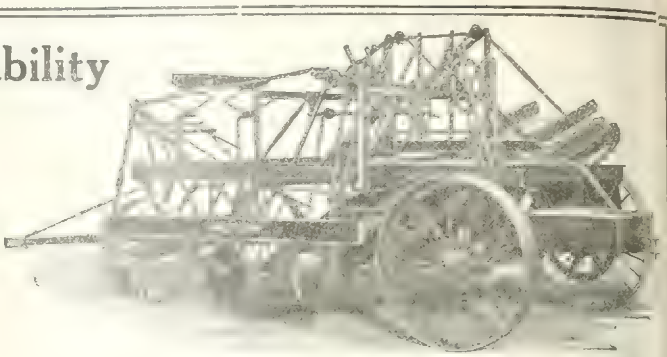

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e rrigation Works of the Canadian Pacific Railway.

[illegible]
they are perhaps unequaled. Be-
this structural distinction they loom
[illegible]
ts for public benefits. It is instruct-
e, therefore that just outside United
[illegible]
ll all the projects of our Reclama-
ce is being constructed by a private
[illegible]
rigation works of the Canadian Pa-
which are described in another col-
his issue. The description by Chief
A. S. Dawson leaves little to be add-
ing the general structural features
rpose and extent of these Canadian
heir work among great irrigation
nts, however, merits the public no-
ve give them here.

nadian Pacific works alone are suf-
[illegible]
irrigation countries. These works, how-
are only one among several, although
re by far the largest. As an example of
other private projects reference may be
to the works described in our issue of
10, 1912, which will carry water to
than 300,000 acres. Two features of the
ian Pacific works which deserve empha-
as the completeness of the distribution
n and the very successful disposal to
rs of the land being put under irrigation.
distribution system is so constructed as
liver water to the boundary of each farm
of 80 or 160 acres. The only ditch work
n the farmer is that on his own land. Also
arm may at any time be put under irriga-
without respect to the occupation of adja-
farms or the dispositions of their owners.
tless this feature besides bringing econ-
s in construction, has been a factor in
ging about the remarkable success which
been had in disposing of land to settlers.
ly, nearly one-half of the area to be ir-
ed by the completed works has been taken up by settlers. This record has not been the result of chance, but has been systematically worked for by a publicity and sales organization reaching all over America and Europe. Altogether the irrigation work of the Canadian Pacific Railway is deserving of attention for a variety of reasons.

Why Engineers Should Keep in Touch With Colleges of Engineering.

The practicing graduate engineer who possesses a broad interest in the standing of his profession should retain an active interest in engineering education. The problems of technical instruction are such that the best thought in the profession is required in their solution. A successful working out of these problems will require the exchange of ideas between the engineer and the professor of engineering.

The present tendency of the graduate engineer is to get entirely out of touch with the professors in the institution of which he is a graduate as well as all other institutions. Incidentally, this fact forms the basis for explanation of a point which often has been discussed in relation to the supply and demand for engineers. The professors say they have requests for more men than they can graduate. At the same time, it is well known that engineers often are out of work and are forced to hunt for positions. We are speaking now, of course, of men only a few years out of college. There is an apparent inconsistency between the statement of the professors and the conditions existing, and in view of the condition the professors have been criticised for the statement. The explanation is simply that the professors do not know how or where to reach their graduates when attractive positions are to be filled. It is not an uncommon thing to see from one to a half dozen letters, asking for men, posted on the bulletin board of the professor of engineering. Usually a note is added by the professor to each letter asking undergraduates for the names and addresses of any known graduates who might be interested in the positions offered. Often the men who might be interested cannot be located at the moment and the professor is forced to reply that he has no graduate to consider the position. This condition long has existed and should have been understood long ago. However, less than a year ago a prominent engineering journal stated that the editors could not understand why professors continued to say that they had a demand for graduates which exceeded the supply while at the same time so many young engineers were looking for work. The apparent inconsistency is explained by the fact that graduates get out of touch with the professors almost immediately after leaving college, and cannot be found when wanted. From a selfish point of view alone, then, the graduate would do well to keep in touch with his professors for at least five years after graduating.

However, it is not of the selfish point of view of which we wish to speak, or of the young engineer, or of the benefits to be derived by the practicing engineer who maintains an interest in his college, but of the benefit to the institution arising from this interest and consequently, of the ultimate benefit to the engineering profession.

Any active minded engineer must have ideas and theories relating to engineering education. Much good to his college would result if he would take the trouble to crystallize such ideas and offer them as suggestions to a teacher of young engineers. Such ideas need not relate to changes in the course of study offered, but preferably should relate to methods of teaching whereby the most instruction could be derived from the course now in vogue. Some features of a study should be given more prominence than others, some phases of a subject should be handled by the lecture method, others by the laboratory method, and others by recitations including the usual examinations. Where do graduates show weakness, where strength in knowledge of subjects studied and presumably mastered? On such points the employing engineer surely would be able to give the professor data on which to base changes in methods of instruction and on which he could measure the efficiency of his plant.

When an engineer designs a structure, a waterworks system, or any other engineering work, he always has an opportunity to observe [illegible] results of his work. He enables him to do better work the next time from the experience he has gained. The professor is not favored by a condition analogous to this. He turns out his finished product, the graduate, and often never finds out what attainments led to the success or what deficiencies of knowledge or methods of study and thought contributed to the graduate's failures. On these latter points the employing engineer has much data, and should offer them for what they are worth to the professor. It is believed that professors would receive such suggestions in the same broad-minded spirit in which they should be offered.

The close relation, which should be maintained between the college and student for the first five years following graduation for the [illegible] should be continued thereafter for the benefit of the engineering college and the engineering profession.

Common Faults in Photographs Selected to Illustrate Technical Articles.

Good illustrations for technical articles always are desirable. They add to the appearance of an article, lighten up the printed page, and, what is of greater importance, they convey ideas of methods and conditions which could not be so concisely presented by descriptive matter. These points doubtless will be conceded by any reader or writer who has given the matter thought. Writers, however, seldom employ sufficient care in the selection of views to make them of most value as illustrations.

It is true that many photographs which accompany contributed articles must be rejected because they do not show anything in sufficient detail to justify their publication. The mistakes made in taking pictures on a construction job may be divided into two general classes, namely, uninteresting things are photographed, and interesting things when photographed often are crowded into a corner of the picture and blended with the distant landscape, while the foreground of the view is filled with an object or objects of no interest whatever. Two examples will be given to illustrate the points just mentioned.

As an example of uninteresting things which are photographed and sent in with contributed articles elevated water tanks on steel trestles may be mentioned. These tanks are so common and so much alike in the general views which are readily photographed that a journal addressed to engineers and contractors will seldom find such views acceptable for publication. Notwithstanding this fact, which must be apparent to all, practically every article on waterworks offered to this journal, on jobs where elevated tanks were erected, is accompanied by an excellent view of the equally excellent tank. Such pictures lack the element of novelty, are therefore uninteresting, and must be rejected. All standard machines, tools, and forms of construction which are familiar to all must be included in this class of uninteresting things from the present point of view.

As an example of the manner in which interesting features often are pushed aside to make room, apparently, for objects of no interest, the view of a crushing plant recently submitted may be mentioned. The arrangement of the plant, as stated in the text, held some features of interest which were worth showing. However, a study of the view showed that in reducing it to the width of two columns, 5 ins., the cut would be divid lows along its long dimension: One wagon 2½ ins., distant cathedral 1½ crushing plant and appurtenances, 1

Editors appreciate the fact that cases such views were not taken for pose of illustrating technical article the records of the engineer or cont the job. In general, however, the sa ples apply to both cases. The se views on a job which are to be pho is a matter of more than incidental in importance, and should be given con consistent with the value of good records.

An Example of an Old Concrete Sewer.

In this issue we publish an illustr description of a concrete pipe sew was in use for at least 40 and prob years in the Chicago stockyards. is in good condition and the greate of it will be put in service again manent improvement now being buil

Among other concrete sewers wh been used for many years may be a considerable part of the system in Brooklyn, N. Y. This system conta 400 miles of concrete sewers, some were installed 50 years ago.

South Bend, Ind., has several sewers some of which are 30 years hart, Ind., has about 4,000 ft. of 3 crete pipe which were laid in 1883 and in service. The city of Allegheny, 13 concrete sewers between 1872 a These are all in service at the pres and the pipe is hard and sound.

GENERAL ARTICLES

Some Striking Reductions in Costs Effected by the Piece Work System.

Our readers will not have forgotten the derision that greeted the statement of Mr. Brandeis that railways can greatly reduce operating and maintenance costs by a more thorough application of the principles of scientific management. At the time the snort of indignation at the suggestion was loudest, we remarked that already several railways had applied certain of the laws of scientific management with marked success, and that, in due season, the results would be made public. In the *Electric Railway Journal*, Apr. 6, is an excellent article descriptive of the methods and results of applying unit timing and piece rate payments in the car shops of the Interborough Rapid Transit Co., which operates the subways and elevated roads in New York City.

The result has been to cut the labor cost of car maintenance fully one-third, and to increase the wages of the workmen more than one-third. In many classes of maintenance work the output of the men has been more than doubled.

To those who have themselves applied scientific piece rate and bonus systems of payment, there is nothing unexpected in such a result, but we venture that this striking object lesson given by a large company in the railway world will cause a rattling of old bones such as has rarely been heard before.

The following are some of the statements in the article above mentioned:

> The result of the introduction of this piece price was to reduce the cost of stripping and [illegible] approximately [illegible] per cent of the cost existing under day-work payments, notwithstanding that the wages of the workmen were increased about [illegible] per cent.
>
> The introduction of these [piece work] prices [for equipping motor cars] effects a saving in labor costs amounting to 41 per cent for conduit and pipe work, 49 per cent for electrical work and [illegible] per cent for carpenter and machinists' work.

The Interborough Co. has adopted two methods of payment, one being a straight piecework and the other a bonus method. For simple routine operations that can be analyzed accurately, payments are invariably made by the piece. For complicated operations in which the elements of cost differ considerably on different jobs, a bonus system of payment is used. Car cleaning, motor wiring, installation of new equipment on cars, etc., are paid for by a bonus system.

Both systems of payment have one important element in common: They are based upon unit timing with a stop watch. Each "job" is analyzed into its elementary operations, and an average workman is timed repeatedly on each operation until a fair average time for each operation is obtained. Then, based on this unit timing, a "key" price is assigned to each operation. A summation of the products of the "key" prices by the number of operations gives the piece price for the given job. An illustration will suffice to indicate the method of arriving at "key" prices and piece prices.

In the problem of determining the piece price for stripping a subway motor car of a certain type, it was found that 1,318 wood screws must be taken out. While the screws vary in length, stop watch timing disclosed the fact that the size of the screw does not appreciably affect the time of removing it, for most of the time is spent in the initial effort of starting it. The location of the screw, however, does affect the time, screws for seat backs, for example, being much more difficult of access than screws for sash locks.

The time of the operation of removing screws of each class includes also the time of removing the piece held by the screws, where the piece is small, but, where the piece is large—a window sash, for example—a separate time for removing that piece is ascertained. To the actual time of removing screws and pieces, is added 33⅓ per cent to provide for rests; or the equivalent is accomplished by adding one-third to the hourly rate f If the hourly rate of carpenter pay is then the actual time per piece is by one-third more than 24 cts., or 3 get the piece-price, thus providing f period equal to one-third the time work.

The following is a condensed sum the piece price of stripping a certain subway car:

Items Removed.	C
28 window sashes at 0.4[illegible] ct.	
2 signal ends at 2.60 cts.	
1,0[illegible] sash screws and other screws 0.045 ct.	
74 sash rod screws and other screws [illegible]	
176 door and seat screws at 0.1[illegible] ct.	
Total piece price	

The nearest whole cent is take "piece price," so, in this case, the pie would be 92 cts. for stripping the ca "key" prices in the above example ct. for window sashes, 2.60 cts. for signa etc. As above stated, this piece price of workmen engaged in car stripping sulted in decreasing the cost to the c by 40 per cent, and increasing the wo income by 40 per cent.

The foregoing is an illustration of th work pricing where only manual labo volved. An illustration of machine pricing will next be given, a car sill be lected for illustration.

A wooden end sill, 3x12 ins. x 8 ft be perforated with 20 holes and mus four "gains" cut in the side. The tot price for the labor on the sill is as fo based on an hourly rate of 36 cts.:

Item.	
22 ft. B. M. dressed in a planer at 0.04 ct	
Cut to length with cross-cut saw	
Laying out with templet	
Boring holes with machine	
Gaining, 4 gains	
Sawing ends with hand saw	
Total	

ct. price of boring the 20 holes is

	Cents.
handled at [illegible] ct.	[illegible]
(20 holes) at 0.01 ct..........	0.680
shifts (6-in.) at 0.035 ct....	0.525
at 0.02 ct....................	0.060
[illegible] at [illegible] ct.	[illegible]
[illegible] price	

ct. price for cutting 4 gains is es-

	Cents.
andled, at 0.033 ct............	0 [illegible]
[illegible]	0 [illegible]
itenal shifts, at [illegible]	[illegible]
aining price.....................	2.106

ichines used in boring and gaining new three-spindle boring machine with [illegible] carriage, and a [illegible] [illegible] with [illegible] vide.

of "handling" the 22 ft. B. M. ig the piece on and off the table nd setting the piece for the first gitudinal shift" is a shift of the iage; and the time varies slightly nce shifted, so that each length be timed to establish a correct A "cross-shift" is a shift of the timber without moving the ta-rriage shift" is a shift of the tim- [illegible]

ece price for a given sort of gned a "contract number"; thus 51 designates "Westinghouse air strip, clean, repair, assemble and ich the piece price is $3.50.

port cards are entered the names mbers" of the workmen, the car er, the "contract number," the [illegible] , and the amount earned.

stated, a bonus system of pay-d to certain kinds of work that it been, or cannot be, very ac-zed and timed. But even when ient is to be made, piece prices mined in the same general way vork payment, and to these piece 20 per cent is added to secure st price."

standard day's work consists of r of pieces that, when multiplied is list price"; will yield the or-vage. For every additional piece n excess of the standard day's rkman receives *half* the "bonus [illegible] daily wage. By this method, in doubles his day labor output, and eight-tenths times as much that this form of bonus payment s advantageous to the workman piece-work payment under which [illegible]

ior to the adoption of the bonus st the company 14 cts. to clean he barns. It now costs 5.6 cts. the bonus system, and the work-per cent more per day than they [illegible]

In car cleaning the men work in l the total bonus earned is prorated n in the gang.

once adopted a piece price, no cut-e price is made unless new methods he work are developed. This insures l co-operation of the workmen, nfidence in the good intentions of npany.

be interesting in this connection to ew sentences from the recent report ngressional committee that "investi-ientific management," and found it tinkling cymbal.

[illegible] may be able to deter-[illegible] which a piece of work [illegible] do not thereby alone deter-length of time in which it ought to The time study of the operations of [illegible] can be made with a [illegible] accuracy, because all of the elements taken into consideration in making the

[illegible] as no [illegible] place in the social order. With a workman it is different. He is a living, moving, sentient, social being; he is entitled to all the rights, [illegible] sideration given to other men. He would be less than a man if he did not resent the introduction of any system which deals with him in the [illegible] machine.

And then follows much more of the same molding of snowmen in the image—the very distorted image—of "scientific management," as target for rhetorical periods.

Piece-work neither makes men "beasts of burden" nor does it reduce them to the status of "inanimate machines." On the contrary, piece-work, or its equivalent, converts work into a game of skill, and animates the machine-like laborer. That it operates to the great advantage of both employer and employee is well illustrated in the results secured in the shops of the Interborough Rapid Transit Co., as it has resulted in scores of industrial establishments.

Method of Measuring the Displacement of Material in Scow Barges.

A method of [illegible] on deck scows is described by Mr. Howard J. Cole in the Journal of the American Society of Engineering Contractors as follows:

[illegible] measured by steel tape and the point A' plumbed up from A, see Fig. 1, similarly B', B'' and A'' were obtained, and the distance A' B' A'' B'', A' A'' and B' B'' likewise measured by steel tape; the depths A A' and B B' and corresponding depths on the other side of the boat were carefully measured by a graduated rule and noted on a sketch of the boat. When the latter was empty the point C' was plumbed up from C, D' from D, and again on the further side, and the four dimensions corresponding to the loaded measurements recorded. From a comparison of the depths (light and loaded), and with the complete measurements taken, the displacement was computed as hereafter shown.

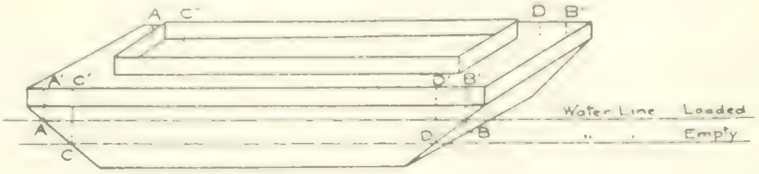


Fig. 1. Displacement Diagram of Scow Barge.

The length A' B' and A' A'', and the other two corresponding measurements were obtained direct on the scow deck, and the depths were obtained by taking the difference between the readings loaded and light and the displacement thus figured.

By averaging the lengths A' B' and A'' B'' and multiplying by the width A' A'', also averaging the lengths C' D' and C'' D'' and multiplying by the width C' C'' and multiplying the average of these two by an average of the differences between the load lines (C' C—A' A, etc.) at the four corners, the cubic feet of displacement is obtained, which multiplied by 62.5 and divided by 2,000, gives the displace-[illegible]

[illegible]

$$\frac{\text{Area of boat loaded water lines} + \text{Area of boat light water lines}}{[illegible]} \times \text{distance between the two planes} \times \frac{62.5}{[illegible]} = \text{Displacement in tons.}$$

A method of transporting long wire rope for the construction of a tramway for the Teziutlan Copper Company at Aire Libre, Pueblo, Mexico, was carried out by means of a long line of Mexican peons. Each man carried a coil around his waist which formed a portion of the continuous rope passed on to the coil carried by the next man. In this way over 12,000 ft. of 1¼ in. steel rope, made by the A. Leschen & Sons Rope Company, was carried over a country too rough for the location of mine railroad.

Cost of Engineering in Small Towns.

Sirs: Referring to your issue of March 27, I beg leave to submit the accompanying Table I of costs of engineering for municipal work in several small towns in Mississippi, in reply to the query of "City Engineer."

[illegible] I.—COST OF [illegible] IN SMALL MISSISSIPPI TOWNS.

[illegible]	Newton	West Point	Columbus	Booneville	West Point
[illegible]	[illegible]	[illegible]	1911	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2,000	4,500
[illegible]	Street grading Storm drains Brick gutters	[illegible] storm sewers, concrete sidewalks	Storm sewers, concrete curb and gutter	Concrete sidewalk	Macadam [illegible]
Amount of contract	[illegible]	Macadam and storm sewers, [illegible] sidewalks, [illegible]	$8,000	$15,000	[illegible]
Supervision and [illegible]	Whole time	[illegible] sidewalks		Monthly check-[illegible] estimate	
[illegible]		4 per cent of total[4]	7 per cent[4]	3½ per cent[4]	
Salary or per diem	[illegible] month[1]				[illegible] per day[5]
Duration of work.	[illegible]	[illegible] street and sewer work 10 months on sidewalks	3 months	[illegible] estimated at 5 months	In progress estimated at 2 months
[illegible]	[illegible]	$1,100	$560	[illegible]	Survey $80, supervision and [illegible] $375
Percentage of contract	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Net salary equivalent to percentage paid	$125	[illegible]	[illegible]	Estimated [illegible]	

[1] Town furnished [illegible] so the cost properly charged to grading, etc., was 6.6 per cent. [3] Engineer employed help only while making surveys, setting grade and alignment stakes. Any help needed during progress of work, such as resetting stakes and making estimates of work done, etc., was furnished by the contractor. Paid help $150. [4] Engineer furnished maps, stakes and help. [5] Same as [3] except paid help $8[illegible]. [6] Town [illegible]

It will be noted that the commissions paid the engineer are about equivalent to a salary of $150 or $160 per month. However, most small towns prefer a commission or percentage payment to a salary rate, as by so doing they are better able to estimate the total cost of the work.

Very truly yours,
CHAS. LYON WOOD,
Civil Engineer.
Columbus, Miss., March 30, 1912.

The Supply and Demand for Engineering Graduates in the United States.

The claim is frequently made that too many engineering graduates are being turned out by colleges. This claim is quite as frequently disputed by the counter claim of the colleges that they can scarcely fill the demand for engineering graduates. Once in a while some one kicks over both stools and takes his stand on the contention that the scheme of things has no place for the engineering graduate or for the institution which produces him. Perhaps as fair a view of the disputed question as has recently appeared is a paper by Prof. C. N. Little, University of Idaho, read before the National Education Association. This paper gives many statistics which will interest engineers, and we publish it nearly in full as follows:

A paper on the supply of and demand for engineering graduates must be statistical. It would seem to be a very easy matter to turn to those agencies which are actively engaged in collecting educational statistics for the facts pertinent to this inquiry, and having received the desired information, to base the discussion upon it.

The matter is not so simple as it seems, nor is it so easily disposed of as just indicated. I wished to know as a primary fact the number of engineering graduates in the United States for the school year 1909-10. In the first place, what is an engineering graduate? A committee of the Society for the Promotion of Engineering Education, appointed in 1908, found that ninety-two institutions confer fifty-seven different degrees on engineering students who complete courses of three, four, or five (usually four) years of undergraduate study; and fifteen degrees for distinctively graduate work. In this paper I shall use the term engineering graduate to mean a student who has completed his undergraduate course of study and received any one of the fifty-seven degrees of the first-mentioned group.

In beginning this inquiry I sent to the United States Commissioner of Education and to the Carnegie Foundation for the Advancement of Teaching for lists of institutions in the United States conferring degrees in engineering in 1910, and for the number of engineering graduates from these institutions for the same year. Very courteously both sent replies and manuscript lists, which were not regarded, however, by their senders as complete. These lists have been of much service to me, and I wish here to express my hearty appreciation of my obligation for them; but a few days' work on files of catalogs in the University Library, and later an examination of replies by return-card postals, showed me that there is no easy road to even a small bit of educational statistics, and that such information as I had received must be carefully checked as well as completed.

In this country engineering was hardly recognized as a profession before the middle of the last century. The census of 1850 enumerated 512 civil engineers and surveyors in the United States. In 1870 this number became 4,703, which increased to 31,697 in 1880, and 43,239 in 1890. Now comes a statistical jolt. The 1900 census gives for precisely the same class, namely, civil, mechanical, mining and electrical engineers, and surveyors 43,533 as against 43,239 in 1890. Whatever may be the explanation of this curious fact it is clear that the engineering profession is of comparatively recent origin and of pretty rapid growth.

With its development have come the establishment and growth of engineering schools, where young men can secure instruction in the principles of the profession. The Rensselaer Polytechnic Institute opened its doors as a school of applied science in 1825 and in 1828 gave lectures on surveying and engineering. This was the beginning of engineering instruction in schools in any English speaking country. The Sheffield Scientific School was opened at Yale in 1847 and the Lawrence Scientific School at Harvard in the same year. Michigan was the first of the state universities to offer engineering courses, which were begun in 1853.

In 1892-93 A. M. Wellington, author of that monumental work, "The Economic Theory of Railway Location," made a protracted investigation of the technical schools of this country, publishing his results in a series of forty-one articles in the "Engineering News," of which he was at the time one of the editors. Upon the numbers of graduates given in his article [illegible] "Engineering News" for Aug. 4, 1892, Vol. XXVIII, p. 112, I base the following table of graduates per million population in the continental United States.

TABLE I.—GRADUATES OF ENGINEERING SCHOOLS IN CENSUS YEARS.

Year	Number of schools reporting	Total number of graduates	Graduates per million population
1840	1	13	.8
1850	3	12	.6
1860	5	31	1.0
1870	18	107	2.8
1880	41	226	4.5
1890	[illegible]	666	10.5

I find that in 1910, 118 schools reported 4,645 graduates or 50.5 per million inhabitants.

These figures show that during the past fifty years there has been an astonishingly rapid increase both in schools and in graduates. In the future the increase in schools will be slower. Over half the number now established are state-supported schools and there are not likely to be many more of these. On the other hand, I look to see the increase in number of graduates continue but not at such a rapid rate as in the recent past.

Considering this rapid increase in output of technical graduates the question is very naturally asked: Is it possible that the demand is increasing with corresponding rapidity? That the number of graduates is quite responsive to changing demand is made evident by studying Wellington's chart of graduates for each year from 1860 to 1892, "Engineering News," Vol. XXVIII, p. 113. The entering class for every year following a time of commercial depression shows a marked decrease. In the hard times following the panic of 1873 the number fell off fully one-fourth. These drops are quickly recovered when good times come again, and the rapid increase in numbers sets in anew.

I cannot hope to answer very confidently the various questions that cluster about the relation of the supply of graduates to the demand. I must be content if from one or another angle I can throw a little light upon this interesting subject.

Question 1.—How readily does an engineering graduate get a foothold which may lead to professional standing? Certain schools publish in every catalog lists of alumni by years, with their occupations. From the lists which include classes that have been out one year or less, it is possible to get some [illegible]swer to the question just asked and from th[illegible] catalogs of a half dozen representative [illegible]titutions of good standing I have construc[illegible] th[illegible] following table. Any engineering occ[illegible]tion no matter how humble is included i[illegible] numbers, for it should be remembered [illegible] graduate is not an engineer, but the [illegible]erial from which an engineer may be devel[illegible] practical life. It is highly desirable t[illegible] the practical side, he should begin at t[illegible] foot of the ladder. Many men, at least in [illegible]stern schools, make this beginning in summe[illegible] vacation work, and have a corresponding ad[illegible]tage over their fellows on commencement d[illegible]

This table is sufficient to show tha[illegible] most engineering graduates find an opportu[illegible] to begin engineering work almost imm[illegible] after graduation.

Question 2.—What is the attitude of [illegible]ployers toward technical graduates? It w[illegible] be easy to quote individuals of all sha[illegible] of opinions, from those who will have not[illegible] do with engineering graduates to tho[illegible] wh[illegible] make it a rule to give them the prefere[illegible] have sought for some indication of t[illegible] est[illegible]mate that employers put upon technical [illegible] tion in the columns of advertisements o[illegible] tions open in three leading engineering [illegible] to see what percentage of advertisers th[illegible] required or preferred as applicants me[illegible] an engineering-school training. In [illegible] this count I have omitted advertiseme[illegible] foremen, salesmen, draftsmen, instruct[illegible] engineering, and those positions requir[illegible] vestments of capital, as for obvious [illegible] these positions are not fairly represe[illegible] on the one side or the other of this q[illegible]

In the "Engineering and Mining Jo[illegible]" from January to June, 1911, 20 per c[illegible] the "Electrical World," from January [illegible] 1910, 23 per cent; and in the "Engi[illegible] News," from July, 1910, to June, 1911, [illegible] cent of the advertisers either required [illegible] preferred technical education.

Perhaps the individual opinion most [illegible] esting to me is that of Mr. Frederick W[illegible] lor, known to engineers as the man wh[illegible] a lifetime of experiment has complete[illegible] lutionized the art of cutting metals. [illegible] contribution to the discussion on the r[illegible] of education to industries at the meet[illegible] the American Society for the Promot[illegible] Engineering Education, held in New [illegible] June, 1909, Mr. Taylor, who has been [illegible] employer of engineering graduates, sa[illegible] ten years before, he made up his mind [illegible] to employ, if he could help himself, gr[illegible] who had not been out two years at leas[illegible]

A part of his explanation is, that [illegible] graduation the student has the attitud[illegible] sponge or absorber; when he begins [illegible] things the process is reversed and h[illegible] the squeeze painful; it takes about tw[illegible] for the graduate to accustom himself [illegible] reversal of function, and during this ti[illegible] employer and himself are mutually dissa[illegible]

In 1909, Professor Diemer, of Penns[illegible] State College, reported that of 122 ma[illegible] turers of machinery, each employing o[illegible] men and having had experience with te[illegible] graduates, 98 returned answers to the [illegible] tion, "Have you found technical graduat[illegible] isfactory?"—which he summarized as f[illegible] "affirmative, 60; undecided, 15; negati[illegible] 22."

In civil engineering and surveying th[illegible] are many subordinate positions into which graduates drop without friction; if these gra[illegible]

TABLE II.—PERCENTAGE OF GRADUATES SECURING ENGINEERING OCCUPATIONS THE FIRST YEAR AFTER GRADUATION.

Name of Institution.	Place of Institution.	Date of graduation.	Date of list.	Number of graduates	
Stevens Institute of Technology	Homoken, N. J.	1909	1910	[illegible]	[illegible]
Lehigh University	South Bethlehem, Pa.	1910	1911	126	11[illegible]
University of Pittsburgh	Pittsburgh, Pa.	1910	1911	[illegible]	1[illegible]
Case School of Applied Science	Cleveland, Ohio	1910	1911	[illegible]	[illegible]
Sheffield Scientific School	New Haven, Conn.	1910	1911	151	[illegible]
Armour Institute	Chicago, Ill.	1905	1906	48	[illegible]
Georgia School of Technology	Atlanta, Ga.	1909	1910	26	[illegible]

III.—PERCENTAGE CLASSIFICATION OF LIVING [illegible] BY FIVE YEAR GROUPS

	1878-82 Inclusive Percentage	[illegible] Inclusive Percentage	[illegible] Inclusive Percentage	[illegible]	[illegible]	[illegible]
...le positions	94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
...ponsible positions	[illegible]	[illegible]	14	[illegible]	1	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
...ed available	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

...d practical experience in summer [illegible] positions that may [illegible] from $75 to $100 per [illegible] in the field, are [illegible] in the West in [illegible] other hand, Dr. Waddell, [illegible] engineer, of Kansas City [illegible] the office of a civil engineer [illegible] a large amount of practical [illegible] ...umnus is worth less than nothing; he [illegible] that even an unpaid [illegible] will ultimately prove more [illegible] graduate than a well-paid [illegible] the opportunity for a broad experience. ...clear that a real objection exists in the ...many employers to some engineering ...tes for a year or two after graduation. ...s who have had the most experience with ...al graduates, however, would agree with [illegible] and Dr. Waddell [illegible] the [illegible] value of engineering school [illegible] ...it is supplemented by practical experi... ...n the shop, field, or office, either before ...mediately after graduation.

...o Mr. R. T. Crane's condemnation of ...r form of instruction beyond that of the [illegible] school, an examination of [illegible] ...ngs he has written discloses such a bias ...wness of mind as to make it un... ...to discuss his opinions.

...n 3.—Are engineering graduates suc... To answer this question I can turn ...areful investigations. In each case ...de practically all of the graduates of ...l school where the number was suf... ...arge to warrant general conclusions. ...sor Furman has published in the ...ngs of the Society for the Promotion ...eering" for 1908, Vol. XVI, p. 337, ...tigation of the records of the grad... Stevens Institute of Technology, at ... N. J., a leading school of mechan... ...neering. The number of graduates, ... the class of 1908, is 1,394 men.

...f the conclusions are the following:

... graduates rise rapidly into positions [illegible] Nearly [illegible] per cent of the ... then living are classed as successful [illegible] five years after graduation, 90 per [illegible] success after fifteen years and [illegible] ...ent after thirty years.

...An apprenticeship course of one or two ... immediately following graduation has ...d itself a sure road to eminent success in [illegible]

...cond investigation was made by Dean ...nd Professor Moyer of the University ...higan. It was published in the "Pro... ...of the Society for the Promotion of ...ring Education" for 1909, Vol. XVII. It consists of two parts. The first part ... upon annual letters from 1,234 of the ...ing graduates in engineering of Mich... ...University, including the class of 1907.

...ave copied Table III, p. 182, of the article ...d which shows the percentage classifica... ...f living graduates by five-year groups.

...making out this table a graduate was ...dered to occupy a responsible position ...ever his work was of such a character as ...quire him to exercise his own judgment ...r than follow that of another.

...would hardly seem possible to bring for... ...more striking or conclusive evidence as ...e ultimate success of engineering grad... ...than that afforded by these thoroughly ...le investigations.

... second part of the investigation of ...igan University engineering graduates is ...erned with their salaries and total in... ...s. This information is based on returns ...nsigned cards from 980 of the 1,234 grad... ...s who regularly gave information for the ...ersity record of graduates.

...appears that for the first year after leaving ..., the average annual salary is a little

[illegible] men who have been out from fifteen to twenty years were eliminated the increase would be [illegible]

Question 4.—To what extent do the graduates from engineering schools follow engineering as a profession? Professor Furman in his investigation of the careers of graduates of Stevens Institute of Technology reached the following conclusion:

> Forty per cent reach executive or managerial positions, nearly all in engineering or commercial manufacturing lines; 37 per cent, broad technical positions such as consulting engineers, etc.; 11 per cent settle into positions calling for technical detail; 10 per cent go upon the retired list, and the occupations of 2 per cent are unknown.

Dean Cooley in the article cited above gives the occupations of 1,378 engineering graduates of Michigan.

> Including professors, presidents of corporations, managers and superintendents, 73 per cent are in occupations for which the university training of the graduates may be regarded as direct preparation.

Other institutions, notably the Massachusetts Institute of Technology, at Boston, publish tables of occupations of graduates. A study of these lists discloses the fact that a considerable number of graduates do not adhere closely to the professions corresponding to their undergraduate courses. I regard this ease of adjustment to environment and opportunity as an evidence of the breadth of their preparation rather than of defect in their undergraduate courses.

Obviously education and schooling are two things not necessarily joined and it is freely granted that one may obtain the former entirely apart from the latter. Nevertheless it is clear that in most cases a school training is a wise investment. As Henry L. Doherty, a prominent manager of electrical properties, has put it, such an education backed up by proper practical training is a capital that cannot be spent or mortgaged and may often be made to have an earning power of $500,000 in cash.

Question 5.—Do engineering graduates have an advantage over non-graduates? In the "Engineering News" for 1902, Vol. XLVIII, p. 112, an editorial note quotes from the report of William Barclay Parsons, chief engineer of the Rapid Transit Commission of New York City, the following table:

TABLE IV.—PERCENTAGE OF GRADUATES AMONG EMPLOYERS OF THE NEW YORK CITY RAPID TRANSIT COMPANY.

	Graduates of [illegible]	Non-graduates	Percentage of graduates
Chief engineer	1		100
Deputy chief engineer	1		100
Division engineer	5	2	71.4
Assistant [illegible]	[illegible]	16	85.3
Rodmen	[illegible]	1	73.3
Axmen	11	19	36.6
Total	[illegible]	[illegible]	[illegible]
Omitting rodmen and axmen	100	18	84.7

All of these positions below the grade of division engineer were filled after competitive examination by the Municipal Civil Service Commission.

The editorial goes on to say that few engineers will dispute the value of a technical education and such figures as those above demonstrate that technical-school graduates succeed in obtaining positions in open competition with the men who have not had such training.

It would be an interesting question to investigate what percentage of the members of the different engineering societies of the United States are technical graduates. On the assumption that the members of these societies are successful practitioners, an answer to this question would give an indication as to what extent the possession of a technical education is necessary to success in the engineering profession.

For the American Society of Civil Engineers this was done in 1892 by Wellington, and his results were published in the issue of "Engineering News" for Nov. 17, 1892. He included among the graduates all those who had taken over two years of the regular course at an engineering school. These cases were few. Of the total of 1,073 whose records on this point were available 55 per cent were graduates. It would be instructive to compare this percentage with that existing at the present time. The number has undoubtedly increased in view of the tremendous increase in the number of engineering graduates in the last eighteen years. I was not, however, able to get the necessary information. A letter from Charles Warren Hunt, the secretary of the society, under date of June 21, 1911, reads as follows:

> It would be a large task to get the figures showing the ratio of members of this society who are graduates of technical schools to those who are non-graduates, and we have no statistics on the point. There is no doubt, however, that a very large percentage of our membership are technical graduates, but just what that percentage is I am unable to say.

I have shown that the phenomenal increase of engineering graduates of recent years continues in full force and amounts now to a yearly contribution of approximately 5,000 young men who have been taught the principles underlying the engineering profession.

These graduates quickly find opportunities to add to their training acquired in the schools a practical experience gained for the most part in the subordinate posts of the engineering calling. It has been seen that their rise to responsible positions is rapid and that ultimately they achieve success in numbers that without proof would seem impossible. From these facts, and others deduced in the body of this paper, I conclude that the supply of engineering graduates has not outrun the demand, and that American education is to be congratulated on the present development of engineering instruction in colleges and universities.

Some Notes on Timber Flume Construction.

[illegible] The timber flume described on page [illegible] of the issue of April 17 is a curiosity to engineers of this generation. The engineer who built it followed modern methods of management in laying out his work and achieved some low costs to be proud of, but his design is such as his grandfather would have produced. I remember years ago in the far west when I was engaged in irrigation and hydraulic mining work, examining with interest the flumes built by the pioneers. Nearly all were made like cabinet work, with dovetails and rebates and wedges, whereas the flumes built within the past twenty-five years have nothing of the sort. They are not necessary.

The flume illustrated is only 30 ins. wide inside and 24 ins. deep. Notice the very heavy framework and the elaborate cutting and fitting. Modern engineers know that when wood is cut into there results a loss of just so much strength and the joints permit water to collect and thus accelerate the process of rotting. The cost of labor is also increased. The modern designer of flumes uses larger timber, of course, than would be indicated if strength alone were considered, because durability must be considered, but he does not use as large timbers as were formerly used as so much waste occurred in the old flumes because of the elaborate joinery.

If nails are not used then some sort of dovetailing and wedging becomes necessary, but in this South American flume we are told about the use of spikes. The modern American engineer would have made such a simple plan for the flume that the cost would have been greatly reduced. On page 453, in the same issue, you have an article on experiments made to determine the holding power of nails and an illustration is given of a flume 12 ft. deep and 16 ft. wide inside which is entirely devoid of joinery work. It is as simply framed as a packing box and nails are used freely.

The old flume builder guessed at his proportions. The modern engineer computes all strains and stresses and then designs for joints cut to angles and resting on pieces to which they are nailed. If there is much sliding pressure a block of wood well spiked is placed at the foot of the brace. In designing a flume the frames are spaced at intervals determined by the stiffness of the bottom planks. The bottom planks must carry the weight of the water, so deflection must be considered. It is, of course, impossible to put a bent under each frame so the side boards are considered as deep, thin beams and the moment of resistance of this U section found. The span is thus fixed. The span is one-third of the distance between bents, for diagonal braces are run up from each bent to the third span points, thus carrying much of the weight to a lower point on the bent, which all conduces towards stiffness.

The water presses against the sides of the flume and for this reason the diagonal braces are used, the pressure at each frame being the pressure due to an unsupported length of flume equal to the distance between frames. This pressure cannot be very great in a flume of the size shown in the article mentioned, and very light diagonal braces could have been used. In the present case it would have been sufficient to have used thin pieces nailed top and bottom to the sides of the frams instead of being butted in the customary fashion.

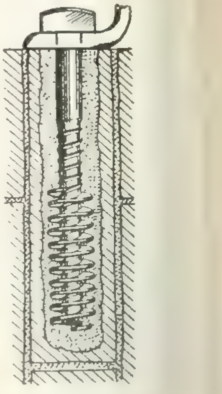
However, in the present case the diagonal braces were not necessary except to prevent the flume from warping, as the piece across the top, carrying the running board, when well spiked to the side pieces, is a sufficient tie. The man who designed the flume was so very old-fashioned and behind the times that he even cut into his top piece to set in the running board. Is it possible for any one to conceive of any reason for doing this? Why not nail the board on top of the frame?

Yours truly,
ERNEST McCULLOUGH.

Chicago, April 20, 1912.

A Screw Anchor for Concrete or Other Masonry.

The accompanying drawing shows a screw anchor for fastening attachments to concrete or stone, brick or tile masonry. The device consists of a square-headed screw and a flat wire spiral into and from which the screw can be twisted. In old work, like that illustrated, a hole is drilled and filled with cement into which the screw carrying its spiral is screwed. When the cement has hardened the screw is screwed out of the hole leaving the spiral in place as an anchor to hold the scre at any future time it is put back. In n the screw carying its spiral is built masonry. By means of the broad strong anchorage is had for the sc one which is durable—does not loos fectiveness by frequent removal and ment of the screw. These screw are



An Improved Screw Anchor

made in lengths of from 1½ to 12 in. diameters of from ¼ to 1 in., bu special sizes are made on order. It is that this same device may be used i as well as in masonry. It is made Richmond Screw Anchor Co., 9 Ch New York, N. Y.

EARTH AND ROCK SECTIO

Methods and Costs of Constructing Two Rock Tunnels Under the Erie Canal for the Buffalo, N. Y., Water Works.

By C. H. Hollingsworth, Superintendent of Construction.

(Concluded from page 436.)

II.

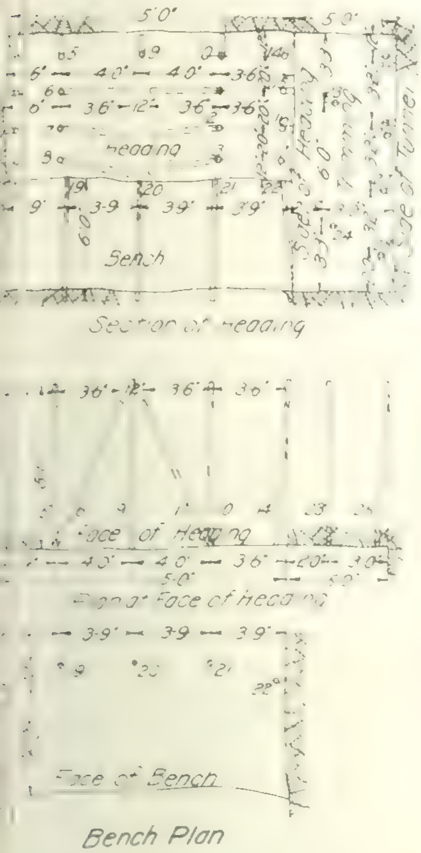
TUNNEL EXCAVATION.

Both tunnels were of exactly the same dimensions, they being 12 ft. 6 ins. high by 20 ft. wide to the excavation lines and 18 ft. by 10 ft. inside, when concreted. The somewhat peculiar shape made them rather difficult to drive. Therefore it was decided to take out a heading and bench about 14 to 16 ft. wide along one side of the tunnel and then trim the remainder off after the heading was through. This plan was carried out.

Jersey St. Tunnel.—The Jersey St. tunnel was driven from Shaft 4 and was started Feb. 6, but as the first two rounds had to be drilled from tripods, allowing the use of only two machines, the progress was retarded for the first two days. The rock in this tunnel was partly black flint and partly a very hard limestone. The rock being hard, the blasting made considerable concussion, and as the district nearby was thickly populated, a steady stream of complaints began to come in. To make matters worse, the weather, which at the start of the blasting was mild and wet, suddenly turned very cold, freezing the ground so that the slightest shock was transmitted a long way. Windows were broken and crockery was shattered. In order to shut off some of the complaints, the following system was tried: First a round of 8-ft. holes was drilled and fired every eight hours in the heading, the holes being spaced as shown by Fig. 8, and two rounds were drilled on the bench. In shooting, in order to make as little disturbance as possible, the four bottom cut holes were fired first, next the two top cut holes, next the six holes in the side round and lastly the five dry holes. This did not seem to please the public any better than when the entire six holes in the cut were fired in the first shot, so shorter holes were tried. The scheme was to drill a 6-ft. round in the heading and shoot four times in 24 hours, instead of three times. The result showed that about the only way to please the residents in the neighborhood was to stop blasting entirely, and as this could not be done, the writer concluded to try a method of his own, which was to hurry up and get the agony over, so the three shot schedule was resumed, and 8 ft. rounds were drilled, the entire cut being fired in the first round. As an interesting side light on the question of short holes versus long holes in drilling a heading, it was found that, while the three shots could easily be made in 24 hours, with an average advance of about 5.5 ft., the four 6-ft. rounds could not be drilled and shot in 24 hours. The best that could be done was at the rate of seven shots in two days, averaging 4.1 ft. per shot; so that with the long holes the daily advance was 15.6, while with the short holes the daily progress was 14.3, showing a percentage in favor of the former method. The amount of work required by the short hole method was also vastly greater for the smaller progress, as it required an extra setting up and tearing down, and the shooting time, instead of coming at the end of the shift, came at all sorts of unseemly hours. The heading was taken out 15 ft. wide and 7 ft. high, leaving a bench of 5½ ft. Three drilling gangs were used, each working an eight-hour shift, and each composed of one heading foreman, one nipper, four drill runners and four helpers in the heading and one runner and one helper on the bench. This gang had to muck out, set up, drill an 8-ft. round and shoot in eight hours, and this they did without any trouble. In shooting, delay action exploders were utilized in the following way: The cut holes and first round on the bench were loaded, using the ordinary exploders, the side round and second round on the bench were loaded with first delay exploders and the dry holes were loaded with second delay exploders. The cut and the two bench rounds were fired first. Then if the cut needed reloading this was done, using ordinary exploders, after which it and side round and dry holes were nected up and fired, making only tw In drilling, Ingersoll E-24 drills with cylinders were used, mounted on a 6½-ft. columns. An air pressure 105 lbs. at the compressors was main giving an effective pressure at t about 90 or 95 lbs. The powder per cent dynamite and the compressed used to blow out the smoke after ev As the tunnels were short, the much trouble from smoke. The head at all times kept about 25 ft. ahead bench.

In mucking a muck foreman and men were used. The muck was load 1½ cu. yd. dump buckets, the same as sinking the shafts. These buckets we on flat cars and when loaded were ru the shaft, picked up by the der dumped into bottom dump wago hauled the muck to a dump a short away. These wagons took just one b each. The buckets were each provide safety chain, with a snap hook on tripping lever of the bucket should c any of the timbers. In loading the bu the tunnel a double track was laid f shaft into the bench without any switch, one bucket was run in and loaded part muck wheeled out from the heading in barrows and partly by shovelers w the foot of the bench. While this buc being loaded, the one on the other tra been pushed out, set up, dumped and re Instead of using a hook on the der hook on to the buckets, a special bl clevis was used. This was to prev dents from the bucket striking a timbe being lowered and becoming unhooke Fig. 9. The clevis was about as quic tach and take off as a hook, and w safer. Owing to the hard and blocky of the rock in this tunnel, no extra fas ress was made, although a fair ra maintained. During the first week a p of 77.5 ft. was made, but for the first t of the week only two drills on tripod be used in starting the heading from th and a shot was lost later on, as the ga

ken back to the shaft to drill a sump
e trimming holes. For the second
ding Monday forenoon, Feb. 20, the
was 108.2 ft. of both heading and
h The third week the heading was com-



-Spacing of Holes for Blasting In Tunnels.

[illegible]

ading—ordinary exploders.

[illegible]

ers.

, 26, 27 and 28 = 1st shot in trimming—lay exploders.

n Wednesday forenoon, Feb. 22, and hen 35.3 ft. were driven, making the [illegible] side of shaft 3 of 222 ft. in 15 ys (including time of turning the), or about 15 ft. per day.

nming off the additional 5 ft. to widen el to 20 ft., it was first trimmed out to th for a distance of about 20 ft. at a idway between the two shafts. From int the trimming was worked both sing four drills mounted on two 10-ft. . The column was set up close to the the two machines mounted on it. ft. holes were drilled running parallel tunnel line. Four holes were drilled the rib and two about 2 ft. out. The ere fired first and the other four holes n this way each shift advanced about each direction, or 14 ft. in all, and the f trimming took just 16 shifts, or 5⅓ line of 12x12-in. timbers on the exact ine of the tunnel was placed with the 12 ft. centers. These timbers were out 12 ft. behind the face of the trim- The tracks for the muck cars were left original locations and used for the g work, as the greater part of this as thrown well across both tracks.

[illegible] *Tunnel.*—The Porter Ave. vas driven from Shaft 1, the heading rned Monday, Feb. 13. The heading a belt of fine grained hard sandstone ft. thick, reaching from the roof the top of the bench. This stratum hout any slips or seams whatever and was excellent rock. In spite of the fact that the heading was turned with two machines on tripods, they drilled and shot a 10-ft. round in eight hours. The heading and bench were carried on by the same methods as the Jersey St. tunnel. Owing to the scarcity of men, only two drilling shifts were put on at first, and the heading ran about 50 ft. ahead of the bench the first week, but this was reduced to [illegible] drilled and broke well, a 10-ft. round could have been drilled and fired every eight hours, but for the fact that the city authorities about this time limited the depth of holes to 8 ft. on account of complaints regarding the jar of the blasting. The progress was much better in this tunnel than at Jersey St. As stated before, only two drilling shifts were worked during the first week, and the progress for that week ending Feb. 20 was 96 ft., including in this, however, two shots made on Sunday, the 19th, or 15 shots in all, averaging 6.4 ft. per shot. On Monday, the 20th, three drilling gangs and three full mucking gangs of 14 to 16 men each were started and the progress for the week ending Monday forenoon, Feb. 27, was 126 ft. of heading and bench. In fact a gain of 25 ft. was made on the bench. This progress was made in the six days and one extra 6-ft. round fired on Sunday to finish up the tunnel to the further side of Shaft 2. The advance made on the 6-ft. round was 5 ft., and deducting this the average advance of the other 18 shots was 6.7 ft. per shot. The only difference between here and the Jersey St. work in the men employed was that at Porter Ave. during this last week an extra muck foreman was used in the heading and this resulted in a much faster handling of the muck with the same number of muckers. The entire distance of 222 ft. was taken out in 34 shots or 11⅓ working days, averaging about 6.5 ft. per shot. In both of these tunnels the same methods were employed as in the Buffalo water works tunnel described in ENGINEERING AND CONTRACTING of Aug. 17 and 24, 1910.

Fig. 9—Details of Derrick Block, Shackle and Pin.

Owing to the extremely cold weather prevailing during all the work, air reheaters were used. A 3-in. air line ran down each shaft and at the top of the shaft three 2-in. reheaters of the Ingersoll type were set up and so arranged that any of them could be cut out at will.

The shaft sinking was one of the hardest propositions in that line that the writer has ever seen. At the dryest shaft (No. 4) the pumpage averaged 300 gals. per minute when the shaft was sunk to grade. At Shaft 3 the leakage was 350 gals. per minute after it had been sunk the full depth, but at times during the sinking the leakage amounted to 1,050 gals. per minute. At Shaft 2 the leakage at times during the sinking ran as high as 1,650 gals. per minute and when the shaft was down to grade it was 400 gals. per minute. In Shaft 1 the leakage at times ran as high as 1,300 gals. per minute, and when sunk to grade the leakage ran about 500 gals. per minute. From these figures it can be seen that the pumping was a very considerable item and after drilling a round it was a serious problem to remove the pumps before shooting and replace them after the shot. Oftentimes there was 6 ft. of water in the shaft before the shot could be fired. Added to this was the fact that the severe weather caused everything in the shafts to be coatd with ice and it was remarkable that the men stuck so well to the work. Only one shaft pump was used and all the other pumps—of which there were 12 in all, used at different times—were horizontal, duplex plunger pumps of various sizes. These pumps were hung in the shaft, being suspended from the timbering.

CONCRETING.

A small amount of concrete was placed in Shafts 2 and 3 before they were sunk to their full depth, but the greater part of it was left until the shafts and tunnels were excavated and trimmed. The first concreting was done at Jersey St. A Hains mixer was set up in the upper section of Shaft 3, which had been concreted, and a 12x12-in. chute led from the bottom of the mixer down to a point about 5 ft. above the grade of the tunnel floor. See Fig. 10. A track was laid with a switch near this chute, the rails being laid on 4x6-in. ties. Every 12 ft. there was a 4x6-in. timber on edge running from the center props to a hitch cut in the rock at the side. Between these timbers the track was blocked up temporarily, which blocking was removed as the concrete came up to it. The ties were set at a level high enough to bring their bottoms about 2 ins. above floor grade. See Fig. 11. The floor concreting was then started in the bottom of Shaft 4 and was carried back toward Shaft 3, so that there would be no passing over the green concrete. The floor consisted of 18 ins. of concrete with 1 in. square reinforcing rods across the tunnel every 12 ins. The concrete was pushed to the point of depositing in side dump cars and dumped in place. At first an area 12 ft. long by the full width of the tunnel was leveled up to within 3 ins. of the finished floor grade and the reinforcing rods placed. The remaining 3 ins. of

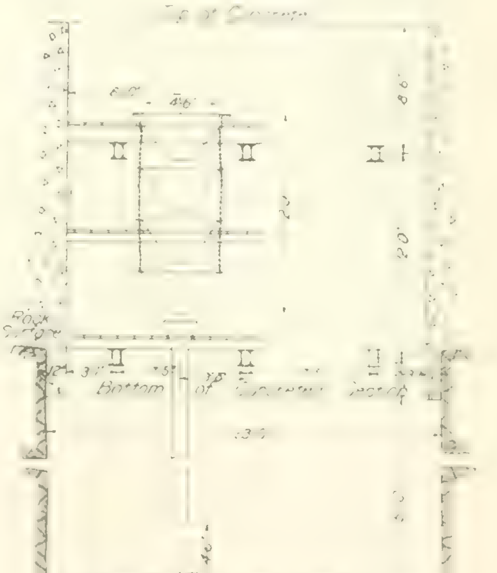


Fig. 10—Installation of Haines Mixer in Shaft.

concrete was placed and the top smoothed off. All blocking underneath the track was removed and two 2-in. planks slid under the ties between the cross timbers, referred to above. These planks prevented the ties from making indentations in the soft concrete. Along each side of the tunnel, close to the rock, a gutter about 6 to 8 ins. deep was left in the concrete. This served the double purpose of providing a drain for any water coming through the sides of the tunnel and also of affording a bond between the side walls and the bottom.

Tunnel Forms.—The forms for side walls and roof were of wood and the details can be seen from the accompanying plan, Fig. 12. The side wall forms were made up in 12-ft. sections. The uprights were 2x6 ins. spaced 18-in. centers, resting on a 2x6-in. sill and finished off with a 2x6-in. cap. These sections were sheathed up within 3 ft. of the top with 1-in. matched boards. After the concrete had reached the top of these boards, 1x6-in. boards were placed as the concrete was filled up. At the floor level 2x8-in. pieces ran across the tunnel between each pair of uprights, bracing them apart. At a point 4½ ft. above the floor level 4x6-in. braces ran across between the uprights and on these was the working platform, consisting of 2-in. planks laid longitudinally with the tunnel and for the entire width of the tunnel. On one side of the platform between the center timbers and the side wall was a 24-in. gage track from the concrete mixer. The concrete was brought in on cars and dumped on the flooring and then shoveled into place.

The roof forms consisted of 4x6-in. cross timbers with 2-in. planed plank as lagging. See Fig. 13. For about 2 ft. on each side of the tunnel this lagging ran along continuously, but for the remainder of the distance across the tunnel it was put in in 4-ft. lengths, which were placed as needed. Under the cross timbers of the roof, in the center of the tunnel, ran a 6x6-in. cap with 4x6-in. props from it down to the working platform, which in turn was propped from the bottom of the tunnel in the same manner. Previous to the starting of the concrete it had been decided to leave the center timbers in place and concrete them in. A 3x3-in. angle was cut to fit the space between each two timbers and a 2-in. cleat was nailed on the face of the timbers for this angle to rest on. The lower face of the angle was set flush with the lower side of the roof slab, and when concreting, the reinforcing rods in the roof were laid across the upper edge of the angle, which afforded a center support for the roof slab. Through forms were made for one-half the length of the tunnel (110 ft.) and these forms were set up, starting from a point half way between the two shafts and running to Shaft 4. The track for the concrete cars was built on a trestle from Shaft 3, to where it ran on to the working platform. Only one track was used and two cars were run on this. In loading at the chute from the mixer, there was room for one car to run past the chute. The first car was loaded and the second then brought under the chute and loaded. These two cars kept the concrete gang busy until two more came. The concrete gang at the bottom consisted of a foreman and six shovelers, two tampers and two men pushing cars. On the mixer there were two men and on top the gang consisted of a foreman and six men loading buckets. The concrete was made of river gravel, which contained a large amount of sand. The proportions were 1 cu. ft. of cement to 7 cu. ft. of gravel. This amounted to a mixture in the proportion of 1:2½:4½. Four bags of cement were dumped in with 1 cu. yd. of gravel in the bucket on top, and this was sent down to the mixer, where it was sent through and the water supplied for it. The sides and roof were concreted in about 50-ft. sections, it being arranged so that a section of the roof was going on at the same time as a section of side walls. The 110-ft was completed in about 5 days. T forms on the oldest 50-ft. section, wh at the middle of the tunnel, were tak and moved close to Shaft 3 and set up they were concreting this, the carpent down the next section and moved it b so on. By this method forms did not be handled through forms when they be reset.

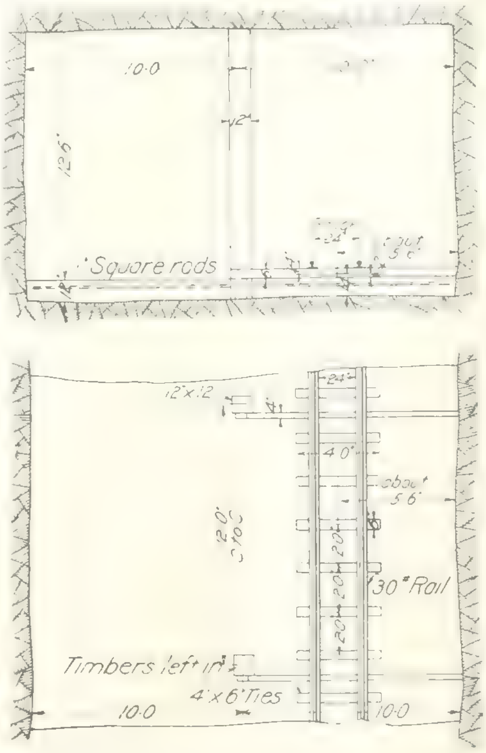


Fig. 11—Track Arrangement for Placing Concrete in Tunnel Floor..

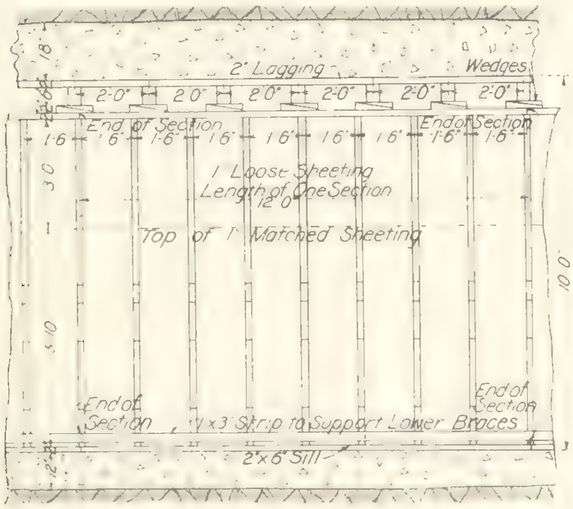


Fig. 12—Elevation of Wall Forms for Tunnels.

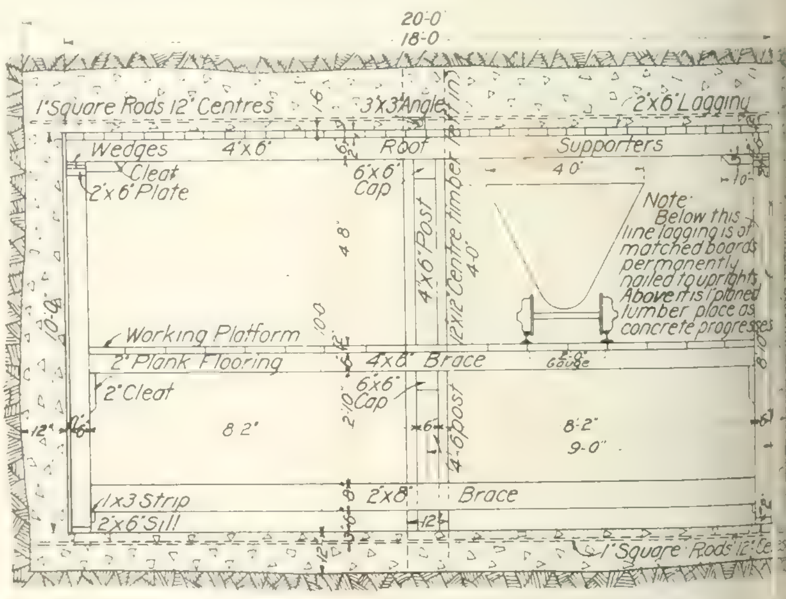


Fig. 13—Cross-section of Tunnel Showing Details of Concrete For

Shaft Forms.—When the tunnel h concreted, the forms for the shaft w At the bottom, two 6-ft. sections wer carrying the concrete above the to tunnel. Then 12-ft. sections were set were lagged for only 6 ft. of their hei a working platform placed on the bra up on the section and even with the to lagging. When the concrete reached of the lagging, the platform was pu braces placed at the top of the 12 ft. the lagging carried up to the top of tion, the platform replaced, and concre resumed, see Fig. 14.

The corner posts and uprights, 2 were 4x6 in., and these were braced b by 2x8 in. plank tied together at the sections. The lagging was 2 in. plane After the concreting at Shaft 4 had the height of the tunnel roof, the r of the concrete was mixed by hand, mixer at Shaft 3 was not available. 3 the concreting from the tunnel flo the bottom of the section previously mixed by the Hains mixer, as the la set with the bottom of it about 5 the bottom of the lined section. T was carried up in 6 ft. and 12 ft. sect as it was brought up, sections were from the chute leading down from t so that it would end about 2 working platform each time. In car all the shaft linings, steel plates resti cross braces were used for working p These plates were 8x10 ft., and by ov the end the two plates just covered inside the uprights excepting about 2 the sides. Along each side and acros a 2x12 in. plank was stood on edge t the wet concrete, gravel, etc., from ru the edges of the platform.

In concreting the Porter Ave. tunne mixer was set in the finished portion 2 and the tunnel and shafts were con exactly the same manner as the J tunnel. When it came to the conc Shaft 1 the water caused a great trouble which was overcome by b wooden collar around the shaft, ab below the rock surface, and lea water collected by this collar dow sump by means of sections of hose. concrete had reached as high as th at a water seam, pipes enough t flow of water from the seam were the concrete and the [illegible] to take the water from the rock When the concrete [illegible] more pipes were built in, and after te had set sufficiently all pipes were 100 lbs. pressure. After the grout grout pipes were cut off flush with f the concrete.

shaft there were steps made of 1 in. set in one corner and the design a reinforced concrete covering of but this was omitted to allow of tation of the pipes.

ire work was completed in the me (4 months), the last concreting early in April, and the forms re- tunnel cleaned out by April 10th.

SUMMARY

shaft sinking, outside of the earth he work was slow and expensive, brings to mind the matter of fast [illegible] Given a dry shaft of size, in almost any kind of rock, d drilling and mucking gang, I per- n see no earthly reason why a pro- 8 ft. per day cannot be kept up of 200 or 300 ft. On the other a shaft making a large amount of progress is a very indefinite quan- refore any comparison of shaft- rds or even of costs per cubic t work at various places, is very [illegible] often becomes not a question of shaft can be sunk, but whether or sunk at all. Grouting is without [illegible]

in uncertain rock should be kept ahead of each shot. If the shot r 3 ft. of the water seam it will the rock to it and make grouting ssible. The writer had cases like of the shafts described herein e, and found the best remedy was whole bottom of the shaft to a r 3 ins. with loose sand, apply the a thick mixture, and wherever broke up through the sand to place [illegible] t may seem, this will stop the leak Another scheme used where there e leaks was to shred up oakum and th the grout. Still another method is the water to rise several feet above to be grouted and then grout them y through long pipes, allowing the flow from a height a few feet above level. Although this grouting method [illegible] rs, it has just lately come into general is being hailed by many as a new e, in fact one man has gone so far ure a patent on it.

g the grout its consistency, mixture ure should be varied to suit condi- can be easily ascertained whether or m encountered is a heavy or a light the former, a mixture of 1 part 2 parts sand will work well, although s much slower than neat cement. In rk, it is of course the idea to get the pped by using as little material and little delay as possible, and if the heavy and extends over a large area l to use the mixture mentioned, and ick, using as short a hose as possible grout machine to the holes, so that ot clog. Another important point is the holes placed within a few feet of er around the outside lines of the l grout them alternately, pumping one batches in each hole until all are f it is desired to penetrate the seam possible the grout should of course d thin. On light seams the grout e made of neat cement and mixed thin ery light seams the holes may have aced only a foot apart and the seam e to be blown out with air before Grout with sand in it is much better [illegible] method of mixing as the paddles help keep the mixture moving, as it is blown out, and gradually work the sand and cement toward the outlet. When using neat cement there is very little difference in speed and results between the mechanical mixer and the air jet mixer.

On the tunnel work the conditions were more favorable for fast work and the results accordingly show to better advantage, although had the conditions permitted of the drilling and shooting of 10 ft. rounds the progress would have been much better. The Porter Ave. tunnel presented the better working conditions as the rock in the heading, though hard, was even drilling with no slips, except at the tunnel roof and one at the top of the bench. Consequently it was a rare occurrence to find a blocky hole. The actual time for mucking out the heading, setting up, drilling and tearing down was often only 6 hours, or less in this tunnel, while at Jersey [illegible] time ran about 7 hours. In the tunnels the four drill runners in the heading and their helpers mucked out the heading, while the bench runner and his helper cleared a space for the first bench hole. The muckers cleared off for the other bench holes while he was drilling the first one. As the muck was usually so high that it was impossible to find the face of the bench the bench driller on each shift on tearing down placed his three tripod weights in a pile close to the right hand rib exactly where the next round would come. As these weights were uncovered in the first few minutes the runner on the bench knew where to place his holes without waiting to find the face of the bench, which usually was not uncovered until the middle of the shift. The drillers in the heading each drilled five holes 8 ft. deep and the runners on the bench drilled usually one round of five 6-ft. holes. While the short distance from heading to shaft would have at all times been advantageous, much of this advantage was lost from various reasons. One was that the quick handling of muck was in a measure checked by the slowness of its disposal on top by the teams. The advantage of better ventilation was overcome by the fact that there was a continuous sheet of water falling down the shaft and this held the smoke back in the tunnel. In firing the heading delay action exploders were used and that and the method of working enabled us to complete the shooting in from 15 to 30 minutes, as only two shots were required. In going in after the second shot, the heading foreman took with him one day the two runners and helpers from the top machines, and the next day took the two from the bottom machines, while the bench man saw to the wires and watched at the firing switch which was located at the top of the shaft. The mucking gangs attended to getting the machines, columns, arms, etc., into the heading when the drillers were ready for them and to taking them out after the runners had torn down.

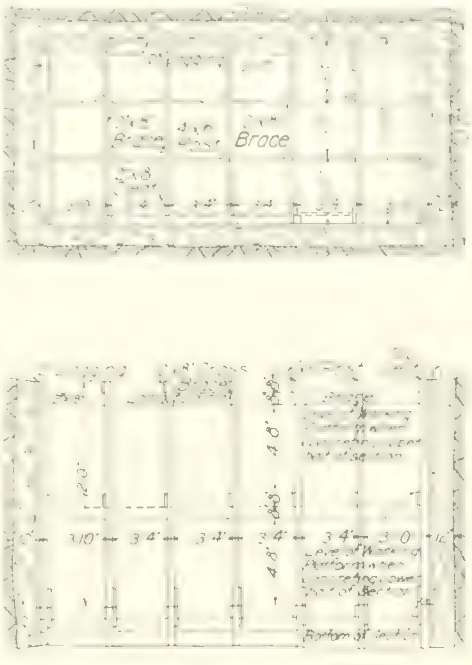


Fig. 14—Details of Concrete Forms for Shafts.

In [illegible] there has been lately a number of claims made for the scheme of firing a heading with fuse and caps as against electric exploders. This is largely due to the fact that of late there are a number of miners who have drifted east and into tunnel work and they, aided and abetted by parties who are always after something new, have hauled out this fuse and cap [illegible] is but one shot to be made and that the fuse can be cut various lengths so that the holes will go each at a different and appointed time. Now in the first place the method of placing the holes, which in almost all classes of rock gives best results, is the center cut and side round method, with, of course, dry or trimming holes for taking the roof of the heading to grade and line. With this method, always supposing there is only one side round, there will be only three shots not counting the holes on the bench which of course can be fired with the heading holes. In the heading in question there would be six cut holes, six side round holes and five dry holes and it becomes a question not of cutting the fuse of different lengths but of in two cases cutting six pieces of fuse exactly the same length, as to get results it is absolutely necessary to have all the cut holes go at exactly the same time and there is no question about the utter impossibility of cutting that number of fuses so that the six holes will go at exactly the same instant. Even if the fuse is measured to a hair and all taken from the same coil there are bound to be some places in it with a larger amount of powder than in others and therefore the different pieces of fuse will vary considerably in the time of burning. In addition to this it is impossible to light all the fuses at exactly the same instant. Another reason that electricity is better than fuse in a tunnel, is because the fuse adds a great deal to the smoke and if any sort of a fast schedule is to be maintained this is quite an item. At first glance it might appear that the extra smoke would not amount to much, but there are in this case, counting the bench round, 22 holes at one shot and allowing say 5 ft. of fuse to the hole there would be 110 ft. of fuse in all. It must also be taken into consideration that the tar, and tape covering of the fuse makes the worst kind of smoke. The advantages of the electric exploders are so obvious to anyone that it should not be necessary to explain them but in spite of this the writer knows of several tunnel contracts in the eastern states where fuse and caps are used and electric exploders dismissed with the contemptuous remark that they are no good. There are of course places where it is advantageous to use fuse. For instance, when it is desired to set off several holes at intervals of a few seconds in an open cut or in some place where a battery or electric current is not available. It is a fact, however, that in tunnel headings in mines where fuse is used largely, the holes are so drilled that they have to be fired a few at a time, and for that reason the fuse is advantageous. And right there is the whole argument. The fuse is used because the holes are drilled that way and the holes are drilled that way because they use the fuse. The writer has seen a great number of these combinations, or one might say complications of holes, has tried both in the east and in the west and has never seen any advantage over the center cut method and in all but a few of the softest formations has found decided disadvantages, chief among them being that more holes are required for a given area of heading and a great deal more powder.

Another point which should be mentioned is in regard to the hard rock encountered in connection with some remarkable rock tunneling progress records, which have been published in the last few years. The parties in charge of some of these tunnels tell of the extremely hard rock encountered and later on go into the details of an elaborate system of timbering which was necessary to hold up the arched roof of headings which in some cases are as small as 8 ft. wide. Naturally one wonders about this extremely hard, or quite hard, or medium hard rock that requires continuous timbering. Of course there are cases of extremely hard rock which had to be timbered in places but that is on account of seams in the rock. A case in point was in some of the headings from the East Ave. shaft of the Pennsylvania Railroad tunnels at Long Island City. There the rock varied, but in most cases was extremely hard and at some points needed timbering as the tunnels were of large diameter and there were occasional seams running in such a way as to detach heavy pieces. In general, however, if rock is so soft as to need continuous timbering it will be easy to make rock tunnel records and the heading can usually be shot by almost any sort of an arrangement of holes.

There has arisen of late years quite an argument as to whether the best method of tunnel driving is to use a top heading and bench system or to use the bottom heading method. This argument has somewhat the aspect of two parties arguing as to whether a section of sewer across a valley and through a mountain should be built in tunnel or open cut. To the casual onlooker it would seem that the part across the valley should be open cut, while through the hill it should be tunnel. Similarly, there are tunnels and tunnels. Some can be driven better by one method than by the other but the only way to get quick work and economical results is thoroughly to study the work, get the most suitable plant and then carefully systematize the work and organize it so as to run as nearly as possible without friction. Also do as much work as possible by machinery.

On the tunnels described herein the men were paid a bonus for fast work. There was no bonus system that could be applied to the shaft work but as soon as the headings were turned a system, similar to that used by the contractors on their previous tunnel work, was put into effect. The minimum week's work was set at 55 ft. This was divided into three parts giving a progress of 18 ft. 4 ins. for each gang to make in one week. Th ing advance was measured carefully af shot and each foreman credited with tance made by his shot. For everythi over the required amount the heading fore re-ceived 50 cts. per ft., the drill runners cts per foot, and the helpers and nippers cts per foot. In case any of them lost m than one day during the week they rece no bonus. As the tunnels were short it not thought necessary to pay bonus to th muckers and concrete men.

It was an extremely hard matter t rrive at anything like an accurate unit cost th shaft work but tables of the cost of nel excavation is appended and also t the concrete work. These are averag for the entire tunnels.

This work was carried out for the Buffalo and was designed by the Dep of Public Works, F. G. Ward, Commi and S. J. Fields, Engineer in Charg contractor was the Buffalo Dredgin pany, S. J. Dark, Vice-Preside John Record, Chief Engineer, with C. lingsworth in charge as Manager o struction. R. E. Mosier and W. B were Superintendents on the differen

ROADS AND STREETS SECTIO

Costs of Constructing and Maintaining Petrolithic Roads and Streets, Together With Data On Other Liquid Asphalt Roads.

Contributed by K. F. Postle, Los Angeles, Calif.

In view of the tangle of statements that have been made at various times in the past, in talk, in various reports, and in newspaper and magazine articles, regarding the oiled roads of California and their values, a few facts that can be positively confirmed are pertinent and valuable. Much of the confusion and contradiction is only seeming. It is caused by an unscientific consideration of the subject, and unfortunately this blame has attached to engineers almost as much as to non-professionals. There has been a failure to gather together all the facts in any given case, combined with a failure carefully to consider all the relations of such facts as were actually taken. Hasty, unsound reasoning and conclusions thus have been inevitable. These conclusions, too quickly formed, and statements, too quickly made, have caused a vast deal more trouble than the mere original errors, because few men, particularly professional men, care to retract.

The use of oil on roads in California goes back perhaps about 30 years, but it was first merely splashed on the roads irregularly and indiscriminately. Real construction dates back only 8 to 12 years. Perhaps the real beginning of constructive work may be set at about 12 years ago, when a road builder in Kern County invented a sheeps-foot tamping roller, now known as the petrolithic rolling tamper, and began to compact roads with it. The development was slow for a few years until the value of this method of road construction began to be perceived. Then it advanced with unprecedented rapidity. This rapidity of development, as always happens in extremely rapid development, has been accompanied by and involved with much confusion and much misapplication of methods and materials.

The terminology is still confused and misleading. For example, in the beginning, crude and comparatively light asphaltic oil was used; now heavy refined asphaltic oil is used, which is properly a modified liquid asphalt. In view of this actuality and because the term "oil" conveys a wrong conception to the larger part of the road world, the terms "liquid asphaltic construction" and "liquid asphaltic roads" will be used in this article instead of "oiled," as it is termed locally in California. We deem "liquid asphaltic" properly the correct descriptive term. Another specific term which it will be necessary to use is "Petrolithic built," referring to construction in which the tamping roller has been employed for compacting the roadway. The tamping roller is made by the Petrolithic Pavement Co., Los Angeles.

There are in southern California (the particular home of "oiled" roads) 1,500 or more miles of liquid asphaltic roads that may be considered as passably well built. There are hundreds more miles of oil-splashed roads, which are an improvement over the original dirt and sand roads, but can not be considered as modern liquid asphaltic constructed roads. These roads have been a very great element in the unparalleled development of southern California. Some of them are very cheap construction and are not to be compared with costly pavements; but in spite of cheapness they have served their purpose more effectively at less cost than any other country road system in any other part of America has served its community. No matter how wet the weather one can go practically all over the settled parts of southern California without getting into bad mud. No matter how dry, one can go almost everywhere without getting into bad sand Because of these roads our teamster larly haul two, four, six, eight, and ten a load—loads which ordinary eastern te would consider as horrible nightmar cause of these roads our people g freely and easily throughout the entire Because of these roads, together w equable climate, automobiles are in u practical use. Automobiles have bec valuable in modern life, as incalcul creasing the range and amount of a m pacity and activity.

The cheapest of these roads, which considered passably well built, have c than $1,000 per mile. The upkeep cheaper roads has varied under differ cumstances between $25 and $50 per year. As population and traffic have i (and they have increased in many ca overwhelming rapidity) the cheape have been or are being replaced wit costly construction to meet the increa mands. The great increase of traffi must be provided for may be gauged degree from the fact that many of ou

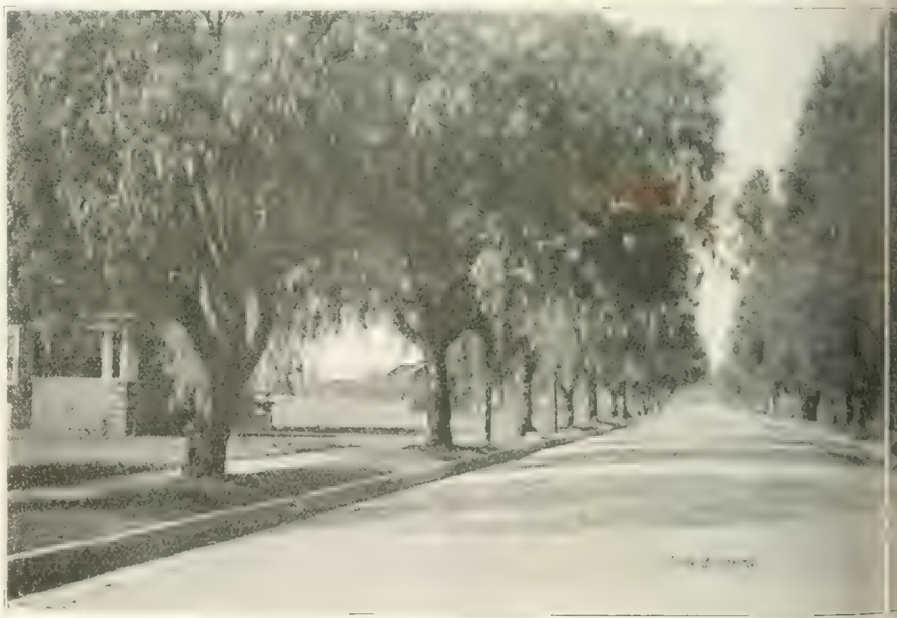


Fig. 1. Petrolithic Built Asphaltic-Natural Soil Pavement on Adams St., Glen

ry roads carry more and heavier traf- he ordinary streets of many cities of aving a popula [illegible] ore durable liquid asphaltic construc- [illegible]

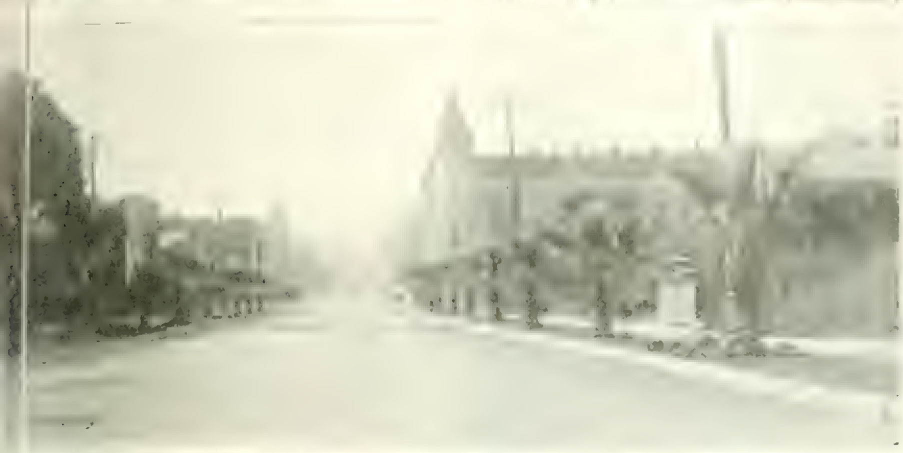


Fig. 2. Petrolithic Built Liquid Asphaltic Macadam on Main St., Ventura.

45 cts. to $1 per sq. yd. It has not than this except under special ex- conditions, or financial misman- In some instances, where the mate- eculiarly ready to hand, the con- is cost as low as 30 cts. per sq. yd. of these durably constructed as- ls have been in service six, seven, ears. Many of these roads have irs put on them as yet. The worst ve had as much as 4.5 cts. per sq. [illegible] s. This heaviest expenditure has partial rebuilding to correct de- struction and has usually been in where perfection of smooth sur- emanded.

s been costly misconstruction, how- s class of work, just as there is in of work the world over. There rs and contractors who never leave of road behind them. There are neers and contractors who rarely [illegible] ment, probably most of it, regarding onstruction comes from men who elves failed, and are not willing to they themselves could be in fault. rive to excuse their failure by laying ne on the system. The fact remains system is proving itself and going on such reports.

a very few of the basic facts can be in this article. Several streets still South Pasadena which were Petrolith- nine or ten years ago of merely the soil and oil at a cost of about 18 cts. yd. These streets have had no re- nd, though not in A 1 condition, are yet that the city does not consider that ave to be repaired and the residents e same.

lale, Los Angeles County, has a number s of liquid asphaltic streets Petrolithic sing only the native sandy soil as it he roadway. Most of the streets have use four, five, and six years, have had irs, and are today equal in appearance of the sheet asphalt streets in some of tern cities, though not so hard. The e streets cost from 18 to 35 cts. per sq. ig. 1 is a view of one of these Petro- uilt streets in Glendale.

[illegible] , Cal., has several miles of liquid as- streets, Petrolithic built, with only the sandy soil, at a cost from 14 to 18 cts. yd. These streets lasted seven years it was thought necessary to make any on them.

automobile race course of Santa Moni- which the world's records have been , is over the ordinary liquid asphaltic of Santa Monica and a short stretch of nt country. This course, with a very exception, is all Petrolithic built of only the native soil, which carries a small per cent of low-grade gravel. These streets were built in 1906 and 1907 (being constructed under vari- [illegible] them, yet to date they have cost less than 1.1 ct. per sq. yd. in upkeep. They have not given way at any point in any of the races.

These are a few of many such facts regarding the much maligned but persistent earth and oil construction. This grade of construction, where no broken stone is used, is not designed for a high grade pavement, but is designed to attain, with very low cost, durable, serviceable, economical country roads and small town streets for light traffic.

Monrovia, in Los Angeles County, has over 25 miles of asphaltic streets, most of which have been in service from four to six years. These streets are Petrolithic built, using just the native soil, which, however, is an excellent granite gravel lying on the mountain slope. No expenditure for upkeep has been put on many of these streets, although they are subjected to comparatively heavy trucking and auto traffic. On the few streets that have been retouched as yet, and the expenditure has been so slight that the street department has considered it negligible. The cost of construction has ranged between 25 and 40 cts. per sq. yd. These streets are so good that visitors usually think that the pavement is costly sheet asphalt.

Ventura, California, has over 13 miles of liquid asphaltic streets, which were built about four years ago at a cost of about 58 cts. per sq. yd. These pavements are a form of Petrolithic built liquid asphaltic macadam. A view of one of these Petrolithic built streets is shown in Fig. 2. Some of them show some minor defects of construction, but as a whole they are considered by many of the residents as equal to sheet asphalt. Certainly no other equal aggregation of streets that cost less than $1 per sq. yd. will stand comparison with them. There are no records of upkeep expenditure of any sort on them as yet.

Santa Ana, California, has several miles of liquid asphaltic streets which have been in service about three years. They are Petrolithic built asphaltic macadam, and cost between 59 and 68 cts. per sq. yd. These pavements are on several higher class residence streets and side business streets, and are deemed by most of the residents superior to regular sheet asphalt. No repairs have yet occurred on the streets. Fig. 3 shows one of the Petrolithic built asphalt macadam pavements in this city.

About 6½ miles of road lying along the foot of the mountains back of Pasadena, and constituting a link of the Los Angeles County good road system, was Petrolithic built about two years ago, using only the soil of the mountain slope, which bears a large proportion of granite gravel. This road carries a great deal of automobile and hauling traffic and is subject to the wash of heavy mountain rains, yet it is proving superior to the great mass of much more costly 8-in. asphalt macadam laid about the same time. It is deemed one of the best pieces of road in the system.

North Grand Ave., in Pasadena, has been under service for six years without any outlay for repairs. It is Petrolithic built liquid asphaltic macadam, and is in excellent condition today.

Pasadena has many miles of asphaltic streets of various grades and variously built. Its asphaltic macadams range between 1 in. and 6 ins. in thickness of the actual stone pavement. Some of these streets carry a traffic of 1,000 to 1,500 automobiles a day besides other light and trucking traffic. Some of the streets have records of very heavy hauling. The asphaltic macadam pavements cost from $1 per sq. yd. downward. Most of them have called for no repairs as yet. The extreme cost of repair, when misconstruction made necessary a partial reconstruction of the pavement, has been 4.5 cts. per sq. yd. or less; this cost covered scarifying and reshaping the entire surface, and pavements so treated are now A 1.

Outside of the slight surface abrasion, all of the pavements referred to are apparently improving in quality with age instead of deteriorating. Such improvement under aging is coming to be accepted as one of the sure qualities of plastic asphalt (asphaltic) pavements.

It may be interesting also to cite, along with these roads, the boulevard built by the United States through the Fort Rosencrans Reservation on Point Loma, San Diego County, Cal., and the extensive boulevards built by A. G. Spalding through the adjoining territory. These are sand-clay roads, Petrolithic built, except that no liquid asphalt was used. They are accounted among the finest auto roads in the world.

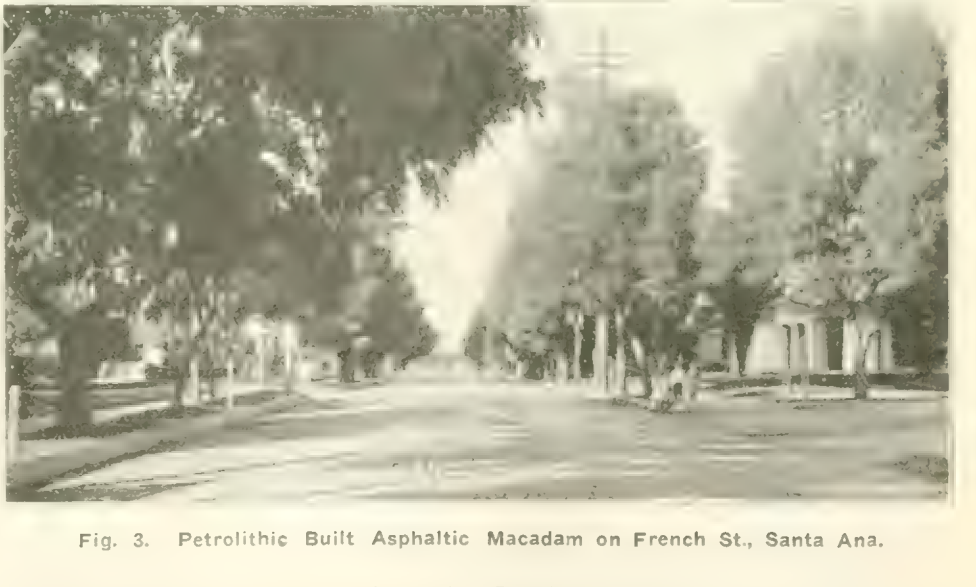


Fig. 3. Petrolithic Built Asphaltic Macadam on French St., Santa Ana.

The cost data herein quoted are either the contract prices or the maximum totals of all expenditures. A great many lower cost data could be quoted, but these seem sufficiently illustrative. These pavements are only a few representatives of liquid asphaltic roadway construction. They explain, in a small way, why California liquid asphaltic construction is spreading despite no small amount of misunderstanding, misapplication, and misstatement. This type of construction is not fitted to California conditions alone, but is proving its worth under all climatic conditions. It has stood up even in so wet a climate as South Bellingham, Wash., and is withstanding the freezing weather of Spokane.

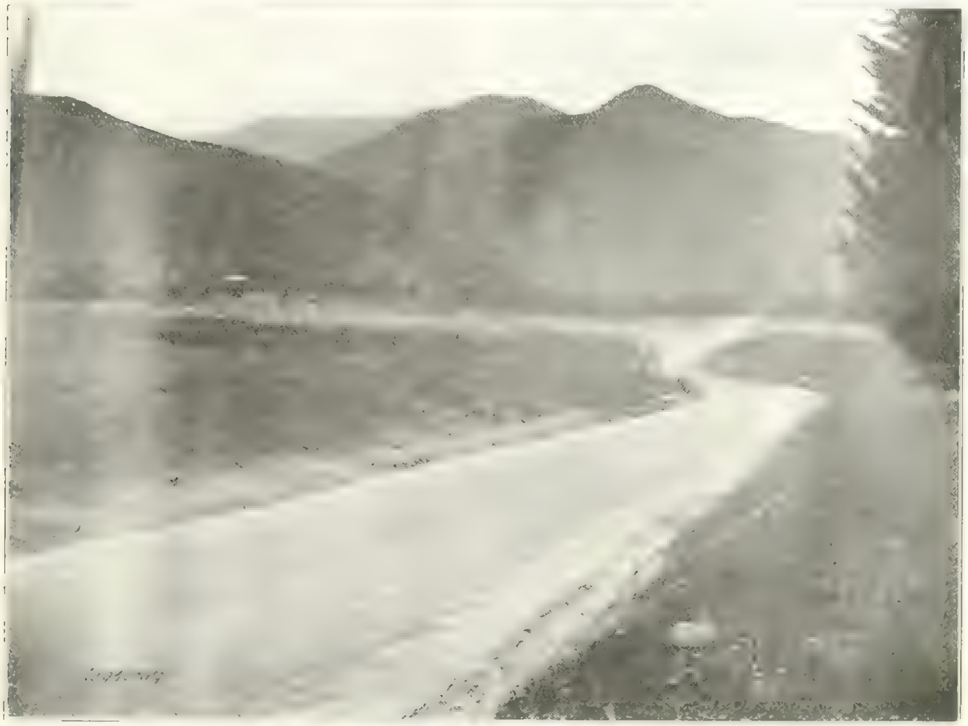


Fig. 4. Petrolithic Built Asphaltic-Gravel Construction on Altadena Drive, Los Angeles County Road System.

At the Nepissing Mine in the Cobalt District of Canada prospecting for outcrops has been carried on extensively by surface trenches. During a three-year period 91.9 miles or 485,232 ft. of trenches have been made by the company, as stated by the Engineering & Mining Journal. The average depth of trenches in 1909 was 4.1 ft.; in 1909, 3.4 ft.; in 1910, 2.7 ft., and the average depth for all work during that period 3.37 ft. Assuming an average width of 2 ft., this would give 6.74 cu. ft. per lin. ft. of trench. All the work was done with an average of 78 men during the working season, equaling 18½ months. Allowing a total of 500 working days, the average day's work was about 9.70 lin. ft. or 6,537 cu. ft. of trenches. This would indicate that the average work per man on trench work under similar conditions should be approximately 12.5 ft. of trench averaging 3.37 in depth, or about 84 cu. ft. The average cost per ft. of all the trenching was 23.2 cts. in 1908; 15.2 cts. in 1909, and 13.9 cts. in 1910. The average cost of 91.9 miles was approximately 17.3 per ft.

Water and Light Association Meeting.—The Tri-State Water and Light Association of the Carolinas and Georgia held its second annual convention in Salisbury, N. C., on April 16 and 17. Mr. W. F. Stieglitz of Columbia, S. C., was elected president, and J. W. Neave of Salisbury, N. C., was reelected secretary-treasurer for the coming year. Many new members were added at the Salisbury convention.

Cost of Crushing Rock at the Pacoima Quarry of the Los Angeles County Highway Commission.

The following data, which were taken from the report of the Los Angeles Highway Commission for the six months, July 1, 1911, to Jan. 1, 1912, show the cost of crushing rock at the Pacoima quarry of the commission. A description of this quarry, the methods of working it, and detailed data for the previous 6-month period, were given in our issue of Oct. 4, 1911.

The plant includes one No. 4 and one No. 6 Austin gyratory crushers, loading bins, steam shovel, track, quarry cars, electric locomotive, scale house, bunk and boarding house. The labor consists largely of Mexicans, who are paid $2 per 8-hour day.

Table I. shows the number of men employed and the output for the six months. Ta II shows the unit costs of operation and tenance and Table III gives the amo of powder used, and its cost.

As will be seen from Table I, the tota ber of 8-hour shifts worked from Jul to Dec. 31 was 331, which is equivalent t 648 hours. The power consumption for the was 89,994 K. W. hours at 1¾ cts. and 646 K. W. hours at 1½ cts., making a t of 107,640 K. W. hours. The average consumption per hour was 40.65 K. W. or 55.25 h.p.

TABLE III.—AMOUNT AND COST OF POWDER USED.

	Powder used. Lbs.	Per ton crushed rock. Lbs.	Total cost powder
July	1,860	.11	$213.90
August	1,337	.07	153.76
September	1,655	.09	190.32
October	860	.04	98.50
November	1,055	.05	131.80
December	243	.01	27.82
6 mo. period	7,010	.06	$816.10

Endurance Tests on Specimen Roa faces.—The National Physical Labc of Great Britain has installed in a new division of its engineering department atus for making endurance tests on roa faces. In these tests the specimen road tested is laid in the form of a circula 2 ft. 6 ins. wide of a mean diameter ft. The endurance of the center 2 ft. track is tested by the roling on it of eig steel wheels, the wheels being at an distance of 45° from each other, an wheel rotated by a separate 2 b.h.p. motor mounted on a steel arm, which round the center post. The radial distr of the wheels is such that the whole w 2 ft. is covered in one revolution of the and as a further precaution to insure u wear each wheel is moved backwards a wards radially by a cam mechanism a distance of 1 in. The eight arms hinged to a rotating boss on the cente and at their outer ends are connected by springs to eight corersponding cantileve idlv fixed to a second rotating boss co with the former and immediately bel By means of a regulating wheel on each the pressure of each wheel on the track adjusted to any desired value up to The armatures of the eight motors ar nected in series, the maximum voltage o the machines being 440 volts. The mai rent is supplied from a motor ge through two slips-rings on the cente

TABLE I.—FORCE EMPLOYED AND OUTPUT.

Period	Force: Average Men Day.	Night.	Total.	Average stock.	Output: Shifts run.	Tonnage
July	68	52	120	26	56	16,781
August	[illegible]	[illegible]	125	26	57	18,439
September	70	48	118	26	56	16,719
October	57	34	91	26	57	22,122
November	38	23	61	26	55	20,546
December	44	24	68	26	50	21,617
Six month period	58	39	97	26	331	116,224

TABLE II.—UNIT COST OF OPERATION AND MAINTENANCE OF THE PACOIMA QU OF THE LOS ANGELES COUNTY HIGHWAY COMMISSION FOR SIX-MONTHS PERI

	July Per ton. Cts.	August. Per ton. Cts.	Sept. Per ton. Cts.	Oct. Per ton. Cts.	Nov. Per ton. Cts.	Dec. Per ton. Cts.	Average Per ton. Cts.
Superintendent and other salaries	2.30	2.17	2.30	1.74	1.87	1.48	1.94
Stripping, labor	7.12	5.95	7.46	2.36	.04	3.71	4.19
Drilling and blasting, labor	1.27	1.19	.84	.37	.31	.11	.64
Drilling and blasting, powder	1.27	.83	1.14	.44	.64	.13	.70
Drilling and blasting, other material	[illegible]	.06	.02	.02	.01	....	.03
Loading and transporting quarry to crusher, labor	24.94	23.96	23.55	18.04	14.50	13.41	19.28
Loading and transporting quarry to crusher, material	.81	.99	2.22	1.36	1.49	1.40	1.38
Handling muck, labor	14.42	13.44	13.18	7.06	5.96	3.74	9.20
Handling muck, material	.06	.87	....	....	....	....	.28
Plant operation, labor	[illegible]	2.30	2.57	2.05	2.54	2.27	2.34
Loading and shipping, labor	.79	.50	.44	.29	.59	.82	.57
Maintenance, labor	1.42	1.28	1.62	1.16	.90	.90	1.19
Maintenance, material	4.37	2.13	2.12	2.54	2.33	2.05	2.55
General, labor	[illegible]	.41	.17	.20	.06	.20	.19
General sundry		.09	.06	....	.01	.08	.04
Power	1.92	1.62	1.80	1.32	1.53	1.43	1.58
Totals	64.17	77.79	59.49	38.95	32.78	31.73	*46.10

*The profits from the employes' boarding house, run by the Commission, amounted to $ 1.89 cts. per ton, deducting this from 46.10 cts. gives a net cost of 44.21 cts. per ton nt-field coils of the motors are con- eries, and supplied direct from the [illegible] through two smaller slip [illegible] ated, states *The Surveyor*, that, in a road of tar-macadam, by the use el wheels running at 10 m.p.h., 24 co inuous runing would represent one on a typical heavily trafficked road. e will, of course, be available for tests of rubber-tired wheels at the [illegible] which can be attained [illegible]

nterest on Repairs Be In- l in the Total Annual Cost of a Pavement?

[illegible] reply to my letter of Mar [illegible] [illegible] pavement [illegible] [illegible] issue of Engineering & Contr [illegible] that I am in error on several [illegible] [illegible] is considerable room for [illegible] opinion and trust you will [illegible] [illegible] side.

[illegible] place the definition of [illegible] portant. As stated, the basis [illegible] is that "the average annual cost of [illegible] pavement may be defined as that oney which, if contributed annually, the existing conditions keep the ally paved and repaired."

on this basis, the first point of s in regard to including the item of repairs to pavement surfacing when [illegible] kinds on an annual cost [illegible]

[illegible] says this is improper. I [illegible] lly done, but strictly speaking be- correct.

e the difference, assume an as- g to last 20 years with a typical [illegible] for repairs as follows:

Yearly cost of repairs per sq. yd.
[illegible]
[illegible]
.016
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
.102
.113
.125

thod of finding the annual cost of uld be to add these yearly expendi- h would give $0.862 and then divid- 20 would give [illegible] as the annual pairs.

[illegible] I suggested would find the total [illegible] to the end of the 20 years with compound interest at say 4 per cent, which in the same example would be $1.027. Then the annual cost of repairs would be taken as the [illegible] aside annually during the 20 years at 4 per cent to equal this $1.027, which would be $0.033. [illegible] cluding interest reduces the annual repair cost 25 per cent.

Your method would give the same result [illegible] general your method would be strictly true only where the annual expenditure for repairs was a constant starting at zero life a very improbable condition for pavements. The other method takes account of when the expenditure was made and it gives the actual payment to be made each and every year during the life of the pavement to just pay for all the repairs during its life. This method in cases may be an unnecessary refinement, but it is strictly in accordance with the definition of annual cost given which I believe to be a sound one.

As for calculating interest on the interest, the results by both methods would be identical, as the annual interest charge on the first cost is a constant, but it would be an absurd waste of time. The statement likewise applies to your illustration of tie renewals as the annual expenditure would be, for the 100-year period, practically a constant and hence is not a parallel case to that of an asphalt pavement where the repair cost increases year by year during its life.

A modern pavement surfacing such as asphalt has in general a limited life which is quite independent of the life of a possibly everlasting concrete foundation. The surfacing, moreover, is subject to an increasing yearly cost of repairs. The proper unit of time to be considered in comparing annual costs of surfacing is the present probable life of those surfacings, and not some multiple of the life as suggested. The annual cost of the foundation can be considered separately in the same way. For all practical purposes it is immaterial whether a concrete pavement foundation costing say $1 per sq. yd. lasts one century or ten centuries.

The other main point of difference is as to whether the method outlined in the "Handbook of Cost Data" (of which article I was not previously aware) or the one referred to in the 'Municipal Journal" is correct.

The general principles underlying both are similar, viz.: that the economic time to renew a pavement surfacing is at that period of its life which shows a minimum annual cost during its whole existence.

The method of arriving at this annual cost, however, differs, the essential difference being that for the [illegible] investment you use the first cost divided by the age in years of the pavement, whereas I used a sinking fund with interest to redeem, in the same number of years, the net cost (i. e., making due allowance for cost of removing or salvage value) of the surfacing.

I can see no reason for neglecting the item of interest as is done in your method, a very important factor when dealing in long time periods such as 20 years. In fact this point is practically conceded in your illustrative example in the editorial in Engineering & Contracting of March 20.

The question of including interest in determining the annual repair cost again comes up as explained in the first part of this letter, but this is a comparatively minor matter.

Perhaps an example will best illustrate these [illegible]

[illegible] suming a 20-year life and $1.40 as the first cost of the asphalt surfacing, the annual cost figured by the two methods would be:

Method in "Cost Data."

$1.40 ÷ 20 = $0.07 Annual sum to wipe out investment.

.862 ÷ 20 = .043 Annual repair cost.

$0.113 Annual cost.

Method in Municipal Journal.

Assuming $0.10 as cost of removal of surfacing. Net cost = $1.50.

[illegible] [illegible]

Annual repair cost .... .033

[illegible] [illegible]

Annual interest on first cost is neglected in [illegible]

It will readily be seen from this typical example that the results are materially different, one giving 40 per cent more than the other. Your article stated that your method was correct and mine was incorrect. I believe the reverse to be true. You should allow interest on the annual payments to wipe out the investment, otherwise you have a decreasing capital account in which case yearly interest on the investment is not a constant as you state.

Again, if it be admitted that leaving out the item of interest on the cost of repairs is in general strictly correct only when the annual expenditure for repairs is a constant then it will be observed that in such case the method of determining the economic time for renewal is itself absurd, as renewal would never be economical. In other words, at the only time when your allowance for repairs is correct, the method under discussion is itself inapplicable.

Furthermore, if the above contentions are sound, then it would seem that all the formulae developed on this basis in "Cost Data" are in serious error.

Very truly yours,

J. E. BARLOW,

Assoc. M. Am. Soc. C. E.

Cincinnati, O., April 12, 1912.

ATER SUPPLY, SEWERAGE AND SANITATION SECTION

of the Investigation of the rolytic Corrosion of Under- und Metallic Structures in Milwaukee.

estigation of the effect of electrolysis rface metallic structures in Milwau- made by Ray Palmer, [illegible] of Chicago, during the [illegible] A summary of the findings of the ion is presented herewith, together conclusions drawn and the recom- ns made. This information was this journal by Mr. Palmer. The as made to the Commissioner of orks and will later be published in bulletin of the Bureau of Economy iency.

almer believes that a great mistake by most architects and engineers in do not provide in their specifications protection of the sub-structural steel buildings from electrolytical dam- small expenditure to cover the installation cost of iron or steel ground plates and necessary copper leads for connecting the sub-surface metallic work, will protect the steel work from stray current damage if the local rail returns are properly constructed. The Majestic Building, located on Grand Ave., between Second and Third Sts., is well protected by means of a larger copper ground plate sunk in the ground below the basement floor and connected to the sub-surface metallic work by copper wires.

The amount of damage which has been done by the stray electric railway currents in Milwaukee cannot intelligently be estimated direct, nor can it be approximated any more than the actual damage which is done to a fire-gutted structural steel office building could be estimated without taking an inventory, making an appraisal and examining the physical condition of the building after the fire.

In most of the outlying sections of each feeding station district the water pipes are practically free from electrolysis damage as [illegible] tests taken [illegible] while excavation in these districts might show that considerable damage has been done in the past when the electric current conditions were different from now. The high expense involved makes it impracticable to excavate except in a few places in the present dangerous districts. There are chances that the average damaged conditions may be found, but more probable extreme conditions will be found which cannot be used in establishing the average amount of damage done.

We know, however, that the present Milwaukee water pipe distribution system cost the city $4,507,835.11 since construction began in 1872; that the system at present consists of 463 miles of 4-in. to 42-in. pipe lines; that the pipe lines on 10 miles of streets out of a total of 78 miles surveyed shows from tests that they are being damaged by stray currents at the present time; that most pipes when exposed in these dangerous districts show a damaged condition; that some of the high pipe maintenance cost is due to the bursting of electrolysis-damaged water mains, and that no systematic effort, except repairing the defective bonds and track work as it is found, is being made on the part of the electric railway companies to eliminate the damage or reduce this maintenance cost.

CONCLUSIONS.

The following conclusions are drawn from the facts and figures as shown in the report:

First: That too little thought has been given the electrolysis problem in Milwaukee. When one considers that the citizens of Milwaukee are paying and have been paying for years (in direct costs, rates, or taxes) high maintenance or repair costs due to damage done by electric railway return currents, it becomes a serious problem and every citizen should be interested in its settlement. These maintenance or repair costs may be paid direct to some plumber for repairing or renewing a service pipe, or to the gas and lighting companies in high rates to maintain their lines, or it may be paid to the city in the way of necessary taxes to maintain the water pipe system.

Second: That the water pipe mains have been seriously damaged in certain districts in Milwaukee and that they, with other sub-surface metallic structures, are now being damaged by the stray electric railway currents.

The city of Milwaukee, its corporations and individuals have millions of dollars invested in the pipe lines, cables, structural steel buildings, etc., within the city limits, and we believe this investment should be protected.

All of these sub-surface metallic structures lying within positive areas are more or less subjected to damaging electrolysis conditions as they exist at present in Milwaukee.

Third: That there is no practical way of estimating the total damage which has been done to the city water mains.

Fourth: That there are practical remedies for reducing the damage being done so that no appreciable damage will be done by the Milwaukee single trolley rail return systems if the railway companies make the necessary improvements as recommended and described below.

SUMMARY OF REMEDIES FOR ELECTROLYSIS DAMAGE.

There are three distinct remedies which could be applied in Milwaukee for eliminating or bringing to a practical minimum the damage being done by the street railway return currents.

First: As has already been stated in this report this electrolysis damage can be eliminated by the reconstruction of the present system into an insulated return system like the double overhead trolley or underground slot conduit.

Second: By the installation of what is known as a negative booster system whereby the maximum track return voltage between any two points in the system will not be greater than a fixed amount which would have to be established by law.

Third: By the installation of a return feeder or electric current drainage system from the pipe lines, cable sheaths and other sub-surface metallic conductors which are being damaged at the present time.

INSULATED RETURN SYSTEM.

The first or insulated return system would be impracticable for Milwaukee.

The necessary high initial cost of construction, the increased maintenance and operation costs, the liability of accidents to repair or construction men and the unsightly addition of two more overhead trolley wires in each street makes these systems impracticable for Milwaukee.

If the courts forced the electric railway companies of Milwaukee to install complete insulated return systems, it is likely that the railways would not be able to operate profitably on a 4-cent fare and limited transfer basis, such as is given them under their franchise rights. The increased interest and depreciation on the additional investment and the additional maintenance and operation costs would reduce the net dividend accordingly.

We consequently do not believe that it would be beneficial or profitable to the city of Milwaukee to settle the problem in this way, as the railway companies are entitled to a reasonable return on their investment and consequently the service would suffer.

An insulated slot conduit system will cost from $35,000 to $40,000 per mile of single track. It would cost $2,400 or more per mile of single track to change the present systems to double overhead trolley systems.

NEGATIVE BOOSTER SYSTEM.

The negative booster system which is used principally in foreign countries in connection with the operation of their grounded rail return systems, consists of motor generator sets located in the feeder stations which feed current out of the station into the rails and return it over large capacity insulated cables. The forcing of these currents over the rails directly away from the station causes a reduction of voltage in the negative circuit between the station and outlying districts. Stray currents are reduced whenever the drop in the return circuit is reduced.

To meet these conditions partially, the Board of Trade of England has enforced a regulation, limiting the maximum drop between any two points in the return system to seven volts. By the use of instruments installed on the negative booster feeder panel in each feeding station an accurate record can be kept of the condition of the return circuit so that the seven-volt drop is constantly maintained.

The high cost of installation and operation of this system and the lack of laws for regulating the operation of electric railways in the United States has kept this system from being installed in this country.

We do not believe that it would be practicable at the present time for Milwaukee to insist that this system be installed, but we do believe that this system or a less costly system of keeping the drop below an established low voltage should ultimately be installed by all the present rail return systems in Milwaukee in order permanently to protect the sub-surface metallic structures from the stray currents.

PIPE LINE DRAINAGE SYSTEM.

We believe that the most efficient and economical system that the Milwaukee railway companies can install at the present time in order to reduce to a practical minimum the electrolysis damage which is being done at present, is the pipe line drainage system. This system, which consists of the installation of a number of large capacity insulated cables between different points of the pipe lines and the feeding station negative bus bars, will give the desired results when all the Milwaukee railway return systems are placed in an efficient operating condition. This means:

First: That all the track work in the city should be tested, repaired and rebonded where the joints are found defective.

Second: That all street railway river crossings and bridges should be so equipped with bends, spring contacts, and necessary additional feeder cables so that no appreciable leakage will result when cars operate over the bridges or when the bridges are open.

Third: That a total of 215,258 lbs. of additional copper is estimated as the necessary reinforcing of the return systems of the electric railway lines now operating in Milwaukee. When the necessary repairs are made and the return feeders are installed in ducts or on insulated pins and bonded to the track at regular intervals, the drop in the return system of the several companies will be reduced materially and there will be less stray currents to drain from the pipe lines near the power plants.

This is an advance toward the installation of a system which would keep the drop in the return system below a certain low voltage which should be established by law.

The same type of pipe clamp as described in ENGINEERING & CONTRACTING of Dec. 13, 1911, should be used for the pipe connections.

All pipe line cable circuits should be insulated and contain a shunt indicating ammeter besides a single pole, single throw, knife switch of the same capacity as the ble running from the pipe into the switch rd.

All ammeters should be mounted o ne or two pipe return feeder panels at the ain switchboard in the feeder stations. Tl re-turn feeder distribution systems can ays be efficiently maintained and regulated om time to time as the railway systems gr by use of the readings taken from the amm rs.

RECOMMENDATIONS.

We offer the following recommendatic on the solution of Milwaukee's electrolysis ob lem in order to obtain immediate benef for all concerned.

First: We believe that the different M au kee Street Railway Companies should re quested to carry out the above improve nts as soon as possible, at their expense.

Second: That the city should call a et ing of representatives from all the blic utility corporations who are interested the settlement of this problem so that a co- ra tive plan can be made to facilitate the tion of the necessary work to protect in vestments affected by the stray currents

This work will be more thoroughly and at a less expense if the gas, tele and private power companies work wi the city to better their own electrolysis cond ns

The gas pipes and lead sheath cables be treated in a similar way to that as mended for the water pipe system so th the return currents which do stray pipes and cables will be properly taken fore any appreciable damage is done.

Should a pipe and cable drainage be installed as recommended it would comparatively easy matter to eliminat present existing building conditions small expense by shunting all affected ings with copper cables which tap all ing and outgoing pipes and sheaths, a adding a resistance to the pipe joints building.

Third: That the common council pass an ordinance which would requi operating electric railway companies the city limits to so install their return system that the difference of potenti tween any two points on the same syste not exceed a certain low voltage which be established as a law.

An ordinance of this kind will mal railway companies constantly maintain a cient return system which will minimi damage done.

Fourth: That the city employ an en to make the necessary tests and represen interests on the above work, as it prog

Fifth: That if for any reason the r companies should refuse to make the mended improvements, that suit be b to claim some of the damage which ha done to the water pipe mains by the railway return currents, and to force th way companies to install a returr which will protect the water pipe mains electrolysis damage.

Two Inexpensive Methods of Loc n Leaks in Water Mains.

In discussion a paper on water wast veys, presented before the Illinois Wate ply Association, two inexpensive meth locating leaks in water mains were des Mr. Wheeler stated that he found the lem of locating leaks one of the most esting presented in waterworks operatic H has employed one or two ways that wer inexpensive and apparently successfu pecially if the conditions of the soil wer orable. In clay soil a boring is made to the pipe every 16 ft. with a 2-in. an audiphone is then placed on the top shank of the augur. A leak can then be if located within a rod of the augur, on side. In this way the entire system of may be gone over with comparatively expense and a great deal may be accomp in the way of locating leaks. In gr soil, where the augur cannot be used, take a ½-in. rod and point it so it will easily and drive it down into the grou to he main every 10 ft. and [illegible] it each driving as before.

iscussion of the same paper, Mr. cribed a method he has employed, We made a survey of the [illegible] [illegible] passing the water through a meter [illegible] tion. By taking a large section hen cutting it down we arrived at [illegible] sewers examined we were quite e to locate the leaks in certain [illegible] able to locate the leaks right ervice. This is a comparatively f doing the work. It is not as might be and not as thorough, s any serious trouble on the line pt to find it.

ncrete Pipe Sewer in Service for Over 40 Years.

(STAFF ARTICLE.)

panying view shows a concrete ich was in service at the Union in Chicago for over 40 years.

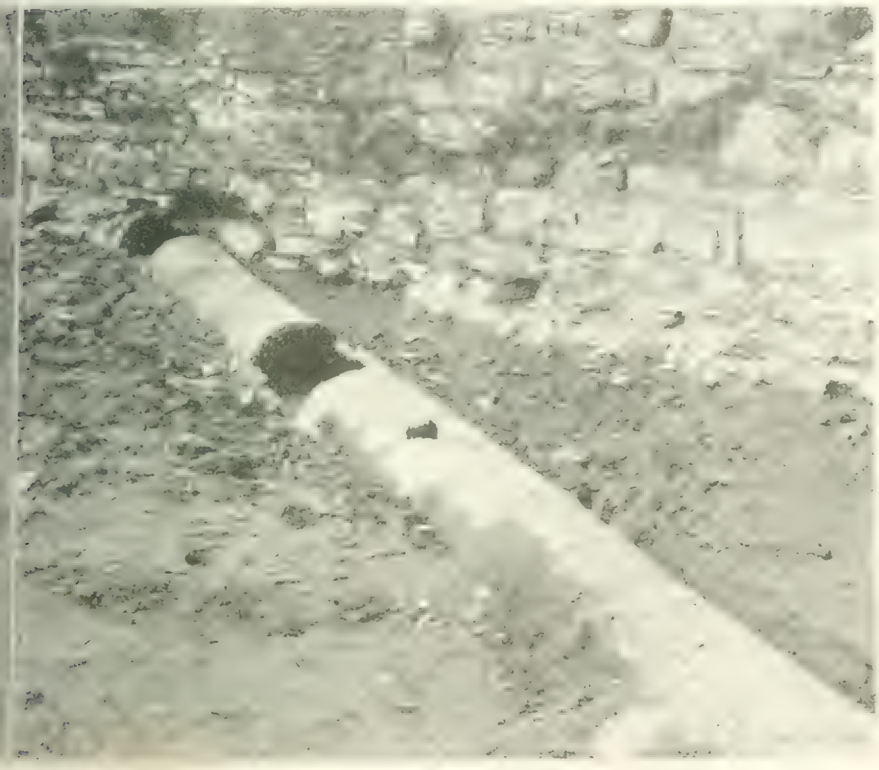


Fig. 1. View of Concrete Pipe Sewer in Service for Over 40 Years.

t date of installation of the sewer own. Old employees at the yards t the sewer was in service at least and believe that it was in service for The holes broken in the pipe were ently when the surrounding earth sh was being excavated and cleaned ablishing the grade for a new buildto provide pieces for examination.

ewer served the Transit House, a ich was in service from December, January, 1912. The Transit House st January and in clearing away the sewer was uncovered. The sewer sed again for the new Stock Yards ch is now under construction. The rtion shown will be removed so that pipe can be laid under the grade of building, but the main part of the sewer will remain in use for the new The new pipe will enter the old e foundation wall shown.

[illegible] ins. in inside diameter, and 2½ ft. evel joints were used. The pipe were bought on the market. A gravel concrete was used, presumably with natural cement.

The writer made a careful hand and eye examination of the pipe and found it in good condition. Small pieces of the pipe were broken off, at the holes shown in the view, by means of a pick. Some of the gravel stones were broken in two in breaking out the pieces for examination. A piece broken from the invert of the pipe was of equal strength with the pieces broken out of the top. The fracture showed a uniform color across the section. In striking the pieces removed from the invert with a pick it was noticed that the material was somewhat softer for the one-eighth inch of thickness lying next to the sewage than in the balance of the section. The portion of the sewer examined has always handled comparatively fresh house sewage.

The writer was unable to find out who manufactured the pipe, and the methods and proportions of materials used in its manufacture. The age of the pipe and its good condition make it of interest. The chief engineer of the Union Stock Yards and Transit Co., Mr. Rogers, called the writer's attention to this sewer and gave some of the information on which the foregoing description is based.

The Design and Construction of the New 100,000 Gal. per Min. Pumping Plant of the Nashville Railway and Light Co.—With Some Costs.

In building the new pumping station for the Nashville Railway and Light Company's power plant, at Nashville, Tenn., many complicated problems were presented to the engineers for solution. There was a large amount of rock to be excavated, part of which was under water, and a large building, able to withstand a 60 ft. head of water at times, was to be built. A statement of the problems encountered, and the methods employed in their [illegible] paper before the Engineering Association of the South, published in the Proceedings of the Association for the first quarter of the present year. An abstract of the paper follows:

To insure reliability of operation, it was decided to place the pumps at the low water level. To secure easy means of erection and removal it was decided to arrange all interior struts and races so that there would always be an ample path of access. Among the problems presented to the engineers the fact that the new station was to be erected with two older stations in continuous operation, connected to the present system of flues, may be mentioned. Also the space available for a construction plant was limited and inaccessible, and there was constant danger of a rising river.

The total buoyancy of the structure was estimated to be for maximum water in the river, about 3,000 tons. The weight of the structure being insufficient to resist this force, it was found necessary to tie to the structure 15,000 cu. ft. of rock. This has been done by a system of reinforcement—200 ¾ in. square bars imbedded in the rock foundation below, the bars being grouted in especially drilled holes and extended into the walls above.

In the space available for the floor structure, 5 ft. in height only, above existing flumes, it was found necessary to build operating pits to reach the suction valves and the strainers. This reduced the space available, none too large considering the intensity of the pressure and the span, to a minimum. Each individual beam between the operating pits carries a load of about 600 tons over a 30-ft. span, creating a bending moment of about 50,000,000 in. lbs. It is made up in a rectangular shape, 5 ft. deep by 8 ft. wide, with top and bottom reinforcement, ten 60-lb. rails being placed at the top to take the tension and eight 60-lb. rails being placed at the bottom to assist in compression. The shear, which is high, is resisted by the concrete; but, in addition, 108 ¾-in. square bars have been provided diagonally. In the floor structure the tension, whether longitudinal or diagonal, has been estimated in the neighborhood of 16,000 lbs. per sq. in., with high water in the river. The maximum simultaneous concrete stress for compression should be about 600 lbs. per sq. in., and the maximum shear 50 lbs. These values may seem to be high for a structure intended to be waterproof, but it should be noted that the maximum load will occur very infrequently, and the strength as well as the elasticity of the concrete will have a chance to improve materially above the customary one-month designing values, thus relieving concrete as well as steel stresses.

A subdivision of the lateral forces, acting against the wall, has been made by the introduction of a series of horizontal T beams and struts, arranged so as to give ample operating clearances. Even with this subdivision the maximum forces to be taken care of by each part of the structure are considerable. The beam on the south side, running transversely near the base, as an example, is expected to carry 500 tons over a span of about 30 ft., creating a bending moment of close to 45,000,000 in. lbs. To carry the produced stresses from web to web would require a comparatively thin wall, but other considerations must be determined. First is the question of buoyancy. A small weight of the structure would mean a big anchorage to the rock foundation, and it is very doubtful whether a big anchorage would be desirable from the view point of safety and economy. Then there is the question of rigidity, and, in connection with same, complicated compound stresses. In every T beam there is compound compression due to bending, and an intense longitudinal shear; but in the case under our consideration there is, moreover, direct compression in two directions, caused, the one by the gravity of the structure and the action of the water, and the other by the action of one beam against another in perpendicular direction, both under the pressure of the water. Questions of waterproofing make it imperative that the entire structure be made continuous; and the problem to follow the capricious chase of forces, stresses, and reactions, in a compound structure without flexible connections, is almost beyond human reach. The better way seems to be to make conservative assumptions and eliminate hazardous refinements in the calculations. The last question is the one of waterproofing. It would be a small matter to make a reinforced concrete structure waterproof if the same were not subject to external forces and consequent deformations. With external forces in action it is a different matter. The design should aim at small deformations as being the only way to eliminate the possibility of cracks of injurious nature and magnitude. This means that little or no tension should be allowed in the concrete; that there should be a liberal allowance of tension reinforcement; that the secondary stresses should be well provided for; and, last, that the construction conditions should be such as to preclude disintegrating action by the steel upon the concrete.

DESIGN.

The design has been based on these considerations. The wall thickness has been made a maximum at the base of 3 ft. 6 ins. and then, in successive steps, 3 ft., 2 ft. 6 ins., and 2 ft. All the bending moments have been based on the formula $\frac{WL}{8}$, but ample provision has been made for reinforcement where negative movements will or may occur. Thus it is hoped that the structure will act continuously; but in case this hope should not be realized, there is absolute guarantee against failure by reason of the conservative method of figuring the bending moments. At worst, therefore, some small tension cracks may occur, which would allow small quantities of water to enter. The vertical bars carry stresses due to bending from web to web, and are estimated large enough to carry also secondary stresses. The horizontal bars, except those in the webs, carry secondary stresses only. Each T beam is an integral part of 12 ft. of wall, but only two-thirds of this height is estimated as resisting the compressive forces of the beam. This is an artificial way; but, according to well-established practice, the maximum compression forces in the beam are estimated in excess. A compounding with compression stresses assumed to be carried from web to web, and in themselves low, would, therefore, indicate actual stresses inside of allowable limits. The reactive influence of beam against beam at the corners of the structure will be limited very much to the webs and will tend to reduce the tensile stresses in the same. Allowance for this has been made in the design. The total depth of the beam previously referred to is 6 ft. and the web thickness is 4 ft. In this web is concealed the required tension reinforcement, two 60-lb. rails and 28 1-in. square bars—in all, 40 sq. ins. of steel. The 28 1-in. bars have been bent up to offer resistance to excessive diagonal tension, and the distribution of these bars has been in proportion to the amount of internal shear. The resultant maximum stresses in concrete and steel are estimated not to exceed 600 and 16,000 lbs. per sq. in., respectively, for compression and tension, with an allowance of 60 lbs. for longitudinal shear.

Corresponding to the webs of the T beams, a series of struts have been placed. The largest of these struts will carry a load of about 200 tons; the next one, about 150 tons. The respective areas are 24 ins.x30 ins. and 18 ins.x 30 ins., and the reinforcement four 60-lb. rails in one and twelve 1 in. square bars in the others. The two struts have been combined vertically by a 10 in. reinforced web, the object being to create an ample resistance to bending, both for the sake of carrying their own weight over a 30 ft. span and also to carry any additional machinery which may be found necessary in the future. On account of the great depth of the girders thus created—12 ft. from center to center of struts—the stresses due to bending will be immaterial, and the customary elaborate calculations in cases of this kind leading to equations of the third degree would, therefore, seem unnecessary. The struts erected above are carried on columns resting on those just described, and bending thus for all practical purposes eliminated. The topmost struts are combined with the top girders, intended to carry the pumping machinery while it is being brought from the railroad track above and near the pump house to within reach of the pump-house crane. The strut and the girder actions, being opposite to one another, maximum load on both will thus only tend to reduce the stresses. Machinery to the extent of 40,000 lbs. can be carried at any point on any one of the girders.

The superstructure consists of a monolithic reinforced concrete frame, with a Warren specification roof on concrete slabs and brick curtain walls. There are 14 columns, 12 of which carry crane runway girders, also made of reinforced concrete. All of the columns extend to the roof and carry the roof beams. On account of a variable and heavy load and variable eccentricity, the columns are made heavy—16 ins. x 20 ins. and 20 ins. x 20 ins.—with 5 sq. ins. of reinforcement. The hooping in the column is for the same reason made substantial. The crane runway girder is 20 ins. x 36 ins., with four 1-in. square bars for reinforcement. Stirrups have been introduced to resist the excess shear. A system of shear reinforcement perpendicular to the neutral plane would seem to offer the most adequate resistance in a case where the shear intensities are constantly varying, and also the curvature of the resultant stress lines. The roof slab is 4 ins. thick, with 24 ins. roof beams on about 6 ft. centers, each containing four 1-in. square bars, concealed in a web 14 ins. wide at the bottom and slightly tapering upward. To secure proper bracing of the superstructure against any possible lateral forces, the connections to the columns are made very substantial. Brick curtain walls between the columns also assist in resisting some of the lateral forces, particularly those created by the crane acceleration.

CONSTRUCTION METHODS.

The methods of construction were governed by the peculiar conditions on the river front. An equalizing flume, connecting two intakes on either side of the proposed pumping plant and serving two pumping stations of lesser capacities now in operation had to be shut off from service, and this was done by a diver. Previous to this a large amount of rock had been removed by means of drilling and blasting, a compressed air plant of 100 cu. ft. per minute capacity having been erected for the purpose. After the excavation had reached the equalizing flume and the bulkheads were erected, an 8 in. motor driven centrifugal pump was used for removing the great bulk of the water; but a steam siphon with a 2 in. water pipe afterward proved sufficient to keep the leakage out.

Sullivan pneumatic tools were used throughout, and proved a great help in so far that they were both efficient and reliable. Some very remarkable drilling records were established. A few of the troubles experienced might be of some interest.

When the diver first attempted to build a bulkhead in the south end of the equalizing flume, connecting the first wooden screen well and its intake with the second intake of later date, it was found that the pumps operating in connection with the second intake were not getting sufficient water. A closer examination revealed the fact that the second intake was almost completely filled with twigs, cinders, and silt—unfortunate remains of the cofferdam which once aided in its construction and now, thanks to the powerful suction of the pumps, had closed the entrance. The incumbrance was removed by turning the discharge of the circulating pumps into the intake flume, the pumps in the meantime receiving their water from the southern intake. The excess material at the intake mouth was previously removed by dredging.

By closing the northern intake and the south end of the equalizing flume and running the circulating pumps, an opportunity was now created to keep the water low and remove the rock cover over the flume. The accumulations in the flume were then removed, the sediment by means of pumping. The bulkhead in the north end of the flume was then built and the water kept under control.

Only once did the water cause serious trouble. A 20 in. pump in one of the old pumping plants lost its vacuum and dropped its water. The bulkhead to the equalizing flume was instantly knocked out by the tremendous impact of the water, falling some 50 ft.; and the
sustaining concrete, to which the
frame was tied or on which it was
was removed in large blocks or crushe
accident caused no injury to any of th
and working conditions were soon re
lished.

For form work 2 in. x 6 in. ship-lay
pine was universally used, with 2 in.
yellow pine studs and plates. Stiffne
secured by the use of an inside s
erected and braced so as to serve this
ary purpose as well. To resist the hy
pressure of the fluid concrete on the
the frame work was securely wired by
of No. 8 iron wire, ample provision
been made so as to allow a rapid cas
the concrete, or one loop for every 18
width and 24 ins. in height at the base
section. In building the form, an atten
made, and successfully executed, to
lumber from sections of concrete alre
The form work and scaffolding was th
tinued from the exterior offsets in t
and from the struts on the inside.
the casting of the concrete had procee
der difficulties and the results, therefor
in doubt, the form was removed at the
possible moment. For the four lower
with their connecting web, the concr
laid bare within 36 hours after the po
a fortunate measure, as some concr
been stopped on its path by obstruction
ing an ugly void. This void could now
paired with full assurance of success,
of the original concrete had taken
set. Grout was used for the purpose
liberal head to force it into all the c
Perhaps it should be noted that the v
indirectly caused by a breakdown in th
ing engine, resulting in a few hours
ruption in the process of casting. So
crete that had settled on the reinfo
had taken initial set and served as an
tion. For reinforcement 60-lb. rails an
⅞ in. and 1 in. plain, square bars we
All the material except the ⅞ in. b
ordered shipped to lengths. The ⅞
serving as expansion reinforcement s
was considered sufficient to have th
shipped random lengths. A small am
minor sizes were used. All crossing ba
wired together with No. 12 iron wire.
amount of bending was done in the
the ¾ in. shear bars for the bottom be
the 1 in. bars for the T beams being
a home-made field bench.

To secure a proper transmission o
through the shear bars in the bottom
the rails, used for tension and for comp
were connected by means of bolt a
separators and the shear bars then be
pletely around the separators. For s
the separators, plain, round bars we
stituted, enough separators being used
secure a rigid unit of rails. Tightnes
shear bar connections was obtained by
the rails a trifle close together and th
ing them apart and building a few sto
to support the rails.

All the reinforcement was placed w
treme care. In the wall structure th
cal bars were kept from the form by
of a series of 2 in. wooden cleats,
every 6 ft. in height by 6 ft. in wid
held to the form by being wired to t
or nailed to the cleats. The cleats w
moved as soon as the concrete level
its lower edge. The horizontal bars w
wired to the verticals, leaving a networ
inforcement of extreme stiffness. Th
cal bars were ordered in about 14 ft.
ft. lengths and placed so that one ser
rying stresses for positive moments
always extend not less than 6 ft. from
surface of one pouring of concrete
next one. The bars carrying negative m
were made to alternate with the others
overlap was allowed for expansion b

Special care was taken with the T b
inforcement. The bars were bent t
dimensions and laid up and fitted
bench before being placed in the for
bench was made of 2 in. rough yell
planks, and rigidly built and braced.
inch pipes, each about 6 ins. long, w

wit wooden blocks and bolted to the erve as a bending gage for th Or was placed for every bend, and a lition, to prevent the bars from One setting of the bench was nt for every beam by making it center distances. The bars were along longitudinally so as to make erve all bars. To prevent long e projecting ends, a 2 in. pipe was r the bar when being bent, close h the gage pipe to eliminate any im- cvature. The men used the 2 in. nding lever. Care was taken to spring effect in the bars, so that ar, hen bent, would lay freely and n along the gage [illegible] lt was very satisfactory, the bars l as true as shop-made reinforce- lacing the bars, they were located th equal care. They were sus- above and wired to the form es and ends, and thus held with ity, with no chance of displace-

e reinforcement, two special fea- be noted. There is one series of ing the rear wall to the rock be- is done to relieve the rear wall ending action which may result getting in between the rock and There are enough bars to take total hydraulic pressure at maxi- evel. The bars are distributed in the intensity of the water pres- rely grouted into the rock. An- bars, or anchor bolts, connects to one of the old pump houses. eing to make the two buildings t. The old building, which is a concrete-filled structure, is relied rb, or transmit, the reactions from orthern wall of the new building e is under pressure of the water. aborers were used to do the en- ement work under the direction n. All the bar material was the le from open-hearth steel mills

g and placing of the concrete has sual interest. The difficulty of niform and reliable product from hood quarries has made it im- letermine experimentally the pro- mix to secure maximum density. g considerations, as well as re the factors which determined a 2:4 for the lower parts of the This proportion, however, while strong, would hardly possess the best fing qualities. The thickness of the ld seem to be ample enough to offer resistance against percolation, while was imperative, owing to the possi- an early and high rise of the river. upper sections of the structure a nd 1:3:6 mix was used. This should ient to meet the requirements of with a maximum spring flood, the then being several months old. As proofing qualities, they should be at al for the 1:2½:5 mix. When more specifications for stone can be made acceptable to the quarrymen of this section, there will be a better chance to predetermine results in high-class, reinforced concrete work. A high grade of river sand was used; and while perfectly acceptable, it was not sufficiently coarse to produce the best results. Lehigh cement was used throughout

The substructure was cast in five sections and the superstructure in two. The flume wall, floor beams, and flooring were cast in the first pouring. Next, the walls went up to the extent of 18 ft. 6 ins., and then the remainder in three 12-ft. sections. Corresponding beams and struts were cast with the walls. In all, about 1,300 cu. yds. were placed.

A Ransome mixer of one-half yard capacity was used for mixing, but all other equipment except the hoisting engine was homemade. The lower parts were cast directly with the aid of a stiff-leg derrick and movable troughs. For the upper sections an elevator was erected and a system of chutes easy to operate. The elevator bucket dumped on a hinged apron connected to a stationary chute, and from this chute the concrete was dropped into a rotating chute swinging on a stand in the center of the building. By this means three of the sides could be reached directly, and the corners were reached by the additional aid of short, stationary chutes. The mixer and the elevator were placed as near the structure as possible to insure minimum loss of labor and material and to reduce the possibilities of breakdowns. The equipment proved satisfactory, the best record being 200 cu. yds. hoisted 40 ft. and placed in eleven hours, with a stop of one-half hour only for dinner. The following men were used: One foreman, one assistant foreman, one engineer, ten men loading material, nineteen men wheeling, one water man, two to empty the mixer and two to dump; in addition, only one man to move the chutes and two men to cut, besides carpenters watching the forms for breakdown. Practically every man was busy continuously.

COSTS.

It is particularly gratifying to note that the cost of construction, in spite of the extreme care, is very reasonable. Below is a preliminary, but reliable, schedule:

		Unit cost.
Rock excavation, 1,500 cu. yds...	$4,500	$3.00
Building forms, 17,000 sq. ft......	2,200	.13
Taking out forms, 17,000 sq. ft...	600	.035
Making concrete, 1,300 cu. yds...	1,100	.85
Making concrete plant, 1,300 cu. yds.	800	.60
Reinforcing, 102 tons...........	1,000	9.80

Rock excavation includes pumping, building bulkheads in flumes, and diver's services. In the building of forms, a shed for carpenter's tools is included, also, the cost of building an inside scaffold, as the same served the purpose of bracing the form as well, and the cost of wiring the forms. In figuring the cost of making concrete, the concrete materials were considered delivered at the plant, the cost of handling from cars to the plant having been charged separately. Reinforcing includes all labor done in the field, not only placing and wiring, but also a large amount of cutting and all the bending—and the bending was considerable, due to the many shear bars provided for.

The carpenter labor cost is not the very lowest, but it is to be considered that the work was done according to the conservative methods of engineering so creditable to this part of the country. Local mechanics were employed, and also the foremanship was secured locally. The foreman entered into his duties with a clear record of many years without an accident, and this record was kept undisturbed. With an ever increasing number of reinforced concrete structures, this section of the country will have good material to draw upon, open for development according to such lines as are characteristic for concrete form work. With such development, a reduction of cost will also be natural.

There is a very creditable showing in the making and placing of the concrete. This showing is due both to the erection and use of an adequate plant and to the profitable organization and general aptitude of the laborers. Part of the efficiency in this division of the work, of course, is due to the complete faith in a well built form. For example, the pouring of 200 cu. yds. of concrete to a height of 12 ft. in eleven hours, and this in the late fall, when the setting was so slow that at the end of a day's work the lowest portions could still be considered fluid. We believe that the concrete cost record is considerably below the average.

The labor reinforcing also presents a very good cost figure. The men doing the work were entirely unaccustomed to any work of the same nature, and yet the results are as satisfactory as could be expected from experts. An average for similar work in other places presents no better figure. Work performed by contractors employing specialists would hardly embrace a large amount of field bending and cutting unless the job were a very large one with an extensive bending plant, and the figures reported are, therefore, probably not in the same class.

The work was started in the middle of July. Excavation was finished on or about Sept. 4, and the building of forms and casting of concrete immediately commenced. At the date of this paper the structure is finished up to the crane girder of the superstructure, with the roof construction yet to be done.

The equipment has not yet been contracted for, but it is fairly well decided that three 30,000 gal. per min. pumps to operate against a 75-ft. head will be purchased. The apparatus will be modern, centrifugal, turbine-driven pumps, and a pump efficiency of 72 per cent seems quite assured. The water rates for the turbines will also represent a quite decided improvement over past records. With a steam pressure of 175 lbs. to the sq. in. and noncondensing operation, the manufacturers are willing to guarantee from 22 to 40 lbs. of steam per brake horsepower hour. The lower figure is, of course, offered with highly developed and costly machines; but even with less sensitive units, a duty of 52,000 lbs. of energy per pound of steam seems to be assured.

RAINAGE AND IRRIGATION SECTION

ow Valley Irrigation Works of e Canadian Pacific Railway Company in Alberta.

ed by A. S. Dawson, Chief Engineer
ent of Natural Resources, C
n Pacific Ry. Co., Calgary, Alberta.

f the greatest irrigation developments ern times is in progress in the prov- Alberta, Canada. This development 1892 when, as the result of a series years, settlers began to consider the ty of assuring their crops growing by ficial application of water. The ques- sumed such importance that it was taken up by the Canadian Government, which first enacted comprehensive laws relating to the use of water in irrigation and subsequently undertook a system of general surveys to determine (1) the source and value of available water supplies, and, (2) the locations of the areas where the water could be used to the best advantage

Briefly the surveys showed that in southern Alberta there were three extensive areas which offered special advantages for irrigation. One area of 250,000 acres was situated in the Lethbridge District and could be irrigated by water from the St. Mary's River. Another area of 350,000 acres lay near the junction of the Bow and the Belly rivers, in Townships 11 to 14, inclusive, Ranges 11 to 16, inclusive. The third area, and the one which will be considered in detail here, was situated along the main line of the Canadian Pacific Ry., and extended about 150 miles east of the city of Calgary. Incidentally it may be noted that the works to serve all of these tracts have either been built or are now under construction.

THE BOW VALLEY IRRIGATION BLOCK

The third irrigable area mentioned is shown by the map, Fig. 1. This tract is owned by the Canadian Pacific Ry., and is known as the Bow Valley Irrigation Block. The block is an open prairie plateau with a general elevation of about 3,350 ft. above sea level at its westerly limits, sloping gradually until a general elevation of about 2,300 ft. is reached at its easterly boundary. Its topography is rolling, particularly in the western portion; but large areas of almost level plains are found in its easterly limits. The soil is good, consisting of a heavy black loam and clay subsoil in the westerly portions; and a lighter sandy loam of great depth overlying clay and hard pan in its easterly limits. The tract is bounded on the west by the fifth meridian; on the south by the Bow River; on the east by the line between Ranges 10 and 11, west of the fourth meridian; and on the north by the Red Deer River and the north boundary of Township 28. Its length east and west is about 140 miles, and it has an average width north and south of about 40 miles. It is intersected by the main line of the railway, and numerous other railway facilities are being provided in various directions. It contains an area of 4,840 square miles, or 3,097,580 acres.

The Bow River, which is the source of water supply, heads in the Bow Lakes on the eastern slope of the Rocky Mountains; and with its tributaries has a drainage area of about 3,800 square miles at Calgary, and about 5,100 square miles at Bassano. It generally reaches its highest stages between June 15 and Aug. 15 of each year, and its lowest stages during January and February. Its maximum flood discharge at Calgary has probably been close to 100,000 second feet, although the hydrographic records for both extreme high and low water are rather meager.

Precipitation.—The precipitation varies considerably from year to year, and decreases easterly as the altitude becomes lower. Meteorological records exist only since 1886, and are applicable only to the westerly portion of the block. The average annual precipitation at Calgary between 1886 and 1910 was 15.15 in.; the minimum for the same period 5.90 ins. in 1889, and the maximum for that period 31.90 ins. in 1902. The average for the irrigation period of five months, from May 1 to Oct. 1, covering the same years, was about 11 ins. This moisture, however, is not always available when most needed; and it is a recognized fact that without irrigation certain crops cannot be raised to advantage; and that in any year the certainty of crop production with large yield can be assured only by artificial means.

Surveys.—Surveys in connection with the project were commenced by the railway company in 1903, and have been gradually extended in detail since that date. These surveys represented a vast amount of work, as an irrigation project demands surveys and examinations far more complete than those for a railway line. Elevation is the controling feature; and lateral extent or width of country is as important as length; and width, length or height have all to be considered. Accurate topographical surveys have been carried on by plane-table methods over practically the whole area at an average cost of about 10 cts. per acre. On this, the complete system has been projected.

On completion of the preliminary surveys it became evident that the block naturally divided itself into three sections, which were designated as the Western, Eastern and Central, of about 1,000,000 acres each and the work is being carried on along the lines of development in the order named. The Western and Eastern sections are complete units in themselves, whereas the Central section, owing to its general elevation, could only be served by an enlargement of a portion of the trunk lines in the Western Section.

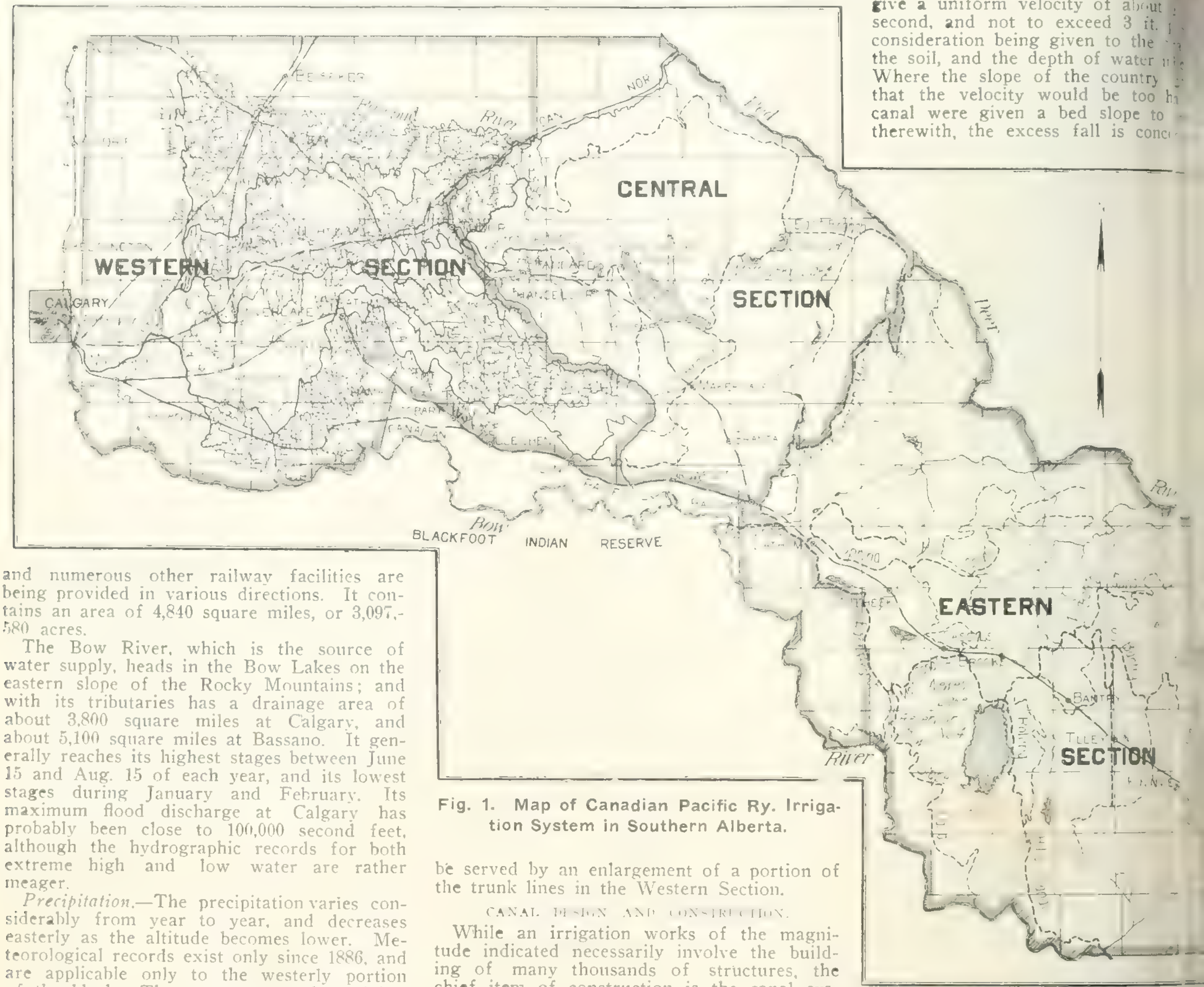


Fig. 1. Map of Canadian Pacific Ry. Irrigation System in Southern Alberta.

CANAL DESIGN AND CONSTRUCTION.

While an irrigation works of the magnitude indicated necessarily involve the building of many thousands of structures, the chief item of construction is the canal system. There will be several thousand miles of canals of all sizes on the Bow Valley works when they are completed and the standards adopted for the design and construction of these canals had to be worked out with care. Complete details cannot be printed in reasonable space, but the following outline gives the main features.

Cross-Section.—The cross-sections of canals and ditches are modified to suit conditions, such as discharge, available grade, nature of soil, and transverse slope of the country. On ditches 2½x1 ft. to 3½x2 ft, 1 to 1 slopes are used, and on ditches 4x2 ft. to 4½x3 ft, 1½ to 1 slopes are standard, with banks 3 ft. wide on top and 1 ft. above water level. On small ditches no dependence is placed on banks as part of the canal prism unless the grade is 1 ft. below the under side

or about 1½ ft cut on an av

larger ditches on level ground th

the water prism is generally about

the depth; the banks being half th

water above water level, with a mi

3 ft.; and having a width equal to

of water on the upper side, and 1½

lower side, where a roadway

Where the depth of water is over

2 to 1 slopes are standard, althou

charged to 1½ to 1 where extr

slopes exist. Where the depth

less than 5 ft., 1½ to 1 slopes are

under ordinary conditions. Endeav

to balance cut and fill, with an al

about 12 per cent. for shrinkage

happens that shorter locations with

ting through a ridge would result

tion in quantities.

Grades.—The grades are so sele

give a uniform velocity of about

second, and not to exceed 3 ft.

consideration being given to the

the soil, and the depth of water

Where the slope of the country

that the velocity would be too h

canal were given a bed slope to

therewith, the excess fall is conc

vertical drops; and where such dr

too close to one another for safety

omy, a short section of flume or line

is employed for the purpose of ov

the excessive grade.

Losses by seepage and evaporatio

lowed for as follows: In prelimin

jection:

Canals, 2 to 100 sec. feet ....
Canals, 100 to 500 sec. feet.........
Canals, 500 to 1,000 sec. feet.........
Canals, 1,000 and over sec. feet ...

For final projection and design th

ing formula is used: $P = CW\sqrt{D}$

P = Loss in second feet per mile

W = The width at full supply level;

depth of water, and C = a con

[illegible] for gravel and sand [illegible] average earth, [illegible] coarse hard clay. [illegible] measure is carefu [illegible]

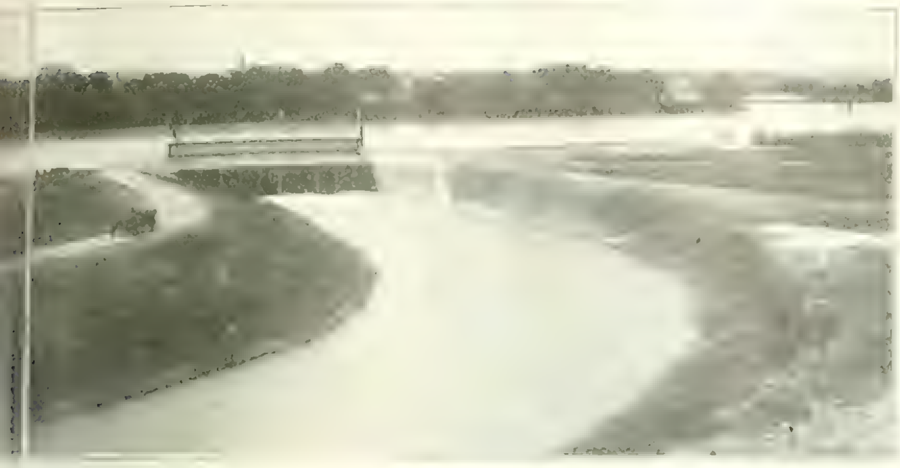


Fig. 2. Headgates Main Canal, Western Section.

the larger canals curves are reg- [illegible] wed on the larger secondary and ils being between 15 and 30 times f water. On smaller distributing lius of 6 to 8 times the depth of a minimum of about 10 ft., is As far as possible the land lines l to in laying out the distribution

nels.—At each point where water by a branch gate, an alternative [illegible] ige channel; the capacity of these [illegible] to that of the various irrigation [illegible] nd feet, and otherwise is 25 per capacity of the canal or ditch These tails are located on the s far as possible; otherwise they reach the drainage channels by t possible route.

ins.—Cross drainage is provided ways: (1) it is taken under the [illegible] aken into the canal system by an t is carried over the canal. The ssing adopted depends to a large he importance of the drainage character of its channel, and to [illegible] out as a rule the cross drainage is l in the order referred to above, with nsideration of cost. The material l in connection with smaller un- gs has been corrugated metal culup to 36 in. in diameter, manufactured oth ingot iron and Toncan metal. For structures reinforced concrete pipe and ulverts are used. Flooded areas are

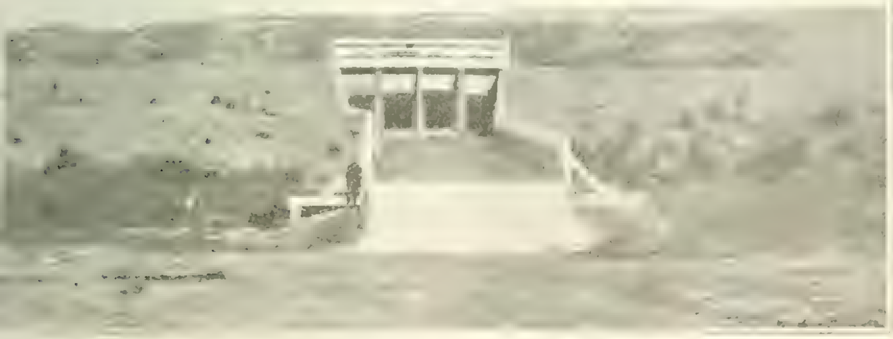


Fig. 3. Spillway on Main Canal, Western Section.

with the necessary structures on the canal system, are provided at frequent intervals, averaging about six miles where possible, on all secondary and branch canals, their capacity being at least 10 per cent and not exceeding 25 per cent of the canal in which they head.

Overhaul.—Overhaul is calculated by the well-known methods of Mass Curve, the limit of free haul being 100 ft. parallel to the canal axis. In case of borrow pits not on the ordinary cross section, the length of haul is measured in a straight line between the centers of gravity of cut and fill.

Excavations.—Necessary waste is used to widen the banks uniformly, and to strengthen the higher fills. Borrowing where necessary is done by (1) deepening the canal; [illegible]

If neither is practicable, borrow pits are made well away from the canal on the high side and so arranged as to drain into the canal. Where side borrow is absolutely necessary, a berm equal to at least the height of the bank is left between the toe of the bank and the edge of the borrow pit.

Embankment.—Embankments are in all cases put up with material from adjacent cuttings or from borrow pits if the former is unsuitable or deficient in quantity. In determining the outer slope, the plane of saturation is considered as sloping from high water level at the rate of $3\frac{1}{2}$ to 1, and this plane is not allowed to intersect the outer slope or to approach the toe nearer than 10 per cent of the base width. In very high fills where the above requirements lead to excessive material, the slope of saturation is increased by draining the rear or outer half of the embankment, or by constructing the first 3 ft. of the outer third of the bank with sand, gravel or other porous material.

[illegible] of embankments is bonded when the head against the banks is 2 ft. or more, and less than half the top width, providing two furrows and one additional furrow for each extra 2 ft., with one furrow just inside the upper or wet toe, one under the center, and the balance, if any, between them. The surface is stripped when the depth against the bank exceeds half its top width; when the [illegible] or when the soil exceeds plow depth. The surface is bonded and stripped when the head against the bank exceeds 10 ft.; when the surface is hard and dry after stripping; or when the cross slope exceeds 1 in 4. The width of stripping is determined by the plane of saturation above referred to.

Fig. 4 Main Canal, Western Section.

Rotation of Supply.—This portion of the system is being designed with a view of rotation in supply being adopted, which will result in each individual farmer obtaining a satisfactory head; a fair division of water; and simplification of operating problems. This is a matter which cannot be worked out in detail until the lands are settled, but the system is being designed on the basis of giving parcels of between 80 and 160 acres a supply of 2 second feet for a period of 96 hours, and parcels smaller than 80 acres a similar flow for 48 hours.

[illegible]

The Western Section comprises an area of 1,039,620 acres, of which about 370,000 acres have been brought under ditch. Construction was commenced in 1903 and completed in 1910, and water was first used in 1907. Water for this section is diverted from the Bow River at a point near the present easterly limits of the city of Calgary. The head works are of timber, and are well protected by a pile and timber wall along the river bank, extending 350 ft. above and 1,400 ft. below the structure. Their sill elevation is 3,353, and they consist of 20 openings, 3 ft. wide and 10 ft. high, subject to side and top contractions. The gates are wood, of the straight lift type, and are operated by rack and pinion [illegible] a triple reduction gear with a power ratio of 100 to 1, arranged on a movable winch mounted on a traveling truck. It is the intention to replace this structure in the near future with permanent works; and at the same time to build a collapsible dam in the river which will admit of obtaining the full head of about 10 ft. required, during all stages of the river.

Main Canal.—Main canal *A* heads at this structure, its capacity being over 2,000 cu. ft. per second at full supply of 10 ft. Its section varies to suit conditions, its maximum section being 60 ft. bed width, 120 ft. at the water level, with 3 to 1 slopes, and a grade of 0.01 per cent. Throughout the greater portion of its length its dimensions are 44 ft. bed width, 84 ft. on the water line, with 2 to 1 slopes, and a grade of .02 per cent; which, with an assumed value of $n = .025$ gives a calculated discharge of 2,050 cu. ft. per second.

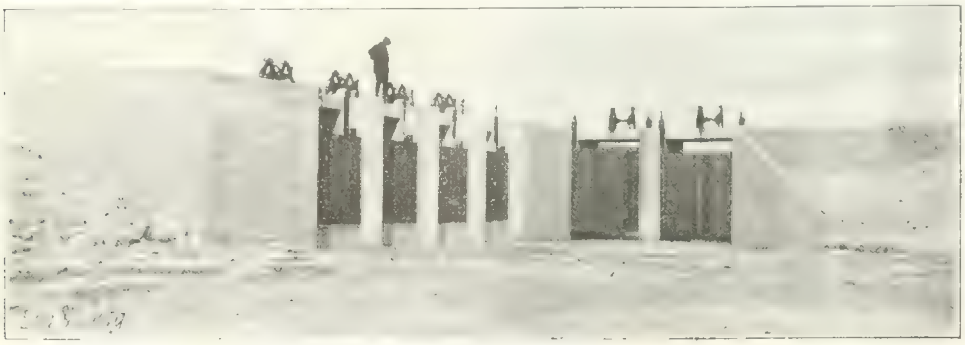


Fig. 5. Reinforced Concrete Headgates and Spillway on Secondary Canal System.

At a point about 2½ miles below the headgates, this canal was crowded close to the river banks by heavy excavation, and at this point a set of escape or regulating gates was provided with a sill elevation 1 ft. below canal grade. This structure is of timber, and consists of four openings 6x11 ft., each controlled by wooden gates. These are known as balanced pressure gates, and are so designed that they will rise of their own accord when the head against them is about 5 ft. Each consists of a rectangular barrier working freely between parallel walls without guides. Each gate is hinged to four long arms arranged in pairs, the location of the hinges being so chosen that the weight of the gate is balanced by any required pressure. They are made practically watertight by rubber flashings, and are lifted by an ordinary chain windlass provided with pawl and brake.

At a point about 15 miles below the headgates, the main canal makes a vertical drop of 10 ft., where an important timber structure was built. The excessive velocity resulting from this drop was taken care of by the contraction of the opening above to 25 ft., and by a water cushion 5 ft. deep below, with an enlargement of the opening to 43 ft. terminating in wings. Piling was extensively used in this and all other important structures built in the early stages of the project.

Reservoir No. 1.—About 17 miles from the headgates, the main canal terminates in Reservoir No. 1, which, however, is in reality only a balancing pool with slight storage for sudden drafts of water; thus relieving the secondary canals from small fluctuations in head. The reservoir referred to, which is about three miles long and half a mile wide, was formed by the building of an earth dam 2,000 ft. long with a maximum height of 30 ft. faced with heavy rip-rap on the water side. From this reservoir the water is taken out in three secondary canals, known as *A*, *B* and *C*, having a combined length of about 250 miles. These are each controlled by timber headgates with sill elevation of 3321.50, and are of a type similar to those described in connection with the main canal spillway. Numerous large structures are located on all of the secondard canals, including headgates, drops, flumes and bridges.

Secondary Canals.—Secondary Canal *A* heads out from the south end of Reservoir No. 1, and Secondary Canals *B* and *C*, together are taken out at the north end. Secondary Canal *A* at its outlet is 18 ft. bed width, carrying 8 ft. of water, with 2 to 1 slopes, on a grade of .03 per cent. It drops twice to cross the railroad; and about 15 miles from its head again drops about 30 ft. and expands into what is known as Reservoir No. 2; at which point its section was changed on account of grade to 22 ft. bed width, carrying 6 ft. of water, with 2 to 1 slopes, on a grade of .035 per cent. About 30 miles beyond, near Strathmore, it again drops and crosses the railway line, splitting into a north and a south branch. North *A* is 10 ft. bed width, carrying 3.2 ft. of water, with 1 to 1 slope, on a grade .06 per cent. South *A* is 18 ft. bed width, carrying 4½ ft. of water, with 2 to 1 slopes, on a grade of .04 per cent. Both continue easterly to the vicinity of Gleichen, covering lands to the Crowfoot Creek at an elevation of about 2,970.

Secondary Canals *B* and *C* together utilize a natural channel for three miles from the north end of Reservoir No. 1, and there divide, *B* turning easterly and *C* northerly. Canal *B* is 28 ft. bed width, carrying 6 ft. of water, with 2 to 1 slopes on a grade of .025 per cent, continuing for four miles to split gates dividing it into a north and a south branch. Canal *C* is 40 ft. bed width, carrying 6.4 ft. of water, with 1½ to 1 slopes, on a grade of .03 per cent, and serves all the land lying between the Rosebud River and the Serviceberry Creek. At a point about eight miles from its upper end it splits into an East Branch, which is 37 ft. bed width, carrying 5 ft. of water, with 1½ to 1 slopes, on a grade of .035 per cent, and a West Branch, which is 12½ ft. bed width, carrying 5.7 ft. of water, with 1½ to 1 slopes, on a grade of .04 per cent. The East Branch utilizes about ten miles of natural channel, in which 175 ft. of grade is disposed of. The West Branch crosses the valley of the Crowfoot Creek by a wood stave pipe siphon of 53 ins. internal diameter and 1,600 ft. long, working under a maximum head of 82 ft., in which grade is used up.

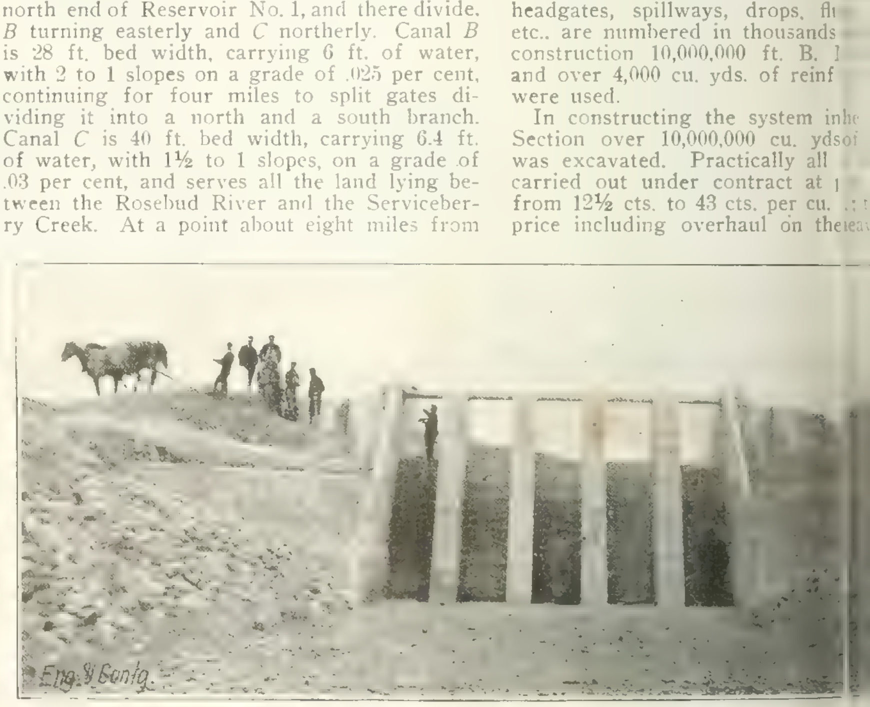


Fig. 6. Reinforced Concrete Drop, Western Section.

Exclusive of the main car Canal *B* North Branch is the waterway in the Western Section, intended ultimately to be used supply channel to the Central block After leaving the jun North and South Branches, it ural channel for about 16 mile being straightened in places by offs. In this distance it falls the elevation of the split gates of the headgates at the lower e ural channel, known as Weed Creek, 3,031. At the dam on this cha el the heads out 18 ft. bed width, carr g 4½ water, with 2 to 1 slopes, on a rade per cent, and extends a distan of 1 to a summit with an elevation 2,99 fore crossing this summit one b nch i off to serve lands in the vicinit of th branch of the Crowfoot Creek. A ing the summit it again spl branch continuing on the nor elevated ridge until Summit La which is the controlling point tral Section of the block, and low valley of about elevation crossed by a siphon.

From the secondary canals again taken out, and distribut comprehensive system of distril which bring it to each parcel served.

Summary.—In the Western S block the following mileage been constructed:

Main canal .. .. ..
Secondary canals . ... . .
Distributing ditches ... .

Total ... .

In addition to the above the hundred miles of small ditches the farmers. The structures, headgates, spillways, drops, fl etc., are numbered in thousands construction 10,000,000 ft. B. and over 4,000 cu. yds. of reinf were used.

In constructing the system in the Section over 10,000,000 cu. yds of was excavated. Practically all carried out under contract at from 12½ cts. to 43 cts. per cu. price including overhaul on the The average price was about 17 cts yd. The cost of timber work been slightly over $55 per thous of reinforced concrete about $2 both figures including all mat well as excavation, trenching a

OUTLINE OF WORKS ON EASTE

The Eastern Section of the b 1,156,220 acres, of which 110,000 be rendered irrigable. Most of a gently rolling character and good drainage. The soil for the

[illegible]
us depths.
of the peculiar topographical con-
[illegible]
The main watershed of the coun-
[illegible]
known as the Horseshoe Bend,
[illegible]
rallels the river for a few miles
southeast corner of Township 18,
[illegible]
almost due east to a point three
[illegible]
to Tide Lake in Township 19.
At the Horseshoe Bend the ridge
by a wide valley which apparent-
[illegible]
95 ft. above the river bed and
from it. A stream known as
in Creek has its source in the
referred to; and this is the nat-
[illegible]
branches of the system.
[illegible]
the surveys takes advantage of
[illegible]
m the Bow River by an intake
[illegible]
two functions. First, it will
er level at the intake, thus ena-
tem to command a much larger
than it otherwise would have
ondly, it reduces the quantity of
e removed from the main canal
e dam. At this point the ordi-
[illegible]
the canal headgates will be
[illegible]
ner, or 2,560.6. The dam is
structure, consisting of a
gh earthen embankment on the
the river, and a reinforced con-
in the existing river channel,
[illegible]
ich gives the locality its name.
[illegible]

e river is approximately 600 ft. wide,
h or left bank having a narrow bench
tely at the water's edge and only a
t above it, beyond which is a cut bank
over 100 ft. above the bed of the
The west or right bank has a gravel
ising gradually until it forms a tongue
the two legs of the horseshoe. This
has a broad flat top several hundred
width and rising gradually to the gen-
airie level; its general elevation near
r being about 25 ft. above the bed of
am

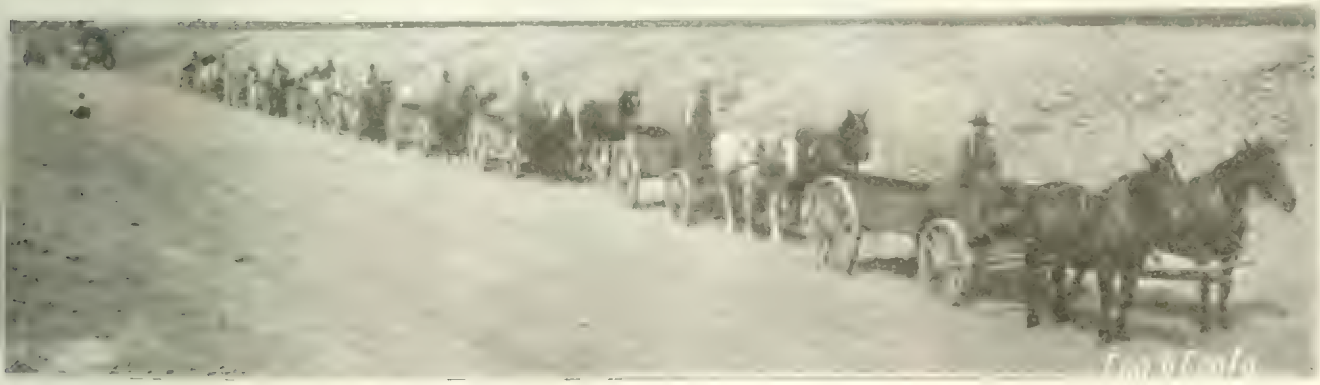


Fig. 8. Canal Construction, Eastern Section.

[illegible] construction, to which the spillway structure will be joined. This embankment will have a maximum height of about 45 ft., a total length of about 7,000 ft., and at its highest point is 310 ft. in width at the base. Its [illegible] of 9 ft. above normal water level. Provision has been made for under-drainage by a wooden box filled with boulders and gravel with

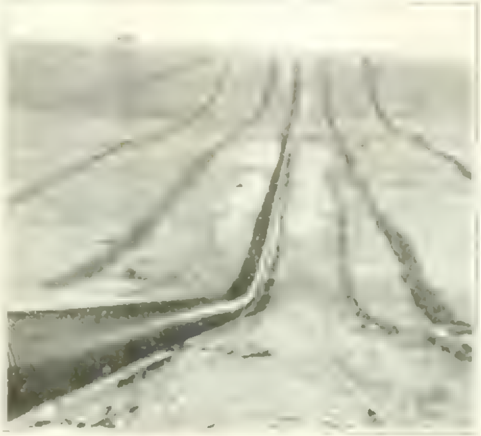


Fig. 7. Wood Stave Siphon [illegible] ins. in Diameter, Western Section.

suitable offtakes, and its upper slope will be paved with concrete slabs. It will contain about 1,000,000 cu. yds., which material is being transported from the excavation from the main canal across the river over a double track timber trestle. The foundations of this dam consist of a deposit of river silt overlying coarse gravel and boulders, which in turn overlie dense blue clay.

The spillway referred to is designed to pass over its crest 100,000 second feet without raising the surface of the pool above elevation 2,563.6 or 14 ft. over the crest, which required a free length of weir of about 600 ft. To allow for end contraction on account of the piers necessary to support the movable crest, a clear length of 650 ft. between piers was decided on.

As the crest of the dam and the sills of the canal headgates were fixed at elevation 2,549.6 the additional depth of 11 ft. for which the canal was designed, had to be maintained by some form of movable crest for the entire length of the spillway in order to pass extreme floods. This movable crest will be divided into 24 sections, and supported between piers giving 27 ft. clear spans, and these openings will be regulated by structural steel gates, of the well-known "Stoney" type.

In the determination of the spacing of the buttresses due consideration was given to the effect upon cost of construction, the time required to build the structure, and to the limitation in length of the gates corresponding to the spacing of the buttresses; with the result that these are to be at 15 ft. centres, with every second buttress carried up in the form of a bridge pier. Emergency gates will also be provided in case of necessary repairs having to be made to the main gates.

[illegible] crete structure of the so-called "Ambursen" [illegible] outline, having a slope on the upstream edge of about 45°. Upon brackets or haunches projecting from the faces of the buttresses and parallel to the upstream edges, is built a concrete slab forming a deck, terminating at the [illegible] the downstream edge of [illegible] downstream a distance of about 75 ft., forming a tumbling hearth. In general the cross section of the spillway is what is known as the Ogee section, and consists of constructing the downstream face of the dam between the crest and the floor in the form of a reverse [illegible] tangential to the floor of the structure, so that the overfalling nappe shall be let down the face of the dam and turned into a horizontal direction parallel to the river bed with the least possible disturbance.

The spillway is founded on a deposit of sand, gravel and boulders, overlying a thick stratum of stiff blue clay. At the upper and downstream edges of the structure heavy cut-off walls are carried well down into the clay and bonded to the body of the carnet. A concrete apron extends about 12 ft. above the upper cut-off wall, and boulder concrete will be placed in the river bed for some distance below the tumbling hearth.

The structure is to be 720 ft. in length between abutments, with a maximum height of 40 ft. to the overflow crest, above which 11 ft. of water will be retained by the gates above referred to. It will contain about 40,000 cu. yds. of concrete, and 2,500,000 lbs. of reinforcing steel.

The abutments connecting the spillway with the earth dam are in the form of reinforced concrete retaining walls of the counterfort type, with a view of cutting off all possibility of leakage at this point. Provision has also been made for a road bridge on top of the structure.

The gates will be operated by a small power plant consisting of vertical turbines with direct connected generators installed inside the dam [illegible] as well as the [illegible] and the operation of other headgates at the end of the [illegible] canal [illegible].

The canal headgates will form an integral part of the structure at its easterly end, and will consist of five openings each of 20 ft., controlled by Stoney sluices. These gates will control the discharge through a main canal of 90 ft. bed width, carrying 11 ft. of water, with 1 to 1 slopes, on a grade of .016 per cent. This canal is designed to discharge 3,800 cu. ft. per second, and has a summit cut of 55 ft. at about Station 10.

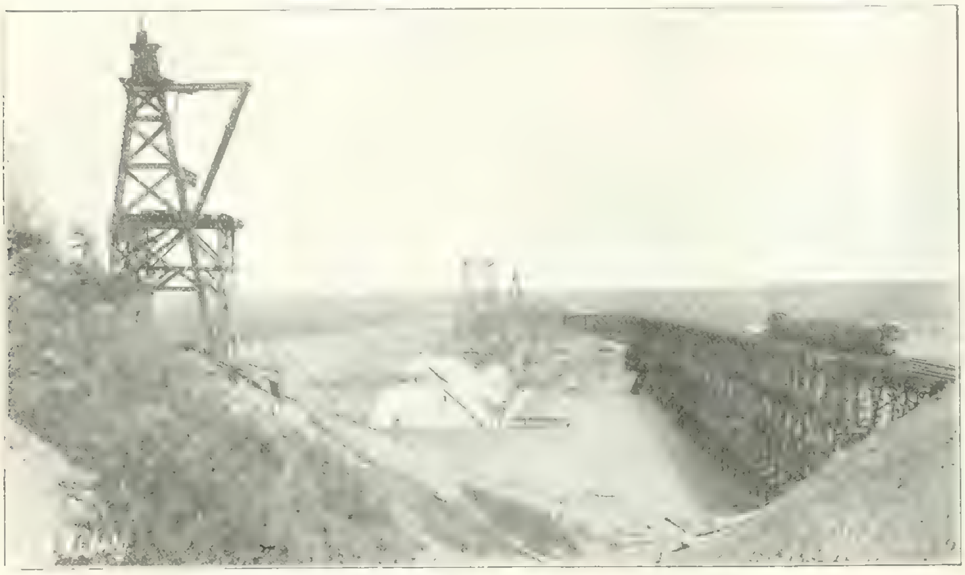


Fig. 9. Horse-Shoe Bend Dam on the Bow River, Eastern Section.

The contract for the spillway structure was let on Oct. 1, 1910, and work immediately started, it being anticipated that it will be completed within 18 months from that date. The earthen embankment referred to is part of a very large contract awarded in June, 1910, which includes the handling of about 20,000,000 cu. yds. of excavation in this section of the block.

Tail Dam and Tail Pool.—At a point about five miles from the intake, an earth dam 1,280 ft. in length, 35 ft. maximum height, containing 80,000 cu. yds., was built across the valley, thus forming a tail pool into which the main canal will discharge. This dam has a top width of 12 ft., 6 ft. above high water; has 2 to 1 slopes on the rear face and 3 to 1 on the wetted slope. Its face is paved with heavy rip-rap well bedded in gravel.

Canals.—From this point two canals head—a North and East Branch. The North Branch with its distributaries will water about 90,000 acres, its dimensions being 29 ft. bed width, carrying 6½ ft. of water, with 2 to 1 slopes, on a grade of .03 per cent. After crossing the railway line about one mile east of Bassano, its location follows the west flank of a deep valley known as Crawling Valley. At a point about eight miles from its intake it drops 18 ft. and crosses the valley by about 1,700 ft. of flume, and runs northerly, gradually reducing in size until it reaches the Red Deer slope.

The East Branch, like the North Branch, heads out in the tail pool of the main canal, its size at the outlet being 68 ft. bed width, carrying 9.3 ft. of water, with 2 to 1 slopes, on a grade of .015 per cent. Near Lathom the first branch takes off, dropping 25 ft. to cross the railway and water an area of about 107,000 acres between the Mat-zi-win and the One Tree Creeks. This branch is known as the Spring Hill Canal and is about 35 ft. bed width, carrying 7 ft. of water, with 2 to 1 slopes, on a grade of .025 per cent.

The East Branch continues southeasterly along the northerly flank of the watershed as a 45.3 ft. by 7.8 ft. canal with a grade of .02 per cent, reaching the height of land at the head of Antelope Creek, which is crossed by a flume 2,200 ft. long with a maximum height of 22 ft. At this point it again forks, the southeasterly branch being known as the Bow Slope Canal, which is about 17 ft. bed width, carrying 5 ft. of water; and will serve all the land on the Bow River Slope of the divide and lying west of the Rolling Hills, amounting to about 42,000 acres. At Cassils a smaller canal to cross the railway is taken off, to serve about 12,500 acres.

Lake Newell Reservoir.—Just south of Brooks the East Branch discharges its waters with a drop of about 17 ft. into Lake Newell Reservoir, which will be formed in a depression in the Little Rolling Hills by the construction of a number of earth dams, the largest of which will be about 2,000 ft. long and 30 ft. in height. This reservoir will be about 9 miles long and 4½ miles wide, and its storage capacity will be about 186,000 acre feet. It will be filled each season after the close of the irrigation period, and was the means of materially reducing the cost per acre of the project as a whole.

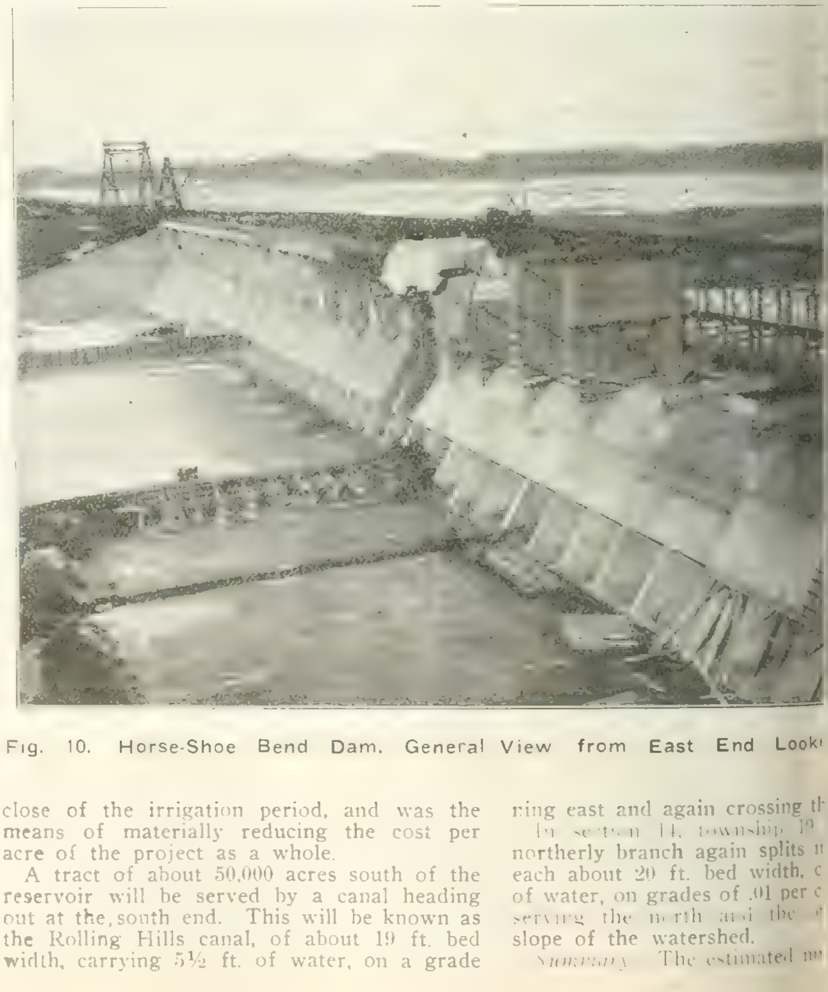


Fig. 10. Horse-Shoe Bend Dam, General View from East End Looki

A tract of about 50,000 acres south of the reservoir will be served by a canal heading out at the south end. This will be known as the Rolling Hills canal, of about 19 ft. bed width, carrying 5½ ft. of water, on a grade of .02 per cent. The outlet f end of the reservoir will serv about 118 acres, known as the Bantry stem, and dimensions are 44 ft. bed widt carr ft. of water, on a grade of .0 per c about five miles in length. end it will discharge into a reinforced crete flume 10,500 ft. in length mum height of 54 ft. and a sectional area 129 sq. ft.

Reinforced Concrete Flu— tions of storage values fixed th elev both ends of this structure, a unde conditions the type of crossi whi the highest velocity for a give fixed head was imperative.

Numerous preliminary studi were for the purpose of comparativ cost, with the result that a s design is likely to be adopte channel is of the suspended used in steel flumes. The exa posed is the elastic curve or li enary. The substructures will vary with the head, and that multi-arched design will b spans varying from 30 to 100 depressed portion under the is intended, as previously inti reinforced concrete siphon, an save excavation and provide m uring the discharge it is propo Venturi meter with a throat s 6 ft. The structure as a whol contain about 25,000 cu. yds. upwards of 2,000,000 lbs. of re

This flume will carry the wat divide in the watershed with i point about 3 miles southeast will serve all the country east

At the easterly end of the f section is 44 ft. bed width, car water, on a grade of .01 per c northeast quarter of section 2 range 14, it splits, one branch width, carrying 7.2 ft. of water .01 per cent running north; branch of about 16 ft. bed wi ft. of water, on a grade of .01 ring east and again crossing th

In section 14, township 19 northerly branch again splits each about 20 ft. bed width, c of water, on grades of .01 per c serving the north and the slope of the watershed.

Summary.—The estimated

serve this section of the block

	Miles
....	
....	475
[illegible]	[illegible]

ire, numbering thousands, will [illegible] concrete and brick.

[illegible]

has not yet been started on ection. Briefly it contains 901,- it was at first contemplated to one quarter of this area. Dehowever, showed that the cost ch an area would be excessive, it is not contemplated to serve ut 75,000 acres in this section, [illegible]

ly intimated this section could ly through an enlargement of a e trunk system already conrve the Western Section of the e consideration has been given wherever possible by spreading far enough apart to admit of additional amount of water [illegible]

Remarks.—It is the intention rds of the receipt and delivery of the outflow through all he system shall be maintained nning: such data being as [illegible] bookkeeping in any commercial institution. The information thus obtained is essential in enforcing proper water economy; in preventing land from being injured, and in keeping farmers from getting into bad habits in using water, which if once acquired, results in reduced crop production, increased cost of operation, and needless annoyance to the management.

World-wide experience in the use of water on cultivated lands under any kind of crops during long periods of years, shows that the duty varies with, (1) the nature of the soil; (2) the age of the soil; (3) the kind of crop; (4) the weather conditions; (5) the slope and condition of the conveying channels of supply; (6) the distance the water is carried in the ditches and channels to the fields; and (7) the experience and skill employed in irrigation. The legal duty in the Province of Alberta is fixed by the Irrigation Act as a continuous flow of 1 cu. ft. per second per [illegible] Sept. 30. Measurement of this supply is arranged for by weirs approved of by the Commissioner of Irrigation.

The company has adopted the plan of constructing the complete distribution system so as to deliver water at the boundary of each farm unit of 160 acres or less; as it was considered impracticable to leave to the settlers the building of the smaller ditches, which would have resulted in delays to the work, excessive cost and a retarding of the development of the area, followed by increased difficulties in operation. In constructing the distribution system, 160 acres has been considered the farm unit, although in the Western Section several colonies have been established on the so-called "Ready-Made" farms of 80 acres. In the Eastern Section of the block about 5 per cent of the farm units will be sold as 80-acre farms, in addition to the establishment of a number of colonies on farms averaging from 80 acres to 120 acres.

The successful outcome of any large irrigation project is only partially solved by good construction; and in some cases the administrative heads of large schemes have failed to realize that the ultimate success of such enterprises cannot be fully brought about without farmers; and that it is their labors that fully determine the real value of such properties. With this realization, the sale of the lands in this block warranted the establishment of a very large organization which has extended over all important points in Canada, the United States, Great Britain and parts of the Continental Europe; and which has resulted during the past five years in the disposal of over 1,300,000 acres.

Everything that follows in the wake of increased population is an argument in favor of irrigation and the cultivation of small areas; which can only be carried out by this means of farming. Moreover, this results in a better type of farmer, greatly improved living conditions, and correspondingly elevated social conditions.

No practical agriculturist can fail to realize the fact that the scope for irrigation in semi-arid conditions in northern latitudes is very great; and that this system of farming will ultimately become a leading factor, and occupy a vitally important place in the agricultural development of Southern Alberta

AM AND ELECTRIC RAILWAY SECTION

rete in the Fourth Avenue f the New York Under- Rapid Transit Railway System.

[illegible] Subway, Brooklyn, is a[illegible] use of reinforced concrete on a ne portion now under construcout four miles from the Brooke new Manhattan Bridge, over nded to connect with a subway hattan. The route, Fig. 1, lies

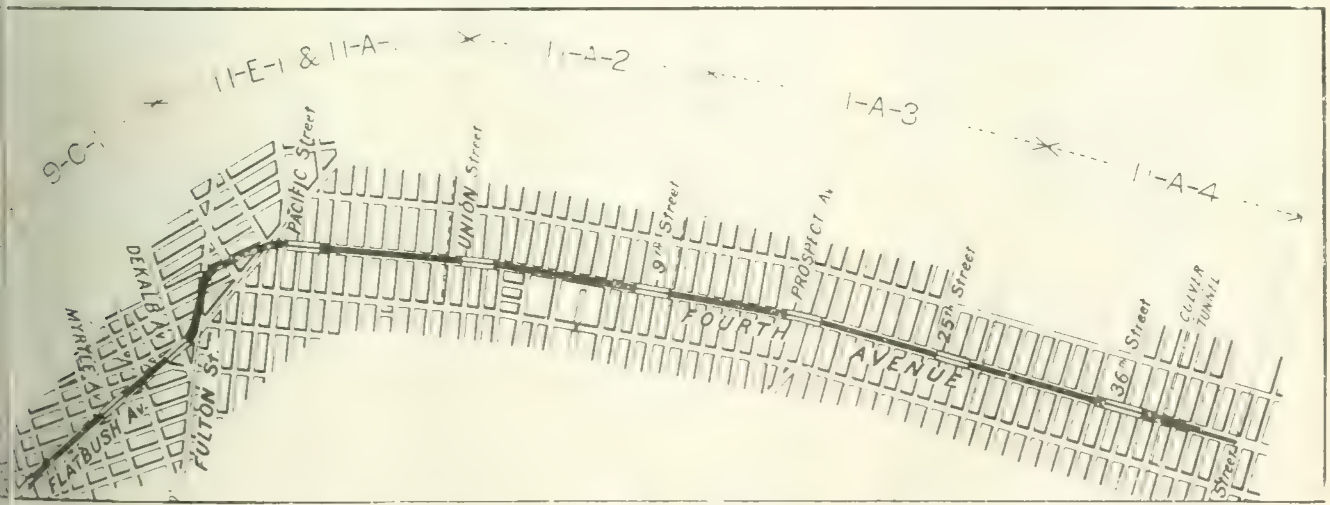


Fig. 1. Map of Fourth Ave. Subway, Brooklyn, New York City. Showing Contract Sections.

sh Ave., Fulton St., Ashland Ave. to Forty-third St., in a lly south. From here it is proit in future by two branches to nts of the borough. The subilt for the city of New York, vision of a state commission, d Craven as the chief engi-: was divided into six contract sections, [illegible] at an aggregate price of about $15,000,000. Construction is now nearly finished.

The concrete work in this subway involved several interesting features which are described in a paper by Frederick E. Noble before the National Association of Cement Users.

The structure normally has space for four tracks, two for local and two for express service. These are increased to seven and eight in places where connection spurs, for future extensions, are provided in two levels to avoid turnouts at grade. There are six local and two express stations, with platforms [illegible] enough to accommodate ten-car trains.

The excavation was principally in a morainal deposit, consisting of sand with more or less gravel and boulders. No rock was found anywhere on the line. Some quicksand was met near the middle of the route, where the subway traverses ground filled in over the bed of an old salt marsh. Ground water was encountered at or near tide level and was controlled by pumping. Excavation was usually carried on under covered roadways, but in the extension of Flatbush Ave. open excavation was permitted.

In connection with the work it was necessary to underpin about forty buildings with masonry piers to sub-grade in advance of the excavation, where it approached close to and below their foundations. It was necessary also temporarily to support the elevated railway on Fulton St. and to drift a crossing under the present subway in operation in Flatbush Ave. Since Fourth Ave. lies along the foot of a considerable drainage area, sloping from Prospect Park, it was necessary to depress or intercept many cross sewers carrying a heavy storm-flow, and to provide under-grade crossings at intervals. About six miles of sewers, of all sizes up to 9½ ft. diameter, were thus built or rebuilt.

The typical four-track section is shown by

Fig. 2. The roof, sides, intermediate walls, and floor where below ground water are reinforced with corrugated bars ranging between 1¼ and ⅝ in. square. The design provides for a uniform live load of 300 lbs. per sq. ft. at the street surface. Waterproofing is used at stations on the roof and sides, and generally below ground water on the sides and floor. Elsewhere the concrete is relied on for sufficient protection against seepage.

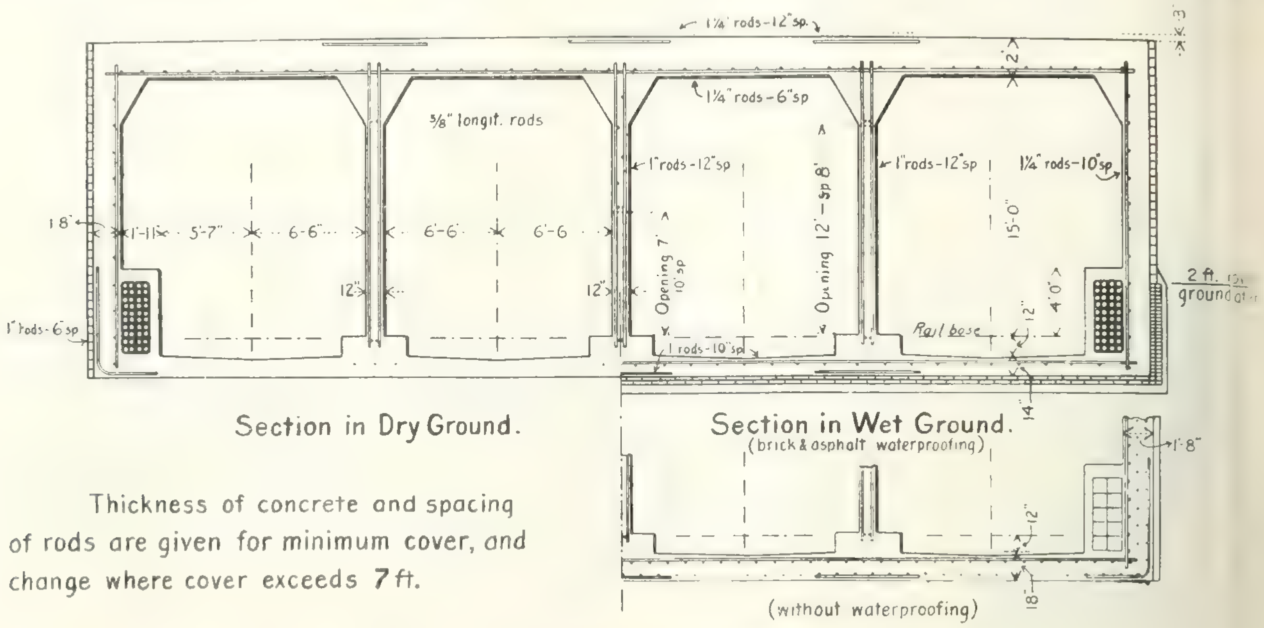


Fig. 2. Typical Sections of Fourth Ave. Subway.

The amount of concrete required is somewhat over 400,000 cu. yds. The usual proportions are 1:2½:4½. Much of the excavated sand is suitable for concrete and is used accordingly. The remainder is washed or dredged sand from the north shore of Long Island. The aggregate is mostly washed or dredged gravel from the same source, usually under 1 in., and well graded in size. At times, when gravel is not readily obtainable, cobbles and fragments of boulders are crushed and used. The concrete is mixed rather wet to facilitate its flowing around the reinforcement, as this is generally spaced quite close.

Reinforcing rods were required to be deformed. The Johnson and Havemeyer patterns were used. Transverse and longitudinal rods were wired at their intersections (Fig. 6). For this purpose special devices of bent wire were used, manufactured by the Wedmore Co. These served at the same time to space the rods, or to hold them at the proper minimum distance from the forms. Where unusually long spans or concentrated loads occurred, the roof was of girder and jack-arch construction. To hold the thin covering of concrete under the lower flanges, special clips or hangers of twisted wire were attached at intervals by bending them over the upper sides of the flanges. Sometimes a strip of coarse wire mesh was wrapped loosely around the flanges to serve the same purpose. In a few instances, where the concrete under the flanges tapped hollow, it was chipped off around the edges of the flange, and a strip of wire mesh was attached and covered with mortar blown in place by means of a "cement gun."

Concreting was permitted throughout the winter, except on the very coldest days. Materials were heated by fires or steam coils, and the freshly laid concrete was covered with salt marsh hay and tarpaulins. Salamanders were placed under the roof forms in some places. On account of the varying conditions of mixing and degree of exposure, it was impracticable to devise a set of rules to fit all cases, but the criterion was held to be the temperature at which the mixture could be deposited in the forms.

Roof forms were struck as soon as the temperature conditions and setting qualities of the particular brand of cement used would permit. As this was a factor limiting progress, especially in the case of large steel forms, it was desirable to strike them as soon as practicable. In summer they were struck after 80 hours, and in exceptional cases even at 50 hours, but in winter it was sometimes necessary to wait a week or 10 days before striking.

The methods of mixing and handling concrete vary between the different sections and are described briefly as follows:

Section M. B. Ex. 1.—This section, extending from Nassau St. through Flatbush Ave. to Willoughby St., is being built by Smith, Scott & Co., contractors.

Materials for concrete are brought on the work over a tramway extending along each side of the cut from a dock under the Manhattan Bridge. Sand and gravel are loaded at the dock in Continental side-dump cars, drawn by Porter & Baldwin 20-ton dinky locomotives. The cars are run up an incline and dumped into bins over the mixer, which is located about centrally on the section. This is a 1½ cu. yd. Ransome machine, operated by a 30 h.p. electric motor. The mixture is discharged at the track level into Ideal bottom dump cars of 1 cu. yd. capacity, in trains of three or four cars, hauled to the point of deposit, and dumped in frame chutes, through which it slides to the forms.

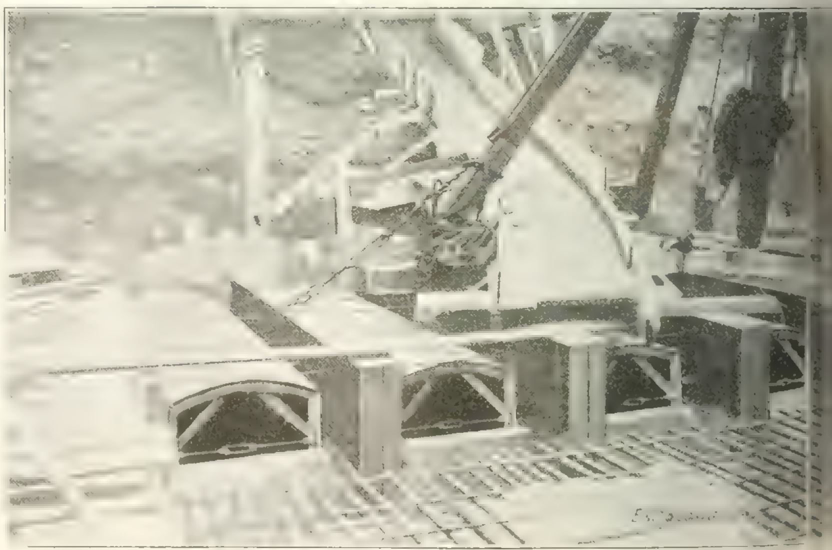


Fig. 3. View Showing Steel Jack Arch Forms, Fourth Ave. Su

As the sides of the cut were almost self-sustaining and as the contract ter excavation on this section, ry timbering was necessary, a ondition greatly facilitated the erecting nd mov forms. These were of the Bla coll. tern, with stiffened steel sides suit the varying widths of r having been laid for the entire ture and the reinforcement sides and intermediate walls. moved into place, one 20-ft. s traveling on tracks laid on th way it was possible to lay walls and roof over four trac ft. long at a continuous forms were very similar to the of the lower sections, in which will be more fully described.

Where structural roof framg tuted for rod construction, (Fig. 3) was used to turn These were of angle-stiffene adjustable center strip of woo span, and were set in positio The span was maintained by which also served to draw striking the forms. After str tion was lowered with a winch

Section 9-C-1.—This section, Willoughby St. along Flatbush ton St. to Ashland Pl., is bein liam Bradley, contractor.

for concrete are delivered at a ongside the subway between Third reets, where this contractor has a [illegible] stable for his horses. mployed for moving all materials. [illegible]

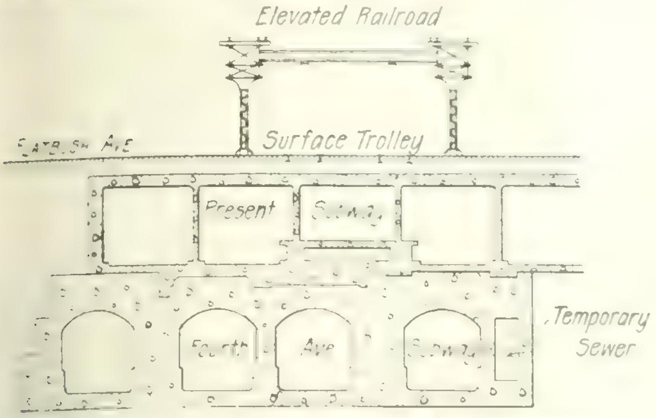


Fig. 4. Crossing of Fourth Ave. Subway Under Present Subway

[illegible] l gravel were placed just below el. These fed four loading hop- one bag batch capacity. After he contents were dropped sucugh three mixing hoppers, rese of water in the first one. r was slightly offset from the The mix was discharged at the into cars which were run onto a [illegible] n overhead bin. From the bin it [illegible] through [illegible] steel cars of yds. capacity, which were teamed of deposit. The mixture was [illegible] and conveyed telescopic chutes to the forms. [illegible] of the hopper was patula until the entire load was

e structure on this section is of l jack-arch construction, so that rm work was required. The re-

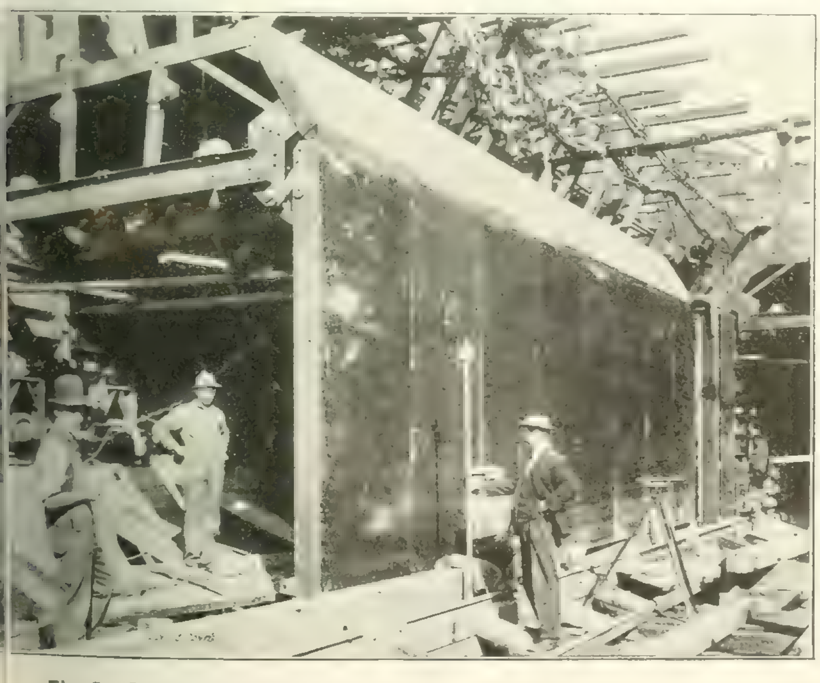


Fig. 5. Steel Collapsible Forms, Fourth Ave. Subway.

older type of design was at the contractor, and partly because rated loadings brought by the ire and building foundations to rmanently on the roof.

-1 and 11-A-1.—These two sec- gether form one contract section, extend from Fulton St. through Ashland Pl. and Fourth Ave. to Sackett St., and are also under contract with William Bradley. The methods of mixing and placing concrete are the same as those described for this contractor's adjoining section. The form of construction is also similar, except where the line passes by a curve under the present subway in Flatbush Ave. Here the design is of massive concrete arches, one for each track, without reinforcement (Fig. 4).

[illegible] This section extends from Sackett St. along Fourth Ave. t Tenth St., is being built by the E. E. Smit Contracting Co.

Materials [illegible] beside the Gowanus Canal at Third St., and are distributed to the work by mule teams. Concrete is mixed in the roadway, directly over the point of deposit, in five small readily-shifted drum mixers of ½-cu.-yd. capacity, each operated by a 15 to 25-h. p. electric motor. Chicago, Lakewood and Chain-belt mixers were used. The mixture was discharged and conveyed to the forms through 10-in. sectional chutes [illegible] with a funnel at the top.

Generally, the floor and walls of the westerly two tracks were built first, then the floor and walls of the easterly two, after which the roof was carried across all four tracks in sections about 30 ft. long. Five such sections would be in progress at one time.

The necessity for maintaining the cross-bracing of the trench precluded the use of large forms such as were used on certain of the other sections. Forms were made of 2-in. lumber, dressed all sides, and with dapped edges. They were assembled in well-braced panels and could be used many times. Jack-arch forms were made of 16-gage iron, nailed on wood ribs, and were suspended in position by long bolts.

On this section the usual waterproofing on sides and bottom below ground water level is omitted. In such situations the concrete is locally made richer, 1:2:4, and the longitudinal reinforcement is doubled (Fig. 2).

Section 11-A-3.—This section extending from Tenth St. along Fourth Ave. to 27th St., is under contract with the Tidewater Building Co. and Thomas B. Bryson.

Materials for concrete are brought on scows to a dock at the foot of 19th St., from which a 3-ft. tramway leads to the cut and through it in both directions. The sand and gravel are transferred from the scows to overhead bins by a crane and clam-shell bucket. The bins discharge through gates into 4-cu.-yd. Continental side-dump cars. These are hauled by a 20-ton American locomotive to the main storage bins, of about 3,000 cu. yds. capacity, situated in the cut near 19th St., near the mixing plant. Jeffrey belt conveyors run under the gates of the bins and take the material to a bucket elevator which raises it to bins over the mixer. The overhead bins feed

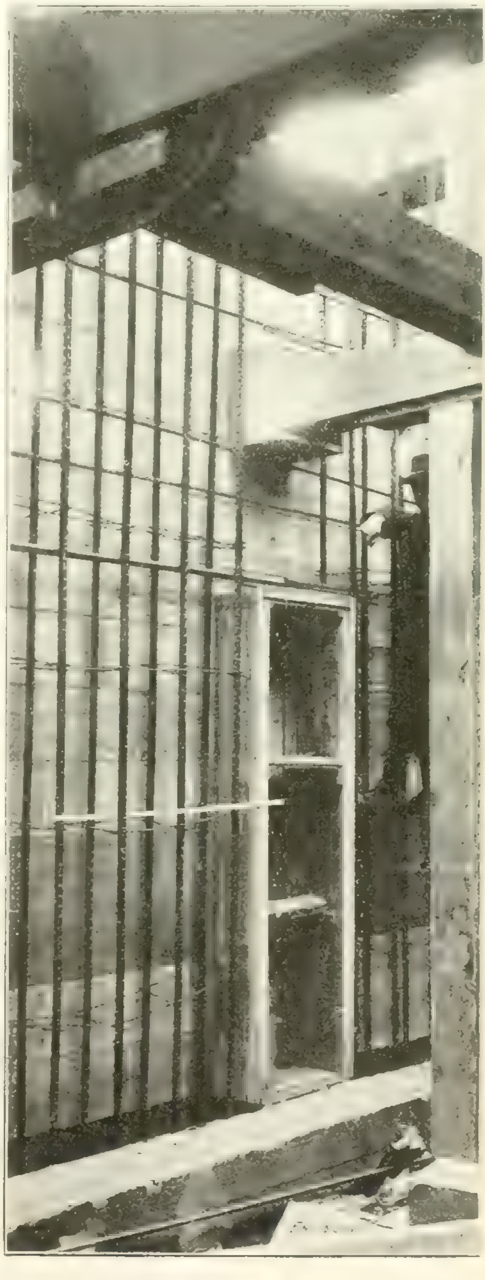


Fig. 6. View Showing Manner of Wiring Side Wall Reinforcement, Fourth Ave. Subway.

into measuring hoppers, where the cement added, and thence into the mixer, which is a 1-cu.-yd. Ransome machine mixing a five-bag batch. Conveyors and mixer are electrically driven.

Taking advantage of the firm character of the ground and the great width of the avenue, a method of excavation was adopted that dispensed with cross-bracing; thus leaving the cut, unobstructed and making it feasible to construct large sections at one time. The floor of the two middle tracks was laid first, and this was followed by the floor and duct bench of each of the two outside tracks. Concrete was brought from the mixer for this part of the work in 2-yd. side-dump cars. On the completion of a section of the bottom, steel forms were moved into place, and the sides, intermediate walls and roof were concreted continuously in a long section.

The steel forms (Fig. 5) were of the Blaw collapsible type, made of 3/16-in. plate and stiffened with shapes. They were composed of 5 ft. units, bolted together in sections 40 ft. long, and traveled on rails. Four such sections, one for each track, made up a set of forms, of which two were in use generally on different parts of the work. The forms were struck, each section separately, by means of a hand tackle arrangement that swung the top leaves down around hinges at each side, and drew in the tops of the side-panels automatically. The vertical reinforcement for the next section being set up, the forms were then pulled ahead, one 40-ft. section at a time, by a locomotive into their new position; an operation that could be performed in a very few minutes. As each section was advanced it was adjusted to exact position and connected to its neighbor by long bolts and pipe separators. The adjustment was effected by the jackscrews and sliding axles of the trucks; affording a range of movement both vertically and horizontally. The reinforcing bars of the roof were then laid in position.

For concreting the roof, the mixer discharged into trains of four or more 2-cu.-yd. Lockwood bottom-dump buckets on flat cars, which were pushed by a locomotive over the tramway through the cut to the forms. Here the buckets were lifted by a Brown hoist locomotive crane and dumped on a hopper raised about 12 ft. above the forms. From the hopper the mixture flowed through shallow troughs to the points both sets of forms were j 80 ft. section, requiring could be concreted in about 5 hours

Section 11-A-1. This sect along Fourth Ave. to 43d St., is by the E. E. Smith Contracting Co., who also the contractors for secti 11-A-2.

Materials are delivered contractor's yard at 31st St. where there is also a cement storeh cars capacity to serve bot methods of mixing and dist and the use of forms, are t described for section 11- Chain-belt and Smith mixers

All cement is inspected shipped in sealed bags. The is in Allentown, Pa., in the Lehigh trict. Over half a million quired. Alpha, Dragon, E Pennsylvania brands have b

Under the specifications, p to brands whose records sh crease in strength over lon criterion of this quality, mor required to show a gain of tween 7 and 28 days.

BRIDGES AND BUILDINGS SECT

A New Type of Saw-Tooth Roof with Some Construction Costs.

Several new principles of construction are embodied in a saw-tooth roof design recently worked out for a weave shed by Mr. Albert G. Duncan, Boston, Mass., and described by him in a paper before the National Association of Cotton Manufacturers. An abstract of this paper follows:

The peculiarity of this saw-tooth roof is the use of steel trusses which give wide bays. The trusses consist of riveted numbers delivered on the ground all fabricated of a height of 8 ft. 6 ins. and a span of 27 ft. The trusses are riveted to the side of the I beams, as is plainly shown by section in Fig. I. This simple method of connection was adopted for securing greater stiffness in the roof structure and also for bringing the bottom of the skylights as near the cloth surface of the looms as was possible. The longer span and consequent height of the trusses employed also allowed the supporting columns to be comparatively short (11 ft. 2 ins. from the floor to the top of the column) without reducing materially the cubical area of the room per operative.

Experiments made previous to the construction of this shed showed that the diffusion of light or the causing of shadows on the cloth in the loom was directly dependent upon the distance the skylight sills were above the weaving surface. In some weave sheds seen, which were very high studded, shadows could be produced by the hand being held approximately 12 ins. above the surface of the cloth, whereas, in the shed under consideration, shadows are hardly perceptible when the hand is held 4 ins. above the surface of the cloth.

The roof consists of 3 in. splined sheathing laid on spiking strips bolted to the side of the top chord of each truss, the trusses being spaced 9 ft. apart. Great care was taken in the design and construction of this roof that no difficulty from condensation on the overhead steel structure should be encountered, and it was felt that this could be avoided if the steel work were kept at all times at the same temperature as the room, and so in no case was any portion of the roof exposed to cold air allowed to touch the steel structure, the top of the nailing strips being raised in each case from 1/4 to 1/2 in. above the top of the trusses and the valleys of the roof being kept at about 4 ins. distance from the supporting I beams.

Various methods have been adopted in weave sheds to prevent valleys filling up in our climate of heavy snows and sudden thaws. Some weave sheds have a uniform pitch from side to side and drain out of the end of the valley.

In the shed under consideration at each of the posts a leader of 3-in. wrought iron pipe was run down through the floor into the basement for connection to the sewers. This gave a distance of 27 ft. between leaders and this space was divided into two equal parts and the valley filled in by cricketing, giving a pitch of approximately 14 ins. in 13½ ft., so that the length of the valley to be drained by each roof conductor was 13½ ft. on each side. This design has been very successful and no leakage of the roof has occurred.

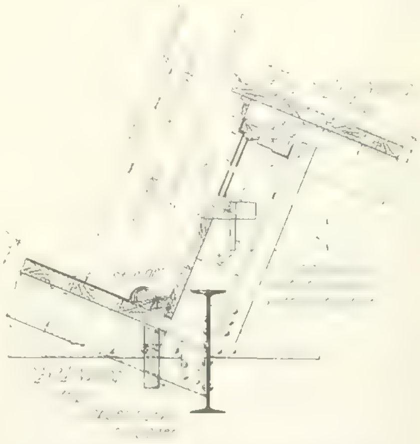


Fig. 1. Detail of Gutter and Skylight Construction for Saw Tooth Roof.

Another advantage of this method of construction of gutter is that it prevents the roofing following the sharp right angle bend at the bottom of the valley, as this angle was materially reduced by the cricketing and the joint which it made with the roof was first reinforced by galvanized iron strips before the first layer of roof was applied. This method has been very successful and the tendency of the roof to crack when it followed the line of the sharp gutter has been entirely obviated.

The skylights in the mill are of the usual construction of 1/4 in. hammered translucent glass outside and 3/16 in. factory ribbed glass inside, the glass being supported on metal sashes which were fabricated in place, and all exposed metal surfaces of these sashes are 16-ounce copper, special attention being given to the metal covering of the skylights, the copper being the inside, where it was rol small condensation gutter a glass, to well down over the covering. This gutter form sill is drained at frequent conductor pipes previously

In some sheds it has bee leave an opening into the s glass to the outside air, fea condensation might collect sheets of glass, but the wr this defeats the whole objec ing, and consequently great this installation to see that t the glass was absolutely air excellent insulation, the buil severe weather being very each of the bays one-half of movable, opening outwards arrangements being made t the floor.

Owing to the long span the roof it was not conside put on the ordinary tar and covering of seven-ply plastic which has proved very satisf cost about the same as the tar and gravel roofing.

In regard to the cost of lowing figures may prove in

The building is 252 ft 140 ft 10 ins wide in th saw tooth, the measurem from the outside to outside tains an addition for cloak an 25 ft 10¼ ins by 14 ft passageway connecting with ings, making the total area cluding the projections abov an inside area in the main r ft, of which 33,890 sq. ft. lights. The cubical contents 600,000 cu. ft., not including

The skylight area consists ratio of 1 sq. ft. of skylight floor surface.

The building was erected o "Percentage Basis" and ment $47,628, including contractor's profit. The cost of area figuring on the basis is as follows:

Excavation
Concrete footings and foundat
Structural steel ....
Posts and girders.
Flooring complete ....
Concrete blocks (making and s
Wood wall ... ...
Roof complete ..

[illegible]	[illegible]
[illegible]	.04
[illegible]	[illegible]
ts, clerks, etc.	.04
[illegible] and tools	[illegible]
....	$1.323

sts are based on the following or materials:

el and columns delivered on per ton	[illegible]
[illegible] wall, columns and [illegible] forms per cu. yd.	10.27
[illegible] steel work, per	[illegible]
long leaf yellow pine, per	[illegible]
[illegible] leaf yellow pine, per M	[illegible]
lank, long leaf yellow pine,	[illegible]
ermediate flooring, per M. ft.	21.00
ring, per M. ft.	33.00
[illegible], per bbl	[illegible]
net, per ton	1.20
[illegible] and erected per sq. ft.	.11

An Extended Series of Re- Concrete Beam Tests with al Crushing, Bond and inforcement Tests.

[illegible] series of tests [illegible] is reported by the [illegible] The numbers and tests made are summarized in

[illegible] 156 beams, together sponding cylindrical and cubical [illegible] tests and 18 bond determine the adhesive strength ates used: Representative ma- of four classes of aggregates, l granite, crushed limestone, and sed in making up the test pieces, ted in triplicate at the ages of 4, [illegible] respectively.

was 1:2:4 mixed by Chicago Mixer. The beams were 8x11 and 13 ft. long and were tested n. The cubes were 6x6x6 ins.; ere 16 ins. high and 8 ins. diam- [illegible] from the tests follow

[illegible] IN TENSION

[illegible] the behavior of the rein- [illegible] reported the fol- ons may be stated:

[illegible] (1) The unit he extreme lower fiber at the currence of the first crack is ne and gravel concrete, 0.00018 rete, and equals the unit elonga- er fiber at rupture of a beam ncrete without reinforcement. t elongation of the extreme time of the occurrence of the [illegible] with the percentage

nce between cracks due to ten- h the percentage of the rein- tly with the kind of aggregate, lent of the age of the concrete.

[illegible] at Maximum Load of the unit stress in the re- maximum load to the yield th the percentage of the rein- dependent of the age of the ows no regular variation with [illegible] of elasticity of the con-

[illegible] (1) The at a load just below maxi- it stress in the reinforcement han the yield point, is almost [illegible] about 120 lbs. per increases slightly as the per- reinforcement increases, in- at with age, and with the [illegible]

[illegible] Moment. (1) Bas- moment of a reinforced con- he tensile stress in the rein- neglecting the tensile resist- crete, the ratio of the resist- he bending moment is always een 0.5 per cent and 1.7 per reinforcement. This ratio is ne kind of aggregate used, de-

TABLE I.

Concrete Mixture	Aggregate	[illegible]	[illegible]	[illegible]	[illegible]	Per cent	In Beam	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.74	[illegible]	144
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	192
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.24	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.47	6	288
[illegible]	[illegible]	[illegible]	[illegible]	18	[illegible]	1.72	[illegible]	336
[illegible]	[illegible]	[illegible]	[illegible]	18	[illegible]	[illegible]	[illegible]	384
Total					18			1,680

²Elastic limit steel approximately 40,000 lbs.

[illegible]

creases with age, and increases with the percentage of reinforcement.

[illegible]

The behavior of a reinforced concrete beam, having the reinforcement in two horizontal planes is identical with a beam having all the reinforcement concentrated in one plane, and equal in amount to the reinforcement in the lower plane plus that in the upper plane multiplied by the ratio of the distances of the upper and lower planes from the neutral axis.

[illegible] Axis.—(1) With effective percentage of reinforcement.—The percentage depth of the neutral axis below the top of the beam increases with the percentage of reinforcement and increases or decreases with different amounts of reinforcement as the intensity of loading increases, depending upon the ultimate strength of the concrete as influencing a compression failure, and the relative stiffness of the concrete for varying degrees of stress as determined by the character of the stress deformation diagram of the cylinders (fixed by the proportions, consistency, kind, and age of concrete).

(2) With age of concrete.—For all practical purposes the percentage depth to the neutral axis for a given unit stress in the reinforcement may be taken as independent of the age of the concrete.

(3) With modulus of elasticity of concrete.—The character of the concrete as measured by its modulus of elasticity exerts an influence on the position of the neutral axis.

[illegible] (1) With effective percentage of reinforcement.—For any given percentage of effective reinforcement the moment of resistance varies as the ordinates of a straight line, and based on the moment of resistance of a plain concrete beam the moment of resistance for a reinforced concrete beam is proportional to the effective percentage of reinforcement.

(2) With character of concrete.—The moment of resistance is appreciably affected by the character of the aggregate used and the age of the concrete.

[illegible] Span.—(1) With effective percentage of reinforcement and character of concrete.—For a given unit stress in the reinforcement the deflection increases with the percentage of "effective" reinforcement and increases as the modulus of elasticity and ultimate strength of the concrete decreases.

(2) With unit stress in the reinforcement.—The deflection of a reinforced concrete beam increases in direct proportion to the increase in the unit stress in the reinforcement.

Variation of the Unit [illegible] in the Extreme Upper Fiber.—(1) With effective percentage of reinforcement.—The unit compressive stress in the extreme upper fiber varies with the percentage of effective reinforcement as the ordinates to a straight line.

(2) With a given unit stress in the reinforcement.—Excepting cinder concrete for the earlier ages and low percentages of effective reinforcement, the unit stress of 16,000 lbs. per square inch in the reinforcement corresponds to a unit compressive stress in the extreme upper fiber of at least 1,000 lbs. per square inch.

CONCRETE IN COMPRESSION

The conclusions as to the general effect of age on the various elements (ultimate strength, initial modulus of elasticity, and yield point) that determine the value of a given concrete are probably of fairly general application.

Comparison of Aggregates.—It should be recognized that the results obtained for each class of material—i. e., granites, limestones, gravels, etc.—used in these tests may not be applicable to other materials of the same class obtained from a different source. There are too many elements affecting the strength of concrete to warrant the assertion that because an individual of a class—i. e., granite—gives excellent results, that therefore all granites will give equally good results. The gravel used in these tests had smooth round surfaces but developed a compressive strength but little inferior to that of the granite, and appreciably greater than that of the limestone. Yet it can not be stated that the use of any given gravel for concrete is permissible, because this particular sample, which originated from a hard flinty rock and is well graded, gives excellent results. A gravel deposit will necessarily partake of the physical properties of the rock from which it is derived and no good results can be hoped for by the use of a gravel which originated from a soft chalky limestone or from some weak cleavable shale or sandstone. The compressive strength of the stone affects the compressive strength of the concrete in which it is used in too great a degree to warrant the neglect of the consideration of this influence, while even for the same stone, the strength of the concrete will be greatly influenced by the uniformity or nonuniformity of the grading.

Again for equally good grading, the material which grades down from the larger particles will nearly always show the greater strength. The effect of a large amount of dust in decreasing the strength of the concrete should not be overlooked. It must be recognized that the quality of the sand used in making the concrete—i. e., its hardness, size and grading, the presence of a large amount of very fine material—are all elements which will modify conclusions as to the excellence of a given stone or gravel.

From a consideration of the above facts it is always advisable to make careful investigation of the materials available, even though the costs of tests seem excessive.

Weight Per Cubic Foot of Concrete.—The weight per cubic foot for a 1:2:4 stone and gravel concrete may be taken as 150 lbs. and a cinder concrete 120 lbs.

Ultimate Strength of Concretes at Four Weeks.—The ultimate strength of 2,000 lbs. per square inch for a 1:2:4 concrete at the age of 4 weeks, frequently the basis for unit stresses, was exceeded by almost 50 per cent for the granite and gravel and by 25 per cent for the limestone concrete, but the value found was 20 per cent less than 2,000 lbs. per square inch for the cinder concrete.

Effect of Age on Ultimate Strength.—The ultimate compressive strength of concrete shows a substantial increase from an age of 4 to one of 52 weeks, the strength of 4 weeks being about 65 per cent of that at 52 weeks.

Position of the Yield Point.—The yield point at the age of 4 weeks averages about 0.30 the ultimate strength and for stone and gravel concretes is well above 500 lbs. per square inch, but for cinders is somewhat less. The yield point shows a substantial increase with age.

Compressive Stress Gross Deformation Diagram.—The compressive stress, gross deformation diagram of concrete may be represented by a straight line up to a unit stress of 1.5 times the yield point with a maximum error of about 6.5 per cent. A working formula for reinforced concrete in flexure, based on a constant stress deformation diagram for concrete in compression, will therefore give correct results up to an extreme unit fiber stress of 0.30, the ultimate strength. This would correspond to a factor of safety of about 3 and for a unit fiber stress 50 per cent greater the error will not exceed 7 per cent.

Initial Modulus of Elasticity.—The initial modulus of elasticity at the age of 4 weeks exceeds 2,500,000, the amount usually specified, by about 85 per cent for gravel, 70 per cent for granite, and 45 per cent for limestone concrete, but is 35 per cent less for cinder concrete. The increase in stiffness with age as measured by the modulus of elasticity while marked is not nearly so great as the increase in strength.

Ultimate Strength of Concrete.—The ultimate strength of concrete in compression as given by the cylinder test is always less than that given by the cube test, the ratio being about 75 per cent at the age of 4 weeks, and showing a substantial increase with age due to the greater percentage increase of strength for the cylinders.

REINFORCEMENT.

A study of the 1,260 tests of the steel used as reinforcement for the beams herein recorded shows that:

(*a*) For even practically identical ultimate strengths there is considerable variation in the percentage of elongation and reduction of area.

(*b*) The yield point bears no relation to the ultimate strength.

Method of Measuring Fascines.

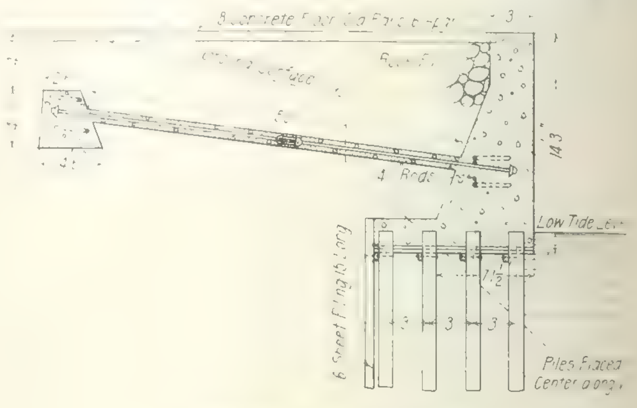
In measuring the cubical contents of fascine mattresses built by contract for the protection of river embankments, one of the methods employed by the government is as follows:

No allowance is made for fascines longer than 20 ft. They are loaded on the barges in regular piles of bundles to a height of 6 ft. At each end the height at the butts, the height at the tips and an intermediate height is recorded. Then between the ends of the pile 2 butt and 2 tip heights are recorded. The sum of all the heights is divided by the number of readings taken, to obtain an average, which is read to the nearest tenth of a foot. The lengths and widths are then multiplied by the average height and divided by 27 to obtain cubic yards.

Water Meters Wanted at Asheville, N. C.—Commenting on the opinion of water consumers in Asheville relative to the desirability of installing water meters, a local paper says: "More demands are being made for water meters just now than at any time in the history of the department and it is said that approximately 400 meters are installed each year. A large number of connections have been made in various parts of the city and the users are anxious to have meters on their lines, while a large number of people who have been using the flat rate want the meter substituted."

Method and Cost of Building a Small Dock in Georgia.

The accompanying drawing shows a dock wall built on piles on the bank of the Savannah River at Savannah at a cost of $100 per lineal foot. Six weeks were required for the construction of this dock wall. This included the time consumed in removing an old timber wharf. The piles for the new dock were driven by a floating driver equipped with a 4,000-lb. drop hammer. The dock is 100 ft. in length and required 98 piles which were driven in five days. These piles were cut off below low tide level and as the variation between high and low tide is about 6 ft., the cutting was done at low tide. To do the cutting a triangular frame was made with the saw forming the base of the triangle. The apex was then swung on a bolt driven into the pile so that the saw edge was at the proper elevation for cutting. Across the middle of the frame a board was nailed to brace the frame and keep the saw from sagging and the ends of this board were allowed to project beyond the frame to form handles for the two operators. By this method it required about 10 minutes to cut off a pile.



Dock Wall Built on Piles.

After cutting off the piles so they would project a foot or so into the base of the retaining wall a board floor was built about them to support the fresh concrete. The floor was built about 18 ins. below the tops of the piles. The 4x8-in. stringers were nailed to the piles under water level after spikes had previously been started in them. On top of these, 1-in. boards were laid transversly with the dock line and another layer was laid on these longitudinally with the dock line. The spaces next to the piles were stuffed with sacks.

The forms were then built of 1-in. tongued and grooved Georgia pine, with 2x4-in. uprights, 18 ins. apart. To brace the outer wall of the form some fender piles were driven about 4 ft. apart along the wall and a 4x6-in. horizontal piece was braced against the fender piles. On the opposite side of the wall the forms were braced back to the ground.

The concrete was mixed by hand at the dock level and wheeled over runways, to place in the wall. After the concrete wall and anchor wall had been placed, a rock fill was made and on top of this the dock floor was built. This consisted of second hand rails 6 ins. apart embedded in the 8-in. floor.

One of the features of the design is the concrete anchor wall with rods placed 8 ft. on centers, joining it to the main wall and encased in concrete as shown.

We are indebted to Mr. M. F. Marshall, superintendent of construction, for the above information.

The city council of Montgomery, Ala., has decided on general meterage of water works services. The mayor is said to be opposed to this action on the part of the council, but it is believed that the ordinance will be adopted and enforced.

The Tiber and Pittsburg Arch Compared

Sirs—In Engineering & Contra
10 you have an editorial on
in Rome" in which you ha
Pittsburg Bridge and the Ak
land Bridge as being mo
Cabin John bridge or any o
than they are like the Tiber B
true reinforced concrete arch
I would like to correct this
Pittsburg Bridge is essentiall
crete arch. The Pittsburg
Aukland Bridge are the only
tioned in the editorial, beside
which are reinforced conc
Larimer Avenue, or Pittsbu
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reinforced with eight 6x4x3
total area of 52.55 sq. ins.
and bottom of the ribs. The
a three-hinged arch and cann
into comparison. It is my
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mon among the larger
structures. The design of t
the Tiber Bridge is truly a
engineering, however.

Yours very t
JNO.

Assistant Engineer of Conc
of Engineering and Cons
Pittsburg, Pa., April 20, 19

Texas Water Works Me
A call for a state conv
works superintendents an
been issued by Patrick
Temple, Texas. Water
meeting is to be held in
6, 7 and 8. Mr. Bracken
already received favorable
out of 325 invitations iss

NEWS SECTION

orial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—
Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

[illegible] Construction Prospects
Government Aid for Roads
[illegible] Work [illegible]
[illegible]
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[illegible]
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Sewerage and Garbage Disposal [illegible]
[illegible]

ion s in h.

A [illegible] of optimism [illegible] this section [illegible] circles and the levee and railroad men are [illegible] with an air of glad[illegible] which has not been noticed in several years, all caused by the prospect of a vast ew work to be done in the South nd to a man, the contractors pre- [illegible] for work and [illegible] the prosperity enjoyed by them No one will deny that the tractor, especially those given to ntirely, have been hard hit for ears. Owing to the low price at as gone and the always increas- ed and supplies, he has found it make more than a bare living cases outfits have been sold out [illegible] this year the flood in the Missis- to create so much new work, which will be of an emergency rom present indications the con- engaged in levee work will not nish the work as soon as will the engineers. Of course, this work go at a premium. From tions, it looks as if the United ment will take charge of the s it has the Panama Canal, and complete a strong line of em- either side of the big river from ulf, thus relieving the state levee nsibility. Just what method f handling the problem, t the state boards will still be and their part of the expense, determined by those who are w scheme, but it is the dis- ple in the valley to have t engineers take charge of the [illegible] the necessary Congress. A great deal of ught to bear on the next d and those who are in a em to think that the de- on will be met. If this is [illegible] River Commission [illegible] e from Cairo to the mouth h sides, which will be high any possible water that t the stream, and the dikes enough to prevent crum- rough them. Some engi- g a core wall of concrete in ees; others say steel sheet world of strength. But all e worked out in due time. st to the contractor is the the work to be done at ontemplation of both he is [illegible] is read, Congress priated to the Mississippi River [illegible], which is to be used for hich have occurred during This is in addition to the y appropriated, so $3,500,- up work" will make business ee builders. Then several of istricts have money carried r which can be used in the The state levee boards have ed their available funds in making the fight to hold the levees. Major Clarke S. Smith of the Memphis district is the first to advertise new work. He has asked for [illegible] between Big Lake, Mo., and a point opposite Hickman, Ky. The yardage, while not as yet estimated, will perhaps involve over 500,000 cu. yds. These breaks must be closed before June 1st, and it will require some hustling on the part of the contractor to accomplish this end. The St. Francis levee board is scheduled to advertise at once for forces to construct new loops around the Hollybush and St. Claire crevasses, but it is possible that Congress may authorize Major Smith to take charge of this proposition. Mayor Crump of Memphis is of the opinion that immediate steps will be taken by the United States to protect the city of Memphis from the overflow of its low sections and to this end has appointed a strong delegation of citizens to urge Congress to take action at once. Chief of Engineers, Gen. Bixby, has directed that Major Smith report to him the best plan for protecting Memphis and the Major is at present hard at work on the report. No matter what plan is decided upon, it will require about $1,000,000 to accomplish the desired result. Then aside from levee work, the railroads will be forced to make extensive improvements throughout the Mississippi Valley and the contractors who build the road look for a banner year. The Frisco had planned some new lines in Mississippi, as had also the L. & N. and there is no good reason, it would appear, why these two roads should not go ahead with the construction and be in position to compete for the Panama business through New Orleans. One in authority on the Illinois Central states that the new line from Haileyville to Birmingham will perhaps go through in early summer. This is a very large contract—about 5,000,000 cu. yds., it is said.

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Government Aid for Roads.

Of the several government [illegible] Congress [illegible] least one which seems to have good prospects of being passed by the House and of receiving serious consideration by the Senate. This is the Shackleford bill, which provides appropriations for the roads used in rural mail delivery and star route service. Under the bill these roads are divided into three classes: Class A, the highest form of improved road in country use; Class B, the next highest form; and Class C, the ordinary dirt roads. The Class A roads are to receive a pension of $25 per mile per year, the Class B, $20 per mile per year and the Class C, $15 per mile per year. There are probably 35,000 miles of Class A roads, 83,000 miles of Class B and 1,061,000 miles of Class C roads. If payments were made on this mileage the bill would call for an annual appropriation of $18,450,000. However, the sponsors for the bill argue that not to exceed 118,000 miles of highway would be entitled to the proposed payments which would call for but $2,535,000 per year until the Class C roads were brought up to the proper standard. This bill in common with most of the other government aid road bills is a "something must be done measure." The rural constituents of the members of Congress have been insistent in their demands for a parcels post, that the trusts be slammed and that something be done for better roads. The express and parcels post question is all tied up, the trusts refuse to be slammed, so the only thing left to do is to put over a road aid bill. As a measure of political expediency the bill will be a success.

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The Doings of the Week.

Railroad construction prospects continue excellent and there is a large amount of work in sight at the present time. The Erie R. R. is to receive bids on the 6th on a considerable amount of double track work; the Wabash R. R. will also let contracts in the near future on $1,000,000 worth of betterment work in Missouri. It is also stated that the St. Paul will in the next few days let a contract for a 20-mile extension from Crystal Falls to Iron River, in Michigan. Dispatches of the past week state that the Chicago, Milwaukee & Puget Sound Ry. is preparing to start construction on a 3-mile tunnel through the Cascade Mountains, which will cost nearly $5,000,000. It is expected that the Chicago, Milwaukee & St. Paul Ry. will place contracts this week for its new line from Great Falls to Lewistown, Mont., 137 miles.

Among the railroad construction contracts let recently are the following: Continental Construction Co., H. V. Finkelstein, President, Chicago Heights, Ill., for completing the projected line of the South Bend-Logansport Traction Co. between South Bend and Logansport, Ind.; Robert Malone, Lincoln, Neb., for betterment work on the Rock Island between Dalhart and the Kansas state line; Costello Bros., Indianapolis, Ind., for double track work for the Wabash R. R. between Worden and Poag, Ill.; P. T. Clifford & Son, Valparaiso, Ind., for double track work for the Wabash R. R. between Montpelier and Aldverton, O.

Bids on one of the largest government dredging contracts of the year will be opened at Galveston, Tex., on May 15. This work calls for constructing the Houston Ship Channel and provides for over 20,700,000 cu. yds. of dredging. The channel is to be 25 ft. deep for its entire length, and 150 ft. wide between Galveston Harbor (or Texas City Channel, alternate route), and Morgan Point at the north end of the canal, a distance of about 134,500 ft. (115,000 ft. alternate route), and 100 ft. wide from Morgan Point to the entrance to turning basin.

In the way of irrigation work the largest contract of the past week is the one for constructing Dam No. 3 for the North Platte Project in Nebraska. The low bidder on the work was Bartlett & Kling, Cedar Rapids, Ia., at $361,387.

A number of good sized highway construction contracts are mentioned elsewhere in this issue. Among them are work for Cooke County, Tex., and for Dade County, Mo. The former calls for the construction of 35 miles of gravel roads and the latter for 47 miles of rock road. In the way of contracts let since our last issue, the largest aside from the New York State road work appears to be the one awarded to R. L. Peters, Knoxville, Tenn. This contract calls for grading about 160 miles of road in Monroe County, Tenn.; it amounts to $275,000.

PERSONAL

Mr. D. F. McCarthy has been reappointed City Engineer and Superintendent of Streets, Sewers and Water for the city of St. Albans, Vt.

Mr. S. K. Titus, City Engineer of Arkansas City, Ark., has been reappointed for a term of two years. This city is now under commission form of government.

Mr. John Callaghan has been appointed Chief Engineer of the Pacific Great Eastern Railway in B. C. Mr. Callaghan was formerly Division Engineer of the Grand Trunk Pacific.

Mr. H. P. Irvin was elected President of the Board of Directors of the Umatilla River Water Users' Association at the meeting held on April 8. Mr. Carl S. McNaught was elected Vice-President, Mr. Frank B. Zwazye, Treasurer, and George H. Upthegrove, Secretary.

Mr. Chas. Waldrich, of St. Louis, Mo., who for many years has been connected with the Engineering Departments of the Pennsylvania and Missouri Pacific Railways, is now associated with the Miller Engineering Company, Engineers and Contractors, Little Rock, Ark.

Mr. C. H. Rust, City Engineer of Toronto, has resigned. Mr. Rust has been connected with the city engineering department since 1877 when he entered the service as a rodman. In 1881 he was appointed assistant municipal engineer and from 1892 to 1898 was acting city engineer. Since 1898 he has been city engineer.

Mr. S. E. Taylor, a civil engineer, formerly of Salt Lake City, his wife and brother, were attacked by Mexican revolutionists while attempting to reach Vera Cruz, Mex., from the interior. Mrs. Taylor was killed. Mr. S. E. Taylor and brother were left unconscious, but were rescued and brought to San Francisco, where Mr. S. Taylor died in a hospital.

Mr. J. C. Gardner has been appointed Chief Engineer of the County of Welland, Ont. The county has decided to spend $400,000 on the construction of the good roads system of 150 miles. Mr. Gardner graduated from the University of Toronto eight years ago. He is at present Engineer for the city of Niagara Falls and for the Dunnville, Welland & Niagara Falls Railway.

Mr. John S. Bates, formerly Chief Engineer of the Fresno, Coalinga and Tidewater Company, has resigned his position with that company to engage in the practice of civil engineering. Mr. Bates went to Fresno 16 months ago from Illinois, where he had been engaged in railroad and engineering work and had been, for three terms, City Engineer of Monmouth, Ill. He is a graduate of the University of Illinois.

Mr. Francis S. Foote, Jr., a graduate of Columbia University's engineering schools, New York, has been appointed Associate Professor of Railway Engineering in the department of Civil Engineering, University of California, his appointment to take effect July 1, 1912. Mr. Foote is at present a member of the instructing staff of the School of Railway Engineering and Administration at the University of Illinois.

Dr. H. C. Bumpus, Business Manager of the University of Wisconsin, on April 22 addressed the instructional staff and the students of the University of Illinois on the subject "Some Methods that Have been Tried in University Business Organization."

Prof. F. O. Dufour of the Department of Civil Engineering of the University of Illinois recently addressed the faculty and students of the Iowa State College on the subject "European Bridges."

Mr. Stephen P. Brown has been appointed Engineer in Charge of the tunnel through Mt. Royal into the heart of Montreal, which is to be built by the Canadian Northern. Mr. Brown was formerly Chief Engineer of the Tidewater Building Company, which recently constructed a section of the new Fourth avenue subway in Brooklyn. He was formerly in charge of important work on the Pennsylvania Railroad tunnels in New York.

Mr. Robert Meeker of Plainfield, N. J., has been appointed State Highway Engineer and also Deputy Commissioner. There are four division engineers in the highway service, two of whom have been appointed. These are E. M. Vail of Plainfield and E. E. Reed of Trenton. There will also be a resident engineer in each county, and county engineers will, as a rule, be given preference for these positions. In addition, there will be 10 inspectors. For these positions a civil service examination was held April 24.

INDUSTRIAL

The Wheeler Condenser & Engineering Co. announces that Mr. Nathan Owitz has been appointed manager of its Cincinnati office.

The McKiernan-Terry Drill Co., 115 Broadway, New York, N. Y., recently received an order for 250 wizard rock drills from the Bradley Contracting Co. of New York City.

Mr. W. H. Sherwin, for the past ten years Northwestern representative at Minneapolis of Joseph T. Ryerson & Son, of Chicago, has resigned to become general manager and vice-president of the Alberta-American Ornamental Iron Co., of Redcliff, Alberta. This concern is successor to the American Ornamental Iron & Steel Co., of Minneapolis, Minn., which is moving its entire plant to Radcliff.

The Eureka Stone & Ore Crusher Co., Cedar Rapids, Ia., reports that at a recent meeting of the directors, Mr. Abner Luenberger was made president and Mr. F. H. Douthitt general manager, to succeed Mr. I. L. Mitchell, formerly president and general manager. The company has recently made a shipment of a coarload of crushers to Portland, Ore., to fill order obtained by their local agents. They are now manufacturing a special portable outfit for road contractors.

The Raymond Concrete Pile Co. of New York and Chicago has been awarded the contract for placing the concrete piles for the foundations of St. Martin's R. C. church at Steuben and Alexander Sts., Pittsburgh; John T. Comes, Architect. This company has also been awarded the contract for placing the concrete piles for the foundations of the Ridder building of the New York Dock Co. at Furman, near Montague St., Brooklyn. Maynicke & Franke, Architects; Tucker & Vinton, General Contractors.

CATALOGUES

Machinery List.—Paper, 3¾x6 ins., 8 pp. A. H. Hitchcock, 1220-1235 Caxton Bldg., Chicago, Ill.

A monthly reference list for buyers of sawmill and woodworking machinery.

Universal Cement.—Paper, 6x9 ins., 16 pp. Universal Portland Cement Co., 72 W. Adams St., Chicago, Ill.

This is the April bulletin and contains interesting articles on subway buidling, dams, roads, etc., where concrete construction is used.

Supplies.—Paper, 5x11¾ ins., 32 pp. The Avery Co., Peoria, Ill.

This contains a list of supplies with sizes, prices and illustrations for the Avery Co.'s threshing, power farming and hauling machinery.

Vanadium.—Paper, 7⅞x10½ ins., 8 pp. American Vanadium Co., Frick Bldg., Pittsburgh, Pa.

This is the April number of "American Vanadium Facts," published by the above company in the interests of metal users. The vanadium alloys are the physical and dynamic and iron. Useful informat

Traction Engines.—Pap pp. J. I. Case Thr shi Racine, Wis

This book contains illus tions and specifications threshing machine engin H. P.

National Mixer.—Paper pp. National Mixer Co.,

This booklet illustrates continuous mixer with a and a force feed.

Another catalog, 6x9 ins illustrations of the mixer ous locations and conditio

Cemcoat.—Paper, 8x11 Sonneborn Sons, Inc., 36 York City.

This circular describes ing for cement which pre rates and prevents damp trating the walls, adding building and increasing

Another folder describes coat for preventing dust

Kaveco.—Paper, 3½x6 K. V. Company, 1 Sigourn N. Y.

This card gives 12 sa directions for using this a flat oil paint for walls, and fills cracks and unev and outside. Directions f en in this and accompany

Portable Dump Boxes— ins., 182 pp. Everett Mf N. Y.

This booklet illustrates detail the Everett Dump Panama, and gives dimens 1½ and 2 yards capaciti is accompanied by letters concerns.

Rotary Screens.—Paper, p. E. C. Converse, Bingh

This circular illustrates improved Converse rotary or power operation. Price sions of sections are given,

Art Stone.—Paper, 3½x6 Art Stone Co., Waynes

This folder gives a syno tial trade notes by Amos tendent of the company, ufacture of marble, lumbe the concrete lawn lists prices for license to sell these patented produ

Milburn Lights.—Pape pp. The Alexander Mill Lombard St., Baltimore,

This catalog illustrates a Milburne Portable Acetyle tractors' use. Illustrations tails of construction and methods of placing and various classes of work. sions are given.

Another catalog describe Steam Acetylene Generato headlights, railroad coache etc.

Engineering Directory.— 1,496 pp. Crawford Pub worth Bldg., Chicago, Ill.

This book is the 1912 ed gineering directory, which year of publication. It co names and addresses of fir supplies, plumbing jobbers bers, electrical supplies, agents, U. S. manufacturers ufacturers, railroad purcha S. architects, power plants, plants, trade associations betical list, occupying abou of engineering materials.

ILWAYS, STEAM AND ELECTRIC

Alabama.

& Nashville R. R. has [illegible] large tracts of land [illegible] the purpose of enlarging its [illegible]city to three times their present [illegible] property necessary for th[illegible] has been acquired and [illegible] Louisville & Nashville intends [illegible] the work. The [illegible] yet been authorized by the [illegible]s, but estimates are under way.

[illegible] Ry., which [illegible]ng under way on its main line, [illegible]planning to let a contract in the [illegible]r a spur to Holt.

[illegible] made that the [illegible]ment Co., J. M. Dewberry, Vice [illegible] begin building the [illegible] to Tuscaloosa [illegible] between Birmingham [illegible] It is expected [illegible]ars in operation on the Birming[illegible]uly 1.

[illegible] that the Illinois Central R. R. [illegible] acquisition of the [illegible] into Mobile, Ala., and the ex[illegible]soon of readiness to receive [illegible] the railroad from [illegible] Tuscaloosa, and [illegible], for which surveys are prac[illegible]ted. A. S. Baldwin, Chicago, [illegible] Illinois Central [illegible]

Arkansas.

[illegible]on & Salina River R. R., now [illegible] to extend its road [illegible]ner north to a connection with [illegible]ff & Western Ry. at or near [illegible]llen, Pine Bluff, Ark., is Presi[illegible]

[illegible]rs, Hawesville, Ky., is promot[illegible] the proposed north [illegible]lroad through Harrison, Ark., [illegible] the project in shape [illegible] within a short time.

[illegible] resumed on the [illegible]sion of the Kansas City & [illegible] at Clear Creek, 6 miles south [illegible]gs, Ark. It is hoped to have [illegible] 30 days.

[illegible] R. R., G. W. L. Brown, [illegible] Sedgwick, Ark., is consider[illegible] Leight, 17 [illegible]

[illegible] has granted [illegible] an extension [illegible] [illegible]r line, on account of se[illegible] impossible to [illegible]ated that a large force of [illegible] work and the grading [illegible]letion as fast as it is possible.

California.

[illegible] secured for a new [illegible] built from Tulare to [illegible]and Lindsay. David Oliver, [illegible]ffin, San Francisco, are in[illegible]

[illegible]nder consideration for the con[illegible] line railway from the termi[illegible] Electric Ry. at La Ramada, [illegible]the summit of the Verdugo [illegible]posed, the name of the road [illegible] & Verdugo Mountain Ry. [illegible]lale, is interested.

[illegible] improvements have [illegible] the Santa Fe System for the [illegible]a: Construction of 6,800 ft. [illegible] the National Orange Co. at [illegible] $32,000; construction [illegible] San Diego, to serve Western [illegible] Co., estimated cost $5,600.

[illegible] System has authorized the [illegible]100 miles of second track on [illegible] during the ensuing year. It [illegible]hat 30 miles will be between [illegible] main line of the system between mile post 888 [illegible]

Central America.

The Guatemala Ry. Co., Minor C. Keith, President, 17 Battery Pl., New York City, has filed amended articles of incorporation by [illegible] to the International Railways of Central America and the capital stock increased from $7,[illegible]

Colorado.

Advices from Salt Lake City indicate that [illegible] line of the Uintah R. R. will be started in the near future. These tunnels are to be driven [illegible] grades on the line. Five tunnels are to be constructed, the longest of which will be 3,000 ft. The Uintah Ry. is a 3-ft. gage line, but it is planned to standardize it as soon as the grades are cut down. An extension to Myton, Utah, is also under consideration. M. W. Cooley, Mack, Colo., is General Manager.

The directors of the Denver, Laramie & Northwestern R. R., W. D. Hodge, Denver, [illegible] action with reference to plans for the financing of the proposed extension of the line from Greeley to Kent, Wyo., a distance of 160 miles, which will cost $5,000,000. It is the plan to build as far north as Scott, Colo., this year and complete the final link to Kent, Wyo., in 1913.

The directors of the Denver & Rio Grande R. R. have authorized the execution of a $25,000,000 mortgage on the property of the railroad to secure the recent bond issue. The proceeds of the bonds, of which $10,000,000 will be marketed immediately, providing their sale is sanctioned by the stockholders, will be used for improving and bettering the system.

Delaware.

The Wilmington Southern Traction Co. has completed surveys and has secured the capital for the 2-mile extension mentioned in our last issue. Construction contracts are to be let at once. J. E. Wallace, New Castle, Del., is Chief Engineer.

Florida.

The Gulf, Florida & Alabama Ry. Co. has about completed surveys for its projected 300-mile line from Pensacola to the Birmingham Mineral District. The capital has been secured and a portion of the line is under construction. The Eastern Construction Co., Pensacola, Fla., has the contract. Roy C. Megargel, 5 Nassau St., New York City, is President of the railroad and G. A. Berry, Pensacola, is Chief Engineer.

Idaho.

The Idaho Railway, Light & Power Co., of Boise, Idaho, has taken bids for the grading necessary to straighten its line between Boise and Nampa.

The Oskaloosa Traction & Light Co., H. W. Garner, General Manager, Oskaloosa, Ia., is considering extending its line from 9th Ave. south on 11th St. to the property of the Country Club. The extension would be about one mile long and would cost about $11,000.

Illinois.

⦿Costello Bros., Indianapolis, Ind., have been awarded the contract for grading embankment for new second track between Worden and Poag for the Wabash R. R.

Promoters of the proposed railroad from the Santa Fe line in Henderson County to the Chicago Burlington & Quincy R. R. at Rushville, of which the old Macomb & Western Illinois line will form [illegible] part, have decided upon the amount of bonds that must be subscribed for by people in the territory through which the road will pass. The line will be about 60 miles long and about $575,000 of bonds will be asked.

The Springfield & Northwestern Interurban Ry. Co., of Springfield, formed to build a line into Springfield from the north by way of Greenview and Mason City, has filed notice with the secretary of state of an increase in the capital stock of the company from $15,000 to $150,000.

Indiana.

The Continental Construction Co., of which H. V. Finkelstein, Chicago Heights, Ill., is President, is reported to have been awarded the contract for completing the projected line of the South Bend-Logansport Traction Co. between the two cities.

The Lake Erie & Western R. R., Wm. G. Atwood, Chief Engineer, Indianapolis, Ind., is planning to build a new freight station at Muncie, Ind. The work will probably be done by company forces.

Indianapolis, Crawfordsville & Danville Electric Ry. Co. of Indianapolis, has been incorporated with a capital stock of $600,000, the incorporators being F. A. Likely, J. P. Todd and H. H. Hornbrook. This company has been organized to take over the Ben Hur properties as soon as the Federal Court approves the sale which took place three weeks ago.

It is now stated that work will be started in June on the proposed Madison and Scottsbury Traction line. This project is being promoted by Fred Hoffstadt and Clarence R. Martin, attorneys of Indianapolis.

The Board of Public Works, Fort Wayne, Ind., has submitted to the officials of the Pennsylvania Railroad Co. the contract containing the agreement between the two parties relative to track elevation west of Calhoun St., street vacation and the construction of a new depot.

Iowa.

⦿The following have obtained sub-contracts from E. A. Wickham & Co., Council Bluffs, Ia., on the Chicago, Milwaukee & St. Paul Ry. betterment work, general contract for which was awarded on April 1. Richard Evans, Minneapolis, Minn., two steam shovels; Anderson Bros., Rockford, Ill., two machines; Underwood Bros., Council Bluffs, Ia., one machine. This contract extends from a point near Woodward to Rhodes, Ia. The other contractors who secured general contracts on April 1 on the C., M. & St. P. work are as follows: P. E. Shugart, Omaha, Neb.; J. A. McDougal, Milwaukee, Wis.; Donald Jeffrey, Delmar, Ia.; List & Gifford, Kansas City, Mo.; Roberts Bros., 125 LaSalle St., Chicago, Ill.; P. T. Walsh Construction Co., Davenport, Ia.

It has been announced that, [illegible] weather permits, laying steel will be commenced on the Fort Dodge-Colmar cutoff of the Santa Fe on May 15. Grading work, which was sub-let to a number of contractors by Ransom & Cook, Ottawa, Kan., as noted in our March 6 issue, is progressing nicely.

The following sub-contractors are working for E. A. Wickham & Co., Council Bluffs, Ia., on the Chicago, Rock Island & Pacific Ry. work between Carlisle and Chariton, Ia.: A. L. Blaksley, 35 teams; Carnes Bros., 10 teams; C. Hammond, 25 teams; Dugan & Nalon, 35 teams; Fred Pettijohn, 20 teams; Geo. Collins, 20 teams; M. O'Rourke, 20 teams; Geo. O'Neil, 35 teams; Thos. Donahoe, 20 teams; R. B. Frazier, 20 teams; E. A. Wickham & Co., 50 teams; B. A. Boyle & Co., 25 teams.

Kansas.

The Arkansas Valley Interurban Ry. Co., O. A. Boyle, General Manager, Beacon Bldg., Wichita, Kan., is securing right of way for its proposed extension north out of Newton to Goessel, a distance of 14 miles. It is believed that the extension will be completed this year.

Kentucky.

Construction works have been started on the new Younts Fork extension of the Lexington & Eastern R. R. into the coking coal fields of Letcher County, Ky. John Marston, Lexington, Ky., is Chief Engineer.

The Indianapolis Construction Co., of Indianapolis, Ind., is reported to have entered into a contract for financing and building the projected line of the newly organized Central Electric Ry. Co. of Glasgow, Ky. This company proposes a line between Glasgow and Hodgenville, passing through Barren, Hart and Larue County. Surveys are now under way. J. M. Richerson, Glasgow, Ky., is President.

Louisiana.

The New Orleans Terminal Co., R. B. Fowler, General Manager, New Orleans, has plans for extensive improvements to the Chalmette slips at New Orleans. These will include dredging, laying of additional tracks, etc.

Maryland.

⦿The Brooks-Ward Supply Co., 24 Commerce St., Baltimore, Md., has been awarded the contract for furnishing the Water Department of the city of Baltimore with relaying rail for laying about 7,000 ft of. single track.

Massachusetts.

✣Bids will be received until noon, May 7, by the Boston Transit Commission, B. Leighton Beal, Secretary, 15 Beacon St., Boston, Mass., for building Section 3 of the Boylston St. subway, extending from Hereford St. to 170 ft. east of Exeter St., a distance of about 1,900 lin. ft.

It is stated that the recent death of C. M. Hays, President of the Grand Trunk Ry., will not make any change in the plans of that railroad for carrying out the New England extensions.

The Bay State Street Ry. Co., 84 State St., Boston, Mass., has applied to the State Railroad Commission for the approval of an issue of common stock of $1,513,000 and for bonds for $2,000,000.

A bill has been signed by Governor Foss, of Massachusetts, authorizing the Boston & Maine R. R. to 4-track its line through the city of Lynn. A. B. Corthell, Boston, Mass., is Chief Engineer.

The New York, New Haven & Hartford R. R., B. T. Wheeler, Engineer of Construction, Boston, Mass., has been making surveys for a proposed short extension of the Hanover Branch from Hanover to Greenbush.

A bill has been sent to the State Legislature by Governor Foss providing for the consolidation of the Boston & Maine and the New York, New Haven & Hartford R. R. under the name of "the New England Lines" and the creation of a public service commission. The proposition, which is understood to meet the approval of the railroad officials, is to dissolve the holding company under which the two systems are now operated and to provide for their actual physical union by a 4-track tunnel under the city of Boston, the electrification of all lines in the metropolitan area, and other improvements involving an expenditure of about $100,000,000.

The Boston & Albany R. R., F. B. Freeman, Chief Engineer, Boston, Mass., has applied to the State Railroad Commission for authority for a $1,000,000 bond issue for construction work. This work is to include $55,000 for third-tracking from Park's Corner to Ashland; $65,000 to extend sidings for additional cars at Mellenville, Adams, East Brookfield, North Grafton, Millbury Junction, Charlton, West Springfield and at Chatham; $250,000 for remodeling yard facilities at Worcester for the handling of local freight; $7,500 for water station at Mellenville; $145,000 for new buildings to be erected at West Springfield, Pittsfield and Worcester; $350,000 for bridges to be rebuilt or repaired in Boston, Allston, Brighton, Ashland, Westboro, Worcester, Jamesville, Rochdale, Warren, West Brimfield, Palmer, Indian Orchard, Middlefield, Becket, Hinsdale, Dalton, Pittsfield, West Brookfield, North Adams Junction, East Chatham, Chatham, Van Hoesen, Newton, Holliston, Metcalf's Station, Glenwood, Barre Plains, West Ware, Cheshire, Cheshire Harbor, Maple Grove, Adams, Renfrew, Zylonite, North Adams, Ghent and Claverack.

Michigan.

Officials of the Wabash Railroad are considering the construction of new east-bound freight yard at Oakwood, Mich. A round house and other buildings will probably be erected.

It is reported at Mt. Clemens, Mich., that the construction work will be commenced shortly on the proposed railroad from Detroit to Bad Axe, via Mt. Clemens. A great deal of the right of way has already been secured and the company has been incorporated with a capital stock of $2,000,000. Alexander Riopelle, Detroit, Mich., is interested.

The Chicago, Milwaukee & St. Paul Ry. is understood to be planning to let contracts early this month for the extension of its line from Crystal Falls to Iron River. This extension will be about 20 miles long.

Duluth and the Ranges.

BY PETER I. MEAGHER

⦿C. J. A. Morris, of the firm of Morris & Shepard, St. Paul, General Contractors, was a caller at this office. He stated that they were bidding on considerable work, but at that time were not sure if they had been the successful bidders or not. After leaving here, Mr. Morris wired us that his firm and J. P. Dougherty had taken 75 miles of work in South Dakota for the Chicago, Milwaukee & St. Paul R. R. Co., estimated yardage about 3,000,000 cu. yds. This work consists of about one-third steam shovel work, one-third drag line work, and one-third grading machine, team and small car work. They have already started to sublet this work, and at this writing have sub-let a great deal of it, but are still in need of some team outfits. Any sub-contractors in the market for work, if they address this office, will receive full information. Morris, Shepard and Dougherty are to be congratulated on landing this contract.

⦿H. L. Bartlett & Co., General Contractors, were awarded a $15,000 sewer contract by the City of Ely, Minn., and will start on the same immediately.

J. M. Pitblado, representing the Minneapolis Steam Machinery Co., was a caller, and reports that business in his line was very good.

We are very glad to report that Greer Thompson, General Superintendent for the Drake-Stratton Co., large stripping contractors in this vicinity, has entirely recovered from his recent illness. He is still in California, but is expected home in the very near future.

Andrew Perrin and Carl Hall, of Carl Hall & Co., Railroad Contractors, left for the West to look over some railroad work, and on their return stated that they did not take it. The work was good work, but they got track of some nearer home that looked better to them.

Eugene McGary, formerly of the firm of Mitchell & McGary, was a caller and stated that he was figuring on some work, and expected to land the contract in the very near future.

H. J. Cooper, the contractor, was a caller here this week, and stated he was not doing anything at the present time, but was figuring on some work, and expected to be busy very soon.

Robert Kingston Contracting Co. have two steam shovels busy on an ore loading contract for one of the large iron mines at Virginia, Minn.

John Bergman, the contractor, was a caller, and purchased some equipment and stated that he has already started on some county road work that he has here, and is also figuring on considerable more work.

Construction work is opening up here with a boom, and at the present it looks as though there was more work than there would be contractors in this section to
are fairly plentiful now, bu
creasing, and, as stated
letters, I believe that ther
in this market for men in t

C. E. Jamison, a railroa
caller, and stated that he ad some w
North Dakota on the Soo Line, and h
ready started his steam shovel on the

Arthur Mitchell, contractor.
He is not doing anything
but is in the market for so
prefer concrete work

Mississippi.

Brewer, Kelsey & Co., Chicago, Ill.,
ported to have acquired the property and
chises of the Jackson Street Railway &
Co. of Jackson.

The Fernwood & Gulf R
General Manager, Fernwood, Miss., is re
to have purchased of W. S. F. Tatum of
tiesburg, all right of way d
12-miles of railroad runnin
The distance between the termini of th
roads is about 30 miles and it is
the Fernwood & Gulf is an
connecting link.

The Pascagoula Northe
capitalized at $545,000 a
from Pascagoula, Miss., to
tion on the Mobile, Jacks
R. R., a distance of 42 mil
north and south. Severa
also said to be under c
Dantzler, Moss Point, Mis
New Orleans, La., and I
Ala., are promoters.

It has been announced at
leans, Mobile & Chicago RR.,
by the Frisco and Louisville & N
have work commenced s
struction of a physical
from Laurel, Miss., to
the latter terminal the lin
the Frisco main line 214 n
ham. By that connection
cure another line into M
leans which will be of gre
tion. The track, it is sta
pound steel rail such as is
part of the line. W. F. Cen.
is President and General Manag
O., M. & C. R. R.

Missour

The Wabash R. R., A. O.
Chief Engineer, St. Louis, Mo.,
to be about ready to award contra
track work in Missouri for which
appropriation has been made

The following minor
planned by the Santa Fe System
of Missouri: Constructio
and power house at Duma
of $2,200 has been made to
ing right of way at various pl
tion of rock drains, ditch excavati
ing drain tile near Hart, $900
construction and pavement of
Leavenworth, $3,000.

The St. Louis-Southwestern
Ry. has filed with the S
Jefferson City, Mo., a cer
the capital stock of the co
000,000 to $130,000,000.

The receivers of the Kansas City
Orient Ry., W. W. Colpitt Ch
Kansas City, Mo., have submitted
to the federal judge at Kansas C
receivers' certificates amounting
for improvements. It was
needed to complete the road from
Alpine, Tex., thus giving through
sired connection with the South
R. R. The present plans
construction work in Mexico r th
of the road from Wichita, in
ceivership lasts.

The Missouri Pacific R.
notices sent out to the stockhold
$11,500,000 to expend for carrying
habilitation plans this year. The
Missouri Pacific treasury at the

[illegible] from the unexpended bal- [illegible] $2,000,000 which can be [illegible] estate. The balance is [illegible] the sale of bonds in the [illegible] which are secured by Den- [illegible] stock.

St. Louis Items.

[illegible]

[illegible] has taken a slice of Cameron [illegible] oyce's grading work in the west y. John left here for the South tfit on to this piece.

[illegible] & Dougherty, St. Paul, [illegible] work on the Milwaukee rth Dakota.

& Llewelling are new people [illegible] contracting business [illegible] is a piece of steam [illegible] from the Wells Co. in the west part of the city.

[illegible] Valparaiso, Ind. [illegible] the Wabash double track be- [illegible], O.

ros. were awarded the contract [illegible] Wabash R. R. between 'oag, Ill.

S. Jones, the boss station man, of the station work from W. E. n the Wabash R. R. near Ramu- [illegible]

& Scott have started work on and ballasting contract on the & Great Northern R. R. in [illegible]

[illegible] for the new Desel [illegible] Side the Municipal Assembly re- [illegible] he permit is for the installation [illegible] St. to cost $1,550 uth Second St. to cost $950.

[illegible] men boarding ton, Texas, the other day. Frank ard the men for Thompson & extensive track-laying and bal- t on the International & Great [illegible]

l was with us a week. Jack ng for work for his 12-team s idle at West Frankfort, Ill. uble in finding all the work that his neighborhood.

ell of Joyce Bros. & Bagwell Marianna, Ark. Bagwell in- the high water is all around e and they have a 20-team outfit Democrat, Ark.

ney, Lane Bros. and Carl Cast fits surrounded by high water [illegible]

ive us a hurry up call the other y West, while the engine was water at the depot here. Come n, but stay longer.

tion of a 19 story Common- Co. building on the northeast dway and Olive St. to cost ap- [illegible]00, is reported to be virtu- ce L. Bertram Cady, a tailor, $25,000 to surrender his lease old Third National Bank y 1. Eames & Young, archi- leting plans for the building, s high as city ordinances per- the promoters contemplate raz- eight-story building and to ground on the new structure

& Co. of Detroit, Mich., write e sub-let all of their work on R. in Michigan.

, of Costello Bros. was in town last issue. They have been ting their steam-shovel on rk, but are hard at work n the Wabash R. R. Have [illegible]

ler, receiver for the Alton, Peoria R. R., thinks $140,000 to complete the electric road operation between Alton and filed a petition in the Circuit sville last week asking permission to issue receiver's certificates to raise money to complete the road. J. J. Cummings of Chicago has agreed to accept the certificates at par and later exchange them for bonds in the [illegible] the dollar. Construction work must be delayed 30 days until the court can pass upon the petition, and all creditors must be given an op- [illegible] and enough rails to lay 3 miles of tracks are needed to build the line into Jerseyville.

Beecher Bros. have made a good start on their Wabash work in Illinois.

Cameron, McManus & Joyce, Clayton Road, St. Louis, Mo., still have a nice piece of team work left that they will let at a good price.

Billy Riddle left here for New York where he is going to work on the subway for Smith, Scott & Co. 263 Bridge St., New York, will be his address until further notice.

The Wabash R. R. announced the official signing of an order for $2,000,000 worth of steel rails to be used in its new second track construction and for renewal of existing tracks. The order amounts to approximately 36,000 tons, or nearly 1,000 carloads. These new rails are practically all 90 lbs. to the yard, and will be used on the lines between St. Louis and Chicago and a part of the western division. The Wabash recently ordered about twenty-five new heavy passenger and freight engines of the heaviest type, and heavier rails to carry them and the new equipment are necessary.

D. E. Murphy will finish his work near Pana, Ill., in a couple of weeks.

The Illinois Traction System has placed an order with a Michigan City, Ind., firm for the construction of 150 freight cars of various types; 50 will be box cars, 75 gondolas and 25 cinder cars. The new rolling stock will cost about $160,000.

W. S. Mitchell of St. Louis, who has active charge of the government's work on the rivers from the mouth of the Missouri to the mouth of the Ohio, will arrive in Cairo Saturday with Cy H. Miller, an expert engineer, who will superintend the work of raising and strengthening the Cairo levees to a 60-ft. grade. The Sycamore St. subway, which was closed when the water reached the 52-ft. mark, was opened on April 25th. The paved street to the city limits is covered by several inches of water with the exception of a short space. One hundred thousand sacks placed against the flood gates at the subway formed a bulkhead, according to City Jailer Lutz, who superintended the work. The interurban service to Mound City will be resumed within a week.

Montana.

E. A. Wickham & Co., Council Bluffs, Ia., have 30 miles of work on the Great Northern line from Moccasin to Lewistown, Mont., and are working two steam shovels and 200 horses. They can use a few more outfits.

The Great Northern Ry., A. H. Hogeland, St. Paul, Minn., has engineers in the field near Collins, Mont., surveying a proposed change of line in connection with the erection of a large steel bridge over the Teton River to replace the present frame trestle.

New York.

The New York Public Service Commission, First District, has granted the Hudson & Manhattan R. R. Co., J. V. Davies, Chief Engineer, 30 Church St., New York City, which operates the McAdoo tubes, an extension of 60 days, namely, from April 28th to June 28th, 1912, in which to begin work upon the proposed extension of the Hudson & Manhattan R. R. from 33rd St. to the Grand Central Station. Thirty-third Streeet is now the northern terminus of the Hudson & Manhattan system, and the company has obtained a certificate from the Public Service Commission for an extension from that point up 6th Ave. and curving through Bryant Park and 42nd St. to the Grand Central Station. It is estimated that this extension will cost about $5,000,000.

The Public Service Commission, First District, of New York City, has decided to reopen the hearings held on the application of the Ocean Electric Ry. Co. for the approval of a proposed extension, about a mile in length, through the property of the Neponsit Realty Co. in Belle Harbor and West Rockaway. The Commission has deferred a decision on the application to await the beginning of proceedings by the Board of Estimate and Apportionment to acquire, by condemnation, the private street through the Neponsit Realty Company's property, on which it is proposed to build the Belle Harbor extension.

North Carolina.

Construction work is under way on a railroad to extend from Canton to Sunburst, and to be used for hauling lumber from the recently acquired property of the Champion Lumber Co. in the Sunburst section. Capt. James Payne, Waynesville, N. C., is in charge of the construction work.

North Dakota.

Cravens & Murphy, St. Cloud, Minn., who have a grading contract on the Firtville-Drake cutoff on the Minneapolis, St. Paul & Sault Ste. Marie in North Dakota, have sent a crew of men under W. A. Holleran to commence work.

The Great Northern Ry. is to construct a revision of the main line this season between White Earth and Tioga, N. Dak. The revision is about seven miles long and will eliminate several heavy curves. A. Guthrie & Co., St. Paul, Minn., have the contract and are now moving their outfit onto the work.

Ohio.

⦿The North Randall Ry. Co., mentioned in our last issue, has awarded the contract for constructing its 3½-mile street car line to H. A. Watterson & Son, 919 Schofield Bldg., Cleveland. This line is to extend from the city limits of Cleveland at Corlett to Randall. Jno. Cannon, Cleveland, O., is President and H. A. Watterson is Chief Engineer.

The Springfield & Xenia Ry. Co. has completed surveys for a 15-mile extension from Yellow Springs to Dayton. The capital for construction has not been secured as yet. The Cleveland Construction Co., Cleveland, O., is the engineer. Warren Bicknell, Cleveland, O., is President and M. Ackerman, Springfield, O., is General Manager.

Right of way is now being secured and engineering work is under way for the extension of the Stark Electric R. R., F. L. Mowry, General Manager, from Alliance to Akron. The extension will be constructed under the name of the Akron-Alliance Short Line R. R.

Oklahoma.

The town of Checotah, Okla., has offered a bonus of $10,000 to secure the construction of an extension to the Warner-Webber Falls R. R. from Warner to that city.

Oregon.

It is reported that a proposition has been submitted to the citizens of North Bend, Ore., by C. J. Millis, Assistant to President Sproule of the Southern Pacific, providing for the construction of a line to that place.

The Southern Pacific Ry., F. L. Burckhalter, District Engineer, Portland, Ore., has received bids and will let contracts in the near future for a branch line to Fir.

Pennsylvania.

The Chambersburg, Greencastle & Waynesboro Street Ry. Co., Geo. B. Beaver, President, Waynesboro, Pa., mentioned in our last issue, has completed surveys for its projected extension from Highfield, and it is probable that the construction contracts will be let in the near future.

The Boroughs of Braddock and North Braddock have passed ordinances for the elimination of grade crossings between the two places. The ordinance calls for the eliminating of the Copeland or Fourth St. crossing, a 60-ft. tunnel at Ajax alley, a 40-ft. tunnel at Sixth St. and a like tunnel at Verona St., a foot-bridge at Frazier St. and a foot and wagon bridge at Second St. The improvements will cost upwards of $150,000, to be borne by the Penn-

[illegible] R. R. and the Boroughs [illegible] and North Braddock.

Rhode Island.

A bill has been introduced in the State Legislature in behalf of the New York, New Haven & Hartford R. R., which controls the trolley system in Providence, asking authority for the Union R. R. Co. of Providence to issue $3,000,000 renewal or refunding mortgage bonds.

South Carolina.

Work has been completed on the Hartsville-Sumter extension of the South Carolina Western R. R. to a point between Lydia and Bishopville. It is believed that when this line is completed it will be extended from Sumter on to Charleston, S. C. J. E. Hancock, Hamlet, N. C., is Vice President and General Manager.

South Dakota.

⦿Morris, Shepard & Dougherty, 801 Globe Bldg., St. Paul, Minn., who have the contract for double tracking and revision of line between Summit and Aberdeen, S. Dak., for the Chicago, Milwaukee & St. Paul Ry., as noted in our last issue, will sub-let about three-fifths of the work. The general contract involves about 3,000,000 cu. yds. of earth excavation. Some good steam shovel and team work is yet to be sub-let.

It is believed that the Chicago & Northwestern Railroad Company is contemplating the extension of its line from Winner, Tripp County, S. Dak., into the Rosebud Reservation, Mellette County, which was recently given out by the government as homesteads.

The Chicago, Milwaukee & St. Paul, which recently let the contract for grading and double-tracking the line from Aberdeen to Summit, S. Dak., a distance of 75 miles, to Morris, Shepherd & Dougherty Construction Co., St. Paul, Minn., has also authorized the grading for a double track between Summit and Milbank, a distance of 33 miles.

Tennessee.

Reports from the flood districts along the Mississippi indicate that the river line of the St. Louis & Iron Mountain R. R. south of Memphis, which has been under reconstruction for the last eight months, has been considerably damaged for a distance of 160 miles from McGehee to Farriday by the breaks in levees.

The Tennessee Railway, Light & Power Co. has been incorporated under the laws of the state of Maine with a capital stock of $70,000,000.

The Cumberland Valley & Interstate Ry. Co., projecting a line the route of which passes through Lafayette, Red Boiling Springs, Stanford, Hartsville, Dixon Springs and Carthage, has negotiations under way for securing the necessary construction capital. Surveys have not been made as yet. W. G. Schamberger, Gallatin, Tenn., is President and Capt. W. H. Spradlin, Gallatin, Texas, is Chief Engineer.

Texas.

⦿Robert Malone, Lincoln, Neb., has been awarded a contract for betterment work on the Rock Island between Dalhart and the Kansas line. The work includes grade revision, widening and reinforcing and some grade elevation.

⦿The following have sub-contracts from Karner Bros. & Co., Dallas, Tex., for grading work for the Waco-Dallas-Corsicana Interurban line: M. M. Montgomery, grading between Milford and Italy; Pat McCarty, grading between Ennis and Palmer; S. F. Worley, work near Ennis; H. W. Byers, four miles from Palmer north; Jack Collins, five miles from Ennis south; Tom Stanley, from Rice north, and J. E. Collins, the next section from the Stanley contract.

A proposition has been submitted to the citizens of Bryan, Tex., providing for the construction of a railroad from that city into the Brazos Bottom for a bonus of $35,000. A committee was appointed to raise the amount. It is believed that work will be started shortly.

Advices from Yorktown, Texas, state that the engineers of the Quanah, Seymour, Dublin & Rockport R. R. have completed a preliminary line to that place, intersecting the San Antonio & Aransas Pass R. R. one-half mile west of the city, thence on to Charco. L. E. Walker, Dallas, Texas, is President of the Quanah, Seymour, Dublin & Rockport Ry.

Engineers who have been making a preliminary survey for the proposed extension of the Orange & Northwestern R. R., from Newton to Hemphill, have completed about 25 miles of the work and are now working in the vicinity of Remlig, Texas. L. Miller, Orange, Texas, is President.

It is rumored that the Missouri, Kansas & Texas Ry. is planning to build a connecting line from Waco, Texas, to Trinity, a distance of about 130 miles, to connect with the "Orphan" line operating between Trinity and Colmesnell, a distance of 75 miles. It is believed that if this improvement is pushed through the "Orphan" line will be extended from Colmesnell to Beaumont, 70 miles, giving the M., K. & T. a through line between the southeastern portion and the middle Panhandle of Texas. A. A. Allen, St. Louis, Mo., is General Manager.

The Port Bolivar & Iron Ore Ry. Co., which has completed 30 miles of line from Long View to Ore City, has filed with the State Railroad Commission an application for permission to issue and register $150,000 of improvement bonds to be used for extending the line.

It is expected that construction work will be started this spring on the projected interurban line between Dallas and Greenville for the East Texas Traction Co., of which J. W. Crotty, Dallas, is Vice President. The Mansfield Engineering Co., 822 Board of Trade Bldg., Indianapolis, Ind., is reported to have the engineering and construction contract.

E. P. Turner, Dallas, has applied to the City Commissioners of Terrell for a franchise for the operating of an interurban line through Terrell. The proposed line would go from Dallas to Terrell and thence to Tyler.

The Houston Electric Co., David Daly, Manager, Houston, Tex., has about completed right of way matters for a proposed extension from its Harrisburg line to the district between Port Houston and the Harrisburg road.

The following minor improvements for its line in Texas are planned by the Santa Fe System. Track changes at Fort Worth, approximate cost $8,500; drainage and sewer construction at Rosenberg, $3,700; construction of a creosote oil tank of 1,000,000 gal. capacity at Galveston, estimated cost $11,300; improvements for machine shops at Clebourne, drilling deep well and machinery to operate same at Sanger, $10,000; construction of a creosoted timber viaduct with a 34-ft. beam span across tracks at Allen St., Fort Worth, at a cost of $17,700; construction of a general office building at Galveston for use of railroads having offices in Galveston, at a cost of $546,269. Instructions have been given to purchase flat tie plates for use as follows: Eastern Oklahoma lines, $6,300; G. B. & G. N., $5,470; G. B. & K. C., $7,768; Cane Belt, $9,436; Beaumont division, $15,208; Galveston division, $19,786; Southern division, $19,953; Northern division, $26,729.

Utah.

It is said that the United States Mining, Smelting & Refining Co., is promoting the construction of an 80-mile railroad from the coal fields of Eastern Utah, to a direct connection with the Union Pacific.

A committee of the Provo, Utah, Commercial Club recently went to Salt Lake City, Utah, to confer with W. G. Sharp in regard to securing the Utah County terminal of the coal road to the Emery County fields. R. R. Irvine, Jr., Provo, Utah, was a member of the committee.

Vermont.

⦿Construction work is to be completed this fall for the new line of the Boston & Maine R. R. (New York, New Haven & Hartford Line) from Hinsdale, N. H., to Brattleboro. The line will be eight miles long, and will be single track construction w [illegible] bridge masonry. The contract [illegible] cu. yds. earth and rock excav [illegible] yds. stone masonry, one 250-ft. bridge over th Ashuelot River and one 1,000 bridge over the Connecticut River. The H brook, Ca & Rollins Corp., 6 Beacon St., Boston, Mass as noted previously in these co contract.

Virginia.

The Norfolk Southern R. R. is as yet d nothing definite in reference erection c shops at West Munden near South Norfol The company has purchased about 60 acres land, but at the present time ll use only portion of this property on which will be b about two miles of freight yard tracks.

The Tidewater & Western R. R., T. M. Talcott, General Manager, Richmond, Va. h surveys under way for an exte Rock to Midlothian and thence The extension would be abou This company at present is operating of 3-ft. gage line, which will prob ard gaged.

Organization of the Will Creek R. R. Co. (a new Nor project) was completed April and officers selected as follow Jos. I. Doran, Philadelphia, Pa. Wm. G. Macdowell, Philadelphia, Pa.; Roanoke, Va.; N. D. Maher, Geo. P. Johnson, Bluefield, W. V Bannon, Portsmouth, O.; W land, Ky. Officers—L. E. Joh Wm. G. Macdowell, First Vic D. Maher, Second Vice Pres eral Manager; T. S. Dav President and Traffic Manage Secretary; Jos. B. Lacy, Trea Coxe, Comptroller; Mr. Jos. eral Counsel; Chas. S. Chu Va., Chief Engineer. This ra tend from Williamson, W. V mines in Pike County, Ky., an completed, including its branch ty miles long. It will cross th Williamson by a six-span bri streams by short span bridges one short tunnel on the line, nect with the Norfolk & West Williamson, W. Va., and exte open and cultivated valley o with good alignment and gr struction of this railroad will com at once and everything possib will to complete it by January 1st, 13.

Washington.

The Seattle, Kenwood & Co. has been incorporated with cap of $400,000 and proposes to construct line from Seattle to the Snoh King and Snohomish counties. rators are Clyde C. Chittenden Chittenden.

The Wenatchee Valley Ry. Co has been incorporated with a $15,000 and proposes to operat tween Chelan and Douglas co merous branch lines. J. H. coma, J. Vermilya of Wenat Quigg of Wenatchee are trust

The Board of Public Works, Seatt has rejected all bids receive struction of the municipal l from Cedar Falls to Camp No River watershed.

It is believed that the Toppenish, coe & Western R. R. will be com Fort Simcoe in the Yakima Va present season. Crews are a final grading and it is expected that be laid shortly.

West Virginia

According to information Fairmount, W. Va., track layin menced shortly on the Rivesv Buckhannon & Northern R. R. be done with a track laying is believed that the line will be rolling stock by June 1.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Wisconsin.

ukee Electric Railway & Light [illegible] is petitioned to build at [illegible] connect Kenosha with Lake [illegible] western terminal. Farmers of [illegible] said to be willing to give land [illegible] way

apolis, St. Paul & Sault Ste. [illegible] rted to have decided to build [illegible] from Amherst Junction to Ne

ted that Jefferson, Wis., has ,000 toward the construction of n Whitewater to that place and e line are already under way.

Canada.

[illegible] under way for doubl [illegible] Canadian Pacific main line be- ver and Calgary, a distance of [illegible] is one of the most ex ements undertaken by the Cana-

[illegible] will [illegible] Busteed, with headquarters at Kamloops, B. C.

Work is to be started this summer on the proposed line of railway from Montreal to the [illegible] Bay. Preparations are now being made to send in supplies by boat so as to begin construction in the bay terminus as soon as possible. F. H. Clergue, Sault St Marie, Ont., is interested.

Surveys are under way for the projected line of the Pacific Great Eastern Ry. Officers of the company are now in England to complete financial arrangements in connection with the organization and construction of the railway. This road is to connect Vancouver with Fort George on the Grand Trunk Pacific. D. Arcy Tate, Victoria, B. C., is Vice President and General Counsel.

Work has been started on the improvements of the Canadian Northern Railway Company's yards at Saskatoon, Sask. The cost of the work is estimated at $250,000.

According to the report of the Delegation of the Regina, Sask., Board of Trade, which recently returned from Winnipeg, Man., a new railway line with Regina as a terminal point will be constructed by the Canadian Northern soon. It will enter the Goose Lake country over a route that has not been definitely fixed. The new line will join the Goose Lake line at Rosetown, but the terminal will remain at Regina. It was not definitely stated when the work on this line would be commenced.

It is rumored that officials of the Pere Marquette R. R. are investigating the condition of the roadbed of the London, Ont., and Port Stanley line with a view to rebuilding the stretch of track. W. K. Tasker, Port Huron, Mich., is Superintendent.

IDGES—STEEL AND CONCRETE

Alabama.

meeting of the Board of Rev- Ala., the national highway and [illegible] taken up and the [illegible] for the construction of the highway from Eufaula to [illegible] Ala., considered [illegible] s been deferred until the June

Arkansas.

s. & Co. has let the contract for n of bridges on the Waco- a Interurban Railway to W. alvern, Ark. The award in- 200,000 and actual construction ced within six weeks. There miles of trestle work and 11 two largest structures on the cted over the Trinity and Bra- ot come under the above con-

California.

f County Supervisors, Fresno, e contract for the construction pan, 2-arch monolithic bridge n Canal ditch on Bullard Ave. [illegible]

Florida.

d Construction Co., Tampa, awarded the contract for the a bridge over Trout Creek in [illegible] Jacksonville, Fla., at

Idaho.

[illegible] County Commissioners s awarded the contract for the [illegible] concrete boxes and one [illegible] Mangun & Son, Boise. [illegible] were opened April 10 [illegible] t for the construction of a r the St. Joe River at Coeur has been awarded to Carscal- [illegible] Idaho, at $16,700 nitted for the work were as d Bridge Co., $17,500; Min- [illegible] O. H. Stratton.

Illinois.

ng corrections are applicable the East North St. bridge, noted under Bridges, Steel our last issue: Estimated [illegible] at 102 cu. yds. while 1.6 cu. yds. Estimated rein- given at 12,934 lbs., while it

received up to 2 p. m., May site, about 6 miles north of he construction of one rein- bridge to be built between rmount and Beverly, Counties of Pike and Adams. Wm. M. Huffman, Acting Clerk, Baylis, Illinois. Seybold Bridge—Span, 60 ft.; roadway, 16 ft.; height, 20 ft.; wings, 16 ft. Estimated amount of concrete in structure, 201.1 cu. yds.; reinforcing steel, 36,213 lbs. Gravel is reported to be available at 8 cts. per. ton, in a creek bed about 4 miles from bridge site. Quality not known. Low water flow about 3 ft. deep and 40 ft. wide; high water, about 14 ft. deep. Stream bed soft for 3½ ft. Piles will probably be needed for foundations and for falsework. No present bridge. Nearest railroad station, Baylis on the Wabash. Work to be completed on or before September 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

The Board of Local Improvements, Rockford, Ill., has recommended that the contract for the construction of the 12th St. bridge over Keith Creek be awarded to Holm Bros., Rockford, Ill. Their bid was $3,360 for bridge with gas pipe handrails and $3,645 with cement handrails. Other bids received were as follows: W. H. Shons, Freeport, $4,747.47; Beckstrom & Bergenson, $4,115; P. J. Peterson Bros., $4,250.

J. P. St. Cerny, Village Attorney, East Peoria, Ill., recently conferred with the officials of the T. P. & W. and the L. E. & W. in regard to having culverts and bridges installed in the vicinity of East Peoria.

Indiana.

✤Bids will be received until [illegible] May 8, by Board of Clinton County Commissioners, Frankfort, Ind., for the construction of three bridges. C. F. Cromwell is County Auditor.

✤Bids will be received until May 7, by Board of La Grange County Commissioners, La Grange, Ind., for the construction of two 100-ft.; one 40-ft.; two 24-ft., and five 18-ft. concrete and iron bridges. C. S. Willard is County Auditor.

⊙The Board of Madison County Commissioners, Anderson, Ind., recently let the contracts for the construction of bridges as follows: Elkhart Bridge & Iron Co., Elkhart, Ind., for superstructure of Pipe Creek bridge, at $2,915; Thomas P. Kelly, Anderson, for sub-structure of same bridge, at $1,088; John E. Mason, Alexandria, Ind., for Clark-Hilligoss bridge, at $561; Stony Creek bridge, $561; concrete floor, County Line bridge, $183; extension of abutments of County Line bridge, $157; floor in Lick Creek bridge, $191; floor in Fall Creek bridge, $165; Thomas P. Kelly, abutments for Sugar Creek bridge, $360. J. B. Benefiel is County Auditor.

⊙The Board of Hancock County Commissioners, Greenfield, Ind., has let the contracts for the construction of seven bridges to the Greenfield Bridge Co., J. A. Parish, Olvey & Brown of Greenfield, Ind., at $8,500.

⊙The Board of Vigo County Commissioners, Terre Haute, Ind., has awarded the contract for the construction of a concrete bridge in Honey Creek township, to Joseph P. Peters, Terre Haute, Ind., R. R. No. 4, at $1,700. W. G. Wallace is County Auditor. Bids were opened April 20.

Iowa.

✤Bids will be received until 1 p. m., May 8, by Board of County Commissioners, at the office of the County Auditor, Nevada, Ia., for the necessary labor and material for the construction of one 75-ft. arch span bridge; one 45-ft. arch span bridge; one 40-ft. arch span bridge and two 20-ft. arch span bridges.

The Department of Streets has referred to the City Council of Sioux City, Ia., the petition for the foot bridge over Perry Creek.

Board of Greene County Supervisors, Jefferson, Ia., has ordered plans and specifications prepared for the construction of a new bridge at Eureka Mill. The structure as proposed will be of steel, with concrete floor resting on reinforced concrete piers and ice breakers.

J. R. Harrigan, Vice President and General Manager of the Des Moines City Ry. Co., has requested the City Council of Des Moines, Ia., to repair the First St. bridge.

Kansas.

⊙The Missouri Valley Bridge & Iron Co., Leavenworth, Kan., has been awarded the contract by the Board of Ada County Commissioners, Boise, Idaho, for the construction of 10 new steel and concrete bridges over various rivers, creeks and irrigating canals, at $25,995. The bridges which will be built by the Missouri Valley company in accordance with this contract, the location of each bridge and the cost of construction of each is as follows: Bridge No. 1, over Dry Creek, one mile north of Eagle, $2,200. Bridge No. 2, over Farmers' Union canal, two miles north of Eagle, between sections 32 and 33, township 5 north, range 1 east, $1,960. Bridge No. 3, over Farmers' Union canal, in section 32, township 5 north, range 1 east, $2,280. Bridge No. 4, over Willow Creek, between sections 8 and 9, township 5 north, range 1 west, $2,620. Bridge No. 5, over Ridenbaugh canal, between sections 17 and 18, township 3 north, range 2 east, $2,290. Bridge No. 6, over Ridenbaugh canal, between sections 21 and 22, township 3 north, range 1 east, $2,000. Bridge No. 7, over Ridenbaugh canal, north of Perkins, $2,000. Bridge No. 8, over Ridenbaugh canal, between sections 20 and 21, township 3 north, range 1 east, $2,000. Bridge

No. 9, over Ridenbaugh canal, in section 24. township 3 north, range 1 west, $1,920. Bridge No. 10, over the west channel of the Boise River on the Meridian road west of the Main street bridge, $7,500.

⊙The Board of Wyandotte County Commissioners, Kansas City, Kan., has awarded the contract for the reconstruction of the Kansas Ave. bridge to the Kansas City Bridge Co., at $112,750. Bids were opened April 20.

⊙The Clay County Commissioners, Clay Center, Kan., have awarded the contract to the Leavenworth Bridge Co., Leavenworth, Kan., for repairing the Air Line, Morganville, Clifton and Vining bridges, which were damaged by the ice this spring; also the contract for a new bridge over Huntress Creek in Clay Center and a new bridge near Oakhill.

Maryland.

✣Bids will be received until noon, May 9, by Baltimore County Highway Commission, E. S. Bosley, secy., Towson, Md., for constructing 20 reinforced concrete culverts, reinforced concrete wall and three reinforced concrete superstructures.

Massachusetts.

⊙The Weymouth Back River Bridge Commission, J. F. Merrill, Chairman, Boston, Mass., has awarded the contract for the substructure of the Weymouth Back River bridge to John Cashman & Sons Co., 49 Cross St., Quincy, Mass., at $54,791. The work will include substructure, guard piers, fenders and approaches. Bids were opened at the office of the Harbor and Land Commissioners, 131 State House, Boston, Mass., April 8.

Michigan.

The City Commissioners of Port Huron, Mich., have decided to accept the proposition of the Osborn Engineering Co., Cleveland, O. to prepare plans for the construction of the proposed new Military St. bridge. It is expected that bids for the work will be advertised for in the near future. E. R. Whitmore is City Engineer.

Minnesota.

The Great Northern Ry., John A. Bohland, St. Paul, Minn., bridge engineer, has made surveys for a concrete trestle bridge near Crookston, Minn.

As the result of soundings recently completed by City Engineer Andrew Rinker, Minneapolis, Minn., he has recommended the construction of a reinforced concrete arch bridge over the Mississippi River, passing over the southerly end of Nicollet Island.

Mississippi.

✣Bids will be received until 8 p. m., May 6, by city clerk, Vicksburg, Miss., for extending arch on Clay St. between Third and Fourth North Sts.; extension of arch between Linn and Spring Sts. Plans and specifications are on file with city engineer. J. J. Hayes is mayor.

Missouri.

✣Bids will be received until 1:30 p. m., May 7, by C. E. Jacoby, Engineer Drainage District No. 3, Carroll County, Carrollton, Mo., for the following work: Chrisman bridge, between section 31 and section 32, Trotter township, 75-ft. steel bridge, with 15-ft. wooden approaches; also 70-ft. wooden Howe truss, with 15-ft. wooden approaches for same site. Ballard bridge, in section 4, Wakenda township, 75-ft. steel bridge, with 15-ft wooden approaches; also 70-ft. wooden Howe truss, with 15-ft. approaches for the same site. Each bid must be accompanied by cash deposit of $25, or a certified check for the same amount.

⊙The Western Bridge Co., Harrisonville, Mo., has been awarded the contract for the construction of concrete bridges across Mud and Washington Creeks, in Douglas Counties. The cost of the structures is $5,100.

The City Council of Rockport, Mo., has made arrangements for the construction of a steel bridge over Rock Creek at the city park entrance. The structure is to rest on steel and concrete piers, and will be 10 ft. higher than the old structure.

Waddell & Harrington, Consulting Engineers, Kansas City, Mo., have completed plans and specifications for the viaduct part of the West Twelfth St. trafficway in that city and the Board of Public Works have approved same. The viaduct is to be of reinforced concrete and 2,265 ft. in length. It will begin at Liberty and Twelfth Sts. and end 337 ft. east of Summit St. It is to have two decks. The upper deck will have a grade of 5 52-100 per cent, and a roadway 30 ft. in width for the accommodation of horse-drawn and power-operated vehicles. North of this roadway is another 22-ft. roadway for the exclusive operation of srteet cars. There is also a sidewalk 5 ft. wide for the use of pedestrians, who will gain access to it at Santa Fe and Twelfth and Mulberry and Hickory Sts. The lower deck of the viaduct will have a grade of 3 15-100 per cent, and a roadway 30 ft. wide. This deck will be used by horse-drawn vehicles and will begin at Hickory and Mulberry Sts. and end at the new Bluff St diversion and connect with north and south outlets, the former by way of Sixth St. and the latter by way of Seventeenth St. The estimated cost of the viaduct is $660,000.

Montana.

Commissioners of Cascade County, Great Falls, Mont., and of Teton County, have decided upon the construction of a bridge over Sun River at Simms and the contract for the work will probably be let within a short time.

Nebraska.

✣Bids will be received until May 7, by Keya Paha, County Clerk, Springview, Nebr., for the construction of two new bridges over the Niobrara River, to be known as the Carns and McCulley bridges.

✣Bids will be received until noon, May 25, 1912, at the County Clerk's Office in Wahoo, Saunders County, Nebr., for the construction of two bridges across the Platte River, one to be located at a point about one mile south of the City of Fremont at the location of the old wagon bridge, and the other is to be located one mile southeast of the town of North Bend, at approximately the same location as the present wagon bridge. Bids on the above bridges will be received as follows: North Bend Bridge: One high truss steel bridge, approximately 1,400 ft. long, all as per plans and specifications. Fremont Bridge: One high truss steel bridge, approximately 1,400 ft. long, and repairs of present steel spans, all as per plans and specifications. Bids may be submitted separately on either bridge. All bids must be sealed and accompanied by cash deposit or certified check for $1,000. All certified checks to be made payable to Mr. J. D. Frahm, County Clerk of Saunders County. Copies of plans and specifications may be had upon application and payment of $5.00 at the office of D. D. Price, State Engineer, Lincoln, Nebr.

✣Bids will be received until noon, May 29, 1912, at the County Clerk's Office in Scotts Bluff County, Gering, Nebr., for the construction of one birdge with earth approaches and fills across the North Platte River, to be located about one-half mile north of the town of McGrew on the Main street of said town. Bids will be received for the above bridge on alternate designs as follows: McGrew Bridge: First—One reinforced concrete girder bridge, composed of 33 ft. spans, approximately 800 ft. in length, all as per plans and specifications. Second—One reinforced concrete arch bridge, composed of 50 ft. spans, approximately 800 ft. in length, all as per plans and specifications. Earth fills on the ends to be made about 2,400 ft. total length, containing approximately 23,000 cu. yds. of earth. Surfacing with gravel six inches deep will be made over the roadway of bridge and 16 ft. wide on all fills, being approximately 900 cu. yds. of gravel. Bids may be submitted separately on the bridge, earthwork and surfacing. All bids must be sealed and those on the bridge or the entire project complete must be accompanied by cash depo check for $1,000.00. Bids on surfacing to be accompanied b cash or certified check for $200. All tified to be made payable to Mr. J. J. Fer County Clerk of Scotts Bluff unty. of plans and specifications ma be had application and payment of $5. at the office of D. D. Price, State Engineer, ncoln, Nebr.

⊙The Standard Bridge Co., maha, Neb. has been awarded the contract for the construction of two steel bridges er the Platte River by Commissioners of Do e and Saunders Counties. One at Fremont ill cost $40,000 and another at North Bend ill cost $68 000

⊙Supervisors of Dodge and ming ties at a recent meeting at Fren nt, N the contract for the constructio of bridges to the Standard Brid structure will span the Elkhor county line and the other over

New York.

✣Bids will be received until by Alto Construction Co., Holl Y., for the construction of gate concrete bridges. Located at N. Y., one mile from railroad: earth, 4,000 cu. yds. rock, 1,000 crete, 8,000 lbs. reinforcement gatehouse, lump sum. Official will be found elsewhere in this i

⊙Advices from Oswego, N. Y Groton Bridge Co. has been aw tract for the construction of a l hydraulic canal at the foot of St. The contract price was $1

Plans have been completed, for the construction of the p Dominnick St. bridge at Rome, is expected that the contract fo tion will be let about the first

Through the efforts of the offi daga and Oswego Counties, N probable that bids will be recei the construction of a new br Oswego River at Phoenix, N the two counties and the tow and the town of Schroeppel sh pense, which will be approxim The bridge spans the Oswego Ri comes a part of the barge can tion of the bridge over the can to be paid for by the state. It i pensive part. The bridge is to bascule type, each of the tw tions being 70 ft. wide, making ft. The state will also build tw install machinery and put in abutments for the movable se parts, it is estimated, will cost Over all the bridge will have a l tle more than 700 ft. Seve ments were constructed last ye $17,000. The contracts to be a the state's portion and the f superstructure to be paid for by counties. Frank E. Bogardus, S is Highway Superintendent County.

North Dakota.

✣Bids will be received until p 20, by Board of County Commis office of F. F. Vaughn, County do, N. Dak., for the constructio steel and concrete bridges. A for $500 must be filed with eac

✣Bids will be opened at 10 a the construction of a one-spa frame bridge for Stark County is to have an 18 ft roadway floored with 3-in. plank. It will high abutments. W. R. Veigel, Dak., is Engineer.

⊙Jardine & Anderson, Fargo, been awarded the contract for tion of the necessary bridges in County, N. Dak., during the com

Ohio.

✣Bids will be received until by State Board of Public Wor O., for the reconstruction of Wl vert, Fry's Valley Culvert, Ston

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ay at Lock No. 15, repairs to Orluct, repairs near Lock No. 22, Port n and Trenton, all in Tuscarawas cton Counties on the Ohio Canal. ller is Chief Engineer of the Board. llowing contracts have been let by ounty Commissioners, Chillicothe, pairing the river bridge at Bridge icture to S. Remick, Findlay, O., superstructure to Capital Construc-olumbus, O., at $580; flooring to Construction Co., at $5,200. R. D. is County Auditor.

unty Commissioners, Youngstown, t the contract for the construction t Lowellville bridge to C. F. Schie-

that the City Council of Spring-contemplating the construction of er the Big Four tracks at Belmont iat the proposition may be taken uture. M. J. Bahin is City Engi-

ity Commissioners, Youngstown, sed resolutions to ask bids for the the floor of the west span of the [illegible] St., Brier Hill, culverts for [illegible]

Oregon.

inty Court, Astoria, Ore., has tract for the construction of ver Big Creek near Knappa id Bridge & Iron Co., Portland, The structure will have an ith approaches 102 ft. in length. mittee of the City Council, Sa-is employed engineers to inspect ige over the Willamette River at

Pennsylvania.

hin County Commissioners, Har-let the contract for the con-ne arch bridge over Clarks ldle Paxton township to Nelson Chambersburg, Pa. Bids were 12. D. F. Lebo is County Clerk. rens & Co., Reading, Pa., have l the contract by D. K. Hoch, oller, Reading, Pa., for repair-s bridge, over Monocacy Creek. was $470.

th Co., Chambersburg, Pa., arded two contracts by D. K. Controller, Reading, Pa., one uction of a new bridge in Cen-nip at $2,601, and the other for at $2,144. Bids were opened

ntroller D. K. Hoch, Reading, the contract for furnishing flooring of Lancaster Ave. D. B. Rentschler Lumber Co., [illegible] M

ract for the construction of a lge over the Iron Stone [illegible] has been awarded h, County Controller, Reading, n-King Construction Co., 708 Philadelphia, Pa., at $5,112. has been awarded by the Bor-Pa., to the Nicola Building [illegible] for constructing a ete viaduct, 500 ft. long and Reed Ave. in Monessen, according to plans and specifications of Chester & Fleming, Consulting Engineers, Pittsburgh, Pa. Main arch span is 150 ft. and floor of bridge is 100 ft. above valley below. Bridge will connect two important residential districts in this Borough and is designed for street car service.

⊙Commissioners of Chester County, West Chester, Pa., have awarded the contract for the construction of the new stone bridge over White Clay Creek, Avondale, Pa., to D. E. O'Connell & Son, Londongrove township, at [illegible]

The Carbon County Commissioners, Mauch Chunk, Pa., have decided to rebuild the Mauch Chunk-East Mauch Chunk bridge over the Lehigh River. The cost of the work is estimated at about $40,000.

The special bridge committee has recommended that the City Council of Wilkes-Barre, Pa., award the contract for repairing the South St. bridge to Charles N. Neeld Construction Co., Pittsburgh, Pa., at $13,461.

City Council of Chester, Pa., at a recent meeting took up the matter of building a bridge over Chester River at Fifth St. Nothing definite has been decided as yet. B. G. Ladomus is City Engineer.

It is reported that plans and specifications have been prepared by engineers of the Jersey Central Railroad and are on file at the office of the Traction Co., Ashley, Pa., for the construction of a new bridge over the Ashley planes along Main St. The structure will be of steel girder type, resting on concrete foundation, and will be 68 ft. in width.

It has been recommended that the County Commissioners, Wilkes-Barre, Pa., take up the matter of constructing a bridge over the Susquehanna River, connecting the borough of Nanticoke with the town of West Nanticoke.

Rhode Island.

✣[illegible] by Ovila Dulude, chairman of Committee on Streets and Bridges, Woonsocket, R. I., at the office of the city engineer, F. H. Mills, for the construction of a reinforced concrete arch bridge and appurtenances on Bernon St., Woonsocket, R. I. A certified check for $500 must be filed with each bid.

The Special Committee on the Rhode Island Stone Bridge in the report submitted to the Senate, Providence, R. I., recommended the appropriation of $70,000 for the purpose of reconstructing the bridge. George B. Francis is Consulting Engineer for the committee.

South Dakota.

⊙The Board of County Commissioners, Rapid City, S. Dak., has let the contract for the construction of two bridges over the Cheyenne River to the Hennepin Bridge Co., Minneapolis, Minn., at $43,000. One structure will be located at Wasta and the other at Creston, S. Dak.

Tennessee.

⊙According to advices from Shelbyville, Tenn., the County Court's Special Bridge Committee has awarded the contract for the construction of a 70 ft. reinforced concrete bridge at Bell Buckle and an 80-ft. steel bridge over Sugar Creek, to B. S. Oldham Bridge Co., Murfreesboro, Tenn.

Texas.

✣The Lavaca County Commissioners' Court, Hallettsville, Texas, will receive bids until May 17, for the construction of an iron bridge over the Lavaca River, between Witting and Moulton.

Utah.

✣Bids will be received until 2 p. m., May 16, by State Road Commission, 321 Felt Bldg., Salt Lake City, Utah, for the necessary steel and iron and all shop labor incident thereto for the following bridges: One 62 ft. steel pin connected truss span over Sevier River, Sevier county, Utah; one 52 ft. steel riveted truss span over Sevier River, Sevier county, Utah; one 30 ft. steel riveted truss span over north fork of Dry Gulch, Wasatch county, Utah; one 18 ft. I beam span over Meads Wash, Carbon county, Utah; one 18 ft. I beam span over Willow Creek Wash, Carbon county, Utah; one 16 ft. I beam span over Cloudy Well Wash, Carbon county, Utah; one 12 ft. I beam span over Horsley Wash, Carbon county, Utah. Caleb Tanner is secretary State Road Commission. W. D. Beers, state road engineer.

⊙The Midland Bridge Co., Kansas City, Mo., has been awarded a contract through the Western representative, M. E. Idle, 401 New House Bldg., Salt Lake City, for removing the old bridge and constructing a new steel girder bridge over the Cottonwood Creek. The contract price was $1,433. M. Z. Witcher, Salt Lake City, is County Clerk. Bids were opened April 16.

City Commissioners of Salt Lake City, Utah, have decided to have the Denver & Rio Grande R. R. build, at once, two steel or concrete viaducts over its tracks at Fourth and Seventh South Sts. The viaducts will each be between 700 and 800 ft. long; that on Fourth South St. to have a driveway 28 ft. wide and to have walks on each side for pedestrians 6 ft. wide; that on Seventh South St. is to have a 36-ft. driveway and walks on each side 6 ft. wide. The driveways must be paved either with asphalt or creosoted wood blocks. Both structures must be started within 60 days from the date of the passage of the ordinance, and must be finally completed for acceptance by the city within eighteen months from the time of passage of the ordinance.

Wisconsin.

✣Bids will be received until 2 p. m., May 1, by Board of Grant County Commissioners, Lancaster, Wis., for the construction of a concrete bridge at the site known as the Rasque bridge.

✣Bids will be received until 10:30 a. m., May 1, by Board of County Commissioners, Olaf Hoffland, Chairman, Lancaster, Wis., for the construction of a concrete bridge at the site known as the Brindley bridge.

Canada.

✣Bids will be received until noon, May 17, by commissioners of Saskatoon, Sask., for furnishing the necessary labor and material for the construction of the superstructure of the 23d St. subway. Further information may be obtained of W. L. MacKenzie, bridge engineer, Canadian Pacific Ry., Winnipeg, Man., or of G. T. Clark, city engineer, Saskatoon.

It is rumored that plans are under consideration for the construction of a high level bridge over the Don River and the continuation of Pape Ave., Toronto, Ont.

ADS, STREETS AND PAVEMENTS

Alabama.

e received until 1 p. m., May ie County Court, Athens, Ala., tion of approximately 7 miles A certified check for $400 th each bid. Profile and speci-seen at the office of the Pro-Athens or in the State Highway offices at Montgomery, Ala. W. S. Keller is State Highway Engineer.

✣Bids will be received until 11 a. m., May 21, by Jackson County Commissioners, Scottsboro, Ala., for grading, draining and surfacing with macadam 2.7 miles of State-aid road; also for grading 6.7 miles of county road. W. S. Keller, Montgomery, Ala., is State Highway Engineer.

✣Bids will be received until 8 p. m., May 6, by City Council, Attalla, Ala., for the construction of 400 sq. yds. of concrete sidewalks, 100 sq. yds. of concrete driveways and 3,700 lin. ft. combination curb and gutter. J. E. Johnson is City Clerk.

Arkansas.

✣Bids will be received until 2 p. m., May 15, by Board of Improvement, at the office [illegible] Ark., for resurfacing with bituminous macadam or concrete (penetration or mixing method) approximately 25,500 sq. yds. of old gravel roadway. A certified check for $500 must be filed with each bid.

California.

⊙The Board of Public Works of Los Angeles, Cal., has awarded the contract for paving and improving Pasadena Ave., from San Pasqual Ave. to Piedmont Ave., and parts of other streets, aggregating a stretch of half a mile and a few hundred feet more of thoroughfare, with gutters and curbs, asphaltum pavement in part and vitrified brick on the slopes, to Fairchild-Gilmore-Wilton Co., at $36,960. Other bidders were Barber Asphalt Co., $37,041, and Benjamin F. Ford, $38,366.

⊙Clark & Henery Construction Co., of Oakland, Cal., has been awarded the contract for paving a portion of East 8th St., and Fairmount Blvd., by the City Council of Eugene, Ore.

The City Council of Marysville, Cal., has under consideration the paving of a number of the principal streets in the city, including 5th Ave., which will be a part of the state highway.

Colorado.

✣Bids will be received until 11 a. m., May 8, by Board of Public Works, Denver, Colo., Henry Read, President, for furnishing the necessary labor and materiai for surfacing the roadway areas of Marion St. Parkway surfacing district.

District of Columbia.

✣Bids will be received until 11 a. m., May 27, by Maj. H. L. Pettus, Depot Quartermaster, Washington, D. C., for constructing complete gutters at Walter Reed general hospital, Takoma Park.

Florida.

✣Bids will be received until 2 p. m., May 7, by Commissioners of Public Works, Tampa, Fla., for furnishing 20,000 lin. ft. granite curbing and 140 corners of 6-in. radius. D. B. McKay is Chairman. Allen Thomas is Clerk.

✣Bids will be received until 2 p. m., May 7, by Commissioners of Public Works, Tampa, Fla., for furnishing 1,000,000 paving bricks to be inspected in Tampa and delivered within 30 days, not less than 200,000 monthly. D. B. McKay is Chairman of the Commissioners.

Georgia.

✣Bids will be received until 4 p. m., May 7, by City Council, Augusta, Ga., for furnishing all materials, tools and labor and constructing complete, approximately 30,000 sq. yds. of street paving on 12th St., from Broad St. to Milledgeville road, on Telfair St., from 8th to 9th, and in Barrett Plaza from Telfair to Walker St. Bids on various kinds of pavements will be received, and bond of $10,000 will be required from the successful bidder. Cash or certified check for $500 must accompany each bid. Nisbet Wingfield is City Engineer.

✣Bids will be received until 3 p. m., May 6, by Mayor and General Council, Atlanta, Ga., for paving the following streets: For repaving North Ave., from Peachtree St. to Williams St., with creosoted wood blocks, approximately 7,300 sq. yds. For paving Moreland Ave., from Euclid Ave. to Ponce de Leon Ave. with vitrified brick between the tracks of the Georgia Railway and Electric Company, approximately 2,550 sq. yds., and outside the tracks with asphaltic macadam, approximately 10,800 sq. yds. For paving 14th St., from Peachtree St. to West Peachtree St., with asphaltic macadam, approximately 6,022 sq. yds. For paving St. Charles Ave., from Moreland Ave. to Mayson Ave., with asphaltic macadam, approximately 6,250 sq. yds. For paving McLendon St., from Moreland Ave. to Mayson Ave., with vitrified brick between the tracks of the Georgia Railway and Electric Company, approximately 2,300 sq. yds., and outside the tracks with asphaltic macadam, approximately 7,900 sq. yds. Each street will be considered separately. Specifications will be furnished upon application. R. M. Clayton is Chief of Construction.

Idaho.

City Engineer Harvey J. Smith of Moscow, Ida., has submitted his official estimate of the cost of paving the street intersections in Moscow's proposed paving district No. 1 to the City Council, totaling $30,752. The total cost of the entire improvement district, which will include the excavations, fills, a complete storm sewer system, curbing and paving of 25 blocks, it is said, will not exceed $150,000 additional to the cost of the intersections, providing there is no curbing.

Illinois.

✣Bids will be received until May 3, by Chief Quartermaster J. L. Clem, Chicago, Ill., for furnishing one 3-wheel, 10-ton steam road roller.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, until 11 a. m., May 8, for furnishing and delivering labor, materials, etc., necessary to construct cement sidewalks in the following streets: Anthony Ave., N. Central Ave., N. Canal St., Elston Ave., S. Elizabeth St., N. 45th Ave., N. 48th Ave., Gage St., Grand Ave., Hollywood Ave., Lawrence Ave., E. 120th Pl., E. 122d Pl., E. 123rd St., N. 68th Ct., S. Sacramento Ave., N. 70th Ave., W. 33rd St., W. 61st st., W. 61st Pl., W. 62d St., W. 62d Pl., W. 63rd St., S. Kedzie Ave., S. Spaulding Ave., S. Homan Ave., W. 14th St., W. 15th St., 42d Ave., S. 42d Ct., S. 43rd Ave., E. 76th St., E. 77th St., E. 78th St., E. 79th St., Greenwood Ave., Dobson Ave., Ellis Ave., W. 77th St., S. Morgan St., W. 56th St., S. Seeley Ave., S. Hoyne Ave., S. Hamilton Ave., Henderson St., W. School St., W. Melrose St., W. Belmont Ave., Drake Ave., N. Central Park Ave., S. 43rd Ave. and S. 43rd St.

✣Bids will be received until 8 p. m., May 8, by L. H. Shadensack, Pres., Board of Local Improvements, Peru, Ill., for the improvement of streets. Estimates of quantities for said improvement of said street are as follows: 5,132 lin. ft. concrete curb, including the necessary excavation and cinder foundation therefor; 9,981 sq. yds. brick paving, including a 6-in. crushed rock and 2-in. sand foundation therefor, and ½-inch sand filler on surface; 5,915 cu. yds. of excavation; 550 lin. ft. 2x6-in. oak plank, and 31 catch basins.

✣Bids will be received until 9 a. m., May 6, by Board of Local Improvements, Rossville, Ill., for the construction of an asphaltic concrete pavement on Chicago and Attica Sts. The work to be done is approximately as follows: 30,430 sq. yds. of paving, 5-in. concrete base, with 1½ in. asphaltic concrete wearing surface; 3,386 lin. ft. of machine dressed stone curb 5x20 ins.; 17,473 lin. ft. concrete combined curb and gutter; 995 ft. 5x20 stone headers; 59 storm water inlets complete with catch basins and connections, and 2,521 lin. ft. of 12-in. vitrified sewer pipe sub-drains.

⊙The Highway Commissioners at Palestine, Ill., have let the contract for laying one and one-fourth miles of crushed rock road within and just outside the village to E. E. Pifer.

⊙The contract for the paving of East William St., has been awarded by the Board of Local Improvements of Decatur, Ill., to S. A. Tuttle of that city at $42,123. Other bidders were: G. W. Prutsman, Danville, $43,830 and Allen & Alexander, Decatur, $44,060.

⊙The Board of Local Improvements of Moline, Ill., has awarded the contracts for brick and asphalt paving amounting to about $90,000, as follows: 55th St., from Railroad Ave. to 4th Ave., with brick, Porter Construction Co., East Moline, $4,300, rejected; 7th Ave., from 15th to 17th St., with brick, Independent Construction Co., Davenport, Ia., $6,215; 8th Ave., from 15th to 17th St., with brick, Independent Construction Co., $7,510; 15th and a half St., from 8th to 10th Ave., with brick, Independent Construction Co., $2,610; 12th St., from 17th St. to 19th Ave., with asphalt, McCarthy Improvement Co., Davenport,
St., from 9th Ave. to 15th S with
and on 7th St., from 12th to 6th
on 11th and a half St., fro
Ave., and on 14th St., from 1
with asphalt, McCarthy Im
$29,700; 14th Ave., from 16t
half St., from 12th to 14th A
McCarthy Improvement Co
St., from 16th St. to 23d A
McCarthy Improvement Co.,

⊙The Board of Local Impr ments of
coln, Ill., has awarded the c
paving of Elm St., from 8th 10th Sts.
Harvey K. Rhoads of Lincoln The pr
pavement will be 20 ft. in w
long.

⊙The Board of Local Im
Peoria, Ill., has awarded the ntract for
paving of Knoxville Ave. to
at $33,410. The street will be
nois to the city limits with
crushed rock and concrete bas

⊙O. T. Dunlap, St. Louis A
Ill., has been awarded the
city of Collinsville for the
pavement in Paving District
ols. The work includes 13,
vitrified brick on 4-in. concr
7,400 ft. 2 ft. curb and gutter,
6 manholes, 370 ft. of 12-in. p
15-in. pipe, 577 ft. of 18-in. pi
of 24-in. pipe. A. C. Powell is
Bids will be opened April 24.

City Engineer Charles Hepn
Ill., has submitted the estima
Taylor Ave. and Henderson S
this to include the storm se
foundation for the pavement w
curb and gutter, to the Boar
provements. The estimate is
$35,000 and $36,000.

The City Council of Peoria,
an ordinance for the paving of
garet, Ann Eliza, Capitol, 4t
7th Sts.

All material furnished and
formed is to be in strict a
plans, profiles and specificati
the Village Clerk's office, Ro
and at the office of Payne &
ing Engineers, Danville, Illino

The citizens of the town of
at a recent election voted to
of macadamized road in the
J. N. Fuller is Commissioner
C. W. Faltz is Town Clerk.

The citizens of Creston, Ill.,
tion voted in favor of the build
of macadamized roads.

The City Council of Granite
passed an ordinance providing
ment of C St., with creosoted
an estimated cost of $40,000.

The City Council of East
passed an ordinance providing
of 1st St., with brick, from 3
railroad. Engineer H. G. Pa
mated the cost at $5,318.

The Board of Local Im
Pekin, Ill., has adopted a res
ing for the improvement of
the Capitol, 4th and 5th St
and has also approved an
of the cost of the proposed in
made by City Engineer John
follows: 36,000 sq. yds. brick
concrete foundation 5 ins. thick ove
a sand cushion 2 ins. thick,
filled with a cement grout fill
there is a spread ½ in. of san
place at $1.60 per sq. yd., $57,
17,699 sq. yds. is on streets of
30 ft., 10,497 sq. yds. on the stre
of 27 ft. and 7,804 sq. yds. on th
of the streets designated as
cu. yds. of excavation and filli
cu. yd., $3,000 (of which
on streets 30 ft. in width, 3,49
streets 27 ft. in width and 2
on the intersections of the
streets). 5,000 lin. ft. new concre
in. at 25c per ft. $1,250. 900 lin.
curb 5 in. top, 8 in. base, and 16

✣ **indicates work now open for bids.** ⊙ **indicates a contract let recently.**

[illegible] 14,825 lin. ft. [illegible]
ned and adjusted at 10c per ft., [illegible] making, [illegible] etc. $1,61[illegible]

Indiana.

[illegible] until 10 a. m., Ma[illegible] Public Works, Indianap[illegible] [illegible] St. by grading [illegible] [illegible]way.

[illegible] received until 10 a. m., M[illegible] Public Works, Indianap[illegible] [illegible]proving Park Ave., from Fall [illegible] 4th St., by grading [illegible]

[illegible] until 10 a. m., Ma[illegible] Works, Indianapolis, Ind., [illegible]rovement of Chester Ave., from St. to Moore Ave., by grading [illegible]

be received until 10 a. m., May of Public Works, Indianapolis, [illegible] Alley, west of [illegible] 24th St., by grading the roadway.

be received until 10 a. m., May [illegible] Works, Indianapolis, improvement of the First Alley St., from Stevens St. to Merrill [illegible]g and paving the roadway.

be received until 10 a. m., May of Public Works, Indianapolis, improvement of New St., from [illegible]eecher St., by grading and pav[illegible]

[illegible]e received until 10 a. m., May 6, [illegible]ublic Works, Indianapolis, Ind., [illegible] R[illegible]son St., from Sherman Drive, by grading and [illegible]ewalks.

be received until 10 a. m., May of Public Works, Indianapolis, [illegible]ving Ewing St., from the south 10th St. to the north property St., by grading and paving the [illegible]

[illegible] until 10 a. m., May 3, [illegible]ublic Works, Indianapolis, Ind., [illegible]vement of Alabama St., from property line of Massachusetts [illegible]utheast property line of Fort [illegible] grading and paving the road-[illegible]

be received until May 1, by [illegible]yer, Quartermaster, Fort Ben-[illegible], Ind., for furnishing 2,000 vit. [illegible] equalizers, 1 road grader ma-[illegible] for Deering mower, 105 cubic [illegible]tone, 70 cubic yards sceenings. [illegible] heating truck, 1 [illegible] scrapers.

[illegible]County Commissioners, Terre [illegible] Auditor, [illegible] [illegible]tracts for the construction of [illegible]vel road in Nevins Township [illegible]lood gravel road in Prairie [illegible]ton Townships, as follows: [illegible] Brazil, Ind., Haynes road, [illegible] & Vangilder, Farmersburg, [illegible] $9,96[illegible] Bids [illegible]

[illegible]ncil of Connersville, Ind., has [illegible] the following streets during [illegible]ncrete paving: Eastern, from [illegible]ntral, from 7th north to City [illegible] from 4th south to Stone arch [illegible]ton Pike, from 8th to 18th; [illegible] present pavement, West [illegible] & D. to Mount and west on [illegible]nbia; Columbia from Mount [illegible] from present pavement to [illegible]1st from Central to Eastern; [illegible] to Eastern; 2d, from Central [illegible]d, from Central to Eastern; [illegible] Western to Eastern; finish [illegible]rn to city limits; finish 6th, [illegible] Eastern; 7th, from Western [illegible] between 7th and 8th, from [illegible]; 8th, from Oak to Eastern; [illegible] Fayette; Washington, from [illegible]nia, from Central to 22d.

[illegible] held in Heth Township. [illegible]

Iowa.

✣[illegible]

✣[illegible]

⊙[illegible] awarded the contract for paving to the Des Moines Asphalt Co., of Des Moines, Ia., at $1.37 per sq. yd. The specifications call for a 5-in. concrete base and a 2-in. asphaltic concrete wearing surface.

The City Council of Clarinda, Ia., intends [illegible] Washington [illegible] St.; 18th St., from Washington St. to State St., and State St. from 18th St., to the west line of [illegible] St. [illegible] sq. yds. of pavement and 7,450 ft. of curbing. C. W. Stuart is City Clerk. Theo. S. De Lay Creston, Ia., is Engineer.

Kansas.

✣Bids will be received until May 1, by Boards of Commissioners, Pittsburg, Kan. for the construction of about 4,500 sq. yds. of brick pavement on a 5-in. concrete base with asphalt filler. All bids received April 21 [illegible] a technical error. L. E. Curfman is City Engineer.

The City Commission of Marion, Kans., has engaged H. A. Rowland, McPherson, Kans., to make plans and specifications for about 15,000 sq. yds. of paving.

The City Council of McPherson, Kans., has passed resolutions for paving about 10 blocks of streets.

Louisiana.

✣Bids will be received at Lake Charles, La., until 8 p. m., June 4, for paving seven streets.

Maryland.

✣Bids will [illegible] 9, by Baltimore County Highway Commission, E. S. Bosley, Secretary, Towson, Md., for the construction of 3,000 ft. of Timonian Road, 3,500 ft. Maiden Choice Road, and 3 miles of the Philadelphia Road; also for grading two hills on the Windsor Mill Road. H. G. Shirley, Towson, Md., is Roads Engineer.

✣The Board of Awards of Baltimore, Md., on April 24 awarded the following contracts upon the recommendation of the Paving Commission. R. Keith Compton, Chairman; Vitrified Block Contract No. 17.—Cunningham Paving & Construction Co., 1345 Arch St., Philadelphia, Pa., approximate bid $35,998; Vitrified Block Contract No. 19.—Consolidated Engineering Co., Emerson Tower Bldg., $2,412. Contracts 14, 15, 16 and 18 will in all probability be awarded on May 1.

Massachusetts.

The report of the special committee appointed at the annual town meeting, Palmer, Mass., in regard to the construction and location of permanent highways, has been accepted. The roads considered are the connecting lines between the villages, also Park St., South Main St., Central, Church and Pleasant Sts., Commercial and Main Sts., in Thorndike and Main St., in Three Rivers. It was voted to improve the highways of the town by laying out not more than 10 miles of oiled gravel or macadam road, and the sum of $50,000 was appropriated therefor. John F. Foley is Town Clerk.

Michigan.

✣Bids will be received [illegible] May 2, by F. P. George, City Clerk, Hudson, Mich., for furnishing the necessary labor and material for paving with bituminous concrete asphaltic concrete, treated macadam or otherwise improving the streets known as Grove St., Main St., and Maple Grove Ave., including approximately 8,400 lin. ft. Smith & Boulay Co., 322 The Nasby Bldg., Toledo, Ohio, are Engineers.

Minnesota.

Cook County, Minn., has voted bonds in the sum of $60,000 for the building of 60 miles of the North Shore road between Duluth and Port Arthur, Ont. Grand Marais is the county seat.

Mississippi.

Contracts will be let some time in July for the construction of 25 miles of stone or gravel and sand clay roads in Beat 1 of Scott County, Miss., estimated to cost $75,000. G. A. McIlhenny, Forest, Miss., is official in charge.

Missouri.

✣Bids will be received until May 7, by County Court, St. Joseph, Mo., for macadamizing the DeKalb road, from the present end of macadam on the King Hill road to De Kalb, a distance of seven miles, and the other a 16-mile stretch of grading on the Sparta road, from the Thomas Ashton place southward to Dearborn, by way of Faucett. This last is to be a link in the Iowa Trail, from Des Moines to Kansas City, and it is hoped that within another year the road will be macadamized its entire length.

✣Bids will be received until June 1, at the office of W. R. Heager, Engineer, Fulton Special Road District, Callaway County, Fulton, Mo., for 120,000 cu. yds. of earth excation. Contractors desiring to look over the roads should furnish several days' notice to enable the engineers to arrange to accompany them.

✣Bids will be received until May 6, by J. L. King, Judge Dade County Court, Greenfield, Mo., for the construction of 47 miles of rock road. J. W. Scott is Engineer.

The Sedalia 12-mile Special Road District, Sedalia, Mo., on April 20 voted the issuance of bonds in the sum of $200,000 for the completion of the 16 rock roads now leading out of the city to the district limits. Charles McEniry, W. H. Powell and C. C. Gentry are Commissioners.

Montana.

⊙Contracts have been awarded by the city of Helena, Mont., Charles W. Helmick, City Engineer, for curbing, sidewalk, etc., work in Districts Nos. 50 and 53, as follows: Adami Bros., District No. 50—6,100 cu. yds. fill at 50 cts.; 1,100 cu. yds. loam at $1.25; 44,200 sq. ft. concrete walks at 14 cts.; 7,280 lin. ft. concrete curbs at 40 cts; 1,240 lin. ft. of concrete cross walks at $1.00; 5,700 lin. ft. of old walks removed at 1 ct.; 66 single light electric lamp posts with wiring and shade at $34.75; 7,400 lin. ft. of fibre conduit set in curb at 9½ cts.; 7,400 lin. ft. of D. B. cambric ins. No. 6 copper conductor at 9 cts.; 24 double water connections at $20.00; 32,000 sq. yds. rolling street at 1 ct.; 280 trees furnished and set at $1.00; 450 lbs. of grass seed sown at 25 cts.; 280 tree holes dug at 60c; 290 lin. ft. circular granite curb set at $1.50. Total, $20,272. Miracle-Tripp Concrete Co., District No. 53—8,306 cu. yds. of fill at 40 cts.; 1,136 cu. yds. of loam at $1.00; 42,200 sq. ft. of concrete walks at 14½ cts.; 7,250 lin. ft. of concrete curbs at 45 cts.; 1,112 lin. ft. of concrete cross walks at $1.00; 5,600 lin ft. of old walks removed at 0 cts.; 61 single light electric lamp posts with wiring and shade at $40.00; 7,200 lin. ft. of D. B. cambric ins. No. 6 copper conductor at 18 cts.; 7,200 lin. ft. of fibre conduit at 12½ cts.; 23 double water connections at $25; 28,000 sq. yds. rolling street at ½ ct.; 264 trees furnished and set at $1.00; 264 tree holes dug at 50 cts.; 450 lbs. of grass seed sown at 25 cts.. Total, $20,811

New Jersey.

✣Bids will be received until May 6, by City Council, Sea Isle, N. J., for the construction of asphalt macadam roadway and concrete gutters estimated to cost not more than $20,000. R. L. Goff, Ocean City, N. J., is City Engineer

⊙The Ocean County Commissioners, Toms

River, N. J., have awarded the contract for the road on Long Beach, connecting Beach Haven with the new bridge across the bay at Manahawkin to the Miller Engineering Co., at Cape May, N. J., at $36,950.

New York.

✣Bids will be received separately until 11 a. m., May 7, by Department of Public Works, Buffalo, N. Y., for paving Deseronte St., repaving Grant St., repaving St. Paul St., repaving Court St. and for repaving Ferry St. Francis G. Ward is Commissioner of Public Works.

✣Bids will be received until May 1, by Board of Contract and Supply, Binghamton, N. Y., for the paving of a number of streets. J. A. Giles is City Engineer.

⊙The Board of Contract and Supply of Rochester, N. Y., has awarded the contract for sprinkling city streets to Bantel & Hartung at 63¾ per cent of the estimate. The work will cost about $52,000.

⊙The Board of Contract and Supply of Rochester, N. Y., has awarded the contract for constructing a creosote wood block pavement in Portsmouth terrace to Brotsch, Hempel & Brotsch at $18,504; also a contract to the Rochester Vulcanite Pavement Co., for an asphalt pavement in Melville St., at $22,655; also a contract to Whitmore, Rauber & Vicinus for an asphalt pavement in Spring St., at $9,390.

⊙John C. Healey of Auburn, N. Y., is reported to have been awarded the contract by the Common Council of that city for the paving of Franklin St., from North St. to the Five Points with vitrified brick. Other bidders were: Brayer Bros., of Auburn and Tine & Willey of Binghamton, N. Y. It is also reported that the contract for paving Lewis St., with asphalt has been awarded to Brayer Bros. at $2.05 per sq. yd.

✣Bids will be received until 5 p. m., May 7, by City of Gloversville, N. Y., for the construction of 30,800 sq. yds. of pavement of vitrified brick, bitulithic and wood block and for setting 18,500 lin. ft. of curb. Morrell Vrooman is City Engineer.

✣Bids will be received until 2 p. m., May 6, by Charles F. Foley, First Deputy Superintendent of Highways, Lancaster St., Albany, N. Y., for the reconstruction of the following highway: County, Erie. Road No., 69 R. Name, Main St., Sec. 1. Approximate length, 1.10 miles. And for the repair of the following highway: Erie County, Contract No. 99. Road No. 130. Main St., Sec. 3. Approximate length, 5,625 miles. Maps, plans, specifications and estimates may be seen and proposal forms obtained at the office of the First Deputy Superintendent of Highways, No. 55 Lancaster St., Albany, N. Y.

✣Bids will be received until 8 p. m., May 7, by Common Council, Dunkirk, N. Y., for paving four streets including approximately 39,000 sq. yds. Bids will be received on sheet asphalt, brick and concrete. The work will include 17,000 cu. yds. of excavation and 19,000 lin. ft. of stone curb and gutter. J. M. Hackett is City Engineer.

⊙The Watson Contracting Co., 2614 Aqueduct Ave., New York City, has been awarded the contract by the President of the Bronx, New York City, for regulating, grading, setting curbstones, flagging sidewalks, laying crosswalks, building approaches, and erecting fences where necessary in Corlear Ave., from 230th St. to 240th St., together with all work incidental thereto. The contract price is $44,983. Bids were opened April 23.

The Common Council of Auburn, N. Y., has ordered City Engineer E. C. Aldrich to prepare plans and specifications for sheet and liquid asphalt pavement in Chedell place, from South St. to Easterly Ave.

The Board of Public Works of Cortland, N. Y., has voted to pave four streets with slag, as follows: West Main, from Homer to Hamlin, 26 ft. wide; West Court, from Main to Pleasant, 55 ft. wide, at the foot of the hill and 30 ft. the remaining distance; Clayton St., Main to Pleasant, 22 ft. wide; Court St., Main to Church, 60 ft. wide, including 20-ft. parkway in center of street and 20 ft. roadway on either side. E. L. Becker is Supt. of Public Works.

The citizens of the village of Stillwater, N. Y., at the charter election voted in favor of the proposition to pave Main St., which is the connecting link between the state road leading north from Mechanicville and the new state road which is to be constructed north of Stillwater, in the direction of Schuylerville, for a distance of 5½ miles. The paving will cost about $85,000. The distance is seven-eighths of a mile, and the width will be approximately 32 ft., of which the state will bear the expense of 16 ft., the Hudson Valley Railway 9 ft., and the village the balance. It is estimated the cost to the village will be $15,500. It was decided to bond the village for $16,000 for this purpose.

Following bids were recently received by the Board of Contract and Supply of Syracuse, N. Y., for resurfacing the pavement in South Clinton St., from West Jefferson St. to West Onondaga St.: Asphalt, Warner-Quinlan Asphalt Co., $7,376; Guy B. Dickinson, $7,712; F. I. Baker, $7,850. Vitrified brick or block and asphalt, Warner-Quinlan Asphalt Co., Cowan block and asphalt, $7,576; Metropolitan block and asphalt, $7,580; J. F. Baker, Olean block and asphalt, $8,009; Sandstone block, Warner-Quinlan Asphalt Co., $18,894; F. J. Baker, $18,948. Vitrified brick or block, Warner-Quinlan Asphalt Co., Cowan block, $12,798; Metropolitan block, $12,954; F. J. Baker, Olean block, $13,738. Sandstone and asphalt, Warner-Quinlan Co., $7,740; F. J. Baker, $8,149.

NEW YORK STATE ROAD BIDS

Following bids were received by the State Highway Commission, Albany, N. Y., on April 19 for the repair and construction of public highways by state aid:

Road No. 977, Albany-Watervliet, Albany County, 2.45 miles: Fitzwater & Terry, Watervliet, $67,591; Patrick Mulderry, Albany, $63,239; Kerwin Construction Co., Albany, $65,501; R. J. Gleason, Troy, $72,667; Corless Construction Co., Troy, $65,480; Dollard & Heeran, Albany, $63,778; Patrick W. Mulderry, Albany, $65,399; John B. Dower, Ballston Spa., $61,125.

Road No. 945, Wellsville-Hallsport, Allegany County, 4.18 miles: Oak Duke Lumber Co., Walesville, $44,921; P. H. Murray, Rochester, $42,247.

Road No. 1011, Brockton-Stockton, Chautauqua County, 4.70 miles: Dunkirk Construction Co., Dunkirk, $68,988; John Johnson Co., Buffalo, $74,522; Niagara Construction Co., Buffalo, $73,739; Dollard & Heeran, Albany, $68,120; Thomas Fitzgerald Co., Fredonia, $68,977; Erie Contracting Co., Buffalo, $76,789; Kerwin Construction Co., Albany, $65,380; Northwestern Construction Co., Franklin, Pa., $78,981; Road No. 1008, Battleman Road, Clinton County, 1.28 miles: Spellman-Oliver Co., Chateaugay, $15,498.

Road No. 668, Bainbridge-E. Guilford, Chenango County, 1.11 miles: Newport Construction Co., Newport, $13,231; Conroy & Nixdorf, Oneida, $14,401.

Road No. 1016, Croton-Locke-Moravia, Cayuga County, 7.96 miles: John Johnson Co., Buffalo, $108,347; Guy B. Dickerson, Syracuse, $119,018; Brayer Bros., Auburn, $115,697; Mosier & Summers, Buffalo, $113,674; Erie Contracting Co., Buffalo, $123,235; Dollard & Heeran, Albany, $108,318; James Anderson Co., Menands, $115,219; W. J. Burns & Co., Syracuse, $114,753; J. H. Weidman, Syracuse, $125,959.

Road No. 5207, Elmira-Lowman, Chemung County, 5.47 miles; Murray & Ford, Elmira, $46,068; F. P. Meckes, Long Pond, Pa., $56,671; T. H. Gill & Co., Binghamton, $52,519; Herlihy Contracting Co., Glens Falls, $41,409.

Road No. 5208, Horseheads-Montour Falls, Chemung and Schuyler Counties, 12.39 miles: Rifton & Murphy, Rochester, $94,542; McGreevey, McGuigan & Baum, Elmira, $86,174; James Anderson, Albany, $97,019; Coleman Bros., Boston, Mass., $96,680.

Road No. 991, East River, Erie County, 4.64 miles: John W. Landel, Tonawanda, $61,304;
Fred J Mumm, Buffalo, $87, L. Miller
Knickenberg, Buffalo, $67,837 Niagara C
struction Co., Buffalo, $68,5
Summers, Buffalo, $65,664; luis
Buffalo, $58,800, Frank L. Glen,
$62,550; Erie Contracting Co., Buffalo
Bush & Percival, Buffalo, $69,

Road No 998, Hunter-Wi ham, Greer
County, 6.27 miles: J. W. Wh en, Whitehal
$81,615; John H. Gordon, A ny, $88,34
Harvey B. Sproul, Peekskill, $ 649; J. &
Murphy, Cobleskill, $88,941; S. Van Wag
nen, Rondout, $75,555; H. B. ooper
$79,588.

Road No. 5209, Utica-Frank rt. Herkim
County, 3.06 miles: Guy V. D kerson, Syr
cuse, $66,581; Julius Friedrich o., Rochest
$65,400; P. H. Murray, Roch
Harry W. Roberts & Co., Utic $57,90
Contracting Co., Buffalo, $71,9
neering & Contracting Co., He
L. L. Melius, N. Y. City, $72,

Road No. 5170, Mohawk Vi
County, 1.35 miles: Warren
Mass., $66,556; Aetna Engineer
ing Co., Herkimer, $66,948; I.
Y. City, $69,086.

Road No. 1010, Livonia Ville,
County, 0.98 miles: Bert W en
Falls, $14,428; Schroeder-Hick
Co., Rochester, $13,806; Hagaan
Rochester, $12,988; Aikenhead
ester, $15,944.

Road No. 633, Walker-Lake
roe County, 3.73 miles: Woo
Hilton, $42,594; Mosier & Sum
$49,087; Hendrickson & McCal
$44,977.

Road No. 1009, Spencerpor
Part 2, Monroe County, 0.52 mi
& Fletcher, Rochester, $5,984; F
Spencerport, $6,520.

Road No. 5176, Marlboro-Ce
tery, Orange & Ulster Counti
Samuel Beskin, Fishkill Landin
folk Construction Co., Hunti
Jova & Kehoe, Newburgh, $3
munk Construction Co., Highl
560; Harvey B. Sproul, Peeksl
L. Melius, New York, $44,498

Road No. 5210, Middletown
Orange County, 6.78 miles: Su
Fishkill Landing, $78,281; Suff
Co., Huntington, $80,483; Jacks
debackville, $72,965; W. Cowha
297; Harvey B. Sproul, Peekill.
Schunnemunk Construction , Hig
Mills, $73,662; Ruddy & Saund
726; L. L. Melius, New York, $
& Hogeboom, Kingston, $83,21

Road No. 949, Nassau Vill
County, 0.29 miles; Thomas
$4,487; County Construction
081; Crowe & Walsh, Pittsfield
M. D. Windsor, Guilford, $5,38

Road No. 5163, Nassau Vill
County, 0.41 miles: Crowe & W
Mass., $6,135; M. D. Windsor
339; County Construction Co
Thomas H. Karr, Troy, $6,127

Road No. 980, Spiegletown-M
laer County, 2.55 miles: John
Schenectady, $32,640; Thomas
$35,068; County Construction
737; Crowe & Walsh, Pittsfie
567; H. L. Baker, Cambridge,
P. J. Malloy, Schenectady, $27,
Sproul, Peekskill, $32,423; Co
tion Co., Troy, $26,720.

Road No. 5211, Painted Post-C
ben County, 3.04 miles: T. H.
hamton, $111,946; Northwester
Co., Franklin, Pa., $93,409; Sha
struction Co., Albany $87,5
Hicks Contracting Co., Rochest
H. Murray, Rochester, $99,608;
son, Albany, $98,033.

Road No. 5212, Hornell-Can
County, 3.94 miles: Northwes
tion Co., Franklin, Pa., $39,9
Construction Co., Hornell, N.
Chas. F. McGuire, Hornell, $4
& Nixdorf, Oneida, $40,104.

Road No 1002, Groton-F

[illegible]pkins County, 2.34 miles: Murray [illegible], $32,021; Bert Warren, Hen[illegible] $32,680, Amos D Bridges Sons, [illegible], $34,525, Whalen & Gaffer, [illegible]2, E. P Hall, Cortland, $3[illegible]

5213, Ithaca-Danby, Tompkins [illegible] miles: Richard Hopkins, Troy, [illegible] Hazard, Trumansburg, $54[illegible] [illegible]ckson-McCabe, $55,217.

5214, Ithaca-Newfield, Tompkins [illegible] miles; McGreevey, McGuigan & [illegible], $66,20[illegible]

[illegible]5, Binghamton-Owego, Tioga [illegible] 10.72 miles: Semper Bros., W[illegible] [illegible]45, Richard Perkins, Troy, $7[illegible] [illegible]emunk Construction Co., High[illegible] $75,771; M. Whalen, Tonawanda, [illegible] Lane Construction Corporation, [illegible]m, $78,322; Hollington Co., Troy, [illegible] & Sproul, Peekskill, $72,9[illegible]

[illegible]992, Marion-Williamson, Part 1, [illegible] George W. Cham[illegible]ster, $22,498; Schroeder-Hicks [illegible] Co., Rochester, $23,581; M. W. [illegible]ns Co., Detroit, Mich., $24,763; [illegible]ver Co., Chauteaugay, $23,025; [illegible]ailey & Donaldson, Rochester, [illegible] Contracting Co., Buffalo, $24,473. [illegible]803, Hudson Falls-Fort Ann, [illegible] County, 8.23 miles: L. L. Melius, [illegible]62; Flood & Van Wirt, Hud[illegible]; James Anderson, Albany, [illegible]d & Wilson, Browne Station,

[illegible] Village, Wyoming [illegible] miles: Thomas F. Murray, Le[illegible] Aikenhead, Bailey & Donaldson, [illegible]0,037; Harradine Bros., Spencer[illegible]; Schroeder-Hicks Contracting [illegible]r, $26,868; John Johnson Con[illegible], Buffalo, $25,699; Falls Bros. & [illegible]hester, $24,361; Fred J. Mumm, [illegible]39; Mosier & Summers, Buffalo, [illegible]nfield Construction Co., Hornell.

[illegible]5227, Lake George-Warrensburg, [illegible]ty, 4.58 miles; H. B. Cooper, Al[illegible]; Joseph Walker Construction [illegible] $57,734; Cunningham & Wood[illegible]on Falls, $63,250; Harvey B. [illegible]kill, $68,256; Shaughnessy Con[illegible], $55,065.

North Carolina.

[illegible] be received until noon, May 6, [illegible] J. C. M. Valentine, Buncombe [illegible] Engineer, Asheville, N. C., for [illegible]ent of approximately 5 miles of [illegible]nanoa Township. Separate pro[illegible]o be received for the construc[illegible]ximately 200 yds. of rubble ma[illegible]ifications for which are on file with

North Dakota.

[illegible]be received until May 6, by City [illegible], N. Dak., for paving alleys.

Ohio.

[illegible] received until noon, May 9 [illegible] date from May 3, noted [illegible] at the office of the Commis[illegible]mi County, at Troy, Ohio, until [illegible] for grading and paving with [illegible]acadam the Piqua-Troy Road [illegible] in Washington Township said [illegible]800 ft. or 1.86 miles. Width [illegible]. Estimated cost of construc[illegible] Alternative bids will also be [illegible] grading and paving with a bi[illegible]face treated waterbound macadam [illegible]ned road. Estimated cost of [illegible]66. A draft or certified check [illegible]e deposited with each bid. The [illegible]er will be required to give [illegible]mount equal to the contract [illegible]et for completion August 1, [illegible]d specifications are on file in [illegible] County Commissioners and [illegible]way Department. The State [illegible]issioner reserves the right to [illegible]all bids. James R. Marker, [illegible] is State Highway Commis-

✣Bids w[illegible] Commissioners of Tuscarawas County, at New Philadelphia, Ohio, until 10 a. m., May 15, for grading and paving with brick for medium traffic highway. Sec. No. 2 the Wooster road Pet. No. 391, in Dover Township, said county. Length 8,190 ft. or 1.55 miles. Width of pavement 15 ft. and 2 ins. Estimated cost of construction, $23,635.70. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion A[illegible] 1, 1912. P[illegible] file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Miami County, Troy, Ohio, until noon, May 9, for grading and paving with waterbound macadam Sec. No. 1 the Piqua-Troy road in Washington Township, said county. Length 9,800 ft., or 1.86 miles. Width of pavement, 16 ft. Estimated cost of construction $15,316.70. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 1, 1912. Alternative bids will also be considered for grading and paving with a bituminous surface treated waterbound macadam the above road. Estimated cost of construction, $16,566. Alternative bids will also be considered for grading and paving with bituminated concrete the above mentioned road. Estimated cost of construction $18,448. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, Ohio, is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Morgan County, at McConnellsville, Ohio, until 1 p. m., May 14, for grading and paving with waterbound macadam the Chesterhill road Pet. No. 359, in Windsor and Penn Townships, said county. Length 6,500 ft. or 1.23 miles. Width of pavement 12 ft. Estimated cost of construction $11,096. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 1, 1912. Alternative bids will also be considered as follows: Bituminated concrete. Estimated cost $13,355. Brick pavement. Estimated cost $14,968. Bituminous bound macadam. Estimated cost $12,657. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Coshocton County, at Coshocton, Ohio, until 1 p. m., May 8, 1912, for grading and paving with a bituminous surface treated waterbound macadam the Walhonding and New Gilford road Pet. No. 356, in New Castle and Perry Townships, said county. Length 12,505 ft., or 2.37 miles. Width of pavement, 12 ft. Estimated cost of construction, $14,986. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 1, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received until 3 p. m., May 6, by trustees of Cass Township, Hancock County. H. T. Nelson, Arcadia, O., Clerk, for 240 rods of pike.

✣Bids will be received at the office of the Commissioners of Lake County, at Painsville, Ohio, until 10 a. m., May 10, 1912, for grading and grading with bituminated concrete the Madison-Southern road State Highway D. Pet. No. 226, in Madison Township, said county. Length 7,465 ft. or 1.41 miles. Width of pavement, 12 ft. Estimated cost of construction, $11,978. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 1, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

⊙Keeley Bros. of Portsmouth, O., have been awarded the contract by the Board of Affairs, Bluefield, W. Va., for the paving of various streets with bituminous macadam and concrete curb and gutter at $50,000. The work includes 38,000 sq. yds. of paving. Bids were opened April 5. W. H. Campbell is City Engineer.

⊙The Capitol Limestone Co., New First Nat. Bank Bldg., Columbus, O., has been awarded the contract by the Board of Licking County Commissioners, Newark, O., Ford S. Cully, County Surveyor, for necessary labor and material for the construction of the Utica, Homer and Centerburg road, 5.41 miles in length, at $50,047, and W. D. Winchell, 41 Hosack St., Columbus, O., secured the contract for the construction of the Linnville road extension, 2.04 miles in length, at $22,731. Both roads will be constructed of waterbound macadam. Bids were opened April 17.

⊙J. M. Stone of Marion, O., has been awarded the contract by the Morrow County Commissioners, Mt. Gilead, O., for grading and constructing with a water-bound macadam having bituminous surface treatment, the Cardington Road, Pet. No. 365, in Cardington and Gilead townships, at $21,400. The length of the road is 15,573.5 ft., and the width is 14 ft. James R. Marker, Columbus, is State Highway Commissioner. Bids were opened April 24.

⊙Adams Bros. Contracting Co., Zanesville, O., has been awarded the contract by the Guernsey County Commissioners, Cambridge, O., for grading and paving with brick for heavy traffic highways the Newcomerstown Road, Pet. No. 252, in Cambridge Township, at $14,447. The length of the road is 5,280 ft., and the width 14 ft. Bids were opened April 19. James R. Marker, Columbus, is State Highway Commissioner.

⊙Adams Bros. Contracting Co., Zanesville, O., has been awarded the contract by the Guernsey County Commissioners, Cambridge, O., for grading and paving with brick for heavy traffic highways the Steubenville Road Pet. No. 390, in Cambridge Township, said county at $15,133. The road is 5,280 ft. in length and the pavement will be 14 ft. wide. James R. Marker is State Highway Commissioner, Columbus. Bids were opened April 19.

City Engineer F. M. Downer of Painesville, O., has estimated the cost of paving Mentor Ave., from Hayes St. to the corporation line, and sewering the same at $20,193 and $18,922, respectively.

Wm. McDowell & Son of Cleveland, O., at $70,527, submitted the lowest bid to the Cuyahoga County Commissioners, Cleveland, John F. Goldenbogen, Clerk, for the improvement of Green Road from North Woodland Road to Anderson Road in Euclid and Warrensville Townships. Bids were opened April 24. Frank R. Lander is County Surveyor.

No bids were received by the Wyandot County Commissioners, Upper Sandusky, O., on April 23, for grading and constructing with a water-bound macadam the Uncapher Road, Pet. No. 406, in Uncapher Township, said county. The road is 10,593 ft., or two miles in length. The estimated cost is $12,-

[illegible] James R. Marker is State [illegible] Commissioner, Columbus.

Oklahoma.

The City Council of Coalgate, Okla., has passed another resolution providing for the paving of the principal business streets of the town.

The Mullergren Engineering Co. of Poteau, Okla., is preparing plans for the construction of 40,000 sq. yds. of macadam and asphalt-macadam pavement in Poteau, at an estimated cost of $40,000. The work will include crushed stone foundation and 26,000 lin. ft. of concrete curb.

Oregon.

• The City Council of Portland, Ore., has awarded the contract for oiling the streets of the city to the Oregon Road Oiling Co., at $39 per mile.

⦿The City Council of Albany, Ore., has awarded the contract for the paving of Seventh St., from Railroad to Calapooia St., with gravel bitulithic, to the Warren Construction Co., at $1.55 per sq. yd.

Petitions have been presented to the City Council of Albany, Ore., for the paving of First St., Montgomery to Main, and Fourth St., from Main to Washington, a total of 22 blocks.

Following bids were recently received by the City Council of Portland, Ore., for paving work: Davenport St., from Patton Road to Governor's Park, concrete pavement—Kibbe-Welton Co., $9,643; Oregon Independent Paving Co., $10,103; Hilliard & Maginnis, $9,165; M. Hansen, $10,038; South Portland Crushed Rock Co., $9,890. Broadway bridge fills—Pacific Bridge Co., $5,474; Crawford & Co., $3,858; Harry Howard, $3,500. Stanford St., from Lombard to Willis, grading and concrete curbs and walks—John Peterson, $4,715; Oregon Independent Paving Co., $4,919; Kibbe-Welton Co., $4,612; Carter Bros., $4,347; Peninsula Feed & Fuel Co., $4,641; Bechill Bros., $4,380. East 52nd St., from East Glisan to East Stark, grading and concrete curbs and walks—Oregon Independent Paving Co., $6,940; Carter Bros., $5,966; Joplin & Meeks, $6,011; M. Hansen, $6,186; Hilliard & Maginnis, $6,303; Crawford & Co., $6,443; Manning & Co., $6,420; A. L. Keenan, $6,271; Bechill Bros., $6,657. Orient St., from Willamette to Portland Blvd.—Grading and concrete curbs and walks—Hilliard & Maginnis, $3,545; Bechill Bros., $3,327; Oregon Independent Paving Co., $3,741; Kibbe-Welton Co., $3,454. East 33rd St., from Marion to Alberta, grading and concrete curbs and walks—Giebisch & Joplin, $4,551; Hilliard & Maginnis, $5,348; Oregon Independent Paving Co., $4,504; M. Hansen, $4,897; Bechill Bros., $4,645. Prescott St., grading and concrete curbs and walks—Kibbe-Welton Co., $4,044; Crawford & Co., $3,150.

Pennsylvania.

✤Bids will be received until May 4, by Board of Swatara township Commissioners, A. W. Ellenberger, Secy., Enhaut, Pa., for the following road machinery: One 10-ton steam road roller, one combination steam road roller and tractor, one fuel and water wagon, one road sprinkler. Bidders must be willing to submit their roller and tractor offered to a competitive demonstration.

⦿The City Councils of Chester, Pa., have awarded the contract for the paving of the remaining streets to be improved under the provisions of the $600,000 loan bill to the Filbert Paving & Construction Co., of Philadelphia, Pa., at $1.72 per sq. yd.

⦿George M. Harris, of Meadville, Pa., has been awarded the contract by the city of Jefferson, Ashtabula County, O., for the paving of three streets, which will aggregate about a mile and a half of pavement. The work will cost about $40,000. Concrete-bituminous will be used.

⦿J. G. McGuire & Co., of New Brighton, Pa., have been awarded contracts at Freeport and Woodlawn, Pa., for street paving. The latter contract was secured from Jones & Laughlin Co., for paving Franklin Ave.

⦿J. G. McGuire & Co., of New Brighton, Pa., have been awarded the contract by the city of Freeport, Pa., for paving of Third St. and Mulberry alley at $3,926. Bids were opened April 15.

South Dakota.

✤Bids will be received until 2 p. m., May 2, by R. A. Zangle, County Auditor, Davison County, Mitchell, S. Dak., for the grading and improving of five and one-half miles of road, beginning at the north end of Main St. of the city of Mitchell and running north to the southeast corner of Section 16-104-60. Bids will be received separately on each mile and on the entire route.

Tennessee.

✤Bids will be received until 7 p. m., May 16, by W. R. Pouder, Recorder, Johnson City, Tenn., for constructing sewers, concrete curb and gutter and street paving with brick, asphalt, bitulithic, wood block, granitoid or concrete, for Improvement District No. 10, according to plans and specifications in the office of the City Engineer. Approximate Quantities: 5,300 cu. yds. excavation, 16,600 sq. yds. street paving, 6,700 lin. ft. curb and gutter, 3,000 lin. ft. 6-in. sewer connections, 2,900 ft. 8-in. sewer. Each bid must be accompanied by a certified check equal to 10 per cent of the amount of the bid.

✤Bids will be received until May 16, by P. F. McDonald, City Commissioner, and W. R. Pouder, City Recorder, Johnson City, Tenn., for constructing sewers, concrete curb and gutter and street paving with brick, asphalt, bitulithic, wood block, granitoid or concrete, for Improvement District No. 10, according to plans and specifications in the office of the City Engineer. Approximate quantities: 5,300 cu. yds. excavation, 16,000 sq. yds. street paving, 6,700 lin. ft. curb and gutter, 3,000 lin. ft. 6-in. sewer connections, and 2,900 ft. 8-in. sewer.

✤Bids will be received until noon, May 15, by W. H. McMurry, Secretary, Dixon County Turnpike Co., Dickson, Tenn., for grading and macadamizing 8 miles of turnpike from Charlotte to Dickson.

⦿S. J. Viltman of Paris, Tenn., has been awarded the contract by the Board of Aldermen of McKenzie, Tenn., for the necessary grading, culvert work and graveling of certain streets. C. H. Jenks, Union City, Tenn., is Engineer. Bids were opened April 24.

⦿R. L. Peters of Knoxville, Tenn., has been awarded the contract by the Monroe County Road Commissioners, Madisonville, Tenn., for grading about 160 miles of road in Monroe County at $275,000. Bids were opened April 24.

Each bid must be accompanied by a certified check equal to 10 per cent of the amount of the bid as a guarantee of the good faith of the bidder.

The Sullivan County Court, Blountville, Tenn., has voted road appropriations as follows: For the completion of the pike road between Bristol and Kingsport, at the Hawkins County line; to complete the Holston Valley pike and to construct a bridge over the Holston at the Shady Ford end of the road.

The Polk County Commissioners' Court, Benton, Tenn., has fixed a 10-cent pike tax to build 10 miles of pike road, five miles from Benton to the Cleveland pike, and five miles from Ducktown station to Copper Hill. The pike commission is composed of B. E. Biggs, W. M. Harrison and J. J. Woody.

Texas.

✤Bids will be received until May 8, Cooke County Court, Gainesville, Texas, for the construction of 35 miles of gravel road. E. M. Thompson is Secretary of the Commercial Club.

✤Bids will be received until noon, May 31, by Maj. E. I. Brown, U. S. Engineer, Galveston, Texas, for constructing concrete sidewalk, brick pavement, concrete curbing, and drains at Fort Travis Reservation, Port Bolivar, Galveston, Texas. Official advertisement will be found elsewhere in this issue.

⦿The City Council of Granger, Tex., awarded the contract for the [illegible] vitrified brick pavement on Main St. to [illegible] Pelehmus of Austin, Tex. [illegible] be completed within 6 months.

⦿M. M. Cravens of Missouri [illegible] been awarded the contract by [illegible] County Commissioners' Court [illegible] Tex., for the building of a gravel [illegible] miles from the intersection of the Ric[illegible] shell road at Stafford to De Witt. The contract price is $18,342. Work will begin at once.

The Robertson County [illegible] Court, Franklin, Tex., has or[illegible] tion held in Calvert precinct f[illegible] the [illegible] of voting on the issuance of bonds [illegible] sum of $150,000 for the building of [illegible] It is proposed to build about 50 [illegible] macadamized road.

The Bastrop County Commis[illegible] Bastrop, Tex., has ordered an [illegible] May 14, in the Bastrop Justice [illegible] trop, Hills, Prairie and Goodn[illegible] $80,000 good road bonds.

All bids were rejected by th[illegible] water, Texas, L. S. Polk, City [illegible] the construction of about 66,[illegible] water-bound macadam street[illegible] 4,000 sq. yds. of asphalt maca[illegible] ing. Bids were received Ap[illegible] Dreyer is City Engineer.

Virginia.

✤Bids will be received un[illegible] 7, by Russell County Supervi[illegible] Va., for the construction of 1[illegible] ing and macadam four roads a[illegible] struction of 106,608 sq. yds. of [illegible] already graded on four roads. [illegible] Lebanon, is County Engineer. [illegible] Wilson, Richmond, Va., is S[illegible] Commissioner.

✤Bids will be received until [illegible] by E. F. Lawrence, Chairm[illegible] East Radford, Va., for paving [illegible] streets. J. B. Walker is City [illegible]

The citizens of Stafford Cou[illegible] burg, Va., county seat, have [illegible] suance of bonds in the sum of [illegible] improvement of county roads.

Washington.

✤Bids will be received until [illegible] by Board of King County Com[illegible] A. Case, Clerk, for the cleari[illegible] way 50 ft. wide, grubbing a[illegible] 24-ft roadway with necessary [illegible] bridges of the D. McCallum Rd. [illegible] City, Wash.

⦿The City Council of Olym[illegible] a recent meeting awarded [illegible] laying five blocks of paving, [illegible] St., from Second to Third St[illegible] St., from Franklin to Water [illegible] dependent Asphalt Paving [illegible] Wash., at $23,570. Bitulithic [illegible] base will be used. Other bid[illegible] frey & Buffton, Portland, Ore[illegible] Allen & Hull, Seattle, brick, $[illegible] & Co., Seattle, brick, $26,255; [illegible] Tacoma, brick, $25,777; B. [illegible] [illegible], asphalt, $24,480; brick [illegible] pendent Asphalt Co., asphalt, [illegible] lithic on concrete base, $24,611 [illegible] struction Co., Portland, bitul[illegible] base, $25,550; bitulithic on bi[illegible] $24,509; W. A. Weller, Olymp[illegible] [illegible]

⦿Geo. C. Dietrick & Co., Glob[illegible] Wash., have secured the first a[illegible] of the $100,000 paving job in [illegible]

• The Chehalis County [illegible] Montesano, Wash., have award[illegible] for the construction of the [illegible] state highway and ferry slips [illegible] be used in opening traffic to So[illegible] Westport to Creech & Walker [illegible] Wash., at $2,210.

⦿Mills Bros. of Olympia, Wa[illegible] awarded the contract by the B[illegible] ton County Commissioners, Ol[illegible]

✤ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] ke a survey and an estimate of [illegible]

[illegible] ate Highway Law. The contract [illegible] to the Washington Paving Co., [illegible] granocrete pavement. C. H. [illegible] Am. Soc. C. E., has been ap- [illegible] to have a width of roadway of [illegible]-it. hard surface, the total yard- [illegible]

[illegible] bidders: (1) Troutman, Seattle, [illegible] Sr., Tacoma; (7, 8) P. J. [illegible] Geo. C. Detrich Co., Seattle; [illegible] T. Ryan, Seattle; (29) Inde- [illegible] Paving Co., Tacoma.

[illegible] yd., have been awarded the contract for the [illegible] Chehalis, Wash.

Following bids were received by the City [illegible] of B St.; kind of pavement to be chosen by the property owners: Warren Construction Co., Portland, Ore., $16,[illegible], on bitulithic; Bar- [illegible] on asphalt.

Following bids were received by the City Council of Olympia, Wash., for the paving [illegible] side Sts.: Washington Paving Co., Tacoma [illegible] $30,227; Warren Construction Co., Portland, [illegible] $37,097; Independent Asphalt Paving Co., Seattle, $37,097, $28,724, $37,671, $35,740; W. A. Weller, Olympia, $35,[illegible] and $32,472.

Following bids were received April 19 by the Board of Public Works of Seattle, Wash., for street improvements, as follows: 80th St., et al., concrete walks—Carl Isidor & Co., $13,- [illegible] & Heltborg, $11,390; S. Lamping & Co., $11,876; Fenn & Brennan, $11,660; Frasca & Coluccio, $13,263; International Dredging Co., $13,265; D. H. Trapshagen, care Lincoln Hotel, Seattle, $10,903; Elliott Construction Co., $11,382. North 82nd St., et al., concrete walks—S. Lamping & Co., $9,126; Elliott Construction Co., $8,731; Fenn & Brennan, $8,949; Frasca & Coluccio, $10,468; Krogh & Jessen, $8,457; De Flong & Heltborg, $8,744; International Dredging Co., $10,396; D. H. Traphagen, care Lincoln Hotel, Seattle, $8,373.

West Virginia.

⦿Geo. Hinkle has been awarded the contract by the Board of City Commissioners, Huntington, W. Va., for paving the alley between Fifth and Sixth Ave., 12th to 13th Sts., at $1.55 per sq. yd., and Seventh Ave., between Fifth and Sixth St., to Geo. Hunt at $1.49 per sq. yd. Bids were opened April 24. A. B. Maupin is City Engineer. John Coon is Commissioner of Streets and Wharves.

Wisconsin.

⦿Christ Petersen, of Kenosha, Wis., has been awarded the contract by the City Council of that city for the paving of Milwaukee Ave., from Grand Ave. to North Main St., with brick at $7,521; also, reported, awarded the contract for the paving of Fremont Ave. with brick at $19,199.

The Wisconsin State Highway Commission, A. R. Hirst, Engineer, Madison, is preparing plans for the construction of from 12 to 15 miles of crushed rock road, 12 ft. wide, at Delton, Wis. The estimated cost is $40,000. The contracts will be let by the Sauk County Commissioners, Baraboo, Wis. G. F. Post of Spring Green, Wis., is official in charge.

Canada.

⦿Hotson, Leader & Goode of Lethbridge, Alta., have been awarded the contract by that city for the construction of 3½ miles of cement walks and 4 miles of curb and gutter at the following prices: Cement walk, $1.49 per sq. yd.; combined curb and gutter, $0.04 per lin. ft. The contract for 7 miles of grading was awarded to Marquardt & Calwait at the following prices: Excavation, $0.30 per cu. yd.; surfacing, $0.02 per sq. yd. A. C. D. Blanchard is City Engineer.

The city officials of Steelton, Ont., have decided to make the following improvements during this summer: Construct sidewalks, estimated to cost $30,000; repair streets at an estimated cost of $10,000, and macadamize [illegible] $2[illegible].

The officials of Welland County, Ontario, have decided to spend $400,000 upon the construction of a good roads system of 150 miles. The county is at present placing orders for road rollers, scrapers, wagons and general road machinery and the work of building the highways will commence immediately. J. C. Gardner has been appointed Chief Engineer of the county.

The City Council of Swift Current, Sask., has decided to lay macadam pavements, granolithic walks, establish a completely equipped health and scavenging department, and adopt the single tax. The city will put in a civic paving plant and do all the work by day labor.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	$1[illegible]	[illegible]	$11,400	$115,734
[illegible]	[illegible]	[illegible]	[illegible]	1.14	[illegible]	7,600	97,958
[illegible]	[illegible]	[illegible]	.718	0.93	[illegible]		100,998
[illegible]	[illegible]	[illegible]	[illegible]	1.40	106,400		112,128
[illegible]rete	4	1½	[illegible],534	1.63	[illegible]	[illegible]	135,134
[illegible]	[illegible]	[illegible]		1.40	106,400	[illegible]	117,003
[illegible]	[illegible]	[illegible]	[illegible]		91,200	[illegible]	101,893
[illegible]	[illegible]	[illegible]	[illegible]	1.55	117,800	[illegible]	129,118
[illegible]	[illegible]	[illegible]	[illegible]	1.43	108,680	7,600	[illegible]
[illegible]		[illegible]	.718	1.41	107,160	7,600	118,478
[illegible]	[illegible]	[illegible]	.719	1.65	[illegible]	[illegible]	136,819
[illegible]	[illegible]		[illegible],220	1.60	121,600	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.554	1.63	[illegible]	3,800	[illegible]
[illegible]	[illegible]	[illegible]	.554	1.71	129,960	[illegible]	139,314
[illegible]	[illegible]	[illegible]	[illegible]	1.50	114,000	[illegible]	123,519
[illegible]	[illegible]	[illegible]	[illegible]	1.65	125,400	3,800	134,919
[illegible]	[illegible]	[illegible]	.719	1.72	130,720	[illegible]	140,239
[illegible]	[illegible]	[illegible]	[illegible],200	1.52	115,520	[illegible]	125,520
[illegible]	[illegible]	[illegible]	[illegible]	1.45	[illegible]	7,600	[illegible]
[illegible]	[illegible]	[illegible]	.718	1.23	93,480	7,600	104,798
[illegible]	[illegible]	[illegible]	.718	1.16	88,160	7,600	[illegible]
[illegible]	[illegible]		[illegible]	1.47	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	1.64	124,640	7,600	135,898
[illegible]	[illegible]	[illegible]	[illegible],244	[illegible]	[illegible]	[illegible]	114,924
[illegible]	[illegible]	[illegible]	[illegible],053	1.37	104,120	[illegible]	118,973
[illegible]ed rock..	4	12	5,728	1.15	87,400		93,128
[illegible]	[illegible]	[illegible]	[illegible]	1.30	98,800		
[illegible]		[illegible]	[illegible]	1.35	112,600		[illegible]
[illegible]		[illegible]		2.03	154,280	[illegible]	161,845
[illegible]	[illegible]	[illegible]	[illegible]	1.85	140,600	[illegible]	147,190
[illegible]	[illegible]	[illegible]	.690	1.90	144,400	1,900	[illegible]
[illegible]	[illegible]		.690	[illegible]	136,800	1,900	143,390
[illegible]	[illegible]		.690	1.95	148,200	1,960	154,790
[illegible]ete	4	4	5,728	1.90	144,400		150,128

[illegible] the oth[illegible] [illegible] 5-in. curb.

[illegible]RGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

[illegible] repared for a ditch system [illegible] Drainage District of Law- [illegible] Jackson Counties. The [illegible] ut 200,000 acres, and the [illegible] about 200 miles of ditches. [illegible] ably be let this fall. The [illegible] Co., Goodwyn Institute [illegible] nn., is engineer.

[illegible] inage District, organized [illegible] and Lawrence Counties, [illegible] construction of about 20 [illegible] The Morgan Engineer- [illegible] Tenn., is engineer.

[illegible] be held in June on the [illegible] system for the Tri-county [illegible] This district is located in [illegible] and Mississippi Counties, and the system will call for the construction of 400 miles of ditches. The Morgan Engineering Co., Memphis, Tenn., is engineer.

California.

✣Bids will be received until 2 p. m., May 16, by U. S. Reclamation Service, 605 Federal Bldg., Los Angeles, Cal., for furnishing cast iron pipe and tunnel linings for the North Platte project, Nebraska-Wyoming. Official advertisement will be found elsewhere in this issue.

Colorado.

A plan is under consideration for the organization of an irrigation district east of Briggsdale, 20 miles east of Greeley, to bring 40,000 acres of dry land under irrigation. The territory is owned largely by Denver business men. It is planned to install an irrigation system drawing water direct from the mountains, more than 50 miles away. T. D. Jones, Denver, Colo.

Florida.

✣Bids will be received until 10 a. m., May 22, by Board of Drainage Commissioners, Tallahassee, Fla., for the construction of three concrete locks and wing dams in the drainage canals near the south shore of Lake Okeechobee. Each bid must be accompanied by a certified check for $2,000. J. O. Wright is chief drainage engineer. J. C. Luning is secretary of the board.

Iowa.

⦿Bids were opened April 25 by G. H. Getty, county auditor, Boone, Ia., for constructing County Drain No. 48, contracts being let as follows: Digging, laying and backfilling—Elmer Knox, Adel, Ia., $11,000; Arthur McHose, Boone, Ia., 36 in., 34 in., 32 in. and 26 in. cement tile, at $16,144; Iowa Pipe & Tile Co., Des Moines, Ia., 22 in., 20 in. and 18 in. clay tile, $2,934; Redfield Brick & Tile Works, Redfield, Ia., 16 in., 14 in. and 10 in. clay tile, $1,429; Dallas County Brick & Tile Works, Adel, Ia., 15 in., 12 in. and 6 in. clay tile, $1,586; Kalo Brick & Tile Co., Kalo, Ia., 8 in. clay tile, $616.

⊙Peterson & Jansen, Forest City, Ia., have been awarded the contract at $1,414 for constructing Drainage District No. 20 of Franklin county, bids for which were opened April 19 at Hampton.

⊙Bids were opened at Hampton on April 19 for constructing Drainage Sub District No. 6, the contract being awarded to Geo. Hake, Belmond, Ia., at $9,296.

⊙E. F. Bardin, Belmond, Ia., has been awarded the contract at $12,105 for the construction of Drainage District No. 23 of Franklin county. Bids were opened April 19.

⊙Peterson & Jansen, Forest City, Iowa, have been awarded the contract at $2,664 for constructing Drainage District No. 21, bids for which were opened April 19 at Hampton, Ia.

The Towl Engineering Co., City National Bank Bldg., Omaha, Nebr., have made surveys and are about ready to start work on a 1-mile ditch at Council Bluffs, Ia. This is a drag-line excavation proposition.

Louisiana.

⊙Dameron-White Co., Ltd., Baton Rouge, La., has been awarded the contract for constructing levees on the Red River in Caddo parish from Blanton Bluff to Peru, the work calling for about 750,000 cu. yds. of new levee and enlargement. Bids were opened April 24 by the commissioners of Cadoo Levee District at Shreveport.

Surveys are being made by T. H. Mandell, C. E., for the proposed drainage system of Cameron Drainage District No. 1. This district embraces about 228,000 acres.

Contracts will be let some time in June for construction of a drainage system for Drainage District No. 2 of Madison Parish, La. The work will include a 20-mile main ditch requiring 1,200,000 cu. yds. excavation, and 20 miles of laterals requiring 800,000 cu. yds. of excavation. The Morgan Engineering Co., Goodwyn Institute Bldg., Memphis, Tenn., is engineer.

Minnesota.

⊙Bids were opened April 20 by John Kelly, County Auditor, Luverne, Minn., for constructing Judicial Ditch No. 2, the work including laying about 15,000 ft. of 10 to 40 in. tile. The contract was awarded to Anderson & Co., Vincent, Ia.

Plans are under consideration for the construction of a drainage system near Albert Lea, Minn. The organization of the district has not been completed nor has the report, and it will probably be about June 15 before the work is ready for letting. The drain will be 30-in. tile for about ⅞ of a mile and then 24 and 22 in. branches. It will cost between $10,000 and $11,000. J. W. Dappert, Taylorville, Ill., is engineer, and W. H. Brainerd, Albert Lea, Minn., is County Auditor.

Mississippi.

Surveys are being made by the Morgan Engineering Co., Goodwyn Institute Bldg., Memphis, Tenn., for the proposed drainage system for the recently organized Coldwater Drainage District of Crenshaw, Miss.

Montana.

✣Bids will be received until 2 p. m., May 21, by U. S. Reclamation Service, Malta, Mont., for the construction of laterals, wastewater ditches, and structures on the first unit, Dodson south canal, Milk River project, Montana. The work involves the excavation of approximately 67,000 cu. yds. of material and the erection of six small structures. For particulars address the U. S. Reclamation Service, Washington, D. C.; Helena, Mont., or Malta, Mont. F. H. Newell is Director, Washington, D. C. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 2 p. m., May 21, by U. S. Reclamation Service, Malta, Mont., for earthwork and structures on the first eleven miles of Dodson north canal, laterals and waste-water ditches. The work involves approximately 277,000 cu. yds. of excavation 1,500 cu. yds. of reinforced concrete, and the placing in structures of 86,000 ft., B. M., of lumber. For particulars address the U. S. Reclamation Service, Washington, D. C.; Helena, Mont., or Malta, Mont. F. H. Newell is Director Washington, D. C. Official advertisement will be found elsewhere in this issue.

Nebraska.

Bids as follows were received April 22, by the U. S. Reclamation Service, A. Weiss, Project Engineer, Mitchell, Nebr., for the construction of Dam No. 3 for the North Platte Project: (1) bid of Bartlett & Kling, Cedar Rapids, Ia.; (2) bid of M. A. Wagan, First National Bank Bldg., Denver, Colo.; (3) bid of Chas. Wilhite & Co., 1602 N. 14th St., Boise, Idaho; (4) bid of Young & Crook, 316 Cooper Bldg., Denver, Colo.; (5) bid of McGuire & Stanton Construction Co., and Edward Jones, Leavenworth, Kan.:

			(1)	(2)	(3)
Preparing surface	15	acres	$200.00	$135.00	$140.00
Cut-off, Class A	[illegible]	cu. yds.	[illegible]	.48	[illegible]
Cut-off, Class A bonus	453,000	C. Y. F.	.02	.02	.02
Cut-off, Class B	[illegible]	cu. yds.	1.00	.60	1.00
Cut-off, Class B bonus	25,000	C. Y. F.	.03	.03	.03
Trenches, Class A	[illegible]	cu. yds.	.60	.90	[illegible]
Trenches, Class A bonus	1,200	C. Y. F.	.02	.02	.02
Trenches, Class B	100	cu. yds.	1.00	1.25	1.25
Trenches, Class B bonus	100	C. Y. F.	.03	.03	.03
Laying drains	[illegible]	lin. ft.	1.00	1.85	1.25
Outlet exc., Class 1	45,000	cu. yds.	.32	.30	.28
Outlet exc., Class 2	7,000	cu. yds.	.60	.50	.50
Outlet exc., Class 3	100	cu. yds.	1.10	.50	1.25
Conduit brule exc.	900	cu. yds.	1.00	.80	1.00
Spillway exc., Class 1	50,000	cu. yds.	.25	.30	[illegible]
Spillway exc., Class 2	2,000	cu. yds.	.50	.50	[illegible]
Spillway exc., Class 3	100	cu. yds.	1.10	.50	1.25
Stripping borrow pits	25,000	cu. yds.	.26	.15	.16
Earth embankment	[illegible]	cu. yds.	[illegible]	.30	.34
Gravel embankment	[illegible]	cu. yds.	.30	.35	.38
Trimming embankment slope	6,000	cu. yds.	.30	.60	.30
Unscreened gravel	14,000	cu. yds.	.45	.60	.45
Screened gravel	11,500	cu. yds.	.60	1.25	[illegible]
Lumber in place	100,000	B.M.	25.00	30.00	40.00
Wells in place	600	lin. ft.	.75	1.00	[illegible]
Concrete A (paving, etc.)	8,500	cu. yds.	[illegible]	7.30	8.00
Concrete B (conduits)	[illegible]	cu. yds.	6.00	6.25	8.00
Concrete C (spillway)	460	cu. yds.	6.00	5.00	7.50
Concrete D (core wall)	4,700	cu. yds.	5.00	5.00	6.75
Reinforcing steel	250,000	lbs.	.01	.01	[illegible]
			$331,387	$416,047	[illegible]

Gene Richards, in charge of sell's big shovel plant at Lam that their outfit is safe. Gen good work in the high water cinity and when the break occu scurried back to camp to make shape and protect the big shov from the water. Gene says th now over, as the water is fallin

G. H. and W. T. Lowrance other day. They were hard p equipment from the water nea La., where they are working o loop. The boys say their ou ground and all safe. Two bre their immediate territory, one their camp, but they manage water to ground high enough thing. In fact, the boys say tractor in that part of the coun big tree, and is going to stay can see some dry land again.

Stanton Palmer, formerly the Roach-Manigan Paving C quarters this city, has resigne

Tennessee.

Resolutions have been introduced in both houses of Congress to make immediately available $1,500,000 for repairing the breaks in the Mississippi levees so that the farmers may plant their crops before the June rise.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE)

⊙Jesse Nichols was awarded the contract for grading 150,000 cu. yds. of the Memphis Compress and Storage Co.'s new site at a price of 21.45 cts. per yard. J. C. Omberg, Jr., is in charge of the work. The work is mostly grader haul and Jesse is preparing his engines to pull the machines with. He has already started some teams on the work.

⊙J. H. Weatherford was awarded the contract for grading a large tract of land for Chancellor Heiskell in the suburbs of Memphis. The work is situated near the Parkway and is for the most part a grader proposition.

⊙C. D. Smith & Co., Memphis, were awarded a very large steam shovel contract last week by a mining concern near Kansas City. The contract calls for stripping about 13,000,000 cu. yds. of earth from a coal mine and it is the intention of Charlie Smith to place five large steam shovels on the contract at once.

Leonard & Lowrance have pulled out of a tight hold on their contract. Word has come in from their section that they were compelled to load their equipment on a raft to save it from the water, which came in on them from the breaks on the Arkansas side of the river. However, these boys are hustlers, and can be counted on to come out on top every time, and when the water falls, they will be right back on the job, making things hum.

automobile tire business, and be known as the Essenkay S manufactures a patent tire fill vent punctures and blow-outs. thusiastic over his new enterp to make a go of the proposit quarters will still be in Mem Hedrick will represent Sta City, Mo.

C. D. Smith met with a very last Friday when he slipped i fell, breaking his right leg just Charlie suffered considerable but at this writing was restin be confined to bed for several states that his accident comes tunate time, when he was ext his affairs needed his entire at

H. N. Pharr, formerly chief St. Francis Levee Board, has on approximately 50,000 cu. yd work situated north of Mem mile the other side of Wolf says his proposition is an ex that he expects the boys to bid ly. Harry feels that now the of idle outfits in town which til the water recedes somewh result his work should go reas

The Memphis contractors i street paving line who were three weeks on account of n secure sand and gravel as a r water putting Lewis Kavanau commission rejoiced last week ment was issued from the off naugh Sand Co. that gravel a furnished on April 29. The chafing under the enforced d diately after the announcemen

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

k preparations for beginning

, assistant to D. J. Brumley, the Illinois Central, met with lent at Jackson, Miss., last Fri his foot cut off by a train in of an old negro woman. Just d succeeded in pulling the old the path of the onrushing train l fell, the engine passing over The foot was amputated at once. contractors in this section re Snow most pleasantly as a who was always ready to help necessary, and the news of his found sympathy among the his.

ssed through Memphis last week Chicago to inspect the work R. R. will let May 6. Ed will rest of his firm, Smith, Scott &

Memphis has adver erect a $3,000,000 hotel on Main and Linden, this city, at his intention to make the f the finest of its sort in the

last about finishing up his Brunswick, Tenn., and states his teams on some Memphis hich was carried over by him on. Sam has been pretty suc ate contracts and feels like go streets.

IcTighe, who during the high their teams to Memphis and rgency work from the city com k they will soon be able to re ontract on the Iron Mountain

A. McWilliams, large drainage ve established an office in the ling, Memphis. They are the men to make Memphis their nd state as their reason for in office from Chicago the vast kind of work which will be the South for many years to

es that he will advertise in 1,500,000 cu. yds. of drainage of Osceola, Ark. It will be a proposition.

nd P. McCadden left last week work which Major Smith or the 13th. They first went to boat for Bird's Point, Mo. ravel south to Hickman.

general manager of the Frisco lemphis last Saturday and be that his company would take the tracks west of r more above high water, so met with during the present ks of the Frisco were in nce of about 20 miles or er happen again. While Mr. the estimate of the amount of to carry on this work was the name the sum propriated, his engineers be the estimate. It is under which of necessity must cubic yards of earth, will that as much as possible l before next high water. Memphis traverse the low-est part of the [illegible], the majority of the country being swamp lands, and the work of raising the tracks will be done under great difficulty, the dirt having to be hauled about 20 miles. It is the plan of the Frisco to establish the same grade as will be adopted by Major Smith of the government engineers. If this is done, there will be no further trouble experienced by the Frisco.

While the Iron Mountain road has made no announcement of an official sort that it too will adopt the United States levee grade west of the river near Memphis, it is generally believed that the road will do so, for it also was hard hit by the [illegible] many thousands of dollars in damage to track, to say nothing of the loss from interrupted freight and passenger service. Mr. Lancaster, the Memphis diplomatic agent of the company, has asked some of the local contractors if they had equipment available to use in track raising in the event he was told to go ahead with this sort of improvement west of Memphis, but he has not indicated [illegible] will raise its tracks and it is thought that the engineering department has not as yet completed its recommendation along these lines. The Rock Island people have stated that they will begin work on their tracks in the overflowed district and are willing to spend all the money necessary to put the line in shape. It is thought that they too will adopt the grade to be established by Major Smith.

S. S. Morris, general superintendent of the Yazoo & Mississippi R. R., has just completed an inspection trip over the part of his system damaged by overflow and has recommended that the line from Smedes to Vicksburg be raised high enough to be free from any future danger from the overflowed Mississippi. This will involve a contract of huge magnitude and will take many shovels and a large equipment to finish the work before the next high water. Aside from this stretch of track to be raised, other parts of the Y. & M. V. line will require immediate attention before trains can be operated and it is understood that the company forces are preparing to cope with the situation at once and will follow up the receding water with fresh earth. Chief Engineer of Construction Brumley was in Jackson last Friday en route to the affected districts, and it is understood that he will prepare an estimate immediately on all stretch of track which needs raising and that bids will be sent out to those contractors that have the proper equipment.

Contractors far and near will grieve to learn of the death of Mike Larkin, which occurred last week after a long drawn out illness—the result of a street car accident about a year ago. Mike Larkin's death robs the city of Memphis of its oldest street and sidewalk contractor, a man who by square dealing and hard work amassed a fortune in the street paving game and one who was honored by the best business element in the country. Mike Larkin came to Memphis and started in the paving business as a boy without means of any sort; he died leaving a fortune of about $500,000. Mike Larkin, Jr., a nephew, falls heir to the business and a goodly portion of the fortune and is considered a very capable young fellow with a bright future. The city of Memphis officials paid tribute to the venerable contractor by personally attending the funeral.

Capt. Chas. H. West of Greenville, Miss., a member of the Mississippi River Commission, was in Memphis last week [illegible] Major Smith went to look at the Lower St. Francis levees near Wyonoke, Ark. Major Smith used his private boat, the Titan.

Memphis had as her guests last week the gentlemen who go to make up the Mississippi River Commission—that body which allots the amount to be expended on each levee for the government. While here the members were in company of Mayor Crump and Major Smith, and at the request of the former made a trip to the inundated districts of the city with a view of making an appropriation to relieve same. Congressman McKeller and Senator Lea of Tennessee and Congresman Garrett of Arkansas accompanied the commission on its trip of inspection.

C. H. Sharp, at work on the Rock Island near Malvern, Ark., is perhaps the only contractor in this section who was not seriously hampered by the high water. C. H. has his work in the foot hills, and his camp was out of reach of the flood. He reports his contract progressing nicely, and says he is confident of finishing on time, which is more than the majority of contractors in the Mississippi valley can say, as many of them have lost their entire outfit, and all have been compelled to hunt [illegible] and lay up.

Texas.

Surveys are now nearing completion in Milam County, preliminary to levee and drainage work by several districts in the county. About 30,000 acres of land are to be reclaimed. Arthur A. Stiles, Austin, Tex., is State Levee and Drainage Commissioner.

⊙A. D. Jamison and E. V. Sweatt, Grand Falls, Tex., have been awarded the contract at 14½ cents per cu. yd. for constructing 18¼ miles of drainage ditches for the Ward County Drainage District of Grand Falls. The ditches are to have 4 ft. bottom, 1 to 1 slope and a depth of 2 to 9 ft. Ground water is from 2 to 6 ft. below the surface. The approximate yardage is 175,000 and the material is sandy loam and water soaked gypsum and clay.

Utah.

✣Bids will be received until 2 p. m., May 16, by U. S. Reclamation Service, Provo, Utah, for the construction of a reinforced concrete drop, chute, and abutments for two bridges on Indian Creek and Trail Hollow diversion canal, located in Wasatch County, Utah, about 35 miles northeast of Thistle, Utah. The work involves the excavation of approximately 4,500 cu. yds. of earth and rock and the placing of 875 cu. yds. of concrete and 225 sq. yds. of paving. For particulars address the U. S. Reclamation Service, Provo, Utah, or Washington, D. C. F. H. Newell, Director, Washington, D. C. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 2 p. m., May 16, by U. S. Reclamation Service, Provo, Utah, for the construction of concrete canal intake structures and concrete bridges on Indian Creek and Trail Hollow diversion canal, located in Wasatch County, Utah, about 35 miles northeast of Thistle, Utah. The work involves the excavation of approximately 2,650 cu. yds. of earth and rock and the placing of 560 cu. yds of concrete, 260 cu. yds. of paving, and a set of sluice gates and miscellaneous steel. For particulars address the U. S. Reclamation Service, Provo, Utah, or Washington, D. C. F. H. Newell, Director, Washington, D. C. Official advertisement will be found elsewhere in this issue.

WATER-WORKS

Alabama.

r the new water supply and Tuskegee Normal & In Tuskegee, Ala., was let Huffman-Conklin Co., of Co er G. Franz, Cincinnati, O., neer

Arkansas.

Winters & Dove, Civil & Hydraulic Engineers, 311-312 Merchants Nat. Bank Bldg., Fort Smith, Ark., have been retained to prepare plans and specifications by the city of Springdale, Ark., for proposed waterworks. It will probably be 90 days or longer before bids will be received for construction.

Colorado.

The Town Board of Johnstown, Colo., has decided to build a $20,000 water works system by constructing a reservoir three miles west of the city, filling it with Big Thompson River [illegible] building a pipe [illegible] reservoir will have a [illegible] gals. The proposition will be submitted to the vote of the people.

District of Columbia.

✣Bids will be received until 11 a. m., May 25, by Bureau of Yards & Docks, H. R. Stanford, Chief, Washington, D. C., for renewal of water piping in [illegible] training station, Newport, R. I.

Florida.

⊙The Common Council of Fort Pierce, Fla., has awarded the following contracts in connection with the construction of water works, sewer and electric lights, for which D. D. & C. M. Rogers, Fort Pierce and Daytona, Fla., are Engineers: American Cast Iron Pipe & Foundry Co., cast iron pipe and specials, $15,000; R. D. Wood & Co., hydrants and valves, $1,400; R. Cole & Co., 7,000-gal. tank and tower, $3,930; Worthington Steam Pump Co., two pumps, $1,400; J. G. Christopher, 8,600 ft. of gal. iron pipe, $838; Ball Engine Co., two engines, and Fort Wayne Electric Co., two generators, $7,100; R. D. Forlaw, pole line construction, $6,000; sewer pipe to Jelks of Macon, Ga., $6,500; pumping building, Maule & Smith, $3,950; Henry Van Dorn, wells, $500; A. J. Brewer, 100,000-gal. reservoir, $3,300.

An election will be held in Orlando, Fla., on May 28 for the purpose of voting on the proposition of granting a new franchise to the Orlando Water & Light Co.

Georgia.

The Board of Water Commissioners of Macon, Ga., has decided upon a crank and flywheel compound condensing, 7,000,000-gal. capacity pump as the one best suited to the needs of the water works.

Idaho.

The Village Trustees of Rathdrum, Idaho, have decided to purchase $1,200 worth of iron pipe to replace wooden mains in the water system.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering polished steel for engine cylinder lagging at Central Park Ave. pumping station and Springfield Ave pumping station. The surface of the steel shall be free from flaws, corrosions, etc., and shall be smooth and clean. The quantities are as follows: Central Park Ave., 150 sheets, 40 ins. wide, by 72 ins. long, 1/16 in. thick; Springdale Ave., 150 sheets 40 ins. wide, 72 ins. long 1/16 in. thick.

⊙The American Well Works of Chicago, Ill., has been awarded the contract by the city of Normal, Ill., T. H. Keys, Clerk, for furnishing deep well pumping machinery at $9,156. The contract for constructing the concrete reservoir and station building was awarded to C. C. Bowman of Bloomington, Ill., at $5,700. Bids were opened April 24.

Following are the itemized bids, as submitted to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing and delivering boiler and furnace tubes to the various pumping stations: Charcoal iron boiler tubes 12 ft. long, outside diameter 3 ins thickness B. W. G. 10, $3.60 each; 12 ft. 6 ins. long, o. d. 3½ ins., th. 10, $4.00; 12 ft. 7½ ins. long, o. d. 3½ ins., th. 9, $4.70; 16 ft. long, o. d. 4 ins., th. 10, $5.20; 18 ft. long, o. d. 4 ins., th. 9, $7.20; 18 ft. long, o. d. 4 ins., th. 10, $5.95; charcoal iron stay tubes, 12 ft. 7 ins. long, 3½ ins. o. d., th. 8, $10.15; 11 ft [illegible] furnace tubes 5 ft. 1¾ ins., o. d. 2⅜ ins., th 6, plain, $2.60; 5 ft. 2 ins., o. d. 2⅜ ins., 6-threaded, $2.93; 5 ft. 3½ ins., o. d. 2⅜ ins [illegible] 6-threaded, $3.10. Jno. Mohrs & Son, 349 W. Illinois St. Recommendations that the contract be awarded have been made. Bids opened April 18th.

Following bids were received April 26 by George W. Burr, Lt. Col., Ord. Dept., U. S. A., Rock Island Arsenal, Rock Island, Ill., for the erection of [illegible] plant at R[illegible] [illegible] water, (b) for increasing length of sedimentation basin; the sump to be placed in same relative position as at present, (c) alternate proposal, (d) replacing the pumps removed from the pump house on the river bank by two pumps, with motors, switches, switch boards, etc., (e) a mechanical stirrer for each mixing tank operated by small motor, (f) device for measuring and recording the amount of raw water flowing through influent pipe into the settling basin, and (g) device to exclude fumes from the hypochlorite from the filter plant: Pittsburgh Filter Mfg. Co., Pittsburgh, Pa., (a) $750; (b) $500 for 10 ft., $1,000 for 20 ft., $1,500 for 30 ft.; (c) $33,400, (d) $1,100, (e) $250, (f) $100, (g) $65, for the plant complete $31,000; The Pitt Construction Co., Pittsburgh, Pa., (a) ——; (b) $300 for 10 ft., $600 for 20 ft., $800 for 30 ft.; (c) $25,500 [illegible] $500, [illegible] $500 [illegible] meter), $600 (Simplex meter); (g) ——, for the plant complete $31,000.

Indiana.

⊙The Board of Public Works of South Bend, Ind., has made preparations for $200,000 worth of improvements in the water works department. A contract was awarded Robert Kersey to sink 20 new wells 50 ft. apart in Leeper Park just north of Foote St., at $10,000. The Board also authorized the advertising for bids for a quantity of pipe.

The Commercial Club and Town Board of West Terre Haute, Ind., recently held a meeting to discuss the probability of a water works system for the town. W. R. Paige is Town Engineer.

Iowa.

✣Bids will be received until 7:30 p. m., May 7, by City Council, Cedar Falls, Ia., for furnishing necessary labor and material for the construction of 4,300 lin. ft. of city water main extension. All pipe will be laid at a depth of 5½ ft. W. H. Merner is Mayor. C. H. Streeter is City Engineer

✣Bids will be received until 7 p. m., May 10, by W. A. Graves, City Clerk, Indianola, Ia., for the construction of a reinforced concrete reservoir for the water works, having a capacity of 750,000 gals. Plans may be had of the engineer, Indianola, Ia., for $5.

Kansas.

Preliminary plans have been made by the Midland Engineering & Construction Co., of Fort Scott, Kans., for the installation of a water works system at Moran, Kans., estimated to cost $30,000. The work includes pipe, tower and tank, deep well pumps, engines—probably oil—generator and pump heads. Bids will be asked for the furnishing of material about June 15.

Plans were completed some time ago by Consulting Engineers Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., for the installation of a new water works system at Chapman, Kans., estimated to cost between $20,000 and $25,000. The city has completed the sinking of wells and will ask for bids within 30 or 40 days for the general construction and material.

Louisiana.

✣Bids will be received until May 3 by Mayor, Kentwood, La., for furnishing and installing pumping machinery for water system. Plans and specifications may be obtained of G. F. Conant, Town Engineer.

✣Bids will be received until noon, June 20, by F. S. Chields, Secy., Sewerage and Water Board, New Orleans, La., for constructing Metairie Relief and Broad St. canals, including wood lining of subchannel under Contract 44-D.

Surveys are being made for the proposed water works system at Mansfield, La. The work will cost about $60,000.

Maryland.

The Water Department of Baltimore, Md., Ezra B. Whitman, Chief Engineer, has retained Consulting Engineer George W. Fuller of New York City to make some experiments with the slow sand filtration plant now being tried out at Loch Raven. The
system will mean an expenditu
000,000 to $2,500,000.

Massachusetts

⊙Chas. Millar & Son Co., Ut
been awarded the contract by
Public Works of Everett, Mas
ing water pipe at $22.10 per
Bears Iron Foundry, Provide
ceived the contract for furnish
$110.08 per ton. Bids were ope

Michigan.

✣Bids will be received unt
May 3, by Board of Water
Saginaw, Mich., for furnishing
Saginaw one feed water heate
on pressure filter independent
one outside packed plunger boi
one low service tank pump and
valves, pipe covering, heater
covering, necessary for the in
complete feed water heating, pi
ing and pumping plant to deli
to the boilers at the East Side
tion of the Water Works of sa
Jahnke is Clerk of the Board

✣Bids will be received unt
21, by City of Grand Haven,
construction of about 3,200 ft
iron suction main from a wel
of Lake Michigan to the pump
S. Williams, Ann Arbor, Mic
Official advertisement will be f
in this issue.

Engineer W. H. Goss of Ba
testing the water supply of H
which is supplied by springs
village. It is planned to clean
and secure an additional supply.

Minnesota.

✣Bids will be received unt
4, by M. P. Philippi, City Cle
Minn., for all the material and
to install three complete ext
water works system for the
ville, Minn., and separate prop
and material. The work will
proximately the following: 2,
cast iron water main, laid in
700 ft. of 4-in. cast iron wate
an 8-ft. trench; 3 4-in. valves
and valve boxes; 2 6-in. valve
and valve boxes; 4-6x6x4 tees
4 Waterous hydrants, with 2 2
nections and 1 4-in. engine c
4-in. inlet, with hub ends; 2,8
275 lbs. of hemp jute; 3 4x4x4
ends. Plans and specifications
may be seen at the office of
Barnesville, Minn. A certifie
per cent of the amount of bid,
Philippi, must be filed with e

⊙The Water Board of Dul
awarded the contract to the
Hardware Co. for 17,784 ft. of
pipe for another gas feeder
Zenith works to the city, at $.8

Missouri.

Citizens of Barnard, Mo., a
question of water works for
Town Board will probably tak
tion in the near future.

Consulting Engineers Rollin
Kansas City, Mo., have prepar
installation of a water works p
Hill, Mo., estimated to cost $2
supply will be secured from we
don is Mayor.

Montana.

The City Council of Billin
employed Engineers Burns
Scarritt Bldg., Kansas City, M
examination and appraise the v
isting water plant and distributi
furnish plans, specifications an
the cost of installing a new
adequate to the needs of
[illegible] population.

Nebraska.

The citizens of Palmer, Ne

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

against the issuance of bonds [illegible] water works system [illegible] & Standevin, Bee Bldg. [illegible] prepared plans [illegible] [illegible] Neb. [illegible] St. [illegible] Bids were [illegible] ft. of 4-in. pipe. T. B. Myers

[illegible] ruce & Standevin, Bee Bldg., [illegible] prepared plans for [illegible] Neb. [illegible] n has been dropped by the city

[illegible] been voted and bids will be [illegible] Gretna, Nebr. Plans and speci- [illegible] Bruce & Standevin [illegible] g., Omaha, Nebr. The estimated

New Jersey.

[illegible] reet and Water Commissioners, J., for furnishing the necessary [illegible] rial, including cast iron pipe [illegible] ngs, involved in the excavation [illegible] trenches for water pipe and [illegible] water pipe [illegible] sack river, in accordance [illegible] n file in the office of the [illegible] reties must be obtained at the [illegible] ef Engineer, City Hall, Jersey [illegible] B. See is Clerk.

New York.

[illegible] received until May 15, it is [illegible] Village Board, Fayetteville, [illegible] water works [illegible]

[illegible] ived until 11 a. m., May [illegible] r Supply, 165 Broadway, [illegible] for Contract 132 for borings [illegible] about 2 miles by trolley [illegible] ry, Staten Island, Rich- [illegible]

[illegible] West 125th St., New [illegible] been awarded the contract by [illegible] ntract and Supply of Yon- [illegible] two covered masonry fil- [illegible] r basin, pipes, gates, castings, [illegible] he contract price is $115,315. [illegible] d April 15.

[illegible] prepared by Morrell Vroo- [illegible] le, N. Y., for the installation [illegible] The work will include [illegible] on plant. The contracts [illegible]

[illegible] of Cortland, N. Y., pro- [illegible] 6-in. main in West Court [illegible]

[illegible] rth Dakota.

[illegible] rict of Fargo, N. Dak., was [illegible] contract at Williston, N. [illegible] ation of a waterworks [illegible] Work on the plant has [illegible]

Ohio.

[illegible] ncil of Hubbard, O., has [illegible] ct for the waterworks [illegible] bids were obtained sev- [illegible] e Petroleum Iron Works [illegible]

[illegible] kley (railway station, Co- [illegible] ted bonds in the sum of [illegible] lation of a waterworks [illegible] tem.

[illegible] ve Water Co., Cleveland, [illegible] ated with a capital stock [illegible] purpose of storing and [illegible] The incorporators are [illegible] R. H. Jamieson, John C. [illegible] A. Welch.

[illegible] klahoma.

[illegible] May 11, [illegible] r furnishing materials and machinery for the construction of water works [illegible] Okla., are Consulting Engineers. The esti- [illegible]

[illegible] awarded the contract by that city for the con- [illegible] $6,126. Other bidders were Economy Construction Co., Oklahoma City, $6,245; Connelly Construction Co., El Reno, Okla., $6,285; Reinhart & Donovan Co., Oklahoma City, $6,800 and Hunter & Hunter, Oklahoma City, $9,400. The Benham Engineering Co., American Nat. Bank Bldg., Oklahoma City, Okla., are Consulting & Supervising Engineers. Bids [illegible]

Plans and specifications for the waterworks system have been approved by the Board of Trustees of Perkins, Okla., and a contract will be let as soon as the bonds have been disposed of. The estimated cost is $25,000. The Benham Engineering Co., 812-14 Amer. Nat. Bank Bldg., Oklahoma City, Okla., are Engineers.

Pennsylvania.

✣Bids will be received until May 17, by Board of Water Commissioners, Erie, Pa., for a 24,000,000-gal. mechanical filter plant, rebuilding pumping station and furnishing pumping machinery, boilers and equipment in accordance with plans and specifications on file with Chester & Fleming, Consulting Engineers, Pittsburgh, Pa.

The Pennsylvania State Health Department has arranged with the Lehigh Water Co., which supplies Easton, to install a water sterilization plant for its service for that city. The water is taken from the Delaware River.

The Pennsylvania State Water Supply Commission, Harrisburg, has approved the following applications for charters: West Norriton Water Co., Montgomery County; Shannopin Heights Water Co., Hopewell Township, Beaver County; Middle Brodheads Power Co., Stroudsburg; Upper Brodheads Power Co., East Stroudsville; Central Brodheads Power Co., Stroud Township Monroe County, and Lower Brodheads Power Co., Smithfield Township, Monroe County. The Commission announces provisions under which it approved a charter for the Clarion River power project, insuring to the State the right of supervision of construction and operation of all dams, the control of flow, reservation for flood amelioration projects and equal rates for the public.

Dr. Samuel G. Dixon, State Health Commissioner, Harrisburg, Pa., has approved the plans of the city of Erie for the filter plant which it will build for a new water supply. The plans call for a 25,000,000-gal. mechanical process filter plant, a pumping plant and water tower and numerous changes to the system. Chester & Fleming, Pittsburgh, are engineers.

John E. Weissenfluh of Scranton, Pa., of the firm of Brooks & Co., have purchased the plant of the Escanaba Water Works Co., Escanaba, Mich., at $75,125.

South Carolina.

The Board of Public Works Commissioners of Beaufort, S. C., has made plans for the laying of about 2,000 ft. of water mains. H. R. Pollitzer is superintendent.

South Dakota.

Easton & Wells, Engineers, Aberdeen, S. Dak., are preparing plans for the construction of a new waterworks plant at Bowdle, S. Dak., estimated to cost about $15,000, bonds having been voted to that amount. C. P. Wells of Aberdeen, is official in charge.

Tennessee.

✣Bids will be received until 11 a. m., May 2, by Board of Water Works Commissioners, at the office of J. A. Denton, Chairman, Dayton, Tenn., for the laying of about five miles 4-in., 6-in., 8-in. and 10-in. cast-iron water mains. Plan of distribution and specifications can be seen at the office of the chairman or engineer. A certified check of fifty dollars must accompany each bid.

✣Bids will be received until 11 a. m., May 2, by Board of Water Works Commissioners at the office of J. A. Denton, Chairman, Dayton, Tenn., for the furnishing of about five miles of 4-in., 6-in., 8-in. and 10-in. cast-iron pipe and about six tons of specials. Specifications can be seen at the office of the chairman at Dayton, Tennessee.

✣Bids will be received until 11 a. m., May 2, by Board of Water Works Commissioners, at the office of J. A. Denton, Chairman, Dayton Tenn., for the furnishing of 46 double-nozzle fire hydrants, 1 10-in. check valve, 1 8-in. check valve, 3 8-in. gate valves, 7 6-in. gate valves and 12 4-in. gate valves. The bid must give price on cars at Dayton, Tenn. Specifications at office of chairman or engineer.

Texas.

✣Bids will be received until 10 a. m., May 22, by City of New Braunfels, Texas, for the construction and improvements of water works and lighting systems, required and specified by plans and specifications prepared by W. K. Palmer Co., Engineers, 717 Dwight Bldg., Kansas City, Mo., and on file at the office of C. A. Jahn, Mayor.

Chief Waterworks Engineer J. M. Bassett of Dallas, Tex., has prepared specifications for the boilers and engine to be installed at the pumping station at Bachman's dam to operate the 36,000,000-gal. pump to be installed there to pump water from the Elm Fork of the Trinity River into Bachman's dam. Bids will shortly be asked on the engine, boilers and pumps, but it is the intention to construct the pump house by day labor.

Virginia.

The Pure Water Co., South Hill, Va., has been incorporated with a capital stock of $10,000 maximum and $3,000 minimum, to supply water to the town of South Hill. The incorporators are R. E. Yancy, President, South Hill; C. A. Saunders, Vice-President, Skelton; N. G. Smith, Secretary and Treasurer, South Hill.

Washington.

⦿The Columbia Engineering & Construction Co., Wenatchee, Wash., has been awarded the contract by the Town Council of Brewster, Wash., for the installation of a water system at $6,379. The work includes engine, pump, reservoir, discharge pipe and distributing system complete with all necessary work connected therewith. E. L. Sawyer is Acting City Clerk. Bids were opened April 19.

The City Commission of Kenosha, Wash., has approved the plans and specifications for the new receiving well to be built in connection with the plant of the Kenosha Water Co. The well will have a capacity of 1,600,000 gals. of water and will cost about $6,500.

Wisconsin.

⦿J. N. Roherty of Janesville, Wis., has been awarded the contract by the Village Board of Belleville, Wis., Robert Luchsinger, Clerk, for furnishing and laying 605 ft. of 4-in., 7,142 ft. of 6-in. and 1,502 ft. of 8-in. water mains; also 14 ft.x50 ft. concrete standpipe, and for drilling a 12-in. by 200 ft. well. Bids were opened April 25.

Wyoming.

A pumping plant of 14,000 gals. capacity will be erected in Kemmerer, Wyo., this spring to supply the towns of Kemmerer, Diamondville, Oakley and Glencoe. The estimated cost is $10,000.

Canada.

The city officials of Steelton, Ont., have decided to make extensions to the water mains of the city at an estimated cost of $8,000.

The citizens of Brandon, Man., have voted by-laws authorizing the issuance of debentures by the city to the total amount of nearly $160,000. The debentures are as follows: $1,500 for improving 18th St., north of the C. P. R. R. tracks; $12,000 to provide a right-of-way of the Brandon Transfer Railway; $33,000 for the new fire hall, and $100,000 to improve the waterworks system.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

SEWERAGE AND GARBAGE DISPOSAL

California.

The city of Venice, Cal., will shortly construct a garbage disposal incinerator and extend the outfall sewer into the sea at an estimated cost of $43,000.

City Engineer F. W. McCarton of San Jose, Cal., has been instructed to prepare plans and specifications for sewers in the unsewered portions of the First Ward.

City Engineer S. J. Van Ornum of Pasadena, Cal., has completed plans for an 8-in. vitrified pipe sewer to be constructed in Broadway, from Glenarm to California St.

Plans and specifications have been adopted by the City Council of Oakland, Cal., for the construction of sewers in portions of the following streets: East 14th St., 61st Ave., 62d Ave., 65th Ave., Orion St., Noble St., Virginia St., Harmon Ave., Harrington St., and Mills St. W. J. Baccus is Commissioner of Streets.

Plans, specifications and resolutions have been adopted by the City Council of Oakland, Cal., for the construction of a sewer in 92d Ave., G St., and 85th Ave., and bids will be asked immediately. W. J. Baccus is Commissioner of Streets.

The City Council of Oakland, Cal., has adopted plans, specifications and resolutions for sewers in portions of the following streets: Maple Ave., Laurel Ave, Midvale Ave., School St., Main St., Arkansas St., Montana St., Delaware St., Dakota St., Georgia St., Hopkins St., Florida St., Kansas St., and sewer rights of way.

Plans and profiles have been adopted by the City Board of Trustees of Fresno, Cal., for Sewer District No. 7. The district includes teh Monroe tract, Iowa Addition and Morris subdivision of Bartlett Heights. C. P. Jensen is City Engineer.

The City Council of Los Angeles, Cal., has ordered the plans prepared for the Hollywood main sewer held in abeyance until such time as the right of way for the Silver Lake parkway shall have been secured. The sewer is to follow the line of the parkway. The entire cost of the work is esitmated at $235,000.

Connecticut.

⊙The Paving & Sewer Commission of Bridgeport, Conn., has awarded the contract for dredging the basin at the outlet of the Noble Ave. trunk sewer to Toole & Sunderlin, and a contract for building the Wilmot Ave. sewer to B. D. Pierce, Jr., Co. The Noble Ave. trunk sewer is to extend into the harbor.

District of Columbia.

✣Bids will be received until 2 p. m., May 18, by Commissioner of Indian Affairs, Department of Interior, Washington, D. C., for furnishing the necessary labor and material for the erection of frame school house and frame quarters and installation of water and sewer extensions at the Tohatchi Indian School, N. Mex.

Florida.

✣Bids will be received until 2 p. m., May 7, by Commissioners of Public Works, Tampa, Fla., for furnishing 1,575 lin. ft. of 18-in. hard-burned No. 1 salt glazed vitrified shale sewer pipe f. o. b. Tampa, Fla. Allen Thomas is Clerk.

✣Bids will be received until 3 p. m., May 20, by Board of Bond Trustees, C. C. Memminger, Chairman, Lakeland, Fla., for sewer and paving work, including material and labor necessary to construct sanitary sewers, with appurtenances, including a sewage treatment plant. Also for paving, curbing and storm drainage work. Specifications may be procured and plans and profiles with details seen at the office of J. N. Hazlehurst, Atlanta, Ga., engineer, Candler Bldg., Atlanta, Ga., or at 215 Drane Bldg., Lakeland, Fla., on and after May 10, 1912.

Georgia.

The citizens of Decatur, Ga., on April 24, voted the issuance of bonds in the sum of $5,000 for extensions to the sewer system.

Idaho.

The City Council of Sandpoint, Ida., has created Sewer Improvement District No. 2, which provides for the construction of laterals in the residence section of the city.

The Village Board of Burley, Ida., is making arrangements for the installation of .a sewer and water system. The proposition will be submitted to the citizens at a special election.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., May 6, for furnishing and delivering labor, materials, etc., necessary to construct a sewer in E. 14th St. from Michigan Ave. to Wabash Ave., according to plans and specifications on file at his office.

⊙The Interstate Construction Co., of Hammond, Ind., has been awarded the contract by the city of Lawrenceville, Ill., for the installation of a sewer system in Sewer District No. 3, at $14,525. J. O. Martin is City Attorney. R. J. Benefield is City Engineer. Bids were opened April 24.

⊙The Illinois Hydraulic Stone Co., 28 Hubbard Block, Elgin, Ill., has been awarded the contract by the City Council of that city, W. F. Sylla, City Clerk, for the improvement of the water course in the W. C. Kimball plat for West Elgin at $1,275. The work includes 170 ft. of 4x4 ft. sewer average cut 2 ft.; 100 ft. of 3x5 ft. sewer average cut 2 ft.; 526 ft. of repair in stone sewer. This work is an outlet for West Chicago St. sewer. Bids were opened April 16.

⊙The City Council of Elgin, Ill., has awarded the contract for the construction of the outlet for the Seventh Ward sewer system to the Illinois Stone Construction Co., at $1,275.

The citizens of Earlsville, Ill., have voted the issuance of bonds for the installation of a sewer system.

The Board of Local Improvements of Woodriver, Ill., has set aside the sum of $27,680 for the installation of a waterworks system.

The Board of Local Improvements of Woodriver, Ill., has decided to expend $55,000 for the construction of sewers and a water system. The sum of $27,320, it is thought, will be required to install the sewers and the remainder to construct the water system.

The City Council of Rushville, Ill., has passed an ordinance for a system of sanitary sewers to cost $46,048, including a disposal plant.

Indiana.

✣Bids will be received until 10 a. m., May 7, by Department of Public Works, South Bend, Ind., for the following work: Trunk sewer on West Sample St., from Webster St. to Olive St.; trunk sewer on Ford St., from Kosciuszko to Olive St.; pipe sewer on College St., from Fassnacht Ave. to 200 ft. south of Michigan Ave.; pipe sewer on Allen St., from Van Buren St. to Vassar Ave; pipe sewer on Miner St., from Notre Dame Ave. to North Eddy St.; pipe sewer on Johnson St., from Michigan Ave. to Vassar Ave.

⊙The Board of Public Works of Gary, Ind., has awarded the contract for the construction of District No. 7 sewer to the Interstate Construction Co. This company has submitted the lowest bid on District No. 8 sewer, $4,571, and will probably be awarded the contract.

Iowa.

✣Bids will be received until May 6 by City of Chariton, Ia., for the construction of a 12-in. sewer 500 ft. long. G. J. Gittingen is City Clerk.

⊙G. W. Ensley of Chariton,
awarded the contract by the C
that city, G. J. Gittinger, City
construction of 24-in. sewer ext
—bends $2 and y's $2 each.
cludes 450 ft. of sewer, three
degree bend. Bids were opene

City Engineer E. F. Stims
Bluff, Ia., has been instructed t
outlining a sewerage system fo
Sixth Wards, west of Indian

Engineers Bruce & Standev
Omaha, Nebr., have complete
sewer system at Griswold, Ia
cost $7,000. The contract will

Maryland.

Following bids were received
of Awards of Baltimore, Md., C
drick, Chief Engineer of the S
mission, on Storm Water Co
Ryan & Reilly, Baltimore, Md.,
McCarthy & Co., Baltimore, M
A. Middleton & Co., Baltimore,
B. F. Sweeten & Son, Baltim
638; The Whiting-Turner Co
more, Md., $20,772.

Michigan.

⊙August Tiedeman & C
Mich., have been awarded the c
city for the construction of
of pipe sewers of various sizes
were opened April 20.

The City Health Departme
zoo, Mich., has adopted a resol
sented same to the City Cou
that lateral sewers in the sanita
absolute necessity and recomme
stallation during the present ye

Minnesota.

✣Bids will be received until
by A. J. Meyer, City Clerk, Ne
for furnishing all labor and m
construction of sewers on Sta
South to South 6th St., all acc
and specifications on file in
Clerk's office.

⊙Lars Overn of St. Peter,
awarded the contract by the
Mankato, Minn., for the instal
will be known as the North 4t
$10,221. The improvement will
ft. in length.

Assistant City Engineer Ba
Minn., has reported his estima
sewer system for that half of A
tween the Great Northern or
Nemadji River marshes. Th
cost will be $46,000, and it will
000 ft. of pipe for the entire dis

Missouri.

✣Bids will be received until
by Board of Public Improvem
Mo., W. T. Findly, Sec'y, for c
der Letting 10,519, sewers in
Sewer District No. 8, as autho
nance No. 26,328, embracing
materials, lengths and sizes as
Brick and Portland Cement
715 ft. of 4½ ft. inside diameter
in.x54-in. inside dimensions; 5
x 51-in. inside dimensions; 174
45-in. inside dimensions; 358
42-in. inside dimensions; 702
39-in. inside dimensions;
pipe sewers, 30 ft. of 30-in
meter; 540 ft. of 27-in. inside
ft. of 24-in. inside diameter; 2
inside diameter; 3,454 ft. of 18
meter; 4,689 ft. of 16-in. inside
ft. of 12-in. inside diameter.
lets, manholes, and all other
Deposit required, $1,254.

⊙The Kelly Construction
seph, Mo., was recently awarded
the installation of a sewer sys
Mo.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Montana.

Board of Health of Montana has [illegible] plans for sanitary and storm s for Fort Benton, Mont. The st is $35,000. Bids will be asked uture. Burns & McDonnell, Scar- [illegible] City, Mo., are engineers. Council of Livingston, Mont., has r the construction of new sewers districts during the summer at an [illegible] $20,000.

Nebraska.

[illegible] received until 11 a. m., May [illegible] A. Martin, Quartermaster, Fort [illegible] for the construction of an ex- e 10-in. sewer outlet.

y Construction Co. of St. Jo- [illegible] awarded a contract for n of a sewer system at Superior,

New Jersey.

[illegible] until 8 p. m., May and Council, Rutherford, N. J., ; all materials, labor and the ex- onstruction of a 20 and 24 in. lrain, for surface water, together d concrete intakes, connections, rtenances, along the northerly [illegible] from Addison Ave. to e. Plans and specifications can and blank forms of proposals informtaion given at the office tson, borough engineer, No. 1 ., or of the borough clerk in the Park Ave., Rutherford, N. J. t be accompanied with a certi- the sum of $300, payable to the orough of Rutherford, N. J. F. Borough Clerk.

be received until 2 p. m., May Valley Sewerage Commission- n, Clerk, Passaic, N. J., for the Section 15 of the Main Inter- , in the City of Passaic and Township. Approximate quan- [illegible] 3,445 lin. ft. 90-in. con- [illegible] from about 15 ft. to depth; 1,080 lin. ft. 90-in. con- tunnel; 2,750 lin. ft. 81-in. con- tunnel; 4,500 cu. yds. Portland in trench; 6,200 cu. yds. Port- ncrete in tunnel; 200 cu. yds. in manholes; 1,500 cu. yds. rock rench. Drawings, form of con- ons and form of proposal may the Commissioners' office from , Chief Engineer.

[illegible] received until 2:30 p. m., layor and Common Council, or furnishing all material and required to complete the con- out nine miles of vitrified pipe [illegible] to 20 ins. in size, with Y oles, flushing manholes and appurtenances, and of a sew- rks and pumping station, in- cessary piping, grading, etc. seen and specifications and sals obtained at the office of ed, W. B. Dunn, Salem, N. J., [illegible] Clyde Potts, 30 Church rk City. Plans may be taken payment of $10, the same to plans are returned within 20 ondition. Each bid must be certified check on a solvent

Bennett, Cape May, N. J., has he contract at Sea Isle City, f, Ocean City, N. J., Engineer, ction of main sanitary sewer, and priestman ejectors at $30,- opened April 15.

introduced at a recent meet- d of Works of Newark, N. J., nstruction of a garbage dis- is proposed to have Deputy Hallock prepare plans and the work.

New York.

rd of Health has granted the Hartford, N. Y., permission to discharge effluent [illegible] sewage plant into the creek [illegible]

City Engineer W[illegible] Sche- nectady, N. Y., has submitted plans for the extension of the [illegible] Van Vranken Ave. [illegible] and Supply.

The Board of E[illegible] N. Y., has authorized the [illegible] acres of land for $12,500. The property is required as part of the site for the sewage disposal plant in Irondequoit.

Ohio.

⊙T. P. Fitzgerald of Ashtabula, O., has been awarded the contract for the construction of a sewer in Pine St., in Ashtabula, at $2,000. Bids were opened April 21.

⊙The Village Council of Hubbard, O., has awarded the contract for the completion of the sewer system to the Cantrel Construction Co. of Parkersburg, W. Va., at $21,245. Other bidders were: Anthony O'Horo, Youngstown, O., $30,946; John Dill & Somma, Pittsburgh, Pa., $29,823; B. W. Ernst & M. J. Burk, Cleveland, O., $26,104; Frank Mannelli, Pittsburgh, Pa., $25,341.

⊙The Department of Public Service of Cincinnati, O., has awarded the contract for the construction of a sewer in Boudinot and Urweiler Aves. to James J. Brown at $3,364, and the contract for a sewer in other parts of Boudinot Ave. and Lisher Ave. to Thos. Maloney at $5,218.

Cumings & Downer of Painesville, O., have been selected by the city of Geneva, O., to do the engineering work on sanitary sewers in Eastwood St. and East Main St.

The citizens of Bexley (railway station, Columbus, O.), have voted the issuance of bonds in the sum of $90,000 for the installation of a sewer and water system.

City Engineer B. M. French of Salem, O., has made plans for a new sanitary sewer in East Green St., from Jennings Ave., east 2,215 ft.

The Board of Control of Cincinnati, O., has adopted specifications for water mains of 16-in. in Glenway Ave., Bridgetown road and Ferguson road. The estimate cost is $12,750.

Oregon.

⊙The Pacific Bridge Co., Portland, Ore., has been awarded the contract by the City Council of that city for the construction of trunk sewers No. 1 and No. 2 for Sullivan's Gulch. The company's bid for No. 1, running from the river to East 15th St., is $69,874, and for No. 2, running from East 15th St. to East 33d, is $70,466.

Pennsylvania.

✣Bids will be received until noon, May [illegible], by Lower Merion Township Commissioners, at the office of R. A. Warner, C. E., Engineer in Charge, Box 708, Ardmore, Pa., for the construction of the necessary additional pumping machinery required to lift 1,500,000 gals. of sewerage per day 175 ft. through a distance of 6,700 ft.

State Health Commissioner Samuel G. Dixon of Pennsylvania has approved the plans for the construction of a sewer system in the borough of Donora, Washington County, Pa. The system provides for the suburban districts and includes a disposal plant.

The electors of Ligonier, Pa., on April 20 vote the issuance of bonds in the sum of $65,000 for the purpose of installing a sewage disposal plant.

The borough government of Steelton, Pa., and the township government of Swatara will probably unite in the construction of a sewer to take the drainage out of Buser's run.

Plans have been submitted by the borough of Ridley Park, Pa., to the State Health Commissioner, Samuel Dixon, for a comprehensive sewage disposal system.

South Dakota.

⊙The contract for the tile and pipe for the new sewage disposal plant at Aberdeen, S. Dak., has been awarded to the H. J. Draheim Lumber Co., of Aberdeen, at $1,026. Most of the pipe will be 8-in. half tile for subdrains of the sprinkling filter, the balance of the pipe consisting of sizes up to 20-in.

The citizens of Pierre, S. Dak., at a recent election voted the issuance of bonds in the sum of $25,000 for the construction of sewers.

Texas.

An election is to be held in Houston, Tex., during the month of June to decide whether or not bonds to the amount of $1,500,000 shall be issued for storm and sanitary sewers, system of parks and street improvements.

Virginia.

✣Bids will be received until 11 a. m., May 10, by Constructing Quartermaster, Fort Myer, Va., for alterations in sewer system at the fort.

Washington.

The City Commission of Spokane, Wash., has approved the redrafted plans for the First Ward subtrunk sewer No. 17, to drain the district bounded by First and Second Ave., Sherman and Garfield Sts. The new estimated cost is $24,110.

Commissioner of Public Works D. C. Coates of Spokane, Wash., has asked the City Commissioners to order the construction of the following sewers: One Boone Ave., Adams to Monroe St., and on Madison, Boone to Sharp Ave., estimated at $2,878; in the alley between Augusta and Spofford Ave., Maple to Adams St., estimated to cost $2,248, and on 27th Ave., Division to Tekoa St., estimated at $1,915.

The City Council of Spokane, Wash., is considering the plans for the downtown intercepting sewer, which, it is estimated, will cost about $212,000. The district affected by the improvement extends from 10th Ave., on the south to the river on the north and from Hilliard St. on the east to the Hangman Creek on the west.

West Virginia.

✣Bids will be received until noon, May 11, by Vester B. Dunn, Mayor and City Council, Kingwood, W. Va., for furnishing labor and material and constructing approximately 19,000 ft. of sanitary sewer, with all connections, etc., to be laid with Standard Vitrified Salt Glazed Sewer Pipe, ranging from 8 to 18 ins. in size. Also at the same time proposals will be received for excavating for, laying and cosntructing said sewer and furnishing sand and cement for the laying of same, the Town of Kingwood to furnish pipe delivering along the various lines of sewer. Cash or certified check for $250 must accompany each bid as a guarantee of good faith. The successful bidder will be required to give bond for $5,000 conditioned for the proper performance of the work. Plans and specifications mav be seen by applying at the Mayor's office in said town.

Wyoming.

The citizens of Cody, Wyo., on April 16 voted the issuance of bonds in the sum of $35,000 for a sewer system. Plans and specifications will be completed within 30 days by Consulting Engineers Burns & McDonnell, Scarritt Bldg., Kansas City Mo., after which bids will be asked.

Canada.

⊙The contract for constructing 2½ miles of sanitary sewers in Lethbridge, Alta., has been awarded to City Engineer A. C. D. Blanchard at $24,601.

⊙Ross & Howard of Vancouver, B. C., have been awarded the contract by the city of Vernon, B. C., D. G. Tate, City Clerk, for the supplying and delivery of 60 cast iron manhole frames and covers, complete with either cast or galvanized iron mud baskets, at $1,085. Bids were opened April 8.

The town of Weyburn, Sask., will construct over three miles of sewer and water mains and seven miles of sidewalks during the year. Debentures in the sum of $25,000 for the sewers and in the sum of $9,000 for sidewalks have been issued. Bids for material have been asked.

The city officials of Steelton, Ont., have decided on the construction of the West End sanitary sewer system at an estimate cost of $40,000.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, TC.

Arizona.

✣Bids will [illegible] 24, by Commissioner of Indian Affairs, Department of Interior, Washington, D. C., for furnishing the necessary labor and material for the erection of a frame office building and [illegible] River Indian School, Ariz.

California.

✣Bids will be received until 3 p. m., June 4, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and lighting fixtures, of a two-story and basement building of approximately 6,560 sq. ft. ground area; stucco, faced with stone and terra-cotta trimming, for the United States post office at Santa Barbara, Cal., in accordance with drawings and specifications, copies of which may be obtained from the ed States post office at Santa Barbara, Cal., in or at discretion of the Supervising Architect.

✣Bids will be received until 11 a. m., May 24, by Maj. J. K. Hampton, Quartermaster, Presidio, San Francisco, Calif., for window and door screens for certain barracks and quarters at Presidio of San Francisco, Calif., and Fort Winfield Scott, Calif.

District of Columbia.

✣Bids will be received until 2 p. m., May 3, by Commissioners of the District of Columbia, Washington, D. C., for constructing a pound and stable building to be located on South Capitol St., between H and I Sts. Southwest, Washington, D. C.

✣Bids will be received until noon, July 1, by U. S. Navy Department, Washington, D. C., for constructing gunboat No. 19. G. V. L. Meyer is Secretary.

✣Bids will be received until 2 p. m., May 3, by Commissioners of the District of Columbia, Washington, D. C., for constructing a pound and stable building to be located on South Capitol St., between H and I Sts. S. W.

Georgia.

✣Bids will be received until noon, May 16, by J. W. Callahan, Mayor, Bainbridge, Ga., for the construction of a graded school building to be erected in Bainbridge for the city schools. Each bid for the construction of the building must be accompanied with a certified check in the amount of $3,000, and each bid for a mechanical blast heating plant with a certified check in the amount of $500, payable to J. W. Callahan, Mayor.

✣Bids will be received until May 18, by Lieut. Wyatto, Selkirk, Quartermaster, Fort Screven, Ga., for furnishing 1 lawnmower grinder, 48 sprinklers, 24 hand rakes, 600 lbs. zinc sheets, 12 lawnmowers, 12 "D" handles, 12 shovels, 48 axes and 24 oilers.

Illinois.

✣Bids will be received by Ray Palmer, city electrician, Chicago, Ill., until 11 a. m., May 6, for furnishing the Department of Electricity with arc light carbons for electric light use in approximately the following quantities: 600,000 14x⅝ in. copper coated carbons, 80,000 12x½ copper coated carbons, 100,000 12x.510 to .520 solid high grade carbons, 100,000 12x.510 to .520 cored high grade carbons, 9,000 pairs white flame carbons for Stave arc lamps, upper carbon dimensions 10¼ ins. by 20 millimeters, lower carbon dimensions 8¾ ins. by 18 millimeters; 70,000 12x⅞ ins. white flame carbons for G. E. Lynn arc lamps. Cash or certified check for $500 must accompany proposal.

✣Bids will be received by L. E. McGann, commissioner of public works, Chicago, Ill., until 11 a. m., May 9, for furnishing, delivering and erecting a steam hoisting engine at Delaware Pl. and La Fayette Ct., according to plans and specifications. Bidders must submit with their proposal drawings showing the dimensions of the following: Piston diameter, length of stroke, piston width, piston rod diameter, type of cylinder valves, etc.

✣Bids will be received by L. E. McGann, commissioner of public works, Chicago, Ill., until 11 a. m., May 9, for furnishing a steam hoisting engine for use of pile driver. Accompanying the bid must be a drawing showing essential features and various dimensions of the parts of engine.

✣Bids will be received by Ray Palmer, city electrician, Chicago, Ill., until 11 a. m., May 8, for furnishing and delivering to the department rubber covered new code double braid cable of the following sizes and quantities: 1,100 ft. of 500,000 c. m., 620 ft. of No. 4-0, 308 [illegible]

Indiana.

✣Bids will be received until May 2, by M. E. Schrock, Starke County Surveyor, Knox, Ind., for 12 miles of dredge work in that [illegible] ditch.

Iowa.

✣Bids will be received until 5 p. m., May 9, by Board of Directors of the Independent School District, Sioux City, Ia., for remodeling of, building additions to, and installing heating systems and plumbing in the following named school buildings in said Independent School District, to-wit: Hunt building and Webster building. All bids must be in strict accordance with plans and specifications prepared by F. E. Colby, Architect, which may be seen at his office in Sioux City.

Maryland.

✣Bids will be received until 10 a. m., May 7, by Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the Naval Academy, Annapolis, Md., a quantity of yellow pine.

Missouri.

✣Bids will be received until 3 p. m., May 17, by James Knox Taylor, Supervising Architect, Washington, D. C., for a hydraulic elevator plant, etc., in the U. S. Post Office at St. Louis, in accordance with plans and specifications on file with the Superintendent, St. Louis, at the discretion of the Supervising Architect.

New York.

✣Bids will be received until 3 p. m., May 27, by Comdr. C. D. Stearns, U. S. N. Inspector, Tompkinsville, N. Y., for polished brass air cocks.

✣Bids will be received until 2 p. m., May 13, by M. J. Terry, chairman Building Committee, Oswego, N. Y., for the construction of alterations to the county clerk's building. Plans and specifications of the proposed work are on file with the county treasurer of Oswego county and at the office of Taber & Baxter, architects, 540 Gurney building, Syracuse, N. Y. The architect will also attend at the county clerk's building in the city of Oswego on Saturday, May 4, 1912, at 2 o'clock p. m., for the purpose of personally exhibiting and explaining the work to any persons interested.

Ohio.

✣Bids will be received until 2 p. m., May 21, by Lieut. Col. H. Jervey, U. S. Engineer, Cincinnati, O., for construction of five loose stone dikes and shore protection in Ohio River opposite Sister Island.

✣Bids will be received until noon, May 23, by New Elks' National Home Commission, Sinton Hotel, Cincinnati, O., for the erection of buildings for the New National Home of the B. P. O. E. at Bedford City, Va. August Herrmann is Chairman of the Commission.

✣Bids will be received until 1 p. m., May 8, by W. H. Ortt, Treasurer Central Branch, N. H. D. V. S., National Soldiers' Home, National Military Home, O., for [illegible] lines.

Rhode Islan

✣Bids will be received unt by Col. F. V. Abbott, U. S. En R. I., for removing the wr Mary Adelaide Randall in Harbor, Block Island, R. I.

Tennessee.

✣Bids will be received un 13, by Board of Education, G Memphis, Tenn., for furnishi complete two smokeless fur proved type under the 150 h. Central High school. Also r [illegible] plete the work. A. B. Hill is

Texas.

✣Bids will be received unt by Maj. E. I. Brown, U. S. E ton, Tex., as noted in our A dredging the Houston Ship work is divided into three di No. 1 being that portion lyi Bay between the 25-ft. depth veston harbor and Morgan be miles south of Morgan Poin is about 105,300 ft. in length the excavation of about 10,53 material to complete to the alternate route for Division 1 portion lying between the deep City channel in Galveston Ba the westerly shore of the bay and Edwards Points, to Morg 5½ miles south of Morgan tion is about 85,800 ft. in len quire the excavation of about of material to complete. Di tends from Morgan beacon No. 1), through San Jacinto and up Buffalo Bayou to the Bayou. It is about 134,220 f there are approximately 6,10 material to be excavated. Di tends from Vince's Bayou t the turning basin at the head This section is about 28,450 f there are approximately 4,02 material to be excavated. T channel through Galveston Ba and from Morgan Point to turning basin 100 ft. wide. [illegible] in this issue.

Wisconsin.

✣Bids will be received u 17, by E. L. Williams, City Wis., for furnishing labor an sary for constructing a ret South River St.

✣Bids will be received u May 2, by Board of Park Con waukee, Wis., for furnishing labor for constructing 450 l less, of breakwater for the of the Lake Shore Drive. F is Secretary.

Canada.

✣Bids will be received unt 15, by Chairman, Board of Co Man., for the manufacture an City Gravel Pit, Bird's Hil one Electric Locomotive with plete, and one electrically oper accessories complete. Instruc [illegible] tained at the office of the Power Department, 54 King or any tender not necessaril Peterson is Secretary of the

✣Bids will be received un by J. A. Bain, Woodstock, O struction of Knox Church

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Tarvia

Preserves Roads
Prevents Dust

Broadway at Dobbs Ferry, N. Y. [illegible] Tarvia B

Dobbs Ferry's Experience with Tarvia

BROADWAY in New York is one of the longest highways in the world, running from the battery in New York City far beyond the city limits to the north, following the line of the Hudson for over fifty miles.

It is one of the great historic thoroughfares of the State and is one of the principal automobile highways in the country on account of its picturesque views overlooking the Hudson and the fine estates which border on it.

The maintenance of this road has proven very expensive and for the purpose of reducing the annual costs, Dobbs Ferry used Tarvia on its section of Broadway. The results are described in the following letter:

Dobbs Ferry, N. Y., January 30, 1912.

Gentlemen:

"The Tarvia-B furnished by your Company to the Village of Dobbs Ferry through Michael J. Francis, Contractor, has proven entirely satisfactory. The roadway of Broadway from the Hastings village line to that of Irvington, which was practically a new macadam road, is now one of the finest in the State and Ashford Avenue, which is one mile in length, also a macadam road, is in perfect condition after having been treated with your Tarvia. The automobile traffic is extremely heavy, being approximately one hundred per hour and on Saturdays and Sundays about double that number, and yet the roadway shows no effects of such traffic.

'The Board of Trustees and the people of Dobbs Ferry are unanimous in their praise of Tarvia and after having a large experience in the use of road binders, Tarvia-B has my unqualified endorsement."

Yours very truly,
Hugh P. Tiernan, Village Engineer.

Tarvia is a coal tar product scientifically and carefully prepared for road use, in three grades —Tarvia-X for road and pavement construction, Tarvia-A for surface work (applied hot), Tarvia-B for dust prevention and road preservation (applied cold.) Illustrated booklet describing the different treatments free on request to nearest office.

BARRETT MANUFACTURING CO.

[illegible] Philadelphia, Boston
St. Louis, Cleveland, Pittsburg, Cincinnati, Kansas City, Minneapolis, New Orleans, Seattle, London, Eng

Canadian Offices:—Montreal, Toronto, Winnipeg, Vancouver, St. John, N. B., Halifax, N. S.

TRADE B MARK

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

PAVING.

Office of Richland County Supervisor,
Columbia, S. C., April 26th, 1912.

Bids will be received in this office, until 10:00 a. m., Friday, May 17, 1912, for resurfacing the road from the City limits of Columbia to Hyatt Park (a distance of 7,648 feet, the road being approximately 25 feet, wide) with an artificially bound macadam wearing surface.

The present road is a water-bound granite macadam, in fair state of preservation, and with not more than 2 per cent of patching, will, on being spiked up and reshaped, make an excellent foundation for the artificially bound macadam wearing surface.

INSTRUCTIONS TO BIDDERS.

The basis for submitting bids must be specified prices per square yard for the artificially bound macadam wearing surface (stating the proposed thickness of said surface, and kind of stone to be used in the construction of said surface), for spiking up the present road and reshaping and preparing it for the foundation for the wearing surface, and a specified price per cubic yard for all stone necessary to repair and prepare the present road for receiving the wearing surface; also unit prices for any other items that may be necessary to the particular type of construction.

With the bids must be a written guarantee that the road will withstand all ordinary conditions of traffic and weather, such as usually tend to develop dust, mud, ruts and holes, and be resistant to the disintegrating forces exerted on the surface by motor cars running at high rates of speed for a specified term of years.

Also bids will be received for supplying the artificial binder, the road to be constructed by the County forces; or the bids may be made spearately for the binder and the construction. In case the bid is made for the binder only, each bid must be accompanied with full instructions for the application of same, and a guarantee as to the merits of the binder.

Work must commence within 15 days of date of signing contract and completed within [illegible] days of later date.

The right to reject any or all bids is reserved.

For further information address

W. F. MULLER, Supervisor,
Richland County, Columbia, S. C.

SUCTION MAIN AND WELL.

Proposals will be received by the City of Grand Haven, Michigan, until 3 o'clock p. m., Tuesday, May 21, 1912, for unloading, delivering, trenching, laying and backfilling about 3,200 feet of 16-inch cast iron suction main from a well on the shore of Lake Michigan to the pumping station.

Also for sinking a 30-foot diameter well on the shore of Lake Michigan.

The right is reserved to reject any or all bids.

Plans and specifications may be seen at the office of the City Clerk at Grand Haven, or at the office of Gardner S. Williams, Consulting Engineer, Ann Arbor, Michigan, or will be furnished on request by the latter office.

GATE-HOUSE AND TWO CONCRETE BRIDGES.

Located at Trenton Falls, N. Y., one mile from railroad, 6,000 cu. yds. earth, 4,000 cu. yds. rock, 1,000 cu. yds. concrete, 8,000 lbs. re-inforcement, details for gate-house, lump sum. The work is within a radius of a few hundred feet and must be completed by October 1st, 1912. Bids to be opened at 12 o'clock on May 10th, 1912. For further information address

THE ALTO CONSTRUCTION COMPANY,
Holland Patent, N. Y.

Published by Authority of the Common Council of the City of Milwaukee.

Water Works Tunnel.

Office of the Department of Public Works,
Milwaukee, April 15, 1912.

Sealed proposals will be received at this office until Wednesday, May 15, 1912, at 10:30 o'clock a. m., for furnishing all materials and doing all the work necessary and required to construct a water works tunnel twelve (12) feet in diameter, for a distance of approximately four thousand (4,000) feet out into and under Lake Michigan, from a point on the lake shore on the center line of Linwood avenue extended; one lake shaft, including connections and steel cylinders; one shore shaft, including two (2) gate wells and all connections, and approximately one hundred and fifty (150) cubic yards of rock excavation, according to plans and specifications on file in this office.

Bidders will submit separate figures for doing the following branches of the work; the contract, however, will be let to the lowest bidder in the aggregate for doing all of the work, based upon the estimated quantities given in the specifications:

First—A price per lineal foot of shore shaft complete, including two (2) gate wells and all connections, copings and covers.

Second—A price per lineal foot of brick tunnel with extensions at the shafts.

Third—A price per lineal foot of lake shaft complete, including steel cylinders with all connections.

Fourth—A price per cubic yard of rock excavation.

Fifth—A price per lineal foot of tunnel if concrete were to be used instead of brick in ring of tunnel.

Work to be completed on or before the 1st day of May, 1914, failing in which the contractor shall pay the city of Milwaukee as liquidated damages the sum of fifteen hundred ($1,500.00) dollars for each and every day's delay in completing the contract.

Bonds required in the penal sum of $90,000.00, or in lieu thereof the bidder may deposit with the Commissioner of Public Works the sum of $45,000.00 in money or certified check.

In case bonds are submitted with bids, local bondsmen or a surety company authorized to do business in Wisconsin will be required, said bond to be approved by the City Attorney as to form and execution before being presented with bid to the Commissioner of Public Works. All bids must be stated in writing and in figures.

All moneys deposited will be returned to unsuccessful bidders on awa of tract and to successful bidder hen tract is entered into.

The Commissioner of Public Works serves the right to reject any all b

Bidders are required to st their proposals the method the intend adopt in carrying out this wo

Plans and specifications w nished to prospective bidders ceipt of $10.00 as a guarante fo safe return.

Signed,

H. E. BG
Commissioner of Pu
Countersigned, April 15, 191
C. P. D

TAMPA BRIDG

Contractors experienced in dg struction are invited to ten bids for the construction of bridge to be built in the City Ta Florida, carrying Lafayette eet the Hillsboro River, in accor nce the detail drawings and specit file in the office of the Boar of missioners of Public Works Fla., and hereinafter referred o as Board, and also in the office the sulting Engineers, Messrs. Bo and Baird, 149 Broadway, New

Bids will be received by th their office in the City of T pa, not later than noon of Wedn 7, 1912.

A certified check for $5,000, able to the Board, must accor bid. Such check will be retu d unsuccessful bidder immedi ly the bids are opened, and to t ful bidder, unless he fails to contract within ten days afte tract is awarded to him.

A bond satisfactory to the oard the sum of 25 per cent of th price will be required.

All bids must be made on f of posal, which with the contrac spe tions, and bond, can be obtain cation to the Clerk of the Boa

Bidders can secure a set o d ings for this work by depositi $10 the Clerk of the Board, which po be returned on the return of ings.

The above work covers tw concrete earth spans of 82 feet ea one deck Scherzer rolling lif dra two wings of 93 feet span, a con retaining walls for the appro to the structure.

The City of Tampa reserves right to reject any and all bids.

CITY OF T
By D. B. McKAY, Chairman o
Commissioners of Public W k.
Attest: ALLEN THOMAS, C k
BOLLER, HODGE & BAI
Consulting Engineers.

U. S. ENGINEER OFFIC City, Mo., April 22, 1912.—Sea als for constructing about 1 standard revetment on Miss about 31 miles below Kansas miles below Missouri City, received at this office until 12 22, 1912, and then publicly o formation on application E SCHULZ, Major, Engineers.

CALLS FOR BIDS

e, $2.40 an inch, single column. **Copy received until Monday noon.**

WATER TOWER AND TANK.

proposals are invited and will ed at the office of the Village mpton, Illinois, until 2 o'clock, [illegible] 1912 for the construction of ater tower and tank.

st be accompanied by a certi- the sum of One Hundred $100.00) to be forfeited to the Compton should the bidder re- eglect to enter into a contract that the work be awarded to

must be made on a standard ch may be obtained from the erk. For further information . S. Archer, Village Clerk. ht is reserved to reject any and

CHARLES BRADSHAW,
Village Board, Compton, Ill.

NGINEER OFFICE.—Galveston, [illegible] Sealed proposals for concrete sidewalk, brick concrete curbing and drains at [illegible] Reservation, Port Bolivar [illegible] will be received here [illegible] noon May 11, 1912, and cly opened. Information on ap- ARL I. BROWN, Major.

TMENT OF THE INTERIOR, STATES RECLAMATION SER- ashington, D. C., April 20, 1912. posals will be received at the the United States Reclamation Provo, Utah, until 2 o'clock p. 8, 1912, for the construction of anal intake structures and con- on Indian Creek and Trail version Canal, located in Wa- nty, Utah, about thirty-five heast of Thistle, Utah. The the excavation of approx- 50 cu. yds. of earth and rock lacing of 560 cu. yds. of con- cu. yds. of paving, a set of s, and miscellaneous steel. iculars address the U. S. Rec- e, Provo, Utah, or Wash C.

F. H. NEWELL, Director.

MENT OF THE INTERIOR, TATES RECLAMATION SER- ngton, D. C., April 23, 1912. sals will be received at the United States Reclamation Federal Building, Los Ange- 2 o'clock p. m., May 16, sisting cast iron pipe and for the North Platte Project, [illegible] ars address the U. S. Rec- 60 Federal Building, Cal., or Washington D. C.

F. H. NEWELL, Director.

MENT OF THE INTERIOR STATES RECLAMATION Washington, D. C., April 20, proposals will be received at the United States Reclama- Provo, Utah, until 2 o'clock . 1912, for the construction l concrete drop, chute, and two bridges on Indian Cree low Diversion Canal, located ounty, Utah, about thirty- heast of Thistle, Utah. The s the excavation of approxi- bic yards of earth and rock, g of 875 cubic yards of con- square yards of paving. rs address the U. S. Recla- e, Provo, Utah, or Washing-

F. H. NEWELL, Director.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE. Washington, D. C., April 23, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Malta, Montana, until 2 o'clock p. m., May 21, 1912, for the construction of laterals, waste-water ditches and structures on the First Unit, Dodson South Canal, Milk River Project, Montana. The work involves the [illegible] the erection of six small structures.

For particulars address the U. S. Reclamation Service, Washington, D. C.; Helena, Montana, or Malta, Montana.

F. H. NEWELL, Director.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE.—Washington, D. C., April 23, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Malta, Montana, until 2 o'clock p. m., May [illegible], 1912, for [illegible] structures on the first eleven miles of Dodson North Canal, laterals and waste-water ditches. The work involves approximately 277,000 cubic yards of excavation, 1,500 cubic yards of reinforced concrete, and the placing in structures of 86,000 feet, B. M., of lumber.

For particulars address the U. S. Reclamation Service, Washington, D. C.; Helena, Montana, or Malta, Montana.

F. H. NEWELL, Director.

U. S. ENGINEER OFFICE, Kansas City, Mo., April 4, 1912.—Sealed proposals for the construction of about 14,000 ft. of standard revetment on the Missouri River, about 215 miles below Kansas City, and at and below Rutland, Mo., will be received at this office until 12 o'clock noon, May 4, 1912, and then publicly opened. Information on application. EDWARD H. SCHULZ, Major, Engrs.

U. S. ENGINEER OFFICE, GALVESTON, TEXAS, April 18, 1912.—SEALED PROPOSALS for derdging the Houston Ship Channel, will be received at this office until 12 m., May 15, 1912, and then publicly opened. Information on application. EARL J. BROWN, Major, Engrs.

U. S. ENGINEER OFFICE—Duluth, Minn., April 9, 1912. Sealed proposals for dredging at Superior Entry, Duluth-Superior Harbor, will be received at this office until noon, May 9, 1912, and then publicly opened. Information on application. FRANCIS R. SHUNK, LT., Col., Engrs.

WATER-MAINS.

Sealed proposals, endorsed with the title of the work, will be received at the office of the City Auditor of the City of Mitchell, South Dakota, up till 8 o'clock p. m., on the 9th day of May, 1912, for furnishing the material for and laying approximately 2,410 feet of 4-inch water-main, 3,580 feet of 6-inch water-main and 1,510 feet of 10-inch water-main. All with appurtenances including valves and fire hydrants, and also for 37 four, six and eight-inch valves to be placed on old mains.

All work to be done in accordance with the plans and specifications now on file in the office of the City Engineer of said city.

A deposit of $5.00 will be required from each contractor for each copy of the plans and specifications furnished him. Deposit fee will be returned upon the return of the said copy of plans and specifications together with the receipt given.

All bids must be accompanied by a draft or a certified check upon some solvent bank in the City of Mitchell, S. D., in the sum of five per cent of the amount of bid, to insure the signing of the contract and the furnishing of a proper and acceptable bond in the amount of forty per cent of the contract price within ten days from the time of notification of the award of the contract.

The City Council, reserves the right to reject any or all bids or to reject either part of the proposal or bid.

By order of the City Council. Dated at Mitchell this 10th day of April, 1912.

N. H. JENSEN,
City Auditor.

WANTED

[illegible] $6.00 per day [illegible]

P. S. TROWBRIDGE
1337 So. Kingshighway ST. LOUIS, MO.

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(Without Moving Parts)
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CALLS FOR BIDS

[illegible]

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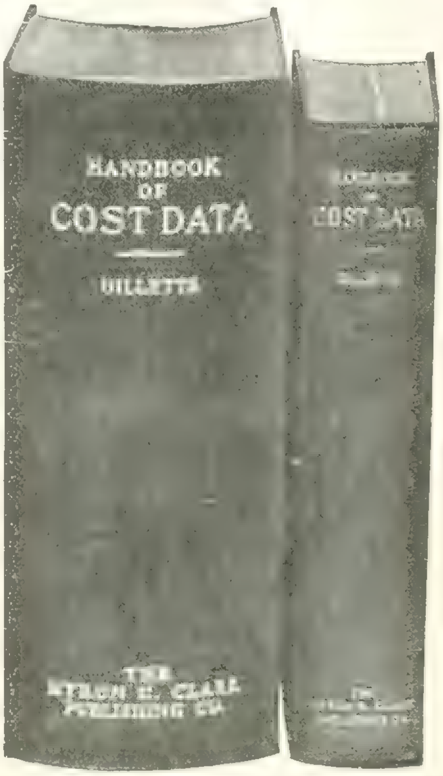

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ond-class matter, April 17, 1907, at the Post Office at Chicago, Illinois, under act of March 3d, 1879. Copyright, 1911, by the Myron C. Clark Publishing Co.

s of Engineering Articles nd Their Reason.

[illegible] for contributions. It compre- ntials of the ideal engineering ther ideals the ideal in article difficult to reach. Contribu- hat was done, describing the and their purpose, are plenti- which describe in a gen- construction methods are ommon. In fact no diffi- editor until he attempts to why one design instead of struction method instead of [illegible] or a cost analysis of the work.

[illegible] section of this issue we ation from a valued sub- izes with more than usual er of the articles in engi- It will be noted that the r in his remarks merely to vspapers, but includes so- proceedings. The faults common in greater or less ls, in all engineering peri- This is without question icates a fact which the engi- nows well but which the read- ke this does not often realize.

[illegible] be induced only with difficulty ns for a particular design hod or to give evidence of ncy of his labor. He will did but he will not tell t or what it cost.

ain that we know the rea- It should not be the fact. lack of effort or of under- t of editors who seek arti- that it is the fact. Neither s fail to realize that it is real deficiency in engineer- he engineers who described the concrete conduits referred to by our correspondent and did not give the coefficients of friction and other design factors certainly were not ignorant of the vital value of such information. Why then were these data not made known? Why are not similar data always made known instead of being quite commonly omitted?

There are various conceivable reasons. One of them is the notion that the statement of such data verges perhaps on triviality. Another is that the statement may offer a handle for criticism or censure. In the matter, for example, of the coefficients of friction just mentioned, the designer assumes that the figure is standard and well known and, therefore, is unnecessary to specify, or he has deduced and used a figure of the justification of which he is uncertain and which, therefore, to avoid criticism, he suppresses. These may not seem to be forceful reasons, but there is no doubt that they are very often the only reasons why certain classes of data are omitted from engineers' descriptions of design and construction. Editors of engineering journals have to combat them frequently and often unsuccessfully. Obviously neither reason has scientific justification. If the constants or formula employed are standard the statement of this fact establishes the validity of the design and makes the information given precise and complete. If these factors are not standard then both they and their derivation should be stated so that the science of design may be advanced by proof of their correctness if they are correct or by demonstration of their error if they are erroneous.

It is most likely to be the novice in the profession who is most influenced by the reasons just cited. The experienced enquirer fails in detail explanation for another reason. By his experience he is familiar with many means and methods and they have all become commonplace to him. Therefore, he passes them by as having no interest as a part of an account of an engineering work. It is from the experienced engineer that the editor receives the most general of the general descriptions that are published in engineering journals. We have no license, perhaps, to expect that the old trained engineer shall in his written article elaborate the minutae of design and construction, but we may expect that he shall present broadly the design and construction economics of his problem and its solution. To say that "careful study of the conditions showed the design or construction adopted to be the most economical and efficient of several possible ones" falls lamentably short of completeness. It is, however, a wearisomely familiar statement to editors. Obviously if the design adopted was the most economical the facts of real importance to engineers are, why was it so and how was this determined?

Another reason for lack of essential data in engineering articles is the fear of giving away some secret of value. This feeling is naturally most common among contractors, and it is held most strongly with respect to costs. Most of our readers know the stock arguments against disclosing cost data, and we have often exposed their fallacy, therefore, we shall not consider them here. The fact is, however, that this charletan-like reluctance to disclose secrets of the trade prevents many engineering articles from being of greatest value, and the editor must take what he can get and not what he would like. So far, too, as cost data are concerned engineering articles frequently lack them because neither the engineer nor the contractor know, except possibly in round total, what the work has cost.

One might easily continue listing reasons why engineering articles are faulty in the respects mentioned by our correspondent, but sufficient has been said to indicate that the main reason is the engineer himself. The engineer as a writer does not write what the engineer as a reader most wants to read.

Institutional Sewage Purification Plants.

Works for the purification of domestic sewage may be divided, with reference to their application, into three general classes, namely, residential, institutional and municipal. The problems of design and operation of the first and third classes have been discussed thoroughly in this journal during the past year. In this issue an article is published on the design of institutional sewage purification plants. The article was arranged for in compliance with requests by readers for information along this line.

The general problem of institutional plant design is considered, and special reference is made to a specific installation in Ohio. The complete plans of the plant selected as a typical installation are given in considerable detail. The problems of operation are discussed, and the desirability of simple operating conditions, and competent and regular supervision of operation for this class of plants, is emphasized strongly. Data on the rate of flow into plants at all hours of the day and night are given. Da
variation in the flow for the d
and the construction cost pe
are given. The study in de
serve as a guide to engineers,
with residential and municipa
when called upon to design
plant.

GENERAL ARTICLES

Tests to Determine the Value of Concrete as Reinforcement for Structural Steel Columns.

In reinforced concrete building construction columns form an important element, and in the case of very high or very heavily loaded buildings the size of the columns and the space they occupy become important considerations. Various types of reinforced columns are in use. Columns with longitudinal reinforcement and hooped columns are common. During the past few years designers have used structural steel columns encased in concrete. Sometimes the structural steel shapes form a relatively small proportion of the column section and are considered as reinforcement for the concrete. In other designs the amount of steel is much larger and the structural shapes will carry a large proportion of the load, so that the column instead of being a reinforced concrete column is really a steel column reinforced with the concrete in which it is embedded. Such columns may occupy less space than the reinforced concrete column as usually designed.

Two points of view seem to exist with reference to columns having a large percentage of structural steel: (a) that the concrete surrounding the steel simply affords protection from fire and corrosion and that the additional strength afforded by the concrete is not considerable in amount and is not available for design, and (b) that if the concrete be present it must act in unison with the steel and that its strengthening effect and its effect upon the permissible deformation of the column should be taken into account. The present building codes either directly or through the relation of stresses allowed, virtually occupy the first position when the steel column forms more than 8 per cent of the column section.

A series of tests planned to throw light on the action of columns formed of structural steel shapes by filling the space between the shapes with concrete or encasing them in concrete as exemplified in a form of column section which has been used in reinforced concrete building construction, is described in Bulletin No. 56 of the University of Illinois Experiment Station. The bulletin was prepared by A. N. Talbot and A. R. Lord. The results recorded in the bulletin will be helpful in discussing the fundamental principles underlying the design of such columns. A general description of the columns tested and the conclusions based on the tests is given herewith.

The investigation was planned with the view of securing information on the following principal points for the section and type of column tested: (1) The effect of length and slenderness on the strength of the plain steel columns; (2) the effect of length upon the strength of similar columns made up with a core of concrete; (3) the effect of richness of concrete in the core filling upon the strength of the column; (4) the effect of adding an exterior coat around the steel section upon the strength of the column, and the action of this coat under load; (5) the effect of spiral hooping upon the strength and stress deformations of the column.

The tests were planned in an effort to obtain the most information on these points with the 32 columns available for the tests. The results may not be applicable to sections or types of columns which differ from the form used.

[illegible]

The structural steel columns used were of the Gray type and were composed of eight angles, 3x2½x5/16 in., tied at intervals of 16 ins. by 5½x¼ in. plates, as shown in Fig. 1. This type of column has been used in the construction of reinforced concrete buildings and has proved very satisfactory. The size of angles, radii of gyration, dimensions of tie plates, slenderness ratio of the flanges between tie plates, radius of gyration of column and slenderness ratio of columns give relations which are in many ways comparable to column sections which have been used in reinforced concrete building construction.

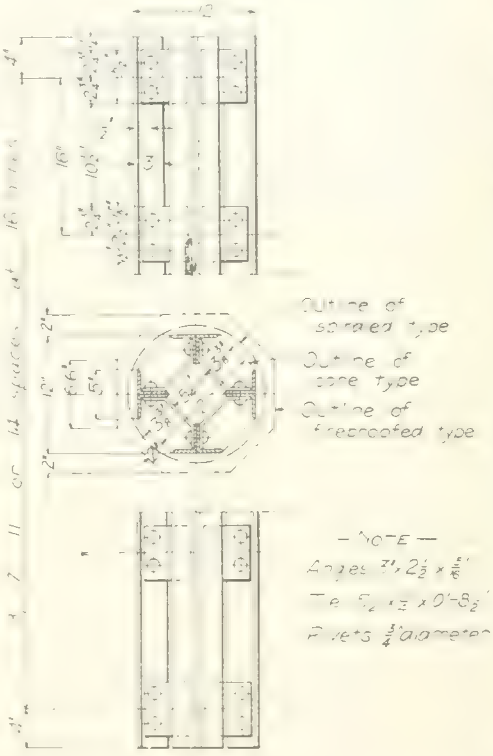


Fig. 1—Details of Test Columns.

The method of fabricating these columns was in no sense unusual. The ends, although milled, did not present a true bearing as they were received in the laboratory. The steel was open hearth structural steel. Tension tests of 1½x5/16x18 in. specimens cut from an untested flange gave an ultimate strength of 62,000 lbs. per sq. in. and a yield point of 39,800 lbs. per sq. in. The ultimate compressive strength of flanges composed of two 3x2½x5/16 in. angles riveted back to back averaged 39,700 lbs. per sq. in. for two specimens 32 ins. long, and 33,200 lbs. per sq. in. for two specimens 7 ft. 10 ins. long.

[illegible]

Ten steel columns were tested without concrete reinforcement; these columns are called "plain steel columns" in the schedule and in the discussion. For studying the effect of concrete in connection with the steel, the space inclosed within the outli
tural shapes, as shown in Fi
with concrete. This combinat
shapes and concrete will be t
type of column." It was adop
cipal form of test piece bec
lieved wisest to obtain the lar
data with the section which i
be the effective section in de
poses of comparison three colu
with 2 ins. of concrete outside
Fig. 1, and the action of this
load was studied. This comb
and concrete is here termed
type." The effect of richness o
the strength of the core type
the testing of columns w
1:3—6 mixtures in additi
mixture. In six columns th
closed within a wire spiral
filled with concrete to the ou
spiral. The spirals were 14 i
were of ¼-in. steel wire with
and 1 ins. respectively, th
spiral reinforcement used bein
The percentage of the structu
in terms of the whole column
ing 10.8 per cent for the core t
for the fireproofed type and
the spiraled columns.

SUMMARY

The columns tested were o
frequently used in building co
percentage of steel used (area
10.8 per cent of the area of
closing the structural shapes)
range used in building constru
clusions given in the discussio
properties of columns which
and sections of the columns te
tions in proportions of meta
may give somewhat different
tests, however, may be expecte
on the properties of columns o
eral type within the limits of
The principal conclusions foun
sion are as follows:

1. The maximum load carri
steel columns is expressed by
[illegible]
ratio of length of column to
tion of the section of the steel

2. Earlier in the test the
upon load carried at a given u
was less proportionate
[illegible]
pared with 155 in the equation
load.

3. The load-deformation di
from a straight line at loads
maximum.

4. In the concreted colum
type the effect of length up
column was almost identical w
in the tests of plain steel colu
words the stress taken by the c
considered to be nearly inde
slenderness ratio of the colu
limits of the lengths tested,
taken by the steel may be co
the same as that taken by a pla
of the same slenderness ratio

tests the concreted columns of showed considerable toughness. [illegible] ral deflection. The final failure [illegible]

The discussion shows that the he columns was less strong than of the cubes and less stiff than of the cylinders.

[illegible] ithin the spiral is approximately trength of concrete of the cylin- nd to two-thirds of the strength 6-in. cubes.

[illegible] f the steel column to that of the under the assumptions used in are much larger than are com- in reinforced concrete design. or use in designing are suggest-

for design which seems rational e the strength of the steel col- e of the column formula for the

el column and then to consider

f the core section (without ref- ength of the column for any or- ratio, say a length of 15 diame- a stress value proportional to f the plain concrete, say two- ube strength. A suitable factor ld of course be somewhere ap-

[illegible] n had a shell of concrete out- the concrete shell remained in- formation was reached as great ped at the maximum load in e core type. This integrity of deformations indicates that the shell need not impose any re- the working stresses available nd for the core concrete. Of re good reasons for the use of like wire mesh or spiral for ll securely in place.

ussion indicates that the stress concrete of the shell is only that carried by the core con- wer strength is not objection- shell is not considered in de-

on of the spiraled columns in- spiral has little effect up to a d load corresponding to the for an unspiraled column. Be- the column compresses rapidly e of the spiral adds materially of the column. The tests do [illegible]

of the large shortening neces- e added strength due to spiral- nd the general toughness of core type, it would seem that nstruction the use of a large iral reinforcement in columns uctural shapes and concrete is [illegible] moderate spiral may e of somewhat higher unit adds to the toughness of the ges a possible higher ultimate will also serve to tie the concrete of the shell together securely and protect it from accident, but it does not seem best to consider this spiral directly in the computations for strength of column.

13. The columns tested possess the qualities of a good structural member and seem well adapted to more general use in building construction.

These comments are made on the assumption that the concrete is placed in as workmanlike a manner as is obtainable in the construction of high grade work in columns rein- [illegible] and spirals.

AGE STRENGTH OF SPECI- VALUES OF n.

en in pounds per square inch.)
ssive Strength.

Cylinder	Column concrete	[illegible]	[illegible]
[illegible]	[illegible]	36	35
1,150	1,050	35	
1,300	1,450	23	25
[illegible]	2,125	16	16

A Metal Diaphragm for Making Water-Tight Joints in Concrete.

Leakage through concrete walls is especially likely to occur at construction or other joints where fresh concrete has been joined to concrete already hardened. One of the most successful experiments for avoiding such leaks is to embed a sheet of metal across the joints. In the accompanying sketch we show a special design for such a diaphragm. As will be seen, the edges of the plates are flanged so as to give it a firm bond with the concrete. This bond is further increased by the V-shaped crimp along the middle of the plate, and this crimp also gives the plate stiffness flatwise and allows a widening of stretch edgewise in case of any opening apart of the joining faces of concrete. The form shown is one only of several forms made by the Water-Tight Cement Binding Co., 261 Broadway, New York, N. Y.

Diaphragm for Making Water Tight Joints in Concrete.

Cost of Concrete Caisson Dock Foundations.

The following cost data apply to the construction of the open caisson foundations for the Panama R. R. dock at Balboa. A description of the dock and of the methods of construction was published in our issue of Jan. 17, 1912. The cost data available at this time apply to the foundations only. Data for the superstructure work will be published in a future issue.

The caissons consisted of sections of concrete pipe 8 ft. in diameter and 12 ins. thick sunk to 60 or 70 ft. below sea level and fill with concrete. The total penetration of the piers for which these data are given, amounted to 902.77 lin. ft. The total hours at work were 2107.5. The following are the unit costs:

[illegible]	Cu. [illegible]	Unit [illegible]
Excavation by hand..........	1,223	$5.3800
Excavation by orange peel...	2,846	.6935
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Division expense	4,069	.1977
Total excavation..........	4,069	$3.3621

Concrete substructure, 558 cu. yds.:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Large rock	.1535
Mixing	[illegible]
[illegible]	[illegible]
Reinforcements	41.2153
Division expense	1.5498
Total	$62.2045

Cost of Removing Stumps by Blasting.

Two separate lots of stumps were blown out at London, Ky., by the Agricultural Experiment Station of the University of Kentucky during 1911. The first lot consisted of 102 stumps averaging 16 ins. in diameter. Most of these were dead oak. There were only seven stumps which were green. The time required for one man to do the work was five days or at the rate of about ½ hour per stump. Fifty per cent dynamite was used at the rate of 2.6 sticks per stump, or 265 sticks for the 102 stumps. The costs follow:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

The above work covered an area of six acres.

A second lot of stumps was taken from the Experiment Station farm and consisted of nine green stumps and seven dead ones. The average diameter of the green stumps was 22 ins. and the time required was 18½ hours for two men. The smallest stump was 7 ins. in diameter and the largest 48 ins. The amount of dynamite used was 93 sticks, or an average [illegible]

Two men at $2.75 per day, 18½ hours......	$ 5.08
[illegible]	8.38
[illegible]	0.60
Total	$14.06
[illegible]	[illegible]

There were three large stumps in this list, however, which averaged 45 ins. in diameter. As these required a large percentage of the labor and dynamite it would be of interest to show what these cost separately. These stumps were 45, 48 and 43 ins. in diameter and required 21, 25 and 24 sticks of dynamite, respectively. The cost of the dynamite for these was $6.70, the labor was $3.85, or a total of $3.52 per stump.

The amount of dynamite necessary to blow stumps seems to vary directly with the square of the diameter or, in other words, with the area of the stump section. The cost of blowing green stumps is from two and one-half to three times as great as for dead ones.

Some Faults of Engineering Articles.

Sirs:—It seems to me that the tendency of the contributors to engineering periodicals is too much toward general descriptions of work, with too little stress laid upon the features which make one piece of work differ from many others of similar nature or upon the features which presented special difficulties and how these problems were overcome. Of course, general descriptions are necessary for the proper understanding of any problem and also necessary that we may know exactly what is being done in the engineering world, but at the same time the subject matter above mentioned should not be omitted. By way of illustrating my point, will add that recently in connection with the design of a reinforced concrete conduit for a water power plant, I carefully searched through all the numbers of "Engineering & Contracting," "Engineering News" and "Engineering Record," which I had with me in Cuba, in the hope of finding some data on the subject of coefficients of friction in concrete pipes. I found considerable literature concerning pipes of various descriptions but nothing concerning coefficients, and I was obliged to fall back on text-book data; good data, to be sure, but better if supported by actual tests of works in operation. I believe that an article should state what coefficients were selected for the design; if a particular section was chosen, what were the reasons which determined that shape of section; if any particular type of machinery was selected, why; if any particular difficulties were encountered, how were they overcome, etc. And after any work is completed, if possible, it should be tested and the results of the test compared carefully with the figures used in the design. These remarks apply not only to hydraulic designs but to all classes. It is the [illegible] One gains little but superficial knowledge of engineering by going to see the completed [illegible]

I do not mean to infer that there are no ar- [illegible] perhaps [illegible] that among the vast number of articles their percentage is small. I do not have reference to any particular engineering periodical, only engineering literature in general. I believe that the subject which I have outlined here is the aim of "Engineering & Contracting" and that it comes as near to the mark as any neering periodicals.

I thank you for the opportuni my ideas on this subject.

Very sincerely,

Sagua La Grande, Cuba.

EARTH AND ROCK SECTION

Methods and Costs of Constructing Two Rock Tunnels Under the Erie Canal for the Buffalo, N. Y., Water Works.

[illegible]

[illegible]

The cost data for the work is given in the five tables following. This includes the cost of excavating the original section of the Porter Avenue Tunnel, the cost of widening that tunnel to its full section as described, the cost of excavation of the Jersey Street Tunnel, the cost of concreting both tunnels and the cost of excavating the shafts. The data follow:

TABLE I.—COST OF EXCAVATING PORTER AVE. TUNNEL, ORIGINAL SECTION.

(Progress 21 lin. ft. per 24 hours; and of section excavated 187½ sq. ft.; cubic yards per 24 hours 146.)

Excavation per shift:	Cost.
1 heading foreman	$ 5.00
5 drill runners at $3	15.00
5 helpers at $2.25	11.25
1 nipper	2.25
1 muck foreman	3.00
14 muckers at $2.00	28.00
1 bottom signal man	2.00
Total per shift	$ 66.50
Total per 24 hours (three shifts)	$199.50
Disposal per shift:	
1 top signal man	$ 2.00
2 dumpers at $1.75	3.50
2 men at dump at $1.75	3.50
4 teams at $6	24.00
Total per shift	$ 33.00
Total per 24 hours (three shifts)	$ 99.00
Grand total	$298.50

Summary.

Item	Per cu. yd.
Excavation	$1.36
Disposal	.68
Powder 2¾ lbs. per cu. yd. at 14 cts.	.39
Exploders and wire	.04
Total	$2.47

TABLE II.—COST OF WIDENING PORTER AVE. TUNNEL FROM 15 FT. TO 20 FT.

(Progress 42 lin. ft. per day; and excavated 62½ sq. ft.; cubic yards per 24 hours 97.)

Excavation per shift:	Cost.
1 heading foreman	$ 5.00
4 drill runners at $3	12.00
4 helpers at $2.25	9.00
1 nipper	2.25
1 muck foreman	3.00
10 muckers at $2	20.00
1 bottom signal man	2.00
Total per shift	$ 53.25
Total per 24 hours (three shifts)	$159.75
Disposal per shift:	
(Same as in Table I.)	
Total per 24 hours (three shifts)	$ 99.00
Grand total	$258.75

Summary.

Item.	Per cu. yd.
Excavation	$1.64
Disposal	1.02
Powder 2 lbs. at 14 cts.	.28
Exploders, wire, etc.	.03
Total	$2.97

TABLE III.—COST OF EXCAVATING JERSEY ST. TUNNEL.

(Progress 18 lin. ft. per day; area excavated 187½ sq. yds.; cubic yards per 24 hours, 121.)

Excavation per day:	Cost.
Same as at Porter ave., Table I	$199.50
Disposal per day:	
Same as at Porter ave., Table I	99.00
Total	$298.50

Summary.

Item.	Per cu. yd.
Excavation	$1.65
Disposal	.82
3 lbs. powder at 14 cts.	.42
Exploders, wire, etc.	.04
Total	$2.93

The cost of widening this tunnel from 15 to 20 ft. was $2.97 per cubic yard.

TABLE IV.—COST OF CONCRETING IN TUNNELS.

([illegible])

Mixing:	Total.	Per cu. yd.
1 foreman	$ 3.00	
6 men at $1.75	10.50	.....
2 mixer men at $2.00	4.00	
Total per shift	$ 17.50	
Total per 24 hours (3 shifts)	$ 52.50	$0.847
Placing:		
1 foreman	$ 3.00	
8 laborers at $2.00	16.00	
2 car pushers at $2.00	4.00	
Total (one shift)	$ 23.00	
Total per 24 hours (3 shifts)	$ 69.00	$1.113
Forms:		
Boss carpenter	$ 4.00	
8 carpenters at $2.80	22.40	
Total (one shift only)	$ 26.40	$0.426
Grand total	$147.90	$2.39

TABLE V.—COST OF CONCRETING IN SHAFTS.

(Progress 12 ft. per day; area 66 sq. ft.; yardage 29 cu. yds.)

Mixing:	Cost.
1 foreman	$ 3.00
6 laborers at $1.75	10.50
2 mixer men at $2.00	4.00
Total one shift	$ 17.50
Total (two shifts) per day	$ 35.00
Placing:	
1 foreman	$ 3.00
8 laborers at $2.00	16.00
Total (one shift)	$ 19.00
Total (two shifts) per day	$ 38.00
Forms:	
Boss carpenter	$ 4.00
8 carpenters at $2.80	22.40
One shift only	$ 26.40
Grand total	$ 99.40
Total per cu. yd.	$ 3.43

Summer School of Engineering.—Announcement is made of the twelfth annual six-weeks' summer school of the College of Engineering of the University of Wisconsin, which opens on June 24, 1912. Courses of instruction and laboratory practice are offered in electrical, hydraulic, steam and gas engineering, mechanical drawing, applied mechanics, testing of materials, machine design, shopwork and surveying, in addition to which subjects may be taken in the college of letters and science. A bulletin may be secured from F. E. Turneaure, University of Wisconsin, Madison, Wis.

Methods of Making a 220,0 Cu. Y Blast in a Sandstone Q rry

A successful blast which lo cu. yds. of sandstone at Quarry Hercules Sandstone Co., Teni ton, was fired on Feb. 17, 1912 the quarry, as shown in Fig deep and 500 ft. across. At th sitions shown and at a dista between their centers, coyote ho ing a section of 3½x4 ft., wer driven at right angles to the the major axis of the deposit. T were of the same section. was driven in 150 ft., and at 5 cross cuts, varying in length bu 259 ft., were driven. Tunnel ft. long and the total of the

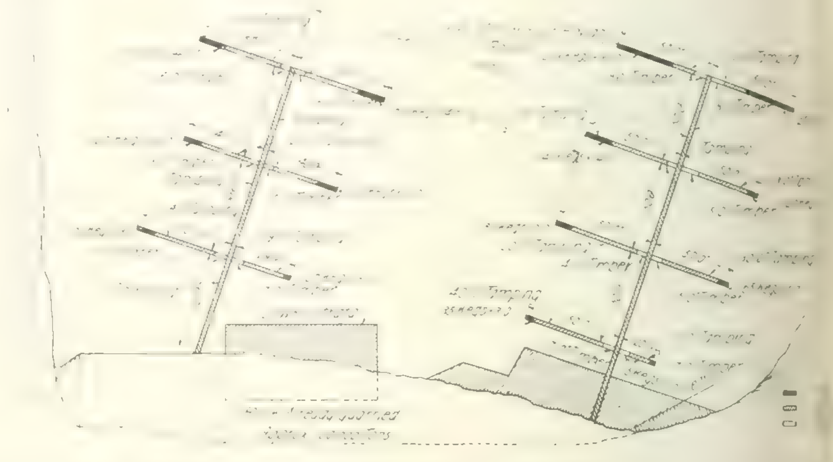


Fig. 1. Plan Showing Tunnels and Loading for 220,000 Cu. Yd. Blast, Herc stone Co. Quarry, Ferrino, Wash.

350 ft. The total length of the was 945 ft. The driving began 1911, and was completed Feb. 16 nel No. 2 was 1½ ft. higher than No. 1. The latter follo ding plane of slate to the former left it at the 50-ft tinued the balance of the distan the sandstone. The presence bed to the end of No. 1, no do in a large measure for the disturbance of the rock on the ing side of the quarry. The tunnel were completed at practic level.

In driving the cross cuts spe was given the presence of joint tered and they were avoided in

Powder Charges.—The total p consisted of 1,724 kegs, or 43,10 Pont's black blasting powder of "Hercules" 60 per cent nitrogl mite. The exact quantities of charged at the ends of the cuts are given on the sketch. shown by the figures given, the pied by each charge.

In arranging the charges, the der was left in the original p bung of every fifth keg being lef kegs were laid and packed in some placed upright and some on the center of each charge of bl rcules," the equivalent of 1 50 lbs. of the former, was ed, as the wiring connections

onsisted, first of of 15 bags aid up against the kegs of ick was shoveled in until s filled to within 6 ft. of The third feature of the placing and wedging of the is connection it should be ross cuts in every instance pposite directions from the e drifts. From where the -in. ties were taken and cut s to lay at right angles to the cross cut. These short se and completed the fill of aving just enough distance site openings of the cross e use of full length ties to he muck tamping in each up to the cross cuts, the layers at right angles to the

ends of each layer ıst the short ties in the cut. tamped from the last cross ıths with muck, excepting ortland cement which were with a cambering of [illegible]

the powder under Mr. R. E. I. Du Pont de Nemours in the morning of Feb. ed at 5:50 a. m., Feb. 17. ours each were worked.

system of wiring was and the circuits were made g through No. 6 "Victor" There were 14 charges in each, 14 to a circuit, or exploder carried 30 ft. of nd contained 15.32 grains ury. The resistance of e ohms.

circuits were laid to- ough made of a 2¼x4- with a groove 1¼ ins. ires were placed in this rotected by a batten laid d to the scantling.

wires connections were insulated, 20-gage copper rried to the mouth of the connections were made with unning out to the battery. re tested by a galvan-

complete the next step the battery. This was one Du Pont's No. 4 "push down reliables," good for 45 exploders and consisted of a magneto with rack bar. In making the test a special rheostat designed with variable resistance from 5 to 60 exploders was used up to its limit with exploders attached. Next the lead wires and battery were carried out into an open field on a line at right angles to the face of the quarry and the battery established at approximately 1,200 ft. distant.

Taking 220,000 cu. yds. as the estimated amount of the rock disturbed by the blast, figuring the stone at 160 lbs. to the cu. ft., this tonnage of rock amounts to 475,200. The powder charge was 43,100 lbs., an equivalent to a trifle more than 11 tons of rock to 1 lb. of powder. The powder ratio to cubic yards is 1 lb. to a little more than 4.1 yards, or, in round numbers, ¼ lb. to the yard. This was a lighter charge than the powder manufacturers recommended, and therefore the results were doubly pleasing to the quarry operators.

In the prosecution of the work three No. D24 [illegible] D24 Ingersoll-Rand hand drills, one No. 20 Sullivan hand drill and one Hardsogg wonder drill (No. 20D), were used. The hand drills were really the only ones that could be worked to an advantage in the coyote holes. These drills were furnished air from a NF-1 Ingersoll-Rand compressor.

A 20-in. track with 26-lb. rails followed the work under ground. Special cars with a low body, having a capacity for 10 cu. ft., were made by the Hercules company and used in transporting waste.

The stone is now being shipped to the Grays Harbor jetty under construction by the Government and under direct charge of Major James B. Cavanaugh, U. S. A. The Government has contracted for 375,000 cu. yds. of the rock, with an additional contingent of 20 per cent. The value of the original contract is $750,000.

The blast was planned by Messrs. H. P. Scheel and Wm. McArthur, officials of the Hercules Sandstone Co. We are indebted to Mr. Scheel for the information given above.

Summer School.

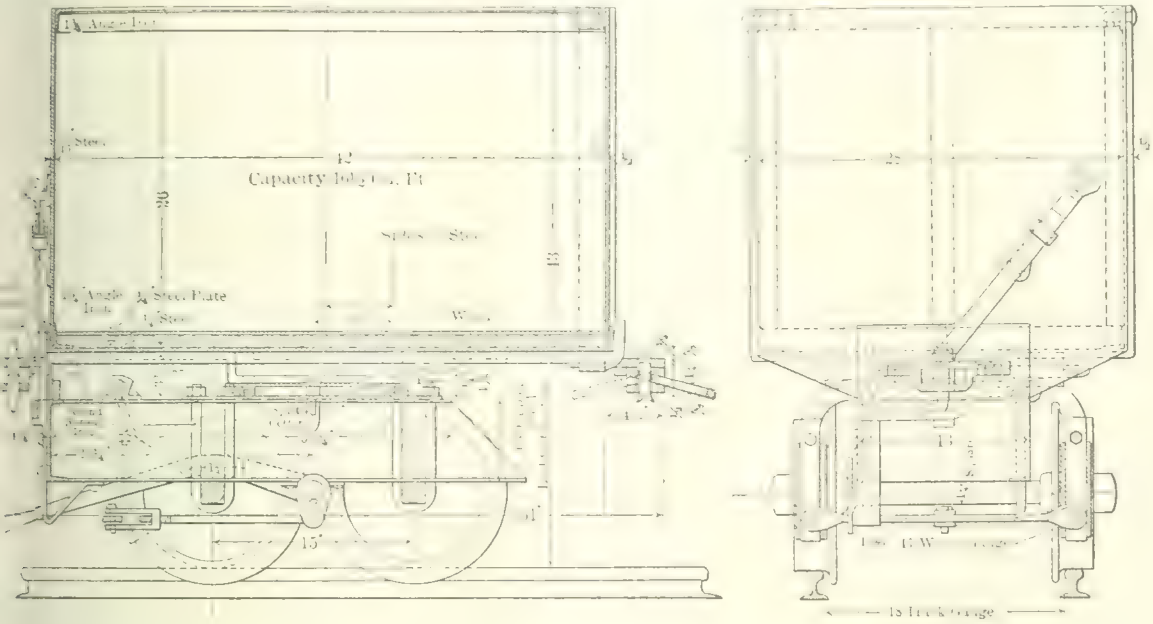
The University of Missouri School of Mines and Metallurgy at Rolla, Mo., announces the summer school session from June 3 to July 13, 1912. Courses are offered in fire assaying, qualitative and quantitative chemical analysis, metallurgy laboratory, cyaniding and cyaniding laboratory. Additional information may be had from L. E. Young, Director.

Muck Car Used in Driving the Laramie Tunnel.

The accompanying plans show the design of the muck cars used for the construction of the Laramie-Poudre tunnel. A description of the work appeared in our issue of April 10, 1912. The plans of the car as shown are given in a paper by D. W. Brunton on the tunnel construction, published in the April Bulletin of the American Institute of Mining Engineers.

In order to obtain, on completion of the tunnel, as much salvage as possible from the sale of machinery and tools, everything purchased was of the very best quality, and wherever possible standard patterns and sizes were ordered. For this reason the tunnel cars shown were of the standard mining type, fitted with brakes and equipped with turntables permitting either side or end dumping. The wheels were of the well known Cowenhoven tunnel pattern, with closed hub ends. These wheels are lubricated by filling the hub recess with non-fluid oil, forced in from a "gun" through an opening closed by a 0.25 in. pipe plug.

As the system of car handling in the tunnel headings necessitated throwing all of the cars over on their sides once, and nine-tenths of them twice, on each trip, the connections between the trucks and bodies of the cars were carefully planned and made unusually strong. The turntables were fitted with two concentric rings, and the locking mechanism for securing the bodies to the trucks was so designed that when the releasing lever was fastened in place the cars were as rigid as if the bodies were riveted to the axles.



Details of Muck Car for Laramie-Poudre Tunnel.

Data on Underground Drilling in Alaska.

The following data give the result of operation and cost of drilling in the Alaska Treadwell mine, as derived from a report of the company and published in the "Engineering and Mining Journal." The data given are for the fiscal years ending May 15, 1907, and 1911.

	1907.	1911.
Footage drilled during year....	....	920,545
Tonnage broken..................	....	1,021,765
Footage drilled per ton broken	....	0.90
Average machine shifts per day, in ore..................	36.08	39.28
Average machine shifts per day, in waste................	0.71	4.59
Average machine shift per day, total......................	36.79	43.87
Average tons broken per machine shift....................	34.21	32.74

[illegible]

Cost per machine shift:

[illegible]

Rate of drilling per machine [illegible]

[illegible] shift:

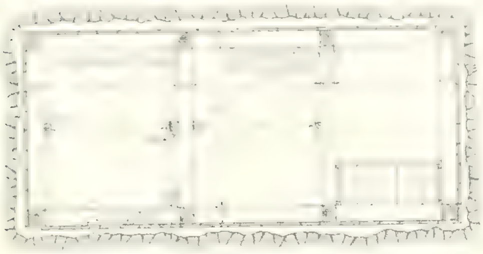


Fig. 1. Section of Construction Shaft, Rondout Pressure Tunnel, Catskill Aqueduct.

Stoping	[illegible]
Station cutting..................	4.28-28.32
Raising	[illegible]
Drifting	[illegible]

The stopes in this mine are from 50 to 60 ft. wide, which probably accounts for the high tonnage broken per foot of hole drilled.

An average of 1 ton was broken for 1.07 ft. of hole drilled. During the year 1911 no work was done in the opencut. The records for 1907 show that an average of 72.2 tons was broken and 44.31 ft. drilled per machine shift in the opencuts. Machine drillers are paid $3.50 and helpers $3.25 per day. During the year 1907 machine drillers working in the opencuts were paid $4.50 per day. The rock is of medium hardness.

Methods of Shaft Excavation in Earth at the Rondout Pressure Tunnel of the Catskill Aqueduct.

The most difficult of construction of the several tunnels comprising parts of the Catskill Aqueduct is generally agreed to be the Rondout tunnel because of its location in water bearing rock. This tunnel is 4½ miles long, and is being driven from eight shafts. The work comprises, therefore, shafts sinking in both earth and rock and tunneling in rock. We describe here from a paper by Mr. Lazarus White, Division Engineer, before the Society of Municipal Engineers of New York, the methods of work adopted in sinking shafts through earth. A second article will describe the shaft work in rock and a final article will describe the tunneling proper.

The overburden at the shafts varied from a few feet to 83 ft. In all but three places it was a stiff boulder clay or hardpan. All the construction shafts but one were sunk with the aid of ordinary timbering sets and lagging of the general type shown by Fig. 1. At three shafts, circular concrete caissons were sunk to rock; at Shafts No. 1 and No. 5 as permanent shaft lining and at Shaft No. 2, because it was found impossible to get the timbering down.

METHODS AT SHAFT NO. 1.

Shaft No. 1 could have been easily sunk to rock with timbering, but as the specifications called for all timbering to be removed to the level of ground water before placing a permanent lining, it was decided to use an open concrete caisson. To the depth of the siphon chamber, ordinary timbering was used, as this could readily be removed. Twenty-three feet below ground a steel riveted shoe was placed and concrete forms placed over it. At first by means of these forms, 25 ft. of caisson was cast. Then the center was excavated with pick and shovel and earth removed with a derrick. Gradually the caisson sank and new sections were added on top. At the beginning it sank plumb, but after a depth of 26 ft. it started to lean. This was partly remedied by digging under the high side more than under the other. No particular difficulty was met until a depth of 34 ft. was reached, when the friction on the sides became so great that the enormous weight of the caisson was insufficient to overcome it even though the cutting edges were undermined. The contractor was forbidden to soften up the sides with water or air, as proposed, for it was feared that this would cause settlement of the surface, upon which a heavy siphon chamber was to be founded. A moderate amount of water was allowed to be placed through grout holes in the concrete caisson, but finally it was necessary to load down the caisson with a box containing about 250 tons of earth.

Nevertheless, a depth of 63 ft. was reached, as originally planned, but it was found that ledge was even deeper, the indicated rock being a flat boulder. As the material was a remarkable stiff, dry and uniform boulder clay, the earth below the caisson was excavated to the required shape 20 ft. to rock. An inside form was placed and concrete deposited between it and earth. This practically founded the caisson on rock. Through grout holes on the sides, the space between the caisson and the earth was grouted. It is not believed that any settlement of the earth surrounding the caisson occurred.

As the material penetrated was absolutely uniform, dry, and stiff boulder clay, a less expensive method might have been used. It was almost too much to expect, however, that such favorable conditions could exist, as in such material sand and clay streaks often occur, and are very hard to detect in borings. The enormous friction that opposes the sinking of the concrete caisson in stiff ground, is especially to be noted. This may develop at the top of the caisson in such a manner as to leave practically all its weight suspended from one of the upper joints. This makes it necessary to have the successive sections well tied together by vertical rods. Such ties were placed at Shaft No. 1, but the neglect of this precaution at Shaft No. 5 led to almost disastrous results. It would appear from the experience of Shaft No. 1 that an open concrete caisson can hardly be sunk more than 50 or 60 ft. through stiff material with excessive friction on the sides. That is, when gravity alone is relied upon and it is not allowable to soften up the sides.

METHODS AT SHAFT NO. 2

At Shaft No. 2, the method of Shaft No. 1 was tried, but as this was only to be a construction shaft no restrictions were placed by the engineers, provided certain size cageways could be secured. The material to be penetrated is supposed to have been deposited in the bottom of a glacial lake formed by the damming up of an old stream by the advancing ice. This material is a very fine sand and clay, such as is carried by streams under glaciers and known as glacial milk. Near the bottom, the material which may properly be called quicksand has large limestone boulders deposited in it. This gives a rare combination of very fine and soft material with large boulders. The boulders, if we allow ourselves to speculate, may have been carried out into the lake by ice and dropped into its soft bottom.

An attempt was made to get down with ordinary wooden sheeting and bracing, but only a very few feet could be penetrated. Next, a few feet below the surface, a steel shoe was built in place and sections of concrete built on it. The material proved hard to dig. It was difficult for a man to stand in it and excavate with a shovel, so it proved necessary to shovel from floating boards. The caisson sank, however, very nicely and evenly, care being taken not to dig below the shoe. A feeling of confidence was given by this, and when the material was supposedly better, the shoe was undermined, being then 19 ft. below the surface of the ground. Suddenly the caisson started to drop and then appeared to take a plunge out of sight. Several men working on the bottom felt themselves raised with it. Fortunately, the caiss
ping 7½ ft. in 35 seconds, sto
top of the concrete level with
material. Had it sunk a few
would have filled up. The caiss
time in a very fine, sandy mater
saturated with water, but allov
to flow through it. It would
flat slope on being dumped, alt
to 100 horizontal.

After waiting a few days, the
gripped the sides of the caisson
a pile, and new sections were
sinking was resumed. The cutt
not be reached until the boulder
tom were struck, because the le
material in the caisson always r
feet above the cutting edge.
great deal of material flowed
ting edge from without and lar
took place. In addition, the cai
wobble and appeared to float
ooze like a huge cork, although
dreds of tons. The derrick
had to be moved back to reach

When the boulders in the sof
struck, the caisson was severa
plumb and sinking was very
boulders were blasted away, a
erected on top of the caisson a
great quantities of earth to righ
tion, to facilitate sinking, compre
blown through grout pipes in
shell. This helped very much
escape in little craters, in some
feet away from the caisson. Fi
reached and the caisson was
plumb and its center of gravit
from its original position. At
several feet out of plumb in d
tions.

Considering the ground
method was about the only one
used with much promise of su
a little cutting of the caisson
obtained for the cages, and th
served its purpose admirably ev
ing out all water, etc. It would
was rather risky to leave a
description entirely open. A
ft. from the cutting edge woul
with openings in which
placed if necessary to use compr

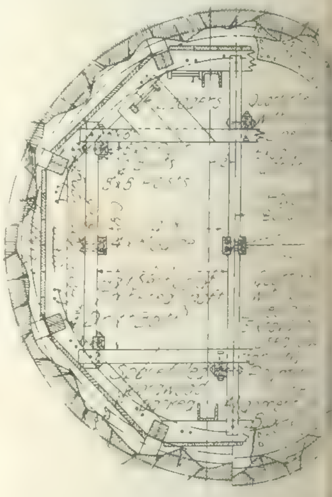


Fig. 2. Section of Permanent
out Pressure Tunnel, Catsk
duct.

Methods at Shaft No. 5—Th
terial here was found by borings
50 ft. in depth. At first, the bor
ported sand and gravel, and s
served in bottles were certainly
rial. As the rock surface here is
below the adjacent surface of Ro
it appeared to be a serious mat
rock. It was known, however, tha
ples are prone, when penetratin
terial, to wash away the clay, le
siduum of sand and gravel. A
to a depth of 15 ft. showed a com
composed of clay, sand, gravel a

ght that this material extend-
Nevertheless, it was advisable
hardpan often contains water-
sand and gravel which would
nguish in the borings. The
eer proposed to sink a drop
t is, an open concrete caisson,
e clear and 2 ft. thick, rein-
ed by horizontal bars. The
this shaft were very rigid.
to sink the shaft nearly
of the discharge pipes, etc.,
system. Also that no ground
no settlement of the surface
the necessity of founding a
mber on the earth at the top
eing very expensive or im-
ry this foundation down to

gave assurances that the dis-
is type of shaft would be
aisson could be sunk plumb
tlement of the surrounding
be kept plumb by wooden
the open timbered portion.
cient rods were to be placed
lf the weight of the caisson

nce, the contractor was al-
A very strong steel shoe
the bottom of the timbered
12 ft. below the original
s shoe was tied to the con-
el bars. About 20 ft. of
placed above the shoe, using
d exterior forms. Timber
outside of the caisson and
s of the timbered portion
edge. The sinking contin-
ten days until a depth of
, at which time the caisson
n a very hard, dry hardpan
this point, the friction be-
at it ceased to sink, even
edge was entirely under-
me, the caisson was 3 ins.
outside of the caisson was
ter and rakers were placed
It was then lowered a little
p until it was only 1 in.

n struck very stubbornly
, even when loaded with
nd with its sides lubricated
oded. Before flooding, a
the center in an effort to
ut 20 ft. below the cutting
ders was struck and above
f stratified clay. In their
wn, the contractors under-
dge several feet, and took
ial in the center. In des-
hout permission, several
were set off in the water
to fill the interior after
the cutting edge was se-
he contractors' delight, the
ft. in a very short time.
k after the caisson first
ion must have strained the
because the following day,
s going smoothly, it broke
edge burying itself $2\frac{1}{2}$
elow. Upon examination,
ich parted company were
y in line, the upper part
boulder clay and refusing
part. It was also found
ersight only one-third of
r of vertical rods were
umber specified for the
used. The two sections
ogether by cables; holes
pper and lower portions;
serted, and the gap, which
ft., was concreted. While
oft, the upper part was
rods along the sides, and
wer portion. It appeared
boulders, wedged against
f concrete, bound it fast.
eing free and practically
whole weight on a weak
ickly into the clay below.
e two portions were re-

united, rock was reached at a depth of 50 ft., the caisson then being only $1\frac{1}{2}$ in. out of plumb.

[illegible] FROM [illegible]

[illegible] ence at Shafts No. 1, No. 2 and No. 5 are as follows:

(1) Drop shafts or open caissons are only good in stiff materials or even in soft materials for about 50 ft., although by telescoping greater depths can be reached.

(2) Caissons should be very strongly tied together vertically, each joint being strong enough to carry the whole weight of the part below.

(3) Caissons should be started plumb and guided well for the first 15 or 20 ft.

(4) In very soft ground, a deck should be provided a few feet above the cutting edge, so that it can be turned into an air chamber and a moderate pressure of compressed air used.

(5) A good strong cutting edge, securely tied to the concrete above, is a great advantage.

(6) Caissons require great watchfulness and care in sinking, but once down, are admirable tops of shafts in any material, and when sunk without mishap are neither expensive nor slow.

METHODS AT SHAFTS NOS. 3, 4, 6, 7 AND 8.

Shafts No. 3 and No. 4 had to go only a few feet to reach ledge rock and ordinary timbering sufficed. The grit ledge at Shaft No. 6 was found to be covered by 27 ft. of drift. This was readily penetrated in the ordinary way with timbering.

Shaft No. 7 was situated in springy ground at the foot of a steep slope at the base of the Shawangunk Mountains. About 35 ft. of drift had to be penetrated, and when only 12 ft. down, soft clay was struck which caused settlement of the timbers. After a great deal of trouble, rock was reached, but a new set of timbers had to be placed inside the old for security.

The uptake shaft, No. 8, is to be surmounted by a large siphon chamber, whose foundations were planned to be carried down to ledge rock. The contractor, therefore, chose to sink the opening for the shaft through 43 ft. of drift large enough to include a portion of the chamber. The situation of the shaft appeared to offer difficulties, as it was started in the center of a small swamp. The shaft was started about 30 by 30 and timbered in the ordinary way, after a few feet of wet ground, hard clay and boulders were encountered. This gave opportunity to place and drive sheeting. At a depth of about 20 ft., soft ground was struck, causing considerable settlement of the sheeting, wales, etc., particularly in one corner. For a time it looked as if the whole framework would be wrecked. However, a new and more skillful superintendent was placed in charge, who built a stout horizontal frame on the bottom of the shaft, with its sides about 2 ft. from the sides of the shaft. This frame followed the excavation down, and from it small braces were run to support the bottom of the sheeting and keep it from coming in. In addition, long sheeting was given up and short planks, about 6 ft. long, were driven ahead as poling boards, in the same manner that they are used in earth tunnels. Using great care and caution, rock was finally uncovered at 43 ft. about six weeks after sinking began.

Method and Cost of Solidifying Fissured Rock by Grouting; Estacada Dam, Oregon.

Solidifying a fissured rock by the injection of cement grout which fills the cavities and hardens, has recently in several instances made successful shaft sinking and foundation construction possible. In our issue of Jan. 24, 1912, we described the methods employed in grouting fissured and chambered ledge rock for a lock foundation. A similar task of grouting fissured rock for the foundation of a concrete dam built at Estacada, Ore., for the Portland Light & Power Co., is described in a paper presented to the National Association of Cement Users by Mr. Herman V. Schreiber, of the firm of Sellers & Rippey, consulting engineers, Philadelphia, Pa. The dam built was of the Ambursen type. The following relates to the foundation grouting alone:

The general idea provided for drilling a double line of holes of an average depth of, say, 50 ft. under the heel of the dam across the entire valley to and under the shore abutments and the subsequent forcing into each of these holes of grout of such consistency as to percolate through the entire substructure and so permeate it as to solidify it throughout the length of the superstructure, thus making the foundations absolutely solid and the equivalent of a deep cut-off wall.

It was recognized that experiments would be necessary to determine the proper spacing of the grout holes and their depth, which would ensure sufficient diffusion of the grout through the varying material encountered to create a continuous impermeable barrier to prevent seepage of water from the reservoir under the hydrostatic head which would be created by the dam.

After drilling the double line of holes, the program contemplated the test of each hole with water pressure, a record being kept of the quantity escaping and the pressure applied to each hole. Upon the completion of the tests, the cement grout was to be pumped into the holes under pressure and after allowing time for hardening, a third line of holes was to be drilled midway between the first two or outer lines and tested with water pressure. The idea was that if water pressure be applied to the center holes at or slightly above the hydrostatic pressure to which this rock would be subjected by the water in the reservoir after completion of the dam and no appreciable leakage occurred, we should feel reasonably certain that the cement grout had proven effective in making the entire foundation impermeable.

Grout Pumps.—Before purchasing apparatus to handle the thin cement grout we communicated with several pump manufacturers and found that in so far as the manufacturers' guarantees were concerned we were limited to the choice of two standard makes of hand operated diaphragm pumps which would require eight men on the handles to develop a pressure of 100 lbs. per sq. in. Only one power diaphragm pump was offered but the manufacturers would assume no responsibility for its successful operation. It was found that in both this and foreign countries, plunger, diaphragm and centrifugal pumps had been successfully used, but after careful study of all the commercial pumps available it was decided that the use of compressed air would be more effective, flexible and economical than any mechanical pump.

Having eliminated the question of pumps it was found that several different types of compressed air plants were available; some being provided with different numbers and shapes of blades which were revolved in the tank for the mechanical mixing of the cement grout, while in others the grout was mixed entirely by the circulation of air. Interviews were had with a number of contractors and engineers who had had occasion to use the different types of machinery, and it was finally decided to purchase the Canniff pneumatic grout mixer and injector. This machine consists of a plate steel cylinder with a conical shaped bottom and flat plate steel top which is provided with a smaller hinged circular lid opening inwards, through which the water, cement and sand are introduced. The tank is provided with a blow-off valve on top of the lid, also an air inlet pipe tapped into the side near the top, a grout discharge pipe tapped into the bottom and a by-pass pipe between the air and grout pipes. The valves are so arranged that when the cement, sand and water are placed into the tank the compressed air is forced into the bottom of the tank through the grout pipe and, having free escape through the blow-off valve at the top, the grout is thoroughly mixed by the passage of air bubbles through it.

When it is desired to discharge the grout, the valves are so manipulated that the air is introduced near the top of the tank and the grout forced out through the bottom pipe, the pressure being limited only by the capacity of the compressor and the strength of the tank. It is possible to connect any number of these tanks onto one main grout discharge pipe, thereby insuring a continuous flow of grout, and by a proper system of pipe connections any one tank may be cut out for repairs without interfering with the operation of the remaining tanks.

Drilling.—After experimenting on the Estacada foundations with both the shot and diamond core drills, an equipment of seven Davis-Calyx shot drills were finally installed and operated night and day for a period of about one year. These drills gave a hole varying from 2⅝ to 8 ins. in diameter, depending upon the character of material.

In advance of the core drilling 3-in. wrought iron pipe casings were set to a depth of from 4 to 6 ft. in the rock and grouted, the upper ends projecting about 1 ft. above the surface and threaded to permit the attachment of the testing and grouting apparatus. While the original plan called for grouting in advance of any construction, the failure to start this portion of the work at once tended to retard the actual construction work and it therefore became necessary to construct a concrete cut-off wall 7 to 10 ft. deep and set the casing in this wall and drill the holes through the casing into the rock below where this was necessary. The cut-off wall was placed upstream from the foot of the dam and the construction of the dam superstructure was continued without interference.

Mr. Frank R. Fisher's final report as resident engineer, under whose direction the Estacada construction was completed, gives the following additional information on the methods used in the grouting:

The plan was adopted of distributing drills over a wide area and each hole drilled was tested and grouted immediately on completion before putting down any other nearby holes. In grouting, the method usually followed was to make connection between the grout tanks and the casing by means of a flexible copper hose, and introduce the grout at the top of the hole; but in order to prevent, if possible, the rapid choking of the hole with cement, which frequently occurred, the method of introducing a pipe into the hole, and discharging the grout at various depths was tried out. For this purpose a 2-in. pipe, made up in sections, was used, and the operation was started with the same inserted to within a few feet of the bottom of the hole. When the hole gave evidence of tightening with the pipe in this position, one section was detached, usually 10 ft. in length, thus raising the outlet, and the operation repeated. At intervals a charge of water was shot in, to keep the pipe from plugging, and also to loosen up the cement that settled in the hole. This method of grouting through the pipes was given a thorough trial, but so far as could be observed, it had very little advantage as to the amount of grout the hole would take, over the less laborious operation of introducing it directly at the top. The changing of the position of the pipes also interrupted the continuous flow of the grout, which it was desirable to maintain in order to accomplish the best results.

The consistency of the grout was varied to meet the different conditions, one part of cement to five of water appearing to give the best results, but the proportion tried out varied from 1 cement—2 water to 1 cement—15 water.

The grout was forced in under air pressure ranging from 50 to 200 lbs. per square inch, depending on the tightness of the hole. While it was desirable to use the higher pressure, in order to accomplish the greatest diffusion, it was not always practicable to do so, on account of it blowing out at the surface.

As the general nature of the rock has been investigated through the cores from the preliminary exploration holes, no special effort was made to preserve the same when drilling the primary holes. That from the proving holes, however, was carefully examined for any traces of grout, and while some very fair specimens of cement core were obtained, the amount was not large. This was probably due to the fact that most of the seams were small, and the cement entering therein would be
ground to powder under the ac
It is also probable that in man
the time the proving holes were
cement had not set sufficiently
the conditions arising from the
of the construction work, as w
of progress to be maintained
sary to follow on with the pro
short time after the grouting
holes

The pressure testing of the
was important and the final pla
a direct pressure from tanks lo
proposed pond water level as be
the final conditions. After t
filled a test run of ten minutes
rate of seepage per minute being
recorded. Besides testing in
several combinations were test
determine if possible the exten
communication beneath the surf
bined seepage in this was foun
erably less than the sum of the
and in some instances was only
additional refinement was intr
testing of each proving hole in
every 10 ft. in depth as it was
thereby giving an indication of
ness of the grouted cut-off wa
depths. In some instances
was found to exist between ho
far as 70 ft. apart.

The excavation of a supple
trench at one point where grou
viously been done offered excell
ty for observing its effects, as
were exposed and all of them
well caulked with cement.

The data of quantities and co
tion of the work are also of int

Labor Drilling . . . .
Grouting . . .
Repairs . . . .
Plant . . .
Cement . . . . .
Power .
Overhead . . . . . .

Total .
Less salvage . .

Total . . .

The total number of holes dri
or 34,038 lin. ft.

ROADS AND STREETS SECTI

A Proposed Method of Interpreting the Elevations of All Portions of Street Surface from the Established Grades.

Under the provisions of The Greater New York Charter the president of each borough is directed to prepare a map of the territory over which he has jurisdiction, for which a map has not been previously adopted, laying out streets, etc., and indicating the width and grades of all such streets. The methods employed for indicating the position of a street, in so far as its location affects the horizontal plane, are practically similar in the four boroughs that go to make up New York City. In the vertical plane, however, the method of indicating the grades of the streets differ in each borough, permitting of considerable variation in their treatment.

Some years ago a study of the methods for determining grades was made by Herman S. Moore, Assistant Engineer Board of Estimates and Apportionment of the city, and an attempt was made to formulate a rule for determining the elevations of the street surface from the established grade. This rule was published in the 1908 annual report of the Chief Engineer of the Board. Mr. Moore has recently made a more complete study of the subject than that previously presented, and this has resulted in some slight modifications in the original rule, but in no radical changes. In a paper presented before the Municipal Engineers of New York City, Mr. Moore gives the modified rule, and also describes its application. An abstract of Mr. Moore's paper follows:

OUTLINE OF PROPOSED METHOD

The method is based on using what is designated as either the "Curb Line Treatment" or the "Building Line Treatment."

Under the former a level platform is to be used for the area enclosed within lines joining the intersections of the curb tangents for all cases where the street grades as originally computed between established elevations are 3 per cent or less, a 2 per cent transverse sidewalk slope being used whenever practicable, the maximum rate being 6 per cent.

Under the latter treatment, the grades of all portions of streets producing transverse sidewalk slopes in excess of the maximum at any building line corner under the "Curb Line Treatment," and the grades of all streets in excess of 3 per cent as originally computed, are to be flattened within the area bounded generally by the street lines and by lines at right angles to the center lines and passing through the building line corners giving the greatest platform area and as follows: If the intersecting streets are of equal width, the grade of the one traversing the shorter block length is to be reduced one-third and that of the other two-thirds. If the streets are of unequal width, the grade of the wider street is to be reduced one-third and that of the narrower street two-thirds. From these reduced grades the elevations at the boundary of the platform are computed; similarly the elevations for the remaining streets, if any, are to be computed from the o
if not herein required to be f
all cases in which the original g
streets adjoining a building line
per cent or less, the maximum tr
walk slope is to be 6 per cent
other cases 10 per cent.

If the elevations above comp
center lines opposite the building
do not result in transverse side
excess of the maximum, they
otherwise the excess in elevation
quired to provide the maximum
moved by adjusting in direct pro
grades used in computing the el
Provision is made for varying
of the curbs with respect to th
to provide proper crowns for va
widths. The roadway of the m
street is to be graded with a long
across the intersection, but
level so far as its transverse cr
concerned. The proposed rule f

PROPOSED ORDINANCE GOVERNIN

**1. Definition of Platforms.—The
Intersection shall be deemed to b**
intersection of the cente
cases where the center lines do
**common point, when it shall be
cluded within the center lines a
section.**

The Curb Line Platform shall
comprise the area included with
**necting the points of intersectio
tangents, or in the case of a stree**
at another street it shall comp

ions of the curb lines across
d a line joining the curb

Platform for rectangular
be deemed to include the
prolongations of the build-
reets across the intersection
the greatest platform area.
than right-angled intersec-
case the area bounded by
of each street and by lines
normal to the center lines
acute-angled building line
is gives the greatest plat-
intersection of the center
the Building Line Platform
the said platform shall be
to include the said inter-
building line corner as formed
[illegible]
[illegible]

Elevations Fixing Grades.—
dicated on the map, the ele-
street intersection shall be
fixed for the point of inter-
r lines of both streets af-
nter Line Intersection.
Center Line Intersection
ersection, when it comprises
unless otherwise shown
[illegible]
[illegible] the elevations
orms herein described, the
tion referred to as a basis
deemed to be the nearest
line of each street at the
id platform.
ine Treatment.
Platform for Streets Having
grade of each of the in-
per cent or less as
lating the rate between the
the elevation of the
street within the limits of
form shall be the same as
nter Line Intersection. The
shall be determined as
aph 8. Provided, however,
n the elevation of points on
osite any building line cor-
greater transverse side-
t fixed as the maximum in
h latter event the Building
be used and the grades of
streets adjoining the said
ttened between the boun-
ng Line Platform and the
tion, as provided in Para-

Line Treatment.
atform for Streets Having
ting at an Acute-angled

any portion or portions of
adjoining a building line
ent, as calculated between
tions, or if a further flat-
orm grade is required to
alk slopes, for any part of
ribed in Paragraph 4, the
ortion or portions of each
ed between the boundaries
Platform and the Center
ollows: If the intersecting
ne width, the grade of the
shorter block length ad-
on shall be reduced one-
he street traversing the
reduced two-thirds. In
ifferent widths, the grade
hall be reduced one-third
rrower street two-thirds
nits. All grades less than
not herein required to be
plied at the same rate as
etween established eleva-
in no case shall the maxi-
sidewalk slopes fixed in
exceeded.
de over that allowed in
removed by further flat-

g of platform grades for
p grades or acute-angled
difference in elevation

[illegible] sidewalk slope [illegible] respectively, ex- [illegible] hereinbefore described, the elevation of each [illegible] Platform shall be adjusted to remove the excess, [illegible]

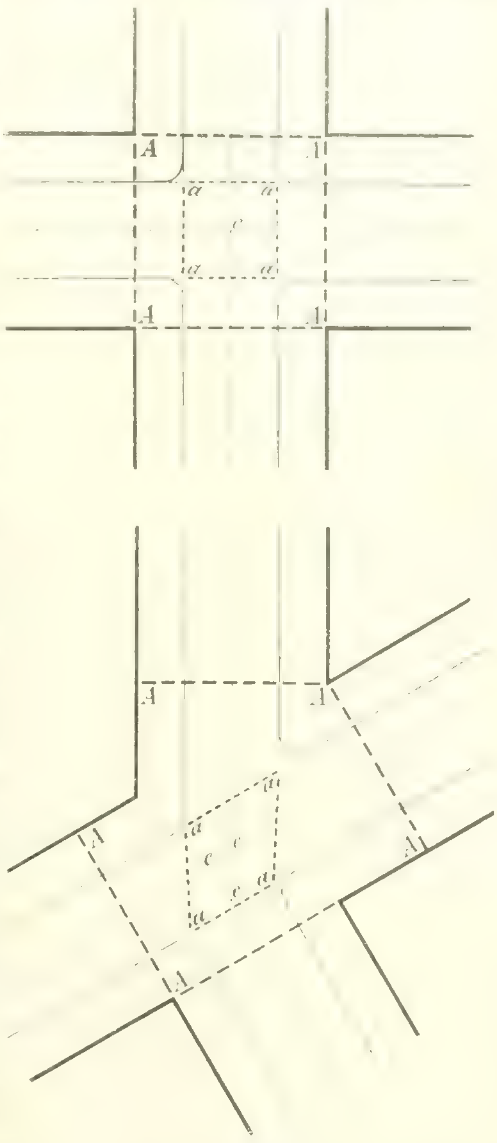


Fig. 1. Diagram Showing Parts of Street Intersections Defined in Rule

C and C' C, C, indicates Center Line Intersection.

a, a, a, a, indicates Curb Line Platform.

A A A A indicates Building Line Platform.

being directly proportional to the grade of each as originally flattened or applied.

For all cases covered by Paragraphs (a) and (b) the elevations at the intersections of the center line of each of the narrower streets or at the streets traversing the longer blocks, if they are of equal width, with the Curb Line Platform of the intersected street shall be the same as the elevation of a point on the center line of the intersected street immediately opposite the first named intersection, except that the elevation at this point shall be abandoned when the grade along the center line between the Curb Line Platform and the Building Line Platform exceeds the grade as originally computed.

The grades of the center line of the wider street or of the street traversing the shorter block, if they are of equal width, shall be uniform between the exterior boundaries of the Building Line Platform and the Center Line Intersection, except that the maximum platform slope hereinafter fixed shall not be exceeded. The grades of the center line of the narrower street or of the street traversing the longer block, if they are of equal width, shall be uniform between the elevations fixed at the exterior boundaries of the Building Line Platform and those fixed at the boundaries of the Curb Line Platform, and also between the latter point and the Center Line Intersection.

6. Maximum Platform Grades.—The maximum allowable grade along the center line between the Curb Line Platform and the Center Line Intersection shall be at the rate of 4 per cent, unless otherwise indicated on the map.

The grades along the center line between elevations established within the limits of a Building Line Platform shall be uniform, subject only to the flattening provided for in Paragraph 5 (b).

7. Transverse Sidewalk Grades.—Whenever practicable, the sidewalk shall slope upwards in a direction at right angles to the curb toward the building line at the rate of 2 per cent.

The elevation of the sidewalk at the building line corner shall be determined by applying this rate to the elevation of the curb, giving the higher building line elevation, at a point immediately opposite the corner, unless the resulting grade on the lower side exceeds 6 per cent, in which case the sidewalk shall be level on the higher side and a greater transverse sidewalk slope up to the maximum shall be used on the lower side.

The maximum transverse sidewalk slope shall be 6 per cent, except in those cases where the street grade as originally computed on any street adjoining a building line corner is more than 6 per cent, when the maximum slope shall be 10 per cent for either street, opposite the said corner. In no case shall the sidewalk at the building line be lower than that of a point immediately opposite it on the curb.

If the transverse sidewalk slope at the building line corner is more or less than 2 per cent, it shall be made to agree with this latter rate at a point distant 25 ft. from the building line corner.

8. Curb Elevations.—The relation between the elevation of the center lines and of the top of the curbs at points immediately opposite it at the boundary of and outwardly from the Building Line Platform shall be as follows: For roadway widths of 24 ft. or less the top of the curbs shall be 0.1 ft. higher than the center line. For roadway widths ranging from 24 ft. up to and including 34 ft. the top of the curbs and the center line shall be at the same elevation. For roadway widths ranging from 34 ft. up to and including 44 ft. the top of the curbs shall be 0.1 ft. lower than the center line. For roadway widths ranging from 44 ft. up to and including 54 ft. the top of the curbs shall be 0.2 ft. lower than the center line, and for roadway widths ranging from 54 ft. up to and including 64 ft. the top of the curbs shall be 0.3 ft. lower than the center line.

The elevation of the intersection of the curb tangents shall be determined from a point immediately opposite on the center line of the wider street or the street traversing the shorter block, if they are of equal width, subject, however, to the same correction in elevation between the top of the curbs and the center line as herein provided.

9. Depth of Gutters.—Whenever practicable a standard depth of gutter of 0.4 ft. shall be used.

10. Curb Grades at Corners.—The tangents in the curbs shall be graded uniformly between the elevations established for them at the boundaries of the Building Line Platform and at the intersection of the curb tangents. The curve formed in the curb joining the tangents shall follow a uniform grade between the elevations of the curb tangents at the points of curve.

11. Grades Between Platforms.—The grades of the center line and of the curbs between the elevations computed at platform intersections, or between a platform and an intermediate established elevation, shall be uniform.

METHOD OF APPLICATION OF THE RULE

The actual method of treating a street intersection as covered by Paragraphs 4 and 5, considering at first Paragraph 4, which deals with streets having a light grade as illustrated by Fig. 2, Intersection "A," follows: The elevations shown on cuts are given to the nearest tenth of a foot, scaled distances having been used, the latter being sufficiently accurate for all practical purposes. In connection with nearly all the computations to be made considerable time will be saved if a slide rule is used.

Curb Line Treatment.

Under Paragraph 4 the Curb Line Platform is to be used, subject to two general conditions. First, the grade of each of the streets forming the intersection must be 3 per cent or less; and second, the transverse sidewalk slope on the lower side opposite any building line corner must not exceed 6 per cent.

It is assumed that streets having a grade of 3 per cent or less are in general adapted to a level platform at their intersection.

For the sake of simplifying the explanation in this case, intermediate elevations have been established for both streets in each direction from the intersection.

The first step in calculating the elevations at any intersection consists of determining the rate of grade, between established elevations for each street immediately adjoining the said intersection.

The rate of grade between the elevation at the intersection of the center lines and the nearest established elevation in each direction having been computed and found to be less than 3 per cent, we make the elevation at the point of intersection of each center line with the Curb Line Platform the same as the elevation at the Center Line Intersection. This determines the elevation of the center lines within the limits of the Curb Line Platform, and the next step is to compute the final rate of grade along the center line, outwardly from the intersection, as fixed between the elevations above determined at the boundaries of the Curb Line Platform and their respective established elevations. From these last rates of grade are computed the elevations of the center line of each street opposite the building line corners, and directly opposite these points we determine the elevation of the top of the curbs as indicated in Paragraph 8.

In the case under discussion one of the streets has a width of 60 ft. and the other a width of 80 ft., with corresponding roadway widths of 30 ft. and 44 ft., respectively. According to Paragraph 8 the top of the curbs at and outwardly from the Building Line Platform in the former street are to be at the same elevation as points immediately opposite on the center line, and in the latter street 0.1 ft. lower than points immediately opposite on the center line.

Considering now the transverse sidewalk slope and the resultant elevations at the building lines we find by reference to Paragraph 7 that whenever practicable the sidewalk is to slope upwardly from the curb to the building line at the rate of 2 per cent; this rate being applied to the elevation of the curb which produces the higher elevation at the building line corner. The maximum allowable transverse sidewalk slope applicable to this case is 6 per cent.

Having calculated the elevation of each building line corner and the resultant sidewalk slope on the lower side opposite it, we find that in no case does it exceed the maximum above referred to. The result of this last operation determines finally that the elevations computed are consistent with the rule governing the Curb Line Treatment, but if the resulting rate of grade across the sidewalk opposite any building line corner had exceeded the maximum, then the elevations thus far derived would have been abandoned and the entire intersection would be subject to the Building Line Treatment. The latter part of Paragraph 7 provides that if the transverse sidewalk slope opposite any building line corner is more or less than 2 per cent, this latter rate shall be resumed at a point 25 ft. distant from the building line corner, the elevation of the building line being computed from that of the top of the curbs as indicated on the plate referred to. Paragraph 8 provides that the elevation at the intersections of the curb tangents are to be determined from the elevation of the center line of the wider street at a point immediately opposite the said intersection, subject to any correction in elevation between the center line and the curbs as provided in the paragraph of reference. The curve formed in the curb joining the tangents is to be graded uniformly between the elevations of the curb tangents at the points of curve. This last operation completes all the elevations required to properly improve the street surface and also the adjoining property.

Under practical conditions intermediate elevations within the block, as assumed for this intersection, will seldom be established, and in these cases it will be necessary to determine approximate elevations for each intersecting street at the adjacent intersections to arrive at the final rate of grade within the block, and to enable the elevations of the center line, curbs and house lines to be computed on these streets. Attention is directed to the slight increase in grade of streets within the block as finally computed. After some experience has been gained in the use of the rule, it is possible by a simple inspection of the adjoining intersections to estimate close enough for all practical purposes what the final rate within the block will be, inasmuch as this rate is only applied for the short distance from the intersection of the curb tangents t site the building line corner, of setting the curb returns secting streets.

It may be undesirable in sor have a level platform at all inte the original grade is 3 per cent treatment could be abandoned upon the map a uniform grade across the intersecting streets, its greater width or location to be more important than th sect it. Care should be exercis lishing grades in this manner tions thus imposed should c transverse sidewalk slopes, pa the streets so treated have gr of 3 per cent, or intersect the an acute angle.

Building Line Treat

The latter part of Paragraph if the resulting sidewalk slope side opposite any building line 6 per cent, the Building Line be used as a basis for com described in Paragraph 5.

Paragraph 5 also provides for grades of all streets which have than 3 per cent as originally extent of this flattening being the maximum allowable transve slope opposite the building line relative amount each street is dependent upon its width or length, and rate of grade.

In treating rectangular inter streets having a grade in cent, and acute-angled interse lower rate of grade, where there ing slope along the roadway aro ing line corner, an excessive tr walk slope is introduced on t opposite this corner. Thus, if 60-ft. streets forming a rectang tion, and having a uniformly de of 3 per cent along the curb aro ing line corner, we shall have a of grade for a distance 30 ft., from a point on the higher angles to the building line at th corresponding point on the results in a difference in elev these points of 0.9 ft. Applying cent transverse sidewalk slope on the upper side to the buildi (a distance of 15 ft.), we hav in elevation between this corner immediately opposite it on the 1.2 ft. Obviously this differenc for a 15-ft. sidewalk necessitates transverse sidewalk slope, which is excessive for streets having

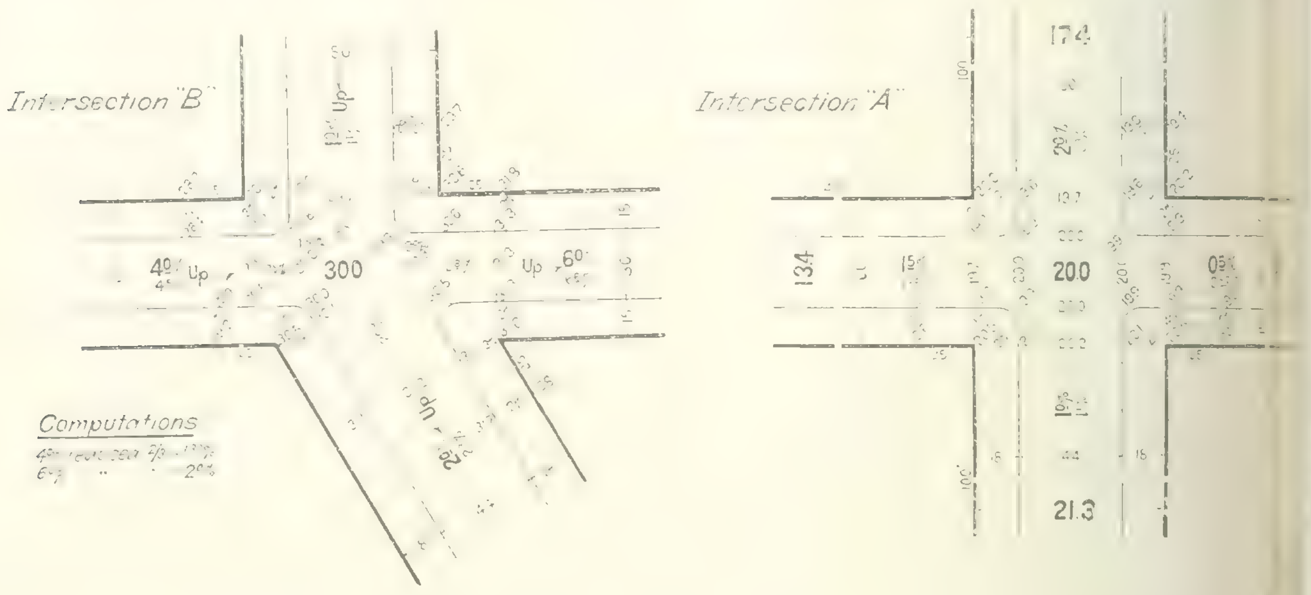


Fig. 2. Diagram Showing Method of Treating Intersection of Streets Having Light Grades.

mately 3 per cent. In order
efinite point where in a large
it will thus be necessary to
of one or all of the inter-
has been arbitrarily assumed
aving a grade in excess of 3
nally computed shall be flat-
limits of the Building Line
so the portions of all other
original conditions as deter-
b Line Treatment, previously
transverse sidewalk slopes
se fixed as the maximum in

ng tangent distances along
the limits of the Building
pposite acute-angled corners,
even with flat grades it will
ssible to use the Curb Line
n those instances where the
proximately rectangular.
n of the streets requiring a
grade at their intersections
ere are two general classes:
ctions formed by streets of
d, second, the intersections
f equal width.
be conceded that the grade
ng the greater importance
the least across the inter-
ting streets in the first class
d that their width is a fair
mportance. In the second
eets are of equal width it is
the grade of the street
rter block length the least
f the intersection, for the
luction in grade across the
in a greater increase in
horter block than an equal
the grade of the longer
in all such cases where a
ade of streets is necessary
Building Line Platform is
grade of the wider street
ted shall be reduced one-
the narrower street two-
imits of the Building Line
treets are of equal width
reet traversing the shorter
be reduced one-third, and
intersecting it two-thirds,
limits. This method of
will result in a slight flat-
tersection, and also change
so as to provide a proper
e streets, based on their

importance, if a further flattening is required to provide proper sidewalk slopes.

To illustrate the Building Line Treatment first take for example Intersection "B," Fig. 2. Computing first the rate of grade in each direction from the intersection we inspect them and find that the rate in one street exceeds 3 per cent, and therefore necessitates the use of the Building Line Platform. As the rate of grade in excess of 3 per cent in this case occurs in two instances on the narrower street, we reduce these rates two-thirds and apply the resultant rate of grade for the distance from the Center Line Intersection to the boundary of the Building Line Platform, measured along the center line of this street. This determines the elevations of the center line of the narrower street at the boundaries of the Building Line Platform. The rate of grade on the wider street is in each instance less than 3 per cent, and these grades are, therefore, not flattened, the elevation of the center line of this street at its intersection with the Building Line Platform being computed at their respective original grades. From these elevations at the boundaries of the said platform determine the elevations of the top of the curbs at points immediately opposite, allowance being made for the difference in elevation between the center line and the tops of the curbs previously described. From the elevation of the curbs producing the higher elevation at the building line corners apply a 2 per cent transverse sidewalk slope if practicable, otherwise the minimum slope on the higher side and up to the maximum of 6 per cent on the lower side. Opposite each of these corners on the lower side compute the resulting rate of grade. If it does not exceed the maximum of 6 per cent the results are proved to be consistent with the rule. Whenever practicable it is proposed to grade the wider street with a longitudinal slope across the intersection but approximately level transversely. To obtain this latter condition the elevation at the intersection of the center line of the narrower street with the Curb Line Platform of the intersected street is made the same as that of a point on the center line of the intersected street immediately opposite the first named intersection. The elevations for the intersections of the curb tangents, for the building line and for the curbs within the limits of the Building Line Platform are derived as previously described under the Curb Line Treatment.

Attention is particularly called to the fact that in intersections similar to this only the grades of the portions of the street that exceed 3 per cent are originally flattened.

In many cases no further flattening than the one just described is necessary, but when treating streets having steeper grades or meeting at a more acute angle a further adjustment is necessary which is provided for in Para[illegible]

For example, assume conditions as represented by Intersection "A," Fig. 3, of two streets, one 60 ft. and the other 80 ft. in width, intersecting at right angles, with grades in excess of 3 per cent in each direction from the intersection.

Under the rule the grades of the wider street are to be reduced one-third and those of the narrower street two-thirds. From these new rates compute the elevation of each center line at its intersection with the Building Line Platform. It should be noted that in this case two of the street grades as originally computed are more than 6 per cent, and, therefore, under Paragraph 7 of the rule a maximum transverse sidewalk slope of 10 per cent is permissible for this entire intersection. Instead of immediately proceeding to compute the elevations of the curbs and building lines considerable time will be saved by an inspection of the results already obtained to determine which corners will control the grades of the streets adjoining it. Thus it will be seen that the differences in elevation between the center lines opposite the upper right-hand and the lower left-hand building line corners are so slight that they will not provide an excessive transverse sidewalk slope at these corners. The differences between the elevations of the center lines opposite the upper left-hand and the lower right-hand building line corners, however, are so large as to indicate that even if the sidewalks are made level on the higher side that there will be a resulting slope across them on the lower side slightly less than the maximum opposite the former corner and slightly in excess of the maximum opposite the latter corner. Therefore, we first proceed to compute the elevations of the tops of the curbs and the building line at the lower right-hand corner and we find that there is a difference in elevation between the building line corner and a point immediately opposite on the lower curb of 2.3 ft., or a resulting slope across the sidewalk of 13 per cent. According to the rule this must be reduced to 10 per cent as prescribed in Paragraph 5 (*b*) by adjusting the elevations of the center lines opposite

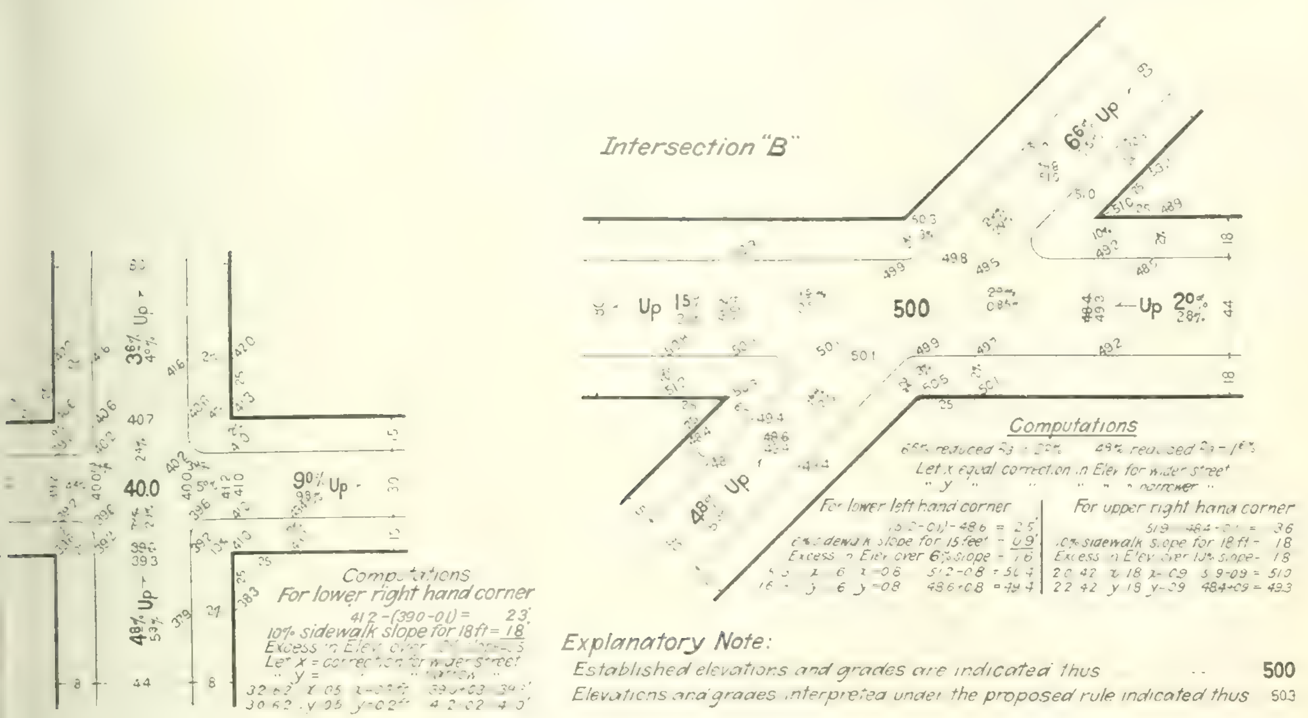

Intersection "B"
66% Up
Up 15%
500
Up 20%
48% Up
Computations
Let x equal correction in Elev for wider street
For lower left hand corner
For upper right hand corner
36% Up
40.0
90% Up
48% Up
Computations
For lower right hand corner
412 - (390 - 01) = 2.3'
10% sidewalk slope for 18 ft = 1.8'
Let x = correction for wider street
Explanatory Note:
Established elevations and grades are indicated thus 500
Elevations and grades interpreted under the proposed rule indicated thus 503

Fig. 3. Diagram Showing Method of Treating Intersection of Streets Having Steeper Grades.

this corner so as to remove the excess in elevation over that required for the 10 per cent sidewalk slope; the adjustment on each street being directly proportional to the rates of grade originally used to compute the elevations of the center lines at the boundaries of the Building Line Platform.

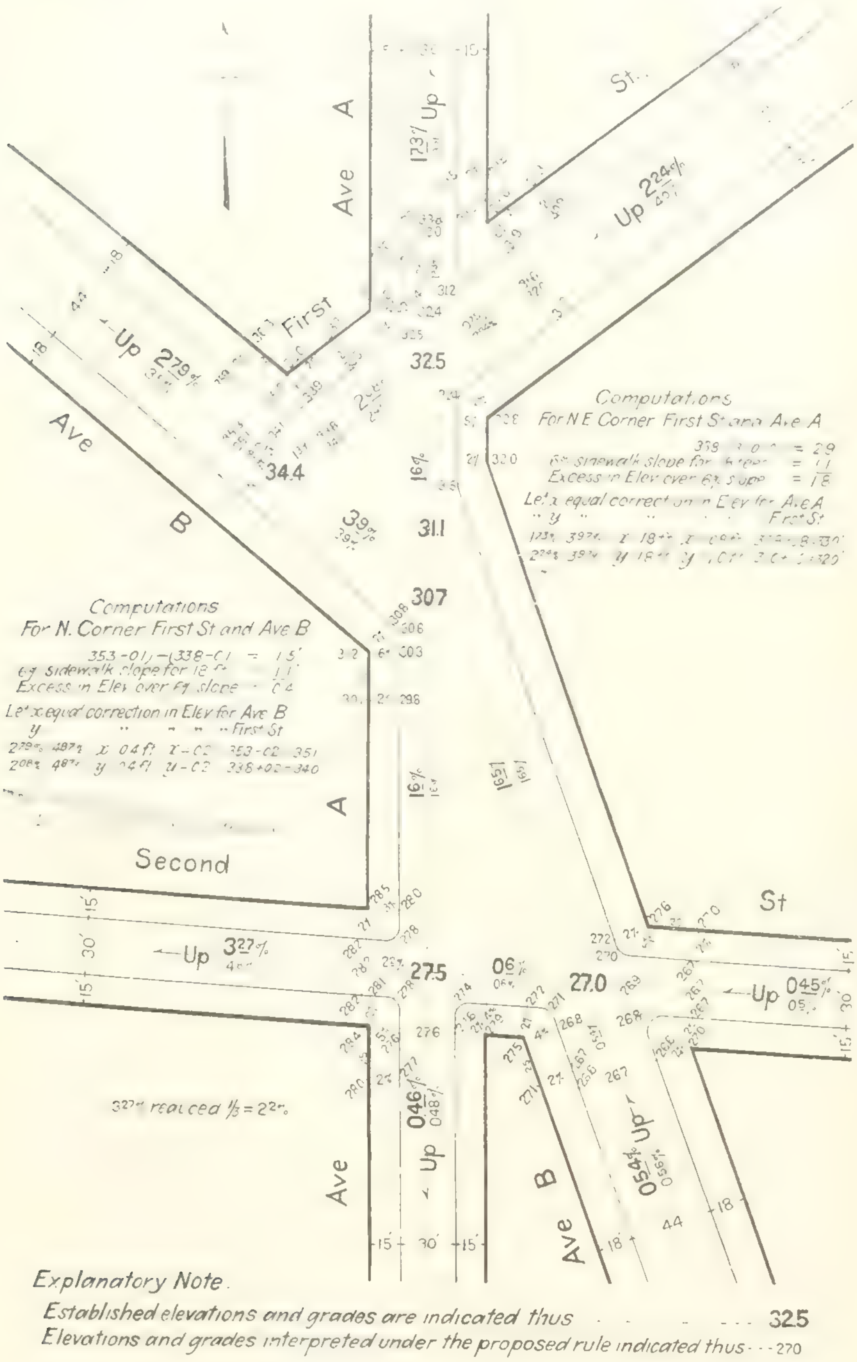

Ave A
First St
Ave B
Second St
1.23% Up
Up 2.24%
Up 2.79%
3.25
34.4
31.1
30.7
3.9%
1.6%
1.65%
Up 3.27%
27.5
0.6%
27.0
Up 0.45%
Up 0.46%
Up 0.54%
Computations
For N E Corner First St and Ave A
Excess in Elev over 6% slope = 1.8
Let x equal correction in Elev for Ave A
" y " " " " First St
Computations
For N. Corner First St and Ave B
353 - 0.1 - (338 - 0.1) = 1.5
6% sidewalk slope for 18 ft = 1.1
Excess in Elev over 6% slope = 0.4
Let x equal correction in Elev for Ave B
y " " " " First St
2.79% 4.87% x 0.4 ft x = 0.2 353 - 0.2 = 351
2.08% 4.87% y 0.4 ft y = 0.2 338 + 0.2 = 340
3.27% reduced 1/3 = 2.2%
Explanatory Note.
Established elevations and grades are indicated thus 32.5
Elevations and grades interpreted under the proposed rule indicated thus 27.0

Fig. 4. Diagram Showing Method of Treatment when Intersections are Formed by More than Two Streets.

Thus, the original grade on the wider street of 4.8 per cent reduced one-third became 3.2 per cent, similarly, the rate on the narrower street was 9 per cent, which, reduced two-thirds, became 3 per cent. The difference in elevation between points on the center lines opposite the building line corner based on these reduced grades is 2.2 ft., to which must be added 0.1 ft., the latter being the difference in elevation between the center line and the top of the curbs on the wider street, making a total of 2.3 ft. From this we deduct the equivalent of a 10 per cent slope for the sidewalk width of 18 ft. or 1.8 ft., leaving an excess in elevation over that allowable of 0.5 ft., which is to be apportioned between the two streets directly proportional to their respective grades as originally flattened, and as follows: The grade of the wider street is to the sum of the grades as the amount of adjustment for the wider street is to the total amount to be apportioned, or 3.2% : 6.2% :: x : 0.5 ft. = 0.3 ft.; similarly for the narrower street, 3.0% : [illegible] = 0.2 ft.

These results indicate that a correction of 0.3 ft. and 0.2 ft. are to be applied to the elevations computed for the wider and narrower streets, respectively, it being added to the lower elevation and subtracted from the higher one. This last operation determines the elevation for the center line of the wider street of 39.3 ft., and 41.0 ft. for the narrower street. The curb on the wider street is to be 0.1 ft. lower than the center line or at an elevation of 39.2, and on the narrower street at the same elevation as the center line or 41.0 ft. Using a level sidewalk on the higher side opposite the latter elevation fixes the elevation of the building line corner at 41.0 ft. The resulting difference in elevation on the lower side is 41.0 minus 39.2 ft., or 1.8 ft., the equivalent of a 10 per cent slope transversely across the sidewalk.

The successive steps required to complete the elevations at this intersection consist of deriving the elevations for the
ing lines at the remaining corn
elevations of the center line o
street at its intersection with
Platform the same as the elevati
ter Line Intersection; determin
f the intersection of the curb
the elevation of the center lin
street, allowance being made
tion due to the roadway width,
vide for resuming the 2 per c
sidewalk slope wherever it has
from. These results are all in
plate of reference as are also t
within the limits of the inters

Intersections "A" and "B" in
tersection "A" in Fig. 3, illustr
the treatment to be given to
classes of intersections, the o
being those intersections forme
equal width. In these latter c
traversing the shorter block le
treated identically the same as th
and the street traversing the lo
same as the narrower street, a
described.

Slight variations in the above
be necessary, consisting of a
adjustment than that previously
along the same lines, as illustrat
tion "B" in Fig. 3, representin
intersecting at an angle of 45 de

The conditions opposite each
corner is somewhat different fr
previously cited. The grades o
of the narrower street exceed 3
they are therefore reduced two-
inspection of the wider street sh
of its grades are less than 3
they are therefore not flattened
elevation of the center lines
section with the Building Line P
former case being computed fro
grades and in the latter case fr
as originally calculated. When
proceed further to remove the
walk slope the mistake should n
reducing the grades of this wi
third, but the difference in elev
the center lines opposite the acut
corners over the amount allowa
rule should be treated as an ex
moved proportional to the gr
isting along the center lines opp
corner. Otherwise the rem
are similar to those previously

The treatment to be given to
intersections formed by more th
deserves consideration on accou
plicated nature and as an illust
general procedure in these case
represented by Fig. 4 has been
the City Map as being typical
somewhat more extreme than th
street-system similar to this w
not be adaptable to other than a
level territory and no changes ha
in the elevations adopted exceptin
them as applying to the inters
center lines.

The rate of grade within the
outwardly from the intersection
computed, the next step consist
whether this case represents a
section or more than one.

The question of what constit
section under the rule might her
raised. If two or more streets int
street approximately opposite
different angles, so as to form a
lar area, or what is commonly ter
Place, this condition is interpret
common intersection comprisin
bounded by the street lines and
right angles to the center lines
through the building line corner
greatest platform area Fig 4 i
an intersection.

The value of a clear interpret
phase of the subject lies partic
fact that elevations fixed within
the Building Line Platform ar
flattened except as a final resort
excessive transverse sidewalk s
scribed in Paragraph 5 (*b*).

of the platform opposite the
ers of First Street at its inter-
Avenue A and Avenue B is
ed, but an attempt to limit the
line at right angles to a center
g through the westerly corner
nd Avenue B results in a plat-
ded by the respective lines of
indicating that the area must
secure this result. Obviously
is obtained by lines at right
espective center lines and pass-
e northwesterly corner of Sec-
Avenue A, the southeasterly
nd Street and Avenue A and
rly corner of Avenue B and
which gives the greatest pos-
area.

onstrated that the area within
venue A and Avenue B from
the northerly line of First
outherly line of Second Street
gle intersection, we find by in-
grade on the westerly portion
t exceeds 3 per cent, and there-
latform is subject to the Build-
ent.

irst the southerly intersection
and Avenue B, it will be
utherly and easterly from the
the center lines the originally
are applied, producing results
quiring no further adjustment.
rades northerly and westerly
ection require no flattening.

ction of Second Street with
eatment is practically the same
grade on the westerly portion
is reduced one-third. Atten-
o the extent of this reduction,
in a comparison between two
e amount of the flattening
d from the street traversing
from Avenue A to

on adjoining the northeasterly
e A and First Street requires
the elevations of the center
e acute-angled corner at the
calculated. The resulting
e the building line corner be-
ons thus calculated is 2.9 ft.,
deducted the equivalent of a
across the sidewalk of the
ing an excess to be removed
adjustment of 1.0 ft. on the
d 0.8 ft. on the narrower

tion of Avenue B and First
ions are somewhat different
iously described. Here the
ted for the northerly build-
m the higher curb results in
sverse sidewalk slope, where-
this case is the maximum.
ewalk slope is to be removed
e original grades, which re-
g of the grade between ele-
d within the limits of a
tform on First Street, and
condition under which simi-
be flattened, *i. e.*, as a final
n excessive transverse side-

line of Avenue B, between
irst Street, the grade orig-
3.9 per cent, which is sub-
on, due to its being within
Building Line Platform and
n no flattening is to be made
des in each direction from
the center lines of Avenue

finding the remaining ele-
described in detail for the
atment is similar to that of
tions described, but all of
shown upon the plate re-

criticism will be made in
levations for points in the
ting streets within the area
ty a warped surface, but
elevations are required for
lating the elevations of the
lines. An inspection of

numerous cases indic[illegible] generally that there [illegible]

It is believed that the proposed method will provide results agreeing very closely with the best average practice for the entire city and that few changes will be required in the present mapped elevations to make it applicable to all intersections. At the same time, it is not to be expected that any ordinance will prove to be a complete success unless some consideration is given to the provisions thereof when originally establishing the grades. This is especially necessary for complicated intersections, for streets that are designed to become important thoroughfares, requiring a uniform grade across the intersecting streets, and for streets having improvements thereon to which it is desired to conform.

Whenever it is desired to provide special treatment for any street, sufficient elevations are to be indicated upon the map to control the principal features thereof, the remaining portions only being subject to the provisions of the rule. Similarly, streets that are improved prior to the adoption of any precise method of treatment will control the intersecting streets that are subsequently improved.

Inasmuch as the center lines have been made the basis of calculation for computing grades, it will be necessary to establish an elevation at their intersection.

In defining the platforms used, no difficulty has been experienced in referring them to some definite portion of the street lines, excepting in those intersections made up wholly or in part of curved streets, and in many of these cases it will be found advisable to indicate on the map the boundaries of the platforms to be used.

Crown, Grade, Drainage and Foundation in Macadam Construction.

Some interesting information regarding practice in drainage and foundation work in road construction was brought out at the informal discussion on road construction and maintenance held under the auspices of the American Society of Civil Engineers on Jan. 19 last. The discussion was printed in the Proceedings of the society, Vol. XXXVIII, No. 4, pp. 546 to 565, from which the following notes have been taken:

Crown and Grade.—Mr. James Owen stated that his practice in crowning varied according to the location, grade, amount and character of the travel. He stated that on a country highway with a single line of travel the best practice has been to build the crown about 2 ins. higher than is ultimately desired, as the work is green to a certain extent, and if allowance is not made for the first settlement there is a likelihood of a flat surface in the center where water will collect. It has been his practice to increase the crown gradually until on a new 16 ft. road it is 5 ins. This will be compacted to about 3 or 3½ ins. In suburban towns or on roads where the travel is divided or heavy, the necessity for so great a crown is not apparent. Where there is a trolley road the crown is practically eliminated by the track in the center, and from it a slope has to be built to the gutter. That slope is of necessity reduced to a minimum, and Mr. Owen has found that in repairing roads along trolley tracks an artificial crown of about 1 in. or 1½ ins. will finally wear down to a normal slope sufficient to shed water. In considering crowning there is always the question of the grade of the road. As a rule, it must be understood that the steeper the grade the greater the crown. If there is a 10 per cent grade, with an ordinary flat crown, the tendency of the water in a heavy rainfall is to follow the grade rather than the crown, or at least to make a curve in its final discharge; but in such cases it is always better to make a rather higher crown. There is great objection to the high crown in thickly populated districts, due to the sliding motion of the vehicles, and also to the extra strain on the lower part of the wheels. Consequently it is desirable to eliminate the crown as much as possible in consideration of this excessive strain. When there is a bituminous surface or even an oily surface, a flatter crown can be used than with ordinary macadam. On country roads the shedding of the water to its final outlet is generally done in the gutter. Mr. Owen states that it is a better practice and a matter of economy even on such roads to provide the drain pipes or sewer pipes along each inlet at intervals of about 400 ft.

Mr. Owen has always insisted that a flat road should never be built; that it is better to build the road so as to shed the water longitudinally rather than continuously sideways. The ordinary level macadam road may be rounding in its first construction, but the travel will wear off that rounding and there will be a depression in the travel line, where water will gather, soak into the road, and make a bad rut. In a long stretch of level country it is sometimes difficult to undulate the road from point to point with a minimum fall of 5/10 in. in 100 ft., but it is better practice than to have a level surface.

As to the question of limiting grades, his standard for a road is between 1 and 2 per cent. He states that the former gives a very efficacious result. Less than 1 per cent causes a retardation of the natural flow of the water, and such roads require more slope to conduct it to the gutter. More than 2 per cent and up to 4 per cent is a good traveling grade, and has been his standard for such purposes. Another question enters here, which, while not related to the grade itself, is worthy of consideration. The first proposition was that on traveled roads, where there is a height of a certain number of feet to be overcome in a certain distance, a certain grade should be adopted. It has been the accepted practice for years to limit the grade to the lowest possible through rate. As a matter of fact, the question of time is a factor as much as that of load. If there is an 8 per cent grade, the horse will have to walk up that grade with his load, but if it is cut into two grades, say of 2 per cent for a section, with the remainder steeper, the horse can trot on the low grade, gaining time on that part of the road, and can walk just as fast up the steep grade as up that of 6 per cent, which is an important matter where time is a consideration. This same rule would apply to automobiles, and it seems fair to presume that with automobile travel and also with auto truck travel there should not be so much insistence on low grades. A great deal of money has been spent in cutting down hills and making deep cuts and fills in order to produce a low minimum grade. It makes very little difference to the average automobile, except as a matter of time and some shifting of gears, whether it goes up a 2 per cent or an 8 per cent grade. Consequently this question has to be decided from the standpoint of the amount of travel and the character of the traffic.

Prof. Arthur H. Blanchard during the past year has adopted a maximum crown of ½ in. per foot for macadam roads which are to remain as ordinary water-bound macadam or are to be finished later with a bituminous surface. Under certain circumstances as low as ⅜ in. per foot has been advised. The same recommendations have been made relative to the crown of bituminous pavements, but in cases where a smooth surface finish was assured or the bituminous pavement was completed by the application of a seal coat, a maximum of ⅜ in. and a minimum of ¼ in. per foot was prescribed.

Drainage and Foundations.—One point in the question of drainage is the problem of handling quicksands. In one case in Mr. Owen's experience a road went through a very bad bed of quicksand. An open trough of wood was constructed with battens on the top and open at the bottom. This was laid on the quicksand, and the men stood on it and dug out the sand. As the trough gradually settled into place it was filled with stone, and provision was made for an outlet for the water at the end. There has been no movement of this road.

[illegible] work is [illegible] swamp or bog. The following method was employed by Paul D. Sargent, while state highway commissioner of Maine, in constructing two sections of improved road over bogs which were very quaky and unstable. In each case the work was really widening an old road. In one section the center line of the new road coincided with that of the old one; in the other all the widening was on one side of the original road. In both cases the bearing power of the bog was improved by the construction of a brush mattress under the new fill. For this work, boughs of pine, spruce, fir or hemlock were used, care being taken to exclude those having stems more than 2 ins. in diameter. These boughs were laid shingle fashion in courses, first crosswise and then lengthwise of the road, and were four courses deep—that is, two transverse and two longitudinal layers—the total depth being about 16 ins. On the boughs was placed a 2-ft. fill of gravel. One of these roads was built in 1908 and the other in 1910, and to Mr. Sargent's knowledge not the slightest settlement of the foundation has occurred. Both bogs were so bad that it was impossible to drive a horse across them, and even a man jumping would shake them for a radius of 50 ft. This method of building a foundation was also used on one section of new county road, constructed under the jurisdiction of a board of county commissioners, where the bog was so bad that even after the mattress was laid it was necessary to unhitch the horses and draw the wagons out on the mattress with a tackle and fall before they could be dumped. After this road had been built about two years, reports indicated that it was in perfect condition, and that large loads were being carried over it. In work of this kind it is absolutely necessary that the turf or sod be not cut. If it is and much of a load is superimposed, settlement will almost certainly occur.

Springs in the roadbed have to be treated according to special conditions, and sometimes an undue amount of money is expended and care taken to provide for what, during construction, seemed to be a spring in the bed of the road. If there is a cut of 12 or 15 ft. in a gravel pan it generally contains a spring, and the usual procedure is to make elaborate efforts to remove the water permanently. Mr. Owen stated that he has found, however, after considerable experience that the first rush of water is merely a lowering of the water level to the new grade and that frequently within a year or two such springs disappear entirely. It is desirable therefore that the topography of a locality where there are springs should be considered, and judgment should be used in determining whether a spring is permanent or whether it is merely due to changing conditions in constructing the road.

Mr. Owen has for a long time been an advocate of the telford type of construction. In the discussion he states that some of these roads built 6, 7, 8, 9 and 10 years ago have stood up without a break. In one case where a road was built of telford it did not receive a dollar's worth of repairs in 19 years, and it was a heavily traveled road. In Mr. Owen's district there is plenty of stone, and telford roads are built as cheaply as macadam roads in the same locality. Mr. Owen has laid many miles of sandstone foundation and obtained good results from the roads. He has adopted a principle which he has found to be fairly successful—namely: to make the thickness of the pavement according to the grade. The following data were established as a basis: Less than 1 per cent, a 10 in. pavement; between 1 and 4 per cent, an 8 in. pavement; and greater than 4 per cent, a 6 in. macadam. He states that it would seem that such a principle might be taken as a governing one in considering the case of foundations for road construction.

Mr. Theodore S. Oxholm stated that when repairs were made to some roads in Richmond borough, New York city, constructed on telford foundation, it was found that that upper or wearing surface, composed of the smaller sizes of stone, was badly worn where it came in contact with the telford. This appeared to indicate that the wearing surface was being worn, both at the top by vehicles and at the bottom by the impact on the heavy telford stone, thereby causing an increased expense for maintenance. It is Mr. Oxholm's theory that in any kind of macadam road construction telford or field stone should only be used for drainage purposes; that on dry and well drained soil the ordinary macadam road, composed of stone ranging in size from 2½ ins. to screenings and dust is suitable for all classes of travel in country districts, where such roads are mostly built.

Mr. F. C. Pillsbury's experience has been that for surfaces which are not subjected to extremely heavy loads such as would require granite blocks or similar pavements, a sandy gravel provides a better foundation than telford or V drains, under any natural conditions.

The experiences in drainage and foundation work in connection with the roads constructed by the Massachusetts Highway Commission was described by Mr. J. A. Johnston, who has been connected with the commission since the beginning of its work. This portion of the discussion follows practically in full:

In beginning its work, the Commission constructed some rather elaborate systems of trench drains and telford paving for foundations. Where such work was done there were no failures, but the cost was excessive. Such foundations were not built everywhere, but, on the contrary, the policy was to build them only where they were thought to be absolutely necessary, and to omit them in case of doubt. In view of the expense, the speaker believes that this theory was correct, and especially because at first greater reliance was placed on blind drains than has since been found to have been justified. Of course, it was expected, if the need developed, to build such additional drains and foundations as were required.

It has been the speaker's practice to locate carefully every frost break and soft spot which shows on the road in the spring, and to remedy such places as promptly as possible. It has been difficult at times to persuade some of the past members of the Commission of the necessity for such work. Some of them have believed that it was a mistake to disturb the crust of a road.

To avoid breaking up this crust, many experiments have been tried. On one section of macadam road, which was so muddy in the spring that the crust had the consistency of porridge, from 6 to 8 ins. of broken stone were placed on what had originally been 6 ins. of macadam. This improved the conditions for one season, but in the second year they were as bad as before applying the remedy. This section was at the foot of a hill and on a fill about 2 or 3 ft. above meadow land. A blind drain, 2 ft. wide and 3 ft. deep, was then built across the upper end of the fill to cut off the ground-water from the hill, but it had very little effect. Similar cross-drains were then constructed at about 100-ft. intervals, but the road continued to be muddy. After that the macadam was stripped off and a foundation, 12 ft. wide, 18 in. deep in the center, and 6 in. deep on the sides, was built with field stones not exceeding 10 in. in their largest dimension. The old broken stone was then screened and replaced, but so much of it had been churned into the mud, that though from 12 to 14 in. had been placed on this road, scarcely enough was recovered to cover the foundation. Since this work was done, 5 years have elapsed, and there has been no further trouble.

Miles of ground-water drains have been built which the speaker now believes to be practically useless, for it is his opinion that under many conditions the capillary action of the soil, intensified by the puddling or tamping action of the traffic passing over a road surface, nullifies, to a large extent, the supposed effect of the drain in lowering the water-table, and this is regardless of the fact that there may be a water-proof top on the road. The speaker has built blind drains entirely around a section of road, 15 ft. square, and with proper outlets, but with no appreciable effect on the enclosed section. He does not absolutely
drains, for there are soils which
and there are places where an exc
must be taken care of, but there
stances where more money has b
drains than would be required to
solutely unyielding foundation und
road.

Under most conditions, a 10-ft.
stone, even 6 in. deep, which will
more than 25 cts. per lin. ft.
immeasurably greater benefit th
drain which will cost more mon
up a road surface by strengthening
tion may not sound as scientific as
indirect method of drainage, but it
successful. By a stone foundation
the hit-or-miss dumping of stor
holes, nor, at the same time is it
hit each stone on three sides wit
and wedge it in place as telford
dirt surface of the sub-grade
smoothed and properly graded to
the water; the stone should be pla
with the smaller stone on top
crevices, and the whole should be
It is not always necessary to
depth of stone, it should be varied
conditions, being, in some places,
in others only 6 in. It is by no me
that the foundation should exte
width of the macadam. On most
in the speaker's division the f
only 10 ft. wide, while the macad
In the spring, when the frost is co
average width of travel is rarely
ft., and, though the eye can readi
line of the edge of the foundation
been no breaks and no trouble fro
tice.

To use more than 4 in. of brok
macadam is a mistake, for anything
depth is merely foundation, and f
stone at $1 per cu. yd. is m
crushed stone which will cost fro
per cu. yd. On very soft soils it m
able to use a layer of gravel under
tion, but a light layer of field st
gravel will give a far better and m
tial road than the gravel alone. In
experience, the speaker never sa
failure over a stone foundation whi
properly laid.

Not long ago, a road official w
recently appointed, told the spe
intended to put a telford bas
roads. Another official, also newl
stated that he did not suppose an
was needed under 6 in. of macada
nately, the speaker could not agre
of them. In Massachusetts the
miles of road where the macad
the natural soil, with excellent
many more which would not ha
year without a foundation.

Mr. Clifford Richardson stated
of the difficulty with broken sto
the United States has been and
subsidence into the soil of the
road. In many cases the soil
properly prepared to receive this
in others the nature of the soil h
that it would be impossible to pr
the purpose without very caref
which has been omitted almost ev
by the construction of a suitabl
of the telford type, or one of hy
crete. A concrete foundation, of
be more costly than one of broken
foundation of this type, 4 ins. t
stronger than a loose one of 2½
stone, 6 ins. thick, and the differ
will not be a serious considerat
the much smaller quantity of st
the 4-in. foundation will largely
the cost of the cement and sand
crete. A concrete foundation, wh
will give an asset which can be
for all time, while a broken stone
is necessarily of a more or les
nature, owing to its displacement
and its disappearance into the soil
ports it. He stated that an effor
made, at least in the case of bu
highways which are to carry heav

...with a concrete foundation, ... for all time, and on which ... can be constructed easily and ... at such intervals as may be [illegible]

... of the subgrade is one of the ... in macadam construction ... is not properly prepared ... into the stone when this is ... result that the actual thickness ... stone layer is materially reduced. ... it is sometimes difficult to get ... the subgrade into ... in clays, especially ... [illegible] ... the process of rolling ... [illegible] ... condition in the case of sub- ...ts, may be caused by too much ... but it frequently occurs on fills ...t rolled too much. Mr. W. W. ... that this flaky condition may be ...isfactorily by spreading a layer ...lers, or stone dust, as may be ... top of the subgrade, to a thickness 2 to 6 ins., and then compacting ...h the roller, so as to secure an ...ictory surface on which the mac- ... without danger of ... the subgrade material and thus ...tion of its effective depth. Still ... which Mr. Crosby found ... is to use for the ... crusher run stone ... Such stone placed ... in the ... is then thoroughly ... the ... wing ... in the bottom of the ... [illegible] ... itself on the ... described.

...f shutting off the water from ... side of a macadam road is ...llows by Mr. H. P. Willis: If ... along the side of the road at ...e macadam, the natural plane is ... soil pipe about ... this ditch and ... back the excavated soil, ...y be, the conditions have been ... manner as to benefit at least ... the ... attraction, because the ... the broken plane. Water try- ... ground water level ... if that force can be ... force which tends to ...e road it will be of great bene- ...out the water. If the material ...e ditch is a clay, and if it is ... over the pipe, a wall ...mpervious to water will be pro- ...utside of the road. The water ... seep into the road from beyond ...neet this impervious wall, fol- ... flow off through the pipe. ...k State Highway Department ...method with success, at a cost ...per lin. ft. Another method of ...ame result is to cover the pipe ...one, which answers the same ...obably more effectually, but is ... The New York State High- ...t is now working on a scheme ...h will be dug next to the mac- ...ing will be put in that trench ... vertical plates made either ...e same kind as the soil pipe, ...d clay mixed or in fact from ... can resist the disintegration ... place in the ground. The ... that plane, follow it down to ... off.

... report of a commission ... considering seriously the ... a fund with which ... purchased and houses erected ... to help themselves ... The houses are to be rented ...erected, at very low rates.

Dragging, Patching and Resurfacing Gravel Roads.

[illegible] ... Act of ... [illegible] ... section of the law gives the State Highway Commission power to [illegible] ... [illegible] ... a gravel road surface:

Dragging.—Gravel roads are never hard enough and smooth enough when opened to travel to prevent almost immediate rutting by the wheels of heavily loaded wagons. In fact, a gravel which contains enough clay to pack immediately under the roller, or in a few days under travel will always prove to be a muddy road when the frost is going out in the spring, and in prolonged wet spells at other seasons of the year. If such gravels are found on a road ... [illegible] ... layer of sandy-gravel, applied when the old gravel is soft and allowed ... [illegible] ... the road drag.

[illegible] ... the first fall until ... and the following spring until the middle of May or the first of June. After that, the dragging will not be very effective, unless the rains are of long enough duration to slightly soften the surface, and may, therefore, be less frequent. But they will still be found ... in the ... fall and in the spring, when the frost is coming out and before the gravel is fully settled.

The plank drag, the ... drag, or the ... [illegible] ... When ... drags are used, they should be faced with some kind of steel plates.

When this dragging is ... [illegible] ... that the cost of maintenance of gravel roads, even with some patching, can be kept below $10 per mile a year.

Patching.—This work is usually neglected or done in such a way as to cause two ruts to form where there was but one before. That is the invariable result of filling a rut too full. This work should always be done when the road is wet, preferably when the water is still standing in every little hollow on the road surface, so that the workmen can see just where to place the new gravel and about how much is required.

Unless the rut is a very large one, it is always best to shovel the gravel from the wagon into it, rather than to raise a sideboard and attempt to dump a part of the load.

Patching done in the proper manner when the road is wet, followed by the road drag, will maintain an old gravel road surface as good as new until it is so badly worn that an entirely new surface is required. The gravel used should never be poorer than that forming the surface layer of the old road, and especially should not contain an excess of clay. The best results will be obtained by using the same kind of gravel as was used to build the old road.

This kind of patching should never be done when the old road bed is hard and dry, for then the new material is soon ground into powder and makes dust and mud.

Resurfacing.—The work of resurfacing an old road is much the same as putting on the top layer of gravel when building a new road. If the layer is to be more than ... thick, it will ... be necessary ... [illegible] ... shoulders ... [illegible] ... material from the center ... of the road ... [illegible] ... [illegible] ... the new gravel can be kept in proper crown by the frequent use of the road drag ... [illegible] ... a road grader.

It should be ... [illegible] ... gravel ... [illegible] ... this work in the spring or fall when the old bed is not too hard, so as to prevent any of the new gravel from being ground up under the wheels of heavily loaded wagons, especially if any part of the new layer is less than 3 ins. thick.

It may be proper to add that the gutters and ditches must be kept clear of dirt, rubbish, weeds and brush so that the water always has a free and unobstructed flow to the nearest drains which can remove it permanently from the road.

Notes on Road and Street Work.

Cost of Hand Sweeping at St. Paul, Minn. —Hand sweeping at St. Paul, Minn., in 1910 was ... [illegible] ... the foreman, ... sweepers, 11 ... and 11 teams, at a cost of ... [illegible] ... with a total area of 1,057,420 sq. yds. ... [illegible] ... streets cleaned was ... per 1,000 sq. yds.

Incline for Loading or Unloading Road Machinery. The accompanying illustration shows the arrangement employed by engineers of the Illinois Highway Commission for unloading road machinery from flat cars, or for loading the machinery on the cars. The incline is built ... [illegible] ... the top layer being covered with 2 in. or 3 in. plank. The rear end of the car is blocked by a cross tie with one end against the car and the other end against cross ties in track ... [illegible] ... are required.

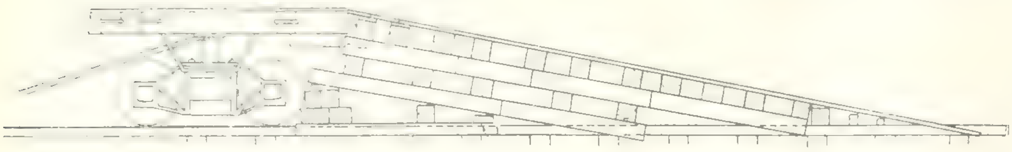
Wetting Streets with Solution of Chloride of Lime. In his annual report for 1910 the commissioner of public works of St. Paul, Minn., states that during the month of December of that year the paved streets of the city were kept constantly wet with a solution of chloride of lime, pulverized and dissolved with the aid of a steam jet. About 1 lb. of the chemical was used to a gallon of water. About 27 tons of chloride and 8 tons of coal were used during the first three weeks. The cost of this material and its application on the streets exceeded $800.

Contract Prices for Pavements at Duluth, Minn.—The following figures from the annual report of the city engineer of Duluth, Minn., for 1911 show the cost per square yard of the different kinds of street surfacing in that city last year:

	Per sq. yd.
Kettle River Sandstone, 6-in. in depth, 5-in. concrete base, 2-in. sand cushion, cement grout filler, average cost	$2.52
Purington Block Brick pavement on ... concrete base, 2-in. sand cushion, asphalt filler	2.10
Creosote Blocks, 4-in. deep, 16-lb. process, on 5-in. concrete base, 2-in. sand cushion, asphalt filler	[illegible]
Sheet Asphalt, 2-in. binder course, 2-in. wearing surface, on 5-in. concrete base	2.30
Sheet Asphalt, 1-in. binder course, 1-in. wearing surface, on 5-in. concrete base	[illegible]
Granitoid (concrete), 5¼-in. concrete base, 1¾-in. wearing surface, on cinder or gravel base, asphalt cement expansion joints	[illegible]
Tar Macadam on 5-in. concrete base, 2-in. wearing surface	[illegible]
Tar Macadam on 6-in. crushed rock base, 2-in. wearing surface	1.25
Tarcon on 5-in. concrete base, 2 in. wearing surface	[illegible]
Tarcon on 5-in. concrete base, 1-in. wearing surface	1.30

[illegible]

Cost of Crushing, Hauling and Spreading Gravel.—The following data on gravel road construction in Longmont county, Colo., were [illegible]



Sectional Elevation of Loading Incline for Road Machinery.

issue of the Inter-Mountain Fruit Journal. The material used was a cement gravel consisting of 50 per cent rock from 4 to 10 ins. in diameter, 30 per cent stones smaller than 4 ins. and about 20 per cent adobe soil consisting of lime, clay, etc. The gravel was run through a portable crusher. The crusher had a jaw opening of 9x18 ins. and a capacity, varying according to the material to be crushed, of from 12 to 20 tons of 2-in. material per hour. The crusher was mounted on a truck equipped with folding elevator for carrying the stone to a 15-ton portable stone bin and a chute screen for classifying the stone. An agricultural traction engine furnished the power to operate the outfit, at a cost of $5 per day, including the services of the owner of the engine. The fuel cost $2 per day. In addition there was the following costs:

	Per day.
[illegible] crusher at $2	[illegible]
Two men handling train cars to feed crusher at $2	[illegible]
Four men shoveling in pit at $[illegible]	[illegible]
One foreman at $[illegible]	[illegible]
Oil and other incidentals	[illegible]
Interest and depreciation	[illegible]
Total	[illegible]

The gravel was hauled to the road by a traction engine and 10-ton reversible stone spreading cars. Two men at $2 per day were also employed in spreading the gravel on the road. The hauling charge was $10.50 per day. The average output of the crushing plant was 100 tons per 8-hour day. On this basis the total cost of gravel per ton spread on the road was 42.5 cts.

Requirements for Drawings for Highway Improvements.—The regulations of the State Commissioner of Public Roads of New Jersey require that all drawings for state aid road improvements filed with the department must be black prints on white ground, either on cloth or cloth backed. The size of the sheets is to be 22 in. by 42 in. The scales are:

Plan, 80 ft. = 1 in.
Profile, horizontal 80 ft. = 1 in.
Profile, vertical 4 ft. or 8 ft. = 1 in.
Cross section, 1 ft. = 1 in.
Detail, cross roads, entrances, etc., 40 ft. = 1 in.

Where there are several sheets and a key map is submitted therewith any scale may be used for such key; sheet must be 22 in. by 42 in. All cross roads and entrances to private grounds are shown on plan, and, where the proper connection thereof with the road requires fill or cut, by profiles and cross sections on separate detail sheets. These must contain all the data necessary for calculation of the quantities involved, which quantities must be given in the calculations under the head of excavation outside road. Drawings must show all important trees within the right of way of the road and in the slopes. Such trees as are to be removed must be indicated. This does not apply to trees less than 4 ins. in diameter, nor in woodland where area to be cleared will be indicated. The center and side lines of the roadway, the exterior lines of the right of way, the location of all buildings [illegible] the center [illegible] and all [illegible] whatever [illegible] on the right of way [illegible] shown [illegible]. Details of [illegible] walls, [illegible] included [illegible] contract, will be shown on the plan and cross-sections. Whenever the slopes extend beyond the right of way such extensions will be [illegible] the plan and the [illegible] property owners indicated. Where the [illegible] is diverted from the previous right of way, and property taken for the new location, its ownership will be shown.

Wood Block Pavement Construction in Europe.—The practice in laying wood block pavements in some of the European cities, notably London and Berlin, differs somewhat from the practice in this country. The following description of the methods employed was given by Mr. F. J. Lewis in a discussion at the last annual meeting of the American Wood Preservers' Association: The concrete foundation is troweled smooth and when finished, has the appearance of any ordinary cement sidewalk. The crown of the street is provided for in this foundation in the usual way. After the smooth cement surface is sufficiently dried it is mopped with a thin coating of hot pitch, this being used to waterproof the concrete. The blocks are laid directly on this pitch and concrete, no sand cushion being used. A thin strip of wood, ⅛ in. thick made from ⅞ in. lumber, is set on the edge between the rows of the blocks, crosswise of the street. This provides for a space of about 1 in. between each row of blocks. There is about the same amount of space left between the ends of the blocks.

After a portion of the street is [illegible] strips are pulled out and hot pit[illegible] poured on the blocks from buckets [illegible] about 4 gals., and this is immediat[illegible] off so that only one half of the de[illegible] blocks is filled with hot pitch. T[illegible] of the opening between the hot pit[illegible] of the block is filled with clean gravel [illegible] about ⅛ in. to ⅜ in. in diameter. [illegible] is applied immediately after the pitch [illegible] been brushed off and becomes mixed with [illegible] pitch between the blocks and the excess [illegible] permitted to remain on the surface, the su[illegible] plus being about 1 in. in thickness. No e[illegible] pansion joints, either crosswise or lengthw[illegible] of the streets are provided for. In one c[illegible] the blocks are laid lengthwise [illegible] for about four to six courses from [illegible] Investigation among the city officia[illegible] tractors indicated that the trifling [illegible] strips were more than compensated [illegible] saving of time in spacing and laying [illegible] and the strips frequently are used over again. This method perm[illegible] blocks being laid in symmetrical fo[illegible] of the crooked, irregular lines, as [illegible] treatment, where strips are not [illegible]

A Distributor for Applying D[illegible] ing and Resurfacing Pre[illegible] arations.

In the use of tar products, road oils [illegible] other material for dust laying and r[illegible] purposes it is necessary that the di[illegible] apparatus should distribute the mat[illegible] ly and in as large or as small qu[illegible] might be desired. The accompanying ill[illegible] tion shows a distributor which ha[illegible] signed especially for the above pur[illegible] consists of a steel tank, equipped wit[illegible] and distributing devices, mounted [illegible] form spring gear truck. The tank is [illegible] heavy sheet steel and riveted wit[illegible] joints to prevent leaking. A dome [illegible] on top of the tank at the rear to [illegible] loading. This dome has a conical w[illegible] to prevent the entrance into the tank [illegible] and other foreign matter. The [illegible] placed at the bottom of the tank, ra[illegible] at the end, which permits the comple[illegible]

Distributor for Applying Dust Laying and Resurfacing Preparations.

The [illegible] valve is tlet pipe, directly under the specially designed quick op- heating device consists of a to burn wood, specially ar- es, and a cast iron smoke box is located near the rear irectly beneath it. By means vice materials can be kept at erature up to 200° F. The is not designed to be used heating of materials, as this regular heating tanks or in ntended to keep the material ature during a long haul or spreading in cold weather. dered this tank is furnished [illegible] heating and distributing [illegible].

The distributing attachment consists of a series of pipes, and a rotary hydraulic pump, located directly in the discharge line from the tank. Power for operating the pump is fur- [illegible] the spokes of the rear wheel of the truck. The controlling values and pressure gage are placed directly in front of and within easy reach of the operator's seat. The attachment is so designed that it can be mounted on the extended bed frame at the rear of any tank or sprinkling wagon. At the end of each of the [illegible] flow to the nozzles. These valves are operated in sets of four by means of two levers, and each set can be operated separately or in unison with the other sets by either lever. Thus strips of roadway either 2 ft. or 4 ft. wide can be spread from either side of the tank, or one 6 ft. strip can be placed. A feature of special value is that the nozzles are placed at the lower end of the valves, which insures the immediate stopping of the flow of material when the valves are shut off. In this way when the distributor is used on streets where cross walks are located it is possible to keep these walks free of oil. It is claimed that with this distributor the application of material can be regulated easily and quickly as desired from .15 gal. to .5 gal. per sq. yd. of surface and can be applied under a pressure varying from 5 lbs. to 25 lbs. per sq. in. This distributor is known as the Monarch distributor; it is handled by the Good Roads Machinery Co., Inc., Kennett Square, Pa.

R SUPPLY, SEWERAGE AND SANITATION SECTION

f Institutional Sewage ts, with Special Refer- nts at the Infirmary hildren's Home of County, Ohio.

[illegible] Kimberly, Consulting Sanitary Engineer.*

911 there were constructed and for the Children's Home , near Xenia, Ohio, sewage serving ultimately 100 and tively. As these plants are those adaptable to the re- smaller institution, a de- with discussion may be of

nty Infirmary buildings are nding and comprise a main al and several barns and the sewage from the insti- scharged at the head of a ry in the summer months hus created has been such nany complaints and threat- These conditions were the sewage treatment at the spring of 1911 there was jacent to that on which the d, and on the same water- ion of a new Children's t the development of con- those caused by the In- ere was also provided a e new Children's Home. are located only a short on account of topographi- could not satisfactorily be

LING TYPE OF PLANT

demanded only the pre- from the sewages of the

water supply nor source endangered. The problem of design therefore was to provide such devices as would insure a treated sewage [illegible]

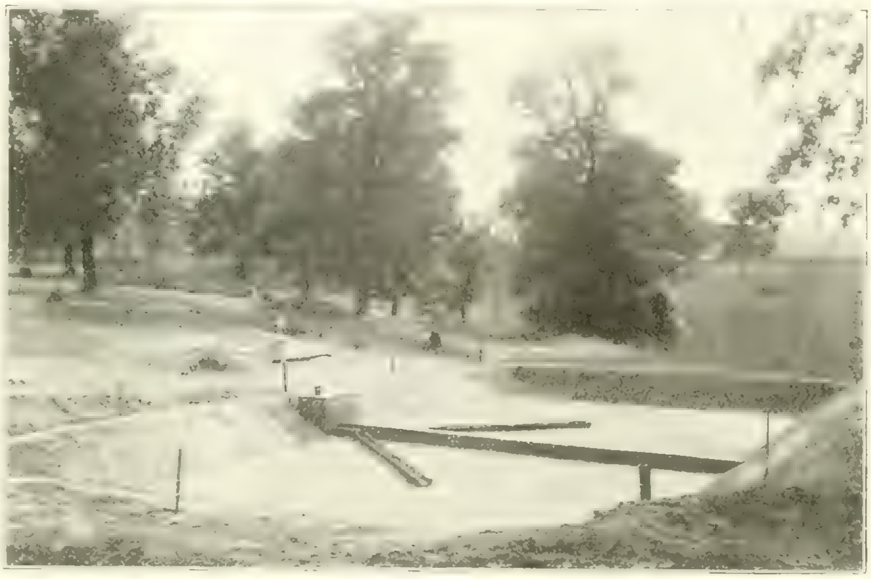


Fig. 1—View of Sand Filters for Sewage at Greene County, Ohio, Infirmary—Ready for Sodding.

result to be effected by a plant possessing permanency, requiring minimum supervision for continued success and capable of construction at the lowest cost commensurate therewith.

Experience with some 25 institutional sewage plants under practical operating conditions has brought out strongly the necessity for simplicity in operation. In the smaller institutions, especially after the novelty of a sewage treatment plant has worn off, the regular institutional employe rarely devotes much attention to the plant's upkeep, unless his salary is increased to correspond with increase in duties. The institutional employe has been engaged for a specific purpose, has been assigned special duties and usually declines to take permanent interest in a sewage plant without increased compensation. It is the duty of engineers to impress upon the executives of institutions that the relatively small expense incidental to caretaker's services is well worth its cost as reflected by the increased efficiency and years of usefulness of the sewage purification plant. In most cases only by intelligent supervision can a plant fulfill the purpose for which it was constructed, and thus justify the approval of the central health authority under whose sanction the plant

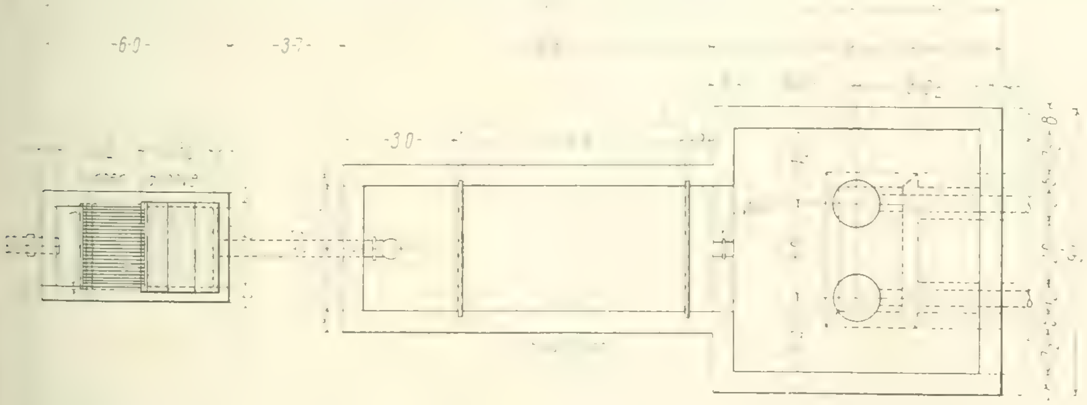


Fig. 2—Plan of Screen Chamber, Settling Tank and Dosing Chamber of Infirmary Plant.

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gs and Trust Bldg., Co-was built and the expectations of the engineer by whom the plant was designed. It cannot be too strongly emphasized that the mere installation of a sewage purification plant is but a partial step in the actual solution of a sewage nuisance or of a water supply pollution problem.

Since filters constructed of fine grain material for sewage are more effective than other primary filtration procedures in removing organic matters, and since their operation is simple, such plants appear best adapted to the sewage treatment needs of the smaller institution. Moreover, the cost of filtering material, while relatively high in regions where the glacial drift formation is absent, does not usually prevent the use of filters of fine grain because of cost as might be true for large institutions or for small municipal plants.

In view of the above considerations, intermittent filters of fine grain material were alone considered for these Greene County plants. Fig. 1 is a general view of the Infirmary plant. In broad terms, the plans provide for the interception by a screen of the coarser matters present to an unusual extent in institutional sewage, removal by sedimentation of a part of the suspended matter and oxidation of the dissolved impurities by intermittent sand filters to which the sewage is applied intermittently, automatically and in considerable volume. Since the plants are practically identical in design, a description of the Infirmary plant will suffice for both.

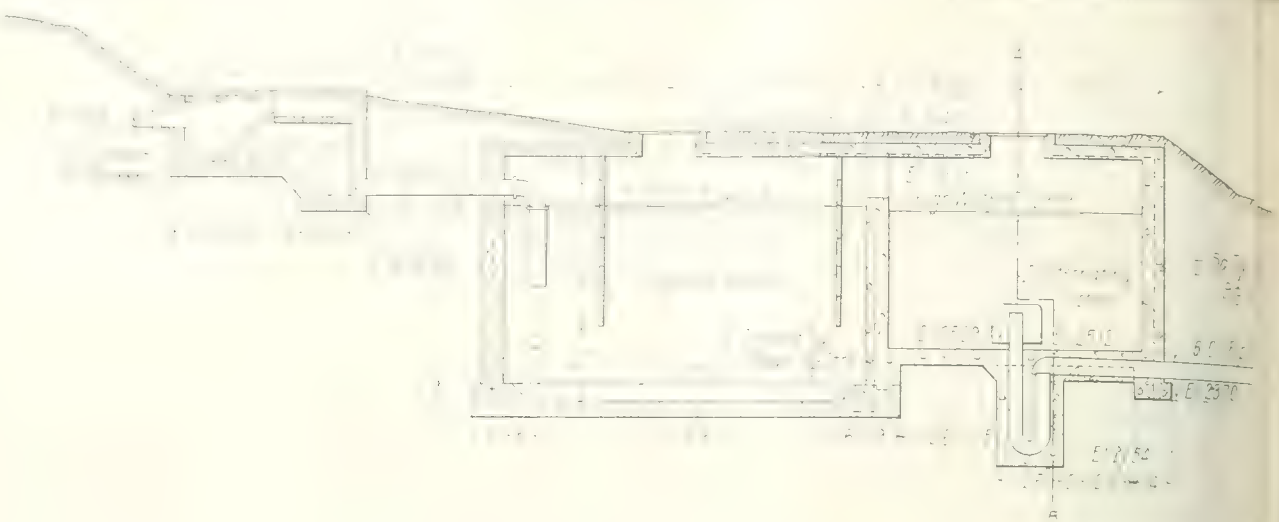


Fig. 3—Sectional Elevation of Fig. 2.

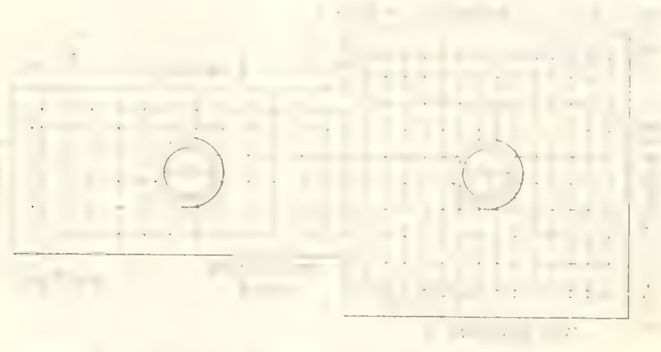


Fig. 4—Roof Plan of Tank and Dosing Chamber.

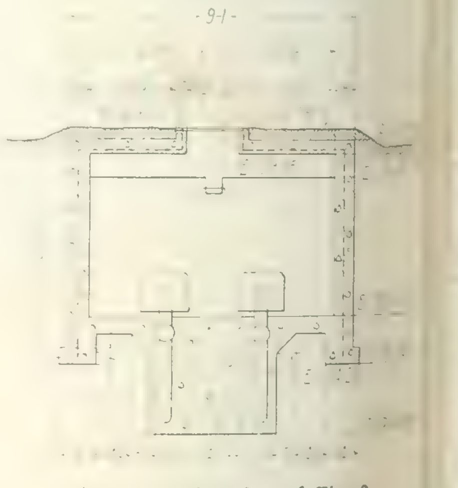


Fig. 5—Section A-B of Fig. 3.

[illegible]

Sewage from the institution is conducted through a vitrified pipe sewer to a concrete drop manhole, distant about 70 ft. from the main building and in an easterly direction, thence on a 4.4 per cent grade to the screen chamber, distant about 80 ft.

Screen Chamber.—The screen chamber constructed of concrete is 2 ft. 6 ins. x 5 ft. in plan and is ordinarily closed with a hinged oak cover. The screen is built of ⅜-in. steel bars, spaced 1⅛ ins. c. to c. set into a ½x2-in. steel bar at each end. To prevent rusting, the screen is coated with two coats of asphalt. The upper end of the screen is bent on a 4½-in. radius to fit against a horizontally placed wooden receiving shelf. The screen rests in grooves in the concrete and in the direction of the sewage flow is inclined at an angle of 45°.

Settling Tank.—The screened sewage enters a covered reinforced concrete settling tank 4 ft. x 10 ft. in plan, with a flow line depth of 6 ft. The capacity of the tank is about 1,800 gals., which affords a period of retention of 11 hours at the maximum capacity of the plant. A manhole is provided for entrance to the tank. Sewage enters the tank through a cast iron elbow extending to a point 2 ft. 6 ins. below the flow line, and flows out over a weir plate 6 ins. in length and placed on the center line. Cypress baffle boards are located 3 ft. from the inlet and 9 ins. from the outlet end, and extend 3 ft. 9 ins. below the flow line.

Dosing Tank.—Contiguous to the settling tank is a covered dosing tank 7 ft. 9 ins. square in plan. It is constructed of reinforced concrete. A manhole is placed in the roof to give access to the siphons. The tank is operated by 5-in. alternating siphons, of the Miller type, set to draw 4 ft. With no allowance for inflow, the discharging capacity of the dosing tank is about 1,800 gals. Independent discharge lines of 6-in. vitrified sewer pipe conduct the sewage to an influent chamber whence it is applied to the sand filters. Plans, sections, and details are shown in Figs. 2 and 6 inclusive.

Sand Filters.—The sand filters are each 38 ft. square in plan. The surface area is 1,444 sq. ft. or 0.033 acre each. They are separated by a concrete wall, the other each unit being formed by [illegible] ing 1½ to 1. The filters conta 3 of sand supported by a graded 6 ins. maximum thickness. The of the sand actually placed i 0.23 m.m.; the uniformity coeffi filter is drained by two lines of sewer pipe leading into a mai in diameter. The lateral drains open joints and with an open s ½ in. between the lengths of p tom of the excavation is sloped and equal areas are tributary t drain. The details of the inle shown in Fig. 8.

The gravel is of four sizes. F the following size and thicknes by passage or rejection by sieve indicated.

Grade.	Passing sieve.	[illegible] sieve
1	3 in.	1 in.
2	2 in.	½ in.
3	½ in.	[illegible]
4	¼ in.	[illegible]

The coarsest gravel fills th trenches up to the grade of th its highest point. The smaller placed, feathering to zero thic meet the shaped filter bottom.

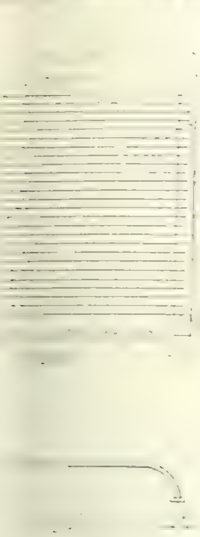
A short distance below the fil ent flows out on to the natural ground. At the influent cham of shear gates, the sewage from discharge line may be diverted as desired. The sewage [illegible] of each unit through a line of pipe which leads to a [illegible] square.

Embankments.—After th

pleted, the inside slopes of the re carefully sodded with firm he tops of the embankments slopes were seeded.

[illegible]

[illegible] designed on the basis [illegible] flow of [illegible] gals. There



ils of Sewage Screen.

-hour period of flow in the an ultimate population of total flow of 4,400 gals. in osing tank capacity is based of sewage equivalent to a r unit of about 2 ins.

lants, according to standard ers may safely be designed ,200 persons per acre. For this figure was increased to acre, because in each case pulation served tend to make nic matter load lower than plants. Further, the rate of [illegible] × 1,500 = 60,000 gals. rs, a most conservative fig- ers which receive clarified

was given to the design of ld readily be cleaned and manency. At most institu- ter, especially clothing and into the sewers and it is it its entrance into the set- ese Greene County plants, adily raked onto the receiv- hey are removed and either Screens at institutional uld be cleaned daily to pre- g up in the sewers, hence cleaning and for the re- enings are advantageously d as easy of operation as

ature of intermittent opera- d filters is, of course, well feature is usually obtained ng tank with automatically These devices insure the lume of sewage sufficient the entire area of the sand iter's experience, the direct ters at institutions (dosing ot advised because the rate in wide limits and at night The directly flooded filter a given number of hours age is diverted to another e entails or should entail ual and intelligent super- from the original premise and ease of operation. tical operating conditions, ectly flooded units receive rganic matter. These areas rates of filtration are cor- ed for the remaining sec- and the resulting effluent ally becoming putrescent.

In the Middle West the item of fine grain filtering material is all important as regards the cost of a small sewage plant. The writer's specifications called for a sharp sand practically free from clay, dust and dirt, less than 1 per cent passing a sieve having 200 meshes per linear inch, containing no particles greater than ¼ in. and with an effective size ranging from 0.20 to 0.45 m.m.; uniformity coefficient not greater than 3.5. These size clauses admit of a wide range and permit the use of local bank sand, provided the fine alluvial components of the bank material are absent.

An important feature of design is a provision against the impairment of the sand filtering material, or any other material, by the washing of soil or clay from the freshly formed embankments. This feature has been strongly emphasized in the writer's experience, and to meet it he provided for the sodding of the inside slopes of the embankments practically as soon as the filters are completely sanded. The embankment tops and outer slopes for reasons of economy are merely seeded. Both of the Greene County plants were protected from embankment wash in the above manner, and this protection against the effect of a copious rain shortly after the filters were sanded fully justified the slight extra expense such sodding entailed. If of good quality, the sod originally on the site of the filters may serve the above purpose, provided it has been wetted occasionally and kept in healthy condition until required for use.

The feature of drainage around a plant will, of course, suggest itself. At Greene County this feature is disposed of by the construction of low levees formed of earth excavated to form the filters.

At each of the above plants the topography admitted of the discharge of the effluent at such a point as to permit of the sampling of the effluent for analysis. When conditions do not admit of this, an effluent manhole or a lamphole is very properly included in the design. Such an arrangement enables the operator of the plant to judge of its efficiency, facilitates the work of centralized supervision on the part of the State and affords the layman an opportunity to determine the near approach of the effluent of the efficient sand filter to the "spring water" ideal.

The sand filter is the most successful of all types of plant for the small institution where there is desired a well-vitrified, stable effluent. In fact, such filters can be considered to advantage even for institutions of from 1,000 to 2,000 population. Of course, the question of cost will largely control for the larger places where the problem really approximates that of the small municipality. Whether the choice be contact filters alone or in combination with sand filters or possibly sprinkling filters, simplicity should be the key note of the design. It is well to emphasize the fact that caretakers are necessary and are important auxiliaries to the sewage plant of the larger institution. Their compensation may range from $15 to $35 per month plus board and lodging depending upon the size of the plant and the required duties.

To assist in the intelligent operation of an institutional plant especially in the event of thorough tests of the plant by a central supervising authority such as the State, it is advisable to provide means for measuring the sewage flow. The larger the institution, the more importance is attached to the rate of flow and in such cases provision should be made for a permanent weir, fully accessible, by which there may be determined, when desired, the actual rate at which the sewage flows to the plant. In the small institution, on the other hand, the rate of flow is of little importance. The actual rate varies within wide limits. The significant factor is the total quantity of sewage in 24 hours. These data may readily be secured with sufficient precision by recording the number of discharges from the dosing tank during the period especially under test.

In the above connection, it may be of interest to present data (see Table I) upon the rate of sewage flow from an institution of about 1,200 population, obtained by the writer in 1906 when in the employ of the Ohio State Board of Health. The data illustrate well the correlation of the rate of sewage flow with the different activities of the institution.

TABLE I.—[illegible] AND NIGHT.*

Hour.	Gals. in [illegible]		Hour.	Gals. [illegible]	Pct. [illegible]
6 a.m.	126,000	217	6 p.m.	43,000	74
7 a.m.	61,000	105	7 p.m.	50,000	86
8 a.m.	91,000	157	8 p.m.	43,000	74
9 a.m.	80,000	[illegible]	9 p.m.	61,000	105
10 a.m.	[illegible]	[illegible]	10 p.m.	43,000	74
11 a.m.	70,000	120	11 p.m.	[illegible]	74
12 a.m.	61,000	105	12 p.m.	43,000	74
1 p.m.	50,000	[illegible]	1 a.m.	[illegible]	74
2 p.m.	50,000	[illegible]	2 a.m.	[illegible]	74
3 p.m.	43,000	[illegible]	3 a.m.	43,000	74
4 p.m.	61,000	105	4 a.m.	43,000	74
5 p.m.	70,000	120	5 a.m.	43,000	74

Population, 1,150.

The following interesting sewage flow data, Table II, taken from the above cited report* illustrate the differing rate of flow for different days of the week. The data were obtained in 1907 at the Ohio State Hospital for epileptics, at Gallipolis, Ohio, population 1,450:

TABLE II.—ILLUSTRATIVE INSTITUTIONAL SEWAGE FLOWS FOR DIFFERENT DAYS OF THE WEEK.†

Thousands of Gallons in 24 Hours.

	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Maximum	[illegible]	[illegible]	[illegible]	[illegible]	211	248	[illegible]
Minimum	150	125	143	114	116	142	122
Average	[illegible]	[illegible]	168	[illegible]	171	188	184

The above figures indicate the variations in rate of flow dependent upon the several activities of the institution, particularly the laundry operation and the feature of bath days. In the design of sewage plants for the larger institution, these features come up for consideration in determining the proper sizes of pipes, tanks and dosing apparatus. The smaller institution similarly shows wide variation in

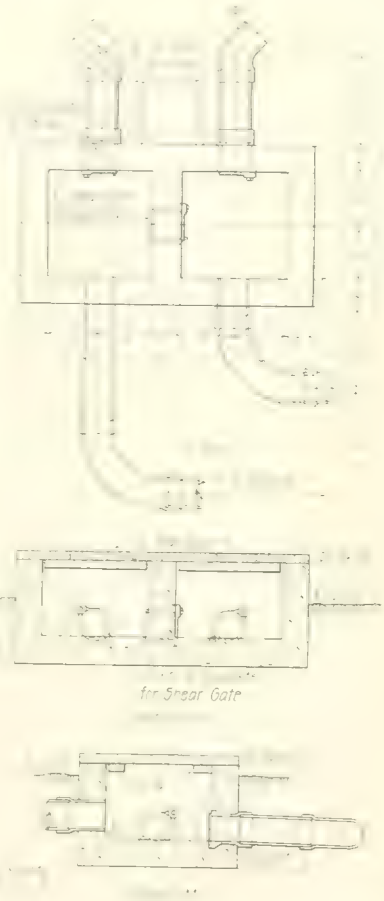


Fig. 7—Details of Inlet Chamber for Sand Filter Beds.

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*Lancaster Boys' Industrial School, Report Ohio State Board of Health, 1908, p. 635.

†Period covered March 10 to June 16, 1907.

the actual rate of sewage flow, but the total quantity is relatively small and the flow is readily equalized by the tanks and other devices by which the sewage is treated.

FEATURES OF CONSTRUCTION.

There are few features of construction worthy of special comment at Greene County. The tanks were built in excavation. The filter embankments were partly in fill, but the bottoms of the filters were wholly in cut. The initial rough excavation was effected by drag scrapers but when nearing the finished slopes hand labor was employed. It is of great importance for the successful drainage of the plant that careful attention be given to the preparation of the bottoms of the filters. The requisite free drainage can be obtained only by careful supervision of the work of shaping the underdrain slopes and trenches.

It will readily suggest itself that for a small plant the cost of preparing gravel of proper character and of several grades is relatively high. At Greene County it was necessary to prepare the several grades by hand. So much depends upon the free drainage of an intermittent sewage sand filter that the extra care and expense necessary to secure clean gravel of suitably graded sizes appears well worth its cost.

An interesting feature of the construction at Greene County was the filling of a former cistern which was a part of a former storm water drainage plan. This cistern was 11 ft. in diameter and 14.5 ft. deep and as it was embraced by one of the filters it was necessary to fill it. The walls were razed to a point about 1 ft. below the bottom of the filter, after which earth was deposited in 6-in. layers and carefully tamped. No water was available to wet down the fill, but for some weeks prior to the sanding of the filters much rain fell which apparently well compacted the earth deposited into the sump. After the first heavy rain subsequent to the sanding of the filters, however, the sand over the sump fell about 10 ins. The filters were resanded to grade and no further settlement has been observed.

The contract price for the Infirmary plant was $1,500; that of the Children's Home $1,310. The per capita costs were $15 and $17.50, respectively, based on the maximum future population to be served.

Mr. S. Milton McKay, C. E., County Surveyor, acted as Resident Engineer, assisted by Mr. F. A. Dubois as Inspector, with the writer as Consulting Engineer. The contractors were Huonker and Williams of Springfield, Ohio.

Proposed Standard Specifications for Post Hydrants.

A committee of the New England Water Works Association, which has been working for several years on a set of standard specifications for post hydrants, recently submitted the specifications given herewith. The specifications offered for adoption by the committee were not adopted by the association. The manufacturers of hydrants are going to collaborate with the committee in the revision of the proposed specifications. It is believed that any changes made will be of a minor nature. Since it may be several months before the revised specifications are agreed upon, we are here presenting the proposed specifications for the guidance of the engineer who may have occasion to write general specifications to govern the construction and operation features of hydrants, during the present season. It is believed that the specifications here given will be of assistance to the purchaser of hydrants now on the market.

1. SIZE.

a. The size of hydrants shall be [illegible] by the nominal diameter of the valve opening which must be at least 5 ins. for hydrants having two 2½-in. hose connections, [illegible] for those having three [illegible] connections.

In hydrants having valve openings of shape other than circular, the designation of size must be the diameter of the circle equal in area to that of the valve opening.

[illegible] of the [illegible] the smallest part when the hydrant is wide open must not be less than that of the valve opening.

In new designs it is recommended that inside diameter of hydrants, especially at the outlets, be 7 ins. and 8 ins., respectively, for hydrants having 5-in. and 6-in. valve openings.

c. Hydrants must be fitted with bell ends to fit New England Water Works Association standard pipe, or with flanges of standard dimensions and having standard bolt layouts, published jointly by the American Society of Mechanical Engineers and the National Association of Master Steam and Hot Water Fitters as given in Table I. Holes are not to be drilled on the center line, but symmetrically each side of it.

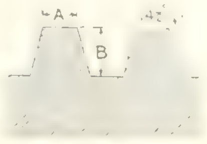
2. GENERAL DESIGN.

a. Any changes in diameter of the water passage through the hydrant must have easy curves and all outlets must have rounded corners of good radius.

b. Hydrants must be so designed that with ordinary usage they will not cause water hammer.

c. Hydrants must be so designed that the leaded joint underground can be strapped.

In any new design it is recommended that the hydrant be so constructed that when the valve is shut it will remain tight when top of hydrant is broken off [illegible]



$$A = \frac{0.3707}{\text{No of threads per inch}}$$

$$B = \frac{1}{\text{Twice No of thds per inch}} + \text{[illegible]}$$

Fig. 1—Acme Standard Thread.

3. MATERIAL OF BODY.

The hydrant body shall be made of cast iron of good quality, such as shall make the metal strong, tough, and of even grain. The strength of the cast iron must be that required by the specifications for standard cast iron pipe 12 ins. and less in diameter.

4. HOSE NIPPLES AND VALVES.

a. Hose nipples must be of bronze, threaded with a fine thread into the hydrant, and securely pinned in place.

b. Hose threads on all hydrants to be installed in any given community must of necessity be interchangeable with those already in service, but, where practicable, threads shall conform to the 1906 National Standard adopted by the National Fire Protection Association. The essential features of the "National Standard" are a 60° V-thread, outside diameter on male threads of 3 1-16 ins. and 7½ threads per inch.

c. Inside hose-gate valves must have bronze working parts and be of rugged design and must not introduce an unnecessary friction loss.

TABLE I.—STANDARD BOLT LAYOUTS FOR FLANGE END OF POST HYDRANTS.

Size of pipe, ins.	Diameter of flange, ins.	Diameter of bolt circle, ins.	Number of bolts	Size of bolts, ins.	Flange thickness at edge, ins.
[illegible]	[illegible]	4¾	4	⅝x2	⅝
2½	[illegible]	5½	[illegible]	⅝x2¼	11-16
[illegible]	7½	6	4	⅝x2½	¾
3½	8½	7	4	⅝x2½	13-16
[illegible]	9	7½	4	⅝x2¾	15-16
5	10	8½	8	¾x3	15-16
[illegible]	11	9½	8	¾x3	1
[illegible]	12½	10¾	8	¾x3¼	1 1-16
[illegible]	13½	11¾	8	¾x3½	1⅛
[illegible]	16	14¼	12	⅞x3¾	1 3-16
12	19	17	12	⅞x3¾	1¼
14	21	18¾	12	1x4¼	1⅜

Where working pressure is from 125 to 250 lbs. the standard for heavy flanges must be used.

There must be ample cleara
gate and the hydrant body w
in any position. The gate and
interchangeable and the valves
cated so as to be as accessible
repairs. The gate must be de
it cannot come off in use. The
must be below the level of the
nut so that the hydrant wrench
freely. If outside hose-gate v
instead of inside valves, they mu
or of iron with bronze trimm
cast on the valve body, each
bolted to the hydrant by two
placed [illegible] ins. on centers. Th
not project further than neces
be of the inside screw type, p
tical position with the hand-w
ins. below the base of the opera

d. The stems of the hose valv
less than ¾ in. in diameter
valves, and not less than ⅞ in
the valves at the steamer con

e. The stem nut of the
valve must be ½ in. square.

5. HYDRANT VAL

a. The seat must be made
curely fastened in place.

b. The valve must be faced
material such as rubber or leat
if of the gate type a bronze ri
The valve must be designed so
easily removed for repairs with
the hydrant.

c. With gate type of valve, cl
must be such that corrosion wi
parts inoperative.

6. DRIP VALVE

a. A positively operating non
valve must be provided and
drain the hydrant when the mai

b. The seat of the drip v
curely fastened in the hydrant
of the drip mechanism must be
easily removed without digging

7. OPERATING ST

a. The operating stem at th
thread where threaded, and
passes through the stuffing box a
be of bronze not less than 1¼ i
The bronze must have a tensil
less than 32,000 lbs. per sq. in
of the stem may be of iron with
area not less than 1½ sq. ins.,
edges where the area may be
operating stem must be attac
operation it will be impossible
detached.

b. The stem must terminate
nut of pentagonal shape, finis
taper to 1½ ins. from point to
hydrants to be installed where ex
have different shape or size of
use the additional hydrant
same operating nut as the old
formity. The nut socket in th
be made without taper so

c. The thread which operates
the Acme standard. See Fig.

8. STUFFING BOX AN

a. The stuffing box and gl
bronze or bronze-bushed. If
used, it must be of bronze. Th
box and end of the gland or pa
be slightly beveled.

b. Gland bolts or studs must
iron, or steel, at least ⅝ in. in
nuts must always be of bronz

9. HYDRANT TO

a. The hydrant top must be
to make the hydrant as weath
sible and thus overcome the
ing the stem. Provision must b
ing both for lubrication and
rosion. A reasonable tight fit s
around stems.

b. There must be cast on th
in characters raised ⅛ in. an
ins. long showing direction to
word "Open" in letters 1 in. hi

10. HOSE CAPS

a. Hose caps must be prov

[illegible] diameter.

[illegible] in a groove to prevent its falling [illegible]

[illegible] MARKINGS.

ust be marked with the name or f the manufacturer, the nominal year of manufacture. All letters ust be cast on the hydrant well und line. They must be 1 in. high in. on the casting.

[illegible] TESTING

[illegible] n before leaving the factory. If ressure is over 150 lbs. per sq. in., nust be tested to twice the work-. The test should be made with the order to test the whole barrel [illegible]

ould be made with the valve shut st the strength and tightness of [illegible]

[illegible] be made as severe as are liable service when using a hydrant st 17 ins. long.

DIRECTION TO OPEN.

ust open to the left (counter-ept those to be installed where nts open to the right, in which tional hydrants must turn the [illegible]

omic Considerations Affect- esign of the Power Plant ater Works Pumping Stations.

[illegible] s published relating to the ions affecting the selection [illegible] umping station service. As in former article, the present paper by Nicholas S. Hill nicipal Engineers of the City [illegible]

[illegible] termine the theoretical horse-[illegible] to pump the quantity of against the pressure which it maintain.

ad equals the static head on [illegible] suction lift. This [illegible] head multiplied by the weight of the water to be pumped in one minute and divided by 33,000 gives the theoretical horsepower. Having determined the theoretical horsepower it is necessary to de-[illegible] ing engine. See Table I, from Hague. The mechanical efficiency of all engines vary, of course, with the size and type, but Table I shows the approximate mechanical efficiency of engines of different sizes. The quotient obtained by dividing the water horsepower by the mechanical efficiency gives the theoretical indicated horsepower.

Having determined the indicated horsepower required, and having determined upon the type of engine to be installed, and knowing its duty, we can learn from Table I, p. 473, [illegible] the number of pounds of steam per i.h.p. required to be furnished by the boilers. It is usually safe, however, to provide in excess of the actual requirements of the engine, on account of the steam consumption of the auxiliaries and the losses due to condensation in the steam pipes, and for other reasons. As a rule, this amounts to about 10 to 15 per cent of the steam actually consumed by the main pumping unit.

Boilers should not be bought which provide less than 1 sq. ft. of heating surface for every 3 lbs. of water to be evaporated, in other words, with not less than 10 sq. ft. of heating surface per b.h.p. It usually will be found good practice and economical to provide reserve power in the boilers and ample heating surface, particularly if the boiler plant is designed on the test duty of the engine, which is never realized in actual practice. The best efficiency under ordinary working conditions is usually obtained by allowing very nearly 12 sq. ft. of heating surface per b.h.p.

Division of Heating Surface Into Units.—The first problem connected with the design of the boiler plant is to determine accurately the maximum number of pounds of steam that will be used by the various pumping engines as well as other parts of the plant that will have to be supplied. As previously explained, and as has already been said, one square foot of heating surface at least should be allowed in most boilers for every 3 lbs. of water to be evaporated into steam. With this proportion and sufficient draft and grate surface, to burn the necessary amount of coal, a boiler can be forced about 33 per cent over its rated capacity. It ought to be stated, however, that the maximum evaporation of a boiler is limited mainly by the amount of coal which can be burned upon the grate. By dividing the total number of pounds of steam that are to be evaporated per hour by three, the total amount of heating surface may be obtained with a fair degree of accuracy.

The next step is the sub-division of this heating surface into a proper number of boilers. This is of importance. Saving in first cost and the cost of operation may result from proper sub-division.

Grate Surface.—The factors controlling the amount of heat generated by the combustion of fuel are the kind of coal, the area of grate surface and the draft. Ample grate surface is desirable. The draft affects the rate of combustion.

The kind of coal to be used should be determined before designing the boiler plant, the cost of the various fuels available and their calorific value, or relative evaporative power. With these data, one can determine the cheapest kind of fuel, and each having been considered, can construct the boiler plant so that it can be used to the best advantage. Some plants are handicapped by failure to consider these questions.

With good coal, low in ash, approximately equal results may be obtained with large grate surface and light draft and with small grate and strong draft, the amount of coal burned per hour being the same in both cases. Bituminous coal, low in ash, gives best results with high rates of combustion, provided the ratio of grate surface to heating surface is properly proportioned. Coals high in ash require a comparatively large grate surface, particularly if the ash is easily fusible, tending to choke the grate. Where a strong draft is available a smaller grate may be used than with moderate draft, as a thicker bed of fuel can be carried. The relation between draft and rate of combustion is also important.

If only a limited amount of coal can be burned on a grate, it must be made larger in proportion to the heating surface, and when it is intended to burn low grades of fuel, provision for a large grate ought to be made in the first place. Then, if it is later desired to change to a fuel of a better grade, this can be done by reducing the size of the grate by bricking off a portion of it.

If it is certain that there never will be a desire to operate a plant with a poorer grade of fuel than that for which it is designed, it would be uneconomical to provide larger grates than are necessary.

From a knowledge of the number of pounds of water to be evaporated and the amount that 1 lb. of coal will evaporate under ordinary conditions, the quantity of coal that will be consumed in a given time can be calculated, and, if the number of pounds of coal that must be burned is known as well as the amount of coal that should be burned on each square foot of grate surface in a given time, for the normal rate of evaporation, the amount of grate surface can be determined.

Table II gives a very approximate estimate of the relative evaporative power of several kinds of coal, or the water that one pound of coal will evaporate, the pounds of coal that may be economically burned per square foot per hour, and the ratio of grate surface to heating surface with ordinary drafts.

TABLE II.

	Pounds of water 1 lb. of coal will evaporate, with steam at 212° F.	Pounds of coal per sq. ft. of grate per hour.	Ratio of heating to grate surface.
Best bituminous...........	9.0	21	55
Ordinary bituminous......	8.0	20	46
Anthracite (nut or larger).	8.0	13	32
Anthracite (buckwheat or [illegible]) ...	7.0	12	26

Types of Boilers.—For high pressures, 125 lbs. per sq. in. or more, the water tube or some form of internally fired boiler, in which the shell plates are not exposed to the high temperature of the furnace is considered safer than the horizontal tubular boiler because the shell plates and the seams of the latter must be of considerable thickness in large units, and being exposed to the hottest part of the fire are likely to give trouble, especially if the

M[illegible]HANICAL EFFICIENCY OF PUMPING ENGINES, SHOWING THE INDICATED HORSE POWER IN THE STEAM CYLINDERS.

Total Water Load Against the Plunger in Pounds Pressure Including Suction.												[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]	[illegible]	130	140	150	
Indicated Horse Power of the Steam Cylinders.												
20	25	[illegible]	35	40	[illegible]	50	[illegible]	60	65	70	75	[illegible]
[illegible]	37	44	52	[illegible]	[illegible]	74	81	90	96	104	111	[illegible]
[illegible]	[illegible]	60	70	80	90	100	110	120	130	140	150	82
[illegible]	60	72	[illegible]	[illegible]	110	120	133	145	160	[illegible]	180	[illegible]
[illegible]	71	84	100	114	128	143	157	171	185	200	214	[illegible]
[illegible]	94	113	132	150	170	188	207	226	245	264	283	[illegible]
93	116	140	161	[illegible]	[illegible]	234	255	280	304	325	350	86
[illegible]	138	166	205	220	[illegible]	276	[illegible]	330	[illegible]	[illegible]	415	87
[illegible]	161	194	225	257	[illegible]	322	[illegible]	[illegible]	418	450	484	[illegible]
[illegible]	182	218	255	291	328	[illegible]	400	435	474	[illegible]	[illegible]	[illegible]
[illegible]	205	245	286	[illegible]	368	410	[illegible]	492	532	572	614	88
[illegible]	225	[illegible]	315	360	405	450	495	[illegible]	585	630	675	[illegible]
[illegible]	247	296	[illegible]	395	446	[illegible]	[illegible]	592	642	690	740	89
[illegible]	266	320	375	[illegible]	480	534	[illegible]	640	692	750	800	[illegible]
[illegible]	289	346	404	[illegible]	520	[illegible]	[illegible]	694	745	809	[illegible]	90
246	[illegible]	370	430	[illegible]	554	617	676	[illegible]	800	860	923	91
[illegible]	330	[illegible]	[illegible]	529	593	[illegible]	726	790	860	922	990	91
[illegible]	[illegible]	418	[illegible]	556	627	[illegible]	[illegible]	832	906	975	1,043	[illegible]
[illegible]	370	444	520	591	[illegible]	740	[illegible]	[illegible]	960	1,034	1,109	92
[illegible]	388	465	[illegible]	619	696	[illegible]	[illegible]	930	1,006	1,042	1,162	93
345	430	518	602	[illegible]	[illegible]	[illegible]	[illegible]	1,033	1,120	1,205	1,290	[illegible]
375	458	[illegible]	[illegible]	[illegible]	843	990	1,030	1,123	1,266	1,310	1,406	91
[illegible]	532	639	745	[illegible]	[illegible]	1,065	1,173	1,278	1,381	1,491	1,596	[illegible]
[illegible]	631	[illegible]	[illegible]	[illegible]	[illegible]	1,262	1,390	1,519	1,640	1,772	1,895	[illegible]
590	738	885	1,033	[illegible]	1,325	1,478	1,622	1,772	1,918	2,063	2,219	95
[illegible]	833	1,000	1,168	1,335	1,500	1,669	[illegible]	2,025	2,165	2,340	2,500	[illegible]

water contains scale or sediment forming elements. This type of boiler, however, for the pressures which it will safely carry, is economical in the use of fuel. There is a limit to the size of these boilers, however, owing to the fact that the thickness of the plate in the shell increases very rapidly as the diameter of the boiler is increased, and it is either necessary to lower the pressure carried in order to get large units or else to install a number of units, where large amounts of power are required, and the duplication of units and boiler settings is expensive. Return tubular boilers are seldom made in sizes over 200 h. p. and hence are not to be considered for large units.

The internally fired type of boiler is advantageous in economy of space, the saving in the cost of repairs to brick settings and its good steaming qualities, although, if properly made, it is not a cheap boiler. In fact internally fired boilers are more expensive than externally fired, though the extra cost of setting and foundations of the latter may bring the total cost of the entire equipment to practically the same figure. The internally fired boiler, with corrugated fire boxes, of the Fox or Morrison type, is an excellent boiler for high steam pressure and will meet all of the conditions now set up for modern boilers.

The water tube boiler is particularly advantageous in view of the fact that high pressure may be carried with perfect safety. The water tube boiler is usually employed in large central stations with high pressure and units of from three to five hundred horse power. It is possible that this boiler has led in the advance of steam pressure and the engine economy resulting therefrom, and that the development of the modern high duty engine has followed in its wake. The danger from explosions in stationary practice is now largely reduced by the water tube boilers and this feature of the boiler has made it popular in water works pumping stations for the reason that the fire hazard of a town, as well as the comfort of the people, is entirely dependent upon the safety and permanency of the water supply.

The economy with which different types of boilers operate depends far more upon their proportions and the conditions under which they work than upon their type. It is certainly true that when the proportions are suitably carried out and when the conditions are favorable the different types of boilers give substantially the same efficiency.

As previously mentioned, the water tube boiler has a decided advantage, so far as safety is concerned. Water tube boilers seldom if ever explode, although the tubes sometimes burst. Water tube boilers also possess a slight advantage in that they contain less water within the shell than the usual designs and consequently steam can be raised in them very quickly. On the other hand, this type of boiler is very flashy and it is harder to maintain a uniform steam line than with the horizontal tubular boiler or the internally fired marine type of boiler.

As in the case of pumping engines, the selection of the type of boiler must be a question to be determined with each individual plant. The relative merits of a boiler should be considered with reference to (1) durability, (2) accessibility for repairs, (3) facility for cleaning and inspection, (4) space requirements, (5) adaptability to the type of furnace and stoker desired, (6) capacity and (7) cost of boiler and setting.

Superheat.—The installation of a superheater is equivalent to an increase in boiler capacity. Superheaters may be independently fired or may be arranged in connection with the boiler proper. Engineers are not agreed as to which arrangement gives the most economical returns. The requirements for a successful superheater are: 1. Security in operation, or minimum danger of overheating. 2. Economical use of heat applied. 3. No exposure of joints to the fire. 4. Provision for free expansion. 5. Disposition such that they can be cut out or repaired without interfering with the operation of the plant. 6. Ease of application to existing plant.

Nearly all superheaters depend upon carrying steam at a high velocity through small tubes in the form of return bends or coils and arranged so as to be heated by the hot gases in the boiler furnace or from some other source.

The independently fired superheater has the following advantages: 1. Degree of superheat may be varied, independently of the performance of the boiler. 2. It can be placed at any desirable point. 3. Repairs can readily be made without shutting down the boilers.

Some of the disadvantages are: 1. It requires separate firing and extra attention. 2. Extra piping is required. 3. Extra space is required. 4. Initial cost is greater. The standard practice in this country seems to tend towards the superheater contained within the boiler setting.

The original tendency with superheating was to superheat the steam several hundred degrees, but the practice of installing superheaters in pumping stations has pretty clearly developed the fact that for this service 100° of superheat is amply sufficient. This corresponds to an increase of from 8 to 10 per cent in the horse power of the boiler, produced in the superheater.

Superheaters are especially effective when applied in the small water works pumping station with low duty, triple expansion engines. There is no class of machinery in which the benefits of superheated steam are more readily apparent. The cost of superheater installation amounts to but $8 or $10 per horsepower, including added cost of piping, and therefore does not materially increase the investment account in a small station. The saving to be effected in fuel ranges from 10 to 20 per cent. The cost of repairs and maintenance is very low, and if properly taken care of they give very little trouble.

Exhaust steam feed water heaters are used to heat the water fed to boiler with steam exhausted by pumping engines and auxiliaries and the saving due to their use is so great that it is strange that small pumping stations are so frequently constructed without them. Generally speaking for every 11° that feed water is warmed there is a saving of 1 per cent in the fuel burned. With sufficient exhaust steam available cold feed water at 50° to 60° can be raised in temperature to practically 200°, thus saving 12 per cent of the fuel. The heater will therefore in many localities reduce the fuel consumption enough to pay for itself in a few months, the exact time depending on the cost of fuel.

With condensing apparatus in conjunction with main pumping unit and a temperature of 100° or 125° in the boiler feed water as a result of the use of exhaust steam from auxiliaries, there is room for consuming other waste heat. It is well to carry all the condensation from the jackets on the main engines as well as from the steam supply piping to a hot well. This will usually raise feed water with an initial temperature of 60° to at least 100°, where steam pipe and jackets are effectively covered, and if it passes from thence through the feed water heater the resulting temperature will be about 150°, and it has been found under these conditions that the addition of an economizer will give good results. One combination that works out favorably under the conditions outlined is to return the condensation to a hot well, carry the exhaust steam from independent auxiliaries to the feed water heater and extract sufficient heat from the flue gases going up the chimney by means of an economizer, to return the water to the boilers at a temperature of from 200° to 225° F. The saving in coal effected by this combination amounts to approximately 15 per cent, with an initial feed water temperature of 60° F. The cost of the complete outfit, hot well, piping, feed water heater and economizer, should not cost in excess of from $8 to $10 per horse power, and if fuel is costly it can be readily seen that the capital outlay will soon be fully repaid by the saving effected. In this connection it is an excellent plan to fit thermometer wells and thermometers for the purpose of obtaining the temperatures resulting from the various parts of the feed water system. As previously stated,
there are so many combinations
worked out that there is no par
which is worthy of more careful
than the feed water heating s
equally true that such study resu
saving in coal, and it is commo
element of the pumping station
lected. Cost of coal must also
account when deciding upon the
the most economical feed water
tem. The higher the cost of co
the allowable initial capital out
water heating.

The factors to be considered b
ing an economizer are, briefly:
the auxiliary machinery and th
the heat to be derived from th
methods of heating the feed wate
er atmospheric heaters are used,
all or part of the exhaust ste
plant is used for heating. 3. Th
perature of the feed water and
feed water is taken from hot w
cold supply. 4. The probable ris
perature due to the installation
mizer. 5. The cost of the econon
cost of the additional building s
reduction of the boiler heating
possible by the economizer. 8. T
of the stack or forced draft app
sary to compensate for the loss
to the installation of the econo
terest, depreciation, maintenance
ing cost, and insurance of all
ments which are included as a
stalling the economizer.

Steam Piping.—In any syst
fundamental object is to condu
from boilers to engines in the s
and most economical manner.
used in the steam pipe system s
best obtainable and the system
flexible that a breakdown in one
not necessitate the closing down
plant. On the other hand, flexib
the number of parts and unless
small importance will materially
initial investment in this portion
As a general proposition it is per
say that the best pipe and fittin
the most economical in the end.
tunate, however, that but few ow
works plants are willing to take

Since steam is hotter than th
air, it must lose some of its hea
age through the pipe lines. Pi
should be of minimum size consi
too great pressure losses resultin
creased friction due to small siz
promise between loss of pressur
heat could be effected, it would
by equating the loss of coal r
the loss of a given amount of p
similar loss due to the heat lost
tion incurred by making the pipe
to prevent the loss in pressur
small loss in pressure a furthe
the diameter of pipe affords but
tion in friction and adds much
radiation losses, so that the use
pipes rather than being econom
volve increased capital expendit
a reduced efficiency. The chief
observed to obtain the maximu
the piping is that it shall take th
course from boiler to engine, a
and engine should be placed as
as possible.

Steam pipes, feed water piping
drums, receivers, separators, et
covered with heat insulating m
duce radiating losses to a minim
of heat from a bare steam pipe
at about 3 B. t. u. per square foot
degree difference in temperatur
loss, of course, depends upon
the diameter of the pipe, wheth
horizontal, the nature of the su
rection and velocity of the su
currents, etc.—but by properly
good commercial covering from
cent of the heat lost by radiatio
vented.

One of the most difficult prob
piping is proper provision for e

to change in temperature, and increases with the use of superh pressure steam. Pipes [illegible] erably fixed. They should perly provided rollers and supow free contraction and expanuse of long radius bends, and expansion joints, where neceserially aid in preventing break- due to an improper provision

f cooling boilers for cleaning as well as the fact that some nes may be idle and cold, while t, causes the connecting pipes oilers or engine and the main in length not only as a result dual contraction and expansion o the change in relative length oiler or engine and the others. perature of 60° F. and the tem- at 200 lbs. pressure the exipe will be over 4 ins. in 100 ft. ical rule to follow is to allow ansion in every 50 ft. of pipe. ted steam the expansion will be han mentioned. Obviously therations must be provided for.

y the cause of the greater part ation pipe work can be traced engineers. There is no other ion work that affords the engir opportunity of showing his station requirements, none that ch time to properly design, and ore certain to develop the sta-down, expensive plant or the piping and pipe system are the of a pumping station design [illegible] ngines, as a rule, are designed for given capacities, and if the system are not properly cared neer, he fails to do that work his and the result is very seation duty of the plant.

'opulation and the Water ystem of Milwaukee, from 1880 to 1910.

on the accompanying diagram th of the city of Milwaukee d the variation in the physical figures of the waterworks system for the same period. One thing that is clearly shown by the curves is that the installation of meters on residential and business services alone is not in all cases sufficient [illegible] water for all purposes, including public uses, leakage, waste, etc., on public and private premises.

As was shown in our issue of April 24 the greater part of the unaccounted for consumption of water, which is estimated at 23 per cent of the total pumpage, is due to underground leakage, or to the misuse of water in sprinkler systems or unmetered service. A study of the curves here given shows:

First: That the daily consumption of water per capita as shown by curve No. 2 ranged from 106 gals. in 1880 to a maximum of 113 in 1887, and to a minimum of 80 in 1901 and 1903, while in the year 1910 it has increased to 111 gals. per capita.

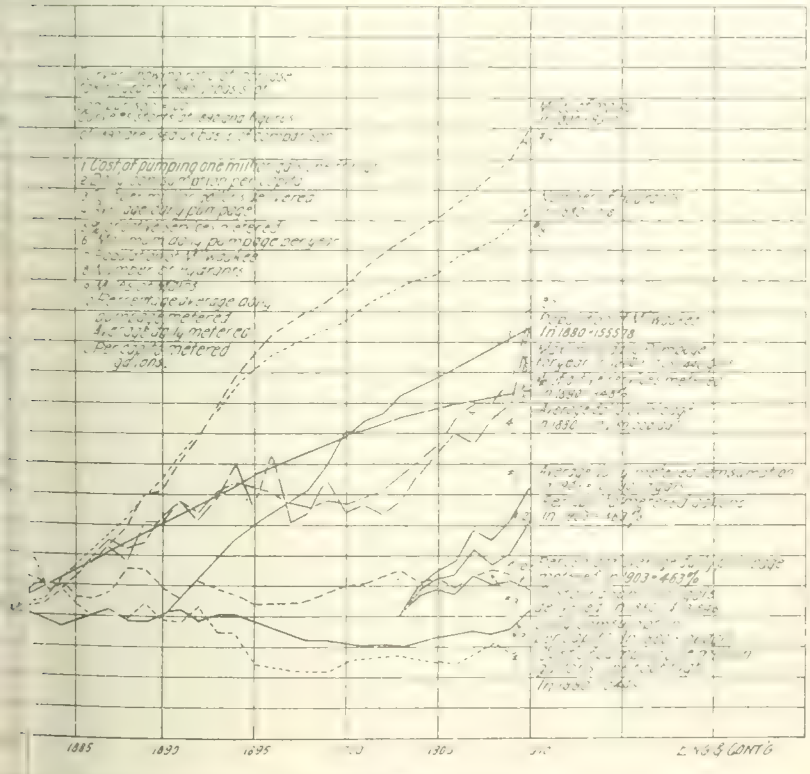
Second: That as the services were metered, shown by curve No. 5, from 1891 when 7,526 were in service, the consumption decreased from 112 gals. to the minimum consumption of 80 gals. in 1903, when 36,415 meters were in service.

Third: That although the number of meters installed has increased from 36,145 in 1903, to 53,051 in 1911, the consumption per capita has increased from 80 to 111 gals. per day or more than 38 per cent, whereas it should have decreased, assuming all other factors to remain the same.

Fourth: That, although during the last three years the daily consumption per capita, curve No. 2, has increased over 19 per cent, from 93 to 111 gals., the percentage of average daily pumpage metered, curve No. 10, has decreased over 8 per cent instead of increasing proportionately. Also, during the same period, the average daily metered consumption, curve No. 11, and the per capita metered gallons, curve No. 12, have both increased proportionately.

These few comparisons show that although the addition of meters for the last 20 years has helped materially to reduce the consumption per capita, the unaccounted for consumption or loss has increased so much faster that the per capita consumption will pass its maximum figure of 1887, unless the underground leakage of water, its misuse and its illegal use are soon stopped.

Allowing 5 per cent as a fair rate of slippage, to be deducted from the pumpage for the last ten years, all the balance of the unaccounted-for consumption is assigned to the distribution system, some being chargeable to illegal use, more to misuse of unmetered services, but most to underground leakage.



am Showing Growth of Milwaukee and the Water System.

Design of the Storm Water Control, Harrisonburg, Va., Sewage Disposal Plant.

The first feature in the operation of a sewage disposal plant is the control of the sewage flow. With a separate sewer system the control of flow is a simple matter, but with combined sewers a special device is required to bypass the storm water around the purification works.

The accompanying illustration, Fig. 1, illustrates the details of design of the storm water control for the disposal plant at Harrisonburg, Virginia, a city of 5,000 population. The disposal works were designed by N. Wilson Davis, M. Am. Soc. C. E., and will be built during the present season by force account. We are indebted to Mr. Davis for the information on which this description is based.

The complete disposal works consist of the storm water control, two Imhoff settling tanks, four sludge drying beds, a dosing tank, and six intermittent sand filters. The sewage flows from the city to the disposal works, located near Black's Run, through a 15-in. pipe sewer.

In examining the conditions of flow in the

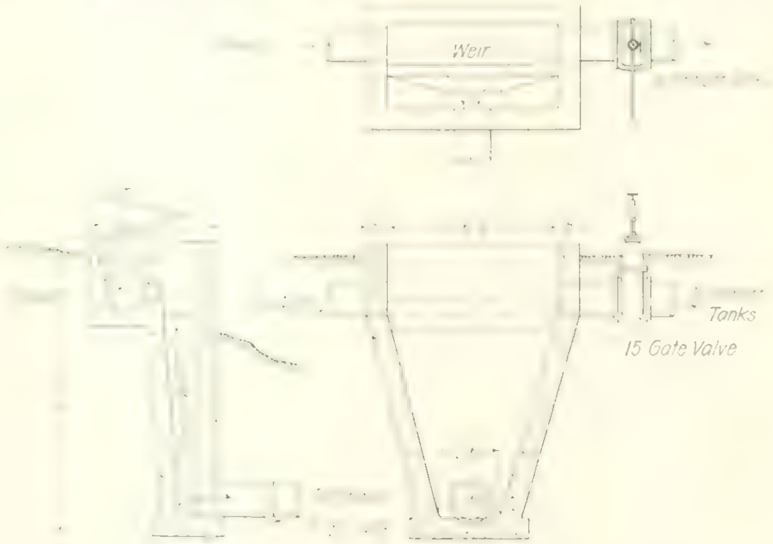


Fig. 1—Details of Storm Water Control, Harrisonburg, Va., Sewage Disposal Plant.

sewer it was found that [illegible] sewer the sewage would [illegible] 15 in. pipe. The pipe is laid [illegible] per cent grade. During storms considerable surface water will enter the sanitary sewers through ventilating manholes, from roofs and through open joints of improperly laid pipe [illegible] the sewer will run full bore from one to five hours, depending on the intensity and duration of the storm.

It is almost impossible, and quite impracticable, to correct these faults in the old sanitary sewer at this time, hence the heavy flow during rain storms must be handled by the proposed storm water control.

About 12½ acres of flat land adjacent to Black's Run are to be used for this disposal plant and the main sewer follows the contours of the hill to a point opposite this flat land and about 9 ft. higher than the average surface and 14 ft. higher than Black's Run, into which the effluent is emptied.

From this point [illegible] across the flat land and the pipes and open conduits, carrying the sewage to various parts of the plant, are laid on top of these fills or mounds. This insures the operation of the entire works by gravity.

It is also quite significant to note, in this connection, that this arrangement permits the top of the storm control, Imhoff tanks, the dosing tank, and filter beds to be about 6 ft. above high water mark.

The 15 in. pipe leading the storm waste by-passed to Black's Run is laid under the surface of the flat land mentioned above and about 8 ft. lower than the main sewer, thus permitting the construction indicated in the accompanying illustration.

The storm water control consists, fundamentally, of a weir 6 ft. long set longitudinally with the main sewer and at an elevation below that of the center line of the sewer, so that when the sewer is more than half full a portion of the sewage will spill over this weir and waste into the adjoining branch. It may be well to note that high water can not prevent the efficient operation of this storm control under the local conditions.

The down stream side of the storm water control is provided with a gate valve having a lock lever, so that the valve may be set and locked at any point desired—permitting only the normal flow of sewage to reach the Imhoff tanks and filters. The entire flow may be diverted if occasion should require.

The Practical Sanitation of Contractors' Construction Camps.

Money expended in the sanitation of contractors' construction camps, especially the large ones, is well invested. By keeping the general health of the men normally good, their efficiency can be held to a rigid standard. Considerable study has been devoted to the subject of camp sanitation within recent years, chiefly in army encampments and in the construction camps of contractors on some of the large works built in our eastern states.

The need of taking precautions to prevent the outbreak of epidemics in encampments is now well understood. It will be recalled that at the time of the Spanish-American war, over 90 per cent of the American volunteer regiment developed typhoid fever within eight weeks after going into camp, and that the mortality from this disease amounted to 86¼ per cent of all fatalities. Approximately the same number of men were encamped at San Antonio, Texas, in 1911, as at Jacksonville, Fla., in 1898, and for about the same length of time, and at about the same season of the year. There were 248 deaths from typhoid at Jacksonville and not a single death from that disease at San Antonio, improved camp sanitation accounting for the difference in the fatalities at the two encampments.

Methods of safeguarding the sanitary conditions in construction encampments are now becoming as well standardized as any other application of sanitary science. The methods successfully employed in the construction camps on the Catskill Aqueduct, the Wachusett Reservoir, and the Morris Dam, are representative of the best present day practice in camp sanitation and are here briefly described. The information given is based on a paper before the Boston Society of Civil Engineers by A. J. Provost, Jr., and discussions by W. W. Locke and H. G. Payrow. The paper in full, with discussions, is published in the Journal of the Association of Engineering Societies for March, 1912.

[illegible]

The principal encampments for the Catskill Aqueduct work are located at Brown's Station, near the site of Olive Bridge dam, where houses are provided for about 4,000 people; and at Valhalla, near the site of the Kensico dam, occupied at present by about 1,000 people, but which will later be enlarged. Along the 90 miles of aqueduct between the Olive Bridge dam and the north limit of New York City, about 15,000 men are employed. Most of these men are housed in about 75 other regulated labor camps. Seven of these camps, housing about 1,500 persons, are located in the Croton watershed, and other laborers are housed within the sheds or other public and private supplies. Every reasonable attempt has been made to secure healthful conditions in the camps and to prevent contamination of these water supplies.

The general procedure in the Croton shed has been as follows: Land for camp sites is usually leased or purchased by the contractors after official examination and approval. A careful topographical survey of the site is then made and mapped by the engineer, upon which the contractor designates the location of his proposed buildings, the source of water supply, the distribution piping, sewer lines, etc. This design is kept as compact as is consistent with proper air and light, for the reason that the area is enclosed with a manproof fence, and all rain water falling within same is collected, filtered and sterilized.

The sanitary works consist of one or more incinerator units, according to the size of the camp, for the combustion of human wastes; one garbage incinerator; drains for the collection of all kitchen, laundry and bath wastes; a grease trap for the reception of these liquid wastes before filtration and sterilization; diverting ditches to exclude rain water falling outside of camp area; collection ditches to deliver to a common point all rain water falling inside of camp area; settling basin with capacity for 24 hours run-off from camp area; sand filters, two or more units, to receive and filter all camp rain water after passing through settling basin; a chlorinating apparatus for sterilizing filtered camp wash and waste water before discharge into streams tributary to the New York City supply.

During working hours away from camp the men are supplied with and obliged to use galvanized iron receptacles. These are returned to camp daily and their contents burned in the incinerators provided for this purpose.

All camp buildings are erected from approved plans. These include sleeping quarters, mess halls and kitchens, wash houses and laundries, hospital and dispensary, isolation hospital, incinerator toilets, stables, etc. Sleeping quarters are provided with 400 cu. ft. air capacity, 2½ sq. ft. window area, ⅓ sq. ft. vent openings for each inmate. All windows, doors and vent openings are screened. Not more than eight men are allowed to occupy any room, and the usual procedure is two men per room. The preferred type of bed is a canvas stretcher laced to an iron pipe frame without mattress or springs.

The storage, preparation and eating of food in sleeping quarters is not allowed. There is usually a recreation room in each barracks, well heated, and the entire building is frequently lighted by electric lights. The mess halls and kitchens are required to be of proper size, well ventilated and thoroughly screened. Wash houses and laundries have cement floors, shower baths, lavatory accommodations and laundry tubs.

The hospital contains a doctor's office and dispensary with complete inventory of drugs, and equipped with first aid to th
operating room with table, full
instruments and adequate light
a ward room with beds for tw per cent
force, allowing 600 cu. ft. for ch bed; a
detention room of about 1,200 cu. ft. capacity
There are also provided slee
for nurses and orderlies, bath om,
for linen, cots, bedding, etc.
hospital is a small building ren
for the reception and treatmen
contagious diseases. It is surr
manproof fence and equipped so
treated therein may be compl
until regularly discharged.

The incinerator houses are as
eled after the United States ar
taining either the McCall or
Evaporative furnaces, with sea
based upon one seat for about
persons using same. The pro
types is slow and frequently ac
somewhat objectionable odors.
being portable, it is too light f
under unskillful management,
densome charges for renewals
To overcome these disadvant
modifications have been tried, th
ising of which appears to be
gested by L. E. Brink, and as
Keystone Construction Compa
Vernon. This consists essential
angular building with concrete
out, well lighted, ventilated and
four corners of which are parti
form four separate toilet rooms
four seats each. They are prov
movable iron receptacles, the
which are transferred to a grat
occupying the central portion of
This type of furnace and build
to replace in labor camps of
army type, which is made purpo
transportation, and is, conseq
lived.

The stables are, as a rule, we
buildings of ample size, having
non-absorbent floors. All manu
ed and removed daily from the
camps. Other buildings usually
commissary for storing and sale
ucts and a bakery where most
is as a rule prepared.

Water Supplies.—The water
camp must be provided from
source, and is frequently exam
hundreds of different supplies h
ed in the course of the work,
aminations have fully confirmed
rulings that open wells, unprot
and surface waters are undesira
places springs and open wells h
closed and protected from surfa
in two or three instances filtered
is used, but, generally speaking, th
factory supplies are furnished
properly cased. The taking of wat
is prohibited, and all tanks and
the storage of water for dome
are required to be covered.

Food Supplies.—Examination
of food products has as a rule b
to regulating the purchase of ra
approved dairies, and to the
foods to be consumed in a raw
out cooking subsequent to th
The restriction of food peddling
some cases required.

Each labor camp is in charg
proved physician employed by th
Applicants for employment are
amined, and open cases of tuber
jected. If accepted, the applican
ed, unless he can produce a rec
of vaccination from one of the
physicians. Vaccine and diphth
are furnished in desired quant
New York City Department of
out charge, in order to provide
fresh products.

Weekly health reports in pre
are prepared by the camp physi
the census of white and black,
and infant population; the numb
and surgical cases, presence

[illegible] infectious disease [illegible] deaths, and matters [illegible] tary condition of [illegible]

In addition, the physician is re[illegible] report by telephone [illegible] prescribed code, all suspicious ntagious or infectious disease as s suspicions are aroused. The gnosis is at once confirmed or means of laboratory examinations ntum or extreta, as the case may [illegible] the establish[illegible] prompt regulation and control eliminates the undesirable excite- so frequently are associated with [illegible]

ong attempts to state as concise- [illegible] which have been formulated and ed out.

[illegible] mps, and, in like manner, no one l times equally well administered. anliness of the living quarters is most difficult matters connected [illegible] tendency [illegible] sistently toward the condition of to them.

has, naturally, attracted the at- any people. Some there are un- [illegible] zeal would like to accomplish nce. Others there are, like some ctors, who think too much is at- t in between there are many proved the work and expressed [illegible] results. [illegible] responsibility rests it has been bserve the substantial absence oughout the entire work, and to of this result all that has been worth while. It may be safely he future no large public work taken without greater attention are of labor than has usually n the custom.

[illegible] RESERVOIR.

[illegible] of contractors [illegible] : Reservoir for the Metropoli- [illegible] described by Mr. [illegible] and the stripping itershed when it was prac- [illegible] in such a location mp too far away from the l on the unstripped surface; gh land or gravelly knolls [illegible] ing for wash water hich were treated with chloride covered with earth when the andoned, unless they were upon stripped, in which case the con- cavated and carried off the [illegible] taken to remove [illegible] d which showed any signs of [illegible]

[illegible]

[illegible] of employes, and all cases of contagious dis- [illegible] the watershed. The total number of typhoid fever cases which developed in the camps or among the employes for the eight years while construction work was in progress was twelve, a remarkably small number in comparison with the thousands of men who were employed during that time upon the work.

While soil stripping was in progress, light, movable privies were carried along just ahead of the stripping gangs and located on the unstripped surfaces, so that the men could have no excuse for going anywhere else, and the foremen were given strict orders to see that they did not go anywhere else. In this way the excreta was removed off the watershed with the soil. This also meant a great saving of time to the contractors.

Camp sanitation at the Morris dam, which is now being built at Waterbury, Conn., was described by Mr. Payrow.

When the construction began in 1909, the camps for the laborers were located outside the watershed, in part on private land leased by the contractor. It was thought, by locating the camps here, no special attention would have to be given to sanitation, but in a short time conditions became neglected and filth was common, so that within a few months from the beginning several cases of typhoid fever had developed, and it became necessary to take radical steps. The sick laborers were removed to hospitals, mattresses and bedding burned, the camps cleaned and fumigated, and all other laborers who had been using these camps were discharged. Furthermore, in order to avoid a recurrence and to establish better sanitary conditions, new camps were located, not off the watershed, but directly on it. By this means, camps came on city property and could receive careful and rigid supervision.

A small area has been fenced in with five strands of barbed wire and only one entrance provided. All around the area a 3-ft. trench has been excavated, and this trench drains into a sump from which water is allowed to percolate through the ground. Water which the men use for washing clothes, dishes, and so on is taken care of by a small sand filter, located conveniently, and into which they are required to empty all receptacles that have been used for washing. Refuse and excrement is deposited in large galvanized ash cans that are provided in the outhouses and on the works. These cans are taken each day to a farm that is located outside of the watershed area. Here the cans are emptied, washed, sprinkled with lime, and afterwards returned. Daily [illegible] camp and all outhouses about the works. During the past two years that the camps have been located on the watershed area these careful methods have been adhered to and no serious sickness has been developed. With a few exceptions, laborers and other employes have readily complied with the established rules and regulations for sanitation.

Proposed Chicago Ordinance on Electrolysis.

In our issue of Dec. 13, 1911, we published an account of the findings of the investigators of electrolysis effects on the underground metallic structures in Chicago. An ordinance on electrolysis will be voted on by the city council on May 6. The ordinance has been favorably reported out of committee and it doubtless will pass in its present form, as given herewith in full.

[illegible]

All uninsulated return circuits must be of such current carrying capacity and so arranged that the difference of potential between any extreme points on the return and the feeding station will not exceed the limit of 12 volts, or between any two points on the return 1,000 ft. apart will not exceed the limit of 1 volt. In addition thereto a proper return conductor system must be so installed and maintained as to protect all metallic work from electrolysis damage.

The return current amperage on pipes and cable sheaths must not be greater than 0.5 amperes per pound foot for caulked cast iron pipe, [illegible] amperes per pound foot for screwed wrought iron pipe, and 16 amperes per pound foot for standard lead sheaths of cables containing 3 per cent of tin or less.

All persons, firms or corporations operating railways within the city must equip their uninsulated return current systems:

First. With insulated pilot wire circuits and voltmeters so that accurate chart records will be obtained daily showing the difference of potential between the negative bus bars in each station and at least four extreme limits on the return circuit in its corresponding feeding district.

Second. With insulated cables, automatic reverse load and overload circuit breakers, and recording ammeters, which limit and record the maximum amperes drained from all the metallic work (except the regular return feeders) to less than 10 per cent of the total output of the station.

The said chart records must be so kept as to always be accessible to city officials.

Any person, firm or corporation in the city failing to comply with the provisions of this ordinance after six months from the date of its passage shall be fined not less than $50 nor more than $200 for each offense; and each day's operation of such equipment contrary to said provisions shall constitute and be regarded as a separate and distinct offense.

RAINAGE AND IRRIGATION SECTION

ver Drainage—A Project ming 500,000 Acres of Land in Missouri.

Staff Article.)

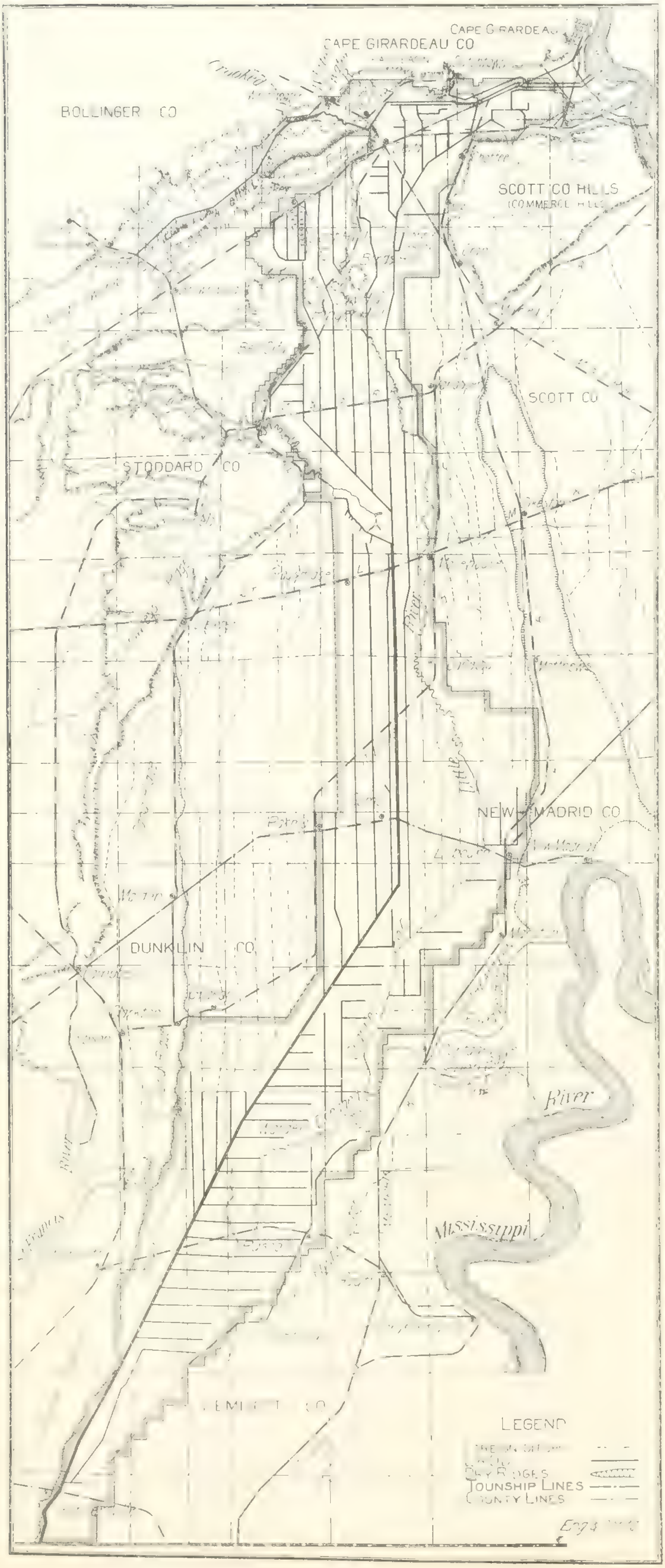
have been completed for re- d control and drainage some f swamp land in the valley theast of Cape Girardeau, the present intention to begin year on the levee system and l control. The accompanying drainage works as planned. the work of a board of engi- g of Otto Kochtitzky, W. A. C. Frissell, who submitted oval of Isham Randolph and n, consulting engineers. Mr. s now chief engineer of the

[illegible]

The Ozark Hills extend from the Mississippi River above Cape Girardeau southwest to the Arkansas state line and form a ridge which cuts off the southeastern corner of the state of Missouri. The area between the Ozarks, the state line and the river is all flat bottom land except the hills along the river at Commerce and the clay hills of Crowley's Ridge on the west. Commerce Hills are continued by Sikeston Ridge to the river at New Madrid. Crowley's Ridge is likewise extended southwest by sand hills which form the watershed between the St. Francis and Little rivers. Between the two ridges and high bottoms is flat, swampy bottom 10 to 20 miles wide and 90 miles long, as indicated by the hatched area on the map. This is the proposed Little River drainage area.

The low bottom or swamp land forming the new drainage district slopes gradually toward the southwest at about 1 to 1½ ft. per mile. The elevation at the river is 334, at Delta 325, at Nigger Wool Slough 302 to 294, and at the state line 234. Across, the valley is almost perfectly flat, except where modified by the upbuilding from streams carrying sediment and except for isolated hills as indicated on the map.

In years past the owners of the high bottoms bordering the swamp area have built ditches as shown by the dotted lines having outlets into the swamp. Into the north end of the valley from the Ozarks there flow Whitewater River, Crooked Creek, Hubble Creek, Ramsey Creek and Caney Creek. Each of these streams has upbuilt the land at its debouche and all of them lose their channels in the swamp. There is also the run-off from Crowley's Ridge and other heights and whenever the Mississippi rises above 333 it over-



Map of Little River Drainage District in Missouri.

flows into the valley at its op ing south
Cape Girardeau.

PLAN OF RECLAMATI

With the topographic and hy graph
ures outlined, the problem of
swamp area involves first the
flood waters from the Ozark ills and the
Mississippi and second the dr ing away of
the water in the swamp.

Flood Protection.—The tota area of
country from which the run- flows upon
the Little River drainage dis ct is
square miles in extent, of whi 1,136
miles lie in the foot hills of th Ozark
lying immediately north of th distr
square miles low hills and g le sl
north part of Crowley's Ridg in S
County and 60 square miles
hill country north of Benton nd
Mississippi River in north
county.

The Ozark Hill watershed
proximately a triangle with it ap
northeast of Fredericktown and s
33 miles long, from three miles es
brier to near the Mississippi Ri
country is generally rough wit
minor valleys from 100 ft. t
wide, lying between hills from 00
ft. high and a very small per
uplands The surface is m
compact subsoil which does
ceive and retain much water.
cent is in cultivation and the r
forest, and probably half of t
in forest for many years beca
value for other purposes. The
valleys of these streams lie h
Mississippi River at Cape Gira
range with each other in eleva
their floods may be collected
channel and discharged into th
point.

To protect the valley from
the Ozark Hills streams they
by a channel running eastward
of the hills to the Mississippi R
diversion channel will be constr te
tor River eastward through t low
lying north of Goose Pond
west end of Hickory Ridge,
Crooked Creek and following
with Whitewater River and
stream to the mouth of its val
ville; thence constructing a n
Whitewater River in a northea
from Allenville and east into
River.

There will be a levee constr ed
west side of Castor Valley al g
side of the channel to the defle
thence along the south side of
nel to the high bottom land l
Crooked Creek Valley and
thus forming a detention basin
north of Goose Pond Hills an h
of Hickory Ridge. This ba
three or four floods per year
from a 6 in. rainfall in thirty
bring it to an elvation of ab
west end and 358 at the east
basin is not filled by flood
braced will be better drained an
now.

There will also be a levee ac ss
front of Whitewater Valley, a
ward along the described chann
water to the Mississippi Riv
also be a levee built from D
along the east bank of Hubbl
one-half mile, and thence south
Creek upbuild to approach wit
the south levee, and thence ea
proach within 1,000 ft. of the
lower bottom and continuing p
to the Mississippi River.

Thus there is formed a flood
south side of the Allenville high
Hubble Creek low bottom, wher
tention basin of 3,300 acres is
the east end of which a floo
wide extends to the river. The
6 in. rainfall in 36 hours will
to an elevation of about 340.
the channel constructed will ser

of these streams and the excess season will be regulated by the [illegible] land elevations at different points

	Gulf level.
at Greenbrier...............	360
[illegible]	[illegible]
alley, at mouth of Crooked	
[illegible]	[illegible]
....	[illegible]
upbuild........................	338
of Hubble Creek...........	333

will be built to the elevation of [illegible] in. The levee along the diver- will be built to the elevation of ille, 352 at the west end of sec- basin, 351 at the east end and the connection with the Mis- levee. East of the levee it will [illegible] itchtown will be built to the ele- from the beginning to the flood- n a grade to the elevation of 342

nel will be constructed for Ram- Scott county, beginning at the [illegible] R. R. [illegible] to the east side of the Rock hence northwest and parallel to intersect the deflection chan- ee built to the elevation of 351 de and a levee on the east side of 345.

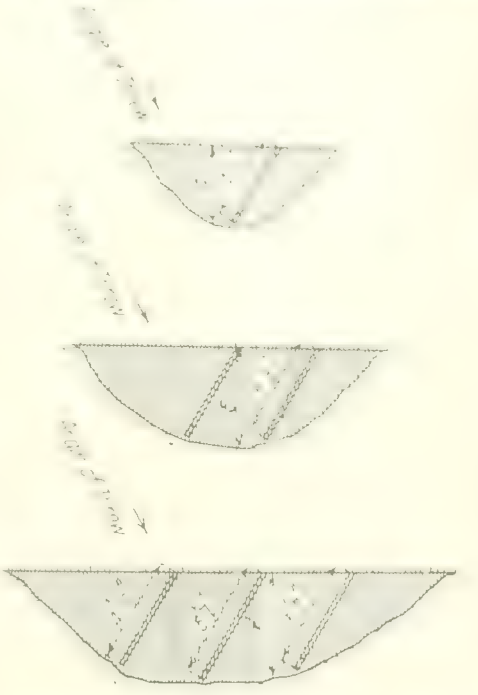
ll be seen from the description, treams flooding the valley will nal flow cut off and diverted by nnel into the Mississippi River. od in these streams the diver- will overflow and the surplus stored in two basins, whence it lly emptied by the diversion periods between floods.

inage.—The system of ditches p the swamp clear of water is y on the map. Briefly it con- floodway extending southwest nces lake and river system and from something like a hun- lateral ditches.

tion of the ditches and levees inage system calls for no par- they being all of familiar size nerally the ditches have side and 10-ft. berms. The levees [illegible] sides sloped 1 on 2. The bridges and other structures required are all small and of ordinary types.

Some Notes on Methods and Cost of Excavating Drainage Ditches with Dynamite.

[illegible] ing is being done with dynamite. Instead of digging these ditches by hand or machine, one [illegible] line of the ditch and a small dynamite cartridge is placed in each hole and the cartridges are exploded simultaneously. The result of the explosion is a channel which with very little labor makes a satisfactory drainage ditch. Dynamiting is confined to the smaller sizes of ditches, say up to 5 ft. deep, but for channels of these sizes in suitable soils some very excellent results are reported.



Sketches Showing Arrangement of Holes for Excavating Ditches With Dynamite.

The accompanying sketches show the arrangement of holes for ditches of several widths. A steel bar driven with a sledge is employed to make the holes. The cartridges are placed at the bottom of the holes and connected up with fuse or wire and then fired in the usual manner. The arrangement and spacing of the holes differ with the soil and had best be determined for each condition by a series of trials. As examples, the following reports of work done at Chadbourne, N. C., for the Brett Engineering Co. are of interest:

"Where the ground was comparatively free from stumps and roots we put down holes 18 ins. apart, 3½ ft. deep, and 100 holes in all. Each hole was pointed 45° and loaded with one stick of Hercules 60 per cent N. G. dynamite 1¼x8 ins., the center hole being primed with an extra stick and a double strength exploder. The result was a good ditch 7 ft. wide on top, 3 ft. on the bottom and 3 ft. deep and 150 ft. long. Costs of finishing and trimming according to specifications per running foot were:

Total cost of explosives used...............	$11.35
[illegible]	[illegible]
[illegible]	[illegible]
Total [illegible]	$16.[illegible]
[illegible]	[illegible]

"The next ditch was shot at Sollo Swamp, where the ground was heavily matted with roots and stumps. The specifications here called for a ditch 14 ft. wide, 2½ ft. deep. We put a double row of holes, 100 in each row, 18 ins. apart laterally, 4½ ft. apart longitudinally, and 4 ft. deep. Both rows pointed 45° in the same direction. The middle holes primed with an extra stick and a double strength exploder. Along the path of this ditch we counted 35 stumps from 6 ins. to 3 ft. in diameter. The result was a clean ditch 12 to 14 ft. wide, 4 ft. deep and 150 ft. long.

Cost of explosives per running ft.........	$0.10
Cost of holes per running ft..............	.0066
Cost of labor per running ft.............	.03
Total cost per running ft..............	$0.1366

"The next ditch was shot at Dunn Swamp, where we decided to put down 150 ft. in the muddiest and stickiest kind of ground. We put down a double row of holes 18 ins. apart, 4½ ft. laterally, 4 ft. deep, both rows pointed 45° in the same direction. Each hole loaded with one stick of 60 per cent and the middle hole of each row primed with a double strength exploder. All the holes well tamped. Result was a very clean ditch 14 ft. wide, 3½ to 4 ft. deep and 150 ft. long. The total cost of this ditch was the same as the ditch shot at Sollo Swamp."

DGES AND BUILDINGS SECTION

sts to Determine Stresses ed Concrete Floors in pleted Buildings.

I.

n tests have been frequently ced concrete building floors. ue in judging the quality of d for the confidence which owner and tenant, but they e as indication of the stresses ntly, therefore, attention has sting completed buildings to ents of stresses and deforma- rmine their amount and dis- e effect of one part of the ther. The first of these tests was described by Mr. our issue of Dec. 28, 1910. e similar tests were made by the committee of the Na- of Cement Users, Prof. A. man. As these tests are a e investigation of reinforced them in abstract in three ar- his is the first. These arti- to a presentation of results hod of conducting the tests the reader is referred to the paper by Mr. Lord mentioned above.

WENALDEN BUILDING TEST.

The building was a ten story structure of the beam and girder type, built by the Ferro-Concrete Construction Co. of Cincinnati, O., and reinforced according to the "system" employed by that company. The panels between columns are 15x20 ft. Figure 1 shows the arrangement of beams and girders and Fig. 2 shows their general constructional features. Only the main reinforcement is indicated by Fig. 2, no stirrups being shown. The beams are 6½ ins. wide and the girders are 7½ ins. wide. Four ¾ in. bars reinforce the intermediate beams, and one ¾ in and three ⅝ in. bars reinforce the side beams; the girder reinforcement consists of four ⅞ in. bars. The concrete was a 1 cement, 2 torpedo sand and 4 crushed stone mixture, and was very hard and of excellent quality. The loading was applied in increments of 80 lbs. per square foot and was arranged so as not to arch. Panel *B*, Fig. 1, was loaded first and after readings this load was removed. Panels *A*, *B* and *C* were then loaded simultaneously, then, leaving this load on, panels *D*, *E* and *F* were loaded. The total load was 400 lbs. per square foot; the floor had been designed for a live load of 200 lbs. per square foot.

In translating from unit deformation to unit stress the modulus of elasticity of steel has been taken at 30,000,000 lbs. per square inch and that of the concrete has been assumed to be 3,000,000 lbs. per square inch. For simplicity the straight-line stress-deformation relation for concrete has been assumed, though it is evident that this relation does not hold for the higher stresses and that calculated stresses based upon this assumption are in excess of the actual stress. The interpreted stress for a number of gage lines is recorded in Table I.

Table II gives calculated stresses and calculated bending moment coefficients. The first line in each set gives the calculated stresses in the reinforcements and in the concrete based upon the value of the bending moments quite commonly assumed in design calculations. $\frac{Wl}{12}$ when *w* is the total distributed load on the beam and *l* is the span length. In three cases the span length was taken as 3 ins. longer than the three span measurements had been made upon the position of the bars and the depth of the reinforcement, which were not [illegible] exactly according to [illegible] calculations have been [illegible] sions found. In the second line of each group the maximum stress obtained by the measurements is given in the column of stresses, and the bending moment coefficient (the coefficient of *Wl*) corresponding to these stresses is recorded in the adjacent column. In these calculations the common assumptions of design calculations are followed except that the width of T-beam is taken as equal to the distance from center to center of beams. In calculating the bending moment coefficient from the measured stress, the position of the neutral axis and the value of the moment arm are assumed to be the same as given by the ordinary assumptions. Although the stress in the reinforcement is measured at the surface of a bar of the outer layer, this stress is considered as being the same as that acting at the center of gravity of the group of bars, for the actual variation in the group is unknown and this method will give a bending moment coefficient larger than that found by considering that the stress in the bars of the other layer is smaller.

It will be seen that in the tests with three and five panels loaded the highest stress observed in the reinforcement in the middle of the intermediate beams was 16,000 lbs. per square inch and the highest stress observed at the ends of the beams was 16,000 lbs. per square inch. The stresses observed in bars having similar positions were lower, and probably the highest stress is not representative of the general stresses. However, it may be best to compare on the basis of the highest stresses. The bending moment given in the table as derived from the measured stresses is .0 6*Wl* at the middle of the beam and .037 at the end of the beam. Measurement of the compression of the concrete in this test was less satisfactory than the measurement of the reinforcement deformations, and considerable variation was found at the different points of observation. Not enough gauge lines gave satisfactory measurements to warrant making quantitative conclusions, but the indications of the action of the concrete may be useful. The value of the bending moment which corresponds to the concrete stresses, on the assumptions made, is .067 *Wl* for the end of the beam. For the middle of the beam the stresses were so small and the indications so irregular that no value of bending moment can be given.

In the beams at the sides of the panel (column beams) the stresses were in general somewhat lower, but with a full loading a stress of 15,000 lbs. per square inch at the middle of the beam was observed and 11,000 lbs. per square inch at the end.

Fewer measurements were made on the reinforcement of the girder. A stress of 17,000 lbs. per square inch was observed at the middle of the girder and 13,000 lbs. per square inch at the end. On the same assumptions these values correspond to bending moments of .075 *Wl* and [illegible] *Wl* respectively. The stress in the concrete at the end of the girder was also very high, but the corresponding bending moment (.07 *Wl*) is less than that for a restrained beam.

Calculating with the usual assumptions of beam formulas, the total compressive stress in the concrete at the end of the beam is greater than the total tensile stress in the reinforcement. Two elements probably enter into the results, the tensile strength of concrete which may be considered as distributed was the width of the floor, and an arching action of the structure. However, it should be noted that the value of the bending moments coefficients derived from the reinforcement stresses at the middle of the beams and girder is not much less than the values commonly used and also that the calculated resisting moments developed at the end of the beams buried in the concrete stresses is not far below the amount usually assumed.

Attention should be called to the fact that the compressive stress in the concretes, both that calculated from an assumed bending moment and that calculated from the measured deformation, is much higher than that to be found by the use of the parabolic stress deformation relation and the actual stress will be less than that given in the table.

Measurements were made on the concrete at the top of the floor slabs in a direction parallel with the beams to find distribution of compressive stresses between eam measurements were not fully s sfa within the limits of accuracy o he ments, no difference in the amo ing over the beams at points w could be determined and the wle dently acted as a part of th member of the T-beam so for d.

TABLE I.—STRESS INDICATIONS IN WENALDEN BUILDING TEST.

	Single panel.	Three panels.	Five panels.
Reinforcement at end of girder		8,000	7,000
	[illegible]	12,000	13,000
			9,000
Reinforcement at middle of girder..........		10,000	11,000
	[illegible]	14,000	17,000
	[illegible]	16,000	17,000
Concrete at end of girder	[illegible]	1,600	2,200
Reinforcement at end of intermediate beam		9,000	10,000
	2,000	9,000	14,000
	[illegible]	14,000	14,000
	9,000	16,000	16,000
	11,000	13,000	13,000
	13,000	13,000	14,000
Reinforcement at middle of intermediate beam.		[illegible]	16,000
	[illegible]	7,000	11,000
		16,000	16,000
	6,000	[illegible]	11,000
Concrete at end of intermediate beam	.....	.....	1,300
	1,500	1,700	2,000
Concrete at middle of intermediate beam	Low	Low	Low
	Low	Low	Low
	Low	Low	Low

TABLE II MAXIMUM STRES MENT COEFFICIENTS IN BUILDING TEST

Member	Reinforcement Stress.	Reinforcement Co-efficient.
Girder		
End ..	44,000	1/12
End	13,000	[illegible]
Middle	19,000	1/12
Middle ..	17,000	[illegible]
Intermediate Beam		
End	36,000	1/12
End	16,000	0.088
Middle ..	22,000	1/12
Middle ..	16,000	0.067
Column Beam—		
End	[illegible]	1/12
End	[illegible]	0.018
Middle ..	26,000	0/12
Middle ..	11,000	[illegible]

Test Cracks.—The surface of e girder had received a white co mitted very fine cracks to be finer than may be observed on crete In the test, as the fine tension cracks in the concr middle of the length of the b servable at stresses in the rein responding to the stresses at whi are detected in the tests of be tory work. To an experienced velopment of the cracks was the measurements of the low oped in the reinforcement of load most of these cracks cl were not visible to the eye.

As the calculated reaction on girder was upward of 40,000 seen that the vertical shearing very high. Diagonal tension oped in these girders just outs with the intermediate beams, m of nearly 45 deg. with the hori cracks did not entirely close of the load. No measurements determine the diagonal deformat probable that the restraint at t girder and the tensile strength acted to prevent the fuller d these cracks. No diagonal cr served in the beams. As may be deflection in the middle panel w one pound loaded than when were loaded.

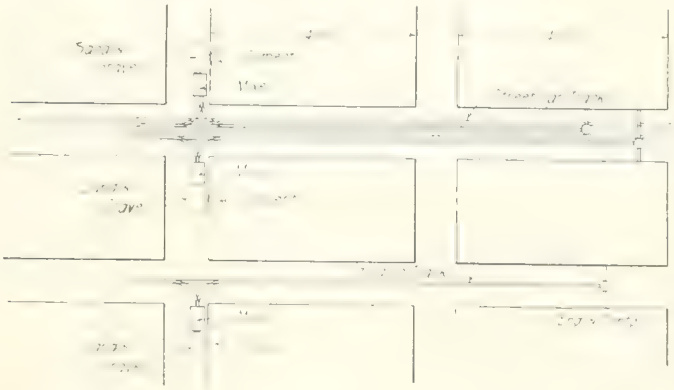


Fig. 1—Diagram Showing Arrangements of Test Load.

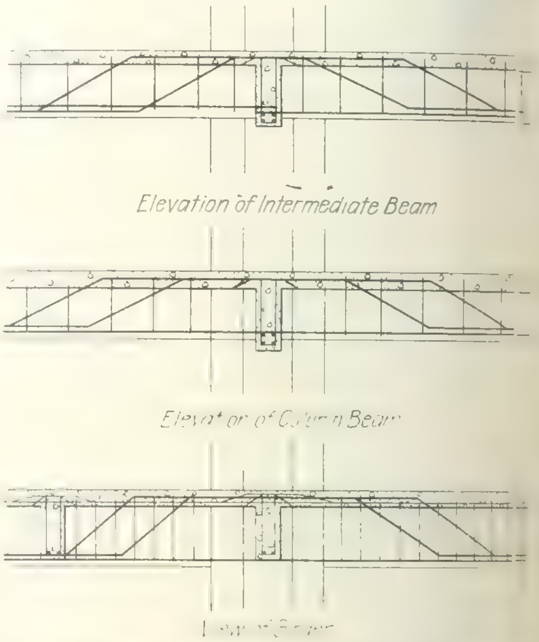


Fig. 2—General Structural Features of Floors

NEWS SECTION

al Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—
ntract News, Embracing Bids Asked, Work Projected, Contracts Let and
Contract Prices on All Classes of Civil Engineering Construction Work.

[illegible]
[illegible]
Work—Two State Commis- 35
[illegible]
[illegible]
[illegible]
Sewerage and Garbage Disposal............ 52
Buildings, Docks, Dredging, Supplies, Etc. 55

A [illegible] railroad construction jobs have been let since our last issue, and more contracts are in sight. Chief of the latter is the Erie double [illegible] which [illegible]
nday. There is a report, which
rmed, that the Grand Trunk
rded the contract for its new
er, Mass., to Providence, R. I.
tracts let during the past few
[illegible]
for constructing the Williams-
reek R. R., a 20-mile line from
V. Va., the contract calling for
[illegible]
Mahoney, San Francisco, Cal.,
nstruction on Geary St., San
the Geary St. municipal rail-
nters, Joplin, Mo., and W. A.
City, Mo., subcontracts from
for betterment work on the
ukee & St. Paul Ry., between
well, Ia.; P. E. Shugart, Ne-
ntract from Donald Jeffrey on
. P. Ry. grade reduction and
in Iowa; Northern Construc-
eg, Man., for 200 miles of new
sions in Canada for the Cana-
Ry.; W. J. Cowan, Winnipeg,
60 miles of branch line for
rthern Ry.; Dunn & Lallande
am, Ala., for the construction
nch from Warrior, Ala., for
Nashville R. R.; Twohey
Ore., for the 7-mile Salem-
egon for the Southern Pacific
Co., Alta Vista, Va., for 23
rk between Varina and Colon
a for the Norfolk Southern
cts for portions of the
n let to Waugh & Waugh,
Fisher & Carozza, Balti-

tion continues to offer
contractors. Since our
York State Commission
arded 83 contracts for the
proved roads, bids on which
[illegible] The [illegible]
out to call for bids for the
more miles of roads. This
t $6,000,000, and contracts
be let early next month.
State Highway Commis-
call for bids on the first
ndertaken this year under
ds are now being taken on
ring about 16 miles of road.
ate Highway Commission is
all for bids for the first
the $18,000,000 appropria-
t completed for four con-
bout 40 miles, and it is
on the work will be opened

eing asked by the Trustees
rict of Chicago on another
n with the construction
channel. This contract
000 cu. yds. of excavation

ck work, the principal con-
ntly appears to be the one secured by Robert Wakefield, of Portland, Ore. This contract amounts to about $976,000, and calls for the construction of two reinforced concrete piers at San Francisco, Cal., for the State Board of Harbor Commissioners. Another California City, San Diego, will shortly be in a position to place contracts for a large dock job. About $1,000,000 is to be expended by San Diego for harbor improvements, to include the construction of a dock, warehouse and bulkhead.

The Board of Supervisors of San Francisco has taken favorable action for the construction of the Fillmore St. tunnel, which will extend from Sutter to Filbert Sts. and connect the Western Addition and Harbor View districts. The Board of Public Works has been directed to immediately furnish the necessary preliminary plans and surveys for establishing the district to be assessed for the construction work and it is expected that the tunnel will be under way within the next four months. The tunnel will cost in the neighborhood of $2,000,000, to be defrayed by an assessment on land to be benefited by its construction. Marsden Manson is city engineer of San Francisco.

A Citizens' Committee.

It seems to be the usual practice of mayors of American cities when appointing a citizens' commit- [illegible] phase of municipal affairs, to select as members of the committee those men who are the least familiar with the matter to be investigated. Last fall the Mayor of New York City appointed a committee of twenty-five to confer on the best method of restoring the pavements in Manhattan. Three of the twenty-five members appointed originally declined to serve, so the arduous task was carried out by a committee composed of the following:

Lawyers	[illegible]
Merchants	[illegible]
Manufacturers	[illegible]
Architects	[illegible]
Presidents (Automobile [illegible] New York Transportation Co., Team Owners' Association, Automobile Club)	4
Rank and file (1 journalist, 1 statistician, 1 commissioner public works, 1 member automobile club [illegible])	[illegible]

A short time ago this committee submitted its report. As was to be expected, it contains a maximum amount of criticism and a minimum amount of helpful suggestions. It is probable, however, that one at least of the suggestions will meet with the approval of the engineers of the city. The recommendation is that the various chiefs of highways be sent abroad, at the city's expense, to study European methods.

River and Harbor Work.

The new river and harbor appropriation bill which will be reported shortly to the Senate, [illegible] provision for a considerable amount of work for levee contractors. Contractors specializing in other forms of Government work are also well taken care of. The Senate [illegible] added $8,006,010 to the appropriations provided for by the House, and the bill now carries a total of $32,126,530. The largest single increase to the House bill was $2,500,000 for the Mississippi River, making an appropriation of $6,000,000 for that for repairing and new levees on account of the tions, $800,000, is provided for the Columbia River between Celilo Falls and the Dalles Rapids; $500,000 for Jamaica Bay, New York; $400,000 for St. Mary's River, Michigan, and $1,500,000 for the Delaware River in Pennsylvania, New Jersey and Delaware. The bill authorizes the appointment of a board of three engineer officers to examine the Galveston harbor and channel, Texas City harbor and channel and the Port Bolivar harbor and channer, near Galveston, with a view of securing a depth of 35 ft., and the necessary cutting off of bends or widening of channels in the Sabine-Nachez canal, Texas. It provides for investigation to determine the need of a new system of impounding reservoirs at the headquarters of the Allegheny, Monongahela and Ohio rivers for flood prevention and navigation improvements. It also authorizes surveys to determine the feasibility of navigation on the St. Francis River in Arkansas, increased depth of Charlevoix River, Michigan, and a 300-foot-wide channel in San Francisco Bay, 18 ft. deep at low tide from the mouth of the Guadaloupe River, 410 ft. northwest.

Two State Commission Decisions.

The Board of Public Utility Commissioners of New Jersey recently refused to allow a rival gas plant to be constructed in a town where one was already in operation. It took the position that a single plant of such a character, properly maintained and operated, is better for the public use than two or more plants constructed at unnecessary cost, each of which must be sustained at public expense or one or both lapse into insolvency. Somewhat the same view was taken last week by the New Jersey State Water Supply Commission in denying the application of a borough for permission to secure a municipal water supply. This borough had been served by a company for a number of years. At the hearings it was brought out that there was no cause for complaint against the rates charged or the service afforded. The only requirement urged in favor of the grant was the fact that the owners of a little more than half the taxable property in the borough strongly desired to own their own waterworks in order that the revenue now going to the private company might go to the borough instead and the profits, if any, from the operation of a water plant might thus inure to the financial benefit of the inhabitants of the municipality. In refusing permission to secure a new water supply the commission expressed the opinion that it would be unwise for the public authorities to lend their assistance to injure or destroy a lawful business, conducted as required by law and in which large sums of money had been invested in good faith.

CATALOGUES

Car Roofing.—Card, 11x17 ins. Hutchins Car Roofing Co., Detroit, Mich.

This illustrates the Hutchins Improved All Steel Carline Roof and the method of application.

Texico.—[illegible] The [illegible]

This is the April bulletin entitled "Paving and Roads." Articles are contained in this issue on the State Roads of Maryland and equipment for surfacing by the penetration method.

Cupola.—Paper, 6x9 ins., 32 pp. J. W. Paxson Co., 102 N. Delaware Ave., Philadelphia, Pa.

Bulletin No. 26 has just been issued on the subject of cupolas, blowers, and cupola practice in general.

Kewanee Unions.—Paper, 8½x11 ins., 8 pp. The National Tube Co., Pittsburgh, Pa.

This is the April N. T. C. Bulletin which gives a complete illustrated description of some expansion tests made recently on Kewanee Unions.

Lehigh Portland Cement.—Paper, 8½x11½ ins., 16 pp. Lehigh Portland Cement Co., People's Gas Bldg., Chicago, Ill.

This pamphlet shows the capacities and locations of six Lehigh cement plants and contains interesting information regarding building and engineering construction where Lehigh cement is being used.

Lock Nuts.—Paper, 3½x6 ins., 20 pp. The U. S. Metal & Manufacturing Co., 165 Broadway, New York City.

This booklet contains illustrated description of the Columbia Lock Nut, with instructions for use and illustrations showing applications. Tables of sizes and prices are given.

Gears.—Paper, 6x9 ins., 4 pp. Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

This announcement describes the policy of the company in furnishing expert assistance in tests of their machines in use. Some results of tests for wear are given. Numerous pamphlets are issued on the products of this company.

This is a sample of Texoderm for railway coach seat upholstering.

Safety Scaffold Winch.—Paper, 6x9 ins., 4 pp. James C. Campbell & Co., First National Bank Bldg., Chicago, Ill.

Bulletin 201 contains illustrations and description of a worm-gear winch for the operation of suspended scaffolding for the erection of high building walls.

Trus-Con.—Paper, 5⅝x7⅝ ins., 84 pp. The Trussed Concrete Steel Co., Detroit, Mich.

This catalog is a complete handbook of detailed information, estimating data and specifications regarding the Trus-Con waterproofing, damp-proofing and techniacl paints.

Permanent Pavement.—Paper, 6x9 ins., 16 pp. Universal Portland Cement Co., 72 W. Adams St., Chicago.

This is the second number of a new booklet issued monthly by the Universal Portland Cement Co. in the interests of concrete paving. Interesting information as to the progress of road building with concrete, cost data, etc., are given.

Holt Caterpillar Tractor.—Paper, 10x6⅝ ins., 32 pp. Holt Caterpillar Co., Peoria, Ill.

This catalog contains illustrations and descriptions of the Holt Caterpillar Tractor and its parts. Specifications, dimensions, etc., are given, together with information regarding the use of the tractor for breaking ground.

Hydraulic Benders.—Paper, 6x9 ins., 64 pp. Watson-Stillman Co., 50 Church St., New York City.

Catalog 83 illustrates and describes hydraulic benders, which are now commonly used for bending all kinds of rails, structural shapes, reinforcing rods and pipe for straightening rods or shafts while held between lathe centers, and in all such work where heavy bending is to be done. The catalog contains illustrations and diagrams showing the construction and operation of the machines with tables of sizes and prices.

Road Graders.—Paper, 12x18 ins., 4 pp. Barron & Cole Co., Barron Bldg., New York City.

This folder illustrates and describes 1912 road graders in three models. Light grader of 750 lbs., one of 875 lbs. and a third of 1,375 lbs. Illustrations are given also of wagons, dump carts, various machines for grading and construction of roads.

Wire Rope & Wire.—Paper, 6x9 ins., 184 pp. John A. Roebling's Sons Co., Trenton, N. J.

This is a complete general catalog on wire rope and fittings. Complete descriptions of construction of wire rope of different classes are given. Illustrations show the methods of handling and installations of all kinds of plants and machines where wire rope is required. The book contains complete tables of sizes, prices, diameters, weights, capacities, etc., for rope of all sizes and materials.

Diamond Steel Pole.—Paper, 6x9 ins., 36 pp. Diamond Steel Pole Co., Philadelphia, Pa.

This is a complete catalog of "Diamond" Pole for electric power line, telegraph and telephone systems, etc. The catalog contains tables of sizes of poles and tables of safe loads and deflections of poles from 25 to 45 ft. in length. Cross arms, caps and bands for attaching cables, and all auxiliaries are shown. The catalog is well illustrated.

Orange Peel Buckets.—Paper, 7¼x9 ins., 4 pp. The Hayward Co., 50 Church St., New York City.

Pamphlet No. 586 deals with Hayward Orange Peel Buckets, showing the operation of the bucket under various conditions and in different classes of materials.

Pamphlet No. 39 (paper, 6x9 ins., 40 pp.), issued by the same company and entitled Hayward Buckets, is one of the most complete catalogs published on this subject. It gives complete necessary information to those who desire buckets for use under various conditions. Tables of capacities, weights, sizes and prices are given. Orange peel and clam shell buckets are shown of capacities from 100 cu. ins. to 10 cu. yds.

Priestman Ejectors.—Paper, 11x8½ ins., 17 pp. Merritt & Co., Camden, N. J.

This catalog illustrates and describes the Priestman Ejector system which uses compressed air for lifting sewage without the employment of actuating mechanism and machined surfaces in contact with the solids, acids, etc., of which the sewage is composed. Descriptions of the applications to which the Priestman Ejector may be put are given. The method of operation is carefully shown, and descriptions of the details of the machines illustrated by dimensions of line drawings are given. Several sheets are attached for the use of architects and engineers which may be filled out when they are making inquiries regarding the application of the system to special requirements. Another catalog furnishes several technical articles on the subject.

Condensers.—Paper, 3½x6 ins., 16 pp. Wheeler Condenser & Engineering Co., Carteret, N. J.

The Wheeler Admiralty Surface Condenser, the Wheeler-Volz Combined Condenser and Feed Water Heater, and the Wheeler Admiralty Surface Condenser Cylindrical Shell Type are described in this catalog. A brief description is also given of the Wheeler Dry Tube Surface Condenser and the Wheeler Rectangular Jet Condenser for high vacuum work. Pages are devoted to the Wheeler Barometric Jet Condensers, the Wheeler-Edwards Air Pump, Wheeler Rotative
Pump and Wheeler Cen
Two types of cooling to
Wheeler-Barnard for force
Wheeler-Balcke for natura
sidered separately and are
description of Wheeler Fe
ers and Wheeler Atmosphe
lief Valves.

PERSONAL

Mr. Ralph Modjeski add
gon Society of Engineers

Mr. G. H. Sykes has be
the commissioners as S
Roads in Howard County,

Mr. Fred H. Bennett ha
mended for appointment a
of the Water Department
Wis.

Mr. Thos. Towers,
Foreman, has been appoi
council of Hamilton as
new city waterworks.

Mr. James R. Finlay of
will give the annual addr
souri School of Mines
graduating class numbers

Mr. John P. Clark has
Engineer of Maintenance
Albany Southern R. R.
City Engineer of Renssela

Mr. Wm. F. R. Griffith,
gineer, has opened an offi
St., Norfolk, Va., for the
hydraulic and hydrographic

Messrs. J. Versluis, D. B
O. R. Reed and Wm. F.
cently been appointed Juni
the Board of Local Impro
cag

Mr. H. M. Harps, for
Engineer in charge of the
the Celilo bridge, is at
in a similar capacity on
of the Broadway bridge in

Messrs. J. G. Gableman,
A. J. Schaimayer, C. O.
Mathews, Jr., and H. E. H
cessfully passed civil servi
for the civil service commis
for the position of Assist
gineer of Streets.

Mr. H. C. Phillips has
Valuation Engineer of the
peka & Santa Fe Railway
office will be in Chicago.
1906 been Chief Engineer
Topeka & Santa Fe Coast
at Los Angeles, Cal.

Mr. C. T. Wilson, form
gineer of Waterloo, Ia.,
half interest in the Dearbo
Co. and will be Resident
other member of the firm
Dearborn. The company
in the Waterloo Savings Ba

Mr. C. V. Kerch, City En
ville, Wis., has been appoi
of the Board of Public W
recently been created. The
under a commission form
since the spring election.
consist of Mayor James A
Engineer C. V. Kerch
Miltimore and Cummings

Mr. C. H. Rust, whose res
Engineer of Toronto was m
last issue, has accepted t
City Engineer for Victoria,
of $6,700 a year. At a rec
the Council of Toronto hi
paid to Mr. Rust, who has
for 35 years. The council vo
six months' salary. Assis
gineer Geo. D. Hall and
Engineer of the Harbor Bo
mentioned as possible su
Rust.

ILWAYS, STEAM AND ELECTRIC

Alabama.

[illegible]
dg., Birmingham, Ala., have been
contract by the Louisville &
[illegible]
[illegible]
by Belton Gilreath. The
[illegible] rugged country and will
erable heavy work.

n Ry., B. Herman, Chief En-
ance of Way, Washington, D.
ood to have plans under way
rable amount of betterment
Mobile division south of An-

ham & Southeastern Ry., W.
ident, Union Springs, Ala., has
ontract for clearing for the
sion from Tallassee to Elec-
Grading contracts for the ex-
let shortly.

mittees have been appointed at
or the purpose of carrying out
uilding of the car line from
to Irondale, Ala. The execu-
is composed of J. W. Forten-
dwell and Luke Ellard.

rd Iron Co., Woodward, Ala.,
e planning the expenditure of
or the construction of a rail-
[illegible] and coke ovens at
mines at Dolomite to its re-
properties at Mulga and Short

Arkansas.

nnounced that the St. Louis,
[illegible] Missouri Pacific
work immediately improving
nwood branch. H. E. Hale,
., is engineer maintenance of

& San Francisco R. R., F.
Engineer of Construction,
is understood to be planning
begin the reconstruction of
Bridge Junction to Jonesboro,
t on the main line to Blythe-
the St. Louis division. The
sas City division from Bridge
esboro will be raised to a
overnment levee, reballasted
built. The track on the St.
ill be raised to a point in-
against a 50-ft. stage of
ssissippi River at Memphis.
is to be expended.

Rock Island & Pacific Ry. is
planning to reconstruct its
rest City, Ark., to Bridge
[illegible] and building a second
ll the way. An expenditure
be required.

California.

Public Works of San Fran-
d the contract for railway
on Geary St., between
th Ave., for the Geary St.
P. H. Mahoney.

Cooperage Co., of Arcata,
t 1½ miles of railroad from
of the Northwestern Pacific
r owned by the company.

opeka & Santa Fe System,
hief Engineer Coast Lines,
undertake the double track-
m a point two miles north
to Kennbrook. Any work
[illegible] surveys and
ions. It is probable that
w years double track will
Cajon Mountain, and sur-
be undertaken to deter-
should be done by paral-
track or by the construction
line.

Northeastern R. R., C. S.
Freeland, chief engineer, Porterville, Cal., has completed surveys for the construction of a branch line from Porterville to the mining district of the upper Tule.

The Sacramento Valley Electric Ry. Co., which filed articles of incorporation last week, proposes the construction of a line from Woodland to Red Bluff, and a branch from Colusa to Willows. Surveys for the main line have been completed and about 90 per cent. of the right of way secured. This is the project promoted by the Sacramento West Side Electric R. R. Co. and the directors of that company are the incorporators of the new organization. The Dozier Engineering Co., Sacramento, is the engineer.

Press reports from Lakeport state that the directors of the Clear Lake R. R. Co. have accepted an offer of San Francisco capitalists to take the entire bond issue of the company—$400,000—and complete the road. A contract to grade the first six miles of road out from Hopland was let last November and about half of this section graded. By the new financial plans the road is to be completed to Lakeport within seven months.

Georgia.

It is planned by railroad promoters of Tifton, Ga., to extend the road, at present leading from St. Mary's to Kingsland, and which has already been contructed to Kingsland, to Waycross, thence to Nashville, to Tifton, to Ashburn, to Oakfield, to Americus. Business men of Americus, Ga., will investigate the proposition.

The Columbus, Chattahoochee Valley & Gulf R. R. Co. has been chartered with a capital stock of $500,000 and proposes the construction of a railroad from Georgetown, Quitman county, to Atlanta, a distance of 180 miles. The proposed route will traverse Quitman, Stewart, Chattahoochee, Muscogee, Harris, Heard, Coweta, Campbell and Fulton counties. The incorporators are John D. Little, of Atlanta; Josiah Flournoy, J. Johnson Williams, L. H. Chappelle, Arthur Bussey, P. J. Williams, L. F. Humber, Henry R. Goetchius, T. T. Miller and E. P. Owsley, all of Muscogee County.

Idaho.

Surveys have been started for the projected route of the Cambridge, Indian Valley & Eastern R. R. This is an electric line which is planned to run from Cambridge to a point about 16 miles through the Indian Valley. About $20,000 is reported to have been subscribed for the project. The estimated cost of the line is about $240,000. L. Highley, New Meadows, Idaho, is Engineer in charge of the survey work.

Illinois.

The Southern Illinois Railway & Power Co., with principal office at Chicago, and capital stock of $2,500, has been incorporated, and proposes to operate a railway from Eldorado, Ill., through the towns of Raleigh, Harrisburg to Carrier Mills, Saline county, Ill. The incorporators and first board of directors are: William Rothmann, Thomas G. Deering, William M. Klein, Samuel Kraus and Ralph G. Crandall.

The directors of the Elgin, Joliet & Eastern Ry., A. Montzheimer, Chief Engineer, Joliet, Ill., following an appropriation for extending the road to the Baldwin Locomotive Works at East Chicago, have ordered surveys and the right of way staked out.

Ray Rariden, Hooppole, Ill., is interested in the proposition of extending the Tampico-Hooppole R. R. north to Sterling and south to Geneseo. It is planned to sell bonds amounting to $150,000 to construct the extensions and to also buy the present Tampico-Hooppole line, which would be moved a half mile east and run on the eastern outskirts of Tampico. Mr. Rariden will ask the citizens and city council of Tampico for an extension of one month's time to operate the road while he is getting the new plan in operation.

The Chicago & Illinois Midland Ry., F. S. Peabody, president and general manager, Chicago, Ill., is contemplating the construction of an extension from Taylorville, Ill., to Nokomis. It is said that surveys are already under way between Lowder and Auburn, a distance of 8 miles.

The Sterling, Cambridge & Southwestern R. R. Co. is being organized with capital stock of $200,000, and proposes a steam line to start at Nelson and will run in a southwestern direction, the southern terminal being at Cambridge in Henry County. It is said to be the intention of the promoters to start work of making the survey and securing the right of way as soon as possible, and if possible get a considerable amount of the construction work done this year. Ray Raridon, Morrison, Ill., is interested.

The Virginia Timber & Gravel Co. of Springfield has been awarded contract by the Cleary-White Construction Co. of Chicago for the furnishing of the gravel for the St. Louis, Peoria & Northwestern R. R., the new C. N. W. Ry. line which is to be constructed from Peoria to Girard, where it will tap the coal field of Illinois. The contract calls for between 50,000 and 60,000 tons of gravel.

Indiana.

Prospects are good, it is said, for the construction of a second track main line of the Erie through North Manchester, Ind. The plan, according to reports, is to have the new second track leave the present line at Bippus and run northwest through North Manchester, rejoining the old line at a point between Laketon and Disko. The present track will remain as it is through Servia, Bolivar and Laketon. It is said that the cost of construction of the second track through new territory would be little more than to build it alongside of the existing track for the distance indicated and that the country along the new route would originate a great deal of profitable freight. As the work of double tracking is starting now, a decision will soon be reached. A. Swartz, Huntington, Ind., is division engineer of the Erie R. R.

Iowa.

⊙List & Gifford Contracting Co., 520 New York Life Bldg., Kansas City, Mo., have about 85,000 cu. yds. of machine or car work to sub-let on their Chicago, Milwaukee & St. Paul work between Collins and Ellwell, Ia. This contract involves 575,000 cu. yds. of earth excavation. L. W. Winters, Joplin, Mo., and W. A. Nelson, Kansas City, Mo., have sub-contracts on the work and List & Gifford are now working two standard gage shovel outfits on this contract.

⊙P. E. Shugart, Nevada, Ia., has secured a sub-contract from Donald Jeffrey, Delmar, Ia., for about 200,000 cu. yds. of earth excavation on the C., M. & St. P. Ry. grade reduction and second track work in Iowa. John Herbert, Marshalltown, Ia., has secured a sub-contract for about 50,000 cu. yds. of work. The general contract awarded Mr. Jeffrey covers work from Louisa to Covington and from Capron to Rhodes, and involves about 600,000 cu. yds. of earth excavation.

Grading work has been started for the new electric line from Waterloo to La Porte City. J. B. Eley Co., Marshalltown, Ia., has the grading contract and the Gould Construction Co., Davenport, Ia., has the bridge work. This extension is being built for the Waterloo, Cedar Falls & Northern Ry., of which L. S. Cass, Waterloo, is president.

Advices from Treynor, Ia., state that the new Treynor Railroad contemplates an extension from that city through Carson and Griswold to Des Moines.

Work is under way by George C. Boileau,

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

engineer of the Red Oak & [illegible] R. endeavoring to shorten the distance of the proposed line from Red Oak to Des Moines, Ia. The original survey is 104 miles in length.

Kansas.

The Winnipeg, Salina & Gulf R. R. Co., H. Leone Miller, Salina, Kan., president, is reported to have surveys and right of way matters so well along that 300 miles of line will be ready for the beginning of construction work by July 1. The first link to be constructed will be south from Salina to Alva and west to Beaver.

Kentucky.

The Mountain Central Ry., J. C. M. Day, General Manager, Winchester, Ky., is considering extending its line from Campton to Hazel Green.

Louisiana.

The Baton Rouge Electric Co., Wm. A. Butterick, Manager, Baton Rouge, has applied to the city council for a franchise to build a line to South Baton Rouge. The Baton Rouge Suburban Electric Co., a new organization formed by residents of Baton Rouge, has also asked a franchise to build a street car line to South Baton Rouge, and also to a point in the north part of the city.

Maine.

Field work for the proposed railroad from Bangor to Houlton has been finished for the present and the engineers are now working on the estimates, which will probably be completed this month. Frederic Danforth, Gardiner, Me., is Chief Engineer.

Maryland.

The Western Maryland R. R., H. R. Pratt, Chief Engineer, Baltimore, Md., will probably have work started this month or early in June on an extension from its main line at a point near Charlton, Md., about 10 miles into the limestone fields of West Virginia. It is estimated this extension will cost about $250,000.

Massachusetts.

It is reported that grading and masonry contractors are all ready to commence work on the proposed 75-mile line of the recently organized Southern New England R. R. (Grand Trunk) from Providence, R. I., to Palmer, Mass. This means the completion of a 58-mile line from Palmer to Woonsocket, a 17-mile line for passenger traffic from Woonsocket to Providence, a 10-mile freight line from Randall's Pond, Wanskuck, to Field's Pond, a three-quarter mile connection at Woonsocket and a one mile connection from Allen's Ave. to the Pacific St. wharf in Providence. E. H. Fitzhugh, Montreal, Que., is vice president of the Grand Trunk.

Michigan.

⦿George A. Fuller Co., Chicago, Ill., according to information received from Detroit, Mich., has been awarded the contract by the Michigan Central Railroad for the construction of the new passenger depot at that place. The total cost of the station will amount to approximately $2,250,000. It is hoped to have the work completed by 1914.

Among the rumors circulating in regard to new construction work contemplated by the Grand Rapids & Indiana R. R. is one to the effect that it is planned to build a northern branch from Muskegon to Manistee, Mich., over the proposed route of the Muskegon-Manistee interurban. H. H. P. Hughart, Grand Rapids, Mich., is vice president and [illegible] company.

The following additional information regarding the projected railroad from Bad Axe to Mt. Clemens, mentioned in our last issue, is now available. The company will be known as the Thumb Ry. Co. and will have general offices at Capac, Mich. The officers are: A. E. Riopelle, President and General manager; Ambrose Herdell, Vice President; R. C. Zike, Secretary-Treasurer; Samuel H. Kelley, Attorney; directors, A. E. Riopelle, S. B. Coddington, O. A. Ruffner, Frebert A. Petz, R. C. Zike, A. Herdell and Martin J. Stoffer. The company is incorporated under the laws of the state of Michigan, with an authorized capital stock of $2,000,000, consisting of 20,000 shares of $100 each. The line will connect at Mt. Clemens with the Detroit United Ry. The railway will run through Macomb, St. Clair, Sanilac and Huron counties and connections will be made at Mt. Clemens with the Grand Trunk for north and south-bound freight, and at Capac Grand Trunk connections east and west. The passenger and express traffic will be handled by gasoline motor cars.

The City Council of Grand Rapids, Mich., has adopted the report of the committee on streets granting the Grand Rapids & Indiana R. R. permission to construct a spur track in Cottage Grove Ave.

Work will not be started until the fall, it is said, by the Grand Trunk R. R. on the construction of the proposed new round house at Kalamazoo, Mich.

The Saginaw-Bay City Ry. Co., Saginaw, is planning to construct about 3,000 ft. of additional trackage on East Genesee Ave., Saginaw, at a cost of $25,000.

A new Canada Southern mortgage for a total issue of $40,000,000 to run for 50 years has been authorized by the stockholders of the Michigan Central Ry. Co. The Michigan Central, being the lessee of the Canadian Southern, will guarantee the new mortgage bonds.

Minnesota.

By a recent decision of the State Supreme Court it is probable that the St. Paul City Ry. Co., will have to build about 3½ miles of new line in St Paul at a cost of about $100,000

The Sioux Falls & Southern Minnesota Traction Co. is reported to have secured practically all right of way for that portion of its proposed line from Albert Lea to Worthington. It is stated that a portion of the road will be put under contract this year. W. H. Knight, Chicago, Ill., is the promoter.

Residents of Fergus Falls are taking steps to incorporate a $250,000 company for building an interurban line. Franchise for a street railway system at Fergus Falls has been granted and it is now proposed to run a line to Elbow Lake on the south and to Perham on the north.

It has been announced that work will be started May 13 by the Chicago, Milwaukee & St. Paul Ry. lowering the tracks on 29th St., Minneapolis, Minn. The tracks between Hennepin and Lyndale Aves. will be lowered this year, but the entire work will occupy three years. About $1,500,000 will be spent. The tracks will be lowered 20 ft. below the street level. The avenues from Hennepin to Lyndale will remain closed during the summer.

It is rumored that the Grand Trunk Pacific R R. has entered into negotiations for the entrance of the road into Minneapolis, Minn., and St. Paul and that engineers are investigating the feasibility of such an improvement.

The Lake Superior & South Dakota Ry. Co. has been incorporated in Minnesota to build a railway from the head of the lakes to South Dakota through Big Stone County. The company is capitalized at $100,000. W. R. Gillis of Superior is interested.

Missouri.

Promotion work is under way for a line to be known as Nevada, Carthage & Springfield R. R. The route of the proposed line is from Nevada to Springfield, through Ash Grove, Dadeville, Arcola, Jerico Springs. As proposed, the motive power will be gasoline motors. W. Henry Harris, Indianapolis, Ind., is interested.

The directors of the St. Louis, Iron Mountain & Southern Ry. Co. have directed the calling of a special stockholders' meeting to authorize a mortgage securing an issue of $200,000,000 of refunding bonds, which bonds will be used to refund, retire or acquire outstanding obligations of the company, and for
acquisitions, extensions, add
and equipment, and the co
quisition of additional railr
This mortgage, together
Missouri Pacific refunding
vide the amounts for the fi
the Missouri Pacific-Iron
The creation of the new Iro
gage, terms of which are be
consultation with Speyer &
the policy of the managemen
time ago.

Montana.

The Roundup Interurban
organized with a capital sto
which $12,000 has been sub
poses to build a line from
along the county road and
shell River to Old Roundup
town of Farrell and beyond
west along and upon the L
Klien Coal Mine. Also alon
to the town of Davis. M
Schrump, M. H. Wall, M. R
Newton, E. E. Congdon and
of Roundup are interested.

New York

✣Bids will be received un
by Samuel Rea, President
necting R. R., 85 Cedar St.,
for the foundations and con
the Eastern viaduct about 3
tending from Lawrence St
Long Island City. Gustav Lin
St., New York City, N. Y.,
gineer.

The Public Service Co
First District, New York
the route for the proposed
East River from Manhatta
which will be used by th
Transit Co. in carrying out
subway extension. This ro
the Broadway subway in Ma
ity Place and Morris St., and
Beaver St. and Old Slip t
and under the River to Cla
continuing up Clark St. to
another subway in Fulton S
erated by the Brooklyn Rap
ests. On the Manhattan
also provided with the Cent
Centre St. loop subway, wl
Williamsburgh, Manhattan
Bridges, is also designed for
Brooklyn Rapid Transit inter
second tunnel to Brooklyn
action of the Commission
the other one being the W
St. tunnel, which will be us
borough Rapid Transit
new Seventh Avenue sub
with the Interborough subwa
lyn.

The Union Railway Co.,
New York city, has pet
Service Commission to app
for an extension through 18
Washington Bridge. The pr
begins in Boscobel Ave. at
the Borough of The Bronx,
over Washington Bridge
St. to the easterly side of
Commission held a hearing
tion on May 3.

The Delaware & Hudson
Burgess, Chief Engineer, Al
made surveys for an extensi
dale to Rondout, N. Y.

A project is under cons
construction of an electric ra
Hartford along the Oxf
Chadwicks and Sauquoit and
A. P. Seaton, New Hartfor
terested.

Surveys have been started
Otsego street railway. Joseph
N. Y., is the Engineer.

The State Public Service
bany, owing to the fact that
provided in the appropri
year for the elimination of

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

to take any steps toward the 57 crossings for which appli- ing before it. Many of these Central crossings. The com- s to proceed with the elimina- gs in the town of Cleveland ntral and Bethlehem on the [illegible] which orders have ade.

an & Jamaica Ry. Co. of New been incorporated with a capi- 00,000 and proposes to operate les in length from 3d Ave. and York, over the Queensboro rd Ave., Queens borough [illegible] following an expenditure of Delaware & Hudson R. R. Co. uction of a new roundhouse, aling station, cinder pits and nents on the company's East Binghamton, N. Y., the com- e an outlay of a still greater o double-track the system from evch. A contract for about two ation work at the Binghamton was awarded to Lathorp, Shea Buffalo and Scranton during October, 1911. The work at the north end of the early in November. Consider- was made before real cold nd at the present time the work forward with rapidity. G. H. N. Y., is chief engineer.

orth Carolina.

[illegible] have been awarded for the construction of the Ra- ection of the Raleigh, Charlotte R., a branch of the Norfolk [illegible] that 1,000 men, 500 t steam shovels are to be put rious sections of the road at the lines and bringing those service up to standard Concord-Charlotte section d to contractors later. Lane already sublet several sections expedite the work. Waugh & ge, Va., have the contract to mile link to Raleigh, N. C., Norfolk & Southern and the port roads, this being through Fisher & Carozza, Baltimore, ontract for several miles of na to the Cape Fear river. Southport, Raleigh to Marina, to be put in standard condi- iliad section of road is being H. L. Lane of the [illegible] has a corps of engineers prings section preparing for of the Raleigh & Southport.

orth Dakota.

Northern Pacific who have the extension of the Stanton zie County, North Dakota, completed their work. The will be built by the Northern inzie County will be from r County, and the road will e county seat of McKenzie ntinue to Sidney, Mont., ac- sent prospects. W. L. Dar- in., is chief engineer

Ohio.

R. R. is to enlarge its O., to accommodate 4,000 ements will be made at $40,000.

ncinnati state that the re- lans for the proposed union which were submitted two mmittee of engineers rep- ng Cincinnati, are satis- committee has reported or of these plans to the cutives of the Cincinnati $40,000,000 project of the epot and Terminal Co., of ekman, Cincinnati, is vice

A hearing will be held May 17, by the State [illegible] build a double-tracked standard-gaged rail- [illegible] secured for it 57 acres for dock purposes, 2,000 acres at Burg Hill with stone, gravel [illegible] is underlaid with a 4½ ft. vein of coal

The Court of Common Pleas has granted the Lake Shore & Michigan Southern Ry. (New York Central Line) permission to construct a double-track line over new right of way through Port Clinton, O. The company must establish automatic alarms at every crossing and gates and watchmen wherever needed. G. C. Cleveland, Cleveland, O., is Assistant Chief Engineer.

It is rumored that the Pennsylvania Railroad is planning the extension of the Toledo, Walhonding Valley & Ohio R. R. from Coshocton through the Harrison County coalfields, in Ohio. A. C. Shand, Philadelphia, Pa., is Chief Engineer of the Pennsylvania R. R.

Oklahoma.

It is expected that the Oklahoma City & Suburban Ry. Co., 120¼ W. Grand Ave., Oklahoma City, will extend its line to Norman, Okla., some time this year.

The Cherokee Central R. R., which was organized, partly constructed and temporarily abandoned in 1904, is taking steps toward the completion of the proposed line and it is hoped to make Fort Smith, Ark., a terminus. The projected line starts at Caney, Kas., and extends in a general southerly direction through Wann, Nowata, Alluwe, Chelsea, Felix, Mark, Peggs, Tahlequah, Bunch and on to Fort Smith. It would cross the Katy at Wann, the Iron Mountain at Nowata, the Frisco at Chelsea, the Katy at Pryor Creek, and the K. C. S. at Bunch. At Caney the road's connection would be with the Missouri Pacific and Santa Fe. J. A. Quinn, Pryor Creek, Okla., is interested in the proposition.

The St. Louis, Bartlesville & Pacific Ry. Co. has submitted a proposition to the citizens of Buffalo, Harper County, Okla., to extend the proposed line west from Alva to Buffalo for a bonus of $75,000, to be raised throughout Harper County. The company was chartered three years ago to build west from Joplin, Mo., across the northern boundary of Oklahoma, hitting the towns of Miami, Bartlesville, Pawhuska, Ponca City, Pond Creek, Cherokee and Alva. This road will have an Oklahoma extension of over 200 miles in the northwestern part of the state and will extend through three large counties.

The Railway Construction Co. has been organized at Oklahoma City, Okla., for the purpose of general railroad construction work. The incorporators are Carlos Combs and L. Langford of the Patterson Co. and E. L. Cole, a railway construction contractor. It is announced that the company has no connection with the Patterson lines, but will do general contracting work for the construction of either electric or steam railroad lines. The capital stock of the company is $5,000.

Oregon.

Ⓢ Twohy Bros., Portland, Ore., have been awarded the contract for the construction of Salem-Fir branch of the Southern Pacific. This branch will be about seven miles long, and calls for a 1,500 ft. trestle. The work will cost about $20,000 per mile.

The Portland, Eugene & Eastern Ry. Co., 502 Fenton Bldg., Portland, Ore., has been granted a franchise at Corvallis and proposes the expenditure of $250,000 this season for the construction of the street car system.

Mayor Rushlight of Portland has recommended to the sub-committee of the charter commission a plan to do away with the grade crossings of the Oregon-Washington Railway & Navigation Co. on its main line through Sullivan's Gulch, which will cost that company approximately $500,000 if it carries at the charter election. He wants the roadbed regraded to a sufficient depth to permit of the passage of trains beneath bridges to be placed by the city.

It is said that negotiations are under way by the Rogue River Valley R. R. for building a railroad from Jacksonville, the present terminus, to Ruch, a distance of 9 miles. W. H. Eccles, Hood River, Ore., is President of the company.

It is rumored that the Mt. Hood Ry. is planning the extension of the line from Cottrell to the foot of the Cascade mountains. M. H. Eccles, Hood River, Ore., is President of the road.

Pennsylvania.

The Cumberland Valley R. R., G. C. Coons, engineer, Chambersburg, Pa., is planning extensive improvements to its line in Newville. The work in that place calls for changing the course of Big Stream, the construction of two subways, and concrete retaining walls. The work, which is to be done this year, will call for the expenditure of several hundred thousands of dollars.

M. Benett & Sons, Indiana, Pa., are reported to have started work on the construction of the roadbed for the branch of the Buffalo, Rochester & Pittsburgh, from Iselin to Jacksonville, Pa

Texas.

The Gulf, Texas & Western Ry., B. B. Cain, vice president, Dallas, Tex., has completed surveys for the extension of its line from Jacksboro to Mineral Wells.

The Bartlett Western Ry., J. W. Jackson, president, Bartlett, Tex., is considering extending its line from Bartlett to Cameron.

Officials of the Crosbyton-South Plains R. R. have been in conference with the State Railroad Commission regarding probable extensions of the line. It is in operation from Lubbock to Crosbyton, 40 miles, and is to be extended 28 miles to a connection with the Stamford & Northwestern at Spur. A line is also in contemplation through Guthrie and Benjamin to Seymour to a connection with the Gulf, Texas & Western and the Wichita Valley lines. A branch to Matador is also contemplated. J. M. Bassett, Crosbyton, Tex., is general manager.

Work has been started near Bronson, Tex., by W. H. Knox, clearing the right of way for the proposed railroad from Broadus, in San Augustine County to Hemphill, in Sabine County. It is thought that the first stretch to be built will be between Bronson and Hemphill.

Utah.

The Commissioners of Salt Lake County have granted a franchise to A. J. Evans, Salt Lake City, and associates, for an interurban line over certain county roads south of Salt Lake City. Franchise for use of city streets was granted some weeks ago. The route in Salt Lake County passes through Farmers, Granger, Taylorsville, South Taylorsville, West Jordan, South Jordan, Riverton and Bluff Dale. It will pass 2½ miles west of the center of Murray, 1½ miles west of Midvale and three miles west of Sandy.

The Oregon Short Line R. R. is considering the construction of a cut off Ballard to Logan on the Cachee Valley Branch, and the work will probably be undertaken. The grading work will be very light, the length of change being a trifle over 8 miles. It is for the purpose of shortening distance between the principal town in the valley and the main line, the southern portion of the valley already being served by loop. This is a piece of work of minor importance, it not affecting main line work.

Vermont.

The property of the St. Albans Street Ry. Co. of St. Albans has been purchased by Walter R. Dame, of Clinton, Mass., representing Massachusetts capitalists. The purchase price was $50,000. The former owners were contemplating a number of extensions and improvements.

Washington.

The Oregon-Washington Railroad & Navigation Co. and the Milwaukee have closed deals for the purchase of $1,250,000 worth of property on Front Ave., between Howard and Washington Sts., in the heart of Spokane, to be used for the union depot.

The Chicago, Milwaukee & Puget Sound Ry., which recently acquired controlling interest in the Bellingham Bay & British Columbia R. R. G. C. Hyatt, General Manager, Bellingham, Wash., is reported to have decided to build a short extension from Glacier to coal mines being developed by Alex Poulson of Bellingham.

The Northern Pacific Ry., A. R. Cook, principal assistant engineer, Tacoma, Wash., has completed plans for the construction of a bascule bridge over the government canal at 12th Ave., N. W., Seattle, and for the reconstruction of the existing tracks between Ballard and Fremont. Contracts will probably be let this month.

It is rumored that the Chicago, Milwaukee & Puget Sound R. R. is planning to let contracts shortly for the construction of the proposed line from Plummer, Idaho, to Bell, Wash. It is hoped to have the line in shape for operation by November 1. E. O. Reeder, Seattle, Wash., is Chief Engineer.

West Virginia.

⦿W. W. Boxley & Co., Roanoke, Va., have been awarded the contract for constructing the Williamson & Pond Creek R. R., a 20-mile line from Williamstown, W. Va., up what is known as Pond Creek. There will be one tunnel on this road and the first 11 miles is very heavy work, and will require a great many men and large team outfits. There is also considerable masonry on this work. The work is to be completed in six months' time. This road was recently organized at Ashland, Ky., with L. E. Johnson, of the Norfolk & Western Ry., as President. It will connect the coal fields in Kentucky with the Norfolk & Western Ry. at Williamson. Work on the road is to be commenced immediately and pushed as rapidly as possible to completion.

Work is to be started shortly, it is said, on the construction of the Cheat Haven & Brucetown R. R. between Cheat Haven and Ices Ferry. Frank Cunningham, Morgantown, W. Va., will be in charge of the work.

Wyoming.

Surveys are now being made by engineers of the Chicago, Burlington & Quincy R. R., according to reports, for the proposed cutoff from Lovell or Cowley to Garland, Wyo. F. T. Darrow, Lincoln, Nebr., is Engineer Maintenance of Way.

Canada.

⦿The Canadian Northern Ry. has awarded contracts for the construction of 331 miles of new branch line extensions in the prairie provinces. One of the most important is the contract for the completion of the Goose Lake line, which has been awarded to the Northern Construction Co., Winnipeg. This calls for the construction of a gap of 110 miles, from the end of steel to Munson. W. J. Cowan, Winnipeg, has the contract for the completion of the Prince Albert-Battleford branch, on which there are 50 miles of steel to be laid, 30 miles of which have already been graded. W. J. Cowan will also build a 21-mile branch north from Canora to connect with the Thunderhill extension. This year the Northern Construction Co. is to complete the Brazeau coal branch, a distance of 170 miles, 100 miles of steel being already laid on the line. The Northern Construction, in addition to the above, has the contract for the construction of 100 miles on the Edmonton-Peace River line.

It is reported that Canadian Pacific engineers are working in the vicinity of the Pend Oreille river and down the east side of the Columbia river, on the proposed line from Trail to Metaline Falls, where a connection will be made with the Idaho & Washington Northern Ry.

The Minister of Railways has approved the following route maps: Alberta Interurban Ry.—Calgary to Carbon. Niagara, Welland & Lake Erie Ry.—Welland and vicinity. Kettle Valley Ry.—Penticton to Osprey Lake Summit. Canadian Northern Ry.—St. Eustache to St. Jerome. Canadian Pacific Ry.—Revision of line from Gleichen to Shepherd, Alberta. Canadian Pacific Ry. (re-hearing)—Swift Current toward Camrose. Campbellford Lake—Ontario Western Ry. Canadian Pacific Ry.—Revision between Belleville and Agincourt. Central Ry. of Canada—Revisions between Hawkesbury and South Indian. Pacific & Hudson Bay Ry.—Kimsquit to Netal-Kus Lake.

McRae & Campaigne have started work at Bayside, six miles from Bellevill their contract for grading for th the new line of the Candian Paci Ry

The city council of Stratford, Ont., granted an extension of time until June 1 the Stratford Street Ry. Co. for beginning construction on the electric car system. franchise for the line has been the Canadian Northern Ry. and part of the system to be controlled by the latter railroad.

Permanent directors have been pointed London, Ont., for a proposed municipa tric radial railway between London an Burwell, touching Belmont and Aher proposed to construct a road length, at an estimated cost of $200 to enter London over the city's the London & Port Stanley, which a terminal at the present Mich station. The Board of Trade of Ldo is interested.

The Ottawa & St. Lawrence Co. is planning to let contracts a struction work started this month tion of the projected line from to Morrisburg, and on the section wa west to Arnprior. The comp, build lines from Ottawa west ar E. Askwith, Ottawa, Ont., is pr

The Canadian Northern Ry., gineer Maintenance of Way, Wi is to start work at once on exte yards in St. Boniface, near Wi railway will do this work itself

The Canadian Northern Ry., District Engineer, Edmonton, Al ing the construction season something like $13,000,000 in Alb line and various branches to be provincial guarantee throughout A large proportion of the total on lines the bonds of which wer by the legislature at the last s Onoway branch to Peace River a Lake extension will be the lines the work will be carried In the neighborhood of 1,000 m work on these two lines within weeks. Work has been started from Oliver through the Panka St. Paul de Metis on the Strat branch. On each branch an out at work. At least 300 station teams will be at work between and the Athabasca River within

ROADS, STREETS AND PAVEMEN

Alabama.

✣Bids will be received until noon, May 22, by Pickens County Court, Carrollton, Ala., for grading and surfacing with sand clay, four miles of road. A check for $400 must be filed with each bid. W. S. Keller is State Highway Engineer, Montgomery, Ala.

The Court of County Revenue of Dallas County, Selma, Ala., has been petitioned to call an election to allow the voters of the county to vote on the issuance of bonds to the amount of $100,000 or $150,000 to complete the good road system, on which $250,000 were expended last year.

The Wilcox County Commissioners, Camden, Ala., rejected all bids received April 30, for the construction of 5 miles of gravel roads, for which bids were rejected before on March 26. Bids were considered too high.

Arkansas.

The Board of Public Improvements of Fort Smith, Ark., plans to lay about 200,000 sq. yds. of brick and concrete pavement this year.

The Commissioners of Paving District No. 9, Helena, Ark., E. D. Ehrman, Secy., have deferred the letting of contract for paving, guttering, curbing, placing culvert pipe and grading in said city, until assessment is properly and legally adjusted. An approximate estimate of the amount of work to be done is as follows: Curb and gutter, 6,400 lin. ft.; grading, 1,000 cu. yds.; culvert pipe, 1,000 lin. ft.; catch basins, 10; radius corners, 220 lin. ft.; headers (stone or wood), 500 lin. ft.; cast iron, 2,000 lbs. Pavement, with 5-in. concrete foundation, 10,000 sq. yds. Bids will be received on the following materials: Brick block paving, sand filled; brick block paving, asphalt filled; creosoted wood block paving; sheet asphalt paving; bitulithic. Bids were opened April 17.

California.

✣Bids will be received until 10 a. m., May 9, by Board of County Supervisors, Willows, Calif., for the construction of a road in Road District No. 3.

The citizens of Fort Bragg, Cal., at a recent election voted against the issuance of bonds for the improvement of streets by constructing asphalt thoroughfares. However, the improvement will be made.

Voters in the Nordhoff Road District, Nordhoff, Cal., at a recent election voted the issuance of bonds in the sum of $30,000 for the construction of a system of first-class roads in the Ojal Valley.

Colorado.

✣Bids will be received until 15, by Board of Public Works, for the necessary labor and ma construction of concrete curb alley returns and crossings and proving the East Side Improv No. 7.

✣Bids will be received until 15, by Board of Public Works, for furnishing the necessary la rial for constructing concrete other incidental improvements Heights Sidewalk District.

The City Council of Boulder ordered petitions drawn calling of Pearl St., from Tenth to 18th St., from Tenth to 16th Sts., an tween Tenth and 16th Sts.; and 13th, 14th, 15th and 16th Sts., nut and Spruce, thus forming trict three blocks wide and six with two additional blocks on take in all of the business distr

Georgia.

A portion of the business sec edgeville, Ga., is to be macadam and sidewalks laid on both sides St.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

been accepted by the City lanta, Ga., Walter C. Taylor, the paving of Marietta St. [illegible] granite cubes or brick will be

Illinois.

e received until 1 p. m., June ighway Commissioners, Ash at the office of George [illegible] Clerk, Ashton, Ill., for mac- 6 miles of road and redress miles of road already mac- ond issue of $22,000 has been ork.

e received until 1 p. m., May Local Improvements, W[illegible] furnishing labor and material 11,837 sq. yds. of vitrified or Portland cement founda- vith 2,660 lin. ft. of concrete of storm water sewer connec- ch basins and other appurten- to plans and specifications on of the President of the Board vements. Plans and specifica- xamined and blank proposals office of the President of the the Engineer, Hugh M tford Bldg., Chicago.

received until May 10, by Improvements, Kankakee, Ill., t Court St.

e received by the Board of ents of Rochelle, Ill., until 7 for furnishing the materials, sary to construct 32,000 sq. ement. Plans and specifica office of the Board or the ng Bureau, 17 N. LaSalle St.,

hy Improvement Co., Daven- een awarded the contract by ra, Ill., M. J. Tarble, City En- paving of Avon St., Jackson St., Bevier Pl., Fourth Ave., nd Linden Ave., at $39,582. April 26.

r has been awarded the con- rd of Local Improvements of or the construction of 10,759 pavement on gravel founda- t. and Washington Pl.; also concrete curb and gutter and [illegible] excavation; 14 storm he contract price is $17,751. ty Clerk. Walter M. Hay is Bids were opened April 25.

for paving one block of Ave- to Chestnut St., in Canton, arded to R. A. Savill by in- owners. The excavation is cu. yd.; brick pavement, $1.28 e curbing, $0.50 a running ft., old curbing, $0.20 per ft.

aham Co. of Freeport, Ill., the contract by the Board ements of that city for the Iroquois St., and a part of 2. The streets will be paved bidders were: James Stew- $ 74, and Keys & McNamara $10,569.

Local Improvements of Can- ded the contract for the pav- tween Main St. and Ave- & Sons at $0.38 per cu. yd., 50 per lin. ft., for new curb- sq. yd. for brick paving.

Springfield, Ill., has been t for the paving of Union Fifth St. in that city at

e low bids received by the provements, Chicago, Ill., ary, for furnishing mate- essary to construct pave- th St., 8,000 lin. ft. sand- x 30 in.), $0.65, 17,280 sq. total $44,636; Ready & 133 W. Washington St. 85 lin. ft. sandstone curb, brick $2.04, total $8,893; 133 W. Washington St. [illegible] total $[illegible]; R. F. Conway Co., 133 W. Washington St. Alley Jefferson St., etc., 700 lin. ft. concrete [illegible] total $1,5[illegible]; Jno. A. McGarry & Co., 189 W. Madison St. Alley Sangamon St., etc., 700 lin. ft. wood curb, $0.20, 600 sq. yds. brick $2.62, total $1,712; P. J. O'Brien, 9 S. LaSalle St. Alley 650 lin. ft. concrete curb, $0.10, 470 sq. yds. brick $243, total $1,207; Jno. A. McGarry Co. Alley Belmont Ave., etc., 1,660 lin. ft. concrete curb, $0.10, 1,270 yds. brick $2.37, total $3,272; Jno. A. McGarry. Alley Winthrop Ave., etc., 1,690 lin. ft. concrete curb, $0.15, 1,320 sq. yds. brick $2.13, total $3,365; Central Paving Co., 179 W. Washington St. Alley Hamilton Ct., etc., 1,480 lin. ft. concrete curb, $0.10, 1,200 sq. yds. brick $2.50, total $3,148; Jno. A. McGarry Co. Alley Pine St., etc., 600 lin. ft. concrete curb, $0.10, 550 sq. yds. brick $2.42, total $1,443; Jno. A. McGarry Co. Alley Lincoln Ave., etc., 1,210 lin. ft. concrete curb, $0.10, 960 sq. yds. brick $2.37, total $2,528; Jno. A. McGarry Co. Alley Garfield Ave., etc., 1,420 lin. ft. concrete curb, $0.10, 1,120 sq. yds. brick $2.43, total $2,863; J. A. McGarry & Co. Alley Dearborn St., 25th St., etc., 1,200 lin. ft. concrete curb, $.10, 700 sq. yds. brick $2.43, total $1,821; J. A. McGarry & Co. Alleys Champlain Av., etc., 1,130 lin. ft. concrete curb, $0.10, 1,130 sq. yds. brick $2.43, total $2,889; Jno. A. McGarry & Co. Alleys Drexel Blvd., 1,230 lin. ft. concrete curb, $0.10, 1,060 sq. yds. brick $2.50, total $2,773; Jno. A. McGarry & Co. Alley Harrison St., etc., 1,400 lin. ft. wood curb, $.15, 1,200 sq. yds. brick $2.26, total $2,712; R. F. Conway Co. 900 lin. ft. concrete curb, $0.15, 1,300 sq. yds. brick $2.33, total $3,164; Central Paving Co. Alley first north of Halsted St., etc., 850 lin. ft. concrete curb, $0.05; 600 sq. yds. brick $2.50, total $1,542; Jas. A. Sackley Co. Alley Congress St., etc., 1,900 lin. ft. concrete curb, $0.05, 1,500 sq. yds. brick $2.58, total $3,965; Jas. A. Sackley Co. Alleys Van Buren St., etc., 2,000 lin. ft. concrete curb, $0.15, 1,600 sq. yds. brick, $2.13, total $1,218; Central Paving Co. Alley Des Plaines St., etc., 400 lin. ft. concrete curb, $0.10, 300 sq. yds. $2.68, total $844; Jno A. McGarry & Co. Alley first south of Taylor St., 500 lin. ft. concrete curb, $0.10, 450 sq. yds. brick $2.68, total $1,256; Jno. A. McGarry & Co. The work includes granite concrete curb and gutter, unless otherwise specified, 6-in. Portland cement concrete foundation, sewer construction and adjustment, cutting, filling, etc. The majority of the contracts have been awarded.

The city of Aledo, Ill., will construct about five miles of Dolarway pavement this summer. Work will be commenced about July 1.

The Board of Local Improvements of Rock Island, Ill., has decided to pave Tenth Ave., from 19th to 20th Sts., with asphalt.

The Board of Local Improvements of Moline, Ill., will ask for bids shortly on the construction of pavements on 23d Ave., from 15th to 27th St., and Seventh St. and 16th Ave.

The Village Board of Silvis, Ill., is about to pass an ordinance providing for the construction of 16 blocks of street pavement, estimated to cost approximately $60,000.

The Board of Local Improvements of Quincy, Ill., has decided to resurface East Vermont St., from Eighth west to 18th St., with macadam-asphalt. J. F. Garner is Mayor.

Indiana.

✣Bids will be received until 10 a. m., May 8, by Board of Public Works, Indianapolis, Ind., for the improvement of Speedway Ave., from the west end of bridge over White River to the east curb line of Lafayete Road by grading and paving the sidewalks.

✣Bids will be received until 10 a. m., May 8, by Board of Public Works, Indianapolis, Ind., for the improvement of Madison Ave., from P. C. C. & St. L. tracks to the north property line of Raymond St. by grading and paving the gutters.

✣Bids will be received until 10 a. m., May 8, by Board of Public Works, Indianapolis, Ind., for the improvement of Madison Ave., from the P. C. C. & St. L. R. R. Co.'s tracks to the north property line of Raymond St. by grading and paving the roadway.

⊙The Board of Public Works of South Bend, Ind., has awarded the contract for the paving of East Madison St., from the east race bridge to Eddy St., to Calvin H. Defrees at $18,915.

Plans and specifications for the improvement of Fifth and 11th Sts. have been adopted by the Board of Public Works of Logansport, Ind. The former street will be improved from Market to Canal St., with brick, while the latter will be improved with macadam.

The City Council of Clinton, Ind., is advertising for bids for the paving of Vine and Ninth Sts.

Iowa.

⊙The City Council of Mason City, Ia., has let the contract for the construction of between 40,000 and 45,000 sq. yds. of concrete pavement to George Gabler of Mason City at $1.08 per sq. yd., and $0.35 per lin. ft. for the curbing. The streets to be improved are Rawlins, from Superior Ave. bridge to the Milwaukee right of way; East State St., from Superior Ave. to and across the Milwaukee tracks east of the city; St. John's place from Main, two blocks east, and Fifth St., from Michigan to Mill St. Other bidders were: Frank H. Hahn, $1.17 and $0.28; A. W. Schweppe, $1.19½ and $0.36, and Hawkeye Cement Tile Co., $1.25 and $0.37.

⊙The Des Moines Asphalt Paving Co., Des Moines, Ia., has been awarded the contract by that city, Horace Susong, City Clerk, for the laying of sheet asphalt consisting of 1-in. binder course with 1½-in. wearing surface upon 5 ins. of Portland cement concrete, on East 13th St., from the north line of Grand Ave. to the south line of Walker St., at $1.64 per sq. yd. Bids were opened May 1.

The City Council of Bloomfield, Ia., recently passed a resolution relative to the establishment of a paving district. The district will comprise that of the streets surrounding the public square of the court house park, one block on each street respectively off the square, on Madison north to the north line of the H. C. Taylor property, south on Madison to the C., B. & Q. depot, west on Jefferson to Bloomfield Ave., south on that street to Walnut, thence west on Walnut to the Wabash depot; in all about one and one-half miles.

Kansas.

⊙The Kaw Paving Co., Topeka, Kans., has been awarded the contract by the city of Abilene, Kans., Kenyon Riddle, City Engineer, for the laying of 57,000 sq. yds. of street paving, for which bids were opened April 22. Bids were asked on brick, asphalt, concrete, asphaltic concrete, sarcolithic or Hassam pavement and curb and gutter.

The City Council of McPherson, Kans., has passed a resolution providing for the paving of Maple St., from Kansas Ave. on the south to Simpson St. of the Santa Fe railroad, on the north. The resolution provides for paving the cross streets connecting with the paving on the side streets from Main St. west. About 10 blocks will be laid.

Kentucky.

⊙The McCracken County Fiscal Court, Paducah, Ky., has awarded the following contracts for the repairing of the county roads: Clinton road, Harry Ross, $0.54; Potter road, Harry Ross, $0.57; Blandville road, Harry Ross, $0.58; Pines road, Harry Ross, $0.85; Benton road, S. B. Gholson, $0.60; Calvert City road, Oscar Rawlinson, $0.40; Cairo road, Major Wood, $0.55; Pool road, Gottleib Beyer, $0.45; Hinkleville road, Harry Ross, $0.75; Clinton road, Harry Ross, $0.50; Friendship road, Harry Ross, $0.50; Woodville road, A. Kuykendall, $0.85; Houser road, T. Houser, $0.55; Collierville road, Thomas Challenber, $0.48; Broadway, Harry Ross, $0.54; Mayfield road, from the Moss home to the city limits,

W. L. Yancey, $0.11, [illegible] home to the county line, H. Ballance, $0.45. Following contracts were awarded for grading direct roads, as follows: Fifth district, Oscar Rawlinsons, $8 per mile; Sixth district, W. L. Yancey, $10 per mile; Seventh district, Harry Ross, $12.75 per mile; Eighth district, R. M. Ross, $14.45 per mile.

Louisiana.

⦿The Southern Bi[illegible] awarded two paving contracts in West Shreveport, Shreveport, La. The first was for the paving of Cedar St., from Texas Ave. to Park Ave.; on Park Ave., from Cedar to Caperton St., at $1.84 per sq. yd. The other was for the paving of Laurel St., from Madison Ave. to Harriett Ave., at $1.65 per sq. yd.

The property owners and City Council of Crowley, La., at a recent meeting decided on the use of vitrified brick pavement for the improvement of Parkerson Ave.

The City Council of Lake Charles, La., has adopted ordinances for the paving of two streets, Hodges and Kirby. Hodges will be laid with creosoted wood blocks. Kirby will be asphalted. S. O. Shattuck is City Clerk

Maryland.

⦿The Board of Awards of Baltimore, Md., on May 1 awarded the following contracts upon the recommendation of the Paving Commission, Charles A. Edel, Secretary: Bituminous Concrete Contract No. 14—Warner-Quinlin Asphalt Co., Syracuse, N. Y.; approximate bid $48,655. Sheet Asphalt Contract No. 15—Warner-Quinlin Asphalt Co., Syracuse, N. Y.; approximate bid $61,595. Sheet Asphalt Contract No. 16—Warner-Quinlin Asphalt Co., Syracuse, N. Y.; approximate bid $78,012. Granite Block Contract No. 18—Cunningham Paving & Construction Co., 1345 Arch St., Philadelphia, Pa.; approximate bid $28,526. Contracts Nos. 1 to 19, inclusive, which have been awarded to date, represent an outlay of approximately $1,000,000.

The citizens of Pocomoke City, Md., at a recent election voted in favor of the issuance of bonds to the amount of $35,000 for the construction of new pavement. The entire cost of the proposed improvement is $60,000.

Massachusetts.

⦿Steve Meraignal of Stockbridge, Mass., has been awarded the contract by the Authorized Committee of that city, A. T. Treadway, for the construction of a road including 20,000 sq. yds., at $1.10 per sq. yd. Bids were opened April 27.

Michigan.

✣Bids will be received until 1 p. m., May 13, by the County Road Commission, Iron County, Crystal Falls, Mich., for the construction of 8 miles of dirt road from Iron River to Beechwood and 4 miles of dirt road from Mastodon to the Brule River. Each proposal must be accompanied by a certified check for $50. A. L. Burridge, Crystal Falls, Mich., is engineer. Official advertisement will be found elsewhere in this issue.

⦿It is reported the Department of Public Service of Detroit, Mich., has awarded the following contracts for paving work: F. Porath, paving Martin Ave. with cedar blocks at $2.50 per sq. yd., or $7,698; J. A. Mercier, Waterman Ave., section No. 1, with cedar blocks, $2.51 per sq. yd., or $21,991; J. A. Mercier, Waterman Ave., section No. 2, with cedar blocks, $2.46 per sq. yd., or $31,099; T. E. Currie, Garland Ave., with cedar blocks, $2.26 per sq. yd., or $7,439; T. E. Currie, St. Clair Ave., $2.24 per sq. yd., $5,499; James H. Hanley, Theodore St., with cedar blocks, $2.49 per sq. yd., $18,539; W. M. Hatch, Willis Ave. with cedar blocks, $2.38 per sq. yd., $8,966; Julius Porath, Dexter Blvd., with asphalt, $3.02 per sq. yd., $30,654.

Plans have partly been completed by Engineer R. W. Roberts of Saginaw, Mich., for the construction of one mile of concrete pavement at Hastings, Mich., to include cement curb. C. H. Osborn of Hastings is official in charge.

Minnesota.

✣Bids are being received, it is reported, by Board of County Commissioners, Minneapolis, Minn., for the work upon Superior Blvd. estimated to cost about $65,000.

✣Bids will be received until 11 a. m., May 20, by A. P. Erickson, county auditor, Minneapolis, Minn., for the construction of a concrete road.

✣Bids will be receivel until 10 a. m., May 27, by P. A. Hoffman, county auditor, Hastings, Minn., for the grading of San Cooley Road on State Road No. 2, located 3 miles south of Hastings.

✣Bids will be received until 8 p. m., May 14, by A. M. Childs, city clerk, Crookston, Minn., for furnishing a street flusher.

⦿Fielding & Shepley of St. Paul, Minn., have been awarded the contract to pave on several streets in Faribault, Minn., with creosote wood blocks at $31,487. The work includes 13,896 sq. yds.

⦿On April 9 Fielding & Shepley of St. Paul, Minn., were awarded the contract at Faribault, Minn., for the construction of 14,000 sq. yds. of creosoted wood block pavement on a 5-in. concrete base, at $31,500. The work includes 4,140 ft. of sandstone curb, tar filler and 4,600 cu. yds. of excavation. F. W. McKellip of Faribault is engineer.

⦿Henry Wilder of Crookston, Minn., has been awarded the contract by the Polk County Board, Crookston, for doing road work on the state road on line between the towns of Gentilly and Kertsonville, at 18½ cts. per yard. The work will cost approximately $2,000. Material will be secured from the sides of proposed road. Bids were opened April 23. S. Steenerson is asst. state's engineer, St. Paul, Minn.

The city of Crookston, Minn., A. M. Childs, city clerk, has postponed indefinitely the project of purchasing a gasoline road roller, for which bids were to have been opened April 23.

The Village Courcil of Hibbing, Minn., has instructed Engineer Wilson of Duluth, Minn., to prepare plans and specifications for three miles of creosote block pavement on the following streets: Second and Third Aves., from North St., to the Missabe railroad tracks; Pine St., from First to Fourth; Center St., from Third to Fourth and Cedar St., from Second to Third Aves.

Property owners on Central Ave., city of Duluth, Minn., have circulated a petition providing for the paving of Central Ave., from Cody St. to Gosnold St.

Missouri.

✣Bids will be received until noon, May 17, by Board of Public Improvements, St. Louis, Mo., for the improvement of a number of streets under lettings from 10524 to 10537 inclusive. W. T. Findly is Secretary.

⦿The Board of Public Improvements of St. Louis, Mo., Wm. T. Findly, secretary, on April 26 awarded the following contracts for street work, for which bids were opened on April 26; Jas. C. Traville, street commissioner: Brick—No. 10,459, for improving John Ave., between 11th St. and Von Phul St., John McMahon, $2,245; 10,460, for improving Gasconade St., between Pennsylvania Ave. and Minnesota Ave., Eyermann Construction Co., $3,175; 10,461, for improving Grace Ave., between Gravois Ave. and Fairview Ave., Eyermann Construction Co., $8,073; 10,462, for improving Newhouse Ave., between Blair Ave. and 19th St., John McMahon, $3,357; 10,463, for improving Shaw Ave., between Tower Grove Ave. and Kingshighway Blvd., Eyermann Construction Co., $26,365; 10,464, for reconstructing Arsenal St., from Louisiana Ave. to Grand Ave., Evermann Construction Co., $7,[illegible]7; 10,465, for reconstructing Cherokee St., from California Ave. to Nebraska Ave., Eyermann Construction Co., $3,701; 10,466, for reconstructing Mound St., from Second St. to Broadway, John McMahon, $3,413; 10,467, for reconstructing North Market St., from Broadway to 15th St., John McMahon, $31,5[illegible]. Total [illegible]. Wood—10,468, for improving Delmar Blvd., between Skinker Road and western city limits, Harry F. Heman, $7,733; 10,469, for imp mar Blvd., between Rosedale Ave. Road, Granite Bituminous Paving 10,470, for reconstructing Locust Fourth St. to 13th St., Eyermann Co., $16,749; 10,471, for reconstru St. from Channing Ave. to Grand mann Construction Co., $8,678. T Grand total, $137,916.

The City Council of Tarkio, Mo an ordinance calling for an add miles of street paving, to be con mediately. The new district wi Sixth St. on Main and will cont considerable distance, thence nort to McNary Ave., then west to 1 north along the Tarkio College cam blocks, then east on College Ave., St., then south and east to Main

Nebraska.

The City Council of Lincoln, Ne, an issue of $37,300 paving bonds Rorick & Co., of Toledo, O.

A movement is under way Nebr., to pave Lincoln Ave., fro lington tracks south to the North road station.

New Jersey.

⦿The Miller Engineering and Co., Cape May, N. J., has been contract by the Long Beach Tow mission, Elmer D. Wilt, chair county, N. J., for the buildir road in the township of Long B ning at the northeast line of the Beach Haven and extending north the southwest line of the borou City, a distance of 34,480 ft., or 6 The contract price is $3[illegible] opened April 15.

New York.

✣Bids will be received until 8 20, by Village Board, Randolph, furnishing necessary labor and paving portions of Main St., De Washington St. F. A. Babbitt Clerk.

✣Bids will be received until 5 20, by D. J. Coutant, City Clerk, N Y., for furnishing the necessary material for permanently improvi facing with bitulithic pavement of the macadam roadway of Bro between the west side of Liberty east side of Mill St., in accordanc and specifications prepared by Blake, Jr., City Engineer. The 15,000 sq. yds. to be resurfaced, roadbed, including excavating, an where necessary, etc. Cash or a of $500 must accompany each tions and forms of proposals will upon personal application, and seen at the office of City Enginee

✣Bids will be received until May 20, by Board of Public W burg, N. Y., for furnishing the ne and material for the constructi 1,600 sq. yds. of creosoted wood ment on Broad St. and about 59 creosoted wood block pavement side of Trinity Park. C. A. Ba Clerk. H. J. Langlois is City E

✣Bids will be received until 11 14, by M. E. Connolly, president Queens, New York city, for eig provement contracts, one of the No. 7, for regulating and repavi phaltic concrete on a macadam and all work incidental thereto. Blvd. from Grand St. to Jamaica 4th wards. The time allowed fo completing the above work will be days. The amount of security req $22,500. The engineer's estimate tities is as follows: 50 cu. yds. of cu. yds. of reinforced concrete sq. yds. of stone gutters furnish 1,000 sq. yds. of stone gutters rel yds. of vitrified block binder fu laid, 50 lin. ft. of 12-in. vitrified

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] 12 [illegible] catch basins completed as per [illegible] pavement [illegible] ltic concrete pavement (laid ilroad franchise area and five ce).

[illegible] as follows:

	Amount	Road No.	Miles
[illegible] n. N.	[illegible]	351	7.80
[illegible] N.	19,965	352	1.91
[illegible] Newport.	[illegible]	[illegible]	[illegible]
[illegible]	9,675	[illegible]	[illegible]
[illegible] ook.	19,159	574	11.41
[illegible], Pittsford,	41,811		4.08
Spencerport,	18,633	588	2.08
[illegible] N	[illegible]		3.73
o., Newport,	[illegible]	[illegible]	[illegible]
[illegible] N	33,362	[illegible]	4.10
Albany, N.	63,012	803	8.23
[illegible] N	42,787	945	4.18
[illegible] N. Y	[illegible]	949	0.29
o., Catskill,	5,198	954	[illegible]
engineer's		955	0.43
alo, N. Y....	37,353	960	2.80
[illegible] Water	[illegible]	[illegible]	[illegible]
o., Chateau-	29,961	[illegible]	3.30
[illegible] N. Y	[illegible]	[illegible]	5.67
Co., Hornell, ...	23,189	975	[illegible]
lston Spa..	61,126	[illegible]	[illegible]
[illegible] Co.	41,215	978	4.35
[illegible], Glens	81,406	979	8.27
Troy, N.	[illegible]	980	[illegible]
Albany, N.	34,472	[illegible]	3.14
bany, N. Y.	20,325	983	2.56
Cons. Co.,	[illegible]	988	0.35
[illegible] Fr[illegible]-	[illegible]	989	2.25
nia, N.Y.	33,954	990	1.03
[illegible] N. Y	[illegible]	991	4.64
[illegible] chester,	22,493	992	1.99
[illegible]	10,180	993	1.20
[illegible] chester,	[illegible]	994	[illegible]
[illegible] chester	47,533	995	4.86
[illegible] ord, N	20,608	996	2.25
[illegible]	74,556	998	[illegible]
[illegible] n, Wat-	65,562	[illegible]	6.68
B[illegible] on, Mass.	60,453	1000	5.95
[illegible] N. Y	[illegible]	1001	6.45
Whitehall,	[illegible]	1002	2.54
[illegible]	24,743	1007	2.72
Cha-	15,499	1006	1.28
Roches-	12,989	[illegible]	9.98
[illegible] any, N.	65,380	1011	4.70
[illegible] any, N	48,940	1012	3.30
[illegible] hamton	3,143	1013	0.19
[illegible] N. Y.	1,404	1014	0.08
[illegible] any, N.	108,185	1016	7.96
[illegible]	[illegible]	1018	6.79
Boston	38,264	5091	1.06
Boston,	[illegible]	5131	1.20
Boston.	[illegible]	5161	1.51
Troy, N	5,606	5163	0.41
Hudson,	46,583	5166	[illegible]
Boston.			
[illegible]			1.35
[illegible]			0.41
[illegible]		5176	2.18
[illegible] N. Y.	[illegible]	5193	2.84
[illegible]			1.48
Hollington Co., Troy, N. Y..	[illegible]		1.93
[illegible] N. Y.	[illegible]		9.80
Atlanta Const. Co., Atlanta, N. Y.	34,728		6.37
[illegible]		5205	5.38
[illegible]			1.51
[illegible] Baum, Elmira, N. Y.........	86,174	5208	12.39
[illegible] N. Y.		5209	
Shaughnessy Const. Co., Al[illegible] N. Y.		5211	8.04
Greenfield Const. Co., Hornell, N. Y.	38,140	5212	3.94
R. Hopkins, Troy, N. Y.......	54,893	5213	4.43
McGreevey, McGuigan & [illegible] N. Y.	72,095	5215	10.72
Newport Const. Co., Newport, N. Y.			
Erie Contr. Co., Buffalo, N. Y.	156,313	5217	7.96
Alfred Musso, Frankfort, N. Y.			
Erie Contr. Co., Buffalo, N. Y.	165,386	5220	4.87
Semper Bros., Watertown, N. Y.	57,922	5221	4.69
Snead & Wilson, Brown Sta[illegible]	[illegible]		
Merritt Const. Co., Tuckahoe, N. Y.	134,850	5223	8.54
Shaughnessy Const. Co., Albany, N. Y...................	71,709	5224	9.43
Wm. Hazzard, Trumansburg.	13,328	5225	0.53
Wm. P. McDonald Const. Co., Mt. Vernon, N. Y..........	79,992	5226	7.01
Shaughnessy Const. Co., Al[illegible] N. Y.			

Contracts will be let in about three weeks by the city of Niagara Falls, N. Y., F. S. Parkhurst, Jr., city engineer, for the construction of 25,000 sq. yds. of pavement on a concrete foundation, to include 20,000 ft. of Medina stone curb. The estimated cost of the work is $75,000. The kind of material has not been chosen.

The Board of Public Works of Fulton, N. Y., on April 29 voted to pave West Broadway with brick, with a 60-ft. roadway and concrete curbs.

Ohio.

✣Bids will be received until noon, May 13, by Director of Public Service, Cincinnati, O., for the improvement of Halpin Ave. from Linwood Ave. to Greist Ave., by grading, setting cement combined curb and gutters and macadamizing the roadway with special binder and finishing course. M. J. Keefe is Clerk.

✣Bids will be received until noon, May 31, by Board of Hamilton County Commissioners, Cincinnati, O., for the oiling, under specifications No. 321, of the Loveland and Madeira Road from Remington to the bridge in Loveland in Symmes Township. A certified check for $500 must be filed with each bid. Albert Reinhardt is Clerk of the Board.

✣Bids will be received at the office of the Commissioners of Belmont County, at St. Clairsville, Ohio, until noon, May 18, 1912, for grading and paving with brick for medium traffic, the Belmont-National road, State Highway H. pet. No. 191, in Union Township, said county. Length 11,932 ft. or 2.26 miles. Width of pavement, 13 ft. Estimated cost of construction, $30,958. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 1, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Geauga County, at Chardon, Ohio, until 12 noon, May 22, 1912, for grading and paving with a bituminated concrete, the Scotland-Station road, State Highway D. pet. No. 411 in Chester Township, said county. Length 8,960 ft. or 1.70 miles. Width of pavement, 14 ft. Estimated cost of construction, $11,843. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 15, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received until May 13 by the director of public service, Dayton, O., for the construction of 16,400 sq. yds. of pavement on 6-in. concrete foundation with grout or asphalt filler. The work will include 8,000 lin. ft. of stone or cement gutter. The cost of the proposition is estimated at $32,000. Harvey J. Dressler is engineer.

✣Bids will be received at the office of the Commissioners of Ashtabula County, at Jefferson, Ohio, until 12 noon, May 23, 1912, for grading and paving with a bituminated concrete, the Andover road, State Highway E. pet. No. 366 in Andover Township, said county. Length 8,523 ft. of 1.61 mile. Width of pavement, 16 ft. Estimated cost of construction $12,477. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 15, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Mahoning County, at Youngstown, O., until 10 a. m., May 11, for grading and paving with a waterbound macadam Sec. No. 2 of the Ellsworth Center Easterly road, State Highway G. pet. No. 341 in Ellsworth Township, said county. Length 6,802.5 ft. of 1.29 miles. Width of pavement, 14 ft. Estimated cost of construction, $11,617. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, August 1, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

⦿Bloom & Connci of Wilmington, O., have been awarded the contract by the Commissioners of Clinton County, Wilmington, O., for grading and paving with waterbound macadam the Wilmington-Xenia road in Union Township, said county, at $22,975. The road is to be 20,750.4 ft. or 3.93 miles long, and 14 ft. wide. Bids were opened May 2. James R. Marker, Columbus, is State Highway Commissioner.

⦿Geo. W. Rich, Loveland, O., has been awarded the contract by the Board of Hamilton County Commissioners, Cincinnati, O., for the improvements under Specifications No. 297, of Fallis Road, from Union Cemetery Road to Rich Road, in Symmes Township. The contract price is $6,589. Bids were opened April 26.

⦿Lambert Bros. & Wert of Delaware, O., have been awarded the contract to pave certain streets at Forest, O., for $30,000.

⦿Gordon, Brewer & Tumlinson of Chillicothe, O., have been awarded the contract by the Vinton County Commissioners, McArthur, O., for grading and constructing with a waterbound macadam the McArthur-Hamden Road in Elk and Clinton Townships, said county, at $22,389. The road is to be 3¼ miles in length and is to be completed by Aug. 1. Bids were opened April 17. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Delaware County, at Delaware, Ohio, until noon, May 13, 1912, for grading and improving with a waterbound mac-

[illegible] Sunday [illegible] State Highway [illegible] 387, in Delaware and Brown Town[illegible] [illegible] counties. Length [illegible] ft. [illegible] Width of pavement, [illegible] ft. Estimated [illegible] $7,[illegible] [illegible] deposited with [illegible] successful bidder will [illegible] [illegible] County Commis[illegible] sioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., State Highway Commissioner.

City Engineer F. L. Weaver of Hamilton, O., has submitted plans and an estimate of cost for the paving of North D St., from Main St. to Elvin Ave., as follows: Limestone curb: Sheet asphalt, 2-in. top, $24,000; vitrified brick, $22,930; creosoted block, $28,590. Cement curb and gutter: Sheet asphalt, 1½-in. top, $23,722; vitrified brick, $21,347; creosoted wood block, $27,592. Plans were also submitted for the paving of Vine St., from Linn to Front St., estimated to cost as follows: Limestone curb: Sheet asphalt, 1½-in. top, $36,058; sheet asphalt, 2-in. top, $37,582; vitrified brick, $33,772; creosoted block, $43,6[illegible]. Cement curb: Sheet asphalt, 1½-in. top, $34,71[illegible]; sheet asphalt, 2-in. top, $36,111; brick, $32,574; creosoted block, $41,856.

Following low bids were received by Service Director Veeder Heasley of Youngstown, O., for street improvements: Steel St. grading: A. O'Hern, $5,875; J. Cummiskey, $6,219; Kennedy Bros., $7,185. Salt Springs St. paving: A. Seratine, $12,893; James McCarron, $13,066; Martin P. Connelly, $13,172.

The Exchange National bank of Canal Dover, O., has purchased the $35,500 paving bonds of that city.

Oregon.

Following bids were received at McMinnville, Ore., for the construction of approximately 26,000 sq. yds. of pavement in that city:

Name.	Kind.	Cost sq. yd.
Dennis & Christenson,	dolarway	$1.50
Carbolineum Wood Preserving Co.,	wood blocks	2.[illegible]
[illegible] Paving Co.,	Portland asphalt on bituminous base	1.[illegible]
H. Blake, Los Angeles,	El Oso, 4-in. concrete base	1.[illegible]
H. Blake, Los Angeles,	El Oso, 6-in. concrete base	1.95
H. Blake, Los Angeles,	El Oso, 4-in. concrete bitum base	1.68
Warren Const. Co.,	standard bitulithic	1.95
Warren Const. Co.,	light bitulithic	1.79
Warren Const. Co.,	gravel bitulithic	1.[illegible]
Universal Const. Co.,	El Oso asphalt, [illegible]-in. concrete base	2.10

Pennsylvania.

✣Bids will be received until 8 p. m., May 10, it is reported, by Borough Council, Dormant, Pa., for grading, curbing and paving Belrose Ave., from Potomac Ave. to Hillsdale Ave., including 3,600 cu. yds. of grading; 2,650 sq. yds. of paving; 1,850 lin. ft. of concrete curb.

✣Bids will be received until 8 p. m., May 8, by Department of Highways or F. H. Raub, City Engineer, Easton, Pa., for paving Second St. from Northampton to Ferry, and Ferry St. from Second to Fourth with Dolarway pavement.

✣Bids will be received until 10 a. m., May 21, by State Highway Department, Harrisburg, Pa., for the construction of 4,217 ft. of telford macadam road, 15 ft. wide, extending from the present improvement at Dunning Creek to the bridge over Bobb's Creek, Reynoldsdale, in East St. Clair Township, Bedford County. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; No. 1001 Chestnut St., Philadelphia; and Hollidaysburg, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $1,000. Edward M. Bigelow is State Highway Commissioner.

✣Bids will be received until May 21 by Department of Highways of Pennsylvania, Harrisburg, Pa., for the construction of 8,08[illegible] ft. of brick road, 16 ft. wide, beginning at the southern borough line of Sharon, Mercer County, and extending northward through Hickory Township to the southern borough line of Sharpsville, Mercer County. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; No. 1001 Chestnut St., Philadelphia; and Franklin, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $2,000. Edward M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., May 28, by State Highway Department, Harrisburg, Pa., for the construction of 24,605.5 ft. of asphaltic concrete road, 16 ft. wide, beginning at end of Section No. 1, Station 1526-50, near the property of R. M. Hall, and extending west to the east line of Claysville Borough, Station 1772-53.5. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; No. 1001 Chestnut St., Philadelphia; and Washington, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $4,000. Edward M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., May 21, by State Highway Department, Harrisburg, Pa., for the construction of 18,100 ft. of asphaltic concrete road, 16 ft. wide, extending from the East Buffalo Township line 18,100 lin. ft. to the West Buffalo Township line and connecting with the present improved road. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; No. 1001 Chestnut St., Philadelphia; and Bloomsburg, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $3,000. Edward M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., May 21, by State Highway Department, Harrisburg, Pa., for the construction of 6,494 ft. of brick road, 16 ft. wide on Route No. 246, Pittsburgh to New Castle, being a portion of Section No. 1 extending from the south borough line of Westview to the north borough line of Westview Borough, Allegheny County. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; No. 1001 Chestnut St., Philadelphia, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $2,000. Edward M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., May 21, by State Highway Department, Harrisburg, Pa., for the construction of 20,085 ft. of asphaltic concrete road, 16 ft. wide, beginning at the north city line of Harrisburg, Dauphin County, and extending northwardly to the northern boundary line of Susquehanna Township, Dauphin County, at Fishing Creek. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; and No. 1001 Chestnut St., Philadelphia, Pa. Each bid must be accompanied by a certified check in the sum of $1,000. Edward M. Bigelow is State Highway Commissioner.

⊙Director Howard B. Oursler of the Department of Supplies, Pittsburgh, Pa., has awarded the contract for furnishing the city with three motor trucks for the handling of hot asphalt to the Alco-Pittsburgh Sales Co., Pittsburgh, for $17,025. Each of the new trucks will carry 6½ tons at a speed of from 10 to 15 miles per hour. Delivery to be made within six weeks.

South Carolina.

✣Bids will be received until 10 a. m., May 17, by W. F. Muller, Supervisor, Richland County, Columbia, S. C., for resurfacing the road from the city limits of olumbia Hyatt Park, a distance of 7,648 of 9 with road with artificially bon wearing surface.

Texas.

✣Bids will be received until n May of by Maj. Earl I. Brown, U. S. E neer, Galveston, Texas, for the construc n of concrete sidewalks, brick pavement, c crete curbing and drains at Fort Travis eservation Port Bolivar, Galveston, Texas.

•J. C. Kelso of Galveston, T awarded the contract by County udge J. P. Pool of Victoria County, Victo Tex gravel surfacing the first 28 miles the way to be built from the $200,0 recently voted for good roads b contract price is $2,100 per mil early part of this month the cou additional 30 miles of roadwork be hauled by the Southern Pacif the county gravel pits near Nu

The Robertson County (Franklin, Tex., have ordered an in Franklin commissioners' pre 4 for the purpose of voting on t bonds in the sum of $100,000 f

Major Robert H. Rolfe, qua Fort Sam Houston, Tex., has b to purchase a steam roller for t improving the condition of the ad the post.

J. R. Johnson, engineer in c ge good roads work in the Sherma T cinct, has completed the prelim and is now engaged with his o drawing up plans and specificati ing to the survey there will be road constructed.

The citizens of Taylor, Tex., it is reported, voted the issuance b street paving, as follows: Thr Main St., from the Internatio Northern tracks on First St., nor ner of the city hall square, an street one block east and one b Main St., including East Fir West Second, East and West Th and West Fourth Sts., making a blocks.

Virginia.

The public improvement comm Council, Norfolk, Va., has recom appropriation of $1,700, one-half cost of paving Archer Lane t Station. The Norfolk Terminal the other half.

Washington.

⊙The town of Cashmere, Wash has ed the contract for the construc ent sidewalks to C. M. Pay Wash., at $16,939. S. H. A clerk. Bids were opens April 22

⊙The Metropolitan Park Boa Wash., has awarded the contract ing of a roadway in Point Defian the Pearl St. entrance to the ru distance of 10,000 ft., to Joseph of Tacoma, at $19,525. The roa crushed rock base of 4 ins. and Warrenite.

⊙P. J. McHugh of Seattle, W awarded the contract for the p State Aid Road at Tacoma with concrete base. The entire w about $125,000. Low bidders on of pavement are as follows: B Co., Seattle, on Warrenite; Fergu Seattle, on Dolarway; T. R brick with stone or gravel base; struction Co., on straight conc Washington Construction Co., on concrete base.

⊙Board of Public Works of Evett W. D. Baskhoff city engineer awarded the contract for the im Rockefeller Ave. from Hewitt St. to the Atlas Construction C were: Atlas Construction Co. $ McHugh, $63,560; F. Kerr Ffo Sloane Bros., $66,997; Walsh & $72,963; Nura Case, $76,310. Th

rial: Removal old lumber, 300
cavation, 13,535 cu. yds.; em-
[illegible] yds.; concrete walks, [illegible]
te curb (armored), 1,023 lin.
ete curbs, 7,912 lin. ft.; asphalt
top, 1 in. binder, one-fifth the
ng 5 in. concrete base, the re-
4 in. concrete base), 26,387 sq.
ters, 747 sq. yds.; pavement
786 lin. ft.; manholes (adj.),
[illegible] year old elm, [illegible]
n. tile drains, 400 lin. ft.; grass
planking, 25.5 M. B. M.; hy-
; catch basins, 27; inlets, 42; 6
onnections, 1,120 lin. ft.; 8 in.
[illegible] 1,588 lin. ft.; [illegible]
nections, 72 lin. ft.; wooden
B. M. Fixed estimate charge,
neer's estimate, $67,014.

Centralia, Wash., is about to
the improvement of K. S[illegible]
Sts., by grading, cement walks
luding eight blocks. The es-
$8,000. Stanley Macomber is

nmission of Chehalis, Wash.,
out $3,500 worth of machinery
k, including dump wagons,
e mixer, etc. F. O. Blair is

were opened by the Board of
f Seattle, Wash., on April 26
ng of Railroad Ave.: W. G.
J. A. Zinkan, $25,132; Holt &
The J. A. McEachern Co.,
attle, $23,970; Sparger Con-
; MacRae Bros., $29,938, and
tract Co., $24,885.

were received by the Board
of Seattle, Wash., on April
g of 42nd Ave. south: Holt
[illegible] & Hadley, $18,016
ell & Gallagher, Bailey Bldg.,

l Commission of Tacoma,
led to repave North I St.,
ve. to North 13th St., the
ich will be $12,000; also to
Fourth and Fifth Sts., from
[illegible]

Shelan County, Wenatchee,
[illegible] to vote on the is-
n the amount of $30,000 for
of good roads.

completed by City Engineer
Seattle, Wash., for the con
sphalt plant at Terry Ave.
ost about $30,000. The struc-
stories in height, with two
o be built adjoining, measuring 112x119 ft. The building will accommodate quarters for an asphalt plant, crushed rock and clinker shed, bitumen shed, and a road roller compartment. The structure will be of frame construction, covered with corrugated galvanized iron sheeting.

West Virginia.

✣[illegible] by Hancock County Clerk, New Cumberland, W. Va., for grading and paving 10 miles of road located in Grant District opposite East Liverpool, O. Plans and specifications on file in office of Clerk, New Cumberland, W. Va.; City Engineer's office, East Liverpool, Ohio, and residence of Jas. A. Bowers, County En[illegible]

Wisconsin.

✣Bids will be received until noon, May 15, by C. J. Morisset, Commissioner of Highways, Superior, Wis., for the following road work: Building a road from the Troy road south along the South Shore R. R. to the line between sections 26 and 35, then west on the line to the northwest corner of section 34, 47-10, according to plans and specifications on file with the County Clerk. Printed form of contract and bid may be had of the County Clerk, or at the office of E. E. Geary at Brule, Wis.

✣Bids will be received until 2 p. m., May 29, by O. S. Norsman, city clerk, Madison, Wis., it is said, for paving and otherwise improving 11 streets throughout the city.

✣Bids will be received until May 15 by commissioners of the first addition to the Rattlesnake Drainage District of Dane County, Wis., Mathias Lindas, president, Deerfield, Wis., for doing work provided for in plans and specifications on file with the president or F. W. Hall, attorney, Room 424, Washington Block, Madison, Wis. Official advertisement will be found elsewhere in this issue.

⊙The city of Waukesha, Wis., Morgan R. Butler, city engineer, has awarded the contract for constructing 36,486 sq. yds. of asphalt macadam, 21,980 ft. of concrete curb and gutter and 12,443 cu. yds. of excavation to G. H. Stanchfield of Fond Du Lac, Wis.

⊙The City Council of De Pere, Wis., has awarded the contract for the paving of two blocks of Main Ave. with sheet asphalt to the White Construction Co. of Milwaukee, Wis., at $1.72 per sq. yd. The total cost will be about $16,000.

The voters of Bayfield County, Wis., at a recent election voted the issuance of bonds in the sum of $50,000 for the construction of county roads, which will include a $10,000 bridge on Fish Creek near Ashland. Washburn is the county seat.

The City Council of Marinette, Wis., plans the expenditure of $30,000 this summer for new pavements. Among the streets to be paved are: Hattie, from the Hattie St. bridge to Hall Ave., with macadam; one block on Ella Court, from Jefferson to Hattie Sts.; a portion of Lewis St., and all of Grant and Starkweather Sts.

The City Council of Oshkosh, Wis., have again rejected all bids received for the repaving of Jackson St., from Irving St. to New York Ave., and has decided to readvertise the work. New bids will be received on the old specifications, calling for asphalt, creosoted block and sarcolithic.

Wyoming.

✣Bids will be received until May 15 (readvertisement) by Maj. A. W. Kimball, quartermaster, Fort D. A. Russell, Wyo., for repair of roads, curbs, gutters, etc.

Canada.

✣Bids will be received until noon, May 15, by City Commissioners, Moose Jaw, Sask., for laying approximately 34,000 sq. yds. of pavement. Plans and specifications may be obtained of J. Antonisen, City Engineer.

✣The Council of Assiniboia, Kirkfield Park P. O., St. Charles, Man., rejected all bids received April 29 for the construction of a permanent pavement 24 ft. wide on the north side of Portage Ave., extending from the western limits of the city of Winnipeg to the western limit of Lot 20, St. James. The Council has decided to receive new bids May 13, and the stretch to be paved has been extended from the western limits to the Assiniboia municipal hall, about four miles in all. Frank Ness is Secretary-Treasurer of the municipality.

⊙Kilbridge, Kilbridge & Sutherland of Calgary, Alta., and North Battleford, Sask., have been awarded the contract by the city of North Battleford, Sask., H. W. Dixon, secretary-treasurer, for Contract T, for constructing 180,000 sq. ft. of concrete sidewalks at 18 cts. on 10 ft. walks and 15 cts. on 6 ft., 5 ft. and 4 ft. walks. Bids were opened April 22.

The Welland County Council, Welland, Ont., has launched a good roads movement. It is proposed to construct 25 miles of roads this year with three complete outfits. Jas. C. Gardner of Niagara Falls has been appointed county good roads engineer. The county has purchased three road rollers, three Champion graders, three ploughs, one crusher, one 25 h.p. International Harvester Co.'s gasoline engine, three wagons and carts, three water tanks and other material.

DGES—STEEL AND CONCRETE

Alabama.

cil of Decatur, Ala., has
uction of two bridges over
one to be located on the
d the other on the Danville
tures will probably be of

the General Committee of
the office of W. G. Kirk-
neer, Birmingham, Ala.,
ch all of the railroads
am were represented by
s and the city was repre-
Engineer Kirkpatrick, the
en toward grade separa-
of Birmingham. Each
be handled by a sub-com-
f the City Engineer and
of each of the railroads
en all the grade crossings
hese plans are to be con-
mittee consisting of the
representative of all the
by their chief engineers.
reported back to the Gen-
sisting of the City Engineer and the chief engineers of all the roads, and thereafter referred to the executive departments of the city and the railroads.

California.

✣Bids will be received until 3 p. m., May 9, by Board of Ventura County Supervisors, Ventura, Cal., for the construction of 11 concrete piers and nine 90-ft. combination truss spans to support intact fence and floor of present pile trestle approaches to the Montalvo bridge. J. B. McCloskey is county clerk.

Senator George C. Perkins has pledged his aid to the Chamber of Commerce, Oakland, Calif., in support of a project to build a bridge from Pittsburg to Chipps Island, connecting Oakland with the upper Sacramento River regions

Delaware.

The following bids were received by the Levy Court, Wilmington, Del., April 23, for the construction of the proposed roller lift bridge over the Christiana River to replace the present Third St. structure: Superstructure—The Oswego Bridge Co., Philadelphia, $133,000; Nellson Meredith Co., New York, $122,000; Penn Bridge Co., Beaver Falls, Pa., $126,980; Stroebel Steel Construction Co., Chicago, Ill., $114,600. Substructure, or Approaches—The Oswego Bridge Co., Philadelphia, from $41,900 to $50,900, according to plans; Nelson Meredith Co., New York, $43,800; Capt. J. J. Williams, Chester, Pa., $45,000 to $55,000.

It is reported that the Levy Court, Wilmington, Del., will not accept any of the bids received for the construction of a bridge over the Christiana River replacing the present Third St. structure. The work will probably be readvertised.

Florida.

✣Bids will be received until May 8, by Board of Putnam County Commissioners, Palatka, Fla., for the construction of three toll bridges, as follows: St. Johns River bridge; Dunn's Creek bridge; Rice Creek draw bridge. Henry Hutchison is Clerk.

Idaho.

Advices from Idaho Falls, Idaho, state that a new bridge is to be constructed in the west end of the city over Crow Creek. The struc-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Illinois.

✣[illegible] May 15, at Folke's Hotel, Frankfort, Ill., for the construction of two reinforced concrete bridges to be built in Green Garden Township, Will County. Ferdinand Haakel, Town Clerk, Frankfort, R. F. D., Ill. Henry Woeltje Bridge—Span, 32 ft.; roadway, 16 ft.; height, 10½ ft.; wings, 12 ft.; estimated amount of concrete, 73.1 cu. yds.; reinforcing steel, 10,064 lbs. Nearest railroad station, Monee, 5 miles. Present bridge, 34-ft. span, wood truss, on old stone abutments. Low water flow, dry; high water, 6 ft. deep. Excavation in black loam to 3 ft. below stream bed. New bridge same position as old. Peters Bridge—Span, 20 ft.; roadway 16 ft.; height, 9 ft.; wings, 10 ft.; estimated amount of concrete, 45.8 cu. yds.; reinforcing steel, 5,125 lbs. Nearest railroad station, Monee, 4 miles. Present bridge, King post truss on wood posts; span, 22 ft. Low water flow, dry; high water, 6 ft. Excavation, clay carried to 3 ft. below stream bed. New bridge, same location as old. No local concrete materials available. Work to be completed on or before September 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing from the Illinois Highway Commission, Springfield, Ill.

✣Bids will be received until noon, May 31, by I. J. Bryan, clerk, Sanitary District of Chicago, 1500, 76 West Monroe St., Chicago, Ill., for the construction of two bridges included in Contract Section 5 of the Calumet Sag Channel of the Sanitary District of Chicago in Palos township, Cook county. Official advertisement will be found elsewhere in this issue.

⦿The contract for the construction of two bridges in Otter Creek Township, LaSalle County, Ill., has been awarded to Ruprecht Voirol Construction Co., 8011 S. Broadway, St. Louis, Mo., at $2,530. A. E. Bach is County Clerk, Ottawa, Ill. Bids for the work were opened April 27.

⦿Burnham & Ives, Bloomington, Ill., have been awarded the contract for the construction of the Champion bridge over the Mackinaw River in Sand Prairie Township. The contract price was $3,394.

Indiana.

⦿The Board of County Commissioners, Marion, Ind., has let the contracts for the construction of two new bridges as follows: New bridge at Tilliston Ave., over White River, in Westside, to Moore & Cline, at $6,875; new bridge over Bell Creek, to W. A. Sunderland, at $2,475.

The Board of Park Commissioners, Board of County Commissioners, and County Council, recently held a joint conference at Indianapolis, Ind., for the purpose of discussing the erection of a bridge over Crooked Creek on the west side of Riverside Park.

Iowa.

⦿The contract for the construction of a steel bridge in Grundy county has been awarded by the Board of County Commissioners to the Clinton Bridge and Iron Works, Clinton, Ia., at $3,500. E. G. Ensminger, Grundy Center, Ia., is county auditor. Bids were opened May 1.

The City Council of Des Moines, Ia., has voted to have plans prepared by the Street Department for the construction of a $50,000 steel bridge over the Raccoon River at Seventh St.

Hardin County Board of Supervisors, Eldora, Ia., are offering $500 for plans and specifications which they will adopt for the construction of the proposed bridge over the Iowa River at Eldora. As proposed the structure will be from 600 to 1,000 ft. long with a 16-ft. roadway and concrete flooring. Plans will be received until June 3. S. B. Gardner, Eldora, Ia., is Engineer, and E. L. Marriage, County Auditor, Eldora, Ia., Official in Charge.

The Board of County Commissioners, Denison, Ia., are preparing to construct two new bridges in the vicinity of Kiron. One will be over Otto Creek and the other over a small creek south of the town.

Kansas.

✣Bids will be received until noon, May 31, by Board of Shawnee County Commissioners, Topeka, Kan., for raising, repairing and reconstructing bridge known as Brick Plant bridge, across Kansas River in Shawnee County; three spans (two 145 ft. and one 36 ft.) now in position, together with tubular piers, to be raised about eight feet and repaired; seven new spans to be erected (three 80 ft. steel riveted truss spans and four 175 ft. steel pin connected spans); also two concrete abutments, five concrete piers and two steel bents on concrete base to be built, all in accordance with plans and specifications now on file in the office of the County Clerk. Full set of plans and specifications can be obtained from Walter J. Arnold, County Engineer, Topeka, Kan., upon deposit of $20, of which $10 will be returned to unsuccessful bidders upon return of plans and specifications in good condition. F. B. Simms is Chairman of the Board and S. G. Zimmerman is Clerk.

Massachusetts.

⦿The Weymouth Back River Bridge Commission, J. F. Merrill, Chairman, Boston, Mass., has awarded the contract for the construction of the superstructure of the Weymouth Back River bridge to the Boston Bridge Works, Inc., 47 Winter St., Boston, Mass., at its bid of $27,103. The United Construction Co., Pittsburgh, Pa., bid $27,617 for the work. Bids were opened April 24.

The Board of Public Works, Holyoke, Mass., is awaiting the action of the Street Railway officials on the plans prepared by the City Engineer for the construction of the Cabot St. canal bridges. T. J. McCarthy is City Engineer.

Michigan.

The Detroit Bridge Co., Detroit, Mich., will probably be awarded the contract for the construction of a steel and concrete bridge over the River Rouge at Dix road in Wayne County, at its bid of $28,000. E. N. Hines is County Commissioner.

Minnesota.

✣Bids will be received until May 24, it is reported, by Board of Polk County Commissioners, Crookston, Minn., for the construction of the following bridges: One in section 16, in the town of Bygland; between sections 29 and 30 in Huntsville; between sections 13 and 14 in Huntsville; 4 and 5 in Euclid; 21 and 28 in Garfield; 14 and 23 in Andover; on sections 12, Euclid, and 7, Belgium; between sections 14 and 11, Tabor; 23 and 24, Fairfax; center of section 27 in Hammond; corner of sections 3, 4, 9, 10 and 11; 2, 11, Keystone; 13, Keystone, and 18, Euclid.

✣Bids will be received until 10 a. m., May 24, by Board of Polk County Commissioners, Crookston, Minn., for the construction of the bridge over the Red Lake River on Washington Ave., in the city of East Grand Forks, Minnesota. The length of this bridge is about 967 ft. Plans and specifications will be on file in the office of H. J. Welte, County Auditor of Polk County, and in the office of City Clerk of the city of East Grand Forks.

Missouri.

✣Contracts will be let from 1 until 3 p. m., May 9, at public outcry, by William M. Morris, County Highway Engineer, Oregon, Mo., for the construction of the following bridges and culverts: No. 1—60-ft. steel bridge at the Sambaugh farm, four miles northwest of Maitland. No. 2—28-ft. steel bridge, north of the Mose Kunkel farm, seven miles northwest of Mound City. No. 3—22-ft. steel bridge south of the Mose Kunkel farm, seven miles northwest of Mound City. No. 4—21-
ft. steel bridge at the Jonas W
eight miles northeast of Mound
22-ft. steel bridge at the Dick H
[illegible] miles northeast of Craig
steel bridge in Mill Hollow, east
Mill and three miles northeast of
7—18-ft. steel bridge, three-fourt
of Fairview School House and
northeast of Oregon. No. [illegible]-ft.
bridge, one-half miles west o
Cowan' farm and seven miles
Oregon. No. 9—22-ft. steel
Prussman Branch, one-half mi
Curzon switch. No. 10—40-ft. st
Henry Hood's place, four miles
Oregon. No. 11—24-ft. steel b
seph Garrett's place, four mi
Mound City. List of Concrete C
1—8-ft. culvert at Elmer Johnso
four miles southwest of Maitla
10-ft. culvert on county line b
and Atchison counties and five
east of Craig. No. 3—8-ft. cul
fried Sommer farm and five mi
of Oregon. No. 4—8-ft. culv
Kline's and five miles east of
No. 5—6-ft. culvert west of J
place and three miles southwest
No. 6—8-ft. culvert west of Ja
son's house and seven miles we
City. No. 7—12-ft. culvert at
cemetery and one mile east of
No. 8—8-ft. culvert at reside
Stout and seven miles southeast
No. 9—8-ft. culvert one-half m
Frank Stout's and seven miles
Oregon. No. 10—10-ft. culve
of Ben Praiswater and nine m
of Mound City.

✣Bids will be received until
by County Court, Andrew count
Mo., for the construction of t
bridges: Steel bridges—No. 3,
Peddler creek, near residence of
Dist. No. 16; No. 4, bridge near
of J. K. Palmer, Dist. No. 86;
near the residence of Ralph Stins
3; No. 6, bridge near the residenc
Hailey, Dist. No. 29. Steel and con
bridge west of the residence of N.
Dist. No. 3; No. 8, bridge near t
of Harvey Farley, Dist. No. 55;
south of the residence of A. L.
No. 58; No. 10, bridge north
of J. W. Bond, Dist. No. 76; N
near the residence of Henry The
50. Concrete culverts: No. 12,
the residence of John Wyatt, Dist.
13, culvert near the residence of H.
Dist. No. 4; No. 14, culvert n
house, Dist. No. 27; No. 15, cul
residence of Phillip Schneider,
No. 16, culvert north of
No. [illegible]; No. 17, culvert
dence of L. F. Krull, Dist.
18, culvert near the residence of
guson, Dist. No. 32. Bidders will
to deposit a certified check mad
Andrew county or the high
E. Schnitzius, or cash in the sum

✣Bids will be received until 11
14, by County Court, St. Joseph,
construction and repair of a
bridges. These bridges are at
farm, on the Jones road, at W
Hebron church, at R. E. Bretz'
Mt. Moriah church, W. S. Cham
ers Elders', at Ajax, and Ian Ke

✣Bids will be received until n
by Board of Public Improvement
Mo., for letting No. 10521, for f
materials, tools and labor neces
construction of the roadway fou
sidewalks for the viaduct on K
from Manchester Ave. to McK
preparing the earth fill, construct
walks complete with necessary
construction of the concrete
granite curbing for the roadway,
tion of drainage pipes and inlets,
tion of gas mains, wire con
manholes and all other work sho
on file in the offices of the Boar

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

and the Street [illegible] red, $1,025. W. T. Findly is the Board.

[illegible] Bridge Co., Kansas City, Mo., at

Nebraska.

[illegible] ismund, county clerk, Sheridan ville, Neb., for the construction to be built in the county during 12. The structures are to be of with concrete substructures. A for $500 must be filed with

be received until 1 p. m., June 4, clerk's office, Loup City, Sher- Neb., for the construction of one the Middle Loup River, located iles northwest of the town of approximately the site of the old will be received for the above lows: Loup City bridge—One [illegible] concrete abutments and tubular er plans and specifications. All sealed and accompanied by cash tified check for $1,000. All cer- be made payable to Mr. W. C. nty clerk of Sherman County. publicly opened at the county n Loup City at 2 o'clock p. m., Copy of plans and specifications pon application and payment of e of the state engineer, D. D. Neb.

act for the construction of a Elkhorn River in Washington en awarded to E. S. Bealy, Blair, 0. Bids were opened at Blair.

County Board of Commission- tte, Nebr., is planning the con- concrete bridge about 1,300 ft. to cost $30,000.

Committee of the Board of ty Supervisors, Central City, es that it will require an ex- pproximately $20,000 to repair dges damaged by the late flood.

New Jersey.

of Freeholders, Trenton, N. J., tract for the construction of a e water power at Riverdrive Concrete Co., Harrisburg, Pa.,

man, Woodstown, N. J., has the contract for the construc- rete bridge between Sharptown [illegible]

New York.

il received until noon, May 21, Peck, Supt. State Board of Albany, N. Y., for the con- Contract No. 89, Erie Canal, superstructures and one sub- ghway bridges over the canal and Palmyra. Detailed plans s may be obtained of State urveyor, Albany, N. Y.

ichmond, Louisa, Ky., have e contract for the construc- es over the Erie Canal under their bid of $258,710.

Genesee and York, N. Y., prepared for the reconstruc- f the Genesee River bridge by high water. The abut- partly rebuilt and strength- steel apronways are to be

Council of Rochester, N. Y., earing on the application of & Son for a license to con- in a bridge over the road- ll Bldg. and Edwards Bldg.

Ohio.

✣Bids will be received until 11 a. m., May 8, by Board of Mahoning County Commissioners, Youngstown, O., for the necessary labor and material for the construction of a steel bridge 136 ft. long over the Mahoning River on Bridge St. I. M. Hogg is County Auditor.

✣Bids will be received until May 21, by Board of Adams County Commissioners, West Union, O., for furnishing material and constructing a steel bridge 90 ft. in length with an 18-ft. roadway. E. C. Zimmerman, West Union, is County Engineer.

✣Bids will be received until 11 a. m., May 29, by Board of Cuyahoga County Commissioners, Cleveland, O., for the construction of a bridge over Nine Mile Creek on the Lake Shore Boulevard in Bratenahl Village and Township, Cuyahoga County, O. J. F. Goldenbogen is Clerk of the Board.

⦿The contract for the construction of a new steel superstructure on the old substructure of the Zoar Station bridge in Fairfield Township, Tuscarawas County, O., has been awarded by the County Commissioners, New Philadelphia, O., to George Lane, Newark, O., at $1,292. W. C. Shot is County Auditor.

⦿The contract for the construction of a concrete arch bridge at Lake Shore Boulevard, Cleveland, O., has been awarded by the Board of Cuyahoga County Commissioners, Cleveland, O., to Colbrum Bros., West Park, O., at $4,380. J. F. Goldenbogen is County Clerk.

⦿The Board of Park Commissioners, Youngstown, O., has awarded the contract for the construction of four concrete bridges in Lincoln Park to W. F. Merrian at $5,500. The contract for building a concrete dam was awarded the same contractor at $1,100.

⦿The Board of Cuyahoga County Commissioners, J. F. Goldenbogen, Clerk, Cleveland, O., has awarded the contract for furnishing necessary labor and material for the construction of the foundation of two river piers for the proposed Detroit-Superior bridge, to O'Rourke Construction Co., New York City, at $276,000. Bids were opened April 27.

⦿George K. Cetone, Dayton, O., has been awarded the contract for the repairing of the Herman Ave. bridge, at his bid of $2,300. The work will include replacing bottom cords of the structure and straightening railings and walks and additional concrete work.

Citizens of Dayton, O., recently held a mass meeting to discuss the proposed change of plans for the contemplated bridge over the Mad River at Keowee St. crossing from a steel girder to a concrete structure. G. C. Cummins is City Engineer.

Oklahoma.

✣Bids are being received, it is reported, by Atoka County, Atoka, Okla., for the construction of a number of bridges. R. W. Harrison is County Clerk.

A movement is on foot in Caddo County to construct a bridge over the South Canadian River near Bridgeport, Okla. The county has pledged $4,000, Bridgeport $1,000, and the Automobile Association $2,000 towards the necessary expense. It is expected that Blaine County Commissioners will take interest in the project.

Oregon.

⦿The Multnomah County Court, Portland, Ore., has awarded the contract for furnishing the steel for the proposed bridge over the Sandy River at Troutdale, to the Northwest Steel Co. The contract for erecting the structure was let to the Oregon Bridge & Construction Co.

Preliminary surveys are to be started at once by Ralph Modjeska, Consulting Engineer, of Chicago, Ill., for the construction of the proposed bridge over the Columbia River between Portland, Ore., and Vancouver, Wash. The cost of the structure is estimated at $2,000,000.

Pennsylvania.

✣Bids will be received until noon, May 17, by Samuel Rea, President of the New York Connecting Railroad, Pa. R. R. Station, New York City, for the construction of foundations and concrete masonry of the Eastern viaduct, about 3,500 ft. long, extending from Lawrence St. to Stemler St., Long Island City. Plans and specifications are on file with Gustav Lindenthal, Consulting Engineer, 45 Cedar St., New York City.

✣Bids will be received until noon, May 15, by J. H. Moffitt, county controller, Washington, Pa., for the construction of two concrete bridges.

Citizens of Hyde Park, Pa., are taking steps to secure the construction of a bridge over the Kiskiminetas River at that place. A company will probably be organized to take charge of the work. The cost of the improvement is estimated at about $25,000.

The County Commissioners and the Traction Co., Wilkesbarre, Pa., are considering the reconstruction of the Market St. bridge. The scheme contemplates a reinforced concrete arch bridge about 850 ft. long and 85 ft. wide crossing the river with seven spans of about 100 ft. clear width each and providing for a 65-ft. roadway and two 10-ft. sidewalks, the roadway being divided in a right and left driveway with the electric car tracks in the middle. Albert Lucius, New York City, is Consulting Engineer. B. H. Finch is City Engineer.

The Council of Ashley, Pa., at a recent meeting with representatives of the Traction Co. and the Jersey Central R. R., decided to accept the plans for the construction of a new bridge over the planes on the Main St. J. J. Yates, New York City, N. Y., is Bridge Engineer of the Central Railroad of New Jersey.

South Dakota.

A petition is being circulated in Meade County, of which Sturgis, S. Dak., is county seat, asking for the construction of a bridge over Elk Creek on the Wasta road south of White Owl.

Texas.

✣Bids will be received until 11 a. m., May 9, by George L. Fearn, County Auditor, Dallas, Texas, for furnishing Dallas County with 12 steel bridges, two 30-ft., six 40-ft., two 50-ft. and two 60-ft. spans, each 16-ft. roadway and 10-ton capacity; one 40-ft. span for immediate delivery, others in from three to four months. Plans and specifications on file in office of County Engineer.

⦿The contract for the construction of eight small bridges in McLennan County were let April 30, at Waco, Texas, to Austin Bros., Dallas, at $5,740. The same firm was also awarded the contract for the repair of a bridge over the Bosque River on the Waco, Bosqueville & China Springs road at $8,896.

Virginia.

✣Bids will be received until noon, May 11, by Circuit Court, Grayson County, Independence, Va., for the construction of a 160-ft. steel bridge over Elk Creek 15 miles from Fries on N. & W. Ry. The structure will have a wooden floor and concrete substructure. Proximity of stone, gravel and sand at site. Plans and specifications may be seen at the office of the Clerk of Court, or may be obtained of Childrey, Sunday Co., Richmond, Va. P. St. J. Wilson, Richmond, Va., is State Highway Commissioner.

The Council Committee on Streets, Richmond, Va., has taken up for consideration the construction of a new steel and concrete bridge over the James River to replace the old Free bridge. It is estimated that the new structure will necessitate an expenditure of approximately $350,000.

Washington.

⦿The Washington Engineering Co., Tacoma, Wash., has been awarded the contract for the construction of the superstructure and approach to the Lewis River bridge near

Woodland, Wash., at $37,500. W. J. Roberts, Olympia, Wash., is State Highway Commissioner.

⊙The contract for the construction of the superstructure of the Skagit River bridge near Mt. Vernon, Wash., has been awarded to Gerrick & Gerrick Co., Seattle, Wash., at $34,673. W. J. Roberts, Olympia, Wash., is State Highway Commissioner.

It is believed that the Northern Pacific Ry. Co. will ask bids shortly for the construction of a bascule type of bridge over the government canal at 12th St., N. W. Seattle, Wash., and also for reconstructing the existing tracks between Ballard and Fremont. A. R. Cook, Tacoma, Wash., is Assistant Engineer.

West Virginia.

⊙The contract for the construction of the new reinforced concrete arch bridge over Berkley Creek at Grafton, W. Va., has been awarded to Boyer, Patterson & Morris, Philadelphia, Pa., at $3,000. The structure will have a 30-ft. span, 22-ft. roadway, 22-ft. clearance, 28-ft. wing walls. Other bids received were as follows: Nelson-Merydeth Co., Chambersburg, Pa., $3,977; Hall & Sugar, Grafton, W. Va., $3,500; W. C. Gates, Flemington, W. Va., $2,990; Farris Bridge Co., Pittsburgh, Pa., $5,295. Findlay Barber is City Engineer.

Wisconsin.

✤Bids will be received until noon, May 9, by C. J. Morisset, Commissioner of Highways, Superior, Wis., for the construction of a wooden bridge on Blue road between Sections 13 and 14, 48-10; also for putting a 42-in. culvert on same road between
and 2, 48-10.

It is reported that engineers of
go, Milwaukee & St. Paul R. R
mitted plans to the City Engin
Crosse. George Bradish, for the
of the proposed viaduct over th
Rose St.

The town of Flambeau, Rusk C
recently voted in favor of issuin
the construction of a steel brid
river about three-quarters of a m
of the city limits of Ladysmith.
the structure is estimated at $20

It is said that Oneida County
ers, Rhinelander, Wis., plan to bu
over the lake on the Hazelhu
Minocqua. The cost of the stru
mated at $4,000.

IRRIGATION, DRAINAGE, LEVEES AND CANA

Arizona.

The Water Users' Association, Phœnix, Ariz., will soon ask for bids on the reinforced concrete work for the Arizona cross cut irrigation canal. This will consist of gates, bridges, intakes, etc., and will aggregate about 8,000 cu. yds.

Colorado.

Engineers are now in the field and it is believed that contracts will be let this month for the completion of the Nile irrigation project near Fort Morgan. This project proposes the irrigation of 27,000 acres of land in the vicinity of Wiggins, and the work will call for an expenditure of $650,000. Frank W. Frueauff, 405 17th St., Denver, Colo., is interested.

Illinois.

✤Bids will be received until noon, May 31, by I. J. Ryan, clerk, of the Sanitary District of Chicago, 1500, 76 West Monroe St., Chicago, Ill., for the excavation and collateral work on Contract Section 5 of the Calumet Sag Channel of the Sanitary District of Chicago in the township of Palos, Cook county, Ill. Among the approximate quantities included in the work are 1,070,000 cu. yds. of excavation of glacial drift, 141,000 cu. yds. of solid rock excavation; also the erection of two bridges. Official advertisement will be found elsewhere in this issue.

✤Bids will be received until 10 a. m., May 18, by Commissioners of Shabbona Special Drainage District of Henry County, for the construction of a main ditch and main ditch outlet, and the laying of two lateral tile drains in said drainage district, the construction of the main ditch and outlet requiring the removal of approximately 60,000 cu. yds. of material. And the construction of the lateral tile drains requiring the laying of approximately 4,700 ft. of 10-in. drain tile; 10,967 ft. of 12-in. drain tile; 4,863 ft. of 15-in. drain tile and 1,000 ft. of 20-in. drain tile. Plans and specifications for the work may be seen at the residence of either of the Commissioners, or at the office of the engineer or attorney. The Village of Atkinson, on the Rock Island R. R., is the nearest railroad point for the inspection of the work. The place of letting is but a short distance from said village. Joseph Gilbraith, R. F. D., Annawan, Ill.; John Doubler, R. F. D. No. 2, Atkinson, Ill., and Cornelius Dwyer, R. F. D., Annawan, Ill., are Commissioners of the Shabbona Special Drainage District in Henry County and State of Illinois. C. C. Martin is Engineer, Geneseo, Ill.; Harry E. Brown is Attorney, Geneseo, Ill.

Bids will probably be asked about May 15 for the construction of a drainage system for drainage district No. 2 of Ross township, Vermillion county. The system will include a 6 ft. open floating dredge ditch, containing 30,000 cu. yds. and 13,000 ft. of 18 in. to 27 in. tile. John F. Fisher, Danville, Ill., is the engineer.

Indiana.

✤Bids will be received, it is said, until 10 a. m., May 16, by Ira Newlin, Trustee of Penn township, Bloomingdale, Ind., for repairing Big Pond Ditch in Penn and Reserve townships.

✤Bids will be received, it is said, until May 11, by R. W. Guenther, County Surveyor, Ft. Wayne, Ind., for the construction of the Stolte ditch in Washington township.

⊙Bids were opened April 27 by Thomas J. Wilson, construction commissioner, Valparaiso, Ind., for the construction of the Kellar ditch in Porter and La Porte counties, contracts being let as follows: William Brown, Hebron, Ind., 119,958 cu. yds. floating dredge work at 9¾ cts.; Wm. J. Cole, Argyle, Mich., 29,936 cu. yds. drag line work at 14 cts. per cu. yd.

Iowa.

✤Bids will be received until 1:30 p. m., May 10, by J. L. Hanrahan, County Auditor, Fort Dodge, Ia., for the construction of Drain 151. The work will be all tile and is estimated to cost $41,000. C. A. Snook, Fort Dodge, Ia., is Constructing Engineer.

Matter of constructing a drainage system in the Wilson district in Harrison county will come before the joint boards of supervisors of Harrison and Pottawattamie counties on May 15, when an order will probably be made to advertise for bids. This work is near Missouri Valley and consists of five miles of open ditch with 10 ft. bottom width, average cut 7 ft. This can be cut with a small dipper dredge. In connection with the main ditch there are three miles of tile lateral drains ranging in size from 10 to 30 inches. Seth Dean, Glenwood, Ia., is engineer.

Bids will probably be asked about July 15 for drainage work in Nishnabotna drainage district No. 2 of Mills county, Ia., for which Seth Dean, Glenwood, Ia., is engineer. This work is near the town of Henderson and consists of six miles of river work, bottom width 24 ft. and average cut 12 ft.; this will be floating dredge work. The plans also call for 2¼ miles of lateral ditch for Farm Creek. This ditch will be 10 ft. bottom width and 12 ft. average cut, and is suitable for a small floating dredge. There are also two miles of open prairie ditch, 6 ft. bottom width and 4 ft. cut, suitable for a small drag line.

Owing to legal troubles bids on the proposed drainage work in Plum Creek district of Fremont county will not be ready for bids before July 1. This work is near the town of Thurman and consists of eight miles of prairie ditch work with 30 ft. bottom width and about 5 ft. average cut. Levees are required on both sides of the channel for about two miles. This ditch can be cut with a drag line. Owing to delays and legal troubles work on the East Nishnabotna River district will not be ready for bids before Aug. 1. This ditch extends from the east line of Fremont county to Riverton, a distance of about twelve
ditch will be 20 ft. bottom width
ft. average cut. This will be su
for a floating dredge. Seth Dean
Ia., is engineer.

Michigan.

✤Bids will be received until
County Drain Commissioners of
Lenawee Counties at the Co
Adrian, Mich., for the constructi
Branch of the Macon Drain. T
cludes 9.4 miles of drain, remov
placing 9 highway bridges and
of abutments and construction
bridge complete.

✤The Drain Commissioners
Midland and Gratiot counties on
sell at public auction the work of
the Weeks drain, 18¾ miles in
lower 1.2 miles will have bottom
ft., 3.57 miles will have bottom
ft., 2.12 miles 18 ft., 3.45 miles 16
ft., 2.1 miles 10 ft., 1.8 miles 6 ft.
mainder will have bottom width
lower 12.15 miles will be dredge
50 per cent of this drain follows
nel. The cuts from hubs placed
vary from 3 ft. to 7 ft. Profile
be seen at Ithaca, Saginaw
prospective contractors will be
showing cuts. E. W. Redman, Ith
is drain commissioner of Gratiot

⊙E. W. Redman, drain comm
Gratiot county, Ithaca, Mich., l
contracts for work on drain No.
lows: Sec. 1, cleaning out 404.4
Tryon, at $1.22 per rod. Sec. 2,
rods, let to Jos. Ray for 75 cts.
includes building one head wall
tile and two catch basins, besides
tion, laying and filling in. The
the tile was let to the American
Co. branch at Jackson, Mich., fo
sewer pipe, exclusive of specials.
tile was let as a separate contract.

Minnesota.

✤Bids will be received until 2
11 by A. G. Lundgren, Cou
Warren, Minn., for the construct
cial ditch No. 27, including
155,000 cu. yds. of material and
cost about $15,600.

Nebraska.

⊙Kilpatrick Bros. & Collins, B
have been awarded the contract
the construction of dam No. 1 fo
Platte irrigation project of the
mation Service. The work calls f
yds. of excavation and 92,000 cu
bankment. The itemized bids re
10 were given in our April 17 issu

North Carolina.

⊙Bids were opened April 30 by
commissioners of Muddy Creek D

✤ indicates work now open for bids. ⊙ indicates a contract let recently.

struction of a drainage [illegible]
ng awarded to the Eastern
[illegible] N. C., at [illegible]
The work includes 240,200 cu.
[illegible] with floating [illegible]
bridges. J. L. Becton, Wil-
s the engineer.

Tenn., and Vicinity.

R CORRESPONDENT

received by Major Clarke S.
30 for closing 21 breaks in
rd's Point, Mo., was made by
& Brother, of Memphis, and
per cu. yd., with the provision
vould be completed within a
[illegible] of June 1, as was
advertisement. Considerable
ressed at only one bid being
contractors stated as their
bidding that they could not
on account of the flood stage
ers said the yardage was not
nd it was too great an uncer-
such a proposition, while still
l that the time limit of June
In the meantime, Major
in a peculiar predicament by
ved. It was specified that the
to be done by June 1; Mar-
s that he will finish the work
ble time. Major Smith real-
s an exceptionally cheap price
f the contract and would no
to the advantage of the Gov-
the time limit of June 1 was
he accept the only bid re-
provision modified? And
reasonable time? However,
river itself is going to decide
at this writing, water is rush-
breaks to be closed and the
the contract is 2 or 3 feet
work can possibly be started
ne latter part of May. And
oes recede sufficiently to per-
. Martin Jennings is wonder-
e a contract or not.

was in Memphis last week.
the letting of Major Smith.
dn't want any of the work
anted to know who the suc-
He seemed to think that
work would be offered later
sk tying one's outfit up on
ich was not very desirable.
he boys, Harry kept hands
finished a piece of railroad
ppi and will be ready for
at comes along within the

mpanies were trying to lo-
llinery last week, said to be
ailroad camp at Democrat,
e illness of his relatives in
was the message to be de-
ne who knows the where-
llinery will confer a favor
e by advising Charlie Mil-
n Wheeled Scraper Co., at

Clavey were about the city
hands with the boys who
the letting held by Major
McClavey brothers are idle
separate outfits being laid
h flood waters, but the boys
complaint is heard from
edict a big amount of new
nd are happy in the pros-
come at a later date.

ghting senator from Mis-
succeeded in getting an
n from Congress of $6,-
y levee work. With the
ney available at once, and
amounts to about $5,000,-
row up the levee embank-
and all in town last week
oad smile which has not
years past. Leroy Percy
ances that his bill will go
itch, but in the meantime
he is leaving nothing undone which might tend to forward the best interests of his new measure.

Jack Rison, the popular young Illinois Central roadmaster lately stationed at Tutwilder, [illegible] his road and is now in charge of the big New Orleans division. This makes Jack one of the youngest officials on the system and at the same time he comes into one of the most important divisions. Jack is well liked by all the contractors in this section, who remember him as the clean-cut young man who was the chief clerk to the late master railroad superintendent, old Bill King of the Y. & M. V. Under Bill King's astute training, Jack developed into a prodigy and the result of his training is seen in his rapid success.

Major Clarke S. Smith is a busy man these days. The Major is in charge of the rescue work in the flood districts and directs the fleet of government boats where needed. In addition, he is keeping a close watch on the high water and reporting to President Taft the situation each day. He must not only look after his own district, but being the senior United States officer on the river, he has a supervision over all the districts and as a result has his hands full of many details which ordinarily are looked after by others. In his private steamer, the Tital, the Major goes up and down the river on inspection tours and reports conditions as found, suggesting to Col. Bixby, Chief of Engineers, such remedies as he may deem necessary for the immediate protection of property and lands and live stock.

It is proposed by some of the leading construction firms in this section to call a meeting of levee contractors at an early date and take action on the eight-hour law which the Government engineers have been enforcing so strictly of late. It is pointed out by those who build many million yards of levee each year that, with the present need for immediate repairs to breaks which have occurred during the flood, it would be a good time to get Congress to repeal a law which at best can do no good, and which in the present instance could only work a hardship on the best interests of all in the Mississippi Valley. It will be remembered that Contractor Garbish of Louisiana, when indicted under the eight-hour law some years ago, won his case in the lower courts, it being held that levee building was at all times emergency work. On an appeal to the Supreme Court of the United States, it was held that levee work was not truly emergency work and that the eight-hour law should hold. Under this ruling, many think that the present breaks cannot be considered as emergency contracts and only the actual struggle to keep the embankments from breaking could be so construed. If the levees are to be repaired in time for the 1913 flood, a hurculean effort will be necessary; in fact, many think that conditions will be far from satisfactory this time next year, on account of the number of breaks and the damaged condition of the dikes. All hope seems to be abandoned for closing breaks in time to withstand the June rise. It is pointed out that the June rise is now upon us. Therefore, these being the facts, the contractors want their representatives in Congress to work for a repeal of the eight-hour law as being applicable to levee work, and they all think that the time is now ripe for action. It is believed that the members of the Mississippi River Commission are not in sympathy with the law as it stands, and it is thought that the members of this body can be persuaded to recommend a repeal. Some of the contractors have already written certain members of Congress in regard to the subject and the answers in all cases have been most encouraging. It is therefore the intention of the levee boys to get together a strong committee and urge the abolishment of the law which has worked such a hardship on them for so many years past. In speaking on the subject, one levee builder said that this law has caused the contractors on the river to maintain an outfit of 25 per cent larger size than was necessary before the law was passed and that the Government has had to pay accordingly for the extra force.

T. C. Owen, Supervisor of Bridges, Shelby County, has requested bids on repairing the damage caused the county bridges during the recent flood waters. He will recommend new steel bridges where the old ones have given way and are not worthy of repair; in other cases the old structures will be fixed up to withstand the traffic which will pass over them.

J. A. Cordeal, chief Southern representative of the Western Wheeled Scraper Co., was in Memphis last week in the interest of his firm. Joe realizes the fact that the boys in the Southern territory will have a world of work this season and wants to be the first to sell them the extra equipment which they will to a certainty require. Joe is well liked and is there with the goods at all times. He sells the goods whenever goods can be sold.

L. W. Johnston, the Chicago street builder who has secured several nice jobs in Memphis, states that he is now making some good progress on Iowa Ave. which is to be paved with brick. Mr. Johnston has, like all the other street pavers, been up against an extremely hard winter and, coupled with that fact, he had a nasty proposition in Iowa Ave, but with that grit which has characterized all his work, he has gone ahead and conquered; as a result he has gained the good will of the City Commissioners.

From present indications, Major Clarke Smith will have a new problem on his hands—that of directing the dredging of the Memphis harbor. On account of the breaks in the St. Francis levee at St. Clair and Wilson, over 2,000 square miles have been flooded and the water thus taken from the main river has not passed Memphis, and as a result the current has not been sufficient in front of the city to take away the silt which would naturally accumulate in time of extreme high water, the width of the flooded district being responsible for the diminution of current. If, when the vast stream, which is now about 40 miles wide in some places, does not scour out sufficiently on coming into its banks again, dredging will have to be resotred to, and Major Smith will have to make a survey and take soundings of the bed. The work will be carried on under his personal supervision.

Tom Garvin states that he will begin work at once on his Helena, Ark., sewer contract, which was secured recently—and at a good price, too. Tom says Memphis contractors are always in demand, and that he expects to secure many more similar contracts while working in Helena.

President Killough, of the Interstate Levee Association, announces that this association will immediately open up offices here in the Business Men's Club. This new levee organization is the outcome of a trip to Washington by several prominent men connected with drainage and levee boards, and will do much to help the country which is now inundated owing to the numerous breaks in the chain of levees. Officers of this organization are as follows: President, O. H. Killough; Secretary, H. A. Morrison; Treasurer, James F. Hunter; State Vice-Presidents, D. H. White, Tennessee; Hugh Tomlinson, Arkansas; William Wilms, Illinois; H. C. Shults, Missouri; Lee Richardson, Mississippi; H. Godschaux, Louisiana, and Frank Anderson, connected with the Frisco Railroad. A branch of the Interstate Levee Association will also be maintained in Washington, to arrange for levee appropriations, etc.

Madison County, Tennessee, is preparing for an extensive campaign in the improvement of roads. The County Court on May 1 passed a tax bill providing for a tax of 15 cts. per hundred during 1912 and 1913, to be used in the construction and maintenance of oil and gravel roads. This follows an inspection of a committee from Jackson, Tenn., which visited several cities in the interest of good roads. This committee said that the gravel-and-oil roads of Fulton County, Georgia, were the finest ever seen. This tax, which will provide something over $30,000 to be used,

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] ested in making Madison County roads the finest in existence. Work will start at once.

Mayor Crump of Memphis and W. A. Percy left recently for St. Louis, where they will meet members of the Mississippi River Commission for a conference. Mayor Crump says that though a hard fight will be necessary, he is confident that they will win their point, which is the appropriation by the Government of sufficient funds to enable Memphis to prevent any further floods through the backing up of high water through Bayou Gayosa. Mayor Crump says that as the raising of levees in Arkansas throw the water onto Memphis, it is only fair that the Government should help Memphis out. Senator Percy of Mississippi and Senator Lea of Tennessee will go before the House of Representatives and speak in favor of the appropriation.

Texas.

The La Pryor Irrigation Co., the chartering of which was mentioned in our March 27 issue, is reported to be completing preliminary details preparatory to beginning work on its proposed irrigation project at La Pryor. This company proposes to construct a dam across the Nueces River at a point near La Pryor which will develop a storage basin of sufficient capacity to thoroughly irrigate at least 10,000 acres. F. R. Young and A. R. Helzschuker, San Antonio, and James W. Grant, La Pryor, are interested.

The Artesian Gardens Water Co. of San Antonio, Tex., has been chartered with a capital stock of $1,450 and proposes to supply water for irrigation purposes and build canals. The incorporators are H. D. Manton, C. H. Jackson and E. F. Walker of San Antonio.

Utah.

The Ogden River Reservoir Co. has been incorporated with a capital stock of $100,000 and proposes to build dams and reservoirs for irrigation purposes in the South Fork district. William Glasmann, Ogden, Utah, is interested.

Washington.

The recently formed Brew
district, according to advices
Wash., has authorized an issue
bonds for supplying water to
flat.

Wisconsin.

The joint finance committ
Legislature has drafted two b
provement of the levee system
vicinity. One of these bills w
propriation of $20,000 for imm
the levees, which is to be don
rection of the levee commissi
bill will authorize Gov. McGo
a committee of three person
the situation in and near Port
mend a permanent levee syste
perpetually maintained by
levees are located along the
Fox rivers.

WATER-WORKS

California.

✣Bids will be received until 11 a. m., May 17, by Quartermaster, Fort Rosecrans, Calif., for the construction of a 6-in. water main across naval reservation at Fort Rosecrans, Calif.

Colorado.

⊙The Peter O'Brian Construction Co., 403 Nassau Block, Denver, Colo., has been awarded the contract by the Town Council of Westminister, Colo., for the installation of a waterworks system at $23,496. The work includes well, engine, reservoir, ditching and piping. Bids were opened April 25 by S. R. Rigg, Town Clerk.

The City Council of Johnstown, Colo., plans to spend $20,000 for the purchase of a reservoir in the mountains three miles away, which will be the basis of a gravity water system.

The town officials of Kersey, Colo., has under consideration the installation of a $15,000 waterworks system. A deep well will furnish the supply.

Connecticut.

✣Bids will be received until 1:30 p. m., May 11, by Board of Water Commissioners, Southington, Conn., for laying approximately 21,000 ft. of 12-in., 8-in. and 6-in. cast iron water pipe and appurtenances. Samuel H. McKenzie is Engineer.

Illinois.

✣Bids will be received until 7 p. m., May 15, by Board of Local Improvements, St. Charles, Ill., for the extensions of water mains, including the laying of about 1,344 ft. of 4-in., 8,841 ft. of 6-in. pipe. G. N. Lamb, St. Charles, Ill., is Engineer. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 1 p. m., May 23 (readvertisement) by the Village of Ashton, Ill., for the construction of approximately 6 miles of 4-in., 6-in., and 8-in. mains, an elevated tank, deep well and pumping machinery. Plans and specifications are on file at the office of the Village Clerk or at the office of the Engineers, Aetna Engineering Bureau, 17 North La Salle St., Chicago, Ill. S. T. Zeller, Jr., is President of the Village. Official advertisement will be found elsewhere in this issue.

The City Council of Moline, Ill., on April 29 passed an ordinance providing for the 27th St. sewer and water main district. The work includes 2,940 ft. of 12-in. sewer pipe, 2,100 ft. of 10-in. sewer pipe, 12,000 ft. of 8-in sewer pipe, and 19 manholes; 1,040 ft. of 4-in. cast iron water pipe, 11,800 ft. of 6-in. pipe, 4,560 ft. of 8-in. pipe, 25 valves and 37 hydrants. Bids for this work will be opened in about 60 days. Lyle Payton is City Engineer.

The City Council of Mendota, Ill., has secured the services of Ewing, Stone & Co., 53 W. Jackson Blvd., Chicago, for a thorough investigation of conditions in the waterworks system.

The State Board of Administration, Springfield, Ill., has decided upon plans for a water system for the State Hospital for the Insane at Anna, Ill. Water will be impounded from a spring five miles east of Anna and will be stored in a reservoir of 30,000,000 gals. capacity, and from there piped to the hospital. The system will be installed at an estimated cost of $104,305. The State Legislature appropriated $137,000 for this improvement.

The city officials of Warsaw, Ill., have decided to put in a gravity filtering system with a capacity of 45,000 gals., and to cost about $4,[illegible]

Indiana.

The Town Board of Plainfield, Ind., is considering estimates for the installation of a waterworks plant.

Iowa.

⊙The Blackhawk Construction Co., Waterloo, Ia., has been awarded the contract for the making of extensions to the water mains of Cherokee, Ia., at $3,402. The work includes 1,600 ft. of 4-in. cast iron water pipe laid, 2,825 ft. of 6-in. cast iron pipe laid, 5 hydrants, and 6 valves and fittings. Bids were opened April 30.

⊙The City Council of Jefferson, Ia., has let a contract for the laying of the new water mains to the Des Moines Bridge & Iron Works of Des Moines, Ia., at $4,122. The work will include 3,000 ft. of mains.

The City Council of Indianola, Ia., has approved the plans and specifications for the building of a 750,000-gal. reservoir and the digging of another well near those of the city system. The reservoir will be constructed of concrete and covered. Bids will be received at once.

It is reported that H. M. Crawford of Centerville, Ia., has purchased the Centerville waterworks and plans improvements, to include a new reservoir.

Kansas.

✣Bids will be received until May 14 by Water and Light Department, Coffeyville, Kan., for improvements to the water works system, plans for which were prepared by Worley & Black, Reliance Bldg., Kansas City, Mo., and for which $130,000 of bonds have been voted. The work will consist of the following: One 300 K.V.A. turbo-alternator with condenser and auxiliaries; two 3000 g.p.m. low service centrifugal pumps direct connected to 75 h.p. slip ring induction motors; one 3000 g.p.m. high pre
pump direct connected to a
chronous motor; two 25 k.v.a
and two 175 k.v.a. 11,000
poles, wire, and line material;
filtration plant with mechanica
four million gallons installed;
lons settling basin; one-fourth
clear water basin, dam and
proximately 8 miles cast iron
sizes from 4 to 16 ins., a
gate valves and 10 fire hyd
Stromquist is Supt. of the W
Department.

✣Bids will be received until
by J. W. Green, City Clerk,
for furnishing material and
constructing a water works
place. Official advertisement
elsewhere in this issue.

Kentucky.

The citizens of Covington,
the regular election Nov. 5, 19
sition to issue bonds in the sum
the purpose of extending an
waterworks system. An emer
be built and extensions
made in former Latonia.

Maryland.

On account of a failure t
tise it the election at Gree
April 20, to determine a
works bond issue, had to be a

The Consolidated Gas
Power Co. and the Baltimore
Co. has filed petitions with th
lic Service Commission for i
plans for the Consolidated
the electric properties of the
ty Water and Electric Co. T
by the Baltimore County Wa
000, will be applied to extend
the water plant of the comp

Massachusett

⊙The Board of Water C
Holyoke, Mass., is reported t
the contract for the completio
the White reservoir in Southa
O'Connell's Sons.

Michigan.

✣Bids will be received
21, by City of Grand Haven,
ing, delivering, trenching, layin
about 3,200 ft. of 16-in. cast ir
from a well on the shore of
to the pumping station; also
30-ft. diameter well on the sl
Gardner S. Williams, Ann
Engineer. Official advertiseme
elsewhere in this issue.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

received until noon, May 17,
of Manchester, Mich., W. J.
r the construction of a water-
Plans and specifications are
village clerk and at the office
npe, Civil Engineer, 610 Nasby
O. The improvement will in-
[illegible] approximate quantities and
extension, 50 h.p. gasoline en-
125 lb. pressure, force pump;
ir, 345 tons cast iron pipe,
ron specials, 1 10-in. valve and
[illegible]
oxes, 5 4-in. valves and
ants. laying, 100 lin. ft. 10-
7,180 lin. ft. 8-in. pipe, laying
n. pipe, laying 5,810 lin. ft. 4-

ouncil of Flint, Mich., has
ntract for furnishing the fire
[illegible] motor-driven [illegible]
n-La France Fire Engine Co.,

Council of Saline, Mich., has
it a proposition to the voters
[illegible] new waterworks and

Minnesota.

received until 8 p. m., May
ncil, Shakopee, Minn., at the
Weiland, City Recorder, for
r works improvement. The
s the following water works
installation complete of exten-
stem, consisting of the follow-
quantities. About 400 ft. of
ater main to be laid on con-
d in the same trench with
of 8-in. cast iron pipe, 1,520
iron pipe, together with five
d two 4-in. hydrants, with all
ctions, specials, valves, etc.,
ith 7-ft. cover. Oscar Claus-
Engineer

ion will be held in Red Lake
May 14 to vote on the propo-
g the city in the amount of
[illegible] of a system of

Mississippi.

held a special election
o City, Miss., to determine
proposed bond issue of $30,-
ade for the purpose of in-
ters and for the installation
boiler and dynamo for the
nd light plant.

Missouri.

received until noon, May 15,
. Commissioner of Supplies,
r furnishing the water com-
[illegible] according to
ile at the office of the Com-

eceived until 6 p. m., May 18,
bster Groves, Mo., for mak-
and extensions necessary to
s system. The work to be
ately as follows: Taking up
iron pipe; taking up 11,330
d iron pipe; laying 23,500
pipe; laying 60,500 ft. 4-in.
ng 47,500 ft. 2-in. galvanized
102 fire hydrants; setting
nd boxes; setting 93 4-in.
setting 117 2-in. valves and
specifications are on file in
ity Clerk, Webster Groves,
the office of the Engineers,
Chemical Building, St.
City Hall, Webster Groves,

eceived until 6 p. m., May
Webster Groves, Mo., for
and extensions necessary
system. The material to
approximately as follows:
ss B cast iron pipe; 60,500
st iron pipe; 36,000 ft. 2-in.
e; 49,000 lbs. special cast-
rants; 26 6-in. stop valves
stop valves with boxes; 117 2-in. stop valves with boxes. Specifications are on file in the office of the City Clerk, Webster Groves, and can be seen at the office of the Engineers, Fuller Coult Co., Chemical Building, St. Louis, Mo., and City Hall, Webster Groves, Mo.

The Board of Public Works of Maryville, Mo., has recommended that the City Council go ahead and issue the $100,000 bond issue for the purchase of the present waterworks plant or for constructing a new plant.

Montana.

✣Bids [illegible] 10, by Shelby, Mont., for the construction of a waterworks system. The date for receiving bids was previously given as May 29. J. E. Nolan is City Engineer.

Nevada.

⊙Stephens-Adamson Co., Aurora, Ill., has been awarded the contract by the U. S. Reclamation Service, Fallon, Nev., for furnishing f. o. b. cars shipping point, the following, at $1,238: One bucket elevator, 66 ft. center to center, capacity 300 cu. ft. of fine, dry sand per hour; 1 bucket elevator for Portland cement, 44 ft. center to center, capacity 200 cu. ft. per hour; 1 12-in. belt conveyor, 95 ft. center to center, with 25-ft. vertical rise, capacity 200 cu. ft. per hour; 1 conical or cylindrical revolving gravel screen, 36 by 60 ins.; 1 pair right and left cast iron quadrant gate reciprocating fenders; 1 8-in. spiral conveyor, complete, and portion of handling equipment for sand-cement plant for Lahontan dam. Bids were opened April 25.

New Hampshire.

At a recent town meeting in Amherst, N. H., to reconsider the vote passed at the annual March meeting, whereby the town voted to establish a system of waterworks at an expense of $20,000 the former vote was rescinded.

New Jersey.

⊙R. D. Wood & Co., Philadelphia, Pa., have been awarded the contract by the Union Township Committee, Lyndhurst, N. J., for the distribution of approximately 35,000 ft. of pipe, special hydrants, valves, etc, at $15,125. The contract for laying the same has been awarded to Partridge & Burke of Lodi, N. J., at $9,054. John F. Woods is Township Clerk. Bids were opened April 29.

The State Water Supply Commission, Trenton, N. J., approved the application of the borough of Stanhope for permission to establish a municipal water supply to be obtained from driven wells.

New York.

The Village Trustees of Lyons, N. Y., have engaged Sanitary Engineers Witmer & Brown of Buffalo, N. Y., to investigate water conditions and locate, if possible, a pure and adequate supply of water. If the supply is found the firm will furnish maps and plans for a new system and an estimate on the value of the old plant of the Lyons Water Works Co.

North Carolina.

✣Bids will be received until 8 p. m., May 21, by Mayor and Board of Commissioners, Reidsville, N. C., for laying about 5½ miles of wood pipe, and for the construction and equipment, complete, of a pumping station containing two turbine pumps, capacity 400 gals. per minute against 212 ft. head, direct connected to 3-phase 60-cycle 2,200-volt motors; and for the construction and equipment of a mechanical filter plant, capacity 500,000 gals. per 24 hours. Plans and specifications will be on file at the Town Hall, Reidsville, N. C., and copies may be obtained at the office of E. W. Myers, Engineer, Greensboro, N. C., by depositing $3 to cover cost of prints. L. H. Hardy, Jr., is Clerk.

Ohio.

✣Bids will be received until noon, May 14, by Director of Public Service J. McCarthy, Newark, O., for furnishing one direct connected steam engine driven pump, capacity 5,000,000 gals. per 24 hours.

Plans are being prepared for the laying of 600 ft. of 4-in. cast iron water pipe, sinking of a new intake well, building of a pump station, new boilers and pumping machinery for the city of Ravenna, O. It is planned to secure a daily capacity of 3,000,000 gals.

Oklahoma.

The Mountain Springs Water Co., Muskogee, Okla., has been incorporated with a capital stock of $10,000. The directors are: C. M. Risig, J. C. Shaffer and H. H. McFann, all of Muskogee.

Pennsylvania.

✣Bids will be received until noon, May 28, by Lower Merion Township Commissioners, Ardmore, Pa., for the construction of the necessary additional pumping machinery required to lift 1,500,000 gals. of sewage per day 175 ft. through a distance of 6,700 ft. Plans and specifications may be seen at the office of the Commissioners, Robley A. Warner, C. E., Engineer in Charge, Box 708, Ardmore, Penn.

⊙Booth & Flinn of Pittsburgh, Pa., have been awarded the contract by Director of Public Works Joseph G. Armstrong of that city, for the laying, relaying and lowering of the cast iron water pipes in the hump district at $30,744.

⊙The Kensington Water Co., which supplies the towns of New Kensington, Parnassus and Arnold, Pa., has awarded the contract for a 3,000,000-gal. mechanical filter plant, designed by Chester & Fleming, Hydraulic Engineers, Pittsburgh, to H. S. White of New Kensington. Work will be done this season.

The Borough of Homestead, Pa., plans the extension of the intake pipe into the Monongahela River. The work will include flexible joint pipe and possibly timber submerged crib. A. H. Trautman is Borough Engineer.

Engineer J. W. Ledoux of Philadelphia, Pa., has been employed by the city of Youngstown, O., to advise the engineering department in the construction of the Milton reservoir dam. The dam will be 2,100 ft. long and about 40 ft. high. It is said that bids will be asked immediately on the work. F. M. Lillie is City Engineer.

Tennessee.

⊙The Board of Public Works of Nashville, Tenn., has awarded the contract for the construction of almost six miles of water mains, to be laid under the supervision of the waterworks department this summer to W. M. Leftwich & Co., at approximately $9,000.

The Artesian Water Department of Memphis, Tenn., has engaged Consulting Engineer George W. Fuller of New York City to investigate conditions of the water supply of the city.

Texas.

The city of Palacios, Tex., has taken over the waterworks plant in that city and plans to reconstruct it so as to furnish the citizens with fire protection. Bonds in the sum of $25,000 will be voted upon for that purpose on May 13.

It is reported that Hydraulic Engineer James H. Fuertes of New York City has completed plans for the water filtration plant for the city of Dallas, Tex. It is planned to commence work July 1.

A temporary organization has been formed at Waco, Tex., to bring about a stock company for the purpose of sinking a test well for hot water at Waco. It is proposed to secure $25,000 for the venture. The officers are: Sam Sanger, President; W. S. Duke, Jr., Vice-President; Peyton Randle, Secretary.

Virginia.

Contracts will be let after July 1 by the city of Dublin, Va., for the construction of new sewers and improvements to the waterworks system. J. R. Bently is Clerk.

Washington.

✣Bids will be received until 11 a. m., May 31, by Capt. J. R. Pourie, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the construction of an electric lighting

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

system and pump house with motor driven pump, installing fixtures in buildings and for delivery of certain electrical apparatus, all at Fort Casey, Wash.

✣Bids will be received until 11 a. m., May 31, by Capt. J. R. Pourie, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the construction of an electric lighting system furnishing and installing fixtures and wire for buildings; also a pump direct-connected motor complete at Fort Ward, Wash.

⊙The Jahn Contracting Co. of Seattle, Wash., has awarded the contract for the construction of a reservoir and distributing system at Gladstone, Ore., at $15,500. Bids were opened April 9 by J. N. Sievers, City Recorder. The contract for the construction of the pumping station was awarded May 4.

According to Superintendent Young of the Water Department of Seattle, Wash., steps will immediately be taken for the purchase of a site in West Seattle on which the department will erect a standpipe having a capacity of 1,000,000 gals. The structure will be of steel construction costing about $30,000. Plans will be prepared by City Enginee A. R. Dimock.

West Virginia.

✣Bids will be received until 4 p. m., June 15, it is reported, by George Henry, City Clerk, Elkins, W. Va., for repairing the city raeservoir. Plans and specifications are on file at the office of the Mayor

Wisconsin.

✣Bids will be received until 7:30 p. m., May 10, by G. D. Richards, Village Clerk, Owen, Wis., for the laying of 1,230 ft. 8-in. and 6,668 ft. of 6-in. cast iron pipe, setting 14 hydrants; 6,200 special castings, 10 valves and 7 valve boxes; laying 1,950 ft. of 24-in. vitrified pipe sewer, 6 manholes, one catch basin and the construction of 4 concrete tower foundations all for a lump sum. A certified check for $300 must be filed with each bid. W. G. Kirchoffer, Madison, Wis., is Engineer.

⊙The contract for the installation of a waterworks system in Belleville, Wis., was awarded on April 25 to J. N. Roherty of Janesville, Wis., at $11,819. Cast iron pipe, valves and hydrants will be furnished by J. B. Clow & Sons of Chicago.

⊙The Allis Chalmers Co., Milwaukee, Wis., on April 29 was awarded the contract by the city of St. Paul, Minn., for furnishing and erecting complete a 1,500,000-gal. pump, except foundations, at $7,870. Bids were opened March 8.

The City Commission of Kenosha, Wis., has approved the plans for the new receiving well, and work will be started at once. The new well will have a capacity of 1,600,000 gals. and will cost $6,500.

Canada.

✣Bids will be received until on, Ma by J. E. Durnin, Secretary-Treasler Sask., for furnishing waterwork for laying same The work i noted completely in the Sewers and arbage posal Columns of this issue.

⊙Following contracts have en awar by the city of High River, Alt for tl stallation of a waterworks an a sew system, for which Chipman & owers, ronto. Ont., are Engineers; bids pened 30: Contract "A," J. A. Broley Co B. C., $27,855, including Contra tract "C," John Inglis Co., T Contract "D," Canada Foundry $20,000; Contract "E," T. McA Johns, N. B., $3,470; Contract Sewer Pipe Co., General Supp gary, Alta., $6,985; Contract Coast Pipe Co., Vancouver, B. C work includes the following: labor laying water mains and tract "C," furnishing materials ing water tower. Contract "D cast iron water pipes and spa Contract "E," furnishing fire valves, etc. Contract "O," labor fall sewer. Contract "S," furni pipes and junctions. Contract ing 4,500 feet of 12-inch wooden

SEWERAGE AND GARBAGE DISPOS

California.

The City Council and Mayor of Verona, Cal., held a special meeting recently for the purpose of discussing plans for installing a sewerage system.

Engineers Olmstead & Gilellen, Wright & Callender Bldg., Los Angeles, Cal., are preparing plans for a sewer system to be installed in Crescent City, Cal., at an estimated cost of $30,000.

District of Columbia.

✣Bids will be receivd until 10:30 a. m., May 9, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for galvanized iron or steel, valves, hose nozzles, vitrified sewer pipe, wrench parts, lanterns, paint brushes, oars, coal baskets, window glass, packing, coke, chrome yellow and black jacket enamel.

Georgia.

Surveys are being made at Vidalia, Ga., for the installation of a sewerage system. Bonds will probably be issued for the improvement. J. B. McCrary Co., Atlanta, Ga., Engineers.

Illinois.

✣Bids will be received by the Board of Local Improvements, Rochelle, Ill., until 7 p. m., May 20, for furnishing the labor and materials necessary to construct approximately 2 miles of sewers, varying in size from 6 ins. to 18 ins. in diameter, in the streets of the city. Plans and specifications on file at office of the board or the office of the Aetna Engineering Bureau, 117 N. La Salle St., Chicago.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., until 11 a. m., May 13, for furnishing materials, labor, etc., necessary to construct sewers in the following streets: Byron St., 300 lin. ft. 12-in., av. depth 7 ft.; Darwin Terrace, 930 lin. ft. 12-in., av. cut 8.0 ft.; N. 48th Ct., 270 lin. ft. 12 in., av. cut 8.5 ft.; N. 57th Av., 610 lin. ft. 15-in., av. cut 10.5 ft.; S. Green St., 700 lin. ft. 12-in., av. cut 90 ft.; wing sewers 70 lin. ft., 12-in., av. cut 8.0 ft.; Wrightwood Av., 300 lin. ft. 12-in., av. cut 9.0 ft.; N. 41st St., 530 lin. ft. 15-in., av. cut 10.5 ft.; S. Oakley Ave., 640 lin. ft. 12-in., av. cut 7.5 ft.; alley e. of Western Ave., 890 lin. ft. 12-in., av. cut 8.0 ft.; Green St., 78th St., 370 lin. ft. 12-in., av. cut 8.5 ft.; N. Kedzie Ave., 630 lin. ft. 15-in., av. cut. 10.0 ft.; N. Kedzie Ave., 680 lin. ft. 12-in., av. cut 9.0 ft.; N. 36th Ct, 510 lin. ft. 12-in., av. cut 9.5 ft.; Avondale Ave., 710 lin. ft. 20-in., av. cut 11.0 ft.; N. Central Park Ave., 620 lin. ft. 15-in., av. cut 9.0 ft.; Constance Ave., 610 lin. ft. 15-in., av. cut 10 ft.; wing sewers, 140 lin. ft. 12-in., av. cut 8.0 ft.; Ridgeland Ave., 640 lin. ft. 15-in., av. cut 10 ft., 670 lin. ft., 12-in., av. cut 8.5 ft.; wing sewers, 140 lin. ft. 12-in., av. cut 7.0 ft.; Saginaw Ave., 670 lin. ft. 20-in. double strength, av. cut 11.0 ft., 670 lin. ft. 18-in. double strength, av. cut 10.0 ft., 670 lin. ft. 15-in., av. cut 9.5 ft., 630 lin. ft. 12-in., av. cut 7.0 ft.; Yates Ave., 670 lin. ft. 18-in. double strength, av. cut 11.0 ft., 670 lin. ft. 15-in., av-cut 9½ ft., 510 lin. ft. 12-in., av. cut 7.5 ft.; Greenwood Terrace, 160 lin. ft. 15-in., av. cut 11.0 ft; Montclare Ave., 670 lin. ft. 15-in., av. cut 9.0 ft., 670 lin. ft. 12-in., av. cut 9.0 ft.; E. 70th St., 180 lin. ft. 3.0 ft. double ring brick, av. cut 11.0 ft.; Yates Ave., 670 lin. ft. 18-in. double strength, av. cut 9.0 ft., 670 lin. ft. 15-in., av. cut 8.0 ft., 565 lin. ft. 12-in., av. cut 8.0 ft., 640 lin. ft. 18-in. double strength, av. cut 9.5 ft.; E. 71st St., 510 lin. ft. 15-in., av. cut 9.5 ft., 510 lin. ft. 12-in., av. cut 8.0 ft.; Houston Ave., 500 lin. ft. 15-in., av. cut 8.0 ft.; Illinois Ave., 1220 lin. ft. 12-in., av. cut. 6½ ft.; Bond Ave., 1020 lin. ft. 15-in., av. cut 7.5 ft, 700 cu. yds. rock excavation at $3 per cu. yd. Total amount of contracts, $47,300.

The City Council of Elgin, Ill., has passed an ordinance providing for the construction of the West Chicago St. sewer between South and Highland Ave., and west of Jackson St. The estimated cost of the work will be $78,500. Carl E. Plum is City Engineer.

Plans are being prepared by City Engineer Elmer Folsom of Bloomington, Ill., for the construction of a sewer to drain the East Lawn district and all other property annexed to the city in that section with the coming year.

Indiana.

✣Bids will be received until 10 a. m., May 10, by Board of Public Works, Indianapolis, Ind., for the construction of main sewers and appurtenances in and along Brightwood Ave. from 25th St. to 26th St.

✣Bids will be received until 10 a. m., May 10, by Board of Public Works, Indianapolis, Ind., for the construction of local sewers with appurtenances in and along the alley east of Barth Ave. from Beecher St. to Iowa St.

✣Bids will be received until 10 a. m., May 10, by Board of Public Works Ind., for the construction of loc appurtenances in and along the 30th St. from Dye St. to the Northwestern Ave.

✣Bids will be received until 10, by Board of Public Works Ind., for the construction of loc appurtenances in and along Bri from 25th St. to Roosevelt Ave

The Board of Public Works o Ind., has adopted a resolution the construction of a sewer whi the following described territo Kentncky Ave., north of Tennes of St. Joseph River and south of ary line of the city limits. Tl have five branches and the pipe the specifications which have b will be at various places, 42, 2 ins. in diameter.

The City Council of Connersv decided to construct the follo Eastern north from present sew D.; 11 from Central to Easte Eastern to C., H. & D., and nor to 18th; 12th, from Eastern to diana, from 19th to 21st; Grand, 22d.

Iowa.

✣Bids will be received until 5 by F. A. Lee, City Clerk, Waverl construction of storm sewers as ft. of 24-in. No. 1 sewer pipe an 18-in.

✣Bids will be received until 7: 13, by Sam Middleton, Clerk, K is reported, for the construction tile sanitary sewer with cement cluding catch basins in Broadway

⊙The City Council of Mason let the following contracts for tion of sewers: East State St., Bowen, earth excavation, $0.62; $1.85; hard rock, $4.38; 8-in. pip $0.90; manhole, $48. East 12th S. R. Bowen, earth excavation, rock, $1.96; hard rock, $4.25; $0.22½; Y's, $0.90; manhole, $4 Oak St., running east 1,270 ft— Co., earth excavation, $0.60; loos hard rock, $6; 8-in. pipe, $0.20; hole, $40.

⊙The J. W. Turner Improve

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Ia., has been awarded the con-
city for the building of the
ark sewer system at $1.58 per
ewer will be 15,000 ft. in length
erated with a pumping station.
will be $23,700. T. J. Cassel-
he contract for the construction
nd Center Sts. sewer system at
t. The system will be 1,300 ft.
will cost $1,118.

⊙Following are five itemized low bids received by the City Council of Boise, Ida., E. G. Eagleson, City Engineer, on April 18, for the construction of main sewer district No. 2, and lateral sewer district No. 111: (1) standing for bid of Reliance Construction Co., Portland, Ore.; (2) Idaho Hardware & Plumbing Co., Boise (awarded contract); (3) K. Sauset, Corvallis, Ore.; (4) M. Jennings, Pasco, Wash., and (5) Jas. Kennedy, Salt Lake City, Utah.

MAIN DISTRICT.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
in place	90	lin ft.	7.50	15.00	7.50	8.50	11.50
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ipe in place	974	lin. ft.	1.00	1.15	1.25	1.10	.96
pipe in place	3,337	lin. ft.	1.55	1.75	1.70	1.70	1.75
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ipe in place	1,476	lin. ft.	2.45	2.50	2.50	2.55	2.40
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LATERAL DISTRICT.

e in place	36,177	lin. ft.	$0.695	$0.75	$1.00	$0.90	$0.85
[illegible]	[illegible]	lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
les, complete	124		45.00	40.00	40.00	50.00	40.00
op manholes and flush tanks,	12		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
p manholes and flush tanks.	9		115.00	110.00	135.00	110.00	115.00
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ay pipe in place	36,177	lin. ft.	$0.65	$0.74	$1.00	$0.85	$0.75
[illegible]	[illegible]	lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	124		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
manholes and flush tanks,	12		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
manholes and flush tanks,	9		115.00	130.00	135.00	110.00	125.00
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

d call for bids the City Coun-
, Ia., has let the contract for
of over two miles of sanitary
& Burras of Kansas City.
Other bidders were A. Kor-
Ia., $14,119; J. W. Turner
., Des Moines, Ia., $14,090;
on, Iowa City, Ia., $13,827;
truction Co., Waterloo, Ia.,
E. Rosecrans, Ames, Ia.,

Construction Co. of Water-
mitted the lowest bid to the
Sioux City, Ia., for the con-
storm sewer to be laid in
orning Side before that thor-
ing Side is paved. The item-
ollows: 720 ft. 15-in. pipe,
in. pipe, $0.83; 530 ft. 20-in.
ft. 24-in. pipe, $1.93; 400 ft
800 ft. 30-in. pipe, $2.37; 8
$30 each; concrete manholes,
chbasins, brick, $22.60 each;
ns, $27.60 each.

cil of Burlington, Ia., has
ion providing for the com-
0 ft. gap of Hawkeye sewer
St. and Mt. Pleasant St.

arlson of Ida County, Ida-
ing surveys for the installa-
e system in Holstein, Ia.

Idaho.

Construction Co., 407 Roch-
nd, Ore., has been awarded
he Board of Public Works,
e construction of sewers in
istrict No. 111 at $35,349.
es 36,177 lin. ft. of 8-in.
78 lin. ft. of 10-in. sewer at
concrete Y's at $9.50; 12
lush tanks at $116; 9 flat top
s at $115, and 124 concrete
Vitrified clay pipe will be
pened April 18.

Kansas.

✣Bids will be received until 11 a. m. (central time), May 27, by Maj. G. G. Bailey, Constructing Quartermaster, Fort Leavenworth, Kan., for the construction of a garbage crematory at Fort Leavenworth, Kan.

Kentucky.

⊙The city of Henderson, Ky., has let a contract to Ed. Manion for the construction of 9,000 ft. of sewer, to cost more than $3,000. This sewer is to divert the flow from Canoe Creek into the Ohio River.

The Chesapeake & Ohio R. R., F. I. Cabell, Richmond, Va., Chief Engineer, has notified the Kentucky State Board of Health that it will construct a sewage disposal plant at the outlet of the sewer system now being constructed at Melbourne, Ky. E. B. Mark is Engineer of the State Board of Health.

Maryland.

The citizens of Chestertown, Md., at a recent election voted against an appropriation for the installation of sewers. W. T. Dwyer is Town Commissioner.

Following bids were received by the Board of Awards of Baltimore, Md., on Sanitary Contracts Nos. 87 and 88, Calvin W. Hendricks, Chief Engineer of the Sewerage Commission: Contract No. 87, District 18—B. F. Sweeten & Son, Baltimore, $163,976, 125 days at $30 per day; Whiting-Turner Construction Co., Baltimore, $176,810, 250 days at $30 per day; Jas. Ferry & Sons, Pittsburgh, Pa., Crafton Station, $194,132, 200 days at $30 per day; Ryan & Reilly, Baltimore, $207,861, 150 days at $30 per day. Sanitary Contract No. 88 District No. 40 B—Jas Ferry & Sons, Inc., Crafton Station, Pittsburgh, Pa., $84,905; B. F. Sweeten & Son, Baltimore, $85,803; Ryan & Reilly, Baltimore, $102,701.

Massachusetts.

⊙The Sewage Commissioners of Fitchburg, Mass., has awarded the contract for furnishing all castings for Section 1 of the main trunk sewer and for new sewers to the Union Foundry Co. of Fitchburg.

⊙Little & Seretto of Leominster, Mass., have been awarded the contract by the Board of Sewage Disposal Commissioners, 352 Main St., Fitchburg, Mass., for constructing Section 1 of the main intercepting sewer, covering the following work: 903 lin. ft. of earth excavation and building 48-in. sewer; 180 lin. ft. of 2-in. tile and reinforced concrete sewer; 5,081 lin. ft. of trench and laying 30-in. cast iron pipe; 1 siphon chamber at junction of 48-in. sewer and 30-in. cast iron pipe; also necessary manholes and incidental work. The contract price is $24,270. Bids were opened April 18; contract awarded April 29.

The city of Andover, Mass., plans extensions to its sewer system, to cost approximately $70,000. An election will be held in March, 1913, to vote on the proposition. The work will include main sewer, house connections and pump house; also pump and power for same, and filter beds. Plans have already been prepared.

Plans have been prepared by Engineer E. A. W. Hammatt of Hyde Park, Mass., for the construction of an outlet sewer of concrete into the river for the city of Bellows Falls, at an estimated cost of $2,500. J. H. Lawrence of Bellows Falls, Vt., is official in charge.

Michigan.

✣Bids will be received until noon, May 20, by W. G. Conlan, Village Clerk, Otsego, Mich., for the construction of sewers in the following streets: North St., running south from the center line of Orleans St. to the center line of Hammond St.; on Hammond St., from the center line of North St. to the center line of Fair St.; in Orleans St., from the center line of North St. to the East line of Special Assessment District No. 1.

✣Bids will be received until 2 p. m., May 8, by F. P. George, City Clerk, Hudson, Mich., for the construction of sewers and necessary appurtenances on Maple Grove Ave.

Miner C. Taft of Kalamazoo, Mich., is making preliminary surveys, plans, etc., for the installation of a sewerage system in Charlevoix, Mich.

The City Council of Saline, Mich., has decided to submit a proposition to the voters of the village of a new sewer system and waterworks system.

Minnesota.

✣Bids will be received until 2 p. m., May 10, by G. H. Hayes, Comptroller, University of Minnesota, Minn., for the construction of a sewer from a point near the Agricultural school, St. Anthony Park, to connect with the city sewer, corner Cleveland and Scudder Ave. Plans and specifications are on file with Prof. J. T. Stewart, Agricultural School, St. Anthony Park.

✣Bids will be received until 8 p. m., May 28, by City Council, Shakopee, Minn., for the construction of sanitary sewer extension and for the construction of water main. The contract will include the following sewer work, as shown on plans and in the specifications and embracing the construction of sewers in sewer district No. 2, 3, 4 and 6, and consisting of the following approximate quantities: 1,505 ft. of 12-in. sewer pipe, 365 ft. of 10-in., 1,900 ft. of 8-in., at depth from 8 to 12 ft. There will be 8 manholes and 1 lamp hole, about 400 ft. of this work will be in solid rock. All the above to be installed complete and connections to be made to the present sewer system. Oscar Claussen, St. Paul, Minn., is Engineer.

⊙L. S. Redman of Pipestone, Minn., has been awarded the contract by the city of Tracy, Minn., Lester J. Fitch, City Recorder, for the construction of a septic tank and sludge bed. The contract price is $2,016. Bids were opened May 2.

⊙The City Council of Crookston, Minn., has awarded the contract for the installation of a sewer in South Crookston to P. McDonnell of Duluth, Minn.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Missouri.

✣[illegible] of [illegible] about 10 miles of sewers ranging in size from 12-in. to 14-ft. with necessary manholes, inlets, catchbasins and septic tanks. R. E. McMath Surveying Co., 226-227 Title Guaranty Bldg., St. Louis, Mo., are Engineers. F. E. Buibor is Mayor and M. F. O'Brien, Maplewood, is City Clerk.

✣Bids will be received until noon, May 14, by Board of Public Improvements, St. Louis, Mo., for the construction, under Letting No. 10,538, sewers in Rock Creek Sewer District No. 1, embracing sewers of the materials, lengths and sizes as follows: Brick and Portland cement mortar sewers: 627 ft. of 34x51-in. inside dimensions, 874 ft. of 32x48-in. inside dimensions, 298 ft. of 30x45-in. inside dimensions, 317 ft. of 26x39-in. inside dimensions, 265 ft. of 24x36-in. inside dimensions, 919 ft. of 22x33-in. inside dimensions. Vitrified clay pipe sewers: 1,265 ft. of 24-in. inside diameter, 306 ft. of 21-in. inside diameter, 937 ft. of 18-in. inside diameter, 446 ft. of 15-in. inside diameter, 9,890 ft. of 12-in. inside diameter, with sewer inlets, manholes, and all other appurtenances. Deposit required, $1,125.00. W. T. Findly is Secretary of the Board.

⦿Patrick McIntyre, 1383 Union Blvd., St. Louis, Mo., has been awarded the contract by the Board of Public Improvements of that city for the construction of the Gratiot Joint District sewer and branches at $68,484. The work includes the following: Brick and Portland cement mortar sewers: 1,325 ft. of 7-ft. inside diameter, 1.85 ft. of 5-ft. inside diameter, 766 ft. of 36-in.x54-in. inside diameter, 980 ft. of 34-in.x51-in. inside dimensions, 216 ft. of 32-in.x48-in. inside dimensions, 912 ft. of 30-in.x45-in. inside dimensions, 374 ft. of 28-in.x42-in. inside dimensions, 67 ft. of 26-in. x39-in. inside dimensions. Pipe sewer: 520 ft. of 12-in. inside diameter. With manholes, junction chambers and all other appurtenances. Bids were opened April 19.

⦿Wm. F. Riley Construction Co., Victoria Bldg., St. Louis, Mo., has been awarded the contract by the Board of Public Improvements of that city, W. T. Findly, Secretary, for the construction of sewers in Glaise Creek Sewer District No. 5, at $29,743, as follows: Brick and Portland cement mortar sewers: 126 ft. of 40-in.x60-in. inside dimensions; 475 ft. of 34-in.x51-in. inside dimensions; 188 ft. of 32-in.x48-in. inside dimensions; 330 ft. of 30-in.x45 in. inside dimensions; 604 ft. of 24-in.x36-in. inside dimensions. Vitrified clay pipe sewers: 1,760 ft. of 24-in. inside diameter, 415 ft. of 21-in inside diameter, 2,220 ft. of 18-in. inside diameter, 1,420 ft. of 15-in. inside diameter, 7,440 ft. of 12-in. inside diameter. With sewer nets, manholes, and all other appurtenances. Bids were opened April 26.

The citizens of Warrensburg, Mo., at a recent election voted the issuance of bonds in the sum of $40,000 for permanent street improvement and sewer extension.

New Hampshire.

✣Bids will be received until noon, May 11, by town of Newmarket, N. H., for the construction of approximately 4 miles of sewers. A. H. Place is Secretary of the Sewer Committee and W. M. Ames, Berwick, Me., is Consulting Engineer.

New Jersey.

✣Bids will be received until May 28, it is reported, by Passaic Valley Sewerage Commission, J. S. Gibson, Clerk, Passaic, N. J., for the construction of Section 9 of the main intercepting sewer.

Plans prepared by Engineer Frank Campbell for the new sewerage system of Hackensack, N. J., have been submitted to the State Board of Health. The estimated cost of the system is $353,000. C. W. Bell is Mayor.

New York.

✣Bids will be received until 11 a. m., May 15, by Alfred E. Steers, President of the Borough of Brooklyn, New York City, for 16 sewer construction contracts, the largest being No. 1, for furnishing all the labor and materials required for constructing a sewer in W. 17th St., from Surf Ave. to Mermaid Ave., and outlet sewers in Mermaid Ave., and from W. 17th St. to W. 19th St., and in W. 19th St., from Mermaid Ave. to Neptune Ave.

⦿The Town Board of Springville, N. Y., has let the contract for putting in a two-pipe system of sewers from Buffalo to Pearl Sts., to Fitzgerald & Co.

⦿W. C. Cullison has been awarded the contract at Buffalo, N. Y., for the sewer in Rounds and Adoptus Aves., at $8,288.

The Village Board of Lyons, N. Y., has engaged Sanitary Engineers Witmer & Brown of Buffalo, N. Y., to estimate the cost of installing a sewerage system.

City Engineer Charles H. Snyder has completed plans and specifications for the proposed new sewerage systems on the east and west sides of the river for the city of Oswego, N. Y. The plans have been submitted to the State Board of Health. Prof. Olin H. Landreth, Union College, Schenectady, N. Y., is Consulting Engineer. H. S. Rauch is City Clerk.

City Engineer P. J. Lamb of Watervliet, N. Y., has been instructed to prepare maps and estimates for the construction of a storm sewer up Fourth St., and down Third and Sixth Aves., to points near the city line.

Consulting Engineer C. C. Vermeule, 203 Broadway, New York City, has been engaged by the Board of Public Works of Corning, N. Y., to prepare the plans for the sewage disposal plant, which has been ordered constructed by the State Board of Health.

North Dakota.

City Engineer H. R. Evans of Williston, N. Dak., is drawing up plans and specifications preparatory to advertising for bids on work that will approximate $40,000. The improvements will include parking, grading, water and sewer extensions and sidewalks.

Ohio.

The city of Barberton, O., is considering the installation of a garbage disposal plant, and is desirous of getting in communication with manufacturers in this line. Frank M. Adamson is City Clerk.

The Akron Sewage & Garbage Power Co., Akron, O., has been incorporated with a capital stock of $25,000 to dispose of sewage and garbage. The incorporators are Charles D. Crouch, Francis Selberling, Francis M. Cooke, J. B. Huber and S. Allen.

Oklahoma.

W. C. Burke of Oklahoma City, Okla., has made a proposition to the City Commission of Dallas, Tex., calling for the construction of an electrical sewage disposal plant at an estimated cost of $81,000.

The city of Pond Creek, Okla., has employed the Benham Engineering Co., 812-14 American Nat. Bank Bldg., Oklahoma City, Okla., to make surveys, draw plans and specifications and supervise the construction of a system of sanitary sewers for the city. Bonds will be voted in approximately the amount of $20,000.

Oregon.

⦿The Reliance Construction Co. of Portland, Ore., has been awarded the contract by the Board of Public Works of Boise, Ida., for the construction of lateral sewers in District No. 111, covering the territory recently annexed by the city. The contract price is $37,233.

Following bids were received April 16 by the City Council of Portland, Ore., for the construction of sewers, as follows: Sullivan's Gulch No. 1, from the river to East 15th St.—Consolidated Contract Co., $71,869 for brick invert and $73,447 for stone block invert; Jeffrey & Bufton, $72,646; Pacific Bridge Co., $69,874; K. G. Lundstrum, $81,202; Giebisch & Joplin, $70,906. Sullivan's Gulch No. 2, from East 15th to East 33d St.—Consolidated Contract Co., $84,832 for brick invert and $86,586 for stone block invert; James Kennedy
Construction Co., $78,389; Jeff
$77,198; Pacific Bridge Co.,
bisch & Joplin, $75,232. East
Long to Holgate—Bechill Bros
Keating, $261; E. W. Riner, $293
$200; Giebisch & Joplin, $252.
Cherry St. district—John Keat
wood Wiles, $676; E. W. Rine
Lundstrum, $646; Hilliard & M
Bechill Bros., $622. East Sta
East 38th to East 41st—John K
E. W. Riner, $1,229; Elwood
K. Y. Ozar, $1,392; Bechill
Giebisch & Joplin, $1,274; Hillia
$1,096; J. Desko, $1,100; Edw
$1,276; K. G. Lundstrum, $1,284
Gay St. district—E. W. Riner,
Bros., $337; Hilliard & Maginn
Keating, $401. East Yamhill S
Water—E. W. Riner, $498; Bech
East 29th and East Irving Sts.
$278; K. G. Lundstrum, $249.
East Irving St. district—James
struction Co., $8,799; Pacific
$8,725; Jahn Contracting Co., $8
& Joplin, $8,936; Jeffrey & Buft
W. Riner, $7,777; Hilliard & Ma
John Keating, $8,512; K. G.
$8,490; Kibbe-Welton Co., $8,944

Pennsylvania.

The Department of Health, H
has approved the plans of City
Youngman of Hazleton, Pa., for
of the sewer system of Hazleto
Mayor Stabler of Williams
signed an ordinance appropriat
the construction of the Park A
is probable that bids will be as
short time for the construction
State Health Commissioner
Dixon, Harrisburg, Pa., has gr
sion to the borough of Donora
County, to proceed with the con
sewer system. Provision is mad
ing the system beyond the borou
for the construction of a sew
plant at the proper time.
State Health Commissioner
Dixon, Harrisburg, Pa., has not
site of the proposed sewage disp
the Cobb's Creek region
Township, Delaware County, P
plans and specifications were pre
gineer Albert F. Damon of Da
the present permission has bee
drain the sewage into the creek
ship must construct a trunk sew
pared to go ahead with the wo
months.
The Councils of Wilkes-Barre,
granted permission by the State
partment to construct a concrete
omon's Creek on certain condit
which is that the sewage from
carried through a channel separ
storm channel.
Plans have been prepared by
H. Trautman of Homestead, Pa.,
struction of 850 ft. of 12-in. sew
6 manholes, and estimated to cost

South Dakota.

✣Bids will be received until
H. Drew, County Auditor Highm
for the construction of sewer
mated to require an expenditure
mately $12,000.

Texas.

The City Council of Calvert
dered an election for May 28, to
issuance of $25,000 of bonds for
of constructing a sewer system
of Calvert.
The citizens of Cuero, Tex.,
election voted the issuance of b
sum of $25,000 for the installatio
The citizens of Austin, Tex.,
voted bonds in the sum of $750
following improvements: Perm
improvements, $250,000; moder
system, $250,000; school buildin
additional cemetery grounds, $50,0

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

structi[illegible] of a new building al.

Virginia.

received until 12:30 p. m., -d of Control, Norfolk, Va., on of sewers and accessories nth and Tenth Wards of the A certified check for $2,500 [illegible] W. T. Br[illegible]

Normayle of Roanoke, Va., ed the contract by that city, rk, for the construction of a odate property on the north s. e., between 13th and 15th h side of Campbell Ave., be-15th Sts. Also for the con-rm drain through Highland at Park St. and 11th Ave., ugh the park. The contract Bids were opened April 30.

Vashington.

ntracting Co., 114 R. R. Ave., is been awarded the contract Cashmere, Wash., S. H. An-erk, for the construction of Bids were opened April 22. [illegible] the Board of Seattle, Wash., on April ruction of sewers in Tenth [illegible] & Jesser, $22,-ffery, $23,772; Dahlstrom & International Dredging Co., [illegible] & Joseph Co., $20,844. $21,458; Clark & Colosurdo, Const. Co., $21,712; J. N. $20,276; F. I. Peterson, $20,-Sons, $22,213; C. Cristofan, [illegible] Becker & Walker, [illegible] $20,628; Young & S. Lamping Co., $22,085. Public Works of Everett. [illegible] sewer project [illegible] system would embrace the territory bounded by Rainier Ave. and Snohomish River, Everett Ave. to 18th St. Preliminary plans have been prepared by City Engineer W. D. Barkhuff.

West Virginia.

The Town Council of Warwood, W. Va., has approved the plans prepared by Civil Engineer H. J. Watson for the establishment of a complete sewerage system for North Warwood. The citizens will be asked to vote on the proposition. John S. Ritz is City Solicitor.

Wisconsin.

✣Bids will be received until 1 p. m., May 16, by Board of Public Works, Superior, Wis., for the construction of a main sewer in the alley south of Pelknap St. from the alley between Susquehanna and Lackawanna Aves. to Elmira Ave. D. J. Arris is a member of the Board. E. B. Banks is City Engineer.

✣Bids will be received until May 16, by Village Board, Johnson Creek, Wis., for the construction of a sanitary sewerage system including an Imhoff septic tank and laying approximately 4,500 ft. of sewer pipe. Plans and specifications are on file with E. Deibel, Village Clerk.

⦿N. F. Reichert of Racine, Wis., has been awarded the contract by the Board of Public Works of that city for the construction of the Milwaukee Ave. sewer at the following bid: 18-in. pipe, $2; 12-in. pipe, $1.35; 10-in., $1; manholes, $35; syphon, $35. Mr. Reichert secured the contract for the sewer in Davis Place as follows: 15-in. pipe, $1.90; 12-in., $1.35; 10-in., $1.25; manholes, $35; catch-basins, $35.

Canada.

✣Bids will be received until noon, May 29, by J. E. Durnin, Secy.-Treas., Melfort, Sask., for the supply and delivery of the following machines and materials and for the performance of certain works: Tender "A"—For the supply and delivery of generator, exciter and switchboard, transformers and meters, series Tungsten street lighting apparatus. Tender [illegible] B. H. F. internal combustion engine. Tender "C"—Supply, delivery and erection of pumps and motors. Tender "D"—Supply and delivery of poles, wires, line material, etc. Tender "E"—Erection of pole line. Tender "F"—Erection of power house and construction of reservoir. Tender "G"—Erection of sewerage disposal works. Tender "H"—Supply and delivery of approximately 29,000 ft. of steel water pipe and specials; approximately 30 hydrants and 30 valves. Tender "I"—Trenching and laying steel water pipe, setting hydrants, valves, etc., and back filling. Tender "J"—Supply and delivery of approximately 13,500 ft. of vitrified sewer pipe, excavating and laying and construction of manholes, etc. Tender "K"—Supply and delivery of two pneumatic storage tanks. Plans and specifications may be seen at the office of McArthur, Murphy & Underwood, Consulting Engineers, Bottomley Block, Saskatoon, Saskatchewan.

✣Bids will be received until May 14 by Neil F. Macnachtan, County Clerk, Cobourg, Ont., for the construction of a sewage disposal works for the House of Refuge, Cobourg. Specifications may be obtained of T. Aird Murray, Engineer, 303 Lumsden Bldg., Toronto, Ont.

✣Bids will be received until noon, June 25, by City Commissioners, Saskatoon, Sask., for the complete installation, including all buildings, of a 70-ton per 24 hrs. incinerator plant.

Engineer Willis Chipman, Mail Bldg., Toronto, Ont., is preparing plans for the establishment of a sewerage system in the town of Ingersoll, Ont.

DINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

Co., Union and H. Sts., San een awarded the contract at ucting a suction dredge for Diego. Bids were opened

rd of Harbor Commissioners has awarded the contract to of Portland, Ore., at $975,981 concrete piers to be erected sco water front.

hat the City Council of San r bids shortly on the entire improvements, for which expended. The work will ction of a dock, warehouse M. Capps is harbor engi-

Colorado.

eceived until noon (Moun-20, by Secretary, Colorado Capitol Managers, Denver, storage batteries for the l Bldg., Denver. Speci-en at the office of F. E. t, 512 Opera House Block. K. Burchinell is Secretary Managers.

of Boulder, Colo., has em-ilson to draw plans for a lant; $40,000 in bonds have

elaware.

were received April 29 by nd, U. S. Engineer, Wil-dredging harbor at Wil-d Dredging & Contracting l., 9¼ cts. per cu. yd.; Co., Philadelphia, Pa., August Nelson, Philadelphia, Pa., 12.49 cts. per cu. yd.; Rickards Dredging Co., Philadelphia, Pa., 8.45 cts. per cu. yd. The work calls for about 890,800 cu. yds. of dredging.

District of Columbia.

✣Bids will be received until 10:30 a. m., July 3, by Maj. F. C. Boggs, general purchasing officer, Isthmian Canal Commission, Washington, D. C., for the purchase of steel lighters offered for sale by the commission. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until noon, May 31, by Lieut.-Col. W. C. Langfitt, U. S. Engineer, Washington, D. C., for furnishing and delivering about 400 tons of sulphate of alumina.

✣Bids will be received until 10:30 a. m., May 15, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing lumber under Canal Circular 708.

✣Bids will be received until 10:30 a. m., May 20, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 707, structural steel, rivets, galvanized conduit, electric cable, wire, fuses, sockets, plugs, dry cells, carbons, galvanized red fiber, wire solder and wire clamps.

Illinois.

✣Bids will be received until 3 p. m., May 13, by Maj. C. Keller, U. S. engineer, Rock Island, Ill., for widening and deepening South Slough at Milan, Ill. The work will be suitable for dredge. Official advertisement will be found elsewhere in this issue.

Bids as follow were received April 26 by the U. S. engineer, Chicago, Ill., for dredging in Calumet Harbor, Ill.: Great Lakes Dredge and Dock Co., Chicago, Ill., 21¾ cts. for 174,000 cu. yds.; Buffalo Dredging Co., Buffalo, N. Y., 30 cts.; Fitz Simons & Connell Dredge and Dock Co., Chicago, Ill., 23 cts.

Work has been commenced upon the construction of the new Ceramics and Mining Engineering Laboratories of the University of Illinois at Champaigne. These buildings are to form a part of the group of engineering buildings to be located upon ground east of Mathews Ave., which has recently been acquired by the university. The contracts for the new Transportation Building and the Locomotive Testing Laboratory will be let soon. W. M. Goss is Dean of the College of Engineering.

Louisiana.

✣Bids will be received until 10 a. m., May 14, by city of Shreveport, La., for the following: One auto combination chemical hose wagon engine, not less than 4 cylinder and 50 H. P., A. L. A. M., with two ignition systems, including Bosch magneto and battery, two sets of spark plugs, anti-kicking device, etc.; tires, solid rubber; hose body, length not less than 9 ft., capacity 1,200 ft. 2½-in. hose; chemical tank, 50 gals., with 200 ft. ¾-in. hose; usual fire and auto equipment, including speedometer. Two auto combination pump engine hose wagons; equipment, engines and tires as specified for No. 1; capacity of pump, not less than 600 gals. per minute; hose body, length not less than 8 ft., capacity not less than 1,000 ft. 2½-in. hose. One tractor to pull 75-ft. Seagrave aerial truck; engines, tires and equipment as specified in No. 1. One chief's car; engine and equipment as specified in No. 1, except that engine may be 30 H. P., A. L. A. M.; pneumatic tires; extra heavy chassis, two electric headlights and speedometer. 2,000 ft. 2½-in. rubber-lined double-

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

jacket standard fire hose, with standard screw couplings attached, and guaranteed pressure up to 350 lbs. Nine latest improved, non-interfering fire alarm boxes, one auxiliary non-interfering fire alarm box, one electric bell striker for 1,400-lb. bell, one 15-in. latest improved gong and indicator. A certified check for 10 per cent of amount of bid must accompany each bid. L. H. Baker is secretary-treasurer, City Hall, Shreveport, La.

Maryland.

✣Bids will be received until 3 p. m., May 14, by Lieut. D. N. Swan, Jr., Quartermaster, Fort Washington, Md., for furnishing materials and labor required for overhaul and re- [illegible] Wilhelm.

Massachusetts.

⊙N. H. Ellis, 18 Tremont St., Boston, Mass., has been awarded the contract at $1.90 per ton for stone furnished and placed and $5 each for iron clamps, for repairs at Cherry Island Breakwater, Revere, Mass., for the State Harbor and Land Commission. The work calls for about 1,800 tons of stone.

⊙Bids were opened April 12 by the State Harbor and Land Commission for jetty repairs at Cuttyhunk, the work requiring about 1,300 tons of stone. The contract was awarded to Eugene S. Belden & Sons, Hartford, Conn., at $1.97 per ton for stone furnished and placed and $7.50 for each iron clamp.

⊙The J. S. Packard Dredging Co., Providence, R. I., has been awarded the contract at $7,400 for dredging in Cuttyhunk Harbor for the state.

Bids as follows per cu. yd. scow measurement were received April 12 by the State Harbor and Land Commission, Boston, Mass., for dredging in Manchester Harbor: Eastern Dredging Co., Boston, 27.7 cts.; J. P. O'Riorden, Boston, 27.1 cts.; Bay State Dredging Co., Ltd., Boston, 25½ cts.

Bids as follows were received April 22 by Col. Frederic V. Abbot, U. S. Engineer, Boston, Mass., for dredging in Mystic River below the mouth of Island End River, Mass. (1) being bid per cu. yd. for dredging, scow measurement, (2) bid for removing bowlders exceeding 2 cu. yds. each: Bay State Dredging Co., Ltd., Boston, Mass. (1) 23½ cts., (2) $10; G. H. Breymann & Bros., Boston, Mass., (1) 24½ sts., (2) $5; Eastern Dredging Co., Boston, Mass., (1) 23.9 cts., (2) $5.

Michigan.

⊙John Ginzal of Detroit, Mich., has been awarded the contract by C. M. McCormick, lighthouse inspector, Detroit, for placing reinforced concrete caissons and completing the foundation piers for lights 1, 2, 3 and 4, Detroit River. The contract price is $18,800. Bids were opened April 24.

Missouri.

✣Bids will be received until noon, May 22, by Maj. Edward H. Schulz, U. S. Engineer, Kansas City, Mo., for the construction of about 12,000 ft. of standard revetment on the Missouri river below Kansas City and 3 miles below Missouri City, Mo.

⊙The following bids were received May 4 by Maj. Edward H. Schulz, U. S. engineer, Kansas City, Mo., for the construction of 14,000 ft. of standard revetment at Providence Bend on the Missouri River: Rust, Swift & Co., St. Louis, Mo., $10.14 per ft.; De Witt & Shobe, Glasgow, Mo., $8.37 (accepted); J. W. McMurray Contracting Co., Kansas City, Mo., $10.10; McGuire & Stanton Construction Co., Leavenworth, Kan., $8.90; A. W. Farney, Kansas City, Mo., $10.50.

Nebraska.

✣Bids will be received until 10:30 a. m., May 22, by city of Kearney, Nebr., for the installation of a municipal lighting plant. Plans and specifications may be seen at the office of the Oscar Claussen Engineering Co. of St. Paul, Minn., or at the City Clerk's office, Kearney, Nebr. Additional copies may be had at $5 per set from the Engineers. The work consists approximately of the following: Brick power station, 95 or 120 h. p. fuel oil engine or producer gas plant, electric installation of 1-60 or 1-75 k. w. generator, pole line wiring consisting of 870 poles, 176,000 ft. of No. 8 weather proof wire, also about 6,000 ft. of 3-conductor cable, 60 5-light ornamental posts and 122 cross suspensions, 122 bracket lamps. Certified check for $1,000 for the entire work or $200 for each one of these divisions, must accompany the bid. Geo. E. Ford is City Clerk, Kearney, Nebr.

New Jersey.

⊙The Captain John J. Williams Contracting Co., Chester, Pa., has been awarded the contract at $40,250 for rebuilding a pier for the New York Shipbuilding Co., Camden, N. J. The work will require 1,600 cu. yds. of concrete.

The City Council of Camden, N. J., has adopted an ordinance authorizing a bond issue for $300,000 for the purpose of paying for the construction, maintenance and operation of a municipal lighting plant. L. E. Farnham is city engineer.

New York.

✣Bids will be received until noon, May 12, by Col. W. M. Black, U. S. Engineer, New York City, for furnishing and delivering rubblestone on dikes in Hudson River, N. Y.

✣Bids will be received until 10 a. m., May 14, by Martin E. McClary, President of the Board of Managers, New York State Hospital for Incipient Pulmonary Tuberculosis, Ray Brook, N. Y., for fire equipment, pumps, piping and hydrants at the hospital.

✣Bids will be received until 8 p. m., May 10, by Board of Trustees, School District No. 1, Salina, N. Y., for remodeling and enlarging Liverpool Union School building. T. J. Gillette, 811 Park St., Syracuse, N. Y., is Architect.

Ohio.

✣Bids will be received until noon, May 23, by New Elks' National Home Commission, Sinton Hotel, Cincinnati, O., for the construction of buildings for the New National Home of the B. P. O. E., at Bedford City, Va.

Plans for purpose of estimate have been prepared by Engineer Robt. L. J. Wagar of Sandusky, O., for the installation of a municipal light plant, estimated to cost $160,000. The work will include steam plant; present boiler room for pumping station to be converted into 1,500 K. V. A. generating room. Bonds for the improvement will be voted upon May 31. City Engineer Wagar is official in charge.

Oklahoma.

✣Bids will be received until 3 p. m., June 5, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, except mechanical equipment, of the United States Post Office and Court House at Muskogee, Okla. The building to be of fireproof construction, four stories in height, stone faced, and copper roof, with a ground area of approximately 20,400 sq. ft. Drawings and specifications may be obtained from the custodian of site or at the discretion of the Supervising Architect.

The Washata Electric Power Co., Pauls Valley, Okla., has been taking figures on building a timber dam across the Washata River at Pauls Valley.

Oregon.

✣Bids will be received until 3 p. m., May 23, by City Auditor A. L. Barbur, Portland, Ore., for furnishing the Fire Department of the city of Portland, Ore., with monitors or turret nozzles and a water tower for the new fireboat David Campbell, all in accordance with specifications for same on file in the office of the chief engineer, city hall.

Pennsylvania.

✣Bids will be received until 3 p. m., May 31, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and lighting fixtures, of the United States Post ffice at Cha leroi, Pa. This building is to h e two stor and basement of approximate 4,156 ground area; stone faced, slate oof, ar proof construction except the oof. ings and specifications may be tained the custodian of the site or his the discretion of the Supervisi

✣Bids will be received until 26, by Trustees of the Pen Lunatic Hospital, Harrisbu erection and completion of b k and chapel. J. A. Dempwolf, York Pa., is Ar tect.

✣Bids will be received until 18, by Superintendent of th State Hospital for the Insa Pa., for furnishing and equipp for the Commonwealth of Pe M. Young is Secretary and Tr

South Carolina

✣Bids will be received unt by city of Florece, S. C., for installing 10 non-interfering fir W. H. Berry is chairman of t tee.

Texas.

✣Bids will be received unt 11, by R. T. Milner, President tural and Mechanical College lege Station, Texas, for furnis and material necessary for the completion of 2 or 3 gravity h ing systems for dormitories gether about 8,400 or 13,600 sq ing surface and of a rein tunnel costing about $8,000, an ing mains ranging in size from located in said tunnel Plans tions may be seen at office of College Architect, College Stat

✣Bids will be received until p. m., by Hall County Nationa phis, Texas, for the constructio bank building. R. H. Stucke Texas, has plans and specificat

Virginia.

✣Bids will be received unt Capt. R. B. McBride, Post Fort Monroe, Va., for furnishin ard white oak railroad ties.

Washington.

✣Bids will be received unti 31, by Capt. J. R. Pourie, Co termaster, 482 Arcade Annex, S for the construction of a transmission line and furnish converter, transformers, wattme electrical apparatus, all at F Wash.

✣Bids will be received until 31, by Capt. J. R. Pourie, Const termaster, 482 Arcade Annex, S for the construction of a st transmission line and furnish converter, transformers, wattme electrical apparatus, all at F Wash.

✣Bids will be received until 14, by Lieut. D. N. Swan, (Fort Washington, Md., for fur rials and labor for semi-annual repair of the Quartermaster ste Robert Swartwout.

⊙The Puget Sound Bridge & Central Bldg., Seattle, Wash., ha ed the contract at about $ dredging of the west side chan head work at Olympia for the S. ment.

Canada.

✣Bids will be received until 10, by H. F. Maulson, Secretary nedosa Power Co., Minnedosa, construction of the spillway, inta and power house foundations o dosa Power Co. Plans and may be seen at office of W & Co., Grain Exchange Bldg., W at the office of F. G. Taylor, B tage la Prairie, and at the offices pany at Minnedosa.

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NOTICE TO BIDDERS.

WATERWORKS IMPROVEMENTS BURR OAK, KANSAS.

Sealed proposals will be received by the City Clerk of Burr Oak, Kansas, until 8 o'clock p. m. May [illegible], 1912, for furnishing f. o. b. cars Burr Oak, Kansas, the following material and machinery, also for furnishing tools and labor required to construct and install a waterworks system in Burr Oak.

Bids will be opened by the Mayor and City Council the same evening at the Council Chamber and bidders are invited to be present and to submit bid on the following items:

[illegible] tons of Cast Iron Pipe, sizes 4, 6 and 8 inch.

11,550 lbs. of special castings.

[illegible] lbs. of lead.

100 lin. ft. 2 in. galvanized wrought iron pipe.

32 fire hydrants.

Miscellaneous list of 2, 4, 6 and 8 inch valves.

50,000 gal. elevated steel tank complete, including foundations.

2-20 H. P. gasoline engines.

2-200 G. P. M. deep well triplex pumps.

Also for furnishing all the tools, labor and material required to construct a circular well, 18 ft. inside diameter and about 60 ft. deep, a pump house 18x32 ft., excavate trenches, lay mains, set valves and hydrants, install pumps and engines and perform all the construction work necessary to install a complete waterworks system.

Complete plans and specifications are on file with the City Clerk, or may be seen at the office of the Consulting Engineers, Goodwin & Harper, 920 Scarritt Bldg., Kansas City, Mo. Bidding blanks will be furnished with the plans and specifications.

Parties desiring separate copies of the plans and specifications for their own use may obtain same from the engineers on the payment of $3.00 to cover cost of blue-prints, etc.

Each proposal must be accompanied by a certified check of not less than 5 per cent of the amount bid, made payable to J. C. Modlin, City Treasurer of Burr Oak, Kans., as a guarantee that the bidder receiving the award will enter into contract with the City and furnish satisfactory bonds within 10 days after the contract is awarded.

Bonds have been sold and the City will pay cash for everything.

The City reserves the right to reject any or all bids, to waive any informality, and to award the contracts as may be deemed to the best interests of the City.

J. W. GREEN, City Clerk.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE.—Washington, D. C., April 2[illegible], 1912. Sealed proposals will be received at the office of the United States Reclamation Service, 605 Federal Building, Los Angeles, Calif., until 2 o'clock p. m., May 16, 1912, for furnishing cast iron pipe and tunnel lining for the North Platte Project, Nebraska-Wyoming.

For particulars address the U. S. Reclamation Service, 605 Federal Building, Los Angeles, Calif., or Washington, D. C.

F. H. NEWELL, Director.

THE SANTIARY DISTRICT OF CHICAGO.

CALUMET SAG CHANNEL CONSTRUCTION.

To Contractors:

Sealed Proposals indorsed "Proposals for Excavation of Section Five" will be received by the Clerk of The Sanitary District of Chicago at the office of said District 1500-76 West Monroe St., Chicago, Ill., until 12 m. standard time, on May 31, 1912, and will be publicly opened by the Board of Trustees at a meeting to be held on that day or at the first meeting thereafter.

The work for which said tenders are invited consists of the excavation and collateral work on contract section 5 of the Calumet-Sag Channel of the Sanitary District of Chicago, in the township of Palos, county of Cook, state of Illinois.

The approximate quantities to be used in comparison of bids are:

(a) 1,070,000 cubic yards of excavation of glacial drift.

(b) 141,000 cubic yards of excavation of solid rock.

(c) 69,000 square yards of riprap slopes.

(d) 4,800 lineal feet of roadway construction.

(e) [illegible] cubic yards of No. 1 concrete.

(f) 600 cubic yards of No. 2 concrete.

(g) 900 cubic feet of completed concrete cylinders.

(h) 30,000 pounds of reinforcing metal.

(i) Erection of McLaughry road bridge (Lump Sum).

(k) Erection of West 82nd St. bridge (Lump Sum).

All bids must be made upon blank forms of proposal furnished by the Sanitary District, and shall be made in accordance with and to conform to all the terms and conditions set forth in "Requirements for Bidding and Instructions to Bidders" attached thereto.

Specifications, forms of proposal and plans may be obtained upon deposit of Five ($5.00) Dollars at the office of the said District. Said sum of Five ($5.00) Dollars so deposited will be refunded if said plans and specifications are returned on or before June 15, 1912.

The Board of Trustees reserves the right to reject any or all bids.

THE SANITARY DISTRICT OF CHICAGO,

By Thomas A. Smyth, President of its Board of Trustees.

Attest:

I. J. BRYAN, Clerk.

Chicago, May 2, 1912. 19-1t

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE.—Washington, D. C., April 20, 1912. Sealed proposals will be received at the office of the United States Reclamation Service at Provo, Utah, until 2 o'clock p. m., May 16, 1912, for the construction of a reinforced concrete drop, chute, and abutments for two bridges on Indian Creek and Trail Hollow Diversion Canal, located in Wasatch County, Utah, about thirty-five miles northeast of Thistle, Utah. The work involves the excavation of approximately 4,500 cubic yards of earth and rock, and the placing of 875 cubic yards of concrete and 225 square yards of paving.

For particulars address the U. S. Reclamation Service, Provo, Utah, or Washington, D. C.

F. H. NEWELL, Director.

NOTICE OF RECEPTIO OF BIDS.

Notice is hereby given that missioners of the First Additio Rattlesnake Drainage District County, Wisconsin, will receive als for doing the work provided plans and specifications of said on and up to the 15th day of May 91.

Copies of the plans and spe may be obtained from Mathias President of the Board of Commi Deerfield, Wis., or from F. W. H torney, Room 424 Washington Bl ison, Wis.

Dated April 26, 1912.

MATHIAS LIN
J. H. AUBY.
H. G. CLARK.
Comm

READVERTISEMENT

Sealed proposals for the const a complete water system will be by the Village of Ashton m. May 25, and then publi Approximately six miles of s in mains, an elevated tank and pumping machinery are incl the work. Plans and specifi on file with the Village Clerk at and in the office of the Aetna Eng Bureau, 17 N. LaSalle St., Chica village reserves the right to re and all bids. Certified checks fo cent of bid must accompany prop

S. T. ZELLER,
President Village of As

SUCTION MAIN AND W

Proposals will be received of Grand Haven, Mich., until 3 o' m., Tuesday, May 21, 1912, for delivering, trenching, laying filling about 3,200 ft. of 16-in. suction main from a well on the Lake Michigan to the pumping st

Also for sinking a 30 ft on the shore of Lake Michigan.

The right is reserved to rej all bids.

Plans and specifications m the office of Gardner S. William Consulting Engineer, Ann Arbor will be furnished on request by t office.

STEEL WATER TOWER TANK.

Sealed proposals are invited a be received at the office of the Clerk, Compton, Illinois, until 2 p. m., May 10, 1912, for the constru a steel water tower and tank.

Bids must be accompanied by fied check in the sum of One dollars ($100.00) to be forfeited Village of Compton should the bid fuse or neglect to enter into a c in the event that the work be awa him.

Proposals must be made on form which may be obtained fr Village Clerk. For further infor address J. S. Archer, Village Cle

The right is reserved to reject a all bids.

CHARLES BRADS
President Village Board, Compto

CALLS FOR BIDS

, $2.40 an inch, single column. Copy received until Monday noon.

ON MAIN AND WELL.

will be received by the City [illegible] Haven, Michigan, until [illegible] n., Tuesday, May 21, 1912, for delivering, trenching, laying ling about 3,200 feet of 16-inch [illegible] main from a well on [illegible] Lake Michigan to the [illegible]

[illegible] 30-foot diameter [illegible] of Lake Michigan.

is reserved to reject any or

d specifications may be seen e of the City Clerk at Grand at the office of Gardner S. Consulting Engineer, Ann Ar- [illegible] or will be furnished on the latter office.

Authority of the Commo[illegible] of the City of Milwaukee

Vater Works Tunnel.

e Department of Public Works, waukee, April 15, 1912.

oposals will be received at this Wednesday, May 15, 1912, at a. m., for furnishing all ma- doing all the work necessary d to construct a water works ve (12) feet in diameter, for a approximately four thousand [illegible] nto and under Lake rom a point on the lake shore er line of Linwood avenue ex- lake shaft, including connec- eel cylinders; one shore shaft, o (2) gate wells and all con- d approximately one hundred 30) cubic yards of rock ex- cording to plans and specifi- le in this office.

ll submit separate figures for lowing branches of the work; , however, will be let to the r in the aggregate for doing rk, based upon the estimated ven in the specifications:

rice per lineal foot of shore [illegible] including two (2) gate ll connections, copings and

— price per lineal foot of brick t extensions at the shafts.

price per lineal foot of lake te, including steel cylinders ections.

— price per cubic yard of rock n.

ice per lineal foot of tunnel [illegible] to be used instead of of tunnel.

ompleted on or before the , 1914, failing in which the ll pay the city of Milwau- ated damages the sum of d ($1,500.00) dollars for each y's delay in completing the

ired in the penal sum of in lieu thereof the bidder with the Commissioner of the sum of $45,000.00 in ified check.

ls are submitted with bids, n or a surety company au- business in Wisconsin will said bond to be approved ttorney as to form and ex- being presented with bid issioner of Public Works.

[illegible] figures.

All moneys deposited will be returned to unsuccessful bidders on award of contract and to successful bidder when contract is entered into.

The Commissioner of Public Works reserves the right to reject any or all bids

Bidders are required to submit with their proposals the method they intend to adopt in carrying out this work.

Plans and specifications will be furnished to prospective bidders on the receipt of $10.00 as a guarantee for their safe return.

Signed,

[illegible]
Commissioner of Public Works
Countersigned, April 15, 1912
C. P. DIETZ,
Comptroller

GATE-HOUSE AND TWO CONCRETE BRIDGES.

Located at Trenton Falls, N. Y., one mile from railroad, 6,000 cu. yds. earth, 4,000 cu. yds. rock, 1,000 cu. yds. concrete, 8,000 lbs. re-inforcement, details for gate-house, lump sum. The work is within a radius of a few hundred feet and must be completed by October 1st, 1912. Bids to be opened at 12 o'clock on May 10th, 1912. For further information address

THE ALTO CONSTRUCTION COMPANY,
Holland Patent, N. Y.

St. Charles, Ill., May 3, 1912.

"Sealed bids will be received by the Board of Local Improvements of the city of St. Charles, Ill., until 7:00 o'clock p. m., A. D. May 15, 1912, on extensions of water mains covering 1,344 feet of 4-inch pipe, and 8,841 feet of 6-inch pipe, and laying.

Plans may be examined at the office of city clerk, Karl C. Wettstein, or City Engineer G. N. Lamb, St. Charles, Ill."

19-1t

Crystal Falls, Mich.

Bids will be received by the County Road Commission until 1 o'clock May 13, for building eight miles of dirt road from Iron River to Beechwood and four miles of dirt road from Mastodon to the Brule River.

Each proposal must be accompanied with a certified check for $50.00, payable to the Chairman of the Board of County Road Commissioners, which will be returned upon the execution of the Contract.

Plans and profiles may be seen at the office of the County Road Engineer, Crystal Falls, Michigan.

19-1t A. L. BURRIDGE.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE.—Washington, D. C., April 23, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Malta, Montana, until 2 o'clock p. m., May 21, 1912, for earthwork and structures on the first eleven miles of Dodson North Canal, laterals and waste-water ditches. The work involves approximately 277,000 cubic yards of excavation, 1,500 cubic yards of reinforced concrete, and the placing in structures of 86,000 feet, B. M., of lumber.

For particulars address the U. S. Reclamation Service, Washington, D. C.; Helena, Montana, or Malta, Montana.

F. H. NEWELL, Director.

[illegible] Canal Commission, which are no longer needed. Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., July 3, 1912, at which time they will be opened in public, for the purchase of the above-mentioned articles. Blanks and general information relating to this Circular (No. 709) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State St., New York city; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point St., San Francisco, Cal.; also from the U. S. Engineer Offices in the following cities: Seattle, Wash., Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Commercial Club, Tacoma, Wash.—F. C. Boggs, Major, Corps of Engineers, U. S. A., General Purchasing Officer.

U. S. Engineer Office, Rock Island, Ill., April 29, 1912.—Sealed proposals for widening and deeping South Slough at Milan, Ill., (dredge work), will be received until 3 p. m., May 13, 1912, and then publicly opened. Information on application. C. Keller, Major, Engrs.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE.—Washington, D. C., April 20, 1912. Sealed proposals will be received at the office of the United States Reclamation Service at Provo, Utah, until 2 o'clock p. m., May 18, 1912, for the construction of concrete canal intake structures and concrete bridges on Indian Creek and Trail Hollow Diversion Canal, located in Wasatch County, Utah, about thirty-five miles northeast of Thistle, Utah. The work involves the excavation of approximately 2,650 cu. yds. of earth and rock and the placing of 560 cu. yds. of concrete, 260 cu. yds. of paving, a set of sluice gates, and miscellaneous steel.

For particulars address the U. S. Reclamation Service, Provo, Utah, or Washington, D. C.

F. H. NEWELL, Director.

DEPARTMENT OF THE INTERIOR, UNITED STATES RECLAMATION SERVICE.—Washington, D. C., April 23, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Malta, Montana, until 2 o'clock p. m., May 21, 1912, for the construction of laterals, waste-water ditches and structures on the First Unit, Dodson South Canal, Milk River Project, Montana. The work involves the excavation of approximately 67,000 cubic yards of material, and the erection of six small structures.

For particulars address the U. S. Reclamation Service, Washington, D. C.; Helena, Montana, or Malta, Montana.

F. H. NEWELL, Director.

U. S. ENGINEER OFFICE.—Galveston, Texas, May 1, 1912. Sealed proposals for constructing concrete sidewalk, brick pavement, concrete curbing and drains at Fort Travis Reservation, Port Bolivar, Galveston, Texas, will be received here until 12 o'clock noon, May 31, 1912, and then publicly opened. Information on application. EARL I. BROWN, Major, Engrs.

U. S. ENGINEER OFFICE, Kansas City, Mo., April 22, 1912.—Sealed proposals for constructing about 12,000 ft. of standard revetment on Missouri River, about 31 miles below Kansas City, and 3 miles below Missouri City, Mo., will be received at this office until 12 noon, May 22, 1912, and then publicly opened. Information on application. EDWARD H. SCHULZ, Major, Engineers.

U. S. ENGINEER OFFICE, GALVESTON, TEXAS, April 18, 1912.—SEALED PROPOSALS for derdging the Houston Ship Channel, will be received at this office until 12 m., May 15, 1912, and then publicly opened. Information on application. EARL J. BROWN, Major, Engrs.

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nd-class matter, April 17, 1907, at the Post Office at Chicago, Illinois, under act of March 3d, 1879. Copyright, 1911, by the Myron C. Clark Publishing Co.

tion of Improved Highways.

[illegible] there was very little [illegible] to engage in high-[illegible] be sure New Jersey, d Connecticut had state aid [illegible] were compara[illegible] least one of these states, [illegible] greater part of the [illegible] the towns in which the work [illegible] 1898 the state of New [illegible]rst appropriation for the im-[illegible] highways, and from that time [illegible] contractors to engage in this [illegible]ve increased steadily. That [illegible] not been slow to take advant-[illegible]portunities is shown by the [illegible] bids were opened last month [illegible] State Commission of High-[illegible]racts for road improvement [illegible]rs submitted proposals.

[illegible] years there has been not [illegible]ease in the amount of road [illegible] has also been great changes [illegible] construction. A few years [illegible] type of improved road was [illegible]cam; the specifications of the [illegible] Commission of Highways for [illegible] 13 different kinds of road [illegible] the more important high-[illegible], the class of pavements [illegible] approaches in quality [illegible] pavement. This condi-[illegible]solely to the eastern states. [illegible]ad letting in Pierce Coun-[illegible] total of 34 bids were sub-[illegible]actors. Of these bids 25 [illegible] surface constructed on a [illegible] contract was awarded at [illegible] a pavement on this kind

[illegible] single contract also has in-[illegible] recent years. Of the 84 [illegible] York state, referred to [illegible] to over $30,000 each. One [illegible] 37 miles of road was let [illegible] for 7.96 miles was award-[illegible]ird covered 9.8 miles and [illegible]00. Two other contracts [illegible] worthy of note. One of [illegible] improvement of 1.51 miles of road and amounted to $74,445; the other covered 1.35 miles and totaled $66,557. Large single contracts are not confined entirely to work in New York state. In the southern states it is not unusual for one contractor to secure the work of constructing an entire system of improved highways for a county. In some cases these contracts have amounted to $200,000 or $300,000 and have covered several hundred miles of road. Contracts covering 30, 40, 60 or even 100 miles of road are being advertised daily in some of the southern and western states. Only the other day Monroe County, Tennessee, awarded a contract for grading some 160 miles of roads, the successful contractor securing the work at $275,000.

At the present time there are over 30 states that render aid, financial or otherwise, in building roads. In many of these states, unfortunately, the appropriations are so small that the aid rendered must be classed as "otherwise." In these states, however, each year sees the appropriations increased, and it will be only a question of time before highway improvements will be undertaken on a larger scale. Of the other state aid states, New York is spending the last of a $50,000,000 bond issue, and probably will provide a like amount in the near future; California will this month open bids on the first roads to be constructed under a $18,000,000 bond issue; Pennsylvania is now taking bids for the first six roads to be constructed under the Sproule act, which provides an appropriation of several million dollars; Ohio has $1,320,000 available for construction purposes this year, and New Jersey has $1,500,000. The other states have sums available ranging from $400,000 to $800,000. These figures indicate only approximately the amount of road construction that will be undertaken this year. Towns, counties and districts are undertaking the improvement of their roads without the aid furnished by the states. In Texas about 50 counties, last year, voted an aggregate of $8,915,500 of bonds for road construction purposes; in Tennessee 16 counties voted a total of $2,109,933 of bonds, and in Alamaba $1,480,000 of bonds were voted by six counties.

The work now being done is just a beginning. The next few years will see the construction of more miles of improved highway than have been built in all the time since state aid was started, 21 years ago.

Method of Computing Rope Capacity of a Drum.—The rule used by the A. Leschen & Sons Rope Company for computing the rope capacity of any sized drum is as follows: Add the depth of flange in inches to the diameter of the drum, and multiply this result by the width (out to out) of the drum. This product is then multiplied by the figure below corresponding to the size of rope used:

¼ in	[illegible]	[illegible] in	[illegible]
[illegible] in	[illegible]	[illegible] in......	[illegible]
7/16 in............	1.37	[illegible] in............	.099
½ in............	1.05	[illegible] in	[illegible]
9/16 in	.828	[illegible] in	[illegible]
[illegible] in	[illegible]	2 in......	[illegible]
¾ in.	[illegible]	[illegible] in............	.058
[illegible] in	[illegible]	[illegible] in	[illegible]
1 in	[illegible]	[illegible] in......	[illegible]
[illegible] in............	.207	[illegible] in......	[illegible]
[illegible] in	[illegible]		

Weight of Concrete.—The weight per cubic foot of concrete as molded into beams for flexure tests and into cubes and cylinders for comparison tests is given in a report issued by the Bureau of Standards. The specimens were weighed at the ages of 4, 13, 26 and 52 weeks and for each age generally 21 specimens were averaged. As the concrete showed no increase of weight with age we give below only the general averages as follows:

Kind.	Beams, lbs.	Cylinders, lbs.	Cubes, lbs.
Granite concrete......	148	148.6	147.7
Limestone concrete....	146.6	146.7	145.7
Gravel concrete........	144.1	144.8	144
Cinder concrete........	119	119.3	118.1

Cost of Pumping Sand for Use in Concrete.—The cost of pumping sand for use in concrete is stated by Mr. D. G. Keith in a paper before the Interstate Tile Association to run about 10 cts. per cubic yard, but has been as high as 17 cts. under unfavorable conditions. A 6 in. centrifugal sand pump is used with 60 ft. of suction pipe and 10 ft. of discharge pipe. It is operated by a threshing engine, which is rented at $5 per day including the engineer's service. This engine uses 1,500 lbs. of coal per day. The pump is operated at about 250 revolutions per minute.

GENERAL ARTICLES

Science of Management—The Law of Competitive Planning.

Competition is charged by Socialists with being the greatest source of industrial waste, and it is praised by individualists as being not only the sharpest spur to achievement, but the cause of all mental evolution. Some economists, therefore, would eliminate competition as far as possible, while others urge that it be fostered even to a greater degree than at present.

There are several sorts of competition, but for the present purpose we need consider only two: (1) Competition among "producers," and (2) competition among "planners." When the distinction between these two sorts of competition is clearly apprehended, we shall understand better why one kind of competition, if carried far, leads to economic loss, while another kind of competition leads to enormous economic gain, even though the degree of competition seems excessive to the ordinary observer.

We use the term "producer" in the ordinary sense to denote the worker in distinction from the manager, engineer or inventor. These latter we shall call "planners." They design, plan and direct. They are, in truth, producers also. Indeed, they are the greatest of all producers, if the word produce is used in a philosophic sense; for, by their plans, production has been increased many fold.

It may readily be shown that if competition among "producers" of any class is carried far, there will not be enough demand for their product to keep all of them busy, and their "output factor" will consequently fall. Our discussion of the "output factor" in a previous issue makes it unnecessary to do more here than to mention the fact that a low "output factor" is always a cause of a high unit cost. This is the reason why it is uneconomic to have two telephone plants, for example, serving the same community. This, also, is the reason why there is so much waste in existing competitive methods of marketing produce. Innumerable examples of the waste arising from low "output factors" caused by competition will occur to anyone who gives the matters thought.

Turning to competition among "planners" we find a wholly different condition. There is almost no limit to the lowering of unit costs that "planners" may effect in any line of production except in marketing the product, and the more vigorous the competition among "planners," the more rapidly do they revolutionize industrial production. This is well illustrated in Germany and America, where technical education has developed more trained "planners" than in any other countries.

In order to secure a perspective view of what competitive planning can accomplish, let us consider for a moment what it has accomplished in a single line of production, namely, the production of ton-miles.

To make comparisons readily comprehensible, let us express all costs in terms of the ton-mile unit, on the assumption that the transporting instrument travels one way loaded and returns unloaded, or has a 50 per cent load factor.

Let us assume that the daily wage of the average workman is $2, and that the daily cost of a horse is $1. Then we shall have approximately the following costs of transportation overland by nine different methods:

	Cents per ton-mile.
1. Carried on man's shoulders, 50 lbs......	1,000
2. Ordinary wheelbarrow, 100 lbs. .. .	500
3. Chinese wheelbarrow, 200 lbs............	250
4. Pack horse, 200 lbs......................	125
5. One-horse cart on earth road, 1,000 lbs.	75
6. Two-horse wagon on earth road, [illegible],000 lbs.	50
7. Ditto on macadam road, 6,000 lbs.......	17
8. Car on light rails, 2 horses, 12,000 lbs..	9
9. Locomotive and train, 1,000,000 lbs......	0.5

In none of these nine methods is any allowance made for plant interest, repairs and depreciation, except in the ninth case. Of course, the cost of freight transportation by railway is largely a function of traffic density and first cost of plant. The estimate of one-half cent per ton-mile for rail transportation is given mainly for illustration, but is not far from the average cost under the conditions assumed for this illustration.

The first great "planner" in the transportation department of human production was the man who invented the wheel and axle. The immediate result was to increase the transporting output of men several fold, and the ultimate result was to enable other "planners" to develop the railway.

It will be noted that the cost of carrying produce on the backs of men is 2,000 fold as much as the cost of carrying produce by rail.

Under favorable conditions as to density of traffic, etc., the ratio of railway to man carriage cost is more than 4,000 to 1. This ratio seems startling enough, yet there is still another point of view that brings into even greater eminence the worth of planning brains.

In America the steam railways transport more than 200,000,000,000 ton-miles annually at a charge of about ¾ ct. per ton-mile, making a total annual charge of more than $1,500,000,000. If this traffic were carried on men's backs the annual cost would be 1,333 times as great. Hence, if there were a perpetual monopoly in the right to use the invention of the wheel and axle, if money were worth 5 per cent, and if the owner of the assumed wheel and axle monopoly could collect all that is annually saved in America by virtue of carrying produce by rail instead of on men's backs, the capitalized value of the invention of the wheel and axle would be $1,500,000,000 × 1,332 ÷ 5 per cent = $39,960,000,000,000. The figure is incomprehensible until expressed in terms of some other unit. It is equivalent to about $400,000 for every individual in America. This value, it should be remembered, rests upon the assumption that the daily wage is $2; but, in fact, the daily wage would be only a small fraction of $2, were all freight carried on men's backs. Furthermore, no such volume of freight could possibly be moved, for it would take men to the number of more than 20 times the total population of America to carry as many ton-miles by man portage as are now carried by rail.

Society at large ultimately gains enormously by every plan that reduces the unit cost of production, and the measure of such gain is found by dividing the total annual saving by the rate per cent of interest, i. e., by *capitalizing* the annual saving. While this rule is applicable in considering the *value to society* of a "planner's" services, it is not applicable in determining the value of such services to an individual or to a corporation that does not possess a perpetual monopoly.

If the right to enjoy the annual saving effected by a given "plan" is perpetual—not limited to a term of years—then the value of the "plan" is the capitalized annual saving in cost of production effected by it. If the enjoyment of the saving effected by a "plan" is limited to a given term of years, then the value of the saving is the capitalized annual saving minus the sum of money which, placed at compound interest, will amount to the capitalized annual saving at the end of the given term of years. In other words, the "present worth" of the annual saving is determined by the well known method of calculating the present value of an annuity. Although the method of such calculation is well known, there is unfortunately no single word to denote the method. We shall, therefore, use the word *valuate* to denote the process of finding the present worth of an annual saving. If the right to enjoy an annual saving is perpetual, then the word valuate becomes synonymous with capitalize.

It is of the utmost importance to valuate the annual saving that a "planner" effects if
we are to obtain a clear idea
of a "planner's" services, and,
the extent to which competition
ners" can be carried with econ
not ordinarily done. Indeed, we
it is never done systematicall
done at all. Consequently, engin
expert "planners" are rarely pa
are worth, to say nothing of wh
be worth were competition brou
to stimulate them to do their
quently, also, competition amo
is frequently non-existent in th
where its existence would result
saving.

To continue our use of trans
as illustrative of what planning
plish, let us consider what is or
for railway location and what m
be spent.

The cost of locating a railwa
exceeds $300 per mile of railwa
struction cost is $30,000 per mile
considerably less than 1 per cen
struction cost is spent in locati
the average has been 0.5 per ce
is this expenditure for planning
it sinks to much smaller prop
contrasted with the capitalized a
ing expense that is effected by ch
tion. Every engineer familiar
economics knows that variations
tion cost often amount to seve
according to the skill of the loca
Likewise, variations in capitali
expense are often surprisingly l
between locations made by skill

If the annual operating expe
be varied by changes in location
mile of road, and if the interest
5 per cent, then the capitalized
$3,000 annual expense is $60,00
added to $30,000 construction c
$90,000 per mile as the total capit
the part of the railway that ma
by location. A variation of onl
between the results of two locati
therefore, means $1,800 per mile.
of only one-third of one per cen
per mile, which is the assumed c
tion made by one locating pa
then, it is economic folly not to
two competing parties engaged in
of such a railway.

We have used the above given f
for illustration of the principle
in measuring the net gain that ma
by competitive planning. Anothe
will probably elucidate still more
of management under considerat

If the planning relates to a pl
be operated at a considerable an
then, as we have just seen, the a
ing expense must be capitalized o
the case may be, before the prope
for planning can be correctl
Often, however, the "plant" is a
ture, like a bridge, whose opera
is mainly maintenance and so sm
almost negligible. In that case
may be confined only to the firs
structure. If, for example, a
costing about $20,000 is to be d
if extreme variations in desig
differ by no more than, say, 10 pe
cost of the structure, it is clear th
design will *probably* be within
the minimum cost attainable. H
lows that competitive designing
not result in a net saving in the
more than $1,000 is spent to se
design. But if a railway were
bridges of this same span and
might possibly pay to spend
$1,000 − $100,000 in securing
signs. Obviously, no such expen
be required to obtain a consider
of high class competition in desig
ard bridge. But the point that i
vious is the economy that results

g where much capital is at

$7,000 annually per mile of te the average railway in capitalized at 5 per cent. is 40,000 that is at stake in the h mile. It has been claimed he present operating expense d by better management. As- within the bounds of proba third of $140,000, or $47,000. d value per mile of railway ved by competitive planning nt probably sufficient to build average mile of railway in e we do not subscribe unre- proposition that one-third the g expense of railways can be strong reasons, based on actual us, that such a saving can be d, we may add that it is cost of freight transportation o a third of what it now aver- radical changes in the mechan- transportation. But without lm of the *possible* we find in *probable* enough reason for of seemingly huge sums of itive planning of railway con- eration.

e existence of a large number railway lines already insures able amount of competitive counts largely for the remark- ton-mile costs that has been this country. However, there that all the money thus far tive railway planning has been at is economically warranted lized saving that can certainly

companies that virtually have safely weigh the value of an capitalizing the saving; for are public agents, and, as may properly regard an an- erating expense as being lic asset. Private companies can not safely capitalize an- the saving to them is limited less definite term of years; nnual savings must be valu- xplained. In this connection o express a valuated annual f a capitalized annual saving, ditions. If the interest rate e valuated annual saving is cent of the capitalized an-

Per cent.
25
50
75
90

nual saving can be enjoyed or company for 14 years, it of a perpetual annual saving nt; that is, the valuated an- 14-year term is half the saving. A 17-year patent, at best, only slightly more as a perpetual patent; and nsiderably less than that consumed in developing new device or process. A exclusive franchise—is h as a perpetual monopoly, s 5 per cent.

ctors to consider in esti- f a limited term saving mpetitive planning: (1) that a saving may be en- al capitalized value of the pense and fixed charges of he probable range of differ- hat will occur as between ent planners.

he foregoing, we may ex- generalization the law of thus:

um economy, competitive provided, so long as the lans is less than the valu- n probably be effected by lanning.

ord "capitalized" may be ated" if the annual saving [illegible]

By "plans" we mean not merely designs of structures and machines but designs of methods of performing work.

The word "profit" should be substituted for "saving" in the above law, if the planning involves selling or marketing the produce.

A broad application of this law carries us into political economy, and enables us to draw the line between competition that is productive of economy and competition that is wasteful. It illumines the fallacies of extremists, whether socialists or individualists, who either damn or crown "competition." But this is a phase of the subject not under our present study.

The significant thing for industrial managers to grasp is this: Competitive planning is almost non-existent in the organization of the average industrial establishment. There is competitive planning, of course, between *competing* industrial establishments; but, while this is excellent for society at large, and while it is a stimulus to the "planner" in each industrial establishment, it is not the sort of competitive planning that yields the greatest profit to any particular establishment.

There is beneficial competition among different railways, but probably no railway company base ever made it a practice to secure competitive planning in all its own departments. Competitive locating parties should always be sent into the field. Competitive planning of operating methods is even more essential, but, instead of welcoming such an idea, it is usually resented. Heads of departments seem to consider it a slur upon their ability when it is suggested that operating methods can be improved by advice from "the outside." False pride is at the bottom of such objections in most cases, and in the cases where false pride does not exist there is a lurking fear that competitive planning will disclose unsuspected weaknesses of management.

These remarks about railways apply with equal force to every other industry. The besetting industrial sin of present management in every line is the resistance to any proposal that involves competitive planning. "Two heads are better than one"—except in the opinion of each of the two heads. Then each of the heads is positive not only that its head is better than two but better than any number of heads. If this feeling of pride were accompanied by a perfect willingness to submit to the test of competition, it would be laudable, but such willingness is not usually in evidence. Therefore it devolves upon the general manager to insist upon competitive planning in every department of the industry that he controls.

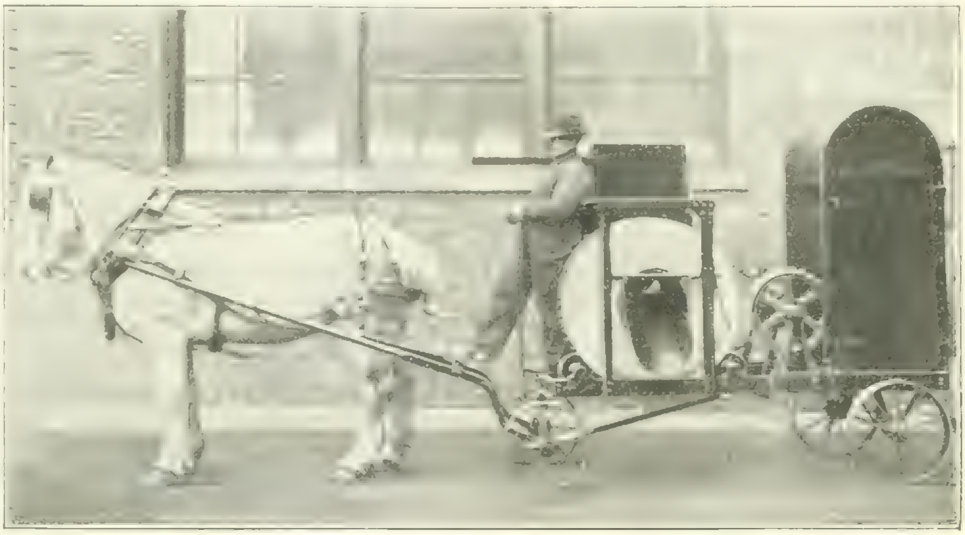
Competitive planning obviously need not be continuous in every department of an industry, but it should be sufficiently frequent to prevent heads of departments from getting into ruts.

A mild form of competitive planning exists in those establishments that pay employees for suggestions as to improved methods or devices. This, of course, should be encouraged, and the encouragement that is most apt to yield big results involves paying bonuses that bear some relation to the real value of the suggested ideas. Usually such bonuses are so small as to be little more than a kindly pat on the head.

Competitive planning will become more common when more engineers are in managerial command of industrial enterprises, for an engineer quickly recognizes the differences between the results of different "planners." Moreover, an engineer's training is such as to give him respect for the ability of the man who "plans"; and, coupled with that respect, a perception of the possibilities of great variation in the economic results secured by different "planners," even where every "planner" is an able man.

We have said nothing of the stimulus that competition gives to "planners" who are striving to excell one another, nor shall we more than mention the desirability of adding to this stimulus by paying the most successful competitor an adequate bonus.

Competition and payment proportionate to performance are the two stimuli that are essential in every industry if there is to be great progress and marked reduction in unit costs.



Portable Concrete Mixer.

A Portable Concrete Mixer for Work Requiring Quick and Frequent Moves.

The accompanying illustration shows a new concrete mixer which has been placed on the market to meet the demand for a machine of small capacity, that can easily be moved from place to place with one horse. It is particularly well adapted for the use of contractors who have occasion to do small jobs of sidewalk laying, and for use in the country in building silos, barn floors, troughs, etc.

The mixer has a capacity of 4½ cu. ft. of loose material, or 3½ cu. ft. of mixed materials per batch. It is furnished with gasoline power, being provided with a 3-h. p. water cooled engine. It can also be rigged up with an electric motor. The drum is made entirely of a special mixture of semi-steel, and is cast in two sections. The mixing is accomplished by means of ¼-in. steel mixing blades and malleable iron buckets in the interior of the drum. The drum is driven by steel roller chain belt. The roller track surfaces of the drum and the rollers on which it rests are made of chilled semi-steel and there is the least possible opportunity for the moving parts to wear out. This mixer is made by the Chain Belt Co., Milwaukee, Wis.

A Tamper for Securing Mortar Surface on Concrete.

Where horizontal concrete surfaces are required to be finished with a mortar surface two measures are possible: (1) Apply a mortar coating or (2) tamp the concrete so as to drive down the stone and flush a layer of fine material to the surface. When the latter practice is adopted a special tamper shown by the accompanying cut will be found advantageous. The illustration shows the face of the tamper. This is 8 ins. square and is provided with pyramidal projections connected at their bases in such a way as to prevent particles of stone from becoming wedged between them. For use after the layer of concrete has been spread and roughly leveled with the customary straight edge, the workman proceeds to tamp, with the result that the freer sand, cement and water come to the surface, leaving the latter in such a condition that it may be smoothed off with a float or trowel, substantially as the separately applied finish layer is smoothed off or finished according to the present practice.

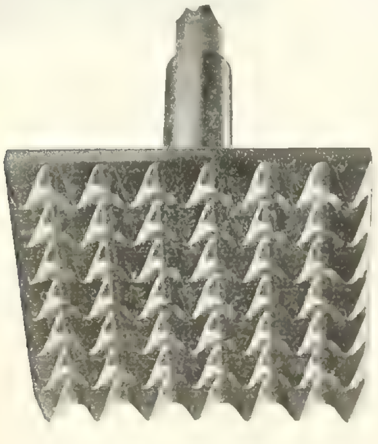
The manufacturer of this tamper, the Harold L. Bruel Co., Boston, Mass., gives the following cost comparison for a 6-in. concrete floor with granolithic finish when laying the finish separately and when forming it with a corrugated tamper:

100 SQ. FT. SEPARATE FINISH.

2.40 bbls. cement in 5-in. base (1:2:4 concrete) at $1.50	$ 3.60
1½ cu. yds. stone in 5-in. base at $1.75	2.625
¾ cu. yd. sand in 5-in. base at $1.20	.90
Labor placing 1 5/9 cu. yds. concrete at $1.50	2.33
1.36 bbls. cement in 1-in. top (1, 1½) at $1.50	2.04
.30 cu. yds. sand and pea stone at $1.75	.525
Labor mixing, placing and trowelling at $0.02 sq. ft.	2.00
Total cost per 100 sq. ft.	$14.02

100 SQ. FT. CORRUGATED TAMPER

2.80 bbls. cement in 6-in. (1/2/4 concrete) at $1.50	$ 4.20
1.80 cu. yds. stone at $1.75	3.15
.90 cu. yds. sand at $1.20	1.08
Labor placing 1 23/27 cu. yds. concrete at $1.50	2.78
⅛ bbl. cement for sprinkling top at $1.50	.19
¼ cu. ft. sand for sprinkling top at $1.20 and	.01
Labor trowelling and tamping at $0.0125 sq. ft.	1.25
Total cost per 100 sq. ft.	$12.66
Actual saving per 100 sq. ft.	$ 1.36



Corrugated Tamper for Securing Granulithic Finish on Concrete.

Steam Shovel Records.—The highest day's record for a 70 ton shovel was made by shovel No. 120 in the west borrow pit for the Gatun dam on April 2. The shovel loaded 175 cars containing 3,315 cu. yds. in all, in 8 hours. The previous highest daily output was 2,900 cu. yds. and was recorded for March 14, 1912. The crew on shovel No. 120 (T. P. Kelleher, engineer, and L. P. Bonnell, craneman) has also the record for a 45 ton shovel. This was made with shovel 51 on Dec. 6, 1910, when 2,448 cu. yds. was excavated at the Gatun spillway.

Notes on the Bonus System of Payment Employed in Driving the Laramie-Poudre Tunnel.

General methods and records of progress in driving the Laramie-Poudre Tunnel were described in our issue of April 10, 1912. The bonus system used in paying the men and descriptions of the method of loading the holes is of special interest and are further described in a paper by David W. Brunton, published in the April Bulletin of the American Institute of Mining Engineers. We abstract from this paper as follows:

European tunneling methods were copied as closely as the American wage scale and differences of conditions would permit. A workman once assigned to a position in the tunnel remained there, not being allowed to change even from one side to the other. He was not allowed to drop his tools at shift-change, but was obliged to hand them to his successor, and, in case of his successor's non-arrival, was expected to work another shift, care being taken, of course, that either a substitute was found or meals were sent in to the man working a double turn.

To give each man a personal interest in the work a bonus system was maintained. At first, the bonus paid to each underground workman was 25 cts. per day for each 25 ft. in excess of 400 ft. for the month.

After a few months this schedule was discontinued, as it was found to be both cumbersome and excessively high, considering the rate of progress made possible by the superior equipment; and the following bonus rate was adopted:

When the rate of driving for any calendar month exceeded 400 ft. and was less than 500 ft., each underground employee was paid $10 extra; between 500 and 600 ft., the bonus was $15; and between 600 and 700 ft., $20.

This bonus should have been paid to the men in currency, so as to distinguish it from the earnings under the wage schedule, but, as this was impracticable, money earned under the bonus was paid with a separate check, thus giving the men a better opportunity to realize what speed meant to them as well as to the contractor.

The list of employees and their rate of wages is as follows:

1	Superintendent		$ 10.00 per day
3	Foremen	each	5.00 per day
9	Drillers	each	4.50 per day
6	Helpers	each	4.00 per day
18	Muckers	each	3.50 per day
6	Drivers	each	4.50 per day
3	Dumpers	each	3.50 per day
1	Track and pipeman		3.50 per day
1	Master mechanic		6.00 per day
1	Stable boss and janitor		3.00 per day
2	Power engineers	each	110.00 per mo.
1	Car greaser		3.00 per day
1	Man at odd jobs		3.00 per day
1	Timberman		4.00 per day
1	Timberman's helper		3.50 per day
2	Blacksmiths	each	5.00 per day
2	Blacksmith's helpers	each	3.50 per day
1	Book and timekeeper		110.00 per mo.

In the operations of setting up the machines, drilling, firing and mucking, the utmost regularity and system were observed; and, while the time consumed in these different operations varied somewhat from day to day, there was a remarkable degree of uniformity in the amount of work performed by the different shifts.

Picking down the roof and squaring up places on the sides for the drill-bar rarely occupied more than 10 minutes. The adjustable end of the cross-bar was always placed on the right-hand side of the tunnel, the lifter on this corner having been exploded last for the purpose of clearing away the muck and leaving plenty of room for the men to operate jack-bars. The drillers and the foreman attended to this work while the helpers were busy bringing forward the hose, air-pipe, water-pipe and steel. Even with the tremendously heavy charges fired, most of the broken rock lay within 30 ft. of the face and rarely exceeded 5 ft. in depth at any point, making it easy to bring the bar and drills over the muck pile.

The fuses were always ignited and the charges fired in rotation, the following order being carefully observed, (see Fig. 1).

1. Short cut-holes ..
2. Top cut-holes ....
3. Lower cut-holes ..
4. Relief cut-holes ..
5. Relief back-holes
6. Top side-holes ...
7. Lower side-holes ..
8. Back holes ......
9. Corner back-holes .

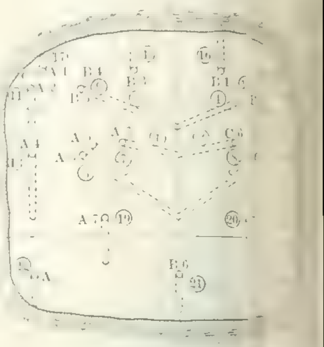


Fig. 1—Sketch Showing Loc
Holes in Heading of Lara
Tunnel.

10. Lower relief-holes ....
11. Center lifter ....
12. Left-hand lifter ....
13. Right-hand lifter ....

The usual practice of tampin
the explosive was soon di
was found that with such he
powder formed its own tampi
ther advantage that when the
ed to the collar the rock was
pulverized and consequently m
eled into the cars than when g
were used.

Holes will occasionally miss
loaded with the greatest care
tamping is employed they ca
fired by simply pushing a prin
upon the unexploded charge,
the risk of performing that
of all operations, picking the
a "missed" hole.

At first, each pair of fu
about 10 seconds before the
40-second fuse, gave 3-in. ste
ing line of fire. This interval
repeated on 10 pairs of holes,
erable time, and the smoke
erable that some method of
rate of fuse-lighting had to
one which proved most satis
ceedingly simple. The fore
from the ends of the fuse pro
short cut holes; 20 ins. off th
upper cut holes; 18 ins. off
lower cut holes, and so on. T
provided a difference of 2 ins
the fire had to travel, and,
fuse-ends were lighted as ra
at least another inch was re
time between the lightings,
shot-firers could secure the n
between the explosions, and y
the face before the smoke f
fuse became too dense.

The following tabular reca
drilling-operations shows tha
not only complete a round in
but had sufficient extra tim
shooting missed holes or tak
of the minor difficulties whi
tunnel work:

TIME OCCUPIED IN VARIO

Exhausting smoke from face	
Picking down roof and sides	
Jacking cross bar in place...	to
Attaching drills, making hose and water connections	to
Drilling from top set-up.....	3 h to
Dropping horizontal bar to lower position	
Drilling on lower set-up.....	1 h to
Removing drills, cross bar, hose, etc.	
Blowing out holes, loading and firing	
Ignition to explosion of last hole	
Total time required to complete cycle of operations	5 hr. 21 mi

March, April and May, 1911, the nths for driving, the following data ered, showing the amounts of work

	March.	April.	May.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	12,510	15,263
[illegible]	[illegible]	139	[illegible]
[illegible]	[illegible]	16,171	18,311
[illegible]	[illegible]	[illegible]	[illegible]

ing the hardness of the rock, the ned in drilling, as shown by the figures, was exceptionally good; but even ages fall considerably below what le with the equipment used. For inumber of the best drill-runners were erage over 60 ft. of holes per shift. m making a monthly shift average .; another of 61.75 ft., and a third

is work shows a great advance over merican practice, it still falls behind s obtained in the best examples of tunnel driving. A direct comparison ver, is not quite fair to the United [illegible] n anything yet attempted in this At first sight, it would seem that length would tend to retard instead te the rate of progress; but this is se. It has been clearly shown that ed length of transportation and difntilation are much more than off- ved conditions and the perfection effected by time and ex- As a rule, the greater the magnitude dertaking the more thorough the ; and the time and labor expended conditions and designing plants fferent Alpine tunnels have been justified by the results obtained. nnel engineers have also the ad- able to select their employees unlimited supply of highly- men from the Tyrol, Switzerland ont, which gives them an incomter selection than can be drawn eterogeneous labor supply.

Iauling With a Motor Truck in Arizona.

1 Saurer dump truck is used to om the Plumed Knight mine of Smelting Co. to the smeltery, a 7.7 miles. In this distance the fall at there are two hills against the load going down. Each is 300 ft. long on an 8 per cent grade. A long stretch going down [illegible] The roads consist of a material which packs hard under traffic. The trip requires two hours, of which 20 minutes are required for loading and unloading. Six trips per day are made with a total consumption of 18 to 20 gals. of gasoline and 1 gal. of oil costing, respectively, 22 cts. and 56 cts. per gallon. Including 15 per cent depreciation the cost per ton-mile for hauling is 75 cts. The truck is worked with two shifts of drivers and has traveled 6,000 miles on one set of tires which are be- [illegible] cost of hauling by teams would be from $1.50 to $2.00 per ton.

Cost of Taking Topography by Transit and Stadia.

During the last winter the writer made a topographic survey by the transit and stadia method of a 180-acre tract for the purpose of platting the fence lines, streams, buildings and land corners, together with 2 ft. contours on the general contour map of the city. The land in question was within the city limits, though outside the platted portion, and was what is generally termed rolling prairie in nature, with few buildings and one general drainage system running lengthwise throughout the entire tract. It lay in a long strip about ¼ mile wide and 1⅛ miles long. As we had no regular stadia board at that time an ordinary level rod was used for that purpose, which, owing to the small size of the graduations, limited the length of shots to an average of about 400 ft. to keep within the desired limit of accuracy. This made it necessary to run a line of transit points down the center of one-half of the tract and back the other half, which was about double what would have been necessary had a regular stadia board been used. The transit points were marked with a small hub and not tacked, and the vertical angle and wire interval were checked by backsight on each set-up. In reading all wire intervals the level rod was turned upside down so as to be able to set one wire on the zero. This lessened the chance of making a mistake in the foot reading, though it perhaps increased the chance for making a mistake in reading the tenths and hundredths because the figures were inverted. The transit had disappearing stadia wires, which necessitated re-focusing the telescope every time the wires were thrown in or out of view, and consumed no small amount of time. The vernier to the vertical arc did not fit closely to the graduated scale which made it difficult to read the vertical angle quickly and accurately, especially in bad light. The weather was very disagreeable at times, frequently the temperature was as low as zero, and nearly every day a strong wind was blowing. The advantage of making the rodman move faster between shots was offset by the disadvantage to the instrument-man. The writer was in charge of the party and kept the notes. One man ran the instrument and another handled the rod, both being fairly well acquainted with their duties. While the instrument-man had to wait occasionally between shots, it was seldom, and showed that two rods were unnecessary under the conditions mentioned.

The final check on the line and bench mark started from, revealed an error of 0.4 ft. in level and 0°-12′ in azimuth, which was close enough for the purpose desired. Larger errors in both level and azimuth were discovered by checking on previous transit stations, and altogether two hours were lost by the party in retracing the line and checking up. The average distance from the office was 1½ miles and required from 15 to 20 minutes from the time the party left the office to get set up ready to start work. On good days an average of 70 to 80 acres was covered, including the time going and coming. The cost of the work per acre was as follows:

[illegible]	[illegible]
[illegible]	6.48
[illegible]	6.48
Horse and wagon, 20¾ hours at $0.09⅜....	1.95
Total for 182 acres	[illegible]
Per acre	$0.126

It will be noted that the rodman was a higher priced man than was necessary to do the work required, but he was the only available man at the time. The cost of working up and platting the notes taken on the above survey at $0.37½ per hour was $0.035 per acre, making a total cost of $0.16 per acre for the survey complete on paper. In making the above survey nearly 2½ miles of line were run, while with stadia board less than half of that would have been necessary. However for small jobs, and where one is not equipped specially for that work, the writer believes the above cost to be fair average for work done under similar conditions.

ARTH AND ROCK SECTION

s f Sinking Shafts in Rock for e Rondout Tunnel of the Catskill Aqueduct.

(STAFF ARTICLE.)

ot of the rock gorges at the location uct crossing of the Rondout valley necessary to place the tunnel low the ground at the upper t the lower end. The characountered in the preliminary enced this location to some shafts were required for the the tunnel at such a rate as 4½ years. To determine the hi it would be possible to sink the d unnels two experimental excavade which gave results upon te was based and which were the work. The rate assumed was nth for a shaft in shale and 20 in Shawangunk grit.

of May 8, 1912, we published f the shaft sinking in earth a paper by Mr Lazarus efore the Society of Municipal New York City. This article ne source describes the shaft [illegible]

et of the work the T. A. Gillespie Co. secured the services of two shaft-sinking organizations from the coal regions of western Pennsylvania, the Dravo Contracting Co., for Shafts No. 1 and No. 2; the S. J. Harry Co. for Shafts No. 3, No. 4, No. 5 and No. 6. For Shafts No. 7 and No. 8 a skilled shaft superintendent from the coal regions was obtained, and the organization under him was of course benefited by the presence and rivalry of the two others. Nevertheless, although excellent work was done at shafts Nos. 7 and 8 the work here was both slower and more costly than at the others. The shaft contractors having their plants and organization at hand, made very quick starts, plant and men arriving a very few weeks after the letting of contracts. Here, plants were operated independently until the main power house could furnish compressed air.

At Shafts No. 1 and No. 2, The Dravo Contracting Co. installed for each an independent little plant, composed of boiler, air compressors, dynamos, steel head frames, etc. Before the caissons at these shafts had been sunk, the main power house was furnishing compressed air.

Shaft No. 3 was supplied with a complete plant by the S. J. Harry Co., consisting of boilers, compressor, dynamo, headframe, hoister, etc., and the plant operated independently for quite a while, about 200 ft. in depth having been reached before air was supplied from the central plant. At Shaft No. 5 a good-sized steam plant was installed by S. J. Harry. This furnished power for Shafts No. 4 and No. 5. A depth of about 200 ft. was reached at Shaft No. 4 before the main plant was in operation, at Shaft No. 6 an independent small plant was used to sink to a depth of 150 ft. before use was made of the main supply.

A fine little compressor plant was installed by the contractor for Shaft No. 7, and then operated till the shaft reached a depth of about 150 ft. This plant also furnished air for Shaft No. 8, using a part of the main power line.

Although the main power plant was constructed in a very short time, considering its size, the temporary shaft-sinking plants installed at the shafts saved about three months.

THE MAIN POWER PLANT.

The plant was carefully designed as a whole. A careful estimate of the probale amount of compressed air needed was made at the outset, and is as follows:

	Cu. ft. per min
8 hoisting engines	2,600
15 headings, 6 drills each, assuming ½ working at a time	5,600
Miscellaneous use of air........................	1,000
Total	9,200

The contract specified that compressed air [illegible] furnished for a certain minimum pumping requirement [illegible] 150 gals. at 6 shafts [illegible] 300 gals. at two shafts) with an emergency outfit capable of lifting 1,800 gals. per minute from the bottom of the deepest shaft. This figures up to the enormous total of 16,820 cu. ft. of air for pumps alone, or a total of 26,000 cu. ft. of free air per minute compressed to 100 lbs. pressure.

To provide this amount of air, the power house was designed to hold ten cross-compound Ingersoll-Rand air compressors with compound condensing engines. The compressors were the Imperial type X-3, each with an average capacity of 2,400 cu. ft. of free air per minute. Steam at a pressure of 150 lb. is furnished by Sterling and Heine water-tube boilers, operating under forced draft, with a total boiler capacity of 2,500 h.p. In addition there is a large auxiliary plant consisting of pump and Curtis steam turbines for operating the dynamos, the whole being enclosed in a building 80x160 ft. Adjacent to it is a machine shop containing a complete equipment of machine tools, for repairs. The distribution of compressed air was through a 12-in. pipe line, which gradually reduced to 8 ins. at the terminal shaft. The pipe as laid was such as is used in the distribution of natural gas, employing the Dresser joint. Each pipe end is plain except for a slight bead. The pipes are butted together with a sleeve fitted over the end, and between this sleeve and two plates, which are drawn together by bolts, two rubber gaskets are compressed. The pipes are laid on the surface of the ground and lowered in place. As each joint is practically an expansion joint, the pipe can be laid to a very irregular profile. Except in one instance, no joint pulled apart. Considering the length of the line, over 4½ miles, this is very satisfactory service.

Construction on the plant was started July 20, 1908, and by Nov. 4 it began to supply air regularly to the various shafts, and to date there has been only one interruption of service, when, at a very sharp change in grade, the pipe line pulled apart. Moreover, it has never been overtaxed. At the time when all the headings were going at their maximum, its capacity was just reached, showing that it is well proportioned to the work. However, due to trouble with the use of air in very large pumps, a small auxiliary steam plant was installed at Shaft No. 4.

SHAFT NO. 1 IN ROCK

After the shaft had been excavated to rock, through 84 ft. of earth, there remained about 516 ft. of rock to be penetrated to reach subgrade. A good deal of time had been lost in getting ready to sink the caisson, and the progress was about one month behind. Nevertheless, in less than six months the shaft was put down, gaining about six months in the progress schedule of the contract. The first month only about 60 ft. in rock was sunk. The superintendents were changed so that the next month 100 ft. was made, followed in turn by another of 120 ft., and this by the record month of 138 ft. of shaft sunk with 132 ft. timbered. This could not be bettered as the shaft was then near the bottom. There were no shafts on record in this country at the time which had been put down at such a high rate of speed. The same organization later, at Shaft No. 1 of the Moodna Siphon, excavated 168 ft. in Hudson River shale untimbered, and better still, recently, at Breakneck shaft, sank the shaft 183 ft. in granite. This is undoubtedly the best record for the United States. The best depth made in any shaft of record is that at New Klempintown, South Africa, 213½ ft. in one month, probably made by hand-drilling and Kaffir labor.

While the design of the shaft was under discussion, there was considerable hesitation in adopting the circular shafts, as up to a very few years ago they were practically unknown in this country, although universal in England and largely used in other countries. It was claimed by many American contractors that they would prove to be slow and difficult to excavate to line. This was apparently borne out by the experience of the contractors for the Hudson River test shaft, who, however, tried to operate without skilled shaft-sinkers. An investigation showed that in England from 3 to 6 ft. per day was readily made in circular shafts by skilled shaft-sinkers, including simultaneous brick lining. As there appeared to be no intrinsic reason against them, the circular section was adopted for all the permanent shafts.

The first superintendent in charge of No. 1 had no experience sinking shafts of circular section, and at first it appeared that it was going to be slow work sinking and hard work trimming to the circular section. The first 60 ft. or so of Shaft No. 1 approximated the rectangular section due to the use of too few trimming holes, and the work of trimming out to make room for the segmental timbers was very slow. Another superintendent was secured with some experience in circular shafts, the first superintendent going to Shaft No. 2, a rectangular shaft, where he did excellent work.

The Dravo Contracting Co., in charge of the work at Shafts No. 1 and No. 2, imported a complete shaft-sinking organization from one of the contracts in western Pennsylvania or West Virginia. The men were Slavs, originally from southeastern Europe. The superintendent and foremen were Americans. The men appeared to be the steadiest, the hardest working and in their own particular sphere the most skilled, it has been my good fortune to see.

Mr. Styles, the superintendent, aimed to have a complete cycle of shaft-sinking operations in one day and not to attempt to make a greater advance than consistent with such a cycle. By this method, one day's advance while mucking was increased from 5 to 6 ft., and monthly progress, including timbering, from 100 to 138 ft. During the whole of three months, one could come here while sinking and find the men engaged on exactly the same work at a given time of day.

During the first shift, all the holes in the shaft were drilled from tripods. The rock, being Hamilton and Marcellus shale, was easily drilled. A circle of holes, called the cut holes, were first drilled to a depth of 8 ft., top of holes 5 ft. 6 ins. distant from the center of the shaft. The holes were readily located from the bucket hoisting rope swinging in the center of the shaft. They sloped inward to blow out a cone. The second row, called relief holes, were drilled 6 ft. de
in. radius. The third or trim
in all and 6 ft. deep, were plac
line, or effective breakage line
were drilled quite close togethe
ing of the trimming holes is pa
essary in circular shafts. They
trimming and give the true sh
drillers and five helpers in the sh
5 hours to drill 31 holes, a total
ft., at an average rate of drillin
hour. The remainder of the 8 h
in hoisting drills, etc., out of
in "shooting" the central cone b
6 cut holes.

The second shift consisted of
the exception of one or two dri
the blasting and any odd drill
They mucked out the sump a
second round of relief holes. T
consisting entirely of muckers, w
the material thrown down by th
or rim holes. Usually, I belie
work is to have the shaft clean
time the drilling shift arrives.
method, during the record mo
1909, an average of 5 ft. 9 ins.
advance. This corresponds to
of rock shoveled into buckets in

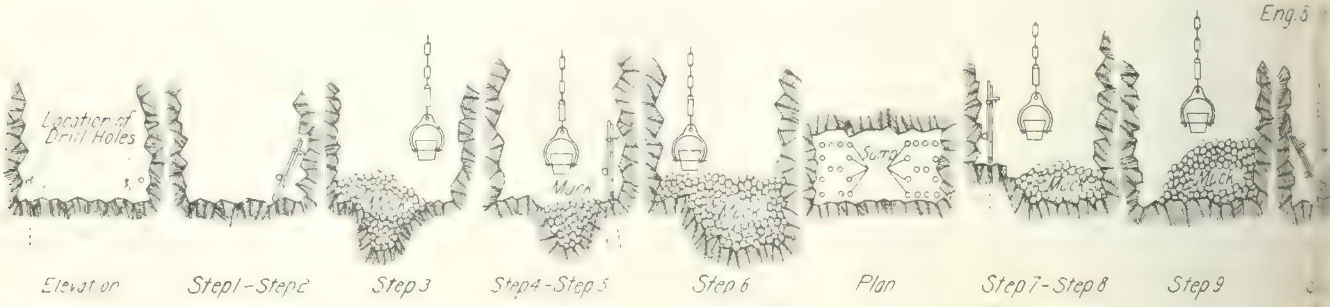


Fig. 1—Sequence of Operations in Sinking Rectangular Shafts, Rondout Siphon, Catskill Aqueduct.

hours. Each man filled about fi
muck in his shift, which is very

During the record month, dril
on 24 days, each day making a
vance of 5 ft. 9 ins. Four of t
Sundays when no work was d
exception of some timbering. T
only 8 shifts. Not only was t
faster and truer to shape than
the timbering was also done bet
faster than elsewhere. Durin
month, if the shaft had been
down without timbering, it is p
working on Sundays 170 ft
have been sunk. However, only
of rock wall was allowed to be
time. Hitches or niches in the
cut and on them heavy round
ber were placed parallel to the
bers placed above. On these "d
first set of squared segmental
placed. The next set would be p
so as to space bents 5 ft. apart,
between, lagging spiked on, and
tween rock and lagging thoro
with cordwood. To facilitate th
genious platform was devised
built in three parts, so that by m
fastened to each it could be rais
at a time, by the winding rop
bent, and on it as a secure and
work the men could place lagg
ing. In the other shafts, platf
plank were used which were not
move, but were insecure, and c
erable loss of time.

In commenting upon the prog
No. 1, it must be noted that the
favorable, it being a dry and
about horizontal layers which
the holes placed. But, neverthele
a remarkable organization and
achieve the results noted. In add
bonus was given based upon a m
ress of 90 ft., each 5 ft of tim
ing as one foot. During the r

ned about 10 per cent of th[illegible] is. This was amply sustained in [illegible] cost per foot of shaft lining

oted that the waterway shafts of Siphon were all timbered before [illegible]. As all the timbers had to be ore concreting, the question nat- Why not sink in short sections as you go down? This was con- n the designs were originally t at that time it was thought to ced a practice to be ventured on k of this character. The argu- t the shaft-sinking would be de- concrete lining and therefore de- el. It was also thought that a could be secured by concreting tom up in one stretch. There is argument against concreting r but all the later siphons have shafts concreted in short le sinking, no timbers whatever the shafts. It is thought that omy is effected by omitting d using the concrete lining rt the sides. This method advantage in sinking through that the concrete cuts off much into the shaft, and whatever seams are encountered may be away to ring pumps. In addi- ifficult to get ordinary concrete in deep shafts, shaft-sinkers set the forms much quicker.

w of Head Frame and Cages, Shaft 1, Rondout Siphon Tunnel, Catskill Aqueduct.

to interrupt the work in the shaft lining was going on, it place the cages in an inde- in the center of the shaft so could be placed while the cages on. The contractor chose, how- much larger cage than contem- sign, and this feature was sac- btful whether the form for lining could be satisfactorily with the center of the shaft cage timbering. Where mason- monly placed while sinking in s usually employed. However, concrete-lined shafts are com- been employed by the U. S. Steel Co. in the elliptical shafts of their West Virginian mines. These shafts are not timbered, but the concrete lining was placed while [illegible] Moodna siphons. The elliptical shaft gives more cage room for a given area than the full circle used in our siphons. The enlargement of the shafts had to be made at the expense of the contractor, as the prices bid were per linear foot. The contractor was given the option of enlarging the temporary shafts if he deemed it advisable. In this case, the area excavated was increased about 70 sq. ft., or 31 per cent, allowing increased cage areas of over 100 per cent. This probably increased the cost of the shaft only about $10 per ft., as it meant only that much more mucking and somewhat larger timbers to handle. On a 500-ft. shaft this would amount to only $5,000, a charge of only 5 cents per yard of muck and concrete handled. This additional expense was more than compensated, in my opinion, by the increased capacity of the cages, and freedom of getting materials in and out of the tunnels. Tunneling and concreting, at times, has to be forced at the highest obtainable speeds, and averages are deceptive. For instance, over the entire period of this contract, only an average of 7 cu. yds. per hour need be handled by two cages, whereas at Shaft No. 7, during the maximum tunnel driving (also the most economical), 20 cu. yds. of muck per hour were removed. In addition, men and materials had to be lowered and hoisted, taxing even the large cages to their capacity. During concreting, as much as 30 cu. yds. were placed per hour. The additional room provided was invaluable at Shaft No. 4, where at times even the enlarged space was crowded with pipes and pumps.

On the basis of Gillespie's experience, the Degnon Contracting Co. adopted even larger shafts for the Wallkill than were used on the Rondout, and, so far as known, never regretted it.

Larger cageways are secured at the circular shafts by rearranging the timbering, doing away with the independent tower. Nevertheless, these cages were about 1 ft. narrower than those used in the rectangular shafts, causing the use of smaller cars for muck and concrete. This was something of a handicap, and there was not the same freedom as at the other shafts.

Too much is made of the analogy between deep tunnels driven from the bottom of shafts and mines. Superficially they are much the same, but actually quite different. A mine has many levels and workings, so that materials can be regularly moved toward the shafts, thus using the cages at about maximum capacity for the whole day. For the deep tunnels, we have only two headings and two small working faces, from which the muck comes only intermittently, due to the interruption from blasting, etc.; thus, at times, the cages are nearly idle, at other times worked up to the maximum capacity. Mining men have not been found to work well in the long, straight-away driving of tunnels, as they are used to independently working in small gangs in the workings, and laying off at their own convenience. A tunnel, to go well, must have the men under strict discipline, reporting every day at the same time and working at the same speed throughout one shift. This proves irksome to mining men, who usually drift away from tunnel jobs. Similarly, mining engineers do not do the bulk of tunnel-driving. Long tunnels are usually in charge of civil engineers, or superintendents, not especially identified with mining work.

SHAFT No. 4 AND TUNNEL No. 4 NORTH

By far the greatest difficulties encountered in the construction of the Rondout Siphon were those at Shaft No. 4. Here the porous Binnewater sandstone and High Falls shale had to be penetrated both in shaft and tunnel. In the shaft they yielded a flow of 1,000 gal. or more per minute, and even more in the tunnel. These difficulties, by the energy, skill and persistence of the contractors, were finally overcome by replanting the work several times, and, in the case of the shaft, by the free use of grout in cementing the open seams.*

Great credit must be given to the T. A. Gillespie Co. for their energy and for their willingness to spend large sums in combatting the water with the most improved pumps and devices which could be obtained.

A Small Power Tamping Machine for Trench Backfilling.

A machine for tamping backfill in trenches which have been opened through pavement is shown in the accompanying illustration. Two laborers can tamp with it from 1,200 to 1,500 sq. ft. per hour, covering this surface one time. The machine strikes fifty to sixty blows per minute with a 12-ft. stroke, and with a tamping head weighing 80 or 90 lbs. and 8x9 ins. in area.

The machine consists of two principal parts: the sweep, on which is mounted the lifting mechanism, the engine, and the two-wheeled truck on which the sweep is mounted. The sweep of the standard machine is built of two 3-in. steel channels, with the necessary spacers, bracing, and truss rod. The sweep is mounted near its center of gravity, on a saddle casting which has a bearing on a pivot on the truck axle. The sweep swings in a horizontal direction on this pivot, thus moving the tamper across the work, while the movement along the work is had by moving the track forward about 8 ins. for each complete swing of the sweep. The truck of the standard machine has 4x36 in. steel wheels and a 1½-in. arched steel axle. The truck frame is formed of one-piece of 2x2x¼-in. angle. The steel axle spindle is cast into a square socket through which passes the vertical leg of the axle; the axle at this point is pivoted with about 8 ins. of vertical adjustment, and a like amount of adjustment is provided in the cast iron shoe on the bottom of the truck legs. This adjustment will allow the machine to be operated with one wheel on the curb or other unlevel surface, and is a valuable feature when the machine is required to work close up to the curb.

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*Engineering & Contracting, April 1, [illegible]

The lifting mechanism is very similar to the well known board drop-hammer used in drop forge shops. The mechanism as applied to the power tamping machine is even more simple than the drop-hammer. This lifting mechanism consists of two parallel rolls mounted on shafts running in bearings bolted to the sweep; the rolls are geared together by spur gears, and are driven by a pinion gearing into the gear on the rear roll; the driving shaft runs in bearings bolted to the sweep. The length of stroke as well as the gripping and releasing of the lifting board is automatically regulated by cutting away a part of the circumference of the lifting rolls, thus the board is automatically gripped, raised and released, once for each revolution of the lifting rolls.

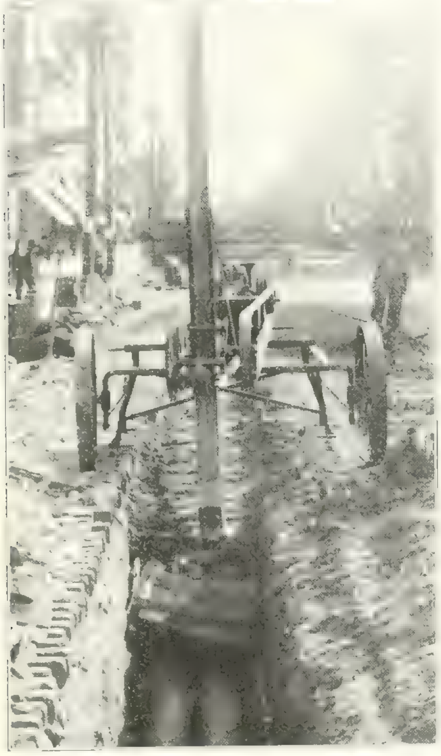


Fig. 1—View Showing Construction of Tamping Machine.

The engine used on the machine will develop about 1⅜ h. p. on the brake and has proven to have ample power to handle a 100-lb. tamper. The engine requires 1½ gals. of gasoline in 10 hours.

The machine is regularly equipped with a 10-ft. lifting board, which will allow the tamper to reach a depth of 6 ft. This will be found to answer for trenches up to 9 ft. in depth. Where conditions require it, however, the lifting board may be made as long as 16 ft., which will allow the tamper to reach 12 ft. below the surface.

While one man can handle the machine on small trenches and surface work where the footing is good, on trenches that are wide or where the footing is soft, it will pay to have two laborers handle the machine, putting one man on each side of the machine, where they will be in the best position to keep the machine moving along the work and the sweep across. The power machine with two men to handle it should do as much work as from 8 to 10 men using the hand tampers, as the power machine will not shorten the stroke or reduce the number per minute, for this is automatically regulated, and the operator can give his whole attention to moving the machine over the work.

The machine is known as the Staley Power Tamping Machine, and is sold by James C. Campbell & Co., Chicago.

Methods and Cost of Operating Automatic Railways for the Storage of Materials in Bulk.

Contributed by A. Eugene Michel.

The automatic or gravity railway for carrying sand, cement, coal or bulk materials from railroad cars or vessels to storage bins or piles, is not a new appliance but it is capable of effecting such economies that its utility on contract work should be more familiar. Railways of this type are now operating on inclined runways within a distance of 600 ft. and under a wide range of conditions.

The operation of the railway consists in releasing a car with its load on a down grade on a trestle and stopping it by means of a counterweight attached to a wire cable which the car picks up on its way down the track. The weight of the counterbalance is so adjusted that it will allow the car to reach its destination over the bin or dump, where it is dumped by means of a tripping block. Then the momentum of the car having been spent, and its weight reduced, the counterweight falls back to its former position. In doing so the car is given sufficient momentum to carry it back to the point for receiving another load.

By reference to Fig. 1, the car may be seen, together with the cross-bar,—attached by wire cable to the counterweight—the truck, and dumping block. A section of the car is shown by Fig. 2. In this is clearly seen the method of opening the sides and discharging the load. The angle of the raised bottom shown in the figure may be made to suit the class of material handled.

The standard types of car are built of one and two tons' capacity with the ridge in the center so that all the material will discharge simultaneously and equally and without danger of overturning. The sides are fastened to each other so that one side cannot open unless the other side opens equally at the same time.

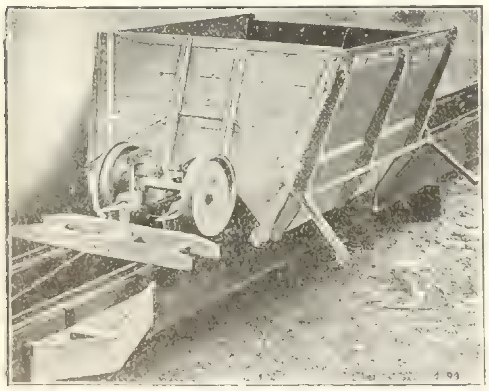


Fig. 1—View of Automatic Railway Car, with Crossbar, Tripping Block and Truck.

An installation of the automatic railway where 5,000 tons of ore are handled daily, is at Port Henry, N. Y., at the Cheever Iron Ore Co. In this case two railway lines of the Hunt type, made by the C. W. Hunt Co., New West Brighton, N. Y., carry ore from headframe storage bins to oth bins separating mill. The headfram is 200 ft. from and the trestle uneven ground has a grade

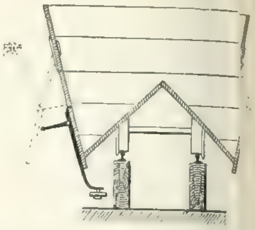


Fig. 2—Section of Automatic Showing Bottom Angle and ripping Device.

3 per cent. A grade of 1¼ per on the scales platform and in t the drop is 18 ins., while the gra from this point to the last 60 level. The other headframe is from the mill storage and the t given a fall about 9 feet.

Wooden cars, plate-lined, and capacity are used. Two men automatic systems. After dra storage from one bin they unl other storage. The car is loade frames and weighed on a 50-t Ore may be drawn from any chutes, all of which are opened erated by air hoists.

On the shorter system, a roun in 30 seconds, while 45 seconds in locking the car gates, loading the car. On the longer system, is made in 45 seconds and the consumed in loading. At this railways can handle about 5,000 of two 10-hour shifts, and perm delay during the 20 hours' work to this capacity, the transport crude ore from the headframes would be less than ¼ ct. per t cludes labor and maintenance an an approximate charge per ton fo

Another plant in which an auto effects important economies is t Quinlan, New York. In this in tons of coal are handled annually shown in Fig. 3. The coal is hois of an electric hoist from the c 1/3-ton tubs, on a mast and gaff matic railway car by which it i in the yard.

Fig. 3—View of Installation of Automatic Railway for Handling Coal fr

With the previous equipment, hoisted by horse power and trimm stock pile. The old equipment co new one $2,800. The unloading c the old plant was 120 tons per d new machinery the capacity is 2 day, an increase of 80 tons.

The power is purchased by me per horse-power-hour, and costs mills for each ton of coal hoist livered to the car.

required to operate the new plant,
e coal from the vessel to the stock
ollows: Three shovelers are em-
e hold of the vessel, one man op-
lectric hoist, another dumps the
car, weighs it, and attends to the
ilway.

of handling to the stock pile, in-
depreciation included, was, with
17¾ cts. per ton; with the new
[illegible] 7¼ cts., the comparative [illegible]
being analyzed in Table I.

TABLE I.

New Plant.

	Per day.
[illegible] tons	
at $1.[illegible]	$ [illegible]
$2.00	[illegible]
[illegible] weigh and tend a [illegible]	
	[illegible]
r, oil, waste, etc.	2.00
taxes yearly, 10 per cent	2.24
[illegible] 10 per cent	[illegible]
[illegible] based on a year of 12[illegible] days' work.)	
	$[illegible]
[illegible] in stock pile	[illegible]

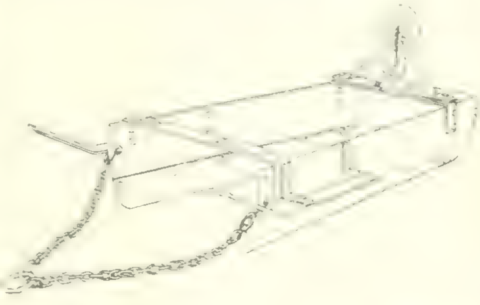
Old Plant.

	Per day.
ity 120 tons.	
[illegible]	$ [illegible]
s and driver, at $3.00	9.00
[illegible] driver, at $[illegible]	[illegible]
[illegible]	[illegible]
axes yearly, 10 per cent	1.40
yearly, 10 per cent	1.40
ems based on a year of 125 days' work.)	
	$21.30
ton in stock pile	17¾c

[illegible] of 10½ cents per ton on
[illegible] an actual saving of $2,62[illegible]
us every 13 months the cost of
is saved in reduced pay roll.

craper for Loose Material.

[illegible] sketch shows a scraper
ch used in the Joplin, Missouri,
t for loading mine tailings into
[illegible] prove useful for handling
of other kinds. As shown by
is scraper has no bottom and
he material by pushing it ahead
operated by means of tail and
[illegible] two-drum engine [illegible]
[illegible] is 5 ft. 2 ins. long, 3½ ft.
and 4 ins. wider at the rear, and



Simple Drag Scraper for Loose Materials

quipment for Sinking a aft and Costs of Power.

electrically driven shaft sinking
ksburg, South Africa, has been
nsiderably more economical than
orary steam plant. The sinking
e shafts usually occupies a pe-
three years, and it is therefore
install at once the permanent
nent. With the electric power
rchase from the Victoria Falls
has been possible to install a
nt which will pay for itself in
shaft sinking by the difference
power. A description of the
of sinking is given below as
an article in the *South Af-*
[illegible]

d, the approximate dimensions
ll be 43 ft. 6 ins. wide, 7 ft. 6
[illegible] ft. deep, divided into six
ments and one pipe-and-lad-
first work carried out at this
ink for some 10 to 12 ft. by
ble steam cranes, and then to
[illegible] set. As soon as this was
head-gear was erected, but
sheaves over four compart-
e same time two double-drum
hoists were erected in a tem-
ouse located between the head-
ojected site of the main wind-
etails of the hoists and their
follows: Drums: Two per
eter, 2 ft. 3 ins. wide. Brakes:
post brakes on each drum.
hand brake on first-motion

shaft. Gearing: Double reduction. First-motion, double helical power-plant steel gear. Second-motion, machine-molded cast-iron gear. Depth indicators: Dial type, without overwinding attachment. Mine shaft: Vertical, final depth 3,000 ft. Load, 3,000 lbs. of rock. Skip: 2,500 lbs. Rope: 1-in. diameter, 4,500 lbs. Hoisting speed: 1,000 ft. per minute. Each hoist is driven through an elastic coupling by a 180 b. h. p., three-phase, 50-period, 500-volt, Westinghouse, type A. I. F., slip-ring induction motor, capable of carrying a load of 450 b. h. p. for short periods. Power is obtained from the high-tension lines of the Victoria Falls and Transvaal Power Co., Ltd., and transformed to 500 volts for the hoists and auxiliary apparatus. The control of the hoists is effected by standard Westinghouse liquid controllers. By means of these controllers the hoists are stopped, started, and reversed at any speed from zero to full speed in either direction. A main switchboard of three panels is supplied.

The sinking of this shaft entails a good deal of blasting. Should the supply of electric power cease whilst the sinker is starting a blast, his means of escape would be cut off, with almost certain death as the result. This power storage set consists of an exciter, a synchronous motor, which may act as a generator, a heavy flywheel running in heavy bearings with forced lubrication, and a starting motor for bringing the synchronous motor up to full speed. The synchronous motor is connected directly to the line, and automatic devices are arranged so that a failure of the power supply causes the main circuit to be interrupted. The power for driving the hoist is then derived from the flywheel until power supply is restored. In this case the generator is of the 150-kilowatt capacity, running at 750 revolutions per minute, and the flywheel in slowing to 375 r. p. m. gives out sufficient energy to run the set light for five minutes and then hoist a load of 700 lbs. in the skip through a distance of 400 ft., bringing the sinker out of danger.

The power-storage set is only in operation during the blasting period, and seldom for more than half an hour at a time, three times in 24 hours. The manner in which it is operated is as follows: When all the shot holes are drilled the shaft is emptied of workmen and the sinker descends to charge the holes. About 15 minutes before he is ready to light the fuses, the sinker sends a special signal to start the power storage set. Another signal is sent as soon as he is ready to fire the charges, and the engine driver raises and lowers the skip about 2 ft. to show that all is right. The sinker then lights the fuses, gives the hoist-away signal, and is carried out of danger whether the power supply has failed or not. The value of the power-storage set is shown by the log kept on the mine. It is recorded that in five months seven interruptions occurred, one being during blasting, yet in every case the skip has been brought to safety. The value of this feature cannot be exaggerated, while the knowledge that their lives are adequately safeguarded inspires the men with an easy confidence in working which more than compensates for the cost of installation. These interruptions of power are due, of course, to the great difficulties under which the Victoria Falls and Transvaal Power Co.'s stations operate, for there are few places in which thunder storms are so violent and so frequent. These difficulties would not be experienced to such a degree in countries having a more equable climate. A record of the distance sunk with the equipment up to May 31, 1911, is given here

	Ft sunk.	Cost of [illegible] for hoists.	Cost per ft.
January, 1911.	142	[illegible]	$1.86
February, 1911	[illegible]	151.53	[illegible]
March, 1911...		[illegible]	2.0[illegible]
[illegible]	116	285.77	2.46
May, 1911.....	153	389.60	2.55
Total	[illegible]	[illegible]	$[illegible]

Note.—66 ft. were sunk in December, 1910, before using electrical equipment.

The cost of power varies, but averages $1.28. The cost of the two hoists and flywheel set delivered in South Africa, but not including erection or cables, was approximately $24,350. Records show that the cost of sinking 148 feet with a steam sinking hoist was approximately $867 for power under conditions similar to those in which 142 feet were sunk by the electric hoists at a cost of $264.46. This means a saving of $3.99 per foot in power alone. In addition to this, it is estimated that there is a further saving of $5.00 per foot due to the delicate control of the electric hoists which enables them to carry out maneuvers impossible to a steam hoist. On this basis the hoists and power-storage sets will pay for themselves before the shaft is completed, and even then would possess considerable value at second hand, as such hoists are by no means worn out in three years. Messrs. E. Farrar and J. N. Bulkley, consulting engineers to the General Mining and Finance Corporation, have kindly permitted the publication of the figures taken from their log books.

Cost of World's Deepest Diamond Drill Borings.

What is claimed to be the world's deepest boring is a hole 7,347 ft. deep drilled in Upper Silesia. The boring as described by "Mines and Minerals" was undertaken to determine the relations of the coal beds in the Knurow royal mining district, and was conducted by the Schoenback division of the Prussian Royal Drilling Bureau. The locality of the drilling is 2.1 miles north of Czruchow village, in the Rybnik district. The drill used was a crude combination of the scoop, or wimble, chisel and diamond-bit types, in conjunction with water rinsing. Operations were begun Sept. 25, 1906, but the outfit was not installed until Oct. 15.

The mouth of the hole was 1.44 ft. wide, exclusive of casing, but the diameter gradually diminished to 3⅝ ins. at a depth of 3,214.17 ft., which also marks the lower limit of casing. From this point down to 5,546.79 ft. depth the diameter was 0.30 ft.; down to 5,649.06 ft. the diameter was 0.221 ft.; down to 6,848.64 ft. the diameter was 0.164 ft.; the remainder of the hole is 0.157 ft. in diameter.

A total of 982 days was consumed in drilling, including 169 Sundays and holidays, and 119 days in accessory operations, as in drill repairing, etc., leaving 694 net working days. The maximum speed attained was a 24-hour record of 54.87 ft. with the 3⅝-in. diamond bit. Altogether 704-3/32 carats of diamonds were consumed. The total cost of the drilling was $77,043.57, representing an average of $1.04 per foot.

The list below shows the Prussian drillings exceeding 5,250 ft. in depth, and the cost per foot.

	Depth, feet.	Cost per ft.
Hoetmar	5,329.21	$0.547
Schladebach	5,734.70	0.850
Ottweller	5,915.02	0.521
Everswinkel	[illegible]	[illegible]
Paruschowitz V	[illegible]	[illegible]
Schubin	7,050.20	0.480
Czuchow	[illegible]	[illegible]

The deepest hole in South Africa was made with a diamond drill and put down 6,340 ft. to cut the main reef. The hole was 2 ins. at the start and 1⅝ ins. in diameter at the bottom. A Sullivan machine was used.

ROADS AND STREETS SECTION

Methods and Cost of Constructing a 3-in. Creosoted Wood Block Pavement at Longview, Texas.

Contributed [illegible]
C. E., Consulting Civil and Sanitary Engineer, 17 N. La Salle St., Chicago.

Longview is a typical southern city of east Texas. It has a population of about 8,000 and is growing very rapidly. It has never had any considerable amount of public improvements until within the last year or two, when some macadam pavements were constructed outside of the business center of the town. These macadam pavements were constructed on entirely wrong principles, so that in less than a year they were in very bad condition. In the spring of 1911 the city decided to pave the central business part of the town with a permanent pavement and on Aug. 11, 1911, received bids on approximately 17,000 sq. yds. of brick or creosoted wood block pavement on 5 ins. of concrete. The specifications called for No. 1 brick to have a 2-in. sand cushion and the joints to be filled with asphaltic cement; and the wood block to have a 1-in. sand cushion and the joints to be filled with sand.

The low bid for the brick was $2.35 per sq. yd., including a 5-year guarantee; for the wood block the bid was $2.41 per sq. yd. under the same guarantee. The specifications for the brick called for a 20 per cent abrasion test in the new standard rattler as recommended by the Association for Standardizing Paving Specifications. The wood block specifications called for yellow pine timber, the blocks to be from 5 to 10 ins. long, 3 ins. in depth and 4 ins. in width. The preservative specified was the best grade of coal tar creosote having a specific gravity of from 1.03 to 1.07, and to contain not less than 25 per cent of napthalene and 25 per cent anthracene.

Considerable attention has been given by the writer to the quality of the oil to be used in preserving wood block, and it is believed that there is little question but that the light oil as specified is more desirable. It has been maintained that what is desired for paving purposes is a waterproofing product rather than a preservative. In connection with this assertion it is stated that the block treated with a heavy oil, having a specific gravity of not less than 1.10, is more desirable than the light oil because its waterproofing qualities are greater. It is not believed that this contention is sound. Numerous experiments have shown that light oil is an efficient waterproofer, and that it has in addition much greater preservative qualities because of its greater content of napthalene and anthracene oils than has the heavy oil in which the preservative agencies are either distilled off or when the oil is made of a high specific gravity by mixing the light and heavy oils the quantity of the preservative oil is so far reduced as to be of small value. In addition a higher temperature and greater pressure is required to get the same degree of impregnation in the timber with a heavy oil than with a light oil, and there is also the possibility that the quality of the timber may be adversely affected by the high temperature. There is unquestionably also much less probability of "bleeding" in the blocks when treated with a light oil, and this was especially noticeable in the work described in this article, for even under the hot sun of Texas there was little tendency on the part of the blocks to bleed.

As stated previously the bids on brick were $2.35 and on the block $2.41. Because the wood block is less noisy and more attractive in appearance than brick, and because also in such a location as Longview it is probable that the life of the pavement would be at least 20 years, it was decided to let the contract for a wood block pavement.

It might be noted that the work was to be paid for from the proceeds of a bond issue, the bonds to run for 40 years with the privilege of retiring them at the end of twenty. It need hardly be stated that this is not good financiering, as it is hardly probable that the pavement will be in good condition at the end of 40 years when the bonds mature.

That part of the city to be paved consisted of five blocks arranged in the form of a right-angled cross. The grades, as is usual in a city which has never established any, were in frightful condition, though the natural drainage facilities were excellent. The subgrade consisted of a red sandy clay. The specifications called for 5 ins. of concrete upon which was to be spread 1 in. of sand as a bed for the blocks, and on top of this the pavement proper was to be laid. The city had purchased a second-hand jaw crusher having a capacity of about 60 cu. yds. of crushed stone per ten hours. This was done with the idea of crushing the local stone, which was an inferior iron stone, and furnishing it to the contractor at a stiplated price, as shown on the bidding blank, of $1.25 per cu. yd. It was found, however, that not enough stone was available, and a supplemental agreement was made with the contractor in which he furnished bank run gravel and received $2.45 per sq. yd. for the completed pavement instead of $2.41 as originally bid. This gravel was a good grade of material somewhat impregnated with the red clay which is characteristic of this section of the country, and a yard of this as delivered contained about 8/10 of a yard of gravel and 5/10 of a yard of sand.

Concrete specifications called for a mixture of one part cement, three parts sand and six parts stone, but stated that the amount of cement used was to be at least 1 bbl. for each 8 sq. yds. of foundation 5 ins. thick. This proportion was maintained in the gravel used, and resulted in a very dense strong concrete, which was difficult to shatter with a 12-lb. sledge after seven days.

A combined curb and gutter of unusual design was constructed. The curb itself was 6 ins. thick and the gutter but 12 ins. wide. The foundation face of the gutter was 10 ins. thick, decreasing to 5 ins. at the back of the curb. This style of gutter was adopted because it was thought that a wider gutter was unnecessary, all that was desired being, first, that a line of drainage should be established, and, second, that the source of weakness always developed at the junction of the gutter and the pavement be eliminated. A great many instances of failure where the usual thickness (5 ins.) is specified may be noted. This is only natural since it is absurd to think that the 5-in. concrete gutter will stand the wear and pounding as well as the pavement on top of the 5 ins. of concrete foundation.

The sand used for the bed for the blocks was a fine local sand carrying considerable clay. It was well suited for the sand bed since it would stand a very considerable washing, such as it would receive in a rain storm. It was observed that after a heavy rain lasting 24 hours there were but little signs of washing of such sand as was exposed and that during the entire time of the rain the water draining off from this sand bed ran clear.

Yellow pine having annual rings averaging not less than eight to the inch was specified for the paving blocks, and in no case were
the annual rings to be less tha
inch measured radially. Such a
called for a very good grade of
siderable difficulty was found,
maintaining this standard, as a
the timber shipped in by the
had four or less rings to the i
probably a poor quality of sho
The six to the inch standard
maintained with the result that
of culls was 7 per cent, or nea
yds. These culls were afterwa
paving an alley where the we
would not be so great.

Part of the wearing surface w
hot dry weather, and this afforde
opportunity for observing the e
pansion and bleeding. Expansio
wide had been made at each c
roadway being 70 ft. in widt
verse expansion joints were us
been stated previously, the filler
ment was sand thoroughly sw
joints, and the expansion joint
were filled with asphaltic ceme
inally planned the blocks were to
gutter to gutter at right angles to
but at the request of the contra
allowed to lay two longitudina
blocks at the gutter lines and d
pansion joints between these
When the work was half finishe
dent that this was a mistake.
tudinal joints are not bonded or
rest of the pavement and have li
resistance to transverse pressu
phaltic filler tends to get slightly
and expansion taking place across
forces the longitudinal blocks up
would then be forced still furthe
making it difficult to get the bloc
original position. It was then d
turn to the original method o
blocks, and no further trouble
enced from this source.

During the latter half of the w
verse conditions prevailed, there
most continual succession of hea
this climate there is not much
but in the late fall and early w
in November and December, t
very heavy. The blocks therefo
opportunity to become thoroughly
with water, and according to s
should have bulged in every dire
ing like this happened, however, a
no movement that was not take
the expansion joints.

In the center of one of the st
antiquated horse car line. On a
financial condition of the company
line it was impossible to provid
and the old rails consisted of a
about 20-lb. weight. The block
between the rails, and it was in
that the only real trouble from c
curred. These blocks bulged alo
line of the railway, and rep
seemed to do no good. Betw
there had been no provision f
made, as it was not thought
within the short width of the ga
ins.) expansion would be noti
finally decided, however, that th
rails were deformed by the press
outside, and this pressure being

TABLE I.—CHARACTERISTICS OF CREOSOTE OIL USED AT LONGVIEW.

Specific Gravity.		Distillate.						
		150° to 170°		170° to 235°		235° to 300°		
Specified	Obtained	Specified	Obtained	Specified	Obtained	Specified	Obtained	Specifi
1.03 to 1.07	1.048	0.015	0.0	0.35	0.2079	0.35	[illegible]	Soft
	1.044	0.015	0.0	0.35	0.3236	0.35	[illegible]	Soft
	1.042	0.015	0.0	0.35	0.3400	0.35	0.3270	Soft
	1.054	0.015	0.0	0.35	0.3340	0.35	[illegible]	Soft
	1.041	0.015	[illegible]	0.35	0.3360	0.35	0.3200	Soft
	1.044	0.015	0.0	0.35	0.3320	0.35	[illegible]	Soft
	1.045	0.015	0.0	0.35	0.2941	0.35	0.3215	Soft
	1.040	0.015	0.0	0.35	0.3000	0.35	0.3740	Soft
	1.040	0.015	0.0	0.35	0.3000	0.35	0.3740	Soft
	1.040	0.015	0.0	0.35	0.3000	0.35	0.3740	Soft

[illegible] between the rails [illegible] up.

[illegible] of construction aided to bring [illegible] about, and this incident also [illegible] the best of plans [illegible] [illegible]use apparently minor details are [illegible]t was originally specified that a [illegible]ck brick be laid against the in[illegible]ils. On account of the lightness [illegible]ction it was not possible to get [illegible]ck, and hence it was decided to [illegible] blocks directly against the rail. [illegible] 3 ins. high and the necessary [illegible]lowed on the head for the wheel [illegible] in. Hence the end block had to [illegible] on the bottom so that at its end [illegible] a depth of 2 ins., leaving ¼ in. [illegible]ortar bed. A section across the [illegible]veen the rails would then show [illegible]e rise being ¾ in. As has been [illegible]reciable expansion was expected. [illegible]ks might have been beveled on [illegible] at the bottom, but the object[illegible]as that the fresh surface of the [illegible] be exposed to the weather and [illegible] experience showed that this [illegible]en better, for it was the arched [illegible] developed weakness under the [illegible] the outside blocks, as might [illegible]

[illegible]n joint was made down the cen[illegible]k by cutting individual blocks [illegible] asphaltic cement, and [illegible] [illegible]e was experienced from this [illegible]

[illegible]ail of construction, somewhat [illegible] the laying of the brow pave[illegible]r. This was done in order to [illegible]tting or forcing down of the [illegible]e rail, where the traffic is gen[illegible]

[illegible] in the treatment of the blocks [illegible] Table I shows what was speci[illegible] [illegible] London, England.

[illegible]ws the cost in detail of this [illegible] rigid [illegible] [illegible] the Resident Engineer. It is [illegible] accurate.

[illegible] account of the [illegible] [illegible]ble III is the cost account of [illegible] with culls obtained from the [illegible]

[illegible]S OF THE MAIN STREET
W[illegible]

[illegible]in. Pipe (520 ft.).	Total.	Unit
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		.$0.901
[illegible]		. 1.140
[illegible]ipe (1,741 ft.).		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible] (11).		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]		. 15.00
[illegible] Basins (2).		
[illegible]	[illegible]	[illegible]
[illegible]	. 41.15	20.575
[illegible]		$24.775
[illegible]		7.00
[illegible] Manholes (5).		
[illegible]	.$ 49.30	[illegible]
[illegible]	121.00	24.200
[illegible]		[illegible]
[illegible]		27.50
[illegible] including grading (3,427 ft.).		
[illegible]	$1,02[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible] (336 ft.).		
[illegible]	.$ 61.75	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible] rolling (3,200 cu. yds.).		
[illegible]	$1,[illegible]	$0.[illegible]
[illegible]		.30
[illegible] Base (15,242 sq. yds.).		
[illegible]	$1,948.70	$0.127
[illegible]	8,296.40	.544
[illegible]		$0.671

[illegible]		
Labor		[illegible]
Material		[illegible]
Total		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
Labor		[illegible]
Material		[illegible]
Total		[illegible]
[illegible]		[illegible]
Total [illegible]		[illegible]
[illegible]		[illegible]

TABLE III. [illegible]
[illegible]

	Total.	Unit.
Labor	[illegible]	[illegible]
Concrete Foundation (1,072 sq. yds.).		
Labor	[illegible]	[illegible]
Material	604.00	.564
Total	[illegible]	[illegible]
Wood Block [illegible]		
Labor	[illegible]	[illegible]
Material	812.15	.758
Total		[illegible]
[illegible]		
Labor	[illegible]	[illegible]
Material	[illegible]	[illegible]
Total		[illegible]
Total [illegible]		[illegible]
Received by contractor		2,251.00

The prices of materials were as follows:

12-in. pipe, per ft.	[illegible]
15-in. pipe, per ft.	0.40
Brick, per M	[illegible]
Cement, per bbl.	[illegible]
[illegible], per lb.	[illegible]
Gravel and sand per cu. yd.	2.32
Asphalt, per ton	[illegible]
Wood block, per sq. yd.	1.35
Wood block (for depot), per sq. yd.	0.70
Coal, per ton	5.00
Angle bars, per ton	30.00
Cushion sand, per cu. yd.	0.55

The wages paid on the work were:

Foreman	[illegible]
Engineer	[illegible]
Skilled labor	2.50
Unskilled labor	[illegible]
Water boy	[illegible]
Teams	[illegible]
Teams, for concrete carts	7.00
Timekeeper	[illegible]

The total gross cost of the work, outside of overhead expenses, depreciation on plant, traveling expenses, etc., amounted to $41,060.55, while the total received by the contractor was $45,775.96. If the overhead expenses, etc., amount to 10 per cent of the cost of the work, it will be seen that the contractor barely came out even.

The contractor for this work was the Roach & Manigan Co., of Fort Worth, Texas. The Aetna Engineering Bureau, of Chicago, Ill., was the consulting engineer, and Mr. Kendrick Harger, B. S. C. E., was the Resident Engineer for the Consulting Engineer.

Bituminous Road Surface Construction in Massachusetts and Maryland.

In the discussion of the subject of road construction and maintenance at the last annual meeting of the American Society of Civil Engineers, Mr. A. H. Dean, Chief Engineer of the Massachusetts Highway Commission, gave some details of the experience of that commission in the surface treatment of roads with bituminous materials. The following abstract of Mr. Dean's discussion is taken from the Proceedings of the Society, vol. xxxviii, No. 3, pp. [illegible].

[illegible] Massachusetts.—For surface treatment of broken stone roads, a light or medium oil acts mainly as a dust layer, yet if frequently applied it preserves the road to a very appreciable extent. In determining what bituminous material would be the most economical and advantageous for the preservation by surface treatment of broken stone roads, a knowledge of the traffic over the road is absolutely essential. If the road is subjected to light motor-vehicle traffic and light team traffic, with the motor vehicles predominating, experience has shown that an asphaltic oil, of such viscosity that it requires heating to at least 250° F. before application, forms a bituminous surface which withstands the traffic and thoroughly preserves the road for a period of time depending partly on the quality of the material and workmanship and partly on the quantity of traffic.

Fully as important as the quality of the bituminous material is the quality of the workmanship in applying it. In the preparation of the broken stone surface, extreme care should be taken to sweep and remove every particle of dust and dirt, so that the stones will be absolutely bare. Many failures of bituminous surfaces can be traced directly to the improper preparation of the broken stone surface, the heavy oils being distributed on dusty and dirty sections, and, consequently, peeling up through lack of adhesion. In order to get the best adhesion of asphaltic oils, it appears that the stone surface should also be somewhat moist rather than extremely dry. In distributing the oil, if the stone surface is comparatively new and smooth, the best results appear to be obtained by applying the oil under pressure in two applications, each of ¼ gal. per sq. yd., covering the first application with grit or pea stone before putting on the second, and covering the second application with the same material as soon as possible after it has been made. The effect of applying the material in this manner is to make the distribution more uniform and prevent surplus oil from flowing on the sloping crown of the road, thereby causing ridges and bunches to appear after the work has been done. If the stone surface is full of slight depressions, however, a single application of ½ gal. per sq. yd., applied with or without pressure, has proved satisfactory. The oil tends to run to the depressions, causing a slight surplus of oil in them, so that when the grit is applied on top of the oil, the portions over the depressions absorb more grit, consequently rendering the road more smooth.

The character of the grit or other material used for covering the oil is of great importance. Where the traffic is confined exclusively to motor vehicles, sand appears to be as effective as any material for covering, but if there is some steel-tired horse-drawn traffic, a coarse material like pea stone or fine gravel is necessary.

The cost of a bituminous surface as just described will vary, of course, with the availability of the material to be used for covering, and the length of haul of all materials. In Massachusetts, during the last four years, several hundred miles of macadam roads have been improved or preserved by a bituminous surface of this kind. The average cost during 1910 was a little less than $0.08 per sq. yd., and, during 1911, a little more than that price, with labor costing from $1.75 to $2.00 per 8-hour day, and asphaltic oil costing $0.06 per gal. delivered in tank cars. The detailed cost on an average road is as follows: —

	Per sq. yd.
Cleaning and sweeping	$0.0056
Patching old surface	0.0016
Cost of oil	0.0319
Heating oil	0.0031
Delivering oil	[illegible]
Distributing oil	0.0029
Furnishing sand on the road	[illegible]
Spreading sand	0.0073
Watering	0.0012
Rolling	0.0002
Supervision	[illegible]
Total	[illegible]

The road mentioned was treated with ½ gal. of heavy asphaltic oil in two ¼-gal. applications. The average haul was 2 miles for the oil and 2½ miles for the sand. No allowance is made in the foregoing detailed statement for rental or depreciation of machinery, or for profits to contractor, the work being done by labor force account.

On roads where the prevailing traffic consists of steel-tired horse-drawn vehicles, this application of bituminous surface, consisting of heavy asphaltic oil and grit, has proved unsuccessful, in most instances, the surface being cut and dented to such a degree that it soon disappears. On such a road, it is possible that a heavy, refined tar surface may be economical, or it may be economical to use oil of a lighter grade, applying it with sufficient frequency to keep the surface of the stone covered with oil at all times. The results, in the surface treatment of such roads in Massachusetts, would indicate that bituminous surfaces are not economical where the prevailing traffic consists of horse-drawn vehicles, but that a more durable construction of the crust of the road must be made by either mixing or penetrating the upper course of stone with bituminous material.

Cost of Maintenance of Bituminous Surfaces in Massachusetts.—In maintaining these bituminous surfaces a re-treatment of about ¼ gal. of bituminous material per sq. yd. is only made on those places from which the bituminous material has disappeared. To show the probabilities of the cost of maintenance of roads by applying bituminous surfaces thereon, Mr. Dean cites 18 miles of State highway constructed in nine towns in Massachusetts in 1909, the bituminous surface consisting of ½ gal. of residuum asphaltic oil. The first cost of the bituminous surfaces on these roads, in 1909, averaged $0.0742 per sq. yd. In 1910, there was expended for patching and sanding, $0.0146, and, in 1911, $0.0088 per sq. yd. The present condition of these roads indicates that the expense for patching and sanding in 1912 will not exceed $0.01 per sq. yd., in which case the total expense of maintenance of the surfaces on these roads for four years will have been $0.1076, making the cost $0.0269 per sq. yd., or approximately $236.72 per mile per year for a 15-ft. road, which cost does not exceed that of maintaining similarly located macadam roads previous to the advent of motor vehicles. Whether or not a bituminous surface, such as that just described, on a macadam road, will withstand the traffic of heavily loaded motor trucks cannot now be determined, as motor trucks have not been in use on such surfaces for a sufficient length of time and in sufficient numbers to permit such determination.

Bituminous Surface Work in Maryland.—During 1911, more than 100 miles of water-bound macadam and gravel road in the state of Maryland were treated with a dozen varieties of asphalt oils and tars. The work was done under the direction of Mr. W. D. Uhler, Second Assistant Engineer Maryland Roads Commission. The following description has been taken from the above mentioned Proceedings:

The cost of these surface applications varied from 1.8 cts. to 8.93 cts. per sq. yd., or from $148 to $734 per mile; the cost of bituminous material varied from 3.75 cts. to 9.1 cts. per gal., f. o. b. at the point of delivery; grit for the top dressing cost from 0.33 cent to 3.5 cents per sq. yd. in place, depending on its character and location. With the exception of 16 miles on which the bituminous material was applied under pressure, it was all applied with gravity oilers. While varying conditions will affect the figures slightly, a fair average of the detailed costs is as follows:

	Per sq. yd.
Sweeping	$0.0015
Pitch (delivered)	0.0300
Applying pitch	0.0045
Grit (delivered)	0.0030
Applying grit	0.0010
Total	$0.04

In view of this experience, Mr. Uhler has arrived at the following conclusions:

(1) The road to be treated must be thoroughly swept before applying the bituminous material; otherwise the results will not be satisfactory.

(2) On a newly finished macadam road, about ½ gal. per sq. yd. will be necessary.

(3) In applying ½ gal. per sq. yd., it should be applied in two treatments of ¼ gal. each, wherever practicable.

(4) After applying the bituminous material, sufficient time (from 12 to 24 hours) should be allowed, when possible, for it to penetrate, and the road should then be covered with a light application of coarse sand, pea gravel, or granolithic chips. About 10 tons to the mile (14 ft. wide) have been found to be sufficient in most cases.

(5) In view of the experience with gravity and pressure distributors as to results, time, etc., it is thought advisable, as well as economical, to use a motor truck, fitted so as to apply the bituminous material under pressure.

Bituminous Macadam Sidewalks for the Development of Suburban Properties.

One of the most essential undertakings in the development of suburban properties is the construction of sidewalks. In many cases the promoters of the enterprise postpone this work, owing to the expense of constructing cement sidewalks which are usually considered the only kind suitable for a high class development. In the Monthly Journal of the Engineers' Club of Baltimore, Mr. W. G. Stone, Landscape Engineer, suggests that such sidewalks be constructed of bituminous macadam, as being more economical, and at the same time having a rustic effect which harmonizes with the rural surroundings of such suburban properties. He suggests that such sidewalks should be formed of no less width than 15 ft. on both sides of the roads, and that the edge adjoining the so-called "property-line" be at least 12 ins. above the level of the center of a finished roadway, or 12 ins. above the curb, in which case a good fall is given for the watershed to the roadside gutters. Fig. 1 shows a section of one of these sidewalks. The method of construction as given by Mr. Stone is as follows:

When the road sides have been formed, have them well rolled and brought to a true grade by adding or removing material; then stake out the position of sidewalk and excavate the same 2 ins., putting the material removed on both sides so as to act as shoulders; then put into the trench excavated the following: A layer of No. 2 trap rock (stones that pass through a 2-in. ring) to a depth of 3½ ins., and roll same until compact; cover this layer of stone with a thin coating of No. 3 trap rock (stones that pass through a 1-in. ring) and roll again. When this second course has been laid and rolled to grade, pour in a good quality of asphalt binder, while hot, at the rate of about 1 to 1¼ gals. per sq. yd. surface, and cover immediately with screenings from which all dust has been removed. These screenings should be in size from ¼ to ½ in., and should be spread to a thickness of at least ¾ in. and then rolled down as soon as possible. The following day the surface should be swept clear of all loose material and a second light application of binder should be poured over and screenings as above mentioned should be spread evenly over the entire surface so as to completely cover the binder and rolled immediately. The rolling down of these screenings immediately after the application of the asphalt binder is very important; therefore the roller should be in constant attendance during the construction of this description of sidewalk, and after rolling down the macadam portion of walk, should roll down the earth shoulders on each side to a width of about 2 ft.

The hardest or best quality of trap rock should be used for the top course in the construction of macadam sidewalks, but gravel or a softer quality of stone can be used to equal advantage for the lower course, provided it is laid in courses as previously described for macadam, and also provided that it is free from clay, or, in other words, is what is known as "washed gravel" or screened stone.

One other matter which is of importance is that the trap rock or gravel must be perfectly dry before the binder is appl
work is done in cool weathe
for top course should always
fore being used.

A walk 4 ft wide will req
tons of crushed stone if rolled
ness or 8¼ tons if rolled to
and about 67 gals. or say 1
for every 100 ft. in length, and
of 2.45 cu. yds., if cut to the
as previously described.

After the sidewalks have beer
and the excavation made, sever
of this macadam sidewalk can
the help of four or five men, in
ery instance when work of
to be done it is advisable to
purchasing stone, for an extra
clean screenings (stone of ¼

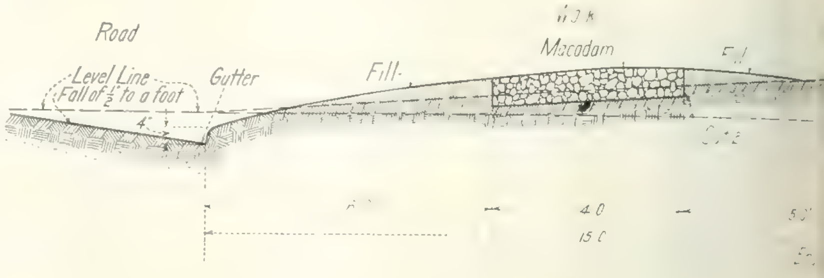


Fig. 1—Section of Bituminous Macadam Sidewalk.

so that in case any bleeding or
binder on the surface should
likely to do during the first sum
may be covered with screenings

Bituminous Surface Appli Water Sprinkling in Br ough, New York C

In 1910 the officials of the B
Bronx, New York City, conduc
periments with bituminous surfa
for dust prevention purposes on
earth roads. In the informal
Road Construction and Mainten
January under the auspices of
Society of Civil Engineers, Mr
Connell, Assistant Commissione
Works of the Borough, stated th
ence in 1910 with these surfac
had proved more efficacious an
than water sprinking on macad
roads, and as a consequence the
ling division had been abolished
macadam and a number of ear
received a surface treatment of t
road oil. The following descr
work has been taken from the
American Society of Civil En
XXXVIII, No. 3, p. 335. The
tar have been very satisfactory,
½ gal. per sq. yd. being applied
with torpedo sand or fine wash
formed a very desirable surface,
$0.035 for ⅓ gal. and $0.045 f
sq. yd. In these treatments the
plied cold.

The Grand Boulevard and C
treated with a heavier tar, which
under pressure through a hose a
ture of 220° F., ⅔ gal per
used, and then covered with
or fine washed gravel. This road
use for 6 months, and although
subjected to very heavy, high-sp
bile traffic, it is now in first-cla
The cost was $0.138 per sq. yd., w
owing to the lack of proper facili
dling the bituminous material an
ous delays which occurred. In
of the Bronx a fair cost would b
to $0.10 per sq. yd. for this treatm
the application of tar in these
the road was thoroughly swept
drawn and hand brooms.

Asphalt road oil of about 20° B
was applied to a number of mac
using ¼ gal. per sq. yd. On road
light or medium traffic, one applic

to keep the road dustless, heavily ways required two and, in some ce applications. The cost of this , $0.013 per sq. yd. when ¼ gal. vas used. The oil was applied ure distributor on a number of l the cost was $0.009 for ⅕ gal. This method of treatment is both nd desirable. Just enough pres- lied (about 15 lbs.) to drive the nterstices of the stone to a suffi- o avoid having a mushy road ore the application of the asphalt surface was swept with a horse- r only.

s are now under way to equip us Application Division with a nber of pressure distributors to tuminous surface work in 1912. reatments, the distributing device d to an ordinary water sprinkler. materials will require the use [illegible]

nous material applied to the dif- ays was selected from the stand- adaptability for each particular stone used consists largely of ke and Clinton Point crushed

ing table gives a comparison of surface treatments and water the Borough of the Bronx, the [illegible] being based on sprinkling [illegible] times a day for 180 days, [illegible] a team, and water at $0.10

[illegible] sq. yd.	$0.035
[illegible] sq. yd.	0.047
[illegible] about 20° Baumé grav- [illegible] sq. yd.	0.013
ons	0.026
[illegible] about 20° Baumé grav- distributor 2/10 gal. per [illegible]	0.009
[illegible]	0.018
[illegible]	0.051

ng figures relate to material and laborers in the Borough of the

[illegible]	$4.00
[illegible]	2.25
[illegible] tar at freight yard, per [illegible]	0.061
[illegible] asphalt road oil at freight [illegible]	0.04
on work but not spread, per [illegible]	1.30

se of pressure distributors in : of applying the tar will be d. The former method required f three laborers, whereas a dis- need only one man to operate ver the time required to apply e reduced.

ırds of the New York State Department for Brick Paved Roads.

ork State Highway Department i to a considerable extent for s, and during 1911 constructed l of this kind of pavement on r its jurisdiction. Fig. 1 shows rd section of the Department

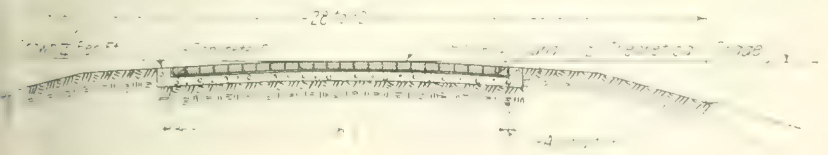


Fig. 1—Standard Section for Brick Paving With Edging.

with edging. In this typical erences in elevation between and center of shoulder (n) nter of road and center of as follows: 6 ft. shoulder, =13¼ ins.; 7 ft. shoulder, =15⅛ in.; 8 ft. shoulder, n in. Fig. 2 shows a combined sometimes used with the brick . 3 shows a type of concrete pavement with macadam base s a type for the paving on a Fig. 5 shows a concrete curb, which [illegible] brick pavement.

The specifications under which the brick paved roads are constructed require that the blocks must have lugs or projections and must also have a semicircular groove with a radius of not less than ⅛ in. and not more than ¼ in. in the two ends. Fire clay blocks are required to be [illegible] ins. in size and shale block 3¼ ins.x8 ins. in size. Grout is used for filling the joints of the blocks and [illegible] roller is preferred. When a roller [illegible] S wheel type is used, a weight [illegible] 10 tons is allowable.

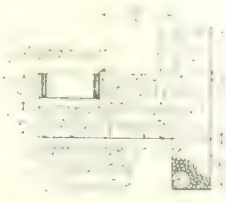


Fig. 2.

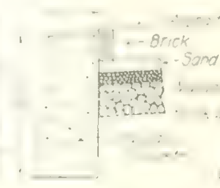


Fig. 3.

Fig. 4.

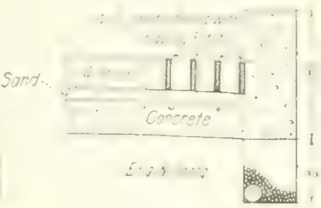


Fig. 5.

The concrete for the foundation is made of 1 part Portland cement, 2½ parts approved sand or crusher dust and 5 parts crushed stone or screened washed gravel. This class of concrete is also used for the edging. The sand cushion is 1½ ins. thick and is spread not less than 11 days after the concrete foundation has been laid. The cushion is rolled with a hand roller weighing about 200 lbs. and is then brought to the exact form and crown by means of a template. The blocks are set at right angles to the edging line, except at road intersections, where they are laid at such angles and in such manner as the engineer may direct. All the longitudinal joints are broken by a lap of half the length of the block. After the blocks are laid the end joints are made close and compact by the use of a steel bar applied to the ends next the curbs. At every fourth course, or as often as required, the side joints are closed up as much as possible and the courses straightened.

An expansion cushion is provided for next to each edging. For a 16-ft. wide pavement this is 1½ ins. in thickness; for greater widths it is increased proportionately. This cushion is composed of heavy pitch or asphaltum composition, having a melting point of not less than 120° F. nor more than 140° F.

The grouting of the joints is done in the following manner: The grout is removed from the box to the street by means of scoop shovels, and from the moment it touches the block is swept thoroughly into all joints by means of push brooms. The work is carried forward the entire width of the pavement in line until sufficient time has elapsed for the grout to penetrate thoroughly all the joints. The entire force then goes over the same portion of the work a second time, using the same mixture of grout, care being taken in each instance to fill thoroughly all joints flush with the top of the block. To secure flush joints, a third, fourth or fifth coat of cement is then swept in and smoothed off with a squeegee.

After the joints are filled flush with the tops of the blocks, and sufficient time for hardening has taken place, ½ in. of sand is spread over the whole surface, and an occasional sprinkling, sufficient to dampen the sand, is kept up for six days. The board occupying the place to be filled with pitch is withdrawn and the pitch or asphalt applied within 30 hours after the application of the cement filler.

Cost Data on the Construction and Maintenance of Bituminous Macadam.

At the informal discussion on Road Construction and Maintenance held last January under the auspices of the American Society of Civil Engineers, a considerable amount of data were brought out on the construction and maintenance of bituminous macadam pavement. Portions of this discussion were printed in the Proceedings of the Society, Vol. XXXVIII, No. 4, pp. 580 to 610. The matter that follows has been abstracted from these proceedings:

Bituminous Macadam by Penetration Process in New York State.—During 1909, 1910 and 1911 the New York State Highway Department built about 1,300 miles of bituminous macadam by the penetration process. General observation of these roads, which have now been open to traffic for periods varying from one to nearly three years, indicate that they are in good condition, are giving excellent results and apparently will continue to give satisfaction for some time to come. There has been some few failures—probably not more than 1 per cent of the mileage built. These failures are ascribed to the following causes: To pouring too late in the season; to poor workmanship; to wet or dirty stone; brittleness in the bituminous material; and to poor foundation. A trap rock road is naturally the hardest to bind, and it is stated that raveling occurs more frequently on those built with this material than on those where other kinds of stone have been used. It is believed to be of the greatest importance that bituminous macadam, made by the penetration method, shall be laid early enough in the season to have traffic over the roads for at least one month of warm weather, so that it may be thoroughly compacted before cold weather arrives to harden the bituminous material.

During the season of 1910 cost data reports were received from a large number of roads. These were examined, and computations and tabulations were made from a few of them, the highways selected being those rendering the best and most complete reports. The figures merely show the cost of completing the macadamized portion of the road, after the top stone has been placed and rolled, ready for the bituminous material and filler. As stated in Table I, the average cost per square yard was

$0.199 for Residuum products, one pouring
0.238 for Residuum products, two pourings.
0.319 for fluxed Bermudez products, two pourings.

Though some of the figures in Table I are evidently in error, especially those showing prices of material, the errors are not large. In many cases they will compensate each other, and will not affect materially the average cost. Furthermore, as these figures represent the cost under somewhat varying conditions, for work done in different parts of the state, by different engineers and contractors, on approximately 70 miles of highway, it is believed that they are of more value, for determining the cost of roads of this type, than those obtained from a short-time observation on a single piece of work.

Bituminous Macadam in Massachusetts.—Mr. F. C. Pillsbury, Division Engineer, Massachusetts Highway Commission, described a form of bituminous macadam, constructed as follows:

First: Assuming that the sub-grade and surface are properly drained, on the foundation is first placed a layer (4 in. after rolling)

TABLE I.—COST OF BITUMINOUS MATERIAL AND FILLER IN PLACE COMPLETE, BY THE PENETRATION METHOD, SEASON OF 1910, NEW YORK DEPARTMENT OF HIGHWAYS.

Highway No.	Length treated, in miles.	Width treated, in ft.	Bituminous Material: Cost per gal. at road.	Gals. poured.	Square yards	Average Number of Gals. per Sq. Yd.: First pouring	Second pouring	Average Cost Per Sq. Yd.: Labor.	Materials.	Engineering.	Total.
[illegible] in One Pouring.											
321......	4.35	16	[illegible]	61,278	40,890	1.50		[illegible]	$0.180	[illegible]	$0.219
[illegible]	[illegible]	[illegible]	[illegible]	49,239	33,648	[illegible]		0.041	[illegible]	0.009	0.196
491	[illegible]	16	[illegible]	41,185	30,091	1.37		0.031	0.134	0.004	0.169
[illegible]	[illegible]	14	0.090	29,413	19,575	1.50		[illegible]	0.178	0.008	[illegible]
[illegible]	[illegible]	16	0.079	68,201	44,285	1.54		0.044	0.143	0.003	0.190
[illegible]	[illegible]	14	0.110	[illegible]	[illegible]	1.24		0.047	0.145	[illegible]	[illegible]
769......	1.76	[illegible]	[illegible]	21,737	[illegible]	1.50		0.041	0.120	0.004	0.165
[illegible]	[illegible]	14	[illegible]	52,512	[illegible]	1.45		0.037	0.145	0.008	0.190
[illegible]	[illegible]	14	0.077	60,137	37,710	1.60		0.045	0.168	[illegible]	0.216
856......	1.13	16	0.095	14,440	10,581	1.77		0.022	0.171	0.007	0.200
Totals ..	33.11			[illegible]	[illegible]						
Averages.	3.31	[illegible]	[illegible]			1.45	....	$0.040	$0.153	[illegible]	[illegible]
Residuum Products—Application Made in Two Pourings.											
323......	2.44	[illegible]	$0.097	31,293	22,931	[illegible]	0.11	$0.063	$0.160	$0.011	$0.234
637......	3.54	14	0.094	45,064	29,063	1.30	0.25	0.067	0.155	0.008	0.231
[illegible]	[illegible]	14	0.110	11,674	[illegible]	1.35	0.32	0.040	0.183	0.009	0.232
821	[illegible]	14	0.095	60,607	33,415	1.33	0.49	0.075	0.178	0.009	0.262
[illegible]	[illegible]	16	0.095	23,353	15,111	1.10	0.44	0.023	0.160	0.003	0.186
[illegible]	[illegible]	16	0.090	32,718	18,638	1.41	0.34	0.033	0.191	0.008	0.232
5011......	1.73	16	0.096	28,748	16,259	1.30	0.47	0.080	0.160	0.015	0.265
5012......	2.78	16	0.093	43,041	26,079	1.25	0.40	0.035	0.220	0.004	0.259
5016......	2.97	16	0.093	[illegible]	27,806	1.29	0.44	0.056	0.176	[illegible]	0.238
5017......	2.46	16	0.078	37,608	23,141	1.20	0.43	0.064	0.172	0.008	0.244
Totals ..	24.51	...	...	[illegible]	[illegible]						
Averages.	2.45	15.4	$0.094	....	....	1.28	0.37	$0.054	$0.176	$0.008	[illegible]
Bermudez Asphalt Fluxed—Application Made in Two Pourings.											
571......	2.32	14	$0.126	38,190	19,016	1.35	0.65	[illegible]	$0.277	$0.014	[illegible]
665......	1.01	12	0.125	12,487	7,094	1.27	0.49	0.061	0.263	0.010	0.334
[illegible]	[illegible]	14	0.127	8,158	4,652	1.17	[illegible]	0.072	0.276	0.023	0.371
762......	4.70	16	0.118	77,507	44,242	1.25	0.50	0.054	0.230	0.010	[illegible]
867......	0.97	16	0.120	15,542	8,890	1.22	0.53	0.023	0.232	0.005	0.260
Totals ..	9.57			151,884	83,894						
Averages.	1.91	14.4	$0.123			1.25	[illegible]	$0.051	[illegible]	[illegible]	$0.319

of egg-size broken stone, 1¼ to 2½ in. in longest dimensions. This layer is thoroughly bound with stone dust or other suitable material, rolled, and flushed with water until it is practically impervious to the bituminous material.

Second: On this heavy asphaltic oil is evenly distributed, by a pressure distributor, ¾ gal. per sq. yd.

TABLE II.—ACTUAL COSTS OF BITUMINOUS MACADAM CONSTRUCTED AT NORTH ANDOVER IN 1911.

Length, 8,107 ft.; area, 13,615 sq. yds.; width, 15 ft.

Broken Stone—Bottom course—		
Stone, 2,898 tons, at $1.15.........	$3,332.70	
Cost of laying, including unloading, teaming, spreading, rolling, binding, etc......................	1,637.70	
Total cost for bottom course....	$4,970.40	
Cost per sq. yd.............$0.3651		
Broken stone dust used to bind bottom course.		
Top Course—		
Stone, 1,148 tons, at $1.15.........	$1,320.20	
Cost of laying......................	686.21	
Total cost for top course.......	$2,006.41	
Cost per sq. yd.............$0.1473		
Oiling—First application, ¾ gal. per sq. yd.—		
Cost of oil per sq. yd......$0.0438		
Cost of heating per sq. yd. 0.0225		
Cost of hauling per sq. yd. 0.0025		
Cost of applying per sq. yd. 0.0168		
Total cost per sq. yd.....$0.0856		
Second application, ⅝ gal. per sq. yd.—		
Cost of oil per sq. yd.......$0.0369		
Cost of heating per sq. yd. 0.0192		
Cost of hauling per sq. yd. 0.0022		
Cost of applying per sq. yd. 0.0168		
Total cost per sq. yd.....$0.0751		
Sand covering—		
Total cost per sq. yd.......$0.0373		
Cost per sq. yd. for bottom course, broken stone...........	$0.3651	
Cost per sq. yd. for top course, broken stone	0.1473	
Total		$0.5124
Cost per sq. yd. for first application of oil	$0.0856	
Cost per sq. yd. for second application of oil	0.0751	
		0.1607
Cost per sq. yd. for sanding......		0.0373
Total		[illegible]
Total cost per sq. yd. for pavement.....		0.7104

Average length of haul for broken stone, 1 mile.
Average length of haul for oil, 1 mile.
Average length of haul for sand covering, 1 mile; sand not screened.
Broken stone trap rock shipped by rail.
Oil delivered in tank cars.
Cost of labor, 22 cts. per hour.
Cost of teams, 55 cts. per hour.

Third: On the oil a layer of nut-size broken stone, ½ to 1¼ in. in longest dimension, which will roll to 2 in. thick, is immediately placed and carefully spread with shovels, the carts containing it being driven along the side of the road. The depth of the stone is regulated by wooden cubes placed on the first course, which is sanded at the points where the cubes are placed, in order to prevent them from sticking to the oil. This nut-size stone is then compacted with a steam roller.

Fourth: On the nut-size stone is distributed under pressure about ⅝ gal. of the same kind of oil used before, the application being absolutely perfect in distribution, and the penetration reaching well down into the stone.

Fifth: On the oil is immediately spread fine gravel, gravelly sand, or stone screenings, just sufficient in quantity to fill the surface voids in the nut-size stone, and to take up the thin coating of oil left on the top. This is then thoroughly watered and compacted by the steam roller until there are no signs of movement.

The actual costs of such work to the contractor, on two state roads in Massachusetts built in 1911 are as shown in Tables II and III.

The traffic on these roads does not consist of a large volume of heavy horse-drawn vehicles, but probably from 500 to 600 automobiles per day pass over them, except during the winter, and there is also considerable heavy farming and other teaming.

Cost of Maintenance of the Park Ave. Height Road in Maryland.—A description of the methods employed in the construction of this experimental road was given in our issue of Sept. 7, 1910; additional data on this road were given in our issue of April 19, 1911. In a discussion before the American Society of Civil Engineers, Mr. W. W. Crosby, Chief Engineer of the Maryland State Road Board, under whose supervision the Park Ave. Heights work was done, presented data showing the expense on the road to Jan. 1, 1912. These data are shown in Table IV. The following remarks refer to the sections noted in the table.

Sections 15, 16, 28 and 29 are really surface treatments.

Sections 1 and 3 were resurfaced in (August to October, inclusive) 1911, because of their uneven and unsatisfactory surface conditions. The older surface was
depth of about 3 in., and the mi
and pitch removed. Clean N
was then spread to a depth of
rolled, and poured with 1½ g
The stone was then chipped, ar
of ½ gal. per sq. yd. was appli
of chips being spread on the
2 remains somewhat wavy, as
year ago.

Complaints were made that S
20 and 23 were slippery in col
the expense reported on these
year is largely that of attemptin
this slipperiness. The latter
Crosby's judgment, due more t
the pitch originally used, to th
perhaps, in some cases, to th
existing on these sections, th
factors.

Sections 6, 8, 23, 24, 25 ar
the rolling in of additional st
to absorb the excess of pitch a
weather.

Section 12 bled somewhat
weather, and the expense rep
largely for overcoming the resul

Section 15 required patching
small spots (less than 1 sq. ft.
ing 1911, and the expense the
It is now in first-class conditio
ently, is likely to remain so, f
at least.

Section 16 appears to be losing
probably require extensive re
1912.

Section 17 showed a perfect
in the spring of 1911, but
[illegible] is slowly disappearing
the pitch rising in warm weath
up the surface.

The remarks made in connect
tion 17 will apply to Section 1
the action and results referred t

Section 19 bled badly in warm

TABLE III.—ACTUAL COSTS
OUS MACADAM CONSTRU
TYNGSBORO IN

Length, 4,350 ft.; area, 7,250
width, 15 ft.

Broken stone—Bottom course—
Stone, 1,492.05 tons, at $1.15.....
Cost of laying including
teaming, spreading, rolling,
etc. ....

Total cost for bottom course..
Cost per sq. yd.
Broken stone dust used to bind
Top course—
Stone, 612.49 tons, at $1.15.........
Cost of laying....................

Total cost for top course........
Cost per sq. yd.
Oiling—First application, ¾ gal.
per sq. yd.
Cost of oil per sq. yd........
Cost of heating per sq. yd...
Cost of hauling per sq. yd........
Cost of applying per sq. yd.......

Total cost per sq. yd............
Second application, ⅝ gal. per
sq. yd.—
Cost of oil per sq. yd..............
Cost of heating per sq. yd........
Cost of hauling per sq. yd........
Cost of applying per sq. yd..

Total cost per sq. yd...........
Screened gravel covering
Total cost per sq. yd.............
Cost per sq. yd. for bottom course,
broken stone
Cost per sq. yd. for top course,
broken stone ....

Total
Cost per sq. yd. for first application of oil ....
Cost per sq. yd. for second application of oil ....
Cost per sq. yd. for graveling application of oil

Total
Total cost per sq. yd. for paveme
Average length of haul for brok
mile.
Average length of haul for oil, ¼
Average length of haul for screene
ering, about 1 mile
Broken stone trap rock shipped by
Oil delivered in tank cars.
Cost of labor, 22 cts. per hour.
Cost of teams, 55 cts. per hour.

TABLE IV.—[illegible] BALTIMORE [illegible]

[illegible]	Length	Width	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Maintenance Per Sq. Yd. of Macadam [illegible]	Total	Earthwork	Painting [illegible]	Oiling and chipping	Net actual repairs
		35	11,226.11				$0.327	$0.664	$0.088	$0.9011				$0.9011*
	[3,715	24												
Co.—Asphalt oil. A	[illegible]	[illegible]	1,936.00	Aug., Sept., [illegible]		0.339	0.431	0.773	0.080	0.0455	[illegible]			[illegible]
[illegible]	[illegible]	24	1,242.66	Sept., 1909			0.418	0.754	0.187	0.9947	[illegible]			[illegible]
Co. Fairfield	[illegible]	24	1,173.33	Sept., [illegible]			0.449	0.786	0.081	0.0093	[illegible]			[illegible]
Sample No.	[illegible]	[illegible]	1,712.00	Sept., 1909	[illegible]	0.339	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		$0.0364	0.0093
Brand No. 1	[illegible]	24	1,826.66	Sept., Oct., 1909	[illegible]	[illegible]	0.606	0.939	0.079	0.0587	[illegible]			[illegible]
	[illegible]	24	1,909.33	[illegible] 1909 .		0.337	0.618	0.955	0.082	0.0268	[illegible]		0.0180	0.0034
Co. [illegible]	[illegible]	24	1,816.00	Oct., 1909 .	3.41	0.336	0.605	0.941	0.080	0.0195	[illegible]			[illegible]
[illegible] work)	[illegible]	[illegible]	1,170.66	[illegible] 1909	4.46	0.340	0.454	0.894	0.091	0.0236	[illegible]		......	0.0049
[illegible] work	[illegible]	24	3,232.00	[illegible] June, 1910.	1.43	0.397	0.242	0.639	.....	0.0177	[illegible]		......	0.0080
	2,243	[illegible]	5,981.33	June, 1910	1.25	0.397	[illegible]	[illegible]		[illegible]	[illegible]			[illegible]
[illegible]	473	24	1,261.33	[illegible] 1910	1.65	0.397	[illegible]	[illegible]		[illegible]	[illegible]			[illegible]
Manf. Co..	1,757	24	4,685.33	[illegible] 1910.	1.70	0.397	0.327	0.724	.....	0.0378	[illegible]		......	0.0349
sphalt ...	1,576	24	4,202.66	[illegible] Aug., 1910	1.45	0.397	0.325	0.722	.....	0.0158	0.0057	$0.0101	......	0.0000
[illegible]	1,194	24	3,184.00	Aug., Sept., 1910	1.69	0.397	0.292	0.689	.....	0.0166	0.0048	0.0013		[illegible]
[illegible]	2,904	18	5,808.00	Oct., 1910		0.397	[illegible]	[illegible]		[illegible]	[illegible]			[illegible]
Antidust.	[illegible]	18	1,100.00	Sept., Oct., 1910.	0.94		0.140	0.537	.....	0.1050	[illegible]			[illegible]
	2,676	12	3,568.00	Oct., 1910 .	1.42					[illegible]	0.0136	0.0161		[illegible]
1910 work).	[illegible]	12	1,893.33	Oct., 1910 .		0.397	0.287	0.684	.....	0.0434	0.0091	0.0281	0.0062	0.0000
[illegible]	[illegible]	14	127.55	Nov., 1909	3.92	0.241	0.174	0.415	0.087	.0.2929	[illegible]		0.0484	0.2179†
	[illegible]	14	1,294.22	Oct., 1909 .	3.86	0.230	0.408	0.638	0.088	0.1528	[illegible]		0.0332	0.0513
[illegible]	[illegible]	14	693.77	Oct., 1909 .	4.70	0.228	0.551	0.779	0.088	0.1991	[illegible]		......	0.1805
[illegible]	[illegible]	14	976.88	Oct., 1909 .	2.95	[illegible]	0.405	0.634	0.082	0.2242	[illegible]		......	0.1851
uritan Brand No. 1	[illegible]	14	844.66	Oct., 1909 .	4.71	[illegible]	0.691	0.915	0.082	0.0900	[illegible]		0.0293	0.0463
....	[illegible]	14	[illegible]	Sept., 1909	2.23	0.229	0.257	0.486	0.081	0.0669	[illegible]		0.0041	0.0514
Co.—Fairfield...	[illegible]	14	1,532.22	Sept., 1909	2.73	0.228	0.353	0.581	0.057	0.0854	[illegible]			[illegible]
L. & P. Co.	[illegible]	14	3,758.22	Aug., 1909	[illegible]	0.216	0.303	0.519	0.057	0.0324	[illegible]		......	0.0286
	[illegible]	[illegible]												
L. & P. Co......	27.5	12	1,011.77	Aug., 1909	1.95	0.216	0.227	0.436	[illegible]	0.0147	0.0088	0.0055	......	0.0004
	555	12	740.00	Oct., Nov., 1910.	1.46	0.369	0.414	0.783		0.0232	[illegible]	[illegible]		[illegible]
	10,027	12	13,369.33	Oct., Nov., 1910.	0.56	0.337	0.103	0.440		0.0447	[illegible]			[illegible]

nted, 1911. †Material gratis. ‡Complete top of U. G. I.

[illegible] in cold weather, which [illegible] large expense for putting [illegible] under "Repairs") and for "Oiling."

bled somewhat, requiring addi- and was slippery enough to re- nd chipping.

[illegible] required the addition of considerable stone in 1911. utted and began to move later- pplication of more stone at dif- [illegible] remedy these defects.

vas so slippery in cold weather oiling and chipping.

like Section 15, required some nall holes, but not to as great [illegible] May 15 and July 1, 1911 [illegible] tons of stone were hauled ion (and Sections 26 and 27) uction of a branch road, in ad- egular traffic.

was treated twice during 1911 plications of solutions the same [illegible] material. These solutions two parts Glutrin and three nd the mixture was applied to the road each time, at the rate [illegible] sq. yd.

except Section 2, are now in lition and, as far as the ma- rned, need no repairs.

V the column, "Earthwork," (per square yard of macadam) gutters, etc. The column, "Paint- ows expense per square yard r this item in those cases where pitch failed to flow out suffi- h sides) the edges of the ma- deteriorate under traffic. The [illegible] and Chipping," shows ex- e yard of macadam for remedy- by a light coat of cold, thin by a coat of stone chips. The ctual Repairs," shows the ex- e yard of macadam for actually [illegible]

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esy Service of the Govern- ablish a plant for the treat- aph poles for preservation at eld, Nevada County, Calif. e extraction of oil from pine be established at the same

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Methods and Cost of Constructing Concrete Combined Curb and Gutter and Concrete Sidewalks.

Contributed by E. W. [illegible], [illegible] City Engineer, Webb City, Mo.

There are at present 15 miles of concrete combined curb and gutter and 18 miles of concrete sidewalks in Webb City, Mo., besides 3 miles of plain curb, 2 miles of stone curb and gutter and 9 miles of stone and brick sidewalks. Owing to the fact that excellent sawn limestone can be obtained from quarries within the county most all of the earlier curb and some of the sidewalks were constructed of stone. Most of the sidewalks, however, up to some four or five years ago were constructed of brick, which in the main gives poor satisfaction. In 1909 the City Council passed an ordinance forbidding the further use of brick as a sidewalk material, and from then on concrete has been the only material employed.

The following table shows the amount of concrete combined curb and gutter and sidewalks constructed in this city during the last three years, as well as that constructed prior to 1909, both by private and public contract:

	Sidewalks. Miles.	Curb and gutter. Miles.
Prior to 1909..............	6	•3½
1909	1	2½
1910	[illegible]	4
1911..............	5	5
Total	18	15

About 60 per cent of this work was done by public contract; that is the city let the contract and paid the contractor in special tax bills issued against the lots and tracts of land abutting on the work as provided by the Missouri law. On small jobs it is generally cheaper for the property owner to take out a permit and let his work by private contract, owing to the fact that the contractor generally has to sell his tax bills at considerable discount as soon as he receives them to obtain money to carry on further operations. In either case the work is put in under the same specifications, and under the direct supervision of the city engineer who keeps an inspector on each job. The inspector is required to be thoroughly acquainted with the specifications and is also required to make out a daily report on the blank shown below (Fig. 5) on the amount of material used, amount of work constructed, state of weather, number of men employed on the work, and the time of each man and team upon each of the different operations as well as any general remarks. In this manner a complete record and check is obtained on each particular contract, and from these reports the office man works up cost data on most of the jobs.

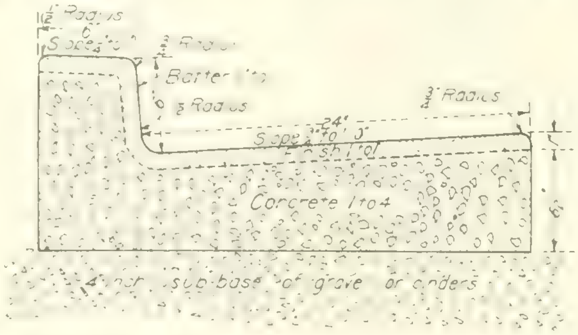


Fig. 1—Cross-Section of Combined Curb and Gutter.

The following are the principal points of the specifications, in a condensed form, for the work constructed during 1911. They contain a few minor changes from those in force during the years preceding:

The cement shall be of a reputable brand of American Portland cement which shall meet the requirements of the specifications for Portland cement of the American Society of Testing Materials.

The sand shall be clean, coarse and of grains varying in size. It shall not contain more than

.. ..ent of clay or loam, and no vegetable matter.

The stone shall be crushed from clean, sound, durable rock and screened through a 1-in. mesh. "Mill tailings" acceptable to the City Engineer may be used instead. (Is used altogether for concrete in this district.)

The water used in mixing the concrete and mortar shall be reasonably clean and free from acids and strong alkalis.

The sub-grade shall be constructed to the proper grade and line and should any soft, spongy material be encountered it shall be taken out and replaced with suitable earth. On deep fills the earth shall be tamped or rolled in 6-in. layers and flushed if necessary.

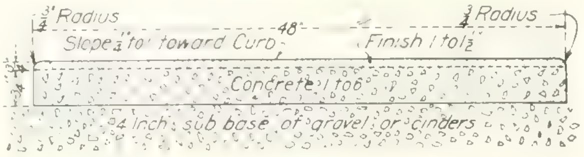

3/4" Radius
48"
Slope 1/4" to 1' toward Curb
3/4" Radius
Finish 1 to 1 1/2
Concrete 1 to 6
4 Inch sub base of gravel or cinders

Fig. 2—Cross-Section of Sidewalk.

The sub-base shall be constructed of crushed rock or cinders, or other acceptable material that will allow drainage. It shall be thoroughly tamped, and on hot, dry days shall be sprinkled immediately before concrete is placed thereon.

The forms shall be smooth, straight and of sufficient size and staked in such manner that the finished work will be true to line and grade.

Steel templates or dividing plates at least 1/8 in. thick shall be used to separate the work into independent slabs, about 6 ft. in length for curb and gutter, and about 5 ft. for sidewalk. Sand joints will be allowed in place of dividing plates on sidewalks, in which case a ½-in. expansion joint must be left every 50 ft.

Concrete for curb and gutter shall be composed of 1 part of Portland cement to 2 parts of sand to 4 parts of crushed stone, or else 1 part of cement to 4 parts of "mill tailings." Concrete for sidewalks shall be composed of 1 part Portland cement to 3 parts of sand to 5 parts of crushed stone, or else 1 part cement to 6 parts of "mill tailings." It shall be mixed to a uniform color and consistency. A sack of cement weighing 94 lbs. shall be considered as having a volume of 1 cu. ft. Concrete base shall be thoroughly tamped and kept free from foreign matter before the finish is applied.

The finish on curb and gutter shall be 1 in. in thickness and shall be composed of 1 part of Portland cement to 1 part of river sand. On sidewalks the finish shall be ¾ in. thick and shall be composed of 1 part Portland cement to 1½ parts river sand. The finish shall be applied before the concrete base takes its initial set. No re-tempering of mortar will be allowed. The finish shall be allowed to partially set, then be floated and troweled smooth. The edges shall be finished with an edger of the proper radius. Joints between slabs shall be cut through to the base and kept open that each slab be independent of the other.

In hot, drying weather the top shall be protected and kept damp. In all cases it must be protected from animals and pedestrians until fully set up.

The "Mill Tailings" mentioned under "stone" is the by-product of the lead and zinc mines of this district. It consists of crushed blue and white flint varying in size from 1/8 to ¾ in. While there is usually an excess of fine material, generally about 60 per cent will pass a No. 4 mesh. It makes a very good material for concrete for this purpose, without screening and re-mixing or the addition of any sand whatever. This "Tailings," or "Chats" or gravel, as it is commonly known, can be found in large piles at every mill in the district and can usually be had for the hauling. The length of haul varies from ½ to 1 mile from most of the jobs, and it is the usual custom to figure gravel laid on the job at $0.50 per cubic yard, though quite often it can be hauled for $0.35 or even less.

Figures 1 and 2 show the cross-section of 6-in. combined curb and gutter and sidewalk as constructed in 1911. In the 9-in. curb and gutter the same section was used except that the curb was 9 ins. above the top of the gutter. The principal changes over the sections used in 1910 is in the thickness of the sub-base of gravel or cinders. For curb and gutter the sub-base was 6 ins. thick, and for sidewalk it was 7 ins. thick, while now both are made 4 ins. thick. It was thought the latter figure was sufficient owing to the good natural drainage of the ground here. Figure 3 shows a sketch of the combined tool for finishing the top of the curb. Besides being a time saver it insures good straight alignment and even thickness of the curb. These tools are made by a local machine shop. Figure 4 shows the steel template and forms as generally used on the curb and gutter work here. A local machine shop furnishes these templates for $9 per dozen.

The excavation was made by first loosening as much of the top as possible with rooter or plow and then finishing with pick and shovel. In some cases slips were used to advantage, but owing to the generally rocky nature of the ground and the comparatively small amount of dirt to move it was seldom possible. The contractors always found ready buyers for black dirt at from 10 to 20 cts. per load delivered on the lot, and in some instances this item amounted to no small figure compared with the contract price. Other excavated material was generally wasted on vacant lots within a haul of two or three blocks.

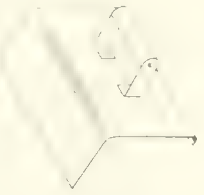


Fig. 3—Tool for Finishing Top of Concrete Curb.

After the trench was excavated to the proper width and depth and the sub-base material dumped therein the forms were started. Generally two men constituted the form setting gang and kept from 50 to 100 ft. ahead of the concrete gang. Stakes for line and grade are set by the City Engineer from 2 to 4 ft. from the street edge of the walk, their tops being on the established grade of the curb and tacked to the proper off-setted line. In the majority of cases the face of the curb is 5 ft. from the street edge of the walk, so one line of stakes was sufficient for both walk and curb and gutter. In cases of greater parkway two lines of stakes were generally set. The street edge form of the walk was first staked to line and grade by use of straight edge and hand level. The back form was then set from this by a gage and hand level. On curb and gutter work the back form, consisting of a 2x4 and 2x10, or two 2x6's cleated together, was first staked to line and grade. The front form of the gutter was then staked in place, the template holding it to line while the elevation was obtained by hand level from the top of the curb. Forms were staked every 6 or 8 ft., and in the case of the high back form for the curb were held perpendicular by means of braces nailed to short stakes set on bank of trench. On the sidewalk and top of the gutter the proper depth of mortar finish was obtained by striking off the concrete with a notched straight edge. There have been three methods used here for applying the mortar to the face of the curb. The one most commonly used as to plaster the face of the face board as the dry concrete backing is brought to the top. Good results have been secured by this

method, but when used it req res const
oversight to see that the men d not get ca
less and in a hurry and slight eir wor
getting ½ or ¾ in. thickness i ead of
as required. The second meth
placing the mortar in a sheet i
deep and the same size as the fa
for a 6 ft. section, and clamping
face board until the concrete
place. The pan must be turne n edge
placed against the face board q kly to keep
the mortar from running off, a l the inside
must be kept clean to keep mort from sticking
ing to it when it is withdraw The third
method is to clamp a 1-in. boa against the
face board and after the dry co rete backing
has been tamped in place to
board and pour the finish in the avity left by
board. This method insures a ll even ind
in thickness but when the mo r
wet enough to pour it takes to lo
sufficiently to stand up and be twe
this method concrete work mu
in the afternoon, especially on
days, and the finisher works u
occasionally by lamp light. Wi a
methods outlined above it requir
judgment and practice to know
the face board down, for if eithe
backing or the finish is too gree
time is lost trying to build it u
in place, and it is seldom that su
sents a smooth and straight ap
the other hand if left on too lo
harder to finish it properly an
duces a good appearance. With t
tures the time required to keep t
in place will vary considerably
days due to the temperature an

All mortar surfaces are floated
en float and then troweled smoo
trowel marks showing. The e
ished with edges of the required
top of the curb is finished with
tion tool shown in Fig. 3. The s
are removed just before the final
given the work, and the joints
with a fine hair brush after
grooved with the proper tool.

The size, organization and
the different gangs doing this cl
and the amount of work done
day of nine hours varied conside
ferent jobs. On some contracts
was formsetter and finisher, an
even was the contractor, and
from 400 to 500 sq. ft. of 4-ft.
hours with three other men.
stances the foreman had a gang
twelve men, would do no actua
self and would construct 1,500 to
of 4-ft. walk per day. Both bat
tinuous mixers have been used,
hand mixing with No. 2 square pu
els. As the inspector did not g
until concrete work started no
obtained on the excavating.

The following costs are typi
done here in the last two years. No
ance has been made for interes n
invested or depreciation. In mos
contractor maintained no office a
overhead charges.

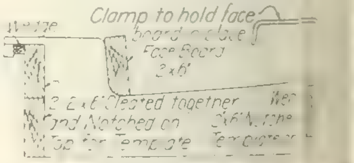

Wedge
Clamp to hold face board in place
Face Board 2x6
2 2x6' Cleated together and Notched on Top for Template
Template

Fig. 4—Templet and Forms fo C
Curb and Gutter.

It will be noticed that there is c si
variation in the cost of the diff nt
for different jobs, though the t ls
pretty closely. There are several
this. In the first place there as
siderable difference in the efficie
men and methods employed. Al
kind of work it is not always ecom
have a gang organized so that eacl

[illegible] things, and such frequent [illegible] is hard to follow in [illegible] ne on each operation. In some [illegible] he personal equation of the in- [illegible] division of labor on the differ- owever the totals give a fair cost of this work in this city vo years.

[illegible] AND GUTTER, [illegible] LIN. FT.

[illegible] gang. [illegible] mixing and placing only. Public

Cost per lin. ft.
[illegible]
[illegible] $0.1[illegible]
[illegible]
e, 338.4 cu. yds. at $0.50.. 0.05717
cu. ft. at $0.005.......... 0.00311

rial $0.24434
[illegible] and material $0.[illegible]

[illegible] AND GUTTER, [illegible] LIN. FT.

[illegible] Includes setting [illegible] and placing only. Work inter- [illegible] Foreman [illegible] Public contract.)

Cost per lin. ft.
[illegible]
226 hours at $0.25........ 0.02704
ers, 544 hours at $0.222.... 0.03787
[illegible]
:61½ cu. ft. at $0.08...... 0.01384
[illegible]
bor and material........ 0.42247

[illegible] GUTTER, [illegible] LIN. FT.

[illegible] Public contract. [illegible] Work.)

Cost per lin. ft.
[illegible]
2 hours at $0.222....... 0.0107
[illegible]
bor.........................$0.1409
and concrete, 626 sacks
..............................$0.1957
cu. ft. at $0.08......... 0.0136
[illegible]
.... 0.0517
[illegible] $0.26[illegible]
terial and labor..........$0.4019

AND GUTTER, 2,900 LIN. FT.

with Eclipse batch mixer. [illegible] setting forms and mixing [illegible] water or gasoline. [illegible] work lost because of [illegible] gang.)

Cost per lin. ft.
[illegible]
s at $0.30, 14 hours at
[illegible] 0.0123
hours at $0.2333....... 0.0159
[illegible] hours
.... 0.0159
hours at $0.222.......... 0.0356
[illegible] $0.1[illegible]
d concrete, 1,291 sacks
..............................$0.1767
[illegible]
cu. yds. at $0.50..... 0.0210
61.1 cu. yds. at $0.50.. 0.0278
terial.......................$0.2371
and material ....$0.[illegible]

SIDEWALK, 436 SQ. FT.

by hand. Includes setting d placing only. Foreman was nd finisher. Private contract.)

Labor:	Cost per sq. ft.
1 foreman and finisher, [illegible] hours at $0.50..	$0.0103
4 [illegible]	[illegible]
1 mixing and placing mortar, 7 hours at $0.222	0.0036
Total for labor	$0.0261
Material:	
[illegible] at $0.35	$0.0265
Sand, mortar, 25 cu. ft. at $0.08	0.0046
Water, 6 bbls. at $0.10	0.0014
Gravel, concrete, 4 cu. yds. at $0.50	0.0046
Total for material	$0.0371
Total for material and labor	$0.0633

(6) 4-FT. SIDEWALK, 4,934 SQ. FT.

[illegible] forms, mixing and placing only. Foreman did some finishing, but was attending to other business most of time. Otherwise gang was efficient. Lost 50 ft. of finish by rain. Public contract.)

Labor:	Cost per sq. ft.
1 foreman and finisher, 42 hours at $0.555	$0.0047
1 finisher, 17¼ hours at $0.444	0.0015
3 mixing and placing [illegible] at $[illegible]	[illegible]
4 mixing [illegible]	[illegible]
2 placing concrete, 82 hours at $0.25	0.0042
2 setting forms, 58 hours at $0.222	0.0027
Total for labor	$0.0247
Material:	
Cement, concrete and mortar, 414 sacks at $[illegible]	[illegible]
Sand, mortar, 444 cu. ft. at $0.08	0.0072
Gravel, concrete, 49.6 cu. yds. at $0.50	0.0050
Water, 9 tanks at $0.50	0.0009
Total for material	$0.0467
Total for material and labor	$0.0714

(7) 4-FT. SIDEWALK, 12,504 SQ. FT.

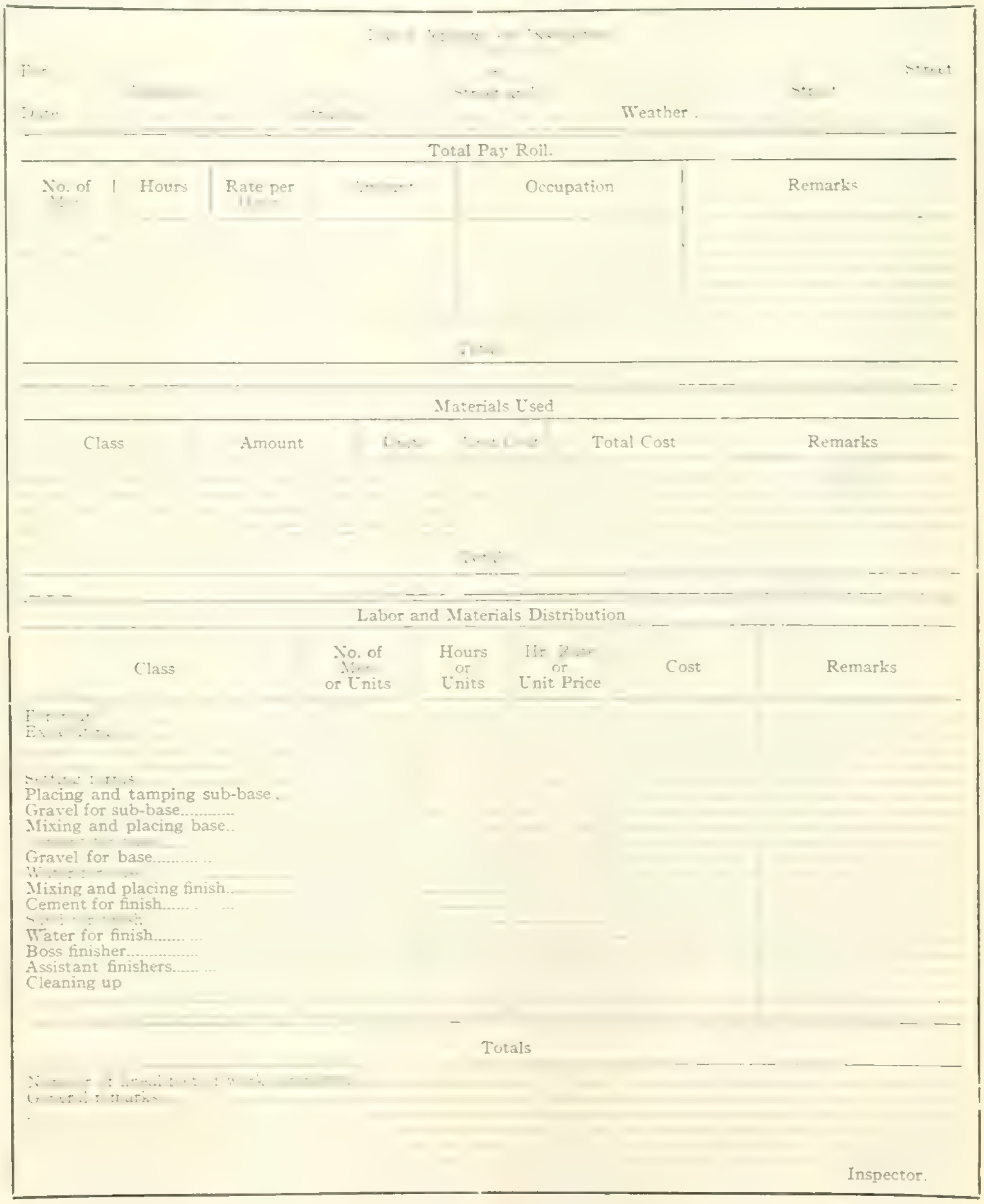
(Concrete [illegible] mixer. Includes setting forms, mixing and placing [illegible] Foreman was [illegible] and helped at all times; 50 lin. ft. lost by rain. Public contract.)

Labor:	Cost per sq. ft.
1 foreman, 18 days at $5.00	$0.0072
2 finishers, 105¼ hours at $0.555, 45 hours at $[illegible]	[illegible]
2 mixing and placing mortar, [illegible] hours at $0.222	0.004[illegible]
4 mixer men, 505½ hours at $0.222	0.0090
1 water boy, 94 hours at $0.111	0.0008
Total for labor	$0.0275
Material:	
Cement, concrete and mortar, 853 sacks at $[illegible]	$0.027[illegible]
Gravel, concrete, 113 cu. yds. at $0.50	0.0045
Sand, finish, 853 cu. ft. at $0.08	0.0053
Water, 152 bbls. at $0.10	0.0012
Total for material	$0.0[illegible]
Total for labor and material	$0.0659

(8) 4-FT. SIDEWALK, 9,566.7 SQ. FT.

(Concrete mixed with a Coltrin continuous mixer. Includes setting forms, mixing and placing only. Does not include water and gasoline. Fairly efficient gang. Foreman did no actual work but was a hustler. Was also the contractor. Public contract.)

Labor:	Cost per sq. ft.
1 foreman, [illegible]	$0.00[illegible]
1 finisher, 63½ hours at $0.444	0.0030
2 mixing mortar, 104 hours at $0.222	0.0024
2 feeding mixer, 109 hours at $0.222	0.0025
2 wheeling mortar and concrete, 125 hours at $0.222	0.0029
2 placing concrete and mortar, 119 hours at $[illegible]	0.002[illegible]
Total for labor	$0.0174
Material:	
Cement, concrete and mortar, 748 sacks at $[illegible]	$0.031[illegible]
Sand, mortar, 467 cu. ft. at $0.08	0.0039
Gravel, concrete, 97 cu. yds. at $0.50	0.0051
Total for material	$0.040[illegible]
Total for labor and material	$0.0577



Street

Weather

Total Pay Roll.

No. of Men	Hours	Rate per Hour	[illegible]	Occupation	Remarks

Materials Used

Class	Amount	[illegible]	Total Cost	Remarks

Labor and Materials Distribution

Class	No. of Men or Units	Hours or Units	Hr. Rate or Unit Price	Cost	Remarks
[illegible]					
[illegible]					
[illegible]					
Placing and tamping sub-base					
Gravel for sub-base					
Mixing and placing base					
[illegible]					
Gravel for base					
[illegible]					
Mixing and placing finish					
Cement for finish					
[illegible]					
Water for finish					
Boss finisher					
Assistant finishers					
Cleaning up					
Totals					

Inspector.

Fig. 5—Blank Used by Inspectors for Making Daily Report on Sidewalk Work.

WATER SUPPLY, SEWERAGE AND SANITATION SEC

The Design and Cost of the Permanent Hypochlorite Disinfecting Plant at International Falls, Minn.

Contributed by J. A. Childs, Assistant Engineer, Minnesota State Board of Health.

The city of International Falls is located in Minnesota on the Rainy River, which forms at this point the boundary line between the United States and Canada. The city has grown in three or four years from a very small village to a city of 2,500, with prospects of a considerable increase in the near future.

There has been for several years typhoid in and about International Falls, but as this condition is usual in a new country, it was taken as a matter of course, and nothing was done until the fall of 1911, when a sharp outbreak of typhoid led to an investigation by Dr. A. J. Chesley, Epidemiologist of the State Board of Health. His findings showed that the water was undoubtedly the principal cause of the epidemic at this time, and accordingly the emergency hypochlorite plant, owned by the Minnesota State Board of Health (described in Engineering & Contracting, Oct. 25, 1911) was sent for and installed on Oct. 26, 1911, under the supervision of the writer.

The water intake is located just above the power dam. About two miles east of International Falls is Rainy Lake, of which Rainy River is the outlet. Between International Falls and Rainy Lake is the village of Ranier. There are also a couple of saw mills, one of which has a small sewer from the toilet room in the office discharging into the river above the water works intake. The river and lake are used by several small steamers and launches, some of which are provided with closets.

Logs are floated down the Little Fork River, a tributary of the Rainy River, and down the Rainy to Loman, a town about 20 miles below International Falls. Here they are loaded upon cars, shipped to International Falls, and again dumped into the river above the dam and a short distance above the water works intake. The sewage from both International Falls and Fort Frances is discharged into the Rainy River below the dam, so that there is a possibility of these logs being the means of carrying the typhoid bacteria to a point where they may enter the city water.

As the emergency plant could be depended upon to last but a short time, and as the continuous treatment of the water was considered necessary, arrangements were made for the construction of a permanent plant.

The centrifugal pumps which supply the city are owned and operated by the Minnesota and Ontario Power Co. and supply water to the paper mill as well as to the city. Each of these pumps has a capacity of 2,000,000 gals. per day. Only one is operated at a time and the present rate of pumpage is about 1,500,000 gals. per day. While probably the city is not using more than one-fifth of this amount, it was necessary under the existing conditions to treat the whole supply. For economy's sake, it was desirable to construct a plant which would require the minimum of an attendant's time, and this necessitated one which would need recharging not more than two or three times in 24 hours. The plant was therefore designed to run 12 hours without attention.

The plant as constructed is shown in plan and elevation by Fig. 1. The essential parts are the mixing tank, motor, storage barrels, regulating keg, and necessary piping.

Mixing Tank.—The mixing tank is built of fir lumber, dressed to a thickness of about 1½ ins. The inside dimensions of the mixing tank are, diameter 2 ft., 7 ins.; depth 2 ft. 10 ins. Its capacity is sufficient to fill two of the storage barrels. The mixing is effected by the two-blade propeller or agitator fastened to the vertical shaft. The shaft is driven at a speed of 800 to 1,000 r.p.m. by a ¼ h.p. electric motor, belt connected. About 10 lbs. of hypochlorite are used to a tank of water. To mix this, the mixer is run about five minutes.

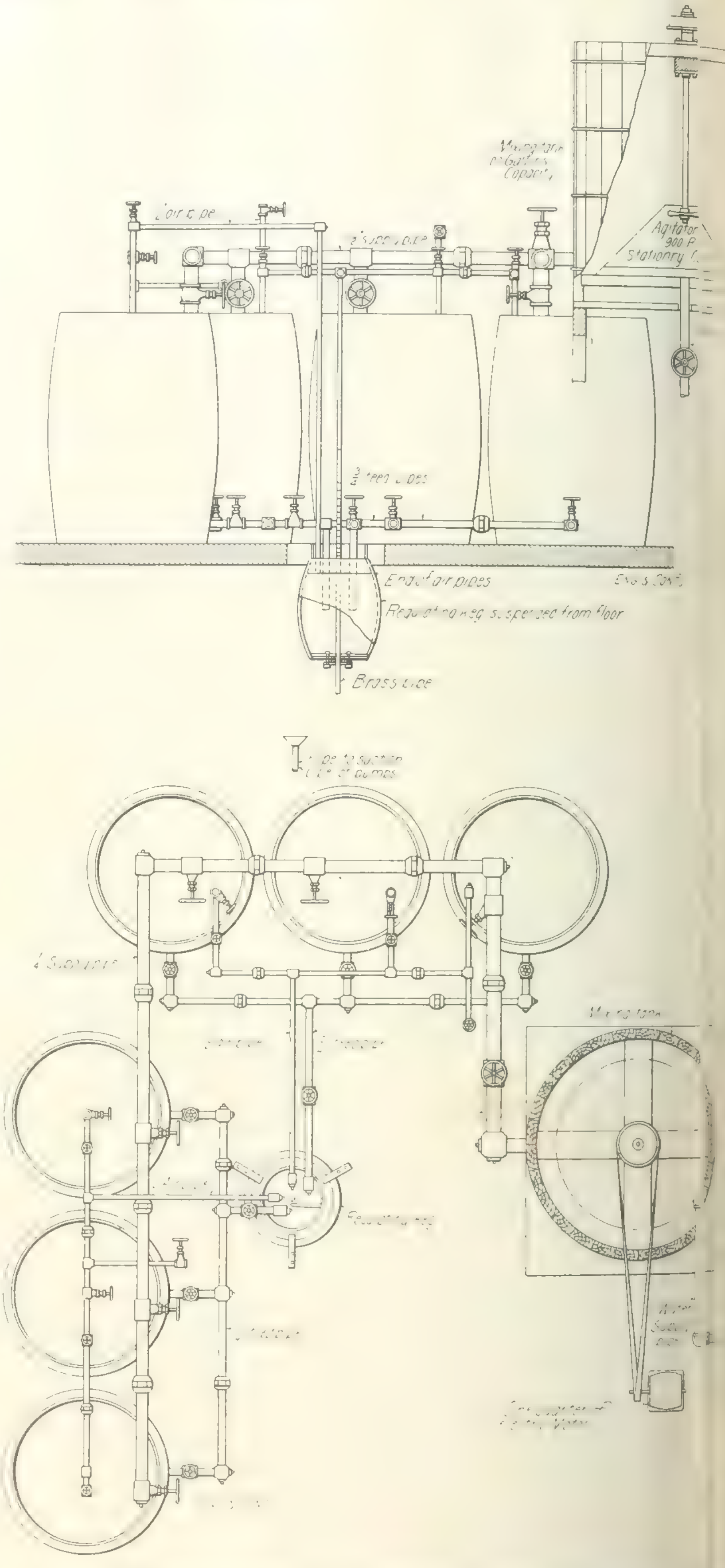
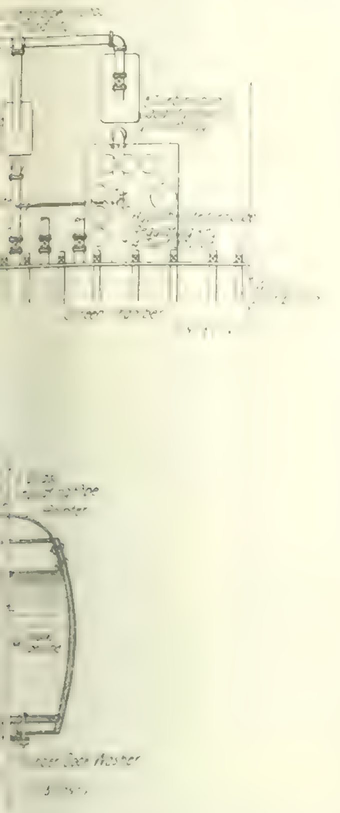


Fig. 1—Plan and Elevation of Hypochlorite Plant at International Fal

The mixing tank and all me the action of the hypochlorite ha ed with two coats of a bitumino "Elaterite." It is claimed th

rotects the exposed surfaces from
f the hypochlorite solution.

arrels.—The storage barrels, of
are six, are airtight, and of heavy
inted. The capacity is about 50



Showing Relative Location of
orite Plant and Pumps, and
Section of Regulating Keg.

l shows the arrangement of these
he connecting piping, better than
bed in words.

ows a few of the storage barrels
nnecting piping. Owing to the
s in which the plant is housed,
sible to obtain a picture which
he whole plant.

Keg.—This is a five gallon oak
with a brass pipe which can be
down through the rubber cork
bottom. See Fig. 2.

n. hole in the brass pipe allows
o flow into and through it. This
on the same principle as the
rgency plant described in a
of this magazine. From the reg-
ne solution flows directly to the
of the centrifugal pumps. In
gh these pumps, the solution is
xed with the water.

plant cost approximately $280,
ows:

mplete	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
.0 each	[illegible]
[illegible]	28.30
mber for platform and hardware, electrical tor and electrical service	158.00
at 50 cts. per hour, con- and setting up plant..	12.00
	$280.6

AL EFFECT OF TREATMENT.

s of treated water collected for
analysis showed a count of
cteria per c.c. with B. Coli ab-
00 c.c. amounts. Two samples
ater showed counts of 60 and
c.c. with B. Coli present in 100

the time required in erecting
, and housing in the plant, it
three eight-hour days to con-
parts and get the plant ready

The plant was designed by the Engineering Division of the Minnesota State Board of Health and was installed under the writer's personal direction.

Methods of Handling House Refuse Before Collected by the City.

[illegible] there were only three complaints made against the Milwaukee city refuse incinerator. During the same time the complaints against the collection service have averaged 20 per day, and have sometimes amounted to over 50 in a single day. When these complaints against the collection service are investigated it is found frequently that the fault lies with the householder. Thus it is seen that the method of handling house refuse, on the premises where it is formed, is a matter of first importance in the broad problem of city wastes disposal. We present herewith the recommendations of Samuel A. Greely, C. E., of Milwaukee, relative to the house treatment of refuse, as given before the New Jersey Sanitary Association.

A system of treatment for house refuse should be judged from the following considerations: (1) Its cleanliness. (2) Its simplicity and ease of adoption. (3) Its effect upon flies. (4) Its effect as to cleanliness and economy upon the *collection* system. (5) Its effect as to cleanliness and economy upon the *disposal* system.

(1) *Cleanliness.* From many points of view, the one-can system of refuse treatment seems to be the cleanest. The greatest nuisances from the garbage are from the odor of decomposition and from the free water which fouls everything with which it comes in contact. Both these nuisances are moderated if the garbage is mixed with and obscured by the ashes and rubbish. That garbage stored by itself creates a nuisance is evident if one considers what various cities are compelled to do to suppress it. In Milwaukee, the officials were forced by public opinion to collect garbage at night, in order to keep the foul-smelling garbage wagons off the streets during the day. In Minneapolis, householders are required to wrap each day's garbage in paper. In Buffalo, the contractor for the collection of garbage is required to wash and disinfect the wagons used in the collection service.

The greatest nuisance from ashes is the dust which blows from them. Wet garbage tends to lessen the amount of dust. The greatest nuisance from rubbish comes from the loose paper which blows away from the can, wagon or dump. This is less likely to happen if the rubbish is weighted down with garbage and ashes.

(2) *Simplicity and Ease of Adoption.* From experience in many cities in this country, it is possible to maintain a two or three-can system of house treatment. However, this is not done without effort. It is the common experience that a rule is necessary, ordering that the refuse will not be removed by the department unless the proper degree of separation is maintained. Many people do not readily understand exactly *how* the separation should be made, and some *why* it should be made. In Chicago some garbage finds its way to the dump by way of the ash-can. It is my observation that, from the point of view of simplicity and ease of general adoption, the one-can system is the most advantageous.

(3) *Flies.* Flies breed in garbage far more than in ashes and rubbish. Garbage, during the summer months, is often seen to be swarming with thousands of fly maggots. The extent to which the flies actually develop from garbage does not appear so evident. It requires about two weeks for the fly to develop after the egg is laid. Therefore, if garbage is destroyed within two weeks after it has originated, the contained maggots will be destroyed with it. Some of the maggots probably crawl from the house-can into the ground and bury themselves during the period of incubation. Just what effect the house treatment of refuse has on the number of flies developing from garbage has not been determined. Observations of mixed refuse in European cities point to the fact that mixed refuse harbors fewer maggots than does garbage. Certainly, if the ashes and rubbish are a large enough part of the whole to produce a dry, dusty refuse, the environment will not be suitable for fly maggots. In any event, the organic matter will not be a great attraction for the flies when it is mixed with dry ashes and rubbish. Possibly the Minneapolis method of wrapping the garbage in paper is as effective as any in preventing the multiplication of flies. Flies are such a nuisance and menace, and visit the garbage so frequently, that some simple, practical way of removing their breeding place should be found.

(4) *Effect on the Collection System.* The house treatment of refuse affects the cleanliness of the collection system in much the same way as it affects the house-can. Raw garbage soils the collection wagons so that, in warm weather, they rapidly become foul and require frequent cleaning. Mixed refuse, containing less free moisture, does not soil the collection wagon so readily.

There are very few cost data available from which to determine the relative economy of

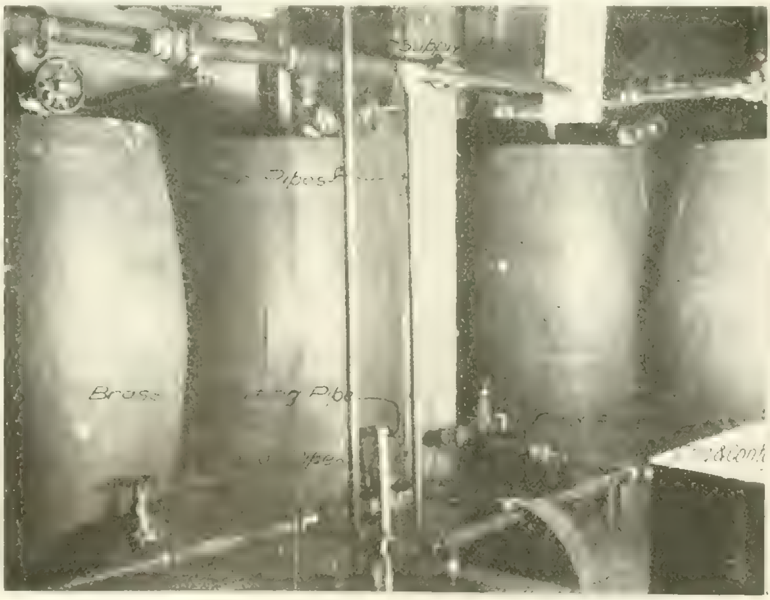


Fig. 3—View of Storage Barrels with the Connecting Piping.

collecting separated refuse and mixed refuse. There are, however, several considerations entering into this phase of the problem which should be enumerated. First, the size of the house-can affects the economy of the collection system. From the common sense viewpoint, the receptacle should be as large as can be readily handled. The collector should not have to empty the contents of a large can into his own small one, because this takes time and is unclean. A full, 12-gal. can is about as heavy as one man can empty easily into his wagon. The size of house-cans used in several cities may be seen from the following list:

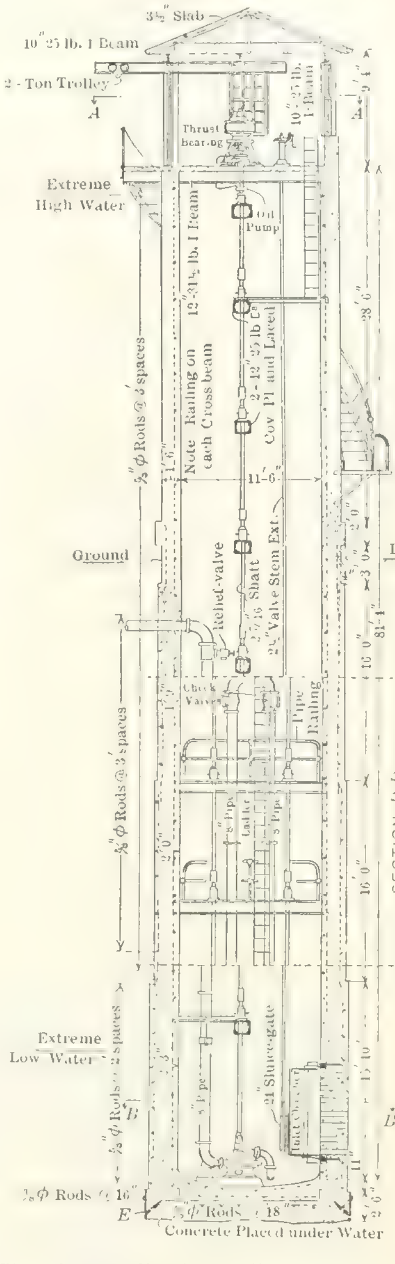
Frankfort, 8 gals.; Essen, about 10 gals.; Cologne, 10 gals.; Rochester, 3-10 gals.; Milwaukee, 20 gals.; Minneapolis, 30 gals. for ashes, and 20 gals. for garbage and rubbish; Borough of Richmond, N. Y., not over 15 gals.; Columbus, not over 18 gals.

Second, the place where the house-can is kept, or where it is put just prior to collection, affects the cost of the collection. In practically all German cities and in Paris, the householder places the can at his front step in the evening, and it is emptied during the night by the collector. I found a sentiment at Cologne and Paris against this practice, because the cans were sometimes stolen, damaged or tipped over. In most American cities the can is supposed to be kept in a regular, easily found place near the kitchen or in the rear of the house. One of the difficult parts of garbage collection in this country is the locating of the can. Frequently, cans are kept in such odd, out-of-the-way corners of the premises that the collector, especially if he is working at night, cannot possibly find them. The department chief in Milwaukee is contemplating putting an inspector on the pay-roll just to teach people where to place the refuse at the house.

These two considerations hold true whether the refuse is collected separated or mixed. But the degree of separation affects the necessary frequency of collection, and this in turn affects the cost of collection. That is, it is probably cheaper to collect a load from one block on a weekly collection than to collect a load from six blocks on a daily collection. Mixed refuse does not need to be collected as frequently as garbage, but should be collected more frequently than ashes or rubbish. In German cities, the common frequency of collection is three times a week. In American cities, the frequency of the collection of garbage varies from daily to weekly; while ashes and rubbish are sometimes not collected oftener than once a month. It is probable that only considerable differences in the frequency of collection affect the cost materially. It is unfortunate that more comparable data are not available on this subject. It should, however, be borne in mind that mixed refuse is a cleaner material for the collector to handle than is garbage, and that therefore a more capable man can be secured to do the work. Probably the costs of collection under different systems of house treatment of refuse will not vary greatly.

(5) *Effect on the Disposal System.* Undoubtedly, at the present time, the system of final disposal frequently determines the manner of treatment of the house refuse. If, for instance, a reduction system of garbage disposal has been installed, the separate treatment system is necessary. If incineration is the method of disposal, then it will generally be advisable to adopt the one-can method at the house. Therefore, it would seem proper at first to determine upon the best method of house treatment, without regard to the ultimate system of disposal. Then, if this method of house treatment requires a method of ultimate disposal which is more costly than some other, the difference in cost between the disposal system required and a more economical, but equally efficient one, can be taken as a measure of the expense necessary to secure the desired method of house treatment. There are many cities and towns in which improved methods of refuse disposal will be introduced, and it should be emphasized that the house treatment of the refuse is a considerable factor in deciding upon a wholly sanitary and efficient refuse disposal system. Where there are one or several points of disposal, from which nuisances may arise, there are several thousand back-yards, each one of which may create a local nuisance.

As to the effect of the house treatment on the cleanliness of the disposal system, it does not seem likely that any place of disposal, to which garbage unmixed with ashes or rubbish is delivered, can be free from nuisance, because the accumulation of raw garbage is bound to foul that with which it comes in contact. Only the efficiency of the means for suppressing such possible nuisances can prevent them from detrimentally affecting the environment.



Infiltration Well with Cylindrical Casing of Reinforced Concrete.

With regard to the house treatment, therefore, it is chiefly the degree of separation practiced that affects the disposal system, and not the size of the can, its location and such other features of the house treatment system.

To summarize the effect of the house treatment on the refuse problem, it may be said that, from the point of view of cleanliness and thoroughness, the frequent collection of mixed refuse kept at the house in good metallic cans accessibly placed, is advantageous, that such a treatment will make it difficult for flies to propagate in the garbage and that it will react favorably on the cleanliness of both the collection and disposal systems.
treatment will not greatly affec
the collection system, but in
likely to increase the cost of dis
increase may be taken as a m
cost of a better service secure
can system. Finally, it should
that, to secure proper house t
co-operation of the householder
cured, and that this requires pati
and intelligent guidance on the
department officers.

Method of Sinking a Reinforced Concrete Cylindrical Well Casing with Some Costs

An infiltration well constructe
a reinforced concrete caisson 1
diameter is described in a paper
N. Hatch in Proceedings Ame
of Civil Engineers, Vol. XXX
This well supplies water for t
the Chesapeake & Ohio Ry., a
near the bank of the Ohio Ri
Grove, O. Here the variation
River between high and low w
Test borings, made at several
river bank, showed that the top
laid by sand and gravel, and t
bed is in the same formation.
mind, it was decided to sink a
bank and provide openings in
would receive water by infiltrati
river through the intervening san
It was expected that water obt
way would not contain much sus
matter, though the Ohio is a
during high-water stages.

The entire shell of the well,
motor-house and roof, is of rei
crete. The shell was designed
as an open caisson below the
Sufficient reinforcement was pro
vent the walls from pulling apar
upper part of the shaft should
the forms or the friction of the
the lower part was free. Besi
for the erection stresses, the w
tom were reinforced to withstand
unbalanced earth or water press

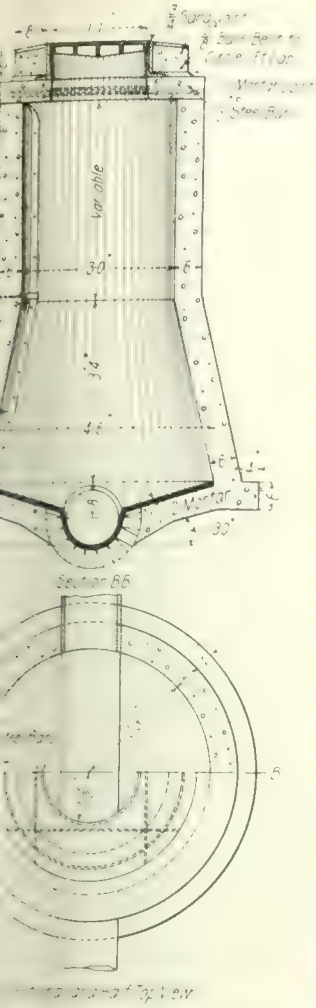
Water is admitted to the wel
openings, each 5 ins. in diame
aggregate area of 8¾ sq. ft. In
three openings are inclosed by
inlet chamber.

The estimated weight of the
is 530 tons and the gross buo
extreme high water with no wate
is 465 tons.

After leveling off the site, th
cutting shoe was set up, and the
erected over it. The forms w
sheathing nailed to waling pieces
Those for the outside of the wa
ported by the posts of the work
and were held together, in secti
bands arranged so that they could
to allow the wall to slip through
inside forms were hung from cant
ets on the working platform, an
in position by removable cross-b
struction which permitted the fre
entire interior during the periods
vating was being done.

The reinforcing rods were put
and a section of concrete about 5
carefully placed and allowed
forms were then loosened, and
was excavated from the inside
orange-peel bucket handled by a
the excavation progressed the w
sank. The operations of plac
and excavating were carried o
until the foot of the shaft reac
position. The shell sank very fr
the earth, and it became necessar
some means of checking its de
proper place. This was accompli
ing a concrete collar, integral wi
just above the ground level, and
a part of the load off the cutt
blocking between this collar and
surface. The collar was design

f the suspended weight of the ary. By the use of the collar the wall was stopped at the and there was no settlement



n and Section of Concrete
or Sewers, Hamilton, Ill.

was being removed from be- ng shoe.

aft reached the water level, nber was bolted in position ate was attached to it. When ached the water level, a large p was used to remove part d fine sand.

water through the open bot- was too great to be handled r was sent down to level off he excavation and place the r the rough bottom of the tributed the concrete for this wing the concrete to harden, mped dry and the finished n.

of the shaft was constructed orms by stages as the wall nd no conditions unusual to f similar structures were en-

n of that part of the well l level was accomplished in and the entire part above king days.

tion of the well was only a work done at Silver Grove, job has not been closed up, costs can be given. The actual costs of construction, e engineering, drafting, and arges.

tion, 370 cu. yds. at....$1.65
ing reinforcement, ma- at.......................... 3.15
ding reinforcement, la- t 3.85
and labor at $2.85 per and labor, at per cu. 2.85

All steel work, [illegible] material, 28,[illegible] .... [illegible]
All steel work, [illegible] otherwise, labor, 28,000 lbs. at.......................... 0.022
(Costs of steel [illegible].)
All equipment, piping, wiring, etc., in place .... $[illegible]

This pumping station was designed, constructed and [illegible], Church, Kerr & [illegible].

Plans and Specifications for Concrete Sewer Manholes and Forms for Same, at Hamilton, Ill.

The plans and specifications for concrete manholes for sewers, and forms for same, given herewith, were prepared by L. P. Wolff, Consulting Engineer, of St. Paul, Minn., for the new sewerage system [illegible] to be installed in Hamilton, Ill.

The standard concrete manhole is shown in Fig. 1. The tops of these manholes may be built of brickwork 8 ins. thick, as shown by the full lines, or of concrete 6 ins. thick, as shown by the dotted lines, in the section marked alternate designs for manhole top in Fig. 1.

In place of the iron ladder shown on the plan, ¾-in. round ladder irons, 8 ins. wide, projecting 4 ins. from the wall and spaced 14 ins. apart, may be used.

Foundation line A marks the [illegible] for straight manholes in firm ground, and the outline of the foundation for all junction manholes, and for straight manholes in soft ground is indicated by foundation line B in Fig. 1.

The detail of the forms for the concrete manholes is shown in Fig. 3. The top section may be from 3 to 4 ft. high, one or more sections being used to secure the required height. The outside forms of the bottom section are made in two or more sections. The inside forms are made in six sections. The position of the cast-iron head, and of the reinforced concrete cover slab, is shown by dotted lines at the top of Fig. 3.

SPECIFICATIONS.

Dimensions.—Both straight and junction concrete manholes shall have the same dimensions, except that the foundation outlines marked A shall be used for straight manholes, and the outlines marked B shall be used for straight manholes in soft ground and for all junction manholes.

Manhole Tops.—Manhole tops of both straight and junction manholes may be constructed with vertical walls covered with reinforced concrete slab, or with battered walls of brick work 8 ins. thick, or concrete 6 ins. thick, at the option of the Contractor.

Concrete.—Concrete for reinforced cover slabs shall be of 1 part Portland cement, 2 parts sand, and 4 parts of 1 in. broken stone or screened gravel.

All concrete shall be well mixed in a machine batch mixer of the revolving type or mixed by hand in a box suitable for the purpose. If a machine mixer is used, it shall be a batch mixer of a make and design acceptable to the Engineer, and shall be so used as to give thorough and complete mixing. In case hand mixing is employed and broken stone or screen gravel is used, the sand and cement shall first be thoroughly mixed dry until the color of the mixture is uniform and shall then be mixed with water to form a mortar. The mortar shall then be spread uniformly over the aggregate and the entire mass turned twice with shovels and more if necessary to secure a thorough mixture, enough water being added to make a wet concrete.

In case hand mixing is employed and pit gravel is used, the gravel shall first be spread in a mixing box in a layer of uniform thickness and the cement spread evenly over the gravel. The mixture shall then be turned at least twice with shovels before being wet and twice after being wet and more if necessary to secure a thorough mixture, enough water being used to make a wet concrete.

The concrete shall be deposited in horizontal layers not exceeding 12 ins. in thickness and shall be thoroughly puddled and rammed immediately after it is put in place. When fresh concrete is deposited on that already set, the surface shall be first thoroughly cleaned and wet and washed with a mixture of neat cement mixed with water. After the concrete is deposited, care shall be taken not to disturb it until it has thoroughly set.

In case of voids or other defects occurring when the forms are removed, such defects shall be remedied in a manner satisfactory to the Engineer.

Where forms are required to hold the concrete in place they shall be set true to line and shall be securely fastened so that they will not become distorted while the concrete is laid.

If concrete work is carried on during freezing weather, the materials shall be heated so that the temperature of the concrete when deposited in the forms will be between 70° and 100° Fahr., and after being deposited in the forms, the concrete shall be kept at a temperature sufficiently high to prevent it from freezing and to enable it to harden rapidly until it has thoroughly set.

Excavation.—The excavation for all flush tanks, manholes and other appurtenances shall be sufficient to leave at least 6 ins. in the clear between their outer surfaces and the embankment or timber which may be used to protect it.

Straight and Junction Manholes.—Manholes may be constructed either of brick or concrete at the option of the Contractor, but shall be constructed in detail in accordance with the drawings therefor.

Brick manholes shall be built of hard well burned brick and plastered on the outside with cement mortar. Brick manholes shall have concrete foundations when in the opinion of the Engineer the same are necessary.

Concrete manholes shall be constructed with walls and bottoms of concrete mixed in the proportion of one part of Portland cement, two and one-half parts of sand and five parts of 1½ in. broken stone or screened gravel, or of one part of Portland cement and six parts of selected pit gravel approved by the Engineer, and containing no greater proportion of voids than would be contained in a mixture of one part of sand and two parts of screened gravel. Concrete manhole tops may be finished with a reinforced concrete slab or with tapering top of brick or concrete as indicated on the plans, at the option of the Contractor. Wherever reinforced concrete tops are used, they shall be of concrete mixed in the proportion of one part of Portland cement, two parts of sand and four parts of 1 in. broken stone or screened gravel. The forms used for the construction of the concrete manholes shall be constructed as indicated on the plans or shall be in accordance with plans prepared by the Contractor and approved by the Engineer.

Manholes shall be built complete and fitted with covers as the work progresses and the location of each is reached. The backfilling about manholes shall be put in in layers and thoroughly rammed. The prices bid for all manholes shall include furnishing and putting in place the cast iron head and cover, dust pan, steps and concrete paving.

Inverts.—Depth of invert channels to be ⅔ of sewer diameter and top width to be 2 ins. more than sewer diameter. Bottom part of channels to conform to inner circumference of sewer. Inverts in all manholes shall be finished with a half pipe where the alignment permits, otherwise with a 1:2 Portland cement mortar not less than 1 in. in thickness. Great care shall be taken to form the inverts, especially those in junction manholes, so that there will be as little interruption to the uniform flow in sewers as practicable. Provision shall be made in junction manholes for future branches as indicated on map and plans by making arched openings in walls for the future sewers and also by forming inverts for same; these openings shall be temporarily closed with brick work.

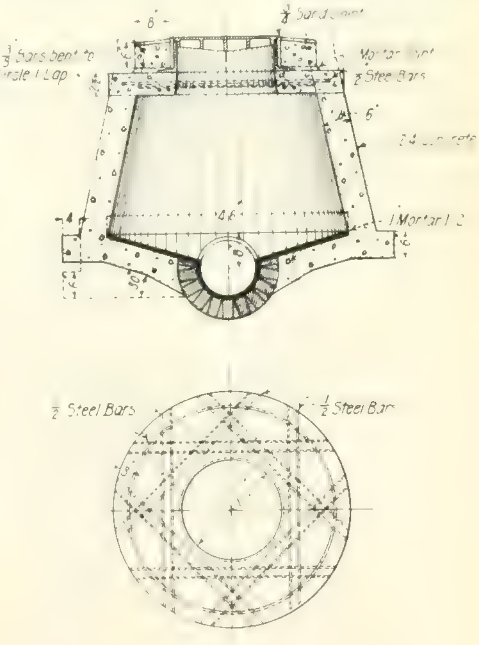


Fig. 2. Section of Shallow Concrete Manhole, and Plan of Reinforced Concrete Cover Slab.

Paving of Manholes.—A reinforced concrete ring shall be used to form a pavement around the covers of all manholes, flush tanks, lampholes and inspection pipes as indicated on the plans, the concrete to be mixed as herein specified under the head of "Concrete" and to be

[illegible]

Drain Tile.—When drain tile are used they shall be laid through manholes and provided [illegible]

Methods of Protecting Pipe Lines in Alkaline Soils.

A problem which has caused engineers in the southwest considerable trouble arises from the corosion of metal pipes by alkaline soils. In the San Joaquin valley the total alkali salts in the soils range from 0.05 up to 5 per cent. The average percentage of sulphate is about 33 and on an average the sodium chloride content is about 23 per cent. In some places in the arid regions overlying the large oil pools, the soil is of such nature that steel pipes 5/16 in. thick are eaten entirely through in three years, although the pipe had been given three coats of asphaltum paint. Some of the methods which have been successfully employed for protecting pipe lines in such soils are described by Mr. C. P. Bowie, an engineer of the Associated Pipe Line Co., in Western Engineering, from which the following information is taken.

Various kinds of asphaltum paint have been used, but with little success so far. Crude oil also has been applied by covering the pipe after it has been lowered into place to a depth of 6 ins. or more with crude oil, and then backfilling the trench immediately. If the soil is at all sandy, the oil is absorbed and leaves the pipe exposed to the alkali.

Quick-setting bituminous enamels, applied in a layer ⅛ to ¼ in. thick, give promising results. The enamel cools rapidly and cannot be spread on a pipe of lower temperature than 60° F., although the enamel is heated to 200° F. before application. The action of the mop with which it is applied is merely to roll it into a myriad of balls or globules which do not stick to the pipe at all but fall to the ground. This not only causes a great waste of material, but is apt to leave many small portions of the pipe, especially on the under side, wholly unprotected even though several coats of enamel are put on. This difficulty can be overcome largely by applying the enamel in warm dry weather only, or to pipes through which warm oil is being pumped. There are no lines in California which have been covered by this process and allowed to remain in the ground for any great length of time. One line passing through slightly alkaline territory, which was covered in this manner about two years ago, was found to be in excellent condition upon a recent examination.

The method of covering most extensively used, and perhaps the most successful one, is that employing especially prepared roofing papers. The papers commonly used are those made from ordinary deadening felt run through a mill in which the felt is plunged into a number of successive baths of hot asphaltum and rolled hot and under pressure after each successive bath until the fibres of the paper are thoroughly impregnated with the asphaltum. Just before entering the last set of rolls the paper is sprinkled with either mica or soapstone, which mineral, while it no doubt adds somewhat to resistance against the attack of chemicals, has for its principal function the quality of affording a means of keeping the paper from sticking in the roll in hot weather. Asbestos papers, prepared somewhat in a similar manner to the felt papers, have also been used in a number of places.

These papers are applied to the pipe by two methods called the spiral wrap and longitudinal lap methods. The spiral wrap method, which is usually the more efficient, consists of applying the paper to the joints between collars by wrapping it around the pipe spirally. The paper is cut for this purpose in the mill into rolls of the desired size, varying from 3 to 12 ins. in width, and containing from 50 to 100 ft. in length as best suits the diameter of pipe to be covered. The pipe is covered immediately after being screwed together and while still on skids over the ditch. It is coated with hot asphaltum and the wider strips are wound on spirally before the asphaltum sets. The crack which is left between each wrap of the wide strip is then coated with hot asphaltum and wound with a 3-in. strip of the paper. The asphaltum used is a thin grade of the ordinary refined product. It is applied at a temperature of about 200° F. and sets in about five minutes.

At the joint 3-in. strips stuck together with asphaltum are wound around the pipe on either side of the collar until a shoulder is built up flush with the outer surface of the collar. The sleeve and shoulders are then coated with hot asphaltum and the whole is covered with a 12-in. strip of paper. This strip is bound on with wire, as are also the ends of the paper where it is wrapped spirally. If this is not done the ends will curl up and allow dirt to get between the paper and the pipe after the pipe has been lowered into the ditch, and before backfilling.

The longitudinal lap system, which to the present time has been much more extensively used than the system just described, consists of wrapping the paper longitudinally around the pipe. The paper is delivered in the field in rolls, about 6 ins. wider than the circumference of the pipe to be covered, each roll containing approximately 72 lineal ft. Two men go ahead of the paper gang and measure up each joint of pipe between collars and cut the paper into the desired lengths.

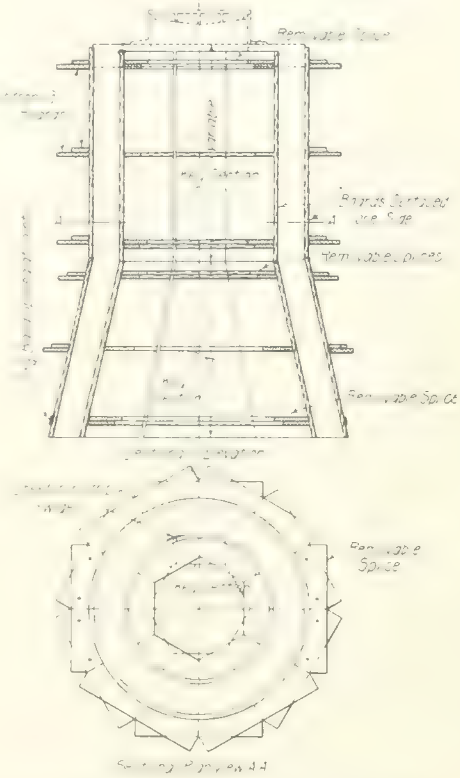


Fig. 3. Detail of Forms for Concrete Manholes.

In applying the paper to the pipe, undoubtedly the best method is first to coat the pipe with asphaltum as previously described; then to wrap the sheet of paper around the pipe and stick down the lap with hot asphaltum. This, however, is not often done when covering lines where the oil passing through is to be heated, the supposition being that the heat of the oil, usually about 130° F., combined with the pressure of the earth on the pipe after it has been buried will be sufficient to soften whatever asphaltum there is in the paper and form the necessary bond between the paper and pipe to keep the water out. Without question, this supposition is correct to a certain extent. The paper, especially where a heavy quality is used, will undoubtedly adhere to the pipe in most places where it comes in contact with the metal; but it is to be noted that roofing papers applied to a pipe, while still on skids above the ditch, and al-
lowed to stand in the sun for
will stretch to such an extent t
will be found to be on the up
ence only, there being often a
in. of space between the botto
and the paper. It is a seriou
this same thing does not occur
from the oil first reaches th
though the pipe has been low
ditch and covered up. The pa
does not bag uniformly as in t
ground, but the surplus is take
kles, and these wrinkles are ve
connected for the entire length
pipe. Should an injury occur t
wrinkles or a crack develop in
undoubtedly be the case as c
on, it is not at all improbabl
which would enter, would reac
in a joint of pipe where the pap
curely stuck on, and thus ren
covering practically useless.
tum is used as a binder, the
form will be filled, thus preven
from entering, even though the
in time crack at these points.
however, can answer this questi
are no lines in California pro
manner that have been laid a s
of time for these cracks to dev

For covering the collars, the
is used as with the spiral wra
the binder is often omitted.
seem, is even more serious tha
binder from the main body of
it gives the water a chance t
the paper and pipe through the
wrinkles.

Whether a binder is used or
should always be made on the t
with the outer portion of th
down, and wires should be place
16 ins. This is necessary to p
per from being pulled away fro
its own weight before it can be
the ditch and covered.

Some Water Purification Co
Value of Pure Wat

According to the United S
Bureau for the year 1907, the
public water supplies in cities o
population amounted to $638,000,
per capita. The approximate v
properties was estimated at $
$31.60 per capita. The annual
penses of these 105 cities, with
ulation, supplying 142 gals. per
amounted to $29,000,000, includ
1-1/3 per cent on the present va
cent is allowed on the present
value to the people of the mo
and 2 per cent to cover deprecia
of this water will average $71.5
gals., or $3.68 per capita per ye
ments on the premises of the co
ably bring the cost of water up
1,000,000 gals., or $5 per capita.
costs were given for the purificat
and an estimate was made of
pure water by C. B. Burdick b
diana Sanitary and Water Suppl
presented herewith. These fig
value for purposes of prelimin
and in urging the adoption of f

As cities develop, the needs of
in the household and the facto
appreciated, and while water s
been practiced in the industries
erable time, it is only recently th
ties have turned their attention
tion, and only a very few mu
have been built. The financial
soft water in the household is n
estimate. Experiments and figur
ple on the basis of 1 gal. per ca
purposes requiring soap, with s
a pound, indicate a value of $10
gals. for each 100 parts per 1,0
tion in hardness. There are oth
economies brought about by soft
as the maintenance of plumbing

[illegible] in the wear of clothing in in manufacturing cities very con- [illegible] in steam plants and [illegible] ts in which water is used. There no doubt but that the large ma- water supplied in the Middle e softened with great profit.

oftening is practiced today it is to construct the municipal fil- that the water may be softened ial addition to the plant invest- h plants, therefore, the question is an operating question, and in the waters are excessively hard iods of the year only, it is prac- cur the rather high operating such times as the softening ap- f financial benefit.

us, O., for the year 1910, for operating cost of the filtration plant is stated as $19.42 per of which probably $12 to $15 cost of softening. This plant [illegible] from 111 to 35 [illegible] tion of 76 parts per 1,000,000, hardness from 270 to 85, a re- [illegible] parts per 1,000,000. Where temporary hardness only is re- t is much less. Thus, at New he year 1910, the alkalinity was [illegible] to 39 parts per 1,000,000. perating cost for filtration and 6.60 per 1,000,000 gals.

the standpoint of health that ings its largest financial return. nportant of the water-borne dis- atic cholera and typhoid fever. as been practically eradicated in lightened communities. Great een made in the reduction of ath rate, but this disease is still ughout all civilized communities. h remains to be done in Amer- eighton estimates the average taken by typhoid at $4,635. Five rs is very commonly considered [illegible] a life. There are from 10 [illegible] very difficult to estimate the cost per case, but statistics available seem to indicate actual expenditures of about [illegible] for each death.

[illegible] introduced that appear to indicate that for each typhoid death saved, three additional lives have been saved from other causes. The pure water has evidently a very beneficial [illegible] probably also engenders an increased vitality that assists in the resistance to other diseases not water-borne.

After considering all these figures, Whipple concludes that $10,000 per typhoid death saved is a conservative estimate of the saving secured through the purification of a polluted supply. Upon this basis a saving of 10 per 100,000 living is equivalent to $1 per capita per annum (a convenient figure for estimating purposes), and he estimates the value of the purified water at $9.50 per capita per annum at Lawrence, Mass., $4.75 at Albany, N. Y., $3.80 at Binghamton, N. Y., and $4.75 at Watertown, N. Y.

The filtration works at Cincinnati, placed in operation in 1907, have apparently been effective in reducing the typhoid death rate per 100,000 from 80, 41 and 71, during the three years preceding the starting of the works, to 18, 13 and 6 for the three years following—an average reduction of 52, equivalent to $5.20 per capita. This, on the basis of the present population of 364,000, is equivalent to $1,900,000 per annum, which is 6 per cent on $31,000,000. [illegible] $1,750,000.

At Columbus, O., the saving based on two years following, compared with three years preceding the beginning of filtration operations, has been about 34 typhoid deaths per 100,000, worth to the citizens of Columbus $3.40 per capita, or $616,000 per annum. This is 6 per cent upon $10,600,000. The filtration works are reported to have cost about $500,000. Other statistics are available that show savings of from $3 to $7 per capita per annum through the benefit of pure water upon health.

The cost of filtration has been very generally estimated at $10 per 1,000,000 gals. of water filtered, including operation and fixed charges. In mechanical filtration the operation costs run from $3.50 to $7 per 1,000,000 gals., with fixed charges, including basins, of about the same range. The writer has the figures upon about a dozen modern plants, large and small, that run from $15,000 to $25,000 per 1,000,000 gals. of filter capacity, including basins. The average is about $17,500. Allowing 7 per cent for fixed charges, the above figures of cost and operating cost produce annual charges of from $7 to $14, with $10 as an average. This figure corresponds fairly well with estimates upon slow sand filtration plants, in which the principle item of cost lies in the fixed charges. They also handle waters materially different from the turbid waters handled by many of the Western mechanical filtration plants.

At $10 per 1,000,000 gals. and a consumption of 100 gals. per capita, the total cost of filtration is 36½ cts. per capita per year, and at 150 gals. per capita, which is nearer the average consumption in cities using river water, 55 cts. per capita per year.

Assuming the cost at 55 cts. and the value of a life at $10,000, including incidental losses, a saving of 5½ lives per 100,000 will balance the cost of filtration. A reduction in the death rate of 11 will show a return double the net cost, and in all of the cities whose death rates have been cited above the indicated net return amounts to from 6 to 20 times the yearly cost of purification, including fixed charges. Viewed as a business proposition it can be stated conservatively that where a polluted water is filtered effectively, the net return in lives saved, after deducting operation costs and depreciation, will amount to from 50 to 200 per cent per annum upon the investment in filtration works.

IDGES AND BUILDINGS SECTION

ests to Determine Stresses ced Concrete Floors in pleted Buildings.

II.

tests frequently have been rced concrete building floors. lue in judging the quality of nd for the confidence which owner and tenant, but they are as indication of the stresses ently, therefore, attention has esting completed buildings to ents of stresses and deforma- ermine their amount and dis- e effect of one part of the another. The first of these ng tests was described by Mr. in our issue of Dec. 28, 1910. e similar tests were made and he committee of the National Cement Users, Prof. A. N. n. As these tests are a new vestigation of reinforced con- em in abstract in three arti- is is the second. These arti- to a presentation of results thod of conducting the tests ferred to the paper by Mr. above.

ARTER BUILDING TEST.

as eight stories high and 60x nd was built by the Turner , New York, N. Y. The and girder type, with panels t continuously with the col- ers are 10x24 ins., and the beams in each panel are 7x18 ows the girder and beam arrangement. The general construction features are indicated in Fig. 2. Beams and girders were designed as simple beams but reinforcement is supplied for continuity. A live load of 150 lbs. per square foot was assumed.

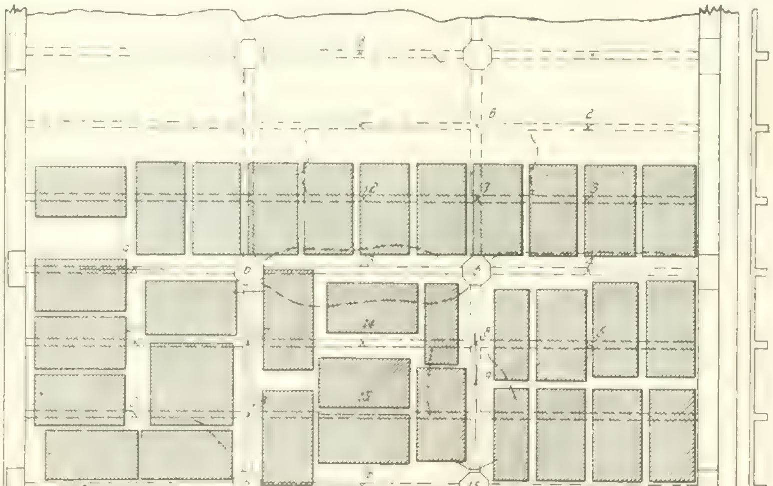


Fig. 1—Girder and Beam Arrangement.

The aggregates were an excellent grade of sand and gravel obtained from the sand banks in Hempstead Harbor on the north shore of Long Island. The gravel ranged in size from ⅜ to ⅞ in. For the beam and girder reinforcement bars having an elastic limit of about 50,000 lbs. per square inch were used. The beams have one 1-in. square bar and two ⅞-in. square bars at the middle and one 1-in. square bar over the support carried about 15 ins. beyond the center line of the girder. Ten ⅜-in. round bars placed in the slab are also available for tension reinforcement in the end of the intermediate beams, as is also one T-bar used for supporting the slab reinforcement during construction. The girders have two 1-in. square and three ⅞-in. square bars at the middle, placed in two layers, and two 1-in. square bars over the support carried nearly to the farther face of the column.

Figure 1 shows the arrangement of the test load which was equivalent to 300 lbs. per square foot and was applied in increments of 100 lbs. per square foot.

Stresses and bending moment coefficients are summarized in Tables I and II.

For the tensile stresses in the reinforcement at the middle of the intermediate beams at the full load of 300 lbs. per square foot, the highest stress observed was 11,000 lbs. per square inch and the average stress recorded may be said to be 8,500 lbs. per square inch. At the end of the intermediate beams, the highest stress observed in the reinforcement was 8,000 lbs. per square inch, and the general value may be said to be 7,500 lbs. per square inch. Using the assumption for resisting moment ordinarily taken in design calculations, these stresses may be considered to correspond to a bending coefficient of .05 *Wl* for the maximum stress at the middle of the beam and .03 *Wl* for the maximum stress at the end of the beam.

Assuming a modulus of elasticity for the concrete 2,500,000 lbs. per square inch the concrete on the compression side of the beams at the middle showed a compressive stress of 350 lbs. per square inch and at the end of the beam 1,100 lbs. per square inch. It is apparent that the total compressive stress in the concrete is greater than the total tensile stress in the reinforcement of the beams. A possible explanation is that end thrust exists, involving so-called arch action in the beams and floor structure, and that the tensile stress is relieved by the presence of this thrust. The tensile strength of the concrete must have a large effect on the resisting moment. The coefficient of *Wl* in the bending moment, necessary to give a compressive stress equal to the maximum measured in the concrete, on the assumptions made, is .077 for the middle of the beam and .06 for the end of the beam. These coefficients are lower than the value 1/12 usually assumed in design of such beams.

For the tensile stresses at the middle of the girders the observations showed about 8,000 lbs. per square inch in the reinforcement at the middle. This corresponds to a bending moment coefficient of .05. The reinforcement at the end of the girder was inaccessible.

Assuming a modulus of elasticity of 2,500,000 lbs. per square inch, the concrete on the compressive side of the beam at the support showed a compressive stress of 900 lbs. per square inch. The reading at the middle of the beam showed very little compression. Assuming that the loads on the girder are concentrated at the points where the intermediate beams are connected, and making the same assumption of distribution of stress as before, the coefficient of bending moment was .05. It seems probable that the compression at the middle of the span must be distributed a considerable width of floor, or larger readings of compression would have been obtained.

In four beams measurements of compressive deformations were taken at a series of gage lines from the support to a location near the point of inflection. The measurements recorded for the column beams show considerably more compressive stress than do those for the intermediate beams, perhaps one-third more. This difference in stress may be due partly to the deflection of the girder, and to the deflection of the intermediate beam between its support and a point opposite the end of the column beam, which would permit a larger part of the load to be carried by the column beam. It may be due somewhat to the fact that reinforcing bars are bent down from a point at the end of the column beam, while in the intermediate beams the bars tally for a foot from the face

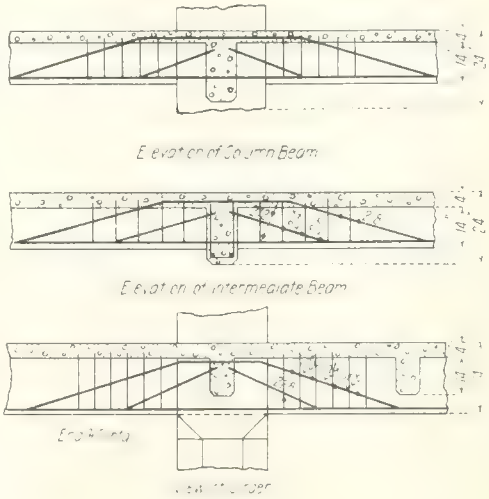


Fig. 2. General Construction Features.

TABLE I.—STRESS INDICATI
NER-CARTER BUILDING TEST.

Member.	Rein forcem
End of girder	...
Middle of girder	8,
Middle of girder	9,
End of beam	8,
End of beam	8,
End of beam	4,
End of beam	..
Middle of beam	7,
Middle of beam	11,
Middle of beam	9,
Middle of beam	8,
Middle of beam	8,
Middle of beam	11,0
Middle of beam	5,0
Bent up bar in girder	5,0
Bent up bar in girder	5,
Bent up bar in beam	3,0

TABLE II MAXIMUM STRESS
MENT COEFFICIENTS IN TH
TER BUILDING TES

Member.	Reinforcement. Stress.	Reinforcement. Co-efficient.	St
Girder—			
End	31,000	1/12	1
End	..	...	
Middle	12,500	1/12	
Middle	8,000	0.05	L
Intermediate Beam—			
End	21,500	1/12	1
End	8,000	0.03	1
Middle	18,500	1/12	
Middle	11,000	0.05	
Column Beam—			
End	19,600	1/12	1
End	..	...	
Middle	17,000	1/12	

The direction of the lines ind stress at about 45 ins. from the fa in the column beams and at about the face of the girder in the beams. In both cases the resul point of inflection at about 0.22 span.

The distribution of compressi the T-beam formed by a beam slab (which involves the distance the beam for which compressive developed) has been a fruitful s cussion. Measurements parallel t the beam were taken on the upp the floor slab immediately above intervals between them. It is a a somewhat higher stress existed than in the other. Taking this i ation, the compressive stress vari formly from one beam to the o full width of the floor slab ma be effective in taking compression hang (counting to the midp beams) is 6½ times the thickness will be noticed that the conclus same as given for the Wenalden

STEAM AND ELECTRIC RAILWAY SECTI

Reports of Appraisal of the Physical Properties of the Elevated Railways of Chicago.

The city of Chicago has for some time been formulating plans for the permanent establishment and maintenance of the best possible transportation facilities for the city, and during the last six months has by agreement with the elevated railroad companies and with their co-operation, secured reports of the estimated value of the tangible properties of these railways. These railways are the South Side Elevated, the Metropolitan West Side Railway, the Northwestern Elevated and the Chicago & Oak Park Elevated. A physical valuation of these properties was necessary to further progress of plans to arrive at a satisfactory scheme for the operation and maintenance of all the transportation facilities within the city. The City Council, through its committee on local transportation, Mr. Peter Reinberg, chairman, appointed the three members of the present Harbor and Subway Commission to undertake the valuation of the elevated railroad properties. This committee consisted of Messrs. John Erickson, E. C. Shankland and J. J. Reynolds. Mr. George Weston of the Board of Supervising Engineers was later added to the committee, which was known as the Valuation Committee. The representative of the Chicago elevated railways, who was also appointed as a member of this committee, was Prof. George F. Swain.

The Valuation Committee was instructed to deal finally and solely with the physical values, leaving all questions of overhead charges to the sub committee of the Local Transportation Committee, it being held that the Council Committee on Local Transportation was the proper authority for considering the intangible values or any claims of that sort made by the elevated railway interests.

After several meetings of the Valuation Committee it was found that the members representing the city and the representative of the railways could not agree on all the methods for valuating the various items of physical property. Prof. George F. Swain therefore withdrew from the com presented an independent minority give herewith abstracts of the re Valuation Committee submitted to the cil committee on May 8, 1912, and by Prof. George F. Swain, subm same time.

VALUATION COMMITTEE RE

The Valuation Committee ap following experts to determine th several items of physical property submitted in inventory taken by elevated railways: Real estate, Jo berger; structural steel, Wm. rolling stock, M. K. Northam; plants and signals, F. H. Ewald; F. W. Watts.

The inventories were taken month of January with the excep for real estate, which was submitt was assumed that four years' tim required to reproduce the syste order to arrive at the proper costs to be applied to the various item

TABLE I—ESTIMATE OF PHYSICAL VALUE [illegible] BY VALUATION COMMITTEE'S REPORT

	[illegible]		—Outside City Limits			
	[illegible]	Present value.	Cost to reproduce new.	Present value.	Total cost to reproduce new	Present value.
and right of way	$16,[illegible]	$16,248,864	$241,864	$241,864	$16,4[illegible]	$16,490,728
s and public utilities	[illegible]	2,230,841			2,230,841	2,230,841
steel	[illegible]	9,609,759			11,127,025	9,609,759
		1,248,333	73,249	44,868	[illegible]	1,293,201
		196,650			[illegible]	196,650
		153,344	[illegible]	4,755	[illegible]	158,099
		118,351	[illegible]	6,765	185,957	125,116
ds including track, special work and interlocking		340,568	25,122	19,458	[illegible]	360,026
plants and block signal		[illegible]			388,399	292,003
ions					3,962,672	2,570,356
s and batteries	[illegible]	1,180,777	176,172	147,618	1,652,025	1,328,395
lines, overhead and bonding	[illegible]	946,841	50,316	[illegible]	1,192,366	[illegible]
	[illegible]	7,790,502			[illegible]	7,790,502
ldings and platforms	[illegible]	1,397,590	46,247	44,313	1,784,887	1,441,903
s, tools and supplies	[illegible]	269,250			359,000	269,250
g construction		[illegible]			150,000	150,000
	$52,045,387	$44,744,029	[illegible]	[illegible]	$52,673,247	$45,297,611
head charges	[illegible]	8,053,925	113,015	99,645	9,481,185	8,153,570
	[illegible]	[illegible]	$740,875	[illegible]	$62,154,433	$53,451,181

analyses of costs, prices and corresponding period of improved methods of work re, and in applying prices used on, has been governed by this

the depreciation of the proper- tion Committee considered the and the sinking fund method t be called the individual judg- The first method is based on that depreciation takes place at during the entire time of the The sinking fund method con- eciation as conforming to the sinking fund created by annual ith interest compounded, which the useful life of the property original cost of the property ge. The individual judgment s no fixed rule, but is based on gment and a consideration of conditions.

arked difference in the amounts as shown by the Valuation rt and the minority report ow- rent methods used in calculat- The Valuation Committee used ne method. By referring to II the amounts estimated in the various classes of physical e seen.

paragraphs take up several items shown in the table, giv- nations of the amount shown nding items:

—The committee accepted the Donnersberger.

Foundations.—The foundations of the elevated railroad structures, being almost entirely below the surface, could not be accurately measured. Plans and quantities submitted by the railway companies were checked as carefully as possible and accepted as correct. The prices of materials and other elements entering into foundation construction were determined and applied in the calculations. Consideration was made of the probable cost of taking care of public utilities both below and above ground, which would interfere with construction. The estimated cost of changes in these public utilities is included.

Structural Steel.—Prices both past and present of steel construction on elevated roads and on other structures were analyzed by the Valuation Committee, and the cost figure arrived at was believed to be fair and liberal.

Power Plants, Sub-Stations and Storage Yards.—Various details of making up these costs were considered in joint conference with representatives of the railway companies and agreed to. The items of power stations and sub stations were treated in the same manner as the above, with the exception of one item, that of engines.

Rolling Stock.—A detailed inspection was made of the cars of each class to ascertain that the equipment was in accordance with the specifications of the particular class. The reproduction value was then determined with a reasonable allowance for freight, assembling, testing, etc., being included. The life of the various parts of the cars being available, a special determination of the depreciation of the rolling stock was made, taking into consideration the scrap value remaining at the end of its life.

Stations and Buildings.—Bills of material contained in this item were taken off in detail from the plans submitted by the railway companies, and prices covering a period of years were applied. All parts of the building except steel, which in this valuation is included in item No. 3, are higher on account of labor than several years past.

Overhead Charges.—Certain expenses inseparable from the construction of the elevated railway system and a necessary part of the physical costs have been included in the estimated valuation. These are (1) engineering, (2) legal expenses, (3) organization and administration, (4) contingencies, (5) interest or carrying charges during construction. These overhead charges were estimated at 18 per cent of the total cost. In addition to these expenses there may have to be considered the items of promotion expenses and brokerage on construction capital. These two items are of a strictly financial nature, however, and in accordance with instructions from the Council Committee the Valuation Committee omitted them from consideration.

MINORITY REPORT.

Prof. George F. Swain based his report on a report by A. L. Drum & Co., who were engaged to appraise the values of the physical properties except real estate, rights of way or overhead charges. The real estate was appraised by Mr. J. Milton Trainer, whose figures were accepted without change. Prof. Swain also was advised by Mr. C. H. Cartlidge, engineer of structures of the Chicago, Burlington & Quincy R. R., on the subject of the depreciation of the steel structures; by Stone & Webster on the subject of sub-stations and batteries; and by Mr. C. T. Fernald,

II.—ESTIMATED VALUE OF PHYSICAL PROPERTIES OF THE CHICAGO ELEVATED RAILWAYS FROM REPORT OF PROF. GEO. F. SWAIN.

	Estimate of A. L. Drum & Co.				Original Estimate of Commission. Subject to change.		Estimate of Prof. Geo. F. Swain.	
	New (a)		Depreciated (b)		New (c)	Depreciated (c)	New (d)	Depreciated (d)
	Amount.	Percentages Included.	Amount.	Percentages Included				
el ...	$ 2,800,193	5%	$ [illegible]	5%	$ [illegible]	$ 1,926,605	$ [illegible]	$ 2,600,000
el	14,885,725	[illegible]	14,7[illegible]	[illegible]	10,200,048	8,835,278	12,884,132	12,584,000
c	2,513,324	1[illegible]	1,825,993		1,802,376	922,826	2,347,431	1,656,989 (e)
t, ...	262,200	[illegible]	196,650	5%	251,400	196,650	251,400	188,550 (e)
ll	396,551	1[illegible]	288,908	1[illegible]	309,332	156,289	[illegible]	[illegible]
	[illegible]	10%	156,583	1[illegible]	168,272	70,733	189,775	142,350 (e)
ails, including track, special interlocking	632,808	1[illegible]	505,504		351,587	215,338	550,270	385,189 (e)
ants and block signals.....	[illegible]	10%	[illegible]	1[illegible]	394,839	297,816	412,000	309,000
	4,813,416	10%	3,824,104	10%	3,586,149	2,318,662	4,166,325	3,274,876
and batteries	1,975,767	10%	1,675,659	1[illegible]	1,484,867	1,089,194	1,753,458	1,476,734
lines, overhead trolley and	1,529,619	15%	1,389,726	15%	1,269,858	979,459	1,360,104	1,238,500
	11,205,966	[illegible]	10,144,346	[illegible]	9,700,887	7,790,502	10,098,652	8,106,134
ldings and platforms.	2,717,377	1[illegible]	2,598,527	10%	1,784,887	1,441,903	2,250,000	2,160,000
us, tools and supplies......	359,000		269,250		359,000	269,250	359,000	269,250
real estate and rights of head charge...........	$41,[illegible]		$40,750,892		$33,219,77[illegible]	$[illegible]	$39,552,247	$34,634,396
physical	[illegible]		8,954,705				11,865,674	11,865,674
real estate and rights of	$[illegible]		$49,705,597				$51,417,921	$46,500,070
nd rights of way (J. Milton ires)							44,551,498	44,551,498
real estate and rights of							2,227,575	2,227,575
							$98,196,994	$93,279,143

tages included represent cost of construction organization, including engineering, superintendence, inspection, accounting, office and ng supplies, etc.

tages included for cost of construction organization, etc., but depreciated.

centages included for cost of construction organization, etc.

tages for cost of construction organization, etc., included in item overhead on physical.

eciation on labor items.

engineer of the Boston Elevated Railroad Co.,

By reference to Table II the figures as [illegible] revised by Prof. Swain, may be seen. The following paragraphs refer to the items in detail in which Prof. Swain has disagreed with the Valuation Committee. It will be noted that the reports of the valuation of the real estate were each accepted without change, Mr. Trainer's report being $44,551,498.02 and Mr. Donnersberger's report being $16,490,728, which is the largest difference between the Valuation Committee's and Prof. Swain's reports.

Foundations.—The most essential difference between estimates of A. L. Drum & Co. and the estimates of the Valuation Committee with reference to foundations lies in the charge which should be made for the expense of taking care of sub-surface and aerial obstructions applying to other public utilities. The proper charge to be made for these if the roads were to be built new today is of course uncertain. The Valuation Committee considered that they had made ample allowance for this. After talking with contractors in Chicago and Boston, Prof. Swain assumed that A. L. Drum & Co.'s estimates were more nearly correct. If the estimate were to be made today of the cost of building these foundations, the cost of interfering with these utilities would have to be estimated by using judgment, and in addition to such estimate an allowance for foundations would have to be made, as is usually in all engineering estimates. In Prof. Swain's report the valuations of these foundations were not depreciated.

Steel.—With reference to the steel structure Prof. Swain states that the valuation is almost entirely a question of the price per pound erected and painted. At this point there is a wide diversion between the commission and himself. A. L. Drum & Co. estimated the steel at 4 cts. per pound, while the commission has used the figure of 2.75 cts. per pound. Prof. Swain concluded that the A. L. Drum & Co. figure was a little high and that the Valuation Committee's was entirely too low, and he therefore adopted a price of 3.50 cts. per pound.

Track.—Mr. Fernald of the Boston Elevated Railway Co. reported to Prof. Swain that the prices used by A. L. Drum & Co. for material were almost identical with those paid by the Boston Elevated for rails and fittings, while for timber they were very much lower than those paid by the Boston Elevated Co. With reference to the depreciation of track, the labor involved in the laying of track or decking, on the assumption that when the track and deck have to be renewed this labor will be furnished by the railroad company and its cost charged entirely to operating expense and therefore the labor was not depreciated. This is in accordance with the methods prescribed by the Interstate Commerce Commission.

Substations and Batteries.—Figures for this item were made by A. L. Drum & Co. and also by Stone & Webster and agreed almost exactly and were therefore put in Prof. Swain's report with a slight revision, after conference with the experts of the Valuation Committee.

Rolling Stock.—The figure for the rolling stock as estimated by A. L. Drum & Co. seemed to Prof. Swain somewhat high and in his figures he adopted the figures as given him by the expert for the Valuation Committee with slight modifications.

Stations, Buildings and Platforms.—This item was appraised by Prof. Swain after examination of all the data submitted, including records of the original cost of some of these stations, and after careful consideration he adopted a figure about 10 per cent below that of A. L. Drum & Co.

Overhead Charges.—The estimate of A. L. Drum & Co. includes, as is shown in the table, a certain percentage for engineering and inspection in each item, varying with the different items from 5 to 15 per cent. To the sum of the items 20 per cent is added in Prof. Swain's estimate to cover the remaining overhead charges—namely: interest during construction, financing, brokerage, organization, legal, development expenses, and contingencies. After consideration it seemed that a total overhead charge of 35 per cent for a project of this kind would be reasonable. This charge would cover (1) promotion, (2) organization, (3) engineering, (4) legal and real estate charges, (5) administration, (6) taxes during construction, (7) interest, (8) interest during construction, (9) brokerage and (10) contingencies. All of these charges are real and tangible and represent actual money which must be paid out in order to produce the property in its present condition. They should therefore be included in a physical valuation. Regarding the total charge to cover all these items Stone & Webster reported that in their opinion 35 per cent would not be too high a charge. In order to be conservative Prof. Swain used 30 per cent for his final figures.

Depreciation.—The following on depreciation is taken verbatim from Prof. Swain's report, as this was one of the principal points of disagreement between the Valuation Committee and himself, especially as to the method of calculating the same:

If the object is to determine the actual present value of the material constituting the physical property, this is a concrete problem and is not to be determined primarily by any formula, but by careful inspection. The actual condition and wear of each element must be measured. Take, for instance, the case of the steel in the structure. A railroad bridge generally has to be renewed in a comparatively few years, but this is not because it wears out, but because it becomes too light on account of the rapid increase in the weight of locomotives. Steam locomotives have doubled in weight on our main railroad lines in a comparatively few years. On an elevated road, however, using multiple unit cars, there is no reasonable prospect of any material increase in the weight of rolling stock. Under these circumstances, if the steel has been kept protected from corrosion, it should last forever. Its depreciation is not measured by years, but by the actual corrosion which has taken place. Actual depreciation, then, is a question of maintenance and wear. A rail wears according to the traffic, and its life depends upon its wear. Some elements of physical value, like a car, consist of different elements, having different lengths of life; the car body may last a long time, the trucks, motors and wheels wear out more quickly. The actual depreciation will depend upon the wear and the maintenance, as in the case of steel. This actual depreciation will enable the probable life to be judged.

Taking now a single element not composed of elements having various lengths of life, say, for instance, a rail whose actual depreciation depends upon how much it has worn down, this actual depreciation, under constant traffic, will be properly determined by the straight line method, using the life which is the actual life under the traffic to which it is exposed. This actual depreciation, subtracted from its value new, will give the actual present value. But this present value is not necessarily the proper price to be paid for the rail, the reason being that for actual purposes as a part of a going concern, the rail is as good as new and no expenditure will have to be made to renew it for some time to come.

Suppose an element to cost new $20 and to be worthless when worn out, and suppose it has a life of twenty years and that it is ten years old. Its life is half over, its actual value half its value new, or $10. But it is as good as new, so far as actual use is concerned, and will be for ten years, at which time it will have to be renewed at a cost of $20. The party purchasing it will have to take steps to provide for having $20 at the end of ten years with which to renew it. He may lay aside $2 per annum and put it in his stocking, or he may lay aside a much smaller sum per annum, and put it at compound interest at 4 per cent in bank; in either case he will have $20 available at the end of ten years. The difference between the straight line depreciation fund and the sinking fund depreciation fund is simply that the former is not

supposed to earn interest, wh
Now if the rail were new, th
equally have to prepare to rene
end of twenty years. He could
annum without interest or a le
num at interest, and in each ca
plus his depreciation fund would
as good as new; not that the
fund depreciation fund would at
the actual depreciation, but tha
this actual depreciation at the
it would be necessary for it to e
when the actual depreciation
point when renewal would be
that time the money would be
new it.

Now the owner of a property,
preciation fund calculated on t
basis for every element of
possessed of a property as go
should not sell the property
sinking fund, for any less tha
Likewise the purchaser who pa
and receives the property and t
or who pays in cash the cost ne
in the sinking fund and receiv
without the fund, is in as good
he had built the property new
parts will be renewed from tin
he has the funds for renewal pr

It would seem therefore that t
depreciation would be the pr
use in fixing a price at which a
be taken by the city. I have us
so far as applicable, the sinkin

General.—As a matter of inte
add a comparison of the estimat
I have given with current value
New York and Boston.

In Boston the engineers of th
road company, in making their
double track line, use in general
foot, which they think is a fair
cludes structures, foundations, tr
cluding third rail and electrical
excluding signals. It does not
ger stations, switch towers, sign
car houses, repair shops, or pow

In New York recent prices
chief engineer of the Interborou
H. Pegram, based on recent ext
elevated lines, indicate a cost
foot, double track line, and $127
for three tracks. This includes
which are named above as inclu
ton estimate, together with adm
stations.

If I am correctly informed
lines, not including surface trac
following mileage:

[illegible] ft. double tr
78,500 ft. third track
38,000 ft. fourth trac
4,300 ft. single trac

Using the New York figures
following estimate of cost for th
elements of these [illegible] respe
$3,145,500 and $[illegible],900 mak
$31,[illegible],400. By reference to
find that my final estimates for
production of the elements
above figures (including surface
follows:

Item.
2
3
4
4A
5
6
7
8
11
13

Total
per cent.

You will note that my total for
considerably less than that ind
New York figures. This compar
as well as every other compariso
been able to make and the judg
engineer whom I have consult
parts of this appraisal, indicates t
are conservative. I believe that
the actual fair cost of reproductio
ent time.

RAINAGE AND IRRIGATION SECTION

and Estimates of Costs of 33,000 Acres of Swamp nd in North Carolina.

ge of the swamp lands known as [illegible] th Carolina, will render 33,000 [illegible] and parallel to Lumber River, hey will be drained. Briefly, the as Back Swamp has a watershed and from ½ to 1½ miles wide; 550 acres. Jacobs Swamp has a iles long and from 1 to 4 miles ins 9,980 acres. In an addition large areas there is a tract of [illegible] the Gum and Cotton M[illegible] e Lumber River which will be e drainage district, which thus f 32,850 acres.

[illegible] the district as a whole has while the secondary watersheds es toward the runs. A few ve the general surface, one of separates the Back Swamp and watersheds. The drainage and tortuous, with no definite t in places. They are not large of channel, to carry off the r is the Lumber River large y off the drainage without im- laximum rainfall occurs from er. Study of the rainfall and to the conclusion that drain- ple which provided for a run- 24 hours for Back Swamp and urs for Jacobs Swamp.

DRAINAGE PLAN

r drainage plan provides for h larger runs and the channel Lumber River. The ditches carry 1 in run-off per 24 ning 5½ ft. deep and 30 per running bank full. They are ft. wide minimum for dredge side slopes of 1 on 1. Fig- mum ditch section. Also the led so that the maximum ex- sible without rebuilding the neral map, Fig. 1, shows the lines and the ditches by full

SWAMP DRAINAGE.

area of Back Swamp and its ns 21,550 acres, all of which [illegible] be drained by a main ditch, located in Back Swamp, and five lateral ditches located as shown on the accompanying map of the district.

Back Swamp Ditch.—The main ditch starts [illegible] shed and continues to the southeast, following the course of the present drain to a point near Back Swamp Church, where it turns to the north and enters Lumber River, which is the outlet for the drainage of the district. The main ditch, from the starting point to the mouth of Little Back Swamp, is to have a 14-ft. base. From the mouth of Little Back Swamp at station 760 to station 800 the base is to be 16 ft. wide; from station 800 to station 850 the base is to be 18 ft. wide; and from station 850 to the outlet at the Lumber River the bottom is to be 20 ft. in width. The ditch will have an average depth of approximately 6.5 ft. The capacity of the ditch is computed from the formula

[illegible]

[illegible] of 0.025. The total estimated excavation is 480,000 cu. yds. and the estimated cost is as follows:

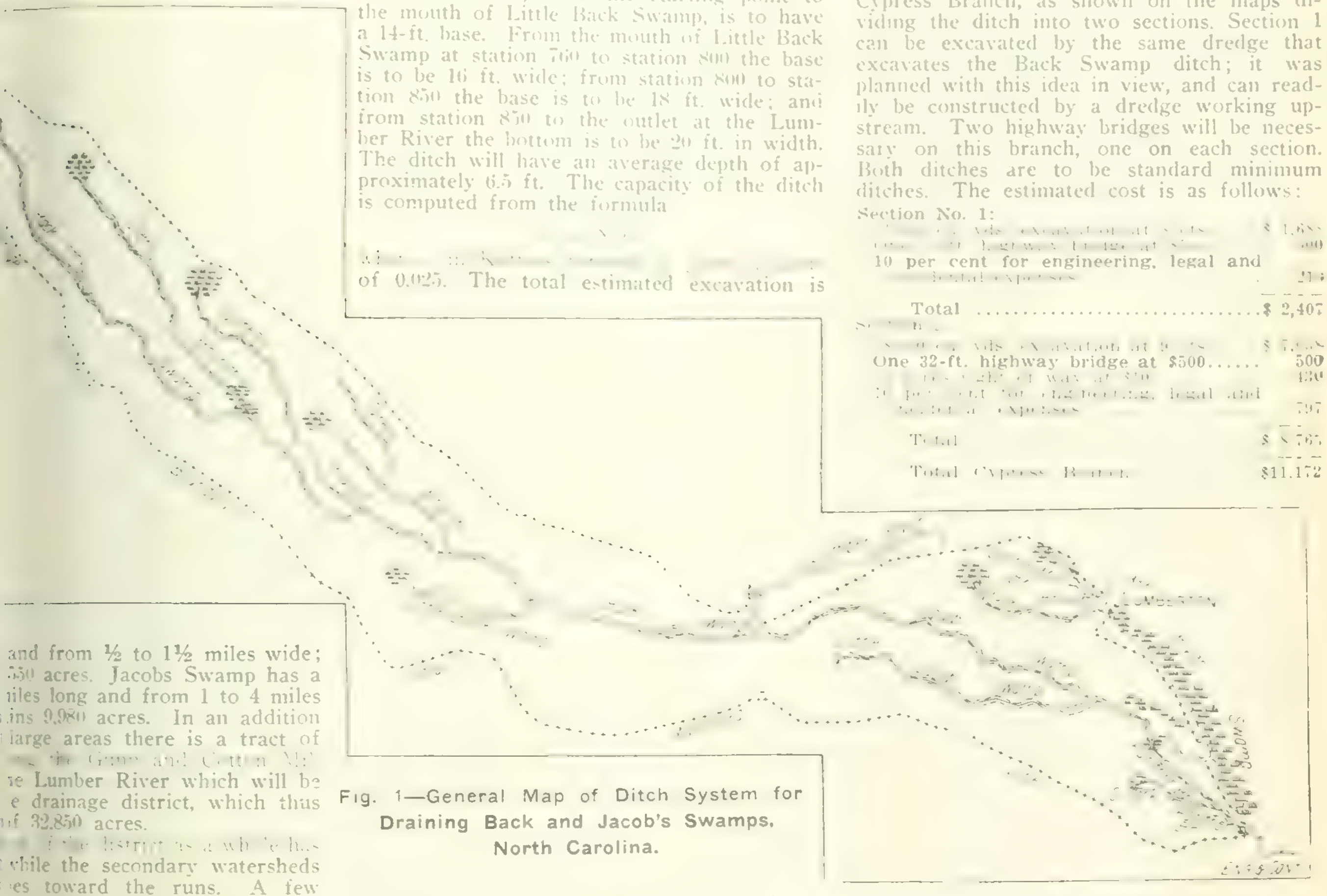


Fig. 1—General Map of Ditch System for Draining Back and Jacob's Swamps, North Carolina.

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] acres right of way [illegible]	[illegible]
Improving Lumber River	2,000
10 per cent for engineering, legal and incidental expenses	4,625
Total	$50,875

Lateral A.—This is a short lateral, 2,000 ft long, that drains a large and very wet bay or swamp on the north side of Back Swamp, and it should be dug by the same dredge that constructs the ditch in Back Swamp. The lateral is so short that it can readily be dug upstream. It is to be a standard minimum ditch, having a 14-ft. bottom. Its construction will require the excavation of 8,300 cu. yds. of earth, and is estimated to cost as follows:

8,300 cu. yds. excavation at 8 cts	$664
[illegible] acres right of way at $10	[illegible]
10 per cent for engineering, legal and incidental expenses	69
Total	[illegible]

Dees Branch.—Dees Branch is about 5 miles long, lying north of Back Swamp, which it enters, as shown on the map. It drains approximately 2,260 acres. The branch has no channel, but is simply a flat swamp covered with undergrowth and large trees. The proposed ditch is to have a 14-ft base and an average depth of 6 ft. The estimated excavation and costs are as follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
10 per cent for engineering, legal and incidental expenses	[illegible]
Total	$13,152

Cypress Branch.—Cypress Branch heads in the flat woods north of Dees Branch and runs to the southeast and enters Back Swamp. The plan adopted was to construct the ditch in Cypress Branch, as shown on the maps dividing the ditch into two sections. Section 1 can be excavated by the same dredge that excavates the Back Swamp ditch; it was planned with this idea in view, and can readily be constructed by a dredge working upstream. Two highway bridges will be necessary on this branch, one on each section. Both ditches are to be standard minimum ditches. The estimated cost is as follows:

Section No. 1:	
[illegible] cu. yds. excavation at 8 cts	$ 1,688
One [illegible] highway bridge at $[illegible]	500
10 per cent for engineering, legal and incidental expenses	219
Total	$ 2,407
Section No. 2:	
[illegible] cu. yds. excavation at 9 cts	$ 7,338
One 32-ft. highway bridge at $500	500
[illegible] acres right of way at $10	130
10 per cent for engineering, legal and incidental expenses	797
Total	$ 8,765
Total Cypress Branch	$11,172

Turkey Branch.—The proposed ditch is to start in the branch and follow the course of the branch as shown on the general map. After the survey was completed it was decided that it would be best to locate a sublateral which would drain the branch that leaves Turkey Branch about 1½ miles above Back Swamp. No ditch line was located on this branch. The approximate location that the ditch should have is shown on the map. It will be approximately 6,500 ft. long and will require the excavation of 25,000 cu. yds. Both ditches are to be standard minimum ditches. The estimated cost follows:

Main ditch:	
[illegible] cu. yds. excavation at 9 cts	$ 7,120
2 highway bridges at $500	1,000
[illegible] acres right of way at $10 per acre	[illegible]
10 per cent for engineering, legal and incidental expenses	[illegible]
Total	$ 9,29[illegible]
Sublateral:	
25,000 cu. yds. excavation at 9 cts	$ 2,250
12 acres right of way at $10	120
70 per cent for engineering, legal and contingent expenses	237
Total	$ 2,607
Total for Turkey Branch	$11,902

Little Back Swamp.—Little Back Swamp drains approximately 1,740 acres lying south of Back Swamp. The ditch starts in and follows the course of the swamp to Back Swamp. It is to be a standard minimum ditch and the estimated cost is as follows:

[illegible] yds. excavation at 9 cts	$4,014
[illegible] right of way at $10 per acre	190
10 per cent for engineering, legal and incidental expenses	420
	$4,624

JACOB SWAMP DRAINAGE

The drainage area of Jacob Swamp and tributaries contains 9,980 acres. The plan adopted for draining this part of the district consists of a main ditch and three lateral ditches, the locations of which are shown on the general map.

The main ditch begins in Jacob Swamp, follows the course of the swamp, and cuts across a low flat ridge to the head of Panther Branch, and thence down Panther Branch to Panther Lake, and through the lake to the river. This location was chosen because it discharges the water from Jacob Swamp into the river approximately 1 mile below where it would if the location followed the north branch of Jacob Swamp, thus reducing the elevation to which back water from the river will rise by the amount of the fall in the river between the two outlets. The outlet into the river through Panther Branch has the advantage of not requiring the ditch to cross the wide river swamp in order to reach an outlet, as would be necessary if the ditch followed Jacob Swamp. The fall and the amount of excavation is the same for both locations. An additional reason for choosing this location was the fact that practically all the land owners in the lower end of the district were in favor of this route for the ditch.

The ditch will be a standard minimum dredge ditch throughout, having a fall of 2.64 ft. per mile above station 380 and of 3.696 ft. per mile below this point, and having a capacity at the lower end, when running at a depth of 5.5 ft., of 399 cu. ft. per second. It will drain an area of 9,980 acres, which area, on the basis of ¾ in. in 24 hours, would have a run-off of 319 sec.-ft. Its average depth is 6.5 ft.

The Lumber River should be improved from the point where Panther Lake enters it to a point 1 mile below. The improvement should consist of removing all trees, snags, logs, and other obstructions from the channel and banks of the river and cutting off the worst bends. The cost of improving the river should not exceed $1,500. The improved channel was not located at the time the survey was made, as it was impossible to tell how much work would be necessary at this point. The approximate location of the improved channel is shown on the map. The estimated cost of the work follows:

231,000 cu. yds. excavation at 8 cts	$18,480
1,500 cu. yds. embankment at 15 cts	225
4 highway bridges at $500	2,000
Improving Lumber River	1,500
87 acres right of way at $10	870
10 per cent engineering, legal and incidental expenses	2,308
Total	$25,383

Little Jacob Swamp.—Little Jacob Swamp heads in the fields southwest of Back Swamp Church and flows to the east, joining Jacob Swamp. It is very low and swampy in the upper ditch, the water apparently coming from springs in the swamp. The ditch as located follows the run of the swamp and is to be a standard minimum ditch. Two highway bridges will be required. The estimated cost is as follows:

88,500 cu. yds. excavation at 9 cts	$7,965
41 acres right of way at $10	410
2 highway bridges at $500	1,000
10 per cent for engineering, legal and incidental expenses	938
Total	$10,313

South Fork, Panther Branch.—The south fork of Panther Branch drains the land south of Panther Branch, following the general course of the branch. The ditch is a standard minimum ditch. One highway bridge will be required. The estimated cost follows:

30,300 cu. yds. excavation at 9 cts	$2,727
1 highway bridge	500
13 acres right of way at $10	130
10 per cent for engineering, legal and incidental expenses	336
Total	$3,693

Lateral X.—A short lateral ditch 3,175 ft. long was located to drain Jacob Swamp below the point where the main ditch leaves it. This is to be a standard minimum ditch. The ditch can best be constructed by the same dredge that constructs the main ditch in Jacob Swamp. The construction of the ditch will require the excavation of 9,600 cu. yds. of earth and is estimated to cost as follows:

9,600 cu. yds. excavation at 8 cts	$768
5 acres right of way at $10	50
10 per cent for engineering, legal and incidental expenses	81
Total	$899

Cotton Mill Branch.—Cotton Mill Branch flows southeast to Lumber River and is about 1½ miles long. From station 9 + 00 to station 31 + 00 the located line follows closely the existing ditch. Balance of the located line follows the general course of the swamp, leaving it at one point to cut across a low ridge, by doing which it was possible to shorten the located ditch line. The ditch has so much fall that it will not be possible to construct it with a dredge working up stream. The small amount of excavation would make it very expensive to construct a dredge at the upper end to excavate the ditch. For this reason it was decided that it would be most economical to make the ditch as small as possible and excavate it by hand. As planned, it is to have a 4-ft. base, 1 to 1 slopes, and 6-ft. berms. One highway bridge will be required. The estimated cost follows:

12,800 cu. yds. excavation at 20 cts	$2,560
14 acres right of way at $10	140
1 highway bridge	200
10 per cent for engineering, legal and incidental expenses	290
Total	$3,190

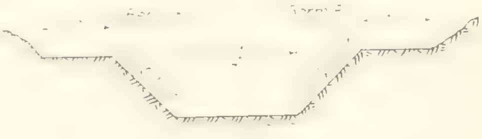


Fig. 2—Minimum Drainage Ditch Section, Back and Jacob's Swamps.

Gum Branch.—Gum Branch heads in a cypress brake about three-fourths of a mile southwest of the National Cotton Mill and flows east to the Lumber River. The ditch as located will be 2¼ miles long. For the same reasons as governed the size of ditch adopted on Cotton Mill Branch, a 4-ft. bottom was adopted for Gum Branch. Two highway bridges will be required across the ditch. The estimated cost is as follows:

27,100 cu. yds. excavation at 20 cts	$5,420
2 highway bridges at $200	400
23 acres right of way at $10 per acre	230
10 per cent for engineering, legal and incidental expenses	605
Total	$6,655

Summary of Estimates.—A summary of the detailed estimates of ditches in Back Swamp and Jacob Swamp drainage district, is as follows:

Back swamp	$ 50,875
Lateral A	763
Dees branch	13,152
Cypress branch	11,172
Turkey branch	11,902
Little Back swamp	4,624
Total Back swamp	$ 92,488
Jacob swamp	$ 25,383
Little Jacob swamp	10,313
South Fork Panther branch	3,693
Lateral X	899
Total Jacob swamp	$ 40,288
Cotton Mill branch	$ 3,190
Gum branch	6,655
Total	$ 9,845
Total cost Back swamp and Jacob swamp drainage district	$142,621

REVIEW AND CONCLUSION

The poor drainage conditions existing in the territory covered by the Back Swamp and Jacob Swamp drainage district are due to the failure of the natural watercourses within the district to afford efficient outlet, these watercourses being usually broad, flat swamps ered with timber and undergrowth and h in general little or no well-defin them.

The Lumber River, which is th for all the drainage of the di have certain improvements in of the mouths of Back Swamp and Lake. These improvements, as ed in the report, are in the nature of straightening and clearing the river channel, and are estimated to cost about $3,500.

The main feature of the i however, is the construction of efficient ditches in the principal drainage channels within the district. These ditches are designed with sufficient capacity to take care of the water that they may reasonably be expected to be called upon to handle, and they are of sufficient depth to act as outlets for future drainage in the district. The ditches follow, in general, the natural swamps, but in one or two cases as stance, in Cypress Branch and Job certain diversions have been me is believed will prove advantageous to struction of the ditches and for of the water.

The total cost of the recommen ments, which will make availabl tion all the land within the d acres, is estimated at $142,621. cost per acre of $4.34.

Progress Record of Panther Tunnel.

The Panther Creek Drainage Tunnel Mauch Chunk, Pa., which was st 1906, was completed on Feb. 5, 19 nel is 4.1 miles long and in se high and 12 ft. wide. The tun with a grade of 0.25 per cent. notes describing the progress of given in articles in "Mines and November, 1907, and May, 1912

For the first 300 ft. the grou and there was considerable difficu and in timbering, but after 300 f the solid red shale was struck a was required. About 5,500 ft. was driven through and about 2,0 glomerate before the Buck Mo was encountered.

On January 1, 1911, it was dec the drainage tunnel from both en of 9,700 ft. to connect. This w 400 days, averaging 24¾ ft. per 1911, a distance of 459 ft. was dri shaft end and 588 ft. on Coal P ing a total of 1,047 ft. per month a 35 ft. per day. The greatest dis on one end was in September, were driven on the Coal Por 22.7 ft. per day.

Meterage in Topeka, Kans.—Th consumers in Topeka, Kans., by the water company that all se be metered by May 1. Water been shut off in all services r metered on that date. The pany states that it costs $12 per se change from the flat rate to rate. The cost of the meter is cost of installation is $2. In deposit of $2 is required before th will be turned on again after installed. The deposit is refu the subscriber removes from Mr. H. P. Miller, Commissioner of explains the reason of the com quiring a deposit as follows: "M water users do not understan charge is made. In many moves out of a house and we k of the change. Another famil and uses the water. A mon learn of the change, and if we the deposit of $2 against the firs are many times we would not collect our bill."

NEWS SECTION

ial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—
ontract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

ent The Doings of the
ng a Railroad R. R. Con-
New England Road Notes
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Railways, Steam and
Roads, Streets and Pavements.............. 51
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s

A number of big railroad
construction jobs have been
let in the past few days, and
many other big contracts
are in view. The Erie R.
R. has awarded its double
track work on which bids
to J. G. & H. Patterson,
V. Va.; John R. Lee, Paterson,
Shoemaker, Arcade Bldg.,
Another big piece of work
racts have been let recently is
construction of the Southern
R. R. the new Grand Trunk
er, Mass., to Providence, R. I.
105 S. La Salle St., Chicago,
grading and masonry for the
section, and the O'Brien Con-
75 Morris Park Ave., New
ured the Rhode Island section.
ity bids were opened last week
vay contract. Bids were taken
of construction, the low bids
ypes being as follows: Arthur
K. $3,889,775.05; Type H.
Construction Co., $4,297,
O'Rourke Engineering Con-
972,943.95. Including the tun-
n is 3,176 ft. long. The Ste-
on Co., noted above, is headed
ens, formerly Chief Engineer
Canal and later with the Hill
he other railroad construction
the last few days are the fol-
n & Hickey Bros. Construc-
ee Bldg., St. Louis, Mo., for
or the Wabash R. R. in Fort
H. Flick Construction Co., 37
St., Chicago, Ill., for a 25-mile
Crystal Falls, Mich., for the
kee & St. Paul Ry.; Watson
, for grading 3-mile spur to
the Tuscaloosa Mineral Ry.;
racting Co., Diamond Bank
Pa., for the construction of
adbed on the Lake Erie &
hrough the city of Youngs-
Rice & Co., Seattle, Wash.,
bridging for 71 miles of new
le Valley Ry. in British Co-
Nawn Contracting Co., 83
ry District, Boston, Mass., at
tructing Sec. 3 of the Boyls-
Boston, Mass.; H. C. Hen-
g Seattle, Wash., for the con-
iles of railway for the Chi-
& Puget Sound Ry. from
to Bell, Wash.

irrigation work about the
the past week appears
the Northern Colorado
t. The directors of the
meeting at Greeley, Colo.,
nsider a proposition to
r $2,400,000 for an irriga-
istrict adjoins the Greeley-
the north, comprises 50,000
n Nunn and Carr and ex-
imer county. It is proposed
voirs to catch flood waters
the district. Michigan,
r and other small streams
of the supply. It is under-
lders generally favor bond-
nd it is expected work of
ommence in two months.

Levee contractors will watch with interest the action taken by Congress on the bill introduced last week to appropriate $30,000,000 for maintaining, raising and protecting the levees of the Mississippi and its tributaries. The money would be spent under the direction of the Secretary of War.

The budget recommendations of the officials of the Southern Pacific for the fiscal year beginning July 1 call for appropriations of $25,000,000 and $5,000,000. The general recommendation for the $25,000,000 relates to necessary expenditures for maintenance of way, upkeep of stock and roadbed, the continuance of electrification work across the bay from San Francisco, under plans outlined previously, and the construction of spur tracks and "feeder" tracks. The special recommendation of $5,000,000 is applied to the necessity of rushing to completion the double-tracking work between San Francisco and Ogden. Much of the double track between the two points has already been constructed and it is believed that the entire distance will be double-tracked by the end of 1913.

Moving a Railroad.

This is what happened to a small railroad when it stood in the way of progress progress as it was viewed by a larger railroad. This large railroad desired to build two new tracks at one of the terminals of the smaller road. This could not be done without crossing the tracks of the latter or moving them. Efforts to reach an agreement failed. So the larger railroad took the matter into its own hands. While the representatives of the other railroad were spending Sunday at home, at the end of the line, a gang of 400 men were put at work and 1,100 ft. of the track of the smaller railroad were moved, and a new station built. When the smaller road's representatives returned on Monday morning they got off at a new station some 400 or 500 ft. from the old terminus.

R. R. Construction in New England.

The awarding of contracts by the Grand Trunk R. R. for its new line from Palmer, Mass., to Providence, R. I. means a great deal for New England. For one thing, it means that the first considerable piece of steam railroad construction undertaken in that section for the past 30 years will soon be underway. It indicates further that the Grand Trunk is in earnest in its plans and that the construction by this road of another new railroad from White River Junction, Vt., to Boston, Mass., is more than a possibility. These are but two of the railroad construction prospects in the new England states. There is a bill now before the state legislature of Massachusetts, which, if passed, and it undoubtedly will be, will mean the expenditure of $5,000,000 or $6,000,000 by the New York, New Haven & Hartford R. R. for the extension of its trolley lines. Still another bill before the legislature of the state provides for a lease of the Boston & Maine R. R. to the New York, New Haven & Hartford R. R. for electrification of the railroads entering Boston, for railroad tunnels, for the expenditure of $80,000,000 by the New Haven road and $20,000,000 by the Boston & Albany within the next five years in electrifying the lines within the metropolitan district. It is also stipulated that the New Haven road shall establish physical connection with the Boston & Maine by means of a four-track tunnel under Boston. If all the prospects for railroad construction develop into realities, New England will be qute a desirable section of the country for contractors.

Road Notes.

Much interesting information regarding the good roads movement may be gathered from the items in the newspapers of the smaller cities and towns. From one of these items we learn that the merchants of a Colorado city have decided not to issue calendars advertising their business, but instead will invest the $1,200 or so saved in the betterment of the highways leading into the city. We also learn of the scheme of an auto club in a city in South Dakota for keeping the roads near the city in good condition. In the club rooms they have a large sectional map of the country for 20 miles about the city, and have marked on it the principal roads. Reports are invited as to any place on the roads which is particularly bad, or which needs some special attention. This place is marked on the map and the next time any members of the club have occasion to go over that road they take up the matter with some of the parties in the neighborhood of the bad place, the road overseer, or county commissioner, to the end that it may be repaired. In some cases places are reported which can be fixed in an hour's time with a shovel. In this case they take the shovel along and do the work themselves. Another item of interest concerns a 100-mile road constructed through the sand hills of New Mexico. This road was constructed especially for motor traffic and a fee of 5 cents per mile is stated to be charged for the use of it. The bridges over the ravines on this road consist of two runways, with no planking between, so that the structure is open the entire length and consequently horse drawn vehicles cannot use it.

New Use for Traction Engines.

A new use for traction engines has been discovered in northern Colorado. They were used for furnishing the motive power for transplanting a town. This town in its original location was situated many miles from a railroad. Last summer a branch line was surveyed and a new line laid out some 18 miles from the old town. The new town had nothing but prospects and a railroad, while the old town was a hustling metropolis of 200 inhabitants. As the railroad wouldn't come to the town, the town decided to come to the railroad. Accordingly the buildings were mounted on wagon trucks, traction engines were attached and the whole outfit wheeled over the frozen prairie for the 18 miles to the new town.

PERSONAL

Mr. Jos. H. Stone has been made City Engineer of Franklin, N. H.

Mr. Edw. Henry Keating has been elected an officer of the institution of civil engineers.

Mr. J. A. Heaman has been appointed Division Engineer of the Grand Trunk Pacific Ry.

Mr. J. Blair Gilmer has resigned as Assistant General Manager of the Missouri, Oklahoma & Gulf R. R.

Mr. F. M. Radford has been appointed Assistant to the Commissioner of the Geodetic Surveys of Canada.

Mr. Wm. O. Peacock, a well-known retired contractor of Camden County, N. J., died May 4 at the age of 76 years.

Mr. Edw. J. Hogan, a member of the firm Walsh-Hogan Construction Company, at Davenport, Iowa, died April 6 at the age of 41 years.

Mr. H. C. Estep has been appointed Engineer of Construction of the Massachusetts & Rhode Island lines of the Southern New England R. R.

Mr. Tenny S. Ford has been appointed Division Engineer to take charge of sewer construction and design for the Board of Local Improvements, Chicago, Ill.

Mr. Wm. P. Brown has resigned as Contracting Engineer of the King Bridge Co., to become associated with Wilbur J. Watson & Co., Civil & Architectural Engineers, Citizens Building, Cleveland, O.

Mr. G. Dwight Tompkins has been appointed Junior Engineer of the Board of Local Improvements. Mr. Tompkins heretofore was a Junior Engineer for the Government on irrigation work in Arizona.

Mr. Geo. D. Lenth, until recently Division Engineer in charge of sewer designs and construction for the Board of Local Improvements, Chicago, Ill., has been appointed Assistant Chief Engineer of Sewers.

Mr. Chas. Waldrich has become associated with the Miller Engineering Co., Little Rock, Ark. He was formerly connected with the engineering department of the Pennsylvania & Missouri Pacific Ry.

Mr. Julius G. Gableman, until recently Division Engineer of Pavements for the Board of Local Improvements, Chicago, Ill., has been appointed Assistant Chief Engineer of Streets of Chicago. Mr. Gableman has been succeeded by Mr. Jno. Van Wakeman.

Mr. Kenneth H. Matheson has received a commission as mining engineer for the New York & Honduras Rosario Mining Company and has sailed from New York to take charge of his work in Honduras. Mr. Matheson's home is in Denver.

Mr. Frederick H. Avery, who for some time past has been Engineer of Bridges for the Chicago Terminal Ry., has been appointed to the position of Engineer in charge of bridge construction and repair for the City of Chicago. Mr. Avery headed the civil service list for this position.

Mr. L. K. Jones, I. S. O., Secretary of Railways and Canals, Canada, was appointed Assistant Deputy Minister of the department. His connection with the Government Railway System began in 1871 when he was engaged in connection with the Intercolonial Railroad.

Mr. J. A. S. Redfield, Division Engineer of the Chicago & Northwestern Railway, has been transferred from Sioux City, Ia., to North Fond du Lac, Wis. He succeeds Mr. W. W. Gaffin, formerly Division Engineer at Fond du Lac, whose resignation was noted in a former issue.

Messrs. Walt G. Kirkpatrick, Massena L. Culley, John E. McCorkle, Jr., and John B. Baylis announce that they have organized to continue engineering practice in the southern states, making a specialty of consultation reports, appraisals, plans, specifications and supervising the construction for hydro-electric power developments and municipal improvements. Their offices are at 703-4 Farley Bldg., Birmingham, Ala.

Mr. Carl R. Gray, formerly President of the Spokane, Portland & Seattle Ry., is to be made President of the Great Northern Ry. succeeding Louis W. Hill. Mr. James J. Hill has made the announcement of Mr. Gray's appointment and states that he and his son, Louis W. Hill, will probably be members of the Executive Committee.

Mr. Frank W. Hodgdon has been appointed to the position of Chief Engineer to the Directors of the Port of Boston. His name had been under consideration for several weeks. Upon him will fall the duties of carrying out the plans of the directors in regard to developing the Port of Boston. He now has three assistants, Mr. J. B. Russell being the Chief Assistant, Mr. John R. Ferguson, 2nd Assistant, and Chas. S. Biar, 3d Assistant. A 4th assistant will be appointed. Mr. Hodgdon was born in Arlington in 1856 and was graduated from the Massachusetts Institute of Technology in 1876. For two years he was employed by the Massachusetts Harbor Commission on the improvement of the South Boston flats, and in 1879 an engineer for the Land Commissioners he designed and superintended the construction of the pile platforms at Piers 1 and 2, South Boston. From 1879 to 1893 he was Assistant Engineer of the Harbor and Land Commission and designed all the work on Boston Harbor and the South Boston flats, and from 1893 to January, 1912, he was the commission's engineer in charge of all engineering work. In 1897 and 1898 he served on special State commissions. Since 1908 he has been Consulting Engineer for the Florida Coast Line Canal and Transportation Company, and in 1911 was appointed the representative of Panama on the commission of engineers to determine the boundary between that country and Costa Rica.

INDUSTRIAL

William Haslap, founder and President of the Sidney Steel Scraper Co., of Sidney, O., died April 21 last.

The Great Lakes Dredge & Dock Co. has moved its offices from the Chamber of Commerce Bldg., Chicago, to the Monroe Bldg., Chicago.

On account of the constantly increasing volume of its business, the Weber Chimney Co. has found it necessary to take larger quarters and has removed its offices from 209 South State St., Chicago., to 1452-1456 McCormick Bldg., Chicago.

The Lynchburg Foundry Co. has opened an office at 461 Market St., San Francisco, Cal., with Mr. J. W. Blair, formerly Treasurer of the American Cast Iron Pipe Co., Birmingham, Ala., in charge. Mr. Blair will also handle the product of the American Company on the Pacific Coast.

The Murphy Iron Works, Detroit, Mich., has awarded the contract for foundations, including Raymond concrete piling, of a new foundry building to be erected at the foot of Walker St., Detroit, to the Raymond Concrete Pile Co., of New York and Chicago; George W. Graves, Architect.

A contract for the new double leaf transfer bridge for the Staten Island Rapid Transit Co., to be located at St. George, Staten Island, New York, was recently awarded to the Fort Pitt Bridge Co., of Pittsburgh, who in turn awarded the Earle Gear & Machine Co., of Philadelphia, the contract for the designing and production of the operating machinery. The latter company has specialized in this direction and has built the machinery for some of the largest bridges in railway and highway service, including rolling lift and
swinging types. The machiner
George's Bridge presents some
ing engineering features, as
must be designed to operate
the same time be sufficiently h
excessive weights, as the traffic
heavy freight service. The ma
produced at the shops of the
Machine Co., in Philadelphia,
a number of like contracts are

The Hess Flume Co. has
its new plant at 2166-76 15th
Colo. This factory will ena
company to turn out orders fo
ture of the Hess smooth
head gates, pressure pipe, metal
metal intakes and outlets, drop
ing water meters, etc, on ver
The Hess Flume Co. now has
and Western factories, the East
at Canton, O.

Aside from its financial featu
report of the General Asphalt
the Barber, Trinidad and Be
panies), issued May 14th, con
tion of interest especially to t
road-building industry. The to
business increased from $16,004
542,281.14. For the first time
pany's history the item "aspha
cludes crude and refined asphal
products in all forms, exceeds
count. Sales of asphalt increa
491 tons in 1910 to 265,677 tons
while the consumption of aspha
the amount just stated, and pro
enue increase of $2,297,030, th
by the company shows a slight d
to the fact that a greater
asphalt construction is done b
the company using Trinidad a
asphalts rather than by the com
full account is given of the d
Trinidad oil, which, the report
ready being produced at the r
bbls. annually, and is being incr
who have surveyed these
estimate the oil available at 2
Four hundred miles of road we
Trinidad liquid asphalt last year
period 247 miles of roadway w
with Bermudez road asphalt, t
creasing from 173,760 in 190
1910, and 2,699,762 in 1911. M
sale of asphaltic products, of wh
item is roofing, amounted to $1,
an increase of $173,844 over 191

CATALOG

Wiener Industrial Railways.
5 ins., 8 pp. Ernst Wien
Church St., New York City
This folder contains illustr
dustrial railways and equipme
descriptions.

Cameron Steam Pumps.—Pa
12 pp. Ingersoll-Rand Co.
New York City.
Bulletin 7004 is descriptive
Steam Pumps. The catalog
ferent styles manufactured an
of sizes, capacities and prices

Expanded Metal Constructi
x9 ins., 12 pp. Northweste
Metal Co., 37 Van Buren St
This is the May number o
issued by this company conta
tions and articles describing
where expanded metal lath h

Supply & Machinery Deal
tions.—Paper, 5x8 ins., 48
Westbrook, Monticello Hotel,
This contains the program
ment and subjects of discuss
triple joint convention of
Southern & American Supply
Manufacturers' Association h
14 and 15. The book contains
members of the three associat

ILWAYS, STEAM AND ELECTRIC

Alabama.

[illegible]
neral R. R. The work will in-
[illegible]
llande Bros., Birmingham, Ala.,
[illegible]
for the construction of the
branch from the main line of
& Nashville R. R. near War-
llend and S. M. Smith & Co.,
Dunn & Lallande will do most
themselves. This contract, as
last issue, involves some quite
t also includes about 700,000 ft.
trestle. The branch will open
district in the Upper Warrior

a Farm Land Ry. Co., incor-
[illegible]
Mobile & Bay Shore R. R. to
ear Union Church in the west-
ne county. The company will
use and do a general transpor-
[illegible]
n H. Veasey of Mobile, presi-
ne of Mobile, secretary; Allen
Fort Wayne, Ind., vice presi-
J. Veasey, Charles A. Wilding,
Wayne, Ind., directors.

Arkansas.

Arkansas & Eastern R. R. Co.,
Foster, President, has under
ne construction of a line north
a connection with the Iron
is said that right of way for
already been secured through
orthern limits.
[illegible] Ark., state that
started on the right of way
[illegible]
ine River R. R., via Millers-

Arizona.

& Colorado River R. R. Co.,
[illegible]
[illegible]
[illegible]
ndian Reservation. This com-
build a 45 mile railroad be-
d Ehrenberg, on the Arizona
The incorporators are Paul
[illegible]
. Chalmers and J. L. Gust of

California.

urveys are to be started at
posed electric railway to con-
d Imperial, and it is possible
work may be started this
st survey of the line will be
o El Centro in the Imperial
t part of this line to be built
ris to El Centro and this, it
be in operation by March of
re line, according to pres-
completed about August.
[illegible]
C. B. Conlin, Los Angeles,
[illegible]

lwood Lumber Co. of Kor-
ys made for a railroad from
l to timber lands four or five
ank E. Herrick, Eureka, is

& Mount Tamalpais Scenic
odge, Chief Engineer, San
lanning to electrify its local
to construct a 600 ft. incline
Muir Woods. Arrangements
ve been completed with the
for building the incline.

Charles E. Clinch of Grass Valley, Cal., is reported to have secured options on the rights of way of the California Midland and also the Nevada county traction line. Outside capital is thought to be behind the deal and it is believed that it is the idea of those projecting the road to continue the electric road from Grass Valley to Marysville over the route originally surveyed for the California Midland.

It is believed that definite steps will be taken shortly toward the construction of the municipal harbor railway connecting the industrial and business centers of Los Angeles, Calif. Thomas E. Gibbon, Harbor Commissioner and George Alexander, Mayor, are interested in the scheme.

Miller & Lux, Inc., of San Francisco, Calif., have applied to the State Railroad Commission, Sacramento, Calif., for permission to build a spur track from the Santa Fe in Butchertown over the tracks of the United Railroads on Kentucky St., to the packing house on First and Railroad Aves.

The Tidewater Southern Ry. Co., J. H. Wallace, Chief Engineer, Monadnock Bldg., San Francisco, Cal., is not now pushing the matter of extending its line to Kerman and Fresno. It is intended to complete the first section, Stockton to Turlock, and get it into working condition, before devoting much energy to its extension south of Turlock. The company [illegible] River, where it is now putting in a bridge; as soon as this is completed it is expected to complete track-laying to Stockton.

Colorado.

Propositions has been made to the business men of Alamosa, Colo., by Charles E. Logan for a new railroad in the San Louis Valley. The plan is to build a line of standard gage railroad from Alamosa to the village of Center, thence to the county seat town of Saguache, thence eastward to the Denver & Rio Grande Ry. at the station of Moffat, a length of 76 miles in all, as the first under[illegible].

At a meeting of the San Juan Congress at Durango a committee was appointed by President J. A. Clay to take steps to perfect an organization with a view to building a 113 mile line from Farmington to Gallup.

Georgia.

Plans are under consideration for the construction of a railroad from Milltown to Americus, via Nashville, Tifton, Ashburn, Doles and Oakfield. Irwin Myers, President of the Chamber of Commerce of Tifton, Ga., is interested.

Delegates from Americus, Oakfield, Milltown, Ashburn and Tifton, Ga., recently held a meeting and effected a preliminary organization of the proposed Atlantic & Northwestern Railroad, which will build a line in Georgia through Nashville, Tifton, Ashburg, Doles and Oakfield to Americus. Among those interested in the proposition are I. S. Shingler and I. L. Evans, of Ashburn; M. M. Conner, of Milltown; F. C. Hall, of Oakfield; W. M. Cook, of Americus, and H. H. Tift and I. W. Myers, of Tifton. A charter will be applied for shortly

Idaho.

The Albion-Marshfield R. R. Co., Ltd., is [illegible] line, five miles of which will be in a mountain canyon and five in a level valley. The grading work will be done by the local shareholders. T. E. Harper, Albion, Idaho, is President and W. C. Calvert, Albion, is Chief Engineer.

The Oregon Short Line has completed preliminary surveys for a loop, beginning at Menan and extending up the west side of the valley to St. Anthony, skirting the foot hills and then running down to Blackfoot.

Illinois.

The Eastern Illinois & Peoria R. R. Co., with principal office at Chicago, has been incorporated and proposes to construct and operate a railroad from St. Elmo, Ill., to Peoria, Ill., through the counties of Fayette, Shelby, Montgomery, Christian, Macaupin, Sangamon, Menard, Macon, Tazewell and Peoria. Incorporators and first board of directors: Frank R. Austin, Evansville, Ind.; Robert A. Dennis, Kenneth L. Richmond, Frank G. Nicholson and Fred W. Krohn of Chicago, Ill.

The Illinois Central Electric Ry. Co., Canton, Ill., has secured all but one option for the right of way for an extension from St. David to Lewistown, and it is believed that grading work will be started in the near future.

E. E. Headley & Son, Centralia, Ill., have just completed their work on the yards at Centralia, Ill., and are in the market for more work.

The La Salle County Electric R. R. Co. has clearing work underway for that portion of its line from Ottawa to Prairie Center, and grading work on this portion will be started shortly. From Prairie Center the line will run to Triumph and Mendota. The company has offices in the Fort Dearborn Bldg., Chicago. G. H. Dodge is President.

Articles of incorporation have been issued to the Aurora, Mendota & Western Ry. Co., which proposes the construction of a line from Yorkville, Kendall county, to Mendota, La Salle county. The pricipal office of the company will be at Plano, Ill. The capital stock of the road is $2,500 and the incorporators are: George H. Simpson, Wheaton; Fred W. Simpson and C. S. Williams, of Yorkville; G. S. Stewart and C. A. Darnell, of Plano.

The Elgin, Joliet & Eastern Ry., Arthur Montzheimer, Chief Engineer, Joliet, Ill., has made plans for building a connecting track to the plant of the Baldwin Locomotive Works at East Chicago, and expects to start with the work in a short time.

In regard to the construction of the proposed railroad from Fort Madison to Hamilton, it is stated that Nauvoo, Ill., has raised $32,000 of the necessary $100,000 to have work started. About $25,000 has been raised at Fort Madison. M. Payne, Fort Madison, Ia., is interested in the project.

Indiana.

Grading work is reported to have been started for the Fort Wayne-Mayville division of the Toledo, Fort Wayne & Bryan Electric Ry., of which R. T. Bastress, Harlan, Ind., is General Manager.

Surveys are reported to have been made for the proposed Vincennes and Jasper traction line, and it is said that as soon as a few remaining right of way properties are secured construction work will be started. George B. Hazelton, Vincennes, Ind., is President.

The Pennsylvania Railroad Co., will start work shortly on the construction of a new roundhouse at Indianapolis, Ind., estimated to cost about $212,920.

Kansas.

The Salina & Tipton Ry. Co., which expected to let contracts about May 1 for the construction of the proposed line from Salina to Lincoln via Tipton, has been delayed in its plans. H. W. Neiswanger, Osborne, Kan., is interested.

The Hutchinson & Western Interurban Ry. Co. has completed surveys from Hutchinson into Hudson, and its engineers are now working on surveys to Larned and Great Bend. F. P. Roehr, Hutchinson, is General Manager

It has been announced by W. F. Brown, President of the Wichita & Denver Air Line

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

R. R., Natron, Kan., that a portion of the [illegible] line will probably be ready for operation by the end of the year.

The Missouri Pacific, it is reported, has decided to construct the proposed extension from McPherson, Kan., to Marquette. J. R. Stephens, St. Louis, Mo., is Assistant Chief Engineer.

Kentucky.

Advices from Barbourville, Ky., state that English capitalists are financing the construction of the proposed railroad from that city to Manchester, a distance of 26 miles. The new line will pass through the coal fields of northern Knox and Clay counties.

Louisiana.

An ordinance authorizing the issuance of $2,000,000 of bonds for the improvement and extension of the Public Belt Railway system of New Orleans, but limiting the first sale of $300,000 thereof, has been introduced in the Council of New Orleans. The ordinance passed on its first reading and was referred to the finance committee. W. J. Hardee, City Hall, New Orleans, is Chief Engineer.

The Mississippi Valley Railroad is to decide shortly on the proposition regarding the construction of a belt line at Baton Rouge, La. The company, it is believed, will accept the proposition, which is to give the road additional rights on the river front, in exchange for the Baton Rouge and Hammond lot in Florida street, and conditional upon the Mississippi Valley road properly handling the cars of the Frisco and Louisiana Railway and Navigation roads from the interchange.

Massachusetts.

⊙The Boston Transit Commission of Boston, Mass., has awarded the contract for constructing section 3 of the Boylston St. subway to the Hugh Nawn Contracting Co., 83 Savin St., Roxbury District, Boston, Mass., at $413,135. Bids on this work were opened May 7 It calls for the construction of about 1,900 ft. of subway.

⊙Contracts for the construction of the Southern New England Ry., the new line of the Grand Trunk Ry. from Palmer, Mass., to Providence, R. I., have been awarded as follows: O'Brien Construction Co., 576 Morris Park Ave., New York City, for the grading and masonry on the Rhode Island section, 27 miles; John Marsch, 105 S. La Salle St., Chicago, Ill., for similar work on the Massachusetts section, 49 miles. The contract for the steel bridge superstructure has been let to the American Bridge Co., of New York City, and the contract for the erection of the steel bridge has been let to the Stroebel Steel Construction Co., Chicago, Ill.

The Committee on Railroads of the State Legislature has voted to report a bill for a lease of the Boston & Maine R. R. to the New York, New Haven & Hartford R. R. for electrification of the railroads entering Boston, for railroad tunnels, for the expenditure of $80,000,000 by the New Haven road and $20,000,000 by the Boston & Albany within the next five years in electrifying the lines within the metropolitan district. It was also stipulated that the New Haven road shall establish physical connection with the Boston & Maine by means of a four-track tunnel under Boston.

The Boston Transit Commission, E. S. Davis, Chief Engineer, Boston, Mass., is now working on the contract specifications for the work on the excavation of Winter St., the first section of the Dorchester tunnel to be undertaken. Structural steel for this section has already been bought. The tunnel will connect with the Cambridge subway at Park St., this station serving for both. Other stations will be on the northeasternly corner of Washington and Summer Sts. and nearly opposite South Station on Summer St. To that point the plans are fairly complete and the commission engineers are now working on plans for the other end, by Dorchester Av. to Andrews Sq., with a station at Broadway.

Michigan.

⊙The J. H. Flick Construction Co., 37 W. Van Buren St., Chicago, Ill., has been awarded the contract for constructing a 25-mile extension from Crystal Falls, Mich., for the Chicago, Milwaukee & St. Paul Ry.

A reconnaissance survey of the eastern and western routes of the proposed Muskegan & Manistee Interurban Ry. have been made. Stacy C. Thompson, Manistee, Mich., is interested.

Minnesota.

It is said that among the improvements contemplated by the Great Northern is the relaying of the track between Evansville, Minn., and Barnesville, with 90-lb. steel. The roadbed will be regraded, the cuts widened and the ties placed closer together. A. H. Hogeland, St. Paul, Minn., is Chief Engineer of the railroad.

The Lake Superior & South Dakota R. R. Co., which, as mentioned in our last issue, was incorporated to build a line from Duluth to western boundary of Big Stone county, has elected the following officers: President, Jay M. Smith, Duluth; vice-president, W. R. Gillis, Superior; treasurer, William Gotty, Duluth; and secretary, Frank Crassweller, Duluth. The board of directors is made up of the officials, the only other member being Elmer Blu. The new company is capitalized for $100,000, there being 1,000 shares of stock at a par value of $100. The limit of indebtedness is placed at $7,000,000. The life of the corporation is fixed at 999 years.

Duluth and Vicinity.

BY PETER E. MEAGHER

⊙J. B. Mishler, Railroad Contractor, of Duluth, was awarded a small concrete and earth contract by the Duluth & Iron Range R. R. Work to be started immediately.

⊙John Lofberg, Grand Rapids, Minn., was awarded a contract by the village of Kewatin, Minn., to build a concrete reservoir. About a $3,500 job. To be started immediately.

⊙Lou Barber, of the J. H. Flick Construction Co., Chicago, Ill., spent a couple of days with us here this week. They were awarded a contract for constructing 25 miles of railroad for the Chicago, Minneapolis & St. Paul Railway in the vicinity of Crystal Falls, Mich. Mr. Barber was up here to sublet the work. In looking over his profiles we noticed some excellent steam shovel work and quite a bit of good-looking small car work. Anyone interested in this work, by addressing the J. H. Flick Construction Co., Chicago, Ill., will get full information.

John Davis, one of the old-time contractors, was a caller at this office this week. He is not doing anything at the present time, but is in the market for some team work.

G. F. King, General Contractor, came in to see us a few days ago. They have several jobs under construction at the present time, one of them being the laying of the intake pipe, at Marquette, Mich.

William, Ord, representing the Marsh Capron Machinery Co., manufacturers of concrete mixers, spent a couple of days with us here in Duluth. He was on his way to the Pacific Coast. He stated that business was fine.

A. J. Perrin returned from looking over some Milwaukee work in Michigan. He did not take any of it. They are still looking around for work.

James Harding, representing Brodrick & Bascom, wire rope manufacturers, spent a few days in the city recently. Business is picking up.

The Walsh Construction Co., who have the contract for the tracklaying and ballasting on the Canadian Northern R. R., have resumed operations. They started one steam shovel this week. They will rush the completion of this work as fast as they possibly can.

Andrew Porter, of the railway contracting firm of Porter Brothers, Portland, Ore., spent a few days in the city here recently. He stated
his firm had considerable work
ent time, and were figuring on
more. They expect to be very
ing season.

H. J. Cooper, contractor, has
and concrete work on the Ran

E. W. Coons, walking boss
& Stratton Co., stripping contr
Iron Range, came in to see us th
firm is not doing very much a
time.

E. A. Dahl, a Duluth contracto was award
ed some sewer work by the city Duluth
week, and has already started o the sam

Contractors and paving me
quite a bit of fun in Duluth
weeks. The city is going to pa
streets here, and the contract
about $70,000. There is in the
of 15 contractors bidding on th
there are about 30 different
of paving concerns in the city.
a fight on, and at the time of
letter it has not been decided as
do the work or what paving wil

McCullough, Cheney & Evans
combination of McCullough an
Richard Evans, contractors, have
contract from Morris & Shep
work on the Milwaukee in S
They have already started on

The writer just returned fr
St. Paul and Minneapolis and f
booming. All of the contractors
I did not meet one that did n
work under course of constructi
a few of them had about all
this coming season.

The labor situation at Dulut
is tightening up rapidly, and wh
stating about the labor situation
three months have come to a show
are conservatively two to three
laboring man in the vicinity.
going up and, in my opinion,
higher. Duluth and vicinity c
servatively about 5,000 more la
present time. Every branch o
this section is in need of additi
with the large amount of pro
to be done this year, unless a gr
come in here, the contractors a
of labor will be seriously handi
E. Meagher, 409 West Michiga
Minn., is in need at the prese
large number of Austrians, Bul
garians, Italians, and other for
We have work that we will gi
years' contract on. Any leade
wishing to come up this way, get
us at once.

Mississippi.

Promoters of the Meridian &
road are engaged in securing
way from Meridian, Miss., to
New Orleans, Mobile & Chica
several condemnation proceedin
filed. It is expected that work w
1 and that the road will be
November 1. The line will be
and is a Frisco project.

Missouri.

It is believed that the Missou
Mountain Board of Directors
visions for the construction of
line from Springfield to Bag
definite in regard to the matter
tained as yet. B. F. Bush, St.
President of the company.

St. Louis Items

BY A. B. [illegible]

•Hannon & Hickey Bros
Company, Navaree Building, St.
awarded the contract for the t
by the Wabash R. R. at Ft. Way
have just finished their work o
City Southern and are movin
shovel that they had on this
Wayne to begin work immediat

⊙Harrington Brothers secure
of double track work on the Il

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

n Centralia and Shattuck, Ill., ve sublet to Harris Bros. Harris [illegible] finished shortly.

[illegible]

he largest excavating contracts Middle West has been awarded tt & White of Memphis, Tenn., s. Mo. The contract calls for [illegible] contract Smith, Scott & White rangements to place on the job [illegible] sed in that section. The shovels beam and their dippers remove every drop. It will take several [illegible]

[illegible] le track work north of Carpen- [illegible]

[illegible] work near Edwardsville, Ill., to work is suitable for teams or

[illegible] e of days in town on business.

writes us from West Frank- he is in the market for some ork.

s., Claypool Bldg., Indianapolis, several small team outfits on the

ith has finished his drag line Frankfort, Ill., and is on the ne more of this kind of work.

nerney passed through St. Louis on his way to Des Moines, Ia., [illegible] k lately. In addition to losing law he lost 14 head of mules wned when the high water got on the Memphis-Mariana cut- n Mountain R. R. near Demo- d he surely has the sympathies ractors and business men in this [illegible]

s. are moving a steam shovel w Wabash contract near Poag,

cManus & Joyce are making the ling big estimates on their grad- ear University City west of St.

Meara, member of the Execu- e of the Upper Mississippi River Association, has called a meet- ants and citizens of St. Louis ested in river improvement for ar Thomas Wilkinson of Bur- he president, make an address of the association. The meeting [illegible] Martin of St. Louis, one of [illegible] ociation is to get a 6-foot chan- [illegible] hing completion.

J. Putnam has been appointed neer, Chicago & Northwestern [illegible] located at Tunnel City, Wis., in struction on the line recently

Nebraska.

ka Northwestern Ry. Co. of rough its vice president, C. A. plied to the State Railway Com- ave to issue $500,000 of securi- of capital stock and the bal- for paying for the construction of the line. The company pro- a railroad from Bassett in Rock ngview in Keya Paha county, a miles.

New Jersey.

R. R. Co., G. F. Joly, Jr., Gen- Atlantic City, N. J., has peti- Council for consent to lay new will connect with the city trol- uth Carolina and Adriatic Aves. The company proposed to extend its present one-track system, which leads to Venice Park.

New York.

⦿The Oswego Terminal Association, composed of citizens of Oswego, has awarded the contract for constructing the trolley terminal for the Syracuse, Lake Shore & Northern R. R. Co. in that place to Peter Roby of Oswego.

The New York Public Service Commission has given the New York, New Haven & Hartfort R. R. Co. permission to acquire all the stock of the Westchester St. Ry. Co. and to acquire the ownership of the line formerly known as the Tarrytown, White Plains & Mamaroneck St. Ry.

The Manhattan & Jamaica Ry. Co., of Manhattan, New York City, has been incorporated to build a surface railroad. The capital has been placed at $300,000. The incorporators are J. S. Stetson, Brooklyn, New York; W. D. Sloane, New York City; G. J. Brigham, Brooklyn.

In a hearing before the State Public Service Commission it was brought out that the Delaware, Lackawanna & Western R. R., G. J. Ray, Chief Engineer, Hoboken, N. J., was contemplating the following improvements at Syracuse and vicinity: Elimination of 12 grade crossings in Syracuse to cost from $1,000,000 to [illegible] facilities in Syracuse, $200,000; new freight yard at Rock Cut, between Syracuse and Jamesville, $590,000; double tracking, 19 miles, $600,000; rock ballasting, $378,000.

Bids as follows were received May 7 by the Public Service Commission First District, New York City, for the construction of Section 14 of the Lexington Ave. subway in New York City: (1) being bid on Type H, (2) bid on Type K, and (3) bid on Type L: Arthur McMullen, New York City (2), $3,889,775; O'Rourke Engineering Construction Co., New York City (3), $3,972,944; John F. Stevens Construction Co., New [illegible] $4,025,120; Fred L. Cranford, Brooklyn (2), $4,177,449, (3), $4,182,142; Pitsburg Contracting Co., New York (2), $4,396,126; J. F. Cogan Co., New York City (1), $4,922,980, [illegible] gineering Corp., New York (2), $4,492,127, (3) $4,519,335; T. A. Gillespie Co., New York (2), $4,553,666; Degnon Contracting Co., New York (1), $4,838,817, (2) $4,590,639, (3) $4,753,004. Type "K" consists of four steel tubes laid in concrete under the river; Type "H" consists of four cast iron tubes laid in concrete two and two together; Type "L" is four cast iron tubes laid all four together in concrete.

The Public Commission of the Third District has given its permission and approval under the Public Service Commissions Law for the exercise of a franchise for and the extension of the Union Railway Co.'s New York lines over Boscobel Ave., in the Bronx, to Aqueduct Ave. and across the Washington Bridge over the Harlem River to 181st St. and Broadway, in the Borough of Manhattan. In connection with the 167th Street crosstown line, this new extension will give the Union Railway Company a continuous line across the Bronx from Long Island Sound on the east to Broadway, Manhattan, on the west.

The Public Service Commission of the First District, New York City, has adopted a resolution suspending indefinitely certain pending proceedings for the elimination of grade crossings. The last legislature appropriated $350,000 as the state's quota for grade crossing elimination in New York City. This appropriation, however, was vetoed by the governor on the ground that there was already an unexpended balance from previous appropriations in the treasury. While unexpended this balance had already been allotted by the Commission to grade crossing work now in progress, but as the law provides that the state money shall not be paid until the work is completed, it necessarily remains in the treasury. The Commission had counted upon an additional appropriation for this year, and had initiated proceedings for elimination work to cost about $1,400,000. As the state pays only one-quarter of the cost, an appropriation of $350,000 this year would have enabled the Commission to close these proceedings and order the work done. Lacking the appropriation, the Commission was compelled to suspend action. The crossings affected by these suspended proceedings were mainly in the Borough of Queens on the White Stone branch, the Montauk division, the main line and the Ozone Park and Far Rockaway branches of the Long Island R. R. There was also one group of crossings on the line of the Staten Island Ry. These will now have to await an appropriation by the next legislature.

North Carolina.

⦿Tucker & Laxton have been awarded a contract by Paul Chatham of Charlotte for the construction of a 2½ mile trolley line through his property east of the city. Materials have been ordered for the road.

North Dakota.

The Northern Pacific Ry. has taken bids on the laying of about 40 miles of track on its north branch out of Mandan, N. Dak. Among the contractors who have been over the work are: S. A. McCoy of Spokane, H. W. Church, W. L. Johnson and E. T. Foley of St. Paul, R. A. Grim of Chicago, C. J. Johnson and W. J. Coore of Seattle, and C. Craven and J. M. Dwyer of Minneapolis.

Ohio.

⦿The Duquesne Contracting Co., Diamond Bank Bldg., Pittsburgh, Pa., has been awarded a contract by the Pittsburgh & Lake Erie R. R. Co. for the construction of two miles of roadbed on the Lake Erie & Eastern R. R. through the city of Youngstown, O. The work involves about 35,000 cu. yds. of concrete and 50,000 cu. yds. of grading.

The Columbus, Kenton & Toledo Traction Co., with offices at Kenton, O., has amended its charter so as to provide for a line from Columbus to Findlay, 90 miles, through the counties of Franklin, Union, Marion, Hardin and Hancock, and has its application before the State Public Service Commission to allow the issue of capital stock and bonds sufficient to build 50 miles of the above said line between Findlay and Richwood. The Board of Directors are: A. G. Ahlefeld, Burr Finnell, Abe Rosenthall, J. W. Caine and J. E. Gasson, all business men and residents of Kenton, O. The officers of the road are: A. G. Ahlefeld, president; J. W. Caine, vice president; B. Finnell, secretary; Abe Rosenthall, treasurer. G. T. Wiswell Kenton, O., Chief Engineer and General Manager.

Application has been made for a charter for the Sharpsville & Western R. R., which proposes a line to extend from Sharpsville to North Sharon, a distance of 1½ miles. The incorporators include: Floyd K. Smith and Frank W. Tickner of the Valley Mould & Iron Co., C. D. Dyer of Pittsburgh of the Shenango Furnace Co. and D. B. Thompson of Cleveland of the Sharpsville Furnace Co.

Oklahoma.

The Congressional Committee on Indian Affairs has recommended the granting of authority to construct a railroad through Roger Mills County, Okla., into the Texas Panhadle by the Clinton & Oklahoma Western Ry. Co. T. J. Nance, Clinton, Okla., is General Manager of the C. & O. W. Ry.

The Lawton Railway & Lighting Co. of Lawton, Okla., chartered on May 3 with a capital stock of $10,000, proposes to construct an interurban line from the city of Lawton to Medicine Park, near there. The estimated length of the line is 16 miles and the estimated cost is $375,000. The route goes through the Fort Sill military reservation and the Wichita forest reserve. The following are the incorporators: B. R. Stephens, W. H. Fuller, R. L. Schleig, B. W. Hilgard and B. E. Tabler, all of McAlester.

The Dunlap Northern Pacific Ry. Co. of

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] a railroad from Dunlap, Harper County, Oklahoma, to Ellis, Ellis County, Kansas. The estimated length of the line is 200 miles and the estimated cost $2,500,000. The route runs through the counties of Comanche, Clark, Kiowa, Ford, Edwards, Hodgeman, Pawnee, Ness, Rush, Trego and Ellis, in the state of Kansas. The only Oklahoma county traversed is Harper. The incorporators are: H. D. Knight, W. J. Rodman, Gus A. Elbow and Claude Nowlin of Oklahoma City and P. J. Farney of Moweaqua, Ill.

Oregon.

The Multnomah Central Ry. Co. has been incorporated with a capital stock of $1,000,000. According to the articles the company will construct a single track line from Multnomah county into Clackamas county, and also is empowered to purchase and control waterways. The incorporators are E. R. Ernsberger, Forrest S. Fisher and Homer D. Angell, all of Portland.

Pennsylvania.

⊙T. D. Casale, Williamsport, Pa., has been awarded the contract for grading and tracklaying for about eight miles of railroad near Liberty for the Central Pennsylvania Lumber Co.

Special committee of the City Council of Pittsburgh, Pa., is considering a plan submitted by O. E. Gelston, Superintendent of the Bureau of Surveys, for building a 3½ mile street car line around Schenley Park.

The Philadelphia Rapid Transit Co., H. B. Nichols, Chief Engineer, 820 Dauphin St., Philadelphia, Pa., is understood to have prepared plans for its Broad St. subway at Philadelphia. It is said that the company will run cars in the Broad St. subway to Erie Ave., emerging from the subway on the tract purchased at York road and Luzerne Sts. and thence on Erie Ave. by an elevated road to Erie Ave. and Richmond St. A double line will be constructed on Erie Ave., the street having been chosen on account of its width, and from the fact that it is expected little opposition will be encountered from property owners to an elevated road. Some of the cars in the Broad St. subway will be turned in a loop on the ground purchased at York road and Erie Ave. Others will proceed to Richmond St. and Erie Ave., a distance of about 14 squares east.

It is stated that the Pittsburgh & Lake Erie R. R. will soon substitute electricity for steam power on its line between Pittsburgh and College, below Beaver, a distance of about 31 miles. The work will entail the expenditure of about $1,000,000. The company has placed an order for a gasoline-electric car for early delivery.

The Philadelphia Rapid Transit Co. and the Baltimore & Ohio R. R. have negotiations under way in an effort to agree upon terms and plans for the removal of the steam road's grade crossings in Darby.

South Dakota.

Promoters of the Sioux City, Mitchell & Pierre Railroad, according to advices from Mitchell, S. D., are busy drawing up contracts [illegible] farmers and property owners along the route, in order to raise $250,000 nec- [illegible] construction of the line.

Tennessee.

It now seems likely that the St. Louis & San Francisco R. R., F. G. Jonah, Chief Engineer of Construction, St. Louis, Mo., will have work started this month or early in June on repairing the damage done to its roadbed by the high waters of the Mississippi from Memphis to a point beyond Jonesboro, Ark. The Frisco will probably spend about $6,000,000 for this work and for making improvements on the main line of the road between Birmingham and Memphis and on to Kansas City, Mo. It has been decided to raise the entire roadbed from Memphis to Jonesboro, Ark. The tracks of the main line will be raised 4 ft. from the present level and this work alone will cost a considerable amount, as it will mean the reconstruction of the line between the places mentioned. In addition, to handle the heavy traffic which is expected to be transferred from the New Orleans, Mobile & Chicago road at New Albany, Miss., it is understood that the road from that place to Memphis will be double tracked.

Three engineering parties are now in the field working on the projected route for the Memphis & Pensacola Ry. It is expected that the engineering work will be completed in about two months and that construction work will be started by fall. C. D. Smith & Co., Memphis, Tenn., have the construction con-

Texas.

The Artesian Belt R. R. has been acquired by H. E. Hildebrand of San Antonio, Tex. This is a 43 mile steam line extending from Christine to Macedona. It was built by the late Dr. C. F. Simmons in the development of the Live Oak country, where he owned large tracts of land. This road has been regarded as a link of a proposed road to Brownsville or for one of the lines that are now building to the Aransas Pass coast.

The Palacios, San Antonio & Pecos Valley Ry. has started surveys for a line from Yoakum to Smithville. The portion of the line between Palacios and Yoakum is ready for construction gangs and it is expected that work will be started shortly. H. L. Montandon, Palacios, is Vice President and General Manager.

The Texas Electric Co., chartered on May 4, with a capital stock of $100,000, proposes the construction of an interurban railway from Palestine to Austin by way of Dallas. The route of the proposed line has already been surveyed between Palestine and Dallas, and the party of surveyors is now working between Dallas and Austin. It is believed that the work of actual construction will begin early this fall and that cars will probably be in operation before the end of 1913. All of the capital stock is subscribed and 50 per cent of it is paid in, according to affidavit filed with the charter. The line is to run south from Dallas through Ellis County, and near the southern boundary of Ellis County the road is to divide, one branch going to Palestine via Corsicana and the other to Austin, passing through Blooming Grove, Hubbard City, Mart, Marlin, Temple, Cameron, Taylor and into Austin. J. V. Watkins, Dallas, Tex., is interested.

Grading work was started on May 4 by W. H. Knox for the extension of the Orange & Northwestern R. R., W. H. Stark, Vice President, Orange, Tex. Mr. Knox will grade first from Bronson to Hemphill.

The San Antonio Belt & Terminal Co. chartered early this month with a capital stock of $200,000, of which $175,000 is paid in, was organized to provide terminal facilities at San Antonio for the Missouri, Kansas & Texas R. R., which has heretofore been using the freight and passenger terminals of the Galveston, Harrisburg & San Antonio R. R. A. M. Achison, Dallas, Tex., is Chief Engineer of the Missouri, Kansas & Texas Ry. of Texas.

Utah.

Ordinance is before the City Council of Salt Lake City to grant a franchise to Samuel Newhouse, Salt Lake City, and associates for an interurban railroad, which is planned to run from Salt Lake City to Spanish Fork and the coal fields of southern Utah. It is proposed that the interurban road will enter the city over 1st West St., the same route granted to the Utah county interurban, both lines to use the same tracks.

Directors of the Uintah Railroad have authorized the construction of an extension from the present terminus to Fort Duchesne and Vernal, Utah, connecting with the Denver, Northwestern & Pacific. Work is to be started shortly and will necessitate an expenditure of about $3,000,000. The plans include the broad-gaging of the present line from Mack,
Colo., to Dragon, Utah, the boring
nels to reduce the heavy grades of the narro
gage line and a possible exten
road into Grand Junction. The ans, as at
present outlined, will virtually ma the road
a feeder for the Denver, Northwestern & Pa-
cific when it is ultimately ext ded from
Steamboat Springs into Salt Lak ity. Th
largest engineering work to be ne on the
line will be at Baxter Pass, just the boun-
dary line between Garfield and to Bl
counties. This tunnel will be 3 ft l
and will cost $1,000,000. The rou to Vernal
will follow closely the present tol oad. The
extension to Fort Duchesne will
White River, which river it will f
Duchesne. Practically all the
traffic handled by the road at pre nt is f
Mack to Vernal and Fort Duch
which is hauled more than half
wagons. W. M. Cooley, of Mac
general manager, will be in ch ge
work John M Mack, of Ph
president. The directors are me ers
board of the Barber Asphalt Co

Vermont.

An election was recently held
boro, Vt., to submit to the voter
sition providing for extensive imp
that place. The Central Vermon
& Maine Railroads are to spend a
$300,000 in relocating Vernon st.,
the Central Vermont, the freig
that road, the building of a $58,
tion and construction of a vi
to abolish the Bridge St. grade c
railroads ask the town of Brattle
tribute $30,000 toward the expens
posed development. F. W. Deniso
Vt., is Assistant Engineer of the
mont Ry.

Virginia.

The Tidewater & Western R. R.
making surveys for a 23-mile ex
Lilburn Post Office to South Ric
capital for construction has not
as yet nor has any definite time
awarding construction contracts.
liams, Richmond, Va., is Presiden
mour, Box 402, Richmond, is Ch
and T. M. R. Talcott, Richmon is
Manager.

Washington.

The Oregon & Washington Rai
gation Co., has placed engineers
running preliminary surveys for
extension from the south side of
to Montesano, Wash. The impr
cost $177,000. G. W. Boschke, P
is General Manager.

West Virginia.

⊙The Redfox Construction Co
W. Va., has been awarded th
building a number of wooden
Clarksburg Northern R. R., now
struction from New Martinsv
burg.

Wisconsin.

⊙Schmidt Bros., Superior, Wi
awarded the contract by the G
Railway for the construction of
to the roundhouse at Belknap S
will involve an expenditure of a

Grading work has been starte
tension of the Fairchild & N
Peter Nelson, Fairchild, Wis., is
or for the work.

Bids were opened last week
struction of the projected line o
& Wisconsin Valley Ry. from
Portage and Madison to Middleto
du Sac. George S. Foster, Mad
Chief Engineer, and Allen T
Fisher Bldg., Chicago, Ill., is Pr

Wyoming.

The Colorado & Southern
Cowan, Chief Engineer, Denve
placed an order with the Colorad
Co. for 8,000 tons of 85 lb

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ack between Hartwell Junction
[illegible], Wyo., and [illegible]
nk. A contract will be let in a
,000 treated railroad ties, which
n repairing the track when the
Work will begin on the im-
[illegible] as the material is [illegible]
[illegible] 60 days [illegible]
esent plan is to have the track
[illegible] service about Sept. 1. [illegible]
its expected the Burlington's line
[illegible] to Powder River will be

Canada.

Valley Ry. Co., A. McCulloch, [illegible]
, Penticton, B. C., has awarded
[illegible] grading and bridging to [illegible]
[illegible] Wash., for [illegible]
ni west; same contractors were
[illegible]
tle Valley Ry. will lay the track
[illegible]

ricton & Grand Lake Coal &
Thomas Tait, President, has
ntract for the construction of
E. Trites & Son. The railway
o Minto is 31 miles long, and
[illegible] a line running [illegible]
. The contract which Messrs.
lls for the construction of the
he construction of the masonry

structures of the several bridges on the line. The [illegible] it is understood, has the contract for the [illegible] the railway, which is [illegible] trunk line char- [illegible] that the Messrs. Trites will commence work early, as under the contract the entire work is to be completed this season. The work to be undertaken at once will consist almost entirely of construction of camps and other preparations for commencing the main work. It is expected that upwards of 1,000 men will be employed.

Steps have been taken to secure a charter for an electric railway to run from London to Port Burwell and to be owned and operated by the municipalities through which it passes. It is the intention to finance the matter by the municipalities entirely. J. Grant Henderson, Commissioner of Industries, London, Ont., is interested.

The Canadian Northern Ry. has started surveys from Prince Albert, Sask., for its Hudson Bay line. It has been stated that 50 miles of a line from Prince Albert to Split Lake to connect with the government Hudson Bay line at the latter place would be graded this year.

The street railway branch of the Light Commission is to ask the Town Council of Berlin, Ont., to submit a by-law to the rate payers to raise $17,000 by debentures for the purchase of two new cars and to build new car barns.

The Winnipeg Electric Ry. Co., 218 Portage Ave., Winnipeg, Man., will probably extend its line to Stonewall this season.

Announcement has been made that the Niagara, St. Catherines & Toronto Ry. Co., E. F. Seixas, General Manager, St. Catherines, Ont., will extend its traction line to Niagara-on-the Lake this summer.

A special meeting will be held by the Alberta Central Railway at Montreal, Que., on June 4, to consider the leasing of the line to the Canadian Pacific Ry., and to decide upon means to raise funds to defray the cost of constructing and equipping new branches.

Information received from Calgary, Alta., is to the effect that an American Syndicate, including a number of Standard Oil stockholders, has acquired charters for railroad lines in the western part of Canada, including the Dominion Western, formerly known as the Alberta Pacific Ry. The company is said to be arranging to survey from Calgary to Pincher Creek. This and a line tapping the mineral fields of British Columbia are to be built this year. The line is to be built across the international boundary to connect with some of the transcontinental lines.

ADS, STREETS AND PAVEMENTS

Alabama.

e received until noon, June 4,
nty Commissioners' Court, We-
r grading and surfacing with
nately 5 miles of State Aid road
t $8,000. W. S. Keller is State
eer, Montgomery, Ala.
e received until 11 a. m., May
of Randolph County Commis-
ke, Ala., for grading, draining
with sand clay or top soil the
estimated to cost $10,000. W.
ate Highway Engineer, Mont-

California.

County Supervisors, Willow,
petitioned for the opening of
from the Simpson bridge on
to Grindstone, a distance of
proposed road will follow the
y Creek and when built will
and wagon road from Orland
k station.

Colorado.

e received until 11 a. m., May
Public Works, Denver, Colo.,
the necessary labor and ma-
construction of concrete curb
erts and crosswalks and other-
South Denver Improvement
Henry Read is President of
certified check for $2,000 must
ch bid.

rict of Columbia.

e received until 10:30 a. m.,
j. F. C. Boggs, General Pur-
Isthmian Canal Commission,
. C., for furnishing under
710, lumber, stair balustrades,
res, grille for cashier's office
roller.

Idaho.

County Commissioners, Sand-
ve decided to include $25,000
appropriation for the building
state highway between Sand-
Montana-Idaho state line. The
appropriated a like amount for
ng a total of $50,000.

Illinois.

✣Bids will be received until 1 p. m., May 20, by Board of Local Improvements, Woodstock, Ill., for furnishing labor and material for the construction of 14,837 sq. yds. of vitrified brick pavement on Portland cement concrete foundation; 2,660 lin. ft. of concrete curbing; 1,321 ft. of storm water sewer connection.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, until 11 a. m., May 22, for furnishing materials, labor, etc., necessary to construct pavements in the following streets and alleys, 35th St., 7,030 lin. ft. sandstone curbing, 530 lin. ft. curb wall, 15,590 sq. yds. creosoted wood block; Washington Ave., 6,000 sq. yds. creosoted wood block; 56th St., 1,262 lin. ft. concrete curb and gutter, 2,550 sq. yds. creosoted wood blocks; Madison Ave., 4,610 lin. ft. concrete curb and gutter, 6,900 sq. yds. creosoted wood block; alley, Belmont Ave., etc., 1,460 lin. ft. concrete curbing, 970 sq. yds. brick; alley, State St., etc., 700 lin. ft. concrete curbing, 500 sq. yds. brick; alley, Michigan St., etc., 1,800 lin. ft. concrete curbing, 1,500 sq. yds. brick; alley, Michigan Ave., 2,390 lin. ft. concrete curbing, 2,400 sq. yds. brick; alley, Michigan Ave., 2,660 lin. ft. concrete curbing, 2,660 sq. yds. brick; alley, Sholto St., etc., 1,940 lin. ft. concrete curbing, 1,100 sq. yds. brick; alley, Throop St., etc., 1,200 lin. ft. concrete curbing, 900 sq. yds. brick; alley, Congress St., etc., 500 lin. ft. concrete curbing, 300 sq. yds. brick; Costello Ave., 1,200 lin. ft. concrete curb and gutter, 1,870 sq. yds. brick; Catalpa Ave., 900 lin. ft. sandstone curbing, 3,280 sq. yds. asphaltic macadam; 51st Ave., [illegible] lin. ft. gravel concrete curb and gutter, 4,550 sq. yds. asphalt; Hollywood Ave., 380 lin. ft. concrete curb and gutter, 540 sq. yds. asphalt; Irving Park Blvd., 3,150 lin. ft. sandstone curbing, 4,610 sq. yds. brick; Lake View Ave., 2,350 lin. ft. concrete curb and gutter, 4,800 sq. yds. asphalt; Maxwell St., 500 lin. ft. concrete curb and gutter, 4,200 sq. yds. asphalt; 99th St., 1,380 lin. ft. sandstone curbing, 2,300 sq. yds. granite top macadam; Richmond St., 1,200 lin. ft. concrete curb and gutter, 1,800 sq. yds. asphalt; Rockwell St., 2,250 lin. ft. concrete curb and gutter, 3,150 sq. yds. asphalt; S. Sangamon St., 1,250 lin. ft. concrete curb and gutter, 1,960 sq. yds. asphalt; 23rd Pl., 3,800 lin. ft. concrete curb and gutter, 6,940 sq. yds. asphalt; 77th St. system, 400 lin. ft. sandstone curbing, 2,000 lin. ft. curbing to be reset, 24,000 sq. yds. asphaltic macadam. The work includes 6-in. Portland cement concrete foundation, sand cushion, earth excavation, sewer, manhole and catch basin construction and adjustment, unless otherwise specified.

✣Bids will be received until 1 p. m., June 4, by George B. Stephan, Town Clerk, Ashton, Ill., for the macadamizing of about 6 miles of road and redressing about 5½ miles of road already macadamized. A bond issue of $22,000 has been voted by the township for the work.

✣Bids will be received until 9 a. m., May 24, by E. E. Jacobs, Mayor, Du Quoin, Ill., for about 2½ miles of street improvement, including curbing, grading and paving. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 7 p. m., May 20, by City of Rochelle, Ill., for the construction of approximately 32,000 sq. yds. of brick pavement and two miles of sewers. Aetna Engineering Bureau, 17 North La Salle St., Chicago, Ill., are engineers. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 8 p. m., May 20, by Board of Local Improvements, Waukegan, Ill., for grading and paving streets. A. L. Rogers is Secy. of the Board. Official advertisement will be found elsewhere in this issue.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., May 17, for furnishing the materials, labor, etc., necessary to repair pavement in Randolph St., from Halsted St. to Desplaines St. (Haymarket Square), with granite blocks, according to specifications on file at office of the Commissioner. Cash or certified check for $350 must accompany proposal.

✣Bids will be received by Mr. Ray Palmer, City Electrician, Chicago, Ill., until 11 a. m., May 21, for furnishing, delivering and installing street signs, brackets and posts at various points on the city streets according to specifications on file at his office. Approximate quantities are as follows: 3,500 street signs, 500 street posts, 3,000 street sign brackets. Proposal must be accompanied by a certified check or cash for 5 per cent of total bid.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., until 11 a. m., May 17, for furnishing and delivering the labor, materials, etc., necessary to construct Portland cement concrete sidewalks in the following streets:

	Minimum. Sq. ft.	Fill. Ft.
S. Clark St.	6,000	3.0
Exchange Ave.	....	..
W. Erie St.	6,000	8.0
S. Michigan Ave.	900	1.5
Melrose St.	2,400	1.5
W. North Ave.	28,000	1.5
E. 97th St.	10,000	..
E. 90th St.	1,600	2.0
W. 103d St.	1,000	1.0
E. 103d Pl.	1,400	1.5
W. 104th St.	1,600	1.0
S. Sangamon St.	[illegible]	1.0
Superior St.	2,000	3.0
S. State St.	5,000	1.0
Waveland Ave.	3,800	1.5
Winona St.	4,000	1.0
W. 61st St. System	36,000	1.5
E. 87th St. System	28,000	2.0
E. 89th St. System	40,000	1.0
E. 90th St. System	50,000	1.0
W. 113th St. System	4,000	1.5
W. 88th St. System	15,000	1.0
W. 76th St. System	6,000	4.0
Laurence Ave. System	690	1.5
W. 71st St. System	30,000	1.5
Cortez St. System	3,000	1.5

⊙The contract for furnishing and delivering 3,500 tons asphaltic surface mixture and 2,000 tons of asphaltic binder to the street department has been awarded by L. E. McGann, Commissioner of Public Works, Chicago, Ill., to Jos. Hanreddy, 79 Dearborn St. Bids opened April 18.

⊙Edward M. Laing of Highland Park, Ill., has been awarded the contract by the city of Glencoe, Ill., for improving Downing Ave. etc., at $3,302. Bids were opened May 7.

The property owners along Crescent Blvd., in Glen Ellyn, Ill., at a meeting recently held, decided to have the road paved with an 18 ft. roadway of crushed stone with a bituminous binder. The Aetna Engineering Bureau of Chicago, Ill., have been retained to prepare plans and estimate.

City Engineer Lee S. Trainer, 108 S. Locust St., Centralia, Ill., has prepared plans for the construction of 20,954 sq. yds. of brick pavement on a concrete foundation, estimated to cost $45,831. The work will include 12,685 lin. ft. of sandstone curb, cement grout, and 5,824 cu. yds of excavation. Contracts will be let soon.

The City Council of Attalla, Ala., rejected all bids received May 6 for the construction of 400 sq. yds. of concrete sidewalks, 100 sq. yds. of concrete driveways and 3,700 lin. ft. of combination curb and gutter. J. E. Johnson is City Clerk.

The citizens of Ganeer Township, Kankakee County, Ill., at a recent election voted the issuance of bonds in the sum of $81,000 for the purpose of building stone roads. It is estimated that this will build 12 miles of road and will connect Momence with Kankakee and Grant Park. Kankakee is the county seat.

The Board of Local Improvements of Lewistown, Ill., has rejected all bids received May 2 for the construction of about 16,400 sq. yds. of vitrified brick paving on a concrete base. Heckard, Roller & Savill of Canton, Ill., at $38,897, submitted the lowest bid. The work will be re-advertised. Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., are Engineers.

Following are the low bids as received by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, for furnishing the materials, labor, etc., necessary to construct pavements in the following streets and alleys; 43rd Ave., 5,300 lin. ft. concrete curb and gutter., $.65, 8,400 sq. yds. asphalt, $2.12, total $23,903; Standard Paving Co., 9 S. La Salle St., N. 44th Ct., 6,625 lin. ft. concrete curb and gutter, $.65, 9,540 sq. yds. asphalt, $2.02, total $28,362; R. F. Conway Co., 133 W. Washington St., E. 50th St., 6,070 lin. ft. concrete curb and gutter, $.60, 9,230 sq. yds. asphalt, $2.05, total $25,179; R. F. Conway Co., E. 56th St., 4,300 lin. ft. concrete curb and gutter, $.62, 6,780 sq. yds. asphalt, $2.02, total $18,071; the American Asphalt Paving Co., 133 W. Washington St., Hillock St., 3,900 lin. ft. gravel concrete curb and gutter, $.58, 8,000 sq. yds. asphalt, $2.02, total $20,163; American Asphalt Paving Co., W. one-half of May St., 350 lin. ft. concrete curb and gutter, $.64, 950 sq. yds. asphalt, $2.19, total $2,669; the American Asphalt Paving Co., 133 W. Washington St., N. Marshfield Ave., 650 lin. ft. concrete curb and gutter, $.65, 760 sq. yds. asphalt, $2.32, total $2,492; Parker Washington Co., 133 W. Washington St., W. 73rd St., 2,610 lin. ft. sandstone curbing, $.65, 4,580 sq. yds. asphaltic macadam, $1.13, total $8,222; Calumet Coal & Teaming Co., 9,022 Commercial Ave., E. 77th St., 3,220 lin. ft. concrete curb and gutter, $.59, 4,110 sq. yds. asphalt, $1.99, total $11,566; Parker Washington Co., Southport Ave., 5,000 lin. ft. sandstone curbing, $.65, 9,350 sq. yds. asphaltic macadam, $1.13, total $15,688; Central Paving Co., 179 W. Washington St., Stewart Ave., 4,200 lin. ft. sandstone curbing, $.66, 8,710 sq. yds. asphaltic macadam, $1.15; Jno. A. McGarry Co., 189 W. Madison St., W. 36th St., 1,800 lin. ft. concrete curb and gutter, $.65, 2,330 sq. yds. asphalt, $2.01; R. F. Conway Co., W. 32nd St., 3,520 lin. ft. concrete curb and gutter, $.66, 6,200 sq. yds. asphalt, $2.04, total $16,283; the American Asphalt Co., alley, Menominee St., etc., 1,200 lin. ft. concrete curb, $.10, 950 sq. yds. brick, $2.44, total $2,438; Jno. A. McGarry Co., alleys, South Park Ave., etc., 1,000 lin. ft. concrete curb, $.05, 800 sq. yds. brick, $2.49, total $2,042; Jno. Dillon & Co., 179 W. Washington St., alleys, Cottage Grove Ave., etc., 1,890 lin. ft. concrete curb, $.15, 1,410 sq. yds. brick, $2.43, total $3,696; Central Paving Co., alleys, Calumet Ave., etc., 1,540 lin. ft. concrete curbing, $.15, 1,480 sq. yds. brick, $2.23, total $3,531; Central Paving Co., alley, Jackson Blvd., 800 lin. ft. concrete curbing, $.15, 500 sq. yds. No. 2 granite blocks, $3.09, total $1,965; Central Paving Co. The work includes granite concrete combined curb and gutter, 6-in. Portland cement concrete foundation, cutting, filling new sidewalk construction, manhole, catch basin and sewer construction or adjustment, sand cushion asphaltic filler, etc., unless otherwise specified. Bids opened April 24.

Indiana.

✣Bids will be received until 2 p. m., June 5, by Board of Monroe County Commissioners, Bloomington, Ind., for the construction of stone roads in Bloomington and Washington townships. Horace Blakely is County Auditor.

✣Bids will be received until 11 a. m., June 5, by Board of Wayne County Commissioners, Richmond, Ind., for the construction of a highway in Wayne township. L. S. Bowman is County Auditor.

✣Bids will be received until noon, June 4, by Board of Sullivan County Commissioners, Sullivan, Ind., for the construction of two stone roads in Haddon township. W. S. Bicknell is County Auditor.

✣Bids will be received until 1:30 p. m., June 4, by Board of Wabash County Commissioners. Wabash, Ind., for the construction of two gravel and macadamized roads in Liberty township. Daniel Showalter is County Auditor.

✣Bids will be received until 10 a. m., June 4, by Board of Montgomery County Commissioners, Crawfordsville, Ind., for the construction of highways in Coal Creek and Union townships. B. B. Engle is County Auditor.

✣Bids will be received until 1:30 p. m., June 4, by Board of Wabash County Commissioners, Wabash, Ind., for the improvement of two highways in Liberty township. Daniel Showalter is County Auditor.

✣Bids will be received until 2 p. m., June 4, by Board of Grant County Commissioners, Marion, Ind., for the construction of highways in Jefferson, Mill, Center, Franklin, Richland and Pleasant townships. E. H. Kimball is County Auditor.

✣Bids will be received until 10 a. m., June 3, by Board of Huntington County Commissioners, Huntington, Ind., for the construction of gravel road in Huntington township. Harold Guthrie is County Auditor.

✣Bids will be received until 1 p. m., June 3, by Board of Ripley County Commissioners,
Versailles, Ind., for the construc
adamized roads in Brown and De
ships. J. Francis Lockard is Co

✣Bids will be received until 1
by Board of Dubois County C
Jefferson, Ind., for the constructi
roads in Patoka and Bainbridg
J. H. Seng is County Auditor.

✣Bids will be received until 1
3, by Board of Jennings County
ers, Vernon, Ind., for the const
pike road in Spencer township.
gan is County Auditor.

✣Bids will be received until 1
3, by Board of Jay County C
Portland, Ind., for the constructi
el road in Jackson township. J
County Auditor.

✣Bids will be received until 2
by Board of Crawford County C
English, Ind., for the construct
roads in Ohio township. J. E
County Auditor.

⊙The Ohio Construction Co.,
has been awarded the contract
County Commissioners, Rushvil
the construction of the Ezekiel
am road in Rushville township at
were opened May 6.

⊙Hawkins Bros., of Brazil, In
awarded the contract by the
Commissioners, Brazil, for t
tion of the R. L. Kennedy road
ship line, at $13,168. Bids were
7 by E. A. Staggs, County Aud.

⊙A. J. Freeland, Freeland Pa
been awarded the contract by
County Commissioners, Fowler,
construction of three roads at
prices; $9,400, $9,170 and $6,400
& Co., of Fowler, Ind., secured
$8,235 and $6,190. Bids were o
by L. Shipman, County Auditor.

⊙O. L. Osborn of Wayneto
been awarded the contract by the
County Commissioners, Crawfor
for grading, draining and pavin
Graves, et al., road in Coal Creek
$10,349. Bids were opened May
Engle, County Auditor.

⊙W. E. Patton of Campbellsb
been awarded the contract by the
County Commissioners, Salem,
construction of a road in Vern
at $2,878. Bids were opened M
Munkelt, County Auditor.

⊙B. L. Oilar, R. F. D., Lafay
been awarded the contract by th
County Commissioners, Lafay
construction of a gravel road at
were opened May 8 by Geo. W. K
ty Auditor.

⊙The Crown Point Constructio
Point, Ind., has been awarded
the Newton County Commission
Ind., for the construction of t
road in Lake Township at $8,18
opened May 6 by E. R. Bring
Auditor.

⊙Geo. Saunders of Muncie, I
awarded the contract by the Blac
Commissioners, Hartford, Ind.,
struction of a macadam road o
tween Harrison and Jackson T
$6,850. Bids were opened Ma
Cronin, Jr., County Auditor.

⊙Hobbs & Cox of Tipton, In
awarded the contract by the T
Commissioners, Tipton, Ind., for
tion of the Amos Murray grave
790. The road is located in Cic
Bids were opened May 6 by H. J.
County Auditor.

⊙The Board of Marion Cou
sioners, Indianapolis, Ind., W. F
Auditor, awarded the contract f
80 cars of stone to Zearing Con
ply Co., of Indianapolis, and 125
to A. B. Meyer & Co., of India
stone is to be used on the count
were opened May 2.

⊙J. R. Chastain of Campbellsb
been awarded the contract by
Orange County Commissioners,

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] of a gravel road [illegible] , at $2,475. Bids were opened B. Ham, County Auditor.

[illegible] of Michigan City, Ind., [illegible] ded the contract by the town of [illegible] J. M. Nye, Clerk, for the [illegible] 425 sq. yds. of paving [illegible] Bids were opened May 6. [illegible] May 8.

County Commissioners, Indian- [illegible] May 2, received the following furnishing of 200,000 gals. of placed on more than 30 miles trial: William C. Smith, fur- pplying, $0.07½ a gal.; R. B. ing, $0.0395 a gal., furnishing [illegible] a gal., applying, $0.02½ Breslin, furnishing, $0.04 a gal., applying oil with 40 per cent 54 a gal., same with 50 per cent 056 a gal., and same with 60 tum, $0.07 a gal.; Empire Road and applying, $0.082 a gal., $0.042 a gal.; Denny J. Bush, applying, $0.062 a gal.; Stand- furnishing only, $0.032 a gal.; Road Oil Co., furnishing, $0.06 , $178 a mile.

ls were received by the Marion ssioners, Indianapolis, Ind., on furnishing of a large amount ised on the roads of the county: ctors' Supply Co., $1.10 to $1.25 ording to place of delivery; Co., $1.10 to $1.30 a cu. yd., lace of delivery; Ohio & In- o., $1.06½ to $1.15 a cu. yd., lace of delivery; Reinheimer 2½ to $1.20 a cu. yd., accord- f delivery.

e received on May 6 by the Commissioners, Vernon, Ind., ction of a pike road in Geneva W. Brogan is County Auditor.

County Commissioners, Indian- ive rejected all bids received furnishing of 200,000 gals. of se on the county roads. The [illegible]

Iowa.

be received until June 4, by y, Ia., for the construction of of pavement and 16,000 lin. ft. paving will be bitulithic, sarco- rubber, Portland cement con- concrete, brick block and particular kind to be chosen etting the contract. Plans and or all this work may be pro- A. Lee, City Clerk of Waverly, h B. Slippy, Civil Engineer of

[illegible] received until 8 p. m., Ma Klingaman, City Clerk, Vinton, n. ft. of curbing and approxi- q. yds. of pavement. Bids will on brick block, concrete base avement. P. P. Smith, Cedar onsulting Engineer.

e received until 2 p. m., May ncil, Iowa Falls, Ia., for paving follows: Main St. from the North St. to the north line of e; Washington Ave. from the ver street to the west line of d Stevens St. from the north St., to the south line of Estes Falls, Ia, with the best qual- cement concrete paving, all in the plans and specifications on file in the office of the City ork comprises approximately of cement paving, and 15,000 nt curbing. Said work to be efore July 1, 1912, and to be e Nov. 1, 1912. J. O. Gregg is

be received until June 4, it is Council, Fort Dodge, Ia., for of approximately 63,000 sq. idewalks and 6,000 ft. of ap- H. Reynolds is City Engineer.

Kansas.

⦿Throgmartin & Gardiner, of Fort Scott, Kans., have been awarded the contract by the Board of Commissioners, Pittsburg, Kans., for the construction of 4,500 sq. yds. of brick paving on a 5-in. concrete base with asphalt filler at $1.74 per sq. yd. The work includes excavation below finished grade and all material and labor necessary to complete pavement. The excavation above top of finished pavement is extra, $0.20 per cu. yd. Bids were opened May 1. L. E. Curfman is City Engineer.

⦿Following bids were received at Manhattan, Kan., on May 7, for the construction of brick and asphaltic concrete pavement: (1) Standing for bid of Cleveland Trinidad Paving Co., Kansas City, Mo. (awarded contract on asphaltic concrete); (2) Kaw Paving Co., Topeka, Kan. (awarded contract on brick); (3) Peak & Stingley, Manhattan; (4) O. C. Chapin, Leavenworth, Kan.; (5) J. R. Ramsey, Topeka, Kan., and (6) J. Ritchie & Sons, Topeka, Kan.:

[illegible]	[illegible]	[illegible]	(2)	[illegible]	(4)	[illegible]	(6)
No. 1 Brick, cement filler	[illegible]		$[illegible]	$[illegible]	$1.74		$[illegible]
No. 1 Brick, asphalt filler	[illegible]		1.93	1.95	[illegible]		1.92
No. 2 Brick, cement filler	[illegible]		1.79	1.80	[illegible]		1.76
No. 2 Brick, asphalt filler	17,781 sq. yds.		1.87	[illegible]	[illegible]		1.84
Excavation	[illegible]		.30	.30	.33		[illegible]
18-in. concrete gutter	[illegible]		.17	[illegible]			.24
36-in. concrete gutter	[illegible]			.36	.36		[illegible]
8-in. curb and 18-in. gutter	9,044 lin.ft.		[illegible]	.45	[illegible]		[illegible]
[illegible] oak headers	[illegible]		.10	.10	[illegible]		.12
No. 1 Brick, cement filler			39,749	40,121	38,285		[illegible]
No. 1 Brick, asphalt filler			41,172	41,721	39,707		42,029
No. 2 Brick, cement filler			38,682	39,054			[illegible]
No. 2 Brick, asphalt filler			[illegible]	[illegible]			[illegible]
Asphaltic concrete	[illegible]	$[illegible]	[illegible]			$1.[illegible]	[illegible]
Excavation	4,710 cu. yds	[illegible]	[illegible]			.30	
18-in. congrete gutter	3,259 lin. ft.		.17			.25	
36-in. concrete gutter	90 lin. ft.	.46	.35			.35	
48-in. concrete gutter	60 lin. ft.		.45			.45	
8-in. curb and 18-in. gutter	6,182 lin. ft.	[illegible]	.43			.44	
[illegible] oak headers	[illegible]	.20	.10			.12	
Siphons and catch basins	[illegible]	35.00	70.00			[illegible]	
Totals		[illegible]	$25,530.99 El-oso $24,158.89 Texaco			$26,079.09 Trinidad. $24,606.99 any other.	

*Trinidad asphalt.

†El-oso; also bid $1.40 on Texaco.

§Trinidad; also bid $142 on any asphalt made in U. S.

Maryland.

✤Bids will be received until noon, May 21, by Board of Caroline County Commissioners, Denton, Md., for constructing a section of state aid highway in Caroline County upon or along the Denton-Willow Pond road, between Denton and Willow Pond, for a distance of about 1.63 miles. Each bid is to be accompanied by a certified check for $200. W. H. Anderson is Clerk.

✤Bids will be received until 8 p. m., May 30, by Easton Street Improvement Commission, Easton, Md., for furnishing necessary labor and material for grading and constructing about 60,000 sq. yds. of street surface with brick and bituminous pavements. Clyde Potts, 30 Church St., New York City, is Engineer.

The Montgomery County Commissioners, Rockville, Md., are preparing to build the roads authorized by the Legislature. Bonds of $47,000 will be immediately issued for the construction of the roads from Rockville to Travilah, from Rockville to the Potomac district line on the Falls road, from the Georgetown pike through Garrett Park to Kensington, and from Forest Glen to the Brookeville pike.

Massachusetts.

✤Bids will be received until 1 p. m., June 10, by Capt. R. H. C. Kelton, Constructing Quartermaster, 263 Summer St., Boston, Mass., for the construction of roads, walks, etc., at Fort Andrews, Boston Harbor, Mass.

⦿Steve Menaguale has been awarded the contract by the Village Board of Stockbridge, Mass., for the construction of 20,000 sq. yds. of road with tarvia at $1.10 per sq. yd. Barner & Spaulding of Pittsfield, Mass., are Engineers.

The State Highway Commission, Boston, Mass., has decided to recrown and widen the Lenox-Pittsfield road its entire length from Lenox to Pittsfield, which will cost approximately $30,000. Arthur W. Dean is Chief Engineer of the Commission.

Michigan.

✤Bids will be received until noon, May 21, by City Clerk, Hillsdale, Mich., for the construction of 9,500 yds. of pavement on concrete base with a bituminous wearing surface either poured or mixed. C. L. Herron is City Engineer.

✤Bids will be received until noon, May 28, by Jesse Button, Village Clerk, Milan, Mich., for paving Main St. from east line of Church St. to the east line of Gay St; Tolan St., from the north line of Main St. to the north line of 1st St; River St., from the south line of Main St. to the north end of the Saline River bridge, in the Village of Milan. Plans and specifications are on file in the office of the [illegible] of George Champe, Civil Engineer, 610 Nasby Bldg., Toledo, Ohio.

⦿The City Council of St. Johns, Mich., has awarded the contract for paving on Walker, Ottawa, Higham and State Sts., to the Northern Construction Co., of Traverse City, Mich., at $1.30 per sq. yd. The pavement is to be of 2-course concrete, the bottom course 5 ins. thick, made of one part Portland cement to five parts of clean bank gravel; the top course 2 ins. thick, made of one part Portland cement and two parts clean screened sand and gravel. Triangle steel-wire mesh reinforcement will be used.

The city of Holland, Mich., will construct 20,722 sq. yds. of asphaltic concrete pavement on 6-in. concrete base by day labor. The pavement is to be laid on 12th St. The city will let by contract 13,634 ft. of combined curb and gutter. H. A. Naberhuis is City Engineer.

The Board of Fillmore Township, Ottawa County, Mich., it is reported, has decided to purchase a road roller. The township will soon begin the construction of 2 miles of stone road. Grand Haven is the county seat.

Minnesota.

✤Bids will be received until 2 p. m., May 23, by Board of Polk County Commissioners, Crookston, Minn., for grading State Road No. 1 on line between sections 13-24, town of Reis, sections 18-19, 17-20, town of Liberty, sections 20-21, 28-29, 32-33, town of Russia, according to plans and specifications on file in the office of S. Steenerson, assistant state highway engineer, at Crookston, Minn. H. J. Welte is County Auditor.

✤Bids will be received until 11 a. m., May 16, by Board of Hennepin County Commissioners, Minneapolis, Minn., for furnishing and building a road No. 41, Contract No. 26, from the city limits westerly. A. P. Erickson is County Auditor.

[illegible] $1\frac{1}{2}$ miles of state road No. 1 has been awarded by the Board of County Commissioners of Rock County, Luverne, Minn., to Henry Enke of Lake Wilson, Minn., at $3,516. P. N. [illegible] The work will consist of approximately 10,000 cu. yds. of excavation and embankment, 3,000 cu. yds. of gravel, and the construction of 5 concrete culverts. Work will begin May 15.

Mississippi.

Madison County, Miss., has issued bonds in the sum of $50,000 to construct good roads. It is planned to construct a model highway to join one being constructed northward from the city of Jackson. Canton is the county seat.

Missouri.

✣Bids will be received until noon, May 17, by Board of Public Improvements, St. Louis, Mo., for improving King's Highway Boulevard from Arsenal St. to the intersection of Vandeventer Ave. and Old Manchester Road.

✣Bids will be received until noon, May 17, by Board of Public Improvements, St. Louis, Mo., for reconstructing North Market St., from 15th to Glasgow Ave.

⊙The City Council of Springfield, Mo., upon the recommendation of the street and alley committee, awarded the following contracts: Concrete waterway on Harrison St. between Jefferson and Kimbrough Sts., by J. G. Ridenour at $120. Asphaltic concrete paving on Main St. from Walnut St. to Mount Vernon St., to Jarrett Richardson Paving Co. at $1.57 per sq. yd. Asphaltic concrete paving on Main St. from Mount Vernon St. to Phillips St., Jarrett Richardson Paving Co., at $1.57 per sq. yd. Concrete paving on Mount Vernon St. from New St. to Fort St., Fox & Cornwall, at $1.30 per sq. yd. Concrete paving on Center St. from Main St. to Grant St., J. A. Kerr Construction Co., at $1.23 per sq. yd. Concrete paving on Center St. from Boonville St. to Main St., J. A. Kerr Construction Co., at $1.25 per sq. yd. Concrete paving on Center St. from Grant St. to Broad St., J. A. Kerr Construction Co., at $1.19 per sq. yd. Concrete paving on Page Ave. from Holland St. to King's Highway, Fox & Cornwall, at $1.20 per sq. yd. Concrete paving on Clay St. from Center St. to Commercial St., Kelso, Knox & Waddell, at $1.32 per sq. yd. Sarcolithic mineral rubber paving on Jefferson St. from Elm St. to Madison St., Jarrett Richardson Paving Co., at $1.73 per sq. yd. Second class stone curbing on both sides of Grand Ave. from King's Highway to Holland St. Concrete curbing on both sides of Center St. from Boonville St. to Broad St., Kelso, Knox & Waddell, at $.34. Concrete curbing on both sides of Nicholas St. from Campbell St. to Broad St., Kelso, Knox & Waddell, at $.36. First class 4-ft. cement sidewalk on both sides of State St. from New St. to Kansas Ave., J. G. Ridenour, at $.64 per lin. ft. First class 4-ft. cement sidewalk on both sides of Webster St. from Summit Ave. to Sherman St., J. G. Ridenour, at $.69 per lin. ft. First class 5-ft. cement sidewalk on the north side of Commercial St. from Washington Ave. to the west side of Nixon's addition, Fox & Cornwall, at $.65 per lin. ft.

The city of Nevada, Mo., will let contracts about June 10 for the construction of 20,000 sq. yds. of brick pavement on a cinder foundation, estimated to cost $35,000. The work will include 7,000 lin. ft. of concrete curb, asphalt filler. Excavation will be done by the city. James M. Clack is City Engineer.

The Dade County Court, Greenfield, Mo., J. G. King, County Judge, on May 6 sold bonds for the construction of 47 miles of rock roads. Bids will soon be asked for the grading and graveling of the roads per mile. J. W. Scott is Engineer.

The Board of Public Improvements, St. Louis, has received the following bids for proposed street work: Telford-Lloyd, from Tamm, westwardly about 393 ft, Heman Construction Co., $2,915.25; Russell Pl., between Parker and Hartford, Fruin-Bambirk Construction Co., $14,759.20; Utah St., between Guthine and Russell, Eyermana Construction Co.,$4,519.79. Telford (oil treatment)—The Heman Construction Co. made bids for telford oil treatment of streets as follows: Byron Pl., between Commonwealth and Esplanade, $1,729.47; Esplanade, St., between Byron and Tennyson, $1,478.76; Manhattan Ave., between western city limits and Leamington, $4,498.15; Tennyson Sq., between Commonwealth and Canterbury, $2,395.82; Canterbury Ave., between Ellendale and western city limits, $3,922.63; Commonwealth Ave., between western city limits, as located south of Piccadilly and western city limits as located west of Tennyson Sq., $5,839.83; Piccadilly Ave., between Fyler and western city limits, $2,322.33; Ellendale Ave., between Canterbury and Old Manchester Rd., $5,768.97; Blow St., between Grand and Field, $8,867.46; French Ave., between Grand and Eugene, $3,447.17; French Ave., between Eugene and Field, $3,014.08.

Street improvements and reconstruction to cost property owners $238,389 are provided for in bills sent to the Municipal Assembly by the Board of Public Improvements of St. Louis. It is planned to lay wood blocks on Pine St. from 12th to 19th; Franklin Ave., from 4th to High, and Linden St., from 12th to 13th. Following is a list and estimated cost of the proposed improvements: Asphalt—Iowa Ave., between Arsenal and Gravois, $11,910; Abner Pl., between St. Louis and Ashland, $8,646. Bitulithic—Northland Ave., from Union eastwardly for 515 ft., $5,570. Brick—St. Louis Ave., between Belt and Clara, $10,439; Blow St., between Pennsylvania and Virginia, $9,441; St. Louis Ave., from Euclid eastwardly for 430 ft., $3,693; Alabama, between Bates and Delor, $19,692; John Ave., between Von Phul and Blair, $6,999; Roosevelt Pl., between Clara and Goodfellow, $13,789; Anderson Ave., from Newstead westwardly for 650 ft., $7,967; Tennessee Ave., between Itaska and Osceola, $14,767; Vermont Ave., between Eichelberger and Virginia, $8,232; Clarence Ave., between Kossuth and Lee, $3,710; Belt Ave., between North Market and St. Louis, $20,686; De Soto Ave., between Penrose and Florissant, $11,353; Beethoven Ave., between Gravois and Morgan Ford Rd., $11,473; Penrose St., from 20th to Florissant, $6,407. Telford—Wise Ave., between Tamm and Childress, $3,112; Arkansas Ave., between Wyoming and Arsenal, $7,906. Wood—Pine St., from 12th to 19th, $20,277; Franklin Ave., from 4th to High, $29,711; Linden St., from 12th to 13th, $2,609.

New Jersey.

⊙The Roman Catholic Diocese of Newark, N. J., has let the contract for grading, road making and general construction in the cemetery at North Arlington, N. J., to Fairfield Landscape & Nurseries Co., Terminal Bldg., 41st St. and Park Ave., New York City, at $172,000. Otto Sonne, 132 Nassau St., New York City, is Landscape Engineer. The company is in the market for bids on material consisting of sewer pipe, wrought iron, galvanized iron pipe, trap rock, gravel, sand, cement, manure, granite curbing, grass sod and steel for reinforcing.

⊙James McLinden & Co., of Wildwood, N. J., have been awarded the contract by the City Council of Sea Isle, N. J., for the construction of asphalt macadam or tar macadam roadways, consisting of 20,000 sq. yds. on a 5-in. concrete base and 3-in. trap rock surface filled with Tarvia X. The contract price is $20,000. R. L. Goff, Ocean City N. J., is City Engineer. Bids were opened May 6.

New York.

✣Bids will be received until noon, May 21, by George Cromwell, President, Borough of Richmond, New York City, for furnishing all labor and material necessary for furnishing and delivering 60,000 gals. of macadam road binder with asphalt base. The time for the completion of the work and the full performance of the contract is August 31, 1912. The amount of security required is $1,800. Bids will also be received for furn
labor and materials required f
and delivering 250 bbls. of Po
The time for the completion of
the full performance of the cont
ber 31, 1912. The amount of se
is $200.

⊙Arthur D. Osborn of Bingh
has been awarded the contract
for paving Leroy St. with 15,5
Mack brick on a 6-in. concrete
per sq. yd., and M. S. Hotchkiss
Binghamton, secured the contra
Water and Henry Sts., with 1,5
concrete pavement on either a
or bitumen top at $1.12 per sq.
opened May 8. J. A. Giles is Ci

The Village Board of Truste
N. Y., has voted to pave Da
bitulithic, its entire length, 2
pavement will be 39 ft. wide th
dential part of the street. A di
ft. will be 28 ft. wide, with con
1-ft. gutter on each side.

The citizens of the village o
have voted to spend the sum of
their main street.

Ohio.

✣Bids will be received until
by F. E. Harman, Director of
Lima, O., for grading, curbing
paving the central portion o
from Metcalf St. to Washin
vitrified brick.

✣Bids will be received unti
J. C. Edie, City Clerk, Findla
construction of 3,700 sq. yds. of
pavement on concrete foundati
will include sandstone curb.
Findlay, O., is Engineer.

✣Bids will be received until
by Board of Hamilton County
Cincinnati, O., for oiling under
No. 318, Cleves and Warsaw pi
way Ave. to east line of Add
and Delhi townships. Albert
Clerk.

✣Bids will be received until
by Board of Hamilton County
Cincinnati, O., for oiling under
No. 321, Loveland and Madei
Remington to the bridge in
Symmes Township. Albert Rei

✣Bids will be received until
by Board of Union County
Marysville, O., for the constr
miles of gravel roadway on
Road in Dover and Leesburg t
Morelock is County Auditor.

✣Bids will be received until
by Pultney township Clerk, W J.
Bellaire, O., for the construct
roadway from the corporation
to Pease township, a distance

✣Bids will be received until
by J. H. Hodgkin, Township C
township, Rochester, O., for
necessary labor and material fo
ment of certain roads.

✣Bids will be received until
1, by Board of Cuyahoga C
sioners, Cleveland, O., for th
of Green road from Woodlan
Road in Euclid and Warrensv
A certified check for $1,000
with each bid. J. F. Goldenbo

✣Bids will be received until
5, by Board of Bronson towns
the office of the Huron Count
ers, Norwalk, O., for furnishin
labor and material for the
about 1 mile of concrete roa
Fairfield road, beginning at th
said Bronson township, ext
southerly along said road, also
of macadam roadway upon
road, from the end of the pr
roadway upon said road, south
ter of the township. Plans an
and bidding blanks for this w
tained at the office of the cour
Huron county at Norwalk, O.
be accompanied with a certified

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

f $300, payable to the clerk. wnship. A. F. Ward is Tow

l be received at the office of the rs of Fairfield County, at L[illegible] until 10 a. m., May 25, for grad- ing with a waterbound macadam -Newark road. State Highway 119 in Walnut township, said gth 22,616.5 ft. or 4.28 miles. vement 12 ft. Estimated cost of $28,887. Estimated cost of con- ior furnished, $25,219.50. A draft check for $300 shall be deposited d. The successful bidder will be give bond for an amount equal act price. Date set for comple- 1912. Plans and specifications n the office of the County Com- nd the State Highway Depart- State Highway Commissioner re- ight to reject any and all bids. larker, Columbus, O., is State mmissioner.

received at the office of the rs of Coshocton County, at hio, until 1 p. m., May 20, for paving with a bituminous surface rbound macadam, the Walhond- ford road. State Highway A. in New Castle and Perry town- unty. Length 12,505 ft., or 2.37 h of pavement 12 ft. Estimated ruction $16,320. A draft or cer- for $300 shall be deposited with he successful bidder will be re- e bond for an amount equal to price. Date set for completion, . Plans and specifications are e office of the County Commis- State Highway Department. ighway Commissioner reserves eject any and all bids. James R. umbus, O., is State Highway r.

be received at the office of the rs of Trumbull County, at War- until noon, May 24, 1912, for paving with bituminated concrete -Northern road. State Highway 453 in Hartford Township, said gth 14,200 ft., or 2.69 miles. vement 12 ft. Estimated cost of 18,473. A draft or certified check ll be deposited with each bid. l bidder will be required to give amount equal to the contract set for completion, August 15, and specifications are on file in the County Commissioners and ighway Department. The State nmissioner reserves the right to d all bids. James R. Marker, is State Highway Commis-

be received at the office of the s of Carroll County, at Carroll- noon, May 17, 1912, for grading with brick for light traffic, the ad. State Highway B. pet. No. and Union townships, said th 5,500 ft., or 1.04 miles. Width 14 ft. Estimated cost of con- 03. A draft or certified check ll be deposited with each bid. l bidder will be required to give amount equal to the contract set for completion, August 1, and specifications are on file in the County Commissioners and ghway Department. The State nmissioner reserves the right to all bids. James R. Marker, ., is State Highway Commis-

be received at the office of the s of Carroll County, at Carroll- n, May 17, 1912, for grading with brick for light traffic, the Canton road. State Highway C. in Center township, said county. ft., or 1.33 miles. Width of pave- Estimated cost of construction draft or certified check for $300 shall be deposited with each bid. The successful bidder [illegible] for an amount equal to the contract price. Date set for completion, August 1, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is S[illegible]

⊙The Champaign County Commissioners, Urbana, O., have let the contract for the construction of 1 mile of road west of Urbana to S. M[illegible] & S[illegible], at $8,893. The road will be built of macadam and is to be completed by September.

⊙The Fairfield County Commissioners, Lancaster, O., have awarded the contract for the building of a good roads speedway over the Newark-Lancaster roadway to Thomas J. McKim of Cincinnati, O., at $78,810. The road will be about 4.28 miles long and will be constructed of waterbound macadam. The state has appropriated $48,810 toward the construction of the road.

⊙Houston & Henderson of Logan, O., have been awarded the contract by the Hocking County Commissioners, Logan, for grading and paving with brick Section No. 1 of the Logan-Enterprise road in Falls Township, said county, at $17,464. The road is 8,400 ft. long and 14 ft. wide. Bids were opened May 1.

⊙Wm. H. Ringwall & Sons of Chillicothe, O., have been awarded the contract by the Ross County Commissioners, Chillicothe, O., for grading and paving with bituminated concrete the Frankfort Road in Scioto Township, said county, for 1.31 miles, to a width of 16 ft. The contract price is $10,900. Bids were opened May 6. James R. Marker, Columbus, O., is State Highway Commissioner.

⊙The American Construction & Supply Co., of Dayton, O., has been awarded the contract by the Miami County Commissioners, Troy, O., for grading and paving with concrete the Piqua-Troy Road, Section No. 1, at $16,237. The road is in Washington Township, said county, and is 1.86 miles in length and 16 ft. wide, to be constructed under the supervision of the State Highway Commission, James R. Marker, Commissioner. Bids were opened May 9.

⊙A. W. Crouse of Arcadia, O., has been awared the contract by the Trustees of Cass Township, Hancock County, O., for the construction of 60 rods of pike at $8.90, and H. H. Harkness of Arcadia secured 180 rods of pike at $9.97 and $9.84. Bids were opened May 6 by H. T. Nelson, Arcadia, Clerk.

⊙The Stark County Commissioners, Canton, O., have awarded William H. Voght & Son of Massillon, O., the contract for the paving of the Louisville road from the Louisville corporation line west to the line between Nimishillen and Plain townships, a distance of 2½ miles. The contract price is $37,159. Construction work will start immediately. O. W. Holl is County Surveyor.

The Summit County Commissioners, Akron, O., C. L. Bower, Clerk, did not award the contract for grading and paving with bituminated concrete the Ghent Road in Copley and Bath Townships, said county, for which bids were opened May 7. The road is 12,546.2 ft., or 2.38 miles long and 14 ft. wide; estimated to cost $18,423. James R. Marker, Columbus, O., is State Highway Commissioner The work will be readvertised.

The City Council of West Unity, O., has sold paving bonds to Stacey & Braun of Toledo, O., to the amount of $21,000.

Oregon.

✣Bids will be received until May 16, by Stacy M. Russell, County Clerk, Eugene, Ore., for the construction of a macadam road in Lane County, Ore., about 27,577 ft. in length.

⊙The City Council of Salem, Ore., has let the contract for the construction of El Oso pavement on South High St., from Mill to Bush, to the Montague-O'Reilly Co., at $18,747. The work also includes the installation of curbs, the filling at the base of the hill and grading. The Council has also awarded the contract for the paving of North 21st St., from Center to State, with Dolarway pavement, to the E. W. Geiger Construction Co., at $10,883, and a contract to gravel-concrete 23rd St., from State to Mill, to W. D. Pugh at $1,333.

The City Council of Roseburg, Ore., has adopted plans for the paving of North Roseburg streets with concrete at an estimated cost of $39,000.

The City Council of Silverton, Ore., has ordered eight streets paved.

The City Council of Eugene, Ore., has sold paving bonds amounting to $50,000 to Merrill, Oldham & Co., of Boston, Mass.

Pennsylvania.

✣Bids will be received until 10 a. m., May 20, by Department of Supplies, Philadelphia, Pa., for furnishing eight 2-horse road rollers and trap rock and trap rock screenings for the Bureau of Highways.

⊙The Department of Public Works of Pittsburgh, Pa., has awarded the following contracts for paving work, for which bids were opened on April 29 by Joseph G. Armstrong, Director: Repaving with blockstone, Penn Ave., to H. C. Howard, $27,821; Selby alley, Thomas Cronin Co., $1,600; South 25th St., Thomas Cronin Co., $6,848; West Carson St., Booth & Flinn, $2,195; Wilkins Ave., Thomas Cronin Co., $8,747; Liberty Ave., H. C. Howard, $8,582. Repaving with wood block: Sandusky St., M. O'Herron Co., $2,157; Ohio St., H. C. Howard, $16,274. Repaving with brick: Pretense alley, J. B. Sheets, $1,341. Repaving with asphalt: Penn Ave., Booth & Flinn, $8,837; Fifth Ave., Booth & Flinn, $21,846; Perrysville Ave., Booth & Flinn, $18,463. Grading, paving and curbing with brick: Loretta St., M. O'Herron Co., $9,749. Grading, paving and curbing with blockstone: Merriman alley, Thomas Cronin Co., $1,967.

Rhode Island.

✣Bids will be received until noon, May 29, by State Board of Public Works, Providence, R. I., for the construction of 30 miles of macadam highway in sections of 2 miles to 14 miles in length. Plans and specifications will be ready May 22.

⊙Following bids were received recently by the Board of Contract and Supply of Providence, R. I., for furnishing the city with 100,000 granite blocks: Rockport, Mass., Granite Co., $63.50 per M.; Booth Bros., Hurricane Island Granite Co., New York, $64 per M.; New England Granite Works, Westerly, 25,000 at $64 per M., 25,000 at $65 per M., 25,000 at $66, and 25,000 at $67 per M.; Hildreth Granite Co., Boston, Mass., $74 per M. The contract was awarded to the Booth Bros. Co., and an additional 25,000 was awarded to the New England Granite Works at $64 per M.

Governor Pothier of Rhode Island has signed the resolution appropriating $250,000 for the maintenance, construction and repair of state highways; the money to be spent by the State Board of Public Works. In addition to this amount, the board has also the expending of $600,000, raised by a bond issue, which the people ratified in the fall of 1911. John H. Edwards is Chairman of the Board.

South Dakota.

⊙F. L. & S. W. Rowley of Mitchell, S. Dak., have been awarded the contract by the Davison County Commissioners, Mitchell, for cutting, filling, grading and leveling of 5½ miles of road, beginning at the north end of Main St., of the city of Mitchell and running north to the southeast corner of Section 16—104—60. The total cost will be about $2,700. Bids were opened May 2 by R. A. Zangle, County Auditor.

Tennessee.

⊙F. D. Harvey & Co., of Memphis, Tenn., has been awarded the contract by Good Roads Commission of Supervisors, District No. 4, Monroe County, Aberdeen, Miss., for the hauling, purchase and placing of about 52,000 cu. yds of rock and gravel for surfacing 26

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

miles of public highway in that district. The longest haul is 5 miles and average haul is 2½ miles. The contract price is about $50,000. Bids were opened May 7.

Benjamin H. Case, C. E., Ducktown, Tenn., is now making runways for eight miles of improved roads. Contracts are to be let at an early date.

Texas.

⊙The city of Marlin, Tex., has entered into a contract with F. L. Wood for paving Winter and Railroad Sts. Granitoid will be used.

The Commissioners' Court of Anderson County, Palestine, Tex., has rejected all bids received recently for the building of 80 or 100 miles of sand clay roads in the county.

The Board of Municipal Commissioners of Dallas, Tex., has ordered paving laid on Carroll Ave., from Ross to Munger Ave.; Exposition Ave., from Main St. to Parry Ave., and Parry Ave., from Exposition Ave. to Haskell Ave. Bids will be received at once by the City Secretary on bitulithic for Carroll Ave., and either bitulithic, creosoted block or vitrified brick pavements on the other two streets.

Virginia.

✣Bids will be received until 3 p. m., May 16, by Richmond, Va., for paving Broad St. with asphalt block, wood block, bituminous macadam, sheet asphalt, bitulithic or first-class granite block pavement. C. E. Bolling is City Engineer.

No contracts have been awarded by the Russell County Supervisors, Lebanon, Va., for grading and macadamizing 13¼ miles of four roads and for the construction of 106,608 sq. yds. of macadam roads on already graded roads. Bids were opened May 7. S. H. Fletcher, Lebanon, is County Engineer, and P. St. J. Wilson, Richmond, Va., is State Highway Commissioner.

It is reported the citizens of Augusta County, Va., on April 30, voted the issuance of bonds in the sum of $1,000,000 for the construction of good roads. Staunton is the county seat.

Washington.

✣Bids will be received until 2 p. m., May 28 (extension of date from May 21), by Board of King County Commissioners, Seattle, Wash., for the construction of Highways No. 1 A. and 3 A. The work consists of grading, preparing, subgrade, ditches and shoulders, and construction of a hard surface road. Road No. 1 A. is in the vicinity of Redmond and 3 A. near Kent. Otto Case is Clerk of Board; N. M. Wardall is Deputy.

✣Bids will be received until 5 p. m., May 28, by City Clerk, Wenatche, Wash., for grading, constructing concrete walks and curb, wood walks, gutters, catch basins, box drains, gravel roadway, etc., on Walker St., from Stevens to Spokane Sts.

✣Bids will be received until 2 p. m., May 21, by Board of King County Commissioners, Otto A. Case, Clerk, Seattle, Wash., for clearing 60 ft. wide grubbing and constructing a 24-ft. roadway with culverts and bridging.

✣Bids will be received until May 20, by R. G. Trask, County Auditor, Montesano, Wash., for the improvement of portions of state road No. 9, grading, bridging, clearing, etc., in Chehalis County.

✣Bids will be received until 2 p. m., May 21, by Board of King County Commissioners, Seattle, Wash., for the construction of Highway No. 1 A., near Redmond, Wash. Otto Case is Clerk.

⊙C. M. Payne of Spokane, Wash., who was recently awarded a contract in Calgary, Alta., for the construction of 40 miles of pavement, including concrete sidewalks, has sublet the work to Massie Bros. & Long of Spokane, and work will be started at once. The work will cost approximately $225,000.

⊙W. F. Manney & Co., 1009 17th Ave., Nw., Seattle, Wash., have been awarded the contract by the Board of Public Works of that city for the grading of West 51st St. et al., at $22,840. Other bidders were: Robt. J. Barter, $24,935; Holt & Jeffery, $27,453; Andrew Peterson & Co., $25,498, and Macquaid & Moore, $24,655.

⊙Wm. Martell, 421 Arcade Bldg., Seattle. Wash., has been awarded the contract by the Board of King County Commissioners, Seattle, Wash., for the necessary labor and material for the construction of Permanent Highway No. 2-A at $16,975. The work consists of clearing right of way 60 ft. wide, grubbing, constructing roadway and graveling from Station 245†00 to Station 527†00. Length of improvement 18,200 ft. O. A. Case is clerk of the Board. Bids were opened April 30.

⊙Fenn & Brennan, 540 30th St., Seattle, Wash., have been awarded the contract by the Board of Public Works of that city for the paving of East Madison St., at $3,243. Other bidders were: Young & Uhrich, $3,756; S. Normile, $3,973; Sparger Concrete Co., $3,884; Holt & Jeffery, $3,726; DeFlong & Hertborg, $3,280, and Xura Case, $3,631.

⊙The contract for paving in South Bend, Wash., has been awarded to the Barber Asphalt Paving Co., of Seattle, Wash., at $15,658. The city has also awarded a contract for the construction of a concrete retaining wall and for grading to the Jahn Contracting Co., of Seattle, at $13,606.

The City Council of Puyallup, Wash., has authorized City Engineer George Ball to proceed with the work of paving Meridian St., from the end of the present pavement to the foot of South Hill. The resolution calls for a 24-ft. roadway.

Following low bids were recently received by the City Commissioners of Walla Walla, Wash., for the laying of hard surface pavement in the alleys of the business section of the city: Plain concrete—District 76, Ralph A. Tribou, $872; district 77, Ralph A. Tribou, $2,575; district 78, Ralph A. Tribou, $907; district 79, Borski & Stack, $597; district 80, Borski & Stack, $2,993; district 81, Borski & Stack, $1,428. Total $9,370. Two-course concrete—District 76, Hassam Co., $924; district 77, Hassam Co., $2,743; district 78, Hassam Co., $9,062; district 79, Hassam Co., $630; district 80, Hassam Co., $3,224; district 81, Hassam Co., $1,534. Total $10,016. Concrete with top—District 76, Tribou, $929; district 77, Tribou, $2,756; district 78, Tribou, $651; district 79, Tribou, $674; district 80, Tribou, $3,405; district 81, Tribou, $1,614. Total $10,345.

Wm. Martel, Arcade Annex, Seattle, Wash., on April 30, submitted the lowest bid to the King County Commissioners, Seattle, Wash., for the construction of Permanent Highway No. 2 A., being 18,200 yds. Bothell. The principal item is excavation of 12,000 cu. yds. of material which Mr. Martel bid $.28. The specifica include plain concrete, reinforce cavation, clearing, grubbing, rails, bridges, corrugated pipe, wrecking existing structures an

West Virginia.

✣Bids will be received until by Clerk of County Court, Nev W. Va., for grading and pavin road in Grant District, opposit Eas pool, O. J. A. Bowers, Weirt County Engineer.

Wisconsin.

✣Bids will be received until p. m. 27, by Board of Public Wor Wis., for furnishing the necessy lab material for paving Vine St. from Ave. to the west line of Sixteth granite top macadam The to approximately the followi quantities—5,052.9 sq. yds. of granit cadam, 3,212.0 lin. ft. of cemt gutter, 1,677.9 cu. yds. of grag tion). J. T. Day is Chairman

⊙John Lutz of Janesville, W awarded the contract by the C that city for building the city ing 1912 at $0.70 per yd., an additional where excavation is q

⊙The Board of Public Work of C Falls, Wis., has awarded the contr the paving of Columbia St. to Menasha, Wis. Other bidders Wooley of LaCrosse; Fraser & St. Paul, and the Advance Co of Menasha.

Canada.

✣Bids will be received until by F. G. Griffith, Secretary-Tr brooke, Que., for the followi mately 5,000 sq. ft. of grano with crossings and curbing i sections of the city. A deposit of the estimated cost amount of accompany each tender. Plans tions can be obtained from Tho City Engineer, Sherbrooke, Que

✣Bids will be received until p. m. 17, by F. J. Griffith, Secre Sherbrooke, Que., for paving streets: Wellington St., from Bridge to south side of King St. along yds. King St., from Wellington St. to Bridge, containing about 6,200 yds. St., from Aylmer Bridge to east Bowen Ave., containing about 00 pot St., from King St. to Gra tion, containing about 1,100 yds. Ten be received for natural, lake, or bitulithic. Further instructic as fications and forms of tender c from Thomas Tremblay, City En brooke, Que.

✣Bids will be received until p. m. 27, by W. H. Munro, Mayor, Sat Ste Ont., for the construction of about sq. ft. of cement concrete sidewk and 21,000 lin. ft. of concrete curing and specifications may be seen at of W. W. Van Every, City Engineer

BRIDGES—STEEL AND CONCRET

Illinois.

✣Bids will be received up to 1 p. m., May 25, at the Supervisor's room, Court House, Belleville, Ill., for the construction of two reinforced concrete bridges to be built in Smithton township, St. Clair county. William P. Kunz, Town Clerk, Smithton, Ill. Kraft Bridge: Span, 40 ft; roadway, 16 ft.; total height, about 15 ft. Estimated total amount of concrete, about 110.0 cu. yds.; reinforcing steel, 15,330 lbs. Nearest railroad station, Freeburg, on the Illinois Central, 3 miles. Stream channel to be changed by Commissioners. No bridge at proposed site. Average excavation, about 12 ft. Sugar Creek Bridge: Span, 35 ft.; roadway, 16 ft.; total height, about 14 ft. Estimated amount of concrete 95.8 cu. yds.; reinforcing steel, 12,306 lbs. Nearest railroad station, Freeburg, on the Illinois Central, 4 miles. Stream channel to be changed by the Commissioners. No bridge at proposed site. Average ex 12 ft. No local concrete materials are able. Work to be completed September 1, 1912. More detail infor may be had by an examinatio and specifications prepared b Highway Commission, which may be the Town Clerk's office or m upon application in writing, from the Highway Commission, Springfie, Ill.

✣Bids will be received up to

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Town Clerk's office, Watseka, Ill., rced concrete bridge to be built tween Middleport and C[illegible] quois county. Charles L. B[illegible] lerk, Watseka, Ill. Texas Bridge each 55 ft. in the clear; roadway, height, about 24.5 ft. Estimated concrete, 541.2 cu. yds.; reinforc- ,340 lbs. Nearest railroad sta- rn, on the T. P. & W. railroad, s. Watseka about 6 miles. No materials available. No present en timber can be cut near bridge work. Ordinary flow of stream eep and 108 ft. wide; high water 6 ft. deep. Stream bed soft, will for falsework and probably piles ed for supporting abutments and be completed on or before 912. More detailed information an examination of the plans ations prepared by the Illinois mmission which may be seen at lerk's office or may be obtained tion in writing, from the Illinois nmission, Springfield, Ill.

received up to 11 a. m., Ma[illegible] upervisor's room, Cook County [illegible], Ill., for the construction rced concrete bridges to be built etween Addison township, Cook Elk Grove township, DuPage ard Ehlers, Town Clerk, Bensen- ittmueller Bridge: Span, 12 ft.; t.; total height, about 8 ft. Esti- t of concrete, 37.5 cu. yds.; re- l, 1,620 pounds. Nearest railroad enville, about 4 miles. No pres- ow water flow, dry; high water ½ ft. deep. Excavation in clay, about 2½ feet below stream bed. e abutments; reinforced concrete lack Sea Bridge: Span, 20 18 ft.; height, about 13 ft. Esti- t of concrete in structure, 65.1 cu. ing steel, 6,037 lbs. Nearest rail- Bensenville, about 3 miles. No Low water flow, about 1½ 10 ft. wide; high water about 5 avation to be carried about 3 ft. bed in clay. Average excavation deep. Reinforced concrete abut- perstructure. No local concrete available. It is reported that y not known) may be had at $1 l F. O. B. Bensenville. Work to on or before August 1, 1912. information may be had by an the plans and specifications e Illinois Highway Commission, seen at the Town Clerk's office tained upon application in writ- llinois Highway Commission.

son, Orion, Ill., has been award- ct for the construction of four es in Western township, Henry $2,160. Bids for the work were d. F. L. Anderson is township Ill.

Commissioners of Ottawa, Ill., nsideration the construction of a he tracks of the Chicago, Rock e Ry., at the County House

Property owners of Clinton and Jefferson townships have filed a petition with the County Auditor, Logansport, Ind., asking the commissioners not to change the site of the pro- [illegible] bridge, which was destroyed this Spring by ice and high water.

[illegible] Ind., has under consideration the construction [illegible] ture at Second St., which was recently destroyed by high water.

Indiana.

be received until noon, June 12, DeKalb County Commissioners, for the construction of a dou- arch at Newville, Ind. A. W. nty Auditor.

of Knox County Commission- , Ind., has awarded the contract ruction of nine bridges to the idge Co., Vincennes, Ind., at

l of Jasper County Commis- laer, Ind., has awarded the con- construction of two bridges, as McColly, Chicago Heights, Ill., M. Williams, Winamac, Ind., at Hammond is County Auditor. ed May 6

Iowa.

⊙The Board of Union County Supervisors, Creston, Ia., has awarded the contract for the construction of a reinforced concrete deck girder bridge with 24-ft. driveway and 1½ ft. walk to the Kimballton Construction Co., Atlantic, Ia. T. S. DeLay is County Surveyor.

It is planned by the Board of Polk County Supervisors, Des Moines, Ia., to construct a number of new steel bridges with concrete floors to replace the structures recently washed out by high water.

⊙The contract for the construction of bridges in Lyon county, Ia., during the year of 1912 has been let by the Board of County Supervisors, Rock Rapids, Ia., to the Western Bridge & Construction Co., Omaha, Neb.

The Board of County Supervisors, Dubuque, Ia., has appointed a committee to confer with the offiecals of the Illinois Central R. R. in regard to the construction of a viaduct over the tracks at Rockdale. It is believed that such an improvement would not necessitate an expenditure of more than $66,000.

Board of County Supervisors, Montezuma, Ia., it is said, is considering the advisability of constructing a reinforced concrete bridge on the road from Grinnell to the Hazlewood cemetery. As proposed the structure would be 16 ft. long and 60 ft. wide.

Kansas.

⊙The Missouri Valley Bridge & Iron Co., Leavenworth, Kan., has been awarded the contract for the construction of a steel bridge over the Gasconade River at Indian Ford, 2 miles east of Vienna, Mo.

Louisiana.

At a meeting of the Progressive League, Lake Charles, La., President Perkins was authorized to appoint a committee to urge the Police Jury to submit to a vote of the people in Wards 3 and 4, the proposition of the Westlake-Lake Charles Bridge tax.

Michigan.

⊙The Marion Township Board, Marion, Mich., has let the contract for the construction of a cement arch bridge over Main St. to W. H. McKenzie, Port Huron, Mich., at $1,250.

⊙The Grand Trunk Ry. has let the contract for the construction of concrete piers and abutments of the railroad company's bridge over the Saginaw River to W. J. & I. G. Meagher, Bay City, Mich. The contract amounts to about $90,000.

The Central Bridge Co. has filed a notice of intention to apply to the Board of Supervisors of Saginaw county for permission to rebuild and repair the bridge over the Saginaw River at Bristol St. The outline of the proposed work is as follows: The east approach to be filled in part with earth and the balance repaired as a trestle. Where now is the east arm of the Howe Truss Swing Bridge will be placed an entirely new, modern, permanent steel, through plate, girder bridge, 75 ft. long and 24 ft. wide from center to center; girders for roadway, and a projecting sidewalk 7 ft. wide on one side, the roadway to be of concrete pavement or other satisfactory and desirable pavement. The sidewalk to be concrete. Pile piers will be built for the support of this permanent structure. Under the present west arm of the Howe Truss Swing Bridge, a new pile bridge will be built and the balance of the long pile bridge up to the Thatcher Truss Bridge, will be repaired and renewed substantially the same as before. The present Thatcher Truss Bridge will be taken down and replaced by two complete, modern, permanent steel, through plate girder bridges, each 75 ft. long and 24 ft. wide from center to center. Pile piers will be built for the support of this permanent structure. Sidewalk on north side of bridge will be removed and a new sidewalk on the south side of the bridge only be laid. The west approach to be rebuilt as a trestle. J. A. Cleveland is Vice-President of the company, Saginaw, Mich.

Minnesota.

The special council committee, Minneapolis, Minn., on new bridges has adopted a report recommending that the proposed Third Ave. bridge be built of concrete and that the city engineer submit an estimate of the cost of preparing complete plans. Andrew Rinker is City Engineer.

The Town Board of Grand Rapids, Minn., and the Commissioners of Itasca county, at a recent meeting, rejected all bids received for the construction of the proposed bridge over the Mississippi River on the west line of the village of Grand Rapids. The structure will be built jointly by the town and county, each paying one-half the cost, which will be about $20,000. The work will be readvertised.

Missouri.

⊙C. E. Jacoby, Engineer, Drainage District No. 3, Carroll county, Carrollton, Mo., has let the contract for the construction of two bridges, as follows: R. G. Culbertson, Hale, Mo., for the erection of 75-ft. Class A. Riveted Pony truss steel span bridge with 15-ft. wooden approaches at each end and resting on laced legs cased in concrete, at $1,500; Kansas City Bridge Co., Kansas City, Mo., for similar structure resting on cylinder piers filled with concrete, at $1,624.

The Board of Public Improvements, St. Louis, Mo., has submitted bills to the Municipal Assembly providing for the abolition of the crossing at grade of Union Boulevard and the Terminal Belt. The bills require the southern approach to the proposed viaduct to begin on Union Boulevard 380 ft. north of Brown Ave. The north approach will begin 1,570 ft. north of Brown Ave. A minimum clearance of the viaduct over the rails is 20 ft. The floor system and the columns are to be concrete. The roadway is to be 60 ft. wide and the sidewalk 20 ft. In case one of the proposed ordinances is passed by the Assembly, work must begin two months after the approval of the plans. A time limit of one year is made for the completion of the viaduct under penalty.

Nebraska.

✣Bids will be received until noon, May 17, by W. K. Newcomb, County Clerk, Clay Center, Nebr., for the construction of a 30-ft. steel span bridge between sections 7 of Sutton township and 12 of Lewis township. A certified check for $500 must be filed with each bid.

⊙The contract for the construction of the Arlington State Aid Bridge, as mentioned in our last issue, has been let by the County Commissioners, Blair, Nebr., to E. S. Beaty, Blair, Neb., at $11,200. The structure will be 180-ft. high truss steel span on concrete abutments with creosoted wood block floor and will be completed, according to the terms of the contract, October 1, 1912.

The Union Pacific Railway has started preliminary work for the construction of bridges necessary on the second track between Laramie and Lookout. Actual construction work on the bridges will be commenced by July 1, it is expected. The structures vary from 30 to 3,000 ft. in length and will necessitate an expenditure of about $500,000. R. L. Huntley, Omaha, Nebr., is Chief Engineer and Assistant General Manager.

It is reported that engineers of the Chicago, Burlington & Quincy Railroad are preparing plans for the construction of a new bridge over the Platte River at Ashland, Nebr., estimated to cost approximately $1,000,000. L. J. Hotchkiss, Chicago, Ill., is Assistant Bridge Engineer.

New York.

⊙The United Construction Co., Albany, N. Y., is reported to have been awarded the contract for the superstructure of the highway bridge over the Connecticut River at East Haddam, Conn., at a bid of $107,693. Work is already under way on the substructure.

The Board of County Supervisors, Monroe county, Rochester, N. Y., has passed a resolution authorizing Good Roads Committee and the County Superintendent of Good Roads to advertise for bids for the construction of a new county bridge over the Genesee River at the present location of the Rush-Wheatland River Bridge, in accordance with the plans and specifications prepared by the bridge engineer of the Highway Department of New York State, which are now on file in the office of the County Superintendent. The bridge will cost $25,000.

The State Engineer's Department of Bridges, Albany, N. Y., is about to take up the matter of reconstructing the bridge on the Weedsport-Cato Road over the Seneca River.

A special town meeting has been held at Central Bridge, N. Y., to submit to the voters the proposition of erecting a new bridge over Cobleskill Creek at Wetsel's Hollow at an expense of $9,000.

City officials of Syracuse, N. Y., are taking steps to have the State rebuild the bridge over Lay Creek in Park St., which recently collapsed. H. C. Allen is City Engineer.

It is expected that the State of New York will let the contract about June 1, for the construction of a bridge over Black River Canal on E. Dominick St., Rome, N. Y.

North Carolina.

The Board of County Commissioners, Greenville, N. C., has decided upon the construction of a new bridge over the branch near Lon Sluder's place in Pitt county.

Ohio.

✣Bids will be received until noon, May 31, by Board of Franklin County Commissioners, Columbus, O., for furnishing the necessary labor and material for the construction of a reinforced concrete arch bridge over the Olentangy River on King Ave., Columbus, O. F. M. Sayre is County Auditor.

⊙The Board of Mahoning County Commissioners, Youngstown, O., has awarded the contract for the construction of concrete abutments for a bridge over Mill Creek on the Shields Road in Boardman township, to Link & Hewig, at their bid of $1 per cu. yd. for excavation and $9.23 per cu. yd. for concrete masonry.

⊙The Board of Ashtabula County Commissioners, Jefferson, O., has awarded the contract for the construction of a plate girder bridge over Ashtabula Creek on Gulf Road to the Brookville Bridge Co., Brookville, O., at $1,245. Bids were opened May 8.

⊙The contract for the construction of a bridge over Auglaize on the Putnam-Paulding county line has been awarded to the Oregonia Bridge Co., Lebanon, O., at $12,830. Bids for the work were opened at Ottawa, O., May 7.

Oregon.

Board of Jackson County Commissioners, Jacksonville, Ore., has decided upon the construction of a new $40,000 bridge over Bear Creek in Medford. The city will pay $13,500 toward the cost and will receive in turn the present structure which will be moved to Jackson Boulevard. Bids for the new bridge will be asked for shortly.

Members of the Rose City Park Improvement League are petitioning the city of Portland, Ore., for the construction of a double deck steel bridge in place of the present Burnside St. bridge.

Pennsylvania.

✣Bids will be received until 10 a. m., May 22, by D. K. Hoch, County Controller, Reading, Pa., for the erection of a wooden truss bridge crossing the Schuylkill Canal at Leesport, Berks county, Pa., also repairing abutments and wing walls. Plans and specifications can be had at the County Commissioners' office, Reading, Pa., upon payment of five dollars, which will be refunded when the same are returned. All bids must be accompanied with a certified check equal to 10 per cent. of the aggregate amount of the bid.

⊙Advices from Ebensburg, Pa., state that the Commissioners of Cambria County have awarded the contract for the erection of a bridge over Solomon's run in Dale to Charles Schenkemeyer & Sons at $2,570. Other bids received were as follows: B. Gigliotti, $3,625.72; Polo Azzara, $2,930; M. M. Sheesley, $2,645.20; Farris Bridge Co., $2,793; W. A. Schmidt, $2,600; Thiele Construction Company, $2,650.

Commissioners of Luzerne County, Wilkesbarre, Pa., are to build the proposed bridge connecting Nanticoke with West Nanticoke before 1913. Hugh McGeehin is Secretary of the Board.

Commissioners of York and Cumberland counties have decided upon the improvements necessary for the joint bridge near New Cumberland, Pa. York, Pa., is county seat of York county.

The Supervisors of Londonderry township have asked the Commissioners of Dauphin county, Harrisburg, Pa., to have specifications changed for the construction of the proposed bridge in that township.

Commissioners of Luzerne county, Wilkesbarre, Pa., have retained Charles Miles, 7 South Franklin St., Wilkesbarre, Pa., as consulting engineer to prepare plans for the construction of a permanent floor in the Berwick-Nescopeck bridge.

The County Commissioners have offered to pay five-thirteenths of the cost of building a highway bridge between the
Sixteenth Wards of the city of
The cost to the county will not

Vermont.

Plans prepared by F. O. St
ton, Vt., for the construction
reinforced concrete viaduct o
& Maine, Grand Trunk Railr
boro at Bridge St., have been
Public Service Commission.
will be 413 ft. long and wil
grade crossing and will cost a

Wisconsin.

The Board of Directors of t
Chamber of Commerce has ad
tion asking the Board of P
build a bridge on Mill St., to
The County Board will take a
sisting the city in the project.

The Board of Marinette C
sioners, Marinette, Wis., has d
on the petitions asking that
half the cost of the following
across Beaver Creek, $700.
Little River of the Peshtig
Amberg, bridge over the nort
Pike, $500; Stephenson, across
Noquebay, $1,000. The am
each instance is one-half of t
the bridge.

In connection with the cons
proposed highway through
Wis., a new bridge will be c
Fish Creek to replace the old
ture. The cost of the bridge
$10,000. Washburn, Wis., is c

Canada.

✣Bids will be received un
County of Waterloo, for the
a bridge over the Grand Rive
structure will have two 10
with concrete abutment, pier,
Connor, Berlin, Ont., are En

✣Bids will be received un
Henry Tillman, Secy.-Treas., S
for the construction of a b
Qu'Apelle River at St. Lazar

⊙The Dominion of Canada
awarded the contract for the
the St. Andrews lock bridge
Construction Co., Ltd., Win
$150,000. The contract calls f
span to be operated by electri
and closing for the passage
structure will require in the
tons of steel and 25,000 cubic
crete.

⊙The contract for the const
inforced concrete subway und
Pacific Ry., on 11th St., has
City Commissioners, Moose
Wilson, Townsend & Saunde
Sask., at $82,365. E. B. Bonne
Bids for the work were opene

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

✣Bids will be received from 1 until 3 p. m., May 30, by Directors of Beaver Bayou, Drainage District, at the Board of Trade room, Solomon bldg., Helena, Ark., for the construction of the following described floating dredge ditches: Johnson Bayou Ditch, 625 Sta's., 307,000 yds.; Lick Creek Ditch, 340 Sta's., 539,000 yds.; Beaver Bayou Ditch, 840 Sta's., 675,000 yds.; Hillside Ditch, 250 Sta's., 85,000 yds. Maps, profiles and specifications will be sent to prospective bidders by C. B. Bailey, Wynne, Ark. J. A. Guissinger, Helena, Ark., Resident Engineer, will go over the work with contractors by appointment. A bidder's bond for $5,000 will be required from each bidder. E. M. Allen is Secretary.

Colorado.

The directors of the Northern Colorado Irrigation District held a meeting at Greeley, Colo., on May 7 to consider a proposition to bond the district for $2,400,000 for an irrigation system. This district adjoins the Greeley-Poudre district on the north, comprises 50,000 acres lying between Nunn and Carr and extends west into Larimer county. It is proposed to build five reservoirs to catch flood waters to partially supply the district. Michigan, Stonewall, Boxelder and other small streams will furnish most of the supply. It is understood that landholders generally favor bonding the district, and work of construction, it is expected, will commence in two months. W. W. Wilson and E. S. Smith of Denver, Colo., are interested.

Illinois.

✣Bids will be received u
Diveley Levee & Drainage
Township, Fayette County, Ill.
000 cu. yds. of levee work, 6 t
6 ft. top and about 20,000 cu
ditches, 3 to 4 ft. deep, 4 to 6
est railroad station is St. Elm
the work. Total estimated c
000. J. V. Waddell is Enginee

✣Bids will be received unti
R. Jones, Clerk, Big Rock, Ill.
material and labor necessary
ditches in Big Rock Drainage
of Big Rock Township, Kane C
work requires the following sh
tile: 2,000 ft., of 22 in., avera
2,500 ft. of 24 in., average dept

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

erage depth 5 ft.; 2,700 ft. of 28 depth 4 ft. Soil is loam. No rail- oss. Nearest railroad station is miles from the work. The engi- n & Wells, 317 Coulter Bldg., Certified check for $1,000 to bids. Estimated cost of work

Indiana.

pened April 29 by T. J. Johnson, r, Mt Vernon, Ind., for about dredge ditch work, the contract d to Fred C. Morgan, Vincennes, nts per cu. yd. for excavation, to ng right of way 100 ft. wide. alls for dredging Big Creek for ith Creek for 48,100 ft., Macadoo 350 ft., and New Latteral, 1,600

Iowa.

received until 1 p. m., May Greene County Supervisors, t, for the necessary labor and essary for the construction of istrict No. 80 in Green County, Ia. County Auditor.

Drain 18 in Kossuth County, were opened at Algona on May warded to W. H. O'Brien, Fort t $6,016, and to Shinn & Busch, $2,730. The work includes to 24 in. tile.

Louisiana.

rson-Plaquemines Drainage Dis- cted its formal organization at the at Gretna, La., and has elected officers: George A. Hero, presi- Dauenhauer, Sr., vice-president, J. Ehret, secretary and treasurer. e issued to carry on the work.

jury of Calcasieu Parish, Lake granted the petition for the for- ulphur Drainage District No. 1, ,680 acres of land surrounding commissioners named by the for the district are: S. M. Lyons, g and J. J. Koonce. The Union will pay about 90 per cent. of the the district.

Parish Police Jury, Lake Charles, d the formation of Keystone strict No. 1, a few miles west of , embracing 5,500 acres of land. on of a district was resisted by land owners, but a committee lice Jury held a hearing and re- vor of the district.

Michigan.

range, Grand Rapids, Mich., at low bidder for straightening and ldbrook Creek for the Board of rand Rapids.

ler & Sons of Ann Arbor have d the contract from E. P. Decker troit for building the embankment am on the Huron River, one mile Arbor. This dam is to be built stern Michigan Edison Co., and ut 70,000 cu. yds., mostly wheeler

Minnesota.

& Co., Cottonwood, Minn., have d the contract at $13,071, for the of Judicial District No. 1 of Mar- bids for which were opened May unt, Minn. The work calls for 20-in tile, 3,400 ft. of 18-in. tile, 16-in. tile, 4,200 ft. of 15-in. tile; 4-in. tile, 2,800 ft. of 12-in. tile, 10-in. tile 11,650 ft. 8 in. tile, and tile.

um, Auditor of Koochicking Coun- nal Falls, Minn., has not awarded for the construction of Judicial which will be 23 miles long and 28,000 cu. yds. of earth excava- were opened May 9. The cost of estimated between $28,000 and $29,- 000. Notices [illegible] set.

Nebraska.

✣Bids will [illegible] by [illegible] W[illegible], Nebr., R. F. D. No. 2, German Drainage District, York County, Nebr., for the construction of a drainage system, estimated to cost about $[illegible]

North Carolina.

✣Bids will [illegible] by the Commissioners of [illegible] Swamp Drainage District, Lumberton, N. C., for the construction of drainage canals. The work will include approximately 1,240,400 cu. yds. of material [illegible] the Board. Official advertisement will be found elsewhere in this issue.

Tennessee.

A bill has been introduced in Congress to appropriate $30,000,000 for maintaining, raising and protecting the levees of the Mississippi and its tributaries. The money would be spent under the direction of the Secretary of War.

Memphis, Tenn. and Vicinity.

[illegible]

◉Jesse Nichols and McClavey Brothers of Memphis, were awarded a grading contract last week by Lamb Land Co., for about 50,000 cu. yds. of sub-division work in the eastern part of the city. It is understood that the contract price is between 15 cts. and 16 cts. per cu. yd. While both Nichols and McClavey have their outfits hard at work on other contracts in the city, it is said they can sub-let the Lamb work at a neat profit and that forces will be placed on the work at once.

Luther Y. Kerr, Assistant United States Engineer, has returned from the White River levee district, where he made a determined fight against the flood near Modoc, Ark. But the odds were too great against him, and a crevass occurred on account of the river flowing over the top of the embankment. On account of the exposure to the rain and cold, Mr. Kerr was ill for a few days, but is now his old self again.

Last week the Illinois Central placed an order for 2,000 freight cars and previously, it is said, had been a heavy buyer of rails; this is all taken as an indication of prosperity during the present season and shows that the road is getting ready to turn loose some of the contracts which it has had bottled up for some years past.

The announcement that Isele Brothers are to begin erection at once of a 10-story hotel at the corner of Main and Adams St., Memphis, has been received with delight by the citizens living in the north end of town. The building will be of reinforced concrete construction and will cover half a block. Plans and specifications are now being prepared and will be sent out to local contractors within the very near future. It is estimated that the structure will cost about $450,000.

Fred Bownes, for many years the Chief Clerk to the General Superintendent of the Y. & M. V. at Memphis, has been promoted to the head of the Vicksburg division of the same road in charge of operation. Fred was well liked by all the construction boys who will be glad to learn of his rise. In line with the new system inaugurated by the new management of the I. C. and Y. & M. V. roads, merit counts above all else and Fred's friends are showering him with congratulations on his new advancement.

M. J. Roach, one of the leading levee builders in this section and a member of the National River & Harbor Congress has always good news on tap to give out when it comes to helping those in his district. Mike's latest dope is from the bureau of Publicity of Congress which in a nutshell outlines one of the best features ever embodied in the River and Harbor measure. The River and Harbor appropriation bill reported by Senator Nelson of the Commerce Committee of the Upper Branch of Congress is in many ways the most important measure the committee has recommended in years, as it urges legislation that cannot help but prove of far reaching character. In extending the scope of the usual investigation on the part of engineers, which is required in order that comprehensive reports may be made on same, the committee emphasizes the position taken by the National River and Harbor Congress early in its history, that of fixing a time limit for the completion of some of the large projects in order that the public may be prepared to use the harbor or waterway thus improved. The bill, however, goes farther than any similar measure, appropriating money for rivers and harbors as it calls upon the Chief of Engineers of the Army and the Board of Engineers of Rivers and Harbors to report to Congress "in which shall be included a preliminary report not later than Dec. 11th, 1912, upon the saving as well as other advantages which can be accomplished by the adoption of the continuing contract system and rapidity with which projects should be completed, upon methods of standardization by which the waterways of the country may be improved uniformly in proportion to their capacities." To enable the Board of Engineers to properly secure this information an appropriation of $100,000 is made. While this is a decided step forward, the Commerce Committee is not content to stop there, but requires that inquiries shall be made into both private and public terminals, and transfer and dock facilities contiguous to the waterway to be improved. The question of terminals has been one of very great importance ever since the adoption of the present system of treating the waterways of the country, for one of the most serious handicaps to water transportation has been the lack of public dock facilities at reasonable rates and within the reach of all desiring to use them. "The tendency has been toward ownership and control of such facilities by railroads," the report says, "or by these and steamship lines acting in conjunction with them, a practice not conducive to healthy competition on the cheap handling of freight. While many communities, including several of the larger cities, are awakening to the importance of freeing commerce from handicap in this direction, by municipal or other public ownership or control of docks and terminal facilities, there is much remaining to be done." Senator Nelson, Chairman of the Commerce Committee, who is looked upon as the father of the Continuing Contract System, which has been of incalculable benefit in establishing a comprehensive policy of waterway improvements, is enthusiastic in support of these new departures in the River and Harbor bill and hopes to see the bill signed by the President as it will pass the senate.

George Lipscome, a well known and much liked concrete contractor of Memphis, has finished his job for the Union Station company and is casting about for new work in his line. He has a well equipped force and George claims he can lay a sidewalk almost as quick as a man can walk over it—and then keep a little ahead of the pedestrian.

C. D. Smith, the well known Memphis contractor, is still laid up at his home from the effects of a broken leg. Charlie's leg gave him lots of trouble after the break, which turned out to be an extremely serious one, and on top of that handicap, sickness set in and now the doctors are making a hard fight to ward off pneumonia. Last week Charlie could see no one on business, but he hopes to be in such condition within a few days that his associates may be able to call.

✣ indicates work now open for bids. ◉ indicates a contract let recently.

[illegible] these streets are to come up in Memphis in the next two weeks. Webster and Mississippi. The one is to be paved with wood block, the other with brick. All the local boys have begun to sharpen their pencils and hope to keep the work in the local rank. Mike Larkin will be the close bidder for the wood block, it is touted. while the Roach-Manigan Paving Co., will go to the cloth for the brick, Mississippi Ave. being one of the brick streets this latter firm is now finishing on the south end.

Guy Shuford, of Shuford Brothers, was in town last week, looking better than ever. Guy feels a little raw, however, for his outfit got caught where they were working, just below Benoit, Miss., and is now under about 10 feet of water. Guy states that they were barely able to save the live stock, but the canvas and commissary will be almost a total loss. The Shuford Boys always were optimists, however, and declare that they will more than break even with all the good picking in the dirt moving line coming up.

The recent Rivers and Harbors bill passed on May 9th failed to include any appropriation for Memphis, and Mayor Crump will have to cast around for some other manner of saving Memphis from the annual overflow. This appropriation of $6,000,000 additional is for the immediate repair and strengthening of the full line of levee on the big river and with the raising of all levees, the North End of Memphis will "catch it in the neck" each year unless some means is devised to prevent the flooding. So far, about the best plan proposed is to extend a line of levee straight down Front St., to the Bayou Gayosa mouth, dam the bayou, and then install a battery of powerful pumps to keep the water pumped over the dam. In this way, it will prevent the water backing up the bayou, which is the immediate cause of the flooded section of Memphis. This plan is thought favorably of by Engineering experts in this section, and is recommended by Major Clarke S. Smith, the United States Engineer at Memphis, in his report to the Mississippi River Commission.

Recent soundings taken at Memphis show that the Harbor is filling up deeper every day. Last week the depth was a trifle over 13 ft. from the Kate Adams Wharf, while today, though the river has risen but 1½ ft., soundings show between 9½ and 10 ft. Ordinarily, at this stage there should be 30 ft. of water at the point soundings were made, but the height of the water permits the current to cut across Hopefield Point, which, by the way, it is carrying away piece-meal, and forms an eddy at Memphis, which deposits the silt along the harbor.

Texas.

The Commissioners of Drai No. 1 of Hidalgo County, M have awarded a contract to J. moving about 110,000 cu. yds. of

Washington.

The City Council of Prosser, jected all bids received early th the construction of a municipal tem and will call for new bids.

Wisconsin.

✣Bids will be received until B. Angelo, Plainfield, Wis., f excavating 18.59 miles of ditch, including approximately 231,192 cu. yds. of earth. Offi ment will be found elsewhere in this

✣Bids will be received until Commissioners of the First Rattlesnake Drainage District, Deerfield, Wis., for drainage Hall, Madison, Wis., is Attorney. vertisement will be found else issue.

Canada.

✣Bids will be received until 30, by A. B. Robertson, Reeve, W Ont., for the construction of the bell Municipal Drain in the E of the township of Wellesley of Waterloo, Ont.

WATER-WORKS

Arizona.

✣Bids will be received until 10 a. m., June 12, by Capt. J. L. Jordan, Constructing Quartermaster, Fort Huachuca, Ariz., for the construction of an 8-in. steel water pipe line 8½ miles long. Official advertisement will be found elsewhere in this issue.

Arkansas.

The Brinkley Water & Light Co., Brinkley, Ark., is planning improvements to its waterworks plant.

California.

The citizens of San Diego, Cal., on May 7, it is reported, voted the issuance of bonds for the purpose of extending the water system, to the amount of $340,000.

The Limited Mutual Water Co. has been incorporated with a capital stock of $20,000, according to advices from Pomona, Cal., to furnish water, beautify and make profitable and desirable land within the limits of its jurisdiction, and to pack, handle and market any products from this land. Charles W. Churchill is President and L. W. Cushman is Secretary.

Georgia.

The Water Commissioners of Macon, Ga., have approved the specifications prepared by Consulting Engineer George W. Fuller of New York City for the new pumping engine soon to be installed at the waterworks. Bids will shortly be asked.

The City Council of Atlanta, Ga., has been asked to spend $7,000 on the repair of the dam at the Hemphill reservoir, which has cracked across the top.

Idaho.

The citizens of Rupert, Ida., on May 21 will vote on the proposition of issuing bonds for the construction of a waterworks system.

Illinois.

The Champaign & Urbana Water Co., Champaign, Ill., has increased its capital stock from $5,000 to $400,000. The increased capital is to be held in the treasury for future improvements.

✣Bids will be received until 11 a. m., May 20, by Board of Administration, Springfield, Ill., for equipping the water works of the Elgin State hospital, Elgin, Ill., with motors, triplex pumps, centrifugal pumps and other electrical supplies. F. D. Whipp is Fiscal Supervisor.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, until 11 a. m., May 22, for furnishing the necessary labor and materials to properly design, construct and deliver to the city of Chicago, 1 75 H. P. steam boiler, Scotch marine type, for use on a floating pile driver, complete with smoke stack, valves and gauges; general essential details are as follows: Working steam pressure, 125 lbs. per sq. in.; are of heating surface, 645 sq. ft.; length over all, 14 ft.; grate area, 22.5 sq. ft.; working stresses tension on plates, 12,000 lbs. per sq. in.; shear on rivets, 7,500 lbs. per sq. in.

⊙Following are the lowest bids and contracts awarded for furnishing, delivering and laying water supply pipes for the Board of Local Improvements, Chicago, Ill. Ed. J. Glackin, Secretary: 2,012 lin. ft. 8 in., $1.14 per lin. ft; 1 valve basin, $29.99; total, $2,326; Simon Ryan, 2927 W. Congress St., Ellis Av., 605 lin. ft. 6 in., 93 cts; total, $562; Simon Ryan 41st pl., 636 lin. ft. 6 in., 92 cts.; total, $585; Simon Ryan, Iowa St., 496 lin, ft. 6 in., $1.02; total, $505; Simon Ryan, 101st St., 335 lin. ft. 8 in., $1.25; valve basins, $29.99; total, $448; Simon Ryan, 114th St., 335 lin. ft. 8 in., $1.10; valve basins, $29.99; total, $398; Simon Ryan, Springfield Av., 670 lin. ft. 8 in., $1.30; total, $871; Malachy Murphy, 5315 Wabash Av., W. 38th St., 254 lin. ft. 6 in., $1.10; valve basins, $29.99; total, $398; Simon Ryan, Winchester Av., 670 lin. ft., 88 cts.; total, $589; Simon Ryan, Harding Av., 1,382 lin. ft. 8 in., $1.11; valve basins, $29.99; total, $1,594; Simon Ryan, Hayes Av., 1,040 lin. ft. 8 in., $1.12; valve basins, $29.99; total, $1,194; Simon Ryan, Hermitage Av., 1,298 lin. ft. 8 in., $1.12; valve basins, $29.99; total, $1,483; Rhodes Av., 1,230 lin. ft. 8 in., $1.19; valve basins, $29.99; total, $1,493; Rockwell St., 2,570 lin. ft. 8 in., $1.11; valve basins, $29.99; total, $2,912; Simon Ryan, Vernon Av., 1,365 lin. ft. 8 in., $1.19; valve basins, $30; total, $1,684; Mal. Murphy, Vincennes Av., 1,365 lin. ft. 8 in., $1.19; valve basins, $30; total, $1,684; Mal. Murphy, West End Av., 1,487 lin.. ft. 6 in, 88 cts.; valve basins, $30; Mal. Murphy, 58th St., 3,060 lin. ft. 8 in., 91 cts.; valve basins, $30; total, $3,425; Euclid Av., 2,275 lin. ft. 8 in. basins, $29.99; total, $2,744; Sim bany Av., 1,340 lin. ft. 8 in., basins $30; total, $1,598; Edwar work consists of furnishing hy etc. Bids opened April 24.

⊙Following are the low bids awarded for furnishing and labor, materials, etc., necessary to struct and deliver a steel smoke in height and 7 ft. in diameter, guy lines, boiler connections, clusive of concrete foundation, View pumping station, Montre Clarendon Av., Chicago, Ill.: Works, 2830 S. Ashland Av., time limit. Bids opened April Gann is Commissioner of Publi

⊙Bids were opened April 13 awarded by L. E. McGann, Co Public Works, Chicago, Ill., f the labor, materials, etc., necess to erect and deliver to the Lake station, Montrose Av. and Clarendon steam, water, blowoff and exhaust valves, fittings and traps neces the temporary boiler plant and to same with engine No. 1 an turbine units and air pumps; nishing and erecting of 1 ope feed water heater 1,000 H. P. capacity, 2 steam separators and 1 blowoff basin. H 606 W. Randolph St., $6,100; days.

⊙Bids were opened and cont award by L. E. McGann, Commissio Works, Chicago, Ill., for remov 14th St. pumping station to th Lake pumping station 3 180-H. P. Ba cox water tube boilers and the mechanical stokers; from electric light pl Lincoln St., 1,500-H. P. Freem boiler and stoker; W. J. Gibbon $1,

⊙Bids were opened and contr awar by L. E. McGann, Commission Works, Chicago, Ill., for furnis the materials, etc., necessary to des struct at Montrose Blvd. and 1 temporary boiler house, 1 el 1 ash hopper and hopper ho structural steel, corrugated in, track, hoppers, etc., exclusive c foundati

., elevator machinery, plumbing ter & Sons, $6,410

Indiana.

tern Railway Co. plans to install its own waterworks at the shops t, Ind. The proposed plant will neighborhood of $15,000. A reser- capacity of 300,000 gals. is to be on the hill about 300 yds. south ds. Edwin Gray, St. Louis, Mo., gineer of the St. Louis-Louisville

Iowa.

l be received until 1 p. m., May the town of Kimballton, Ia., struction of a waterworks system. dn is Clerk. C. D. Forsbeck, Wa- s Engineer.

lkhawk Construction Co. of Cedar d Waterloo, Ia., has been award- by the City Council of Cedar rnishing the labor and material r the construction of 4,300 lin. ft. r main extension; all pipe to be th of 5½ ft. Bids were opened

Kansas.

f Coffeyville, Kans., has postponed tract from May 14 indefinite oposed improvements to the water wing to difficulty in securing ocation of filtration plant. Carl E. Supt. of water works.

Kentucky.

received until noon, May 24, Hydraulic & Manufacturing Co., Ky., for the construction of a at Lexington water works. The nclude the following approximate [illegible] yds. of excavation, [illegible] rete; 50 tons cast iron pipe.

Louisiana.

d States Cast Iron Pipe & Foun- mitted the only bids to the Sew- ter Board of New Orleans, La., g cast iron pipe and specials, as ton for 4-in. pipe, $24 a pipe, $23 for 8-in., 10-in. and 12- for sizes from 14 to 48-in. For and spigot, $50 a ton.

Maine.

tees of Brunswick and Topsham ict, according to information re- Brunswick, Me., have voted to at once on the construction of a reservoir on Noyes Hill, at eights.

Maryland.

ens of Myersville, Md., at the election voted bonds in the sum r the installation of waterworks. Pettingall is Burgess.

Michigan.

d of Public Works of Jackson, ecided to readvertise for bids for e smokestack and setting boilers ing station.

Minnesota.

Council of Minneapolis, Minn., water mains laid in portions of t an average depth of 8 ft., with ates and connections therewith. Knott is City Clerk.

Missouri.

Pacific Railway Co. has pur- old plant of the Nevada Water l three miles northwest of the ada, Mo. It is proposed to re- plant and get a supply of soft he boilers for engines and other ompany. A reservoir will be con- the round house.

New Jersey.

to advices from Whippany, N. mandy Heights Water Co., which uired the plant owned by John D. Camfield, is planning improvements to the property. Water is supplied to the residents of the heights and park sections.

New York.

✣Bids will be received until 5 p. m., May 27, by Water Commissioners, East Williston Water District, at the office of F. L. Oakley, East Williston, Nassau County, N. Y., for 12,225 ft. of 4 to 8-in. pipes laid, 27 hydrants and necessary valves and specials set in place, one meter pit and one 8-inch meter, furnished and set in place. Plans and specifications will [illegible] Civil Engineers, Denton Building, Mineola, New York, from whom specifications and pro- [illegible] all inquiries should be addressed.

⦿The Village Council of Middleport, N. Y., Clifford A. McDonald, Clerk, has awarded the contract for the construction complete of a municipal water system, including about 8 miles of cast iron pipe, pumping stations, pumps, standpipe and appurtenances; also for construction complete municipal sewer system, including about 6 miles of pipe sewers, treatment works and appurtenances, to Cusano & Dower of Niagara Falls, N. Y., at $40,725 and $36,730. Bids were opened April 24 Charles Hopkins, 349 Cutler Bldg., Rochester, N. Y., is Engineer.

⦿Cusano & Dower of Niagara Falls, N. Y., have been awarded the contract for the installation of a waterworks system in Middleport, N. Y., at $40,725. The work will include a complete system with the exception of a pumping station and the standpipe, estimated to cost $10,000, and awarded to the Dover Boiler Works. Other bidders on the work were: The H. C. Brooks Co., Inc., $45,000; S. V. R. Malcolm & Son, $57,000, and Charles R. Lewis, $41,976.

⦿The Board of Water Supply of New York City, J. P. Morrissey, Secy., has awarded the contract for the borings on and near the site of the proposed Silber Lake reservoir, situated about ½ mile west of Tompkinsville, and about 2 miles by trolley from St. George ferry, Staten Island, Borough of Richmond, to the Healey Contracting Co., 13 Park Row, New York City, at $3,306. Bids were opened May 7.

⦿Alfred C. Barne of Lancaster, N. Y., has been awarded the contract by the Board of Water Commissioners of Jamestown, N. Y., for furnishing all labor and material for the construction of a 5,000,000-gal. reinforced concrete covered reservoir, at $58,773. Chester & Fleming, Union Bank Bldg., Pittsburgh, Pa., are Engineers. Bids were opened May 2.

The Delancey Water Co. of Delancey, N. Y., has been incorporated with a capital stock of $5,000. The directors are: Amasa G. Seaman, Chauncey S. Hymers, Edward Walker, Alexander Bailey, Peter J. Pinney, Alexander Mitchell and Robert Hutson, all of Delancey.

The Common Council of Oneida, N. Y., has voted to raise $7,000 for extensions of water mains and ordered a special election to be held May 31 for that purpose. Otto Pfaff is Mayor.

The Hempstead & Oyster Bay Water Co., Hempstead, Nassau County, N. Y., has been incorporated with a capital stock of $30,000, to supply water. The incorporators are: Geo. M. Hewlett, Joseph W. Birch, Merrick, N. Y., Alvin G. Smith, Freeport, N. Y.

The contract for furnishing approximately 275 lengths of 24-in., and 235 lengths of 16-in. cast iron pipe and specials, and for laying the same, for which bids were opened by the Board of Water Commissioners of Jamestown, N. Y., on May 2, will not be awarded for 30 days. Chester & Fleming, Pittsburgh, Pa., are Engineers.

Ohio.

The Wilcoxton Water Co., Twinsburg, O., has been incorporated with a capital stock of $5,000, to supply water to Twinsburg Township, Summit County. The incorporators are: John C. Blackman, A. W. Elliott, R. B. Chamberlin, W. H. Boose, and Walter S. Lister.

The city of Cleveland, O., has decided to reject bids received for the building of the new aqueduct tunnel to connect the municipal lighting plant and the Kirtland St. pumping station and do the work by day labor. The estimated cost is $20,000.

The State Department of Health, James E. Bauman, Secy., has urged the city of Youngstown, O., to take immediate steps to improve its water supply by the repair of the present purification plant and the enlargement of the filtering capacity.

Oklahoma.

The Mountain Springs Water Co., Muskogee, Okla., has been incorporated with a capital stock of $10,000. The directors are: C. M. Risig, J. C. Shaffer and H. H. McFann, all of Muskogee.

Oregon.

An ordinance has been presented to the City Council of Cleone, Ore., proposing to bond the city for $10,000 for a water system. Negotiations also are in progress for taking over a spring on the Stone estate as a water supply.

The Jewell Filter Co. has been awarded a contract to install a 100,000-gal. filtering plant at Hood River, Ore.

Pennsylvania.

The Borough of Homestead, Pa., has employed Chester & Fleming, Hydraulic Engineers, Pittsburgh, Pa., to design and install a high service pumping station to supply the high districts of the borough with water.

Following bids were received April 30 by the Water Department of Lancaster, Pa., F. H. Shaw, Superintendent, for the construction of coal bins and retaining walls: Geo. C. Souder, $6,911; Otto Paving & Construction Co., $7,480; Reading Contracting Co., $7,623; J. Soloman, Jr., $7,634; Concrete Engineering & Contracting Co., $7,831; Linker-Loose Co., $8,137, and J. H. Wickersham, $8,568.

South Dakota.

No bids were received by the city of Mitchell, S. Dak., on May 6, for digging, casing and connecting an artesian well complete with appurtenances. The city has not decided to readvertise. N. H. Jensen is City Auditor.

Texas.

The citizens of Shamrock, Tex., at a recent election voted the issuance of bonds for the installation of a waterworks and for street improvements.

A waterworks company has been organized at Irene, Tex., for the purpose of installing a system of waterworks. A well has already been sunk 915 ft., which will supply artesian water.

The citizens of Palacios, Tex., on May 13 voted on the issuance of bonds in the sum of $25,000 for the purpose of reconstructing the recently acquired water plant so as to furnish an adequate system of fire protection.

The citizens of Sherman, Tex., have voted the issuance of bonds in the sum of $30,000 for the installation of a waterworks system.

It is reported that S. M. Williams has purchased the water and light plant of Mercedes, Tex., and will at once install gasoline engines and make other repairs.

Asst. City Engineer Couch of Dallas, Tex., is completing plans for the Oak Cliff pumping station of the city waterworks, to be built upon the old station grounds on Marsalis Ave. The plans call for a plain structure, faced with pressed brick and with ornamental windows and eaves. The estimated cost is $12,000.

Utah.

✣Bids will be received until 10 a. m., May 20, by Board of County Commissioners, Salt Lake City, Utah, for the work of excavating and laying water mains for the county on 12th South St., between Main and Sixth East Sts., in accordance with plans and specifica-

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

tions on file with the County Engineer. J. C. Mackay is Chairman of the Board.

Washington.

⊙Buffton & Jeffery of Portland, Ore., have been awarded the contract by the city of Sutherlin, Wash., for the installation of a waterworks system, at $14,500.

Wisconsin.

✣Bids will be received until 8 a. m., June 5, by Mayor and Board of Commissioners, Appleton, Wis., for the equipment complete of a pumping station. C. H. Vinal is Engineer. Official advertisement will be found elsewhere in this issue.

⊙The Gould Mfg. Co., Ohio & Franklin Sts., Chicago, Ill., has been awarded the contract by the city of Watertown, Wis., for furnishing 700-gal. low lift centrifugal pump and a 10-h. p., induction motor and compensator, at $423. W. G. Kirchoffer, Madison, Wis., is Engineer. Bids were opened April 12.

The citizens of Palmyra, Wis., recently held a public meeting to discuss the proposition of putting in a waterworks and sewerage system.

Canada.

✣Bids will be received until 5 p. m., May 20, by W. Griffiths, Comptroller, Burnabay, B. C., for the construction of Reservoir No. 2 on the Royal Oak Road. Plans and specifications may be obtained of Cleveland & Cameron, 506 Winch Bldg., Vancouver, B. C.

⊙The Stuart Machinery C Winnipeg, Man., has been awa ed the con tract by the Board of Controll M. Peterson, Secy., for furni ing and installing two deep well turbine by an electric motor capable 000,000 gals. per 24 hours. he contract price is $4,575 each. Bids ere April 1.

⊙McManus Construction Co., North B tleford, Sask., has been awarde the contby that city, H. W. Dixon, Se etary-T urer, for Contract "A," for water mains and sewers. Bids May 1. Chipman & Powers, Toronto, are Engineers.

SEWERAGE AND GARBAGE DISPOSA

California.

⊙Bent & Pennebaker have been awarded the contract at about $160,000 for street work at Torrance for the Dominguez Land Co., according to advices from Los Angeles, Cal. The work will include paving, oil macadam, grading, curbs, gutters and sidewalks, and a sewer plant to cost $50,000.

⊙The Board of Trustees of Anaheim, Cal., has awarded the contract for the construction of Section 1 of the outfall sewer to Chamberlain, Williamson & Chamberlain at $3,033.

It is reported that the citizens of San Rafael, Cal., on April 27 voted the issuance of bonds in the sum of $152,050, segregated as follows: $97,050 for sewer and street improvements, $25,000 for a municipal bathing and swimming establishment, $15,000 for electric lights on streets and $15,000 for other expenditures for improvements on sidewalks, etc.

The citizens of San Diego, Cal., on May 7 voted on the proposition of issuing bonds for improvements, as follows: $80,000 to extend the fire fighting system; $120,000 to extend the sewer system; $55,000 to rebuild bridges and extend streets; $340,000 to extend the water system; $75,000 to purchase sites for and to build playgrounds, and $10,000 to build comfort stations.

Connecticut.

⊙The Pierce Mfg. Co. has been awarded the contract at Bridgeport, Conn., for the building of the East End trunk sewer and the construction of smaller sewers on Boston Ave., Huntington Ave., and French St. The trunk sewer will cost approximately $28,000. The B. D. Pierce Co., secured the contract for constructing a sewer on John and Beers Sts.

Delaware.

The City Council of Wilmington, Del., has passed the ordinance authorizing a loan of $100,000 for street and sewer improvements. Of this amount $50,000 is to be turned over to the Street and Sewer Department for a permanent sewer fund and $50,000 to pay for the widening of 11th St.

District of Columbia.

✣Bids will be received until 2 p. m., May 28, by Commissioners of the District of Columbia, Washington, D. C., for furnishing the District government with the following materials during the fiscal year beginning July 1, 1912, and ending June 30, 1913: Granite curbing, asphalt paving blocks, repressed vitrified paving blocks, repressed vitrified invert sewer bricks, red sewer bricks, terra cotta sewer pipe, Portland cement, miscellaneous castings, sand and gravel and hauling broken stone. Form of proposal, specifications and necessary information may be obtained upon application to the purchasing officer, D. C., room 320, District Bldg.

Florida.

An election was held in Apalachicola, Fla., on May 14 for the purpose of voting on the issuance of bonds in the sum of $12,263 to make extensions and complete the storm drainage and sewer system.

Illinois.

✣Bids will be received until noon, May 18, by Board of Local Improvements, Murphysboro, Ill., for furnishing all material and labor necessary for the construction of West Side Sewer Extension No. 2. The approximate quantities included are 3,300 ft. of 8 to 10-in. vitrified pipe. Plans and specifications are on file with R. A. Rollo, City Engineer.

✣Bids will be received until 1:30 p. m., May 16, by Board of Local Improvements, Rockford, Ill., for the construction of public sewers in Harlem Ave. and Daisy Ave., estimated to cost $4,000 and $3,500 respectively. W. W. Bennett is President of the Board. Edwin Main is City Engineer.

✣Bids will be received until 1 p. m., May 20, by Board of Local Improvements at the office of C. L. James, City Engineer, Mattoon, Ill., for the construction of sewers as noted under Roads & Streets in this issue.

✣Bids will be received until 1 p. m., May 20, by Board of Local Improvements, Mattoon, Ill., at the office of C. L. James, City Engineer, for paving and sewer work including the following approximate quantities: 6,500 yds. of excavation; 14,770 sq. yds. brick paving with cement filler; 606½ lin. ft. marginal curb; 9,396 lin. ft. combined curb and gutter; 380 ft. 10 in. sewer pipe relaid; 760 ft. 12 in. sewer pipe laid; 360 ft. 8 in. sewer pipe laid; 7 catch basins; 17 inlets.

✣Bids will be received until 2 p. m., May 21, by Board of Local Improvements, Sandwich, Ill., for furnishing the necessary labor and material for the construction of a system of sanitary sewers comprising the following approximate quantities: 3,410 ft. of 18 in., 260 ft. of 15 in., 2,050 ft. of 12 in., 4,950 ft. of 10 in., 25,300 ft. of 8 in. and 3,900 ft. of 6 in. tile pipe sewer with 126 circular three-foot manholes, 10 flush tanks, 552 ft. of 12-in. outlet drain and a sewage purification plant. Maps, plans, profiles and specifications may be examined and blank proposals obtained at the office of the President of the Board in Sandwich, Ill., and at the office of The W. S. Shields Co., Engineers, Room 1201, Hartford Building, Chicago, Ill.

Plans and specifications have been prepared for the building of a sanitary sewer system in Genoa, Ill., and the same have been accepted by the city officials. The system will be 9⅓ miles long and empty into the Kishwaukee River. Its deepest depth will be 20 ft., but on an average it will be about 8 ft. deep. The largest tile will be 18 ins., while the laterals will be no smaller than 6 ins. The estimated cost is $38,150.

The Board of Local Improvem gin, Ill., has been petitioned struction of a sewer on that from Slade to Dexter Aves. cost is $10,000.

Indiana.

City Engineer John E. And Vernon, Ind., has estimated th structing the proposed sewer i part of the city at $15,000.

Plans, specifications and esti ing prepared for the constru north side sewer for Boonville.

The Board of Public Wo Bend, Ind., plans to spend abou year on the construction of ad and new pavements. Wm. S. Engineer.

Iowa.

✣Bids will be received until by J. W. Clark, Town Clerk, A the construction of 4,290 ft. of sewers. M. Schirgi & Sons, 1 ance Bldg., Dubuque, Ia., are E

⊙G. W. Ensley of Chariton, awarded the contract by that cit struction of a 12-in. sewer 500 ft per lin. ft. The work also inclu 1 drop hole and 13 Y's. Bids May 6.

⊙The City Council of Eldor the contract for the constructi blocks of sewer and two bl mains to O. Johnson of Alden, The work is to be completed June

⊙The city of Fort Dodge, I following contracts for the c the 6 miles of sanitary sewer rie and Crawford Park section Construction Co., Waterloo, Ia., 1 and 3; W. E .Rosencranz, trict No. 2. The entire work 657.

The City Council of Cresto to construct an 8-in. sanitary fied, glazed pipe with 6-in. curb lines on Sycamore St., fr main on Northwest Jefferson 100 ft. south of the south line St. The work will include 3,0 sewer, 100 6-in. Y's, and 1,50 lateral. T. S. DeLay is City E

Kansas.

State Sanitary Engineer Wil of Kansas has made prelimina the town of Stafford, Kans., a make a report as to the practica sibility of installing a sewer ford.

Louisiana.

✣Bids will be received until (readvertisement), by Sewer Board, New Orleans, La., sluice gates. F. S. Shields is

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Maryland.

ns of Preston, Md., on May 6 ssuance of bonds in the sum of nstruct a sewerage system. Th empty into Linchester River, [illegible] distant Alexander N [illegible] rd of Commissioners.

Cumberland, Md., has decided storm sewer from the vicinity of Smallwood and Cumberland Creek.

Massachusetts.

& Montague of Springfield have ed the contract by the Selectmen [illegible] Mass., for the building of laying of conduits in North Elm pot Square, at $8,964. Other bid- E. B. Roberts, Boston, $13,357; ay & Cellilli, Springfield, $14,- Conti & Co., Hartford, Conn., igham & Moganio, Boston, $11,- Bros., Hartford, Conn., $11,- [illegible] N. Y., $977; George w Haven, Conn., $10,176; D. A. [illegible] The [illegible] d Construction Co., Hartford, [illegible] M. [illegible] & Son [illegible] 11,653; Quinlan & Lyons, Brook- ; E. M. Denom & Co., Spring- s only), $9,469; F. T. Ley & Co. nly), $3,618; Birnie, Adams & Rux- ction Co. (conduits only), $3,189.

Michigan.

ll be received until 8 p. m., May V. Dexter, City Clerk, Crosswell, the construction of a sewer in [illegible] No. 1 [illegible] Mich., commencing at the inter- Harrington Ave. and Mills St., h along Mills St. to Wells St., hwest to McMorran Ave., thence IcMorran Ave. to Sanborn Ave., to Howard Ave. and southwest elow the dam on Black River pur- e plans and specifications, now on office of the clerk. Work is completed by Oct. 1, 1912. Each ust be accompanied by a certified Croswell bank for 3 per cent of l.

H. N. Beck of Muskegon, shortly prepare plans and specifi- the installation of a new sewer the district including the Sixth ween Washington and Laketon

Minnesota.

ill be received until 8 p. m., May Council, Fergus Falls, Minn., for of sewer on Vernon Ave., west, and Alcott Ave., west, together basins, manholes, and house according to plat, profile and s on file at City Clerk's office; he construction of an outlet for from intersection of Fremont St. Ave. to River. S. A. Levorsen rk.

ebster of St. Paul, Minn., has been e contract by the city of New Ulm, ert J. Meyer, City Clerk, for fur- abor and material for the construc- ers on State St., from 2d St. South h St. Bids were opened May 7.

Council of Thief River Falls, under consideration the construc- e sewer systems, estimated to cost eorge Walker is Consulting En-

Missouri.

ill be received until 8 p. m., May . O'Brien, City Clerk, Maplewood, he enlargement of Sewer District tioned in our last issue.

Montana.

of Lewistown, Mont., is offering nds in the sum of $60,000 for the installation of a sewerage system. C. W. S[illegible] neer.

New Jersey.

✣Bids will be received until 8 p. m., May 15, by Common Council, Ventnor City, Atlantic, City, N. J., for the construction of 1,000 ft. [illegible] 8-in. salt-glazed vitrified sewer pipe. W. I. Risley is City Engineer.

✣[illegible] as mentioned in our last issue, by Passaic Valley Sewer Commission, J. S. Gibson, Clerk, Passaic, N. J., for the construction of Section 9 of the Main Intercepting Sewer, including the following approximate quantities: 1,700 lin. ft. 126-in. concrete sewer in trench, from about 23 ft. to about 30 ft. in depth; 2,300 lin. ft. 126-in. concrete sewer in tunnel; 4,500 cu. yds. Portland cement concrete in trench; 6,000 cu. yds. Portland cement concrete in tunnel; 100 cu. yds. brick masonry in manholes; 100 cu. yds. rock excavation in trench.

New York.

⦿The Board of Public Works of Fulton, N. Y., on May 6 awarded the contract for the installation of a sewer system to Tony [illegible]

⦿Cusano & Dewer of Niagara Falls, N. Y., have been awarded the contract by the village of Middleport, N. Y., for the installation of a sewer system, with Imhoff disposal system, at $36,727. The work must be completed by Jan. 1. Other bidders were: S. V. R. Malcolm & Son, $57,931; Frank, George & Arthur Shaw, $49,048, and the Frontier Contracting Co., $50,000. C. C. Hopkins of Rochester is Village Engineer.

⦿Tibbits, Maher & Carnevallo Bros., of Oneida, N. Y., have been awarded the contract by the town of New Hartford, N. Y., for the construction of a sewer and disposal plant, at $38,664. A. M. Scripture of New Hartford is Engineer. The work is to be completed by Feb. 1.

⦿Following contracts have been awarded by the Board of Contract & Supply of Binghamton, N. Y., for the construction of sewers: George Pignatello, Robinson St. sewer, $4,333; George Serifina, Fairview Ave., sewer, $3,300; Tumpusky & Stenta, Valley St., sewer, $204; Hotchkiss St. sewer, $436; George Pignatello, Ogden and Yager St., sewer, $535.

⦿Nicola Desiderio has been awarded the contract by the Board of Contract & Supply of Rochester, N. Y., for the construction of the Gordon Park and Ward St. sewer, at [illegible]

⦿The village of Middleport, N. Y., Clifford A. McDonald, Clerk, has awarded the contract for the construction of a complete sewer system, including about 6 miles of pipe sewers and treatment works, to Cusano & Dower of Niagara Falls, N. Y., at $36,730. Charles Hopkins, 349 Cutler Bldg., Rochester, N. Y., is Engineer. Bids were opened April 24.

Consulting Engineers Hering & Gregory of New York City recently submitted their report to the officials of Montclair, N. J., relative to the construction of a joint sewage disposal plant for Orange, East Orange and Montclair, including the necessary mains to connect the lateral system of each municipality, with the proposed plant in Belleville. The estimated cost, including land, right of way, engineering and contingencies, will be as follows: East Orange branch sewer, $139,000; Orange and Montclair joint sewer, $47,000; trunk sewer, $79,000; joint disposal works, $815,000; total $1,080,000.

County Engineer Diehl has prepared preliminary map and estimates for the installation of a sewer system in Springville, N. Y. The cost of a complete system and disposal plant is estimated at $168,000.

The Board of Local Improvements of Jamaica, N. Y., Dennis O'Leary, Commissioner of Public Works, has approved a comprehensive sewer system for the Richmond Hill and Morris Park sections, which, according to an estimate made, will cost $250,146.

Ohio.

The Pleasant Hill Sewerage Co., Pleasant Hill, O., has been incorporated with a capital stock of $10,000, to construct sewers and drains. The incorporators are: F. M. Longmaker, Daniel Moul, Jesse Beery, I. A. Deeter, and Charles F. Sebusselin.

The Ohio State Board of Public Works has granted the permission to the city of Akron to build the main line sewer under the tow path of the Ohio canal, between the canal and the Little Cuyahoga River. R. M. Pillmore is Service Director.

The City Council of Ashtabula, O., has passed an ordinance providing for the construction of a sanitary sewer in the following streets in the Bunker Hill section: South Ridge road, from South St. to Austinburg road, in West St., from the South Ridge road to South St., and in Adams St., from the South Ridge road to South St.

The City Council of Dover, O., has passed a resolution declaring it necessary to construct sanitary sewers in all of District No. 3, part [illegible] No. 2 and part of District No. 1. Cletus Weaver is City Clerk. T. P. Peter is Mayor.

Oregon.

City Engineer Henry D. Forneri of Eugene, Ore., is making surveys for the installation of a new sewerage system.

The City Council of Portland, Ore., plans the construction of the East 33rd St., sewer extension of the Sullivan's Gulch system, which, it is estimated, will cost $104,475, for lock-joint and brick and concrete sewers, while the reinforced concrete and vitrified sewer pipe, it is estimated, will cost $118,295.

Pennsylvania.

✣Bids will be received until noon, May 16, by City Clerk, York, Pa., for furnishing the necessary labor and material for the construction of a storm water sewer on Richard Ave. Plans and specifications may be obtained of the City Engineer, G. A. Warner.

✣Bids will be received until noon, May 28, by Lower Merion Township Commissioners, Ardmore, Pa., for the construction of the necessary additional pumping machinery required to lift 1,500,000 gals. of sewage per day 175 ft. through a distance of 6,700 ft. Plans and specifications may be seen at the office of the Commissioners. Send all communications to Robley A. Warner, C. E., Engineer in Charge, Box 708, Ardmore, Pa.

⦿F. G. Diefendorf has been awarded the contract in Erie, Pa., for the construction of the 9-in. sewer in 26th St., from a point 80 ft. east of Holland St., eastwardly 140 ft., at $0.95 a ft.

⦿Stephen Flanaghan & Son, 1719 Luzerne St., Scranton, Pa., have been awarded the contract for the construction of 19 miles of sewers in Newark, N. J., at approximately $70,000.

Engineer J. W. Geary, P. O. Box 131, Shenandoah, Pa., has prepared plans for the construction of sewers in the southwest part of the city, to be of tile and reinforced concrete pipe. The work will include furnishing and laying about 12,000 ft. of pipe from 10-in. to 60-in. in diameter. The estimated cost is $15,000.

City Engineer C. H. Milholland of Newcastle, Pa., has presented a communication to the City Council showing several plans whereby a sewer system could be provided which would take care of the upper East Side. The system, it is estimated, would cost $25,000.

The Select Council of Erie, Pa., has passed an ordinance providing for the purchase of the Boughton farm, east of Belle Valley, to be used as a garbage plant site. The farm consists of 82 acres and will cost the city $5,500.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Preparations are being made to immediately start work on the upper end of the Fourth St. storm sewer in Ellwood City, Pa. City Engineer Alexander Main has completed surveys of the route.

The Board of Public Works of York, Pa., it is reported, has employed an engineer for the purpose of securing final data and the estimate of the cost of completing the sanitary sewerage system in the city.

The city of Norristown, Pa., has engaged engineers to furnish plans and estimates for a sewage disposal plant. S. Cameron Corson is Borough Engineer.

Rhode Island.

✣Bids will be received until 2 p. m., May 23, by Board of Sewer Commissioners, Woonsocket, R. I., for building about 5,700 ft. of 8-in., 1,500 ft. of 10-in. and 1,000 ft. of 12-in. sanitary sewer and appurtenances. Plans and specifications may be seen and blank forms of contract and proposal obtained at the office of F. H. Mills, City Engineer, City Hall, Main St., Woonsocket, R. I. Each proposal must be accompanied by a certified check for the sum of $500, made payable to the order of Arthur J. Follett, City Treasurer of the city of Woonsocket, R. I.

Texas.

✣Bids will be received until May 20, by Capt. R. B. Reamy, Constructing Quartermaster, Fort Bliss, Texas, for furnishing the necessary labor and material for the construction of a 4-in. sewer.

⊙The City Council of Cuero, Tex., has awarded the contract for the installation of a sewerage system to Fountain & Shaw of Dallas, Tex., for which bonds in the sum of $25,000 were recently voted. City Engineer J. W. Benjamin will have charge.

At a recent mass meeting of the citizens of Grand Saline, Tex., a committee was appointed to ascertain the practicability of a sewerage system for the town.

Virginia.

⊙R. E. Boiseau of Washington, D. C., has been awarded the contract by the Constructing Quartermaster, Fort Myer, Va., for making alterations to the sewer system at $2,145. Bids were opened May 10.

The citizens of Chase City, Va., on April 30 voted the issuance of bonds for the installation of a sewerage system.

Washington.

⊙The G. H. Sutherland Co. of Walla Walla, Wash., has been awarded the contract by that city for the laying of the Figuora St. sewer, at $5,531. Other bidders were: Heuser & Elbury, $6,951; Dion Keefe, $6,935; Xura Case, $7,761, and Bemus & Berthold, $6,770.

The city of Seattle, Wash., has notified the Oregon-Washington Railway & Navigation Co., to reconstruct the city sewer on Fifth Ave., South, between Main St. and the Seattle Blvd.

The Graff Construction Co., Crary Bldg., Seattle, Wash., at $85,026, submitted the lowest bid for the construction of the China Creek main, being a part of the Burrard Peninsula sewerage system.

Commissioner of Public Works D. C. Coates of Spokane, Wash., has filed plans with the City Clerk calling for the construction of Fourth Ward subtrunk sewer No. 48, covering some portions of the territory between Cedar and Lincoln Sts., from Spofford to Nora Ave. The estimated cost is $14,418.

Wisconsin.

⊙Patrick & William McGavock of Beloit, Wis., have been awarded the contract by that city for the installation of a sewage disposal plant on the east side, and for laying the sanitary sewer to the plant. ne contr price is $11,585. Thompson & Johnson Racine, Wis., submitted a bid the work.

Commissioner of Public Wo Simmons of Milwaukee, Wis., has mended to the Common Cou struction of the following desc ed section of sewers: West Sewerage sewer in Burleigh St., from Fifth St.; pipe sewer in Brem St. from Concordia Ave. to Keefe Ave. pipe sewer in West 24th St., from Keefe e. to Pease St.; pipe sewer in 25th St., fro Keefe Ave to Pease St.; pipe sewer in 2 St. from Keefe Ave. to Pease St.; pipe ver in Miller Ave., from Island Ave. to a oint 150 ft east of Island Ave. South Sewage District —Pipe sewer in Eighth Ave., fr a point ft. north of Dakota St. to Mani a St., pipe sewer in 31st Ave., from Greer ld Ave Lapham St.

Plans have been prepared by French of Reedsburg, Wis., for tion of sewers in the east side. ed cost is $20,000.

Canada.

✣Bids will be received until 27, by W. H. Munro, Mayor Marie, Ont., for supplying and 21,000 lin. ft. of tile sewer pipe tenances. Plans and specificatio tained of W. W. Van Every, C. J. Pim is City Clerk.

⊙The Point Grey, (P. O. Vanc City Council has let the contract struction of large sewer mains th Kerrisdale and Magee Districts Webster of Magee Station at abc

⊙The City Commissioners Alta., have awarded the contract struction of a reinforced concrete to Manders & Gregory of Edm were opened April 30.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, E

California.

✣Bids will be received until 11 a. m., May 31, by F. Von Schrader, Chief Quartermaster, Chronicle Bldg., San Francisco, Cal., for the construction of an electric-lighting system at Fort Columbia, Wash. Also for furnishing and installing engine, generator and switchboard in present power plant at Fort Stevens, Oreg., and for construction of feeder lines and pump house with pumps and motor at Fort Stevens. Plans and specifications may be seen only in the offices of Quartermaster, Fort Columbia, Wash., Fort Stevens, Oreg.; Quartermaster, Portland, Oreg.

Connecticut.

⊙Toole & Sunderlin, Bridgeport, Conn., have been awarded the contract at $9,812 for the construction of a retaining wall in Glenwood Ave., Bridgeport.

District of Columbia.

✣Bids will be received until May 20, by Chief Signal Officer, War Department, Washington, D. C., for furnishing aerial paper-insulated cable as follows. 50,000 ft. type 401, 4,000 ft. type 402, 10,000 ft. type 402, 10,000 ft. type 404, 30,000 ft. type 406, 20,000 ft. type 407. For further information address Capt. R. J. Burt, disbursing officer, U. S. A.

✣Bids will be received until 2:30 p. m., May 18, by Maj. F. C. Boggs, General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for furnishing plain water hose, suction hose, packing, gaskets, brass globe valves and railway lantern globes.

Florida.

The Board of Commissioners of State Institutions, G. T. Whitfield, Secretary, Tallahassee, on May 6 considered architects' plans and drawings in competition for the proposed Receiving Hospital at the Florida Hospital for the Insane. The plans of Fred A. Bishop, Architect, Candler bldg., Atlanta, Ga., were accepted by the Board. Mr. Bishop is to furnish his working drawings and specifications within the next 30 days. When these are approved by the Board, the Board will advertise for bids upon the construction of the proposed Receiving Hospital.

Indiana.

✣Bids will be received until 2 p. m., June 4, by Board of Clay County Commissioners, Brazil, Ind., for the construction of a new court house, heating plant at jail and connections. E. A. Staggs, is County Auditor.

✣Bids will be received until 10 a. m., May 28, by Center township trustee, 147 E. Washington St., Indianapolis, Ind., for the construction of an 8-room school building. H. C. Schroeder is Trustee.

Iowa.

✣Bids will be received until 8 p. m., May 24, by W. E. Klingaman, City Clerk, Vinton, Ia., for the construction of a power house, estimated to cost $11,000. P. P. Smith, Cedar Rapids, Ia., is Consulting Engineer.

✣Bids will be received until 7:30 p. m., May 20, by E. G. Finch, City Clerk, Newton, Ia., for the construction of a smokestack to be 125 ft. high and suitable for 700 h. p. boiler capacity.

Louisiana.

✣Bids will be received until noon, May 30, for the construction of a 2-story and one-half basement reinforced concrete dormitory building at Natchitoches, La. Pl fications are on file with Favrot Ltd., Architects, 839 Gravier leans, La., or may be seen at th mal School, Natchitoches, La.

The Board of Port Commissioners Orleans is considering four plans sub its consulting engineer, J. F. Colna Orleans, for the new 1,500 ft. wharf added to the Dumser landing. also considering three plans for new wharf for the Frisco R. calls for remodeling and re wharf at a cost of $368,034; th an entire new wharf and modern improvements, to cost third for an even better wharf cost $486,400.

Maine.

Town of Freeport, Me., has chase the wharf owned by the South Freeport for a town land on the wharf will cost about $2,

Construction work is to be st on a $2,000,000 pulp mill at Sha dam 1,000 ft. long for the de 4,000 to 6,000 h. p. will be Purington, Waterville, Me., is the mill and J. L. Parkin, Fairf probably have charge of the c the dam.

Massachusetts.

✣Bids will be received unti 22, by Building Committee, Mai Addition, Dr. C. H. Mack, Cha Springfield, Mass., for the erecti dition to the Main St. School cated on Main St., West Spring

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] and specifications prepared [illegible] Gardner, copies of which [illegible] at their office, 33 Lyman St. A [illegible] $1,000 payable [illegible]

Michigan.

[illegible] received until 3 [illegible] of date from May 7), by C. M. [illegible]wend, Col., Corps U. S. Engineers, [illegible] pumping plant [illegible] Ste. Marie, Mich.

Minnesota.

[illegible] received until 2 [illegible] June [illegible] ioner of Indian Affairs, Wash- [illegible] furnishing the [illegible] aterial for the construction of a [illegible] building and frame quarters at [illegible] day school, White Earth Indian [illegible]

[illegible] R. Shunk, U. S. Engineer, Duluth, [illegible] proving harbor at Duluth, Minn., [illegible], Wis.: (1) Standing for bid per [illegible] 127,000 cu. yds. dredging in en- [illegible] ders or piece of rock per cu. yds.: [illegible] 14 cts., (2) 15¾ cts.; Northern [illegible] ck Co., Duluth, Minn., (1) 14 cts., [illegible] uluth-Superior Dredging Co., Du- [illegible]

New York.

[illegible] lin B. Ware, State Architect, Al- [illegible] stalled complete and connected [illegible] t piping in the Education Build- [illegible] Drawings [illegible] Architects, [illegible] York City, or at the office of [illegible] rchitect. Complete sets of plans [illegible] tions will be furnished to respec- [illegible] Albany, N. Y.

[illegible] be received until May 17, by [illegible] Lighthouse District, Tompkins- [illegible] for furnishing 100 lbs. roofing [illegible] ste form ready for use.

[illegible] be received until 2 p. m., May [illegible] O'Keeffe, Commissioner of [illegible] 1 Park Row, New York City, for [illegible] finish of the municipal building, [illegible] the tower.

[illegible] S. Engineer, New York City, for [illegible] cu. yds. of dredging in Newtown [illegible] the Morris & Cummings Dredge [illegible] St., New York City, at 28½ cts. [illegible] ing the probable contractor.

North Carolina.

[illegible] received until 3 p. m., May [illegible] R. O. Edwards, Constructing [illegible] Fort Caswell, N. C., for the [illegible] s at the fort: 1. Grading around [illegible] ters Nos. 48 and 49, requiring [illegible] 4,954 cu. yds. of fill. 2. Laying [illegible] ain from the steel tank and from [illegible] requiring approximately 500 ft. [illegible] pipe, 200 ft. of 6-in. T. C. pipe [illegible] of universal cast iron pipe.

North Dakota.

[illegible] be received until 5 p. m., June 3, [illegible] rchard, City Auditor, Fargo, N. [illegible] boratory equipment and supplies. [illegible] will be found elsewhere

Oklahoma.

[illegible] be received until 3 p. m., June [illegible] Knox Taylor, Supervising Ar- [illegible] D. C., for the construction complete of the United States Post Office at Kingfisher, Okla. Official advertisement will be found elsewhere in this issue.

Pennsylvania.

✣Bids will be received until 10 a. m., May 20, by Trustees of the Pennsylvania State Lunatic Hospital, Harrisburg, Pa., for the erection of a brick and stone chapel. J. A. Dempwolf, York, Pa., is Architect.

✣Bids will be received until 10 a. m., May 20, by Trustees of the Pennsylvania State Lunatic Hospital at Harrisburg, Pa., for the erection and completion of brick and stone chapel. J. A. Dempwolf, York, Pa., is Architect.

✣Bids will be received until 11 a. m., May 28, by Lt. Col. C. B. Baker, Constructing Quartermaster, Philadelphia, Pa., Depot, for the construction of corrugated galvanized iron shed at that place.

✣Bids will be received until noon, June 5, by Maj. Herbert Deakyne, U. S. Engineer, Witherspoon Bldg., Philadelphia, Pa., for dredging in Delaware River, near Mud Island, Pa., between Philadelphia and Trenton.

Texas.

✣Bids will be received until 10 a. m., May 28, by Building Committee of the Dallas Hall, or Administration Building of the Southern Methodist University, Dallas, Texas, for the construction of the first building, estimated [illegible]

✣Bids will be received until June 20 by El Paso & Southwestern R. R. Co., H. J. Simmons, General Manager, El Paso, Tex., for the construction of the following buildings at Tucson, Ariz.: 1 station building, 1 freight house, 1 engine house. Official advertisement will be found [illegible]

Borings are to be started at once for the foundation of the proposed dam of the Guadalupe Water Power Co. of Seguin, Tex. John Wharton Maxcy, Seguin, Tex., is chief engineer.

Work is to be started shortly, it is stated, on a large electric plant at Waco, which will involve the expenditure of $1,000,000. The Phœnix Construction Co., Amicable Bldg., Dallas, is to construct the plant.

Utah.

✣Bids will be received until 10 a. m., May 21, by M. Z. Witcher, County Clerk, Salt Lake, Utah, for material and labor required for the erection and extension of a tunnel from Power House to Woman's Building, Salt Lake County Infirmary, Salt Lake County, Utah, situated on the northeast corner of 12th South and State St., Salt Lake City, Utah, according to plans and specifications which are on file and open for inspection of the bidders at the office of J. A. Headlund, Architect, 523-527 Dooly Block, Salt Lake City.

Virginia.

The finance committee has recommended to the City Council of Richmond an appropriation of $20,000 for the extension of the Church Hill tunnel, with a view of opening Grace St. across from 29th St. to Chimborazo Park. Chas. E. Bolling is city engineer.

Bids were opened April 23 by Lt. Col. Mason M. Patrick, U. S. engineer, Norfolk, Va., for dredging and rock excavation in James River, Virginia, the bidders and their bids being as follows: (1) Coastwise Dredging Co., Norfolk, Va.; (2) Atlantic, Gulf & Pacific Co., Park Row Bldg., New York city; (3) P. Sanford Ross, Inc., 277 Washington St., Jersey City, N. J.: Sec. 1—Earth excavation, including its carriage and deposit at specified localities between the points of excavation and [illegible] cu. yds.): (1) $0.65, (2) $0.70, (3) $0.58. For earth excavation, including its carriage and deposit near City Point (15,000 cu. yds.): (1) $0.65, (2) $0.60, (3) $0.58. Hard rock excavation, including its carriage and deposit at specified localities between the points of excavation and deep bottom (1,000 cu. yds.): (1) $10.90, (2) $16, [illegible] its carriage and deposit at specified localities between points of excavation and deep bottom (7,300 cu. yds.): (1) $0.65, (2) $0.80, (3) $0.58. Hard rock excavation, including its carriage and deposit at specified localities between the points of excavation and deep bottom (5,200 cu. yds.): (1) $10.90, (2) $12.80, (3) $9.45. Sec. 3—Earth excavation, including its carriage and deposit at specified localities between the points of excavation and deep bottom (6,400 cu. yds.): (1) $0.65, (2) $0.80, (3) $0.58. Earth excavation, including its carriage and deposit near City Point (10,000 cu. yds.): (1) $0.65, (2) $0.70, (3) $0.58. Hard rock excavation, including its carriage and deposit at specified localities between the points of excavation and deep bottom (5,000 cu. yds.): (1) $10.90, (2) $14.70, (3) $9.45.

Washington.

✣Bids will be received until 8 p. m., May 15, by City Clerk E. J. McCall, Bremerton, Wash., for the construction of the municipal dock at the foot of Front St., estimated to cost $15,000. Plans may be had of the City Engineer.

✣Bids will be received until [illegible] 31 by Maj. J. B. Cavanaugh, U. S. Engineer, Seattle, Wash., for furnishing and erecting two steel traveling cranes.

Ordinance is before the City Council of Everett, Wash., calling for a bond issue of $65,000, to be used in the repair and reconstruction and enlarging of the city dock.

The engineering department of the city of Aberdeen, Wash., has completed figures on two tide fill districts. The east side district between F St. and the Wishkah River is estimated at $86,000. The area is 70 acres and the average depth 4½ ft., 4,000 ft. of bulkhead will be required. The fill to be dredged from the river. The west side fill estimated to cost $406,000. The area is 360 acres or 1,400 lots. Average fill 4½ ft. Total 2,500,000 cu. yds.; 5,000 ft. of bulkhead. Cost per 50-130 lot to be $290. Work on tide fill district No. 1 is well along and the contractor (Tacoma Dredging Co.) expects to be through in a few months. This fill covers 250 acres and contains 1,200,000 cu. yds. Chas. W. Ewart is city engineer.

West Virginia.

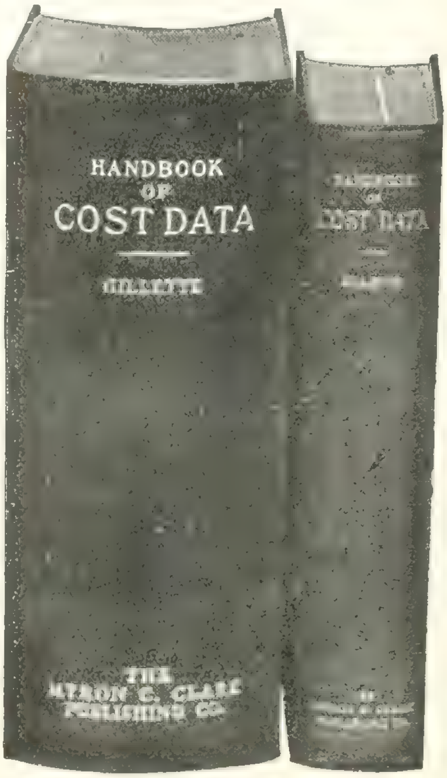
✣Bids will be received until 3 p. m., June 21, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the installation of a heating and ventilating apparatus, etc., for the U. S. Post Office and Court House at Charleston, W. Va. Official advertisement will be found elsewhere in this issue.

Wisconsin.

◉Board of Park Commissioners of Milwaukee have awarded the contract for constructing 450 lin. ft. of breakwater for shore protection of Lake Shore Drive to A. F. Bues of the C. H. Starke Dredge & Dock Co., Milwaukee, at $35.95 per lin. ft.

Canada.

✣Bids will be received until noon, July 2, by Department of Public Works, R. C. Desrochers, Secy., Ottawa, Ont., for the construction of a dry dock in the Port of Quebec, and located either at Lauzon or in the estuary of the River St. Charles or on the Beupor flats.



The New and the Old Editions of Gillette's COST DATA Compared

	Section and Subject	Number of words in Old Ed.	Number of words in New Ed.
I	Cost Keeping	34,500	65,000
II	Earth Excavation	12,500	31,000
III	Rock Excavation	16,500	51,000
IV	Roads, Pavements	23,000	128,000
V	Stone Masonry	32,000	33,000
VI	Conc. and Reinf. Conc.	65,000	65,000
VII	Waterworks	12,000	95,000
VIII	Sewers	21,000	84,000
IX	Timber Work	24,000	74,000
X	Buildings	11,000	64,000
XI	Railways	8,000	172,000
XII	Bridges	7,000	144,000
XIII	Steel Construction		17,000
XIV	Surveys	8,500	20,000
XV	Miscellaneous	8,500	37,000
	Index, Preface, Contents	7,500	24,000
	Total for all sections	291,000	1,104,000

The new edition therefore contains nearly four times as much matter as the old and some of the sections have been notably enlarged. For example: Data relating to Roads and Pavements have been increased more than five-fold; Waterworks nearly eight-fold; Buildings nearly six-fold, and Railways and Bridges over twenty-fold. The new edition contains nearly 1,900 closely printed pages. The price is five dollars.

Sample pages and table of contents will be supplied on request.

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Cloth, 4½x6½ inches; 174 pages. Price $1.00 net, postpaid.

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By J. C. L. Fish, Asso. M. Am. Soc. C. E. Associate Professor of Engineering of Leland Standford, Jr., University.
Paper, 4½x7½ inches. Price, 25 cents.

Telephone Line Construction — Methods and Cost

By Clarence Mayer, Formerly Cost Statistician and Facilities Engineer, Chicago Telephone Company. With additional data by J. C. Slippy, Consulting Telephone Engineer.
Cloth, 6x9 inches; 300 pages, 157 tables, 100 illustrations. Price, $3.00 net postpaid.

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By W. Purves Taylor, M. S., C. E.
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Translated by Prof. D. B. Steinman, Department of Engineering, University of Idaho

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Land Drainage

By J. L. Parsons, C. E.

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608 S. Dearborn Street, Chicago

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noo**

PROPOSALS FOR LABORATORY EQUIPMENTS AND SUPPLIES.

City of Fargo, N. Dak.

Sealed bids will be received at the office of the City Auditor of the City of Fargo, N. Dak., until the hour of [illegible] o'clock in the afternoon, of the [illegible] day of June, 1912.

First—For furnishing equipment to filtration plant chemical laboratory and supplies therefor.

Second—For furnishing equipment and apparatus for the chemical and bacteriological laboratory in the Milk and Meat Inspector's office in said city.

Such proposals shall be carefully sealed and plainly marked "Proposals for Filtration Plant Laboratory" or "Proposals for Milk and Meat Inspector's Laboratory," as the case may be.

Each proposal shall be based upon and refer specifically to schedules which will be furnished, upon application, by Mr. F. L. Anders, City Engineer, Fargo, N. Dak., and by Dr. I. L. James, Meat and Milk Inspector, Fargo, N. Dak.

Each proposal shall be accompanied by a certified check in the sum of $500 to insure execution of contract, if awarded.

The successful bidder will be required to enter into contract with the city for such equipment and furnish a bond in a sum equal to the amount of such contract, indemnifying the city against delay in delivery, or materials below grade

The City Council reserves the right to reject any and all bids, or any part of a bid, and to accept any bid or part thereof.

Dated this 8th day of May, 1912.

E. R. ORCAHRD,
City Auditor,
Fargo, N. Dak.

TREASURY DEPARTMENT, OFFICE OF THE SUPERVISING ARCHITECT. Washington, D. C., May 10, 1912.—Sealed proposals will be received at this office until 3 o'clock p. m. on the 21st day of June, 1912, and then opened, for the installation of a heating and ventilating apparatus, etc., for the United States post office and courthouse building at Charleston, W. Va., in accordance with the drawings and specification therefor, copies of which may be had at this office or at the office of the superintendent of construction at Charleston, W. Va., at the discretion of the Supervising Architect

JAMES KNOX TAYLOR
Supervising Architect.

The work will be let either as a whole or in sections, but no bid will be considered for less than one-third of the entire work. Bidders may submit bids for the whole of said work or for one-third thereof. The right is reserved to reject any and all bids.

G. E. SELLERS
Chairman for Board of Commissioners.
THOMAS L. JOHNSON,
Attorney for Drainage District.

OFFICE OF CONSTRUCTING QUARTERMASTER.—Fort Huachuca, Arizona, May 9, 1912.—Sealed proposals will be received here until 10 a. m. June 12, 1912, and then publicly opened, for construction complete of eight inch steel water pipe line approximately eight and one-half miles long. Deposit of $10 required to insure return of plans and specifications. Information on application. J. L. JORDAN, Capt. and Quartermaster, U. S. A.

NOTICE TO CONTRACTORS.

WATER WORKS.

Appleton, Wis., May [illegible] 1912.

Sealed proposals will be received by the Mayor and Board of Commissioners of Appleton, Wisconsin,, until 9 o'clock a. m. of June 5, 1912, and then publicly opened. for the equipment complete of a pumping station, as follows:

A three (3) million gallon filter plant.

One (1) pumping unit of two and one-half (2½) million gallons' capacity in twenty-four (24) hours.

Two (2) pumping units each of two (2) million gallons' capacity in twenty-four (24) hours.

About 13 miles of pipe, hydrants and fittings. Each bid must be accompanied by a certified check for five (5) per cent of the amount of the bid, made payable to the Board of Commissioners.

A security bond, acceptable to the Board of Commissioners, for fifty (50) per cent of the contract price will be required.

The right is reserved to reject any or all bids.

For plans and specifications address the Engineer, C. H. Vinal.

J. V. CANAVAN, Mayor.
JOHN GOODLAND, JR.,
E. SCHUELLER,
Commissioners.

PAVING.

Office of the Board of Local Improvements.

Waukegan, Ill., May 10, 1912.

Sealed proposals will be received by the Board of Local Improvements of the city of Waukegan, Lake County, Illinois, until 8 o'clock P. M., Monday, May 20th, A. D. 1912, at the council chambers in said city of Waukegan (No. 107 Washington Street), for the following improvements, to wit:

Doc. No. 416. Grading and paving Hickory Street from Center Street to Ridgeland Avenue.

Doc. No. 419. Grading and paving Gillett Avenue from Sheridan Road to North Avenue.

Doc. No. 420. Grading and paving Ridgeland Avenue from Sheridan Road to North Avenue.

Proposals must be made out upon blanks furnished at said office and be accompanied by cash or certified check for 10 per cent of the aggregate proposal, payable to the president of said board.

J. F. BIDINGER, President.
Board of Local Lmprovements.
ALVAH L. ROGERS, Secretary.

Sealed proposals for approximately 32,000 square yards of brick paving and two miles of sewers will be received by the city of Rochelle, Ill., until 7 P. M., May 20th, and then publicly opened.

Plans and specifications are on file with the Clerk at Rochelle and in the offices of the AETNA ENGINEERING BUREAU, 17 North La Salle Street, Chicago.

The city reserves the right to reject any or all bids.

Certified check for 10 per cent of bid must accompany proposal.

W. B. M'HENRY, Mayor,
City of Rochelle, Ill.

NOTICE OF LETTING DAIN-AGE CONTRACT.

Sealed proposals for the construon of drainage canals in the Back Swa Jacob Swamp Drainage Distric Lumberton, N. C., will be recei the drainage commissioners of s trict at Lumberton, N. C., up o'clock M. June 12, 1912, and time they will be publicly open read. Each proposal shall be in a sealed envelope and addressed chairman of the Board of D Commissioners of the Back Swa Jacob Swamp Drainage District berton, N. C., endorsed "Prop Constructing Drainage Canals."

Each proposal shall be accomp a certified check, drawn payabl order of the chairman of the B Drainage Commissioners, in the of $1,000; this check to be an evid the good faith of the bidder and held as liquidated damages in c award is made and the contra bond are not entered into p Checks of unsuccessful bidders returned as soon as the award is ide

Specifications and blank forms pro posals will be furnished upon appl a and a full set of maps plans a files may be seen at the office Drainage Commissioners, or at th office of the Attorney for the Drainage Com missioners, at Lumberton, N. C.

The approximate length of these ca is 52 miles, and the approximate yda to be excavated is 1,240,400 cu. yd: The work must be finished within two years from the letting of the contract a the commissioners will require three cas to be operated at the same time.

NOTICE OF RECEPTION OF BIDS.

Notice is hereby given that the com missioners of the First Addition the Rattlesnake Drainage District of Dane County, Wisconsin, will receive propos als for doing the work provided plans and specifications of said trict on and up to the 15th day of May, 12

Copies of the plans and specifi ions may be obtained from Mathias ldas. President of the Board of Commissiers, Deerfield, Wis., or from F. W. Ha Attorney, Room 424 Washington Block fadison, Wis.

Dated April 26, 1912.

MATHIAS LIND
J. H. AUBY,
H. G. CLARK,
Commissio rs.

DEPARTMENT OF THE INTERIOR UNITED STATES RECLAM SERVICE.—Washington, D. C., Ap 23, 1912. Sealed proposals will be receid at the office of the United States Recla tion Service, Malta, Montana, until 2 lock p. m., May 21, 1912, for the constr tion of laterals, waste-water ditches and ructures on the First Unit, Dodson outh Canal, Milk River Project, Montana Th work involves the excavation of a oximately 67,000 cubic yards of materi and the erection of six small structures.

For particulars address the U. S. eclamation Service, Washington, D. C.; elena, Montana, or Malta, Montana.

F. H. NEWELL, Dire r

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

ICE OF RECEPTION OF BIDS.

[illegible] Farst [illegible]

ung the work provided for the plans [illegible]

lent of the Board of Commission-
eerfield, Wis., or from F. W. Hall,: [illegible]
Wis.

[illegible]
J. H. AUBY.
[illegible]
Commissioners.

TION MAIN AND WELLS.

[illegible] and Haven, Mich., until 3 o'clock p. [illegible]

right is reserved to reject any or [illegible]

ns and specifications may be seen at [illegible] Gardner S. Williams, [illegible] ng Engineer, Ann Arbor, Mich., or [illegible]

[illegible] 7, 1912.—Sealed proposals will [illegible] n the 18th day of June, 1912, and opened, for the construction, com- [illegible] g apparatus, electric conduits and [illegible] l States post office at Kingfisher. The building is of one story, base . mezzanine and unfinished attic, and ground area of approximately 3,800 re feet, non-fireproof construction. [illegible] r, Okla., or at this office, at the dis- [illegible]

JAMES KNOX TAYLOR,
Supervising Architect.

PARTMENT OF THE INTERIOR. TED STATES RECLAMATION VICE.—Washington, D. C., April 23. Sealed proposals will be received at ffice of the United States Reclamation ice, Malta, Montana, until 2 o'clock [illegible] tures on the first eleven miles of on North Canal, laterals and waste- r ditches. The work involves ap- mately 277,000 cubic yards of excava- 1,500 cubic yards of reinforced con- , and the placing in structures of 86,- eet, B. M., of lumber.

r particulars address the U. S. Recla- on Service, Washington, D. C.; Hele- Montana, or Malta, Montana.

F. H. NEWELL, Director.

S. ENGINEER OFFICE, Kansas , Mo., April 22, 1912.—Sealed propos- for constructing about 12,000 ft. of dard revetment on Missouri River, t 31 miles below Kansas City, and 3 s below Missouri City, Mo., will be ived at this office until 12 noon, May 1912, and then publicly opened. In- on application. EDWARD H ULZ, Major, Engineers.

NOTICE TO CONTRACTORS.

[illegible] until the 20th day of June, 1912, for the [illegible]

1 Station Building
1 Freight house
1 Engine house.

[illegible] Building, El Paso, Texas.

Separate bids on each building must be in writing, addressed to such Engineer, [illegible] to five per cent of the amount bid, as evidence of good faith, and security for the giving of a Surety Company bond for fifty per cent of the contract price for the performance of the work

[illegible] separate envelope endorsed as such bid and have the name of the bidder written thereon.

The Company reserves the right to reject any or all bids.

[illegible]
ROAD COMPANY.
By H. J. Simmons,
General Manager.

NOTICE.

[illegible] and one-half miles of streets by curbing, grading and paving the same, estimated cost is about $85,000.00, will be received by the Board of Local Improvements of the City of DuQuoin, Illinois, until the 24th day of May at 9 o'clock a. m., 1912.

Plans, profiles and specifications on file with the City Clerk.

E. E. JACOBS, Mayor.

BIDS WANTED.

[illegible] of ditch containing approximately 231,192 cubic yards of earth. Time for filing bids expires May 30th, 1912. For full instruc- [illegible] field, Wisconsin.

U. S. ENGINEER OFFICE.—Galveston, Texas, May 1, 1912. Sealed proposals for constructing concrete sidewalk, brick pavement, concrete curbing and drains at Fort Travis Reservation, Port Bolivar, Galveston, Texas, will be received here until 12 o'clock noon, May 31, 1912, and then publicly opened. Information on application. EARL I. BROWN, Major, Engrs.

A Professional Card
in Engineering-Contracting not only forms an asset to your business — but keeps your name constantly before the minds of our readers—the greater portion of whom have more or less need for professional services.
75 Cents a Week
places you in good company

[illegible]

NOTICE TO BIDDERS.

WATERWORKS IMPROVEMENTS.

[illegible]

Sealed proposals will be received by the City Clerk of Burr Oak, Kansas, until 7 o'clock p. m., May 23, 1912, for furnishing f. o. b. cars Burr Oak, Kansas, the following material and machinery, also for furnishing tools and labor required to construct and install a waterworks system in Burr Oak.

Bids will be opened by the Mayor and City Council the same evening at the Council Chamber and bidders are invited to be present, and to submit bids on the following items:

273 tons of Cast Iron Pipe, sizes 4, 6 and 8 inch.
11,550 lbs. of special castings.
16,000 lbs. of lead.
5,000 lin. ft. 2-in. galvanized wrought iron pipe.
32 fire hydrants.
Miscellaneous list of 2, 4, 6 and 8 inch valves.
50,000 gal. elevated steel tank, complete, including foundations.
[illegible]
2-200 G. P. M. deep well triplex pumps.

Also for furnishing all the tools, labor and material required to construct a circular well, 18 ft. inside diameter and about 60 ft. deep, a pump house 18x32 ft., excavate trenches, lay mains, set valves and hydrants, install pumps and engines and perform all the construction work necessary to install a complete waterworks system.

Complete plans and specifications are on file with the City Clerk, or may be seen at the office of the Consulting Engineers, Goodwin & Harper, 920 Scarritt Bldg., Kansas City, Mo. Bidding blanks will be furnished with the plans and specifications.

Parties desiring separate copies of the plans and specifications for their own use may obtain same from the engineers on the payment of $3.00 to cover cost of blue-prints, etc.

Each proposal must be accompanied by a certified check of not less than 5 per cent of the amount bid, made payable to J. C. Modlin, City Treasurer of Burr Oak, Kans., as a guarantee that the bidder receiving the award will enter into contract with the City and furnish satisfactory bonds within 10 days after the contract is awarded.

Bonds have been sold and the City will pay cash for everything.

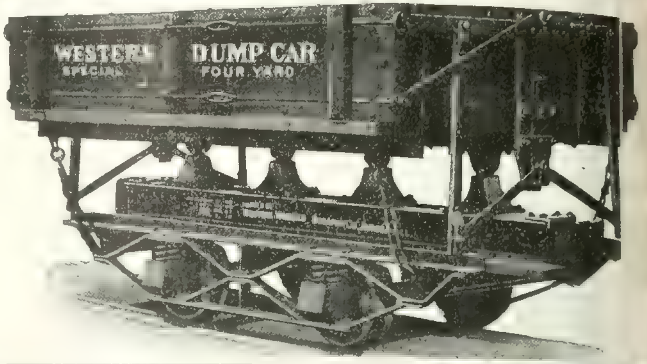
The City reserves the right to reject any or all bids, to waive any informality, and to award the contracts as may be deemed to the best interests of the City. J. W. GREEN, City Clerk.

The STARY For Flushing Sewers
All Sizes **AUTOMATIC**
All Types **FLUSH TANK SIPHON**
(Without Moving Parts)
Let us send you full particulars.
F. STARY & SONS **Cedar Rapids, Iowa**

The Contractor's Dump Car Without a Blemi h

with the ability to do the hardest service is the

Western Special 4-Yard Car



All castings malleable; bed supported by four heavy pedestals and hinges; 20" wheels, forged axles M. C. B. type with collars and large journals; couplers broader and deeper giving greater wearing surface and with yoke attachment; steel I-beam draft beam.

This car has also the celebrated Western features—pivotal doors, steep dumping angle enabling it to be dumped easiest in shortest time, loose hinge construction, two springs over each journal, improved door construction. Not a detail neglected.

Our catalog describes the largest line of dump cars, earth and rock handling machinery made. Write for it.

WESTERN WHEELED SCRAPER COMPANY
AURORA, ILLINOIS

RAILS-RAILS-RAILS

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We have in stock and can make prompt shipment of all weights of No. 1 relaying rails and angle bars. Subject to inspection.

THE HYMAN-MICHAELS CO., Chicago, I
Successors to BLOCK-POLLAK IRON CO., Chicago
Telephone, Central 4799

Bargains in Contractors' Equipment

1 1⅝ yd. Haywood Clam Shell Bucket.
1 1 yd. Haywood Orange Peel Bucket.
1 Lidgerwood Cableway engine, 9x10, Link Motion, D. C., D. D., Drums 33", 1 500 span. 1½" cable, complete with towers and erecting plans.

DUMP CARS

60 Western, 1¼ yard, 2 way, side dump, overhauled, cars.
20 Western 4 yard, 2 way side dump, modern, dia frame cars.
12 Continental, 6 yard A 41, dia. frame, latest type cars, fine.

AIR COMPRESSORS.

1 Ingersoll Sergeant, Class "H C." duplex air compressor, steam 10¼x10, capacity 348' to 100 lbs.
1 Fairbanks Morse, 12x12 compressor with capacity 237 cu. ft. to 100 lbs.

ROCK CRUSHER.

1 No. 3 Style D Rock Crusher Gates.
1 No. 4 Austin Rock Crusher and Screen.
2 No. 5 McCully's Crushers manganese steel head and concaves, nickel steel shaft, with elevator and screens.
1 No. 5 Gates Type D, Rock Crusher, 40"x16' screen, and 48' No. 5 Elevator and Backgear, with extra new eccentric and power plant.
1 No. 6 Style, Type D, Gates Crusher, shop No. 3537.
1 No. 7½ Gates Crusher, Style K.
1 No. 8 Gates Crusher Style D.
1 No. 10 McCully Crusher with 60' elevator and a 60"x25' screen, good as new.

DRAG LINE EXCAVATORS.

2 Heyworth-Newman Drag Line Excavators, 100' boom, 3 cu. yd. bucket, complete.
1 Lidgerwood Crawford Drag Line Excavator, 60' boom, 2 yd. bucket, fine condition.

HOISTING ENGINE.

1 Lambert Page 1½ or 2 yd. full circle, 50 ft. boom, 18 ft. rail circle, 3 drum hoist and boiler and compound swinging engines.
1 American Hoisting Engine, 6¼x10, D. C. D. D., with slowing gear and boiler.
1 Lambert Hoisting Engine, 7x10, with boiler, D. C., D. D.
2 American Hoisting Engines 8¼x10, 3 drums, double cylinder, with independent slowing engines.

LOCOMOTIVES.

1 Porter Locomotive, 36" gauge, 14 ton, 9x14, Dinkey fully overhauled, new cab, A 1.
1 Baldwin Locomotive, 36" gauge, 24 ton, 12x16 Saddle Tank, 6 wheel connected, fair order.
4 Davenport Locomotives, standard gauge, 18 ton, 10x16 Saddle Tank, 4 drivers, rebuilt.

LOCOMOTIVE CRANES.

1 McMyler Locomotive Crane, 4 wheel, M. C. B. truck, standard gauge, boom 33'. 10 ton.
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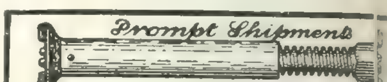

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Volume No. 21. [illegible] May 22, 1912.

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A Correction.

[illegible] May 8 we published [illegible] Proposed Method [illegible] All Portions [illegible] from the [illegible] typographical error the article was accredited to [illegible]e. The author of the paper [illegible] article was taken was [illegible]on, Assistant Engineer, [illegible] and [illegible].

Cements for the Periyar and La Boquilla Dams.

[illegible] construction of the large [illegible] described elsewhere in this issue [illegible] material the American [illegible]dopted the frequent practice [illegible]rs in India in constructing [illegible]n structures of that country. [illegible] very close resemblance, not [illegible]t to the cement used, but in the manufacture, between the work [illegible]d the Periyar Dam built in [illegible]thern India in 1888-97. [illegible]m and La Boquilla Dam do [illegible] The Mexican [illegible]lerably higher, but it is of [illegible]ngth than the Indian struc- [illegible] the use of commercial cem- [illegible]tation from Europe and long [illegible] virgin jungle. At La Bo- [illegible]rtation obstacles are less [illegible]e great enough to make the [illegible]l cements from the United [illegible] expensive. Indeed, with [illegible] the double revolution in Mex- [illegible]be questioned whether the Amer- [illegible] La Boquilla are not [illegible] isolated than were their [illegible]nal brothers at Periyar. [illegible] the conditions existing at the [illegible]with respect to securing cement [illegible]ough alike to make the compari- [illegible]

[illegible]d of making puzzuolan at Peri- [illegible]ribed by Mr. A. T. Mackenzie, Project Engineer, in his "History of the Periyar Project," was as follows: Local limestone was burned in stone and clay kilns and after burning the lime was slacked and stored. Clay molded into flat tiles was under-burned in similar kilns. To manufacture the cement, the tiles roughly broken up were placed in a pan mills with a little water and ground to a fine powder. Lime was then added to this powder by degrees, with more water, and the grinding was continued until a thoroughly mixed and rather sloppy mixture resulted. This mixture was then combined with sand and stone to make mortar or concrete. Except in the detail of grinding the burnt clay, it will be seen from the description of La Boquilla work published elsewhere that the process of cement making at the two dams was closely similar.

The tendency of engineers to resort, on large works separated by difficult transportation routes from the markets, to the manufacture on the job of the cement required is better illustrated, perhaps, by less unique conditions than exist at Periyar and La Boquilla. The construction of cement mills at Panama to supply the canal works was seriously investigated. Later it was proposed to ship the clinker only from the United States and grind the cement on the Isthmus. A government cement mill was built at the Roosevelt Dam and its product was largely used in the dam works. On the Los Angeles aqueduct commercial Portland cement is being ground with volcanic tufa to produce a so-called "tufa cement" for the numerous aqueduct works, and excellent results in quality and economy are claimed by the aqueduct engineers. At the present time the engineers of the Reclamation Service are planning the installation of a plant at the Arrowrock Dam in Idaho to grind sand with Portland cement and to use this mixed but cheaper material for the concrete work.

The choosing of these modified and special cements for the great works named means nothing else than that transportation conditions made commercial Portland cement delivered on the work too costly. The choice of the inferior material, too, is encouraged by the fact that in these massive structures high strength of concrete is not demanded. The fact that a puzzuolan was selected at Periyar and La Boquilla is not precedent for their selection under more favorable conditions with regard to available cement markets. Modified cements in particular have rarely any claim to consideration except where the standard cements are for one reason or another of excessive cost.

A Comparison of Masonry Dam Design and Construction.

A collection of some 40 masonry dam sections is published in another part of this issue. The list of structures described is not exhaustive, but it comprises the great majority of masonry dams of large size and fairly represents the history of practice in these structures. A glance at the various sections and particularly at the group comparison of these sections to uniform scale might easily suggest question of the existence of any science in dam design. Of course, there was none until the middle of the last century. Since 1853 there has been a set of scientific laws of dam design to which engineers have generally conformed. At no time have these laws been definitive, and they are not so now. In a broad way, however, practice has settled down to two general types of sections—the gravity section and the arch section. The Olive Bridge Dam is an example of the first type and the Pathfinder Dam is an example of the second type. Under the conditions assumed both are scientific designs, though one section is as different from the other as two dam sections can be.

The development of the science of masonry dam design is, however, as fully reviewed in the article printed elsewhere as is practicable in the space available in a weekly journal and we need not repeat it here. For the trained designer of masonry dams this review will have little of value, but it is simply and plainly written and can be read understandingly by contractors and others whose special training has been in other fields of work. Contractors probably will note more particularly, however, how the choice of materials for masonry dams recently has confined itself to either cyclopean masonry or rubble concrete. This being the case, it would seem wise to differentiate more clearly than engineer writers are in the habit of doing between these two classes of masonry.

As generally understood by engineers, we think, rubble concrete is concrete of ordinary proportions in which are embedded stones of varying but considerable size. The object of these embedded stones is to take the place of an equal volume of the more expensive regular concrete. The stones have necessarily no regularity of shape nor are they arranged with any regularity except to see that they are spaced at least a certain minimum distance apart and from the faces of the structure. Ordinarily, too, minima and maxima of sizes are specified. The regular concrete is the preponderant material, being seldom less than 75 per cent of the total volume.

Cyclopean masonry is masonry composed of large stones selected with some attention to securing plain surfaces and block-like forms and laid somewhat carefully to reduce interstices between stones. These stones are bedded in and filled between compactly with concrete. Briefly, cyclopean masonry is magnified uncoursed rubble masonry.

If there is a sound distinction of the nature indicated above between rubble concrete and cyclopean masonry it should be defined and recognized in speaking of large masonry structures like dams. There is certainly a distinction between the masonry of the Olive Bridge Dam and that of the Gatun Locks at Panama, though in both structures large stones are embedded in concrete. If the distinction is merely that larger volume and proportion of stone are employed in one than in the other, than where is the dividing line between rubble concrete and cyclopean masonry? Or may it be that both structures are of the same material, but of different grades and two names are unnecessary? We should be glad to hear the opinions of our readers upon these questions.

GENERAL ARTICLES

The Construction of La Boquilla Dam, Mexico: Difficulties Due to Revolution.*

Contributed by Wm. B. Fuller, Chief Engineer, and Member of the firm of Johnson & Fuller, Consulting Engineers, New York City.

La Boquilla Dam, across the Rio Conchos, Mexico, is to be one of the large masonry dams of the world. It will be 79.5 meters (261 ft.) high from the bottom of the heel trench to the top of the parapet, and will retain 69.5 meters (228 ft.) depth of water. its top width will be 5.86 meters (19.22 ft.) and the bottom width of the maximum section will be 61.15 meters (201 ft.) at low water elevation. The dam is curved convex up stream to a radius of 264 meters (821 ft.), and its top length is 256 meters (844 ft.). The maximum section extends lengthways across the stream for about 110 meters (361 ft.). The dam will contain about 300,000 cu. meters (390,000 cu. yds.) of masonry. The reservoir formed by the dam will have a capacity of about 99,090,000,000 cu. ft. and will flood an area of 58½ square miles.

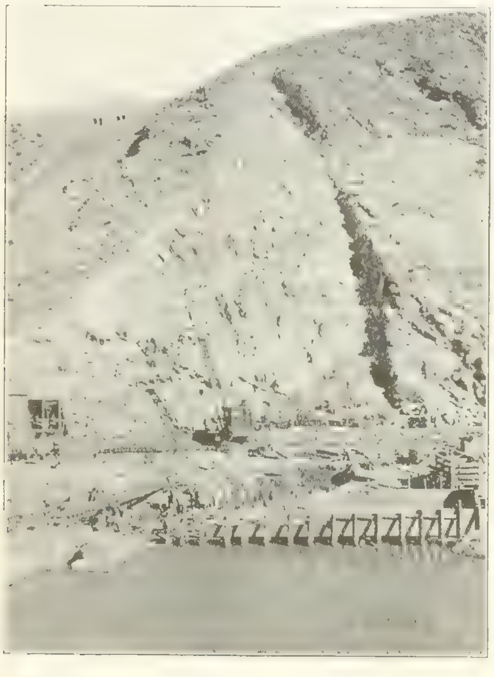


Fig. 1—View at Site of La Boquilla Dam Showing Excavations for Keying Dam in Mountain Side and Commencement of Excavation in El Rio Conchos.

Work on the foundation of the dam was started in the fall of 1910, but owing to failures of cofferdams and to difficulties in building them to withstand the heavy floods no masonry was laid until March, 1911. The cofferdams were again destroyed by flood after only a small amount of concrete had been placed and before the deeper part of the excavation had been made. On top of this damage came the first revolution, and work was entirely stopped for several months, and masonry work was not again started until November, 1911. Since then the work has steadily continued and the masonry is now well above all ordinary heavy flood elevations.

The foundations to a level above ordinary high water are built of concrete made from Portland cement, a very well graded river sand, and graded gravel or graded crushed limestone of a maximum diameter of 4 ins., all mixed in Smith mixers in the proportions of 1 : 1¾ : 6¼. Concrete instead of cyclopean masonry was used in the foundations, as it was easier to handle, did not require an extensive plant, and could thus be started without delay and secure results while the permanent plant was being installed, speed being an essence of the undertaking. This turned out to be a very fortunate choice, as the second revolution, still in progress, has greatly delayed the completion of the permanent plant, but has not materially stopped progress.

It is the intention to build the bulk of the dam with cyclopean masonry similar to that first used at the Boonton Dam in New Jersey, using blocks of limestone up to 10 tons in weight set in Portland cement concrete mixed in the proportions 1:2¼:7¾. Four rapid Lidgerwood cableways and eight derricks are partly installed for this work. The cableways are to place concrete during the day and furnish stone to the derricks at night. The derricks will place the stone in the concrete during the day. All power used on the work is electric and all transportation is by electric locomotives.

A subsidiary dam in addition to the main dam above described is being built to prevent overflow at a low gap between two hills about ⅝-mile from the main dam. This dam is to be 795 meters (2,610 ft.) long, and its maximum section will be 33 meters (108 ft.) high from the bottom of the heel trench to the top of parapet, and retains 22 meters (72 ft.) of depth of water. An earth embankment will be placed against the down stream face. The masonry portion is now half finished and consists of one-man limestone blocks laid in a hydraulic lime mortar made at the site of the work from burnt clay and burnt limestone. The proportions of the mortar are 1 part powdered burnt clay, 1 part powdered lime and 3 parts sand. This character of masonry is rather new on this continent, but is particularly well adapted to the labor and political conditions of Mexico, and its value will be enlarged upon in another article.

About 2.5 miles from the main dam a spillway 3,280 ft. long will be built at another low gap between two hills, but no work except preliminary borings has as yet been started at this place.

The political conditions of this country have added greatly to the troubles of engineering and construction. In May, 1911, occupied by the then rebel forces who was at that time superinten struction for the contractors ca being lined up in front of a firi having brought in and concealed to arm the men in camp. La was practically abandoned and n again until peace was restored, els of that time became the Fe day. On Feb. 1 of this year a rection broke out against the erals and this party, known as so far gained full ascendency The transition from Federal t thority has, however, caused a c of worry on account of the up methods of communication to su as to have practically cut off a the rest of the world and preven any supplies for the last three the end is not yet in sight. F anticipation of trouble, heavy been laid in of most of the nece such as cement, dynamite, coal abling construction to be conti speed with the intention of c work by July, 1913.

The Federals were in contr March 15, when a battle occur

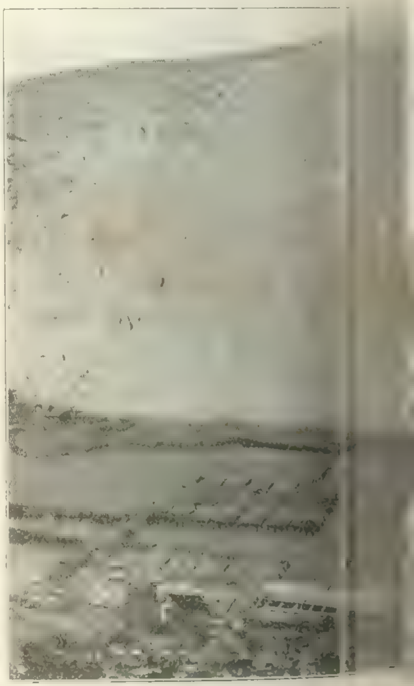


Fig. 2—View of Cofferdams at Dam.

camp between the Liberal and Fe The drafting office, dining room were used as forts during vario the battle and the window pane a beautifully studded with ... one man, mortally wounded, was ... kitchen, two were killed under

---

*As rumors have it that work is stopped at La Boquilla Dam, the writer desires to correct any such impression and to state that a full force is working night and day.

Fig. 3—View Showing Electric Transportation and Cars.

..., and several were found d in the railroad yard. While unded man to the camp hospital, "gringos," including the general of the contractors and the trapped between the fire of both nall adobe house used as a lab- vere under incessant rifle fire for The battle lasted seven hours, time probably 40,000 shots were ns killed and about 25 wounded. the work was going on happened!

Bouston is general superintendent r the contractors, S. Pearson & treal, Canada, who are doing the work on a percentage basis for Northern Power Co. This com- sented locally by the Compania . Shirley C. Hulse is Assistant charge of construction of La B- Messrs. John R. Freeman, Fred- rns and Isham Randolph have d with this work as consulting on general features of the pment and construction work.

ing information is taken from rt of W. H. Wilson, engineer lington, Vt., water filtration rtition separating the chemical from the operating floor has cted, which protects the switch iboratory apparatus from the

Showing Balls of Clay Drying Out Before Being Burned and Ground to Make Puzzuolan Cement.

n of the bleach. Windows uilt in the darker portions of eries and the brass pipe which olution of aluminum sulphate

[illegible] chemicals. A comparison of the operating results of 1910 and 1911 shows a decided increase in the efficiency of the plant. In 1910, 94.7 per cent of the bacteria in the raw water were removed by filtration. B. Coli were found in four samples and the average amount of aluminum sulphate used was 1.06 grains per gallon. In 1911 there was a decrease to 97.1 per cent of the bacteria removed from the raw water, no trace of B. Coli was found in 1,813 samples of filtered water.

Fig. 5—View of Mills for Mixing Lime and Burnt Clay Dust for Making Puzzuolan Cement.

Effects of Age Upon the Ultimate Strength, Modulus of Elasticity and Yield Point of Concrete in Compression.

The influence of age upon the ultimate strength, modulus of elasticity and yield point of four kinds of concrete was determined in a series of tests in 6-in. cubes and 8 ins. diameter by 16-in. cylinders which are reported by the U. S. Bureau of Standards. Altogether 333 cubes and an equal number of cylinders were tested. These cubes were made of granite, limestone, gravel and cinder concrete and were tested at ages of 4, 13, 26 and 52 weeks.

Ultimate Strength.—The tests show conclusively that the concrete increased uniformly and substantially in ultimate strength from the age of one month to the age of one year and that at the latter age the increase was still continuing. Roughly, this increase in strength during the year was 68 per cent. The results in detail are shown by Table I.

Modulus of Elasticity.—The tests show that the modulus of elasticity of concrete increases with age. A reunited concrete shows the smallest increase 5 per cent from 4 to 26 weeks. Circular concrete increased 32 per cent from 4 to 26 weeks and about half this amount from 4 to 13 weeks. Gravel shows scarcely any increase from 4 to 13 weeks, but a substantial increase of 14 per cent from 4 to 26 weeks, while for limestone there is an increase of 6 per cent from 4 to 13 weeks and a 20 per cent increase at 26 weeks over the results at 4 weeks.

The actual values are in all cases, except the cinder concrete, fairly high and while it should be remembered that the concrete did not rest for any length of time under load before the micrometers were read (about one minute per 100 lbs. per sq. in.), yet the moduli are not as high as would be the case if based on elastic rather than gross deformations.

Yield Point.—It has already been indicated that for stresses below the yield point the gross deformation curve for concrete in compression is sensibly a straight line. Even beyond this point many curves follow this line for a considerable distance, so that a constant modulus of elasticity can be assumed for these concretes up to a unit stress considerably in excess of the yield point. Table II shows the percentage variation of the average curves, from the

TABLE I.—PERCENTAGE OF INCREASE IN ULTIMATE STRENGTH OF VARIOUS KINDS OF CONCRETE BETWEEN AGES OF ONE MONTH AND ONE YEAR.

	4 to 13 wks.		4 to 26 wks.		26 to 52 wks.	
	Cubes.	Cyls.	Cubes.	Cyls.	Cubes.	Cyls.
Cinder	19.4	34.7	27.5	22.4	15	9.4
Limestone	.30	44.5	32.8	[illegible]	9.8	16
Granite ...	32.5	....	37.6	...	...	73.4*
Gravel	18.3	...	2.1	...	...	65*

*From 4 to 52 weeks.

TABLE II.—VARIATION OF THE AVERAGE DEFORMATION CURVE FOR A LOAD 1.5 TIMES YIELD POINT.

	Cinders		Granite		Gravel		Limestone	
Age, in week.	Load, lbs. per sq. in.	Variation, per cent.	Load, lbs per sq. in.	Variation, per cent.	Load, lbs. per sq in	Variation, per cent	Load, lbs. per sq in	Variation, per cent.
4	750	[illegible]	1,350	5.3	1,500	5.2	1,050	5.3
13	750	4.5	1,950	3.1	2,250	3.1	2,100	5.0
26	1,350	5.2	1,650	2.1	1,800	3.0	1,500	4.2
52	1,350	3.7	2,700	4.4	2,250	3.2	2,400	6.5
Average		4.0	....	3.7	.	3.6	....	5.4

straight line for an assumed unit stress 1.5 times the yield point.

An examination of the above percentages the percentage variation from a straight line is shows that, even for such high unit stresses, relatively small.

In every case the yield point increases from 4 to 13 weeks and for the granite and cinder continues to increase up to 52 weeks. Although the modulus of elasticity of the gravel and limestone increases from 13 to 26 weeks, the yield point seems to decrease, indicating that while the initial part of the curve at 26 weeks is steeper than at 13 weeks, yet it turns from the straight line at a lower unit stress.

In only one instance, namely, the four-week tests on cinder concrete, does the range fall below 500 lbs. per square inch. It would seem, therefore, that the assumption of a straight-line stress gross-deformation diagram for concrete in compression is permissible for all average concretes of the proportions and ages given and is certainly warranted for all the stone and gravel concretes herein reported.

Methods of Constructing and Placing Reinforced Concrete Sets in Sinking Shafts for the Ahmeek Mining Co., Michigan.

For a number of years solid concrete and reinforced concrete shaft collars and shafts have been used at the Michigan copper mines where the conditions warranted a shaft of any degree of permanence, but not until 1909 was reinforced concrete tried as a substitute to take the form and similar methods of installation as the long-used timber sets for shaft purposes; namely, at the No. 3 and 4 Shafts of the Ahmeek Mining Co. The methods adopted for constructing and placing these sets are described in a paper by Mr. E. R. Jones before the Michigan College of Mines Club at Houghton, Mich., Feb. 25, 1912, and we take the following data from this paper:

In the beginning, two distinct kinds of material were used; a good grade of gravel and natural sand from a local pit; and the trap rock, through which the shafts were sinking, together with clean conglomerate sand from the C. & H. Mill. Sets were molded from these two classes of material and installed with equal partiality and subsequent service has proven both to be equal to the demands made upon them. Pieces set aside for the purpose were allowed to season sufficiently that they might be given a fair competitive test, and it was found, on comparing the fractures in the two combinations of material, that the sand and cement filling the spaces between the rounded pebbles broke away from them, while the fracture in the trap-conglomerate same combination continued through the larger elements of the mixture. The gravel mixture could doubtless have been improved considerably by careful washing, but the cost of preparation, compared with the trap rock and conglomerate sand, prohibited its use in this particular case.

The materials finally used were as follows: Portland cement; conglomerate sand, and trap rock trommeled over ¾-in. through screens. The proportions used were 1:3:5 in wall plates, end plates, and dividings, and 1:2:4 in studdles. The reinforcement in wall and end plates consisted of three ¾-in. Monolith steel bars with ¼-in. webs, crimped onto them, together with two straight ¾-in. Monolith bars. The dividings were reinforced by four ½-in. Monolith steel bars wound spirally with ¼-in. steel wire, the whole presenting a column with square cross section. Studdles were reinforced with two pieces of old wire rope 1¼-in. in diameter. Reinforced concrete slabs were molded for the shaft lining, the material used being fines of trap rock under ¾-in., conglomerate sand and Kahn expanded metal as reinforcement. The mixture used for slabs was 1:2:4.

In the molding of the concrete sets, 2-in. No. 1 white pine was used in the construction of the forms. These were soaked in Delaney's wood preservative, and repainted with preservative on the interior each time before setting up, thus insuring them against warping and prolonging their lives indefinitely, as well as securing a smooth and easy parting from the concrete when removed. A Smith barrel type mixer was employed in preparing the charge for the forms. The amount of water used in the mix was such that, when the batch was piled, it settled rapidly without agitation. A dryer mix was attempted by way of experiment, but due to the amount of reinforcement employed, it was found impossible to ram the dryer mixe into place.

The labor involved in the making consisted of two carpenters, setting up forms and keeping them in repair; one man wheeling forms onto skidways ready for filling, returning used forms to shop and cleaning the same; one man feeding mixer from stock piles of rock, sand and cement; one man delivering mix to forms and shoveling material into place; and one mason ramming charge into final position. With this combination of men as many as four complete sets, consisting of 64 separate pieces, have been molded in one day of nine hours. In ordinary weather, the sides of the forms were allowed to remain in position over night, and then removed, while the bottoms were left in place another 24 hours. The bottoms were removed by turning the pieces on their sides, where they were left to harden one day longer before removal to the stock pile. All through the process of removal, the sets were handled with the greatest care in order to preserve the appearance of the set and prevent cracking, which might not develop to the eye until weathered. All skidways used in making and storing were brought to a level to prevent warping and bending while the sets were green, to insure a perfect fit underground, for unlike timber, the concrete set cannot be brought to place unless perfectly true. Sets should not have been used under 60 days after removing forms, although we, through the reduction of the stock piles, have been forced to install pieces of 14 days set, but the greatest care was observed in handling and putting in place underground. Concrete sets one year old, which have been subjected to all manner of weather, can be abused somewhat and handled almost as carelessly as timber.

As before stated, the above mentioned sets were made for the No. 3 and 4 shafts of the Ahmeek Mining Co. The shafts are of the three compartment variety—two skipways and one manway, dipping at an angle of 80°. The outside dimensions of the compartments are: Skipways, 7 ft. 6 ins. high, 6 ft. 10 ins. wide; manway, 7 ft. 6 ins. high, 3 ft. wide, with the end plates and dividings, making the greatest span of 7 ft. 6 ins. Offsets were molded in all plates 5 ins. from the inside face to accommodate lining slabs. Also, holes were cored for the use of hanging bolts and bracket bolts. The wall plates, end plates and studdles have a cross-section of 80 sq. ins.—dividings 81 sq. ins. The percentages of reinforcement are approximately as follows:

	Per cent
Wall and end plates..	[illegible]
Dividings	[illegible]
Studdles . . .	[illegible]

It was found advisable from the beginning, because of the great weight of the wall plates, to mold them in two sections, one section spanning the ladder way, and on skipway, a the other section spanning the maining sk compartment. These two secti s were co nected when in place by two olts passin through holes, cored for the pu pse, and tw straps of iron spanning the s ce. Studdle were made for 4 ft., 5 ft., an 6 ft. sets t accommodate the ground passe through

The weights of the different ces ing the set are as follows:

Long section of wall plate.....
Short section of wall plate....
End plate ....
Divider ....
3 ft. 3-in. studdles...............

Complete set of 16 pieces.... ..

Taking the weight of No. western fi which has been exposed to the wither in piles, as 33 lbs. per cubic f, concrete set weighs almost the ti of a 12x12-in. timber set whic the set is intended to replace. B additional weight of the concr found necessary to increase the six men on the timber gang to ve ber. In a vertical shaft, to whic th sets are especially adapted, the m per gang might again be reduce T hung or built as the ordinary ti er requiring an additional rope and the pieces in place. After the s to line, bottoms are put in betwen and the surrounding shaft wall nd then tied to the shaft wall by ea crete, in the proportion of 1:3: slabs are then put in place, thrown behind them, filling up remains between the set and t shaft.

After the set is in place, it is portant that it be well prote d blast, for, unlike the timber se not stand the blast. For th writer used flat timber and stee to the under side of the plates and even this precaution was quate. Where the ground was the sets have been as near as miners, and again, when the g pecially refractory, sets 40 ft. have been cut out. It is obv well to keep as far behind the ground will permit. In dang which required timbering close ing, timber sets were used, but played an important part in t ground was met in which conc not have been installed. W seven men, one complete set in a nine-hour shift. This per ts a rate of better than 100 per mon, wh accomplished at the No. 3 and sha

The comparative cost of th conc and timber set, delivered at t is striking. The concrete set for $22.50, the timber set for $37 ures are based on:

Western fir at $28.00 per M
Crushed rock at [illegible] cts. per yd
Conglomerate sand at 60 cts. shaft.
No. 1 Portland cement at $1.15 r bbl., works.
Reinforcement at $12 per set, f. b factor

More than 50 per cent of th water sup of the City of St. Paul, Min is The figures as given in the 191 epor Water Commissioner are as fo connections, 31,554, and meters number of meters set last year as it is expected that a larger num r will be stalled in 1912.

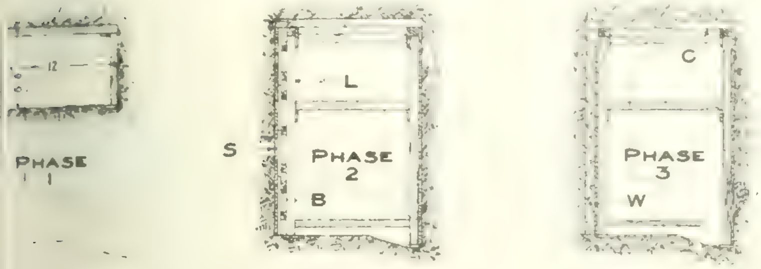
A recently isued bulletin of he High Department of the Missouri Ste Board Agriculture gives the followi as aver costs of maintaining macadam avement various places:

London (city streets).........
Paris (city streets) ....
Boston (city streets) .. . .
Belgium (country roads)........
Austria (country roads)........
France (country roads)..... ..
Bavaria (country roads)..... .
New York (state roads).. .. ..

ARTH AND ROCK SECTION

of Constructing the Beacon Rapid Transit Tunnel, Boston, Mass.

on Hill Tunnel of the Boston Subcently been completed. This is a tunnel in soft ground. The methd in constructing the tunnel are re from information contained in of the Boston Transit Commission The work was carried out in two n 1 and Section 2. The former, ct to Patrick McGovern, was be-, 1909, and completed April 6, 1911. under contract to Coleman Brothgun Sept. 8, 1910, and completed



howing Sequence of Operations in Constructing Beacon Hill Tunnel, Boston Subways.

—This section was about 1,873 ft. ting a flat-roofed section of about s west end, Section 1 has an ex- of about 32 ft. and a height of The structure is built of conrced with steel where required. t. of the west end of the section s out toward the approach of the bridge over the Charles River, was in open cut. The remaining porstructed with a roof shield. The ress from the time the shield was Sept. 24, 1910, when night work nued was 7.33 ft. per day. After e daily average was 4.4 ft. The of work done consisted of 52,371 earth and 16,592 cu. yds. of conforce employed averaged 150 men shift and 150 men for the night he night shift was discontinued tion of the shield work. After were employed at night until the vas discontinued on Oct. 23, 1911. l encountered in Section 1, conrd, sandy, blue and yellow clay mixed with numerous stones and a few boulders, and occasional pockets and veins of sand. The earth became harder as the easterly side of the hill was reached, and light charges of dynamite were used to facilitate excavation after the shield was beyond private buildings.

Section 2.—This section extends 614 ft. from the end of Section 1 to the terminal station. It is entirely under Boston Common. The section includes a three-platform station, located under a portion of the existing Park St. subway station and Boston Common with entrances and exits at Tremont St. and also through the present subway station. The structure is mainly of concrete reinforced with steel rods. In a portion of the station steel posts and I-beams with concrete are used. The first 212 ft. is a single arch bell-mouth; the next 172 ft., comprising about one-half of the station, is a double arch, and the remainder has a flat roof.

Owing to the depth below the surface of the Common, and to prevent injury to trees, it was decided to build the west half of the section by tunneling. Shaft No. 1, 18x41 ft., was sunk near the west end of the section, from which headings were worked. The shaft was 65 ft. deep, that being the depth of the invert of the tunnel below the surface of the ground, and also the deepest part of the section. The site of the shaft was selected on account of its being near the Beacon Street Mall, the only part of the Common over which teaming for the work was allowed by the contract. It was also thought well, for the sake of the store occupants, to defer work on Tremont St. until spring so as to minimize the interference during cold weather with the areas under the sidewalks which connect with the store basements. An agreement therefore was made with the contractor not to begin work on Tremont St. before April 1, 1910, in consideration of which he was allowed to sink shaft No. 2, 18x12 ft., near the middle of the section, on the Common, which enabled him to work double the number of headings for tunneling; the station and approach tunnels being driven between shafts by means of a series of drifts.

The material excavated from shaft No. 2 has been hoisted in buckets to the surface and conveyed by an overhead belt on a trestle to hoppers near shaft No. 1.

For a distance of about 56 ft. west from the terminal point, the open cut method of excavation was necessary for the reason that the roof of the chamber for a connection with the proposed Riverbank Subway comes within a few feet of the surface of the ground.

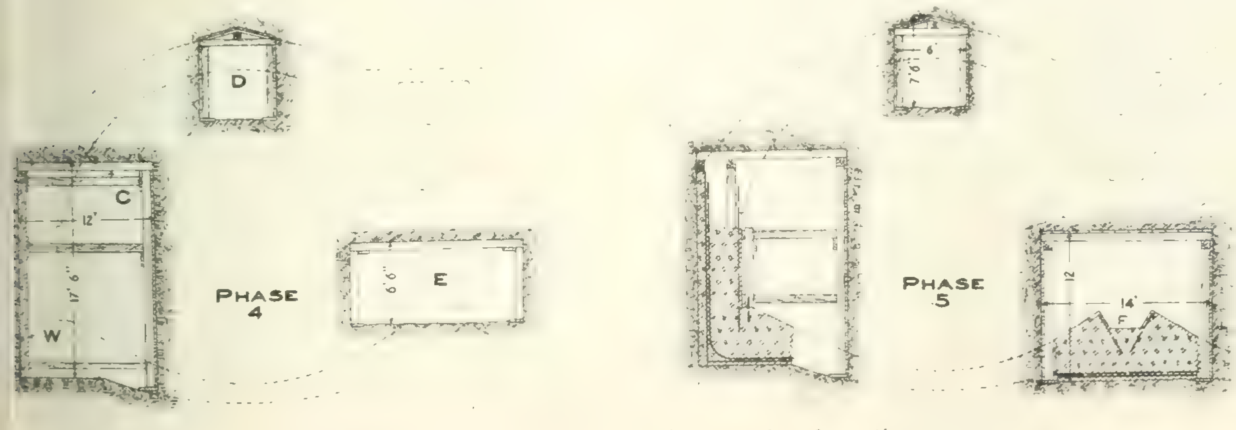
All of the earth from this open cut, or about one-sixth of the entire excavation of this section, has been carried away at night through the old subway, in trains of the Boston Elevated Ry. Co.

The following, with reference to the accompanying illustrations, describes the method of removing the earth and the successive stages in placing the concrete forming the double arch portion of the tunnel:

At the west face of the open cut before mentioned, drifts or headings were started at each side line of the tunnel and were run parallel to the center line, phase 1. After an upper heading had been advanced 15 or 20 ft., a lower heading was commenced and carried after the upper one—see Phase 2.

The material was taken out of the headings by picking and shoveling and wheeled in barrows to the shafts. The leg *L* was placed carefully to line, at a given distance from the digging line, and the sheeting *S* against the earth was kept in place by firmly wedging in the blocks *B*. When the concrete back wall *W* was ready to be placed the blocks were knocked away, loosening the sheeting which was then moved into the position shown in Phase 3 to make the forms for the back wall in the proper place without rebracing. After the concrete back wall had become sufficiently strong the caps *C* were supported on its top, the legs were removed, and the drift was braced directly against the face of the back wall—see Phase 4. At the same time that side-wall drifts were being advanced, drifts *D*, one at the crown of either arch of the double barrel section, were being advanced from the open cut end; also the drift *E* was being excavated on the center line of the tunnel, followed by a lower drift, *F*, shown in phase 5. While these drifts were being advanced westerly from the open cut, corresponding drifts running easterly were being advanced to meet them from Shaft No. 2. Phase 5 also shows the concrete side walls and the concrete footings in place for the center columns.

A narrow drift in which to place the steel center columns and girders was made over the center drift shown in phase 6.



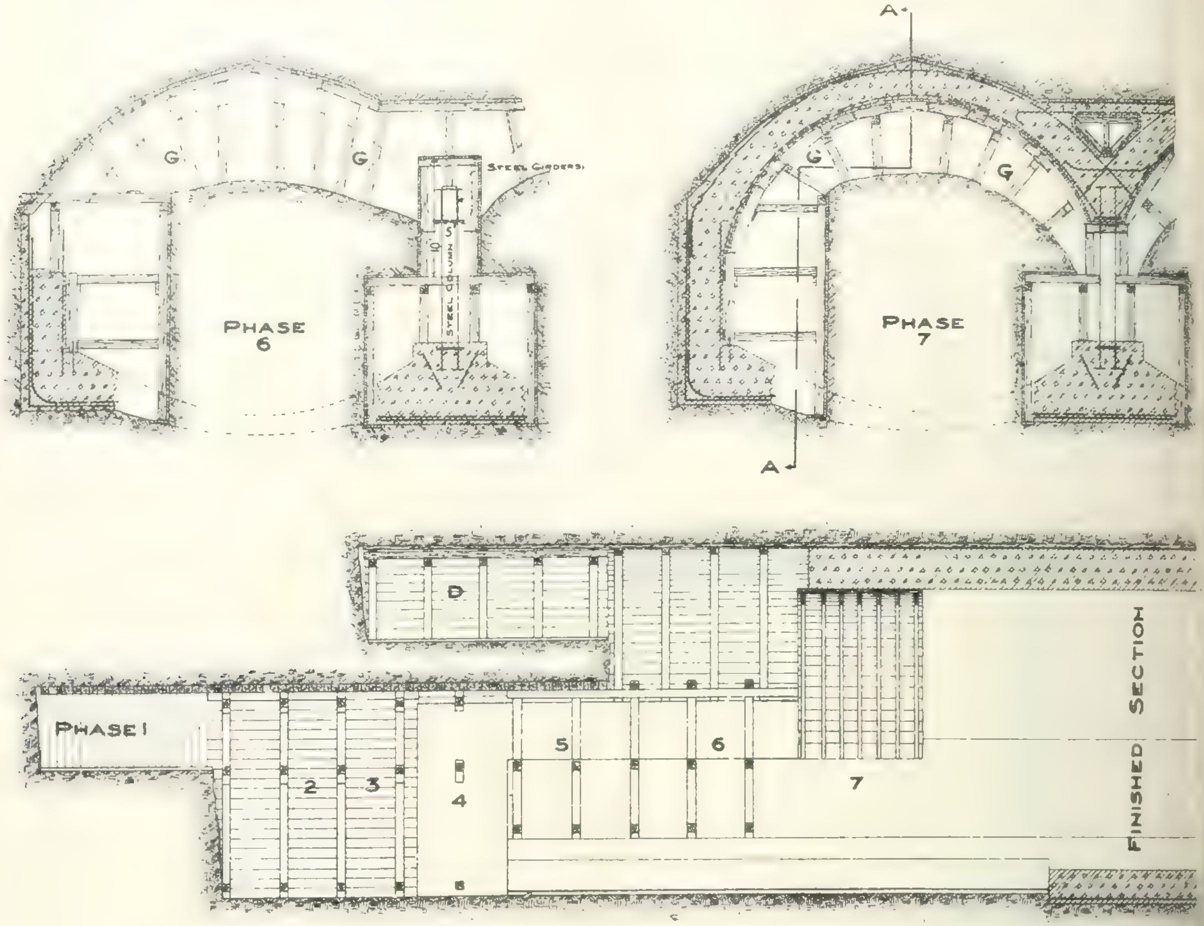
Sketches Showing Sequence of Construction Operations.

From the crown drifts cross-cuts *G*, about 5 ft. wide, were dug in both directions, at right angles to the center line of the tunnel, until they met the tops of the side and center drift, respectively. The tops of these drifts conformed to the outside of the arch roof of the completed tunnel. Phase 7 shows the forms for the concrete arch and the arch in place. Finally, the core was removed and the invert was built, thus completing the section.

The single arch was constructed in the same way, there being only the side drifts and the center crown drift with connecting cross-cuts.

The dates of beginning the work on Section 2 were Sept. 8 and Sept. 30, 1910, for excavation and concrete work, respectively. On June 30, 1911, 38,000 cu. yds. of excavation had been accomplished and 10,000 cu. yds. of concrete had been placed. There were 135 men ordinarily employed on the day and night shifts.

The material encountered on this section has been very hard sandy clay with small stones. There have been a few pockets and narrow seams of sand, some of them water bearing, but in such small quantities as to offer no serious difficulties. No rock has been found. A few small boulders have been encountered, the largest of which measured only a cubic yard.



LONGITUDINAL SECTION
ON LINE A-A
Sketches Showing Sequence of Construction Operations.

Texas Water Works Convention.—The convention of waterworks superintendents and city officials held in Temple, Texas, on May 7 effected permanent organization by the election of the following officials: President, Pat Bracken of Temple; five vice presidents, T. J. Howell of Fort Worth, R. L. Johnson of Houston, H. L. McDuffie of Sherman, Thomas Cronin of Palestine, E. C. Bartholomew of Austin; secretary-treasurer, E. L. Fulkerson of Waco. Fort Worth was selected as the next meeting place. Constitution and by-laws were adopted.

Methods of Constructing the Rondout Pressure Tunnel of the Catskill Aqueduct.

The Rondout tunnel of the Catskill aqueduct is a rock tunnel constructed from eight shafts. Methods of shaft sinking in earth were described in our issue of May 1, 1912, and methods of shaft sinking in rock were described in our issues of April 12, 1911, and May 8, 1912. The tunnel proper is through Hudson River shale and Shawangunk grit, the latter being a very hard conglomerate of quartz pebbles cemented with silica. The methods of driving the tunnel are described here from a paper by Mr. Lazarus White, Division Engineer, before the Society of Municipal Engineers of New York.

TUNNEL SECTIONS.

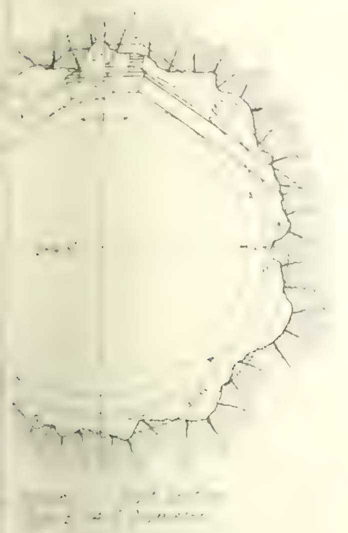
To correct disputes over excess breakage "limit lines" were adopted for all Catskill aqueduct tunnels beyond which no payment for excavation would be made. Referring to the section, Fig. 1 payment is made to the *B* line in any case, although it is possible to save by careful driving in good rock about 8 ins. around the perimeter. The *A* line is a dead or clearance line, the *C* line, 5 ins. outside, giving the desired effective thickness of lining. In rough rock, if points of rock only are allowed to touch the *A* line, the desired effect will be accomplished. In a closely-driven shale tunnel the excavation may very closely approach the *C* line, in which case the contractor would be paid for more than he takes out, but he is felt to be entitled to this for his careful work. In case of excessive breakage outside the *B* line, he is not paid for this excavation, but only for excess concrete, at a fixed price of $3 per yd. As this will not yield a profit, it is not to the contractor's interest to break outside the *B* line. It was felt that the adopted payment lines would be fair to both parties, and this has been the experience so fa
driving was sought for by both
and the contractor on the Ro
After each shot, the face of th
carefully painted in red, the *C* l
From this the heading boss or
laid out his holes. In additio
was trimmed just behind the fa
found to have a very good effe
ing. Cross-sections by means
flower" were taken about eve
plotted in pencil on cross-sectio
were shown frequently to the
Locations of "collars" and "
were also made from time to t
on the cross-section to show
were drilled.

In this manner very accurat
obtained, the contractor savi
in excavation and concrete. F
Bonticou grade tunnel, 3,400
856 yds. over *B* line excavati
ever, was very close work, an
that, ordinarily, the contrac
much over the *B* line.

METHODS OF DRIV

The ordinary American top-
was used. This method is
stood and is in such general u
try that it is hard to impro
economy and speed. During
November, 1909, in the sou
Shaft No. 7, an average of 48
and bench was made in Huds
This was considered the best
for this class and size of tun
on the Wallkill Siphon, in 1
methods, where 523 ft. was m
holes were placed in the he
side and 10 trimming holes.
10 and 12 ft. deep, side ho
deep. Bench holes were 4 ft.
to a row. All holes were 1
cut holes were fired first an
holes. Three shifts of drille

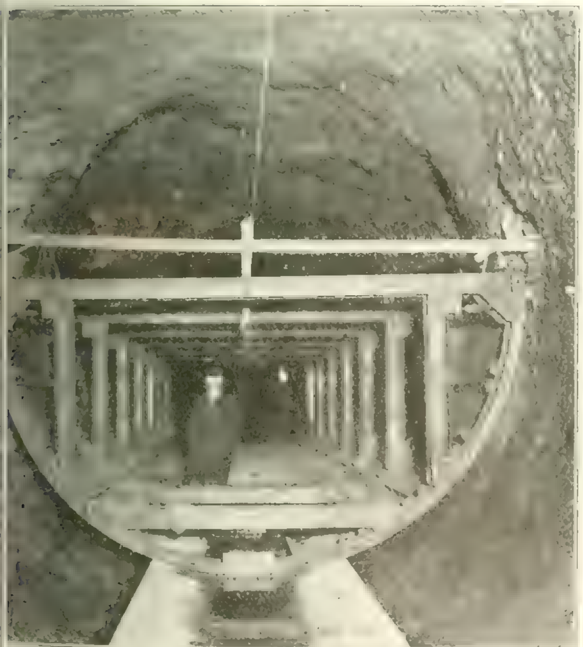
ork, each drilling and [illegible] ing. The drilling force consisted ly foreman, 6 drillers, 6 helpers . Mucking proceeded with the force for each of three shifts



tion of Tunnel Showing Lines ng Payment for Excavation, Rondout Tunnel.

1 foreman, 6 shovelers in head- arrow men, 6 shovelers on bench and drivers. In most cases only s were made per day in shale, rock only one advance. The progress during heading was

mpts have been made to improve rican top-heading method, but it writer that, with a good organi- hard to better. It is true that heading method, as used in s to great progress, as much as ing been driven in hard rock in



-View Showing Invert and Steel Forms Placed for Side Walls, Rondout Tunnel.

n Switzerland. Enormously large n are used, however, the number rtered at a portal being 4 or 5 ny as are employed in this coun- with the high speeds and low the cost per foot of tunnel driven is much greater. This, perhaps, is proper for [illegible] of the question for the ordinary American tunnel. With the progress now common to [illegible]

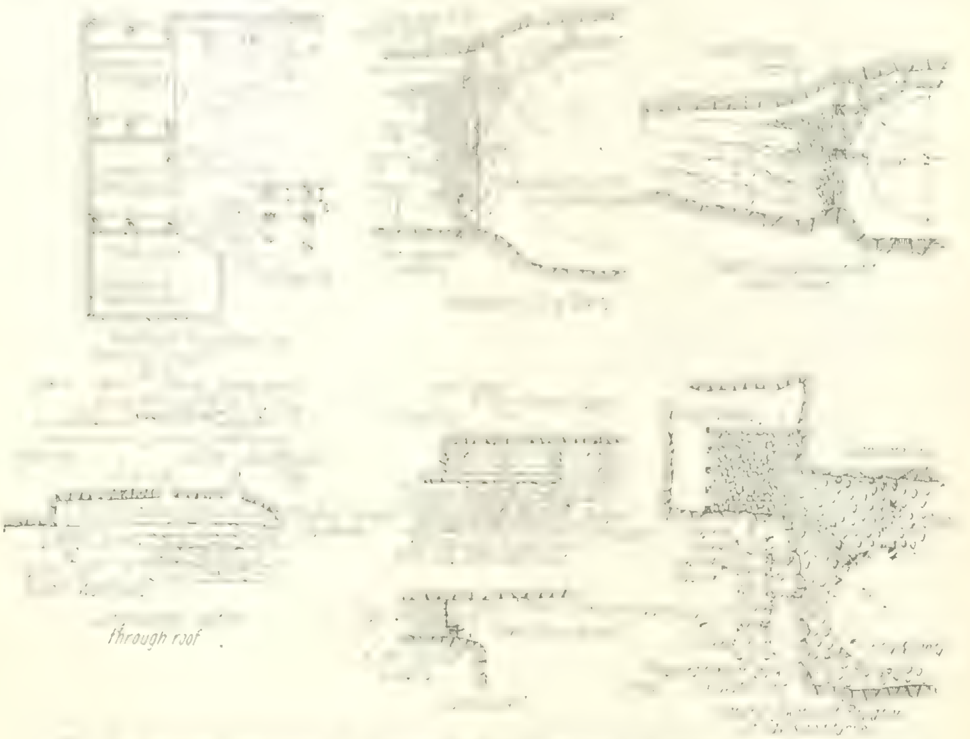


Fig. 2—Various Methods of Concreting and Grouting Seams, Rondout Tunnel.

month) it takes but a few years to drive a tunnel several miles long.

The bottom-heading method has been used to some extent on several short tunnels of the Catskill Aqueduct. As there used, it is not the Swiss method, but rather the reverse of the ordinary American method. The lower half is excavated as heading, and usually holed through before the top is taken out. A moving platform is erected, upon which the drills are set to drill the top, using holes nearly parallel with the axis of the tunnel. The top heading being shot down onto the platform, the muck is shoveled into cars below through trap doors. This has the advantage of saving the bench mucking and shoveling upward into cars, as in the ordinary method, but has the disadvantage of having the platform to bother with, and the increased cost of drilling all horizontal holes. Besides, if there is any ground needing support with timbers or steel, the bottom heading is dangerous or becomes very expensive. Undue risk must be run or timber first set up taken out, or, as an alternative, the very expensive fan-shaped system used in Switzerland adopted. Carrying the heading through is economical in short tunnels, but not where the heading is of unavoidable length (say 1,500 ft.), as the bench can be carried along with proper organization without materially holding back the heading. Fixed and overhead charges, which are high in tunnels, have to be borne for a much shorter period for the combined heading and bench method.

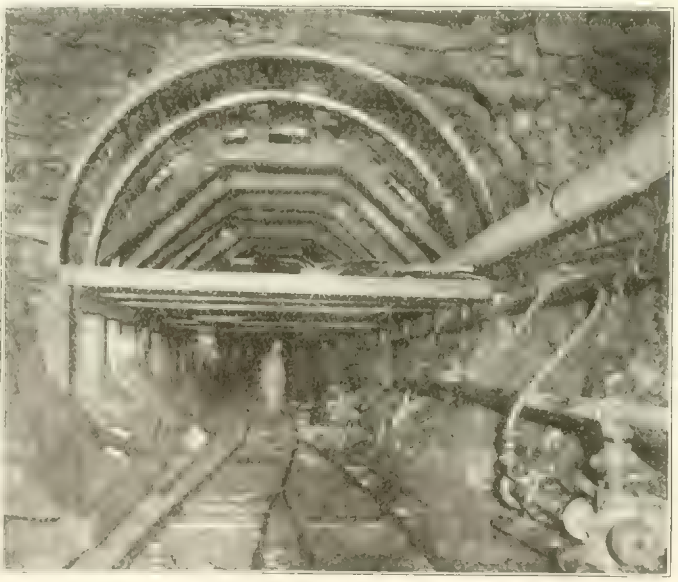


Fig. 4—View Showing Steel Lagging Supports and Temporary Timber Bracing Supporting Heavy Ground, Rondout Tunnel.

The Shawangunk grit and some beds of Helderberg limestone, particularly the top flinty bed (Port Ewen), proved difficult to drill, taking three shifts of drillers to make one advance of 7 ft. This cut down the progress to less than 200 ft. per month. In shale rock, usually two advances per day would be made to one in grit. It was found to be difficult in the hard rock to trim with

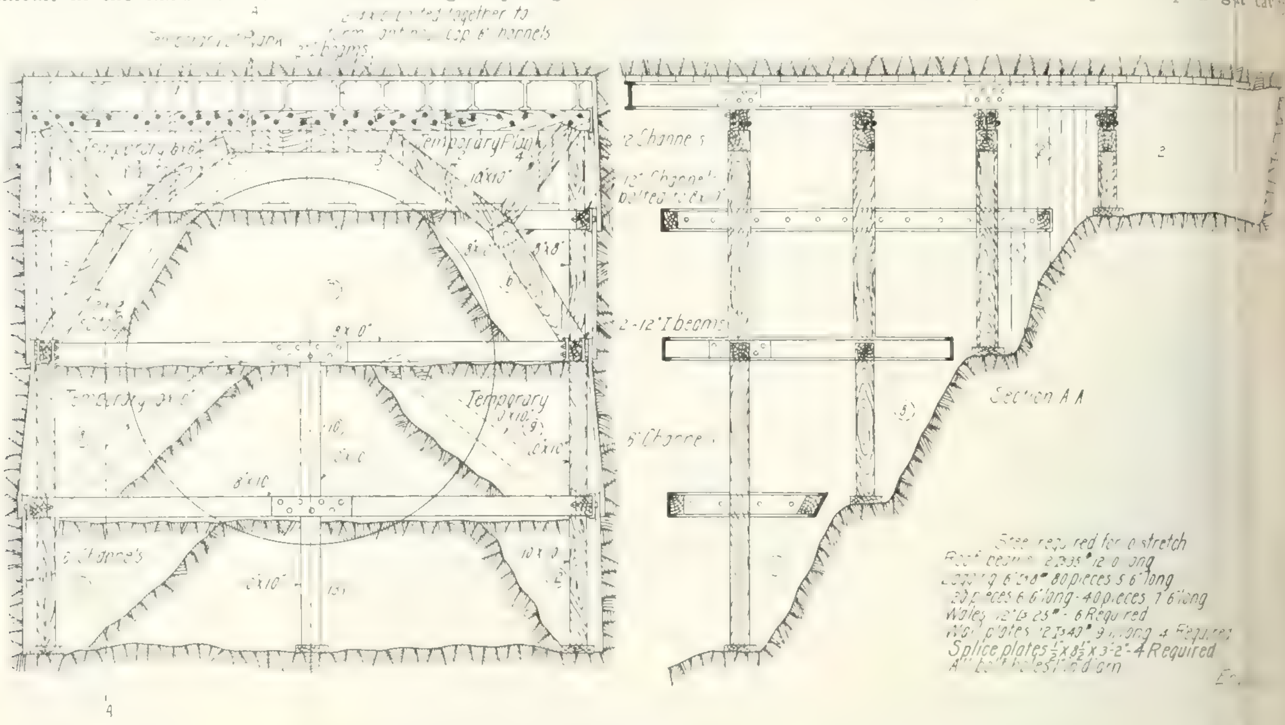

Temporary Plank
12" Channels
2-12" I beams
Temporary
6" Channels
Section A A
Steel required for a stretch
Splice plates 1/2" x 8 1/2" x 3'-2" - 4 Required

Fig. 5.—Method of Tunneling Broken Ground, Rondout Tunnel.

jap drills, so an effort was made to get the tunnel to shape in the first instance. This, as before stated, resulted in the tunnel being driven a little larger in these hard rocks, but this could not be objected to, as trimming was found to be very expensive and slow, particularly in the grit.

Tunneling in Difficult Ground.—The first stretch of heavy ground encountered was that between Shafts No. 4 and No. 5, just below the contact of grit and shale. Here, by faulting, the Hudson River shale was loosened from the overlying grit, and its level beds caused a heavy load to be brought upon the first temporary timbers placed. Fearing that it would be difficult to remove these timbers previous to concreting, they were taken out and the structural steel of the contract drawing placed, but this proved inadequate to carry the load of 20 to 30 ft. of loosened rock, and the steel ribs began to buckle. This was soon caught up by temporary timbers supported by hitches in the rock walls. The steel bents will be carried by longitudinal I-beams, which are to be placed just before concreting.

Soon after the above occurrence, heavy ground was struck south of Shaft No. 3, at Station 587+50, after penetrating 2.150 ft. of Helderberg limestone. This rock proved to be here much shattered by faulting, and consisted of large, irregular limestone blocks, separated by clay seams, some of them water-bearing. One clay seam proved to be many feet wide. Conditions here are shown on one of the sketches of Fig. 2. For the reasons stated above, a new design for structural steel roof support was prepared at the Division office. Before this could be fabricated, in order not to interrupt timbering operations, temporary timbers were placed in this bad ground by carefully excavating at roof level with top heading, supporting the roof by temporary wooden poling. See Fig. 4. Arch bents were so placed as to allow of the replacement of wooden lagging, etc., by steel, in accordance with methods shown on Fig. 5. The contract specified that no wooden lagging, etc., should be left back of the concrete lining, as it was feared that the heavy internal pressure of the tunnel, when in service, would compress the wood and crack or rupture the concrete.

The method of tunneling through heavy, broken rock, as shown in Fig. 5 was designed to meet the difficult conditions where the rock was too shattered and broken to support itself, and yet was hard enough to prevent the driving of poling boards in advance. This is accomplished by the use of a few different lengths of steel channels and I's and wooden timber bents. The principle is to expose as little roof as possible and immediately catch it up with supports and gradually widen the top heading to the full width desired, then to deepen and put in wall plates, and then trench to subgrade. The plan shows a full section supported, but it can be used to support only a part of the roof or sides, in case the remainder is self-supported. As used on the Rondout Siphon, there never was occasion to

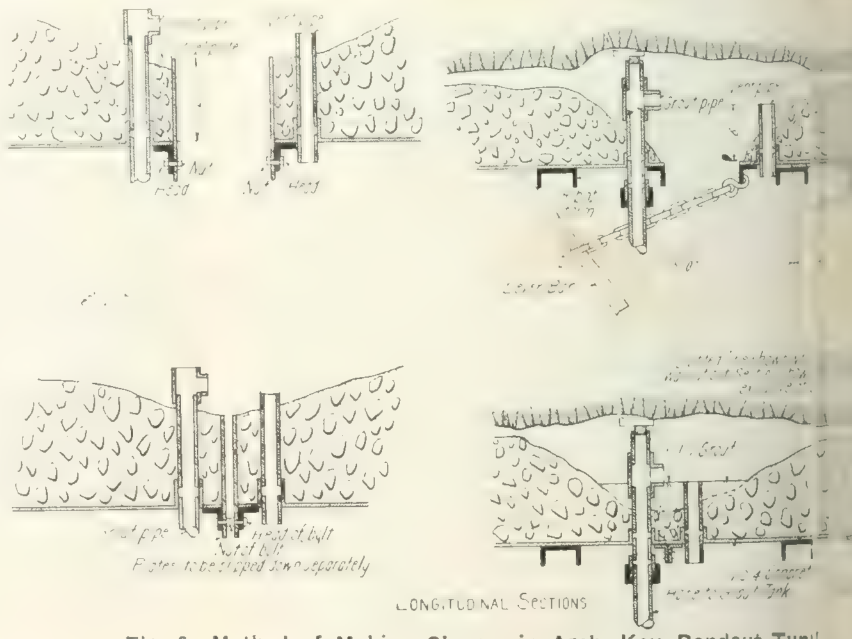


Fig. 6—Method of Making Closure in Arch Key, Rondout Tunnel. Tamping Machine.

use the full section. In one case the roof and a portion of the sides was supported; in another the sides only.

At Station 590+78 a great overthrust fault ground up much limestone and opened a bed to solution, forming a considerable cave, which was subsequently silted up by fine clay with some glacial sand washed in from the surface. This was in spite of the fact that the elevation of the tunnel here is —100 and the lowest point of gorge nearby is sea vel. Near t fault, the rock became blocky and wet were tapped and exposed. pilot driven ahead, showing solid ck. less, a shot opened up a g t cav with soft clay to the left, and ground stream was seen heavy limestone bed. The pilo to penetrate the sound roof this heading was well advanc No. 4, it was shut down in t heavy pumping there would h water. This proved to be the mud seam was supported by th in Fig. 5, and successfully succession of minor clay-filled were passed. Some of these into the roof, as shown in Fig. one of these nearly overwh working in the heading, buryi der a mass of soft clay. T cleaned out gave no further ways driving a top heading roof of the old cave as the r nel, although several feet high, was safely removed. The cla was held by steel lagging.

ass this ground by bottom head-
, great quantities of timber sup-
have been necessary, and the work
been very hazardous. Luckily the
Shaft No. 4 was 150 ft. below
(Elevation 250) and the great
umping there lowered the ground
rwise the difficulties experienced
een much greater as a little more
t have caused great quantities
ow in from the seams and caves.
ment of the sections at the bad
lug the seams, etc., with sufficient
of concrete to bridge over the
equate grouting behind will ren-
ion safe against internal pressure

driving of the experimental tun-
discovered that a great saving in
ation and concrete could be made
ree-piece timbers in moderately
d, placing them in the ordinary
n and taking them out in advance
ete. (This is $30 to $40 cheaper
bout 10,000 lin. ft. of the roof on
Siphon was thus supported, most
s been successfully removed. It
how strong this simple type of
and how well the hitches hold
bly shale. This is because the
end to press outward, instead of
The timbers are usually placed
ringing line of the tunnel arch,
t and sidewalks can be concreted
are removed. The timbers are
with small charges of dynamite
them. This brings down what-
ock is above and makes scaling
e Wallkill Siphon, the timbers
t down by attaching to them the
hoisting engine and pulling the
By using longitudinal I-beams
ary timber bents, rather heavy
be successfully and economically
end of the I's being concreted in
r supported on bents not yet re-
s method was suggested to pass
h was feared would scale too
support was even temporarily re-

THE TUNNEL

ete in the tunnel was placed for
rposes: (1) to prevent leakage
m the tunnel; (2) to present a
the flow of water and
of head from friction. Since the
ng was to be put in, it had to be
h to withstand the outside pres-
nnel was empty. A circular
ed as being the most econom-
17-in. average thickness of lining
l.

ar section presented new problems
on. Most circular tunnels con-
e had been of small cross-section,
gth, and mostly lined with brick.
for this tunnel would necessarily
y, and the work of moving and
up a big item of expense to the

ginally intended to place concrete
ler each rib of the forms and
le circular section of concrete
n. This was tried and found
ve. The contractor then devised a
, which proved very adaptable to
t down the cost, and increased the
his method, which is given below,
lowed in nearly all the pressure
on the aqueduct. The con-
ed in three stages: 1st, invert;
: 3d, arch.

fter cleaning all muck from the
inuous wooden forms were placed
invert strip. These side-boards
a radial line, tied together with
eaders, and braced down. They
equal to the average required
concrete lining. The concrete was
either by dumping directly from
wheeling in barrows from a
ard at the forward end of the
concrete was allowed to run out
he side-boards. When the forms
he concrete was shaped up roughly with a shovel, and as it stiffened, was worked to the required curve by use of screeds and trowels. The 5 ft. width of invert was adopted. as it gave sufficient width for a carriage for the upper forms, and did not have enough to rise to make screeding particularly difficult. The progress per day varied from 75 to 250 ft., depending mainly upon getting the bottom mucked out and the forms set up. The concrete was all placed by the day shift, the other two shifts being used on mucking and forms. A section of the invert is shown in Fig. 3.

Side Walls and Arch.—After the invert had been placed, the side wall and arch forms were erected on a carriage, which ran on the invert concrete. The forms were of steel, semi-circular, and for use either on the lower or the upper half of the tunnel. Their special features consisted of lagging panels and a collapsing turnbuckle at the springing line, by which they could be pulled ahead for a new setting. The special feature of the carriage was the bevel wheel used, which fitted the curve of the invert. A small hoisting engine furnished the power for pulling the forms ahead. These forms had a space between the springing line braces and the invert sufficient for a mule and a car of concrete to pass through to the adjacent forms.

During the first seasson's work the side wall concrete to the springing line was first placed, and after a section of the tunnel side wall between adjacent shafts had been completed, the forms were reversed and the same stretch of arch was completed. In this method, forms 40 to 80 ft. in length were used for the side wall and were filled in from 8 to 12 hours. In the arch, 40-ft. lengths were used, and were filled in 24 hours. By the first method, the side wall concrete was placed very cheaply and good progress made, but the keying of the arch was very expensive and slow, owing to the small number of men actually placing the concrete, compared with the number engaged in getting the concrete to the form.

During the second season, the arch form was set up, trailing the side wall form. In this case, the arch form was filled up to the key and the side wall form filled to springing line while the key was being placed. This lined 40 ft. of tunnel per day, gave a finished job as it progressed, and saved a great deal of labor of moving inclines, track, etc. An incline was used in all cases to get the concrete from the invert to the platform at springing line level. A small air hoist pulled the cars up the incline to the platform. The concrete was dumped from side-dump Koppel cars onto the platforms and shoveled into the forms. All lagging panels were left in place on the side wall forms and about halfway on the arch. The rest of the arch panels were added as the concrete was placed. Radial boards were placed next the key-plates and the concrete banked up above these as steep as it would stand. The key concrete was then placed as fast as possible. These boards were not placed for the first 10 ft. of form, as this much of key could be placed while the remainder of the form was being banked up. Practically all except the key concrete was shoveled directly into place by the men standing on the platform at springing line. The key concrete was shoveled onto a temporary platform, about 3½ ft. above springing line, and shoveled from there into the arch.

All concrete was mixed on the surface at the top of the shaft in revolving Smith or Chicago Cube mixers, dumped into Koppel side-dump cars of 1-yd. capacity, lowered on the shaft cages, and hauled to the placing point by mules. The track for hauling was laid on the finished invert. Three forms were generally placed in each working stretch, and each form was then concreted every third day. One incline was used for each stretch, it being mounted on a car and transferred from form to form as necessary.

Materials Used in Concrete.—The concrete was generally mixed in the proportions of 1 cement, 2 sand and screenings, and 4 crushed stone. The cement used was Giant and Alpha, and was rather slow-setting. The sand was of good quality, having less than 1 per cent of vegetable matter, and was well graded. It was obtained from a sand-pit near Shaft No. 5, and was either carted or conveyed by tramway to the shafts. The stone was obtained from quarries opened up near the line of the tunnel, and was all Shawangunk grit. All stone over ¼ in. was used as stone, and the rest was run in with the screenings. The sand and screenings were mixed for fine aggregate, from 30 to 50 per cent of the total being screenings.

The concrete was mixed plastic for the invert and arch, and wet for the remainder of the work. The wet concrete could not be used in the invert because of the circular bottom, and only in the first 8 ins. or so of the key, as it could not be rammed into place. A cross-board about 8 ins. high was used over the key-plate, so that the 8 ins. of concrete covering the plate could be placed very wet and form a tight connection at the radial joint. This side wall concrete and all arch concrete, except the key, was placed wet, kept level, and well worked and spaded. Keys for water-stops were placed on all longitudinal and vertical joints except the radial joint at the key. The concrete in the arch was rammed as tightly as possible against the rock, and grout was used later to fill the space left by the shrinkage of the concrete away from the rock.

Care of Water in Concreting.—The one object sought for in concreting the pressure tunnel was to so take care of the water coming in that it would cause a minimum amount of damage to the concrete and lead to no porosity, which would let the water out when the tunnel is under pressure. To take the heavy internal pressure great pains were taken to place the concrete in contact with solid ledge, and all loose pockets of rock were cleaned out, and in seamy rock the section was increased. Secondly, rich and wet concrete was used, it being found feasible to use a very wet mixture, thoroughly worked, throughout the entire circumference of the circular tunnel. The body of the concrete, well worked in level layers and carefully keyed up as described, showed very few leaks. Wherever water percolated and showed as springs in the rock, it was carefully led through the concrete by means of pipes. Seams were calked so as to lead the water through pipes, and wet areas protected by sheet iron drip pans, the low points of which were drained by pipes. Even a slight seepage was taken care of in this way, as it was found that any neglect in this respect would lead to the water gradually working its way through the green concrete porous areas. By carefully providing for all water and seepage in this way, surprisingly good results were obtained, the concrete in very wet areas being fully as good and as tight as elsewhere.

The greatest problem was met north of Shaft No. 4, where, in a distance of about 250 ft., there are innumerable leaks, amounting in the aggregate to 1,000 gals. per minute. In this place a special protection for the concrete lining was devised by Mr. Wait. Steel ribs were erected upon longitudinal angles. Bedded in the invert concrete on the ribs, the plates are placed shingle-fashion and erected as the concrete progresses. It is expected that 2 ft. of good concrete can be placed under the protection of this steel. Subsequently, after the lining on each side of this structure is placed, the section will be grouted, the water being then quiescent.

Grouting.—At all wet areas and springs pipes were placed to lead off the water and prevent injury to the green concrete. These pipes served a double purpose, as they were subsequently used for grouting. Pipes were also placed leading to all pockets which might not be thoroughly filled with concrete. In addition, every few feet, pipes were placed, some of them to the highest point of the tunnel roof, to serve as "vent pipes"; others, shorter, to serve as "grout pipes."

During the first concreting of the arch, in every section of arch concrete (about 45 ft.) a cut-off wall of concrete was carefully placed at a low point in the profile, or the arch was [illegible] at the end of a day's work. This was as specified for the purpose of grouting short stretches of arch under pressure. In every case where possible concrete was placed solid to the roof, dry packing being used only for exceptionally high places. It was realized that the settling of the green concrete away from the roof would leave plenty of grouting space, and that dry packing was unnecessary for this purpose.

The contract provided that the grouting was to be done up to a pressure of 300 lbs. and for this purpose Westinghouse high-pressure air pumps were used to raise the normal pressure on the air lines, also Canniff tank grout machines. To get quick service, the Westinghouse pumps and a battery of two or three Canniff grouting machines were mounted on a car, together with necessary piping, etc. The tank machine has no rotating parts and is very quick in action, being stirred and discharged by compressed air.

It was soon found that the cut-off walls did not "cut-off," and that grout passed them rather freely, probably going through small fissures in the rock next to the concrete and between the concrete and the rock. After attempting to fill a few sections, using the cut-off walls, which in no case served their purpose, low points in the rock profile of roof were picked out and filled with grout, using pressures as low as 50 lbs., it being found that higher pressures threw the grout too far and discharged too much air over the arch. After these stretches were set, the intermediate spaces were filled, using the low pipes until the highest ones overflowed. The high pipes were then cleaned, so that the last remaining spaces could be grouted under pressure. It was found that the pipes which opened to the rock below the top of waterway did not connect and could be grouted individually under higher pressures, but usually took little more than necessary to plug them. This was due to the settling of the green concrete, which tends to pack against the rock below the top of the form and to shrink away above this level. It was found difficult to hold the grout under pressure above the arch, as the transverse joints, which occurred every 45 ft., had opened slightly, and leaked considerably when placed under pressure. This was rather unexpected, but it is not so much to be wondered at, as the concrete while setting probably rose to a temperature of over 100 degrees, while at the time the grouting was done (winter of 1909-10) it had fallen to about 50 degrees—enough difference to account for the opening found. The grout was usually mixed 1 cement to 1 very fine sand, by volume, the sand being of great aid in plugging joints and preventing the undue running of the grout. Even the 1:1 grout seemed to run freely for hundreds of feet, when first placed, so that almost any pipe leading to the top of the arch could be used for grouting and no sharp distinction between grout and vent pipes was necessary.

Great care was used in grouting the stretch between Shafts No. 5 and No. 6 (2,500 ft.), and the work was gone over several times until finally there remained no spaces to be filled with grout. Some of the high pipes were opened up repeatedly and re-grouted. The vertical joints in the wet stretches, despite every effort, still leaked slightly. Grout pads were used and holes drilled into them, grout pipes placed and attempts made to fill the joints. In very few cases did any grout leak through the body of the concrete, and these were in sections placed too dry at the beginning of the work. None of the wet, dense sections of concrete was penetrated by the grout.

In the next stretch grouted, between Shafts No. 7 and No. 8, advantage was taken of the experience gained between Shafts No. 5 and No. 6, and a very simple system of grouting adopted. The machines were started at Shaft No. 7 and the grout driven ahead, the normal pressure of 100 lbs. in the air mains being reduced to about 50 lbs. by a diaphragm reducing valve. The isolated pipes below the top of the waterway were plugged with grout, as the plant used pressures up to 250 lbs. A few of the high pipes in the arch were opened and grouted, also at high pressure, but these took comparatively little grout. In this way rapid progress was made and the results were good.

Some sections of arch were cut into and the dry packing and space over the arch were found to be thoroughly filled. The set grout, 1:1 by volume, was found to be somewhat stratified, but nevertheless fairly ing 134 lbs. per cu. ft. The s Shafts No. 5 and No. 6 took lin. ft. of tunnel, and that No. 7 and No. 8 the same. Th was found to have 59 per cent took grout.

Conclusions.—Grouting is bel dispensable and invaluable for of work; nevertheless, various upset, the main one being that the cut-off walls the tunnel co in short sections (about 50 ft pressure, the space behind the rapidly filled with liquid grou to penetrate into all crevices, rock so that the ground water reach the lining, which, by this a surface coat to provide a sm Again, it was not found that pressures could be used to m nor do we believe that these much circulation of grout in th rock, merely plugging the ho seams. This rather upset the tunnel would be tight indepe concrete lining, under the su all the porous spots in the ro would be imperviously filled wit the transverse joints proved some, preventing the placing of able body of liquid grout under persistently leaking in the we grouting, instead of being a pregnation under pressure, prov a silting-up process, the grout fi back of the lining and the vo packing with sand and cement, up springs leading to the vent probably be carried into the tr by percolating water and grad up. I do not believe the grou the ground water from reachin lining, which, after all, must b liance in keeping the water out nel is empty or when in serv reason, the concrete arch shou ably thick, so that the men ca work behind the forms. Ten t of rich, dense concrete, placed rammed in level layers, with all grouted, will prove in time ver joints ought readily to silt up.

ROADS AND STREETS SECTI

Some Costs of Gravel and Macadam County Aid Roads Built in Wisconsin in 1911.

The following matter was condensed from papers presented by County Highway Commissioners at the First Annual Road School of the Wisconsin Highway Commission, and published in the form of a leaflet by the commission. The costs given are for surfacing only, the grading and culvert work having been done by the towns. No cost for machinery used other than cost of operation is included.

Brown County.—During year 1911, 8½ miles of stone road were constructed at an average cost of $2,043.17 per mile, and 5½ miles of gravel road at an average cost of $1,095.30 per mile. On account of difference in length of haul gravel roads varied in cost from $796 per mile to $1,318 per mile. Broken stone road was built for $1,764.96 per mile where stone was loaded into wagons from bins at the crushers, while another mile cost $2,880 due to railroad freight and the most of unloading stone from cars into wagons. Average cost per cu. yd. of crushed stone delivered on road was $1.38. Average cost per cu. yd. of gravel delivered on road was 87 cts.

Columbia County.—Twelve miles of macadam and gravel road 9 ft. wide were built during 1911. Quarry chips laid in a trench to a depth of 6 inches before rolling were used for a foundation. This is stated to have made a good foundation and saves cost of crushing. Crushed local limestone was spread on this foundation to a depth of 4 or 5 ins., rolled thoroughly and bound with screenings and water. The average cost of the macadam road was $1,891.20 per mile.

The subgrade for the gravel roads is made the same as that for macadam roads. Unscreened gravel to a depth of 12 or 14 ins. is spread on this foundation and the larger stones raked into the bottom. The average cost of gravel roads was $963.20 per mile. Gravel roads were not sprinkled.

Dane County.—Average cost of roads (all 9 ft. wide) built in 1911:

Material	Miles built	Av. loose [illegible]	Average haul, miles	Cost per mile
Crushed field stone	[illegible]	[illegible]	1¼	$2,640
Crushed quarried limestone	[illegible]	[illegible]	1½	2,430

Average cost all work $2,480 per mile. Figuring 1,500 cu. yds. to the mile, crushed field stone cost $1.76 per cu. yd. in place in the road and crushed quarried limestone $1.62 per cu. yd. Probably 15 per cent of the total yardage of the latter was used uncrushed in the shape of quarry chips.

Door County.—Roads built of unscreened stone, relying on travel to compact the same gave exceedingly poor results. Later screened stone was used but in a dry season the large stones worked to the top, which drove traffic to the sides of the road. Since 1909, the subgrade has been trenched and larger stone, placed in the No. 2 stone placed on these a courses have been made from 4 thoroughly rolled and bound and water. All work has been tract. In the town of Sturgeon 9 ft. wide, was built in 1911 $1,196 per mile; 1,127 cu. yds. at 85 cts. per cu. yd. were used or at the rate of 1,325 cu. yds mile. In the town of Egg Har 9 ft. wide, were built in 1911 $1,116.45 per mile; 2,032 cu. y stone at 80 cts. per cu. yd. were piece, or at the rate of 1,328 cu The towns did the grading but furnished crusher and roller to did the work complete at the a

Grant County.—The contra work done in this county rang to $3,200 per mile for roads va ft. to 14 ft. in width. They ha built with a 6-in. foundation broken stone and surfaced with of so-called "branch" gravel. R der the day labor system were materials cost as follows:

Stone in place at quarry.
Quarrying ....
Crushing ..... .
Hauling ..... .
Spreading . .
Some sub-grade work is include
costs.

[illegible] roads built in this county [illegible] ,736 per mile.

[illegible] Most of the roads built [illegible] were 9 to 10 ft. wide [illegible]

Miles built 1911.	Material	Cost per mile.
1.00	Stone and gravel	[illegible]
1.60	Gravel	[illegible]
1.53	Stone and gravel	1,026.03
1.00	Stone	
1.00	Stone and gravel	2,226.00
0.5	Stone and gravel	[illegible]
1.56	Stone	[illegible]
0.75	Gravel	[illegible]
2.00	Stone and gravel	[illegible]
1.00	Stone and gravel	[illegible]
0.75	Stone	[illegible]
1.50	Stone	

County.—Cost of quarrying, ma- labor for crushed stone about 75 d. in the bin. Hauling cost about d. per mile of haul from quarry eading, 5 cts. per cu. yd. Rolling, yd. Sprinkling, 5 cts. per cu. yd. five hundred cubic yards of stone [illegible] for the 10 ft. road. W [illegible] aul of one mile, the cost amounts cu. yd., or $1,725 per mile, and or each mile increase in average rd asphalt binder cost $600 per bout 2 gals. of binder were used f 10-ft. road. This is the cost of It is estimated that the cost of [illegible] that of [illegible]

County.—During the year 1911, re built new or resurfaced. All done by the county and is includ- ading work was rather heavy and aged $500 per mile including cul- of the costs were: Average cost [illegible] $0.62 per lin. ft. or $3,274 ximum cost of a 9 ft. road was ft. or $3,854 per mile. Minimum ft. road was $0.48 per lin. ft. or le. Average cost of resurfacing a as $0.36 per lin. ft. or $1,900 per [illegible] per cord for quarried Average cost per cord for crush- ng to road, $2.20. Thus the total 93 per cord, or about $1.46 per [illegible] kept on a ½-mile haul showed ut 15 cts. per cu. yd. for hauling. cost of hauling stone three miles r cu. yd. and the average cost of rs into wagons was 18 cts. per average delivered cost per cord ed stone from contractors was [illegible] per cu. yd. for spreading ing and preparing subgrade was when 50 cu. yds. per day were when 80 cu. yds. were delivered 22 cts. per cu. yd.

[illegible] Average cost per mile for [illegible] estimated, $254 [illegible] per mile for materials and labor. [illegible] cost of road complete to town ,124. The average cost of ma- [illegible] follows:

	Per cu. yd.
[illegible] one delivered for crushing	$1.04
crushed rock f. o. b. cars at [illegible]	1.0[illegible]
of gravel at pit	0.35

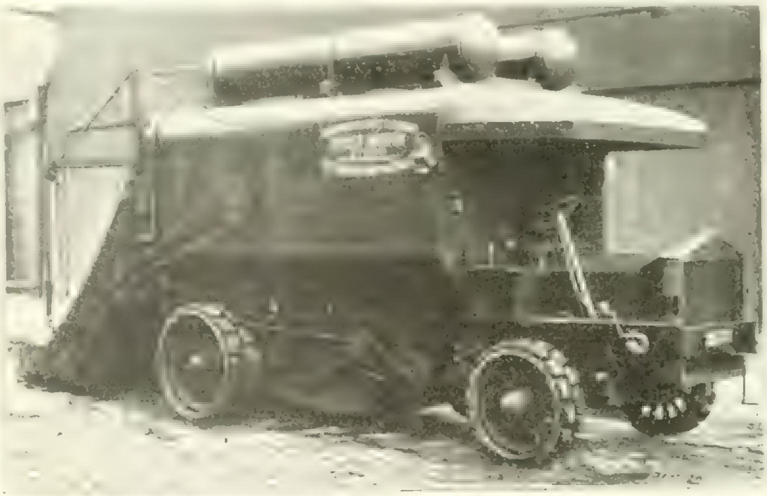
amount of material used per mile [illegible] yds. The average cost for hauling rock, moving machinery, rent of engine and fuel and lay- where average haul was one 1½ per cu. yd. The average cost [illegible] dam with stone unloaded from [illegible] d two miles was $1.20 per cu. yd. on four road outfits for all re- oil and sundry expenses were ear 1911. Wages paid were as

	Per hr. cts.
[illegible] engine to run crusher	40
[illegible] and fuel to run same	75
[illegible] ate roller	30
[illegible] crusher	25
[illegible] read rock on roadbed	25
[illegible]	30 to 35
[illegible] abor	20 to 25
[illegible] eams	40

A Gasoline-Electric Street Sweeper.

One of the latest developments in street cleaning apparatus is the gasoline-electric street sweeper shown in the accompanying illustration. The prime mover for this sweeper is a 4-cylinder gasoline engine. Coupled to the shaft by means of silent chains are two 7½ K. W. generators, which are connected to an equalizer and supply current for propelling the sweeper and for operating the broom, conveyor belt and exhaust fan. The two driving motors are connected by silent chains to an intermediate shaft which in turn is connected by roller chains to the rear wheels. A controller serves in conjunction with the engine throttle to give the desired changes in speed.

The cleaning apparatus consists of a revolving steel brush, 6 ft. wide, made up in sections, with a conveyor belt of about the same width. The brush and conveyor belt are located in a steel chute which can be raised or lowered by the operator, who is seated at the rear of the sweeper. A separator is provided at the top of the conveyor to prevent clogging of heavy material. The entire system is driven by a 125 volt motor, and the necessary changes of speed are provided for by means of a controller. In operation the brush loosens the dirt on the street surface and throws it onto the belt, which carries it into the large tank body. This body when filled can be dumped through the bottom at suitable stations. An exhaust fan, driven by a small motor, is provided to prevent the stirring up of dust by the broom.



The Emerson Gasoline-Electric Street Sweeping Machine.

The apparatus, without load, has a weight of about eight tons, and can carry from four to seven tons of sweepings, according as the material is wet or dry. It is driven at a speed of from three to five miles per hour on level streets, and can climb any ordinary city grade. Four of these machines have been in operation in New York city, and two others will be sent shortly to Boston. This street sweeper is furnished, operated and maintained by the Emerson Contracting Co., 1 Madison Ave., New York city, at a contract price per 1,000 sq. yds. of street surface cleaned.

Notes on Road and Street Work.

Cost of Refilling Roller Brooms.—According to the annual report of the Department of Public Works of Pittsburgh, Pa., for 1910, 544 roller brooms of street sweepers were refilled by city employes at a total cost of $4,429 far labor and material, or an average cost per broom of $8.139.

Cost of Forage for Horses in a Small City.—The following table rearranged from the annual report of the Street and Highway Department of Newport, R. I., shows the amount and cost of forage consumed during 1910 at the city stable. An average of 11 horses were maintained during the year:

	Total.	Per horse.
[illegible]	[illegible]	[illegible]
Oats, 15,636 bu. at 59.7 cts.	[illegible]	[illegible]
[illegible]	17	1.27
Bran, 1,490 lbs. at 1.53 cts.	21	1.91
[illegible]		.02
[illegible]	2	.18
[illegible]	[illegible]	[illegible]

Obliterating Dandelion Growths and Weeds From Park Lawns.—The following method was employed by the Bureau of Parks of Pittsburgh, Pa., preparatory to securing a new growth of sod on the Conservatory lawns in Schenley Park: During the fall the old sod on the Conservatory lawns was removed from the surface and the ground dug up and cultivated. This work became necessary, in order to obliterate the enormous growth of dandelions and other undesirable weeds from the lawns, which had accumlated to such an extent as to destroy the velvet green cast of the entire lawns. The old sod which was removed from the surface numbered 21,550 sq. yds., or a total of 287 loads, was hauled to the old soil pile and mixed with manure, and will be used for the purpose of top dressing flower beds in the early spring. After the removal of the sod from the lawns, the top surface was plowed and dug up rough to the frozen weather. The new surface was then covered with a coating of lime, which was allowed to remain on the same for a sufficient length of time and after it had become absorbed into the ground the surface was re-cultivated and covered with a heavy coating of manure, which was allowed to remain on the surface during the winter months and in the early spring was turned over and worked to a smooth surface and sowed down in lawn seed. It is anticipated that this new lawn will be far superior to the old one.

Cost of Maintenance and Operation of Steam Rollers.—The following table shows in cost of maintenance and operation of the six steam road rollers owned by the city of Grand Rapids, Mich. The figures have been taken from the annual report of the City Engineer for the fiscal year ending March 31, 1911:

Progress Report on Experimental Bituminous Work in Rhode Island.—The experimental stretches of bituminous concrete were laid in 1909 on sections of a stone road in Barrington, R. I., the work being done under the direction of Prof. Arthur H. Blanchard, at that time Deputy Engineer of the State Board of Public Roads. A description of this work was given in our issue of April 26, 1911. The conditions of the road surface in December, 1910, were also described in that issue. In the Proceedings of the American Society of Civil Engineers, Vol. XXXVIII, No. 4, pp. 596-597, Prof. Blanchard gives the following information relative to the condition of these various sections, as observed in January, 1912. It should be noted that all these bituminous concrete pavements were constructed with the same labor, under the same supervision, and by using the same

COST OF MAINTENANCE AND OPERATION OF STEAM ROAD ROLLERS.

	No. 1 Roller.	No. 2 Roller	No. 3 Roller	No. 4 Roller.	No. 5 Roller	No. 6 Roller
Maintenance:						
Labor, shop	$ 117.37	$ 106.72	$ 149.67	$ 116.67	$ 25.11	$ 39.61
Repair parts	232.54	126.46	221.16	128.12	63.57	43.19
Telephone	2.00	1.40	1.15	1.30	1.00	1.05
Engineering	2.00	6.00	3.00	2.00	2.00	3.00
Carfare	.25	.60	.15	.20	.20	.15
Belting	3.18	....	1.14	.81	1.82	1.27
Wagon repair	4.25	4.70	....	.40	....	6.50
Chains and hooks	3.36	....	....	....	....	3.37
Telegrams	.40	....	....	....	....	.64
Paint	.75	1.35	....	....	....	....
Express	.15	.25	....	....	....	....
Hose	....	5.87	....	....	....	....
Roller repair	....	27.18	11.50	....	....	....
New wheels	....	197.10	....	....	....	....
Oilers	....	1.60	....	....	2.70	....
Canvas covers	....	....	22.44	....	....	....
Rolling flues	....	....	7.90	4.50	1.60	....
Seat and spring	....	....	....	1.05	....	....
Hand hole clamps	....	....	....	.25	....	....
Padlocks and chains	....	....	....	....	.60	.75
Brackets	....	....	....	....	2.10	....
Operation:						
Labor, running	807.48	822.40	783.60	835.05	390.00	831.30
Labor, cleaning	34.00	34.00	32.00	58.00	3.50	6.00
Tools	1.34	4.19	.26	1.40	2.08	1.85
Coal	347.32	356.17	316.73	215.01	178.46	278.86
Kindling	25.00	25.00	21.50	15.60	11.50	19.50
Oil	20.47	25.84	20.61	17.68	16.25	14.90
Waste	2.20	3.87	2.48	2.07	2.46	2.46
Cartage	4.73	7.18	3.64	.25	2.40	2.00
Packing	1.25	2.60	2.75	....	.75	....
Boiler compound	6.24	7.80	4.68	1.92	....	3.90
Matches	.13	.05	.04	....	....	....
Lanterns and globes	1.26	.80	....	2.23	1.50	1.26
Grease	....	.37	.72	.11	....	.18
Candles	....	.06	.06	.06	....	.27
Totals	$1,718.46	$1,769.52	$1,609.98	$1,404.71	$704.00	$1,322.01

kind of mineral aggregate. The road is at present subjected to a mixed traffic of about 100 horse-drawn vehicles and 250 to 300 motor cars per day. Many of the motor vehicles are of the large touring car type, and travel at high speeds. The experimental sections were constructed to determine the most economical and satisfactory bituminous material to be used both as the cement and for the seal coat for bituminous concrete pavements subjected to trunk highway traffic. Up to January, 1912, no repairs have been considered necessary, and no new material of any kind has been applied to the surface. The section built with refined water-gas tar, Ugite No. 4, presented a mosaic surface, well bonded and smooth, which was not slippery, although slipperiness had been characteristic of this section during the winter of 1910-11. Apparently, it will need no repairs during 1912. The section constructed with a combination of refined coal-tar and 10 per cent asphalt, Tarite-Asphalt 10 per cent, should be treated with a superficial coat of some kind of bituminous material. The surface presented a distinct open mosaic appearance. This surface has not been slippery since it was built. The section built of a combination of refined tar and 20 per cent asphalt, Tarite-Asphalt 20 per cent, had an appearance somewhat similar to that of the section built with refined water-gas tar, and should not require any maintenance during 1912, but will need a superficial coat of bituminous material in 1913. This surface has not been slippery since it was built. Both sections built of refined coal-tars, Tarite-Malden and Tarite-Springfield, exhibited an open surface, which, although providing an excellent foothold, will probably disintegrate under a horse-drawn vehicle traffic of 100 to 200 vehicles per day unless properly maintained. Of course, a bituminous surface of tar would increase its life and would be efficacious for from 1 to 2 years, dependent on the development of traffic. Either a tar-asphalt compound or an asphalt would be more effective, and would, without doubt, provide a satisfactory surface for at least 3 years. The section constructed with Texaco Macadam Binder had a surface similar in appearance to that of a sheet-asphalt pavement. This surface is not slippery. The surface was slightly indented with the horses' calks even with the air temperature at 12° F. Apparently, it will need no maintenance for 2 or 3 years. It is of interest to note that adjacent sections of the standard type of bituminous concrete pavement adopted for the Rhode Island State Roads in 1909, that is, coal-tar for the mix and a Texaco asphalt, solid at air temperature, for the seal coat, were in excellent condition. They have had no repairs, and apparently will need none during the season of 1912.

Cost of Gravel Road in Wayne County, Mich.—The following is the cost of 1 mile of Class A gravel road, 12 ft. wide, 24 ft. between ditches, constructed in Wayne County in 1911.

Teams	$1,389.56
Other labor	1,540.50
Screened gravel, 171 tons	172.80
Bank gravel, 2,961 tons	977.97
Coal, 34 tons	169.20
Lumber and engineer's stakes	57.60
Drainage	103.53
Blue prints and advertising	15.57
Express, messenger and auto	6.67
Miscellaneous	85.63
Total cost	$4,516.13
Cost per sq. yd.	0.64
Cost per cu. yd.	1.94

Progress Report of Special Committee of the American Society of Civil Engineers on Bituminous Material for Road Construction.

Two years ago the American Society of Civil Engineers appointed a special committee consisting of W. W. Crosby, H. K. Bishop, A. W. Dean, and Prof. A. H. Blanchard, to make a study of bituminous materials for road purposes. At the last annual meeting of the society this committee submitted a progress report, which is abstracted below from the Proceedings of the Society, Vol. xxxviii, No. 2, pp. 74, 75, 76 and 77. In its report the committee submitted under the following heads recommendations as follows:

1.—*Traffic Census.*—Your committee desires to emphasize the fact that experience has demonstrated the value of traffic censuses taken both preliminary and subsequent to the construction of a highway.

The traffic census should be considered one of the most important variable factors in the solution of that important problem, the selection of that type of road or pavement best suited to local conditions considered from both the standpoints of economy and efficiency. In connection with the census returns on any road should be considered the traffic on cross and parallel highways and the effect of improvement of these highways on the traffic of the highway under consideration.

It should not be taken for granted that the bald return of a traffic census should be the sole basis of the selection of the type of road or pavement, but it should be considered a guide in estimating the value of the type of construction adopted.

The form for a traffic census proposed by
your committee has proved satis tory, and
its future use is recommended.

2.—*Crown.*—The investigations
vations of the committee to dat
vinced it that the crown generally
construction of macadam roads
when bituminous materials are u
a crown of even ½ in. to the fo
avoided when a lesser crown ca e secured
without detriment to the surface
3.—*Sub-Grades and Foundat*
committee believes that the use
of a bituminous surface does not
necessity for the construction
drained, thoroughly compacted a
sub-grade. In fact, such improv
road surface frequently attracts h
and thus increases the stresses
grade.

4.—*Bituminous Materials.*—You
feels it is as yet too early to
details as to the characteristics,
undesirable, of such materials.

Your committee recommend
that especial attention be directe
coming year to the following:

a.—The maximum amount
from tars coming over, u
as determined by the test
your committee, that can
torily allowed;

b.—The maximum percentage
bon that can be successfull
a tar used for superficial
der varying climatic condi

c.—The maximum amount of
the limitations of penetra
that can be satisfactorily
an asphaltic oil used fo
treatment when such residu
and tested under the eva
proposed by your commit
materials at 170° C

5.—*Methods of Construction:*

(*a*) Your committee wishes
the fact that the selection of th
construction to be used in a gi
depend upon the results of preli
tigations, and that the recent a
development of mechanical appli
fect the decision to a great de

(*b*) Your committee is of the
whatever method may be used i
is essential, as in water-bound n
struction, that a suitable quality
be used.

(*c*) Your committee is of the
whatever method of constructio
the use of a bituminous material
justifies any lack of care in the
tails to be followed, but rather
need for thoroughness and skill

6.—*Construction Details.*—You
recommends:

(*a*) That trap rock in sizes
that passing a 2-in. screen sh
with caution in the construction
course, unless the voids of t
properly reduced, because of th
the individual stones to rock u

(*b*) That in the use of a hea
for the construction of a bitu
ment, non-uniformity or excess
ing of stone, such as usually oc
use of flat plates or similar cr
for this purpose, should be av

(*c*) The consideration of the
coat on bituminous pavements c
the mixing method, and which
to a traffic of more than 10
commercial vehicles per day per
of metalled surface.

7.—*Cost Data.*—In the work
mittee, it has become apparent
sions may necessitate the use
recorded along uniform lines.
gent that standards for arrivin
established and generally adopte
as possible. Your committee, t
ommends to the attention of t
this important feature of engi
with the hope that uniform me
generally adopted at an early

of construction, such as those the committee in its report [illegible]

[illegible] committee wishes to advise iscontinuance of the use of the asphalt" and "asphaltic con- hese terms are meaningless in many cases, and unnecessary when proper tests, such as are recommended by your committee, are [illegible]

(*b*) For the sake of convenience and uniformity, your committee advocates the adoption of the following definitions covering the present ordinary use of bituminous materials [illegible]

"Bituminous Surfaces" consist of superficial coats of bituminous materials with or without the addition of stone or slag chips, gravel, sand, or material of similar character.

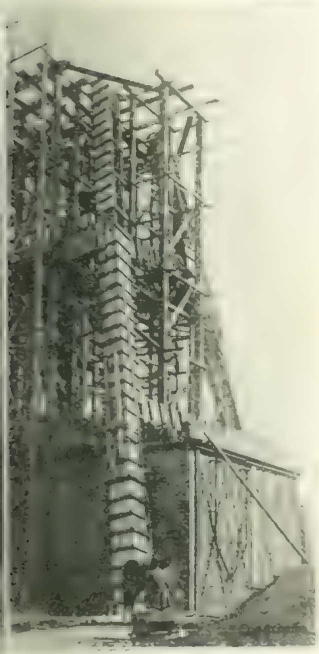
"Bituminous Pavements" are those composed of stone, gravel, sand, shell, or slag, or combinations thereof, and bituminous materials incorporated together.

ER SUPPLY, SEWERAGE AND SANITATION SECTION

and Construction of a 100,- Reinforced Concrete er Tower and Tank.

(Staff Article.)

concrete elevated water tower ust been completed at the 78th [illegible] City Railway C structed as a part of a fire All buildings at the plant th sprinklers. Water is drawn [illegible] pumped into the tank anesville centrifugal pump of ninute capacity. The pump is to a 100-h.p. General Electric otor. Water is pumped into two 6-in. riser pipes, which wo of the legs of the tower.



v of Tower Forms and Main Staging.

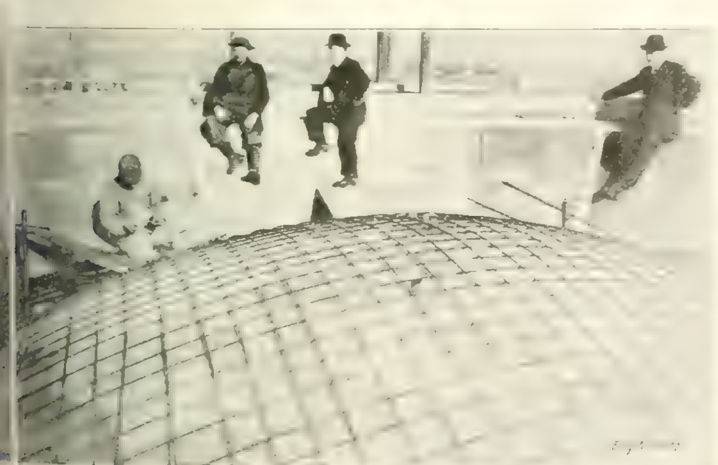


Fig. 2—Forms for Inner and Inverted Domes.

The tank and tower are designed to carry safely 120,000 gals. of water if desired, but the top of a 2-in. overflow pipe is placed at the 100,000-gal. level to fix the present service capacity of the tank. The overflow pipe is [illegible]

A brass steam coil is placed inside the tank, about 2 ft. clear of the bottom, to prevent freezing in exceptionally cold weather. The supply and return pipes of the coil are encased in the leg with one of the two 6-in. riser water pipes. These steam pipes are 1¼ ins. in diameter. They are placed next to the riser pipe so the water is warmed somewhat before it reaches the tank. The pipes change from iron to brass before they emerge from the concrete and enter the water in the tank.

The design of the tank and tower is shown in Fig. 4. The tower is composed of four legs, each 30 ins. by 30 ins. in section reinforced as shown. It will be noted that the tower is set over a building. This made it necessary to spread the legs out of the vertical. The tower was set astride the building to economize on space in the grounds at the plant.

The side wall of the tank is cylindrical in section. The wall is 8 ins. thick. So much trouble was experienced with frost at the plant during the recent severe winter that the tank walls were made thicker on that account. The roof is a portion of a spherical surface ⅜ in. thick, reinforced with ⅜ in. round rods spaced 12 in. centers in both directions.

The construction of the tank bottom is shown by Fig. 4. It will be noted that the bottom spherical surface, referred to elsewhere as the inner dome, is 8 ins. thick, and is reinforced with ⅜-in. round rods spaced 6 ins. on centers both ways. The flaring portion of the bottom, a frustum of a conical surface referred to elsewhere as the inverted dome, is 8 ins. thick, and is reinforced circumferentially with ⅝-in. square bars spaced 5 ins. on centers. The longitudinal reinforcement of the inverted dome is composed of 100 ⅜-in. round rods. The ring girder is shown in section and development in Fig. 4. The two cross girders at the bottom of the tank are 10 ins. by 16 ins. in section, and are reinforced at top and bottom with four ½-in. round rods.

The tower above the footings is divided into three equal panels, each 23 ft. 4 ins. high. The diagonal tension members, commonly placed in towers, are here omitted. This throws a bending stress upon the struts which is a maximum at the columns and a minimum at the center of the strut. The tapering section of the struts is due to the variation in this binding stress.

Work was begun on the construction of this tank in November, 1911. It was finished late in April of this year. For about 110 days work was entirely suspended on account of the cold weather. The structure was built in 10 weeks of actual working time. The tank was filled with water by three equal increments on May 1 and 2.

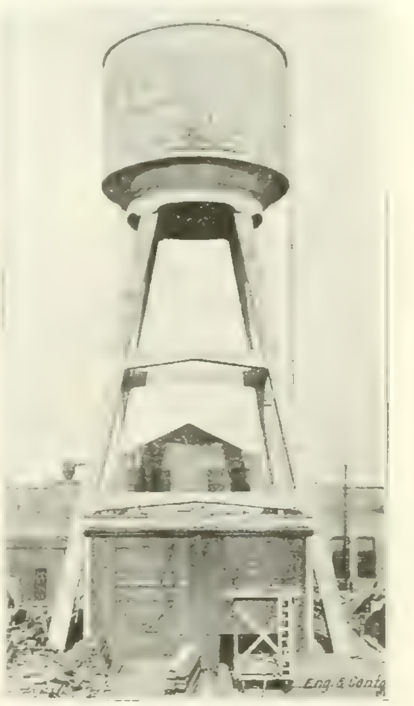


Fig. 3—View of Completed Structure.

All concrete was mixed in a Chain Belt mixer and elevated by means of a 2-car hoist. The rising car carried from 8 to 10 pails of concrete, each pailful weighing from 50 to 60 lbs. For the first half of the tower one horse was used in raising the hoist. After that a 2-horse team was used and while the concrete in the tank shell was being placed two teams alternated in raising the hoist on account of the long haul.

All form work was built up in sections on the ground and then elevated to place. The column forms were built in sections as long as the height of a panel of the tower, and lengths one-third the height of a panel. Three sides of a column form were set up of the long pieces. The fourth side of a column was formed by placing successive lengths of the short forms mentioned as the concreting progressed. All reinforcing rods in the columns were wired in position.

All form work for the tank was supported by the dry kiln building. This load of forms and concrete, aggregating about 400,000 lbs., was distributed over the roof of the kiln building by 12 timbers 6x16 ins. in section and 32 ft. long. Fig. 1 is a construction view showing the tower form work and the main [illegible] crete of the tank.

The vertical elements of the main staging, which rested upon the timbers placed on the roof of the kiln building, were composed of timbers 4x4 ins. in section, bolted together. There were 20 of these vertical supports, of which 12 were composed of four 4x4-in. timbers and 8 were composed of six 4x4-in. timbers. All of these supports were 46 ft. long. The supports made up of six timbers were placed at the outside of the main staging, two being placed at each side of the tower. The inner vertical supports were of the lighter section above given. On top of these columns twelve 12x12-in. timbers 14 ft. long, and eight 12-in. I beams 16 ft. long, were placed. Over these timbers and beams, 100 railroad ties were distributed.

It took four carpenters and three laborers eight days to build the forms for the inner dome, inverted dome, circular girder, cross girder, and to place the 100 railway ties at the top of the main staging. These forms cost between 40 and 50 cts. per square foot for labor and material. The inner dome was built in 15 segments and the inverted dome in 50 segments. The form work, with reinforcing placed, is shown in Fig. 2. The cylindrical portion of the tank was built in sections 4 ft. high. The cylindrical forms cost about $100 for material and labor.

The forms for the roof dome were supported on nine 4x4-in. timbers. Eight of these timbers, supported on the finished concrete bottom, were symmetrically disposed near the walls of the cylinder. One timber was placed along the geometric axis of the cylinder. On top of these timbers three 3x12-in. timbers were laid horizontally. On top of the horizontal timbers 11 trusses with circular top chords were symmetrically spaced about the center. Boards 1x8 ins. in section and 12 ft. long were put in a steam box for four hours and then bent and nailed to the tops of the trusses.

Hooks were attached to the reinforcing at four points on the inverted dome. After the forms were removed at those points pulley blocks were put on the hooks, and the heavy form work and staging was lowered by ropes passing over these pulleys.

The tank was given three coats on its inner surfaces composed of 1 part cement, 1 part sand and 0.1 part of hydrated lime. These coats varied in thickness from ⅛ to ¼ in. The first two coats were floated, and the third coat was hard troweled. A view of the completed tank is shown in Fig. 3. of the specifications which gove struction of the tank follows:

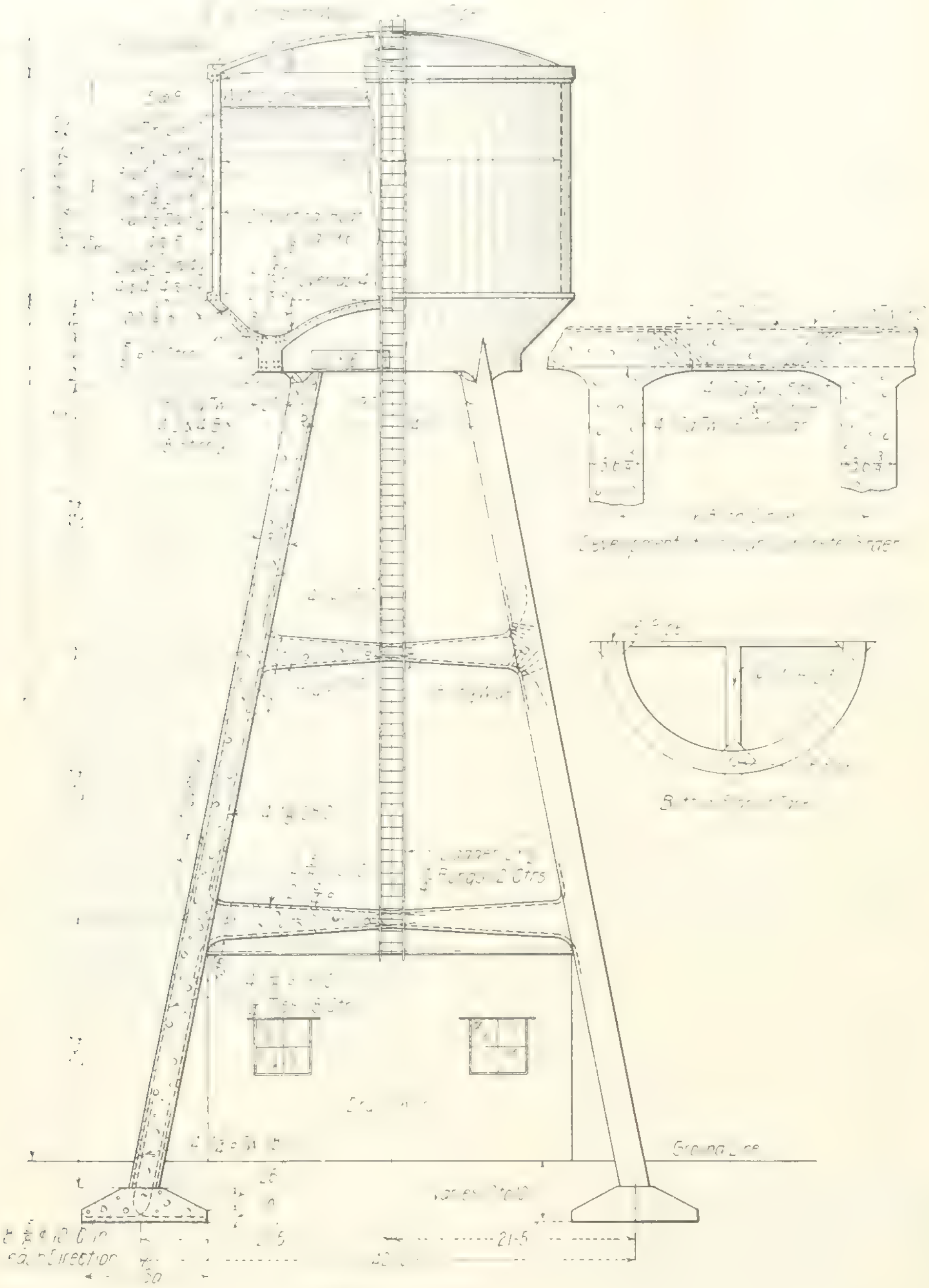


Fig. 4—Details of Design of 100,000 Gal. Water Tank and Tower of Reinforced Concrete.

SPECIFICATIONS.

Concrete: For footings. Con proportioned as follows: 1 sack ment, 2 cu. ft. of sand, 4 cu. ft. of or gravel. For columns and all ot structure. 1 sack of Portland ft. of sand, 2 cu. ft. of crushed s The sand shall be clean, well sand, passing a ¼-in. screen. stone or gravel shall consist of g varying in size from ¼ in. to 1 terials shall be mixed in a unifo wheelbarrows or otherwise, so th ties can easily be determined by and the superintendent. The done in a batch mixer. When ha be resorted to, it shall be done o form and the materials shall be least four times until they are h color and consistency.

The concrete shall be mixed flow freely around the reinforcen out all the corners in the forms shall be used which has partially reting of columns, girders or commenced before they are ins superintendent for cleanliness an tion of the reinforcement. Wh concreting after a suspension of the joints shall be thoroughly cle with water and covered with longer suspension, remove from to 2 in. of concrete before wettin At least one man shall contr column during process of con many more as may be required and walls.

The inside of the tank shall as practicable after the tank is coats of cement finish, each abo in. thick, and the concrete surfa must be previously roughed with a good adhesion of the plaster coa finish shall be mixed in the pro part cement, 1/10 part hydrated part of sand.

Freezing Weather: When the below freezing and above 20° F., may be carried on by using hot sand and gravel and by prote and the concrete from the cold by der which steam circulates. shall have the right to connect the company's steam line and ma air from the dry-kiln through a conduit.

Reinforcement: The reinforce high carbon steel of an ultimate 600 lbs. per sq. in. and a yield p 50,000 lbs. The bars shall bend radius equal to three times its angle of 90° without breaking taken that all bars are bent as s ings and provisions must be ma the proper position of the rods in ing concreting.

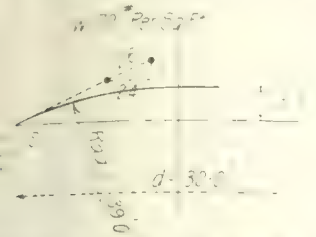
Form Work: The form work fully designed for strength and forms shall be built fairly tigh gross leakage of mortar. The le colored by cement shall not be jurious. The forms shall be ere practicable. The boards for colu shall be surfaced one side and the tank forms shall be mad boards.

The wooden tower which ca work of the tank must be carefull the weight of the tank and tow tributed over the dry-kiln buildin unequal settlement of the build tractor guarantees that the tank tight and that it will comply wit requirements of Associated Fact Insurance Companies of New contractor guarantees to make g lay or expense to the Railway C fects which may develop within acceptance, due to improper mat workmanship.

COMPUTATIONS.

[illegible]tations for the [illegible] the various parts of the structure ndensed form:

[illegible] ameter and 3 ft. high. The shear



gram of Forces Acting on Roof.

oot at the base of the dome equals [illegible]

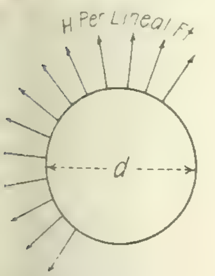
[illegible] ir or vertical reaction is divided mponents, as shown in Fig. 5, the [illegible] H and the thrust [illegible] H = 2.4 S [illegible] or substituting [illegible] ft., S = 525 lbs., H = 1,260 lbs.,

onent H produces a ring action at the dome as shown in Fig. 5, and [illegible] on the reinforcing [illegible] 1,260 × 15 = 18,900 lbs. The area ⅝-in. square bars equals 1.33 sq. tensile stress 18,900 ÷ 1.33 = 14,- sq. in. The Shearing stress per on the concrete at the base is 11 lbs. [illegible] stress at the base is 28.4 lbs. per sq. in. or a factor at least 40 for the dome proper.

ank.—Stress in concrete of shell, he reinforcement at the base, is [illegible] 12 = 195 lbs. per sq. iid-height 97.5 lbs. per sq. in. the reinforcement, neglecting the the base (area of bars 1.34 sq. in), 15 ÷ 1.34 = 14,000 lbs.; at mid- of bars 0.781 sq. in.), 10 × 62.5 × 12,000 lbs. The probable stresses are 180 lbs. on the concrete and the steel bars. Weight of con-

$$(31.33^2 - 30^2)\frac{\pi}{4} \times 144 \times 20 =$$

ottom of Shell.—The vertical load ot at the base of the shell equals ,000 ÷ 30.67 × 3.14 = 2,520 lbs. nay be divided, as shown in Fig. mponents, a horizontal tension on l a thrust on the inverted dome. eing 45°, the tension per lin ft. and the thrust per lin. ft. = 2,520 bs. The stress on the ring re- area 2.65 sq. ins., 2,520 × 30.67/2 [illegible] lbs.



iagram of Forces Acting on Cylinder.

Dome.—The inverted dome is ension in a horizontal direction ter pressure and figured accord- top of the dome is subject to a per lineal foot of 2,520 lbs. and sion per lin. ft. of 3,560 lbs., or a [illegible] of 2,520 ÷ 12 × 8 × √2 = sq. in., and a compressive stress ÷ 12 × 8 = 37.1 lbs. per sq. in.

[illegible]

water on inverted dome $(30^2 - 23^2)\frac{\pi}{4} \times 20.5 \times 62.5$ = 292,000 lbs. Total shear at base of inverted dome equals weight of roof shell, [illegible] 8,100 lbs. This shear or vertical reaction may be resolved into two components, as shown in Fig. 7, a horizontal thrust on the ring girder and a thrust on the inverted dome. The angle being 45°, the thrust on the dome 8,100 $\sqrt{2}$ = 11,450 lbs. per lin. ft. The shearing stress [illegible] = 60 lbs.

The compressive stress per sq. in. is [illegible] = 120 lbs.

[illegible]

The sphere has a radius of 16 ft., and the section of the sphere forming the dome has a diameter of 19 ft. and a rise of 2 ft. 9 ins.

The weight of the dome is approximately $19^2 \times \frac{\pi}{4} \times 1.1 \times 100$ = 31,000 lbs. the weight of the water above it $19^2 \times \frac{\pi}{4} \times 20 \times 62.5$ = 355,000 lbs. and the vertical shear or reaction [illegible] lbs.

This force may be resolved in two components, as shown in Fig. 7, a thrust on the ring girder, nearly counterbalancing the thrust from the inverted dome, and a thrust of 10,800 lbs. per lin. ft. on the dome.

The shearing stress per square inch is 6,400 ÷ 12 × 9.7 = 55 lbs. The compressive stress per square inch is 10,800 ÷ 12 × 8 = 113 lbs., showing also an unusually high factor of safety.

Ring Girder.—The total weight of ring girder is 3 × 2 × 144 × 21 × π = 57,000 lbs. The total weight of concrete of the tank from the foregoing is 382,000 lbs. The weight of 100,000 gals. of water is 840,000 lbs. The total of tank and water is 1,222,000 lbs.

We can assume that 142,000 lbs. are directly carried by the four columns, leaving 1,080,000 lbs. to be supported by the ring girder, or 270,000 lbs. by each of the four sections.

We assume, as shown in Fig. 8, that the straight span "*AB*" is about 13 ft. 6 ins., and the bending moment at *A* or *B* on account of continuity is $270{,}000 \times \frac{13.5}{12} = 304{,}000$ lbs.

There exists also a torsional moment, and in a freely supported girder it would amount to $\frac{270{,}000 \times 1.5}{2} = 202{,}500$ ft. lbs. in the center. On account of the continuity we may assume that the moment at *A* or *B* is only two-thirds, and at the center only one-third of the above moment, or 135,000 ft. lbs., and 67,500 ft. lbs., respectively. The bending moment and the torsional moment may be compounded into an ideal bending moment, according to the formula

$$M_i = .35 M_b + .65 \sqrt{M_b^2 + 4M_t^2}$$

or Mi at A = 350,000 ft. lbs.
and Mi at the center 180,000 ft. lbs.

The depth of the ring girder at the support is 4 ft. and there are twelve 1-in. sq. bars at the top of the girder, including the bent-up bars. If we assume only 10 bars effective and the depth of the girder at the support 3.5 ft., we can obtain the stress in the reinforcement 350,000 ÷ 3.5 × .87 × 10, or 11,500 lbs. per sq. in. Similarly, we find the stresses in the center of the girders is 8,700 lbs.

The shearing stress is 135,000 ÷ 48 × 24 = 117 lbs. per sq. in.

Wind Stresses.—Assuming a force of 50 lbs. per sq. ft. on a flat surface, the total force of the wind on the round tank is 31 × 27 × 50 × ⅔ = 28,000 lbs.

The assumption was made that each of the two bents in one direction takes care of half this force of 14,000 lbs.

On account of appearance and the fact that the structure was built over an existing building, diagonal bracings were omitted, and each bent was figured as a nine times indeterminate structure.

Fig. 7—Diagram of Forces Acting on Inner and Inverted Domes.

Through the omission of the diagonal bracings bending moments appear in the horizontal struts and in the columns, which are greatest at the joints of struts and columns, and practically zero in the center of the struts. The weight of the columns and struts amount to 302,000 lbs. The direct compression from the wind at the base of the column is 14,000 × 84 ft. ÷ 42 = 28,000 lbs., and the greatest load on one column is 409,000 lbs. The greatest direct stress is 409,000 ÷ 900 = 454 lbs. per sq. in., which is increased by 390 lbs. from the bending moment, due to wind stresses through the omission of tie rods in the tower, neglecting the reinforcement. The concrete was mixed in the proportion of 1:1:2, hence the total stress is well within safe limits.

The tank was designed and built by L. J. Mensch of Chicago. The design was checked by Mr. Hugo Schmidt, Superintendent of Buildings for the Chicago City Railway Co. We are indebted to Mr. Mensch for the computations and the construction data, and to Mr. Schmidt for the descriptive matter, specifications and illustrations. The contract price of the tank was $6,200. The appearance of the tank is good. This type of tank readily lends itself to architectural effects. The structure could have been built at a cost of $700 less to the contractor had the legs of the tower been vertical instead of inclined. This saving would have been made by a reduction in the labor and material required in constructing the staging.

Further Comment on the Old Concrete Sewer in the Chicago Stock Yards.

Sir: I have read with interest the article which appeared on page 497 of your May 1st issue, and have considered the sewer which you have described of sufficient importance to get a report on it by a consulting engineer practicing in Chicago and also by the Chief Inspector of Sewer Pipe for the City of Chicago. Great discrepancies appear between these reports which have come to me and the general tenor of your article, which may be explained,

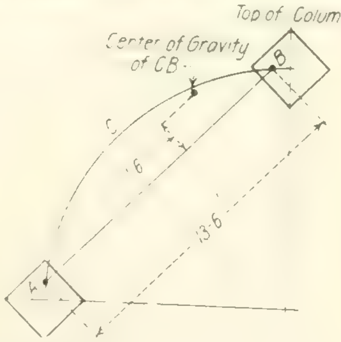


Fig. 8—Effective Span and Center of Gravity of Quadrant of Circular Girder.

[illegible] the fact that your staff writer was looking upon the material itself as a phenomenon interesting solely to engineers, whereas the engineers who reported to me looked upon the [illegible] broader sense and have reported the sanitary conditions surrounding the whole structure.

In these days when the public are so much interested in proper sanitation, even to the extent of depriving themselves of drinking cups, towels and other old-time conveniences, it is very important that their attention should also be rightly directed toward the matter of sewers as one of the most important features of sanitation, and one without which all of our other efforts in that direction are brought to a standstill.

According to the statements of your staff writer, the condition of this old concrete sewer is rather remarkable, considering the time it has been in service. It is indeed very unusual for a concrete sewer of this description to last 40 years or anything like that time, and his findings seem to prove the very recent opinions of some of our engineers that for purposes of conveying water and sewage the natural cements have certain characteristics which make them superior for this particular purpose to the Portland cement. So far so good. But lest engineers and other people reading this article should gather from it that any material is good enough for sewers, and has the power of lasting in that capacity, we suggest that you publish the reports which have been made to us by the Engineer and Inspector in your city, to show that although the material has indeed shown phenomenal lasting powers under the circumstances, it has not fulfilled by any means its purpose as a conduit for sewage, but has, by gradual disintegration and absorption of the material which it carried, become entirely unsound from a structural standpoint, has accumulated much filth which would have scoured out of and passed through a fire-glazed material, and has allowed a sufficient quantity of it to permeate the surrounding ground to render the neighboring conditions anything but safe and sanitary.

I am also sending you samples of this concrete pipe, also samples of the deposit adhering to its inner surface, and samples of polluted earth dug from the outside of the sewer, from which you may be able to draw your own conclusions.

Yours very truly,
Chicago, Ill., May 10, 1912. G. H. TEFFT.

(Of the two reports mentioned by our correspondent we publish only that by Mr. Shields, which covers all the essential differences to which attention is directed. Mr. Shields' report follows.—Editors.)

The sewer is constructed of what appears to be concrete pipe, made in sections 30 ins. long with tapered joints and cemented with what appears to be Utica cement. The sections have the appearance of having been constructed of natural cement and gravel. The shell originally was probably intended to be 2 ins. thick, but at the present time its average thickness is about 1¾ ins.

The present exposed portion of the sewer, I am told, was under the boiler room of the old Transit House, and the top of the sewer is about 5 ft. below the surface of the adjoining alley, and so far as could be learned among the old employes of the Stockyards Company the sewer had been constructed somewhere between 40 and 47 years.

I found some 30 ft. of this sewer uncovered above the invert as shown in the cut in Engineering and Contracting. The removal of a brick wall in the vicinity caused the destruction of several additional sections than shown in the cut by a portion of a brick wall falling upon it and breaking it in. However, there are thirteen sections of the pipe exposed, three or four of which have their tops broken open.

I found that all sections exposed were cracked longitudinally along the top and that those from which the top had been removed were cracked along the bottom, and I assume that all are cracked in bottom, as they are somewhat flattened. Nearly all the sections were cracked across in several places and many were cracked along the side near the top of the invert. The crack along the top is noticeable in the photographs. One section of this pipe has been patched with a large piece of tile pipe cemented in place.

The sewer has not, at least of late years, carried a great amount of sewage, and at the present time is only receiving kitchen sewage from some adjoining buildings. The grade is very flat and the interior of the pipe has the appearance of having been half full of water. At the present time there is 5½ ins. of water and sludge standing in it. A heavy coat of sediment has been deposited on the interior of the pipe below the water line. This has probably been on for a number of years, and is such a coating as might be formed by the grease or scum which would gather on the surface of sewage under such conditions. This coating is from ¼ to ½ in. thick and by removing it some of the cement and sand comes away with it, leaving a rough surface caused by pebbles projecting from the concrete.

I was told that the sewer had been uncovered and exposed to the sun and rain for some four weeks, and the upper portion was quite dry and may have been affected by the atmosphere. The lower part was wet and had the appearance of having been submerged continually. The pipe was easily torn apart and there was no difficulty in removing pieces of broken pipe with the hand, particularly in the lower half of the sewer the concrete was brittle and could be broken off in pieces by pressing against it with the foot.

The pieces broken from the sewer are brittle and it was not difficult to pick out the gravel stones from the surface of the fresh fractures.

In my opinion the sewer if undisturbed might last for a number of years, under the existing service and conditions. The coating on the inside indicates that there has been no considerable amount of water carried by the sewer. The sanitary condition of the sewer is very poor but favorable to the life of the pipe, for had it been laid to a grade which would have given a scouring velocity, or had the sewer been flooded, the coating would have been torn loose and carried away and the sewer destroyed.

(Following the receipt of the above communications the editor who prepared the short news article to which reference is made, again visited the Stock Yards for the purpose of making a second and more detailed examination of the sewer under discussion. About three weeks had elapsed between the first and second inspections. During that period the sewer was exposed to alternate rain, winds, and hot sun. At the time of the second inspection, after the sewer had been uncovered slightly over a month, conditions were found as described by Mr. Shields. The pipe was badly cracked and its inner and outer surfaces appeared much softer than when first examined. Owing to the wrecking operations which had been carried on around the sewer, and the fact that the brick setting of a boiler had rested directly upon the top of the pipe for ten or twelve years, only the quality of the concrete was considered in the first examination.—Editors.)

An Efficient Method of Handling Concrete Base for Street Paving.

The accompanying sketch shows the plan of an installation used in laying the concrete street bases in Portland, Oregon.

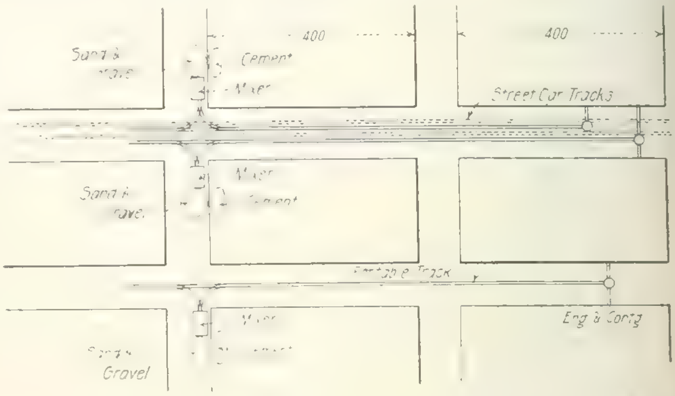
The raw material was piled on a cross street back of the mixer, and a drag bucket was used to haul the sand, gravel, and cement to the mixer.

On the streets where there were [illegible] railway tracks, Koppel portable track was laid down the center of the street, a Y switch leading to the mixer, as shown in the drawing. A [illegible] table was placed at the end of the track [illegible] from the turntable short sections [illegible] track were laid at right angles to the length of the street, and reached to the curb line.

The mixer unloaded directly [illegible] steel dump cars, and the cars were then run down the track to the right or left and the concrete deposited just where it was needed, requiring very little shoveling. In this way [illegible] section of the street base was laid [illegible] the street, after which the turntable [illegible] tracks were moved 6 or 7 ft. back [illegible] mixer, by merely removing a section [illegible] portable track.

On the streets where there were double railway tracks, two different methods were employed in carrying on the work. [illegible] both of these methods the mixer, materials and switch were placed as in the method just described.

On some of the streets the portable [illegible]



Efficient Plant Layout for Paving.

was laid the length of the street [illegible] two railway tracks. This method [illegible] concrete to be dumped to either [illegible] portable track, thus filling in the [illegible] tween the railway tracks. At the end [illegible] portable track a turntable was placed [illegible] which a section of portable track [illegible] curb. This left one of the railway tracks clear, while on the other, when [illegible] along, the cross section of portable track very easily lifted up and replace [illegible] car had passed. The turntable a[illegible] track were blocked up just enough [illegible] the cross track to be laid on top o[illegible] railway rails, so no elevated track [illegible] quired. After the one side of the [illegible] the section between the railway tracks [illegible] completed, the portable track was moved the other side of the street and t[illegible] the street completed. Another [illegible] ployed on streets with double railway tracks was to lay the portable track on one side the street and fill in that side of the street one of the railway tracks. The portable track was then moved to the other side of the street and that side and the other railway [illegible] filled in. This left a space between the railway tracks to be filled in, which was by using the turntable and a cross section portable track which was laying either side the street.

In all three mthods employed the concrete was dumped away from the portable track as a section of the base was laid, a short [illegible] tion of the portable track was removed the turntable and cross section of track [illegible] back toward the mixer.

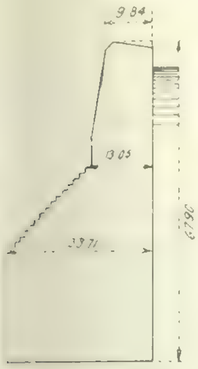
The contractor for this work is [illegible] of Portland. The equipment is furnished [illegible] the Orenstein-Arthur-Koppel Co. of [illegible] burg, Pa.

The citizens of Ballston, N. [illegible] asked to vote on a $10,000 bond [illegible] expended for water meters. A [illegible] gals. has been fixed for each $6 of water paid.

RAINAGE AND IRRIGATION SECTION

y of Masonry Dam Design nstruction Illustrated with oss-Sections of Forty Notable Dams.

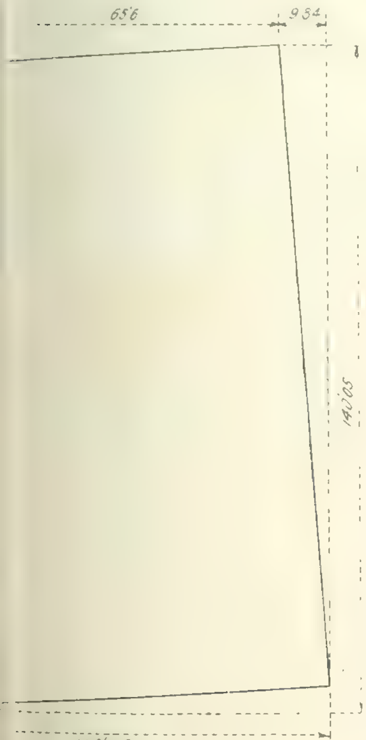
dams began first to be constructed 350 years ago. No record, natu- of many of these structures, but oldest ones are still standing and al features of others are known. describes a few of these old dams es them with more modern works. is based on a paper by Mr. Ed- ıann before the American Society ing Contractors, but many of the and much descriptive text have



Almanza Dam, Spain, 1586.

(Scale 1 in. = 40 ft.)

ed by the editors from other is new matter has been interpo- hout the original paper, and that also been condensed in places. should be carefully kept in mind Mr. Wegmann.



Alicante Dam, Spain, 1594.

(Scale 1 in.=40. ft.)

CH AND SPANISH DAMS.

masonry dam of which there is record is the Almanza Dam in ction of this dam is given by Almanza Dam is still standing at an age of probably exceeding 325 years. It is not certain when the dam was built, but it appears from an old document that it was in existence prior to 1586. The Almanza Dam is founded on rock and is built of rubble masonry faced with cut stone, except for the upper 20 ft., which are of rough ashlar with courses of cut stone at intervals. The lower 48 ft. of the dam was built on a curve of 86 ft. radius, but the part above this, which was added at a later date, is polygonal in plan, with a crest length of about 292 ft. The general sectional dimensions of the dam are given in Fig. 1. An interesting feature of this dam is the maximum pressure of about 14 tons per square foot of masonry which it sustains.

The Almanza Dam impounded water for irrigation and this was the purpose for which a number of masonry dams built in Spain were designed. Notable among these was the Alicante Dam, built 1579-94 in the province of Alicante. A diagram section of this dam is given by Fig. 2. It was built on a curve of 351 ft. radius and had a crest length of 190 ft. A feature of this dam was a silt sluice through the masonry. The maximum masonry pressure in the Alicante Dam is about 11½ tons per square foot; it is rubble masonry with cut stone masonry facing or revetment.

Another Spanish irrigation dam of note was the Puentes Dam, built in 1785-91 across the Guadalantin River, in Sorca. A cross-section of this dam is shown in outline by Fig. 3. It was polygonal in plan, with a crest length of 925 ft. The height of the masonry above the grillage foundation was 164 ft. Like the earlier dams described the body of the masonry was rubble, but the faces were cut stone. The grillage on pile foundation shown was used only for a portion at the middle of the dam where a deep pocket of soft material was found in the rock. In 1802, which was the first time that the water behind the dam had been allowed to reach a high level, the grillage was forced out and a breach 56 ft. wide was opened in the masonry. The flood killed some 608 persons and destroyed much property. The dam was never rebuilt. The Puentes Dam, it will be observed, ranks well up among the high masonry dams of the world, there being scarcely over a dozen others today that exceed its height of 164 ft.

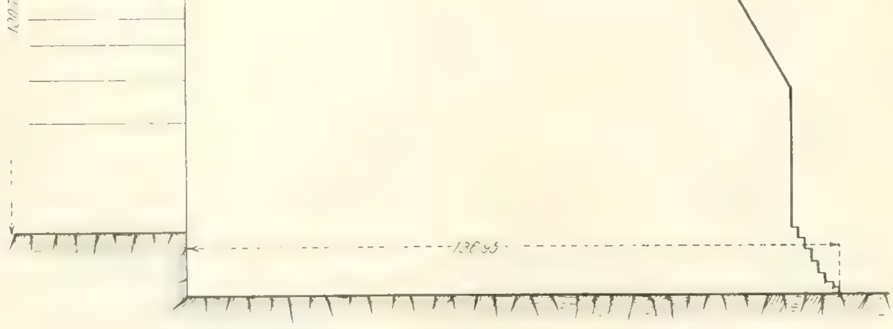


Fig. 4—Val de Infierno Dam, Spain, 1791.

(Scale 1 in.=10. ft.)

Almost contemporary with the Puentes Dam and in the same province of Spain, is the Val de Infierno Dam, shown in cross-section by Fig. 4. This dam impounded water for irrigation and is a rubble masonry structure with cut stone facing. Its plan is polygonal and its crest length is 330 ft. The height from the bottom of foundation is 116 ft. It is interesting to compare the dimensions of these two Spanish dams—the Puentes and the Val de Infierno—built at the same time and in the same province. With a height 64 ft. greater, the base width of Puentes Dam is only about 8 ft. greater.

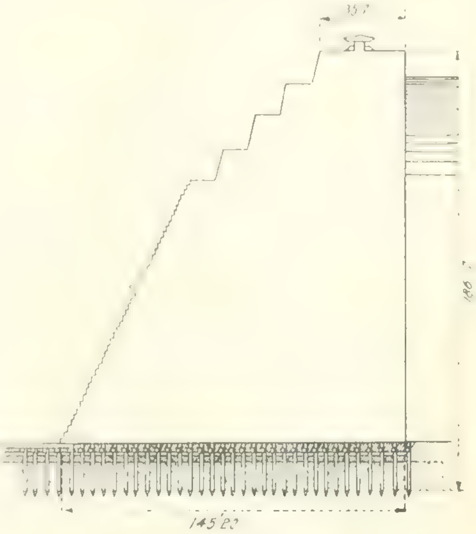


Fig. 3—Puentes Dam, Spain, 1791.

(Scale 1 in. = 80 ft.)

In 1838 French engineers constructed the Gros Bois Dam, shown in section by Fig. 5. This structure crossed the River Brenne and formed a reservoir for feeding the Bourgogne Canal. It was 1805 ft. long on the crest and had a maximum height of 93 ft. above foundations. These foundations were a soft argillaceous rock, and trouble was experienced during construction with fissures. When the dam was filled the wall deflected downstream and opened a crack in the masonry. To strengthen the dam nine buttresses, as indicated [illegible] stream face. This stopped further movement of the dam. In 1896 the further precaution to make the dam stable was taken of building a 58-ft. earth dam 800 ft. down stream to back water against the down stream face.

In 1843 the dam shown in section by Fig. 6 was built near Aix, France, for domestic water supply, power and irrigation. This dam is curved in plan to a radius of 158 ft. and is 126 ft. total height with a crest length of 205 ft. It is built of stone masonry laid in a 1:2 Portland cement mortar.

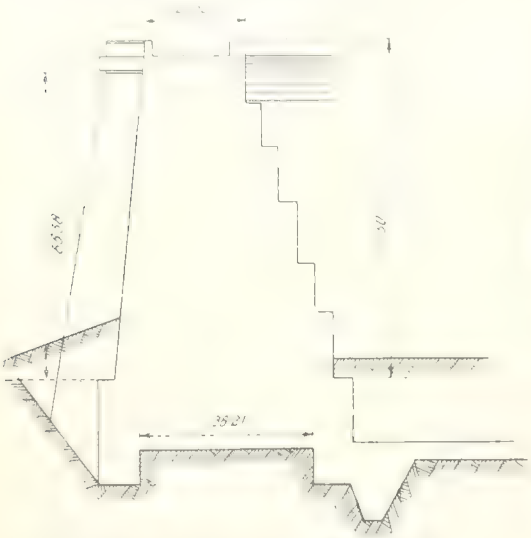


Fig. 5—Gros Bois Dam, France, 1838.
(Scale 1 in.=40. ft.)

In 1852 the dam shown in section by Fig. 7 was built at Madrid, Spain, for domestic water supply. This is a straight dam 291 ft. long on top and 200 ft. long on the base. The masonry was about one-half cut stone.

BEGINNING OF SCIENTIFIC DAM DESIGN

None of the dams described, and in fact, no masonry dam built prior to 1853 was designed according to scientific principles. Indeed, this fact is evident from a glance at the sections. In 1853, the French engineer, Sazilly, presented an analysis of scientific dam design and from it worked out a profile with stepped faces as shown by Fig. 8. The principles developed by Sazilly were first made use of in designing the Furens Dam built near St. Etienne, France. However, Mr. Delocre, who had charge of the working out of the design, conceived that by substituting polygonal outlines for stepped faces a saving of masonry could be effected without decreasing the strength of the dam. The profile worked out by him is shown in Fig. 8 superimposed on that developed by Sazilly.

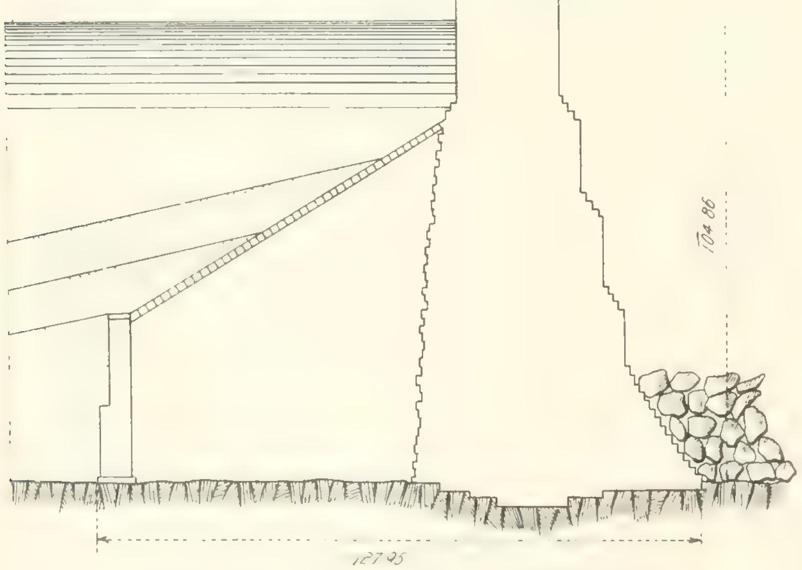


Fig. 7—Rio Lozola Dam, Spain, 1852.
(Scale 1 in. = 40 ft.)

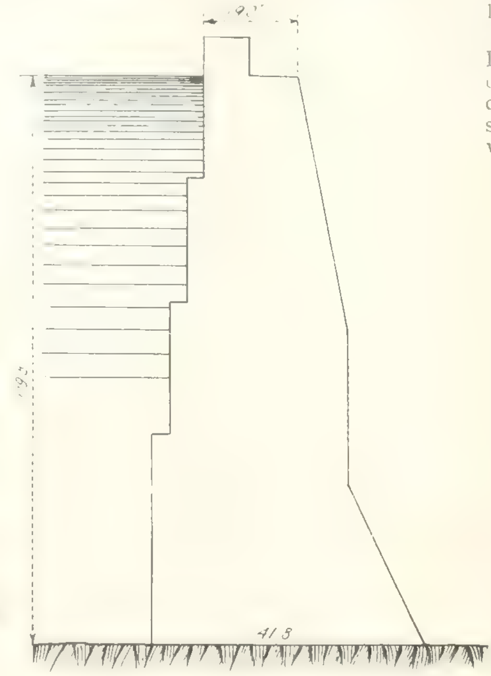


Fig. 6—Zola Dam, France, 1843.
(Scale 1 in. = 40 ft.)

The Furens Dam was designed according to Delocre's profile type. A cross-section is shown by Fig. 9. This dam is curved to a radius of 827 ft., and has a crest length of 328 ft. It was built of rubble masonry in lime of Theil mortar and has cut stone trimmings. It was completed in 1866.

Following the Furens Dam, French engineers designed a number of others all designed to profiles similar to that of Delocre. Among them was the Ternay Dam built in 1865-8 and shown in cross-section by Fig. 10. This dam is curved to a radius of 1,312 ft. and has a total height above foundations of 130 ft.

In 1865-73 the Habra Dam was built in Algiers by French engineers for irrigation. The alinement was straight and the crest length was 1,476 ft. A cross-section is shown by Fig. 11. The total height of masonry was 125 ft. A flood which overtopped the crest about 5 ft. destroyed the Habra Dam in 1881.

The Ban Dam shown in section by Fig. 12 was built in France in 1867-70. It a cur dam built of rubble masonry wit cut trimming. The height above fo 166 ft.

Figure 13 shows a section of Gileppe Dam built in Belgium in 1869-70. is dam curved to a radius of 1,632 ft. nd has a crest length of 762 ft. It is built of ubble masonry with cut stone trimming. impounds water for domestic supply and po

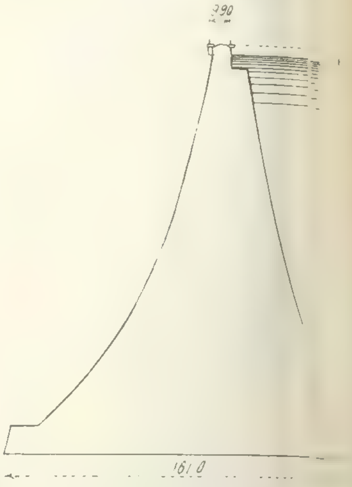


Fig. 9—Furens Dam, France 186
(Scale 1 in.=80 ft.)

The Villar Dam shown by Fig. at Lazoya, Spain, in 1870-8 for do supply. It is curved to a radius o has a crest length of 546 ft. It is sonry laid in hydraulic lime.

In 1880 the dam shown by Fig. in Almeria, Spain, for irrigation. and is built of rubble masonry wi facing.

Figure 16 shows the Gran Ch built in 1882-4 in Algiers. It is a sonry dam and straight in plan length of 509 ft. Another Alge shown by Fig. 17. This dam is o sonry and was built in 1885, f This dam has a crest length of 33 ft.

GERMAN AND AUSTRIAN D

The dams so far described r work of French and Spanish engineers except the Gileppe Dam, Fig. 13, Belgian engineers. Figure 18 sho of the Komotau Dam built n Bohemia and designed by Prof. Fla Austrian engineer. This dam is rved radius of 820 ft. and has a crest length o ft. In order to make the upstream face w tight, it was covered with two yers

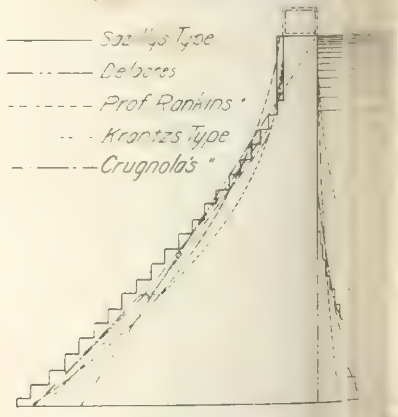


Fig. 8—Diagram Showing The
Types.

mixture of tar and natural asph toward the reservoir by a covering which was dovetailed to the main dam. In addition, a system of d leading to a drainage gallery was masonry.

drainage system was used in the built in Germany in 1901-4 near Prussia. This dam is curved to a it, and has a crest length of 741 by a waste weir 295 ft. long

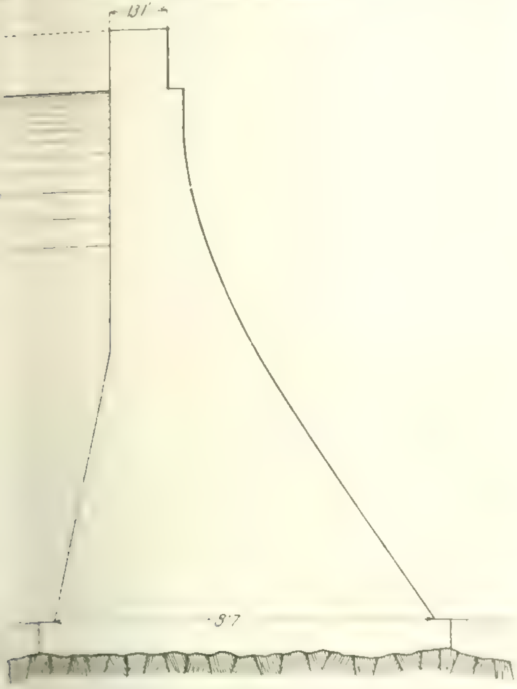


Fig. 10—Ternay Dam, France, 1866.
(Scale 1 in.=40 ft.)

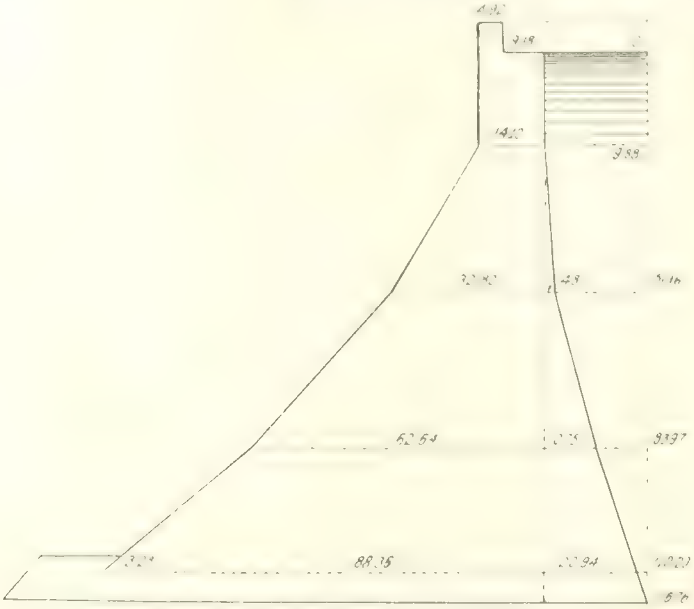


Fig. 11—Habra Dam, Algiers, 1873.
(Scale 1 in.=40 ft.)

stream face of this dam to height is built an earth bank upstream face.

ner German dams are the Queis, the Sengbach, 141 ft. high, and 134 ft. high.

NED BY ENGLISH ENGINEERS

o. Rankin published as a result design of masonry dams a osed of logarithmic curves. This in Fig. 8. A dam according was built at Bombay, India. Ex- Vyrnwy Dam all dams of the first signed by English engineers have Egypt, India and Australia, and many notable structures.

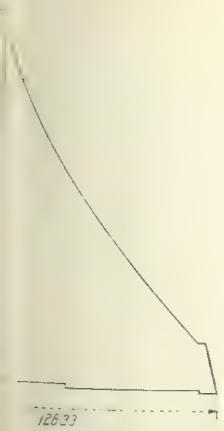
m.—The Vyrnwy Dam is on the in North Wales and forms a the water supply of Liverpool, cross section of the dam is Fig. 19. It is 1,350 ft. long on the straight in plan. The foundation is to which a trench 1,100 ft. long wide was excavated for the ma- trench was 60 ft. deep at the The rock foundation bed was The masonry was rubble with ng. The rubble stones ranged in size to 10 tons. They were a dense tough slate and the lower beds were roughly dressed to approximately [illegible] surfaces and all projecting points were knocked off. The proportions of stone of various sizes were about as follows: 2 ton stone [illegible] ton stone 26 per cent, above 4-ton stone 33 per cent. The stones were laid in a mortar 1½ Portland cement, 2 river sand and 1 fine quarry chips. Small stones were used to fill the interstices and all stones were firmly rammed into the mortar and the mortar was also packed into the interstices with rammers. Tests of large blocks cut from the masonry gave a crushing strength of 300 tons per square foot. The calculated stress on the masonry is 9 tons per square foot. As in the Urft and Komotau dams described above drains were constructed in the masonry of the Vyrnwy Dam. The Vyrnwy Dam contains 260,000 cu. yds. of masonry and this masonry cost for materials and labor $2,532,000 or just under $10 per cubic yard. The dam was built in 1882-9.

Bhatgur Dam.—This dam impounds a reservoir of 126,500 acre feet for irrigation, and is located across the Yelwand River in the Presidency of Bombay, India. The dam is 4,067 ft. long and curves across the valley in an irregular manner following the outcrop of rock on which it is founded. It is constructed of undressed rubble in cement but has dressed rubble facings. There are 17 sluices through the dam closed by gates; these sluices are for canal supply and also for flushing the reservoir from silt. A section of the dam at the highest part is given in Fig. 20.

Beetaloo Dam.—This dam was completed in 1890 to form a reservoir for domestic water supply and irrigation for some 1,715 square miles of territory in South Australia. The dam is curved on a radius of 1,414 ft. and has a crest length of 580 ft. A cross section at the highest point is given in Fig. 21. The construction is entirely of concrete, about 60,000 cu. yds. being used, and the work cost $570,000. This dam impounds about 800,000,000 imperial gallons.

Periyar Dam.—This dam was completed in 1897 across a gorge of the Periyar River in southern India. A cross section at the highest point is given in Fig. 22. The dam impounds a reservoir of about 8,000 acres area which supplies water for irrigating 100,000 acres. The crest length of the dam is 1,168 ft. It is founded on rock and constructed of hydraulic lime concrete with a rubble masonry facing on the upstream side. The notable feature of this dam was its construction in a wild country across a stream subject to frequent turbulent floods with native labor. It cost $768,000.

Barossa Dam.—This dam was completed in 1903 to impound water for domestic use and garden irrigation of the town of Gawler, South Australia. It is a curved dam with a radius of 200 ft. and a crest length of 472 ft. A cross-section at the highest point is given in Fig. 23. The dam is founded on rock and is of rubble concrete. The total volume of masonry is 17,978 cu. yds. and the cost was $9.30



Dam, France, 1870.
1 in.=80 ft.)

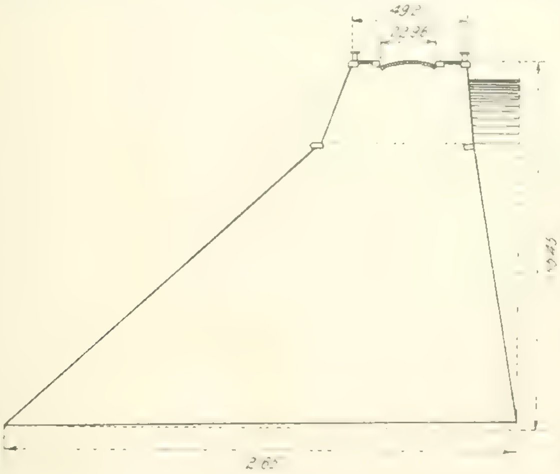


Fig. 13—Gileppe Dam, Belgium, 1875.
(Scale 1 in.=80 ft.)

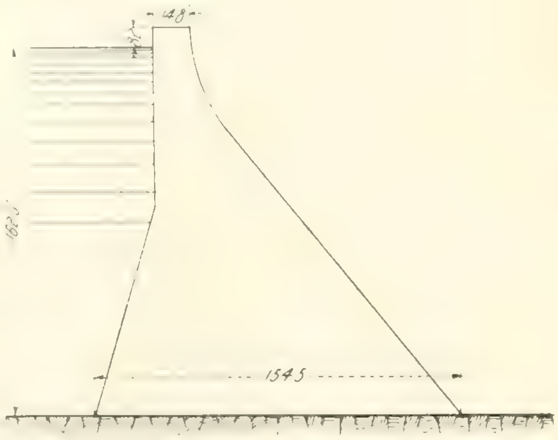


Fig. 14—Villar Dam, Spain, 1878.
(Scale 1 in.=80 ft.)

per cubic yard. The thin section at the top for about 20 ft. below the crest was reinforced with railway rails curved to arc and connected by fish plates.

Tansa Dam.—This dam was completed in 1891 to form a reservoir for the water supply of Bombay, India. It is notable as being the longest masonry dam in the world, its crest length being 9,000 ft. A cross section at the highest point is given in Fig. 24. The dam is constructed of uncovered rubble laid in lime mortar with which some cement was mixed for the highest parts of the section. The volume of masonry is 408,520 cu. yds. The dam is straight.

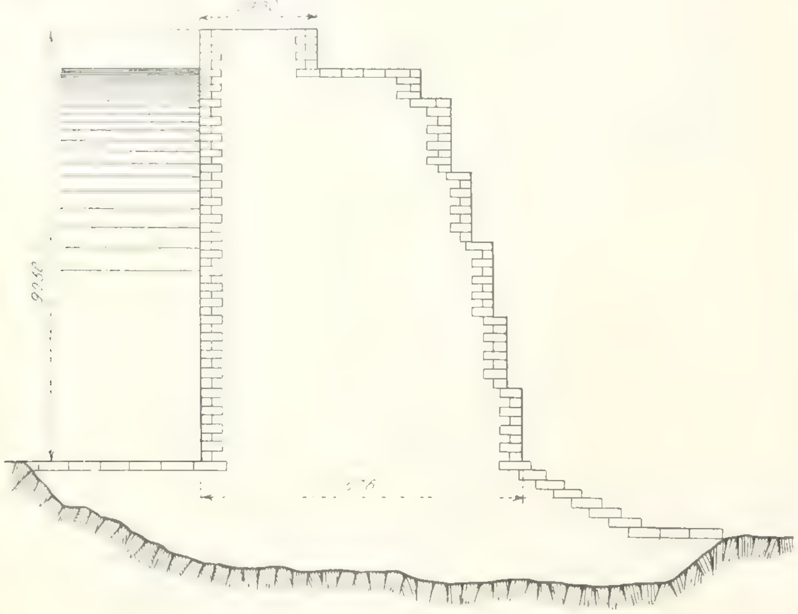


Fig. 15—Hijar Dam, Spain, 1880.
(Scale 1 in.=40. ft.)

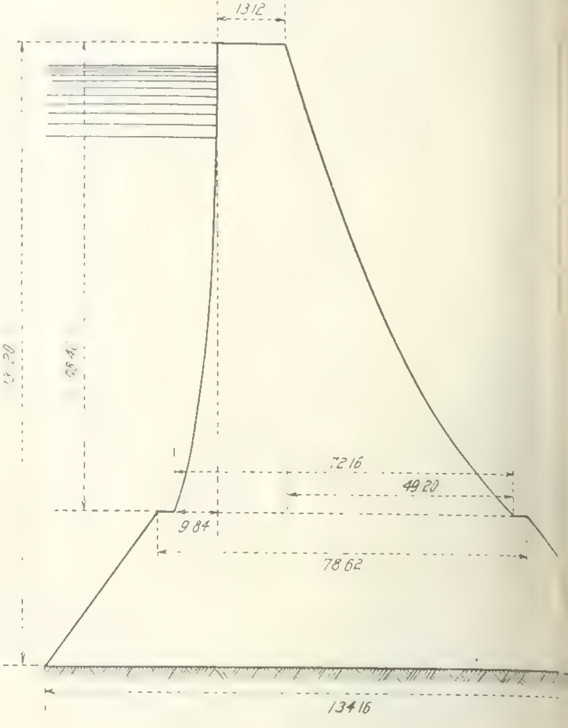


Fig. 16—Gran Cheurfas Dam, Algiers, 1884.
(Scale 1 in.=40. ft.)

Assuan Dam.—Some of the most famous dams, built by British Engineers, are constructed across the Nile in Egypt to store water for irrigation. They are not remarkable for their height, but for their great lengths.

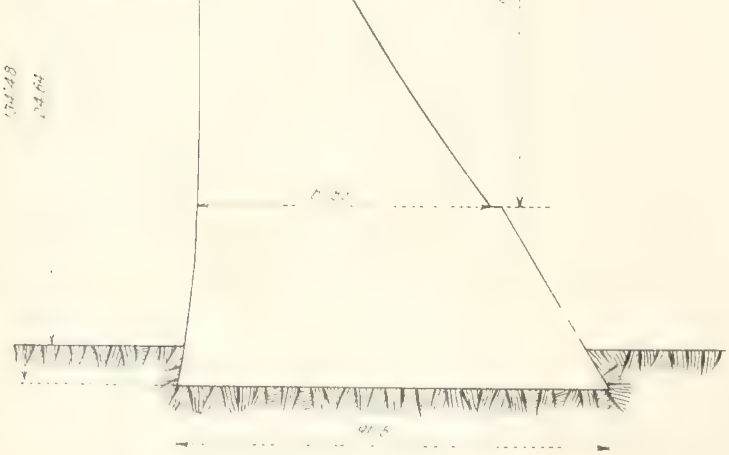


Fig. 17—Hamiz Dam, Algiers, 1885.
(Scale 1 in.=40. ft.)

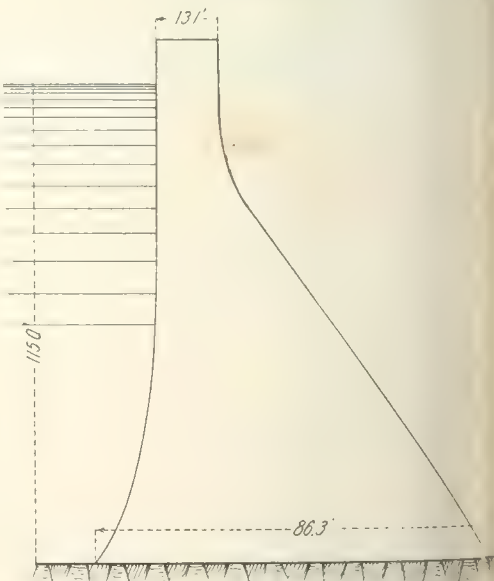


Fig. 18—Komotau Dam, Austria, 1904.
(Scale 1 in.=40. ft.)

The most important of these works is the Assuan Dam, built in 1898 to 1903, about 700 miles from the Mediterranean. This dam is about 6,400 feet long. It had originally a maximum height of 96 feet above the foundation, but in 1907 to 1909, the dam was increased 16.4 feet in height, its cross section being given, at the same time a greater area (Fig. 25). It was a difficult piece of work to make a good joint between the old and the new masonry on the down-stream side of the dam. The method by which this was accomplished was devised by the late Sir Benjamin Baker, connected with the works as consulting engineer. Tie-rods, 1¼ ins. in diameter and 8¼ ft. long, were sunk into the masonry so as to project for about half their length. These rods, which serve to tie the new to the old work, are in rows, a meter apart, both horizontally and vertically. A space of half a foot wide measured normal to the face of the wall was left between the new and the old masonry, with the exception of small supporting lls, 6 ins. thick, which were built 49 ft. apart d extend from the bottom to the top of the m.

These walls and the tie-rods su orted new masonry until the hollow s tioned above were filled with grout not done, however, until a sufficie elapsed to allow the masonry on of the hollow spaces to reach the perature. The grouting was don bottom upwards through perforat ins. in diameter, which were pla hollow spaces, as the masonry was the pipes being bent to suit the dam.

The dam backs up the Nile fo miles and stores enough water f 988,000 acres under perennial cult high water the Nile flows throug ways, constructed in the dam levels, and controlled by suitable These gates are capable of disc maximum flow in the Nile, which about 494,500 cu. ft. per second. O the gates are 6.56 ft. wide by and 40 are 6.56 ft. wide by 11.48

am.—The Cataract Dam crosses

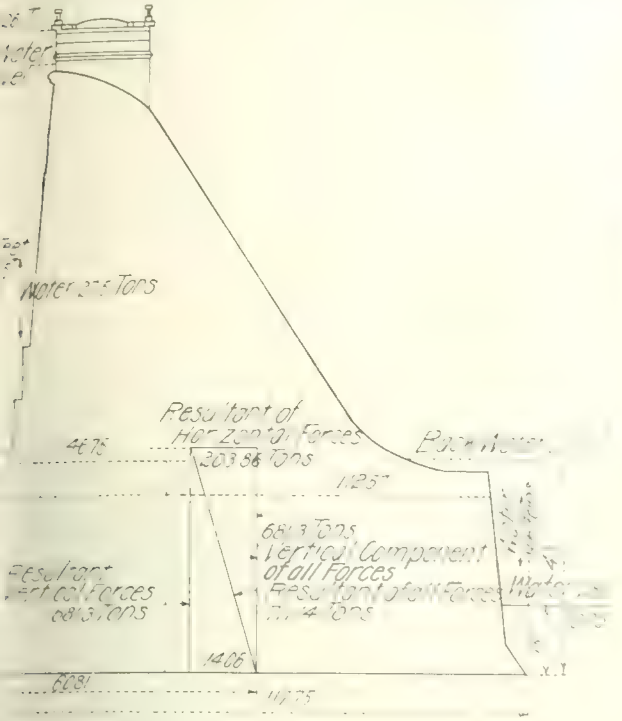
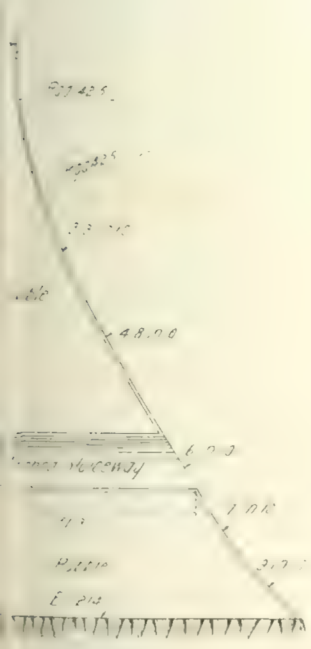


Fig. 19—Vyrnwy Dam, England, 1889.
(Scale 1 in.=40 ft.)

iver in Australia and is straight crest length 811 ft. and a maxi-of 192 ft. The dam is built of ry with an upstream facing of s and a downstream facing of crete. A typical cross section is . 26. The dam contains 146,242 sonry of all kinds and the total 2,000, of which $1,000,000 about of masonry proper.

AMERICAN DAMS.

34 there was only one masonry



0—Bhatgur Dam, India.
(Scale 1 in.=40. ft.)

size in the United States. This s Corner Dam, built in 1866-73 supply of New York city. This t length of 670 ft. and is 78 ft. high. The next notable dam was the San Mateo dam notable as being one of the earliest dams to be constructed of concrete in the United States [illegible] the water supply of San Francisco, Cal. It is a curved dam 700 ft. long on the crest, 170 ft. high and 176 ft. thick at the base. A cross section of the San Mateo Dam is shown by Fig. 27.

La Grange Dam.—This dam was completed in 1893 to impound water for the irrigation of some 250,000 acres of land. It crosses the canyon of the Tuolumne River near LaGrange, Cal., its line being a curve on 300 ft. radius, and its crest length 320 ft. A cross section at the highest point is given in Fig. 28. The construction is of cyclopean masonry on a rock foundation; there are about 40,000 cu. yds. of masonry.

Butte City, Dam.—This dam was completed in 1892 and forms part of the water supply works of Butte City, Mont. It is a concrete dam built on a curve of 350 ft. and has a crest length of 350 ft. A cross-section at the highest point is given in Fig. 29. The masonry is founded on rock and is rubble concrete. The

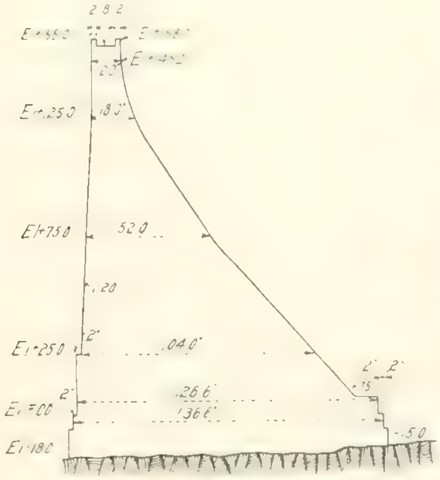


Fig. 22—Periyar Dam, India, 1897.
(Scale 1 in.=80 ft.)

reservoir formed has a capacity of about 1,000,000,000 gals.

Olive Bridge Dam.—This dam is at the head of the Catskill aqueduct at Brown's Station, New York. The dam is across the gorge of the Esopus Creek and with its earth wings has a length of nearly 1 mile (ENGINEERING & CONTRACTING, Oct. 19, 1910). The masonry part, Fig. 30, however, is about 1,000 ft. long, and its maximum height about 251½ ft. It is 190 ft. thick at the bottom and the top, which carries a roadway, is 26 ft. wide. The dam is composed of cyclopean masonry laid between walls of concrete blocks. These act as forms on the faces of the dam and at

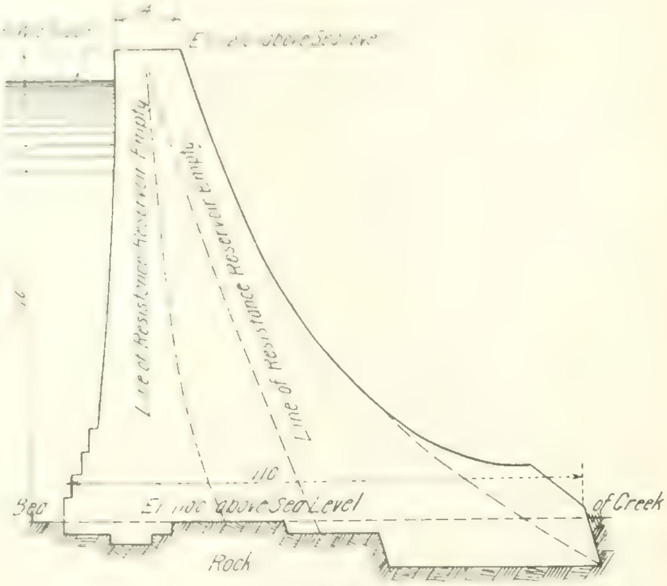

El. above Sea Level
Line of Resistance Reservoir Empty
Line of Resistance Reservoir Full
110
Bed
El. 100 above Sea Level
of Creek
Rock

Fig. 21—Beetaloo Dam, India, 1890.
(Scale 1 in.=40 ft.)

the expansion joints. The dam was begun in 1907 and will be completed bv 1914.

Spier Falls Dam.—This dam is about nine miles west of Glens Falls, New York, on the upper Hudson River. It was built as part of an hydro-electric plant furnishing current to surrounding towns and industries. The dam, Fig. 31, is 152 ft. high and 113 ft. wide on the bottom. The spillway section is 80 ft. high. It is built of cyclopean masonry.

Pathfinder Dam.—This dam is a part of the development of the North Platte, U. S. Reclamation project. The dam is of circular arch

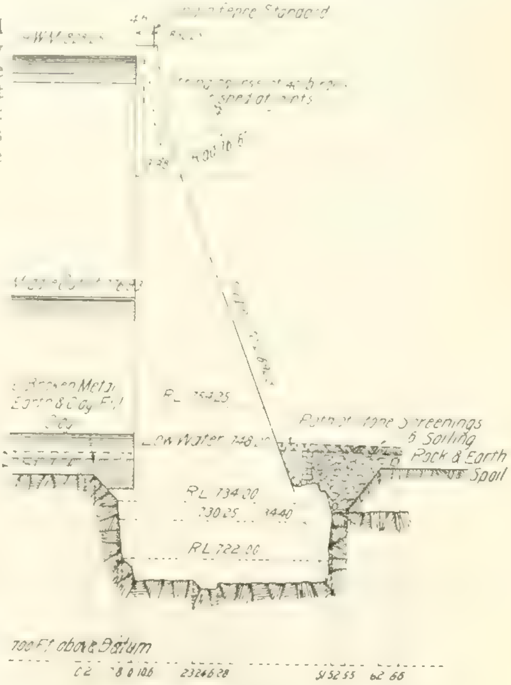


Fig. 23—Barossa Dam, India, 1903.
(Scale 1 in.=40. ft.)

semi-gravity type with an axial radius of 150 ft. It is 210 ft. high, 226 ft. long at the top and 76 ft. long at the bottom along the axis, 94 ft. wide at the bottom and 10 ft. wide at the top, having upstream and downstream slopes of 25 and 15 per cent respectively. The dam contains 53,000 cu. yds. of masonry. Figure 32 is a cross section.

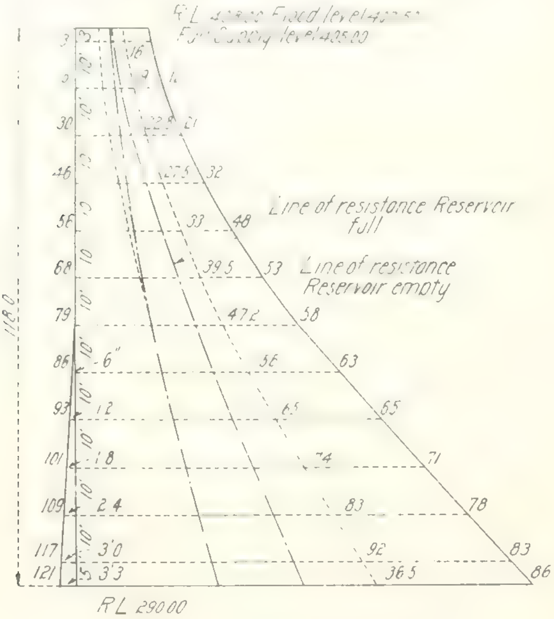


Fig. 24—Tansa Dam, India, 1891.
(Scale 1 in. = 20 ft.)

Shoshone Dam.—This is a part of the Shoshone project of the U. S. Reclamation service and is situated in the Shoshone River in a precipitous canyon about eight miles above Cody, Wyo. It is almost a duplicate of the Pathfinder dam, except in height, length and bottom width of the portion lying below the river bed. Its total height is 310 ft., 70 ft. of which lies below the river bed. The portion below the river bed has a width of 108 ft. and has vertical faces. The total length of the dam along the axis is 187 ft. at the top and 92 ft. at the bottom. The dam contains 69,000 cu. yds. of masonry. Figure 33 shows a cross section.

Lake Cheesman Dam.—This dam was built for the Denver Union Water Co., for the Denver water supply. It was completed in 1902. Its maximum height is 236 ft. and the extreme thickness is 176 ft. With water flowing 2 ft. deep over the spillway the head is 224 ft. which at the time it was built was the greatest head withstood by any dam. The thickness of the dam at the top is 18 ft. It is made of granite laid in Portland cement mortar; the weight of the masonry is 158 lbs. per cubic foot, 74 per cent being granite and 26 per cent mortar. The total volume of masonry is approximately 103,000 cu. yds., requiring 80,000 bbls. of cement or about 0.78 bbls. per cubic yard. The mortar was mixed 1:2½, 95 lbs. of cement being taken as equal to 1 cu. ft. Figure 34 is a cross section.

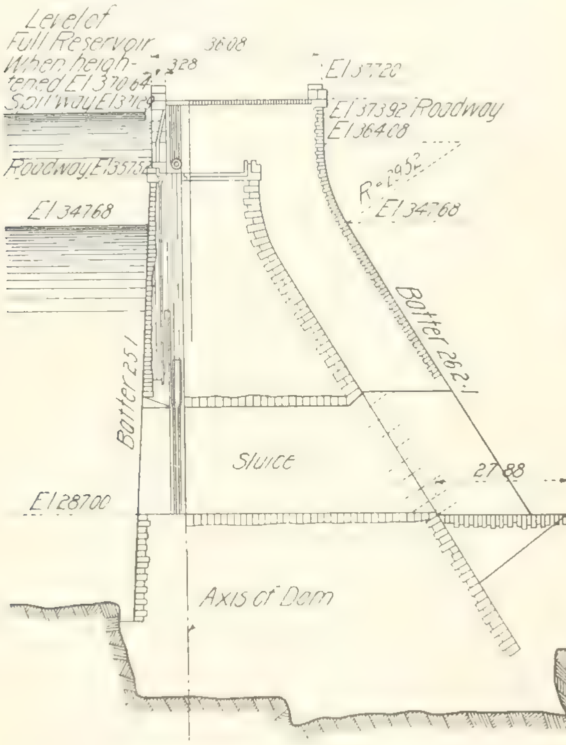


Fig. 25—Assuan Dam, Egypt, 1911.
(Scale 1 in. = 40 ft.)

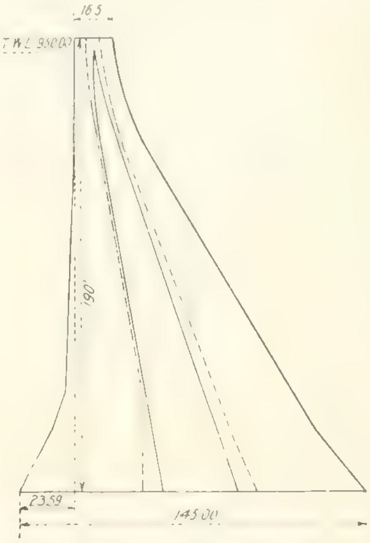


Fig. 26—Cataract Dam, Australia.
(Scale 1 in =40 ft.)

Croton Falls Dam.—This dam
a part of the Croton water suppl
New York city and cost about $2,8
main dam, Fig. 35, is of cyclope
1,100 ft. long and 167 ft. high.
also a waste weir 700 ft. long, and
dam of rolled earth with a mason
about 1,100 ft. long and 50 ft.
waste weir 1,000 ft. long. The max
of the base is 128 ft.

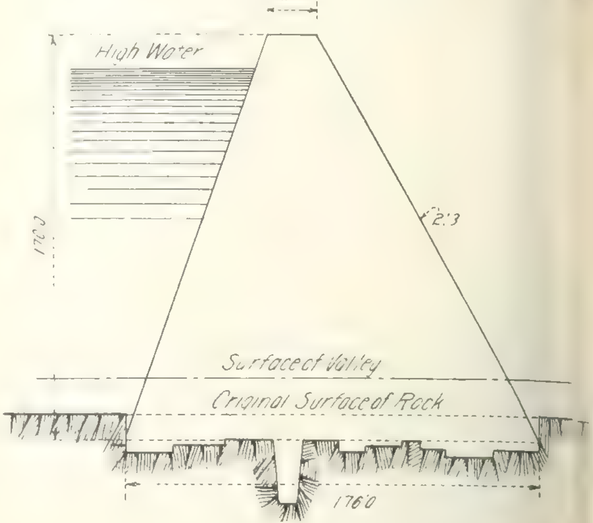


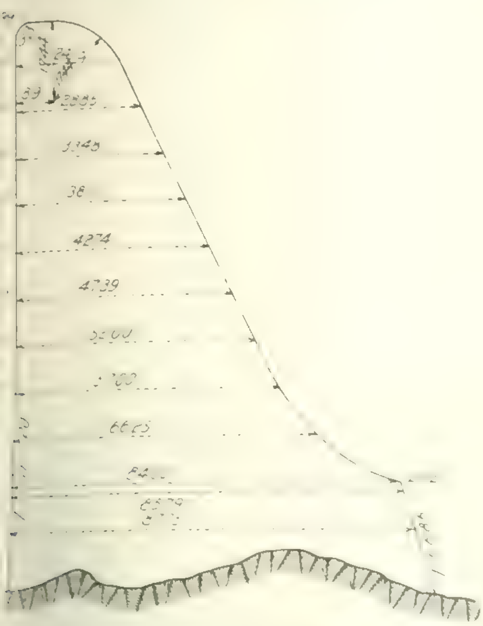
Fig. 27—San Mateo Dam, California, 1889.
(Scale 1 in.=80 ft.)

Croton Dam.—The new Croton
pleted in 1906 after 14 years' wor
about 3¼ miles west of the old
(completed in 1842) for forming a
ervoir for New York city's water
original plans called for a waste
long to be built along the rocky si
ing the north slope of the valley,
dam 600 ft. long and an earth dam
with masonry corewall. The eart
afterward changed to masonry w
ception of a short piece 26 ft. high
long on the south end. The maxi
of the base is 206 ft. and the max
excavated below the river bed wa
ft. The dam itself is 297 ft. high
and 19.8 ft. wide below the roadw
carries on its top. Figure 36 is a c

Roosevelt Dam.—This dam,
part of a U. S. Reclamation servic
the Colorado River in Arizona.
concrete masonry and is 284 ft
maximum point. Its length is 1,
maximum depth of water against
The width of the crest is 16 ft.
stream face slopes 3:2 and the up
20:1. The cubical contents of
340,000 cu. yds.

Kensico Dam.—This is the prop
form the Kensico reservoir on the
Catskill aqueduct 30 miles nor
York city. The contract was awar
to H. S. Kerbaugh of Philad
dam is to be built across the
Bronx River. The dam contains
000 cu. yds. of material and will

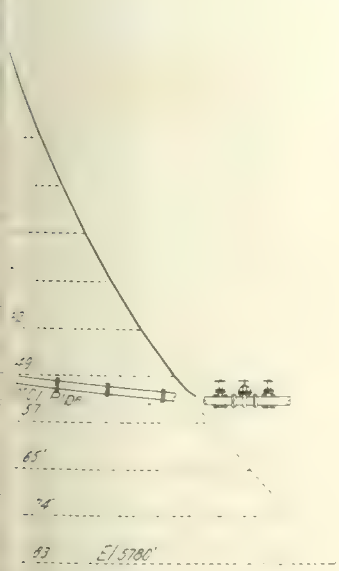
nstruction, to the Olive Bridge or am. The height of the dam will be ft. at its deepest point measured to



g. 28—La Grange Dam, California, 1890.
(Scale 1 in.=40 ft.)

ase will measure 228 ft. in thickts top about 28 ft. The dam is ft. long. The excavation below to bed rock will be about 120 ft. deepest point. The work is estiompleted in 1922 or 10 years eginning of the work. Figure 38 ection.

Dam.—This dam, Fig. 39, is the Nashua River near Clinton, he Metropolitan Water Board for water to the Boston Metropolitan t is founded on rock and contains 0 cu. yds. of masonry. At its crest across the valley is 1,250 ft., but ngth of the dam is about 1,400 ft., te wier is placed at an angle with m. In the deepest part of the valof the dam is 140 ft. above the river and 200 ft. above rock. The ut 175 ft. thick and the top about



9 Butte City Dam, Montana, 1892.
(Scale 1 in.=40. ft.)

ver Dam.—This dam was built to e storage on the Croton water shed ted about 40 miles north of New York city. The maximum height of the dam is about 155 ft. and its length nearly 900 ft. Its top is 17 ft. thick and its base about 114 ft.

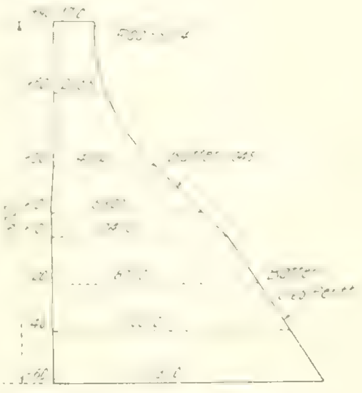


Fig. 31—Spier Falls Dam, New York, 1905.
(Scale 1 in.=80 ft.)

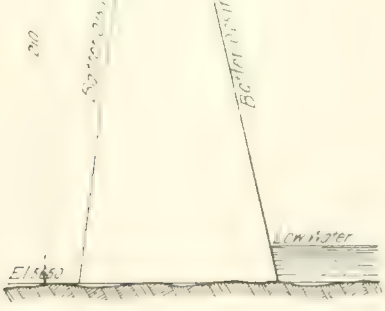


Fig. 32—Pathfinder Dam, Wyoming, 1910.
(Scale 1 in.=80 ft.)

It is built of cyclopean masonry with concrete blocks for facing. This was the first dam built by the New York Board of Water Supply using the concrete blocks. The Ashokan and Kensico Dams are of practically the same construction. The dam was begun in 1905 and

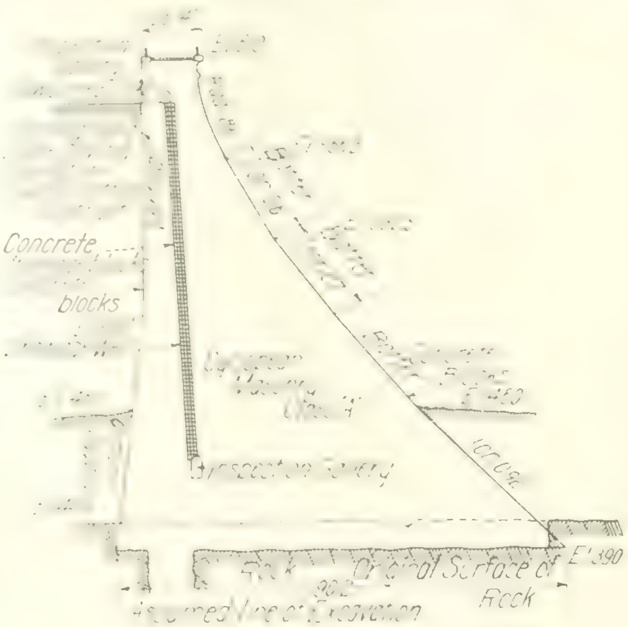


Fig. 30—Olive Bridge Dam, New York.
(Scale 1 in.=80 ft.)

completed in 1907. Figure 30 is a cross-section.

THE THEORY OF MASONRY DAMS.

As stated in a preceding paragraph the French engineer, de Sazilly, was the first engineer to propose rational principles for the design of masonry dams. He pointed out that there were three ways in which such a dam could fail, viz.: (1) By overturning. (2) By sliding or shearing. (3) By the masonry or the foundation being crushed by the pressure it had to sustain.

To insure safety the dam should have ample margins of resistance against all of these

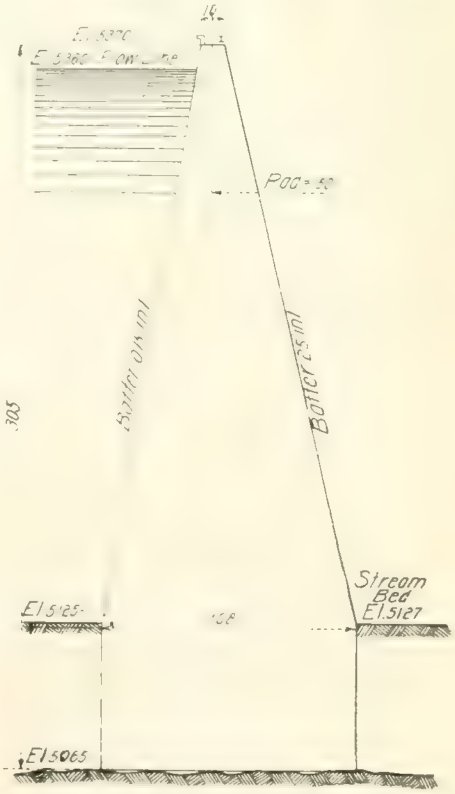


Fig. 33—Shoshone Dam, Wyoming, 1910.
(Scale 1 in.=80 ft.)

modes of failure. De Sazilly was unable to devise equations for determining the outlines of a profile which should contain the minimum area consistent with the given conditions, but he found that, within the limits of actual practice, a dam having sufficient strength against overturning and crushing would, as a rule, also resist safely all tendency to slide or shear.

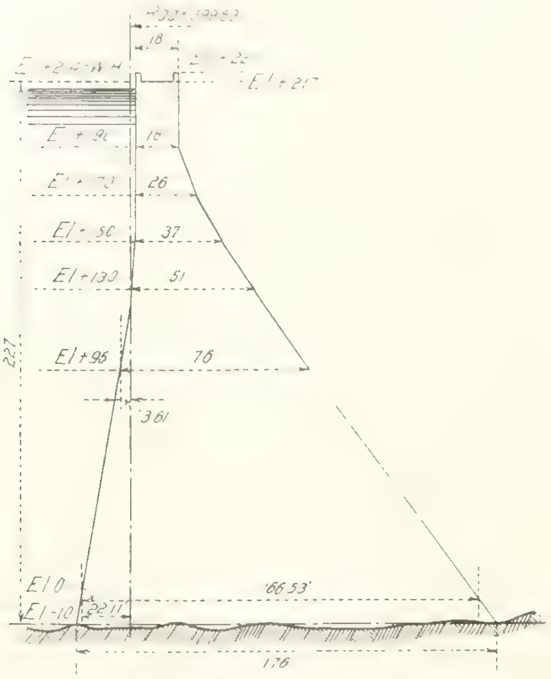


Fig. 34—Lake Cheesman Dam, Colorado, 1904.
(Scale 1 in.=80 ft.)

The reason why this happened to be the case was because de Sazilly limited the pressures in the masonry and on the foundation to the very low pressure of 6 kg. per square centimeter (about 6 tons per square foot). If he had allowed pressures of 16 to 20 tons per square foot, which exist in some modern dams, he would have found that under certain conditions a dam might slide or shear apart even though strong enough against overturning.

Having fixed his limit of pressure, de Sazilly designed a profile type in which the maximum pressures in the masonry (which occur at the faces) just reached the limit established, except near the top of the dam where the maximum pressures are less than this limit. He called this design a profile of equal resistance. De Sazilly was unable to determine the exact outlines of this profile, but he found equations for a stepped profile (Fig. 8), which was an approximation to the ideal type. In calculating the distribution of pressure at any assumed horizontal point, de Sazilly considered the pressure to vary uniformly.

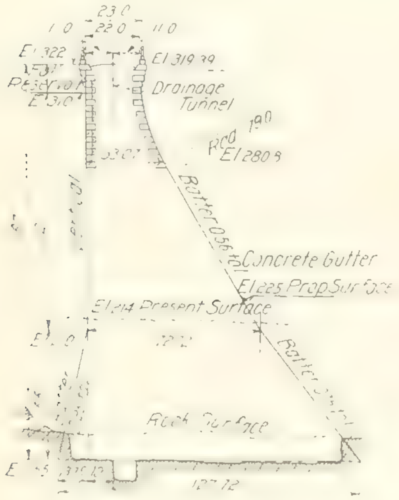


Fig. 35—Croton Falls Dam, New York, 1911.
(Scale 1 in.=80 ft.)

According to this law the pressure is uniformly distributed, when the vertical resultant of pressures on the masonry intersects the assumed joint at its center (Fig. 41). In this case the diagram representing the reaction of the masonry below the assumed joint is a rectangle. If the resultant pressure intersects the joint to one side of the center of the joint, the diagram of reaction becomes a trapezoid (Fig. 42). When the resultant pressure intersects the joint one-third the length of the joint from one of the faces of the dam, the trapezoid of reaction becomes a triangle (Fig. 43) and, finally, when the resultant pressure is nearer one end of the joint than one-third the length of the joint, the diagram of reaction is represented by two triangles (Fig. 44), one of which, *a, b, c*, represents a negative strain, i. e., tension.

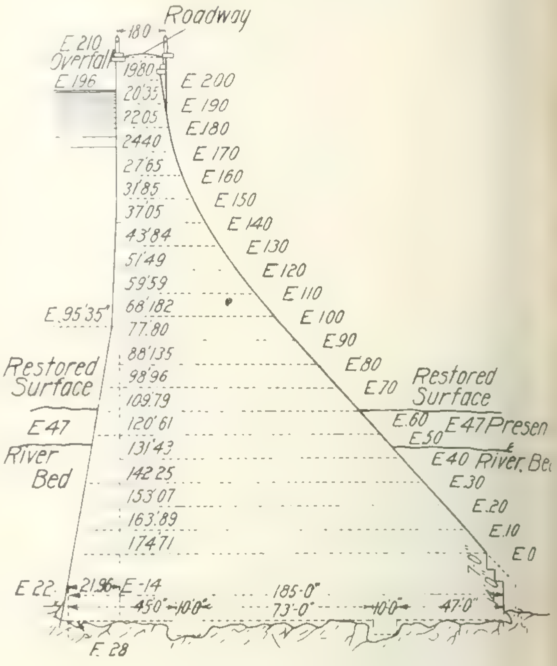


Fig. 36—New Croton Dam, New York, 1906.
(Scale 1 in.=80 ft.)

It is somewhat difficult to understand how tension can occur in the masonry of a dam. With eccentric loading, such as is shown in Fig. 44, the vertical resultant of all the forces acting above a given horizontal plane is supported on part of the joint (*a, b*), and the tendency of the dam to rotate about a point near the downstream face is partly prevented by tension in the masonry along *b, c*.

In Figs. 41 to 44, inclusive, the dam is considered to be a rigid mass. As a matter of fact, the masonry is more or less elastic and this condition, doubtless, modifies the distribution of the pressures at any assumed horizontal joint or at the base. The late Mr. J. B. Francis, Past Pres. Am. Soc. C. E., disputed the correctness of the distribution of pressure in a dam as a uniformly varying stress and claimed that the pressures were zero at the faces and a maximum under the center of the dam (see Trans. Am. Soc. C. E. for 1888). The diagram of reaction given by Mr. Francis is represented by two quadrants of ellipses.

The center of gravity of the diagram of reaction must be vertically under the resultant vertical pressure, or otherwise, we would have an unbalanced couple of forces which would revolve the dam. The latter condition occurs in the diagram proposed by Mr. Francis, which is, therefore, theoretically impossible. When we modify this diagram so as to bring its center of gravity directly under the resultant vertical pressure, the diagram approaches closely to the form of a trapezoid and we get a distribution of stress somewhat like that shown in Fig. 45.

While the distribution of stress shown in Figs. 41 to 44, inclusive, is not absolutely correct, if we take into account the elasticity of the masonry, these figures give safe results by exaggerating, in all probability, the pressures at the faces where the ma weakest.

The distribution of pressure in a uniformly varying stress has been adopted. In making the calculations pressure, the wall is assumed, for conven be divided into a number of courses zontal joints taken a convenient dista (generally 10 to 20 ft.) apart. This is to facilitate the calculations. In ac construction all long joints must be av the bond between the stones being brok directions.

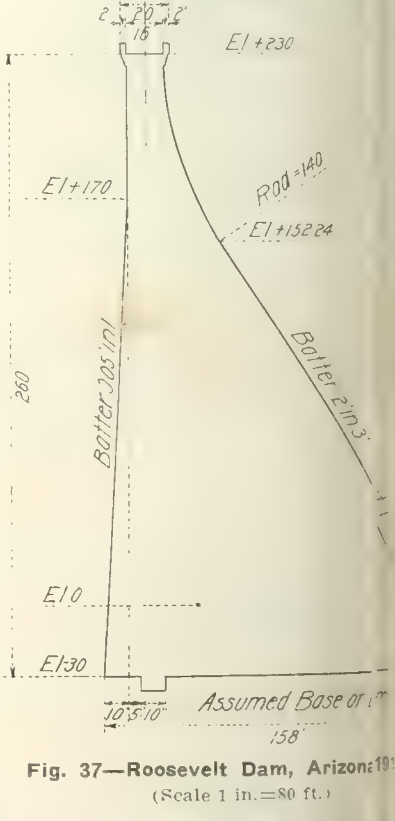


Fig. 37—Roosevelt Dam, Arizona

(Scale 1 in.=80 ft.)

Two cases have to be consider Reservoir full and reservoir empty latter case the masonry has only t vertical pressure, while in the forme sultant of the water pressure and of t

n produces an inclined resultant,
rsects the horizontal joint nearer
tream face than the resultant for
npty does. We find, therefore, that
reservoir is empty the maximum

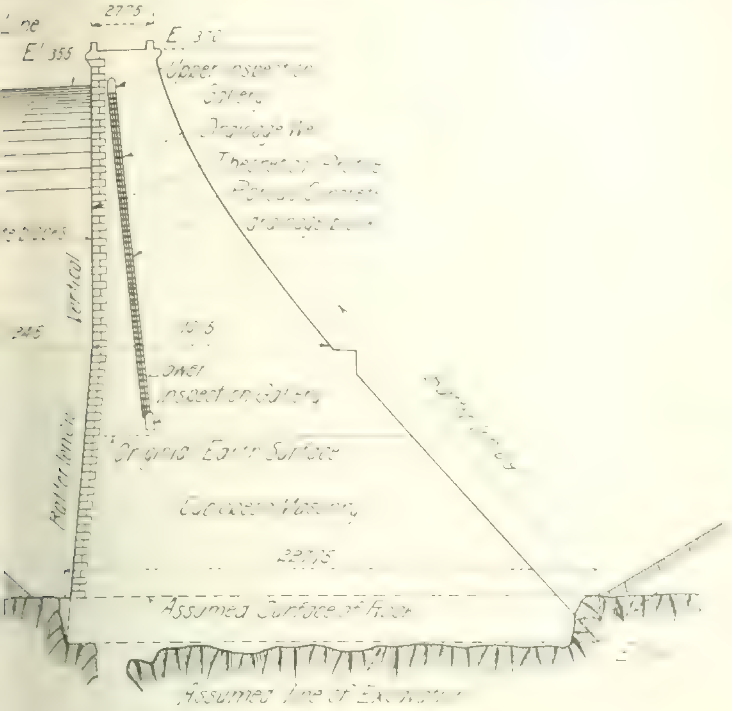


Fig. 38—Kensico Dam, New York.
(Scale 1 in.=80 ft.)

urs near the up-stream face of the
for "reservoir full" the maximum
at the down-stream face. In all
of pressures in the masonry of a
wo extreme cases must be consid-
assumed horizontal point.
ase of "reservoir full," de Sazilly
riters who immediately followed
ted only the distribution of the
nponent of the inclined resultant,
at the horizontal component was
by the resistance of the masonry to
Bouvier, Lévy and other engineers
d out that this method does not
the maximum pressures that may
masonry, as greater pressures will
assuming inclined joints, normal
ant, instead of horizontal joints.
Rankin recommended that some
or greater pressures on inclined
ade by adopting a lower limit of
the masonry at the down-stream
r that at the up-stream face. These
made respectively 15,625 lbs. and
er square foot in the logarithmic
signed (Fig. 8). This writer also
portant condition to those fixed by
engineers, viz.: that the lines of
reservoir full or empty should
in the center third of each joint,
avoid tension in the masonry.
engineers named above, Krantz
a have also proposed profile-types

Atcherly and Pearson startled
ing profession in 1904 by demon-
paper on "Some Disregarded
Stability of Masonry Dams" that
ins might be found by assuming
divided into courses by vertical
orizontal planes.
and Pearson and other engineers
ments with models of dams, gen-
of some uniformly elastic sub-
a view of finding the actual dis-
pressure in a masonry dam. The
all such experiments is that the
a dam (especially if consisting of
ibble) is by no means uniformly
would, therefore, have no reason
at the results obtained with small
els would apply to masses of

We cannot enter here into a discussion of all the theories about the distribution of stresses in masonry dams that have been advanced. Whatever we may think about these theories, the practical fact remains that numerous masonry dams have been designed and built on the simple assumption that the pressures in the masonry were distributed as uniformly varying stresses as recommended by de Sazilly, and none of them have failed except those built on poor foundations or in an imperfect manner.

The early writers on the subject of masonry dams considered these structures to be acted on only by two forces, viz.: the weight of the masonry and the pressure of the water against the up-stream face of the dam. Later it was proposed that the pressure of ice against a dam should be considered in northern latitudes and, also, an upward pressure due to water getting under the base of the wall.

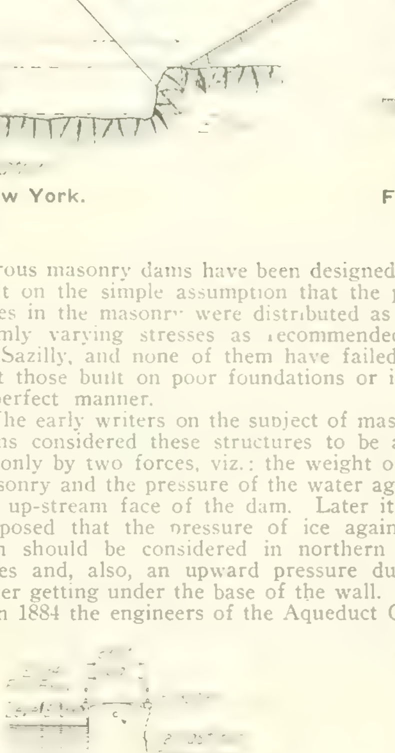


Fig. 40—Cross River Dam, New York. 1909.
(Scale 1 in.=80 ft.)

In 1884 the engineers of the Aqueduct Commission of the city of New York prepared plans for a masonry dam, more than 275 ft. in height, which was to be built across the Croton River, near its mouth, to form a large storage reservoir for the water supply of New York. In this connection a very careful study was made of all theories about masonry dams and of existing works of this kind. Owing to the great height of the proposed dam (which was known from an old bridge near its site as "the Quaker Bridge Dam"), the engineers of the Aqueduct Commission were obliged to adopt a much higher limit of pressure in the masonry than had been considered safe up to that time.

As has been stated above, de Sazilly adopted 6 kilograms per square centimeter (about 6 tons per square foot) as his limit of safe pressure on masonry.

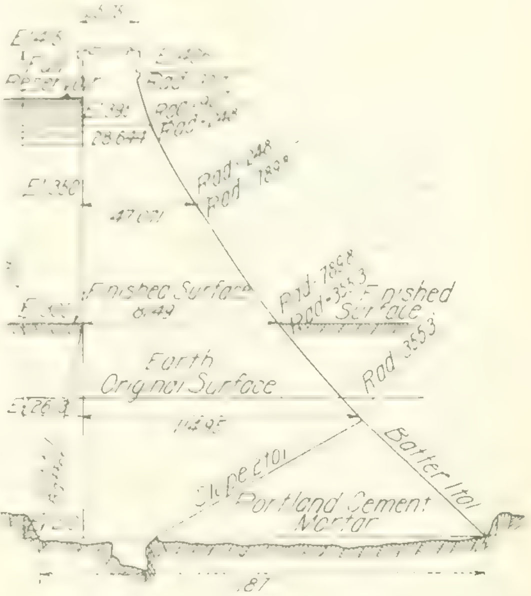


Fig. 39—Wachusett Dam, Massachusetts, 1906.
(Scale 1 in.=80 ft.)

Writers who followed him raised this limit to about 8 to 10 tons per square foot. Had such a limit been adopted for the Quaker Bridge Dam, its base would have been so wide as to have made the cost of work almost prohibitory. Knowing that good masonry could stand safely much greater pressures than 8 to 10 tons per square foot, the engineers of the Aqueduct Commission boldly fixed the limit of pressure in the dam at 16 tons per square foot, which made the base of the wall about 216 ft. wide.

Great opposition arose to the construction of this dam, owing to its unprecedented height —more than 100 ft. greater than that of the highest existing masonry dam, at that time, the famous Furens dam in France.

On account of the importance of the questions involved, the Aqueduct Commissioners appointed in 1888 a Board of Experts, consisting of three prominent engineers: Joseph P. Davis, James J. R. Croes and William F. Shunk, to examine carefully the plans that had been prepared for the Quaker Bridge Dam and to suggest any modifications that the board might deem advisable.

The board agreed generally with the manner in which the engineers of the Aqueduct Commission had designed the profile of the dam, except that it thought that an ice pressure, assumed at 43,000 lbs. per lineal foot at the highest ice-line, should be included in the forces acting on the dam. The introduction of this force into the calculations which, as far as the writer knows, was suggested by the Board of Experts for the first time, increased the upper part of the profile of the proposed dam considerably.

The Board of Experts, recommended also, that the plan of the dam should be curved, whereas the engineers of the Aqueduct Commission had proposed to make the plan straight, in view of the width of the valley (about 1,300 ft.).

The dam was not built until 1892 to 1907. The location was changed to a place about 1¼ miles above the old "Quaker Bridge" and the dam was named "the New Croton Dam." The dam was built in accordance with the plans prepared originally by the engineers of the Aqueduct Commission, viz.: straight in plan and without taking ice pressure into account.

In April, 1900, a masonry dam that had

been built in 1891 across the Colorado River at Austin, Texas, failed after a heavy rainfall that raised the river 11 ft. above the crest of the dam. The wall, which has a maximum height of about 68 ft., was built on a limestone foundation in which a fault, 75 ft. wide, extending to an indefinite depth, occurred. This fault was filled with adobe, having an occasional streak of red clay. The foundation of the dam was not carried down deep enough in this place and it is quite likely that a considerable upward pressure occurred by water getting under the foundation. This force and the fact that the down-stream toe of the dam was undermined by water flowing over the dam contributed largely to the failure, which occurred by sliding.

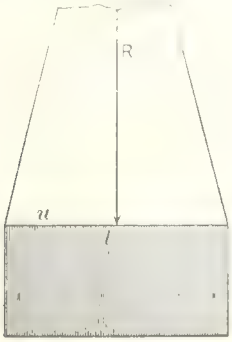


Fig. 41.

About this time, engineers began to take into account, in designing masonry dams, a possible upward pressure under the base of the wall. This was done in calculating the profiles for the Wachusett Dam, built in 1900 to 1906. In this case, for lack of any definite information on the subject, an upward pressure equal to two-thirds of the full head in the reservoir was taken at the up-stream face and assumed to diminish regularly to zero at the down-stream face. In addition to this an ice pressure of 47,000 lbs. per lineal foot was assumed to act at the highest ice-line. The profiles for the Cross River and the Croton Falls Dams were determined in a similar manner, with the exception that the ice pressures were assumed respectively at 24,000 and 30,000 lbs. per lineal foot.

In 1895 Mr. Robert Van Buren presented to the American Society of Civil Engineers a paper on "High Masonry Dams," in which he recommended that the profile of a masonry dam be determined by assuming an upward water pressure equal to the full head in the reservoir, acting uniformly under the whole base of the dam; and, also, by including in northern latitudes in the calculations an ice pressure of about 40,000 lbs. per lineal foot at the highest ice-line. By adopting these conditions, Mr. Van Buren arrived at the profile shown in Fig. 46, which for a height of 250 ft. has a base of 352 ft.

Such a design is, doubtless, very safe and might be adopted if we did not have to consider the question of cost. If safety alone had to be considered, we might as well once for all lay down the simple rule of making the width of the dam at any level equal to one and a half times its height. Skill in engineering consists, however, in obtaining the required security at a minimum expense.

For comparison, we have shown in Fig. 46 profiles of high masonry dams that have been built. If the highest of these structures—the New Croton Dam—had been designed according to Mr. Van Buren's recommendation, its base would have been over 400 ft. wide for a height of 297 ft., whereas, as actually built the base has only a maximum width of 206 ft.

In 1911, Mr. John R. Freeman, M. Am. Soc. C. E., made practically the same recommendations as those contained in Mr. Van Buren's paper, but the conditions made as regards upward pressure and ice pressure seem to be excessive and are not likely to be adopted in practice.

In 1884, Mr. Wegmann assisted the late Alphonse Fteley, Consulting Engineer at the time, and, later, Chief Engineer of the Aqueduct Commission of the City of New York, in the studies and investigations made for the proposed Quaker Bridge Dam. In this connection the subjects of ice pressure and of upward pressure under the base of the dam were carefully considered. While fully realizing the great force exerted by water in freezing, if confined, as between two bridge piers, Mr. Fteley was of the opinion that in the case of a reservoir with sloping banks, formed by a dam built in a narrow gorge, no great ice pressure would be exerted against the dam, as the pressure would follow the line of least resistance and would shove the ice up on the banks.

As regards upward pressure from water getting under the base of a dam, Mr. Fteley thought that in the rock formation existing in the Croton Watershed and with the precautions contemplated to be taken in securing a good foundation for the Quaker Bridge Dam, any upward pressure that might find its way through seams or fissures in the rock would be found on only a small area of the base of the dam. For these reasons he disregarded both ice pressure and upward pressure in designing the profile of the Quaker Bridge Dam, which was adopted, with very slight modifications, for the New Croton Dam.

No one looking at this grand structure would suppose that it was in a very insecure condition, and yet, if we apply to it and to many other existing dams the test recommended by Van Buren and Freeman, viz.: strength to resist upward pressure, equal to the full head of the reservoir and distributed over the whole base of the dam, and, in addition to this, in winter an ice pressure of about 25 tons per lineal foot, the lines of pressure in these dams would fall considerably outside of the profiles, so that the only force preventing them from being overturned would be the resistance of the masonry to tension. Such a condition, doubtless, does not exist.

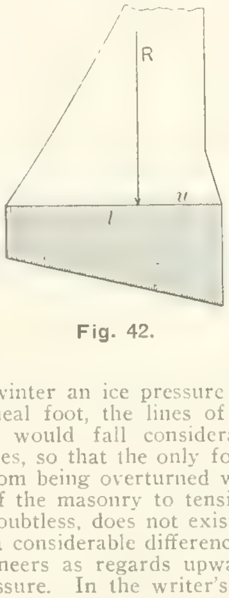


Fig. 42.

There is a considerable difference of opinion among engineers as regards upward pressure and ice pressure. In the writer's opinion the existence of upward pressure depends mainly upon the geological formation at the site of the dam, the depth of the foundation and the care taken in clearing seams and fissures in the rock. If a dam is to be built on porous sandstone, underlain by shale having seams filled with clay and gravel—like that of the ill-fated dam at Austin, Pennsylvania—a considerable allowance for upward pressure should be made—just how much is purely a matter of judgment and cannot be fixed by any rule. If, however, the dam is founded on good rock, which is practically impervious to water, no allowance for upward pressure need be included in determining the profile. Engineering, like the practice of medicine, requires the combination of science and good judgment. We cannot make standard drawings for masonry dams that can be used universally, but must adapt our plans to the conditions existing in any given case.

It is to be hoped that some experiments will soon be made to ascertain how much thrust ice may exert against a dam. One way of obtaining some indication of what this force may be would be to allow ice to be formed against the stop planks of a waste weir, supporting these planks with steel or iron rods which would yield at a certain fixed pressure.

The writer inclines to Mr. Ftele about ice pressure and does not beli e that ordinary reservoirs in this latitude such pressure is exerted against a dam. A gre many weak mill dams exist which ould ruptured each year if ice exerted the hig pressures assumed to exist by some ngineer These dams do not fail, and we n t, therefore, believe that they have not to s port a great ice pressure.

Thus far the writer knows of nly on case on record in which ice pressure as, practically, the primary cause of the f ure of masonry dam, viz.: that of the d of Minneapolis Mill Company. This all wa 535 ft. long and about 18 ft. high. A retaining wall, parallel with, and 350 ft. di nt from the dam forms the opposite side o he pon In winter, ice 4 ft. thick forms i he pon and ice 10 to 12 ins. thick freezes ainst dam to the depth of 10 to 12 ft.

During the week the pond with i ce in winter is drawn down two or ore to meet the demands for power, b on days the water and ice rise to the n al The ice along the dam and retaini mains, however, adhering to the Cracks caused by the unequal mo ice sheet are soon closed by expansi ing. It is evident that in this exerts against the dam, in addit force caused by expansion, an addit somewhat like that made by a togg

The dam was built in 1893 and cessfully in spite of the great p which it was exposed until the spr when a section of the waste-weir, failed by sliding. In the precedin had been noticed that the pressure the dam to revolve slightly about a its down-stream toe. The top of t moved in this manner about a stream without the walls having sli was cut along the dam, which retu about half the way to its original p prevent a repetition of the motion, were drilled, 25 ft. apart, throug and 4 ft. deep into the rock. Thre anchor bolts were placed in these surrounded with grout. These ro however, like pipestems when the curred in the following spring. the dam that failed was soon rebuil

Thus far, we have supposed a m built straight in plan and to resist e of the water only by its weight. walls acting in this manner are call Dams." The idea naturally sugge curve the plan of a dam, convex so as to make the structure act as arch. That in the case of a na much additional strength may be ga manner, was shown conclusively struction of the Zola Dam, built i 1843, and of the Bear Valley Da California, in 1884. Both of these have been overturned if their pla been curved, causing thus arch-act

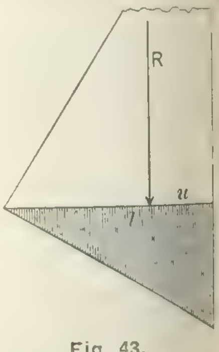


Fig. 43.

The profile of the latter dam, wh high, is especially bold. At the cr is 3.17 ft. thick; at a depth of 48 f top of the wall is 8.42 ft. thick, base the width is 20 ft. The dam is stream with a radius of 335 ft., a 300 ft. long on the crest.

Mr. F. E. Brown, the engineer w

s dam, adopted the plan w[illegible] s all the cement, tools and suppl[illegible] uled 70 miles over rough mountain site of the dam, and the available eans were very restricted. This uccessfully until 1910, when it was a more substantial structure built about 200 ft. further down-stream.

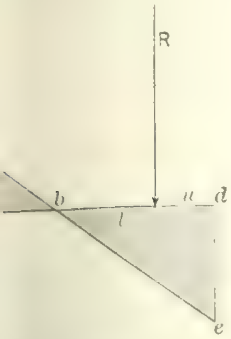


Fig. 44.

ges we have given show that a onry dam, built across a narrow will act as a horizontal arch. If is considerable width, the pressure masonry by arch action would an those resulting from the wall's water pressure by its weight

n act as an arch in a wide valley shall he draw the line between a a wide valley? These are some ons that puzzle engineers.

inks that a curved dam will act if its thickness does not exceed the radius of its up-stream (con- Another French engineer, Mr. laces the limiting value of the the base of the dam at one-half is of the up-stream side. Prof. ommends that a dam be always resist the water pressure by its and that, in the case of a narrow lan be curved to give some ad- ety to the work. For a long rs followed Rankine's advice and out reducing the profile of a dam iption that it acted as a horizontal e, however, this has been success- many instances.

on "Concrete and Masonry Dam in New South Wales" (See Proc. Vol. 178, p. 1), Mr. Leslie Augus- Wales, M. Inst. C. E., describes ed concrete dams built in 1896 se dams equal in boldness the de- Bear Valley Dam, mentioned profiles of these reservoir walls ned by considering the dams to s of rigid cylinders, subject to r pressure, disregarding any ad- ngth that might be due to the e masonry. These dams are all e, having height of 25 to 65 ft. undation.

s of the Roosevelt, Pathfinder and ams, built recently by the U. S. Service, were considerably re- "gravity-sections," by curving the dam and assuming the walls to ntal arches. The method in which were determined was devised Wheeler, M. Am. Soc. C. E., ection of George Y. Wisner, Con- eer of the U. S. Reclamation

vity-dams, across comparatively have been curved in plan, not ngineers expected these walls to s, but with a view of avoiding masonry, as with a curved plan essure tends to consolidate the

NSTRUCTIONAL DETAILS.

asonry dams in Spain were gen- rubble masonry, faced with cut rens Dam and some other reser- lt soon afterward in France were constructed entirely of rubble masonry consisting of stones which one or two laborers could lift. Great care was taken to make its stones break joints in all directions so as to make the dam as nearly as possible a monolith. The best stones were laid at the faces. A cut-stone facing was not used, as the French engineers thought that that kind of masonry would not settle uniformly with the rubble [illegible]

Most of the masonry dams built in the eastern part of the United States to about the year 1900 were built of rubble masonry formed of large stones, 1 to 3 cu. yds. in size, faced with cut stone.

The San Mateo in California was constructed entirely of concrete which was laid in the dam in large moulds, containing 200 to 300 cu. ft. These blocks had numerous offsets and were dovetailed together in an ingenious manner. They were so well bonded in all directions that the dam forms practically a monolith.

In the construction of the Boonton Dam in 1900 to 1905, a class of masonry, known as rubble concrete, came into use. It consists of large rough blocks of stone, just as they come from the quarry, imbedded in, and surrounded by, concrete. In building a dam of rubble, consisting of large stones, each stone must be raised one or more times to ensure that the mortar bed fits the stone properly. With rubble, this expense is avoided. The large stones are placed in a bed of wet concrete and are jarred and joggled by bars, until they settle well into the concrete, which is thoroughly [illegible]

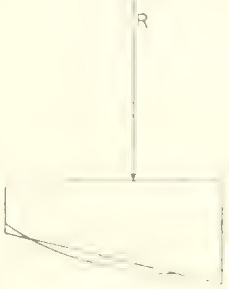


Fig. 45.

In this manner all voids in the beds of the large stones are prevented. The joints are made by concrete into which small stones are placed. About 30 to 40 per cent of the rubble concrete consists usually of large stones measuring 1 to 3 cu. yds., except near the top of a dam where, on account of the narrow width of the wall, the percentage of large stone is considerably less.

This class of masonry is gaining in favor for the construction and was used in part of the New Croton Dam, and in the Boonton, Cross River, Croton Falls, Olive Bridge, Roosevelt, Shoshone, Pathfinder Dams, etc. In some of these structures, the facing consists of concrete block cast in molds. This answers all the purposes so far as strength is concerned, but does not present the fine appearance of a facing of cut granite.

However carefully the masonry be laid in a dam, some leaking through the walls always takes place. In well built dams this leakage shows itself only as wet spots on the downstream face of the dam. Until quite recently no provision was made in masonry dams for expansion and contraction, caused by changes in the temperature, and consequently cracks occurred in the masonry. The central part of the masonry soon acquires a constant temperature at which it remains, but near the faces the masonry is subject to expansion and contraction. To avoid this difficulty and to prevent cracks the masonry in the upper part of the Croton Falls Dam was reinforced near the face for the upper 40 ft. to the crest by means of steel bars 1½ in. square, having their ends forged to a right angle hook, so that the bars could be hooked together in a continuous line forming a tension member. Similar bars were put into the upper 5 ft. of the dam below the roadway. In spite of this precaution three "temperature cracks" occurred.

To allow for expansion and contraction, the Olive Bridge Dam is being built with staggered "expansion joints" at intervals of about 84 ft.

One side is made of concrete blocks which are coated at the joint with a lubricant to prevent the masonry on the other side of the joint from adhering to the blocks. If the offset and key formed by the concrete blocks do not prevent leakage, a copper strip will be inserted across the expansion joint in concrete in the up-stream portion of an inspection well that is to be provided at the joint. As a last resort, the whole inspection well can be filled with some elastic, water-tight material, if it prove necessary. The efficiency of this method of permitting expansion and contraction in the masonry will be watched with interest on the completion of the reservoir.

In the Olive Bridge, Vyrnwy, Urf Dams, and in some others, a system of drain pipes leading to one or more drainage galleries, is built into the masonry to afford an outlet for any water that may percolate into the masonry. Here again we have a question about which engineers are not agreed. The object of the drainage system in a dam is to prevent the water that may enter the masonry from exerting an upward pressure. On the other hand, it is argued that such a system facilitates leakage from the reservoir. Some prominent engineers have held that drainage systems should not be introduced into the masonry and that every effort should be made to close and seal the foundation and to make the masonry as compact as possible.

If the dam has to be built on porous rock, it may be impossible to prevent upward pressure over a considerable part of the base of the wall. In such a case a drainage system built into the foundation masonry may be a necessity. To what extent water percolating into the masonry above the foundation may exert an upward pressure is not known. A cautious engineer will feel inclined to make some allowance for such a force, but as a matter of fact a great many fine masonry dams, such as the Furens, Ban, New Croton, Titicus dams and many others are standing in whose design no allowance was made for a possible upward pressure under the base or at any higher level.

If the foundation is of such a character as to require some allowance for upward pressure, the profile of the dam will have to be designed so as to be able to withstand such a force acting practically at any depth below the top of the dam, as the foundation of a dam generally rises gradually from the centre of the valley towards the ends of the dam. To make the same profile applicable to different parts of the dam it is calculated, therefore, to withstand an upward pressure at each assumed horizontal joint.

Every reservoir must have an overflow-weir (called also waste-weir) over whose crest the water in the reservoir can find an outlet when it begins to rise above the fixed "high-water mark." This weir forms what we might call the safety valve of the reservoir. Its length may be calculated by the usual formulae for weirs, so soon as the volume of water that may have to be discharged per second has been estimated, and the greatest depth of

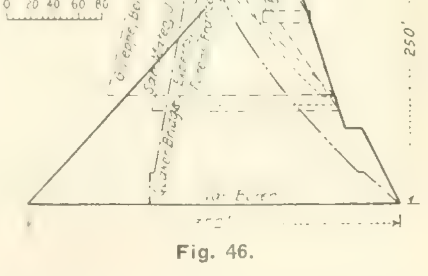


Fig. 46.

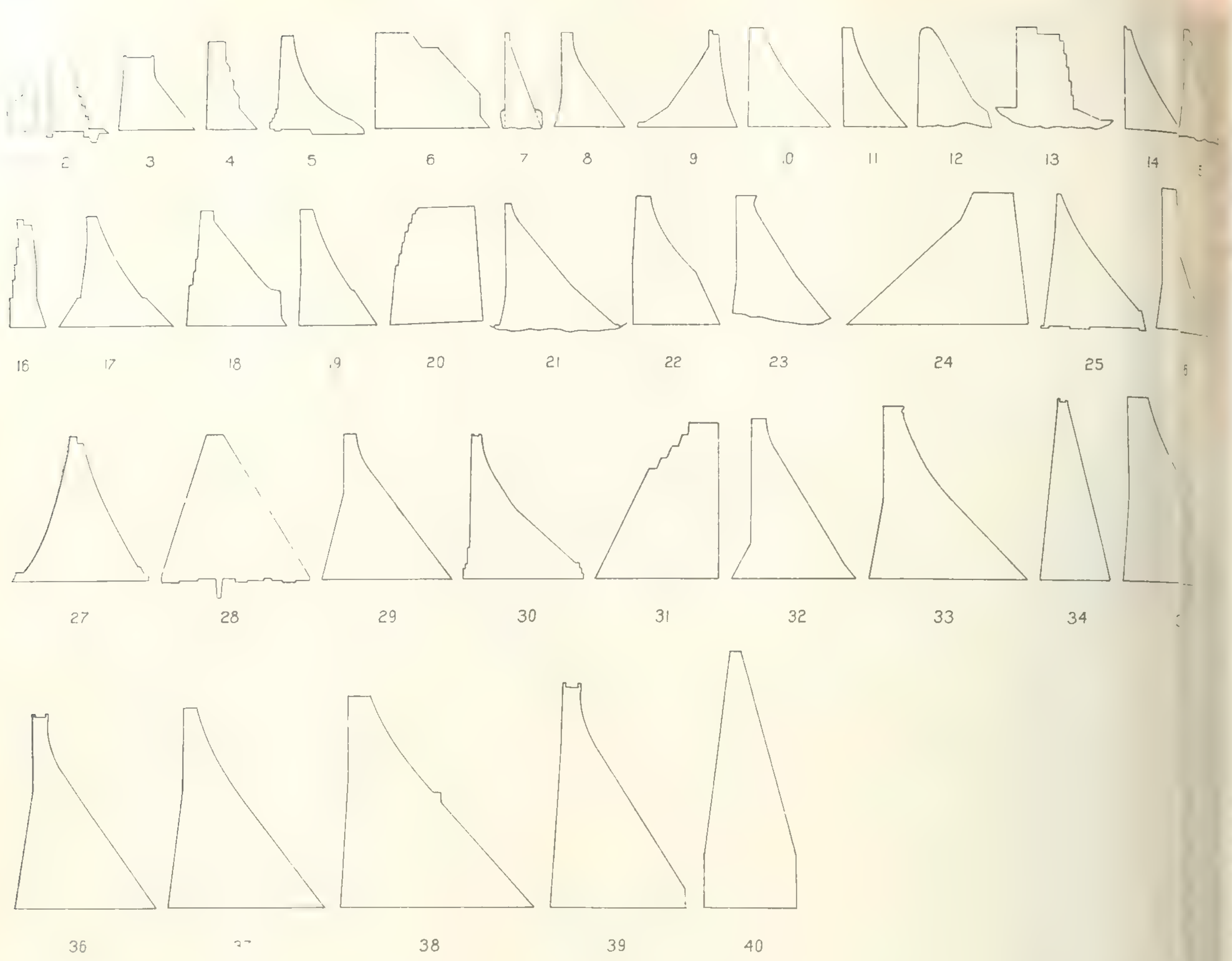


Fig. 47—Sections of Forty Masonry Dams Drawn to Same Scale.

1. Almanza.
2. Gros Bois.
3. Assuan.
4. Rio Lozola.
5. Beetaloo.
6. Val De Infierno.
7. Barossa.
8. Komotau.
9. Habra.
10. Tansa.
11 Bhatgur.
12. La Grange.
13. Hijar.
14. Butte City.
15. Ternay.
16. Zola.
17. Gran Cheurfas
18. Vyrnwy.
19. Hamiz.
20. Alicante.
21. Chatrain.
22. Spier.
23. Gros Bois.
24. Gileppe.
25. Ban Dam.
26. Cararact.
27. Furens.
28. San Mateo.
29. Villar.
30. Periyar.
31. Puentes.
32. Croton Falls.
33. Wachusett.
34. Pathfinder.
35. Olive Bridge.
36. Lake Cheesman.
37. New Croton.
38. Kensico.
39. Roosevelt.
40. Shoshone.

water on the crest of the overflow-weir has been decided upon.

Frequently the overflow weir forms a prolongation of the main masonry dam, but sometimes it is located at some distance from the main dam and discharges into a lateral valley.

The waste-channel from the overflow weir must be made sufficiently large to be able to discharge, without backing up, all the water that may waste over the weir. For small volumes of discharge the waste-channel may consist of a tunnel.

In constructing dams across large streams, liable to great variations in their flow, the whole dam is often built as an overflow weir. Such dams have not only to resist the hydrostatic pressure of the water, but, also, the impact and surging of the overflowing water, the backlash, the filling of mud against the up-stream face, and occasionally a partial vacuum on the down-stream face. These walls are also liable to have an upward pressure under the base.

Overflow weirs require much larger profiles than those which can safely be adopted for reservoir walls. It would be a great mistake to determine the profiles of such weirs by the rules usually laid down for masonry dams—meaning by this designation reservoir walls.

The Vyrnwy Dam in England is an example of a dam designed to act for its whole length as an overflow weir. In this country the most important work of this kind is the La Grange Dam, which has a height of about 128 ft. above the foundation. This dam was built in 1891 to 1894 across the Tuolumne River in California to divert the water of the river into two canals, one on each side of the valley. During floods 46,000 cu. ft. per second—corresponding to a depth of 12 ft. of water on the crest—has passed safely over the dam.

Besides an overflow weir, a dam has usually a gate-house from which the water is taken from the reservoir by means of one or more outlet pipes. Scour pipes are, also, laid through the dam and serve to empty the reservoir when required.

A Device for Inspecting the Condition of Small Pipe Sewers.

The accompanying illustration shows the method of examining the condition of small pipe sewers by means of the G-K Sewer Inspection Device recently put on the market by the Union Clay Products Co., of 40 Church St., New York city.

The inspection device comprises a telescope with a right angle prism at the object end, and an electric torch of eight candle power which is held on the axis of the sewer pipe by means of springs conforming to the size of pipe. The telescope is mounted on a tripod which is set up over the channel through the manhole. The line of sight is directed along the axis of the sewer, and
focuses on the illuminated portio
ner surface. In this manner suc
tions of sewer from 15 to 18 in
be examined by the operator.

The electric torch, which consist
candle power lamp in a glass cy
long, is attached to a cord which
through the sewer previously by
float or rods. A tag line or tape
to the torch, graduated in length

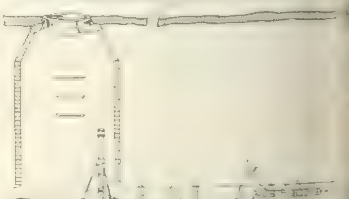


Fig. 1—The G-K Sewer Inspect

less, and it unreels at the feet of
using the telescope. By noting
on the tape and feature of inter
leaks, cracks, branch connections,
located with reference to the man

NEWS SECTION

orial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

of the Week........ [illegible]
[illegible]
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34
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[illegible] [illegible]
Irrigation, Drainage, Levees and Canals.... 48
Waterworks . 50
Sewerage and Garbage Disposal 52
Buildings, Docks, Dredging, Supplies, Etc... 54

ings
eek.

The principal railroad
construction contract let
during the past few days
appears to be the one
awarded by the Southern
Pacific Ry. for the con-
struction of its Fernley
R. R. Bids on the work were
April 1 but the contract was let
days ago. This is a 124-mile
ll cost something like $4,000,000.
Construction Co., Ogden, Utah,
work. It looks now as though
he railroads were holding up
ir contracts until the beginning
fiscal year on July 1. It seems
after that date a number of
contracts will come up for let-
e was a report that the Caro-
nfield & Ohio Ry. had started
work on its contemplated ex-
m Dante, Va., to Elkhorn City,
report is denied by the officials
ay. It looks now though, that
only a short time before con-
let on this work. Among the
nstruction work let recently is
g: Arthur McMullen, 13 Park
York City, at $3,889.775, for the
Sec 14 of the Lexington
y in New York City; Utah Con-
o., Ogden, Utah, for double-
e Southern Pacific Ry. from
Winsted, four miles east of
ev.; the following received sub-
om Lane Bros., Altavista, Va.,
n the new line of the Raleigh,
Southern Ry. from Raleigh, N.
y, N. C.: Fisher & Carozza,
Md.; Waugh, Calder Co., Or-
Ross & Powell, Columbia, S.
rolwell, High Point, N. C., and
Blacksburg, S. C.

y of highway work, the biggest
he year, or for several years,
g advertised by the New York
vay Commission. Bids will be
that Board on June 3, 4, 5, 6
00 miles of highway improve-
n will cost about $12,000,000.
ylvania calling for bids on a
amount of work, Ohio taking
or seven roads each week, and
king bids on the first 40 miles
highway construction, there is
in sight for road contractors.

last issue the Department of
of Canadian Pacific Ry. has
large contracts for work in
with its irrigation system in
ant, Smith & Co. and McDon-
couver secured a contract run-
er $500.000 for the construction
reinforced concrete aqueduct,
n length, near Brooks, which
e next two summers to com-
Bros. and Boomer & Hughes
nd Seattle have been awarded
contract, amounting to about
the construction of a large
reinforced concrete struc-
canal system in that section
tion block lying between Bas-
rooks and the Bow and Red
. Another good sized irrigation job which will come up for letting in three or four weeks is that of the Ogden River Reservoir Co. This company plans to build a reservoir in the South Fork of the Ogden River, 18 miles east of Ogden City. The estimated cost of the dam is $1,057,000. Contracts will be called for to build the first 50 feet of the dam within the next 30 days.

In the way of sewer work one of the largest contracts on which bids have been opened the past week is that of the Passaic Valley Sewerage Commission. This work called for the construction of Section 15 of the main intercepting sewer in the city of Passaic and Acquakanonk Township. The Donlon Contracting Co., Brooklyn, N. Y., at $207,419, was the low bidder. The high bidder offered to do the work at $993,733.

Bids on one of the largest government dredging contracts of the year were opened May 15 by the U. S. Engineer at Garveston, Tex. This work called for the dredging of the Houston Ship Channel and was divided into three divisions, the total yardage being 20,463,000. Under Division 2 an alternate route was bid on which would bring the total yardage to 23,175,000. The Bowers Southern Dredging Co., Galveston, Tex., bid $2,483,980 and $3,094,500, the latter figures including the alternate route. L. T. Gaylord, Mobile, Ala., bid $2,365,791 and $3,079,400.

The U. S. Senate has passed a bill granting Allan C. Rush, Los Angeles, Calif., an engineer, right of way across Goat Island and permission to utilize a portion of land in the Presidio reservation for the construction of the proposed $26,000,000 bridge over San Francisco Bay, from San Francisco to Oakland, Calif. The bridge will be 9½ miles in length.

PERSONAL

Mr. John W. Eber has been appointed Superintendent of the Toronto, Hamilton & Buffalo Ry. to succeed Mr. H. H. Adams.

Messrs. Dodge & Morrison, Architects, announce their removal to larger and lighter offices at 133 Front St, corner Pine St., New York City.

Mr. Thomas Kieft has been appointed Superintendent of the Water Board of Manistee, Mich., to succeed Mr. Stephen Cahill, who has held the position for more than 12 years.

Mr. Wm. S. Clark has been appointed Superintendent of Public Works of Meriden, Conn., at a salary of $3,000. Mr. Clark was formerly City Engineer. He has been acting Superintendent of Public Works for a short time.

Messrs. W. M. Brown and C. D. S. Clarkson announce the formation of a partnership under the firm name of Brown & Clarkson as Mining and Topographic Engineers. Their offices are in the Southern Building, Washington, D. C.

Mr. A. W. Gray has been appointed Assistant Provincial Engineer of Highways, Frontenac, Ont. He was formerly County Road Superintendent.

Mr. Charles W. Helmick, formerly City Engineer of Helena, Mont., has resumed practice as Civil and Consulting Engineer, with his office in the Pittsburgh Block, at Helena. He was not a candidate for reelection.

Dr. Henry Payne, Consulting Mining Engineer, has become associated as Mining and Metallurgical Specialist with Stephen T. Williams and staff, 346 Broadway, New York. He will leave New York with a party the latter part of May for Yukon and Klondike gold fields and will return late in the summer.

Mr. John P. Golden, employed as a foreman at Ancon Quarry, was instantly killed on May 2 by a large stone, which fell through the roof of the quarry storehouse, striking him on the head. The stone was thrown from a blast. Mr. Golden was twenty-four years old, born in Marion Center, Kansas, and had been on the Isthmus nearly four years.

Civil Service Examinations.

There is a vacancy existing in the position of Chief of Drainage Investigations in the office of Experiment Stations, Department of Agriculture, Washington, D. C., at a salary of about $4,000 per annum. The Government is endeavoring to find the best man available for this work and announces that applications for the examination will be accepted until June 10. Competitors for this examination will not be required to appear at any particular place for examination.

There will be an examination held on June 26, 1912, at various cities in the United States for the position of Soil Laboratory Assistant at a salary ranging from $1,000 to $1,500 per annum.

The announcement is also made of an examination for computers to be held on June 5 at various places in the United States. The salary is $80 a month. Further information regarding the above positions may be had from the U. S. Civil Service Commission or the Secretary of the Board of Examinations in most any large city.

The Civil Service Board of the West Chicago Park Commissioners announces examinations to be held on June 12, 1912, for asphalt paving foremen. Information may be had on application at the office of the Civil Service Board in Union Park, Chicago, Ill. Mr. Fred G. Heuchling is Superintendent of Employment.

The State Civil Service Commission, Albany, New York, announces examinations to be held on June 15, 1912, for the following positions: Junior Statistician at $1,200 to $1,500 per annum; Inspector of Hulls, Dept. of Public Works, at $3,000 per annum; Supt. of State Reservation Niagara, $1,800, with gradual increase to $2,400 per annum. Applications must be filed before June 7.

INDUSTRIAL

The Creosoted Wood Paving Block Association has moved its offices to Suite 1052, Otis Bldg., 10 S. La Salle St., Chicago, Ill.

The Continental Car & Equipment Co., owing to the increase of its business and in order to care for the demands in this section of the country, has opened an office at 607 Marquette Bldg., Chicago, Ill. Mr. J. T. Kinberger is in charge of the office.

The Bucyrus Co., South Wilwaukee, Wis., has opened an office at 1250 Brown-Marx Bldg., Birmingham, Ala., under the management of Mr. E. L. Byron, who will have general charge of the sale in the southern states of steam shovels, dredges, drag line excavators and other manufactures of the company.

R. H. Staley, of Springfield, Ill., manufacturer of the Staley Power Tamping Machinery, has received an order from J. B. McCrary Excavating Co., Atlanta, Ga., for two additional tamping machines for use on the company's sewer contract in Atlanta. The McCrary Co. is already using two tamping machines on this work and has advised Mr. Staley to hold four additional machines for them as they will be required in a few days.

Mr. George Price, formerly with the Tide Water Building Co., and later with D. C. Newman Collins and S. Fisher Miller, engineers, has been retained by the Flintkote Manufacturing Co. and J. A. & W. Bird & Co. of Boston, to represent them in the Metropolitan district on their line of building specialties covering roofing, waterproof, sheathings, waterproofing compounds, rex wall board, cold water paints, ripolin enamels, etc. Mr. Price's office will be at 66 Beaver St., New York City.

Dr. B. D. Guilbert of Tegucigalpa, Honduras, received a concession from the government of Honduras for the carrying of mails between San Lorenzo on the south coast and Teguciagalpa. The arrangement is under a four-year contract and the service will start on August 1st. For this purpose two No. 141½ Studebaker Mountain Spring Wagons have been purchased. The "coaches" as they are termed in that country, will also carry passengers and will make the trip in 2½ days, connecting with the Amapala mail boat.

The Miracle Pressed Stone Co., of Minneapolis, Minn., and the Northwestern Steel & Iron Works of Eau Claire, Wis., have been consolidated for the manufacture of concrete machinery and tools. The Northwestern line has been manufactured for the past decade and its concrete making machinery and tools are largely used. The Miracle line consisting of concrete machines of single and double staggered air space, 2-piece wall block machines, brick machines, mixers, tile moulds, ornamental moulds and moulds for cornices, piers, chimneys, burial vaults, etc., is one of the oldest lines in the trade. The Minneapolis plant will be abandoned and all machinery, stock, etc., will be moved to Eau Claire, where the manufacturing will be done in the plant of the Northwestern Steel & Iron Works. This last step was taken because of adequate facilities, added conveniences and more space afforded at the Eau Claire plant.

CATALOGUES

Peerless Motor Trucks.—Paper, 12½x9¾ ins., 8 pp. Peerless Motor Car Co., Cleveland, Ohio.

This folder contains illustrations of Peerless trucks of 3, 4 and 5-ton capacity as used in various classes of work.

Chain Belt Mixer.—Paper, 6x9 ins., 8 pp. Chain Belt Co., Milwaukee, Wis.

This is the May number of the bulletin which contains illustrations of construction of buildings where Chain Belt Mixers are employed. Interesting articles are also contained in this bulletin.

Erie Pumps.—Paper, 6x9 ins., 8 pp. Erie Pump & Engine Co., Erie, Pa.

This catalog contains illustrations and descriptions of light duty centrifugal pumps with price lists and specifications.

Agricultural Plans.—Paper, 6x9 ins., 20 pp. E. I. Du Point De Nemours Powder Co., Wilmington, Del.

This bulletin, entitled "The Agricultural Blaster," describes uses of explosives in agricultural work.

Roofing.—Paper, 12½x10½ ins., 16 pp. Barrett Manufacturing Co., New York City.

This book is entitled "A Word to Architects, Engineers and Roofers." It contains illustrations of concrete covered with Barrett Specification Roofs and useful information regarding specifications, etc.

Champion Crushing Machinery.—Paper, 7x10½ ins., 24 pp. American Road Machine Co., Kennett Square, Pa.

Catalog K. A. Y. contains illustrations and tables of dimensions and sizes of Champion crushers, elevators, revolving screens, belt conveyors, rock drills, cars, etc.

Lehigh Portland Cement.—Paper, 8¾x11¾ ins., 16 pp. Lehigh Portland Cement Co., People's Gas Bldg., Chicago, Ill.

This is the May bulletin of the Lehigh Portland Cement Co. containing interesting articles on the doings of distributors of Lehigh Portland Cement and descriptions of various concrete construction.

Bending Tools.—Paper, 6x9 ins., 20 pp. The Wallace Supply Co., 108 No. Jefferson St., Chicago, Ill.

This is a very complete catalog of tools for bending steel. A number of different types of machines are illustrated with directions for operating. Tables of sizes, weights, prices, etc., are given.

Hoisting Machinery & Buckets.—Paper, 6½x9½ ins., 64 pp. Geo. A. Haiss Manufacturing Co., 141st St. to 143d st., New York City.

This catalog contains illustrations of hoisting machinery, clamshell buckets and complete hoisting and storage plants erected by this company. The machinery is used extensively for hoisting and handling coal, broken stone, sand, etc. The illustrations showing the layout of various hoisting plants are instructive.

Sterling Double System Pump.—Paper, 6x9 ins., 4 pp. Sterling Machinery Co., Norwich, Conn.

Bulletin No. 106 describes the Sterling Double System Pump which was designed for use in connection with continuous oiling systems, drawing the oil from the well or base of the engine and pumping it to the filter. The description contained in this bulletin is illustrated with line drawings, and a table is given showing the dimensions and prices.

Hydraulic Elevators. — Paper, 6¾x10¼ ins., 24 pp. Union Iron Works Company, San Francisco, Calif.

Catalog No. 5 contains complete illlustrations and descriptions, tables of sizes, weights, capacities, etc., of the Evans Hydraulic Elevators and hydraulic mining machinery. Tables are also given showing the amount of flow through nozzles under heads from 50 to 700 ft., and also tables showing the loss of head due to velocity of water of pipes of different diameters.

Lap Welded Pipe.—Paper, 7¾x10 ins., 32 pp. The American Spiral Pipe Works, 50 Church St., New York City.

This catalog contains illustrations showing the construction of this pipe and fittings. Tables of sizes, gages, weights, prices, etc., are given.

Another catalog is entitled "Spiral Riveted Pressure Pipe with Forged Steel Pipe Flanges." This contains illustrated descriptions of installations of pre under high heads. Complete info given as to the construction, prices, dimensions, sizes, gages, detailed line drawings and ha gravings.

Air Pumps.—Paper, 6x9., 32 p Air Pump Co., Indianapolis, Ind.

This catalog deals particularly well pumps for irrigation. Illustr scriptions, tables of sizes, capa are given.

Cisco Led-Kote.—Paper, 3½x pp. The Cincinnati Iron & Stee cinnati, Ohio.

The above booklet describes for roofing composed of open h metal with a coating of practicall applied without alloy of tin or zi

Building Products.—Paper, 6 24 pp. National Fire Proofing burgh, Pa.

This is the regular monthly pul the company containing illustrat on the construction of fire buildings.

Rotary Gate Valves.—Paper, 12 pp. John Simmons Co., 102 New York City.

This circular goes considerably in the description and illustrat Rothschild Rotary Gate Valves, been used by engineering contr good results.

Dickbelt.—Paper, 3½x6 ins., 2 J. Dick, Ltd., 29 W. Lake St., Ch

This booklet contains a descr illustrations and tables relating Belting. A table is given showin power which each inch of width from 3-ply to 10-ply will transmi speed. Prices are given.

The Valve World.—Paper, 8x1 pp. The Crane Co., Chicago, Ill.

This is the April number of World, published by the Crane issue is a memorial to Mr. Ric Crane, whihc should be of spe to those familitr with the li products of this company.

Galco.—Paper, 3½x6 ins., 8 Gardner Artificial Lumber Co., Ohio.

Galco is a material for use i and interior finish in steam a coaches, and as interior lining f ator cars. Its insulating quali and sizes, etc., are shown in thi

Concrete Conveyor.—Paper, 6 4 pp. Concrete Conveyor Mf sonic Temple, Cedar Rapids, I

This pamphlet contains an ill a new type of gravity convey being used for distributing co bridge across the Iowa river at ids. It is stated the concr placed for 30 cts. per cu. yd.

Steel Tanks.—Paper, 6x9 ins., Moines Bridge & Iron Co., Des

This pamphlet illustrates th steel structures which this com pared to construct, and is also engineers and purchasers of formulating their designs. Part tion is given in this edition to tion of water tower structure cently have been built to meet ditions or special requirements.

United Steel Sash.—Paper, 102 pp. The Trussed Concret Detroit, Mich.

This is a useful booklet for fire proof buildings. It conta detailed illustrations and des fire proof sash, including sidew pivoted or sliding ventilators; sash center, pivoted or top hu tor and sawtooth roof construc and sliding doors; metal and tions for all requirements. Thi edition.

ILWAYS, STEAM AND ELECTRIC

Alabama.

tract awarded to the Wat n Co., Birmingham, Ala., noted issue, for building the H h Tuscaloosa Mineral R. R., calls u. yds earth excavation, 50,000 k excavation, 100,000 cu. yds. and six pile trestles of a total .8 lin ft. A sub-contract for vork has been let to Gillespie Tuscaloosa, Ala. The Wat- ting Co. will do all of the itself. The spur is three miles ves the main line of the Tus- eral R. R. at a point near the sane Asylum and extends to the Central Foundry Co. is pe foundry.

ted that at a recent meeting of Directors it was decided to build Eufaula & Chattahoochee Valley of Pittsview in Russell County, er to extend it southward to the McKenzie, Eufaula, Ala., is En-

Arkansas.

announced that the extension of Dallas & Gulf Railroad from rk., to Parey and Cooper, in is practically assured. W. P. lle, Ark., is Chief Engineer of the

are under consideration for be- on the construction of the Bates- eastern R. R. The sum of $60.- d to have been raised by capital- ville, and it is said that a like een promised by private subscrip- nount is to be applied to the first line. This road is to run from either Hardy, Pocahontas or Frisco. V. Y. Cook, Batesville, It is stated that Col. C. C. ontractor of Fort Smith. Ark., first 20 miles.

ey R. R., G. W. L. Brown, Gen- Sedgwick, Ark., is contemplating ne to Newport, south of the main risco, and thence via Des Arc to A. Bertig, Parogould, Ark., Vice the Cache Valley, is also under- ontemplating building a short line ild to the northern terminus of [illegible]

California.

ern Pacific Ry. has awarded the onstructing the Fernley & Lassen mile line, to the Utah Construc- den, Utah. The contract was May 6.

ed that the Southern Pacific Ry. Hood, Chief Engineer, San Fran- has let the contract for the con- he Melrose-San Leandro exten- actual construction work will be mediately.

l Pacific R. R. Co., of the Harri- as mentioned some time ago in & CONTRACTING, has taken over branch lines, including the Ne- ia R. R., extending from Hazen, Southern Pacific, south to Mo- y way of Mount Whitney. The still narrow gage between Ton- and Mount Whitney station, will ed shortly.

n received from San Andreas, at surveyors in the field marking for the proposed railroad from s to Rich Gulch, have completed Mokelumne Hill.

Colorado.

report that the Wichita Falls & Ry., M. M. Cook, Chief Engi- Falls, Tex., is to be extended to Denver, probably entering that city by one of the existing lines from Pueblo.

Connecticut.

There seems to be some prospects that construction work will be started this summer on the projected electric railway from Meriden to Guilford by way of Middlefield. Frank Ar- [illegible]

District of Columbia.

The U. S. Senate has passed the bill authorizing the Washington Railway & Electric Co., 14th and East Capitol Sts., Washington, and the City & Suburban Co. (a subsidiary Washington company), to extend their respective lines along 14th and 15th and C and D Sts. northeast. The object is to provide for connections between the lines now operating on East Capitol, C and H Sts. northeast. The extension must be commenced within six months from the passage of the act and completed within one year, the work to be underground construction.

Florida.

A project is under consideration for the construction of a railroad that will connect Anna Maria Beach with the mainland, by way of Cortez and Bradentown, with a bridge from Cortez to the mainland. The total length of the road will be 12 miles, and it will begin at the gulf beach on Anna Marie Key, cross the mainland and connect at Bradentown with the Seaboard Air Line. The Fidelity Realty Co., of which W. E. Guilford, Tampa, is manager, is behind the proposition. It is planned to use gasoline-driven motor cars on the road.

Georgia.

A charter has been issued by the Secretary of State, Atlanta, Ga., to the Columbus, Chattahoochee Valley & Gulf Ry. and as soon as other preliminaries are concluded, actual work on the construction of the road will begin. It is proposed to start the line at Georgetown, Ga., bring it through Quitman, Stewart, Chattahoochee, Muscogee and on to Harris, Troup, Heard, Coweta, Campbell and end it in Fulton county or Atlanta. Among the promoters is J. D. Little, Fulton, Ga.

Idaho.

Grading work is under way for straightening the line of the Idaho Railway, Light & Power Co., Wm. Mainland, President, Boise, between that city and Nampa. The Cleveland Construction Co., Boise, Idaho, has the contract.

The Cambridge Indian Valley & Eastern R. R. has made surveys for its projected 15-mile steam line from Cambridge, Idaho, up the valley of the Little Weiser River to the town of Indian Valley. The capital for construction has not been secured as yet. Jas. Linder, Indian Valley, Idaho, is President, and Lee Highley, New Meadows, Idaho, is Chief Engineer.

Illinois.

Preliminary survey work on the Central Illinois Railroad, which projects the construction of a line from Chicago, Ill., to Muscatine, Ia., has been started. A line has already been run from Plainfield to Wedron and surveyors are now working between Wedron and Princeton. Promoters will solicit right of way and stock subscriptions shortly. N. W. Evans, Aurora, Ill., is interested.

Indiana.

The Fort Wayne & Northern Indiana Traction Co., S. W. Greenland, Assistant General Manager, Fort Wayne, Ind., is considering extensive betterment work, to include laying new rails and ties on portions of its interurban system.

Iowa.

The Farmers' & Merchants' Tri-County Promotion Co. has been organized and will be incorporated shortly in Iowa with a capital stock of $40,000. The incorporators are H. L. Dehner, president; C. D. Baldwin, secretary, and N. J. Bisenius, P. J. Conlin, A. W. Aitchison, George Rogers, T. J. Finn and Robert Kane, directors. The intention is primarily to work to the end of securing a standard gage line over the present route of the narrow gage, and failing in that, to commence the construction of a new railroad from Cascade down the Maquoketa river valley to Maquoketa to connect with the branch line of the Chicago & Northwestern railroad which runs from [illegible]

It is reported that the Chicago, Milwaukee & St. Paul R. R. has under consideration the construction of second track from Savannah to Council Bluffs, Ia., including the construction of a double track bridge over the Mississippi River.

The Eastern Iowa Ry. Co., projecting an interurban line from Muscatine to Iowa City, is reported to have made arrangements for financing the project. J. D. Wardle, Cedar Rapids, Ia., is interested.

Kansas.

The Kansas City, Lawrence & Topeka R. R. Co., F. P. Dickson, President, Gumbel Bldg., Kansas City, Mo., is planning to extend its electric line this summer, 22 miles, to Lawrence. The cost of the extension will be about $500,000.

The Hutchinson & Western Interurban R. R. Co. has completed the preliminary survey from Hutchinson to Hudson and the estimates, projections, etc., have been made up between these two points. The work was continued the week of May 15th to 18th and lines will be run to both Larned and Great Bend. As soon as the preliminary work is completed the work of location will begin and the first 20 miles out of Hutchinson will be located and as soon as the right-of-way is secured for this the work of construction will begin. At this time it expects this preliminary work will require from six to eight weeks' time and that the construction will begin not later than the fifteenth and not earlier than the first of August. F. P. Roehr, Masonic Temple, Hutchinson, Kan., is General Manager.

The Missouri, Kansas & Texas Ry., S. B. Fisher, Chief Engineer, St. Louis, Mo., has started preliminary surveys for a short line from Parsons, Kan., to St. Louis, via Joplin, Springfield and Jefferson City. The present main line to St. Louis runs via Fort Scott, Nevada and Clinton. At the present time only a stub line connects Joplin with the main line of the Katy at Parsons. The proposed line will shorten the distance to St. Louis by 100 miles.

Kentucky.

A French syndicate has purchased 5,000 acres of coal land in the Beulah field in Hopkins County, and it is said that the Kentucky Midland R. R., M. M. Wheeler, Chief Engineer, Central City, Ky., may be extended from Central City, passing through Madisonville to Providence and Dawson and opening up the field.

Louisiana.

Preliminary survey for the Milton-Eunice extension of the Franklin & Abbeville Ry. has been completed. The recent floods in the Mississippi Valley, however, have made it necessary to postpone for the present any further action. Walter Y. Kemper, Franklin, La., is Chief Engineer.

Maryland.

Town Council of Frederick, Md., has granted a franchise on the main street of the town to the Frederick & Brunswick R. R. The company proposes to build a trolley line between Jefferson and Brunswick, which, when completed, will connect Frederick with Brunswick. The incorporators are Charles Wertheimer, Oscar B. Coblentz, Frederick, Md., Chief Engineer of the Frederick R. R.; Abraham Hemp, Dr. Franklin B. Smith and G. Mantz Besant. The road will cost about $140,000 and will be leased and operated by the Frederick R. R.

Massachusetts.

✣Bids will be received until noon, May 23, by Boston Transit Commission, B. Leighton Beal, Secy., for building Section A. of the Dorchester Tunnel, which section is in Winter St. and is 500 ft. long. Specifications and forms of contract can be obtained at 15 Beacon St., 8th floor, Boston. Mass.

⊙Bids were opened May 7 by the Boston Transit Commissioner for the contract 432—construction of sec. 3 of the Boylston st. subway in Boston, the contract being awarded to Hugh Nawn Contracting Co., 82 Savin St., Roxbury, Mass., as noted in our last issue. The itimized bids received on this work were as follows: (1) standing for Coughlan & Shiels Co., 43 Tremont St., Boston, Mass.; (2) for Bruno & Petitti, 18 Tremont St., Boston, Mass.; (3) for Mullen, O'Riordan & Miller, Charleston, Mass.; (4) for Coleman Bros., Pearl and Marginal Sts., Boston; (5) for P. McGovern & Co., Boston, Mass.; (6) for Hugh Nawn Contracting Co.

	(1)	(2)	(3)	(4)	(5)	(6)
Earth excava., above el., 108, 33,000 cu. yds.	$ 3.75	$ 3.00	$ 3.00	$ 3.25	$ 3.15	$ 2.00
Earth excava., below el. 108, 37,000 cu. yds.	3.75	4.00	3.30	3.50	3.15	2.75
Removing 50 cu. yds. concrete and other masonry	10.00	10.00	10.00	8.00	10.00	4.00
Concrete masonry, 22,000 cu. yds.	9.75	10.50	9.00	8.50	8.50	8.50
Brick masonry, 200 cu. yds.	17.00	17.00	15.00	16.00	15.00	14.00
Laying vitrified pipe, 6" to 10", 500 lin. ft.	.50	.75	1.00	.50	.75	.25
Laying vitrified pipe, 12" to 20", 2,500 lin. ft.	1.00	1.00	1.00	.75	1.25	.30
Laying vitrified pipe, 30", 900 lin. ft.	1.00	1.25	2.00	1.00	2.00	.40
Setting reinforcing rods, less than 6 lbs. per lin. ft., 900 tons	12.00	15.00	12.00	8.00	8.00	6.00
Setting structural steel, more than 6 lbs. per lin, ft., 10 tons	15.00	15.00	20.00	20.00	20.00	10.00
Cement plaster, 20,000 sq. yds.	.50	.35	.50	.40	.30	.40
Waterproofing, prepared textile and asphalt, 50,000 sq. yds.	.50	.50	.45	.40	.35	.40
Waterproofing, tarred felt and pitch, 50,000 sq. yds.	.35	.30	.40	.25	.30	.25
Spruce piles, driven and cut, 40,000 lin. ft.	.33	.25	.24	.20	.30	.20
Other work and risks not covered by these items	3,000	3,000	5,000	1,000	100	100
Crude parafine applied to piles, 500 sq. yds., per sq. yd.	.20	.20	.20	.20	.15	.10
Totals	$564,300	$559,650	$505,600	$487,375	$474,375	$413,135

A bill has been reported to the Committee on Railroads by the State Legislature authorizing the Southern New England Railroad Corporation, the Massachusetts branch of the Grand Trunk, to build extensions to Boston and Worcester. It is probable that the Legislature will pass the bill.

The Boston & Albany R. R., F. B. Freeman, Chief Engineer, Boston, Mass., is making preparations for some betterment work at Westboro, between the station and Water street. It is planned to eliminate a curve 100 yds. west of the station, making a straight track between the station and the Milk street bridge. It will be necessary to move several houses between Water and East Main streets. County Commissioners will hold a hearing in the matter on June 14.

The State Railroad Commission has approved the consolidation of the Lexington, Boston Street Ry. Co., Newtonville, Mass., and Middlesex & Boston street railway, on share for share basis. The Middlesex & Boston Street Ry. Co., Newtonville, is authorized to issue $525,000 additional stock.

The State Railroad Commission has authorized the Boston & Albany R. R. to issue $1,000,000 of bonds for improvements. This company, as previously noted in these columns, is planning a considerable amount of betterment work for the present season. These include laying a third track between Parks Corner, South Framingham and Ashland, and improvement work at the local freight yard at Worcester.

Michigan.

The Port Huron & Northern Ry. Co., 502 Wayne Bank Bldg., Detroit, Mich., has secured franchises for about 35 miles of its line, including the portion in the city of Port Huron. The work for 1912 will probably be limited to the section which includes Port Huron, Lexington and Croswell, a distance of 25 miles. Contracts will be let by the board of directors, of which Walter H. Goodson is secretary.

Frank M. Garland, New York City, has applied to the City Council of Traverse City, Mich., for a franchise on several streets for an electric railroad. It is planned to build an interurban line to run from Traverse City to Charlevoix, Old Mission and possibly to points on the Leelanau peninsula.

R. H. L'Hommedieu, General Manager of the Michigan Central R. R., Detroit, Mich., is quoted in press reports as stating that the company contemplates the expenditure of about $1,000,000 for the improvement of terminal facilities during the coming year. Among the improvements in Detroit this year are extensions of its west side yard and the north yard, on the inner belt line at Milwaukee Junction, enlargement of a number of roundhouses in various parts of the city to accommodate a greater number of locomotives, the laying of new sidings at factories and team tracks and other additions to track facilities. One of the important extensions of terminal work on which a start will be made will be the construction of a new yard on the outer belt line at a point north of the Milwaukee Junction yard. This new yard will materially relieve freight handling conditions for shippers in the section north of the city limits and east of Woodward avenue. Four lines will unite in its construction, two being part of the Grand Trunk system and the other two New York Central lines.

Minnesota.

According to advices from Virginia, Minn., the Virginia & Rainy Lake Co. will start work shortly on the proposed 40-mile logging railroad.

Meetings have been held under the direction of the Commercial Club of Bemidji, Minn., to take steps for securing the installation of a street car system for the city.

Mississippi.

The Meridian & Memphis Ry. Co., Meridian, Miss., is reported to have opened bids for the construction of the first section of its line. This section extends from Meridian to Union.

Missouri.

Practically all right of way cured, it is said, for the propo Chillicothe-Trenton-Camesville expected that actual work will soon. A. C. Knight, Trenton, man of the railroad committee.

The Springfield Traction C Mo., has been making estimate sion of its Monroe St. car lin about $26,000.

Nebraska.

No definite plans have been yet by the Missouri Pacific R provement of its terminals at The improvements to be mad ha-Kansas City line will cons of ballasting the track an roadbed in good condition.

It is rumored that the Unior planning to let the contract for the proposed line from Gering, deaux, Wyo. It may be stated certainty about the extension, company has improved the line port and Gering. The roadbed excellent condition and the com ed fine buildings at Northpo $100,000 electric power plan nishes power to the cities and Bridgeport. The extens out, will reduce the distance Platte and Medicine Bow a and would lessen the grade It is impossible to obtain a formation regarding the ext is believed that the compa complete the line this year the line from Bordeaux to the next year, the distance bein

Nevada.

⊙The Utah Construction Co is said to have been awarded the double tracking of the S line from Lawtons to Winstea of Truckee, Nev. The surveys were completed about one year construction work will be co reported, at once.

New York.

⊙The Public Service Commission First District on May 14 awarded for the construction of Section ington Ave. subway in New York Arthur McMullen, 13 Park R City, at $3,889,775. The itimiz bids contract are given on the ne page section brings the total amou of tracts let on the Broadway-Lexingt subway, route 5, to $37,940,418. The which have been awarded up this subway are as follows:

Section.	Name of Contractor.	Awarded by Commission.	Approve Bd of
2	Degnon Con. Co., 60 Wall St., New York City	Jan. 24, 1912	Feb 1
2-A	O'Rourke Eng. Const. Co., 345 5th Ave., New York City	Mar. 30, 1912	
3	Underpinning and Foundation Co., 290 Bdwy, New York	Jan. 12, 1912	Jan. 1
5	Metropolitan Con. Co., 195 Milk St., Boston, Mass.	Jul. 26, 1911	
6	Bradley Con. Co., 1 Madison Ave., New York City	Jul. 5, 1911	Jul. 21,911
8	Bradley Con. Co., 1 Madison Ave., New York City	Jul. 5, 1911	Jul. 21
9	Patrick McGovern, 6 Beacon St., Boston, Mass.	Dec. 8, 1911	Feb. 1 91.
10	Bradley Con. Co., 1 Madison Ave., New York City	Jul. 5, 1911	Jul. 21,911
11	Bradley Con. Co., 1 Madison Ave., New York City	Jul. 5, 1911	Jul. 21 91
12	Oscar Daniels Co., 38 Park Row, New York City	Aug. 1, 1911	Aug. 3,911
13	Bradley Con. Co., 1 Madison Ave., New York City	Oct. 31, 1911	Nov. 16,911
14	Arthur McMullen, 149 Broadway, New York City	May 14, 1912	
15	Hagerty-Drummond Co., 48 Park Row, New York City	Oct. 10, 1911	Oct. 26

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*Upper Level, $792,779; Lower Level, $119,572.

†Type K—Steel tubes.

Petitions are being circulat asking the Corning & Painte Ry. Co., Corning, N. Y., to to North Corning.

The Transit Committee of Estimate of New York Cit upon plans for eleven new way and elevated lines. Th the new plan are a subway tween New York and Stat way of Brooklyn; new tunn East river to Brooklyn an

various improvements in connec-
een the Brooklyn Rapid Transit
reported to have been started on
tracking of the Putnam Division of
ork Central & Hudson River R. R.
sent only about 8 or 9 miles, located
epperham Station, northward to
n extends from Meridian to Union,
orough subway systems.

lic Service Commission for the
[illegible] in conjunction with a [illegible]
ittee of the Board of Estimate
tionment of New York City dur-
st week agreed upon the laying
ain rapid transit lines necessary
e the proposed dual system of
tension. The most important of
he tunnels under the East River,
connect the lines allotted to the
gh Rapid Transit Co. and the
Rapid Transit Co. in Manhattan
[illegible] of these companies [illegible]
rooklyn. The route for the In-
[illegible] was decided on [illegible]
ving West Broadway, Manhat-
rk Place and running through
[illegible] St., Spruce or Beekman
illiam St. to Old Slip and thence
East River to Clark St., Brook-
to Fulton St. and a junction
existing subway in that street.
for the Brooklyn Rapid Tran-
l run from Whitehall St., Man-
ler the East River to Montague
yn, and up Montague St. to Wil-
., and thence to a connection in
with the Fourth Ave. Subway.
tan there will be two feeders
nnel, one from the Broadway
nning down Church St. and in-
nel by way of Whitehall St.;
her an extension of the Brook-
Subway down Nassau St. and
Broad St. into the tunnel. The conference also agreed that the Brooklyn Rapid Transit Co., at its own expense, may construct a physical connection between the line which runs from Brooklyn over the Manhattan Bridge into Canal St., Manhattan, [illegible] and Canal St. so that there may be through operation of trains from the Fourth Ave. subway, in Brooklyn, into the Broadway subway, in Manhattan, by way of the Manhattan Bridge.

Bids were opened May 7 by the Public Service Commission of the First District, for the construction of Sec. 14, Route 5, of the Lexington Ave. subway in New York City. The lump sum bids on this work were given in our last issue. The section will provide for a 4-track railroad. It is 3,176 ft. long and will pass under the Harlem River in four tubes. Bids were taken on three types of tubes. Type K consisting of four steel tubes laid in concrete under the river; Type H, four cast iron tubes laid in concrete two and two together; Type L, four cast iron tubes laid all four together in concrete. Arthur McMullen, 13 Park Row Bldg., New York City, at $3,889,775, was low bidder on the Type K, the O'Rourke Engineering Construction Co., New York City, at $3,972,944, was low bidder on Type L, and the John F. Stevens Construction Co., New York City, at $4,207,198, was low bidder on Type H. The following are the itemized bids received under the Type K plan: (1) standing for bid of Arthur McMullen, (2) for bid of John F. Stevens Construction Co., (3) for bid of Frederick L. Cranford, (4) bid of Pittsburgh Contracting Co., (5) bid of J. F. Cogan Co., (6) bid of Empire Engineering Corporation, (7) bid of T. A. Gillespie Co., (8) bid of Degnon Contracting Co.

The New York Central & Hudson River R. R. has begun to carry out its plan to rebuild the car shops at West Albany on a larger and more modern scale. Work upon a new paint shop is already under way and that upon other buildings will be begun this summer. The company will expend over $1,000,000 upon this work.

North Carolina.

⦿Lane Bros. Co., Altavista, Va., which was recently awarded a contract for constructing the Raleigh, Charlotte & Southern Ry. from Raleigh to Troy, N. C., has awarded sub-contracts to the following: Fisher & Carozza, Baltimore, Md.; Waugh-Calder Co., Orange, Va.; Ross & Powell, Columbia, S. C.; F. F. Carolwell, High Point, N. C., and Ross Bros., Blacksburg, S. C. The general contract includes 1,200,000 cu. yds. of earth excavation, 75,000 cu. yds. rock excavation, 1,275,000 cu. yds. embankment, two bridges and one viaduct—three 150-ft. through spans, one 50-ft. girder, 12 trestles of a total length of 2,500 lin. ft., 2,500 cu. yds. of concrete masonry and 27,000 lin. ft. of piling. No more of the work is to be sublet.

The Atlantic & Western R. R., a 12-mile line with 20 miles additional under construction, has been purchased by Middendorf, Williams & Co., of Baltimore, Md., and an extension is proposed to Goldsboro, N. C., about 60 miles east of the present terminus. The road is already being extended from Broadway to Lillington, which is on the Raleigh & Southport Railroad, that was recently acquired by the Norfolk Southern, and it is possible that the line which has changed hands may figure as an important connection of the latter. At present it is intended to complete the extension to Lillington and proceed onward to Goldsboro, although the Atlantic

cation.	Unit.	Quantity.	(1)		(3)	(4)	(5)	(6)	(7)	(8)
[illegible]	Lin. ft.	[illegible]	$1,500.00	$1,425.00	$1,600.00	$1,750.00	$1,450.00	$1,740.00	$1,680.00	$1,800.00
[illegible] M. H. W.	Cu. yd.	[illegible]	5.00	3.50	3.63	5.00	6.00	5.00	6.00	3.50
[illegible] M. H. W.	Cu. yd.	139,260	5.50	5.50	6.24	6.00	[illegible]	6.50	6.00	6.00
[illegible] sewers and pipes..	Cu. yd.	1,500	6.00	5.00	5.00	5.00	7.00	8.00	6.00	4.00
[illegible]	Cu. yd.	20,600	6.00	7.00	8.50	8.00	7.00	6.00	7.00	7.50
ldings, less than 7 stories..	Front ft.	1,342	[illegible]	100.00	60.00	50.00	100.00	[illegible]	120.00	50.00
[illegible]	Cu. yd.	25,680	10.00	10.00	9.75	10.00	10.00	9.00	12.00	12.00
outside waterproofing......	Cu. yd.	4,795	9.00	9.00	10.50	10.00	8.00	8.50	12.00	10.00
[illegible]	Cu. yd.	1,370	8.00	[illegible]	7.50	7.50	6.00	7.50	8.00	7.50
[illegible]	Cu. yd.	100	7.00	8.00	6.00	6.00	5.50	6.50	6.00	6.00
[illegible]	Cu. yd.	100	20.00	15.00	15.00	15.00	20.00	20.00	15.00	16.00
[illegible]	Cu. yd.	100	20.00	15.00	15.00	15.00	20.00	15.00	15.00	12.00
[illegible]	Lin. ft.	8,700	.75	1.50	1.50	1.00	.75	1.00	1.00	.60
(Sec. 102 of specifications)......	Lin. ft.	1,000	2.00	2.00	2.00	2.50	3.00	1.00	[illegible]	2.00
[illegible]	Ft. B. M.	2M	100.00	100.00	100.00	100.00	75.00	100.00	100.00	75.00
[illegible]	Cu. yd.	100	3.00	2.50	2.00	3.00	2.50	2.50	2.00	1.75
1-ply	Sq. yd.	37,035	.50	.45	.65	.50	.60	.75	.80	1.00
(b) 2-ply	Sq. yd.	100	[illegible]	.75	.95	1.00	.90	1.00	1.10	1.30
(c) 3-ply	Sq. yd.	[illegible]	1.00	1.00	1.60	1.25	1.20	1.50	1.40	1.40
(d) 4-ply	Sq. yd.	100	1.25	2.00	1.75	1.50	1.50	2.00	1.70	1.60
(e) 5-ply	Sq. yd.	100	1.50	2.50	1.95	1.75	1.80	2.25	2.00	1.80
(f) 6-ply	Sq. yd.	100	1.75	3.00	2.25	2.00	2.10	3.00	2.30	2.00
halt mastic	Cu. yd.	[illegible]	20.00	25.00	[illegible]	25.00	30.00	30.00	[illegible]	35.00
[illegible] 12-in	Lin. ft.	[illegible]	1.00	[illegible]	1.00	1.00	1.50	1.50	1.75	1.50
(b) 10-in	Lin. ft.	100	.80	[illegible]	.90	.75	1.30	1.30	1.50	1.25
(c) 8-in	Lin. ft.	[illegible]	.65	.70	.80	.65	.80	1.00	1.25	1.00
(d) 6-in	Lin. ft.	100	.50	.60	.60	.50	.60	.75	1.00	.75
(e) 4-in	Lin. ft.	100	.40	.50	.40	.50	.50	.60	.75	.50
e—.....(f) 8-in	Lin. ft.	100	1.50	2.00	1.20	1.50	1.50	2.00	1.75	1.50
(g) 6-in	Lin. ft.	[illegible]	1.10	1.50	1.09	1.25	1.25	1.75	1.50	1.25
(h) 4-in	Lin. ft.	100	.90	1.00	.75	1.00	1.00	1.00	1.00	1.00
building to 6-in	Lin. ft.	[illegible]	2.00	2.00	1.50	1.50	1.75	2.00	2.00	1.60
	Duct ft.	110,800	.15	.15	.12	.15	.15	.15	.15	.12
	Tons	6,755	65.00	70.00	66.00	75.00	80.00	80.00	80.00	85.00
	Tons	[illegible]	55.00	65.00	56.00	70.00	72.50	70.00	70.00	75.00
d bars	Tons	110	70.00	50.00	45.00	60.00	65.00	78.00	80.00	60.00
n castings	Tons	12	[illegible]	70.00	65.00	80.00	75.00	100.00	75.00	70.00
	Lbs.	5,230	.06	.10	.15	.20	.10	.10	.10	.08
-in. W. I. galvanized	Lin. ft.	4,260	.50	1.00	.50	.50	1.00	1.50	1.00	.40
	Sq. ft.	2,545	1.75	2.00	2.25	2.00	2.50	2.25	2.50	1.60
restored	Sq. yd.	3,618	1.50	2.50	2.00	2.00	3.00	2.50	3.00	3.00
s restored, temporary	Sq. yd.	5,817	1.50	2.75	2.00	1.00	3.00	1.40	3.00	[illegible]
15-in. vitrified	Lin ft.	220	4.00	5.00	3.15	2.00	4.00	4.50	5.00	4.50
18-in. vitrified	Lin ft.	300	4.50	6.00	3.50	3.00	5.00	5.50	6.00	5.50
haped masonry, 3.6x2.4	Lin. ft.	130	18.00	9.00	6.00	10.00	10.00	12.50	15.00	10.00
masonry, [illegible]	Lin. ft.	100	20.00	15.00	7.00	10.00	12.00	14.00	18.00	11.00
x12.0	Lin. ft.	650	42.00	40.00	12.00	36.00	30.00	35.00	50.00	35.00
[illegible]	Lin ft.	350	21.00	20.00	[illegible]	15.00	16.00	15.00	20.00	14.00
ing electric R. R., single track	Lin. ft.	1,446	15.00	18.00	15.00	15.00	12.00	18.00	20.00	15.00
[illegible]	Lin. ft.	100	1.00	1.00	1.25	1.00	.75	1.25	1.00	1.50
[illegible]	Lin. ft.	[illegible]	1.25	1.50	1.50	1.25	1.00	1.50	1.50	2.00
12-in	Lin. ft.	100	[illegible]	2.50	2.10	2.50	2.00	2.50	2.50	3.00
	Lin ft.	100	1.25	1.25	[illegible]	1.00	1.00	1.50	1.25	2.00
	Lin. ft.	100	1.50	1.50	[illegible]	1.50	1.50	2.00	1.50	2.40
pipe (a) 6-in	Lin ft.	650	1.25	1.50	1.35	1.50	2.00	1.55	1.25	2.50
pipe (b) 8-in	Lin. ft.	400	1.50	2.50	1.60	2.00	3.00	2.00	1.50	3.00
spigot straight pipe, delivered...	Tons	1	50.00	40.00	[illegible]	60.00	40.00	40.00	40.00	40.00
spigot pipe, special cast, deliv..	Tons	[illegible]	100.00	80.00	80.00	100.00	90.00	100.00	75.00	65.00
s in streets	Duct ft	5,000	.50	.20	[illegible]	.40	.30	.32	.30	.50
			$3,889,775	$3,936,558	$4,177,449	$4,396,126	$4,483,626	$4,492,127	$4,558,666	$4,590,639

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] provides that it may build as far west as Tennessee. The road connects with the Seaboard Air Line, the Southern Railway and Atlantic Coast Line. It is stated that all the bonds for the proposed improvements have been disposed of in Paris. The new officers are Herman C. Huffer, Jr., president; B. W. Duer, vice-president; William C. Cook, secretary and treasurer; H. P. Edwards, Sanford, N. C., general superintendent. Messrs. Huffer and Duer are associated with the banking house which has purchased the road.

Ohio.

⦿D. W. McGrath, Columbus, O., has been awarded a contract by the Norfolk & Western R. R., amounting to about $100,000 for shop buildings to be erected at Joyce and 5th Aves., Columbus. The work includes a round house to contain 25 stalls and be 100 by 700 ft. in dimensions, costing about $40,000; a machine shop to be 52 by 139 with an annex, 35 by 64 in dimensions; a store and oil building, one story high, will be 32 by 100 ft. and a yardmaster's office, two stores, 40 by 60 ft.

⦿John R. Lee, Paterson, N. J., who was awarded the contract for the Erie R. R. second track work on the Chicago division from Lima, O., to Elgin, O., and Woen to Decatur, will sublet all team work for about 20 miles of the contract. The contract includes 600,000 cu. yds. of earth excavation, about 700,000 cu. yds. of embankment, two large trestle bridges, and 9,000 cu. yds. concrete masonry. The subcontract for the concrete work on the Lima section was let to Miles & Tighe Contracting Co., Easton, Pa.

⦿The Patterson-Moran Co., Morgantown, W. Va., which was awarded a section of the double track work on the Erie R. R., will not sublet any of the concrete and grading work but will do it themselves.

The City Council of Cleveland, O., has passed an ordinance granting the Cleveland & Youngstown R. R. Co. permission to build a 4-track railroad from E. 110th St. to Huron and Canal roads, S. E. The cost of the improvement, including the terminal station, will be, it is estimated, about $5,000,000.

Oklahoma.

It is rumored that the Santa Fe is planning to purchase the Oklahoma Central R. R. and extend the line from Chickasha, Okla., to Honey Grove, connecting with the Ladonia branch.

The Kansas, Oklahoma & Texas R. R. Co. has been chartered with a capital stock of $20,000,000. This is the new name for the Cherryvale, Oklahoma & Texas R. R., which has been promoted by S. M. Porter of Caney, Kan. The new company is reported to have financed the project and it is said that construction work on a portion of the line will be started soon. The main line as proposed will extend from St. Louis to Galveston, Tex. Another line will start at Kansas City and build south through Eastern Oklahoma to Shreveport, La. A branch line is planned from Caney, Kan., through Fayetteville to Little Rock, Ark. Another branch will run from Pawhuska, Ok., to Oklahoma City and El Reno, thence to Childress, Tex., and it is proposed to build a branch from Oklahoma City to Laredo, Tex. The directors are: R. E. Wade, George A. Masters and S. M. Porter of Perry, Okla., and J. H. Brewster and F. D. Brewster of Independence Kan.

Oregon.

The North Bank R. R., Carl R. Gray, presirent, Portland, Ore., and the allied Hill lines have plans under consideration for extensive developments for the east side shipping district of Portland. The improvement will call for the expenditure of about $2,500,000.

The Multnomah Central Ry. Co., which projects a 24-mile electric line from Cottrell, on the Mount Hood line of the Portland Ry., Light & Power Co., to the base of Mount Hood, near the Welch place, is planning to start construction work on the first 6½ miles of track to Sandy immediately. The officers of the company are E. R. Ernsberger, Portland, Ore., president; G. A. Lovejoy, vice-president; W. J. Conday, of Chicago, secretary, and W. D. Van Kuren, of Philadelphia, treasurer.

Pennsylvania.

The Lehigh & New England R. R., it is reported, has decided to extend its line to Tamaqua, Pa., and has under consideration the construction of the line on to Lansford, Coaldale and other points in the Panther Creek Valley. F. W. Gilcrest, Mauch Chunk, Pa., is Chief Engineer.

It is reported that S. Morris, Altoona, Pa., has purchased the Altoona, Beach Creek & Great Northern R. R., a small narrow gaged line 15 miles long, extending from Altoona to Daughbertys Mines, a coal town on the top of the Allegheny mountains. Work on improvements will be begun immediately. The equipment of the road consists of two locomotives, 30 freight and several passenger cars.

Engineers of the Pennsylvania R. R., Geo. W. Snyder, principal assistant engineer, Pittsburgh, Pa., have been making surveys for the proposed underpass at Verona St., in North Braddock, and will probably have construction work started this month. Two other underpasses are to be constructed in North Braddock. The improvements will cost $175,000, the boroughs of Braddock and North Braddock to stand two-thirds of the cost.

The Philadelphia and West Chester Traction Co., C. A. Entrekin, Chief Engineer, Upper Darby, Pa., has obtained rights of way and franchises for its proposed extension from Drexel Hill to Media, and will take bids for construction work in the near future.

Tennessee.

The St. Louis & San Francisco R. R. has not yet decided what action will be taken in regard to repairing its roadbed between Memphis and Jonesboro. It is probable that only such work will be done as is necessary to restore the track to its original condition. This will not require a heavy expenditure and will only consist of replacing a small amount of grading and ballast where the trcak was washed out. It is not probable that the company will undertake to raise its track at this time.

The City Council of Clarksville, Tenn., has granted a franchise to the Louisville & Nashville R. R. Co. to build a line from its main tracks to the heart of the city, entering near the public square. This improvement will cost the railroad company over $200,000.

The St. Louis, Iron Mountain & Southern R. R. (Missouri Pacific system, E. F. Mitchell, Chief Engineer, St. Louis, Mo.), is understood to be planning to have work started this summer on the completion of the double tracking of its line between St. Louis and Texarkana, 490 miles. At present 71 miles of this section are double tracks; to complete the work will cost something like $5,000,000.

Texas.

The Sugarland Ry. Co., I. G. Wirtz, Chief Engineer, Sugarland, Tex., has filed an application with the State Railroad Commission for authority to issue bonds on the entire mileage of that line and for the registration of bonds authorized by the construction done. The petition is for authority to issue bonds at the rate of $25,000 per mile, and 57 miles is contemplated. Registration is to be on 32 miles now completed and in operation. The company values same at $22,988 per mile, a total of $752,189. The application indicates extensions to Hempstead and points intermediate, in order that it will have a line extending from Oyster, on the International & Great Northern, in Brazoria County, and Arcola, on the Santa Fe, in Fort Bend county, to Hempstead, touching the Santa Fe at Duke, Fort Bend County; the Galveston, Harrisburg & San Antonio at Sugarland, the San Antonio & Aransas Pass at Simonton, the Katy at Rodgers and the Houston & Texas Central at Hempstead. It will also touch the Brownsville line at Brazoria. It is under money is forthcoming, and tha sions are to be made in the nea

Steps are being taken for finan posed Temple & Northwestern has been surveyed and parti This road has been surveyed f to Gatesville, to Hamilton, to about 100 miles. Charlton H Tex., is interested.

The Houston & Texas Central Cushing, Chief Engineer of Houston, Tex., has taken bids fo miles of roadbed from Giddings

The Schocten Bros. Cedar Tex., has been asking bids fro with 15 to 20 teams with wheelers on a contract for about 14 miles a tram road from Lometa.

The San Antonio Belt & Term tioned in our last issue, propos belt line around the city of San main track of the belt line will miles long. It will connect wit portant industrial plants and th roads. While the capital stock pany is the nominal amount it is stated that the improvem templation will cost more tha The terminals will be used souri, Kansas & Texas and two other independent lines th being constructed south from S It is reported that the Missou Texas contemplates an extensio south from San Antonio to some Rio Grande. It will also build i between Austin and either Sa Lockhart. At present the Miss and Texas is using the Southern minals in that city.

The Bankers' Trust Compa Texas, is reported to have finan posed extension of the Bartlett R. from Bartlett east to Camero W. Jackson, Bartlett, Texas, is

Vermont.

The State Public Service Co authorized the New York, Ne Hartford R. R. Co. to purchase of the capital stock of the Rutla owned by the New York Centr give the New Haven control of

The organization of the St. Al ton Traction Co., the new corp has taken over the property and of the St. Albans Street Ry. Co., previous issue, has been effected lowing officers have been electe John W. Ogden of Malden, Mas dent, Fuller C. Smith, St. Alba Walter R. Dane of Clinton, Mas; Charles Royce of St. Albans. Th superintendent of the road will Wilkinson.

The Burlington Traction Co., President, Burlington, Vt., has State Public Service Commissio sion to issue $500,000 of bonds. $200,000 is to be used to pay for of the Vergennes Power Co., an retiring present bonds which mat

Virginia.

The Norfolk, Suffolk & Smit Co., of Norfolk, Va., has comp ganization and proposes to bu erate a railroad between Smithfield. The officers of t are: H. H. Prince, president manager; C. A. Holle, secretar urer; R. M. Johnson, vice-pr general counsel; William J. V Snellings, M. V. Bridgers an Seawall—all of Norfolk, Va.

Washington.

The White Lumber Co., White rejected all bids received for the of its proposed railroad and th be readvertised. The offices of are located at Whites, a smal Whitehall, Wash.

of incorporation have been filed Howell, Secretary of State, Olymby the Washington Western Ry. Lakes, Snohomish County, Wash. stock of the company is $2[illegible] oses the construction of a railroad idewater point on the Puget Sound sh County, through Three Lakes. ord and J. M. Harnett are in-

ed in Ellensburg, Wash., that the waukee & Puget Sound, which has construction down the Columbia Beverly to Hanford, will be exnton City and ultimately to North

ored that the Chicago, Milwaukee and Ry. will shortly build the proline from Palouse, Wash., to the an. E. O. Reeder, Seattle, Wash., gineer.

Milwaukee & Puget Sound Reeder, Chief Engineer, Seattle, to have plans under way for the er depot on Pacific avenue, near t Tacoma. It is stated that work d this summer. The reported cost

West Virginia.

& Co., Clarksburg, W. Va., awarded the contract for gradrds and laying tracks for the of the Maryland Coal Co. at he contract amounts to about

ngahela Valley Traction Co. has for the merging of the Fairrksburg Traction Co., the Fairhern Traction Co. and the Clarkstern Street Ry. Co. The capital new company is $7,500,000. The of the lines will remain the same, aving been brought about for the expediting the operation of the ecure funds for the completion of rg & Western line. A line will Salem, W. Va., from Clarksburg. are: S. L. Watson, Fairmont, H. Wheelwright, Baltimore, vicealton Miller, Fairmont, secretarynith Hood, Fairmont, general su- J. O. Watson, general manager.

Wisconsin.

aukee Western Electric Ry. jestic Bldg., Milwaukee, Wis., to let contracts for grading roadbed between Juneau and C. A. Chapman, Inc., Steger go, Ill., is Chief Engineer.

Council of Merrill, Wis., has lution proposing a special election nd issue for a municipally owned is proposed to construct a stande from Merrill west to the viens, a distance of 23 miles, where ill be afforded with the Soo. Of t, which has been estimated at rill proposes to issue bonds for he county for $135,000. On the nsion 17 miles in length is pro- Langlade county line, where connection with the Northwestern road will be established.

The Lake Superior & South Dakota Ry. Co., the incorporation of which was mentioned in our May 8 issue, is projecting a 250-mile line. The surveys have not been made as yet nor has the chief engineer been appointed. Jay M. Smith, Duluth, Minn., is president.; W. R. Gillis, Superior, Wis., is also interested.

The Chicago & Lake Superior Ry. has made surveys and has secured the capital for the construction of a 3-mile extension from Cambridge to Rockdale. Construction contracts will be let soon. B. L. Delamater, Cambridge, Wis., is president.

Acting City Engineer Pitz of Manitowoc has started the survey work for the Manitowoc & Northern Traction Co.'s extension on the west side. Thos. Higgins, Manitowoc, Wis., is president of the Traction Co.

Wyoming.

The Colorado & Southern Ry. has started initial work of replacing the 52-lb. rail between Hartville, Wyo., and Orin Junction with 85-lb. standard steel. The first work will be done between Glendo and Orin Junction, and the outfit will make its headquarters at Bona. In addition to replacing the light with heavy rail, all of the old ties in the roadbed will be renewed and the right-of-way re-ballasted. When the new line was laid between Wellington and Cheyenne last summer the heavy standard rail was installed that the road might be in shape for main line traffic, and with the completion of the work between Hartville and Orin Junction the C. & S. will be in possession of a right-of-way capable of handling heavy traffic from Denver to the connection with the Northwestern at Orin Junction.

Canada.

✣The Commissioners of the Transcontinental Ry., P. E. Ryan, secretary, Ottawa, Ont., are calling for bids until noon, May 31, for the construction and erection complete, in accordance with the plans and specifications of the Commissioners, of six 200-ton mechanical coaling plants with sand houses and track approaches to be erected at the following points on the line of the National Transcontinental Ry.: 1 at Moncton, N. B., Mile O.O. District "A"; 1 at Napadogan, N. B., Mile 118, District "A"; 1 at Edmundston, N. B., Mile 230, District "A"; 1 at Grant, Ont., Mile 232.7, District "D"; 1 at Calvert, Ont., Mile 109.6, District "E"; 1 at Armstrong, Ont., Mile 240, District "E." Bids are also asked for a 1,000 ton coaling station with inclined trestle approach. at Cochrane, Ont., Mile 103.7, District "D. Plans and specifications may be seen at the office of W. J. Press, Mechanical Engineer, Ottawa, Ont.

Bids were opened May 20 by J. G. Sullivan, Chief Engineer of the Canadian Pacific Ry., Winnipeg, for the erection of a 30-stall round house at North Transcona.

Proposition has been submitted to the City Council of Saskatoon, Sask., for the construction of a street railway system. Local capitalists are interested and are said to have agreed to raise $500,000 to install the system.

The Canadian Northern Ry., M. H. Macleod, General Manager, Winnipeg, Man., opened bids last Saturday for the work of grading for a spur in the city of St. Boniface, Man.

The Canadian Northern Ry. is planning to make a number of improvements at Saskatoon, Sask., this year. These include the enlargement of its depot and freight sheds and a new yard. Plans for the depot extension have been approved and the contract will be let immediately.

Representatives of St. Thomas, Aylmer, Yarmouth and Malahide, have agreed to guarantee the bonds of the London & Lake Erie Ry. Transportation Co. of London, Ont., for the extension of the road from St. Thomas to Aylmer to the extent of $10,000 a mile, a first mortgage to be given as security. The company asked for $20,000. If the offer is accepted the proportion that each municipality is to assume will be decided.

Ratepayers of St. Thomas, Ont., voted to expend $23,500 for improving the St. Thomas Street Ry., which is owned by the city, and for the purchase of three new cars. It was also voted to extend lines on Ross and William streets.

According to an announcement by C. V. Cummings, General Manager of the Northern Construction Co., Winnipeg, Man., about 3,000 men and 1,000 teams are to be engaged on the new Canadian Northern Brazeau branch. Eighty miles of grading remains to be finished and this is being carried on with all speed. The complete section is from Rocky Mountain House to the coalfields, where there are at work today 600 men and 200 teams. Within a few weeks' time 1,000 men will be employed on this branch alone. The frost is well out of the ground at Brazeau now, and there remains nothing to interfere with the progress of work. It will be completed before the close of construction for the season of 1912. On the Onoway Peace River branch the company will complete 100 miles of new line this season through to Athabasca Crossing, while on the Strathcona-Calgary line the C. P. R. line to Pakan, the construction is being expedited. On the Goose Lake line 110 miles of new grade will be laid this year, closing the remaining gap and enabling the Canadian Northern railway to haul out over this route during the coming fall the product of the grain harvest of the year.

Mexico.

The Guatemala Central Ry. Co., a 3 ft. gage line in Central America, has been purchased by Minor C. Keith, 17 Battery place, New York City, president of the Guatemala Ry. The railway is approximately 225 miles long, running from San Jose on the Pacific coast to the capital where it is reported the purchasers intend to complete connections with the Pan-American road and arrange connection with Mexico lines.

The Department of Fomento has approved a contract with S. Pearson & Son, Pte de Alvarado, No. 53, Mexico, D. F., Mexico, for the construction of a railway and an oil pipe line between Ixhuatlan and Puerto Mexico.

ADS, STREETS AND PAVEMENTS

Alabama.

be received until 2 p. m., May . Palmer, Engineer, Elba, Ala., ruction of 30 miles of road. The lude grubbing, clearing, grading, d-claying and other work.

ommission of Mobile, Ala., d plans for the drainage and e 11th venture, which calls for ture of $287,000, and the imf Government St., from Cathcity limits, and Dauphin from Reed Ave. Asphalt, creosoted wood block, vitrified brick and gravel will be used.

Arkansas.

✣Bids will be received until June 8 by city of Little Rock, Ark., for the construction of approximately 45,000 sq. yds. of brick pavement, which will be covered with bituminous filler. Louisiana St. is among the thoroughfares to be paved.

California.

✣Bids will be received until 11 a. m., June 8, by Col. G. McK. Williamson, Quartermaster, Fort Mason, Calif., for the construction of extensions to the roads, gutters and drains at Fort Winfield Scott, Calif.

Preliminary steps have been taken by the Board of Trustees of Coronado, Calif., for the grading and paving of 20 streets, covering a total length of 8 or 10 miles. H. B. Hakes is Trustee.

Florida.

✣Bids will be received by Town of Clearwater, Fla., T. J. Sheridan, Clerk, for paving Osceola St. from Jones Ave. south to Havens

Ave., thence west to Oak St., thence south to Turner St. The material is to be crushed rock, vitrified brick, asphalt, macadam or concrete. The roadway from Jones Ave. about 2,420 ft., 24 ft. wide; distance from Osceola St. to Oak St. and south to Turner St. about 1,060 ft., 15 ft. wide.

✣Bids will be received until 8 p. m., June 10, by City Council, Tallahassee, Fla., for 22,000 sq. yds. of brick paving and 12,000 ft. of curbing. J. E. Craig is City Engineer.

⦿J. Harper Wylie of Interlachen, Fla., has been awarded the contract by the city of Palatka, Fla., S. C. Stallings, City Engineer, for the construction of 21,150 sq. yds. of pavement at $6,768; also concrete curbing at $0.23 per lin. ft. The road will be 16 ft. wide and 8 ft. deep. Bids were opened May 7.

Idaho.

✣Bids will be receved until 10 a. m., May 24, by Board of County Commissioners, Boise, Idaho, for the construction of a hard-surfaced road 20 ft. wide extending along the Valley Road from the city limits of Boise City. A. E. Fox, 518 Overland Bldg., Boise, Idaho, is Consulting Engineer.

The City Council of Twin Falls, Idaho, has granted a petition providing for the formation of an improvement district on Second Ave., west for two blocks, for the construction of concrete sidewalks and curbs; also for curbing on Ninth Ave., east and north for three blocks.

Illinois.

⦿The following contracts have been awarded for constructing pavements by the Board of Local Improvements, Chicago, Ill., Ed. J. Glackin, Secretary: 43d Ave., asphalt, $23,903, Standard Paving Co., 9 LaSalle St.; N. 44th Ct., asphalt, $28,362, R. F. Conway Co., 133 W. Washington St.; E. 50th St., asphalt, $25,179, R. F. Conway Co.; E. 56th St., asphalt, $18,071, American Asphalt Paving Co., 133 W. Washington St.; Hillock St., asphalt, $20,163, American Asphalt Paving Co.; W. one-half of May St., asphalt, $2,669, American Asphalt Paving Co.; N. Marshfield Av., asphalt, $2,492, Parker Washington Co., 133 W. Washington St.; W. 73d St., asphaltic macadam, $8,222, Calumet Coal & Teaming Co., 9022 Commercial Av.; E. 77th St., asphalt, $11,566, Parker Washington Co.; Southport Av., asphaltic macadam, $15,688, Central Paving Co., 179 W. Washington St.; Stewart Av., asphaltic macadam, Jno. A. McGarry Co., 189 W. Madison St., W. 36th St., asphalt, R. F. Conway Co.: W. 32d St., asphalt, $16,283, American Asphalt Paving Co.; Menominee St., brick, $2,138, Jno. A. McGarry Co.; alleys, South Park Ave., etc., brick, $2,042, Jno. Dillon & Co., 179 W. Washington St.; alleys, Cottage Grove Ave., etc., brick, $3,696, Central Paving Co.; alley, Jackson Blvd., No. 2 granite blocks, $1,965, Central Paving Co., prices include granite concrete combined curb and gutter, Portland cement, concrete foundation (6 ins.), sewer, manhole and catch basin construction and adjustment, etc.

⦿The Board of Local Improvements of Rock Island, Ill., has awarded the following contracts for paving: McCarthy Improvement Co., Davenport, Ia., paving Second Ave. from 14th to 20th Sts., with asphalt, at approximately $25,900; Independent Construction Co., Davenport, Ia., paving Fourth Ave. from 16th to 20th Sts., $12,792; McCarthy Co., paving Sixth Ave. from 19th to 20th Sts., with asphalt, $2,804.

⦿The Gund-Graham Co. of Freeport, Ill., has secured another contract from the Board of Local Improvements of that city for paving work. The contract calls for brick pavement on parts of Benton, Float and Delaware Sts. and Park Ave., at $24,268.

⦿The Board of Local Improvements of Joliet, Ill., Wm. S. Welch, Clerk, has awarded the contract for the construction of a bituminous pavement on Sherman St. to R. F. Conway Co., Chicago, as follows: 7,035 sq. yds. of paving, $0.90; 3,000 lin. ft. of curbing, including excavation and backfilling, $0.55; 1,640 cu. yds. of [illegible] and grading, $0.60; 800 ft. of old curbing reset, including the taking up and replacing same as new, $0.20. Bids were opened May 13.

⦿The Board of Local Improvements of Sterling, Ill., has awarded the following contracts for paving work during this year: O'Rourke & Ridge, Sterling, paving East Fourth St. and Second Ave., $1.33 per yd., $0.40 per ft. for combined curb and gutter, $0.20 for curb and $0.21 for gutter; O'Rourke & Ridge, paving Avenue D, $1.34, $0.40 for combined curb and gutter, $0.21 for gutter and $0.20 for curb; McCarty & Fitzgerald, Sterling, paving Avenue B, $1.32, $0.40 for combined curb and gutter, $0.20 for curb and $0.20 for gutter; O'Rourke & Ridge, paving East Eighth St., $1.34, $0.40 for combined curb and gutter, $0.21 for gutter and $0.20 for curb. Brick will be used on all streets.

⦿Hoeffken Bros. have been awarded the contract by the Board of Local Improvements of Belleville, Ill., for the paving of Switzer St. from Main St. to Centerville Ave., at $6,436. Reeb Bros. bid $6,666 on the work. Fred J. Kern is Mayor.

⦿Valentine Wolf of Alton, Ill., has been awarded the contract by the Board of Local Improvements of that city for the paving of Elm St. from State to Alby and Alby from Elm to the C. & A. bridge, at the following bid: Paving, $1.24¾ a yd.; combination curb and gutter, $0.47. The work includes 17,333 yds. of paving and 7,800 lin. ft. of combination curb and gutter. Other bidders were Ryan & Wolf, J. H. Maupin, Jr., C. H. Degenhardt, John Strubel and E. A. Burke.

⦿J. H. Palmer of Danville, Ill., has been awarded the contract by the Village Board of Sheldon, Ill., for the paving of Central St., at $8,500. The pavement will extend from the east to the west limits of the village, a distance of one mile, and will connect the two country hard roads which reach to the township lines to the south and west. The pavement will be a 15-ft. roadway of macadam without curb and gutter.

⦿The Highway Commission of Sterling, Ill., has let the contract for the construction of the new Dixon road pavement to McCarty & Fitzgerald at $1.34 per sq. yd. for paving and $0.15½ per running ft. for curb. Brick will be used. The total cost will be approximately $4,700.

⦿The Board of Local Improvements of Rossville, Ill., has awarded the contract for the construction of asphaltic concrete pavement on Chicago and Attica Sts. to the Capital City Concrete Construction Co. of Springfield, Ill., at $62,000. The work to be done is approximately as follows: 34,430 sq. yds. of paving, 5-in. concrete base, with 1½-in. asphaltic concrete wearing surface; 3,386 lin. ft. of machine dressed stone curb 5x20 ins.; 17,473 lin. ft. concrete combined curb and gutter; 995 ft. 5x20 stone headers; 59 storm water inlets complete with catch basins and connections, and 2,521 lin. ft. of 12-in. vitrified sewer pipe sub-drains. Bids were opened May 6.

⦿The Board of Local Improvements of Lincoln, Ill., has awarded the contract for the paving of Elm St. to Harvey K. Rhoades. Concrete pavement will be laid.

Following are the lowest bids as received by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, for constructing Portland cement concrete sidewalks, 5 ins. thick, in the following streets: S. Clark st., 6,000 sq. ft., 11.7 cts., Jas. J. Ferry, 323 Sigel St.; Erie St., 6,000 sq. ft., 11 cts., Jas. J. Ferry; Michigan Ave., 900 sq. ft., 14.4 cts., A. P. Larson, 11322 Indiana Av.; Melrose St., 2,400 sq. ft., 12.7 cts., Demling & Wendt, LaSalle St.; North Ave., 28,000 sq. ft., Shafgard Construction Co., 4024 W. North Ave.; E. 90th St., 1,600 sq. ft., P. F. Biesen, 14.75 cts.; 103d Pl., 1,400 sq. ft., 12.69 cts., A. P. Larson; 103d St., 4,000 sq. ft., 11.7 cts., Demling & Wendt; 104th St., 1,600 sq. ft., 12.62 cts., A. P. Larson; Superior St., 2,000 sq. ft.,
15.5 cts., P. F. Biesen, 9 S. LaSal
St., 5,000 sq. ft., 11⅜ cts., A. P. La
land Ave., 3,800 sq. ft., 13.9 cts.,
sen Co., 3863 Milwaukee Ave.,
4,000 sq. ft., 11 cts., Barrstow
6084 Ridge Ave.; 61st St. syster
ft., Daniel Ryan; E. 87th St. s
sq. ft., A. P. Larson, 10.74 cts
system, 40,000 sq. ft., 10.94 cts., A
E. 90th St. system, 12.6 cts., A.
W. 113th St. system, 4,000 sq. f
A. P. Larson; W. 88th St. syst
ft., 12.44 cts., A. P. Larson; Lawr
tem, Geo. Kehl & Son, 1224 N. C
690 sq. ft., 24.23 cts.; 71st St. s
sq. ft., Geo. Kehl, 13.96 cts.; 76th
6,000 sq. ft., 11.37 cts., F. K. She
63d St.; Cortez St. system, 3,000
cts., A. Graff, 138 N. LaSalle st.
May 17th. The contracts hav
awarded.

The Board of Local Impr
Monmouth, Ill., has passed
providing for the construction
of new paving in the city. T
paving would be laid on West
from Main St. to the Rock Is
ern; North A St., from Arc
Franklin; North B St., from
way to Franklin, and North
West Broadway to Boston Av
gineer R. M. Ferguson has e
total cost at $39,400.

The City Council of Otta
passed an ordinance providing
ing of Madison St. at an approxi
$35,000. George L. Farnswo
Engineer.

The City Council of Urba
passed an ordinance providing
ing of Clark St. from Linc
Romine St.

The Board of Local Impr
Farmer City, Ill., has decided
with the paving of Main St.
square to Plum St. and on Plu
Big Four depot. The estim
$45,000.

The Board of Local Impr
Silvis, Ill., has confirmed the
ing of First Ave. from Warn
to 16th St. The estimated cos
mately $52,000.

Contracts will be let within
by the city of Decatur, Ill., Ral
City Engineer, for the constru
sq. yds of brick pavement on a
dation with cement grout fille
will also include 4,259 cu. yds.
The estimated cost is $15,452.

The Town Council of Roc
has voted to pave the Manu
trict, which includes the south
St. from First to Fifth Ave.

Following are the low bids
S by Board of Local Impr
cago, Ill., E. J. Glackin, Secr
structing sidewalks in streets
thony Ave., 3,500 sq. ft., 3½-ft
P. F. Biesen, 9 S. La Salle
Ave., 10,000 sq. ft., 1¼-ft. fill,
Larsen, 9 S. La Salle St.;
4,600 sq. ft., Central Ave.,
$0.11.74, Jas. J. Ferry, 323
Elston Ave., 4,800 sq. ft., 1-ft.
& Son Co., 1224 N. Campbell
abeth St., 4,000 sq. ft., 1½-ft
P. F. Biesen; N. 45th Ave.,
1.0-ft. fill, $0.12, Siewert-Call
Milwaukee Ave.; N. 48th Ave
3-ft. fill, Gage St., 880 sq.
$0.15.23, G. Kehl & Son Co.,
8,000 sq. ft., 1½-ft. fill, $0.11.7
gard, 4024 W. North Ave.; L
400 sq. ft., 1-ft. fill, $0.15, G
Co.; E. 120th St., 2,900 sq.
$0.14.9, A. P. Larson, 1132 India
Pl., 6,000 sq. ft., 1½-ft. fill, $0.1
son, E. 123d Pl., 3,000 sq. ft., 1½
A. P. Larson; N. 68th ct., 2,0
fill, $0.12.9, R. R. Anderson;
Ave., 2,900 sq. ft., 1-ft. fill.
Graff, 138 N. La Salle St.;
3,800 sq. ft., 2-ft. fill, $0.14.4.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

ark Ave.; N. 33d St., 1,800 sq. ft.,)14. Jensen-Jensen Co., 133 W. St., W [illegible] St. system [illegible] ft. fill, $0.12.5. Daniel Ryan; W. ystem, 6,000 sq. yds., 1-ft. fill, Graff. E. 7[illegible]th St. system, 24,000 ft. fill, $0.11½, P. J. [illegible] W. 200 sq. ft., 2½-ft. fill, G. Kehl & . 56th St. system, 15,000 sq. ft., .12.18, G. Kehl & Son Co.; Hen- system, 6,000 sq. ft., 1½-ft. fill, Kehl & Son Co.; W. 14th St. 000 sq. ft., $0.12.39, A. Graff. All be built of Portland [illegible] ins. thick, and guaranteed [illegible]

Indiana.

ill be received until 2 p. m., June [illegible] Grant County Commiss- n, Ind., for the construction of ad on line between Wayne town- ngton County, and Washington Grant County. E. H. Kimball is [illegible]

ill be received until 10 a. m., [illegible] Commissioners, Adams Counties, at Bluffton, Ind., for ction of a gravel road on county Williamson is Wells County [illegible]

[illegible] received until 11:30 a. m. Board of Clay County Commis- zil, Ind., for the construction of road in Brazil township. E. A. ounty Auditor.

ill be received until 10 a. m., Board of Wells County Com- Bluffton, Ind., for the construc- gravel road on line between nship, Adams County, and Har- ship, Wells County. L. A. Wil- Wells County Auditor.

ll be received until 2 p. m., June d of Harrison County Commis- rydon, Ind., for the construc- avel or macadamized roads in township. William Taylor is litor.

ill be received until 10 a. m., Board of Porter County Com- Valparaiso, Ind., for the con- f gravel roads in Boone and hips. C. A. Blachly is County

ill be received until noon, June d of Dearborn County Commis- wrenceburg, Ind., for the con- roads in Washington township. ly is County Auditor.

ll be received until 2 p. m., June d of Daviess County Commis- shington, Ind., for the construc- gravel roads. L. S. Core is litor.

ll be received until 2 p. m., June d of Hamilton County Commis- blesville, Ind., for the construc- gravel roads in Clay township. ffin is County Auditor.

ll be received until 2 p. m., June d of Rush County Commission- lle, Ind., for the construction of ls in Ripley and Center town- l. Stone is County Auditor.

ll be received until 2 p. m., June d of Knox County Commission- nes, Ind., for the construction of ad in Stern township. J. T. Scott Auditor.

ill be received until noon, June d of Pulaski County Commis- inamac, Ind., for the construc- roads. W .E. Munchenburg is litor.

ll be received until 1 p. m., June d of Lawrence County Commis- dford, Ind., for the construction r macadamized roads in Marion, Guthrie and Perry townships, all Ezra W. Edwards is [illegible]

ll be received until 1 p. m., June d of Scott County Commission- [illegible] for the construction [illegible] Auditor.

✣[illegible] sioners, Kentland, Ind., for the construction of a macadam road in Iroquois township. E. R. Bringham is County Auditor.

✣[illegible] June 3, by Board of Vermillion County Commissioners, Newport, Ind., for the construction of gravel roads in Highland [illegible]

✣Bids will be received until 2 p. m., June 3, by Board of Blackford County Commissioners, Hartford City, Ind., for the construction of two gravel roads in Harrison township. James Cronin, Jr., is County Auditor.

✣Bids will be received until 3 p. m., June 3, by Board of Jasper County Commissioners, Rensselaer, Ind., for the construction of macadamized roads in Keener township. J. P. Hammond is County Auditor.

✣Bids will be received until 1:30 p. m., June 3, by Board of Washington County Commissioners, Salem, Ind., for the construction of roads in Howard, Jackson and Jefferson townships. F. S. Munkelt is County Auditor.

✣Bids will be received until 11 a. m., May 25, by Board of Vigo County Commissioners, Terre Haute, Ind., for the construction of gravel roads in Prairieton, Fayette and Lost Creek townships. N. G. Wallace is County Auditor.

✣Bids will be received until 7 p. m., June 7, by Board of Town Trustees, Osgood, Ind., for the construction of cement sidewalks on both sides of Buckeye St. J. E. Ebel is Town Clerk.

✣Bids will be received until 7 p. m., June 7, by Board of Trustees, Osgood, Ind., for the construction of cement sidewalks on both sides of Maple St. J. E. Ebel is Town Clerk.

✣Bids will be received until 7 p. m., June 7, by Board of Trustees, Osgood, Ind., for laying cement sidewalks on both sides of Cravens St. J. E. Ebel is Town Clerk.

✣Bids will be received until 10 a. m., June 14, by Constructing Quartermaster, Jeffersonville, Ind., for the construction of a public roadway, from East End Ave. intersection to the Belt Line Railway track, including 2,500 sq. yds. of asphaltic concrete or asphalt binder macadam paving; 1,400 lin. ft. of straight combined cement curb and gutter; 700 lin. ft. 10-in. terra cotta storm water drain pipe. Bids will also be received for paving roadway from Belt Line Railway tracks to Cemetery entrance, including 1,400 sq. yds. of asphaltic concrete or asphalt binder macadam pavement; 1,030 lin. ft. straight combined cement curb and gutter, etc.

✣Bids will be received until 1:30 p. m., June 3, by Board of Washington County Commissioners, Salem, Ind., for the construction of several roads. F. S. Nunkelt is County Auditor.

⊙The Cass County Commissioners, Logansport, Ind., awarded the following contracts at their May term for road work: Chas. H. Barron, road, Eeel Township; Walter Girton, Logansport; John H. Williams, road on county line between Cass and Pulaski Counties, Martin McHale, Logansport; concrete abutments to Samuel Cotner, Lokansport. J. E. Wallace is County Auditor.

⊙Lawrence Jenkins, Broadway, Monticello, Ind., has been awarded the contract by the Board of Public Works of that city, W. J. Gridley, City Clerk, for a brick pavement in Broadway St.; cement sidewalks and gutter. Bids were opened April 23.

⊙A. A. Douglass has been awarded the contract by the city of Monticello, Ind., for the paving of Second St. and Market St. with crushed stone at $990 and $1,103.

⊙Contracts for the paving of Mulberry St., between Evans and Willard Aves., and Iowa St., from Edgar to Garvin St., have been awarded by the Board of Public Works of Evansville, Ind., to the Western Construction Co. at $1.95 per sq. yd. for Trinidad lake asphalt and $0.41 per lin. ft. for curb and gutter.

⊙Ralph Davis of Greensburg, Ind., has been awarded the contract for the construction of a macadam road in Sand Creek Township, Decatur County, Ind., at $12,420. Bids were [illegible] May [illegible]

⊙The Board of Public Works of Indianapolis, Ind., has awarded a contract for the paving of Ruckle St., from 30th St. to the Fall Creek Blvd., to the Union Asphalt Construction Co. at $3.08 a lin. ft. on each side.

Iowa.

⊙The Bryant Asphalt Paving Co. has been awarded the contract by the City Council of Des Moines, Horace Susong City Clerk, for paving Fourth St., Orchard St., and Clark St. with sheet asphalt at $1.58 per sq. yd. The work will include 1,357 sq. yds. Bids were opened May 8.

Contracts will be let about May 27 by the city of Keokuk, Ia., for the construction of two blocks of brick, two blocks of macadam and six blocks of concrete pavement; also five miles of cement gutter. The estimated cost of the work is $22,000. J. F. Winters, Keokuk, is Engineer. T. J. Hickey, Keokuk, will have charge of the work.

The city of Burlington, Ia., will let contracts about June 20 for the construction of brick block or wood block pavement on a 6-in. concrete foundation, with asphalt or pitch filler. H. G. Vollmer is City Engineer.

Property owners on Otley Ave., city of Perry, Ia., have petitioned the City Council for the paving of that thoroughfare. Bitulithic or concrete would be used.

The City Council of Algona, Ia., has passed a resolution for paving State St., from the garage east to the hospital, comprising four blocks. About four blocks is under consideration on Thornton St.

The City Council of Sioux City Ia., has been petitioned for the paving with concrete of 16th St., from Jackson St. to Jones St., and 12th St., from Jackson St. to Jennings St.

Kansas.

✣Bids will be received until 11 a. m. (central time), June 12, by Maj. G. G. Bailey, Constructing Quartermaster, Fort Leavenworth, Kan., for the construction of sidewalks, curbs, gutters, etc.

Louisiana.

✣Bids will be received until 7 p. m., May 27, by J. S. Power, Mayor, New Iberia, La., for paving East Main St. from Weeks St. to Jefferson Road, a distance of about 6,290 ft.

✣Bids will be received until noon, June 4, by Highway Department of the Board of State Engineers, Frank M. Kerr, President and Chief State Engineer, 104 New Orleans Court Bldg., New Orleans, La., for the construction of a public highway from Colfax to Montgomery, Grant Parish, La., a distance of about 33 miles. Gervais Lombard is acting State Highway Engineer.

The City Council of New Iberia, La., has rejected the bid received from Chatham Construction Co. for the paving of East Main St. New bids will be received about May 24.

Maine.

City Engineer L. O. Norwood of Rockland, Me., is preparing plans for the construction of 3,300 sq. yds of granite block pavement on a foundation of stone chips mixed with clay (old road surface), and sand filler. The work will also include 800 cu. yds. of excavation. Curbing already set. The estimated cost is $8,900. Date for letting of contract not set.

Maryland.

✣Bids will be received until noon, May 23, by State Roads Commission, Union Trust Bldg., Baltimore, Md., for the construction of three sections of the Baltimore-Washington Boulevard. Section 10—About .37 mile in length, from end of Section 8 to Paint Branch, near College Station, Prince George's County (macadam). Section 14B—About .47 mile in length, from eastern run to eastern run through Bladensburg, Prince George's County (macadam). Section 13—About .80 mile in length, from Patapsco River to Baltimore & Ohio Railroad overhead crossing near Halethorpe, Baltimore County (macadam). E. E. Goslin is Secretary.

✣Bids will be received until May 28, by City of Annapolis, Md., for the construction of 10,000 sq. yds. of macadam and 2,000 sq. yds. of bituminous concrete pavement. The work will include 2,000 sq. yds. of concrete foundation and 1,300 cu. yds. of excavation. J. C. Little, Annapolis, Md., is Engineer.

⊙The Board of Awards of Baltimore, Md., has awarded the contracts for the paving of the streets in the Annex as follows: F. E. Schneider Paving Co., with asphalt, amount to nearly $18,000, Denison St., from Clifton Ave. to Elgin Ave.; Windsor Ave., from Hilton St. to Garrison Ave.; Elgin Ave., from Denison St. to Garrison Ave.; Allendale St., from Clifton Ave. to the Windsor Mill road. The bid was $1.59 for a 4-in. concrete base. Pen-Mar Construction Co., with vitrified brick, amounting to $21,254, Garrison Ave., from the Frederick road to Baltimore St.; Catherine St., from Lombard to Baltimore; Pratt St., a distance of 150 ft. eastward from Garrison Ave. The bid was $2.08 a sq. yd.

Massachusetts.

✣Bids will be received until 1 p. m., June 10, by Capt. R. H. C. Kelton, Constructing Quartermaster, 263 Summer St., Boston, Mass., for the construction of roads, walks, etc., at Fort Andrews, Boston Harbor, Mass.

⊙Commissioner of Public Works L. J. Rourke, Boston, Mass., has awarded the contract for the paving of Washington St., from Blue Hill to Talbot Aves., with wood blocks to William J. Barry at $105,299. Other contracts were awarded as follows: Paving the northerly side of Massachusetts Ave., from Tremont to Albany Sts., with wood block, F. S. & A. D. Gore, $32,179; paving Hammond St., between Shawmut Ave. and Tremont St., with wood block, J. C. Coleman & Sons Co., $18,782.

Plans have been made by City Engineer Stephen Kearney of Lowell, Mass., for the construction of about 20,000 sq. yds. of grouted granite blocks on a concrete base with cement filler. The work will be done by day labor and will cost about $73,000. Old edgestone curb will be used. Geo. H. Brown, Commissioner, will have charge of the work.

Michigan.

⊙Marsman & Green of Grand Rapids, Mich., have been awarded the contract by the City Council of Hudson, Mich., for the paving of Main St., Grove St., Maple Grove Ave., etc., at $31,000. Bids were opened May 8.

⊙The Board of Public Works of Grand Rapids, Mich., has let the contract for the grading and macadamizing of Morris Ave., between Wealthy Ave. and Logan St., to Kloote & VanderVeen of Grand Rapids at $4,720. This company also secured the contract to lay a sewer in the same street at $501.

Alderman R. R. Brenner of Kalamazoo, Mich., is advocating a municipal paving plant, estimated to cost $25,000. City Engineer H. A. Johnson has been instructed by the City Council to report on the feasibility of the project. The proposition will probably be submitted to a vote of the people.

Minnesota.

⊙Wm. Hendrickson of Ortonville, Minn., has been awarded the contract by that town for the construction of cement sidewalks, gutters and curbs at $0.08½ per sq. ft. Bids were opened May 6.

The City Council of Chisholm, Minn., has passed resolutions providing for the paving of six blocks of Lake St.

The council roads and bridges committee, Minneapolis, Minn., has decided to have Central Ave., from 29th Ave. northeast to the city limits, paved with creosoted wood blocks to a width of 60 ft.

Mississippi.

The Board of Aldermen of Tupelo, Miss., has sold the $50,000 of street improvement bonds to the People's Bank & Trust Co. of that city. Work will begin within a short time on the streets.

Missouri.

⊙Harry F. Heman, Chemical Bld., St. Louis, Mo., has been awarded the contract by the Board of Public Improvements of St. Louis, W. T. Findly, Secy., for the construction of roadway foundations and sidewalks of Kingshighway, from Manchester Ave. to McRee Ave., at $25,891. Bids were opened May 10.

⊙The Young Bros. Construction Co. of St. Joseph, Mo., has been awarded the contract by the County Court, St. Joseph, for the paving of about 7 miles of road at $0.97½ per lin. ft. Bids were opened May 7.

⊙Drum-Bambrick Construction Co., 800 So. Spring Ave., St. Louis, Mo., has been awarded the contract for the improvement of Russell Pl., between Parker Ave. and Hartford St., at $14,759. Bids were opened May 17.

⊙The Rackliffe-Gibson Construction Co., St. Joseph, Mo., has been awarded the contract by the Board of Public Works of that city for the paving of 22d St., Felix to Messanie, with Hassam, at $1.35 per sq. yd.

Following bids were submitted to the Buchanan County Court, St. Joseph, Mo., for the macadamizing of the DeKalb road, from the end of the present macadam to DeKalb, a distance of about 7 miles: DuBois Reinforced Concrete Co., $1.34½ per lin. ft.; Halsey & Rice, $1.24; Mike Costello, $1.38; Halsey & Smith, $1.15; Craig Dunn, $1.17½; DuBois Co., $1.44, and J. P. Young, $0.97½. Following bids were received at the same time for the grading of the Sparta road from near the city limits to the Platte County line, a distance of about 16 miles: Kelly Construction Co., earth $0.19.3, stone $1.50 per cu. yd.; J. F. Buis, $0.18 for earth and $0.70 for stone; Griffiths & McMurray, $0.24 for earth and $0.79 for stone; M. B. Wilson, $0.24 for earth and $0.90 for stone; Mike Costello, $0.13¼ a cu. yd. for both earth and stone; E. P. Olsen, $0.16.7 for earth and stone; C. M. Humberd, $0.32 for earth and stone.

Montana.

✣Bids will be received until noon, June 10, by J. E. Farnum, City Clerk, Miles City, Mont., for furnishing f. o. b., Miles City, 7,000 vitrified paving brick. Official advertisement will be found elsewhere in this issue.

New Jersey.

⊙The Township Committee of Mount Holly, N. J., has awarded to Field, Barker & Underwood of Philadelphia, Pa., the contract to macadamize Broad and Garden Sts. and Madison Ave., and construct amiesite roadways on Pine St. and the business section of Mill St. The contract price is $16,873.

✣Bids will be received until 11 a. m., May 31, by Board of Chosen Freeholders, Memorial Hall, South New York Ave., Atlantic City, N. J., for the construction of Main Road in Hammonton, N. J., from the Camden County line to Atsion Road, also for the Mays Landing and Tuckahoe Road, from the Downstown Road to the bridge over the Tuckahoe Road at Tuckahoe, N. J. Plans and specifications are on file with State Commissioner of Public Roads, Trenton, N. J., or at the office of County Engineer F. D. Rightmire, 530 Bartlett Bldg., Atlantic City, N. J.

New York.

✣Bids will be received until 1 p. m., June 3, by State Commission of Highways, Albany, N. Y. for the improvement of following highways:

County.
Allegany
Broome
Broome
Cayuga
Chautauqua
Cattaraugus
Cattaraugus
Cattaraugus
Cattaraugus
Dutchess
Erie
Erie
Franklin
Greene
Hamilton
Jefferson
Jefferson
Jefferson
Niagara
Niagara
Oneida & Herkimer
Onondaga
Onondaga
Onondaga
Oswega
Oswego
Oswego
Rensselaer
St. Lawrence
Schenectady
Tompkins
Westchester
Yates

✣Bids will be received until
4, by State Commission of Hi
bany, N. Y., for the improve
following highways.

County.
Albany
Albany
Allegany
Broome
Clinton
Clinton
Cayuga
Columbia
Chautauqua
Cattaraugus
Erie
Erie
Greene
Greene
Hamilton
Jefferson
Monroe
Nassau
Niagara
Niagara
Onondaga
Onondaga
Onondaga
Orange
Oswego
Oswego
Saratoga
Seneca
Sullivan
Tompkins
Ulster
Warren
Suffolk

✣Bids will be received until
5, by State Commission of H
bany, N. Y., for the improveme
lowing highways:

County.
Albany
Broome
Clinton
Cayuga
Chatauqua
Cattaraugus
Delaware
Erie
Erie
Erie
Franklin
Jefferson
Jefferson
Livingston
Livingston
Monroe
Niagara
Niagara
Oneida
Oneida
Onondaga
Onondaga
Onondaga
Oswego
Oswego
Ontario
Orange
Orleans
Putnam
Rensselaer
St. Lawrence
St. Lawrence
Schenectady
Warren

✣Bids will be received until
6, by State Commission of Hi

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

y for the construction of the fol-
[illegible]

	Road No.	Approx. Length.
	[illegible]	[illegible]
	5261	.16
	704	[illegible]
	[illegible]	5.47
	[illegible]	4.27
	.1017	6.13
	[illegible]	3.69
	[illegible]	1.31
	[illegible]	2.12
	5272	4.26
	[illegible]	[illegible]
	[illegible]	3.19
	[illegible]	[illegible]
	[illegible]	4.24
	672	7.59
	1041	6.08
	[illegible]	10.48
	[illegible]	6.37
	.5240	5.72
	5277	1.03
	5281	1.75
	[illegible]	3.90
	5287	5.99
	1032	[illegible]
	[illegible]	4.58
	1033	1.00
	[illegible]	6.56
	5295	5.15
	1048	[illegible]
	5294	6.67
	1003	1.17
	5289	3.65
	1015	7.24
	5298	7.07
	5293	6.01
	[illegible]	10.72

[illegible] until 1 p. m., June
[illegible] of Highways, Al
for the improvement of the
[illegible]

	Road No.	Approx Length
	5260	3.00
	705	3.81
	667	2.33
	5208	12.39
	982	13.37
	5239	6.19
	5238	6.21
	5236	6.06
	5311	4.97
	5194	1.01
	1020	[illegible]
	828	7.21
	5271	[illegible]
	5302	6.43
	962	5.09
	410	6.20
	5305	[illegible]
	5247	12.21
	1019	[illegible]
	[illegible]	6.88
	5254	3.92
	[illegible]	17.19
Franklin	[illegible]	11.66
	[illegible]	[illegible]
	[illegible]	[illegible]
	1031	[illegible]
	969	[illegible]
	[illegible]	11.25
	5299	1.32
	5300	1.04
	5234	[illegible]
	5296	1.37
	5257	9.83
	5290	7.00
	976	3.52
	1049	[illegible]
	5310	0.95
	1050	1.58

is, specifications and estimates
and proposal forms obtained
of the Commission in Albany,
so at the office of Division En-
cer J. Stewart, Realty Bldg.,
s, N. Y., for highways in the
Dutchess, Nassau, Orange, Put-
and, Suffolk, Sullivan, Ulster
ster; at the office of Division
ul McLoud, Humane Bldg., Al-
for highways in the counties
linton, Columbia, Essex, Ful-
e, Montgomery, Rensselaer,
henectady, Warren and Wash-
at the office of Division Engi-
H. Sturdevant, Cleveland Bldg.,
N. Y., for highways in the
Franklin, Hamilton, Herkimer;
ewis, Oneida, St. Lawrence;
office of Division Engineer
eele Strong, South Clinton and
on Sts., Syracuse, N. Y., for
the counties of Cayuga,
Cortland, Madison, Onondaga,
swego, Seneca, Wayne and
at the office of Division Engi-
F. Morrissey, 423 Cutler Bldg.,
N. Y., for highways in the
Allegany, Cattaraugus, Chautaqua, Erie, Livin[illegible], Monroe, Niagara, Orleans and Wy[illegible] and also at the of- [illegible] highways in the counties of Broome, Chemung, Delaware, Otsego, Schuyler, Steuben, Tioga and T[illegible].

[illegible], N. Y., has passed a resolution in favor of paving the Hamburg turnpike with vitrified brick to a width of 42 ft., from the Buffalo city line to the northern boundary of the town of Hamburg. A special election will be held May 31 to vote on the proposition. The estimated cost is $40,000.

Louis H. Gipp of Buffalo, N. Y., submitted the lowest bid to the Board of Public Works of North Tonawanda, N. Y., for the paving of Tremon St., at the following bids: Brick, $2.25; wood block, $3.40; granitoid, $1.60; concrete, $1.60; Dolarway, $1.50; concrete curb, $0.40; stone curb, $0.62; concrete curb and gutter, $0.65; catch basins, $48; receiving conductors, $0.60. Other bidders were: Niagara Construction Co., Buffalo; Frontier Construction Co., Buffalo; Erie Construction Co., Buffalo.

The Common Council of Fulton, N. Y., has passed a resolution to approve plans as submitted by the State Highway Commission for the road known as the Fulton-West First St. road, extending from city line to city line. The plans call for a macadam pavement. The estimate is $133,498. The cost is apportioned as follows: State, $48,348; city of Fulton, $62,398, and county, $22,752.

The voters of Westfield, N. Y., at a recent election authorized the payment of $26,000 as the village's share of paving Portage St., from Campbell road to English St.

Bids will be received until 8 p. m., June 4, by Common Council, Cohoes, N. Y., for paving Bemis Alley in accordance with plans and specifications on file with S. R. Tighe, City Engineer, and W. J. Elliot, City Clerk.

Ohio.

✣Bids will be received at the office of the Commissioners of Highland County, at Hillsboro, Ohio, until noon, May 28, 1912, for grading and paving with waterbound macadam the Fairfax-Sugartree Ridge road, State Highway B pet. No. 338 in Concord Twp., said county. Length, 5,280 ft. or 1.00 mile. Width of pavement, 12 ft. Estimated cost of construction, $7,483. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date for completion Aug. 1, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Madison County, at London, Ohio, until noon, May 29, 1912, for grading and paving with waterbound macadam the London-Lafayette road. State Highway A pet. No. 440 in Deer Cr. Twp., said county. Length, 8,914 ft., or 1.70 miles. Width of pavement, 16 ft. Estimated cost of construction, $11,379.78. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, Aug. 31, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received until noon, May 23, by Director of Public Service, Toledo, O., for furnishing the necessary labor and material for paving Auburn Ave. from Monroe St. to Central Ave. F. G. Stockton is Secretary.

✣Bids will be received until noon, May 27, by Director of Public Service, Steubenville, O., for furnishing necessary labor and material for paving with fire brick Sherman Ave., from Franklin Ave. to the P. C. C. & St. L. R. R. F. M. Kennedy is Clerk.

✣Bids will be received until noon, May 23, by Director of Public Service, Zanesville, O., for grading and improving of Ohio St., Sunset Ave., Hall Ave. and North St.

✣Bids will be received until noon, June 4, by G. L. Bonar, Clerk of York township, Belmont County, Powhatan Point, O., Route 1, for grading, furnishing material and macadamizing 2 4/10 miles of road in York township.

✣Bids will be received until 1 p. m., May 25, by Board of Delaware County Commissioners, Delaware O., for constructing the Penry Road East and the Penry Road West. The Penry Road East extending to the Delaware and Marion Pike at Troy Chapel, 2.46 miles. The Penry Road West extends west 1.44 miles to the Radnor Pike. These roads will be improved by grading, draining and macadamizing according to plans and specifications on file at the County Surveyor's office. Each bidder will be required to deposit with the County Surveyor the sum of $500 in cash or a certified check. W. F. Whittier is County Surveyor.

✣Bids will be received until noon, June 4, by Board of Franklin County Commissioners, Columbus, O., for the necessary labor and material for the improvement of the following roads: Gibson-Snouffer Road, located in Perry township; Harrisburg and Georgesville Road from the north corporation line of Harrisburg northerly to the Opossum Run Pike, a distance of about 2.7 miles, located in Pleasant township; Columbus and Westerville Road from the Blendon and Mifflin township line to the old south corporation line of Westerville, located in Blendon township. The plans, profiles, specifications and estimates of quantities for doing this work, as per county plans, are on file in the offices of the County Surveyor.

✣Bids will be received at the office of the Commissioners of Summit County, at Akron, Ohio, until 1 p. m., May 27, for grading and paving with concrete the Ghent road. State Highway E. pet No. 409 in Copley and Bath townships, said county. Length, 12,546.2 ft., or 2.38 miles; width of pavement, 14 ft.; estimated cost of construction, $21,546; estimated cost of construction, labor furnished, $18,475. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, Sept. 1, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

⊙The Village Board of New Matamoras, O., has awarded the contract for the paving of two streets to Rosser & Harper of Bellaire, O., at approximately $10,000. Other bidders were: Thomas & Maxon, Brookville, Pa.; Peters & Palmer, Marietta, O., and Cisler & Morse, Marietta, O. Wheeling brick will be used. A. F. Cole, Marietta, is Village Engineer.

⊙The Board of Control of Youngstown, O., has awarded the following contracts for street work: A. Serafino, Erie St. grading, $4,971; James McCarron, Mt. Pleasant St. paving, $17,276; Turner & Olson, Garland Ave. paving, $1,007; Kennedy Bros., Earl Ave. paving, $4,474.

⊙Turner & Olson of Youngstown, O., have been awarded the contract by the City Council of Girard, O., for the construction of pavement and storm sewers in State St., at $70,839 on Bessemer brick paving with cement filler and $13,384 on sewers.

[illegible] Mineral Ridge, O., has been awarded the contract by the Mahoning County Commissioners, Youngstown, O., for the construction, under the supervision of the State Highway Department, one and one-fourth miles of waterbound macadam road in Ellsworth Township, known as section No. [illegible] Bids [illegible] April 26. James R. Marker, Columbus, O., is State Highway Commissioner.

The city of Delaware, O., will let contracts about June 20 for the construction of 12,000 sq. yds. of brick, wood block and asphalt block pavement on a 6-in. concrete base of 1-3-6 mix, with pitch, asphalt and cement filler. The work will also include 5-in. sandstone curb and 6,000 cu. yds. of excavation. Plans were prepared by Geo. S. Irwin, City Engineer.

The Department of Public Service, Lancaster, O., will let contracts about July for the construction of 21,000 sq. yds. of brick pavement on a bank gravel foundation with sand filler. The work will also include sandstone curb amounting to 9,500 ft., and 12,600 cu. yds of excavation. The estimated cost is $25,200. John N. Wolfe is Engineer.

No bids were received by the Mahoning County Commissioners, Youngstown, O., on April 26 for the construction of 1.29 miles of waterbound macadam road in Ellsworth Township, known as the Ellsworth Road, Section No. 2. James R. Marker, Columbus, O., is State Highway Commissioner.

The Board of County Commissioners, Columbus, O., has granted the State Highway Department permission to use two miles of the Chillicothe pike, north from the Hartman farm, for experimental road building. Sections, ranging in length from 400 ft. to 1,200 ft., will be constructed out of 16 different kinds of materials. James R. Marker, Columbus, O., is State Highway Commissioner.

The City Council of Delaware, O., is considering a resolution declaring it necessary to construct about 80,000 sq. ft. of new sidewalks in the city. Concrete or flagstone are provided. The work would include about 16,000 lin. ft. of 5-ft. walks. George S. Irwin is City Engineer.

The citizens of Roseville, O., will vote May 25 on the proposition of issuing bonds in the sum of $10,138, to pay for the village's cost of paving five streets.

Oklahoma.

The town of Coalgate, Okla., will construct two miles of pavement this year on a concrete foundation with concrete curb and gutter. E. F. Brown, Coalgate, is Engineer.

Oregon.

⊙The City Council of Newberg, Ore., has awarded the contract for the construction of bitulithic pavement to the Warren Construction Co. of Portland, Ore., at $1.70 per sq. yd., using the present rock foundation on First St. and gravel on Main as a base.

⊙The City Council of Willamina, Ore., has let a contract for hard surfacing the streets to G. E. Gross of Sheridan, Ore. The contract calls for three blocks of concrete overlaying a bed of crushed rock, and for several hundred feet of sewerage.

⊙The contract for the improvement of North High St., from Court to Marion St., with El Oso pavement, in the city of Salem, Ore., has been awarded to the Montague-O'Reilly Co. at $13,595, and the contract for paving Oak St., from 12th to Winter, with concrete, to August Kehrberger.

⊙Joplin & Meeks, 816 Board of Trade Bldg., Portland, Ore., have been awarded the contract by the city of Oswego, Ore., E. L. Davidson, City Recorder, for the construction of cement sidewalks at $1,100. Bids were opened May 2.

The City Council of Albany, Ore., is about to call for bids for the paving of Fifth Ave., from Main to Elm Sts., at an estimated cost of $50,000.

Pennsylvania.

⊙The Department of Public Works of Philadelphia, Pa., has awarded the contract for asphalt repairs on non-traction streets to the Eastern Paving Co. at $0.98 per sq. yd. for surface repairs and $1.58 per sq. yd. for repairs where the foundation is renewed. The contract will amount to about $15,000.

⊙The Borough Council of Schuylkill Haven, Pa., has awarded the contract for the paving of Dock St. with vitrified brick to the Coryell Construction Co. of Williamsport, Pa., at $1.75 per sq. yd. The Council also awarded a contract for the opening of Paxson Ave., from Dock to Haven Sts., to Charles Becker of Schuylkill Haven.

The J. F. Shanley Co. of Philadelphia, Pa., on May 13 submitted the lowest bid to the City Council of Atlantic City, N. J., for the $100,000 paving contract. Six bids were received.

Tennessee.

✣Bids will be received until May 25 by County Court, Benton, Tenn., J. H. Williamson, Chairman, for the construction of a pike road from Bradley County line to Benton, via Benton station and from Ducktown Station to Copperhill via Isabella. H. W. McClary, Benton, Tenn., is Secretary.

⊙The Cleveland Trinidad Paving Co., Cleveland, O., has been awarded the contract by the city of Johnson City, Tenn., for the construction of 16,600 sq. yds. of Bermudez asphalt, 2-in. top, 5-in. base, and 1-in. binder at $1.96 per sq. yd. The work also includes 6,700 lin. ft. of curb and gutter, $0.42; 3,000 lin. ft. of 6-in. sewer, $0.20; $2,000 lin. ft. of 8-in. sewer, $0.33½, and 9 manholes at $18. Bids were opened May 16. P. F. McDonald is City Engineer.

Texas.

The City Council of Victoria, Tex., has called an election for May 28 for the purpose of voting on the issuance of bonds in the sum of $40,000 for city improvements.

The Orange County Commissioners, Orange, Tex., will employ J. F. Harvey of Jennings, La., as road engineer to represent the county in the building and repairing of roads under the recent $200,000 bond issue. The engineer will co-operate with Marshall & Weir, government road experts, in the building of the roads.

The City Council of Houston, Tex., has been petitioned for the paving of Austin St., between Texas and McGowen Ave. The total frontage is 9,850 ft.

The city of Terrell, Texas, will let contracts in June or July for the construction of from 40,000 to 60,000 sq. yds. of pavement. W. Irving Bean is City Engineer.

Utah.

✣Bids will be received until June 4, by City of Ogden, Utah, for the construction of two blocks of paving and 3 intersections, estimated to cost $2,600. The pavement will be 3-in. asphalt on 6-in. concrete ase. A 1,600 cu. yds. of excavation will e necess H. J. Craven is City Engineer.

Virginia.

✣Bids will be received until by Town Council at the office o Mayor, Chatham, Va., for the c 4,350 sq. yds. of pavement of 900 sq. yds. granite sprall, 1 tarvia macadam, 2,500 cu. yds. A. F. Brown & Son, Chatham, gineers.

Washington.

✣Bids will be received un June 15, by H. R. Stanford, Ch of Yards and Docks, Navy Washington, D. C., for conc on Burwell Ave., Bremerton,

⊙Petersen, Webel & Hawki ham, Wash., have been award tract by the Board of Public W city for the improvement of Harris Ave. to Forest St. and to Olive St., with concrete and gutters, etc. The cont $15,229. Other bidders were: $16,219; J. H. Lich, $16,361; C ing & Construction Co., $17 North is City Engineer.

⊙Following bids were rece Walla, Wash., W. R. Reho neer, on May 7 for the constru pavement in six districts: (1 bid of Henry Benzel, (2 Stack, (3) Tribon & Blackm contract in all districts, t $1.24), (4) Pacific Paving C Hardy, (6) Xura Case, (7) H C., (8) Wilson & Bailey Con (9) Henser & Elbury, (1 Forbes & Co.:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	[illegible]
District No. 76.								
Excavation, 261 cu. yds.	$0.60	$0.62	$0.52	$0.70	$0.70	$0.80	$0.55	$0
1-course paving, 640 sq. yds.	1.19	1.12	1.15	1.12	1.29	1.25	1.19	1
2-course paving, 640 sq. yds.	1.40		1.24	..	1.35	1.30	1.22	1
Top paving, 640 sq. yds.	1.60	..	1.24	..	1.40	1.45		1
District No. 77.								
Excavation, [illegible] cu. yds.	0.60	0.62	0.52	0.70	0.70	0.80	0.55	0
1-course paving, 2,000 sq. yds.	1.19	1.12	1.15	1.12	1.29	1.25	1.19	1
2-course paving, 2,000 sq. yds.	1.40	.	1.24	.	1.35	1.30	1.22	1
Top paving, 2,000 sq. yds.	1.60	.	1.24		1.40	1.45	. .	1
District No. 78.								
Excavation, 292 cu. yds.	0.60	0.62	0.52	0.70	0.70	0.80	0.55	0
1-course paving, 657 sq. yds.	1.19	1.12	1.15	1.12	1.29	1.25	1.19	1
2-course paving, 657 sq. yds.	1.40	.	1.24	..	1.35	1.30	1.22	1.
Top paving, 657 sq. yds.	1.60		1.24	. .	1.40	1.45	.	1
District No. 79.								
Excavation, 162 cu. yds.	0.60	0.62	0.62	0.70	0.70	0.80	0.55	
1-course paving, 443 sq. yds.	1.19	1.12	1.15	1.12	1.29	1.25	1.19	1
2-course paving, 443 sq. yds.	1.40		1.24	..	1.35	1.30	1.22	1
Top paving, 443 sq. yds.	1.60	.	1.24	...	1.40	1.45	...	1
District No. 80.								
Excavation, [illegible] cu. yds.	0.60	0.62	1.00	0.70	0.70	0.80	0.55	0
1-course paving, 2,512 sq. yds.	1.13	1.12	1.15	1.12	1.29	1.25	1.19	1.
2-course paving, 2,512 sq. yds.	1.40		1.24	.	1.35	1.30	1.22	1
Top paving, 2,512 sq. yds.	1.60	.	1.24		1.40	1.45		1
District No. 81.								
Excavation, 169 cu. yds.	0.60	0.62	1.13	0.70	0.70	0.80	0.55	
1-course paving, 1,181 sq. yds.	1.19	1.12	1.15	1.12	1.29	1.25	1.19	1
2-course paving, 1,181 sq. yds.	1.40	.	1.24	.	1.35	1.30	1.22	
Top paving, 1,181 sq. yds.	1.60	..	1.24		1.40	1.45	...	.

Cement costs $2.60 per bbl. on j san per cu. yd. on job, gravel $1.60 job rock $1.40, common labor is $2.2 A 1—3—5½ mix and a 1 2 mi Concrete is to have 5-in. base a 1-in

The Municipal Commission Wash., it is reported, is advert for the paving of Seventh Av Monroe St., upon the recom Commissioner of Public W Coates. The estimates are as lows kane bituminous, $9,900; asph and $17,000; wood block and b Hassam concrete, $12,300; con bitumass, $10,100; bitulithic, $ 80

The City Council of Sumne instructed City Attorney R. and City Engineer D. F. Wh pare the necessary resolution ing of Main St., from the cou Wood St., and Narrow St., fr to the Northern Pacific dep the business section of the cit will be 40 ft. wide, tapering to 20 at the outskirts.

been filed with the City Com-
Spokane, Wash., by Commis-
ates for the paving of S
rom Howard to Monroe St
ovide for seven kinds of pav-
timates of cost as follows:
brick, $17,000; bitulithic, $14,-
, $10,100, Spokane bituminous,
ete, $13,000; Hassam, $12,300;
ind brick, $18,300.

pal Commission of Tacoma
ordered work started at once
h Tacoma hard-surface blvd.,
limits at 80th St. to 36th and
estimated to cost $102,000.

Council of Goldendale, Wash.,
, rejected the 11 bids received
the construction of 52 blocks
which was estimated to cost
bids were opened May 17
riginally received from the
ms: Washington Paving Co.,
sh.; Jeffery & Bufton, Port-
E. O. Hall, Hood River,
n Hassam Paving Co., Port-
ockalite Paving Co., Chicago,
George W. Armstrong
sh.; Warren Construction Co.,
Portland, Ore.; L. Willett & Co., Spokane, Wash.; Kibbe-Welton Co., Portland; Henry L. Lilienthal, Spokane.

Wisconsin.

⊙[illegible] of Racine, Wis., for the paving of Grand Ave., from 16th St. to DeKoven Ave., with Barr brick, at $1.75 per sq. yd. Other bidders were: Birdsall-Griffith Construction Co., brick, $1.85; James Cape & Sons, Purington brick, $1.80 and asphalt block, $1.88.

City Engineer E. B. Banks of Superior, Wis., has completed the specifications for the paving of Tower Ave. Bids will be considered on brick, asphalt, bitulithic macadam, asphaltic concrete, sandstone blocks, asphalt blocks and solid concrete. Plans are now being prepared.

Canada.

The Good Roads Commission of York County, Ont., has suggested a change in the construction of county roads in the future, to Hon. J. O. Reaume, Minister of Public Works. It is proposed to substitute concrete for macadam, involving a portion of the Lake Shore road, comprising about two miles from Sunnyside; the road leading to Weston; a part of Yonge St., from the city limits of Toronto, and a portion of Kingston road. The present standard roadway cost about $5,000 per mile, while the proposed concrete roadway would cost about $12,000 per mile.

The City Council of Prince Albert, Sask., has received a communication from the Highways Commission of the Province stating that $1,500,000 will be expended to improve roads, and urges the co-operation of the Council so that a system of main roads may be established.

The ratepayers of Edmonton, Alta., have approved by-laws totaling $420,000 to purchase golf links from the Hudson's Bay Co. and the Hillside property from Alberta College for civic parks.

The county of Halton, Ont., will commence work immediately upon the construction of 100 miles of roads to cost $300,000. It is proposed to construct 50 miles this year. Joseph O. Reaume, Toronto, is Minister of Public Works.

IDGES—STEEL AND CONCRETE

Arkansas.

ouncil of Little Rock, Ark., has
inance instructing the railroads
a viaduct at West 13th St. As
structure will have a 36-ft. road-
sidewalk.

Commission of Cleburn County,
s, Ark., plans to let a contract
e erection of three bridges over
l River. On account of the swift
e stream, and the fact that the
by lumber companies to float
the river at high stages of the
mmission expressed in their re-
nce for suspension bridges.

California.

States Senate has passed a bill
n C. Rush, Los Angeles, Calif.,
right of way across Goat Island
n to utilize a portion of land in
reservation for the construction
sed $26,000,000 bridge over San
y, from San Francisco to Oak-
The bridge will be 9½ miles in
on eight massive concrete piers,
the water, each span being 2,230
From the tide flats at Emery-
e would extend to the north side
d, then to the base of Telegraph
ver Lombard St. to Van Ness
the passenger terminal will be
nce on to the Presidio, where the
nals will be located on Govern-
, this being part of the permis
the Senate.

hat Lt. Col. Thomas H. Rees, U.
San Francisco, Calif., will recom-
U. S. War Department that the
omply with several requests of
County Board of Supervisors for
ent of estuary bridges.

Colorado.

be received until 11 a. m., May
of Public Works, Denver, Colo.,
President, for furnishing the
r and material for the construc-
parapet walls and superstructure
Boulevard Bridge over Cherry
rtified check for $2,000 must be
h bid

Idaho.

be received until 10 a. m., June
of County Commissioners, Twin
for the necessary labor and ma-
construction of two steel bridges
eek Canyon in Twin Falls Coun
ty. E. J. Finch is Clerk of the Board. Official advertisement of the work will be found elsewhere in this issue.

Illinois.

✣Bids will [illegible] 29, at the Town Clerk's office, Paxton, Ill., for two reinforced concrete bridges to be built in Patton Township, Ford County. V. E. Johnson, Town Clerk, Paxton, Ill. Richardson Bridge: Span, 20 ft.; roadway, 16 ft.; total height, about 14 ft; estimated amount of total concrete, 72.5 cu. yds.; reinforcing steel, 6,640 lbs. Present bridge wood, 30 ft. long; excavation in clay, to be carried about 3 ft. below stream bed; low water flow, dry; high water about 8 ft. deep; timbers of old bridge can be used for false work. Scott Bridge: Span, 20 ft.; roadway, 16 ft.; total height, about 12 ft.; estimated amount of total concrete, 57.2 cu. yds.; reinforcing steel, 5,900 lbs. Present bridge wood, 22 ft.; excavation to go about 3 ft. below stream bed in clay; low water flow, dry; high water about 6 ft. deep; timbers of old bridge can be used for false work. It is reported that concrete gravel may be obtained at a pit about 5 miles from each of the bridges, at a cost of 50 cents per cu. yd. at the pit, quality not known. Work to be completed on or before Sept. 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Ill.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., May 31, for furnishing labor, machinery, tools, etc., necessary to remove the substructure of the 92d St. bridge over the Calumet River, and dredge the channel and site of piers for the new 92d St. bridge. The work comprises the removal of the entire center pier, center pier protection, both abutments and approaches up to dock lines of river (the center pier is built on 150 piles, closely driven, chained together, and covered by three layers of timber. On top of this rests the pier of masonry and coping stones). The river channel is to be dredged to a depth of 22 ft., except certain areas, which are to a depth of 17 ft. below city datum, approximate quantity 17,000 cu. yds. Contractors are responsible for the care of seven or more electric cables submerged at the site of the work. Cash or certified check for $500 must accompany proposal.

⊙The Commissioners of Trivoli Township, Peoria County, Ill., have let the contract for the construction of a new highway bridge to Grinnin & Son, Galesburg, Ill., at $2,360.

A hearing will be held, June 4, at the office of Lieut. Col. George Zinn, U. S. Engineer, Federal Bldg., Chicago, Ill., on the proposition to remove the present Chicago, Burlington & Quincy Railroad bridge over the Illinois River at La Salle, Ill. It is proposed to require the following alterations to be made in the bridge within one year: Reconstruction of the center pier spans of the bridge so as to provide a clear draw opening of approximately 60 ft., measured perpendicularly to the axis of the channel; such draw opening to be provided either by swing, bascule or vertical lift spans. If vertical lift span is used the clear head room when open must be 55 ft. above low water.

The Santa Fe System has announced that the following bridges will be renewed, some of which have already been appropriated for: Middle division, one, estimated cost $4,000; Colorado division, six, estimated cost $54,000; Valley division, one, estimated cost $3,500; New Mexico division, two, estimated cost, $1,000; other divisions, ten, estimated cost $30,000.

It is rumored that the Chicago, Milwaukee & St. Paul Ry. will build a new double track bridge over the Mississippi River at Moline in connection with the double track work planned by the company. W. H. Penfield, Chicago, Ill., is Assistant Chief Engineer.

According to advices from Paris, Ill., a proposition to build a new bridge over Sugar Creek in Elbridge Township was carried. The new structure, it is estimated, will cost $3,000.

Indiana.

✣Bids will be received until noon, June 18, by Board of White County Commissioners, Monticello, Ind., for the construction of 33 bridges. A. G. Fisher is County Auditor.

✣Bids will be received until 1:30 p. m., June 4 by Board of Fayette County Commissioners, Connersville, Ind., for the construction and repair of several bridges. J. L. Kennedy is County Auditor.

✣Bids will be received until 2 p. m., June 4, by Board of Rush County Commissioners, Rushville, Ind., for the construction of several bridges. J. M. Stone is County Auditor.

✣Bids will be received until 2 p. m., June 3, by Board of Spencer County Commissioners, Rockport, Ind., for the construction of 21 bridges throughout the county. J. T. Stevenson is County Auditor.

✣Bids will be received until 10 a. m., June 3, by Board of Hancock County Commissioners, Hancock, Ind., for the construction of bridge on Hancock-Rush County line. Lawrence Wood is County Auditor.

✣Bids will be received until 2 p. m., June 4, by Board of Greene County Commissioners, Bloomfield, Ind., for the construction of two new spans on the west end of the bridge over the White River, known as the Elliston Bridge. Abutments and piers of new spans to be the same height as spans and piers of the east end of said bridge; according to plans, specifications and details now on file and open to inspection in the office of Caswell H. Jennings, County Auditor.

✣Bids will be received until 2 p. m., June 5 (readvertisement) by Board of Clinton County Commissioners, Frankfort, Ind., for the construction of the Armstrong St. bridge. C. F. Cromwell is County Auditor.

⊙J. A. Crosbie, according to advices from Bluffton, Ind., has been awarded the contract for the erection of 10 bridges. The contract price was $4,145.

⊙The contract for the construction of 8 bridges in La Grange County has been awarded by the Board of La Grange County Commissioners, La Grange, Ind., to J. J. Hime and J. E. Doty at $3,722. O. S. Willard is County Auditor. Bids were opened May 7.

⊙Board of Clinton County Commissioners, Frankfort, Ind., has awarded the contract for the construction of two bridges to the Frankfort Construction Co., Frankfort, Ind., at $2,705 and $4,550. Bids were opened May 8. C. F. Cromwell is County Auditor.

J. C. Curtis, receiver of the C., B. & C. R R., has filed a petition in court, Bluffton, Ind., for permission to construct a steel bridge over the Wabash River at Markle, Ind., to replace the old wooden structure.

Iowa.

⊙The Clinton Bridge & Iron Works, Clinton, Ia., has been awarded the contract for the construction of repairs to the Lyndon bridge in Whiteside County, Ill. The contract price was $1,780.

Board of Greene County Supervisors, Jefferson, Ia., has rejected all bids received for the erection of a new bridge over the Eureka Mill crossing. The work will probably be readvertised.

It is reported that the Iowa State Highway Commission, T. H. McDonald, Chief Engineer, Des Moines, Ia., has approved the plans for the construction of bridges in Marshall County. E. B. Emes, Marshalltown, Ia., is one of the county supervisors.

It has been announced by E. O. Wesley of the Sioux City, Ia., Street Department that it will be necessary to rebuild four bridges over Bacon Hollow Creek near Greenville.

Kansas.

Information from Topeka, Kan., states that specifications have been completed by Walter J. Arnold, County Engineer, for the construction of the proposed bridge over the Kansas River west of the water works. The cost of the structure, it is estimated, will be about $29,500, a portion of which will be paid by the Chicago, Rock Island & Pacific Ry.

A. L. Berger, Kansas City, Kan., Attorney and A. E. Harvey, Chief Engineer of the Metropolitan Street Railway Co., Kansas City, Kan., have reached an agreement with the commissioners of Wyandotte County, Kan., whereby they will bear one-half the expense of raising the East Kansas Ave. bridge. The cost of the improvement is estimated at $5,500. This action will be taken as a temporary measure, pending an agreement between the two cities, the railroads, the drainage board, county commissioners and other parties concerned in regard to whether the bridge shall be replaced by a viaduct.

Kentucky.

Notice of intention has been filed by the Owensboro & Rockport Bridge & Terminal Co. to build a bridge over the Ohio River at a point between Rockport, Ind., and Owensboro, Ky., and about 5,400 ft. below Puppy Creek dike. A. H. Kennedy, Owensboro, Ky., is President of the company.

The Southeastern Improvement club, Louisville, Ky., recently took up for discussion the matter of building a bridge at Dupuy and Kentucky near the church and one at the St. Louis Cemetery over the creek.

Michigan.

⊙Worden, Allen & Co., Milwaukee, Wis., have been awarded the contract for the construction of bridges on the Wakefield-Watersmeet trunk road in Michigan, at $16,700.

All bids received for the construction of the Mill St. bridge were rejected by the Mayor and the Board of Aldermen, Kalamazoo, Mich., and new bids for the improvement asked.

Minnesota.

✣Bids will be received until 7:30 p. m., May 31, by H. N. Knott, City Clerk, Minneapolis, Minn., for furnishing steel work to be used in the construction of the 42d Ave. north and Plymouth Ave. bridges in accordance with specifications on file with Andrew Rinker, City Engineer. A certified check for $1,500 must be filed with C. A. Bloomquist, City Treasurer.

✣Bids will be received until 11 a. m., May 28, by Board of Hennepin County Commissioners, Minneapolis, Minn., for the construction of three bridges over Ditch No. 21, estimated to cost $3,150, and two bridges over Ditch No. 22, estimated to cost $2,200. A. P Erickson is County Auditor.

⊙The Hennepin Bridge Co., Minneapolis, Minn., has been awarded the contract for the erection of the Winnibonjou bridge near the south shore road where it crosses the Brule River in St. Louis County, Minn. The contract price was $2,722.

The Minneapolis, St. Paul & Sault Ste. Marie Ry. has filed plans with City Engineer Oscar Claussen, St. Paul, Minn., for the construction of a viaduct over the tracks on Mississippi St. at Cayuga St. Work will be commenced on the structure, which will cost $20,000, as soon as the council approves the plans. The Northern Pacific and the Omaha Road have filed plans for the construction of the proposed Earl St. bridge to cost $75,000. The construction of the Hamline Ave. bridge, which will cost $40,000, will be taken up soon.

Mississippi.

The Bridge Committee of the Board of Hancock County Supervisors, Bay St. Louis, Miss., has reported favorably on the proposition to erect a bridge over Bay St. Louis.

Missouri.

✣Bids will be received at 2 p. m., June 4, by B. F. Savacool, Road and Bridge Commissioner, Denver, Mo., for the construction of one steel bridge 60 ft. long and one 48 ft. steel bridge; also one 16-ft. I-beam bridge and a car load of red cedar piling.

✣Bids will be received until 1 p. m., June 4, by Clark Jacoby, Engineer, Drainage District No. 3, Carroll County, Carrollton, Mo., for removing and replacing the following bridges in order to allow the dredge boats to pass: 1. "Schaffer" Bridge, at station 4, Main Canal, 56 ft. pony truss on cylinder piers. 2. "Wire" Bridge, at station 410, Main Canal, 53 ft. pony truss, on cylinder piers. 3. "Becker" Bridge, at station 705, Main Canal, 53 ft. pony truss, on steel legs. 4. "Wakenda Village" Bridge, at station 734, Main Canal, 80 ft. pony truss, on cylinder piers. Note.—The above 4 bridges are steel structures, in removing and replacing the trusses the supports will not be disturbed. 5. "Shinn" Bridge, at station 233, Main Canal, 47 ft. steel truss, on steel legs, the truss and two steel legs at south end of bridge to be removed and replaced, the legs at north end not to be disturbed. Each bid for removing and replacing each bridge above mentioned must be accompanied by a cash deposit or certified check of $15.00. New bridges to be constructed as follows: 1. "Jeff Sherwood" Bridge, at station 145, Main Canal 2. "Old Sherwood" Bridge, at station 176, Main Canal. 3. "Robinson Bend" Bridge, at station 343, Main Canal. Note.—Alternate bids will be called for on the construction of the above bridges as follows: 75 ft
truss spans on cylinder piers,
wooden approaches each end.
pony truss spans on laced legs
crete, with 15 ft. wooden approa
70 ft. wooden Howe truss, on
ft. wooden approaches each
bridge to be constructed near sta
key Creek Lateral, 50 ft. steel
ft. wooden approaches at each
bridge to be constructed near sta
key Creek Lateral, 50 ft. steel
ft. wooden approaches at each e
for the construction of each brid
tioned must be accompanied by
or certified check of $25.00.
or checks will not be required t
nate bids. Plans and specificati
the office of the County Clerk, C
Extra plans may be secured by
cation to Brooks & Jacoby, Ci
Shukert Bldg., Kansas City, Mo.

Receivers of the Wabash R.
authorized by Judge E. B. A
United States District Court, to
000 for the improvement of t
Hannibal, Mo. The Missouri Va
tion Co., Leavenworth, Kan., i
have the contract for the work.

City Council, St. Louis, Mo., h
sideration the construction of a r
crete viaduct over the River
Kingshighway, the construction
bridge over the Oak Hill tracks
Ave., and a concrete bridge to
highway into Carondelet Park a

Montana.

⊙Advices from Lewiston, Mo
the County Commissioners have
tract for the construction of tw
the Security Bridge Co., Minnea
at about $5,000. One structure
the Cottonwood Creek at Glen
other over Warm Spring Cree
field.

Nebraska.

✣Bids will be received until
3, by H. E. Wells, Clerk, Lanc
Lincoln, Neb., for the constru
bridges ordered in the county
from date of contract. Bidders
plans and specifications upon bla
furnished and shall be by lineal f
structure, and by lineal foot for
structure, and per 1,000 ft. B. M.
sway braces in wooden bridges.
iron bridges must be by the lineal
superstructure complete; for sub
the lineal foot for tubing; by t
for concrete in place and at a s
per pound for all other metal in
structure. It is estimated that
built about forty wooden and ten
located as follows: Iron bridg
section 34, Mill precinct; iron b
side section 5, Mill precinct; iron
side section 32, West Oak precinct
in section 23, West Lincoln pr
bridge, East side section 32, Olive
cinct; wood bridge, East side sect
land precinct; wood bridge, East
20, Olive Branch precinct; woo
section 25, Nemaha precinct;
South side section 17, Nemaha p
at various other places as are ne
caster county.

✣Bids will be received until Ju
missioners of Nuckolls County,
for the construction of concrete
bridges not exceeding a width of
Wright is one of the commissio

⊙The contract for the construct
truss steel bridge over the Lou
near Monroe, Neb., has been aw
Platte County Clerk, Columbus,
Omaha Steel Structural Work
Neb., at $29,975. The structure
of six 136-ft. 6-in. spans and will
crete substructure. John Fraf is C
Bids were opened May 14.

⊙The Lincoln Construction C
Neb., has been awarded the cont
construction of two bridges in Kep

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] follows: Carns Bridge, [illegible]
ncrete arches with [illegible]
McCulley Bridge, consisting [illegible]
rete arches with 14-ft. roadway, at
The work is to be completed by
other bids received for similar struc-
ding 7 weeks as follows: M[illegible]
g Co., Falls City, Neb., Carns
[illegible] McCulley Bridge [illegible]
Bridge & Structural Co., Kansas
$[illegible] and $13,200; Western [illegible]
tion Co., Omaha, Neb., $14,650 and

New Jersey.

Council of Burlington, N. [illegible]
to secure the construction of a new
r the Assiscunk Creek in that city.
gton County Board of Freeholders
ly take the matter up for considera-

g to advices from Seaside Park,
mpany is being organized to build
cross Barnegat Bay to the north
oms River, near Island Heights.
connect Seaside Park directly with
nd. The company is being formed
Maja Leon Berry. It is supposed
ridge can be built for something

New York.

ll be received until May 25, by
erintendent of Highways, Roches-
for the construction of one 233-ft.
ridge on concrete foundation be-
and Wheatland. The structure
20-ft. roadway with a brick on
or. The abutments will include
u. yds. of concrete, and will cost
e superstructure will cost about
Y. McClintick, Rochester, N. Y.

ntract for repairing and repaving
ver the Onondaga Creek at West
., Syracuse, N. Y., has been let by
of Contract and Supply to O. D.
[illegible]

of Syracuse, N. Y., has decided to
matter of rebuilding the bridge
reek. Plans and specifications will
by Henry C. Allen, City Engineer,
r the work will be advertised by
[illegible] and Supply shortly.

North Carolina.

nderson County Board of Commis-
ndersonville, N. C., has awarded
t for the erection of two steel
the French Broad River to the
idge Co., Roanoke, Va., at $9,450.
will be built at the site of the old
idge, which was washed away by
het, and at McClain's bridge. The
e will have a span of 180 ft. with
e, the other will be 119 ft. long.
ready for inspection by Nov. 1.

Ohio.

l be received until 10 a. m., June
of Darke County Commissioners,
O., for furnishing the necessary
aterial for the construction of the
County Bridge in accordance with
ecifications on file with the County
L. Morgan is Clerk of the Board.
l be received until 1 p. m., June
of Ashtabula County Commis-
tabula, O., for making the fill of
to a bridge over Hubbard Road
ad, Plymouth township. J. S.
unty Surveyor, and A. V. Hillyer

l be received until 11 a. m., June
l of Cuyahoga County Commis-
eland, O., for the erection of a
nal Road over Tinkers Creek in
wnship, Cuyahoga County. J. F.
is Clerk.
l be received until 11 a. m., June
l of Cuyahoga County Commis-
eland, O., for the construction of
per Report No. 2934, drain pipe,
Station 60, Newburg Township.
935, abutments, Canal Road, over

[illegible] No. 2937, steel bridge, Canal Road, over Tinkers Creek, Newburg Township, in accordance with the form of contract and specifications to be furnished by Frank R. Lander, County Surveyor. J. F. Goldenbogen is Clerk.

⊙The Board of County Commissioners, Youngstown, O., has awarded the contracts for the construction of the following bridges: The Massillon Bridge Company secured the Shield's road steel bridge job at $1,015; and the contract for replacing a steel span of the Credit Mobelier bridge for $3,310. The contract for painting the McGuffey St. bridge went to Antonio Gloras who bid $684. Link and Henry secured the work of constructing abutments of the Shield's road bridge at $1 per cubic yard for excavation and $9.23 per cubic yard for masonry.

⊙The Board of Hamilton County Commissioners, Cincinnati, O., has awarded the contract for the construction of the concrete bridge and fill in the McCormack and Columbia Roads in Columbia Township to the Gorden Engineering Co., Third St., Cincinnati, O., at $2,780. Bids were opened May 18.

A delegation of citizens of South Brooklyn, Cleveland, O., recently conferred with the Commissioners of Cuyahoga County at Cleveland, in regard to the construction of a new bridge over the gully between Brooklyn and South Brooklyn.

Oklahoma.

⊙[illegible] Pawnee, Okla., have awarded the contracts for the construction of bridges as follows: Houser Bridge across Lagoon Creek between Quay and Maramec; steel superstructure to Canton Bridge Company for $655.00; stone abutments to M. B. Cave for $191.50. Mishler Bridge across Ranch Creek two miles northwest of Hallett; steel superstructure to Canton Bridge Co. for $560.00; stone piers to M. B. Cave, $547. Arnold stone arch across House Creek between Jennings and Hallett; awarded to Ed Etherton, $581. Fowler Bridge across Little Greasy in Otoe Township; to P. C. Myers, complete, $1,185. Tipton Bridge 11 miles northwest of Pawnee; steel superstructure and concrete floor to Canton Bridge Co. for $382; in this case the township is to build the piers. Walker Bridge across Turkey Creek eight miles northwest of Pawnee; steel superstructure to Canton Bridge Co., $500; stone abutments to J. T. Allen, $150. Peck stone arch three miles southwest of Cleveland, to A. E. Etherton for $665. Ripley Bridge across Panther Creek about eight miles southwest of Pawnee; steel superstructure and concrete floor to Canton Bridge Co. for $280; stone piers to J. T. Allen for $300. Total $580. Helmick Bridge over Cedar Creek one mile southwest of Cleveland; steel superstructure and stone piers to P. C. Myers, $1,225. The two bridges which were advertised for but not contracted were the Bronco Bill Bridge over Lagoon Creek about two miles northeast of Quay, and the Shipman Bridge about two miles northwest of Pawnee. In the advertisement for the Tipton and Ripley bridges bids were asked for both steel superstructures and stone arches. In both cases the steel bids were much the lower and the contracts awarded to the Canton Bridge Co.

Plans have been prepared by W. C. Burke and D. C. Merry, Oklahoma City, Okla., Engineers, for the construction of the proposed bridge to be constructed over the South Canadian River by the Oklahoma City & Newcastle Bridge Co. The structure, which will be located at a point 2½ miles north of Newcastle, will cost, it is estimated, about $70,000. It will be 2,175 ft. long and will be steel laid on steel pillars inbedded concrete foundations.

Pennsylvania.

✣Bids will be received until 11 a. m., May 27, by Commissioners of Montgomery County, Norristown, Pa., for the construction of two bridges as follows: For the rebuilding and widening of stone arch bridge over the East branch of the Stony Creek on the DeKalb St. road and about 200 ft. north of the Germantown turnpike, East Norriston Township, shipping point Norristown, Pa., distance about 1½ miles. Also for the widening of a stone arch bridge over the Gulf Creek at Bird-in-hand, in Upper Merion Township, Montgomery County, Pa., according to plans and specifications on file. John N. Jacobs, Controller.

✣Bids will be received until 7:30 p. m., June 10, by Borough Council, Lewiston, Pa., for the construction complete of two alternate masonry and reinforced concrete arch bridges. J. H. Sexton is Secretary.

⊙Commissioners of Chester County, West Chester, Pa., have awarded the contract for the construction of a stone arch bridge over Valley Creek to P. J. McCormick, at $1,948.

Advices from Scranton, Pa., state that an ordinance is still pending in the City Council providing for a subway or under-crossing to be built by and at the expense of the Delaware, Lackawanna & Western R. R. Co. It will consist of a plate girder bridge, 50-ft. spans, carrying railroad bridge, with necessary approaches leading to it. The improvement, when completed, will cost about $60,000, not including damages or the purchase of private property. This expense will be borne by the City of Scranton.

Commissioners of Montgomery County, Norristown, Pa., are having plans prepared for the reconstruction of the Frog Hollow Bridge near Jenkintown.

Tennessee.

Advices from Bristol, Tenn., state that the work will be started shortly on the proposed viaduct of the Southern R. R. over its yards at English St., Bristol, Tenn. The city will have charge of the approach construction.

Texas.

⊙The Commissioners of Anderson County, Palestine, Texas, have awarded the contracts for the construction of 12 steel bridges to the Kansas City Bridge Co., Kansas City, Mo. The contract for the reinforcements and culverts has been let to Austin Bros., Dallas, Tex.

Citizens of Cass and Bowie Counties, Texas, recently held a meeting at the Board of Trade rooms, Texarkana, to discuss the proposition of building two steel bridges across the Sulphur River connecting the two counties south of Texarkana.

Virginia.

✣Bids will be received until noon, May 29, Circuit Court, Louisa, Va., for the construction of a steel bridge on reinforced concrete substructure over the South Anna River in Louisa County about 8 miles from Pendleton on the Chesapeake & Ohio Ry. Stone and sand may be secured within one mile of the site. The structure will be 123 ft. 6 ins. long and will have a 12-ft. roadway. A certified check for $250, payable to the State Highway Commissioner, P. St. J. Wilson, Richmond, Va., must be filed with each bid. Bids will be received in lump sum on superstructure and substructure separately. Blue prints and plans may be secured of Childrey, Sunday Co., Richmond, Va.

Washington.

⊙The contract for the construction of a reinforced concrete bridge over Hangman Creek at Tekoa, Whitman County, Wash., has been awarded to O. H. Stratton, Spokane, Wash., at $6,200. The same contractor was awarded the construction of the steel bridge over lower Union Flat south of Pullman at $2,180.

Officials of the cities of Spokane and Hillyard, Wash., have under consideration the construction of a viaduct over the yards of the Great Northern Ry. It is estimated that the structure will cost about $15,000, of which it is hoped that the railroad will pay one-third. The structure will be built at either Crown or Everet Ave. Morton Macartney is City Engineer of Spokane.

Plans are being prepared under the supervision of W. L. Darling, Chief Engineer, Northern Pacific Ry. Co., St. Paul, Minn., for the construction of a bascule bridge over the government canal at 12th Ave., Northwest Seattle, Wash.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

West Virginia.

✣[illegible] 3, by County Court, Elkins, W. Va., for the [illegible] 14 ft.

[illegible] Marlinton, W. Va., have awarded the contract for the construction of the concrete substructure for a bridge over Clover Creek to G. W. Duncan, Marlinton, at $7 per yard. The steel superstructure was awarded to the York Bridge Co. at $693. Bids were opened May 7. C. J. McCarty, Marlinton, W. Va., is Clerk.

⊙The Commissioners of Brooke County, Wellsburg, W. Va., have awarded the contracts for the construction of two bridges as [illegible] Creek, Hollidays Cove, to the Luten Bridge Co., York, Pa., at $2,985; a steel bridge over Buffalo Creek McBrooms Ford to the Canton Bridge Co., Canton, O., at $2,080. The contract for the substructure of the latter bridge was awarded to Leibfarth & Leicht, Wellsburg, at $5.50 per cubic yard for masonry and $1.50 per cubic yard for excavating. K. C. Brashear is County Clerk. Bids were opened May 14.

In connection with the construction of the new Western Maryland R. R. branch from Charlton Station 12 miles west of Hagerstown over the Potomac River into Berkeley County, W. Va., it will be necessary to construct a bridge over the Potomac River 2 miles above Williamsport, Pa., estimated to cost $240,000. H. R. Pratt, Baltimore, Md., is Chief Engineer.

Wisconsin.

The bids received for the construon of the river bridge at Chippewa Falls, is., have been rejected and the work will readvertised. The cost of the improvem will about $24,000.

Canada.

✣Bids will be received until 5 m., M 25, by Frank Barber, Engineer, 5 Adela St., East Toronto, Ont., for the construct of a concrete arch bridge over [illegible] Creek, between Con. 13 and 14, Township Tiny, County of Simcoe.

Jansey Bros., Boomer & Hughes, 2 Mackie Block, Calgary, Alberta, have abou 20,000 cu. yds. of concrete work distribute in small bridges, abutments, head-gates, which they will sublet in quantities

IRRIGATION, DRAINAGE, LEVEES AND CANA

Arizona.

⊙Grant Bros. Construction Co., Los Angeles, Cal., has been awarded the contract at $91,392 for the concrete work for the Arizona cross cut irrigation canal of the Salt River Valley Water Users' Association. Bids on this work were opened May 10 at Phoenix, Ariz.

California.

✣Bids will be received until 11 a. m., May 27, by Common Council, San Diego, Cal., for furnishing the necessary labor and material for the improvement of the harbor at San Diego, Cal.

It is proposed to construct a drainage system for about 1,000 to 1,500 acres in Chino and Prado. Jas. W. McAllister, Chino, Cal., and George Bent, Prado, are interested.

Colorado.

A modification has been made in the requirements of the Reclamation Service in reference to the Grand Valley reclamation project so that the Secretary of the Interior may proceed with construction work on it without further adjudication of water rights, or completing the purchase of rights of way for the projected canals across lands in private ownership. It is believed that the water supply and the rights for its use are ample for the project and arrangements have been made for acquisition of all but three of the rights of way across private lands for the projected canals. The land which will be irrigated by the project totals 53,000 acres, of which 30,000 is public land and 23,000 private land. The estimated cost of construction is $3,621,000, or about $69 per acre. The project presents no serious engineering difficulties. It will require a diversion dam in the canyon of the river several miles above Palisade, and a canal partly in open cuts and partly through tunnels to conduct the water down the canyon to the main canal, bordering the lands to the irrigated. The sum of $1,500,000 is now available for commencing work on the enterprise. J. H. Miner, Grand Junction, Colo., is project engineer

Iowa.

⊙The contracts for constructing Drain 151, bids for which were opened May 10, by J. L. Hanrahan, County Auditor, Fort Dodge, Ia., have been let as follows: Anderson & Co., Vincent, Ia., at $23,999.70; S. E. Edwards, Lehigh, Ia., at $13,050. This is a tile drain.

Kansas.

The Delaware River Drainage District of Jefferson County will be ready to let contracts in a few weeks for the construction of a number of cutoffs on the Delaware River requiring about 450,000 cu. yds. of excavation. H. B. Walker, Manhattan, Kan., is the Engineer.

Louisiana.

The Atchafalaya Land Co., Plaquemine, La., has sold to Francois Rouge of New Orleans, 9,500 acres of swamp land. The price paid was $33,920.

Taxpayers of the Town of Kaplan, La., and Coulee de Jon Drainage District have voted in favor of constructing a drainage system.

The Police Jury of Ascension Parish, Donaldsonville, La., has adopted ordinance creating the Bayou Conway Drainage District, composed of lands situated in the Fifth, Sixth and Seventh Wards of the parish, on the east bank of the Mississippi River. The project of the district comprises the dredging of Bayou Conway with a view of draining approximately 20,000 acres of land between the upper line of the Ashland plantation and the Riverton plantation, including the village of Darrow, the New Hermitage farms and the townsite of St. Elmo. The names of T. H. Dyer, C. S. McFarland and L. W. Armitage will be recommended to the Police Jury, and those of Jones Weill and John T. Many to the governor for appointment as members of the Board of Commissioners. It is proposed to issue $50,000 of bonds.

Massachusetts.

Specifications have been prepared and bids will be asked in the near future for the improvement of the Neponset River under an appropriation of $150,000 authorized by the State Legislature in 1911. The work involves the rectification and deepening of the main channel of Neponset River from a point near the dam at the Mattapan Paper Mills to a point below Pleasant Street, Norwood, at total distance by the present river of about 12.906 miles. The elimination of many of the worst bends in the river is planned so that the final length of the new main channel will be reduced to about 10.3 miles. The actual work of construction is expected to start as soon as the flood conditions on the meadows will allow and this work will involve the removal of approximately 180,000 cu. yds. of mud and soft material, and approximately 150,000 cu, yds. of gravel and hard material, a total earth excavation of about 330,000 cu. yds. In addition to this, about 1,000 cu. yds. of ledge rock will have to be blasted out. The river is crossed by five railroad bridges, two trolley bridges, six highway bridges, two foot bridges and two small private bridges, on many of which it may become necessary to do some work of alteration or reinforcement. Four lines of cast iron water pipe and two lines of cast iron sewers cross under the river in the Hyde Park section, and it is very likely that several of these will have to be relaid at a lower elevation. The design and construction are under the supervision of X. H. Goodnough, Chief Engineer of the State Board of Health, State Capitol, Boston, Mass.; Edmund M. Blake is Engineer in Charge.

Minnesota.

✣Bids will be received until May 25, by J. J. Stevens, County Auditor, Montevideo, Minn., for furnishing the necessary labor and material for the construction of Dn The cost of the work is estimate at The following tile will be require, of 14-in., 1,800 ft. of 12-in., 1,300 of 4,100 ft. of 6-in., and7,400 ft. of in

✣Bids will be received until 10 m 23, by L. G. Vogel, County Auditor Minn., for the construction of D estimated to cost $10,800.

⊙County Commissioners at [illegible] Minn., have awarded the contract for d in Lake Minnetonka to J. R. John 000.

⊙Union Drainage Co., Staple has been awarded the contract at cu. yd. for excavation and $75 leveling roads, for the constructi cial Ditch No. 27, bids for which May 11 by the County Auditor Minn. The work includes 155,00 excavation.

No bids were received May 9 by cum, County Auditor, Internat Minn., for constructing Judicial The work calls for 128,000 cu. yds of tion.

Montana.

The Big Horn Canyon Irrigation Co. is contemplating the constructi approximately 165 ft. in height, and on the base, and about 400 ft lon This dam will be located at the canyon where the Big Horn Rive way through the Big Horn Mou canal lines will be approximate long, and for the most part locat construction will be easy. There siphons at Creek Crossings appro mile long in each case. It is using the water power developed generate electricity and this will pump water to irrigate higher and also to operate an electric rail will traverse the Big Horn Vall from town of Custer on the Northern Pacific to Hardin on the Burlington, and ence the river valley. The railroad will give an let to market for the products of about acres of land, which is now und irrig Before actual construction can gin be necessary to secure permissi from government to construct the dam across Big Horn River, as the land has been drawn for a power site, where the dam be located. It will also be necessary to se the rights of way for canals and lread the Crow Reservation. It will ta some to do this, but it is expected it done. B. C. Lillis, Billings, M neer of the Company.

Ohio.

✣Bids will be received until 27, by Board of Bedmont Con sioners, St. Clairsville, O., for f terial and constructing concre walls along Captina Creek, near

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

300 ft. long, 6 ft. high, 3 ft. at [illegible]
s. on top. Emerson Campbell is
uditor.

will be received until June 3 for the
on of the Kurtz drain in Lake
Franklin County. The [illegible]
stimated at $3,000. [illegible]
., is County Engineer.

phis, Tenn., and Vicinity.

[illegible]

has reached Memphis contractors
ty of Little Rock, Ark., will receive
ne 8, for approximately 45,000 sq.
pavement which is to be covered
uminous filler. Louisiana St. is the
aved.

reaches Memphis that another local
as had the good fortune to pick
eat contracts outside of its home
[illegible] Roach-Manigan Paving [illegible]
wo streets in Dallas, Texas, last
osition and Parry avenues, at a to-
approximately $50,000. This is the
that a Memphis street paving con-
ver been able to secure in Dallas
al boys are making preparations to
[illegible]
in order that the Dallas people may
he push and enterprise of the Mem-
t. Harry McCullom did the bid-
he Roach-Manigan Company.

Jennings was awarded the contract
revasses near Birds Point, Mo., last
ajor Clarke S. Smith of the U. S.
with headquarters in Memphis. The
ice was 23 cts. This is the work
bid in last month, but on account
er being over the proposed dikes,
ssible to do any work, and Major
not see the necessity of making an
the proposition was in such shape
[illegible]
is the only bidder on the contract.

his Asphalt & Paving Co. have now
resume the construction of cer-
streets which they had in Mem-
is expected that before long this
aded by the genial Billy McGehee,
und up all old jobs and be in posi-
n the few remaining asphalt con-
awarded by the city of Memphis
1912 season. Just now Billy Mc-
pany is busily engaged in paving
e., under the subway crossing.

[illegible] the name of Memphis'
[illegible] firm. It is the [illegible]
W. F. Roper & Co., and [illegible]
he well known hustler and capital-
per, a leading citizen of Byhalia,
[illegible] W. F. Roper is known
ds and admirers, feels that he
assistance of a younger member,
Poke has not been enjoying the
h and the growing business of his
ed the attention of one of active
d ability. Roper Brothers will be
on the batch of Memphis street
be let May 28.

n has sold his steam shovel and
his whole time and attention to
its and gravel pits. Billy has sev-
ntracts with the city of Memphis
streets and at present has his
n some choice subdivision work.
was able to close a very attractive
t with a local paving concern.

stood that work on the big Hunt-
levee for the Mississippi Levee
resumed by June 1. On this con-
ge steam shovels are used and a
[illegible] locomotives and dump cars
first levee to be built with this
inery, and tends to revolutionize
evee construction.

ke S. Smith left last week for
attend the meeting of the Missis-
Commission and submit to that
his recommendations for Dis-
and 2, which embrace the terri-
ro to Arkansas City. As a rule,
otments of the River Commis-
made until June, but on account
the big stream it is desirable to
have the money given out as early as possible; hence the emergency call which Major Smith received.

A private dispatch going the rounds of the levee boys in Memphis last Saturday contained the glad tidings that on Friday the River Commission allotted over a million dollars for emergency work between Cairo and White River. While no authentic information could [illegible] the filling of breaks and that the other large allotments would come later. Major Smith of the Army Corps and the chief officer in charge of the new work could not be reached in time to give out definite information regarding the exact work to be done under the first appropriation.

The good roads train operated by the Frisco Railway at a great personal expense to the latter road, arrived in Memphis on the 17th, and was enthusiastically received by the leading citizens of the town. The train is doing a wonderful lot of good throughout the South and Southwest and wherever it goes is accorded a great welcome. Inside the car are [illegible] electricity, showing how much can be accomplished if the correct methods are pursued in this direction.

Levee builders were very much pleased with the proposition advanced by Senator Williams of Mississippi in the discussion of the River and Harbor appropriation bill which passed the Senate on Thursday of last week, carrying in round numbers $31,053,000, which goes to conference unless the House should see fit to accept the Senate amendments. Senator Williams' suggestion was that the river project should be segregated and dealt with as the Panama Canal was handled. The Mississippi River, contends the gentleman from the State of that name, does not present a thousand problems. It presents but one. He thought it would be a good thing for the government to move up the dredge fleet and other machinery from the Canal after its completion and utilize this quipment on the Mississippi River from St. Louis to the mouth in dredging the river and if possible, in establishing a 12 to 14-foot continuous channel. The levee boys think that if this is done it will mean that the United States will ultimately take control of the levee system, authorize enough money to complete the line of dikes on either side of the big stream, besides raising and widening them sufficiently to withstand an even greater water than the Delta was visited with this season. It is the general opinion in this section that the government engineers would find the contract system of building levees much more satisfactory than having the embankments built by the government forces, and it is also believed that if Uncle Sam takes hold of the proposition it will be much more satisfactory in all details; with the present system of having State levee boards build certain portions of the work, the [illegible] handicapped by politics which seem always to creep into certain contracts and then, too, he has had to take bonds on certain contracts and trust to luck in disposing of some of them. With the new arrangement, a cash payment would always be ready as the work progressed and the boys who pile up the dirt would know exactly where they stood on all propositions.

While there will be plenty of levee work to be dished out to the boys this season, and while prices for this sort of work are expected to reach top notch, it must not be forgotten by the contractor that the prices of mules—the only sure machinery for building levees—will go up accordingly. Already Tom Bruce, the leading levee mule dealer of the South, has sounded the warning note and advises that the boys who put up the dikes for your Uncle Sam have a care, and inquire into the price at which Old Ned must be bought before making out his cost date for the new mounds. The vast amount of mules drowned by the flood will make the farmer more strongly in the market than ever before in the history of the South, says Tom Bruce. Then all the contractors will have to increase their outfits if they are to cope with the levee situation and be able to close the crevasses on time. With the price of mules already very high, and with an unprecedented demand, there is no telling how high one must pay for the dike climbers. Tom says that an increase of from $25 to $75 per mule would not be abnormal this summer.

An enthusiastic meeting of the citizens living in the St. Francis basin was held in Memphis on May 15, when the State of Arkansas was importuned to issue at once bonds to the amount of $1,500,000 to provide funds for further levee protection and for the closing of all gaps which have occurred in the St. Francis chain of levees from the recent flood. A strong committee was organized, headed by President O. N. Killough of the St. Francis levee board, and it is the purpose of the committee to make a determined fight to accomplish the ends for which it was organized. It is the consensus of opinion that the fight will not be a hard one for the people of Arkansas at large realize what a terrible thing has happened to their state by the breaking of levees and no doubt an effort will be made to make a recurrence of such a catastrophy an impossibility in the future.

The revised estimates of streets to be let by the City of Memphis on May 28 follows: Butler Ave., 3,500 cu. yds. excavation, 12,500 sq. yds. wood block or brick pavement; Beechwood Ave., 2,500 cu. yds. excavation, 1,400 sq. yds. gravel pavement; Richmond Ave., 5,000 cu. yds. excavation, 5,290 sq. yds. Dolarway pavement; East Edna Place, 1,150 cu. yds. excavation, 1,170 sq. yds. gravel pavement; S. Sommerville, 4,500 cu. yds. excavation, 2,900 sq. yds. gravel pavement; N. Willet, 1,650 cu. yds. grading, 5,000 sq. yds. Dolarway pavement; East Butler Ave., 2,500 cu. yds. excavation; Lane Ave., 500 cu. yds. excavation, 1,560 sq. yds. old stone pavement; Nelson Ave., 7,000 cu. yds. excavation, 6,400 sq. yds. Dolarway; Oakview St., 1,500 sq. yds. grading, 4,490 sq. yds. Dolarway. The above are the streets which were to have been let on May 21, but late Saturday afternon City Engineer Weatherford announced that all the estimates had not been completed in time and he gave out these corrected figures with the announcement of postponement until May 28. It is expected that the streets will attract keen competition among the local contractors. The Dolarway pavement is controlled by one firm in Memphis, so the rest of the boys will have to content themselves by bidding cheaper prices of the other materials which are permitted under the specification, if they desire to come close to the price on Dolarway streets.

The Riverside Drainage District disposed of approximately $397,500 worth of their bond issue to the Commercial Savings Bank of Greenville, Miss., and will let contract for the construction of a drainage system, consisting of a main canal from Swan Lake to Williams Bayou, in Boliver County, Mississippi, and numerous small lead ditches. It is supposed that bids will be asked in a few weeks and work commence this summer.

It is probable that Congress will appoint a committee of five men for the puspose of making a general inspection of all the levees on the Mississippi River, in order that some plans may be submitted for the taking over of all the levee systems by the United States Government. A resolution was entered last week by Representative Garrett, of the Ninth Tennessee District for the appointment of this committee, and it will probably be passed upon during the coming week.

Work will soon commence on the resurfacing of the entire Memphis Parkway. This drive, which is one of the most magnificent roads in the South, extending for a distance of over twelve miles, and touching practically every park of importance in the city, will have to be entirely torn up along the top surface and new gravel applied. The recent cold winter has brought the oil up, forming a crust, which speedily disintegrates under the heavy traffic, and it will be necessary to scarify the road, apply new gravel, oil same, and then roll back to wearing surface. Work will commence immediately, and we are promised the drive back in first-class shape by the middle of summer, and possibly sooner.

Word comes in from Bob Leonard that his outfit managed to pull through the flood with no serious damage. Bob says he will finish his contract on the Red River in plenty of time to come within the time limit. He has good work, which will dry off quickly, and expects to be back at work soon.

Utah.

Ogden River Reservoir Co. will build a reservoir in the South Fork of the Ogden River, 18 miles east of Ogden City. The estimated cost of the dam is $1,057,000. It will store 25,000 acre feet of water. The principal object of this reservoir is to supply water for July and August to the present farmers of Weber County, who already have sufficient flood water, but are short of water during these two months. The excavations clear across the canyon have already been made showing the bed rock clear across the canyon. Contracts will be called for to build the first 50 feet of the dam within the next 30 days. William Glassman, 360 24th St., Ogden, Utah, is interested.

Canada.

⦿A. S. Dawson, Chief Engineer of the Canadian Pacific Ry. Department of Natural Resources, reports the awarding of three large and important contracts in connection with the construction work in the eastern section of that company's irrigation block in Alberta. Grant Smith & Co. and McDonnell of Vancouver, have been awarded a contract running into over $500,000 for the construction of a large reinforced concrete aqueduct, two miles in length, near Brooks, which will take the next two summers to complete. Janse Bros. and Boomer & Hughes of Calgary and Seattle, have been awarded a two-year contract, amounting to about $300,000, for the construction of a very large number of reinforced concrete structures on the canal syst
section of the irrigation block lyin
Bassano and Brooks and the Bo
Deer Rivers. The Canada Found
also been awarded a large contract
plying and erection of 30 steel bridg
main canal system, containing abo
lbs. of steel, which, with masonry
will provide practically permanent
Work on all of these contracts wi
menced in the immediate future,
hundred men, large numbers of tea
elaborate construction plant will
for their completion

Kimball Bros. are just finishin
work on the Canadian Pacific R. R
ditches at Bassano, Alta., and
1,500,000 cu. yds. on the same d
of Brooks, Alta. Kimball Bros. c
eral good sized outfits as well as
on this work. They are locate
Alta.

WATER-WORKS

Alabama.

⦿W. W. Moore of Birmingham, Ala., has been awarded the contract by the city of Fayette, Ala., for the construction of a water works system at $14,000. The work includes power house, two 80,000-gal. reinforced concrete tanks, 40 hp. gas engine, 500-gal. triplex pump, compressor and air lift, 26 hydrants, 4,900 ft. of 8-in. cast iron pipe and 4,600 ft. of 6-in. cast iron pipe. Edgar B. Kay, Tuscaloosa, Ala., is Engineer. Bids were opened on May 3.

Colorado.

✤Bids will be received until 10 a. m., June 15, by Capt. T. T. Frissell, Constructing Quartermaster, Fort Logan, Colo., for sinking one 8-in. tubular deep well at that depot.

⦿Charles A. Smith has been awarded the contract by the town of Milliken, Colo., for the building of a waterworks plant, estimated to cost $15,000. An artesian well and a pump will form the basis of the system. Bonds were voted on April 2 in the sum of $15,000 for this work. R. M. Benton is Mayor.

Georgia.

✤Bids will be received until 3 p. m., May 27, by Mayor and Council, McDonough, Ga., for the construction of a water works and sewerage system. Water works system embraces one 500-gal. turbine pump and motor, one brick building, one steel or reinforced concrete 75,000-gal. tank on 75-ft. tower, 100,000-gal. reinforced concrete reservoir; 3,000 ft. 8-in., 18,000 ft. 6-in. c. i. pipe; 53 hydrants, 20 6-in. valves, 10 8-in. valves with necessary valve boxes and special castings. J. B. McCrary Co., Atlanta, Ga., are Engineers.

⦿The C. W. Murray Co., of Savannah, Ga., has been awarded the contract by the Mayor and Council of Sylvester, Ga., for the construction of a partial sewer system and water works improvements at $13,740. The work includes water works machinery, water mains, sanitary sewers and septic tank. Bids were opened May 15 by R. B. Pollard, City Clerk. The J. B. McCrary Co., Atlanta, Ga., are Engineers.

The citizens of Cartersville, Ga., will vote May 25 on the proposition of extending the water, gas and electric light plants of the city at an estimated cost of $50,000. Plans for the improvements have been made. G. W. Young is Mayor.

Illinois.

✤Bids will be received until 2 p. m., May 29, by City Clerk, Breese, Ill., for furnishing material and labor and constructing improvements to the municipal water works system, plans and specifications for which are on file at the City Clerk's office or at Fuller-Coult Co., Engineers, Chemical Bldg., St. Louis, Mo. The work will include the following approximate quantities: 2,280 ft. 8-in., Class B, C. I. pipe, to be furnished and laid; 492 ft. 6-in. Class B, C. I. pipe, to be furnished and laid; 6,480 ft. 4-in. Class B, C. I. pipe, to be furnished and laid; 1,570 ft. 8-in vitrified clay pipe, to be furnished and laid; 7,400 lbs. special castings, 5 8-in. valves, to be furnished and set, 5 6-in. valves, to be furnished and set, 1 4-in. swing check valve, to be furnished and set, 6 fire hydrants, to be furnished and set, 2 750,000-gal. per day steam pumps, to be furnished and set, 1 500,000-gal. reinforced concrete reservoir to be built, and 1 brick coagulating house, to be built.

✤Bids will be received by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, until 11 a. m., May 29, for furnishing materials, labor, etc., necessary to construct water supply pipes in the following streets: Yates Ave., 2,574 lin. ft., 8-in., 8 fire hydrants; Wabash Ave., 2,640 lin. ft., 8-in., 9 fire hydrants; E. 98th St., 320 lin. ft., 6-in., 1 fire hydrant; Spaulding Ave., 442 lin. ft., 6-in., 1 fire hydrant; 38th Pl., 675 lin. ft., 6-in., 2 fire hydrants; Yale St., 516 lin. ft., 6-in., 1 fire hydrant; California Ave., 2,620 lin. ft., 12-in., 8 fire hydrants; Claremont Ave., 625 lin. ft., 8-in., 3 fire hydrants; Indiana Ave., 1,040 lin. ft., 8-in., 3 fire hydrants; Irving Ave., 1,300 lin. ft., 8-in., 2 fire hydrants; 71st Ave., 1,380 lin. ft., 8-in., 3 fire hydrants; Saginaw Ave., 645 lin. ft., 8-in., 2 fire hydrants; Marianna St., 720 lin. ft., 6-in., 1 fire hydrant; E. 83d St., 682 lin. ft., 12-in., 12 fire hydrants; Cegier Ave., 1317 lin. ft., 8-in., 4 fire hydrants; Ridgeland Ave., 1,317 lin. ft., 8-in., 4 fire hydrants; 71st Pl., 1,187 lin. ft., 8-in., 3 fire hydrants; 72d St., 1,187 lin. ft., 8-in., 3 fire hydrants. All 12-in. pipe to weigh 82.1 lbs. per lineal foot; 6-in., 33.3 lbs., and 8-in., 47.5 lbs.

✤Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., May 25, for furnishing the materials, labor, etc., necessary to construct at the Lake View Pumping Station, Montrose Blvd. and Clarendon Ave., 1 electric freight elevator of sufficient capacity to carry 3,000 lbs., besides its own weight at a speed of 60 ft. per minute, together with the necessary machinery, guides, cables, etc. Cash or certified check for $100 must accompany proposal.

✤Bids will be received until May 28, by C. M. Fox, Chairman of the Water Committee, DeKalb, Ill., for a deep well pump with capacity of 500 gals. per minute.

⦿Wm. F. Healy, Reaper Bldg., Chicago, has been awarded the contract for constructing the sewer in 14th St. by L. E. McGann, Commissioner of Public Works, Chicago. The work consists of 18-in. double strength tile pipe, contract price $2,770, including manholes and catch basins. Bids opened May 6th.

⦿The Board of Local Improvements of Joliet, Ill., Wm. S. Welch, Secy., has awarded the contract to William Tunny of that city for the construction of a watermain in Broadway, as follows: 1,640 ft. 6-in. cas
$0.64; 940 ft. rock excavation 1 ft.
210 ft. excavation and backfilling tr
mains, $0.27; 6 lead service connec
long, $16; 35 lead service conne
long, $5.50; 6 6-in. gate valves,
6-in. hydrants, $42 each; 41 Bu
boxes in place, $1.30 each; 6 val
in place, $22 each; 4 6-in. tees,
1 6-in. plug, $2; 1 connection ma
to 8-in. main on Ruby St., inclu
fittings, etc., $55. Bids were open

⦿ The Board of Local Impr
Rock Island, Ill., has awarded the
the laying of water mains for the
tween 44th and 46th Sts., and 1
Aves., as follows: 12-in. water
8-in. main, $1.45; 6-in. main, $1
$0.65; fire hydrants, $44; auxiliar
12-in. valves, $65; 8-in. valves, $40;
$28; 4-in. valves, $20; specials, per

Following bids were received b
Andrews, Quartermaster, U. S. A.,
dan, Ill., for constructing a pressu
plant, item 1 being filters; 2, tabl
ing: International Filter Co., C
item 1, $24,700; G. E. Gurdling,
St., Chicago, item 3, $595; Ame
Softener Co., Philadelphia, Pa., i
650; 2, $1,500; Roberts Filter Co.,
Pa., item 1, $14,580, $15,750 and $
York Continental Jewel Co., New
item 1, $17,900; 2, $2,000.

The City Council of Elgin,
structed Commissioner Charles
prepare specifications and advert
for the new artesian well.

City Engineer Elmer Folsom o
ton, Ill., has presented a new esti
Board of Local Improvements for
20-in. water main. The board h
the estimate which amounts to $63

Bids were opened May 16th fo
and delivering to the city of Chi
General Park Ave. pumping station
field Ave. pumping station, 150 sh
wide, 72 ins. long and 1/16 in. thick
sheet steel for engine cylinder lag
man Boker Co., New York City,
bid of 12½ cts. per pound, which
E. McGann is Commissioner of Pu

Bids were received May 9th by
Gann, Commissioner of Public W
go, Ill., for furnishing and deliv
city, 1 steam hoisting engine for
with a working steam pressure of
sq. in.; 2 10-in. x 12-in. cylinder, 2
etc. Wm. B. Hough & Co., 53
Blvd., submitted a bid of $1,11
low. The contract has not been

Bids were opened May 13th b
Gann, Commissioner of Public W
go, Ill., for furnishing, delivering
at the Roseland pumping station,
Stewart Ave., 1 four-panel switc

✤ indicates work now open for bids. ⦿ indicates a contract let recently.

ɔus items noted in specifications. Co., 122 S. Michigan Ave., sub- f $1,425, which was low. The t been awarded.

Indiana.

icials of Mishawaka, Ind., have for the new waterworks pump- East Mishawaka. The station flats near the country club and [illegible] ıtal outlay for waterworks im- placed at $70,000. C. M. Cra- endent of the waterworks.

Public Works of Indianapolis, ed the Indianapolis Water Co. ıains in the following streets: n Lee St. to Belmont Ave.; rom Raymond St. to Legrande nnsylvania St., from Raymond Singleton St., from Iowa to eonard St., from Lincoln to Garfield drive, from Shelby to St., from Shelby to Boy St.; Tabor to Kelly St.; Dearborn gan St. to a point 450 ft. north; e., from Audubon road to a ıst; Arlington Ave., from the sent mains to a point 100 ft. 'le road, from Washington to

Iowa.

received until June 1, by F. Clerk, Decorah, Ia., for the ater mains on East Main St.

received until June 4 by R. B. dvertisement), Town Clerk, r the extension of the water- Iowa Engineering Co., Clinton,

ıncil of Charles City, Ia., has o call a special election to vote l pumping station and the ex- [illegible] f the issue carries.

Rock Island & Pacific Ry. Co. 17 acres of land northwest of which will be built a reser- ne-half miles long and will The dam will be three-quar- ıg. About two miles of piping in order to connect the same J. B. Berry, Chicago, is Chief

ion will be held in Logan, Ia., e purpose of voting on the recting a standpipe and ex- ewing the water mains. The f improving the water system

to be held in Garden Grove, late for the purpose of voting [illegible] ion of a waterworks system. put in a 40,000-gal. steel tank with mains. The Des Moines Works, Des Moines, Ia., are

cil of Defiance, Ia., has called for June 8 to vote on the suing bonds for the installa- rks system

Kansas.

uncil of Lyndon, Kans., has tract for constructing water- mmercial Construction Co. of). The tower and tank was r & Tank Co. of Memphis, tion equipment to the Pitts- ., Pittsburgh, Pa., and hy- d pumps to the English Tool Kansas City, Mo. The total terworks is $27,471. J. W. n is Engineer.

a Construction Co. of Ton- been awarded the contract ion of a waterworks system lighting system in Fowler, pipe will be furnished by the idge & Iron Works, Des S. Worley of Kansas City,

[illegible] City, Mo., will prepare plans for the installation of a new water works system in Gypsum, Kan., at an estimated cost of $15,000. The work will probably include steel tower and tank and about 12 blocks each of 6-in. and 4-in. mains; for fire protection only. The source of supply will be wells. C. H. Gaumer is City Clerk.

Preliminary plans have been prepared by E. T. Archer & Co. of Kansas City, Mo., for the making of extensions to the water works system of Larned, Kans., and for street lighting, estimated to cost $40,000. The work will include electric power station operating street lighting and 8 deep well pumps. Bonds will be voted upon for the improvement.

Kentucky.

The Louisville, Ky., Water Co. has applied to the city building department for permission to construct a two-story brick meter shop, to cost about $17,000, and a one-story brick shed, to cost about $9,000.

The Lexington, Ky., Waterworks Co., Lexington, has purchased 15¾ acres of land adjoining the waterworks grounds. The tract is adjacent to the proposed new subsidence basin of the filtering plant which the waterworks company will construct in the near future, at a cost of approximately $50,000.

The Court of Appeals has declared the issue of $75,000 in bonds for waterworks and sewerage system by the city of Madisonville, Ky., constitutional. The bonds will at once be placed on the market.

Michigan.

The Board of Public Works of Battle Creek, Mich., has decided to purchase 500 five-eighths water meters or a proportionate number in various sizes.

The City Council of Grand Rapids, Mich., has voted to sell the final $145,000 issue of filtration bonds to A. B. Leach & Co. of Chicago, Ill.

Minnesota.

The City Council of Barnesville, Minn., M. P. Phillippi, City Clerk, rejected all bids received May 4 for the making of extensions to the water works. The work would consist of approximately the following quantities: 2,400 ft. of 6-in. cast iron water main, laid in an 8-ft. trench; 700 ft. of 4-in. cast iron water main, laid in an 8-ft. trench; 3 4-in. valves with hub ends and valve boxes; 2 6-in. valves with hub ends and valve boxes; 4 6x6x4 tees with hub ends; 4 Waterous hydrants, with 2 2½-in. hose connections, and 1 4-in. engine connection, with 4-in. inlet, with hub ends; 2,800 lbs. of lead; 275 lbs. of hemp jute; 3 4x4x4 tees with hub ends.

Nebraska.

✣Bids will be received until June 4 by Village Clerk D. K. Barr, Louisville, Neb., for the construction of a waterworks system. Plans and specifications are on file with the clerk and the Alamo Engine & Supply Co., Engineers, Omaha, Neb. The cost of the improvement is estimated at $15,000. Official advertisement of the work will be found elsewhere in this issue.

The citizens of Coleridge, Neb., have voted bonds in the sum of $8,500 for the purpose of extending its waterworks and erecting a new standpipe.

P. G. Wagner submitted a bid of $3,900 to the City Council of Crawford, Neb., for the construction of a flushing reservoir.

The city of Eustice, Neb., has voted $17,000 in bonds for the installation of a water works.

The Water Board of Omaha, Neb., has sold bonds in the sum of $7,000,000 to Kountze Bros. of New York City.

New Jersey.

◉P. L. Braunworth, 90 West St., New York City, has been awarded the contract by the Quartermaster, Fort Hancock, N. J., for furnishing and installing 8-in. water mains and water meter at the fort. The contract price is $4,419. Bids were opened April 23.

◉Vippett & Wood of Phillipsburg, N. J., have been awarded the contract by the City Council of South Amboy, N. J., for the construction of a steel water tank and connections at $5,296. Richard M. Mack is City Clerk. Bids were opened April 30.

New York.

✣Bids will be received until 5 p. m., May 27, by Water Commissioners, East Williston Water District at the office of F. L. Oakley, East Williston, N. Y., for furnishing and setting in place 12,225 ft. of 4 to 8-in. pipes, 27 hydrants and necessary valves and specials in place, one meter pit and one 8-in. meter. Plans and specifications are on file with Fairfield & Dow, Civil Engineers, Denton Bldg., Mineola, N. Y.

✣Bids will be received until 11 a. m., June 4, by Board of Water Supply, 165 Broadway, New York City, for Contract 101, for furnishing and erecting 150 miles of wire fence with concrete posts and short lengths of wooden fence and sandstone walls at reservoirs and at various localities along Catskill aqueduct. J. P. Morrissey is Secretary of the Board.

◉Chas. R. Lewis of Ilion, N. Y., has been awarded the contract by the city of Fayetteville, N. Y., W. T. Collin, Clerk, for the construction of a 9,000,000-gal. reservoir and accessories at $9,175. Bids were opened May 15. Other bidders were: Walter J. Raleigh & Co., Syracuse, N. Y., $14,130, and W. H. Lafler, Rochester, N. Y., $11,148.

The Committee on Finance and Waterworks of the City Council, Rochester, N. Y., has reported favorably on the recommendations of the mayor for waterworks improvements. The recommendations included the connection of the two lakes, Hemlock and Canadice; the erection of a dam at the foot of Hemlock Lake to retain the surplus flood water, and the construction of a third conduit to the city. The aggregate cost of all the improvements may be as high as $1,500,000.

Following bids were received by the Water Commissioners of Jamestown, N. Y., on May 2 for the furnishing of pipe and castings for the proposed waterworks improvements for which Chester & Fleming, Pittsburgh, Pa., are Engineers, (1) standing for bid of U. S. Cast Iron Pipe Co., (2) Warren Foundry Co., (3) Donaldson Iron Co., (4) R. D. Wood Co., (5) Emery Construction Co., and (6) Field, Barker & Underwood, Inc.:

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
140 tons 24" Class B	$21.90	$23.50	$22.84	$23.00	$26.00	$25.25
[illegible] Class C	21.90	23.50	22.84	23.00	26.00	23.25
[illegible] Class C	21.90	23.50	22.84	23.00	26.00	25.25
17,000 lbs. special [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Following bids were received by the Water Commissioners of Jamestown, N. Y., for the laying of water pipe to the proposed reservoir for which bids were opened May 2, Chester & Fleming, Pittsburgh, Pa., Consulting Engineers, (1) standing for bid of Mahony & Sarvak, (2) W. M. Chisholm & Son, (3) Emery Construction Co., (4) John Johnston Construction Co., and (5) Field, Barker & Underwood, Inc.:

	(1)	(2)	(3)	(4)	(5)
2,500 lin. ft. 24" pipe..	$1.20	$1.14	$1.60	$1.52	$1.25
800 lin. ft. 24" pipe..	2.00	1.50	2.50	1.46	1.70
1,500 lin. ft. 16" pipe..	2.10	1.00	2.05	1.06	.76
1,400 lin. ft. 16" pipe..	1.05	.70	1.05	.75	1.15
300 cu. yds. rock ex.	2.50	1.50	2.40		4.00

Ohio.

✣Bids will be received until noon, May 28, by Board of Public Affairs, D. D. S. Klotz, Clerk, Malvern, O., for the construction of 3 miles of 4, 6 and 8-in. pipe, pumping unit 250 gals. per minute, stand pipe 20x52 ft.

The city of Zanesville, O., plans the construction of an entire new system of water works, to cost approximately $175,000. The work will include new pumping station, storage reservoir and one mile of 20-in. pipe line. E. A. Evans is Director of Public Service.

Oklahoma.

✣Bids will be received until 10 a. m., June 10, by G. Maury Cralle, Constructing Quartermaster, Fort Sill, Okla., for constructing and installing 10-in. C.-I. water supply pipe line, lectric motor and pump, and water-purifying apparatus, furnishing and installing oil burners in 4 boilers, oil pumps, oil heater, oil storage tanks, etc., at new Fort Sill and addition to lighting system and installing motor-driven pump, etc., at old Fort Sill.

Oregon.

The citizens of Hood River, Ore., on May 8 voted the issuance of bonds in the sum of $90,000 for the installation of a municipal waterworks system.

The City Council of Salem, Ore., has adopted a resolution to buy the Salem Water Co.'s plant for $300,000, plus the cost of betterments.

The city of Clatskanie, Ore., will sell bonds June 10 in the sum of $20,000 for the construction of a water system. J. M. Blackford is City Recorder. W. H. Powell is City Attorney.

Pennsylvania.

✣Bids will be received until May 28 (readvertisement) by Water Commissioners, Erie, Pa., for the improvement of the water works at that place.

Dr. Samuel G. Dixon, State Health Commissioner, has approved the plans for preliminary treatment of the water supply of Pittsburgh, Pa., before it reaches the slow sand filters.

The City Concil of Dawson, Pa., is about to ask for bids for the construction of a new waterworks reservoir. According to the plans the reservoir will be circular, 90 ft. in diameter.

South Carolina.

The Anderson Water, Light and Power Co.'s holdings in the city of Anderson, S. C., consisting of the waterworks system and lighting system, are reported sold. H. A. Orr is President.

The Board of Commissioners of Florence, S. C., has employed Consulting Engineer Gilbert C. White of Durham, N. C., to report on the advisability of installing a new water supply system. It is probable that bonds in the sum of $100,000 will be voted for this work.

Tennessee.

The City Council of Lonsdale, Tenn., has ordered the water mains on Tennessee Ave. extended for a distance of 10 blocks.

Texas.

✣Bids will be received until 2 p. m., May 31, by City of Cleburne, Tex., for furnishing material and labor for rebuilding a pumping station and extending a system of water mains, separate bids being entertained as follows: 1. For furnishing material and labor (except as outlined in subsequent items) and extending water mains; certified check $1,000. 2. For furnishing and erecting one 1,200-cu. ft. air compressor; certified check $500. 3. For furnishing material and labor and drilling an 8-in. deep well; certified check $500. 4. For furnishing cast iron pipe and special castings, f. o. b. cars, Cleburne, Tex.; certified check $500. 5. For furnishing hydrants and valves, f. o. b. cars, Cleburne, Tex.; certified check $100. All the above material and work to be furnished and done in accordance with the plans and specifications on file at the City Hall, Cleburne, Tex., and at the office of the Engineers, Burns & McDonnell, Scarritt Bldg., Kansas City, Mo.

A public service commission has been appointed by the citizens of Port Arthur, Tex., to investigate and report on the advisability of purchasing the present waterworks plant owned by Charles G. Gates.

Plans and specifications for the water purification plant for Dallas, Tex., have been submitted to the City Commissioners by Consulting Engineer James H. Fuertes of New York City. The work, to cost about $175,000 for the plant, is to be on the site of the boiler room of Turtle Creek pumping station. It is to care for 20,000,000 gals. a day and to be capable of extensions by units. It is expected that the work will begin by summer and be ready for use within a year.

The citizens of Longview, Tex., on May 4 voted in favor of issuing $100,000 worth of bonds for the purpose of enlarging their waterworks system and constructing filtration plants. The Aetna Engineering Bureau, 17 N. LaSalle St., Chicago, has been retained to prepare plans and specifications.

The city of Cleburne, Tex., contemplates letting a contract at once for the building of the waterworks pumping station which is to be 48x100 ft. The plans also call for a 1,200-ft. air compressor, an 8-in. well to be sunk to a depth of 1,200 ft., 4 miles of new 6-in. mains, 1 mile of 4-in. mains and 38 new hydrants to be placed at stated intervals about the city.

The City Commissioner of Waco, Tex., will sell bonds June 4 in the sum of $400,000 for waterworks and $20,000 for public work. John C. Davis is City Secretary. Lud Williams, City Attorney.

The city of Bryan, Tex., will construct by day labor 4-in., 6-in., and 8-in. extensions to the water mains of the city at an estimated cost of $8,000. The work will also include 20-ft. lift for part of territory, 5,000 ft. of 6-in. line, and numerous 4-in lines. A. B. Carson of Bryan is Engineer.

The city of Henrietta, Tex., will install a new water works system at an estimated cost of $18,000. The work is only in its preliminary stages. R. C. Green is City Secretary.

Virginia.

The citizens of Dublin, Va., will vote at the regular June election on the proposition of issuing bonds in the sum of $10,000 for the purposes of providing water supply and sewage system.

Washington.

⊙The Paine Construction Co., of Tacoma, Wash., will be awarded the contract by the town of Wapato, Wash., W. G. Ellington, Clerk, for the construction of a distributing system of water works at $8,290. The work includes furnishing of all material. The contract is not to be made for 30 days, to give time to install machinery in pumping plant. Bids were opened May 8.

⊙The Payne Construction Co. of Tacoma, Wash., has been awarded the contract by the City Council of Wapato, Wash., for the construction of the distributing syst waterworks plant at $8,200. have the plant completed by Ju

The citizens of Centralia, Wa on May voted against the issuance of bo in the su of $250,000 for the construction the mu ipal gravity water system. Stan Macn is City Engineer.

The citizens of Chehalis, Wa on M voted in favor of installing a avity system. The City Commissione immed will take steps to sell the bon and praise the present water system the ington-Oregon Corporation, pparator buying the same.

Wisconsin.

⊙Senn & Boson of Marshfie been awarded the contract at O the laying of water mains and 435. The work includes laying of water mains, 1,950 ft. of foundation for tower and con also setting hydrants, castings, and one catch basin. Bids wer 10. Geo. D. Richards is Clerk

The Board of Public Works Wis., will advertise for bids a laying of water mains on streets: Greenfield, 63rd, 76th, 6 63rd, 54th and Worden Aves and Hicks Sts.

Canada.

✣Bids will be received until 10, by D. G. Tate, City Clerk, for Waterworks Contract No. ply and delivery of 125 gate hydrants, ranging in size fron Specifications can be obtained Engineer's office, City Hall, A deposit equal to 5 per cent bid must accompany each tend

✣Bids will be received until 10, by D. G. Tate, City Clerk, for Waterworks Contract No. ply and delivery of 17,000 ft. of pipe and 10,500 ft of 6-in. Specifications can be obtained Engineer's office, City Hall, Ve deposit equal to 5 per cent of must accompany each tender.

✣Bids will be received until 3, by G. H. Lees, Mayor, Chai Control, Hamilton, Ont., for two units of synchronous mo connection to turbine pumps w ers, switching apparatus and ac plete. S. H. Kent is City Clerk,

The citizens of Vernon, B. C. election voted by-laws to the am 500,000 for improvements, as llows provements to municipal buildin improvements, $24,000; purcha ment, $10,000; construction o new house and extensions to prese $10,000, extensions to present $10,000

The Town Council of Port in making preparations to ext works system into the new a west side of the town, whic taken in.

SEWERAGE AND GARBAGE DISPOSA

Alabama.

⊙Long, Sullivan & Hagerty of Bessemer, Ala., have been awarded the contract by the city of Fayette, Ala., for the construction of sewers at $7,375. Edgar B. Kay, Tuscaloosa, Ala., is Engineer. Bids were opened May 3.

Georgia.

✣Bids will be received until 3 p. m., May 27, by Mayor and Council, McDonough, Ga., for the construction of sewerage system and water works. Sewerage system embraces 5.4 miles of sanitary pipe sewers, sizes 6-in. to 15-in., with the necessary manholes, flush tanks and appurtenances. J. B. McCrary, Atlanta, Ga., is Engineer.

⊙The city of Augusta, Ga., has let a contract for the construction of a brick sewer on Central Ave. to A. J. Twiggs & Sons at $18,524, and a contract for the construction of all terra cotta sewers during the year ranging from 12 to 24-ins. in diameter, to T. G. Brittingham.

Idaho.

✣Bids will be received until noon, June 15, by Sewer Commissioners, W. J. Costello, Clerk, Sandpoint, Idaho, for the necessary material and labor in laying about 23,000 ft. of sewers. Official will be found elsewhere in

Illinois.

✣Bids will be received by t Local Improvements, Chicag Glackin, Secretary, until 11 a. m furnishing the labor, tools, mat essary to construct sewers in streets.

⊙The Board of Local Im Joliet, Ill., Wm. S. Welch, awarded the contract for the a sewer in Broadway to Will that city, as follows: 1,700

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible]
depth, $0.23; 850 ft. of excava-
[illegible]
ft. rock trench, $0.27 per ft. in
[illegible]
[illegible] Bids were [illegible]

[illegible] Joliet, Ill., has [illegible]
of that city, Wm. S. Welch,
[illegible]
pipe sewer, etc., $0.30; 150 lin.
sewer, etc., $0.20; 460 lin. ft.
er, etc., $0.13; 380 lin. ft. back-
ft. in depth, $0.25; 1,060 lin. ft.
backfilling over 6 ft. and under
[illegible]
manholes complete, each, $28;
complete, each, $28. Bids were

of Local Improvements of
has awarded the contract for
n of the Harlem Ave. sewer to
of Watertown, Wis., at $11,-
lders were: William Moran &
$9,787 with $3 per cu. yd. for
avation; J. W. Turner, $11,317;
[illegible]
$11,775.

Indiana.

received until noon, Ma[illegible]
n Council, Bedford, Ind., for
necessary labor and material
uction of a sedimentation ba-
[illegible] and pumping station
for furnishing 3 electrically
ugal pumps and power for
n at the river and from the
basin.

[illegible] of Public Works of
nd., has awarded the follow-
for sewer improvements for
[illegible] opened May 14: Sample
er, L. H. Webster, $8,005;
sewer, DePoppe & Cous-
hnson St., pipe sewer, L. H.
Miner St., pipe sewer, L.
$966; Allen St., pipe sewer,
er, $1,682; College St., pipe
, $1,728.

of Public Works of South
awarded the contracts for the
six sewers, as follows: L. H.
k sewer on Sample St., from
ve. $8,005; pipe sewer on Allen
Buren to Vassar Ave., $1,603;
Miner St., from Notre Dame
Ave., $960; Johnson St., from
to Vassar Ave., $904. Henry
ewer on College St., from Fass-
eth of Michigan Ave., $1,728.
ussens—Trunk sewer on Ford
usko to Olive St., $5,466.

Iowa.

e received until 10 a. m., May
k, Sioux City, Ia., for furnish-
ry labor and material for the
a sanitary sewer portions of
t. and Jay Ave.

e received until 6 p. m., May
Sandberg, City Clerk, Keokuk,
ver and street improvement.

e received until June 4 (read-
R. B. Ferguson, Town Clerk,
r the extension of the sanitary
Iowa Engineering Co., Clin-
gineers.

Kansas.

ouncil of Lyndon, Kan., has
ntract for the construction of
ommercial Construction Co. of
o., at $9,743. J. W. Mavity of
s Engineer.

Michigan.

✣Bids will be received until 7:30 p. m., May 22, by Ross Granger, City Clerk, Ann Arbor, [illegible] sewer on Church St. from Roosevelt Ave. to [illegible]

Missouri.

⊙Harry F. Heman, Chemical Bldg., St. [illegible] St. Louis, Mo., has been awarded the contract by the Board of Public Improvements of St. Louis for the construction of sewers [illegible] $36,033. Bids were opened May 14 by W. [illegible]

Nebraska.

⊙The city of Omaha, Nebr., has awarded [illegible] Katz Construction Co., Brandies Theatre Bldg., Omaha. The contract for the reinforcing bars was let to Harry W. Mool Co., of Omaha. The work will cost about $25,000. Geo. W. Craig is City Engineer.

⊙William Fitch of Omaha, Neb., has been awarded the contract by the city of Crawford, Neb., for the construction of a trunk sewer at $8,932.

Ohio.

⊙The City Council of Girard, O., has awarded the contract for the construction of storm sewers to Turner & Olson of Youngstown, O., at $13,385.

⊙The Board of Control of Youngstown, O., has awarded the contract for the construction of the South Ave. sewer to J. C. Hanni at $7,[illegible]

⊙The Board of Control of Springfield, O., has let two sewer projects to Patrick Caffrey as follows: Storm sewer in West Columbia St., $2,580, and storm sewer in West North St., at $2,345.

⊙Patrick Caffery has been awarded the contract by the Director of Public Service of Springfield, O., for the construction of a storm water sewer in North St., from Indian Run to Jackson St. Bids were opened April 29.

Pennsylvania.

⊙The contract for the construction of a sewer system and a sewage disposal plant at the new State Sanatorium for tuberculosis patients near Cresson, Cambria County, Pa., has been awarded to Julian M. Solomon, Jr., 30 North Seventh St., Philadelphia, Pa. The work will consist of 1¼ miles of sewers and a disposal plant. Construction will be started immediately and completed within 100 days.

⊙J. R. Fike, Jr., has been awarded the contract by the Borough Council of Uniontown, Pa., for the laying of a sewer in Everson at $10,665.

⊙The Town Council of Pen Argyl, Pa., has let a contract to George V. Lynn of that town, to construct a concrete drainage sewer from Railroad Ave., the length of Chestnut St. It is to be 3 ft. in diameter.

⊙The Director of Public Service of Philadelphia, Pa., has awarded the contracts to the lowest biders in each instance for main sewer extensions as follows: Rock Run sewer, Cantrell Construction Co., $17,495; Cohocksink main sewer, between Diamond and Dauphin Sts., Emilio Puscuzzi, $62,596, and river front extension of sewers in east and west streets between Dock and Christian Sts., across Delaware Ave., John McMenamy, $29,365. Vincent Jafolla secured the contract for the construction of manholes, at about $900.

⊙Chas. S. Detweiler of Schuylkill Haven, Pa., has been awarded the contract by the Borough Council of that place for furnishing sewer pipe to be used on Paxson Ave., at the following bid: 24-in. pipe, $0.65; 12-in. pipe, $0.22½, f. o. b. on ground; tees, 24x12, $2.60 per ft.; tees, 24x15-in., $3.25.

South Dakota.

✣Bids will be received until 8 p. m., June 3, by James A. Rose, City Auditor, Pierre, S. Dak., for furnishing all material, labor, tools and the performing of all work necessary for the construction and completion of five miles of vitrified pipe sewers from eight to fifteen inches in diameter, with manholes, flush tanks and lampholes complete and to be in accomrdance with the plans and specifications now on file in the office of the City Auditor and also in the office of the City Engineer

Tennessee.

⊙The Board of Mayor and Aldermen of Lexington, Tenn., have decided to install an up-to-date sewerage system at an estimated cost of $11,000. Consulting Engineer R. C. Huston of Memphis, Tenn., and Contractor Zeb Ward of Little Rock, Ark., have been given charge of the work.

Texas.

✣Bids will be received until noon, June 10, by Capt. R. J. Reaney, Constructing Quartermaster, Fort Bliss, Texas, for furnishing the necessary labor and material for the construction of a sewer pipe line connecting outfall sewer at Fort Bliss with sewerage system of El Paso, Texas. Further information may be obtained of the Constructing Quartermaster. Official advertisement will be found elsewhere in this issue.

Wisconsin.

✣Bids will be received until 2 p. m., June 1, by Board of Public Works, Watertown, Wis., for the construction of sanitary sewer and storm water sewers and appurtenances. Plans and specifications are on file with the board. Arnold Kraeft is City Engineer. Official advertisement will be found elsewhere in this issue.

Canada.

✣Bids will be received until June 1, by G. H. Love, Town Clerk, Lunenburg, N. S., for the construction of a system of sewerage for the town, in accordance with the terms of a report, plans, and specifications furnished to the town by Snow & Barbour, Civil Engineers, and now on file in the Town Office. The report, plans and specifications may be seen at the office of the Town Clerk at any time during office hours. Tenderers are requested to state in their tenders what brands of cement and what make and quality of sewer pipe and of brick they proposed to use.

✣Bids wil be received until noon, June 4, by Chairman, Board of Control, Toronto, Ont., for the construction of a storm overflow sewer, Main Garrison Creek Section No. 2. G. R. Geary is Chairman of the Board. Plans and specifications are on file at the office of the City Engineer.

✣Bids will be received until noon, June 4, by G. R. Geary, Chairman, Board of Control, Toronto, Ont., for the construction of storm overflow sewer, Main Garrison Creek, Section No. 2. Plans and specifications are on file at the office of the City Engineer.

⊙Geo. H. Webster, 73 Fairfield Bldg., Vancouver, B. C., has been awarded the contract by the Point Grey, B. C., Council for the sewerage scheme for Kerrisdale and Magee Districts at $153,569 (mentioned in our last issue). The work includes concrete sewers varying in diameter from 27-in. to 36-in.; reinforced concrete outfall sewer, 60 ins. in diameter; vitrified clay sewer pipes varying from 8-in. to 24-in. In all about six miles together with manholes, flush tanks, etc. D. W. Johnston is Municipal Engineer. Bids were opened April 29.

⊙The City Council of St. Boniface, Man., has awarded the contract for the construction of trunk sewer on Dawson street, to serve the Public Markets, Ltd., to Van Horenbeck & Co., at $147,651. Other bidders were: Marivet Cotteiner & Graham, $206,970; Guilbault & Co., Ltd., $149,488. Bids were opened May 13.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Delaware.

✣Bids will be received until [illegible] June [illegible] by Maj. Herbert Deakyne, U. S. Engineer, Philadelphia, Pa., for furnishing and placing about 3,000 tons of riprap stone around the substructures and resetting about 100 cu. yds. of ashlar stone in superstructures of ice piers of the Harbor of Refuge, Delaware Bay, Del.

District of Columbia.

✣Bids will be received until noon, June 1, by Brig. Gen. William Crozier, Chief of Ordnance, War Department, Washington, D. C., for furnishing 5 15-pounder dummy gun carriages, model 1912; 7 10-in. dummy disappearing carriages, model 1912, and seven 12-in. dummy mortar carriages, model 1912; also 4 15-pounder, 6 10-in. disappearing, and 6 12-in. mortar carriages.

✣Bids will be received until 10:30 a. m., June 10, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 712 structural steel, rivets, wrought pipe, cast-iron pipe, sheet lead, chinaware, glassware, mess kit cups, dish pans, bakers' sheets, teaspoons, flesh forks, and waiters' towels.

Illinois.

✣Bids will be received until 7 p. m., June 5, by City Clerk, Altamont, Ill., for furnishing and installing two 150-h. p. return tubular boilers in the Municipal electric light plant. Plans and specifications are on file at the office of the city clerk or with Fuller-Coult Co., Chemical Bldg., St. Louis, Mo.

Kentucky.

✣Bids will be received until 3 p. m., June 11, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for an air-lift pumping plant at the U. S. Post Office and courthouse at London, Ky., in accordance with the specification and drawing, copies of which may be obtained of the custodian at London, Ky., or at the office of the supervising architect.

Louisiana.

✣Bids will be received until 10 a. m., June 4, for electric fans and lighting fixtures for the Calcasieu Parish Courthouse at Lake Charles, La. Plans and specifications are on file with Favrot & Livaudais, Ltd., Architects, 839 Gravier St., New Orleans, La.

Michigan.

⦿Osceola Light & Power Co. has awarded a contract for constructing a $6,000 concrete dam at Reed City, Mich., to Wm. Fargo, Jackson, Mich.

Minnesota.

✣Bids will be received until 3 p. m., June 19, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the interior marble work, except toilet roms, for the U. S. Post Office at Minneapolis, Minn. Drawing and specifications may be had of the superintendent of construction at the building or at the office of the Supervising Architect.

New Jersey.

✣Bids will be received until 11 a. m., May 31, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for removing wreck of coal barge Saratoga, lying sunk in channel of inland waterway of New Jersey.

New York.

✣Bids will be received until 3 p. m., May 28, by Board of Education, Union School District No. 9, Camillus, N. Y., for the construction of a school building. E. H. Sacket, 34 Syracuse Savings Bank Bldg., Syracuse, N. Y., is architect.

✣Bids will be received until 3 p. m., June 26, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior fixtures of the United States post office at Newark, N. Y. The building is one story and basement and has a ground area of approximately 3,900 sq. ft., non-fireproof construction, stone, brick, and stucco facing, and tin roof. Drawings and specifications may be obtained from the custodian of site at Newark, N. Y., or the Supervising Architect.

Ohio.

✣Bids will be received until 3 p. m., June 25, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures of the United States post office at Mansfield, Ohio. The building is two stories and basement and has a ground area of approximately 7,800 sq. ft.; first floor only of fireproof construction; tin roof; stone facing. Drawings and specifications may be obtained from the custodian of site at Mansfield, Ohio, or of the Supervising Architect. Official advertisement of the work will be found elsewhere in this issue.

✣Bids will be received until 3 p. m., July 1, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures of the U. S. Post Office at Newark, O. The structure is two stories and basement and has a ground area of approximately 6,900 sq. ft.; fireproof construction throughout; granite and marble facing and tin roof. Drawings and specifications may be obtained of the Custodian of Site, Newark, O., or at the office of the Supervising Architect.

Oregon.

✣Bids will be received until 10 a. m., June 3, by Board of Multomah County Commissioners, Portland, Ore., at the office of Whidden & Lewis, Architects, Wilcox Bldg., Portland, Ore., for the fixed furniture for four Circuit Court rooms and for two Justice Court rooms, as called for in the specifications for the west wing of the new Courthouse for the County of Multnomah, State of Oregon. Plans and specifications may be obtained at the office of the architects.

✣Bids will be received by the Board of Multnomah County Commissioners, Portland, Ore., at the office of Whidden & Lewis, Architects, Wilcox Bldg., Portland, Ore., for the painting and finishing work of west wing of the new courthouse for Multnomah County, State of Oregon. Plans and specifications may be obtained at the office of the architects.

✣Bids will be received until 10 a. m., June 3, by Board of Multnomah County Commissioners, Portland, Ore., at the office of Whidden & Lewis, Architects, Wilcox Bldg., Portland, for the office counters, with the wood work, steel, marble, iron and metal work, etc., in connection therewith, as called for in the specifications for the west wing of the new courthouse for the County of Multnomah, State of Oregon. Plans and specifications may be obtained at the office of the architects.

Pennsylvania.

✣Bids will be received until 3 p. m., June 27, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures of the United States post office at Chester, Pa. The work contemplated is the construction of a 2-story basement and unfinished attic ex
proximately 2,300 sq. ft. grou
first floor only is fireproof co
terior facing of stone and br
roof, and there will be certai
alterations in the present buildi
and specifications may be obtai
custodian at Chester, Pa., or of
ing Architect. Official adverti
found elsewhere in this issue

⦿Scofield Engineering Co
has been retained as Consul
in connection with a steam p
be built by W. J. Massee,
Plans are in progress and
start immediately.

South Carolina

✣Bids will be received until
21, by James Knox Tayl
Architect, Treasury Departmen
D. C., for the construction incl
gas piping, heating apparatu
duits and wiring, and interior l
of the United States post office
The building will be one story
of approximately 4,117 sq. f
brick faced, with stone trimmin
Copies of the drawings and sp
be obtained from the office of
of the site at Union, S. C., or
vising Architect.

Washington.

✣Bids will be received unt
28, by L. E. Pitz, Quartermas
Wash., for the repairing of
post.

✣Bids will be received until
22, by H. R. Stanford, Chief
Yards and Docks, Navy Dep
ington, D. C., for water closets
men, buildings 82 and 159 at n
Sound, Bremerton, Wash.

West Virginia

✣Bids will be received until
by James Knox Taylor, Superv
Treasury Department, Washing
the installation of a heating
apparatus, etc., for the Unit
office and courthouse building
W. Va., in accordance with th
specifications on file with the
of Construction at Charleston,
the Supervising Architect.

Wyoming.

✣Bids will be received
June 10, by Constructing
Mammoth Hot Springs, Wy
ing labor, and material fo
Annex to Hospital includ
heating, electric wiring and
Yellow Stone, Wyo. Officia
will be found elsewhere in t

✣Bids will be received unti
10, by Constructing Quart
moth Hot Springs, Wyo.,
and installing pews and oth
Chapel at Fort Yellowstone,
advertisement will be foun
this issue.

Canada.

⦿Barnett & McQueen of Min
have been awarded a contract
Northern Ry. for the constru
steel dock at Port Arthur, a
construction of new grain elev
have a capacity of several milli
cost of the dock will be in the
$30,000.

The Canadian government h
the two new departmental b
erected at Ottawa will be const
signs adopted after competitio
tects. The cost of the struc
up to over $5,000,000.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Practical Books for Engineers and Contractors

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Mathematics of the Paper Location of a Railroad

By J. C. L. Fish, Asso. M. Am. Soc. C. E. Associate Professor of Engineering of Leland Standford, Jr., University.
Paper, 4½x7½ inches. Price, 25 cents.

Telephone Line Construction — Methods and Cost

By Clarence Mayer, Formerly Cost Statistician and Facilities Engineer, Chicago Telephone Company. With additional data by J. C. Slippy, Consulting Telephone Engineer.
Cloth, 6x9 inches; 300 pages, 157 tables, 100 illustrations. Price, $3.00 net postpaid.

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By Homer A. Reid, Assoc. A. Am. Soc. C. E., Assistant Engineer, Bureau of [illegible], New York City.
Cloth, 6x9 inches, 906 pages, 70 tables; 716 illustrations. Price, $5.00 net, postpaid.

Engineers' Pocket Book of Reinforced Concrete

By E. Lee Heidenreich.
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Cloth, 6x9 inches, 700 pages, 306 illustrations. Price, $5.00 net, postpaid.

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By G. F. Dodge, M. West. Soc. Eng.
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By Arvid Reuterdahl, Sc. B., A. M., Chief of Bridge Department, Engineering Department, City of Spokane, Wash.
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Concrete Bridges and Culverts

By Henry Grattan Tyrrell, C. E.
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By Richard K. Meade, B. S., Formerly Editor of The Chemical Engineer
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Translated by Prof. D. B. Steinman, Department of Engineering, University of Idaho

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By M. B. Wells, C. E., Associate Professor Bridge and Structural Engineering, Armour Institute of Technology.

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By Jerome Cochran, C. E.

Land Drainage

By J. L. Parsons, C. E.

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CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noo**

NOTICE FOR BIDS.

Notice is hereby given that sealed bids will be received by the Board of County Commissioners of Twin Falls County, [illegible] A. M. [illegible] 1912, for the furnishing of all material and labor for the construction of two steel bridges across Rock Creek Canyon, in Twin Falls County, No. 1 to be located at or near the section line between Sections 21 and 22, Town 10 South, Range 17 E. B. M., and No. 2 at or near the section line between Sections 8 and 9, Town 10 South, Range 17 E. B. M., said bid to be according to specifications furnished by the bidders. Each bid to be accompanied by a certified check in a sum equal to 10 per cent of the amount of the bid; check made payable to the Treasurer of Twin Falls County, Idaho, as a guarantee of good faith on the part of the bidder that if awarded the contract he will forthwith accept the same and will enter into a contract under bond within ten days with the Board of County Commissioners of Twin Falls County, Idaho, and if he fail to do so said guarantee of 10 per cent will be forfeited to said Twin Falls County as liquidated damages to be used for the benefit of the Road and Bridge fund of said county.

Separate bids shall be submitted for each bridge. Bids to be sealed and marked "Proposal to construct Rock Creek Bridge No. 1"; "Proposal to construct Rock Creek Bridge No. 2," addressed to O. G. Zuck, Chairman, and mailed to E. J. Finch, Clerk, Twin Falls, Idaho, so that bids will be on file with said clerk on the date first above mentioned.

Profiles will be furnished on application to the clerk of the Board of County Commissioners. The Board reserves the right to reject any and all bids.

By order of the Board of County Commissioners, Twin Falls County, Idaho.

Dated Twin Falls, Idaho, May 14, 1912.

O. G. ZUCK, Chairman.

Attest:

E. J. Finch, Clerk.

NOTICE OF RECEPTION OF BIDS.

Notice is hereby given that the commissioners of the First Addition to the Rattlesnake Drainage District of Dane County, Wisconsin, will receive proposals for doing the work provided for the plans and specifications of said district on and up to the 29th day of May, 1912.

Copies of the plans and specifications may be obtained from Mathias Lindas, President of the Board of Commissioners, Deerfield, Wis., or from F. W. Hall, Attorney, Room 424, Washington Block, Madison, Wis.

Dated April 26, 1912.

MATHIAS LINDAS,
J. H. AUBY,
H. G. CLARK,
Commissioners.

BIDS WANTED.

Wanted, Bids for excavating 18.59 miles of ditch containing approximately 231,192 cubic yards of earth. Time for filing bids expires May 30th, 1912. For full instruction to bidders write W. B. Angelo, Plainfield, Wisconsin.

NOTICE OF LETTING DRAINAGE CONTRACT.

Sealed proposals for the construction of drainage canals in the Back Swamp and Jacob Swamp Drainage District, near Lumberton, N. C., will be received by the drainage commissioners of said district at Lumberton, N. C., up to 12 o'clock M., June 12, 1912, and at that time they will be publicly opened and read. Each proposal shall be inclosed in a sealed envelope and addressed to the chairman of the Board of Drainage Commissioners of the Back Swamp and Jacob Swamp Drainage District, Lumberton, N. C., endorsed "Proposal for Constructing Drainage Canals."

Each proposal shall be accompanied by a certified check, drawn payable to the order of the chairman of the Board of Drainage Commissioners, in the amount of $1,000; this check to be an evidence of the good faith of the bidder and to be held as liquidated damages in case the award is made and the contract and bond are not entered into promptly. Checks of unsuccessful bidders will be returned as soon as the award is made.

Specifications and blank forms of proposals will be furnished upon application, and a full set of maps, plans and profiles may be seen at the office of the Drainage Commissioners, or at the office of the Attorney for the Drainage Commissioners, at Lumberton, N. C.

The approximate length of these canals is 52 miles, and the approximate yardage to be excavated is 1,240,400 cu. yds. The work must be finished within two years from the letting of the contract and the commissioners will require three dredges to be operated at the same time.

The work will be let either as a whole or in sections, but no bid will be considered for less than one-third of the entire work. Bidders may submit bids for the whole of said work or for one-third thereof. The right is reserved to reject any and all bids.

G. B. SELLERS.
Chairman for Board of Commissioners.
THOMAS L. JOHNSON.
Attorney for Drainage District.

NOTICE FOR FURNISHING PAVING BRICK.

Sealed bids will be received by J. E. Farnum, City Clerk, up to 12 o'clock noon of Monday, the 10th day of June, 1912, for furnishing f. o. b. Miles City, Montana, 7,000 vitrified paving brick.

Bidders must submit samples, sizes and weights.

The Council reserves the right to reject any or all bids.

By order of the City Council.

Miles City, Montana, May 13, 1912.

J. E. FARNUM, City Clerk.

OFFICE OF CONSTRUCTING QUARTERMASTER.—Fort Huachuca, Arizona, May 9, 1912.—Sealed proposals will be received here until 10 a. m. June 12, 1912, and then publicly opened, for construction complete of eight inch steel water pipe line approximately eight and one-half miles long. Deposit of $10 required to insure return of plans and specifications. Information on application. J. L. JORDAN, Capt. and Quartermaster, U. S. A.

PROPOSALS FOR LABORA RY EQUIPMENTS AND SUPP ES.

City of Fargo, N.

Sealed bids will be received at fice of the City Auditor of the Fargo, N. Dak., until the hour o'clock in the afternoon of the of June, 1912.

First—For furnishing equipme filtration plant chemical laborato supplies therefor.

Second—For furnishing equipme apparatus for the chemical and b logical laboratory in the Milk an Inspector's office in said city.

Such proposals shall be carefully and plainly marked "Proposals for tion Plant Laboratory" or "Propo Milk and Meat Inspector's Labor as the case may be.

Each proposal shall be based up refer specifically to schedules whi be furnished, upon application, by L. Anders, City Engineer, Fargo, and by Dr. I. L. James, Meat ar Inspector, Fargo, N. Dak.

Each proposal shall be accompa a certified check in the sum of insure execution of contract, if aw

The successful bidder will be to enter into contract with the such equipment and furnish a bo sum equal to the amount of suc tract, indemnifying the city agai lay in delivery, or materials below

The City Council reserves the reject any and all bids, or any pa bid, and to accept any bid or part of.

Dated this 8th day of May, 1912

E. R. ORCAHR
City Audi
Fargo, N

PROPOSAL.

Fort Bliss, Texas, May 17

Sealed proposals in triplicate wil ceived until 12 Noon, June and then opened for furnishing la material for constructing sewer p connecting outfall sewer at with sewerage system of El Paso Information furnished upon app Envelopes containing proposals dorsed "Proposals for Sewer Pip and addressed to constructing master.

CAPT. ROBERT J. RE
Constructing Quarte

TREASURY DEPART
Office of the Supervising A
Washington, D. C., May 16th

SEALED PROPOSALS will be in this office until 3 o'clock p. m 27th day of June, 1912, and then for the extension, remodeling, etc. ing plumbing, gas piping, heating tus, electric conduits and wiring, terior lighting fixtures), of the States post office at Chester, Pa.

The work contemplated is the c tion of a 2-story basement and un attic extension of approximate square feet ground area. The fi only is of fireproof construction facing of stone and brick with sl and there will be certain repairs terations in the present building

Drawings and specifications ma tained from the custodian at Ches or at this office, at the discretio Supervising Architect.

JAMES KNOX TAY
Supervising A

CALLS FOR BIDS

e, $2.40 an inch, single column. Copy received until Monday noon.

CE TO CONTRACTORS

WATER WORKS.

Appleton, Wis., May 9, 1912.
posals will be received by the
Board of Commissioners of Ap-
sconsin., until 9 o'clock a. m.
1912, and then publicly opened.
pment complete of a [illegible]
, as follows:
[illegible] gallon filter [illegible]
pumping unit of two and one-
[illegible] gallons capacity [illegible]
(24) hours
pumping units each of two (2)
lons' capacity in twenty-four

miles of pipe, hydrants and
ach bid must be accompanied
ied check for five (5) per cent
unt of the bid, made payable
rd of Commissioners.
bond, acceptable to the Board
sioners, for fifty (50) per cent
ract price will be required.
t is reserved to reject any or

and specifications address the
. H. Vinal.

J. V. CANAVAN, Mayor.
JOHN GOODLAND, JR.,
E. SCHUELLER.
Commissioners.

)TICE FOR BIDS.

[illegible] specifications for a system of
ks to cost about $15,000 are on
e Village Clerk of Louisville,
the Alamo Engire & Supply
ers, Omaha, Nebr. All con-
iring a copy of the plans and
s for their own personal use
a copy from the Engineers for
at Louisville, Nebr., May 13,

C. A. RICHEY,
Chairman of Board.

R CONSTRUCTION.

[illegible] will be received [illegible]
Commissioners of Sandpoint
the necessary material and
[illegible] about [illegible] feet of

be received until 12 o'clock
15 1912, and then publicly

n on application.

M. J. COSTELLO, Clerk,
Sewer Commission.

Hot Springs, Wyo., May 1
proposals in triplicate, wi
ere until 2 P. M. [illegible]
then publicly opened, fo
abor and materials for con-
[illegible] to Hospital, including
ating, electric wiring and
Fort Yellowstone, Wyo. In-
rnished on application. En-
aining proposals to be in-
osals for Annex to Hospital"
d to Constructing Quarter-

Hot Springs, Wyo., May 17.
proposals in triplicate, will
ere until 2 P. M. June 10
then publicly opened, for
d installing pews and other
Chapel at Fort Yellowstone
nformation furnished on ap-
nvelopes containing propos-
orsed "Proposals for Furni-
pel" and addressed to the
r Quartermaster.

NOTICE TO CONTRACTORS.

[illegible] until the 20th day of June, 1912, for the following buildings at Tucson, Arizona:

1 Station Building
[illegible]
1 Engine house.

[illegible] Building, El Paso, Texas.

Separate bids on each building must be in writing, addressed to such Engineer, and accompanied by certified check equal to five per cent of the amount bid, as evidence of good faith, and security for the giving of a Surety Company bond for fifty per cent of the contract price for the performance of the work.

Each separate bid shall be enclosed in a separate envelope endorsed as such bid and have the name of the bidder written thereon.

The Company reserves the right to reject any or all bids.

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General Manager.

NOTICE TO SEWER CONTRACTORS.

Sealed proposals for the construction of sanitary sewer and storm sewers and appurtenances in the city of Watertown, Wisconsin, will be received at the office of the board of public works in said city, until Saturday, the first day of June, 1912, at two (2) o'clock P. M.

The work comprises, approximately:

SANITARY SEWERS.

2,627 feet of 8 inch vitrified pipe;
60 feet of 8 inch cast iron pipe;
2,815 feet of 10 inch vitrified pipe;
991 feet of 15 inch vitrified pipe;
16 manholes;
2 ordinary flushtanks;
[illegible] automatic flushtanks;
63 lineal feet of 6-inch risers.

STORM SEWERS.

160 feet of 10 inch vitrified pipe;
365 feet of 12 inch vitrified pipe;
327 feet of 15 inch vitrified pipe.
6 catch basins;
2 manholes.

Plans, profiles, specifications and form of contract may be seen at the office of said board.

ARNOLD KRAEFT,
[illegible]

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., May 15, 1912. SEALED PROPOSALS will be received at this office until 3 o'clock p. m. on the 25th day of June, 1912, and then opened, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures), of the United States post office at Mansfield, Ohio. The building is two stories and basement and has a ground area of approximately 7,800 square feet; first floor only of fireproof construction; tin roof, stone facing. Drawings and specifications may be obtained from the custodian of site at Mansfield, Ohio, or at this office, at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

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Calgary, Alberta.

U. S. ENGINEER OFFICE.—Galveston, Texas, May 1, 1912. Sealed proposals for constructing concrete sidewalk, brick pavement, concrete curbing and drains at Fort Travis Reservation, Port Bolivar, Galveston, Texas, will be received here until 12 o'clock noon, May 31, 1912, and then publicly opened. Information on application. EARL I. BROWN, Major, Engrs.

NOTICE.

Bids for the improvement of about two and one-half miles of streets by curbing, grading and paving the same, estimated cost is about $85,000.00, will be received by the Board of Local Improvements of the City of DuQuoin, Illinois, until the 24th day of May at 9 o'clock a. m., 1912.

Plans, profiles and specifications on file with the City Clerk.

E. E. JACOBS, Mayor.

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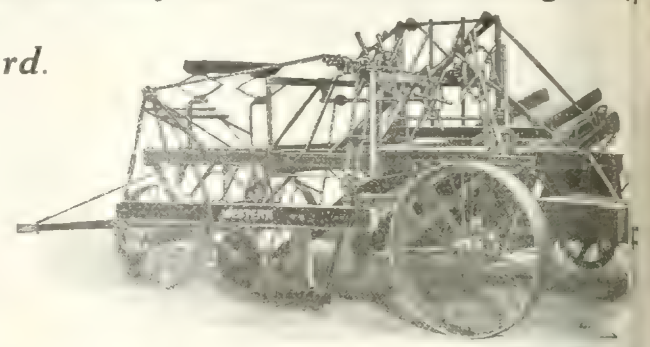

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BY HALBERT P. GILLETTE, M. Am. Soc. C. E.
Editor Engineering & Contracting

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A Correction.

[illegible] May 15, page 547, the cost [illegible] the world's deepest diamond drill given. The decimal point is mis- he column showing the cost per It should be one place more to aking the cost per lineal foot ten indicated.

as a Means of Preventing of Buildings in Sinking djacent Foundations.

is a familiar resort for solidify- . Recently it is becoming increas- ar as a means for solidifying earth d rock. Its first considerable use ter purpose was perhaps in sink- through unstable and water-bear- l. Then came its use in tunnel- osing rock seams which admitted e workings. Lastly it has been n solidifying subsoils on which dations were to be built. In all grouting has proved its efficacy, now be included, we think, among engineering procedures.

estion has been seriously raised mage may not exist to the founda- icago buildings because of the ac- draining off in new foundation e sand lying between bed-rock and vering. To appreciate the possibil- f explanation of the subsoil con- Chicago's heavy building district y. Bed-rock in downtown Chi- t a depth varying from 80 to 130 ng it are gravel and sand, hard- clay. In places the hardpan lies rock, but more generally a sand stratum intervenes. In heavy rk curbed wells are sunk to rock, es, only to the hardpan above it, wells, filled with concrete, form which the building columns are naller buildings universally and e older heavy buildings are found- ager footings, or piles, within the verlying the hardpan. The possi- nt feared is that of the older and ildings, whose foundations are above hard material, due to the process of sinking foundation wells to rock for new [illegible]

In sinking these wells the earth is excavated and the well curbed with wood staves until rock bed is reached. When the material directly overlying the rock is sand and gravel it commonly carries water enough to make considerable pumping necessary. This pumping draws quantities of sand from the gravel layer adjacent to the well and when a score or more wells are sunk for a single building the depletion of sand from the surrounding material may easily be considerable and may extend for considerable distances beyond the actual building area. It is anticipated that the void thus left may allow the material above to sink and carry down with it the floating foundations. Obviously the amount of settlement cannot be great, but of course no great sinkage, particularly if it be uneven, is required to cause material damage to building superstructure.

That the possibilities cited are not groundless is indicated by frequent instances of settlement of buildings adjacent to new well foundation work. As a specific example we may instance the foundation work now in progress for a new large building near the Dearborn St. railway station in Chicago. Well foundations are being sunk. The adjacent buildings are all of the older generation and have foundations at no great depth within the upper clay. The old building immediately adjacent to the new foundations was underpinned in anticipation of damage, but no precautions were taken in case of the next building beyond. Both buildings have settled. In the case of the building which was underpinned this settlement has been uniform and the upper structure has suffered no damage. The second building, which was not underpinned, has, however, settled unevenly and has been considerably damaged.

Such instances of settlement are of course common under other conditions of subsoil and foundation construction than have been described as peculiar to Chicago and to lay the cause in this instance to the removal by pumping of the sand next to the bed-rock may seem like seeking far afield for a reason that sits on the doorstep, but this is the cause to which the builders lay the trouble. It is to be noted in support of their contention that settlement followed the pumping of the wells and progressed as the pumping continued. Altogether the building which was shored up and settled evenly sank about 4 ins. This example is only one of many that are offered as evidence by architects and engineers who support the argument that there is hazard in the continual removal of sand from over the bed-rock by sinking foundation wells.

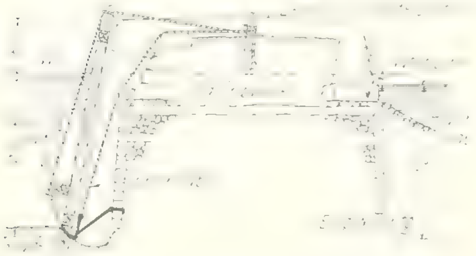
Without going into details of the exact method to be followed, it would seem from the success had with grouting that it might be employed in foundation well sinking so as to do away entirely with the abstraction of sand from the soil surrounding these wells and perhaps even might make pumping unnecessary. For example, if when the gravel stratum had nearly been reached in sinking a caisson, several pipes, say, for example, well points, were driven downward and outward at points around the periphery of the excavation and grout were forced through these into the gravel, it would harden and form a collar around the well bottom and completely prevent any dangerous inflow from the sides. Only very simple apparatus would seem to be necessary for this grouting operation; the distance from the surface down to the gravel stratum would, it would seem, be great enough in nearly all cases to give a gravity pressure sufficient to inject the grout well into the soil. In such case, a surface grout tank and lines of hose from it to the well points would be all the apparatus required.

We are not aware that grouting has ever been attempted for the exact kind of work described. In an instance of which we know in Chicago air locks were fitted into the wells and the water-bearing strata were excavated through under air pressure. Doubtless this would be the logical procedure when the depth of water-bearing material was considerable. In most cases, however, we understand that the gravel stratum is not thick, and when it is not, grouting would seem to be a very simple recourse. We should be glad to hear the opinion of our readers experienced in foundation well driving in Chicago.

GENERAL ARTICLES

Method of Facing and Capping With Concrete a Crib and Stone Dam.

The accompanying drawing shows a section of a crib and stone dam which was faced and capped with concrete, while submerged as indicated. The work formed a portion of the Lachine Canal improvement and is described as follows in "Contract Record," April 24, 1912, by Lieut.-Col. Lordly, Engineer in Charge, Lachine Canal:



Sketch Showing Method of Facing Submerged Dam with Concrete.

At the time of doing the work there was a head against the upper side of the dam of about 1 ft. and accompanied by heavy waves during windy weather. This dam was originally a crib and stone structure which had been badly damaged by the action of the ice and freshet of previous years, thus causing heavy leaks through it. The object of the dam is to form an entrance into the upper end of the canal and to prevent vessels from being swept into the swift current of the River St. Lawrence. The sketch shows the method of holding in place the big timber molds, behind which the concrete was to be deposited, and secured to the cribwork of the dam.

The 100-ft. molds, formerly made for the work on the canal slope walls, were used but were secured in a different manner than before as the facing of the dam is almost vertical. The slope walls were 1 to 1, and it was quite easy to keep the molds from sliding. In this case the footing for the mold was also poor as the toe of the dam had been clammed out to form a trench for the new foundation. This meant a different method than before of holding up the molds in position and providing means to keep them in place at the bottom.

Five steel cables were used with each mold, three of ⅝ in. and two of ⅞ in. The former were attached to the inside bottom of the mold and sufficient tension was put on when tied to the top of the dam to make the cable tight. The other two cables were first fixed by the divers to the bottom of the crib, about 3 ft. up, and carried out under the mold and then up over the outer face, twisted around a timber at the top of the mold and then secured to a post fixed on the dam. These cables were got ready and laid on the bottom before the molds were lowered into place. Without these latter cables the weight of the concrete mass behind the mold would cause it to swing outward on the hinge formed by the three inner cables. The inner cables were only to carry the weight of the mold and to keep it from settling down. A bulkhead of plank was then placed at the ends of the mold, and at intermediate points, depending on the current, thus confining the water and stopping the eddies. The greatest difficulty appeared in preventing the water from rushing through the loose crib and stonework of the old dam. This was overcome by placing large sheets of canvass against the face of the old crib and securing it well down at the botom. Once in place the water held it in position and a few batches of concrete at the bottom soon overcame any leakage. The entire length of concrete facing done in this manner was exactly one-half mile and every leak in the dam was successfully stopped. The wave action due to the winds, and passing steamers, which came close to the dam, caused some trouble in operating the plant at times, but the steel cables prevented the molds from moving. The success of this kind of work depends largely on the precautions to firmly secure the molds in position and to keep them watertight.

The concrete is usually best filled in behind the molds, under the conditions of this work, by filling about one-third the depth first, moving from end to end of the mold while filling, and completing the section after this has set. If the molds are filled immediately to the top a slide is apt to occur.

A concrete consisting of good coarse sand and run of crusher stone, mixed a little better than 1:3:6, proves suitable for ordinary work, but if there is much agitation behind the molds, and some leakage, it will be necessary to add at least one bag of cement more per each yard placed. The molds were generally removed on the fifth day after the concrete had been placed behind them. With some slight exceptions the face of the wall was even better than is ordinarily seen in work done in the dry. The dam above described when finished completely will have both the sides and the top faced with concrete and the nose of the coping protected by a 14x⅜-in. steel plate. The outer end, or ice breaker, is completely protected by a steel plate covering.

Dry Season at Panama.—The dry season, now closing at Panama has been the driest of record on the Isthmus since the American occupation of the Canal Zone, and judging from the records available, probably the driest since the earliest French days. The month of April completes five months of continuous dry weather. During the period from December, 1911, to April, 1912, inclusive, the rainfall has amounted to only 5.18 inches or 27 per cent of the normal for the dry season. Last year the dry season rainfall amounted to 36.57 inches or 188 per cent of the normal.

Backwater Effects of Exposed d Submerged Dams on the Rock and Rapids of the Upper Mi sissippi River.

Contributed by Charles W. Durham, Assistant Engineer, Upper Miss River Improvement.

It is not the intention of the wri cuss the merits of the various back mulas, but to state actual results in authenticated cases on the Rock Islar

Much attention has been given of to the backwater effects of both and exposed dams in modifying s reducing currents on river rapids bottom is of rock, and in deepening on shoals. In many instances streams, especially in France and submerged dams extend entirely river and form ground-sills, but th are usually built on alluvial or toms, and not so much for the backwater as for the collection o and prevention of scour. In the tioned below, the dams run across channel water only, connecting, h one case (Dam 18) with an expos

On the upper Mississippi River efficient example of submerged dams below Duck Creek Chain on the R Rapids. Figure 1 is a sketch of D Chain and vicinity, showing the other features mentioned in the below.

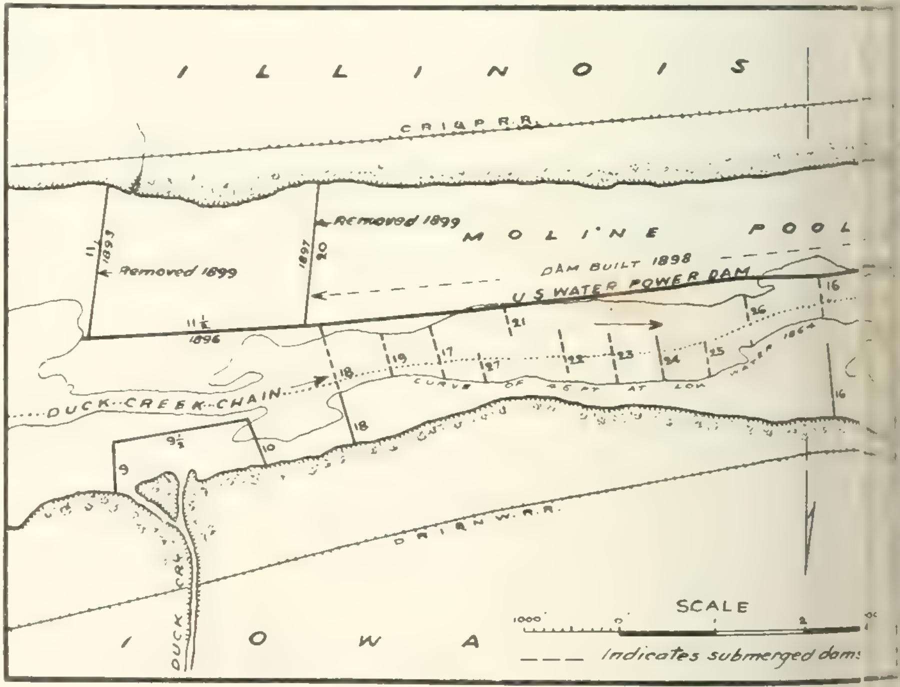


Fig. 1—Duck Creek Chain, Rock Island Rapids, Mississippi River, Improvem Backwater of Submerged Dams.

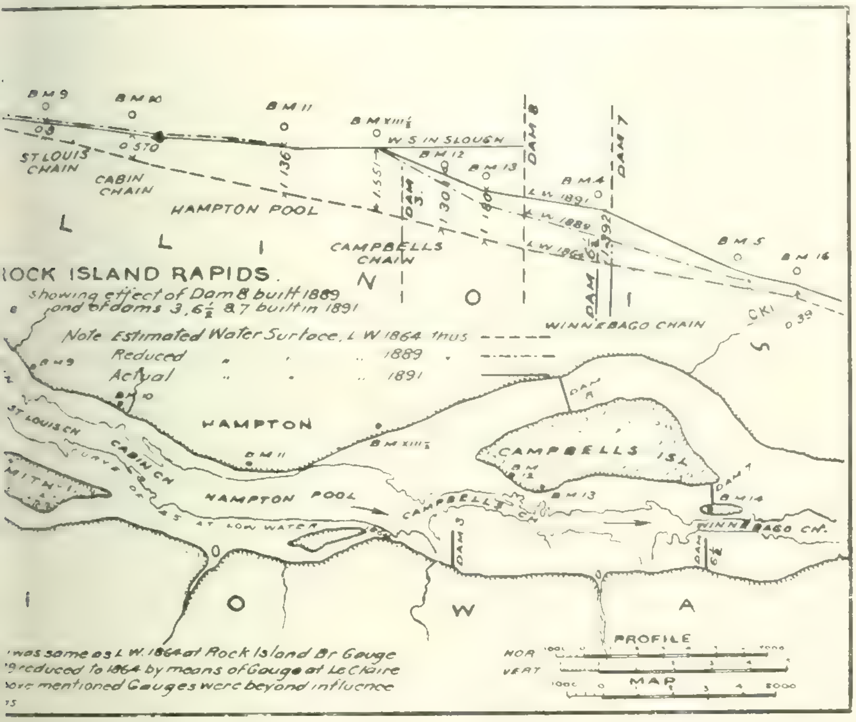
Duck Creek Chain was the first merous rocky chains obstructing to be improved (1867), and it was covered that the supposed extreme plane to 4 ft. below which, th by cofferdam and chisel boats wa out, was erroneous, and that the channel through the chain was shallow, affording only 3 ft. inste required 4 ft. at extreme low w remedy this error by rock excava cofferdam and chisel boats or drillbo have been very costly, and recourse to contraction of waterway. A tra (9½—1885) was built along the low ek Chain, connected with the shore lam traverses (9 and 10—1893). A ½—1896) was also built on the I opposite Duck Creek Chain, con- e wing dams 11 and 20. It is to be the contraction thus secured was e to the Illinois' wings, as the long d the Moline pool dam was not nuous, and the gap was not closed

The effect of these dams, all of e built to a crest elevation of 4 ft. water, was to deepen the channel entire length of the chain, but not at the foot. The current, mod- he beginning, was so increased pstream navigation very difficult; in current on this chain became the the rapids. To moderate this cur- to increase the depth on the lower e chain, a series of 11 submerged constructed in 1898, crossing the low the chain at about 500 ft. in- e upper one being about 1,000 ft. n from the lower end of the chain, wer one about 6,000 ft. farther

determine the [illegible] backwater due to the submerged dams, on account of the complications introduced by the numerous wings and longitudinal dams, but in view of the moderated current and soundings at the foot of the chain, it is estimated that the resultant backwater is about 1 ft. at that locality.

A project has been made for raising the low-water surface at head of Duck Creek Chain 2 ft., so as to afford 6 ft. at low water, by means of the backwater from a series of exposed wing dams extending upstream from Bettendorf, which is about 4 miles below the foot of the chain.

To still further improve, by means of backwater and contraction, the channel at Campbell's Chain (Fig. 2) after the rock excavation by means of cofferdam and chisel boat had been completed, the chute was closed (8—1889, and 3 others were built, 3, 6½ and 7—1891). Of these dams, which were built of the regular shape of rock and brush, the closing dam had a crest elevation of 6 ft. and the others 4 ft. at low water. The backwater effect of these dams has resulted in



etch Showing Effects of Dams Built to Obtain a Deeper Channel for Navigation.

. These dams, with a crest eleva- t. below low water, extend wholly across the channel (not the water- rding to the depth of water at ty. The submerged dams were in reducing the slope and conse- ity of the current, and in providing depth at the lower end of the ere was no attempt to build these ny regular cross section or shape, l, which was broken rock obtained nse other than the handling, from ation at other chains being thrown es on prescribed lines with more speed than accuracy.

en found impracticable to exactly

material increase of depth on Winnebago, Campbells, Cabin and St. Louis chains, and a lesser but beneficial increase above. The sketch and profile (Fig. 2) and Table I shows the results in detail.

The velocity of the current on Campbell's Chain was sufficiently increased to keep the channel clear of troublesome sand deposits working down from Hampton Pool, but not enough to interfere with upstream navigation.

A bill has been introduced in the French Chamber of Deputies to authorize a loan of about $30,000,000 for various railway and harbor improvements in French West Africa.

WATER SURFACES ON THE ROCK ISLAND RAPIDS, SHOWING THE PERMANENT EFFECTS OF DAMS 3, 6½, 7 AND 8.

Inter-mediate stances Feet.	Elevation At L. W. 1864. Feet.	Elevation At L. W 1891. Feet.	Increment. Feet.	Location of Bench Marks.
..	39,758	39,769	0.011	Head of Sycamore Chain.
2,000	38,009	38,112	.013	800 ft. above foot of Sycamore Chain.
3,100	36,668	36,761	.093	Head of Crab Island Chain.
2,650	36,263	36,608	.345	Head of St. Louis Chain.
3,000	35,704	36,274	.570	800 ft. below head of Cabin Chain.
6,400	34,787	35,923	1.136	Hampton, Ill.
3,300	34,372	35,923	1.551	600 ft. above head of Campbells Chain.
2,800	33,812	35,113	1.301	Foot of Campbells Chain.
1,300	33,512	34,692	1.180	Opposite pool below Campbells Chain.
4,650	32,838	34,230	1.392	Head of Winnebago Island.
4,900	32,265	32,665	0.400	Abreast of pool below Winnebago Island.

The L. W. of 1891 coincided with that of 1864 at all points along the river from St. Paul except on the R. I. Rapids.)

Use in Italy of Pozzuolana with Portland Cement for Marine Concrete Works.

The use of reinforced concrete for structures in sea water is questioned by many engineers. The possibility of corrosion of the reinforcing metal exists and prudence, it is asserted, urges that no chances be taken. It is interesting to note, therefore, in a report to the International Congress of Navigation by Mr. L. Luiggi, Inspector General, Corps of Civil Engineers, Italy, the claim that a mixture of pozzuolana with Portland cement will produce a concrete impervious to and unaffected by sea water and in which, consequently, reinforcement can be used safely. The following extract describes the process of making the impervious concrete:

A proportion which gives good results is that of the addition of 100 to 150 kgs. of finely powdered pozzuolana, according to the quantity of soluble silica contained in the various classes of pozzuolana from Baccoli or Rome, to the weakest regulation mixture, adopted by the Italian government for reinforced concrete, of 300 kgs. of cement, 0.4 cu. m. of sand and 0.8 cu. m. of gravel, or stone broken to pass through a ring 3 cms. in diameter. When the proportion of cement is to be increased, as happens, for example, in the manufacture of the large hollow or floating blocks used in the foundation of breakwaters, or other structures exposed to the shock of waves, and in which 400 to 450 kgs. of cement should be used; or again for piles to be driven with the pile driver and wherein the amount of cement is raised to 450 or 500 kgs., the quantity of pozzuolana should also be increased and carried to one-third to one-half the quantity of cement entering into the composition of the mortar. The cement and pozzuolana should be mixed dry. The use of crushers is to be advised in order to grind up the grains of pozzuolana and to obtain a close and uniform mixture with the cement. This is the method which has been adopted for certain works in California. The mortar or the concrete is then made by mixing the ingredients with all the precautions recommended by experience.

Cost of Making Cement Drain Tile by Hand on an Isolated Job.

Contributed by R. C. Hardman, Superintendent of Construction, War Department, Fort Huachuca, Arizona.

The work here described was in an isolated place where clay drain tile could be secured only at an exhorbitant price. The freight alone amounted to about 20 cts. per ft. Resort was, therefore, made to cement tile matched by hand, using unskilled Mexican labor. The length of the tile made was 297 lin. ft.

Two sets of wooden forms were built, each having molds for six sections of tile; these formed the outside. For the core mold, or inside form, a galvanized iron cylinder was used. This cylinder was centered inside the wooden mold and pulled as soon as the cement was placed, to be inserted in another wooden mold. The wooden forms were let stand 24 hours before removal. All cement was hard tamped and was a 1:4 hand mixture. The tiles molded were 8x8 ins.x2¼ ft. outside and 6 ins. diameter inside. The cost was as follows:

Materials:	Cost.	Cost per ft.
Cement, 4.5 bbls., at $3.43...	$15.44	
Sand on site....................	.	.
Lumber, scrap	.	
	$15.44	$0.0519
Labor:		
Carpenter, 9 hrs. on forms, at $0.50	$ 4.50	$0.0152
Laborers, 66.5 hrs., at $0.15625...	10.39	. .
Laborers, 17.0 hrs., at $0.1875...	3.19	0.0457
	$18.08	$0.0609
Total	$33.52	$0.1128

EARTH AND ROCK SECTION

Types of Shaft Bearings for Gyratory Crushers.

The central or vertical shaft on which the crushing head of a gyratory crusher is mounted must necessarily be itself strong and heavy and be supported by a bearing of great strength and durability. In some of the largest crushers the weight of the shaft and head amounts to 75,000 lbs. The bearing has to provide not only for this great weight and all crushing shocks but has to permit of both a lateral or "rockable" motion and a rotary motion of the shaft. Naturally different designers have worked out different solutions of this bearing problem, and in the accompanying cuts and descriptions we outline three of these solutions. The descriptions are substantially as contributed by the engineers of the different manufacturers.

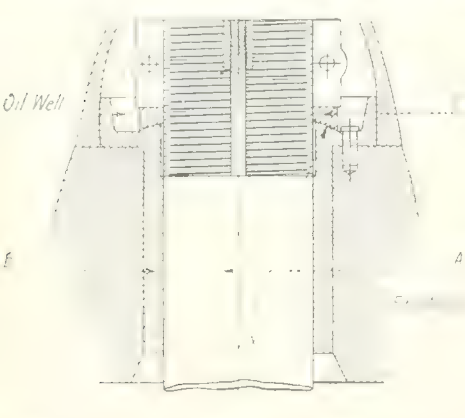


Fig. 1—Section Showing Design for Ball and Socket Suspended Shaft in a Gates Crusher.

BALL AND SOCKET SUSPENSION

The suspension bearing illustrated by Fig. 1 is known as the ball and socket type used on the Gates breaker built by Allis-Chalmers Co., Milwaukee, Wis. This bearing, besides taking care of the lateral movements, permits of a fixed lower fulcrum plane for the shaft as well as an easy vertical adjustment. The shaft *A* has surrounding it a bushing *B* which bushing is fixed in the spider. The upper surface of this bushing is machined in the form of a portion of a sphere, whose center is the fulcrum point of the shaft. Upon this spherical portion of the spider bushing there is placed a bearing ring *C*, the lower side of which is also machined as a portion of a sphere whose center also is the fulcrum point *X* of the shaft. The upper side of the bearing ring is machined flat and grooves are cut in both the lower and upper sides. Around the upper end of the crusher shaft and engaging in a threaded portion at the top of the shaft there is a heavy split supporting nut, the bottom surface of which rests upon the upper plane of the supporting ring. To adjust the shaft vertically this split nut may be loosened and the shaft raised or lowered by screwing up or down the split nut. This type of suspension forms a true ball and socket bearing, whose center is the fulcrum point of the shaft and with this construction the full surface of the bearing is effective at all times.

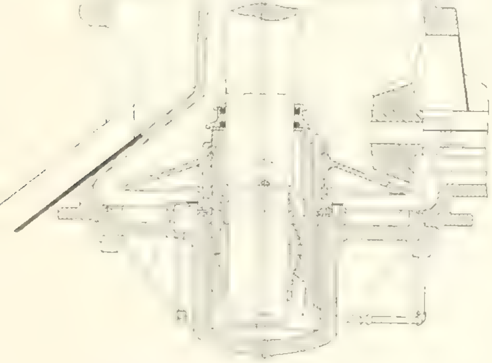


Fig. 2—Section Showing the Bronze Ball Supported Shaft in a Chalmers and Williams Crusher.

Around the outside of the spherical machined portion of the spider bushing there is an upward projecting flange forming a deep well for the reception of oil and into this well a large quantity of oil is poured, making the bearing operate submerged in oil at all times and insuring ample lubrication without constant attention.

In the operation of the breaker before stone is dumped into the machine friction may cause the shaft to rotate in the same direction and with the eccentric at the bottom of the machine. However, when rock is introduced into the breaker the rotation of the shaft in that direction has been found not only to be retarded with the ball and socket bearing, but the shaft sometimes turns in the opposite direction. It accordingly appears that this shaft has two independent motions, the bearing ring taking care of both these movements, the rocking motion caused by the eccentric on its lower curved bearing surface and the rotation caused by the load on its upper planed surface.

BRONZE BALL BEARING

Figure 2 shows the spindle bearing of the gyratory crusher made by the Chalmers & Williams Co., Chicago Heights, Ill. The following description is from information furnished by Mr. W. B. Easton, chief engineer of the company:

The main spindle which carries the head in all gyratory crushers is inclined at a slight angle from the vertical line—approximately 1/100 in. to the inch in its length. This, of course, brings one side of the head nearer to the concaves than the other side. The lower end of this main shaft or spindle rests in a bearing which in turn revolves in the bottom casting, this bottom casting being bored out true with the vertical center line of the crusher.

The bearing itself, which surrounds the lower end of the main shaft, is bored out by a center line which is drawn through the point where the inclined axis or the center of the inclined shaft would intersect the center of this bearing. This, of course, makes the inside bore of the bearing about a different center or eccentric to the outside surface of the bearing so that as this bearing is revolving in the bottom casting, a point on the head on the main shaft, on account of the angularity of the shaft is continually approaching the concaves which surround it and which are fastened inside of the liner section.

This bearing, which runs around the main spindle outside of the bottom casting and to which the bevel gear is fastened, is called the eccentric. In all other eccentrics but the Bronze Ball eccentric, the bore or hole through this eccentric is and must be at the same angle with the vertical line as the main shaft.

If the material of which the main shaft is made was such as to permit of absolutely no spring or variation from its position when standing still, there would be no reason for any other bearing or kind of bearing than the one described, but, as a matter of fact, no manufacturer of crushers can put a sufficient amount of material into these main shafts or can get a material which absolutely will not spring out of line; therefore, the action of crushing continually tends to bend the shaft which is supported at the top in one and at the bottom in another. For the effect of a very hard mass jammed in on one side would be the head to the opposite side, or, as is held rigidly at the top and bottom, it at about that point. This, of cours tend to deflect the lower end of the that instead of lying parallel through of the eccentric, it would tend to

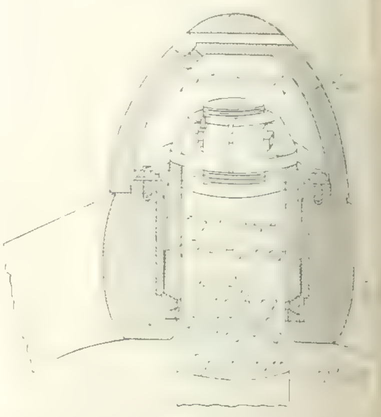


Fig. 3—Section Showing Upper Su of Shaft in an Austin Crushe

the top in one direction, and at t in the opposite direction.

Referring to Fig. 2 it will be the bearing *Y* in the eccentric is the bearing in a ball and socket pill and therefore the bore through it, the vertical shaft runs, can be made to the shaft and because it is free to it can take any position in its ball an seat to suit any change in the ang the lower end of the shaft may ma the vertical line.

The difference in distance between caves and the head on one side and caves and head on the other is du amount of angularity which the given from the vertical line. If t shaft occupied a vertical position, the would, of course, not crush at the greater this angularity, the gre rapidity of crushing. Therefore, which tends to reduce this angularity amounts to the same thing) reduces centricity of the bearing in which shaft runs, reduces the output of the

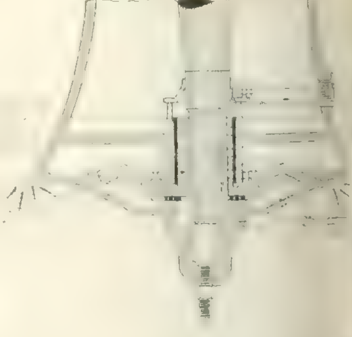


Fig. 4—Section Showing Lower Be Bearing of Shaft in an Austin Cr

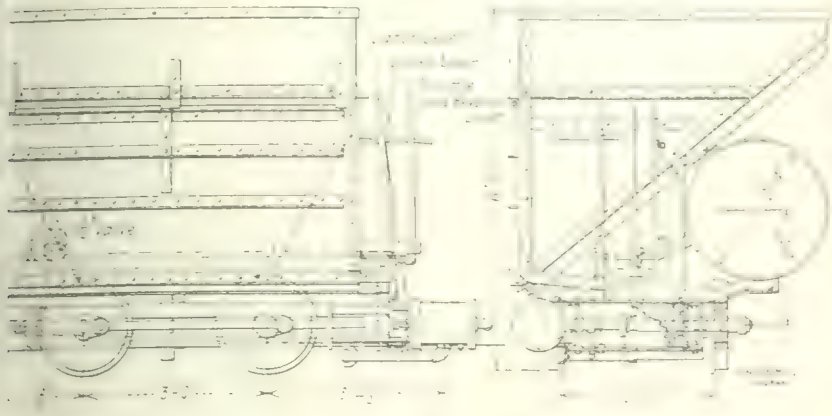
SUSPENSION AND ECCENTRIC BEAR

Figures 3 and 4 show the suspen eccentric bearing of the gyrating crus by the Austin Manufacturing Co., Ill. The following description is formation furnished by Mr. O. E sales manager:

The design shows a suspended bear

below which is used [illegible] vle making an adjustment on the pension bearing. As shown by Fig. it is suspended upon a [illegible] the hub of the spider, the eccentric the shaft being the least possible this point. The ideal suspension would be from a point [illegible] o motion but as this point is lo- in the shaft itself such suspension hanical impossibility. The object the Austin design was to provide tion in which the weight is carried surfaces formed concentrically with of gyration and located as near to as possible. The result is a col- from the shaft and bearing upon ng ring as shown in Fig. 3. The the ring and collar are curved so oduced in the direction of the mo- e shaft these surfaces would inter- xis of gyration at the point where on is zero, or, in other words, these rfaces are made to conform to the the shaft.

er eccentric bearing of the Austin [illegible] Fig. 4, which [illegible]



Dump Car Driven by Air Engine Automatically Charged Each Trip.

the lubricating system. The shaft ough a babbited collar which is the beveled gear. The weight of and gear is carried on several brass shown. The collar is babbited ec- that is, there is a greater thick- bbit on one side than on the other. collar is revolved therefore the ring through it is caused to gyrate. nut and bolt through the extreme c crusher, shown in Fig. 4, is used e shaft while making adjustment to bearing, this adjustment affecting the crushed material.

matically Charged Air-Driven Side Dump Car.

illustrated in the accompanying vas designed by S. A. Worcester a mine where it carried material d returned empty. The car is de- Mr. Worcester in the "Engineering Journal." Air was available at 100 re but electricity could not be con- used for the work.

-in. air receiver is mounted on the and is automatically recharged after while at the loading station. A coupling on the car which is con- the receiver, enters a corresponding tionary coupling as the car strikes r at the loading station. When the are brought together the stems of valves encounter each other and opened, thus admitting air from the air line to which the female coup- tached, to the receiver on the car. car starts away, separating the the pressure instantly closes the es, thus preventing any loss of air. ines are of simple construction and so that as few adjustments as pos- necessary, for they are used by unskilled operators. The construction of the car is inexpensive, the number of parts being few and the same pattern being used for both engines with but few and slight changes. The engines are reversed and controlled by a single throttle and reversing slide-valve in front of the operator and exactly similar to the slide-valves of the engines. Moving the lever controlling this valve in either direction starts the car in the corresponding direction and placing it vertically shuts off air from the engine.

The axle bearings and rod bushings are made of cast iron. The crossheads are made of cast iron turned to fit the guides, and are equipped with straight pins. The cylinders are cast in one piece with the valve chests and front heads. The pistons are riveted to the piston rods which are screwed into the crossheads. Plain snap rings are used for piston packing. The eccentrics are cast on the drive wheels and eccentric straps and rods are forged in one piece and valve stems are made without any adjustment for length, so that when set they cannot be moved out of adjustment by unskilled operators. The brake [illegible] pressure at the air coupling, which is sufficient to push the empty car away if the brake is not set. The car door latches are lifted by the lever at the left of the operator and all three operating levers are nearly vertical and close together, making a convenient and safe arrangement.

Recent Practice in Subaqueous Rock Excavation in France.

Harbor and channel improvements in France involving the excavation of rock under water are reported upon for the International Congress of Navigation by Mr. P. Vidal, Engineer in Chief, Ponts et Chaussees. Mr. Vidal states that except for isolated small areas where expensive plant was not warranted very little rock excavation has been done recently by blasting. For larger works involving considerable quantities recourse has been had either to excavation inside caissons or to stamping followed by dredging of the matters disaggregated. The movable caisson has generally been preferred when it was required to deepen the bottom along a wall founded on the rock, for increasing the draft of water in front of quay. It is thus that, at Nice, part of the harbor was cleared of rock by means of a caisson having an area of 82.5 sq. m. (99 sq. yds.), suspended from two lighters. The plant was electric, both that for compressing the air and that for raising and lowering the suspended caisson by means of 41 electric jacks, and bringing up the debris. The motors had a collective force of 90 to 100 h. p.; and a gang of 14 miners, in the caisson working, removed from 3 to 4 cu. m. (on an average more than 4 cu. yds.) per hour.

At Nantes the removal of 6,000 cu. m. (20,987 cu. yds.) of hard rock was lately undertaken, in order to form, at the foot of a quay wall, a depth (*souille*) 20 m. (nearly 22 yds.) wide. As the stability of the quay wall appeared precarious, only execution by compressed air was contemplated; but as the expense and the time required seemed too great, it was dcided to take off, by means of a movable caisson, a band only 6 m. (6½ yds.) wide, quite at the foot of the masonry, and to remove by stamping the remainder of the rock, thus isolated from the works that had to remain. The removal by stamping has also been provided for of 20,000 cu. m. (21,872 cu yds.) to 25,000 cu. m. (27,340 cu. yds.) of rock emerging from the channel of the Loire, above the depth of bottom to be obtained for allowing passage under good conditions of vessels drawing 8 m. (26¼ ft.) of water.

At Brest important works for deepening the military harbor have required the removal of more than 125,000 cu. m. (156,954 cu. yds.) of various rocks—shales in the sheltered roads, and hard gneiss with quartz veins in the approach to the harbor proper. The depths to be obtained for the bottoms varied from 15.6 m. (51 ft.) to 16.5 m. (54 ft.) under the high water mark of spring tides, which attain the level of 7.1. The depths required were less in some parts of the channel; but the thickness to be removed, very variable, never fell below 1 m. (3¼ ft.). After attempts with compressed air, which did not give good results, a rock-remover with central stamps 17.5 m. (58 ft.) long, weighing about 18 tons, was tried. The yields it afforded were very variable according to the nature of the rocks encountered, the quantities removed having sometimes attained 200 cu. m. (219 cu. yds.) daily, and have even exceeded that figure in shale; but they sometimes fell to a minimum of 15 cu. m. (16½ cu. yds.) daily in very hard gneiss. The results generally appeared sufficiently favorable to warrant fresh contracts being entered into for continuing the work of deepening on a larger scale; and one of the new rock-removers will have its stamping arrangement at the end, so as to be able to work quite up to the foot of the quay.

In the southern portion of the Suez canal the deepening works have encountered rock beds of which the total area to be demolished and lowered exceeded 39,000 sq. m. (35,880 sq. yds.). Their removal therefore formed the subject of an important contract. These rocks, entirely calcareous, are besides of very different nature, consisting of ordinary limestones, calcareous and sometimes siliceous conglomerates (as a rule shelly), colored tufa and alabaster. Their hardness, also very variable, is only however considerable in some compact beds and in the siliceous conglomerates. The first of these beds was met with 25 years ago, when the first increase in the draft of water was taken in hand; and their removal down to the required depth was from the beginning effected by stamping. Although the method of mechanical rock-drilling with the use of explosives was minutely investigated, it was rejected on account of its cost, which appeared high for two reasons—increase in the expense of the cube unit to be removed, and obligation to remove a larger quantity than was strictly necessary, because a regular bottom cannot be obtained, and its highest points must not exceed the level imposed. Besides, the explosions might hurl to some distance pieces of rock which, if not recovered, would form a shoal above the newly-formed bottom.

In these stampings, which were continued and became more and more important, the power of the machines brought into operation increased regularly with the increase of the quantities to be removed, and also with the extension of the plant employed on the contract.

At first a commencement was made by breaking the rock by means of ten stamps of 3½ tons each, carried by a strong bucket-dredge, which afterwards took up the broken pieces of rock.

It was soon perceived, in this case also, that for increasing the yield and diminishing the cost, there was decided advantage in subdividing the appliances, and the stamps were special pontoons. From 14 to 16 blows of the stamp were required for breaking a 50-cm. (20-in.) thickness of moderately hard rock.

Stamps of 5 tons' weight were afterwards employed, with an increase in the production. Then, for larger surfaces, stamps 13.5 m. (44 ft.) long and weighing about 13 tons were arrived at. They were mounted on a pontoon, two together, 1 m. (3¼ ft.) apart.

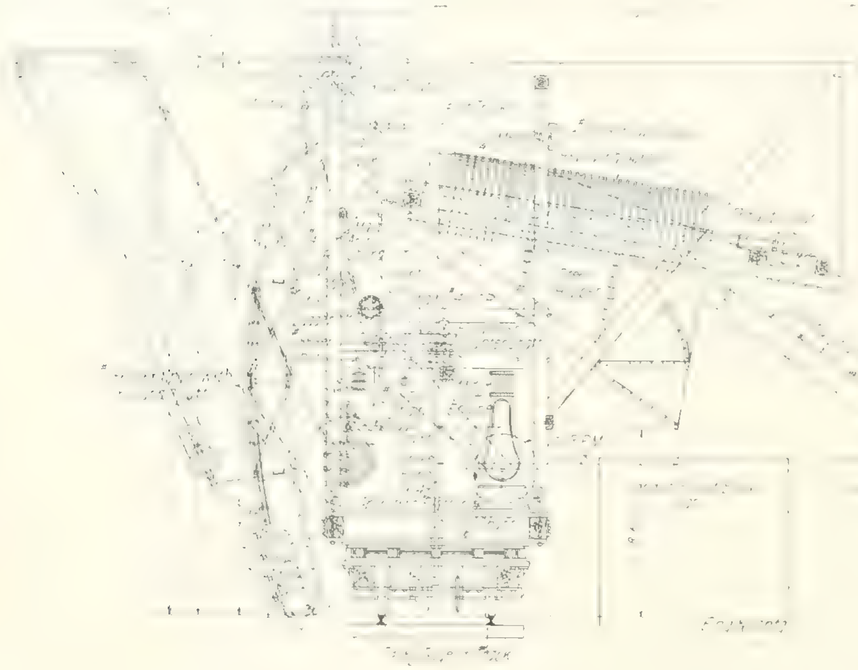
Lastly, and quite recently, the dimensions of the machines have been slightly increased, the coupled stamps employed, 15 m. (62 ft.) long and of 15 tons' weight, permitting depths of 12 to 13 meters (mean 41 feet) being attained below water level.

The arrangement is well known of the winches for rapidly moving the stamps, and also of those for the transverse reciprocating motion, which have been gradually improved. With their aid two stamps now give 132 blows per hour of effective work—and this with a fall varying from 1.5 m. (3¼ ft.) to twice hat figure. In this manner a bed of 80 cm. 32 ins.) thickness is disaggregated on an verage. The number of blows necessary to roduce 1 cu. m. (1.3 cu. yds.) of broken rock aries greatly, both with the hardness and the rittleness of the rock, having been found to ass from a minimum of 1 to a maximum of 0, which is however rarely attained. The ield per hour in disaggregated rock is thus rom 132 cu. m. (173 cu. yds.) to 3,500 cu. n (4,577 cu. yds.), with a real (if not apparent) average of 19 cu. m. (nearly 25 cu. ds.).

A Portable Gravel, Digging and Screening Plant.

A special machine for loading and screenng gravel directly from the bank to gondola ars is shown in the accompanying illustraions. The machine runs on a track by its wn power, digs and elevates the gravel to revolving screen from which the material s conveyed by gravity chutes to cars on parllel tracks, one car for coarse and another or fine material. The machine requires a rew of five men and no spotting engine for he cars as spotting is done by the power furished by the machine. The machine is capble of digging, screening and loading beween 30 and 50 cars of material per day, as hown reports letters from various users.

The elevating and loading machine is suplied with three strands of heavy chain to which are attached the flanged steel buckets equipped with digging teeth. This chain and over and under the crane which is hoisted in the gravel where each bucket digs and loads as it travels around. The buckets deliver the sand and gravel into the chute at the top of the machine where it is emptied into the mouth of the screen. The sand passing through the screen falls into the lower chute and runs into the car next to the machine while the gravel runs through the screen into a cylindrical chute which conducts it to the outside car. The whole is mounted on a truck with steel wheels and axles, which forms the base proper. To this the upper frame is joined by a spider which permits the entire upper part to revolve, thus giving the machine a radial as well as a vertical adjustment, enabling it to cut from either side or end. It is provided with a 20-h.p. vertical engine and 25-h.p. boiler, together with all steel shaft and endless chain connections. It is also provided with a propelling device for moving the machine along the track by its own power.



Elevation of Machine for Excavating Gravel from Bank, Screening and Loading Into Cars.

It is fitted with clutches so that it can be changed from the operation of screening material to loading run of bank in a few minutes time.

The Superior Sand & Gravel Co. of Utica, Mich., state that upon observation of their machine it was noted that a 24-cu. yd. car required 12 minutes to load, a 30-cu. yd. car 18 minutes, and a 40-cu. yd. car 23 minutes. This would mean that from ½ to ¾ minutes time is required for loading a yard. The face of bank varied from 10 to 25 ft., while these cars were being loaded.

The following is the record of operation for 6 consecutive months of a machine at Cochocton, O. The report is dated Jan. 1, 1911:

Month.	No cars 50 tons ea.	Tons.	Labor and Fuel.
June	169	8,450	$ 408
July	220	11,000	427
August	217	10,850	415
September	241	12,050	445
October	236	11,800	442
November	210	10,500	420
Total	1,293	64,650	$2,557

The average cost per ton for labor and fuel is therefore about 4 cts. Assuming a ton of gravel to be 2/3 cu. yd., the cost of 1 cu. yd. would then be 6 cts. Mr. Rollin Moore, who was superintendent, states that difficulties were experienced during the above six months in getting the pit open and in a shortage of cars. The machine is made by Shoemaker & Casparis, Newcom Ohio.

Cost of Sinking a Small Sha

The shaft was sunk to serve as a ve ation and escape shaft for miners and s d in sinking it was deemed more importa than economy in costs. The costs are g n by W. F. Boericke, Mining Engineer, in t "Engineering and Mining Journal."

The time was most unfavorable side work, the work being done in th of winter, at a temperature most of t much below zero.

The shaft was made 5x7 ft. in th and, except for a little top cribbing, timbered. It was sunk through the limestone for nearly the full distance at which point connection was made ith a raise from below. This Galena li tone the principal rock formation of the sin zinc field, is a coarse, crystalline of great strength and firmness, and especially well, hence, except where is to be equipped with a cage or bering costs are almost negligible. T is not particularly hard for drilli breaks well, but the holes have a tend pack and do not clean well; hence speed is not great.

The shaft was sunk on a crevice an hole, the former running diagonally the shaft. By pointing the holes break to the crevice, better progre made than was otherwise possible. N water was encountered than was nee drilling. Two shifts of three men eac employed. Wages in shaft work we and $2.25 per shift of eight hours. The was the regular first-size post Wonde using a 3½-ft. steel. About one-third time was used in drilling, and the in cleaning out and hoisting, which w with a hand windlass. Six to eigh would be drilled before shooting; holes made a round. All shooting w by electricity. About four sticks of cent dynamite were used to the hole. steel used was the customary eight-p used with the Wonder machine.

In calculating the costs, powder is t 11 cts. per lb., and power assumed to to 15 kilowatt-hours per shift, and co 3 cts. per kilowatt-hour. Nothing lowed for superintendence or repairs, a proportion of blacksmith or engin wages. These would not add materi the cost, however.

The costs follow:

	Total.
Total labor	$553.00
Powder, 638 lbs	70.18
Power, 81 shifts at 45 cts	36.45
Total	$659.6

Total time to sink 81 ft., 45 days of shift
Progress per shift, 1 ft.

Population Statistics in the Classes of Communities.—A recent of the Bureau of Census gives the statistics relative to the proportion of the population in the several classes of comm in 1910 as follows:

Urban territory.	No of places	
Places of 1,000,000 inhabitants or more	3	[illegible]
Places of 500,000 to 1,000,000 inhabitants	5	[illegible]
Places of 250,000 to 500,000 inhabitants	11	[illegible]
Places of 100,000 to 250,000 inhabitants	31	[illegible]
Places of 50,000 to 100,000 inhabitants	59	[illegible]
Places of 25,000 to 50,000 inhabitants	120	[illegible]
Places of 10,000 to 25,000 inhabitants	371	[illegible]
Places of 5,000 to 10,000 inhabitants	629	[illegible]
Places of 2,500 to 5,000 inhabitants	1,173	[illegible]
Totals	2,405	42

Rural territory	No of places	
Incorporated places of less than 2,500 inhabitants	11,784	[illegible]
Other rural territory	...	41
Total		49

and Costs of Operating Loeb- Rock Breakers and Drill ts on the Panama Canal.

[illegible] under water has to be ex[illegible] ing the Panama Canal the [illegible] il wed are to break up this [illegible] rock breaking machines [illegible] ist it so that it can be ex[illegible] dredges. Data on this work are Ir. S. B. Williamson, Chief Engi- Division, Panama Canal [illegible] ie International Congress of Navi- ese data are reprinted here:

hinery of the Lobnitz breaker in Panama Canal is installed on a 100x28x8 ft., divided into water- [illegible] of which some [illegible] fresh water and others fuel oil. ie variation in tides together with [illegible] of channel [illegible] [illegible] respectively, 15, 16 and 19.5 tons. hoisted by a 2-in. steel cable at- [illegible] and passing over [illegible] ver the ram, [illegible] high; the cable leads direct from to the drum of a steam winch lo- eck, and designed for continuous he winch is fitted with automatic lubricated steel friction clutch, s the cable to follow the fall and ram immediately after the blow. [illegible] paying off [illegible] is provided with accommodations w. The surface of a rock shoal is th the breaker at intervals of four ay, the positions being located by re and permanent marks on deck. lelivers consecutive blows in one til the limit of penetration, which out 3 ft., is obtained, and when the l has been gone over the breaker red to another shoal while the is being dredged. With a 20-ft. des it has been found more eco- use one length of ram and work on either the high or low tides, [illegible] changing the rams.

The [illegible] time is shown in Table I, from which it is seen that the breaker has broken an average of 16.2 cu. yds. an hour of actual working time, or 11.0 cu. yds. an hour of total service time in the past 15 months, at an average cost of $0.7965 per cubic yard.

As regards repairs the cables have required the greatest attention; they usually kink and give way immediately above the connection with the ram. Four of the cables used on the Panama ram became useless and were removed after breaking 647, 318, 633 and 2,898 cu. yds., respectively. The first three were placed on the breaker direct from the coils and the fourth was straightened out and well greased before using.

A record kept of one of the ram points shows that, after 235 working hours in which 3,855 cu. yds. were broken with a total penetration of 6,679 ft., the point was worn 1¼ ins. and rounded so as to be totally inefficient. Two rams have been broken at about mid length. Aside from the above the amount of repair work has been moderate.

The drill boat "Teredo" which is at work on the Pacific Division of the Panama Canal, has a steel hull 112x36x8 ft., divided into 21 compartments by two longitudinal and six transverse water-tight bulkheads. Two compartments amidship are used as water tanks and six fuel-oil tanks of forty barrels' capacity each are located in others. The boat is maneuvered by four lines attached to kedge anchors and is held in position by 24-in. timber spuds located at each corner and operated by an independent engine through racks and pinions.

Three drill frames, 38 ft. high, are located along one side and arranged to travel longitudinally on rails, the movement being controlled through an endless chain operated by hydraullic power; each drill frame carries a 5½-in. Ingersoll-Rand drill which may be moved vertically through 10 feet by means of a hydraulic ram. Steam is furnished from a central boiler through slip—and swing—jointed pipes. The "Teredo" was put in commission during March, 1910, and worked with only one shift of 10 hours until August of the same year, when two shifts of 10 hours each began working.

Certain weaknesses have developed, especially in the drill frames and hydraulic rams for handling the drills, so that the time consumed in repairs and the cost of the same have been excessive to the present time and better results may be expected in the future.

The performance and costs for this machine are given in Table II. The yardage shown is theoretical, as the rock broken has not been dredged.

On the Atlantic Division of the Panama Canal a drill boat was improvised by placing eight well-drills on an old French scow hull; four well-drills were placed on each side and steam supplied from a central boiler. The two lines of drills are 22 ft. apart and the drills in each line 15 ft. apart. In his annual report for 1910 the Division Engineer states that eight holes are usually drilled, loaded and fired each day, and that the division cost of mining beyond the shore line was 4.5 cts. per cubic yard for both earth and rock, or 8.7 cts. a cubic yard if charged to rock alone; also that the cost of mining 191,872 cu. yds. of subaqueous rock inside of the shore line was 7.9 cents per cubic yard.

It seems in order to briefly refer to a method that is practiced on the Panama Canal that is intimately associated with subaqueous rock excavation inasmuch as it is a way of avoiding the same, with marked economy, when the conditions permit. On both the Atlantic and Pacific sides the channels between the locks and shore lines pass through river valleys containing dredgable material which, at various points, covers rock ledges projecting into the proposed prism. The original intention was to dredge the soft material first and remove the rock by subaqueous methods, but Mr. William Gerig, who at one time was in charge of the dredging in the Atlantic Division, conceived the idea of drilling and blasting the rock before removing the earth, using well drills which are adapted for drilling to

TABLE I.—PERFORMANCE OF LOBNITZ ROCK-BREAKER, PANAMA CANAL.

Weight of ram Tons	Average drop Ft.	No. of holes	No. of drops	Average drops per hole	Penetration Total Ft.	Penetration Per hole	Working Time Effective Hours	Working Time Lost Hours	Working Time Total Hours	Area covered Sq. ft.	Cu. yds. broken	Cost Per Cubic Yard — Operation and maintenance	Overhead	Total
1[illegible]	8	1,578	[illegible]	6.1	[illegible]	[illegible]	[illegible]	144.4	[illegible]	[illegible]	3,606	0.4779	0.0409	[illegible]
[illegible]-14	8	[illegible]28	[illegible]	[illegible]	6,178	[illegible]	[illegible]	75.0	[illegible]	[illegible]	3,731	0.4810	0.0708	0.5318
[illegible]	1[illegible]	1,738	[illegible]	5.2	4,641	[illegible]	[illegible]	10[illegible]	[illegible]	[illegible]	2,417	[illegible]	[illegible]	0.7822
1[illegible]	9	1,[illegible]	13,1[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.8026	0.0700	0.8726
15-1[illegible]	[illegible]	1,[illegible]17	[illegible]	[illegible]	[illegible]	4.04	[illegible]	14	[illegible]	[illegible]	2,136	0.6548	0.0970	0.7518
15-1[illegible]	11	1,988	13,[illegible]	[illegible]	[illegible]	3.8[illegible]	[illegible]	[illegible]	[illegible]	31,808	[illegible]	1.0128	0.1138	1.1266
1[illegible]	1[illegible]	2,[illegible]	1[illegible]	6.4	7,114	[illegible]	[illegible]	[illegible]	[illegible]	37,792	3,618	0.5618	0.0797	0.6415
1[illegible]	10-14	2,42[illegible]	17,764	[illegible]	10,066	4.4	[illegible]	[illegible]	[illegible]	58,7[illegible]	4,551	0.4678	0.0576	0.5254
1[illegible]	12-13	[illegible]	[illegible]	6.[illegible]	[illegible]	4.[illegible]	[illegible]	[illegible]	[illegible]	77,538	3,893	1.5047	0.1130	1.6177
[illegible]	13	4,[illegible]	31,[illegible]	7.7	21,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.8908	0.1184	1.0092
1[illegible]	14	3,710	29,1[illegible]	7.8	[illegible]	[illegible]	[illegible]	[illegible]	1800	[illegible]	4,673	0.8237	0.1030	0.9267
[illegible]	7-8	4,060	24,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61,[illegible]	[illegible]	0.6459	[illegible]	0.6936
[illegible]	10	3,972	[illegible]	7.8	19,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	64,192	6,767	0.8565	[illegible]	0.8986
[illegible]	8-10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.3803	[illegible]	[illegible]
[illegible]	9	3,44[illegible]	[illegible]	[illegible]	[illegible]	2.2	[illegible]	[illegible]	[illegible]	[illegible]	1,861.8	1.1421	[illegible]	1.2201
[illegible]		[illegible]	[illegible]	6.7	[illegible]	4.27	[illegible]	[illegible]	[illegible]	664,498	[illegible]	[illegible]	0.0710	[illegible]

Beginning Sept. 1, 1910, rock-breaker worked two shifts of ten hours each, daily. Beginning March 1, 1911, rock-breaker was operated n-hour shift, daily. Figures showing actual breakage unavailable, so comparison has been made between theoretical and actual break- year 1910, showing the latter 52 per cent of the former; 60 per cent of theoretical breakages has been used in this statement for Janu- [illegible] and March, 1911.

TABLE II.—PERFORMANCE OF DRILL [illegible], PACIFIC DIVISION, PANAMA CANAL.

	Drilling						Working Time			Cost Per Cubic Yard		
	No. of drills.	Total drilled. Ft.	Per drill. Ft.	Powder used. Lbs.	Area broken. Sq. ft.	Cu. yds. broken. Theoretical	Effective. Hours.	Lost. Hours.	Total. Hours.	Operation and maintenance.	Overhead.	Total.
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
....	3	1,706	568.7	1,659	2,655	1,634	124.1	125.9	250.0	1.7824	0.1800	1.9624
....	3	2,557	852.7	2,676	4,470	2,842	149.0	101.0	250.0	0.7208	0.1102	0.8310
....	3	2,446	815.3	2,488	3,690	2,718	114.1	145.9	260.0	1.0590	0.1393	1.1983
....	3	2,348	782.7	2,408	4,020	2,603	339.0	411.0	750.0	0.9496	0.1569	1.1065
....	3	4,180	1,393.3	4,168	7,920	4,605	660.9	959.1	1,620.0	0.9558	0.1348	1.0906
....	3	3,953	1,317.7	4,771	7,860	4,384	663.9	836.1	1,500.0	1.0931	0.1665	1.2596
....	3	4,576	1,525.3	5,534	8,910	4,961	633.2	926.8	1,560.0	1.0020	0.1995	1.2015
....	3	5,208	1,736.0	6,634	11,640	5,785	622.2	817.8	1,440.0	0.9381	0.1414	1.0795
....	3	4,395	1,495.0	5,874	9,330	4,881	591.8	968.2	1,560.0	1.1771	0.0881	1.2652
....	3	11,408	3,802.7	13,684	19,950	12,660	857.3	584.7	1,442.0	0.4867	0.0507	0.5374
....	3	6,763	2,254.3	11,289	9,120	7,515	428.8	232.7	661.5	1.6408	0.0886	1.7294
....	3	24,588	8,196.0	46,418	46,800	27,727	1,299.8	184.0	1,483.8	0.2333	0.0214	0.2547
als	3	74,927	24,975.7	108,023	137,815	82,913	6,484.1	6,293.2	12,777.3	0.7543	0.0860	0.8403

Incomplete.

Beginning August, drill-barge worked two ten-hour shifts daily.

TABLE III.—PERFORMANCE OF WELL-DRILLS, PACIFIC DIVISION, PANAMA CANAL.

	Average number of drills working.	Lineal feet drilled: Earth.	Rock.	Total.	Per drill.	Powder used (lbs.).	Cu. yds. blasted (theoretical): Earth.	Rock.	Total.	Cost per Cu. Yd.: Operation and repairs.	Overhead.	Tot
January	18	5,766	2,925	8,691	482.8	38,036	49,475	25,050	74,525	0.1016	0.0104	0.11
February	14	7,090	4,513	11,603	828.8	44,683	64,882	30,117	94,999	0.1033	0.0128	0.11
March	12	6,416	3,725	10,141	845.1	38,725	55,040	30,459	85,499	0.1742	0.0137	0.1
April	[illegible]	5,401	3,832	9,233	710.2	40,866	38,025	28,975	67,000	0.1196	0.0164	0.1
May	16	2,913	4,775	7,688	480.5	31,538	25,317	23,808	49,125	0.2722	0.0259	0.2
June	[illegible]	1,785	4,301	6,086	468.2	26,886	14,992	35,173	50,165	0.2146	0.0261	0.2
July	[illegible]	1,580	4,889	6,469	431.2	26,629	11,509	34,991	46,500	0.1636	0.0279	0.1
August	15	1,939	5,235	7,174	478.3	20,700	8,292	27,708	36,000	0.3260	0.0427	0.3
September	15	3,909	5,523	9,432	628.8	47,542	33,667	56,452	90,119	0.0996	0.0160	0.11
October	14	6,014	4,623	10,637	759.8	47,872	43,441	42,058	85,499	0.1519	0.0168	0.1
November	11	3,421	3,562	6,983	634.8	39,167	37,116	31,884	69,000	0.1572	0.0164	0.1
December	[illegible]	2,216	3,534	5,750	575.0	24,036	26,158	31,121	57,279	0.1558	0.0078	0.1
Totals	[illegible]	48,400	51,487	99,887	723.8	426,680	407,914	397,796	805,710	0.1576	0.0174	0.1

great depths. The holes are drilled through the earth casing being used to prevent filling, and into the underlying rock to the desired depth; the bottom of each is sprung and the entire hole filled with dynamite to the surface of the rock, and exploded. The experience is that the rock is broken into small sizes that are readily handled by either dipper or ladder dredges and that the method is more economical than subaqueous methods. The record of some of this work is given in Table III.

A Quick Detachable Grab Bucket.

The grab-bucket illustrated by the accompanying views, is handled by merely inserting the crane hook in the yoke to which the ropes for operating the bucket are attached. The latch mechanism is set by lowering the crane hook, and by raising the crane hook the blades are closed and the load is taken. The contents are dumped by pulling a hand rope, which can be controlled by the regular crane operator. Fig. 1 shows the bucket in open position and Fig. 2 shows it closed with its load.

A record obtained from the manufacturers states that in actual work a 2 cu. yd. bucket of this make unloaded 40 tons (about 30 cu. yds.) of sand from a gondola car in 20 minutes.

The quick-detachable feature of the bucket should make it particularly desirable for work which can be handled intermittently by locomotive cranes and derricks which could readily be disengaged for use on other work.

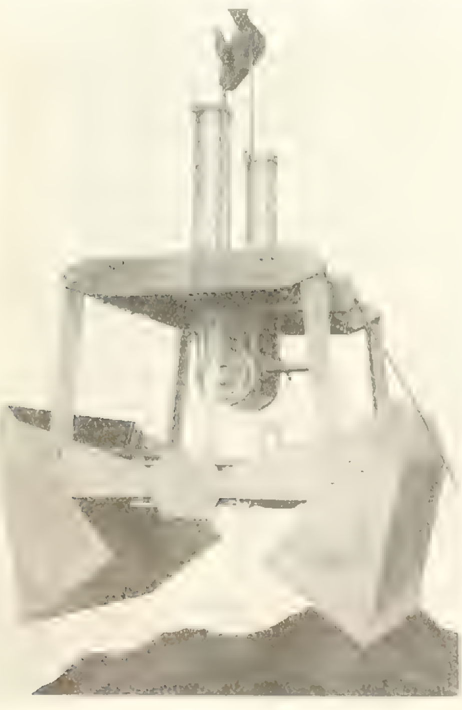


Fig. 1—Quick Detachable Grab Bucket—Opened.

The bucket is known as the Watters Quick-Detachable Bucket, and it is made by the Whiting Foundry Equipment Co., Harvey, Ill.

A Review of Methods Employed for Removing Subaqueous Rock.

The development of methods for excavating subaqueous rock is concisely summarized in a report to the International Congress of Navigation by Mr. Michael Koch, Engineer Royal Hungarian Navigation Board. This review gives several methods not generally familiar and we reprint it somewhat abbreviated as follows:

The various submarine methods of removing rocks may, as we know, be divided into two principal groups, viz., into rock-blasting and rock-breaking methods. By the first mentioned methods the rocks, as the name suggests, are shattered by means of charges inserted in shot-holes, or in cavities, or lying exposed, while by the second they are broken mechanically, by means of chisels, steam or hydraulic hammers, or drop-drills.

The most noteworthy of the older submarine blastings by means of shots fired in bored holes which, as is well known, were applied in the Rhine at Bingen at the removal of the Hole rocks, in the Danube between Grein and St. Nikola, in Boston Harbor, at the removals of the Blosson Rock in San Francisco Harbor and of the Hallet's Point Reef in the Hell Gate, etc., were, owing to want of experience and of the necessary appliances, not only very difficult, but also comparatively inefficient and slow in working.

Under the shelter of a backstow apparatus installed up-stream from the rock to be dealt with and reaching down to the bed of the river, a raft was made use of from which holes were at first bored down by hand; subsequently pairs of ships were substituted, between which the work was continued by means of specially designed boring machines. Charges were then, after the removal of the floating platforms inserted and ignited, after which ships fitted with cranes for the removal of the shattered material had to be brought to the place of operations.

This method of blowing up the rocks, which can indeed be more easily applied in still water, as also the system under which, in the absence of a strong current, the bore-holes are made by the aid of a heavy boring apparatus installed on the rock under the protection of a diving bell, is also in use for blasting operations in the sea.

Submarine rock-blastings, moreover, have latterly been made by means of free-lying charges placed in cavities, as for instance in the case of the Blosson Rock in the harbor of California, and also in the removal of the Hallet's Point Reef in the Hell Gate undertaken for the purpose of shortening the sea route to New York.

At the Blosson Rock where the stone to be blasted away lay about 5 ft. 3 ins. (1.6 m.) below the water at the ebb, the operations were conducted by the aid of a wooden box which was lowered down over the rock. At the middle of the box a shaft lined with iron plating was sunk for a distance of 27 ft. 3 ins. (8.3 m.) into the rock, which was then hollowed out to such a degree by borings that the cavity, which was about 11 ft. 6 ins. (3.5 m.) in height, had an area of almost 3,470 sq. yds. (2,900 sq. m.). The cavity thus created, the well supported top of which had a thickness of 13 ft. 1½ ins. (4 m.) was, in order to increase the effect of the explosion, filled two-thirds full h water, after which the charge was fired.

In the operations at the Hallet's int Reef a watertight dam enclosing a spa of considerable size was first construct on the rock to be blown up, and a shaft was then sunk within it to a depth of 39 4½

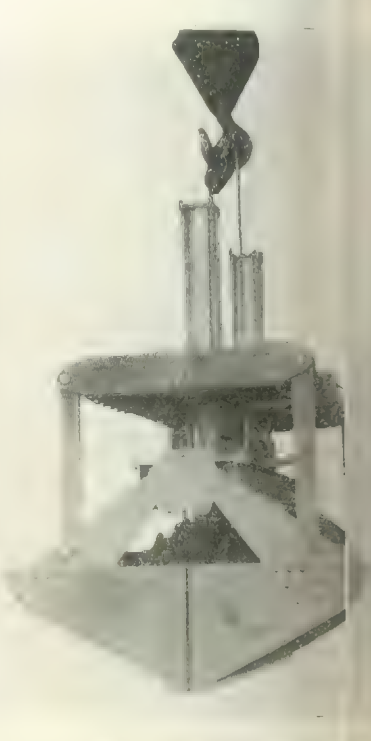


Fig. 2—Grab Bucket—Closed and

(12 m.) below the mean water l leries were driven at the bottom of and a cavity with a ground surfac 3,588 sq. yds. (3,000 sq. m.) was i ner created. At this explosion als lowed rock was partly filled with the charge, which was laid in a had been left standing and also i of rock, was then exploded.

In operations of this kind, and during the sinking of the shaft and ing out of the cavity, the workm considerably from the inflowing wat back which it was hardly possible of even by the use of pumps.

The last mentioned methods of b rocks, for which the stone to b must be of considerable depth, are only in the cases of reefs in the s on account of the deep draught of such rock-blastings become neces they can be applied only where th consists of massive non-porous sto the rock-blasting is now no longe by charges laid in cavities, since method large masses of rock rema and their removal causes consider ble and expense.

After the invention of dynamit and the rise of the boring and el nical arts had paved the way for th ment of the hand boring by mecha ing and the employment of electri the floating platforms which had r hand operations were subjected to so that, in case of shot-firing from s, the high degree of stability de- the case of boring machinery might [illegible]

, ago as in 1870 in the [illegible] rock removals in America, it was t, by the fitting of feet to the bor- by which the latter was supported rock and slightly raised out of the backstow apparatus hitherto used lispensed with and the working plat- tected from wave and current ac- hich also the special advantage was hat the jumper-drills made use of ficiently.

ethod of rock-removal under water of shots from blast-holes, which used by the engineer, E. E. Gilbert. is called the "American blasting

d method for the removal of sub- cks by means of boring ships is ed "English blasting method," which ted in 1882 by J. Th. Jones and J. of Leeds (England). A floating formed by two pontoons coupled ears a movable frame, on which hung hollow rotating drills, which ed down by the working machinery, hich the rock-boring is done, are This method, however, will prob- in question only for small depths and currents of no great strength, for the removal of rock-masses of le thickness, since in the case of the frequent insertion of the drill rous preliminary borings are at- h difficulty. Even in the trials on , the rotating drills did not give . The diamonds in the boring- e with unpleasant frequency owing dness of the rock, while layers of es on the surface of the latter ren- connection of the guard-tubes and borers more difficult, and the sys- consequence to be abandoned. In method will probably not be used

principle to the English one re- is the method of boring applied by engineers Fontan and Tedesco at a Canal works, which, however, ac- the results of the borings made 1891 on the Lower Danube for of rock-blasting, cannot be used in strong currents.

struction of the boring apparatus stem is as follows: On a carriage free to move between two coupled are mounted four revolving drills king heads of which diamonds are a manner that they bear alternately t-hand and left-hand edges of the ll, which has an external diameter [illegible] and an internal [illegible] The boring [illegible] ned about its vertical axis by suita- [illegible] and pressed vertically [illegible] ock. The inserted diamonds cut out al core, which, on the completion of work, is broken off and taken out drill. The bore-hole thus formed, ins. (50 mm.) in diameter, is then nd the shot is fired.

of the fact that at the trials the d with small expenditure of power all expense—for work with the [illegible] with a heating surface [illegible] 10 sq. m.) was required, a boring ship which worked with soll drills a boiler of from 540 to (50 to 60 sq. m.) heating surface sary—this method did not prove for the Lower Danube.

ecting work where a bore-hole sev- ed yards (meters) in depth hap- needed, the diamond drill may be best of tools; in such work, how- rill must stand exactly vertical and complete precision; otherwise, with of working of 800 to 1,000 revolu- minute everything will go to pieces. d and last way of fixing the boring machines is that in which these are attached to diving bells in which they work, and which are lowered into the bed of the river. This method was first used in Germany, and is, in consequence known as the "German blasting method." It has the disadvantage that it commands only a small area of the river bed, and since the setting and keeping to work of the diver's shaft, especially in strong cur- [illegible]

od of this kind cannot be used for the removal of large masses of rock, or for rivers with considerable speed of current; an advantageous use will be found for it only in cases in which small masses of rock with surfaces that are not very uneven have to be removed.

In addition to the blasting methods already alluded to, there remains to be mentioned the so-called "Austrian blasting method," which was invented by the then Major in the 2nd Engineer-Regiment of the Austro-Hungarian army, Johann Lauer. Its salient features are that, on the surface of rock to be destroyed and by means of a specially designed blasting apparatus which is firmly fixed on the rudder of a vessel, comparatively small explosive charges, which up to the time of their ignition are firmly held in the required position by rods, are laid freely on the surface to be shattered and then caused to explode (described in detail in his treatise published in Vienna in 1891 entitled "Method for the Destruction of Rocks in Rivers by Means of Blasting Charges Laid Upon Them").

Although this method proved its vitality in connection with the blasting of a fragment of a buttress in the Danube in Vienna carried out in 1873, and trials made with it in 1875 on the Lower Danube at the Jucz Rapids, in 1881 at Krems, in 1882 on the Danube near Peterwardein, and at Szvinicza (Lower Danube) gave satisfaction, it still could not be made use of in the extensive submarine rock-blasting operations which were carried out in Hungary on the Lower Danube between Moldova and Turn-Severin in the years 1891-1897.

The trials, indeed, which were conducted in 1889 at the Jucz Rapids with the charge laid freely on the rock, convinced the technical authorities concerned that a blasting-charge of this description gives a surprisingly good result in the first series of shots, but that, at the second series fired at the same places, the effect is considerably less, while at the third, fourth and fifth series it is inoperative.

The blasting charges laid on the massive rocks, then, acted in a favorable manner; since, however, the rubbish material formed by the shots of the first series was not washed away in spite of the strong current, the shots of the second series had only thrown the elastic-cushion-like rubbish about without shattering more of the rock.

In these experiments, the freely laid blasting charges acted best in places in which they were exploded on projecting rocks, and they remained almost without any effect when applied to a bed of stone. It appears from the various experiments made, that the Lauer blasting method does good work in the blasting off of isolated projecting submarine groups of rocks or in the removal of other obstacles of this kind, but that for banks of rock of larger dimensions it does not give favorable results.

In connection with the second group of submarine rock-removal methods, in which the stone is broken by mechanical means, mention must, in the first line, be made of the Lobnitz system, which was invented by the shipbuilder and engineer, Lobnitz, of Renfrew (Scotland). By it, a freely hanging 3 to 4-ton iron chisel—the so-called drop-drill—suspended from a holder in a ship, is let fall from a suitable height, as in the case of a pile-ram, between vertical guides onto the rock of a river bed or onto submarine rocks, which are thereby broken.

The Lobnitz ship "Derocheuse," which is equipped with the necessary apparatus, mechanical appliances, and the drop-drills referred to, has already been used in the operations in the Suez Canal.

As a second way of breaking rocks, mention may be made of that used in the rock-removal operation on the Columbia River. Hammers actuated by water power act on long chisels from stages built in the river, much as in a stamp mill, and thus break off pieces of rock.

The third kind of rock-removing method based on mechanical operation is that of the Hungarian engineer, Tunhard, in which the breaking off of the submarine rocks is effected by means of chisels driven by steam hammers.

The rock-breaking ship which was built on the Tunhard system alluded to consists of an iron hull in the longitudinal axis of which, open above and closed below, an elliptically-formed caisson is suspended in such a manner that it can be easily moved up and down by hydraulic pressure. A steam hammer is installed in each of the caissons in such a manner that its lengthened piston-rod can extend through a stuffing-box guide for a distance of 25½ ins. (.65 m) from the bottom of the caisson. At the lower end of this piston rod there is a removable cast-steel chisel 9⅞ ins. (25 m) in thickness provided with cross-mouthed bits, on which the steam hammer delivers from 100 to 150 strokes per minute and thus works on the rock with a striking effect of 21,700 foot-pounds (3,000 mtr. kgs.).

This method, which at the experiments in 1890 in the Jucz Rapids was applied to hard Sienite rock, rests on a sound basis, and at the trials with the Tunhard rock-breaking ship the conviction gained ground that, with a similar but more strongly constructed apparatus, not only thin layers of stone, but also beds of rock of considerable thickness, could, under favorable geological and geognostic conditions, be broken up. This method of rock breaking might, in cases in which not much importance were attached to economical and financial questions, under certain local conditions, find general application.

With the exception of the rock-breaking device last mentioned, all the methods of rock removal hitherto discussed have found practical application. In addition to these practically tried methods, some others are known, which could hitherto only be classed as proposals, and of which in the contract negotiations which preceded the great work of regulation on the Lower Danube in 1890, cognizance was taken. While pointing out that these methods of rock removal, which are regarded only as proposals, were described in detail by the then Colonel of Engineers Johann Lauer in his work published in 1892 in Vienna, we may here remark that their main object is the improvement of the mechanical boring of the holes, and that only a few of them bear reference to the surface blasting or to the mechanical breaking up of submarine rocks.

Record of Drilling and Blasting in Culebra Cut.—The 142 tripod drills, at work in varying material in Culebra Cut, made a total penetration of 146,766 lin. ft. during the month of March, an average of 39.5 ft. per drill each day. The number of drill days was 3,716. The 77 well drills in 1,177.2 drill days penetrated 75,013 lin. ft.; a rate of 42.3 ft. per drill per day. The average for both kinds of drills was 40.4 lin. ft. per drill per day. Fifteen tripod drills, working exclusively in hard rock, penetrated 11,095 ft. in 378 drill days, or 29.4 ft. per drill per day. The working day is 9 hours. These penetrations are regarded as an index of the normal drilling operations in the cut. In blasting, 17,532 holes were exploded in various sorts of material. The aggregate depth of the holes was 303,010 lin. ft., the average depth was 17.3 ft. In all, 363,670 lbs. of dynamite were exploded, an average of 20.7 lbs. per hole. The average efficiency of the blasting during the month, in all kinds of material, was 2.14 cu. yds. per pound of explosive.

Unit Costs of Work on the Panama Canal for the First Three Months of 1912.

[illegible] of work on the Panama Canal for the three months ending March 31, 1912, have just been tabulated and made public and are given herewith. Previous quarterly reports giving similar information as to the costs of work have been published in [illegible] 7, 14 and 21, 1910; Feb. 22, March 1, May 24, Sept. 13, 1911, and Feb. 28, 1912.

Gatun Dam.—The hydraulic fill of the east section of this dam was completed during the year and the work of placing dry fill to bring the dam to its final height, about 107 ft. above sea level, is now in progress, while the work of placing rock along the south toe, against which the lake will wash, is also being carried on. Three suction dredges are working on the hydraulic fill on the west section of the dam and the dry fill is advancing, the material being supplied on cars brought from the steam shovels in the borrow pits above the dam. The cost of work for the past quarter follows:

Dry Fill, Cu. yds.	[illegible]
Clearing site	......
Excavation	[illegible]
Tracks	[illegible]
Trestles	[illegible]
Transportation	[illegible]
Dumping	[illegible]
Maintenance of equipment	[illegible]
Plant arbitrary	.0495
Division expense	[illegible]
Total division cost	[illegible]
Administrative and general expense	[illegible]
Total cost	[illegible]

TABLE I.

Masonry	Gatun Spillway	Gatun Locks	Pedro Miguel Lock	Miraflores Locks
Concrete— Cu. yds.	26,743	70,726	21,552	189,830
Cement	$1.7642	$1.7607	$1.5042	$1.9014
Stone	1.9802	1.8950	.7618	.7544
Sand	1.0188	1.1626	.3527	.3500
Mixing	.2104	.2276	.4002	.2248
Total cost	[illegible]	[illegible]	$3.0189	$3.2306
Large Rock: Cu. yds.	154	28		
Cost	[illegible]	[illegible]		
Masonry Cu. yds.	26,897	70,754	21,552	189,830
Concrete	[illegible]	[illegible]	[illegible]	$3.2306
Large rock	.0204	.0016		
Wood forms	.4273	.6693	1.1130	.3836
Steel forms	.....	.1244		.0506
Placing	[illegible]	[illegible]	.6661	.2018
Reinforcements	.0024	.0226		
Pumps	.0002	.0690	.0212	.0349
Power		[illegible]	.0111	.0343
Cofferdams	[illegible]			
Maintenance of equipment	.2361	.2031	.1353	.1450
Plant arbitrary	.4360	.9670	.5697	.5500
Division expense	[illegible]	[illegible]	.1206	.0577
Total division cost	$6.5493	$7.9731	$5.6559	[illegible]
Admin. and general expense	.2517	.3168	.3352	.2150
Total cost	$6.8010	$8.2899	$5.9911	$4.9035
Reinforced concrete, Cu. yds.	[illegible]	[illegible]	15,421	[illegible]
Cement	$1.7305	$2.4921	$2.3515	$1.8233
Stone	2.0104	1.9603	.7262	.7143
Sand	1.0513	1.0960	.3308	.3252
Mixing	[illegible]	[illegible]	.4239	.6502
Wood forms	2.1778	2.5953	1.9721	1.6690
Steel forms	.....	.0794		1.1854
Power		[illegible]	[illegible]	.0113
Placing	[illegible]	[illegible]	.7801	.6940
Reinforcements	1.5557	.7396	1.5188	[illegible]
[illegible]			.0211	[illegible]
Maintenance of equipment	[illegible]	[illegible]	[illegible]	[illegible]
Plant arbitrary	.4360	.9670	.5700	.5503
Division expense	.3289	.2264	.2260	.2285
Total division cost	$10.6613	$11.4978	$9.0768	$9.4642
Admin. and general expense	[illegible]	[illegible]	.7062	[illegible]
Total cost	$11.2027	$12.2318	$9.7830	$10.1208
*Total masonry, cu. yds.	[illegible]	[illegible]	36,973	196,015
Total cost	[illegible]	[illegible]	$7.5727	[illegible]

TABLE II.—DREDGE EXCAVATION.

Items.	— -Atlantic Division– Quantities, cu. yds.	Unit cost.	Pac Quantities, cu. yds.
Clearing	985,689	$0.0008	....
Operation, seagoing suction dredge	544,939	.0375	707,574
Repairs, seagoing suction dredge	544,939	.0574	707,574
Operation, ladder dredges	306,523	.0735	184,953
Repairs, ladder dredges	306,523	.0236	184,953
Operation, dipper dredges	135,960	.1336	84,470
Repairs, dipper dredges	135,960	.1219	84,470
Operation, pipe line dredges	†1,733	1.2780	..
Repairs, pipe line dredges	†1,733	....	
Pipe lines			...
Pumps		...	
Operation, tugs, clapets and scows	442,483	.0867	269,423
Repairs, tugs, clapets and scows	442,483	.0645	269,423
Drilling	113,797	.1569	....
Blasting	113,797	.1716	126,103
Operation, drill barges			126,103
Operation, rock breakers		..	126,103
Small boats	985,689	.0029	976,997
Repairs, miscellaneous equipment	985,689	.0019	976,997
Plant arbitrary	985,689	.0470	976,997
Division expense	985,689	.0100	976,997
Total division cost	985,689	$0.3311	976,997
Administration and general expense	985,689	.0274	976,997
Total cost	985,689	$0.3585	976,997
Earth excavation, per cent	871,892	88.46	850,894
Rock excavation, per cent	113,797	11.54	126,103

*Denotes credit.

[illegible] Charged to dredging excavation, Prism in error.

Hydraulic Fill, Cu. yds.	[illegible]
Clearing site	......
Clearing for dredges	[illegible]
Dredging	[illegible]
Relay pumps	.0125
Pipe lines	.0180
Wood flumes	[illegible]
Power	.0708
Small boats	.0025
Maintenance of equipment	.0389
Plant arbitrary	.0850
Division expense	.0062
Total division cost	$0.3701
Administrative and general expense	.0173
Total cost	$0.3874

Lock Masonry.—The construction of the concrete portion of the Gatun spillway was carried on throughout the dry season and has reached such a stage that it may be completed during the approaching wet season. The work is 85 per cent complete and about 31,000 cu. yds. remained to be placed on March 31. Three months ago the work was 74 per cent completed.

Over 92 per cent of the concrete for the system of three twin locks at Gatun has been laid, the amount in place at the close of work on March 30 being 1,854,665 cu. yds., out of a total of 2,000,000.

At the Pedro Miguel Lock 98 per cent of the concrete had been placed on March 31, only 9,000 cu. yds. remaining. Since this report was issued, however, the amount of concrete necessary for the Pedro Miguel work has been increased from 837,400 cu. yds. to 890,000 cu. yds., so that the percentage recorded as completed on May 4 is 93. There now remains to be placed at the present writing some 50,000 cu. yds.

At the Miraflores Locks, which were recorded as 58 per cent completed on March 31, some 50,000 cu. yds. have been added, so that these locks are now recorded as 64 per cent completed. The total yardage is 1,412,736.

Table I shows the costs for the three months ending March 31, 1912.

A comparison of the costs of the plain concrete work for the previous four quarters is as follows:

	1911. 2nd quarter.	1911. 3rd quarter.	1911. 4th quarter.	1912. 1st quarter.
Gatun Spillway	$6.78	$7.21	$8.60	$6.80
Gatun Locks	6.63	6.93	7.56	8.29
Pedro Miguel Lock	5.65	6.12	4.71	5.99
Miraflores Locks	4.76	4.76	5.03	4.90

Colon Breakwater.—This is a rock fill breakwater made from a trestle extended for two miles into the bay from Toro Point. The work is nearing completion. The cost for the last quarter follows:

Toro Point Fill—	
Excavation, cu. yds.	139,751
Surveys	...
Clearing	.
Drilling	[illegible]
Blasting	.0467
Loading by power	.0785
Tracks	.0206
Transportation	
Maintenance of equipment	
Total	
Filling, cu. yds.	
Trestles	
Dumping	
Maintenance of equipment	
Total	
Plant arbitrary	
Division expense	
Tug service	
Total division cost	
Administrative and general expe	
Total cost filling	

Culebra Cut.—The excavation th
bra Cut is 89 per cent complete
of lessening the amount of mate
slide into the cut by lightening th
has continued through the year
dry season has been very fav
work. The lowest steam shovel
17 ft. above the bottom of th
Culebra, the summit of excavatio
point it runs down to the final g
ends. At the north end the
practically finished, from the Cl
as far south as Las Cascadas:
south end the trench is nearly to a
mile or more. The greater part w
mains to be taken out lies betw
and Gold Hill, a distance of abou tw

As the Culebra Cut includes
cent of all the "dry excavation"
we give here only the costs fo
which are as follows:

Dry excavation, cu. yds.	
Clearing	
Drilling	
Blasting	
Loading	
Tracks	
Transportation	
Dumps	
Pumps	
Maintenance of equipment	
Plant arbitrary	
Division expense	
Total division cost	
Administrative and general expen	
Total cost	
Dry excavation Prism by contra yds.	
Contract cost	
Plant arbitrary	
Total cost	
Total dry excavation, cu. yds.	
Unit cost	

The yardage and cost for the pa
ters is shown for comparison in t ta
low:

	Cu. y
First quarter, 1911	5,216,
Second quarter, 1911	[illegible]
Third quarter, 1911	[illegible]
Fourth quarter, 1911	3,867,
First quarter, 1912	4,542,

[illegible] long dry season and small rainfall (which is recorded as the [illegible] amount for any dry season since occupation) has aided materially in [illegible] the costs, the number of slides and [illegible] the output. This was [illegible] the engineers, who had expected [illegible] excavation approached the canal [illegible] was finished up at the ends of the [illegible] output would be reduced according [illegible] amount of space available for

[illegible] The costs of dredging [illegible] and Pacific entrances to the canal is [illegible] Table II.

[illegible] rison of the unit costs for the last [illegible] as follows:

1911. 2nd quarter.	1911. 3rd quarter.	1911. 4th quarter.	1912. 1st quarter.
$0.[illegible]	$0.26	[illegible]	[illegible]
0.18	0.17	0.29	0.19

[illegible] and Crushing.—The cost of quar[illegible]ning and transporting rock to stor[illegible]

	Porto Bello quarry.	[illegible] quarry.
[illegible]	[illegible]	209,647
[illegible]	$[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0496
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.0632
[illegible]	[illegible]	.0381
[illegible]	[illegible]	
[illegible] equipment	[illegible]	[illegible]
[illegible]	.6660	[illegible]
	$1.[illegible]	$[illegible]
[illegible]	[illegible]	209,647
[illegible]	$0.0[illegible]	$[illegible]
[illegible]	[illegible]	.0051
[illegible]	[illegible]	.0199
[illegible] equipment	[illegible]	.0271
[illegible]	[illegible]	.0469
	$[illegible]	$0.1212
[illegible] production	$1.[illegible]	$0.6513
[illegible] yds.	135,360	
[illegible] and barges	$0.1[illegible]	
[illegible] equipment	[illegible]	
[illegible] ary	.1190	
	$0.4007	
[illegible]	135,[illegible]	
[illegible] bleways and cranes	$0.0945	
[illegible]	.0263	
[illegible] equipment	[illegible]	
[illegible]	.47[illegible]	
	$0.6[illegible]	
[illegible] ortation to storage.		
[illegible]	20,505	209,647
[illegible]	$0.2480	$0.[illegible]
[illegible] racks	.0199	
[illegible]		.0120
[illegible] equipment	[illegible]	.0209
[illegible]		.0500
	$0.4948	$0.1219
[illegible]	$0.0195	$0.0206
[illegible] storage	$2.6[illegible]	$0.7[illegible]

[illegible] duction.—The cost of dredging and [illegible] sand to storage is as follows:

	Chame [illegible]
[illegible]	149,81[illegible]
[illegible] redges	$0.0770
[illegible] equipment	[illegible]
	$0.1028
[illegible]	$0.01[illegible]
[illegible] st of production	$0.1128
[illegible]	149,817
[illegible] gs and barges	$0.0834
[illegible] equipment	.0451
[illegible] ary	.0200
	$0.1487
[illegible] yds.	149,814
[illegible] leways and cranes	$0.06[illegible]
[illegible]	.0180
[illegible] of equipment	.0249
[illegible]	[illegible]
	$[illegible]
[illegible] rtation to storage, cu. yds.	149,814
[illegible] trains	$0.0[illegible]
[illegible] racks	.0267
[illegible] storage	.0094
[illegible] equipment	[illegible]
[illegible]	[illegible]
	$0.1644
[illegible] xpense	$0.0124
[illegible] st in storage	$0.5775

[illegible] noted that the excavation of sand [illegible] e Dios has ceased, no costs for the [illegible] being given.

[illegible] of the channel in the Pacific Division is being [illegible] is proceeding southward toward the Pacific entrance. The costs of the work for the past quarter are as follows:

[illegible]	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	$0.605
[illegible]	.0272
[illegible]	[illegible]

Cost of Building a 2½-Cu. Yd. Dipper Dredge and Its First Season's Work.

The following notes on the cost of dredging are abstracted from a report by B. F. Powell, Engineer for the Fort Lyon Canal Co., at Las Animas, Colo. The company, previous to 1911, had let all its excavation work by contract, but after an investigation it decided to purchase a dredge and do its own excavation. Accordingly a contract was let to the Marion Steam Shovel Co. for a 2½-cu. yd. dipper dredge, with an 80-ft. boom. It was estimated that the probable cost of the dredge, with boat, etc., equipped and ready for operation, would be $26,000. It was estimated that the work could be done at a cost of operation not exceeding 4 cts. per cubic yard, while the low bid received for the work was 8¾ cts. per cubic yard. The difference on 1,000,000 cu. yds. to be excavated would thus be a saving of $47,000. Out of this the dredge would be paid for and leave a balance of $20,000, and the machine would be had for future work.

The dredge was built under the supervision of the Marion Steam Shovel Co. Work on it was commenced April 3 and the hull was completed and launched May 26, 1911. The boilers were steamed up on June 5 and used from that time on to furnish power for erecting the balance of the machinery. The fifteen-day test was begun on July 1, when it was demonstrated that the dredge would excavate its estimated yardage.

The hull of the dredge is 100x41x8 ft. and required 135,000 ft. B. M. of lumber. It has two 120-h. p. boilers, one double 10x12-in. hoisting engine, a double 8x10-in. swinging engine, an 80-ft. boom and a 2½-cu. yd. bucket. The amount of work accomplished by the dredge in the soft material in which it worked, is given below:

	Cu. Yds.
July	74,000
August and September	130,000
October	71,750
Total	275,750

The cost of operation as given for the month of October was $0.0315 per cu. yd.

The dimensions of the irrigating and storage canal now being completed, are 120 ft. on top and 100 ft. on the bottom for the first two miles from the head gate; for the next mile the width is 20 ft. less and after the third mile the width is again reduced 20 ft., making the bottom width 60 ft., with 1:1 slopes. The depth is 10 ft.

The actual cost of the dredge follows:

COST OF DREDGE.

Materials:	
Dredge equipment	$11,[illegible]
Extra boiler	1,600.00
Electric light plant	500.00
Freight	413.96
Tools	[illegible]
[illegible]	71.17
Boiler flues	236.80
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Oil	317.27
[illegible]	[illegible]
Hardware	1,880.22
Groceries and camp supplies	1,611.45
[illegible]	[illegible]
Total	$31,185.77
Labor:	
[illegible]	$[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Dredge runner	722.83
Labor	1,717.03
Carpenters	1,232.05
[illegible]	[illegible]
Sundry expenses, materials, teams, labor	2,[illegible]
Total	$ 8,619.31
Total, labor and material	$39,804.08

The above table shows the cost of the dredge, its construction and its operation until the end of the season, Nov. 1, 1911, as shown by the company's books. If we multiply the yardage excavated by about 4 cts. (the cost of operation) and deduct this amount, $11,030.00, from the total shown in the table the result should give the cost of the dredge ready for operation. This is $28,774.

Mont d'Or Tunnel, France.—The French railway tunnel through Mont d'Or on the new railway giving a shorter connection between the French railway system and Northern Italy by way of the Simplon Tunnel is making good progress. This tunnel will be 6,104 m., or nearly 3.8 miles long. The headings have been advanced 2,195 m. (7,199 ft.) from one end and 432 m. (1,417 ft.) from the other. The masonry lining is completed for 1,880 m. (6,166 ft.) at one end and for 216 m. (710 ft.) at the other. The tunnel is planned for completion in 1914.

Cost of Feeding Men and Animals, Cobalt Mining District.—The following tables were compiled by Arthur A. Cole, Mining Engineer for the Temiskaming & Northern Railway Commission. Table I shows the detailed cost of food per man for 3,020 men for the year 1911 as compiled from information furnished by the mining companies of the Cobalt District. Table II shows the cost of feed for 122 horses:

TABLE I.—COST OF PROVISIONS FOR 3,020 MEN FOR ONE YEAR.

Article.	Quantity.	Cost.	Quantity per man per year.	Cost per man per year.	Quantity per man per day.	Cost per man per day.
Flour	9,576 bgs.	$ 27,842	317 lbs.	$ 9.22	.87 lbs.	$0.0253
Potatoes	18,918 bgs.	21,554	626 lbs.	7.14	1.72 lbs.	.0196
Vegetables		21,520		7.12		.0195
Cereals		3,290		1.09		.0030
Cornstarch		688		.23		.0006
Biscuits		2,005		.66		.0018
Beef, veal, mutton, lamb	1,039,932 lbs.	134,944	344 lbs.	44.69	.94 lbs.	.1224
Pork, ham and bacon	504,396 lbs.	66,483	167 lbs.	22.01	.46 lbs.	.0603
Fowls	19,152 lbs.	4,897	6 lbs.	1.62	.02 lbs.	.0044
Lard, etc.	113,760 lbs.	15,729	38 lbs.	5.21	.10 lbs.	.0143
Butter	211,518 lbs.	54,890	70 lbs.	18.18	.19 lbs.	.0499
Eggs	2,240,840	46,967	742	15.55	2.03	.0426
Milk and cream	....	21,010	....	6.96	......	.0190
Cheese	20,718 lbs.	3,218	7 lbs.	1.06	.002 lbs.	.0029
Fruit, jams		60,556	....	20.05	......	.0549
		$485,[illegible]	....	$160.79	......	$0.4405

TABLE II.—COST OF FEED FOR 122 HORSES FOR ONE YEAR.

Article.	Quantity.	Cost.	Quantity per horse per year.	Cost per horse per year.	Quantity per horse per day.	Cost per horse per day.
Hay	991,250 lbs.	$ 7,333	8,152 lbs.	$ 60.11	22.27 lbs.	$0.165
Oats	713,882 lbs.	10,058	5,851 lbs.	82.44	16.03 lbs.	.226
		$17,391	....	$142.55	......	$0.391

ROADS AND STREETS SECTION

A Review of the Use of Bituminous Materials in the Construction and Maintenance of Highways During 1911.

At the December, 1910, meeting of the American Association for the Advancement of Science, Prof. Arthur H. Blanchard, M. Am. Soc. C. E., presented a paper* giving a resume of the practice in the use of bituminous materials in the construction and maintenance of roads in the United States. This paper treated of the status of the art and science of the branch of highway engineering during 1908, 1909 and 1910. At the December, 1911, meeting of the American Association for the Advancement meeting, Prof. Blanchard presented a paper describing the development during last year in the use of bituminous materials. This paper shows the work accomplished by some of the prominent state highway departments, the progress in the construction of bituminous surfaces and the use of palliatives, the construction of bituminous pavements by penetration methods the present status of bituminous concrete pavements in the United States and the development of sheet asphalt pavements in municipalities. Prof. Blanchard's paper practically in full, follows:

As considerable confusion arises because of misunderstanding of the various expressions and terms used in describing materials and methods of construction, certain definitions are given in order that the content of the descriptions as set forth below may be manifest to all. The nomenclature used in this paper covering bituminous materials and their use in the construction of roads and pavements, follows:

Asphalts are solid or semisolid native bitumens, solid or semisolid bitumens obtained by refining petroleums, or solid or semisolid compounds which are combinations of the bitumens mentioned with petroleums, or derivatives thereof, consisting of a mixture of hydrocarbons of complex structure, largely cyclic and bridge compounds, melting upon the application of heat.

Asphaltic petroleums are petroleums which yield asphalts upon reduction.

Asphalt cement consists of an asphalt, pure or mixed with foreign matter, which may or may not be fixed with petroleum residuums.

Bitumens are mixtures of native or pyrogenous hydrocarbons and their non-metallic derivatives, which may be gases, liquids, viscous liquids, or solids and which are soluble in carbon disulphide. This defination was proposed by Committee D-4 of the American Society for Testing Materials.

Bituminous concrete pavements are those having a wearing surface composed of stone, gravel, sand, shell or slag or combinations thereof and bituminous materials incorporated together by mixing methods.

Bituminous gravel pavements are those composed of gravel and bituminous materials incorporated together by penetration methods.

Bituminous macadam pavements are those consisting of broken stone and bituminous materials incorporated together by penetration methods.

Bituminous surfaces consist of superficial coats of bituminous materials with or without the addition of stone or slag chips, gravel, sand or materials of a similar character. This definition was proposed in the 1912 Report of the Special Committee on "Use of Bituminous Materials in Road Construction" of the American Society of Civil Engineers.

Sheet asphalt pavements are those having a wearing surface composed of a predetermined graded sand, fine material and asphalt cement incorporated together by mixing methods. Although this definition embodies the ideas of the leading authorities and covers a common usage, it has been inserted because it has been claimed that a bituminous concrete containing as part of its mineral aggregate broken stone passing a ½-in. sieve and retained on a ¼-in. sieve should be classified under sheet asphalt pavements. Fortunately this assertion has not been received with favor by municipal engineers.

In order to give some idea of the extent of the use of bituminous materials in the construction of roads and pavements in the United States, the superficial yardage of roads maintained by surface treatments, of bituminous pavements constructed by penetration methods and of bituminous concrete pavements built under the jurisdiction of the State Highway Departments of Maine, New Hampshire, Massachusetts, Rhode Island, New York, New Jersey, Pennsylvania and Maryland during 1911 is given. In the following table the yardage for 1908, 1909 and 1910 is included for comparison.

	Tars and tar-asphalt compounds	Medium and heavy asphaltic oils and asphalt cements	Light asphaltic oils
Surface Treatment of Roads.			
1908	[illegible]	[illegible]	
1909	[illegible]	[illegible]	[illegible]
1910	[illegible]	[illegible]	[illegible]
1911	433,700	7,980,400	3,765,200
Bituminous Pavements Constructed by Penetration Methods.			
1908	[illegible]	[illegible]	
1909	[illegible]	[illegible]	
1910	339,300	4,840,200	26,500
1911	[illegible]	[illegible]	
Bituminous Concrete Pavements.			
1908	[illegible]	[illegible]	
1909	[illegible]	[illegible]	
1910	[illegible]	[illegible]	
1911	[illegible]	[illegible]	

As under the Rhode Island State Board of Public Roads no construction work was accomplished during 1911, due to the fact that no road appropriation was made by the Legislature, the yardage of bituminous concrete pavements constructed with tar-asphalt compounds in 1911 shows a decrease in comparison with the yardage recorded for 1908, 1909 and 1910, the bulk of which was built by the Rhode Island Board. It is of interest to note, however, that 750,000 gals. of refined tar have been ordered to be used in the construction of bituminous concrete pavements in Rhode Island during 1912. That more permanent forms of construction are favored by our state commissions is clearly shown by the marked decrease in the use of light oils for surface treatment of roads and the decided increase in the surface treatment of roads with heavy asphaltic oils and asphalt cements. As showing the general increase in the use of bituminous material in the construction of bituminous surfaces and bituminous pavements from 1908 to 1911, the total figures for the four years are given. The total number of square yards for each of the above years is given in the following table:

1908	416,700
1909	7,735,100
1910	18,244,600
1911	21,514,600

These totals include the yardage of road surface treated with light asphaltic oils. A comparison of more value and representing material progress along the lines of improved methods of construction and maintenance should be based on totals from which the yardage of road surface treated with light asphaltic oils is omitted. On this basis the total yardage is as follows:

1908	416,700
1909	3,609,200
1910	8,327,700
1911	17,749,400

As noted above, one line of d elopment in
the surface treatment of roads as been
departure from the use of pall ives and a
marked increase in the use of bi minous sur-
faces. This tendency is due ir part to the
unsatisfactory results which l ve accrued
from using bituminous materia which did
not "set up" in from 24 to 48 urs, to the
necessity for repeated closing thorough-
fares and to the recognition on he part of
many that bituminous surface are
economical and efficacious in the ng
treatment with palliatives. This ange
only characteristic of state work out
more characteristic of municipal ork
the tracking of bituminous mat ials
on the whole in more material dam
property. The second marked
under bituminous surfaces is in
use of various types of pressure
distributors which have been
signed for this work. The cons
donment of the use of pouri
ordinary watering carts for thi
be commended. Many types
chines have been used during t
for this kind of work. It has
nate that sufficient information
at hand covering the use of t
machines so that an engineer
the limitations of a machine be
sing. It is self-evident that, give
bituminous material, the temper
material, the rate at which the
travels, the callibration of th
should be such that the operat
how much it will distribute per
Information of this character
doubt be forthcoming with refer
of the distributors to be used du
son of 1912. Extravagant claim
made by the designers and man
distributors. In a certain inst
been claimed that materials, rang
acter from light oil to an aspha
a consistency suitable for use in
tion of sheet asphalt pavements,
distributed by a given machine in
square yard varying from ⅛ ga
Recently the writer's attention w
the fact that a certain designer
mending the use of a pressure
which necessitated the use of a
in its operation, for the distributi
face application, of a palliative
ways applied cold.

During 1911 bituminous surfac have no
only been used extensively on m
gravel roads, but they have also
a considerable degree on cem
pavements. The improvement of
pavement by the addition of the
surface is marked, as, if the pro
bituminous material is used, the
non-productive of dust, is not slip ry, a
less noisy than the ordinary co ete
ment. There is no apparent reas wh
results accruing from the use of itum
surfaces on brick pavements wo d no
equally good. Especially would ch
case where bituminous fillers are se
combining many of the advantages
ous fillers and bituminous surfac
inherent good qualities of brick p eme

In the field of the construction bit
ous pavements by penetration m hods
numerous methods which have bee emp
during 1911 will be described. All ese
ods have as the principal desidera the
ing of the bituminous material win
ins. of the road surface and the c
the uniform incorporation of the it
material and the broken stone
lack of uniformity in the density the su
face and in the amount of bitu ous
terial applied by the many method emp
it is obvious that the uniform i rporatio
of the road metal and the bitumi s ceme
is difficult to obtain. The averag paveme

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*See Engineering & Contracting, March 29, 1911.

generally built in two courses, the n course being about 4 ins. thick ing and the top course about 2 i er rolling. Following are brief de- of the various methods to which has been made. In all the methods ruction is completed by the applica- thin coat of sand, stone chips or

: For the upper course broken stone ontaining sufficient small sized par- materially reduce the voids, as for crusher run stone which passes a reen and is supposed to be retained n. screen. In this method, after the rse is laid, the bituminous material either before or after the surface some favoring the former, because eater depth of penetration secured. upper course is rolled after the of the bituminous material, a coat l matter has usually been spread surface before rolling. The neces- second application or seal coat of s material is determined by traffic in many cases, although standard some departments is responsible se of one or the other method, in- of the traffic.

: In case the metal of the upper a uniform product of about 1 in. in size, the bituminous material is er the course has been lightly rolled. s are then spread upon the surface ighly rolled. After the surface is another coat of bituminous mate- ied. The above method is also used road metal varies from ½ to 2½ ich case ¾-in. stone is usually em- place of chips.

The foundation courses are filled in extent with sand or small sized ne and after the course is rolled, eral matter is swept off. After the se of road metal is applied, its voids to within about 1 in. of the sur- e bituminous material applied. The ished with a coat of sand or chips olled, although in some cases a sec- ation of bituminous material and ed.

A closely packed foundation or a ise is used and large and uniform employed for the wearing course. thod a layer of sand, ¾ in. thick, the bottom course and bituminous istributed, using about 1 gal. per e upper course of metalling is ap- he upper course thoroughly rolled. ious mastic tending to fill the voids r course. Another coat of bitumin- al is applied and the surface fin- e application of a coat of chips lications of bituminous material are g likewise two coats of sand or

The upper course is constructed l manner and in place of sand or a bituminous mastic is applied face, being rolled into the voids g the finished surface of the road. rks pertaining to distributing ma- tioned in connection with the dis- bituminous surfaces apply with to types of distributors used in ction of bituminous pavements by methods.

truction of bituminous concrete t in connection with which broken d in the aggregate has been devel- certain lines during 1911, although gation has restrained many engi- advocating the use of this type of

nplating the work which has been d by the use of bituminous mate- class of construction during 1911, t that even the laity has specified tendency to have faith that the the United States, if necessity recognize that prior art and prin- ons cover many satisfactory com- aggregates which, when embod- ments, have inherent stability.

[illegible] construction will be cited in connection with each of the types of bituminous concrete pavements to be considered later. Although it is not intended to draw up a brief, nevertheless it may be of interest to include in this resume reference to certain specific cases of the early use of each type of aggregate.

It is the opinion of expert patent lawyers that the construction of a pavement according to any description published two years prior to the date of application of the patent, which may be under consideration, could not be prevented regardless of the validity of that patent. It may be that the disclosure of the process may invalidate the patent, as it is entirely possible that in the issuing of the patent some evidence of prior art might easily have been overlooked. It might be well if the old saying "To err is human" was always in mind when considering the validity of patents.

Bituminous concrete pavements, in the aggregates of which broken stone forms an integral part, may be divided into three groups, as follows, the classification being based upon the character of the mineral aggregate:

Type A: One size crusher run stone; that is, any one product of a crushing plant.

Type B: Combinations of one size crusher run stone and fine mineral matter, such as sand, stone screenings and fine gravel.

Type C: Finely graded aggregates of broken stone and sand or other mineral matter.

Naturally Type A has been very popular, due to its inherent simplicity. During the year past the writer has seen excellent pavements constructed by this method where the aggregate was a one size crusher run stone having the following characteristics based upon a mechanical analysis: All the stone passed a 1¼-in. sieve; not over 25 per cent passed a 1¼-in. sieve and was retained on a ¾-in. sieve; and not over 5 per cent passed a ⅛-in. sieve. Descriptions of old pavements of this type are legion. As an illustration may be cited the following specification used in England prior to 1899:

> The hot stone, when ready for mixing, is [illegible] coat, and ¼ to ½ in. for the top dressing. The [illegible] about ¾ in., and the top dressing is used in thinnest layer possible, with a view to filling all [illegible] smaller granite screenings is scattered broadcast, and the traffic at once allowed on the road to work this top dressing into the tarred material. Each of the layers is rolled separately with a 10-ton roller.

The State Board of Public Roads of Rhode Island has used Type A since 1906. It has been admitted in writing by certain patentees.

> that so long as the construction is of the nearly uniform sizes of stone which you are now using, and you do not get the fine material applied from the surface or into the spaces between the particles of bitumen coated stone more than our observations indicate you are now doing, or we believe it is possible to do, we would not claim this feature of the construction to be an infringement of our patent No. 727,505.

The construction referred to in the above quotation covers the construction of a wearing course of a bituminous concrete pavement under the following specification relative to the broken stone:

> The bottom course shall consist of stone from 1¼ ins. to 2½ ins. in their longest dimensions, the upper course of stone from ½ to 1¼ ins. in their longest dimension.

Only the upper course stone was mixed with bituminous material. The product of the crusher which met this specification was obtained from the ordinary type of crushing plant, the broken stone usually passing a 1½-in. screen and commercially being retained upon a ¾ or ⅝-in. screen. A mechanical analysis of a typical product used in Rhode Island may be of interest and hence is given below:

Per cent passing 10 mesh sieve	1.0
[illegible]	[illegible]
Per cent passing ½-in. sieve	30.8
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

As Deputy Engineer for the State Board of Public Roads of Island, the writer had charge of the construction and maintenance of bituminous surfaces and bituminous pavements for a number of years and hence had the opportunity to inspect on numerous occasions the first section of bituminous concrete pavement constructed in 1906 under the above specification. This section has needed no repairs, although subjected to high speed motor car traffic of the heavy passenger type. Without doubt broad-minded judges would admit that this type of pavement has inherent stability.

The second type, that is, one having an aggregate composed of one size crusher run stone mixed with fine material, such as sand, screenings or material of a similar character, is likewise described many times in early technical literature. For example, the following description was published over 30 years ago:

> The manner of preparing, treating and laying the asphalt mass is as follows: He took asphalt, 125 parts; petroleum-oil, 25 parts. These substances were melted and thoroughly incorporated together, and to this mixture he added, in a heated state, sand or powdered stone, 750 parts, and gravel or broken stone, also heated, 1100 parts. The whole was then thoroughly mixed.

During 1911, Type B was very popular in various quarters. In Washington, D. C., under the jurisdiction of Captain Mark Brooke of the office of the Engineer-Commissioner, bituminous concrete pavements were constructed under the following specifications covering mineral aggregate:

> The paving materials shall be composed of crushed trap rock screenings, concrete sand and mineral dust in the following proportions: Trap rock screenings, 2 parts; concrete sand, 1 part, and mineral dust, at least 5 per cent of the above aggregate; mixed with asphaltic cement.

The trap rock screenings referred to above varied in size from 1 in. to screenings and were devoid of dust. Detailed specifications were also given with reference to the character of the sand and the mineral dust. The writer has had the good fortune to examine various streets paved under the above specifications. In his humble opinion these pavements possess inherent stability under commercial traffic.

In connection with the discussion of the use of the third type; that is, a graded aggregate of broken stone with or without sand and fine mineral matter, the consideration of the following description, so old as to be covered with the dust of decades, is apparently pertinent:

> Broken stones are preferred for the whole pavement, and shall alone be used for the covering. The greatest dimension of stones for the base (except as hereinafter noted) shall be between 3 ins. and ¼ in., and for the covering between 2 ins. and 1/20 of an in.; the sizes shall be mixed in proportion, varying with the size to form a close mass, which, when dry and compact, can absorb not more than 20 per cent of water.

During 1911 many thousands of yards of a pavement of Type C have been laid. In the borough of Richmond, New York City, over 40,000 sq. yds. were laid on a total of 18 streets last year under direction of Theodor S. Oxholm, M. Am. Soc. C. E. The mineral aggregate used conformed to the now famous Topeka specifications. A decree was signed by certain officials and representatives of certain patentees covering the use of the Topeka mineral aggregate. The following quotation is from the decree to which reference has been made:

> It appearing to the court that of the mineral matter used in the pavements actually con-

[illegible] the cities of Topeka and Emporia, [illegible] particles of stone were used that would not pass a screen with openings ½ in. in diameter, and that less than 10 per cent of the stone or coarse sand used would be retained upon a screen with openings ¼ in. in diameter, and the remaining mineral matter used being finer than ¼ in.; and it further appearing that pavements constructed by the use of mineral particles as above described do not infringe the claims of complainant's patent, No. 727,505, sued upon in this case. And it further appearing that the pavements as actually constructed in the cities of Topeka and Emporia, Kans., do not infringe the claims of complainant's patent No. 727,505, sued upon in this case, and that any pavements hereafter constructed in substantial compliance with the following formula, to-wit:

	Per cent.
Bitumen	from 7 to 11
Mineral aggregate, passing—	
200-mesh screen	from 5 to 11
40-mesh screen	from 18 to 30
10-mesh screen	from 25 to 55
4-mesh screen	from 8 to 22
2-mesh screen	less than 10

Sieves to be used in the order named would not infringe the claims of said patent.

Mention should be made of the effect of the introduction of various types of low priced mixing machines during 1911. The economical and satisfactory results accruing from the use of these machines for mixing certain types of aggregates with bituminous cements has caused the introduction of the mixing method in many localities where only the penetration method has formerly been used. During the season of 1912 many new machines of this type will be used with the consequent increase in the construction of the various types of bituminous concrete pavements outlined above.

During 1911 considerable thought has been devoted to the methods and materials employed in the construction of sheet asphalt pavements. Notable work has been done by a special committee of the American Society for Municipal Improvements and the committee of the Association for Standardizing Paving Specifications. Throughout the United States there appears to be crystallizing a firm belief that specifications for materials should be opened to admit such asphalt cements as "Bermudez," "California," "Pioneer," "Texaco" and "Trinidad," for instance, which have shown by service tests that excellent pavements may be constructed by their use. This tendency is commendable, as thus competition is increased and the high quality of the asphalt cement is maintained.

An English Specification for the Construction of Wood Block Pavement.

In our May 8 issue we described briefly the methods employed in some of the European cities in the construction of wood block pavements. Through the courtesy of Mr. Clifford Richardson, Consulting Engineer, New York City, we are enabled to present below the specifications of the Metropolitan Borough of Fulham, England, which is a part of the city of London, for this type of pavement. The specification brings out some of the differences between English and American practice.

SPECIFICATIONS OF WORKS TO BE DONE AND MATERIALS EMPLOYED IN CONSTRUCTING WOOD-PAVED ROADWAY.

Sand.—1. The sand to be pit or Thames sand of the best quality, clean and sharp, and free from loam or clay.

Thames Ballast.—2. The Thames ballast is to be clean, the stones are to be regular in size and the proportion of sand to stones is to be to the satisfaction of the Surveyor.

Cement.—3. The cement to be the best Portland cement complying with the British Specification, of a pale gray color, specific of not less than 3.15 or 3.10 one month after grinding and capable of sustaining an average tensile stress of not less than 400 lbs. per square inch of sectional breaking area seven days after gaging and immersion in water 24 hours after gaging, and 500 lbs. per square inch of section 28 days after gaging and it to be delivered in to the works in sacks weighing 200 lbs. net, marked with the manufacturer's name. It is to be ground so that when sifted with a sieve of 5,776 meshes to the square inch there shall not be a residue of more than 3 per cent. Sufficient cement is to be stored on or near the works for a fortnight's use, 14 days before the commencement of the work, and an equal quantity is to remain stored during the progress of the work, and an equal quantity is to remain stored during the progress of the work until only sufficient work remains to be completed to use up the cement stored during the work. The cement will in all cases be tested by the Surveyor with Adie's Testing Machine and the average taken of at least six tests, and any rejected by him is to be removed at once from the work without any question being raised.

Concrete.—4. The concrete is to consist of one part of Portland cement and six parts of clean Thames ballast (the parts being ascertained by measurement of their volume in proper measures) thoroughly mixed together in a dry state on a timber stage not less than 10 ft. by 10 ft. for half a cube yard of concrete, water is then to be added from water-can through a hose and the whole again thoroughly turned over three times at least and mixed until a proper consistency is obtained. If the concrete has commenced to set before being used it is not thereafter to be used except as ballast.

Cement Grout.—5. The cement grout is to be made of one part of Portland cement as described and three parts of clean sand (the parts being ascertained by measurement of their volume in proper measures), thoroughly mixed together in a dry state on a proper banker and made as previously described for concrete.

Cement Mortar.—6. The cement mortar is to be composed of one part of Portland cement as before described and three parts of clean sharp sand mixed on a proper banker as previously described for the concrete, and used while fresh.

Thames Ballast for Top Dressing.—7. The Thames ballast for top dressing is to be crushed and then screened through a ⅜-in. mesh sieve.

Excavation.—8. Excavate the whole of the carriageways as directed, including crossings, channelings, etc., wherever necessary to the proper depths and levels as required, carefully separate the macadam, set aside for re-use fill into contractor's carts and deposit where directed within radius of one mile from the job.

Strip Roads.—9. Carefully strip roads of all old wood blocks and cart away to wharp, depot or where directed.

Existing Channel.—10. The existing granite kerb, sett channels, paved areas, binding courses, crossings and concrete under, where described or necessary, is to be taken up and carted, at the contractor's expense, to the wharf, depot, or as directed. So much of the existing kerb as approved by the Surveyor is to be set aside, rejointed and relaid on Portland cement concrete 6 ins. thick, making out with new 12-in. x 8-in. kerb to be obtained through Borough Council.

Floating.—11. The surface of all existing floating is to be picked perfectly free from all pitch, asphalt, old floating soft concrete, etc., in such a manner that the new floating will not alter the existing contour or increase the height of existing foundations unless otherwise directed, and same is then to be brushed clean and free from dust, well drenched and finished with a floated surface ¾-in. in thickness, composed of one part Portland cement to three parts sand as described for cement grout. The surface of new concrete is to be finished in a similar manner with proper and approved contours and with satisfactory falls to gulleys. The finished level of this surface to be exactly 5 ins. below and parallel to the intended surface of the wood pavement. All floating after completion to be left exposed for seven days or longer as considered necessary by the Surveyor.

Laying of Wood Blocks.—12. After the rendering specified above has been laid sufficiently long to become thoroughly hard and set, it is to be brushed clean, the block to be dipped in a hot mixture of pitch and anthracene oil, and then to be quickly laid in position jointed and in parallel course across the road.

Wood Blocks.—13. The timber fro [illegible] blocks are to be cut shall be caref [illegible] from Swedish close grained yellow [illegible] ing the shipper's mark, and which [illegible] scribed in the current Timber Tra s Journal List. The blocks shall be of unif size and weight and uniformly cut. The ber shall, before being cut, be submitted to Surveyor or his representatives, and no bl shall be sawn from timber of which the Su yor or his representative has not signified his reliminary approval. Four samples sealed d marked with the contractor's name and shi er's mark shall be left at the Surveyor's offic or his ex amination with the tender, and [illegible] which may be brought on to the orks and which may be inferior to those san es may be rejected by him The Surveyor o [illegible] sentative shall have full power t eject any blocks, either at the cutting yar or at the creosoting works, and he shall also ave power to reject any blocks after deliver o [illegible] site of the proposed works or at all [illegible] these places, whether creosoted or [illegible] are not creosoted in satisfactory m ne, or to the extent of 10 lbs. of creosote [illegible] when cut shall be truly square and all meas- ure 9 in. x 5 in. x 3 in. off the saw. Th [illegible] lar rings shall not be less than 10, th [illegible] not more than 2 ins. of sapwood [illegible] in any block and the percentage of [illegible] shall not exceed 15.

They shall also be free from la [illegible] dead knots, shakes or other defe [illegible] not contain more than 5 per cent of [illegible] edges.

Timber that has not been properl to [illegible] become dry will not be accepted. [illegible] be taken to prevent the blocks fro [illegible] wet, as any in such condition eithe [illegible] bilge water or other causes must [illegible] soted.

Creosoting.—14. The council shal appoint a representative to examine the block [illegible] have power to cause the blocks to [illegible] the ground before being creosoted [illegible] or mark as arranged by the Surve [illegible] he may reject. The blocks aft [illegible] proved may then be creosoted [illegible] with each charge being weighted [illegible] and after the process The cr [illegible] forced under pressure into them unt they absorbed an amount of 10 lbs. to eac cub [illegible] and in such a manner that any bloc spa [illegible] will show the creosote to be pene ted [illegible] through.

Creosote.—15. The creosote is to [illegible] heavy oil of tar commonly called creosote an [illegible] tain not less than 8 per cent of t [illegible] will be subjected to analysis and th contractor is only to use such as may be appr ed by the analyst.

Expansion Joint.—16. The contr to [illegible] provide wooden battens 1½ in. wide [illegible] th [illegible] of the blocks which shall be used in [illegible] against the korb and the blocks sh [illegible] up to it. After the paving has bee [illegible] these battens shall be withdrawn a [illegible] left shall be filled in with clay an [illegible] directed.

Examination of Blocks.—17. Aft [illegible] blocks are in position they will [illegible] by the Surveyor and no portion of [illegible] is to be grouted in with either the sp [illegible] cement until this examiantion has een and sanction given for the grout [illegible] mence.

Composition Between Joints.—18. App [illegible] pitch or bitumen is to be heated a car [illegible] run between the blocks to a depth 3 ins. [illegible] directed.

19. The blocks are then to be g ted wi [illegible] cement grout until the joints are horough filled.

Protect for 48 Hours.—20 After [illegible] tion of the grouting the work is to pro [illegible] for at least 48 hours before the roa s thrown open for traffic.

Crossings.—21. At the intersectio of oth [illegible] streets the crowns of the adjoining re [illegible] to be adjusted to run into the cr [illegible] roadway that is being paved for th [illegible] and whenever it may be necessary [illegible] roadways or part or the whole of ossing the adjoining streets are to be tak up a [illegible] similar materials, [illegible] directed, making good [illegible] necessary in the opinion of the S[illegible] any extra charge over the amount [illegible]. At such intersections [illegible] to be laid diagonally as may [illegible] y the Surveyor.

Courses.—22. The course of 7-in. x 5- n. granite setts laid on 6-in. concrete laid as a binding course wherever the [illegible] road. The contractor may retain re- [illegible] for this purpose as approved [illegible]

Coatings of Siftings.—23. After the been inspected a coating of ⅜-in. allast for top dressing as specified is ead over the wood pavement, and the [illegible] e road is thrown open to the traffic. [illegible]

ch portions as the Surveyor shall di- the workmen shall at all times afford ities for local traffic for the conveni- op-keepers as may be directed by the [illegible]

must lay the blocks to such levels [illegible] that may collect on the surface and nnels at any time and the work will en over by Council until this is done [illegible]

[illegible] dule as far as the items refer to any [illegible]

[illegible] n. x 5-in. x 3-in. off the saw is to all necessary cuttings, raising man- ventilators or other covers, stop cock [illegible] ng, relay crossings, binding courses, rk incidental thereto and necessary leave a perfect and satisfactory job. amount of the tender is to be worked [illegible]

[illegible] quantities is attached.

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on Road and Street Work.

n Construction on Sand Sub- Mr. A. L. Burridge, Road Engineer [illegible] Michigan, states that in [illegible] road on a sand subgrade [illegible] ugh the voids in the first course of s difficulty was obviated by spread- layer of iron ore and rock screen- e subgrade, and then spreading the of stone on this. The first course [illegible] rolled, and, by so doing, ngs filled the voids of stone from and confined the sand of the sub-

g Ruts in Macadam Roads.— ing method was used by the Road ers of Alger County, Michigan, ns, County Road Engineer, in re- which had developed in some of m roads of the county road sys- macadam was loosened with a pick om course of rock and the hole . Rock from 1½ to 2½ ins. was he hole, well wet and tamped so p was a trifle above the level of ding road. Screenings were then he rock, thoroughly dampened and a 25-lb. iron rammer. The ruts ½ miles of road were repaired in a cost of $60 per mile. Screen- ck were delivered in cars on spurs ork for 10 cts. per cu. yd., and in wagons and deposited along the road where needed. The average haul was [illegible] mile. Team and driver [illegible] $2 per day.

Cost of Street Sprinkling at Grand Rapids, Mich.—[illegible] by the city highway sprinkling department. The sprinkling by the street railway was started March 18, 1910, and was carried on until Nov. 1, 1910. The number of miles in the route was 28.56. The cost of the sprinkling was as [illegible]

Number of miles sprinkled, 12,637, at 12 [illegible]	$[illegible]
Water used, 30,263,800 gals., at 4 cts. [illegible]	[illegible]
Total cost of sprinkling	$2,727.04

[illegible] was $95.50. The cost of sprinkling per mile [illegible] was 9.58 cts., making the total cost of sprinkling per mile, 21.58 cts. A total of 2,395 gals. of water was used per mile. Sprinkling by the city department was started on May 30, 1910, and was carried on until Oct. 26, 1910. The number of miles of streets included in the route was 167.625. Water was furnished by the Waterworks Department at 4 cts. per 100 cu. ft., 10 per cent off. The number of sprinkling carts in service was 28, each of 750-gal. capacity. The data on the sprinkling were as follows:

N[illegible]	[illegible]
Gallons of water used, 77,601,000	3,724.85
Total cost of sprinkling	$14,599.43
Cost of sprinkling per mile (labor)	$0.3627
Cost of sprinkling per mile (supplies and [illegible])	[illegible]
Cost of sprinkling per mile (water used)	.1318
Average cost of sprinkling per mile	$0.5163
Average cost per mile of route sprinkled	87.10
Average cost per lin. ft. (30-ft. roadway)	.0165
Gal[illegible]	[illegible]

Reinforced Concrete Pavement at Plymouth, Wis.—Several somewhat unusual methods were used in the construction of a reinforced concrete pavement laid in the summer of 1910 at Plymouth, Wis. One of the features was the use of "Pecky" cypress for expansion joints in place of the usual asphaltum or tar. The 1-in.x8-in. boards were used along each gutter and every 40 ft. across the street, and at the ends of the ties of the street car tracks. These boards were used as forms for the outside of the cement gutters and as a template for the crown of street. A considerable saving of lumber as well as time in placing and removing the same was thus effected. The reinforcement used was triangle mesh, style 7 woven wire. This was placed directly on the concrete base so as to lie between the surface and the base. The base was 5 in. thick and the surface coat 1½ in. thick. The latter consisted of granite chips from ¼ in. to ¾ in. in diameter, granite screenings from ¼ in. down to dust and Portland cement in proportion to give the densest mixture. After this mortar was spread over the concrete base and the mesh, it was troweled smooth and while still soft the larger granite chips were cast by hand over the surface of the pavement, giving the entire area a roughened appearance. Some of the stones disappeared entirely into the soft cement mortar, leaving depressions in the pavement, while the others sank in only part way. The result was a surface which, while level enough to cause no annoyance in riding over it, was still rough enough to overcome any slipperiness of surface. This pavement, in monolithic squares of 40 feet, is now nearly two years old, has passed through two winters, and it is stated that there is not the sign of a crack or a flaw in it. It is not slippery and does not wear perceptibly. The expansion joints have worn off some, but not enough to show any abrasion of the concrete along the edges of the boards. The contract price for this pavement, including grading, was $1.23½ per sq. yd. The pavement was designed and constructed under the supervision of Mr. W. G. Kirchoffer, of Madison, Wis. The total yardage was 10,786 and the labor time consumed in constructing it, according to "Permanent Pavement," a publication of the Universal Portland Cement Co., from which this note has been taken, was as follows:

Grading:	Hours.
Teams	[illegible]
Laborers	2,275
Foreman	[illegible]
Engineer and rollers	178
Laying Concrete Pavement:	
Teams	1,157
Laborers	[illegible]
[illegible]	[illegible]
Timekeeper	[illegible]
Carpenter	12
Engineer and mixers	[illegible]

The actual hours per 1,000 sq. ft. were as follows:

Grading:	Hours.
T[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Engineer and roller	16.5
Laying Concrete Pavement:	**Hours.**
T[illegible]	108
[illegible]	[illegible]
[illegible]	[illegible]
Timekeeper	41.8
[illegible]	[illegible]
Engineer and mixers	56.8

Cost of Brick Paved Roads.—The data in this note have been taken from a recently issued Road Bulletin of the Highway Department of the Missouri State Board of Agriculture. The following figures are the actual cost, not including miscellaneous items, etc., upon 12,000 sq. yds. (1,333 cu. yds.) of hand-mixed 1:4:7 street concrete base 4 ins. thick, put down under average good conditions in Missouri:

Labor Mixing and Placing	Per sq. yd.	Per cu. yd.
Wheeling stone, wheelbarrows	$0.0115	$0.1035
Wheeling sand, wheelbarrows	.0033	.0297
Spreading cement	.0033	.0297
Turning sand and cement	.0101	.0909
T[illegible]	.0134	[illegible]
Watering	.0029	.0261
Tamping	.0033	.0297
Off-bearing	.0101	.0909
Foreman	.0135	.1215
Total labor	$0.0714	$0.6426
Total Cost Material and Labor:		
Stone	$0.1300	$1.1700
Sand	.0639	.5751
Cement	.1200	1.0800
Labor	.0714	.6426
Superintendency	.0101	.0909
Grand total	$0.3954	$3.5586

The average of several cost accounts (good cost conditions) upon laying brick pavements in Missouri (actual cost) with common labor at 15 cts. per hour and bricklayers at 20 cts. per hour, is given as follows:

Labor for Laying Brick:	Per sq yd.
Preparing sand cushion	$0.0095
Stacking brick	.0060
Wheeling brick	.0105
Laying brick	.0075
Culling brick	.0035
Batting and grouting	.0045
Cleaning	.0030
Foreman	[illegible]
Total labor	$0.0470
Material:	
Sand	$0.1000
Brick	.7000
Grout	.0180
Total material	$0.8180
Superintendence	.0050
Grand total, labor and material	$0.8700

Other costs for brick pavement on concrete base show the following:

	Per sq. yd.
Shaping subgrade	$0.10
Concrete base, 4-in.	.45
Sand cushion, 2-in.	.10
Brick, [illegible] per sq. yd.	[illegible]
Total	$1.6[illegible]

Data on Bituminous Construction.—The following data on bituminous construction have been taken from the book of "Standards" of the Massachusetts Highway Commission. Figures 1 and 2 show two road sections for macadam with bituminous treatment. The estimated tonnage required per 100 ft. for the section shown in Fig. 1 is as follows:

Lower course No. 1 stone	24 tons
Screenings for binder	4 tons
Upper course No. 2 stone	16 tons

[illegible] figures are for trap rock; for local stone the tons required are as follows:

Lower course No. 1 stone	22 tons
Screenings for binder	4 tons
Upper course No. 2 stone	14 tons

Both of the above tonnages are for bituminous treatment by the penetration method and provide for binding the lower course with stone screenings or sand. For bituminous treatment by surface spraying, screenings or sand binder are used in the upper course, in which case the tonnage required for the section shown in Fig. 1 is as follows:

Fig. 1.

	Trap. Tons.	Local stone. Tons.
Lower course No. 1 stone	22	22
Upper course No. 2 stone	16	14
Screenings for binder	7	7

The section shown in Fig. 2 provides for a 4-in. macadam. The number of tons of trap or local stone required per 100 ft., penetration methdo as in the first case, is as follows:

	Trap. Tons.	Local stone. Tons.
Lower course No. 1 stone	19	17
Screenings for binder	3	3
Upper course No. 2 stone	17	15

Where the bituminous treatment is by surface spraying the tons required are as follows:

	Trap. Per ton.	Local stone. Per ton.
Lower course No. 1 stone	19	17
Upper course No. 2 stone	17	15
Screenings for binder	6	6

For both penetration methods—grouting or the Modified Gladwell method—it is stated that there should be two applications of asphaltic oil, each ¾ gal. per sq. yd. There may also be a third application of ¼ gal. per sq. yd. for a surface finish. For surface treatment there should be one application of ½ gal. per sq. yd., or two applications of ¼ gal. each per sq. yd., on the finished surface of the roadway. The following approximate data for bituminous constructi given:

Bituminous Macadam (mixed):
  1 ton broken stone 10 sq. yd after rolling.
  1½ gals. bituminous material to
  18 gals. bituminous material to e broken stone (loose), approx 2,700 lbs.
Bituminous Macadam (mixed):
  Lower course bound with sand or
  Upper course 2 ins. thick after ed).

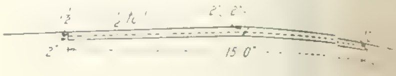


Fig. 2.

  1½ gals. of bituminous material
  Wearing course, .015 ton of pea gal. of bituminous material per
Bituminous Gravel (mixed):
  1 cu. yd., 14 sq. yds. 2 ins. thick a
  1.3 gal. bituminous material to e
  18 gals. bituminous material to (loose).
Surface Treatment—Spraying Mac
  .3 gal. of oil or tar and .016 c stone or gravel per sq. yd.

WATER SUPPLY, SEWERAGE AND SANITATION SECT

The Design and Construction of the Municipal Water Works System at Mountain Home, Idaho, with Some Costs.

Contributed by Edmund M. Blake, Designing and Supervising Engineer.

The town of Mountain Home, Idaho, is located about 7 miles south of the foothills of the Sawtooth Mountains and about 18 miles north of the Snake River, on the main line of the Oregon Short Line R. R. It had in 1910 a population of about 1,800 people, but it is probable that this population would have been much larger at that time had there not been an almost interminable delay in the development by irrigation of nearly 250,000 acres of land tributary to the town. At the present time many of the old difficulties connected with this development have been overcome and active work has already been started on the reclamation of one large tract north of the town which will undoubtedly soon be followed by others. The chances are, therefore, good for a large growth in population during the next decade. That the town is awake to this possibility is evidenced by the installation in 1911 of a modern water supply system for domestic use and fire protection.

The town itself lies on a level plain falling gradually away from northeast to southwest along a natural line of underground waterflow coming down from the mountain above. The irrigation of about 3,000 acres immediately around the town during the past ten years resulted in raising the water table under the town to such an extent that cellars and basements were badly flooded during the irrigation season and the local wells thereby became polluted from the mixture of house sewage and drainage with this underground water. The necessity for an adequate water supply and sewage disposal system became so serious that in the winter of 1911 the Board of Trustees of the town authorized a complete study and report, with estimates, for the installation of such systems. This report was made by the writer and following it the town voted to install at once a water supply system at a cost of $35,000, leaving the sewage disposal system for another year.

A very careful study was made of certain springs existing along the foot hills to the north of the town, but such supplies were finally determined to be inadequate and uncertain so far as inidcated by the available data and a study of the sources of underground water feeding the springs. Northwest of the town was an old coulee bed, dry during a long period each year, but clearly showing a watercourse, and from the gravelly nature of its bed it was thought likely that at all seasons of the year a body of underground water was flowing under and along its course. A location just to one side of this coulee bed, within the town limits, but not in the line of house drainage from beyond, was selected for the driving of test wells. These wells were driven in June, 1911, and in general encountered an underground flow of water at about 10 ft. below the surface, underlaid with compact, impervious clay to a depth of about 25 ft., where another and large flow of underground water was encountered through from 2 ft. to 8 ft. of coarse water-bearing gravel. Below this flow was a bed of clay running to a depth of about 75 ft. at lava bed rock. A 48-hour continuous pumping test on a 6-in. well tapping the 25-ft. strata, using a 4-in. pump cylinder operated from the beam of the No. 5 Keystone Well Driller, see Fig. 1, used in drilling the wells, showed a flow at the rate of about 150,000 gals. in 24 hours without lowering the water in a tell-tale well 25 ft. above it more than about 5 ins., which was recovered almost immediately after the test was closed. The water was clear and sparkling, maintained an average temperature of about 52° F. and, upon analysis by the State Chemist, proved to be of an exceptionally good quality, suitable for all of domestic use and in additio soft. As a result of these tests ful consideration of all other so ply, the Board of Trustees finally site as its permanent source of the time of writing this article, A the system has been in operati months, the wells have constantly their flow as the draft from th cleaned out the sand and pock coarse gravel and perfect conf that the decision to adopt this s entirely justified.

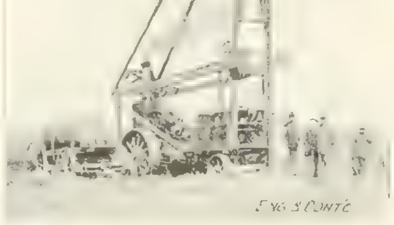


Fig. 1. No. 5 Keystone Driller Rig Drilling an 8-in. Tubular Well.

The system as designed and comprises 6,650 ft. of 8-in., 22,03 and 2,211 ft. of 4-in. wood-stave, water pipe, manufactured by the Pipe and Foundry Co., of Tac 96 pieces of special castings, 42 b ed Ludlow fire hydrants, all wi nections to the mains; seven 8-i in, and two 4-in. heavy pattern valves; a 60,000-gal. steel water 110 ft. from top of foundations when full, furnished and erected J. Burke Co. of Salt. Lake City x8-in. vertical triplex power pum Fig. 2, fitted with double gear factured by the Platt Iron W ton, Ohio, and furnished and er James J. Burke Co. of Salt La 25-h.p. 3-phase, 60-cycle, 220-volt, tric Motors, furnished through th of the General Electric Co. The of the distribution piping is 5.86

The water is drawn from a gr in. tubular wells, the bottoms bedded in coarse water-bearing gr first intended to equip these fiv brass Cook well strainers, but o the coarseness of the gravel it cided to try the effect without the strainers and so far no serious entrained sand has been encoun is not expected that the Cook be required. These wells are c 5 ft. below the level of the grou point they are fitted with heavy te on concrete beams to prevent short branch from each of these them all with a common 8-in. c tion pipe from which the pump is taken off through a long sweep machinery room. Above the tee on 8-in. pipe is continued up to an el 3 ft. above the ground surface in a standpipe to assist in the separ These 8-in. standpipes are capped ¼-in. plugs and plugged. On th

erior of Mountain Home, Idaho, Pumping Station, Showing Vertical Triplex Pumps Direct Connected to Electric Motors.

from each well to the common col- tion pipe is placed an 8-in. hand valve bv means of which any well nected from the [illegible]

A sixth 8-in. well was also driven for emergency connection with the wells, the proper special castings n place for this connection.

ping station building is constructed blocks. Its inside dimensions are 38 he elevation of the machinery floor, concrete sloping to a drainage sump er, is about 5 ft. below the level of for the purpose of reducing the on the wells. The foundation walls y concrete fitted with a water table the ground level where the con- walls start. The roof is a simple ucture covered with cedar shingles crete block chimney at one corner heating the interior of the building. ground this station is fitted with lows which provide a maximum of ll parts of the machinery room. ne large double door, on the side the prevailing winds, of sufficient to admit the largest piece of ma- st inside of this door is a sub- form and stairs leading down to ry floor fitted with a pipe railing. inery, consisting of the two ver- pumps and motors, as described aligned on one continuous shaft, n the middle and the motors on with the suction and discharge d the machinery and between it , leaving a large clear floor space he machinery and between it and l platform. The machinery foun- of a heavy type of concrete and for each pumping unit with a te foundation between to carry post which guides the shaft be- two pumps in order to give it a upport. Either pump can be op- her motor or both pumps can be nce, when their combined capacity tle over 350 gals. per minute or per hour, which is equivalent to gals. per day. There are three tion clutches on the shaft which ed with slip pinions. The shaft l fitted with raw hide pinions.

n main after it enters the build- to each pump through a 6-in. each of which is a 6-in. control- he discharge from each pump is 6-in., each branch being fitted with a 6-in. gate valve. These branches unite into an 8-in. force main which runs out of the building and is connected with the 8-in. riser pipe running up to the water tower tank, which is located on the same lot. A branch leads off to the town fitted with controlling gates so that water can be pumped into the tank alone, or to the town alone or to both against the tank pressure. The 8-in. force main inside the building is fitted with an 8-in. Ludlow check valve next to the 6-in. branches, then a 6-in. pumping to waste branch which discharges into the coulee bed outside of the building, then a 3-in. pressure relief valve discharging into the 6-in. pumping to waste branch, and last the regular 8-in. controlling gate valve. Power is taken from the transmission line of the Great Shoshone Light, Heat & Power Co. through transformers located just outside of the building and all of the controlling switches inside of the building are located on the wall in the corner just above the controlling gates on the force main, so that the control of everything for emergency purposes is centralized in a small space in one corner of the building.

Materials for 150 complete service connections were purchased, the Board of Trustees deciding to install these connections from the main to the property line without cost to the consumer and offering to complete the balance of the work from the property line into the houses at the exact cost of labor and material. It is expected that before the coming hot weather at least 125 connections will have been made. The board decided to require all water to be paid for on meter rates and purchased Empire meters from the National Meter Co. These meters were all ⅝ in. excent in the case of a few large concerns.

The meter rates adopted were on a sliding scale, as follows:

	Per 1,000 gals.
First [illegible] gals. per month at rate of	[illegible] cts.
Over 2,500 gals. per month at rate of	37½ cts.
Over 5,000 gals. per month at rate of	35 cts.
Over 10,000 gals. per month at rate of	30 cts.
Over 20,000 gals. per month at rate of	25 cts.
Over 30,000 gals. per month at rate of	20 cts.
Over 40,000 gals. per month at rate of	15 cts.

Minimum monthly metered water charge—$1.50. Bills sent in monthly.

The raw wool industry is a very important factor at Mountain Home, and one of the largest wool warehouses in the state is located near the center of the town. A private 4-in. connection has been made to this wool warehouse connecting with a modern sprinkler system inside the buildings and with an additional private fire hydrant just outside. The Board of Trustees has just recently passed an ordinance which levies uoon the taxpayers of the town an annual tax of $25 for each fire hydrant in its system, by which arrangement the water department is placed at once upon a firm financial basis and all of the taxpaying citizens, whether water consumers or not, stand their share of the fire protection which the system affords to the town. An operating superintendent was selected and engaged about in the middle of construction of the system, so that by the time the plant was finally put in operation he had become familiar with the details of construction, operation and maintenance. During construction and early operation the town employed Mr. J. F. Moynihan as Construction Superintendent under the writer, he being an old waterworks superintendent of long experience in the east, and the value of his services has been fully realized.

The fire department equipment purchased by the board consisted of 1,500 ft. of 2½-in. rubber-lined fire hose of three different grades, extra brass hose couplings, four 1⅛-in. smooth Standard Underwriters' fire nozzles and two solid frame fire hose reels. This equipment is kept in two buildings in different parts of the town for quick access in emergencies.

COST.

The following cost figures are of interest:

The contract for furnishing 6,650 ft. of 8-in., 15,000 ft. of 6-in. and 3,050 ft. of 4-in. wire-wound, wood-stave water pipe, 72 cast-iron specials, 14 wooden plugs, seven 8-in. gates, four 6-in. gates, one 8-in. check valve, one 3-in. pressure relief valve and 30 Ludlow fire hydrants, was let to the Washington Pipe and Foundry Co. of Tacoma, Wash., for the lump sum of $9,247. Additional pipe hydrants and castings were purchased from them at the following rates: Four-in. pipe at 21 cts. per ft., 6-in. pipe at 30 cts. per ft., 8-in. pipe at 43 cts. per ft.; hydrants at $36.50 each; castings at 5½ cts. a pound. The pipe furnished under this contract was the best product of the factory at Tacoma. The staves being 1¼-in. Oregon fir with close wire spacing and couplings, was laid as taken from the cars and has proved entirely satisfactory. Its depreciation should not exceed 2½ per cent.

The contract prices for laying this pipe, according to very strict specifications, were 14 cts. per ft. for 4 in. and 14½ cts. per ft. for 6-in. and 8-in. Under this contract extra work was done at actual cost plus 15 per cent.

The contract price for the steel water tower and tank, erected on foundations furnished by the town, was $4,075. The tank and tower were painted with three coats of Goheen carbonizing coating. The foundations for this tank consisted of four footings of 13 cu. yds. each and cost $8.15 per cu. yd., finished and placed, including forms.

The pumping station building, above the foundations, was let for $1,169; the excavation cost $78.20; the cement for the walls, $156.80; labor in placing the walls, $147.64; the lumber for forms, $60.12; and the gravel used in the concrete, $50.60; making the total cost for the building, exclusive of the concrete floor, $1,662.36. The unit cost of the concrete walls was $10 per cu. yd., including forms.

The complete material for 150 ¾-in. service connections, including lead flange corporation cocks, corporation goose-neck connections, couplings, brass curb cocks, extension service boxes, brass stop and waste cocks, service box wrenches, curb cock wrenches, and 5,000 ft. of ¾-in. iron service pipe, cost $1,225.10.

The driving of the test wells, the six permanent 8-in. wells, and conducting the tests on the same, cost $1,471.27. The permanent tools and equipments, purchased by the board amounted to $201.55.

The two 7½-in.x8-in. Platt Iron Works triplex power pumps, two 25-h.p. General Electric motors, with fittings, gages, revolution counters, wrenches, oiler sets, and anchor bolts, erected and tested, cost $3,274.

The town entered into a contract with the Great Shoshone Light, Heat & Power Co. for

10 years to furnish the electric power required in the operation of the pumping plant at ¾ cts. per kilowatt hour, which is considered one of the most favorable power contracts ever entered into by a municipality for waterworks pumping in the northwest.

At the time of selecting the kind of pipe to be used bids were called on wood stave, Matheson joint wrought-iron and standard cast-iron pipe and the relative bids received, on the basis of the approximate lengths covered by the call for bids, were as follows:

Wood stave pipe	$ 7,061.13
Matheson joint wrought iron pipe	11,624.6[illegible]
Standard cast iron pipe	19,327.80

Considering the best interests of the majority of the taxpayers, the board wisely decided to adopt wood stave pipe, thereby covering a much larger area of the town with the distribution piping for fire protection and domestic use than would have been possible by the use of wrought-iron or cast-iron pipe, believing that the growth of the town during the life of the wood stave pipe would be great enough to incur the expense of replacing that pipe, if necessary or desirable, with iron pipe at or before the expiration of its usefulness.

Tests of Pumping Engines and Auxiliary Machinery in the New Water Filtration Pumping Station, New Orleans, La.

Contributed by L. E. Strothman, Manager and Chief Engineer, Pumping Engine Department, Allis-Chalmers Co., Milwaukee, Wis.

Until 1848, or a little later, New Orleans was a very active business city and stood fourth in population among the cities of the United States. After that time, for nearly a half century, the city was satisfied to take what came to it in the way of business. While other cities were improving the sanitary and living conditions of their people, New Orleans was content with pavements laid in 1780, drinking water supplied by the rain caught from the roofs, and open ditches and cess pools as a means of sewage disposal. Yellow fever was accepted as a matter of course and no special effort was made to check its periodic appearance.

After the devastating scourge of this fever in the nineties and the example set by the government sanitarians, who came to co-operate with the city authorities, a new spirit awoke among the citizens. They came to realize that New Orleans must be up and doing if it was to regain its lost prestige and take the position commercially to which its geographical location rightly entitled it.

This led, in 1893, to the appointment of a commission to prepare and execute plans for a comprehensive system of drains which would lower the general level of the ground water and make the city other than a swampy breeding place for all sorts of water borne diseases. Later, 1898, came the New Orleans Sewerage & Water Board which employed Mr. George G. Earl, as general superintendent, to study conditions and devise plans for an adequate and modern water supply and sewerage system. The study of the requirements and the working out of details required a great deal of work, so that the first contract for the new water supply, that for the pumping engines was not let until 1905. In the 3½ years following, great strides were made, and in February, 1909, when water was first turned into the city mains, a pumping and purification plant, having a daily capacity of 60,000,000 gals., and a complete distribution system had been constructed. During the period from 1898 to 1909 a complete sewerage system with its miles of trunk and feeder sewers, its two main and seven auxiliary pumping stations had been completed as well as an entire water and sewerage system on a smaller scale for the suburb of Algiers.

WATER SUPPLY.

New Orleans obtains its water supply from the Mississippi River through a cast iron pipe line laid beneath the low water level which conducts the river water to three low lift centrifugal pumps in the pumping station. These pumps lift the water into settling basins where the heavier particles of grit and silt, which are ordinarily carried in suspension, are deposited. After this, lime and sulphate of iron are added in the mixing reservoirs, and the water passes on to the coagulating basins and then to the mechanical filters where the process of clarification and purification is completed. An underground clear water storage reservoir, which is connected with the clear water well in the pumping station, receives the effluent from the filters. The flow of the water from the time it is first discharged by the low lift pumps, which take it from the river, until it reaches the clear water well is continuous and entirely by gravity. The four high lift pumping engines which maintain the pressure upon the city's mains take their suction from the clear water well and discharge directly into the distributing system.

PUMPING STATION.

The chief apparatus in the filtration pumping station is as follows: Six 400 hp. Heine boilers equipped with Roney mechanical stokers, Sturtevant economizers, Foster superheaters, four 20,000,000 gal. vertical triple expansion pumping engines, three low lift 40,000,000 gal. centrifugal pumping engines, one low lift, 20,000,000 gal. centrifugal pumping engine, two 150 kw. 250 volt, engine driven generators and all necessary steam and water piping and accessory apparatus. All the piping and generating equipment was furnished and installed by Allis-Chalmers Company under contract.

While the pumping station was placed in regular operation early in 1909, there were, of course, many things to be done by the contractors before it was in complete shape to turn over to the city. The final payment for all apparatus and the acceptance of the plant as a whole by the Sewerage and Water Board was based on a bonus and forfeiture plan, making it necessary to run very thorough tests on all machinery. These were carried out at various times from March to December, 1910, and the results are given herewith.

TESTS.

All tests were conducted by employes of the Sewerage and Water Board, Mr. A. B. Wood, Mechanical Engineer, in charge of pumping stations, being in direct charge. The main objects of the tests were to determine the pumping capacity of the engines, and the duty upon which to base the payment of forfeiture or bonus.

Previous to running the offic tests, pre liminary trials of short duration were run familiarize the men with the respective duties, and the results of th tests were calculated independently by the engineers the Sewerage & Water Board and of the engine builder, and these resul compared and checked until both upon the final figures.

HIGH LIFT PUMPING ENG

The high lift pumping engines the station as engines Nos. 1, 2, were tested in the following ord 2 and 1.

The pumping engines are eac of the vertical triple expansion type, with three single acting, outside center packed plungers, each located directly under one of the steam cylinders. The engines are entirely self-contained no supports above the pump p required to sustain the steam en the construction of the pump en cylinders are 28, 54 and 80 ins. and the water plungers are 31 ins. The engines have a stroke of 60

There are two eccentrics operat of each cylinder, one for the a

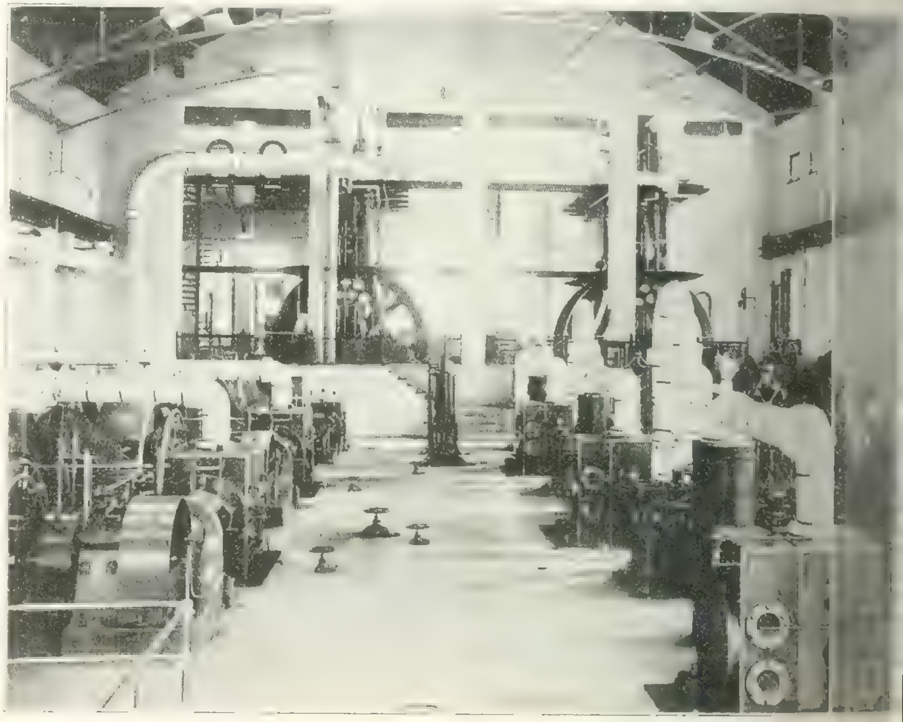


Fig. 1—Interior View of Water Purification Pumping Station, New Or

one for the exhaust. The cutof pressure cylinder is controlled b speed and pressure regulating cutoff of the intermediate cylind is by hand; the low pressure cylind is with a fixed cut-off. All of the located on the main shaft, the transmitted to the respective ste valves, through rods and rocker

The admission and the exha the high pressure cylinder and valves of the intermediate cylin are of Corliss type, located in the hea of the inders. The exhaust valves of th and the admission and exhaust low pressure cylinder are all beat poppet type, operated by ca valves are of rubber, 3⅝ ins mounted on cages, seven of whic are fast onto each of the suction and discharge decks.

The air pump, feed pumps, pressors are permanently att plunger located directly undern pressure cylinder. The steam engine is condensed in a surf having 1,800 sq. ft. of cooling s in the main suction pipe. Acc terms of the contract, these eng were to be credited with the steam co onnecting the boiler and engine. m the separator was [illegible] h a trap and discharged [illegible] t the low pressure [illegible] [illegible] of each pumping [illegible] plunger displacement, [illegible] been inspected and found tight [illegible] ter pressure before test. [illegible] e carefully calibrated and the [illegible] to be exactly 31 ins. [illegible] plungers was carefully measured [illegible] 60 ins. An extra revolution [illegible] provided and placed close to the r of each engine, and both regis- throughout the test.

e water from plunger stuffing eighed continuously throughout found to be less than 200 gals. each engine. The engineers of and Water Board made an t for slip, using a standardized own as a Tulane Pitot Tube, and he capacity, determined in this ed with the capacity based on cement.

rged head was measured with a mn accurately calibrated before [illegible] nd the scale was set to read in [illegible] Cairo datum. [illegible] ed to measure the level of the suction conduit, which also had rately set to read in feet eleva- iro datum. The total net head by subtracting the average suc- dings from the discharge head oth scales were set to a common

consumed by the engine under rmined by weighing the number water pumped into the boiler m to the engine, all piping hav- iously blanked off from the rest n. These weighings were still d by means of a calibrated water in the feed line between the mp and boiler.

level in the boiler was kept as it as possible and was brought arks on the gage glasses at the [illegible] was when the test was er possible. When this was not , the necessary correction for ater level was made, the boiler librated under operating condi- one-tenth of an inch difference read from the scale affixed to el gage glass. No other correc- e made or allowed.

e gage at the boiler was cali- dead weight tester before each test. The temperature of the steam leaving the boiler was also carefully determined with properly calibrated thermometers to see that the steam passing to the engine under test was not superheated. In general, all instruments, gages and scales used on these tests were carefully tested and calibrated. A sufficient number of indicator cards were taken to accurately determine the mechanical efficiency of the pumping engine. Every possible precaution was taken to guard against foreign water or steam getting into the system, by disconnecting piping or by inserting blank flanges in all pipes not properly belonging to the system.

The revolution counters, gages and thermometers were read every five minutes, with the exception of the boiler level gage, and steam temperatures, which readings were taken every 15 minutes. The results of these tests are given in Table 1.

[illegible]

These engines are known in the station as engines Nos. 5, 6 and 7, and were tested in the following order: Nos. 7, 6 and 5.

Although the contract stipulated that all tests of pumping engines were to be of 24 hours duration, it was agreed that a shorter test would fulfill all of the requirements and intent of the contract. The tests of these three engines, therefore, under normal conditions, were of 12 hours duration. An overload test was run on No. 5 engine only, and as all readings were very uniform, an eight hour test was considered sufficient.

The pumping engines each consist of a horizontal shaft, double suction centrifugal pump, directly connected to a horizontal cross compound condensing Corliss engine, the pump being located between the high and low pressure sides of the engines and having its impeller mounted upon the main engine shaft. The steam cylinders are 12 and 28 ins. in diameter and have a stroke of 24 ins. The steam and exhaust valves of each cylinder are operated by independent eccentrics. The cut-off of the high pressure cylinder is controlled by an adjustable centrifugal governor; the cut-off of the low pressure cylinder being adjusted by hand. The steam and exhaust valves of both high and low pressure cylinders, are located in the cylinder heads and are of the Corliss type.

The steam used by these engines is ordinarily condensed in an independent condenser. During the tests, however, the steam was condensed in the condenser of one of the high lift engines. On account of the arrangement of the steam piping in the station, it was agreed that it would not be fair to charge these smaller engines with all of the condensation in the steam pipe system. The engine, was, therefore, credited with the condensation in that portion of the steam line which serves both the low and high lift engines.

The capacity of each centrifugal pumping engine was determined with a Venturi meter. To overcome any inaccuracy in the readings of the Venturi meter register dial, two glass tubes were installed and connected with the leads to the Venturi tube, the difference in elevation of the water level in these two tubes showing the difference in velocity head at the throat and at the inlet to the Venturi tube. The capacity was calculated according to the formula given by the Builders' Iron Foundry and as contained in the 19th edition of Trautwine's Civil Engineers' hand book, and this calculated capacity was found to practically check the readings of the register dial.

The total head against which the pumping engine was operating was determined by piezometers attached to the suction main adjacent to the particular pumping engine under test and to the discharge main at a point about ten feet away from the place where the discharge of the individual pump being tested, entered the discharge main. This resulted in a direct reading in feet head of water, the total head being so small that the introduction of pressure gages or mercury columns would have decreased the accuracy of the results.

The steam consumed by each of the engines was determined in identically the same manner as for the high lift engines, the temperature of the steam leaving the boiler being carefully noted. All instruments, gages and scales used on these tests, were carefully tested and calibrated. Indicator cards in sufficient number were taken to determine the combined mechanical efficiency of each pump and engine. The revolution counter, the manometer tube levels for determining discharge through Venturi meters, the suction and discharge head, and the steam pressure gage at boiler, were read every five minutes, and the remaining gages and thermometers were read every 15 minutes.

Every possible precaution was taken to guard against foreign water or steam getting into the system by disconnecting piping or by inserting blank flanges in all pipes not properly belonging to the system. The results of these tests are given in Table II.

SMALL LOW LIFT CENTRIFUGAL PUMPING ENGINES.

This engine is known in the station as Engine No. 8. The official test of this engine was also shortened from 24 hours to 12 hours duration as it was agreed that a shorter test would fulfill the intent of the contract. The overload test was of six hours duration and the underload test lasted eight hours.

FICIAL TESTS OF "HIGH LIFT" [illegible] GAL. VERTICAL TRIPLE EXPANSION ALLIS-CHALMERS PUMPING ENGINES. STEAM CYLINDERS 28 INS., [illegible] INS., [illegible] INS. DIA. PLUNGERS [illegible] INS. DIA. STROKE [illegible] INS.

	Engine No. 4				Engine No. 3.	Engine No. 2.	Engine No. 1.
	[illegible] per cent of normal capacity, [illegible] per cent of normal head.	Normal capacity, [illegible] per cent [illegible] head	Normal head, [illegible] per cent over capacity	Normal capacity and head	Normal capacity and head	Normal capacity and head.	Normal capacity and head.
	Mar. 15, '10.	Mar. 16, '10.	Mar. 17, '10.	Mar. [illegible]	Apr. [illegible]	June 21-22, '10	Sep. 20-21, '10
hours	[illegible]	[illegible]	[illegible]	24	24	24	24
hes. HG	30.07	30.26	[illegible]	30.22	30.00	29.90	29.94
at boiler, lbs. gauge (corrected)	164.67	164.49	164.67	166.45	165.31	165.763	164.630
throttle, lbs. gauge (cor'cted).	163.51	161.00	161.47	163.21	162.43	164.14	164.20
olumn in exhaust pipe, in HG	28.35	28.43	28.13	28.40	28.23	27.886	27.80
feet	[illegible]	[illegible]	218.564	218.879	219.123	219.1285	219.0631
ater pumped, F°	51.17	51.07	52.72	54.05	68.0	79.00	83.0
d into boiler No. 1 (corrected water level, if any, lbs	[illegible]	[illegible]	81,738.1	210,132.4	209,985.2	209,769.80	214,603.3
mped into boiler No. 1 (cor- n water level, per hr., lbs.)	4,264.2	10,126.4	10,217.3	8,755.5	8,749.4	8,740.40	8,941.8
engine per hour, lbs	4,264.2	10,126.4	10,217.3	8,755.5	8,749.4	8,740.40	8,941.8
of engine	[illegible]	[illegible]	13,069	34,184.5	34,247	34,178	34,222.0
n of engine per hour	[illegible]	[illegible]	1,633.6	1,424.35	1,426.96	1,424.08	1,425.91
of engine per minute	[illegible]	[illegible]	27.23	23.74	23.78	23.73	23.76
ent per revolution	588.1325	588.1325	588.1325	588.1325	588.1325	588.1325	588.1325
ed	4,021,650	6,659,424	7,686,304	20,105,015	20,141,774	20,101,192	20,127,070
gallons per 24 hours	12,064,950	19,978,273	23,058,911	20,105,015	20,141,774	20,101,192	20,127,070
average gallons per hour	113.6	62.6	50.0	139.2	36.1	152.80	103.0
m indicator cards	394.4	932.2	949.95	825.2	838.94	833.23	851.01
sponding with indicator cards.	[illegible]	[illegible]	884.5	770.0	776.60	773.13	772.11
ncy, per cent	92.62	94.22	93.11	93.31	92.57	92.79	90.728
P. from test data	372.26	880.62	884.69	772.47	773.88	771.39	771.49
per cent mech. eff. and pump	401.92	934.64	950.15	827.85	835.99	831.33	850.33
to L. P. cyl. av. of both ends,	[illegible]	25.99	23.0	22.96	23.24	23.10	23.60
H. P. per hour, lbs	10.61	10.83	10.75	10.58	10.466	10.51	10.51
dry steam, ft. lbs	[illegible]	[illegible]	171,444,672	174,689,922	175,130,669	174,709,100	170,833,081

TABLE II.—OFFICIAL TEST OF LOW LIFT ALLIS-CHALMERS 40,000,000 GAL. CENTRIFUGAL PUMPING ENGINES. STEAM CYLINDERS, 2[illegible]-IN.—28-IN. DIA., STROKE 24 INS.

	Engine No. 7	Engine No. 6.	Engine No.	
	Normal capacity Normal head	Normal capacity Normal head	Normal capacity Normal head	Normal capacity Increased head
Date of test	Nov. 2, 1910.	Nov. 4, 1910.	Nov. 7, 1910	Nov. 9, 1910.
Duration of test, hours	12	12	12	[illegible]
Barometer, lbs.	14.80	14.82	14.82	14.72
Steam at engine, lbs. gauge (corrected)	165.23	162.77	165.15	164.30
Steam at boiler, lbs. gauge (corrected)	165.90	163.76	166.64	164.80
Vacuum, ins. HG	26.75	26.69	26.62	26.64
Temperature of water pumped, F°	65.[illegible]	64.00	62.00	62.00
Venturi head, ft. water	6.0577	5.967	6.037	5.947
Area of throat of Venturi meter, sq. ft.	3.1416	3.1416	3.1416	3.1416
Cu. ft. water pumped per second	62.036	61.557	61.936	61.457
Gals. per 12 hrs. from Venturi recorder	20,120,000	19,979,000	20,090,300	20,023,000
Gals. per 12 hrs. from Venturi head	20,046,000	[illegible]	20,013,000	19,858,000
Total net head, ft.	15.064	15.[illegible]	15.867	24.973
Total water pumped to boiler, lbs.	26,054	26,464	27,761	27,702
Total trap water, lbs.	519	444.5	507.5	194
Correction for boiler level, lbs.	122.8	61.4	30.7	61.4
Total net water used by engine, lbs.	25,412.20	25,958.1	27,222.8	27,569.4
Steam used by engine per hour, lbs.	2,117.68	2,163.18	2,268.57	[illegible],446.18
Revolutions of engine per minute	85.42	[illegible]	86.72	102.9
I. H. P. from cards	146.426	150.53	155.10	239.58
W. H. P. corresponding to cards	105.510	110.22	110.83	173.94
Combined efficiency, per cent	72.06	73.22	71.46	72.60
Av. W. H. P. from test data	105.85	110.70	111.40	174.08
Av. I. H. P. from per cent mech. eff. and W. H. P.	146.90	151.10	155.89	239.70
M. E. P. referred to L. P. cylinder	23.18	23.60	24.20	31.40
Steam per I. H. P. per hour, lbs.	14.40	14.31	14.55	14.38
Duty per 1,000 lbs. sat. steam, ft. lbs.	99,035,836	101,275,623	97,251,303	99,980,220

The type of this machine is similar to the 40,000,000 gal. low lift centrifugal pumping engines which have been previously described. The steam cylinders are 8 and 18 ins. in diameter and have a stroke of 24 ins. This engine was also credited with the condensation in that portion of the steam line which serves both the high lift and low lift engines. The capacity of this centrifugal pumping engine was determined by means of two Tulane Pitot tubes placed in the two suction pipes between the clear water well and pump.

Traverses were made of both pipes to obtain velocities of water at ten different points in each pipe. These points were selected in such a manner that the velocity readings would each apply to five annular rings of equal area. An arithmatical average of the ten readings obtained in each suction pipe was then taken and this average was used as the mean velocity in the respective suction pipe. The inside diameters of the two suction pipes were accurately measured with a pair of calipers, and the area of a circle of this diameter in square feet multiplied by the mean velocity in feet per second at this area resulted in the capacity in cubic feet per second passing through such suction inlet. The sum of these two capacities was then taken as the capacity of the pumping engine.

The total head was determined in the following manner: A glass tube or piezometer was attached to the 48 in. discharge main about 10 ft. from the pump discharge nozzle, having its scale accurately set to read in feet elevation above Cairo datum. The suction head was measured with the same float gage which was previously used in the tests of the high lift engines. As both gages had their scales set to a common zero, the net head was obtained by subtracting the average suction readings from the average discharge head readings.

The steam consumed by this engine was determined in the same manner as for the high lift engines. All instruments, gages and scales were carefully tested and calibrated. A sufficient number of indicator cards were taken to determine the combined mechanical efficiency of pump and engine. The revolution counters, gages and thermometers were read every 15 minutes. The discharge head gage was read every five minutes, also the suction level gage. Pitot tube traverses were made every fifteen minutes.

Every possible precaution was taken to guard against foreign water or steam getting into the system by disconnecting piping or by inserting blank flanges in all pipes not properly belonging to the system. The results of these tests are given in Table III.

ELECTRIC GENERATOR ENGINES.

These engines are known in the station as engines Nos. 9 and 10; engine No. 10 being tested first. The tests of the engines and generators, under normal condition, were of 12 hours' duration, it having been agreed that a 24-hour test was unnecessary. Engine No. 10 was also tested for the overload and underload conditions prescribed in contract, these tests being run for three hours.

The units each consist of a horizontal shaft, direct current, railway type generator, directly connected to a horizontal cross compound, condensing, Corliss engine, the generator being located between the high and low pressure sides of the engine, having its armature mounted upon the engine shaft. The steam cylinders are 12 and 28 ins. in diameter and have a stroke of 24 ins. The steam and exhaust valves of each cylinder are operated by independent eccentrics. The cut-offs of both the high pressure and low pressure cylinders are under control of a centrifugal speed governor.

The steam and exhaust valves of both high and low pressure cylinders are located in the cylinder heads and are of the [illegible] On account of the arrangement of the steam piping, in the station, these engines were credited during the official tests [illegible] densation in that portion of [illegible] steam which serves both the high lift pumping engines and the engines in the [illegible] room where the generator engines are located.

The electrical output of each [illegible] obtained from readings of [illegible] meters and ammeters. A water rheo[illegible] constructed and placed outside [illegible] insure a steady load. During, [illegible] after, the various tests, temperature readings were taken of the windings a[illegible] the [illegible] temperature found to be within th[illegible] temperature rise guaranteed. The commutation during all tests, including the 50 per cent overload test, was found to be excellent [illegible] tically without sparking. The sam[illegible] by each of the engines was determ[illegible] identically the same manner as for [illegible] lift engines, and the temperature of [illegible] leaving the boiler, was also carefully [illegible]

All instruments, gages and also [illegible] these tests were as carefully tested [illegible] brated as possible. Indicators were [illegible] by the Sewerage and Water Board [illegible] dicator springs were calibrated in [illegible] spective indicators in which they were used, under the proper steam temper[illegible] the laboratory of Tulane University [illegible] supervision of Prof. W. B. [illegible] siderable pains were taken in the ca[illegible] these springs as the rate of bonus or [illegible] was based upon the number of units [illegible] mercially dry steam consumed per [illegible] horse power.

Indicator cards were taken every [illegible] accurately to determine the [illegible] power and the combined mech[illegible] of each generator and engine [illegible] counter, volt meter, ammeter [illegible] were read every five minutes [illegible] the boiler water level gage a[illegible] perature thermometers were read [illegible] minutes.

The results of these tests [illegible] Table IV.

OFFICIAL TEST OF RONE S[illegible]
NO. 5 BOILER

Date
Duration of test
Make of boiler, Heine Safety, battery.
Size of furnace—
Heating surface of boiler
Grate surface
Capacity, builder's rating
Steam pressure at gage
Absolute steam pressure
Draft in furnace
Draft in uptake

TABLE III.—OFFICIAL TEST OF ALLIS-CHALMERS 20,000,000 GAL. CENTRIFU[illegible] ENGINE. STEAM CYLINDERS, 8-IN.—18-IN. DIA., STROKE 24 I[illegible]

	Engine No	
	Normal capacity Normal head.	Normal capacity
Date of test	Dec. 13, 1910.	Dec. 14, 191
Duration of test, hours	12	6
Barometer in inches, mercury	30.47	30
Steam pressure at engine, lbs. gage	164.4	165
Steam pressure at boiler, lbs. gage	165.20	166.0
Vacuum inches, HG	26.70	26.9
Area of inlet pipe No. 1, sq. ft	2.61	2.6
Area of inlet pipe No. 2, sq. ft	2.565	2.5
Vel. through inlet pipe No. 1, ft. per sec	6.201	6.3
Vel. through inlet pipe No. 2, ft. per sec	6.349	6.2
Capacity C. F. S. of pipe No. 1	16.1846	16.5
Capacity C. F. S. of pipe No. 2	16.2851	16.0
Total capacity C. F. S. of engine	32.47	32.5
Gallons pumped per 24 hours	21,000,000	21,080 000
Temperature of water pumped, F°	53.50	53.5
Total net head in feet	12.209	19.9
Total water pumped into boiler, lbs	12,905.00	9,552.5
Correction for boiler level, lbs	61.40	168.8
Correction for steam pipe drain, lbs	669.00	281
Total net water pumped into boiler, lbs	12,174.6	9,4[illegible]0.3
Total net water pumped into boiler per hour, lbs	1,014.55	1,573.3
Revolutions of engine per minute	90.03	107.5
I. H. P. from cards	66.21	106.5
W. H. P. corresponding to cards	44.92	73.8
Combined efficiency, per cent	67.84	69.2
Av. W. H. P. from test data	44.95	73.9
Av. I. H. P., per cent mech. eff. and W. H. P.	66.30	106.7
M. E. P. referred to L. P. cyl	24.11	32.4
Steam per I. H. P. hour	15.30	14.7
Duty per 1,000 lbs. steam	87,768,857	92,995,081

OFFICIAL TEST OF ALLIS-CHAL[illegible] GENERATORS STEAM CYLINDERS [illegible]

	Engine No. 10			Engine No. 9	
H P. hr., lbs. boiler room...	13.542	14.34	14.62	13.011	13.609
[illegible]	13.70	14.34	14.62	13.011	13.669

.... 591.3° F.

of feed water entering [illegible]° F.

uel, 3.87 per cent....... 576.4 lbs.
el consumed............14,317.1 lbs.
ash, cinder, etc........ 2,893 lbs.

ible, from chem. analysis,
[illegible] lbs.
ted, net....................127,042 lbs.
ter evaporated, from and
.... 146,09[illegible] lbs.
ater evaporated per hr.,
.... 14,609.[illegible] lbs.
ated per lb. dry fuel.....8.873 lbs.
ated per lb. dry fuel from
.... 10.2[illegible] lbs.
ated per lb. dry combus-
at 212° F. ....11.[illegible] lbs.
sepower boiler and super-
..........................423.[illegible] B. H. P.
contained in coal
....................188,012,157 B. T. U.
accounted for in
....................141,152,554 B. T. U.
accounted for in
.... 10,792,[illegible]17 B. T. U.
accounted for.151,944,[illegible]71 B. T. U.
accounted for to
s.......................... [illegible] per cent

MMARY OF ALL TESTS

ows the duties required by the
al Water Board, and which were

TABLE V.

Pumping Engines.

Eng. No.	Date tested.	Duty guaranteed.	Duty obtained.
[illegible]	Ma[illegible]	[illegible]	[illegible]
[illegible]	Apr[illegible]	[illegible]	[illegible]
[illegible]	June [illegible]	[illegible]	[illegible]
1	Sept [illegible]	[illegible]	[illegible]

Low [illegible]

Pumping Engines.

Eng. No.	Date tested.	Duty guaranteed.	Duty obtained.
7	Nov. 2, 1910........	90,000,000	99,035,836
6	Nov. 4, 1910........	90,000,000	101,275,623
5	Nov. 7, 1910........	90,000,000	97,251,303

Clear Water [illegible] Gal. Centrifugal

Pumping Engines.

Eng. No.	Date tested.	Duty guaranteed.	Duty obtained.
[illegible]	Dec. 13, 1910.	85,000,000	87,768,857

Power Engines.

Eng. No.	Date tested	Steam consumption guaranteed	Steam consumption obtained.
9	Dec. 30, 1910..	[illegible]	13.082
10	Nov. 21, 1910.	13.5	13.5

The station has been in continuous service since February, 1909, and during that period the pressure in the distributing system has never been off. The daily records which are carefully compiled show that the machinery is operating at an efficiency very close to the duties obtained during tests, which is due to the very careful management on the part of Mr. George G. Earl, General Superintendent, and Mr. A. B. Wood, Mechanical Engineer, who, with their assistants, deserve great credit for the uninterrupted success of this plant.

The Hydro-Electric Project of the Mississippi River Power Company at Keokuk, Iowa.

I.

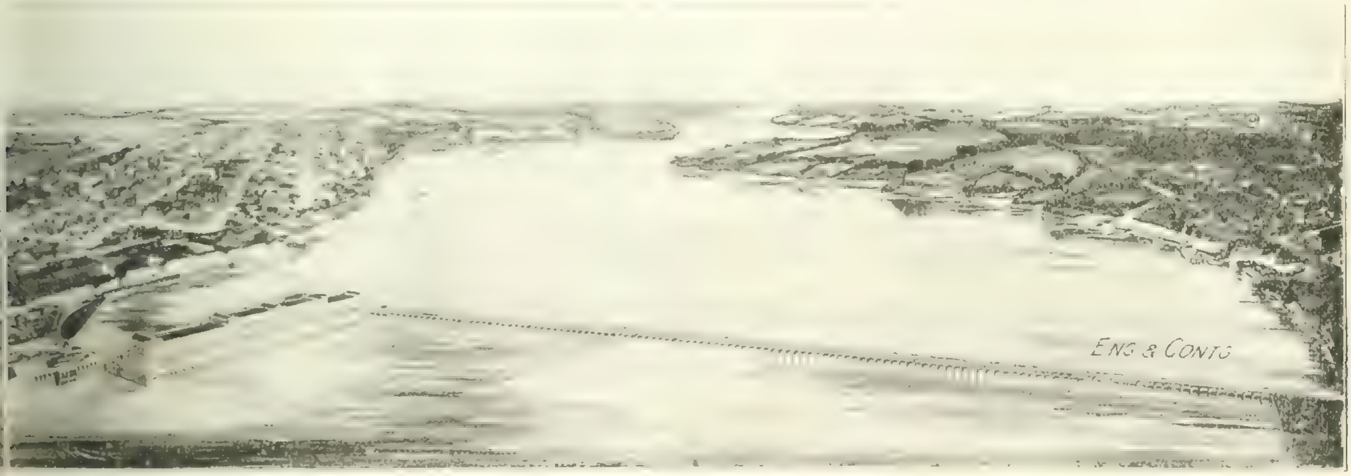
Contributed by David Taylor, Civil Engineer, with the Mississippi River Power Co.

The water power development now in process of construction in the Mississippi River at Keokuk, Iowa, and Hamilton, Illinois, is the largest undertaking of its character in the world. When fully completed the plant will contain 30 turbines each operating a 10,000 hp. alternating current generator and four turbines each operating an exciter. The total power delivered to customers will be 200,000 hp. The work is notable also because all construction is being done by day labor under the direction of the chief engineer.

GENERAL DESCRIPTION

The works comprised in the development are a canal lock 110 ft. wide by 400 ft. long with a lift of 40 ft. on the Iowa side of the river; a dry dock alongside the lock; a power house extending upstream from the lock and 1,750 ft. long, and a main dam 4,568 ft. long extending across the river. These structures are clearly shown by the view, Fig. 1. Incidental to the main structures there will be a fender wall or ice barrier and a sea wall for shore protection.

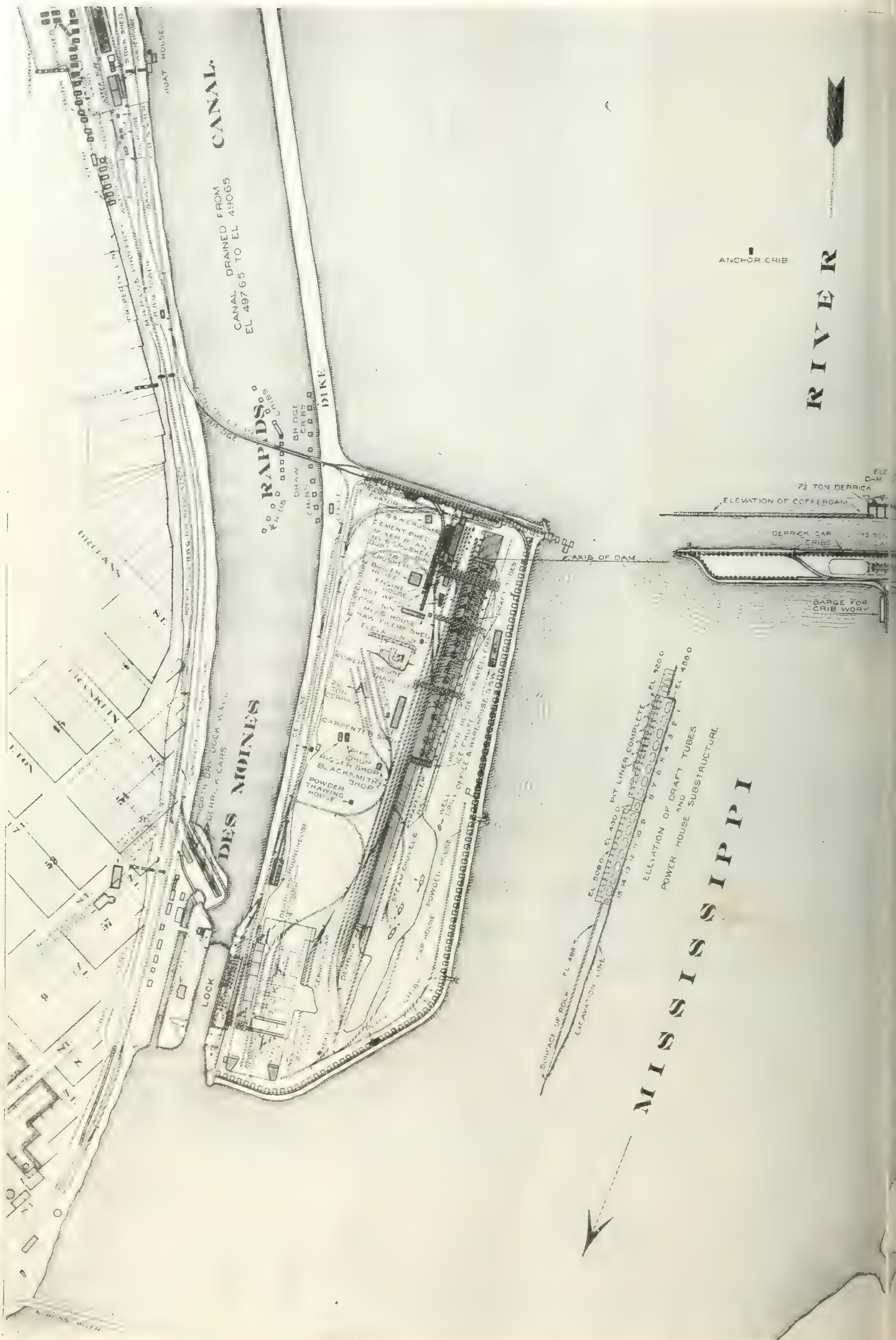
Foundation.—In many respects the natural conditions are ideal for the work to be done. The river cuts across a ledge of limestone which extends up the river a distance of 7½ miles, and so forms the Keokuk Rapids. The river, at the foot of the rapids, where the dam is being built, is quite shallow, seldom exceeding a 15 ft. stage, and the depth is very uniform across the stream. The rock is a very hard limestone without any serious fissures, and so forms an ideal foundation bed. The dam and power house are founded on this firm limestone rock and the draft tubes for the turbines in the power-house extend down into the ledge some 25 ft.

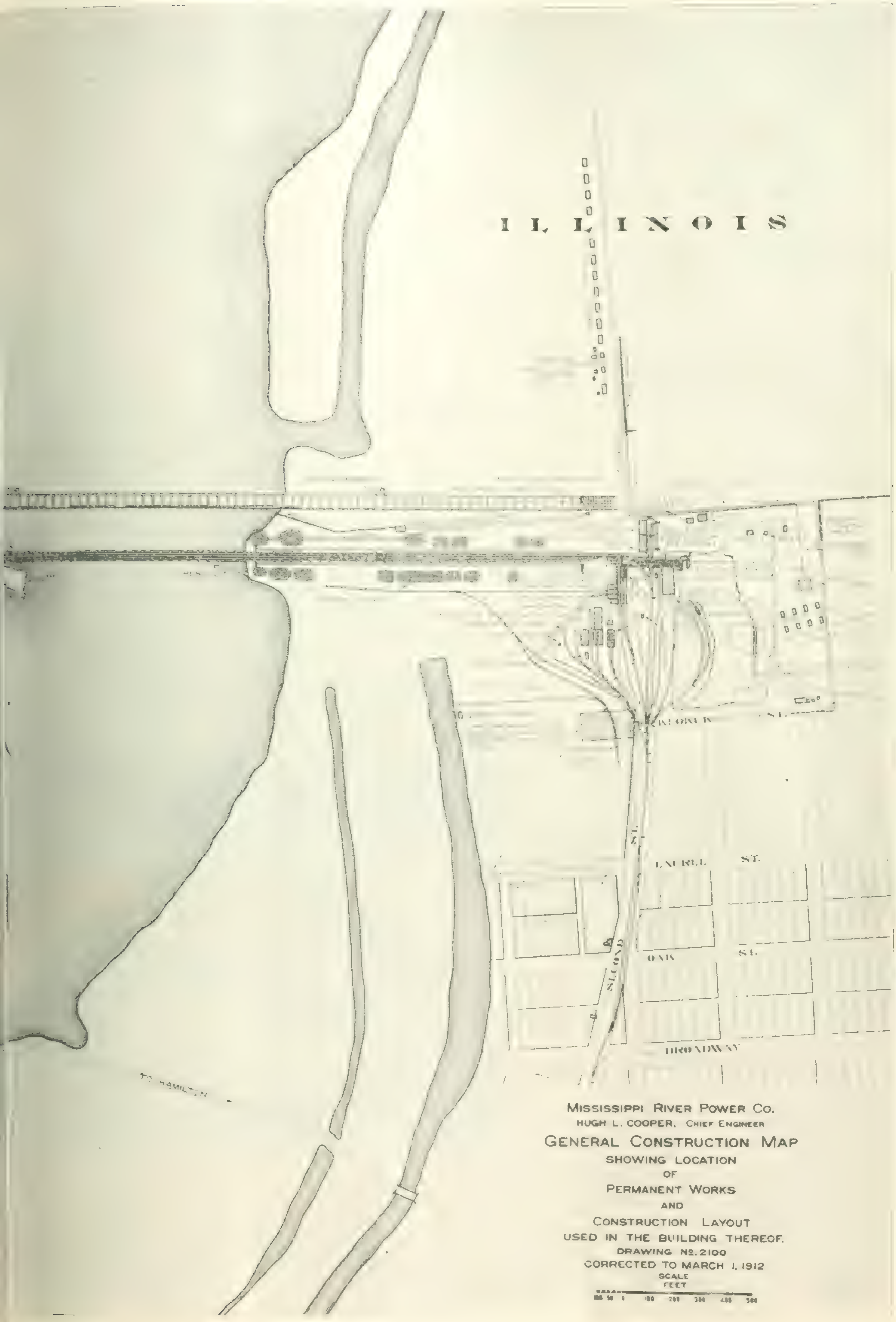


View of the Mississippi River Power Company's 200.000 H. P. Development at Keokuk, Iowa, When Completed.

Main Dam.—The dam is built after an original plan. The work has been mistaken by visitors for a bridge, as in fact it really is. Piers are first built and connected by concrete arches. These piers are 6 ft. thick, 42 ft. wide at the bottom and 36 ft. wide at the top. The arches connecting them carry a 29 ft. roadway, the grade line of which is 50 ft. above the average river bed. The spillways of the dam are built between these piers, and their crests are 32 ft. above the river bed. They will be surmounted by 11 ft. flood gates running in grooves in the piers and electrically operated from the bridge above. Practically all the work of building the dam is carried on from this bridge. Details of the methods of construction used on this work will be given in a later article.

Ice Fender.—From the point where the dam joins the power house at its upper end, a wall will extend upstream and curve in toward the


CANAL
CANAL DRAINED FROM EL 497.65 TO EL 490.65
BOAT HOUSE
DIKE
RAPIDS
DRAW CRIBS
BRIDGE CRIBS
DES MOINES
LOCK
CARPENTER SHOP
PIPE SHOP
RIGGER SHOP
BLACKSMITH SHOP
POWDER THAWING HOUSE
POWER HOUSE
ICE CHUTE
AXIS OF DAM
ANCHOR CRIB
RIVER
7½ TON DERRICK
ELEVATION OF COFFERDAM
DERRICK CAR
CRIBS
BARGE FOR CRIB WORK
PIT LINER COMPLETE
ELEVATION OF DRAFT TUBES AND POWER HOUSE SUBSTRUCTURE
SURFACE OF ROCK
EXCAVATION LINE
MISSISSIPPI


ILLINOIS
KEOKUK ST.
SECOND ST.
LAUREL ST.
OAK ST.
BROADWAY
TO HAMILTON
MISSISSIPPI RIVER POWER CO.
HUGH L. COOPER, CHIEF ENGINEER
GENERAL CONSTRUCTION MAP
SHOWING LOCATION
OF
PERMANENT WORKS
AND
CONSTRUCTION LAYOUT
USED IN THE BUILDING THEREOF.
DRAWING Nº. 2100
CORRECTED TO MARCH 1, 1912
SCALE
FEET
100 50 0 100 200 300 400 500

Iowa shore. This is an ice fender. It will be a series of submerged arches with a wall extending above high water. The water can flow through the arches into the fore-bay, but ice and debris will be barred out.

Sea Wall.—It was also necessary to build a sea wall along the side of the bluff to protect the Chicago, Burlington & Quincy R. R. track in its elevated position. The lower end of this wall will be carried diagonally across to connect with the west wall of the dry dock, which is to be built alongside the lock.

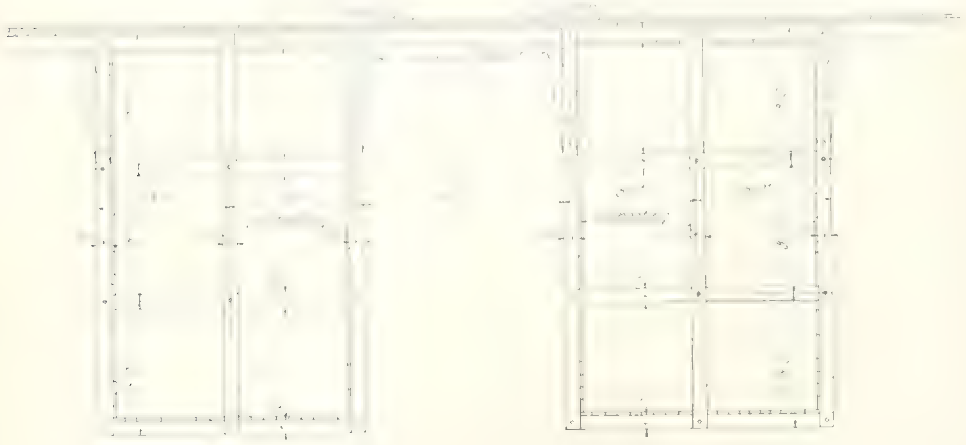


Fig. 3—Detail of Crib Construction for the Iowa Cofferdam.

CONSTRUCTION PLANT.

On account of the immense amount of money tied up in this enterprise, which cannot produce any revenue until the work is completed, speed has been one of the first considerations. For this reason no expense has been spared in getting the best equipment obtainable in every department of the work. Much of this equipment has been designed especially for this particular job.

The progress plan, Fig. 2, will give an idea of the amount of work completed on March 1, 1912. It also shows the relative locations of the different parts of the work. As may be seen, every part of the work is reached by standard gage track, over which dinkey locomotives are run and do all the hauling. Four traveling cranes span the site of the power house. They extend out over four tracks which run parallel to the power house. Each crane has two 5-ton trolleys which are operated by separate engines, and they are used to place forms and concrete. They have proved to be very convenient and economical in operation. It has been necessary to excavate a large amount of rock for the foundation and draft tubes of the power house. This rock has been hauled directly to the crushers. It is delivered from them to the mixers and is again hauled out on the work in the shape of concrete. All the rock needed on the power house and locks so far has been obtained from the excavations. Sand of an excellent quality is obtained from the mouth of the Des Moines River, about three miles from the work. It is pumped out and deposited in a bank on the shore. From this bank it is loaded by means of a clam shell bucket operated from a stiff-leg derrick, onto 12 cu. yd. dump cars, and hauled to the mixers over the Chicago, Burlington & Quincy tracks by the company's own locomotive.

COFFERDAM CONSTRUCTION.

The entire work is being carried on inside cofferdams. The large power house cofferdam encloses 33⅓ acres of the river bottom and covers the location of the power house and the government lock.

Power House Cofferdam.—Work of the main cofferdam was begun by building a trestle across the canal. Part of this trestle was later replaced by a draw span to allow navigation during the open season. This gave access to the work from the Iowa shore. A standard gage track was carried on this trestle together with a foot walk. Work was begun on the cofferdam at the upstream end and extended out from the dike between the canal and the river. It was decided to build only half of the cofferdam at first so that actual construction work could begin as early as possible. With this end in view work was begun at both ends and extended to meet in midstream. As soon as the upper half of the cofferdam was completed the lower half was commenced and was finished a few months later.

It was extremely desirable that the upper half of the cofferdam be completed at as early a date as possible. With this end in view a rivalry was encouraged between the two gangs. A bonus of an increase in wages was offered to the men as soon as they should have placed and filled one crib a day for 25 days. Men enough were provided in each gang so that this was easily possible, and the desired state of efficiency was soon reached. And the cribs were built for the remainder of the work at a greater rate than one a day for each gang.

In talking with the men employed on this work, the writer has come to the conclusion that the rivalry was a more potent factor in securing speed than even the increase of wages. This conclusion would seem to be verified by the fact that they exceeded the speed required to secure the bonus. Of course the bonus was useful to start the rivalry. It required eighty-eight cribs to surround the upper half of the cofferdam.

The cofferdam was made up of a series of timber cribs built as shown by Fig. 3 and filled with rock. An interval of 12 f
tween cribs and after all the cr
pleted this interval was stopped
timbers as shown. Then the enti
sheeted closely with vertical she
was brought and dumped agai
face.

The first seven cribs were bu
and placed through the holes
But a few days of warm weatl
ice to break up and several pa
cribs were carried away. After t
of procedure was to moor a
exact position the crib was to o
ings were then taken around th
raft and the profile thus obtain
the timbers which were used f
that particular crib. These sills
away to this profile and thus t
completed, fitted closely to the
river bottom, and stood firm
The bottoms of the cribs wer
shore and launched and floate
Then they were carefully moo
pleted with the aid of a derric
time they were finished they w
into position, then they were l
inside and filled with coarse
The floors of the crib were 8x
laid flat-wise. This crib work
13 ft. high, but the earth emba
outer face has been carried seve
and the cofferdam has successf
a stage of 18 ft. without any s
At ordinary stages a single 6
pump working about one-half
care of the leakage on the entir

After the cofferdam was un
sets of braces were placed agai
each crib. These sets consist
timber made up of two 10x12 in
together in a diagonal brace
about half the height of the cr
below, where the foot is concret

Heavy timber beams carry a
track over the cribs. This giv
cars to any part of the coffer
great aid in repairing the cla
outer face and raising it in a ti
is also found very convenient
construction work.

The upstream end of the coffe

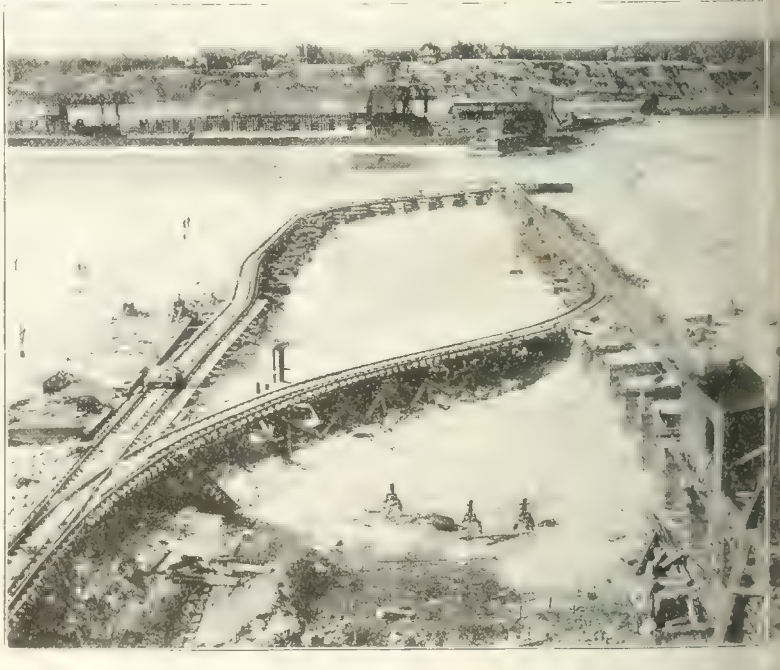


Fig. 4—View of Cofferdam for Main Dam Looking Toward Iowa Cofferdar
House.

heavily reinforced with rock, a
out to carry several tracks.
strong enough to withstand ic
magnitude that solid ice near
was pushed clear up onto the tr

Cofferdam for Main Dam.—T
is being built from the Illinois
work is carried on inside cofferd

omewhat the same plan as the [illegible] s. These cofferdams, however, are ned to withstand any severe flood, llowed to fill and are again pumped the water subsides. Only the up- e is composed of timber cribs. These only 8 ft. wide and 16 ft. long. They opening of 10 ft. between, which is [illegible] structure is sealed with an earthen bank the same as the big cofferdam. See Fig. 4. On the lower or downstream side there is only a bank of earth which is placed from a trestle built for that purpose. This plan was adopted for two reasons. First, it was less expensive to build than all crib work, and second, it could be [illegible] until the piers were placed. This feature is important since the work is advanced in sections. A strip about 400 ft. long is enclosed by each cofferdam and as soon as the piers and arches in one section are completed the cofferdam enclosing that section is removed and the river allowed to flow unobstructed between the piers.

TEAM AND ELECTRIC RAILWAY SECTION

ions to Assistant Engineers for ting Railway Property for entory and Appraisal, Cali- ornia Railroad Commission.

lways of California are being ap- der the direction of the State Rail- [illegible] Mr. R[illegible] Engineer. The Commission requires railways complete maps and profiles to specified forms, an inventory of ty arranged according to a set of ry forms, and statements of original oduction value, and present value. are being supplemented and veri- spection by engineers of the Com- For the instruction of its inspectors ission has drawn up a set of direc- h are of such general interest that them here as follows:

[illegible] party will consist of [illegible] bers, viz.: one assistant engineer in [illegible] inspector, one head chainman [illegible] n. [illegible] will usually be furnished with [illegible] speeder or provided with [illegible] [illegible] for transporting his party ailroad. The inspector will be fur- [illegible] profile of the railroad showing tures, and also with maps of station here same are considered necessary. the duty of the inspector to check own on the maps and profiles, and per and legible form in note books mplete inventory and description of of construction and property. He ully acquaint himself with the in- rms prepared by the commission inventories and appraisals of rail- be made, and will at all times have [illegible] securing and furnishing the data or their proper compilation.

ector will be provided with suitable Upon the left hand page he will tes and descriptions of property, ex- [illegible] may be recorded by the head Upon the right hand page he will r as possible to scale, sketches and buildings and structures of every ll obtain information from every re- e as to the age of all structures, and life of perishable materials in par- ities. Special effort will be made to ection foremen, roadmasters, agents ailroad employes on these subjects. or will record notes of such inter- g the authority. All sidetracks, spurs acks will be carefully measured and ame recorded upon diagrams of sta- s and yards in the note books; these yards, etc., will be made regardless or not inspector has station plats, tion on all station plats must be any corrections noted thereon.

chainman will carry a note book therein, in legible form, data and ative to rails, fastenings, switches, ing, and such other information as ected by the inspector. The left of his book will be used for notes [illegible] hand page for sketches. The e inspector, together with those of ainman, will contain the complete d record of the way structures and the railroad. The head chainman such other duties as may be re- e inspector.

[illegible]

The notes will be grouped by miles, observing preferably the mile posts now on the ground, if any. These should agree with mile posts on the profiles. Where they do not agree, the location of mile posts on the ground should be marked in pencil on the profiles, and the number of each mile post recorded.

The inspector will check the relation between the ground and grade lines, as shown on the profile, with actual conditions, and make note of apparent discrepancies. Note will be made on the profile of all raises of embankments or other changes in grade line not recorded thereon, as far as he can determine same.

Particular attention will be paid to classification of materials in excavations, including borrow pits. The inspector will check the classification of excavation quantities shown on the profile and also may make his own estimates of classification of cuts, using percentages of total where profiles show discrepancies. This will necessarily be only approximate. Generally material will be classified under three heads, viz.: earth (common excavation), loose rock and solid rock. The general character of material, kind of rock, etc., will be noted.

Note will be made of embankments constructed by train haul, and the location of cuts from which material to construct them was taken, in order that the average haul on such material may be estimated.

The present width and slopes of roadbed on embankment and in cuts must be checked at frequent intervals and any differences between actual widths and the orignal standards upon which the roadbed was apparently constructed carefully noted.

All tunnels must be measured. Sketches will be made showing dimensions of portals, cross-sections, etc., and plan of lining. Age of materials must be obtained if possible, otherwise the inspector will estimate same and report condition. As far as possible, character of material encountered in constructing each tunnel will be observed and any peculiar or unusual condition which affected the cost of its construction will be reported.

All bridges and culverts must be carefully inspected and measured and sketches made of those having unusual or special features.

STEEL BRIDGES.—The length, number of panels, and general design of all steel bridges will be noted and a description given of character and kind of floor system, size of ties, guard rails, etc. General plans will be made of all piers and abutments, and material of which built and class of masonry and dimensions noted. Such inspection as can be had from observation and otherwise, as to depth and character of foundation, etc., must be recorded. The ages of all bridges will be taken from the "age" plates and names of manufacturers stated, where these exist.

TRESTLE BRIDGES.—The character and dimensions of all materials used in trestles will be noted, and sketches made of such as vary from the regular standard. The number and kind of piles used in each bridge must be stated. Note number of 4-pile bents, 5-pile bents and 6-pile bents, etc. Where frame bents are used, sketches must be made of sufficient detail to enable the material to be calculated. The character of fottings must be noted, whether mud sill, pile or masonry, and dimensions of material or number of piles in these given as far as possible. Sp[illegible] made stating whether or not timber and piling is treated or untreated.

CULVERTS.—The dimensions, character of material, classes of masonry, etc., of all culverts must be noted. Sketches of these will generally be made showing dimensions of headwalls, sidewalls, etc., sufficient to enable an estimate to be made of the materials in each. The inspector will make special effort to learn the age (year built) of each bridge and culvert, and must report its condition, preferably as a percentage of value now. Where no reliable information can be had as to the age of a structure, the inspector will estimate same.

The character (kind of timber) of ties must be closely observed, and estimates made of proportional amount of each class, where mixed. Note must be made as to whether ties are treated or untreated.

At frequent intervals ties both in main line and sidings must be counted for sufficient distance, say 100 feet, in order to arrive at an average number per mile. Information as to average life in particular localities must be obtained from every available source, and careful note made. Note will be made of the general condition of ties in each mile.

The weight, age and maker of rails will be noted at frequent intervals. Particular attention will be given to securing the amount of rails of different weights in sidings and other secondary tracks. Character of joints will be closely observed and noted, and where possible the inspector will obtain the actual weight of joints. This can frequently be done at section houses and depots.

Careful record will be made of tie plates, anti-rail creepers, rail braces, derails, bumping posts and special appliances. Weights and makes of these must be obtained whenever possible.

The number, length, weight of rail, and kind of frog, kind of switch, kind of stand, guard rail, etc., must be carefully noted for each switch; also taper ralis, composition joints, etc. The style, weight of rail, approximate angle, etc., of crossing frogs must be recorded; also note made of plates, if any, and timbers. The inspector will also report the name of the railroad (usually the one making the crossing) which installed and maintains the frogs.

Full and complete notes will be made of ballast, relative to character, amount, age, and locality (ballast pits, crusher or quarry) obtained from. Sketches will be made of average cross section at intervals and amount per mile in cubic yards estimated. The age (year installed) must be secured where possible and condition noted, stated preferably as a percentage of condition—new.

Inventory will be made of all tools, including hand and push cars, belonging to section gangs, as far as practicable, and condition of each noted. Also list and general description must be made of furniture in depots and other buildings inventoried by the inspector, including baggage and other trucks owned by the railroad.

An inventory and description only of interlocking devices will be made, which will include general dimensions and character of tower, kind of devices and appliances, number of functions of each class operated, etc. A sketch will be made showing relative location of all switches, derails, signals, etc., and all tracks within the limits of the interlocking Notes will be made as to kind of signal poles, whether signals are operated by wire or pipe lines in case of mechanical plants, etc.

With reference to block signals, only the general features will be observed and noted, as these will be finally inventoried by a special inspector. However, the number and location of signals and notes as to pole lines, charging stations, etc., will be taken by the inspector.

The inspector will take general note of all telegraph and telephone line which the railroad owns or in which it has interest, recording the number of wires, kind of poles, distance apart, etc.

All buildings and structures of every kind will be carefully inspected and measured by the inspector and a general plan made of each, with description of design, character, materials of which built, appliances, etc. Usually a ground plan of buildings will be sufficient, with note of any unusual features of elevations. Special attention will be given to noting kind of foundation, floors, walls, roof, general finish, heating and lighting systems, etc., in case of depots. Also age (year built) will be obtained in all cases where possible, and an estimate of condition made.

The dimensions, character, and extent of all curbing, walks, paving, platforms, etc., which have been built by the railroad, whether upon its own right of way or upon public streets, must be carefully noted and diagrams made of same. Also notes and descriptions must be taken of all fencing, curbs, fountains, seats, etc., in parks and around depots. Also note will be made of the character, location and extent of any sewer, water and drainage systems, including valves and manholes which have been built, either wholly or in part, by the railroad. Such information must be secured by the inspector, with regard to all of these, as will enable an estimate to be made of their value.

Unless specially instructed, this inspector will not inventory and make record of the following buildings and property at terminal points, viz.: shop buildings, round houses, turntables, transfer tables, cinder pits, fuel stations, water stations, sand and oil houses, store rooms, track scales, material sheds, foremen and officers' houses and general office buildings and all of their appurtenant machinery, tools and appliances, including light and gas, water and sewer systems. But the inspector at such terminals will inventory as herein instructed all tracks, switches, fences walks, paving, platforms, cattle pens, depots, street crossings, signs, and all other buildings, structures and property not excepted above. When in doubt this inspector will make proper note of any miscellaneous building and structure or property of any kind.

The character and extent of all fencing will be carefully noted. The length can be estimated from the profile. Limits of fencing should be recorded by station number of profile. The full description of fencing must be given, noting kind and number of wires, distance apart and kind of posts, stays, etc. The kind and description of all cattle guards will be noted; also a description of all highway and street crossings. Note must be made of all signs of every kind. The age and condition of all of these must be estimated, where same cannot be stated accurately, and condition noted. It is suggested that the head chainman carry all notes with reference to
in his note book.

When inspecting a railroad the
be furnished a permit from the su
or general manager to operate his
and instructions to employes to ve all de-
sired information. He will pro le himself
with a copy of the current time ta . At tele-
graph offices he will inquire of the operators as
to approach of trains. He will us every pre-
caution and avoid as far as possit endanger-
ing the lives of his party.

The velocipede will be used
movement over the railroad betwen stations
where there are few structures. The party
will be expected to walk through ery station
ground and yard and stop and cloly examine
and measure up every bridge, cul t, building
and structure.

As note books are filled out,
will forward same by express to
the chief inspector, together with
maps and profiles of such railroa
have completed the inspection of.

When leaving or returning to S
or when moving by regular train f
tion of a railroad to another, t
will be transported as baggage.

The inspector will advise the
daily by postal card as to the pre
work and designate the stations
will be called for, such designatic
erally not less than four days
party. He will also make a wee
letter, reporting and discussing su
may be pertinent.

DRAINAGE AND IRRIGATION SECTI

General Methods and Costs of Levee Work in Louisiana for 1910 and 1911.

The aggregate mileage of levee in Louisiana is 1,636.3 miles, including 158.3 miles in Arkansas. These levees have been built by Levee Districts, by the state and by the United States. In the report of the state engineer of Louisiana for the two years ending April 20, 1912, the general construction of the state and district levees is described and costs are given as follows:

In the construction of levees in Louisiana and that part of Arkansas affecting Louisiana, undertaken by the state and the levee districts of the state, the following general specifications, quoted from the "General Specifications and Conditions," usually maintain, viz:

The contractor assumes all risks from subsidence in foundation, or base, accidents, floods and casualties of every kind which may occur before the completion and acceptance of the work, and shall sustain all damages and injury that may be caused thereby.

No part of the work herein contracted for shall be given, sold, or assigned to a sub-contractor without the consent of the president of this board, expressed in writing; nor shall said contractor or his sureties be released from personal and immediate responsibility without like consent.

The embankment shall be built of such material and disposed and distributed in such manner as the engineer in charge may direct, under the requirements of the Board of State Engineers. The required allowance for shrinkage shall be added to the height of the embankment; this allowance to be at the discretion of the engineer in charge, up to one-fifth in excess of the net height of the embankment; it being understood that a cubic yard of embankment under this agreement is a net cubic yard of settled earth, and equal to five-sixths of a cubic yard of material in place, within the limits prescribed.

The contractor shall remove all trees, stumps, logs, roots, stalks, weeds, grass, trash and perishable matter of every kind not specially exempted from this requirement by instructions from the engineer in charge, and plow or spade up the ground over the entire surface to be covered by the embankment. He shall grub up by the roots all trees and stumps within the limits of the base of the embankment, and three feet on either side of the base. He shall remove all buried logs, brick or walls and other material considered unsuitable by the engineer in charge. He shall refill all holes made by grubbing or by the removal of unsuitable materials, as aforesaid, with solid earth up to the level of the natural surface of the ground, and the refilling of such holes shall not be paid for by the cubic yard (except in special cases, when so directed by the engineer in charge), but shall be considered as a part of the clearing and grubbing to be done as incidental or auxiliary work, payment for which shall be included in the price per cubic yard of embankment hereinafter stipulated. He shall carefully clean all ditches crossing the line of embankment, and fill them with solid earth up to the level of the natural surface of the ground for a distance of 20 ft. from the base of the embankment on the land side, and for the width of the berme prescribed on the river side. He shall cut muck ditches of such depth and size as may be prescribed by the engineer in charge. If required by the engineer in charge, the clearing, grubbing, preparation of base and cutting of muck ditch, as above, shall be completed, and the muck ditch refilled throughout the whole length of the embankment, or any part thereof, before the embankment be begun. In the construction of the embankment he shall, except where other material may be ordered by the engineer in charge, use earth only, and shall place it in layers of such thickness as may be directed by the engineer in charge, and extending the full width of the embankment. Except when otherwise granted permission in writing by the engineer in charge, he shall obtain all earth from the river side of the embankment, leaving a berme of the natural surface of the ground ...... feet wide between the base of the embankment and the borrow pits. Unless otherwise directed by the engineer in charge, all borrow pits shall be sloped on the side nearest the embankment not steeper than 3 horizontal to 1 vertical, and on that side shall not be deeper than 3 ft., from which poi
of the pit may slope away from
a slope not steeper than 7 ft. vert
horizontal for 100 ft., at which
yond, the depth of the pit, for
may be required to supply ma
embankment, shall not exceed 10
natural surface of the ground.
not greater than 300 ft., "trav
natural surface of the ground,
20 ft. wide, shall be left undistu
ing entirely across the pits,
ditch of such dimensions as ma
by the engineer in charge shall b
the "traverses," on the side of t
the river, to allow drainage fr
another. He shall plant the ent
the completed embankment wit
or sods of Bermuda grass, not
ft. apart, and to the satisfactio
neer in charge. He shall cut d
bushes and saplings for a width
each side of the embankmen
through woods or timber, and,
he shall cut down such trees,
ft. of the embankment as th
charge may direct. Unless other
he shall cut all trees and stump
ty-five feet of the base of the e
the land side, down to the level
(but shall not disturb or dest
neer's bench marks or other ref
and shall leave the ground clea
timber, brush or other debri
obstructing free passage along t
embankment on the land side
of 25 ft. He shall take care t
engineer's stake and bench ma
at all times keep the station
opposite their proper location.
the engineer in charge, he shal
age ditch on the land side
bankment, of such dimensions
distance from the base as
scribed, but shall not otherwise
surface of the ground on the la
embankment, except by written
the engineer in charge. He shall
ings through the old embankme
ments as may be required by t
charge. When required by th

he earth taken from openings made the old embankment and from drain-es, shall be deposited in the embank-ler construction, in which case it shall for as embankments only, but other-hall be measured and paid for in ex- Except by special permission of the in charge, all existing embankments, of old embankments, must be left ed.

ition to the foregoing, whenever prac-he following specifications have, dur-ast two years, been prescribed:

[illegible] ner as may be prescribed by the en- [illegible] said ditch or canal may be utilized [illegible] stumps, trees, logs, etc. [illegible] to facilitate the observance of speci- [illegible]

ade line usually observed by the horities of the state is that adopted ribed by the Mississippi River Com-

matter of cross sections, slopes of 2 [illegible]

[illegible] feet, dependent upon location, height of levee, stability of bank, whether the bank requires protection by revetment or not, the availability of means, etc., are in practice.

By law, banquettes are required to be built over all bayous or sloughs crossed by levees. Banquettes have also been generally prescribed across depressions of the ground in marked contrast with the general elevation of the natural surface in the vicinity of the levee; also where the general height of a levee exceeds 15 ft. Such banquettes are, as a rule, located along the land side of the line of levee, forming part of its land side base. A disposition, however, continues to gain favor to as much as possible avoid the construction of banquettes, and, in lieu thereof, adopt flatter slopes.

Where lines of levee are generally exposed to wave-wash, due to wind, the passage of steamers, etc., wooden revetments are, where practicable and the means are available, built and maintained by the state and levee districts.

The United States also, when called upon to protect from wave-wash lines of levees built under its direction, on the "Lower Coast" (the Mississippi River below New Orleans), has, after considering various forms of protection, selected the paving of the entire river side slope of the levee with a layer of concrete.

Thus far, such paving as has been done presents a fine appearance, and is performing its offices satisfactorily.

The earth utilized in building the levees of the state, by the levee districts of the state, still continues to be moved mostly by scrapers drawn by mules. Wagons and graders are, in most instances, used in conjunction with scrapers. Men with wheel barrows and power-driven machinery, in the order named, come next in volume of work accomplished, the latter gaining material ground over former accomplishments.

During the past two years, the work performed by the districts and the state, by the various methods employed, was (exclusive of the Orleans Levee District) as follows: By scrapers drawn by mules, 59.8 per cent.; by men with wheel barrows, 21.5 per cent., and by power-driven machinery, 18.7 per cent.

The average cost of the levee work performed by the levee districts and the state, by all methods, during the past two years, was (exclusive of the Orleans Levee District) 20.10 cts. per cubic yard; and by the three methods named, as follows: By scrapers drawn by mules, 17.30 cts. per cubic yard; by men with wheel barrows, 21.5 cts. per cubic yard, and by power-driven machinery, 22.10 cts. per cubic yard.

RIDGES AND BUILDINGS SECTION

of Field Inspection of Concrete in Building Work.

.mple of careful inspection of con-ding work is given in a paper by yles before the National Association it Users. The general methods fol- of interest and will serve as a guide. ly it may be remarked that though tion was close and strict, it was ac-the contractor not only without fric-with full co-operation. A factor in was doubtless the selection for in- men experienced in concrete work ng them in charge of the engineer ned the building and who kept on in close touch with inspectors and . We abstract from Mr. Bayles' follows:

gineer who designed the building n charge, assisted by two inspectors, rts in the making and placing of re-concrete. The engineer assumed arge of the work. One inspector ded the proportioning and mixing ncrete, and the other the work of in the forms. They collaborated in tion of constructing and wrecking cing reinforcement and testing ma-

eemed to be no recognized system concrete or concrete materials on a series of tests was arranged to we believed, the necessary require-nese tests were as follows: For ce-ts for fineness, constancy of volume, tting, initial and final, specific grav-rushing strength of 1:2 cement or sand: Tests for loam, fineness tage of voids. For stone: Tests age of voids. For concrete: Tests g strength. No tests of the steel on the job.

rary laboratory was built near the necessary apparatus installed. ry was intended to be such as [illegible] any job and no arrange-e made for heating it except the mall oil stove in extreme weather. x8 ft., built of ⅞-in. sheeting on me, with felt roof; one door at and windows on one side and at

six samples for testing were taken car of cement but later this number was reduced to three. For the fineness tests the usual 100-mesh and 200-mesh sieves were used. The inspector shook the sieves in his hands and judged by the eye when no appreciable quantity of cement was going through. Scales graduated to milligrams were used to determine the proportions. A nearby tinsmith made the boiler and wire rack for the constancy of volume tests and the glass plates were cut on the job from scrap window glass. The boiler is 13 ins. high and 8 ins. in diameter with a lid, and the rack was made to hold twelve pats at a time. The test pats were boiled for five hours or more. The Vicat needle was used to determine the time of setting. The variable temperature made the results of these tests vary so greatly as to be of little value. Le Chatelier's specific gravity apparatus was used with gasoline for making the specific gravity tests.

The test for crushing strength, not being in such general use as the other tests requires more detailed description. It consisted in testing to failure 4-in. cubes of 1:2 cement and sand mortar. More elaborate apparatus was necessary for making these tests. For this purpose there were required gang molds for 4-in. cubes, a damp closet large enough to hold four gang molds, pans of water in which to submerge the test specimens, and a compression testing machine. The gang molds were made of 1-in. lumber held together by iron clamps. The measurements were not exact, but the surface areas were approximately correct within the limits of accuracy of the tests. While only two cubes were used for each test the gang molds were made for four cubes, as the same molds were to be used for the concrete tests. They were made by a carpenter on the job and the clamps were made by the company's blacksmith.

The damp closet was built into the corner of the laboratory, the sides and floor of the laboratory forming two sides and the bottom of the closet; the other sides and top were of ⅞-in. T and G sheeting. Two shelves were put in the closet, each large enough to hold two gang molds, and space was left below for a large pan of water. When a mold with test specimens was placed in the closet a wet coffee sack was thrown over it, the ends of the sack dipping into the water below. A better arrangement would be to have the closet lined with felt, the lower edge of the felt dipping into the water. The simpler method was used as being one easily provided on any job.

The pans for water in which the test specimens were to be submerged were made 28x28 ins. and 5 ins. deep, large enough to hold thirty-six 4-in. cubes each. The same size pan was used in the damp closet. Five pans were required and they were made by one of the company's sheet metal workers.

The selection of a compression testing machine was more difficult. Most machines designed to do this kind of work are elaborate and expensive. A simple and comparatively inexpensive machine was desired and after careful investigation a hydraulic machine* was acquired, consisting essentially of two horizontal plane surfaces, one fixed, the other movable, between which the test specimens were crushed. The top surface is fixed being held rigidly in place by two side posts extending upward from the base. The lower or movable surface is fixed rigidly on top of a 5-in. cylindrical ram with cup leather packing moving in a copper-lined cylinder. The pressure is applied by means of a hand pump and is measured on a gage reading total tons on the 5-in. ram. The gage is graduated from 0 to 60 tons, and while the rated capacity of the press is 50 tons cubes were crushed which required as much as 60 tons' pressure. As many of the newer cubes crushed at low pressure and exact readings on the gage that was furnished on the machine were difficult, a second gage was attached reading up to 10 tons only. When cubes requiring a greater pressure to crush them were being tested this second gage was shut off by a valve.

On account of the high values which were obtained at the beginning of the work suspicion was directed towards the accuracy of the machine, but comparisons of the cubes by testing on an accurately gaged machine at the testing laboratory of Columbia University showed that the small press used on the work was correct within reasonable limits.

For each test two cubes of 1:2 cement and sand mortar were made. The sand used was taken from that used on the work and was washed clean. To insure uniformity a sufficient quantity for all the tests was taken at one time and stored in a bin until required. For each test a little in excess of 128 cu. ins. of sand and half as much by volume of cem-

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(*Built by John Robertson & Co., Brooklyn, N. Y.—Eds.)

ent were used. The sand and cement were mixed dry, then sufficient water added to make a fairly wet mixture, that is, one that was readily puddled but would not pour. The whole was then well mixed and placed in the molds and puddled with a small trowel. All the operations were done by hand. As soon as the mortar was sufficiently set to hold the markings the date and hour were marked on both cubes and the mold placed in the damp closet. At the end of 24 hours the mold was taken from the damp closet, the forms removed and one cube crushed. The other cube was submerged in a pan of water where it remained for six days and was then crushed. All specimens were tested to failure.

To prevent little inequalities of the surfaces of the cubes from seriously affecting the results three thicknesses of blotting paper were used top and bottom of each cube in the press. After some time it was discovered that the long sides of the gang molds were more nearly parallel than the others and thereafter care was taken to use the sides of the cubes formed by them as the crushing faces. By this means better and more nearly uniform results were obtained.

Every scow load of sand was tested for percentage of loam. If the sand in different parts of the scow appeared to be of different quality more than one test was made. This test consisted in taking a quantity of sand and drying it thoroughly on a stove. A thousand grams of it was then taken in a 12-qt. pail and washed by turning on a hose, giving the water as it flowed from the hose sufficient velocity to keep the mass stirred up and moving, the loam being carried off in the overflow. When the water ran clear the sand was again dried and weighed, the difference in weight giving the percentage of loam. Sand containing more than two per cent was rejected. Tests were also made to determine the comparative fineness of the sand. These were only made when there appeared to the eye to be a difference in the grade. The test consisted in taking a measured quantity of sand (by weight) and screening it by hand through 20-mesh and 30-mesh sieves. These tests showed on an average about 21 per cent retained on the 20-mesh sieve, 27 per cent on the 30-mesh sieve and the remainder passing through the 30.

Occasional tests for percentage of voids in the sand were made as follows: A comparatively large amount of sand was measured and weighed to show the average weight per cubic centimeter. Then a quantity by weight corresponding to 50 c.c. was put into a glass graduate and the volume of water displaced measured. The average volume of voids was thus found to be about 40 per cent.

As the grade of the crushed stone varied but slightly only occasional tests were made to determine the percentage of voids in the stone. To do this a quantity of stone was submerged in water for two hours to permit it to become thoroughly saturated. The water was then poured off and the stone exposed to the air half an hour to permit the surface moisture to evaporate. A vessel of known cubic capacity (nearly 10,000 c.c.) was then filled with the stone and weighed. Sufficient water was added to fill all the voids and weight taken again. The difference in weight showed the percentage of voids. As there was excess of voids around the sides of the vessel this test is only comparative and is not considered particularly important as the inspector can best judge by the appearance of the batch when the voids are properly filled. For the stone used on this work the voids measured by the above method averaged nearly 50 per cent. Measurements of concrete in place and stone on the scows indicated that the volume of stone used was about 97½ per cent that of the concrete produced.

What seemed to us the most important test and the test of most practical value was that of the crushing strength of concrete itself as it was placed in the forms for the building. For these tests the [illegible] used as for the mortar tests. The preparation of the test specimens was simpler. The gang mold for four 4-in. cubes was taken into the work where concrete was being poured. The concrete was taken from the buggies as it was being poured into the forms and was immediately placed in the cube mold and puddled with a small trowel. There was no excessive puddling as it was intended to approximate working conditions as nearly as practicable. One and sometimes two tests were made every day concrete was poured. From this time on the operation was similar to that for testing mortar. After 24 hours in the damp closet the forms were removed, one cube crushed and the three others submerged in a pan of water. Of these three one was crushed at the end of seven days—one day in the damp closet and six in water—one at the end of 28 days and the other was removed from the water at the end of 28 days and laid aside to be tested later. As has already been said no attempt was made to preserve an even temperature in the laboratory, the object being to maintain as nearly as practicable the condition of the concrete in the work, so that it sometimes happened during the winter that ice formed on the water in the pans where the test cubes were submerged. The effect of this is clearly shown in the results of the tests. A practical use of the tests of concrete was to indicate to the inspector as well as to the contractor the safe time for wrecking his forms. This time was fixed at first at seven days but was afterwards shortened to four days during the summer and well into the fall when the decreasing strength of the cubes tested caused the time to be again extended to seven days.

The results of these tests on the whole were so satisfactory and the information obtained was deemed of such importance that they were continued for another piece of work which was done during the summer and fall of 1911. This latter work consisted of the reconstruction of a block of six warehouses. As this work was done with greater despatch than the first job it was thought best to have more inspectors. Consequently a chief inspector was put in charge of the whole work, assisted by one inspector over the proportioning and mixing, one on placing concrete and one solely for making tests. This arrangement worked very satisfactorily and allowed the engineer to devote more of his time to other work.

Records of Lobnitz Rock Breaker Work in Bari Harbor, Italy.

The following records of work done by a Lobnitz rock breaker are given by Mr. Giovanni Fossataro, civil engineer, Venice, Italy, in a report to the International Congress of Navigation:

The bottom of Bari harbor consists of limestone rock overlain by a thin bed of sand. For improving the bottom of this harbor, and increasing the depth of water to 8.7 m. (nearly 29 ft.), it was necessary, during the last few years, to remove 51,177 cu. m. (66,937 cu. yds.) of rock, at a total cost of about 1,637,000 lire (£65,480). For carrying out the works a Lobnitz rock remover was employed, which had the following dimensions, etc.:

	Meters.	=	Feet.
Length	35		115
Depth	1[illegible]		[illegible]
Width	8		26
Power of engine	[illegible]0 h.p.		

Normal pressure, [illegible] kg. per sq. [illegible] ([illegible] lbs. per sq. in.).

For depths of 6 m. (19½ ft.) and over, a stamp of 14 tons weight and 13.4 m. (44 ft.) length was employed; and for depths below 5 m. (16½ ft.) a stamp of 12 tons weight and 9 m. (29½ ft.) length. The height of fall was 4 m. (13 ft.); and the number of blows per minute about 180, the mean hourly production being 4.5 cu. m. (6 cu. yds.).

The weight of the substances dredged generally varied from 40 to 50 kgs. (mean 99 lbs.); but sometimes exceeded 300 kgs. (440 lbs.). At the commencement of the dredging works a steel cutter in the form of a cold chisel was employed, which was very quickly worn out. This was afterwards replaced by a Lobnitz cutter of nickel steel, with which work was carried on for two years w cut the necessity for renewal.

For bringing up the pieces of br en rock two ordinary bucket dredges and ti er-built lighters were employed, the distance f transport being from one to three kilo ters, or about a mile.

The cost of rock broken and car to the place of discharge was 30.2 lire r cubic meter (18 s. per cu. yd.) for the bstances dredged inside the harbor, and 33. lire (20 s.) for those dredged in the mouth.

Health Commissioner Wanted r Boston.—A vacancy will soon exist i the sition of chairman of the board of ealth the city of Boston.

The duties of the chairman a associates are various and responsi. T embrace the control of contagiou di including bacteriological tests, disin preventative measures; the inspecti of vinegar, provisions, tenements, la houses, stables and occupations and dangerous to health; the medical in c the schools, containing more than pils; the management of a smallp and a quarantine station; the cont venience stations throughout the cit pilation and publication of vital st other miscellaneous duties. The has over 200 employes.

The mayor will consider applica physicians, sanitary engineers or sons experienced in this field, who ican citizens.

The salary of the position is now year, but the mayor has recommend crease to $5,000, and is willing to more.

The appointment is made by the ject to confirmation by the civil s mission, and the new appointee wil two years of an unexpired term. term is three years. Applications addressed to Mayor Fitzgerald.

Cost of Electric Power Genera following table gives the cost of ing electrical power by the Pacific tric Co., as given by the "Electri This company generates about 86 hrs. per year. The costs given year 1911.

Generation:
  Labor
  Materials
  Repairs

Distribution
  Labor
  Materials
  Repairs

Administration:
  Labor
  Materials
  Legal expenses
  Fire insurance
  Bad debts
  Advertising
  Damages to persons.
  Rents
  Taxes

Interest on floating debt.
Depreciation

  Total

Cost of Burning Charcoal.—T plant at Gorgona, Panama, has operations, with a stock on ha for a year's supply. Since April kilns have been burned, produ lbs. The cost of this, includin tion of the kilns, was $1,592.76 age cost of producing charcoa cts. per 100 lbs.; the two last k cts. per 100 lbs. The price of year ago was $1.10 per hundre which, the amount produced past would have cost $3,852.52. saving effected by the operat plant amounted to $2,259.76. T use of charcoal in the canal a work is in starting fires in loco steam shovels.

NEWS SECTION

orial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

ment The Dogs of the Week; History The First Train; Work in New York Trees ghways
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[illegible]
Roads, Streets and Pavements [illegible]
Irrigation, Drainage, Levees and Canals.... 52
Water Works [illegible]
Sewerage and Garbage Disposal [illegible]
[illegible]

ngs

Something of [illegible] has been made in [illegible] number of railroad construction contracts let during the past few days, and the end is not yet in sight. As soon as [illegible] another project just as good [illegible] now as though the railroads were [illegible] this season to see which the biggest contracts. The Chi- kee & Puget Sound Ry. is under- opened bids Saturday for the its proposed line from Lewis- Falls, Mont. Other big work ected to come up in the near les the betterment work of the o Grande Ry.; 31 miles of second mostly in Kentucky, for the Cin- Orleans & Texas Pacific (Queen a considerable amount of better- n the Missouri Pacific; the con- new lines for the Frisco in the uite a bit of new construction in r the Illinois Central. Among the t recently are the following: Co., 290 Broadway, New York construction of a low grade line ster to Irvine, Ky., for the Lou- hville R. R., the work including avation; Rinehart & Dennis Co., tional Bank Bldg., Charlottesville, tructing the 35-mile extension of Clinchfield & Ohio Ry., from northward to Elkhorn City, the 19 tunnels varying in length to 8,000 ft., and 3,500,000 cu. yds. of which 65 per cent is rock; have been awarded contracts by R. for second track work on the rie Division: Section "A," Eyre- Co., Arcade Bldg., Philadelphia, "B," Ferguson & Edmondson Co., a.; Section "C," Patterson-Moran own, W. Va.; Section "D," John son, N. J.; Section "E," Ferguson n Co., Brookville, Pa.; Section Lee, Paterson, N. J.; Section oemaker & Co., Arcade Bldg., Pa.; Section "H," Eyre-Shoe- Arcade Bldg., Philadelphia, Pa.; Carter Construction Co., [illegible] ew York City; Section "J," Jones umbus, O.; I. A. Hodge, Syra- or grading, tracklaying and over- tion for 6.2 miles of single track Brewerton, N. Y., for the Syra- Bay R. R.; Swanson Bros., Rock- r constructing new line between Garrett for the Western Mary-

of bridge masonry work the ct awarded since our last issue the one secured by T. A. Gil- w York City. This contract calls lation and masonry on the East- the New York Connecting R. R. will be about 3,500 ft. long, ex- Lawrence St. to Stemler St., City. The Boston Elevated Ry. n, Mass., is now calling for de- for the construction of a 3-track t. between abutments, including nd bascule draw, over the Mystic proposed Malden extension.

[illegible] of the Mississippi River Commission. This work includes 1,600,000 cu. yds. and is located in Mississippi, Louisiana and Arkansas. It calls for the filling in of the worst crevasses caused by the recent floods. The bids are to be opened June 3 by Maj. J. C. Woodruff, U. S. Engineer, Vicksburg, Miss.

The City of Toronto, Ont., will undertake extensive improvements to its water works if it carries out the plans outlined by its consulting engineers in a report submitted last week. Among other things this report recommends the construction of an additional water supply system in the vicinity of Scarboro' Heights at an estimated cost of $5,320,000; the duplication of the Island filtration plant; duplication of the intake pipe and continuation of the present service, the improvements to cost $1,620,000; installation of water meters at a cost of about $1,140,000.

Preliminary steps have been taken in Mississippi for the formation of a drainage district to comprise the greater parts of De Soto, Tate, Tunica, Quitman and Panola Counties. Between 250,000 and 500,000 acres will be affected. A preliminary organization has been formed for the purpose of circulating petitions among the land owners, of whom 10 per cent are required to sign before any further official steps can be taken toward organizing the proposed district.

Natural History. A Missouri contractor now knows more about natural history than he did two weeks ago. This contractor on one of his jobs had erected a large wooden tank for water supply purposes. A few days ago he noticed a bird busily pecking away at the staves of the tank. He watched it awhile and then called his foreman. "That's a robin," said the latter. "Wrong," said the contractor, "it's a bluejay." A few minutes later he noticed that the bird had drilled a neat hole through the stave, and nothing daunted by its ill luck had resumed operations on the other side. The foreman plugged up the opening and drove the bird away, but it was back again in a few minutes as busy as ever. The contractor then shot it, and labored with his employee for half an hour trying to convince him that it was a bluejay. Finally he gave up in disgust, saying, "I'll take the bird into town today, and get an affidavit as to its name." That afternoon when he drove to town for his mail he took the bird with him. Inquiry of the postmaster developed the fact that a man sitting on the office steps was the local authority in natural history. The contractor brought his bird to this man and asked him what it was. The authority straightened up and queried, "Who shot it?" "I did," said the contractor, proudly; "winged him with my first cartridge; what kind of a bird is it?" "That," replied the man, "is a woodpecker. And it will cost you $25 for shooting it; protected by the game law, you know," he added. "I'm deputy game warden, so we'll just walk down to the judge's and settle the case."

The First Train. It is always an interesting event when a new railroad comes to town. Here is the way the correspondent of the LaRue County Herald described the coming of the first train to Hodgenville on March 16, 1888:

It [illegible] and [illegible] and all is well. The long expected day has arrived. The consummation of [illegible] months of labor and anxiety has been realized. Yesterday the first train over the Hodgenville and Elizabethtown Railroad arrived at our depot, and filled every heart with gladness, dispelled all uncertainty and, in a word, made things brighter. Every animate [illegible] of our village was at the depot grounds, canine, feline and humine. Everybody from the wee little tot that couldn't decide between a sugar plum and a railroad train, to the gray haired fathers and mothers who have seen goods hauled through here from Philadelphia to Nashville on creaky, cumbersome wagons. The interest did not simply consist at gazing at an engine followed by half a dozen passenger cars, but that in fact our railroad was a thing of life, it had been born and all gazed on the infant. One glance was sufficient; it was assuring, it told all they wanted to know.

Subway Work in New York. Steps in furtherance of one of the largest construction projects ever financed by private corporations were taken last week by the Board of Estimates of New York City. The Board approved the McAneny report in favor of a dual system of subways for the city. While this action of the Board of Estimates is not legally binding, it is nevertheless a moral pledge to the Interborough Rapid Transit Co. and the Brooklyn Rapid Transit Co. that the city will do its share to carry out the dual subway plan. To carry out the plan will call for the expenditure of something like $325,000,000, of which the city's share will be $160,000,000. During the past 12 months the city of New York has awarded contracts amounting to over $37,000,000 for work on its Lexington avenue subway. With the new work which will come up under the dual subway plan, it is evident that the metropolis will be the headquarters of many a big contracting concern for the next few years.

Trees Along Highways. The New York State Department of Highways is to commence the systematic planting of trees along the improved highways under its jurisdiction. The Department has bought recently 150,000 red oak seedlings and 15,000 Carolina white birch trees for the purpose. In taking this step the New York officials are following the excellent example set by the Massachusetts State Highway Commission. This commission for a number of years has been planting trees along its improved roads. It has had its own nursery and its own forester. Its tree planting has been done scientifically and systematically, and the results have been highly satisfactory.

PERSONAL

Mr. Basil A. Lemke has been elected President of the Water Board of Detroit, Michigan.

Mr. H. A. Taft has been made Acting Assistant Engineer of the Lincoln Park Extension, Chicago.

Mr. C. A. Aycock has been elected Superintendent and Secretary of the Light & Water Plant of Franklin, La.

Mr. Mark Ogan, Ceramic Chemist for the Northern Clay Company at Auburn, Washington, died on May 11.

Mr. W. E. Hall, recently re-appointed as a member of the Board of Public Works of Owosso, Michigan, has been elected President of the Board.

Mr. Geo. W. Cutting, Jr., Consulting Civil Engineer, has removed his offices from 6 Beacon St., to larger quarters at 85 Water St., Boston, Mass.

Mr. W. T. Coleman, Assistant Engineer of the Lincoln Park Extension, has been appointed Engineer in Charge of the Marine Extension, succeeding Mr. Baggott.

Morey, Newgard & Company, Engineers, announce that they have moved their offices from the Isabella Bldg., 21 E. Van Buren St., to larger quarters in the Lake View Bldg., 116 South Michigan Ave., Chicago.

Mr. Thos. Burgess, pioneer dredge builder and former master mechanic of the Chicago & Northwestern Ry., died at his home in Oak Park, a suburb of Chicago, May 20. He has been in retirement for the last three years.

Mr. W. D. Nicholson, Superintendent of the Jackson Water & Light Plant of Jackson, Ga., has resigned his position to become effective June 1, and the council has elected Mr. W. E. Merck of Easley, S. C., to fill the position.

Mr. Walter Busbee Griffin, architect and landscape artist, has been selected as the designer of the new capitol of the commonwealth of Australia. He was awarded the first premium for the plans submitted for the best design.

Mr. A. M. Van Auken, whose resignation as Chief Engineer of the Memphis, Dallas & Gulf Ry. was mentioned some time ago, is now in charge of the construction of a 12-mile extension and independent entrance into Farmersville, La.

Miss Marie Oberlander, a student of architectural drawing at Teachers' College, Columbia University, was elected to junior membership of the American Society of Engineer Draftsmen on May 16. She is the first woman to be elected a member of this organization.

Mr. C. W. Baggott has resigned his position as Engineer in Charge of Marine Extension of Lincoln Park, Chicago, to accept a position as Chief Engineer of the Western Land Securities Co. of St. Paul, Minn. He will go to Ceney, Michigan, to plan and construct a large drainage system.

Mr. Thomas S. Purcell, who was Superintendent of the Construction of the Washington Monument, died on May 19 at Washington, D. C. Mr. Purcell laid the cornerstone of the Patent Office, was Superintendent of Construction of the Cabin John Bridge, at one time the greatest in the world. He was 88 years old.

The Dabney Engineering Co. has been organized with offices in the Porter Building, Memphis, Tenn., for the practice of designing and consulting engineering for municipal improvements and land reclamation by drainage, levees and irrigation. Major T. G. Dabney, Principal Consulting Engineer, is Chief Engineer of the Upper Yazoo Levee District in Mississippi. Major Dabney was until recently Chief Engineer of the Tallahatchie Drainage District and was formerly in municipal practice.

Mr. M. A. Cleveland of Brockport, N. Y., died on May 19. Mr. Cleveland was one of the most prominent contractors of western New York and did much work for the Canadian Government, having been prominent in the construction of the Welland and Murray canals. He built the Cleveland & Toledo Ry., now a part of the Baltimore & Ohio system, and also improved many harbors along the Great Lakes.

Mr. Edw. J. Fort, Chief Engineer of Sewers in Brooklyn, N. Y., and Mr. Geo. T. Hammond, Engineer in Designing under Mr. Fort, sailed on the Amerika of the Hamburg-American line on May 16 for a two months' trip of investigation of sewerage systems in the larger cities of Great Britain and the continent. They will give special attention to sewage disposal and river pollution, visiting London, Manchester, and Birmingham in England, and on the continent Rotterdam, Holland, the Emscher District of Germany and will also study the sprinkling filter system recently installed in Paris to take the place of sewage disposal farms. On their return they will take up the work of improving the sewerage system in Brooklyn.

Major W. W. Crosby, Chief Engineer of the State Roads Commission of Maryland, has resigned. He has held the position since the Commission was organized. He will go into private practice as a consulting engineer, specializing on highway and bridge work, with offices in Baltimore. Mr. Crosby is one of the best known highway engineers in the country and most of the important road work in Maryland has been done under his direction. He was induced to come to Maryland in January, 1901, as County Road Engineer for Baltimore County, which position he held until 1904. As far as he was able to do so, he placed the entire system of road building on a new basis. In 1904 he became General Superintendent of the Baltimore System of Parks and held that office for a year, when he was elected Chief Engineer of the Geological Survey to which had been entrusted the work of building roads under the law giving state aid. When the roads law was passed he was chosen engineer for the road construction surveying, both as Engineer of the Road Commission and for the Geological Survey. Mr. Henry G. Shirley will succeed Major W. W. Crosby as Roads Engineer of Baltimore County.

Mr. E. M. Bigelow, State Highway Commissioner of Pennsylvania, announced on May 21 the appointment of thirty-one Superintendents of State Highways. The superintendents will report to the district engineers and have charge of construction and maintenance of roads where ordered. The positions carry salaries of $1,500 per annum. Nineteen more may be named by the provision of the law. The appointments are as follows: W. D. Myers, Bellefonte; A. M. Worden, Indiana; Harry L. Wilder, Annville; C. B. Ent, Bloomsburg; Isaac L. Seiler, Selinsgrove; James E. McDonald, West Pittston; Charles E. Meals, Kittaning; J. M. Owens, Stratlonville; T. J. McCullough, Wampun; R. M. Sutton, Franklin; Thomas Robinson, Butler; W. H. Pascoe, Allentown; C. E. Steiner, Pottsville; R. D. Deitrich, Easton; M. E. Brenner, Witmer; John R. Pechin, West Chester; W. R. Wolfinger, Norristown; Ernest Harvey, Woodburn; Andrew A. Sellers, Wayne; M. K. Bergner, Chambersburg; L. H. Marsh, Towanda; Albert E. Wilkinson, Williamsport; W. H. Hatfield, Mansfield; E. Leo Caveny, Everett; W. D. Reese and T. A. Schoonmaker, Scranton; Robert Black and C. J. Langenheim, Pittsburgh; J. H. Greer, Beaver; H. B. Stevens, Uniontown; E. O. Brownlee, Taylortown; George D. Jenkins, Waynesburg, and T. C. Fraim, Warren.

CIVIL SERVICE EXAMINAT

An examination for expert
and organization is announced June
by the Civil Service Commission of
City of Chicago. The positions for e
gineering service, grade 4, and the sala
is $3,000 per annum. The lo
requirement is waived. R. A. ddowso
Secretary of Civil Service Commission, 6
City Hall, Chicago.

INDUSTRAL

The Ransome Concrete Machinery Co
putting on the market two new types of st
mixers, Nos. 60 and 61. These designs
brace many new ideas collected the
some Co. in co-operation with
engineers and contractors. Full
of them will be sent on request
some Concrete Machinery C
N. J.

The Independent Powder Co
Mo., has moved its home office to
building at 3d and Walnut Sts.
past few years the company's inc
ness has necessitated the openin
offices at St. Louis, Platteville,
Creek, Denver, Salt Lake City
Memphis and New Orleans.

The contract for placing the
for the foundation of the
building that is to be erected
Wash., for the L. C. Smith Est.
awarded to the Raymond Concr
of New York and Chicago. It i
this building will be the tallest
the world to be built on pile fo
any kind. It will be exceeded i
by the Woolworth and Singer B
the Metropolitan Tower, all of
cated in New York. The concr
be of the standard Raymond ty
driving a tapering sheet steel sh
of a steel mandrel, withdrawing
after the desired penetration h
tained, and thereupon filling th
concrete. Gaggin & Gaggin of
Y., are the architects of the Smi
the Whitney Co. of New York.
contractors, and Christian J. Jepp
cial consulting engineer for the

Contracts for paving with
Blome Co.'s patented granitoid
crete pavements have been awar
as follows: To the Rudolph S
Reynolds Bldg., Fort Worth, for
granitoid concrete pavement We
from Throckmorten St. to Lexin
Fort Worth, and for laying a
ment on Third St. from C
the Fort Worth & Denver City
of way in Fort Worth; to the
struction Co. of Tampa for
pavement on the approaches
way passenger station at Tam
dolph S. Blome Co., City
Chicago, Ill., by the Commissione
County, Florida, for paving wit
Highway Ave. from the city lin
sonville, Fla., to Lincoln Ave.; to
sen & Sons Co. for paving Orego
kosh, Wis., with granitoid con
ment; to the Alberta Grani
Co., Ltd., for 25,000 sq. yds
itoid pavement at Calgary.
Washington Paving Co., Taco
by Pierce County Commissioner
sq. yds. of granocrete pavement
Bros., Spokane, Wash., for paving
toid pavement 8th Ave. from
Chestnut St. at Spokane. In ad
above Rudolph S. Blome Co.,
are completing some 35,000 sq.
granocrete pavement on Gadsden
St., Barrancas and Petterson Ave
cola, Fla.; the B. C. Granitoid &
Co., Ltd., is completing the pavi
minster Road at Vancouver, B. C.
toid, and Egan Bros., New Orle
about to begin paving with gra
ment, Sycamore St., from Lowerli
das St., at New Orleans, La.

TALOGUES

gines.—Paper, 9x6 ins., 4 pp. Clin-
ine Works, Clinton, Mass.
an advance circular of the Wau-
as and Gasoline Engines manu-
y the above company. An 8 h.p.
ngine is illustrated.

—Paper, 9¼x4 ins., 12 pp. Shear-
. 710 Monadnock Block, Chicago,

talog describes the Shear-Klean
ch has a number of new features
to save coal in a hand-fired boil-
rations and descriptions are given.

Boilers.—Paper, 6x9 ins., 20 pp.
eland Co., Inc., 100 William St.,
City.
talog is to be issued June 1 by
any and contains a reprint of a
Geo. H. Babcock on the sub-
irculation of Water in Steam
nd several other articles relating
Boilers.

g Supplies.—Cloth, 7x10 ins., 944
Simmons Co., 106-110 Centre St.,
City.
No. 37 is an illustrated catalog
list of wrought and cast iron pipe,
iron valves and fittings, tools and
lies for steam, water, gas, oil and
construction. This is a very
catalog containing illustrations,
weights, sizes, dimensions, prices,

ous Reinforced Pipe.—Paper, 6x9
Lock Joint Pipe Co., 165 Broad-
York City.
alog illustrates and describes the
ther system of continuous rein-
ncrete pipe laid in sections in
joints between sections are so
o insure freedom from leakage.
ings and descriptions are given
e. A number of illustrations are
n of construction work and pipe
is throughout the country.

Steelcrete Expanded Metal.—Paper, 8x5½ ins. Consolidated Expanded Metal Companies, 1182 Broadway, New York City.

This is a handbook of design containing tables, standards and useful information pertaining to the "Steelcrete" system of reinforced concrete.

Sane Fourth.—Paper, 8x11 ins., 4 pp. National Fire Protection Association, 87 Milk St., Boston, Mass.

This bulletin is issued in the interest of a sane Fourth and copies may be had of it from the above association.

Laclede Fire Brick.—Card, 7x9½ ins. Laclede-Christy Clay Products Co., Manchester & Sulphur Aves., St. Louis, Mo.

This card announces an illustrated catalog and price list of fire brick which the company is prepared to furnish.

Good Roads.—Paper, 7½x8 ins., 24 pp. West Chester & Fairfield Amiesite Co., Room 918, 103 Park Ave., New York City.

This catalog contains a discussion of the advantages of Amiesite pavement and gives illustrations of pavement laid in various towns throughout the country.

Expansion Bolts.—Paper, 6x9 ins., 48 pp. Diamond Expansion Bolt Co., 90 West St., corner Cedar St., New York City.

This catalog contains illustrations and specifications of expansion bolts of all kinds and directions for using in attaching material to brick, stone and concrete walls.

Electric Rock Drills.—Paper, 6x9 ins., 8 pp. Dulles-Baldwin Electric Drill Co., 220 Fifth Ave., New York City.

This bulletin is No. 105 just issued by the company. It contains illustrations and descriptions of the "D B 11" model of the electric rock drill. Special advantages of the drll are discussed, and a table of specifications is given.

Structural Beams.—Paper, 5x7½ ins., 12 pp. Carnegie Steel Co., Carnegie Bldg., Pittsburgh, Pa.

This pamphlet gives information and data on the new line of I-beam sections rolled by this company. The sections are rolled for buildings in which it is desirable to use deeper beams than required by considerations of safe carrying capacity as determined by the specified floor load. To meet these conditions sections are provided of lighter weight than the standard sections of the same depth. These sections are illustrated.

Edison Monthly.—Paper, 7x10 ins., 40 pp. New York Edison Co., New York City.

Edison Monthly for May contains articles of interest to users of electrically operated equipment.

Leschen's Hercules.—Paper, 8x11 ins., 12 pp. A. Leschen & Sons Rope Co., St. Louis, Mo.

This is a monthly bulletin issued by the company, containing articles of interest to users of wire rope.

Tisco.—Paper, 6x9 ins., 4 pp. Iron & Steel Co., Highbridge, N. J.

Bulletin No. 114, just published, describes the application of Tisco manganese steel to crusher and pulverizer parts. A list of bulletins published by the company is given in this bulletin.

Patent Scaffolding.—Paper, 5¼x8 ins., 24 pp. Patent Scaffolding Co., 647 W. 50th St., New York City.

This bulletin contains a reprint from the bulletin of the American Museum of Safety describing the award of the Scientific American gold medal to the Patent Scaffolding Co. for the most useful apparatus for the protection of life. The booklet illustrates scaffolding in use on a number of buildings throughout the country.

Flat Link Chain.—Paper, 6x9 ins., 4 pp. New Jersey Foundry & Machine Co., 90 West St., corner Cedar St., New York City.

This circular contains illustrations and line diagrams of chain links which are shown for convenience in ordering new parts.

Another catalog (No. 110) is issued by the above company on the subjects of cars, hoisting engines, derrick fittings, contractors' dump cars, etc. Various classes, sizes and shapes are shown; also steel skips, buckets, hoisting engines, etc. Tables of prices are given.

AILWAYS, STEAM AND ELECTRIC

Arkansas.

t for reballasting and otherwise
the line of the Frisco between Van
Chester, 24 miles, has been awarded
ayes.

e Rock & Argenta Belt Line R. R.
ormed and application for a char-
made shortly. This company is
e building of a belt line from Fos-
genta, the work including the con-
f a bridge over the river. The
Trust Co., A. C. Read, vice presi-
Rock, Ark., is interested in this

nphis, Dallas & Gulf R. R., W. P.
engineer, Nashville, Ark., has com-
eys from Glenwood to Roseboro
line.

sboro & Nettleton Interurban Co.
organized at Jonesboro and will
eet railway in that city and a line
n. The capital stock is $15,000,
icers are Preston Hatcher, Jones-
dent; Thomas H. Allen, of the
neering Co., of Memphis, vice pres-
es B. Roleson, secretary, and A. L.
asurer.

en announced that the St. Louis-
sco (Frisco) has made arrange-
he improvement of the Central Di-
een Fort Smith and Monett, Ark.,
next four months. The improve-
e made include new ties and the
f the tracks with Joplin chats. A
The raise of the tracks will be put in, which will necessitate the widening of the banks and digging out of a number of cuts to take care of the raise. But few of the bridges will be raised, although all of the bridges this side of Winslow will be reinforced to withstand the heavy power engines that will be placed in operation when the improvements are completed. Many of these culverts were rebuilt with concrete only last year.

The Cache Valley R. R. has completed one-half of the survey work for 50 miles of extensions north and south. No time has been decided upon for awarding construction contracts. A. D. Goldman, St. Louis, Mo., is president, and G. W. L. Brown, Sedgwick, Ark., is general manager.

California.

⊙The Board of Public Works of San Francisco on May 20 awarded the contract for 43 double end, pay-as-you-enter California type motor cars complete, and four extra trucks, to W. L. Holman & Co., 18th and Indiana St., San Francisco, at $337,100. The cars are to be used on the Geary St. municipal railway. Bids for them were opened May 8.

It is reported that the Santa Fe System has let the contract for the construction of the first 6 miles of double track between Keenbrook and San Bernardino, Calif. Work will be started at once. G. W. Harris, Los Angeles, Calif., is Chief Engineer.

The Riverside & Western Ry. Co., projecting a 212-mile line from Riverside to Imperial, via Perriss and Manifire Valley, is now making surveys. The capital for construction has been secured in part, and contracts for a portion of the line will be let shortly. M. Hesselberger, 417 Laughlin Bldg., Los Angeles, Cal., is Chief Engineer and C. B. Conlin, 318 Lissner Bldg., Los Angeles, is President

Information received from Fresno, Calif., states that 19 miles of the Big Creek Railroad have been completed and the line is now within a very short distance of Auberry Valley, the present terminal.

Colorado.

Officials of the Denver & Rio Grande R. R., J. G. Gwyn, chief engineer, Denver, Colo., are now engaged in figuring out the equipment and material needed for reconstruction, and work on the improvements is expected to begin in a few weeks. This work is to be done under the $25,000,000 bond issue approved recently by the directors of the railroad.

The completed graded right of way for the Colorado, Texico & Aransas Pass R. R., chartered to extend from the Colorado coal fields to a gulf terminal, has been purchased by M. C. Vaugh of Portales, N. Mex., who is understood to be backed by Chicago capitalists. The first work will be to build from Texico to Virginia City, opening a rich agricultural section. Arrangements are said to have been made for floating the necessary bonds for completion of the line, and it is believed that work will begin on the uncompleted ends soon after the November election.

The Uintah Ry. Co., M. W. Cooley, general manager, Mack, Colo., has amended its charter so as to provide for an increase of capital stock from $1,750,000 to $2,500,000. This road, as previously noted in these columns, is planning a considerable amount of improvement work.

Florida.

The City Council of Tampa, Fla., has granted permission to the Tampa Electric Co., 810 Tampa St., to continue its double-tracking system on Franklin St. north from Fortune to 7th Av

Georgia.

The Southern Ry., B. Herman, chief engineer maintenance of way, Washington, D. C., is to construct eight standard passing tracks between Macon and Brunswick, during the coming summer. The aggregate length of these tracks will be 27,300 ft.

The Central of Georgia Ry., C. K. Lawrence, Chief Engineer, Savannah, Ga., is reported to be planning to put out a considerable block of bonds as soon as the stockholders have ratified the sale of $15,000,000 preferred stock to provide for the retirement of the three issues of outstanding income bonds. The financing thorough bonds will provide for thorough overhauling of the road and probably for double tracking of considerable portion of the main lines. For 14 years past all improvements made to the property were out of income. Now that the problem of the income bonds has been solved through their retirement, it is expected that the road's development will be more rapid.

Illinois.

⊙E. E. Headley & Son can use three or four small outfits on their Chicago & Eastern Illinois R. R. work at Kirksville, Ill. Headley & Son are at Kirksville on the work.

Petition has been filed in Circuit Court at Edwardsville for permission to issue $150,000 receivers' certificates to complete the Alton, Jacksonville & Peoria Ry. W. W. Butler, 305 Belle St., Alton, Ill., is receiver.

The Chicago, Peoria & Quincy Traction Co., has had location surveys started under Assistant Engineer Richard Watson from the Wabash depot in Quincy, Ill., using 6th St. to Spring St., thence east to city limits; also west from 6th to the C., B. & Q. depot. This comprises 2,900 ft. of trackage with but one curve in streets. Preliminary surveys are now under way for the remainder of the line and it is the present idea to tap Columbus, Timewell, Mt. Sterling, Ripley, Rushville, Astoria, Summum, Banner, Kingston Mines, and Hollis. Branches are planned to Havana, Beardstown and Canton. The preliminary survey will be pushed as fast as the condition of the country permits to Rushville, and then the party will return to Quincy and final location begun between the above named points. The right of way agents are signing up options following the preliminary survey party. The land for right of way is being freely granted by the farmers and townspeople. It is expected to begin grading by Aug. 1 on section between Mount Sterling and Quincy. The general offices of the company are in the Heintze Building, Quincy, Ill. R. H. Baldwin is Chief Engineer.

The directors and incorporators of the Danville, Kingman & Crawfordsville Interurban Co. at a meeting held recently at the rooms of the Industrial Club at Danville, Ill., took steps to effect a preliminary organization for the purpose of beginning work of constructing an interurban line betwen Danville and Crawfordsville.

The Aurora, Mendota & Western Ry., the incorporation of which was mentioned in our May 15 issue, is understood to be planning to begin work this summer on that portion of its line betwen Yorkville and Bristol. The W. H. Zimmerman Co., 386 S. Dearborn St., Chicago, Ill., is the Engineer.

The East St. Louis & Interurban Ry. Co. has applied to the City Council of East St. Louis for a franchise to run an electric line on St. Louis Ave. from 3rd St. to the eastern city limits, and on 8th St. from Trendley Ave. to the northern city limits. The proposed system is headed by Eugene T. Sweeney, a civil engineer.

The Illinois Central Electric Ry. Co. is now making surveys for a 9-mile extension from St. Daniels to Lewiston. The capital for construction has been secured, and contracts will be let in possibly three weeks. L. W. Morton, Canton, Ill., is President, and G. W. Chandler, Canton, Ill., is Chief Engineer.

Indiana.

⊙The following is a list of the successful bidders on the second track work on the Chicago and Erie Division of the Erie R. R.: Section "A" Eyre-Shoemaker & Co., Arcade Bldg., Philadelphia, Pa.; Section "B" Ferguson & Edmondson Co., Brookville, Pa.; Section "C" Patterson-Moran Co., Morgantown, W. Va.; Section "D" John R. Lee, Paterson, N. J.; Section "E" Ferguson & Edmondson Co., Brookville, Pa.; Section "F" John R. Lee, Paterson, N. J.; Section "G" Eyre-Shoemaker & Co., Arcade Bldg., Philadelphia, Pa.; Section "H" Eyre-Shoemaker & Co., Arcade Bldg., Philadelphia, Pa.; Section "I" Carter Construction Co., 42 Broadway, New York City; Section "J" Jones Brothers, Columbus, O.

The Indiana Union Traction Co. and the Union Traction Co. of Indiana have been consolidated and the properties heretofore operated by these companies will be controlled by the Union Traction Co., with offices at Anderson, Ind. It is expected that as a result of the consolidation plans will be made to provide for the betterment of the roadbed in some places, the construction of some new bridges and the addition of needed rolling stock. A total of 15 cars probably will be bought.

The Fort Wayne Union Traction Co. of Fort Wayne has been incorporated with a capital stock of $10,000 and under the terms of its charter may purchase or rent lines of street and interurban railways in the following counties: Whitley, Noble, Elkhart, St. Joseph, Lagrange, Kosciusko, Marshall, Starke, Laporte, Porter, Lake, Fulton, Huntington, Grant, Madison, Tipton, Hamilton, Marion, Adams, De Kalb and Allen. The directors of the organization are Henry M. Williams, Gottlieb Haller, Henry F. Beverforden, William P. Walsh and George Esmond. The principal place of business will be in Fort Wayne, and branch offices may be established. Power to connect with Illinois and Ohio lines also is given in the papers.

Surveys are to be started at once, it is stated, for the proposed interurban line from Danville to Rockville. The Danville & Rockville Traction Co., which has already secured the right of way between Danville and Bainbridge, and the Rockville, Bainbridge & Danville Electric Ry. Promotion Association, which has the right of way between Bainbridge and Rockville, are stated to have merged their interests. F. H. Nichols, Rockville, is interested.

Iowa.

The Keokuk, Nauvoo & Fort Madison Ry Co. is projecting a 32-mile line from Hamilton to Carthage and from Carthage to Nauvoo and Fort Madison. The Herrington Construction Co., St. Paul, Minn., has the construction contract. Chas. H. Petsch, 319 Jackson St., St. Paul, Minn., is President of the railway.

It is stated that if the Cedar Rapids & Iowa Ry. Co. is successful at the election on May 29 in securing its desired franchises at Mt. Vernon, contracts for grading the road will be let at once. Col. W. D. Dows, Cedar Rapids, Ia., is interested.

It is rumored that officials of the Chicago, Rock Island & Pacific R. R. have under consideration plans for the construction of a cutoff across the state of Iowa from Des Moines to Lincoln, Nebr. Nebraska City men, who, it is said, are interested in the project, have guaranteed the company 40 miles of right of way.

Kansas.

Kansas Central Traction Co. of P Mo., capitalized at $1,000,000, has filed its corporation papers at Topeka. The company proposes to build an electric line road from Parsons to Columbus by way of Coffeyville, a distance of 70 miles. The incorporators are: Phillip Strack, Indianapolis, Ind.; D. C. Randall, Altamont, Kans.; A. J. Hia Altamont, Kans.; Barney McDaniel, M nd Valley, Kans.; David E. Toer, Gwynnvil Ind.

An election will be held June at Kearney, Nebr., to determine wheth the town shall issue bonds amounting to $30,000 toward the construction of the posed new railroad from Beloit, Kan., to Kehey.

It is reported that the Wichita nion Terminal Co., C. J. Skinner, Engin, Wichita Kan., has let contracts for the cotruction of a new union depot and elevated racks estimated to require an expenditure

Kentucky.

⊙Winston & Co., 290 Broadwa New York City, have been awarded a contr Howe Peyton, chief engineer of of the Louisville & Nashville R the construction of the low gra Winchester to Irvine, Ky. This a tionally fine piece of work. T curvature will be 4°, the limit o of one per cent. The excavati on this work will be about 2,000 with something over 20,000 yds. crete. The length of the line miles. This will be nearly all work, with 150,000 to 200,000 elevating grader work. There tunnels included. The nature terial is mostly solid rock, lime tion in thin ledges. Winston to sublet practically all of this will have about 15 months to co All of it is very accessible, hav connection at Winchester and Irv L. & N. lines, and water trans the Kentucky River to the interm Winston & Co. have established at Winchester, Ky., for handlin

The Cincinnati, Licking Valley R. R. Co. has been incorporated stock of $80,000 and proposes to from the Ohio river in Kenton, Bracken counties up the Licking to the Virginia line. J. B. Walr bama is president; Thomas G. Stt chester, Ky., vice president, and kirk, secretary and treasurer.

The work preparatory to the co the projected railway of the Ken western Electric Ry. has been hel 60 days by the recent floods. T has now secured about 75 per cen of way and has 18 men working o expected to start about 45 men— on final location surveys about Ju hoped to be ready for contracto 1. W. A. Calhoun, C. E. and M National Bank Bldg., Paducah, Engineer.

The directors of the Cincinnati N leans & Texas Pacific Ry. (Queen Route, C. Dougherty, Chief Enee cinnati, O.), have authorized the nst of 31 miles of second track wor an tracts will be let in the near futu. O work 29 miles will be constructed outh Erlanger, Ky., and two miles w between Boyce, Tenn., and Chatt ooga yards at Oakdale, Tenn., are als to b larged.

Louisiana.

The Public Belt R. R. Commison o City of New Orleans, La., has aro $300,000 bond issue for the impro me extension of the Belt R. R. The m has also approved plans for givin he R. R. terminal facilities on the e between Press and Louisa Sts. Th cost about $55,000, and will inclu th struction of 2½ miles of track. A B New Orleans, La., is engineer bli R R

Massachusetts.

ase of Representatives [illegible] e' Legislature has passed the bill per- [illegible] Grand Trunk Ry. [illegible] er New England R. R., to extend its [illegible] r concurrent action.

rovidence & Worcester Street Ry. h has been before the City Council rster for several years as a petitioner nchise to lay tracks between Worces- y Hall and the town line of Millbury, posed route between Worcester and e, has filed another petition with [illegible] d inside the city limits. In its peti- ks that the time be extended until [illegible]

te Senate has voted down the bill g the Boston & Maine R. R. to unite New York, New Haven & Hartford ler conditions including a tunnel be- city and electrification of the lines tropolitan district of Boston. Gov- ss has served notice on several of rs that he will call the Legislature [illegible] f passing such a measure, with the vision of a public utilities board.

Maryland.

are being made to have the United of Baltimore, Md., extend its electric ystem for a distance of 20 miles to lvania state line. If this is done that the York Rys. Co., York, tend its line to a connection with entioned road. The York Co. has ade a survey from York to the state line.

ederick-Brunswick R. R. Co. men- our last issue, has been incorporated ital stock of $100,000, and proposes n 8-mile trolley road from Jefferson ick. The incorporators include Os- [illegible] Frederick, Md.

Michigan.

Payne, Iron Mountain, Mich., has sub-contract from the J. H. Flick ion Co. for four miles of work on l Falls and Iron River extension of go & Milwaukee & St. Paul Ry.

ntiac, Oxford & Northern Division rand Trunk Ry. will start work at said, on the proposed new exten- Cass City to Bad Axe, giving the two lines of railway. F. P. Sisson, Mich., is Resident Engineer of the [illegible] System

Minnesota.

Swenby of Chisholm, and John isholm, have been awarded contracts ng between Chisholm and Hibbing w line of the Mesaba Electric Street

from Hibbing, Minn., state that the er Logging Co. has started work [illegible] Lake line between that point and

Missouri.

Jennings, Joplin, Mo., has been the contract for grading for new rds for the Frisco in the southwest plin. About 30,000 cu. yds. of dirt [illegible]

Montana.

pson & Davidson Co., 608 Brandeis aha, Neb., have contracted with Cal- s, to take over their work on the Valley Ry. line out of Bozeman. d have a lot of nice Fresno work on or small outfits that they would like Thompson & Davidson Co. have office at Bozeman for this work.

rthern Pacific Ry., F. L. Birdsall, dent, Jamestown, N. Dak., is to ex- ards at Missoula, Mont., at a cost . Authority to start the work has ed.

Announcement has been made that steel [illegible] of the Great Northern. It is the in- [illegible] complete the Lewistown line before doing anything further on the Augusta branch and unless the United States reclamation service makes a decided move towards starting work on the Sun river irrigation project it is doubtful if the track will be completed from its present terminus at Sun River crossing to Augusta this year

The Chicago, Milwaukee & Puget Sound Ry., E. O. Reeder, chief engineer, Seattle, Wash., is understood to have opened bids last Saturday for the construction of its proposed line between Lewistown and Great Falls, Mont. Among the contractors who bid on this work are: Twohy Brothers, Spokane; Porter Brothers, Spokane; Grant Smith Co., Spokane; McArthur Bros. Co., Chicago; Winston Bros., Minneapolis; Siems & Cary Co., St. Paul.

Nebraska.

Citizens of Franklin, Nebr., have voted in favor of issuing bonds amounting to $10,000 for the construction of the proposed railroad across Franklin County.

Nevada.

⊙John Boyle has moved his grading outfit from Imlay, Nev., to Fernley, two miles south of Wadsworth, Nev., where he has taken a sub-contract for work on the new Fernley & Lassen R. R. Connelley Bros. and J. F. Harrison & Son have also taken subcontracts on this work.

⊙Grading work has been started for the Southern Pacific double tracking between Truckee and Reno. Among the subcontractors on this work are Chadwick & Sykes, who have a camp at Week's spur; Meade & Moffatt, with a camp just east of Floriston, and Palmer, McBride & Quale at Ware.

New Jersey.

The Central Railroad of New Jersey is buying up the property in the Lafayette District of Jersey City adjoining its tracks, and these purchases are reported to be part of a plan for tunnels under the Hudson River to New York City to meet the competition of other New Jersey lines.

New York.

⊙T. A. Gillespie Co., New York City, has been awarded the contract by the New York Connecting R. R. Co. for the foundation and masonry on the Eastern viaduct, about 3,500 ft. long, extending from Lawrence St. to Stemler St., Long Island City. Bids on this work were opened May 20 by Samuel Rea, Vice President of the Pennsylvania R. R.

⊙The contract for grading, tracklaying and overhead work for 6.2 miles of single track from Stop 9 on the Syracuse & South Bay R. R. to the Oneida River at Brewerton for the Beebe electric railway system has been awarded I. A. Hodge, Syracuse. The grading and bridging are very light. This road will be operated in connection with the Syracuse & South Bay, so that no new cars, power house equipment or any other equipment will be required.

The Public Service Commission for the First District, New York City, has approved five additional rapid transit routes and sent them to the Board of Estimate and Apportionment for its approval. With these routes, the work of laying out the lines for the proposed dual system of subways is practically completed. The only routes that remain to be adopted are the tunnel from Brooklyn to Staten Island, the Interborough Rapid Transit tunnel connection from lower Manhattan to Brooklyn, and the connection between the existing subway and the Lexington Avenue Subway between 32d and 42d Sts. As soon as a few minor points are cleared up these routes will be adopted and sent to the Board of Estimate and Apportionment. The action of that board on May 24 approving the general plans of the [illegible] assures the consummation of this great rapid transit undertaking. Within five years it will give to New York City a system of subways and elevated lines containing about 600 miles of single track, and costing in its entirety, including the cost of the existing subway, about $400,000,000, exclusive of the cost of the existing elevated railroads which will be a part of the system, though owned by private companies.

The Public Service Commission has ordered the Eighth Avenue R. R. Co. and the New York Railways Co., its lessee, to extend the surface railroad of the Eighth Avenue Co. from its present terminus, at about 149th St., New York City, to the 155th St. viaduct in McComb's Dam Road. The company's franchise covers this distance, but the road has never been operated beyond the present terminus. There is a large interchange of traffic between the Union Railway and the New York City Interborough Railway Companies' lines, which operate east and west over McComb's Dam Bridge, and the Eighth Avenue line, and at present passengers are compelled to walk the intervening distance. It is to do away with this inconvenience that the extension was ordered.

It is rumored that the New York, New Haven & Hartford R. R. is considering a number of improvements at Tarrytown, N. Y. Application has been made to the Government for permission to construct a new channel off Tarrytown.

The Utica & Mohawk Valley Ry. Co., Utica, N. Y., is reported to have engineers in the field doing the preliminary work necessary to establish the feasibility of a new route for the interurban trolley, about 60 ft. north of the Library Bureau plant in Ilion, the same line to parallel the West Shore, which the cars would have to cross to reach the new line when coming from Frankfort Junction, just west of the Ilion village line.

Application has been made to the State Public Service Commission by the Schenectady Ry. Co. of Schenectady, for approval of recently granted franchises in Schenectady. They involve an outlay of about $81,000 in the construction of extensions.

The New York Central Lines has plans underway to make Utica a terminal for the Adirondacks, St. Lawrence and Ontario divisions, as well as for local freight trains between West Albany and De Witt on the Mohawk division and betwen Ravena and De Witt on the West Shore. The Utica freight yard will be enlarged to make room to handle the business mentioned and also to take care of those freight trains on the main line which may be affected by the hours of service law. A new freight station and delivery yards were completed last fall.

The Catskill Traction Co., H. C. Cowen, President, Catskill, N. Y., has sold a $75,000 bond issue, and is understood to be planning to have construction work started early in June on a 6-mile extension from Leeds to Cairo.

North Carolina.

A surveying corps of the Norfolk Southern Ry. has completed the third proposed route for the line from Troy and Mount Gilead to Charlotte, N. C. It is expected that some definite action will be taken shortly in regard to the construction of the road. E. T. Lamb, Norfolk, Va., is President and General Manager of the company.

An effort is being made by the citizens of the city of North Wilkesboro, N. C., to raise a subscription for the necessary right of way for the proposed Yadkin & Wautauga R. R. from that place to Elkville and then on through Watauga to Tennessee.

North Dakota.

It is reported that contracts will be let shortly by the Northern Pacific Ry. for the construction of the proposed cutoff line from Linton through LaMoure, Emmons and Logan counties, N. Dak.

Good progress is being made on the new line of the Minneapolis, St. Paul & Sault Ste.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Marie R. R. north of Esmond, N. Dak. Peter Nelson, Minneapolis, is moving about 5,000 yds. of earth a day at his three camps, where he has about 250 men in his employ. He has a contract for eight miles and sub-contractors under him have about 150 men at work. C. E. Jamison, Stillwater, employs about 200 men, so there are in all about 600 men at work in the vicinity of the new town of Fillmore. Other camps of graders are strung all along the line in Benson and Ramsey counties, and at the rate the work is progressing the grade across these two counties will be finished by July 1, the date called for in the contracts. Bridge material for the new line in Pierce County is being hauled from Rugby, and for Benson County from Brinsmade. The laying of steel rails is expected to commence from both the Drake and Fordville ends about June 1. The grade is practically ready for the steel in all counties except Benson and Ramsey, the central part of the line.

Ohio.

Plans have been made by J. Burke, Cleveland, O., Engineer Maintenance of Way of the Erie R. R., for revision of the yards at Marion, O.

Agreement has been reached between City Engineer H. M. Waite of Cincinnati and W. C. Cushing, Pittsburg, Pa., Chief Engineer Maintenance of Way of the Pennsylvania R. R., on the plans for the Rockwood grade crossing elimination at Cincinnati. Arrangements will be made at once to bring the necessary condemnation suits for the property needed, the city bringing the part of the proceedings for the property wanted for street purposes and the railroad that wanted for the railroad right of way. It is possible that the work of construction will be started in the fall.

Oregon.

The Oregon & California R. R. Co. (Southern Pacific Line) is planning to construct a 25-mile line up the South Santrain Valley from Lebanon to a point above Foster. Surveys for this line have been made and it is probable that construction work will be started this summer.

It is now believed that construction work will be started at once on the Eugene-Coos Bay R. R. MacArthur, Perks Co., 11 Pine St., New York City, have the contract for 95 miles of this line.

The Southern Pacific, having awarded the contract for its Fernley & Lassen line, is now understood to be planning to begin construction work on the Modoc Northern R. R., which will connect Klamath Falls and Alturas. All rights of way have been secured for a good distance south from Klamath Falls. This line will connect with the California Northeastern south of Klamath Falls and with the Goose Lake Southern and the Fernley & Lassen in Modoc County.

Citizens of the Hudson Bay, Vincent and Pleasant View country are taking steps to cooperate with the Walla Walla Valley Ry. Co. of Walla Walla, Wash., in building a branch line to accommodate that section of the country. Surveys for the branch are to be made at once.

The Portland, Eugene & Eastern Ry. Co. (electric) is planning to make extensive improvements at Salem and vicinity. These plans include extensions to Silverton and Rosedale, and possibly a new line to Stayton. An expenditure of about $3,000,000 is proposed. A. Welch, 502 Fenton Bldg., Portland, Ore., is General Manager.

Pennsylvania.

⦿Swanson Bros., Rockwood, Pa., have been awarded the contract for constructing the new line between Rockwood and Garrett for the Western Maryland R. R.

⦿Fred Schusley, Johnstown, Pa., has been awarded a contract by the Baltimore & Ohio R. R. for grading the yards to be established west of Sand Patch tunnel between the water plug below Sand Patch and Slabtown, a short distance above Keystone Junction. The B. & O. will put in extensive sidings at that point on the west side of the main tracks.

The South Fork Ry. Co. has applied for a charter and proposes to build a trolley line from Altoona to Johnstown. It is planned to build first from South Fork to Portage; then from Portage to Cresson, and next from Cresson to Altoona. Charles H. Morgan of Altoona is interested.

South Dakota.

⦿Morris, Shepard & Dougherty, 801 Globe Bldg., St. Paul, Minn., who have the contract for double tracking and revision of line between Summit and Aberdeen for the Chicago, Milwaukee & St. Paul, have also been awarded the contract for the grading of the seven miles between Twin Brooks and Milbank, the work to be completed about July 15. This will necessitate the handling of about 75,000 cu. yds. of dirt.

The Sioux City, Mitchell & Pierre Ry. Co., mentioned in our May 15 issue, has been incorporated with a capital stock of $3,000,000, and proposes to construct a line from Sioux City through Woodbury County, Iowa, and Union, Clay, Yankton, Turner, Hutchinson, Hanson, Davison, Aurora, Brule, Jerauld, Buffalo, Hand, Hyde and Hughes counties, South Dakota. The incorporaters are A. W. Ewert, C. E. Crew, Pierre; Theo. Quale, Blunt; A. E. Hitchcock, D. B. Miller, Mitchell; D. T. Jeckyl, Highmore; F. I. Hall, Gann Valley, and H. P. Will.

Texas.

The Paris & Mt. Pleasant R. R., H. P. Mobberly, Chief Engineer, Paris Tex., will probably let contracts in June for the construction of a 27-mile extension from Bogota to Mt. Pleasant, the work calling for the moving of some 400,000 cu. yds. of earth.

The Commercial Club of Hillsboro, Tex., is promoting the construction of a railroad from that city to Whitney, a distance of 12 miles. If built it is planned to operate motor cars.

Citizens of Beeville, Tex., have succeeded in raising a bonus of $40,000 to insure the construction of the San Antonio, Rockport & Mexican Ry. through that place.

The Railroad Commission, Austin, Tex., has approved the issuance of $220,000 of bonds by the Houston & Brazos Valley R. R. The funds are to be used for the completion of the road from Velasco to Anchor, Tex. Felix Jackson, Velasco, Tex., is President and General Manager.

Virginia.

⦿Boxley & Co., Lynchburg, Va., are reported to have been awarded the contract for constructing about five miles of road for the Gauley & Meadow River Ry. Co., a branch line of the Chesapeake & Ohio, which extends from Belva, W. Va., up Gauley River, into large and rich section of coal and timber lands.

⦿Rinehart & Dennis Co., Jefferson National Bank Bldg., Charlottesville, Va., have been awarded the contract for the extension of the Carolina, Clinchfield & Ohio Ry., from Dante, Va., northward to Elkhorn City, Ky., a distance of 35 miles. The work will involve 19 tunnels, varying in length from 400 ft. to 8,000 ft.; 3,500,000 yds. of excavation, of which 65 per cent is solid rock and the balance principally loose rock, and 40,000 yds. of concrete masonry. The work is to be started at once, and will be covered with about 15 steam shovel outfits, 19 tunnel outfits, concrete outfits, and numerous team outfits, and will provide work for about 4,000 men. Construction camps will be built at numerous points along the line. The northern end of the work will be reached over the Chesapeake & Ohio via the Big Sandy Division, and the southern end will be reached over the Clinchfield Valley Division of the Norfolk & Western and the present line of the Carolina, Clinchfield & Ohio.

The Ellis & Myers Lumber Co., Salem, Va., has no definite plans at this time for the construction of a projected railroad from Crusher Station on the Catawba Valley R. R. to timber lands in the upper part of e Cat Valley, a distance of several mil

Washington.

The Metcalf Shingle Co., of Kso, W and the Monarch Lumber Co., Portland, Ore., are working out a plan to ild a ging road into the Salmon Creek alley.

The Hill lines, according to statement made at Spokane by Carl R. Gr, the new president of the Great Northern, ill expend millions this year and next in ext ding lines into virgin territory of Washingt and Oregon and the province of Britis Columbia. The plan is to drain the rich gr fields of Western Canada by means of nort and south feeders. Contracted work in eastrn Washington to the Pacific coast will b rushed to completion, and additional contras will awarded soon for extensive dev pment northern Washington.

The Washington Western Ry. C has organized, and has obtained 20 m s ging railroads in the Pilchuch Vle. line at present extends from Mac s, Northern Pacific, in Snohomish oun, Woodruff, on the Chicago, Milwa ee get Sound. The company is a make several extensions which the district with transportati The first new line to be const consist of a branch extending Lakes, in Snohomish county, to The officers of the company are: W. Mc Guire, Chicago, Ill., president; A. B. Mill Seattle, vice president; C. W. He Lakes, general manager.

West Virginia.

⦿Waugh, Calder & Co., Will Va., have secured five miles of wo Creek for the Norfolk & Western are now getting started on same. tractors plan to put on a large for expected that the work will be Dec. 1, 1912.

Wisconsin.

⦿P. W. Ryan & Sons, Janesville been awarded the contract for gdin the new electric line between Wa rth and Delavan.

The City Council of Merrill, Wi pa resolution, recently, to bond the ci for 000 for the purpose of building from Merrill to Athens connecting neapolis, St. Paul & Sault Ste. Mar R county will now take up the matter iss bonds for $135,000. This amount vild a total of $200,000, which, it is sa, necessary for the project. Peter leg City Engineer.

Stockholders of the Chicago Sho Line Ry Co. recently held a meeting and re ved the officers and directors be empve contract with the Grant R. R. Co. f to the Chicago Short Line R. R data and surveys. The followin di were elected: George W. She erd E. Davis, C. A. Loveland Webster, Platteville, Wis.; W Beetown; Wm. Forck, North Ander Tanner, Stitzer; Andrew Cairns, A. H. Patch, Bloomington; W mick, Ellenboro; F. G. Wetmore, ertson, Patch Grove; W. E. Lath, Stevens, B. J. Petty, Frank C. Mer, J. Bennett, Lancaster, Wis.

It is believed that steps will be ta n short ly to extend the Cazenovia & Saul Cit from Cazenovia, Wis., to Richland ent way of Hub City and Rockbridge Ed Mead, Cazenovia, Wis., is the Chief ng

According to a rough estimate by he mittee of the council which recen the city hall, Racine, Wis., the cost ing the Chicago & Northwestern tr in the city limits will amount to abou $4

Wyoming.

It is reported that the Union Paci templating the construction of the N h River line west of Gering, buildin an section from Gering to Bordeaux, Wyo., point 75 miles north of Cheyenne. Is woul

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

building of about 80 miles of ng almost half the distance from Medicine Bow, Wyo., where the te river line is eventually to join main line.

Canada.

ction work is to be started at [illegible] John Valley R. R., of which A. R. sque Isle, Me., is President. Con- the work have been awarded as Corbett Construction Co., from St. B., to Fredericton; Quebec Con- [illegible], from Fredericton to Wood- nedy & McDonald, from Wood and Falls.

Schmdall & Co., Spokane, Wash., Heckman & Duffy, Portland, Ore., ed sub-contracts from L. M. Rice tle, Wash., on the latter's bridging g work for the Kettle Valley Ry., in British Columbia. The total estimate on the Rice Co.'s contracts amounts to about [illegible]

The officials of the Grand Trunk are re- [illegible] & Port Stanley Ry.

[illegible] gage line extending from Kaslo into the Slocan mining district, has been purchased by the Canadian Pacific Ry. and will be standardized.

The Canadian Pacific Ry., J. G. Sullivan, Chief Engineer, Winnipeg, Man., is understood to be planning to let contracts in the near future for improvements in Vancouver, B. C., which will call for the expenditure of $2,500,000. The improvements include the construction of a station at a cost of $1,000,000, and overhead viaducts to the docks, new [illegible] gregating in cost to about another $1,500,000. The latter sum represents only the initial outlay in the improvements that are to be made in Vancouver.

The City Council of Stratford, Ont., has reached an agreement with the Stratford Ry. Co., whereby the latter will at once begin construction work on its projected street railway system. The company is subsidiary to the Canadian Northern Ry., and in addition to a street railway also proposes a radial line from Stratford to Grand Bend.

The City Council of Brandon, Mass., has passed a resolution directing that the city engineer order 100 tons of 70 lb. rails and 500 tons of 60 lb. rails for the proposed municipal street railway. Resolutions were also passed that the council take immediate steps to secure the services of a first class street railway engineer to superintend the building of the municipal street railway.

RIDGES—STEEL AND CONCRETE

California.

of Ventura County, Ventura, Calif., contract for the construction of a the Ventura River and one at ar Santa Paula, to the Messerole [illegible]., at $42,300, and $9,000, re-

rthern Electric Co. has let the con- e construction of the bridge over ento River at Meridian, Calif., to ri Bridge & Iron Co., East St. at $73,500. The bridge is for the Colusa branch of the Northern l will be built by the electric com- he counties of Colusa and Sutter, one-third of the cost. The struc- a combination highway and rail-

n has been made to the U. S. War , Washington, D. C., by the Oak- ch & Eastern Railroad for per- build a bridge across Suisun Bay outh of the Sacramento and San vers for the extension of its road nto, Calif.

Delaware.

Court, Wilmington, Del., has in- C. Hopkins, its clerk, to notify the Ohio R. R. Co. to proceed with f erecting an elevated bridge over crossing.

Georgia.

owners of Pryor St., Atlanta, Ga., r of the city abandoning the grade that street and constructing a via- ing the railroad tracks.

Idaho.

will be made shortly to decide up- tion of the proposed steel bridge e Clearwater River at Lewiston. cost of the structure is estimated 0,000 which amount has been ap- by the city.

Illinois.

l be received until 7:30 p. m., June Berscheid, City Clerk, Joliet, Ill., struction of a reinforced concrete over Spring Creek at Ohio St. is to be reinforced concrete le arch span of about 40 ft. The of the superstructure is about 50 are provided two sidewalks, each e-half ft. wide, including curb, and 30 ft. between curbs. The roadway with crushed stone. All bids shall nied by a certified check for $500, the Mayor of the City of Joliet. ful bidder will be required to fur- nds for $5,000 each.

ill be received until 1 p. m., June ge Committee of the Board of , Danville, Ill., for the construc- reinforced concrete arch bridge over Minnehaha Creek in Oakwood township. Plans and specifications are on file with J. T. Fisher, 17 West Harrison St., Danville, Ill., Engineer. Official advertisement will be found elsewhere in this issue.

✣Bids will be received up to 1:30 o'clock p. m., May 28, 1912, at the Court House, Jerseyville, Illinois, for the construction of one reinforced concrete bridge to be built in Quarry Township, Jersey County. William T. Baines, Town Clerk, Grafton, Ill. Williams Hollow Bridge: Span, 30 ft.; roadway, 16 ft.; total height, about 13 ft. Estimated amount of total concrete, about 79.4 cu. yds.; reinforcing steel, about 10,000 pounds. Nearest railroad station, Grafton, about 8 miles. Boat landing on Illinois River, 1¼ miles. Local gravel might be obtained, but would require screening and washing. Low water flow, 6 ins. deep and 4 ft. wide; high water flow, 11 ft. deep. Stream channel to be changed, average excavation about 9 ft. Back fill and approach grades to be included in contract. Work to be completed on or before August 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received up to 2:00 o'clock p. m., June 4, 1912, at the office of M. A. Stiner, Walnut, Ill., for two reinforced concrete bridges, to be built in Walnut Township, Bureau County. E. Schwartzentraub, Town Clerk, Walnut, Illinois. Black Bridge: Span, 12 ft.; roadway, 18 ft.; total height, about 10 ft. Estimated amount of total concrete about 44 cu. yds.; reinforcing steel, 3,355 pounds. Nearest railroad station, Walnut, on the C., B. & Q. railroad. Graham's gravel pit, about 7 miles; gravel at pit for 15 cts. per cu. yd. Quality reported good, but not definitely known. Low water flow 6 ins. deep and 4 ft. wide; high water flow 4½ ft. deep. Present bridge wood, 13 ft. span. Excavation in sandy clay, to go about 3½ ft. below stream bed. Sandberg Bridge: Box culvert, 8 ft. x 4 ft. 4 ins. Total estimate of concrete, 33.4 cu. yds.; reinforcing steel, 3,310 pounds. Nearest railroad station, Walnut, about 2½ miles. Graham's gravel pit about 1 mile. Low water flow, dry; high water flow, 4 ft. deep. Present bridge, 10 ft., wood. Excavation in sandy clay to go 8 ins. below stream bed for box and 3 ft. below for end walls. Work to be completed on or before July 15, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing from the Illinois Highway Commission, Springfield, Illinois.

⊙Julius P. Jaff & Sons, Frankfort, Ill., has been awarded the contract for the construction of two reinforced concrete bridges at $1,800. The structures will be located in Green Garden township, Will County. Ferdinand Haake, Frankfort, Ill., is town clerk.

⊙The contract for the construction of the proposed Abe St. bridge in Joliet, Ill., has been let to Newkirk & Powers, Joliet, Ill.

It is reported that tentative sketches have been made for the proposed viaduct over the tracks of the Peoria & Pekin Union R. R. and the Chicago, Rock Island & Pacific Ry. at the foot of Bridge St., Peoria, Ill. It is estimated that the structure will cost $60,000.

J. Walter Gillette, General Manager Fort Smith Light & Traction Co., has reached an agreement with the Iron Mountain Southwestern (Missouri Pacific) in regard to the construction of the proposed viaduct over the tracks in Van Buren, Ark., and work will be started without further delay. The contract for the structure has been let to the Illinois Bridge & Steel Co., Chicago, Ill.

The Great Lakes Dredge & Dock Co., Chamber of Commerce Bldg., Chicago, Ill., will probably be awarded the contract for the construction of a new strauss bascule bridge over the Black Rock Harbor at Buffalo, N. Y., at their bid of $126,871. The work will include removing the old structure and building sub-structure and superstructure of the new bridge.

Indiana.

✣Bids will be received until 1 p. m., June 3, by Board of Jackson County Commissioners, Brownstown, Ind., for the repairs of Ed Pollert Bridge, on line between Brownstown and Washington townships, six miles east of Brownstown. Topie Bridge, on Brownstown and Seymour Pike, five miles northeast of Brownstown. Lakeanger Bridge, four miles northwest of Kurtz, Salt Creek township. Waters Bridge, one mile southwest of Crothersville. Royce Bridge, across east fork of the Muscatatuck River, three miles southwest of Crothersville.

✣Bids will be received until June 3 by Board of LaPorte County Commissioners, LaPorte, Ind., for the construction of bridges in Noble, Hanna, Washington and Prairie townships. F. A. Hansheer is County Auditor.

⊙The contracts for the construction of steel bridges in Cass County have been awarded to the Elkhart Bridge Co., Elkhart, Ind., and the National Bridge Co., Indianapolis, Ind. The contract for the abutments went to Samuel Cotner, Logansport, Ind. J. E. Wallace is County Auditor, Logansport, Ind.

Iowa.

✣Bids will be received until 2 p. m., May 31, by County Auditor, Scott County, Ia., Davenport, Ia., for the construction of a new tubular steel pier and removal of the old pier. The work includes 19,400 lbs.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] work, 350 [illegible] ft. wood piling, 30 cu. yds. concrete. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until noon, June 17, by J. P. Turregano, Chairman, Finance Committee, Alexandria, Ia., for the construction of a creosoted timber or reinforced concrete bridge over Bayou Rapides near the Red River Oil Company. Official advertisement will be found elsewhere in this issue.

⊙The Waterloo, Cedar Falls & Northern R. R. has awarded the contract for the construction of a concrete Melan Arch bridge over the Cedar River at Elk Run to the Gould Construction Co., Davenport, Ia., at about $45,000.

⊙The Board of County Commissioners, Nevada, Ia., has let the contracts for the construction of five concrete bridges as follows: Three were let to N. M. Stark & Co., of Des Moines; one of 75 ft. over East Indian in section 27 of Nevada township for $4,462; also two over Kegley Branch in Lafayette township, one of 45 ft., between sections 26 and 35 for $2,550, and the other of 40 ft. between sections 22 to 27 for $2,025. The other two bridges are of 20 ft. each in Collins township and are both to L. B. Childs, one between sections 1 and 2 for $995, and the other between sections 20 and 29 for $967.50.

⊙The City Council of Clinton, Ia., has awarded the contract for the construction of a concrete and steel bridge over the waterway on Ninth St., between Sixth and Seventh Aves., in Lyons, to P. C. Donahue, at $2,404.

⊙The Board of Supervisors of Boone County, Boone, Ia., has awarded the contract for rebuilding, with reinforced concrete, the abutments and piers of the Elk Rapids bridge west of Madrid, to the Marsh Engineering Co., Des Moines, Ia.

⊙The City Council of Clinton, Ia., awarded the contract for the construction of a concrete and steel bridge on Ninth St., between Sixth and Seventh Aves., to P. C. Donahue, at $2,404. Other bids received were P. V. Clarke, $2,796; John Danielson, $2,438; Clinton Iron & Bridge Works, $2,667. C. J. Reusche is City Clerk.

Kansas.

⊙Commissioners of Marion County, Marion, Kan., have awarded the contracts for the construction of three bridges to the Topeka Bridge & Iron Co., Topeka, Kan., as follows: 50-ft. truss bridge over Clear Creek, about one and a half miles southeast of Lincolnville, $1,670; 55-ft. arch bridge over Mud Creek, four miles south and one and a half miles west of Marion, $1,800; 24-ft. girder span bridge, three and a half miles southeast of Marion, over Spring Branch, $650.

Commissioners of Sedgwick County, Wichita, Kan., are still undecided in regard to the location of the proposed bridge over the Arkansas River south of Wichita, Kan.

Maryland.

⊙The Caroline County Commissioners, Denton, Md., have awarded a contract to the Chesapeake Construction Company, Preston, for a modern drawbridge across the Choptank River, at Denton, and about one and a half miles of stone macadam road for $45,598.46. The work will go forward as soon as the State Roads Commission approves the award.

It has been sugested to the Highways Committee of Baltimore, Md., that the city build a bridge over the railroad tracks at Front St.

Massachusetts.

✣Bids will be received until noon, June 4, by Special Bridge Committee, Town of Montague at the office of the Board of Selectmen, Turner Falls, Mass., for the construction of a concrete bridge on Prospect St. Each bidder must file a certified check for $500, payable to Treasurer of the town of Montague.

✣Bids will be received until noon, July 15, by Boston Elevated Railway Co., Edward Mahler, Purchasing Agent, 101 Milk St., Boston, Mass., for the construction of three-track bridge 839 ft. between abutments including foundations and bascule draw on its proposed Malden extension over the Mystic River in the part of Boston known as Charlestown. Bids will be received on four types: 1. Reinforced concrete arches not exceeding 120-ft. span; 2. Steel arches not exceeding 120-ft. span; 3. Plate Girder deck, with short spans; 4. steel through bridge with long spans. Plan and profile of site and specifications may be had by applying to G. A. Kimball, Chief Engineer of Elevated and Subway Construction, 101 Milk St., Boston, Mass.

Michigan.

The Duluth, South Shore & Atlantic Ry., according to information received from Houghton, Mich., will build a 100-ft. steel bridge over the Sturgeon River to replace the old wooden structure. V. D. Simar, Marquette, Mich., is Chief Engineer.

Minnesota.

✣Bids will be received until 11 a. m., June 3, by A. P. Erickson, County Auditor, Minneapolis, Minn., for furnishing 50 tons of corrugated culvert pipe according to plans and specifications on file with the County Surveyor.

Missouri.

⊙The Stites Steel Bridge & Concrete Co., 1241 Kingshighway, St. Louis, Mo., has been awarded the contract for the construction of a reinforced concrete bridge over a stream in Mascoutah, St. Clair County, Ill. The contract price was $1,349. Bids were opened May 16.

⊙The Missouri Bridge & Iron Co., St. Louis, Mo., has been awarded the contract by W. M. Morris, County Highway Engineer, Oregon, Mo., for the construction of the superstructures for 11 bridges. John King was awarded the contract for constructing 5 concrete culverts; E. E. Williams, the contract for 3 concrete culverts; Topeka Bridge & Iron Co., Topeka, Kan., for two concrete culverts.

It has been announced that plans have practically been completed by Waddell & Harrington, Kansas City, Mo., for the construction of 10 new bridges for the Canadian Northern in British Columbia. The first structure for which bids will be received is to be located at Cisco and will have a 120-ft. steel span. M. H. MacLeod, Winnipeg, Man., is Chief Engineer and General Manager of the Canadian Northern.

L. R. Ash, City Engineer, Kansas City, Mo., has recommended bond issues for a number of improvements planned by the Board of Public Works. One provides for an increase of $300,000 of the bridge fund, necessary for the construction of the Fourth St. and the Twenty-third St. Viaducts, and the bridges over Brush Creek; also over the Blue at Fifteenth St. and at Twelfth St.

Nebraska.

⊙The contract for the construction of a 30-ft. steel span girder bridge in Clay County has been awarded by the Commissioners at Clay Center, Nebr., to the Hastings Foundry & Iron Works, Hastings, Nebr., at $750.

⊙The contract for the construction of all bridges in Sheridan County, Nebr., has been let to the Canton Bridge Co., Omaha, Nebr., by H. F. Wasmund, County Clerk, Rushville, Nebr. Bids were opened May 10.

The Cuming County Board, Westpoint, Nebr., has appropriated $50,000 for the reconstruction and repair of all bridges destroyed and damaged by the floods this spring.

An ordinance will probably be submitted to the city council, Lincoln, Nebr., declaring it necessary that a viaduct be constructed on North Fourteenth St., over the Missouri Pacific and the Chicago, Burlington & Quincy Railroads. The movement is part of the plan to abolish grade crossings between the city and the State Fair grounds.

An agreement has been reached between the town of Swedeburg, Nebr., and the officials of the Chicago & Northwestern Ry., providing that the company build a viaduct over its tracks in that place. W. C. Armstrong, Chicago, Ill., is Bridge Engineer of the company.

New Jersey.

⊙The Board of Union County Freeholders, Elizabeth, N. J., has awarded the contract for the erection of a new bridge over the Rahway River at Rahway to A. E. Smith, Plainfield, at $12,745.

New York.

✣Bids will be received until [illegible] p. m., June 10, by S. A. Howard, Reservation Superintendent, Court House, Malone, N. Y., for the construction of a 5-span reinforced concrete arch bridge over Raquette River on the St. Regis Indian Reservation, town of Bombay, Franklin County, N. Y. Plans and specifications may be obtained of the Superintendent or of the State Highway Commission, Lancaster, St. Albany, N. Y.

✣Bids will be received until 1 [illegible] m., June 3, by State Highway Commission, [illegible] Lancaster St., Albany, N. Y., for the improvement of Main St. bridge, Salamanca, [illegible] County, New York. C. G. Reel is Superintendent of Highways.

⊙T. A. Gillespie Co., New York City, [illegible] been awarded the contract by the New York Connecting Railroad Co., Samuel Rea, [illegible] for the foundations and masonry [illegible] the [illegible]ern Viaduct, extending from [illegible] St. [illegible] Lawrence St., Long Island City.

⊙The Oswego Bridge Co., Oswego, [illegible] has been awarded the contract for the [illegible]struction of the superstructures and one [illegible] structure for highway bridges over the [illegible] Canal, between Lyons and Palmyra, N. [illegible] $59,616.

The Buffalo Bridge Co., Buffalo, N. [illegible] been incorporated with a capital stock [illegible] 000 and proposes to engage in structural work. The incorporators are F. A. [illegible] Jr., G. L. Ballou, M. L. Skelly, [illegible]

The Board of Estimate, New York City, [illegible] adopted the specifications for the construction of the proposed viaduct in Park Ave. [illegible] 40th to 42d St.

Ohio.

✣Bids will be received until [illegible] 26, by Board of Cuyahoga County Commissioners, Cleveland, O., for the construction of bridge work per report No. 23, [illegible] arch Highland Road over Euclid Creek, Euclid township. F. R. Lander is County Surveyor. J. F. Goldenbogen is Clerk.

✣Bids will be received until 1 p. m. [illegible] 15, by Board of Cuyahoga County Commissioners, Cleveland, O., for the construction of bridge work per report No. 2[illegible] bridge, Cady Road, Royalton township; [illegible] No. 2941, concrete culvert, Wangs [illegible] Royalton township; report No. 25, [illegible] culvert, Drake Road, Royalton [illegible] accordance with the form of [illegible] specifications to be furnished by [illegible] Lander, County Surveyor.

⊙The Massillon Bridge & Steel Co., Massillon, O., has been awarded the contract for the construction of an iron bridge on Moulton & Witting Road over [illegible] River. Bids were opened May [illegible] County Court at Hallettsville, Tex.

⊙The Canton Bridge Co., Canton, [illegible] been awarded the contracts by the [illegible] Court, St. Joseph, Mo., for the construction of four bridges at $5,385. One of the [illegible] will be across Contrary Creek [illegible] the [illegible] Road, one across Reed Branch at the [illegible] farm, and two across Malden Creek in [illegible] township. Contracts for repairing [illegible] at a cost of $1,260 were awarded to Thomas H. Foster and to C. H. Belcher.

Board of Lincoln County Commissioners, Chandler, O., has rejected bids [illegible] the construction of the 42 bridges over [illegible] Fork Creek in Drainage District No. [illegible] it is planned to readvertise the work [illegible] future date.

It is believed that the Newburg & South Shore and the Wheeling & Lake Erie roads will co-operate with the city in the construction of the proposed Clark [illegible] level bridge, Cleveland, O. The cost of the improvement is estimated at about $[illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Oregon.

. will be received until June [illegible] County Commissioners, Jackson [illegible] the construction of a steel bridge Bear Creek at Medford, Ore.

Lane County Court, Eugene, Ore., has to construct two new reinforced con- [illegible] on the river road [illegible] Ore.

Pennsylvania.

. will be received until 12 [illegible] by Lancaster County Commission- [illegible] ster, Pa., for furnishing the [illegible] or and material for the construction idge at Pequea. According to the structure will be 140 ft. steel [illegible] ft. reinforced concrete approaches. Board of County Commissioners [illegible] ton, Pa., has awarded the contracts [illegible] struction of two bridges as follows: [illegible] bridge over Stearns Run [illegible] & Co., Washington, Pa.; bridge ght School to J. W. Wolfe, Mononga- J. H. Moffitt is County Auditor.

inary sketches and a few study plans drawn for the construction of the subway in Broad St. by the Phila. Rapid Transit Co., Philadelphia. No plans have been ordered as yet. H. B. is Chief Engineer.

dinance has been introduced into the ncil of Philadelphia, Pa., providing econstruction of the drawbridge over ylkill River at South St. The intro- [illegible] the ordinance followed a communi- [illegible] Director Cooke, in which he [illegible] at the drawbridge had been examined [illegible] the Highway Bureau and had nd to be in need of repairs. Accord- ne estimate prepared by the Bureau, span and the two fixed spans over should be reconstructed to give a 36- ay, two 10-ft. sidewalks and a clear for navigation on either side of 75 estimated cost of the repairs is about

providing for the construction of a ver the Philadelphia & Reading Ry. ine of Butler St., Philadelphia, Pa., referred to the Steam Railway Com- the City Council of Philadelphia.

ssioners of Berks County, Reading, e decided upon the construction of three bridges estimated to cost $10,000. One [illegible]

Rhode Island.

◉[illegible] bridges, Woonsocket, R. I., has awarded the contract for the construction of a reinforced concrete [illegible] J. J. [illegible], 10 Rush St., East Somerville, Mass. Bids were opened May [illegible]

South Carolina.

✣[illegible] ers, Dillon, S. C., for the construction of a steel or reinforced concrete bridge over Little Pee Dee River near Dillon. The structure will have 12-ft. clear roadway and 28 ft. clear span with 13 ft. rise from the bottom of foundation. R. L. Moody is Clerk of the Board.

Texas.

✣Bids will be received until noon, June 1, by J. B. Ashe, County Auditor, Houston, Texas, for a creosoted bridge over Little White Oak Bayou, to cost not more than $5,000. Plans and specifications are on file with Howe & Wise, First National Bank Bldg., Houston, Texas, County Engineers.

✣Bids will be received until noon, June 1, by J. B. Ashe, County Auditor, Houston, Texas, for the construction of a bridge over White Oak Bayou on the west side of Heights Boulevard connecting with the Houston Electric Co. bridge. Howe & Wise, 722 First National Bank Bldg., are County Engineers.

Commissioners of Gonzales County, Gonzales, Texas, recently inspected the proposed site for the new bridge in the Leesville section.

Utah.

The Board of Salt Lake County Commissioners, Salt Lake, Utah, are planning to make arrangements for the construction of a viaduct on the county road over the Denver & Rio Grande R. R. tracks at Colton.

Virginia.

◉The Circuit Court of Grayson County at Independence, Va., has awarded the contract for the construction of a 160-ft. steel bridge over Elk Creek, near Fries, to the Virginia Bridge & Iron Co., Roanoke, Va., at $2,972. Bids for the work were opened May 11.

◉Curtis & Shumway, Lynchburg, Va., have been awarded the contract by the Norfolk & Western R. R., for the construction of a bridge across Tug River. The structure will consist of five concrete piers, two abutments and steel superstructure. The contract price was $125,000.

West Virginia.

◉The Brooke County Court, Wellsburg, W. Va., has awarded the contracts for the construction of two bridges. The Luten Bridge Company, of Clarington, W. Va., was given the order for the concrete bridge on Harmon's Run for $2,887. It will be 60 ft. in length. The Canton Bridge Company's bid was accepted for the bridge which will span McBroom's ford on Buffalo Creek, for $2,085. It will be steel, 102 ft. long. Messrs. Leibfarth and Leight were awarded the contract for the stone abutments for the bridges.

The Board of Directors of the Wheeling Bridge Co., Wheeling, W. Va., has voted to renew the sidewalk clear across the structure from South Penn St. to the eastern end at a cost of $4,000; also to repaint the iron work at a cost of about $5,000. A. M. Schenk, G. M. Nagle, J. J. Holloway, W. E. Stone and William Lipphardt are directors.

Wisconsin.

◉The City Council of LaCrosse, Wis., has awarded the contract for the construction of an iron bridge over Colman Slough, to Isle La Plume to the Ibling Bridge Co., Minneapolis, Minn., at $1,290.

C. J. Morrisset, Commissioner of Highways, Superior, Wis., rejected all bids received May 9 for the construction of a wooden bridge on Blue Road between Sections 13 and 14, 48-10; also for putting a 42-in. culvert on same road between Sections 1 and 2, 48-10.

Canada.

✣Bids will be received until 8 p. m., June 1, by William Thomson, Secretary and Treasurer, Arundel, Que., for the construction of a steel and concrete bridge over Bevan's Creek in Arundel township, Argenteuil County, P. Q. The structure will be 50 ft. long. Cushing & Barrow, 112 St. James St., Montreal, Que., are Engineers.

OADS, STREETS AND PAVEMENTS

Alabama.

will be received until noon, June 17, of County Commissioners, Chambers County, Lafayette, Ala., for grading and with top soil or sand clay approx- miles of road, estimated to cost 000. W. S. Keller is State Highway

will be received until noon, June 18, of County Commissioners of Lee Opelika, Ala., for grading and sur- th top soil approximately 6 miles of nd Beulah Road at an estimated cost W. S. Keller, Montgomery, Ala., Highway Engineer.

Alaska.

laska Road Commission has at its an appropriation of $125,000 for road work in Alaska during this year. P. Richardson is Chairman of the on.

Florida.

will be received until 2 p. m., June 4, l of Public Works, D. B. McKay Tampa, Fla., for the construction and pavement on Palm Ave. from o Nebraska Ave., including about yds. of asphalt block pavement and ft. of granite curb.

Georgia.

✣Bids will be received until 2 p. m., June 3, by the mayor and Board of Aldermen, Gainesville, Ga., for the necessary labor and material for the construction of 18,000 sq. yds. of vitrified brick, wood block, bitulithic or granitoid block pavement. C. A. Dozier, Jr., Box 14, Gainesville, Ga., is engineer.

◉Jamison & Hallswell of Montgomery, Ala., have been awarded the contract by the city of Bainbridge, Ga., for the construction of 22,000 sq. yds. of vitrified brick pavement at $2.10 a square yard. Bids were opened May 15 by Mayor J. W. Callahan. Jaudon Engineer Co., Atlanta and Savannah, Ga., engineer.

Idaho.

✣Bids will be received until 7 p. m., June 6, by Finn H. Berg, City Clerk, Pocatello, Idaho, for furnishing the necessary labor and material for paving with bitulithic portions of Center and Main Sts. The work will include, acording to the plans and specifications on file with the city engineer, the following approximate quantaties: 32,500 sq. yds. bitulithic paving, 8,100 cu. yds. grading, 1,020 lin. ft. concrete gutters with castiron covers, 200 lin. ft. 15-in. pipe sewer, 400 lin. ft. 10-in. pipe sewer, 620 lin. ft. 8-in pipe sewer, 14 catch basins, 2 manholes. W. E. Moore is Asst. City Engineer.

The citizens of Weiser, Ida., have been asked to vote June 10 on the proposition of issuing bonds to the amount of $15,900 for grading and paving intersections and for the construction of cement sidewalks, concrete curbs and gutters. R. J. Wood of the Weiser Engineering Co. is City Engineer.

Illinois.

✣Bids will be received by L. E. McGann, commissioner of public works, Chicago, Ill., until 11 a. m., June 1, for furnishing and delivering f. o. b. switch tracks, first ward yard and eighteenth ward yard, 100 sq. yds. No. 2 granite blocks according to specifications on file at his office. Cash or certified check for $100 must accompany proposal.

✣Bids will be received until 8 p. m., June 10, by Board of Trustees, village of Dolton, Ill., for paving certain streets. Specifications may be had of village clerk or F. W. Propper, 911 Ashland Block, Chicago, Ill. Official advertisement will be found elsewhere in this issue.

✣Bids will be received by the Board of Local Improvements, Chicago, Ill., Ed. J. Glackin secretary, until 11 a. m., May 29, for furnishing labor, materials, etc., necessary to construct concrete sidewalks in various streets.

✣Bids will be received by the Board of Local Improvements, Cicero, Ill., George Comerford, president, until 8 p. m., June 3, for furnishing and delivering materials, labor, etc., necessary to construct a brick pavement foundation in W. 23d Pl., W. 23d St., 50th Ave., 51st Ave. and 52d Ave., and a brick pavement on W. 25th Pl. from 48th Ave. to 52d Ave. Cash or certified check for 10 per cent of proposal must accompany bid.

✣Bids will be received until 2 p. m., June 5, by Charles Dreisdieker, president Board of Local Improvements, Pekin, Ill., for the construction of 13,770 sq. yds. of brick pavement on concrete foundation with asphalt filler, 8,700 lin. ft. of concrete curb, 4,590 cu. yds. of excavation, 2 catch basins and connections. J. R. Seibert is city engineer, Pekin, Ill. Official advertisement will be found elsewhere in this issue.

⊙The following contracts for constructing Portland cement concrete sidewalks have been awarded by the Board of Local Improvements, Chicago, Ill., Ed. J. Glackin secretary: Anthony Ave., 3,500 sq. ft., R. F. Biesen, 9 S. La Salle St.; Central Ave., 10,000 sq. ft., H. P. Larson, 9 S. La Salle St.; N. Canal St., 4,600 sq. ft., Central Ave., 7,000 sq. ft., James J. Ferry, 323 Siegel St.; Elston Ave., 4,800 sq. ft., G. Kehl & Son, 1224 N. Campbell Ave.; S. Elizabeth St., 4,000 sq. ft., P. F. Biesen; N. 45th Ave., 1,400 sq. ft., 1,400 sq. ft., Sieuert-Callsen Co., 3863 Milwaukee Ave.; N. 48th Ave., 2,700 sq. ft., Gage St., 800 sq. ft., G. Kehl & Son, Grand Ave., 8,000 sq. ft., A. C. Skafgard, 4024 W. North Ave.; Laurence Ave., 400 sq. ft., G. Kehl & Son, E. 120th St., 2,900 sq. ft.; 122d Pl., 6,000 sq. ft.; E. 123d Pl., 3,000 sq. ft., A. P. Larson, 11322 Indiana Ave.; N. 68th Ct., 2,000 sq. ft., R. R. Anderson, S. Sacramento Ave., 2,900 sq. ft., A. Graff, 138 N. La Salle St.; N. 70th Ave., 3,800 sq. ft., R. R. Anderson, 1833 Park Ave.; W. 33d St., 1,800 sq. ft., Jensen Jensen Co., 133 W. Washington St.; N. 61st St. system, 40,000 sq. ft., Daniel Ryan; W. 14th St. system, 6,000 sq. ft., A. Graff; E. 76th St. system, 24,000 sq. ft., P. F. Biesen; W. 77th St. system, 2,200 sq. ft., G. Kehl & Son; Henderson St. system, 6,000 sq. ft., G. Kehl & Son; W. 14th St. system, 20,000 sq. ft., A. Graff.

⊙Reeb Bros. of DeQuoin, Ill., have been awarded the contract by that city, E. E. Jacobs mayor, for the construction of about 2½ miles of vitrified brick pavement, including curbing, grading and paving, at $80,013. Bids were opened May 24.

⊙A. E. Rutledge of Rockford, Ill., has been awarded the contract by the Board of Local Improvements of Rochelle, Ill., for the construction of 32,000 sq. yds. of brick pavement at $77,197. The Aetna Engineering Bureau, 17 N. LaSalle St., Chicago, Ill., are Engineers. Bids were opened May 20.

The citizens of Rochelle, Ill., have voted the issuance of bonds in the sum of $26,000 for paving purposes.

The City Council of Peoria, Ill., has passed an ordinance for the paving of Brotherson St., from Spencer to Saratoga. City Engineer L. D. Jeffries has estimated the cost at $7,054.

The Board of Local Improvements of Decatur, Ill., has passed a resolution declaring that West Main St., from McClellan Ave., west to Dennis Ave., should be paved a width of 30 ft.

The Road Commissioners of Decatur Township, Decatur, Ill., are planning the construction of about one mile of concrete paving for country roads. Frank H. Eckert, Commissioner.

Following are the low bids as submitted to the Board of Local Improvements, Chicago, Ill., on May 22, for furnishing materials, labor, etc., necessary to construct pavements in the following streets: 1,240 lin. ft. concrete curb and gutter 65 cts., 1,870 sq. yds. asphalt $2.30, total $5,682, R. F. Conway Co., 133 W. Washington St.; Catalpa Ave., 1,900 lin. ft. sandstone curbing 5 in. x 30 in. 68 cts., 3,280 sq. yds. asphaltic macadam, $1.13, total $5,962, Central Paving Co., 179 W. Washington St.; 51st Ave., 2,755 lin. ft. gravel concrete curb and gutter 65 cts., 4,550 sq. yds. asphalt $2.18, total $12,607, Standard Paving Co., 9 S. La Salle St.; Hollywood Ave. 380 lin. ft. concrete curb and gutter 67 cts., 540 sq. yds. asphalt $2.10, total $1,742, American Asphalt Paving Co.; Irving Park Boul., 3,150 lin. ft. sandstone curbing 5 in x 30 in. 69 cts., 4,619 sq. yds. brick $2.17, total $13,530, Central Paving Co.; Lake View Ave., 2,350 lin. ft. concrete curb and gutter 70 cts., 4,800 sq. ds. asphalt $1.98, total $12,703, Parker Washington Co., 133 W. Washington St.; Maxwell St., 500 lin. ft. concrete curb and gutter 65 cts., 4,200 sq. yds. asphalt $2.29, total $11,238, Parker Washington Co.; 99th St., 1,380 lin. ft. sandstone curbing 7 in. x 18 in., 2,300 sq. yds. granite top macadam $1.10, total $4,177, Calumet Coal & Teaming Co., 2926 E. 95th St.; Richmond St., 1,200 lin. ft. concrete curb and gutter 70 cts., 1,800 sq. yds. asphalt $2.25, total $5,200, Standard Paving Co.; Rockwell St., 2,250 lin. ft. concrete curb and gutter 65 cts., 3,510 sq. yds. asphalt $2.17, total $9,819, American Asphalt & Paving Co.; Sangamon St., 1,250 lin. ft. concrete curb and gutter 68 cts., 1,960 sq. yds. asphalt $2.14, total $5,860, American Asphalt & Paving Co.; 23d Pl., 3,800 lin. ft. concrete curb and gutter 65 cts., 6,940 sq. yds. asphalt $2.07, total $17,880, R. F. Conway Co.; 77th St. system, 400 lin. ft. sandstone curbing 5 in. x 30 in., 24,000 sq. yds. asphaltic macadam, 6 in. slag, 2½ in. limestone $1.07, total $28,352, A. J. McAllister, 1542 W. Garfield Blvd.; 56th St., 1,262 lin. ft. concrete curb and gutter 65 cts., 2,550 sq. yds. creosoted wood blocks, $3.23, total $9,482; Madison Ave., 4,610 lin. ft. concrete curb and gutter 58 cts., 6,900 sq. yds. creosoted wood block $3.43, total $274.36, Calumet Coal & Teaming Co.; 35th St., 7,080 lin. ft. sandstone curbing 5 in. x 30 in. 68 cts., 15,590 sq. yds. creosoted wood block $3.51, total $65,725, Ready & Callahan Co., 133 W. Washington St.; Washington Ave., 6,000 sq. yds. creosoted wood blocks $3.38, total $21,120, The Ryan Co., 1006 Otis Bldg.; alley Van Buren St., Lincoln St., etc., 500 lin. ft. concrete curb 15 cts., 300 sq. yds. brick $2.70, total $885, John A. McGarry & Co., Security Bldg.; alley Belmont Ave., Sheffield Ave., etc., 1,460 lin. ft. concrete curb 15 cts., 970 sq. yds. brick $219, total $2,574, Central Paving Co.; alley State St., 24th St., etc., 700 lin. ft. concrete curb 12 cts., 500 sq. yds. brick $2.57, total $1,369, Jno. A. McGarry & Co.; alley Michigan Ave., 31st St., etc., 1,800 lin. ft. concrete curb 12 cts., 1,500 sq. yds. brick $2.45, total $3,891, John A. McGarry & Co.; alley Garfield Blvd., Michigan Ave., etc., 2,390 lin. ft. concrete curb 10 cts., 2,410 sq. yds. brick $2.31, total $5,828, Jno. A. McGarry Co.; alley Michigan Ave., 53d St., etc., 2,660 lin. ft. concrete curb, 10 cts, 2,660 sq. yds. brick $2.35, total $7,741, Jno. A. McGarry Co.; alley Taylor St., Sholto St., etc., 1,940 lin. ft. concrete curb 15 cts., 1,100 sq. yds. brick $2.31, total $2,974, Jno. A. McGarry Co.; alley Taylor St., Loomis St., etc., 1,200 lin. ft. concrete curb 15 cts., 900 sq. yds. brick $2.33, total $2,277, Jno. A. McGarry & Co.. The work includes a 6-in. Portland cement concrete foundation, 2-in. sand cushion, sewer, manhole and catch basin construction and adjustment earth cutting, filling sidewalk construction, etc. Bids for curb and gutter are for granite concrete combined curb and gutter, unless otherwise specified. The contracts have not been awarded.

⊙Following are the lowest bids submitted to the Board of Local Improvements, Rochelle, Ill., for constructing sewers in various streets: 2,720 lin. ft. 18-in tile, pipe 73½ cts., total $2,000; 2,070 lin. ft. 18-in. 60½ cts., $1,252; 7 manholes, including iron covers, in 11th St., $25, $175; 5 manholes, including iron covers, in 8th Ave., $25, $125; total bid, $3,553. B. A. Reynolds, Rochelle, Ill., awarded contract. Bids opened May 20. The Aetna Engineering Bureau are engineers in charge.

⊙Following are the lowest unit bids submitted to the Board of Local Improvements, Rochelle, Ill., on May 20, for furnishing labor, materials, etc., necessary to construct completed pavements in 11th St., 7th St., 6th St., etc.: 10,200 cu. yds. earth excavation 32 cts., total $3,264; 1,900 lin. ft. 15-in. tile pipe 68 cts., $1,292; 3,450 lin. ft. 12-in. tile pipe 60 cts., $2,070; 1,270 lin. ft. 9-in. 50 cts., $635; 17 manholes, including covers with iron lids, $30, $510; 42 catch basins, including c ers. $35, $1,470; 4,700 lin. ft. gravel concrete gutter cinders or sand, 30 cts., $1,410; 12, gravel concrete combined curb and cts., $6,096; 32,000 sq. yds. repress paving brick, 2-in. sand cushions, in. Portland cement concrete foundation, a haltic cement filler, $1.87, $59,840; 20 ma oles and flush tanks to be adjusted $3, $60 otal bid, $77,197. A. E. Rutledge, Rochell Ill., has been awarded the contract. The A na Engineering Bureau, 17 N. La Salle St Chicago, are engineers in charge.

Indiana.

✣Bids will be received until 10 am., June 3, by Board of Park Commiss ers, in dianapolis, Ind., for the constructi of cement, sidewalks and concrete curb id gutter along property of the City of Indi apolis at following points: Along Fall Creel Parkway north drive, at intersection with C tol Along Fall Creek Parkway, north d e, tersection with Illinois St. Along ll Parkway, south drive, at interse or Meridian St.

✣Bids will be received until 8 pm 6, by Board of Trustees, Petersbur In. the construction of concrete side lks Hammond is President of the To

✣Bids will be received until 10 am 15, by Board of Jay County Com Portland, Ind., for the construction way in Pike Township John County Auditor.

✣Bids will be received until 2 pm 10, by Board of Posey County Com Mt. Vernon, Ind., for the construct gravel roads in Smith Township Bethel Township. J. R. Haines Auditor.

✣Bids will be received until 2 pm 6, by Board of Clinton County Com Frankfort, Ind., for the construc gravel roads. C. F. Cromwell Auditor.

✣Bids will be received until 10 m. June 5, by Board of Tippecanoe Count sioners, Lafayette, Ind., for the c of three gravel roads. G. W. County Auditor.

✣Bids will be received until no by Board of Carroll County Com Delphi, Ind., for the construction roads in Jefferson and Deer Creek wnsh M. G. Haun is County Auditor.

✣Bids will be received until 10 m. 3, by Board of Bartholomew Count sioners, Columbus, Ind., for the c stru of four gravel roads. Philip J. Sat is ty Auditor.

✣Bids will be received until 1 pm 3, by Board of Benton County Com Fowler, Ind., for the constructio roads in Hickory Grove and Oak G ships. Lemuel Shipman is County udit

✣Bids will be received until 1 pm., 3, by Board of Martin County Com Shoals, Ind., for the construction road in Center Township. J. T. County Auditor.

⊙C. Kirkpatrick of Greenfield, Ind has been awarded the contract by the Board f Pul Works of Richmond, Ind., for the avin Fort Wayne, Ave. and West Main St., Hocking Valley brick, at $1.60 p sq. Other contracts awarded were: All W paving North Seventh St., from Mai o A St., with brick, $3,300; Schneider ing the alley between South Eighth d Sts., from South A St., north, to th rst south of Main St., with cement, sq. ft., also for 5-ft. cement sidewall n D St., from 15th to 16th St., at sq. ft., and $0.11 per sq. ft. for int ect cement walks on South 10th St. F St., at $0.09½, and sidewalks on St., from G to J St., at $0.09¾, cen walks $0.11, and brick crosswalks $0 & Clements, cement sidewalks on from Sheridan to Boyer St., $0.09¾

⊙The Vigo County Commission Terr Haute, Ind., have awarded the c

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

nruction of the Joseph Ostrander ıd in Otter Creek Township to O. f Prairie Creek Township, at $5,800.

rds of Benton and Tippecanoe counıssioners, Fowler, Ind., rejected all ed May 21 for the construction of a r.d on the line between said counties, the Harrington Road. The road re-estimated. Lemuel Shipman is Benton county.

Iowa.

vill be received until June 4, by City ı, Ia., for the construction of 13,000 pavement. Bids will be considered wood block, asphalt and concrete. ne is City Engineer.

vill be received until 8 p. m., June 4, Reusche, city clerk, Clinton, Ia., for ary labor and material for the conof pavement on Fifth Ave. Bids eived on creosoted wood block, vit-c, asphalt and concrete. J. G. Thorne ineer. Official advertisement will be where in this issue.

ity Council of Cedar Falls, Ia., has the contract for the paving of a streets with asphalt to the W. A. ving Co., at $1.44 per sq. yd. The include about 23,000 sq. yds., and mpleted by Oct. 15.

y Council of Greenfield, Ia., has resolution ordering the paving of [illegible] Bids will be asked on brick te.

Council of Marshalltown, Ia., has esolution calling for the paving of [illegible] streets, as follows t., Summit to Jerome; Park St., Fourth; Second St., Church to fth St., Jerome to end of paving; t., Third to Fourth; Fremont St., ourth; Sixth Ave., Main to Church, St., First to Second.

Council of Des Moines, Ia., has necessary to improve the followstreets by constructing bitulithic vith 2-in. wearing surface on a 5-in. ement foundation: 22nd St., from now in place at University Ave. ing now in place at Forest Ave. song is City Clerk.

Kansas.

ill be received until noon, June 8, rk E. R. Kirkpatric, Anthony, Kan., nstruction of curb and gutter on ts of North and South Jennings Anthony Ave.

ill be received until 2 p. m., May H. Krienhagen, City Clerk, Inde-Kan., for grading, paving, curbing ng North Fifth St. from the north rtel St. to the north line of Sycancluding the following approximate Curb and gutter, 4,842 lin. ft.; ı. ft.; brick paving, 9,281 sq. yds.; ation, 5,813 cu. yds.; rock excavacu. yds.; header curbing, 351 lin. asins, 2; 15-in. tile drain sewer, 250 ıcrete gutter, 50 lin. ft.; curb irons, ; 3-ft. brick drain sewer, 200 lin. ınd specification may be seen at the e City Engineer, A. D. Stivers.

Kentucky.

ill be received until May 29, by Public Works, Louisville, Ky., for ction of two streets, estimated to

Louisiana.

ill be received until 2 p. m., June n of Jeanerett, La., for concrete street paving. Plans and specificaare on file with Warren B. Reed. ngineer, 1013 Hibernia Bank Bldg., ns, La.

Maryland.

esapeake Construction Co., Presıas been awarded the contract by of Carolina County Commission-, Md., for the construction of 1.65 one road along the Denton-Willow [illegible] and Willow [illegible] The contract price is $45,598. Bids were opened May 21 by W. H. Anderson, clerk.

The Paving Commission of Baltimore, Md., R. Keith Compton chairman, has outlined additional paving for the following streets: Lexington St. from Aisquith to Central Ave.; Granby St., from East Falls Ave. to Exeter St.; Exeter St., from Baltimore to Lombard; Front St., from Baltimore to Lombard; East St., from Front to Low; Castle St., from Fayette to Madison; Richmond St., from Cathedral to Howard; Low St., from East to Aisquith; Exeter St., from Fayette to Low; Linden Ave., from Dolphin St. to North Ave.; Bolton St., from Lafayette Ave. to North Ave.; Lanvale St., from Madison to Eutaw Pl.; Lanvale St., from Linden Ave. to Park Ave.; McCulloh St., from Lafayette Ave. to North Ave.; [illegible] from Lafayette to Mc-Mechen. In addition to the above the following are to be paved with vitrified block; Dover St., from Eutaw to Hopkins Pl.; Lemmon St., from Greene to Fremont Ave.; German St., from Penn to Fremont Ave.; Forest St., from Lexington to Orleans. Central Ave. will be repaved from Fayette St. to Harford Ave.

A delegation of Queen Anne's County recently conferred with Chairman O. E. Weller of the State Roads Commission, Baltimore, Md., relative to the construction of State-aid roads in the county. The last legislature authorized the county to issue $50,000 worth of bonds for roads and bridges. Centerville is the county seat of Queen Annes County.

⊙The Warner, Quinlan Asphalt Co., Syracuse, N. Y., has been awarded the contract by the Board of Awards of Baltimore, Md., for Contracts Nos. 14, 15 and 16, consisting of sheet asphalt and bituminous concrete, at $78,012. The contract for the construction of granite blocks, known as Contract No. 18, was awarded to Cunningham Paving & Construction Co., 1345 Arch St., Philadelphia, Pa., at approximately $28,526. Chas. A. Edel is Secretary of the Paving Commission.

Massachusetts.

⊙The Paving Committee of Westfield, Mass., has awarded the contract for laying the artificial stone walk in Main and Elm Sts. from the factory of the U. S. Whip Co. to Chapel St., on the east side of the street and on both the east and west sides of North Elm St., from Pochassic to Union Sts., and constructing curbing for the same, to Lopardo, Way & Cellilli of Springfield, Mass., at $4,490.

⊙Fred S. & A. D. Gore Corporation of Boston, Mass., has been awarded the contract by the Department of Public Works of that city for the construction of wood block pavement in Massachusetts Ave. (northerly side), between Tremont and Albany Sts., at $32,179. Other bidders were: James Doherty, $32,317; Hugh J. McGuire, $32,447; Coleman Bros., $33,819 and $35,011; J. C. Coleman & Sons Co., $33,840; Frank O'Connell, $35,610; William L. Dolan, $37,389.

⊙The Department of Public Works of Boston, Mass., has awarded the contract for the construction of wood block pavement in Hammond St., between Shawmut Ave. and Tremont St., to the Fred S. & A. D. Gore Corporation at $17,831. Other bidders were: Hugh J. McGuire, $17,831; James Doherty, $18,730; J. C. Coleman & Sons Co., $18,782; William L. Dolan, $20,464.

Michigan.

✣Bids will be received until 1 p. m., May 31, by Board of Public Works, Grand Rapids, Mich., for the construction of a sewer in Canal St. (now Monroe Ave.) from Dean St. to Hickory St. (now Comstock St.) and in Comstock St., from Monroe Ave. to Coit Ave. and in Coit Ave., from Comstock St. to Burr Oak St.; also in Burr Oak St. and said street extended from Coit Ave. to Oakwood Ave. (so-called) extended; thence south to near the north end of said last named avenue; thence southeasterly to Plainfield Ave. to culvert north of Ann St., according to the plans and specifications on file at the office of the Board. L. D. Cutcheon is Secretary and General Manager.

✣Bids will be received until 7:30 p. m., May 31, by Board of Public Works, Saginaw, Mich. W. F. Jahnke, Clerk, for improving by paving the following streets or avenues in said city: Howard St., Holland Ave. to Atwater St.; Ninth St., Janes Ave. to Walnut St.; Carlisle St., Warren Ave. to Second St.; Brown St., Holland Ave. to Remington St.; Fourth Ave., Walnut St. to Perkins St.; Perry St., Michigan Ave. to Queen St. Each proposal must be accompanied with a certified check on a bank in the City of Saginaw, or a New York draft in the sum of $5,000, or a proportional amount as fixed by the City Engineer, payable to the City Treasurer. Proposals will be received for any one or all of said streets for the following materials: Sheet asphalt on concrete foundation, block asphalt on concrete foundation, brick on concrete foundation, creosoted block on concrete foundation, bituminous concrete on concrete foundation, bitulithic on concrete foundation, bituminous concrete on macadam foundation, bitulithic on macadam foundation, bituminous macadam, concrete pavement.

✣Bids will be received until June 7 by city of Jackson, Mich., for the construction of 2,500 sq. yds. of asphaltic concrete brick, etc., on concrete foundation. A. W. D. Hall is city engineer.

The Common Council of Monroe, Mich., has passed an ordinance establishing the grade of Second St., from Smith to East Chester St., and instructing the city engineer to prepare plans and specifications for the paving of the street witth brick or some other material.

The Common Council of Monroe, Mich., has passed an ordinance establishing the grade of Second St., from Smith to East Chester St. with brick or some other material. The city engineer will prepare plans and specifications.

⊙The Iron County Road Commission, Crystal Falls, Mich., A. L. Burridge, Engineer, on May 13, awarded the contracts for the building of 8 miles of road from Iron River to Beechwood and from the Brule River to Mastadon to the McGrath Construction Co. of Green Bay, Wis., at the following prices: Iron River, Beechwood Road—Clearing per acre, $45; grubbing per square, $0.40; earth excavation, per yd $0.29; loose rock, per yd. $.60; solid rock, per yd. $1.40, and overhaul, $0.01½. Brule River, Mastadon Road, 4 miles—Clearing, per acre $25; grubbing per square, $0.35; earth excavation, per yd. $0.24; loose rock, per yd. $0.60; solid rock, per yd. $1.40, and overhaul, $0.01½.

Minnesota.

✣Bids will be received until June 18 at the office of the county auditor, Winona, Minn., for the macadamizing of about 21 miles of road. O. B. Leland is engineer. Official advertisement will be found elsewhere in this issue.

⊙The General Contracting Co., 1226 Plymouth Bldg., Minneapolis, Minn., has been awarded the contract by the Hennepin County Commissioners, Minneapolis, Minn., Al. P. Erickson, County Auditor, for the building of Road No. 41, Contract No. 26, commencing at the city limits and running westerly. The road, which is 3 8-10 miles long, will be improved with bituminous macadam and will cost $50,000. Bids were opened May 20.

The Council Ways and Means Committee, Minneapolis, Minn., has voted to recommend the issuance of $375,000 permanent improvement bonds. This money will be used for the season's paving in the city.

Mississippi.

✣Bids will be received until 8 p. m., June 4, by Mayor and Board of Aldermen, Kosciusko, Miss., for the construction of the concrete sidewalks and crossings, as per plans and specifications on file with the Mayor. A certified check for $250 must be filed with each bid. Specifications may be obtained of Xavier A.

[illegible] Miss., [illegible] J. H. Hollingsworth is Clerk.

U. S. Highway Engineer D. H. Burrell has been sent by the government to supervise the construction of good roads in Yazoo County, Miss., for which bonds were recently voted to the amount of $75,000. Yazoo City is the county seat.

Missouri.

The County Court of Nodaway County, Mo., has authorized an election in Union Township for June 1 for the purpose of voting on the issuance of bonds in the sum of $15,000 for permanent road improvement in the township. Maryville is the county seat.

Montana.

⦿The Buffalo Steam Road Roller Co., Buffalo, N. Y., has been awarded the contract by the Mayor and City Council of Helena, Mont., for furnishing one 12-ton steam road roller. I. M. Bates, Portland, Ore., is northwestern agent for the company. Bids were opened May 15.

Nebraska.

✣Bids will be received until 8 p. m., June 7, by Havelock, Nebr., for 10,000 sq. ft. of cement sidewalks and on thirty more or less concrete street crossings. Charles A. Currie is City Clerk.

New Hampshire.

✣Bids will be received until June 14 by State Highway Department, S. P. Hooker superintendent, Concord, N. H., for the construction of 1½ miles of native stone road in Tilton, N. H., and 2 miles of native stone road in Rochester, N. H.

New Jersey.

✣Bids will be received until 12 p. m., June 3, by Board of Street and Water Commissioners, Jersey City, N. J., for the improvement of Lake St. between Hudson Blvd. and Germania Ave., in accordance with plans and specifications on file with E. B. Lee, Clerk.

The Street Committee of Camden City, N. J., Council has decided to advertise for bids for the construction of an asphalt plant for the city which will probably cost $15,000. It is the purpose of the committee to prepare all asphalt for street paving, buying it in its crude state. The plant will probably be erected near the city workhouse.

New York.

✣Bids will be received until 3 p. m., June 3, by Board of Contract and Supply, Albany, N. Y., for the improvement of Livingston Ave. from the east curb line of Thornton St. to the east curb line of Judson St. This work includes grading, paving the carriageway with vitrified paving blocks on a concrete foundation, setting granite curb, repairing and laying sidewalks with flags and vitrified bricks, building receiving basins and laying a vitrified pipe sewer under the north sidewalk. Isidore Wachsman is secretary of the board.

✣Bids will be received until 8 p. m., June 6, by Board of Public Works, Fulton, N. Y., for the construction of brick pavement with concrete curbs from the west line of West First St. on West Broadway to the D., L. & W. railroad tracks. Each proposal must be accompanied by a certified check payable to the order of the city chamberlain, Fulton, N. Y., in amount of 5 per cent of the bid. Plans and specifications may be had at the office of the city engineer, 59 S. First St., Fulton, N. Y., upon deposit of $5. The following is the estimate of the work to be done: 9,900 sq. yds. brick pavement, 3,300 lin. ft. cement curb, 212 lin. ft. stone headers, 1,700 ft. 15-in. vit. storm sewers, 300 ft. 12-in. branch pipe, 4 catch basins, 6 inlets, 3 manholes, 5 manholes to be remodeled, 2,000 sq. ft. new cement sidewalk, 1,500 sq. ft. cement walks to be taken up and relaid, 1 concrete protection wall, 24 ft. 12-in. cast iron pipe, 60 ft. 8-in. cast iron pipe. John Frawley, president Board of Public Works.

⦿The borough of Richmond, New York City, George Cromwell, president, has awarded the contract for furnishing and delivering 60,000 gals. of macadam road binder with asphalt base to the Standard Oil Co. at $3,540 and Wm. S. Van Chef, Point Richmond, New York City, $388. Bids were opened May 21.

⦿John J. Fitzpatrick & Sons of Plattsburgh, N. Y., have been awarded the contract by the Board of Public Works of that city for the construction of 1,500 sq. yds. of creosoted wood block pavement at $3.11 a square yard. Bids were opened May 20 by C. A. Barnard, city clerk.

⦿Warren Bros. Co., Boston, Mass., has been awarded the contract by the city of Newburgh, N. Y., D. J. Coutant city clerk, for resurfacing the roadway of Broadway, between the west side of Liberty St. and the east side of Mill St., with bitulithic. The contract price is $29,850. Bids were opened May 20. William J. Blake, Jr., is city engineer.

⦿The Board of Contract and Supply of Albany, N. Y., Isidor Wachsman, Secy., has awarded the following contracts for the pavement of certain streets: Cuyler Ave., from Delaware Ave. to the city line, P. W. Mulberry, $5,557; West Van Vechten St., from Second Ave. to Whitehall St., P. W. Muldorry, $9,848; Livingston Ave., from Thornton St. to Judson St., P. W. Mulderry, $9,886; Plain St., from Phillip St. to Eagle St., B. F. Mulderry, $1,680; Providence St., from Quail St. to Ontario St., T. Henry Dumary, $11,004; Mercer St., Quail St. to Ontario St., T. Henry Dumary, $9,694; Warren St., West Lawrence St. to Allen St., B. F. Mulderry, $1,637; Lincoln Ave., Allen St., westerly, B. F. Mulderry, $6,067.

The Common Council of Lockport, N. Y., has been petitioned to pave Washburn St., from East Ave. to High St., with a 2-in. asphalt surface over the present pavement on a 10-year guarantee.

Following bids were received May 20 by Commissioner of Public Works F. M. Westcott of Syracuse, N. Y., for street sprinkling: District No. 3—C. P. DeLong & Son, $2.37; Daniel A. Kelley, $2.50; American Car Sprinkler Co., $2.59; R. S. Weston Truck Co., $2.40. District No. 4—C. P. DeLong & Son, $2.97; C. T. Hookway, $2.68; Daniel A. Kelley, $3.05; R. S. Weston Truck Co., $2.50; American Car Sprinkler Co., $2.90. District No. 5—C. P. DeLong & Son, $2.75; Daniel A. Kelley, $2.33; American Car Sprinkler Co., $2.79; R. S. Weston Truck Co., $1.94.

Ohio.

✣Bids will be received until noon, June 4, by Director of Public Service, Bellaire, O., for furnishing the necessary labor or materials for the improvements of the following streets, to-wit: Pine Alley from 42nd St. to 44th St., by grading and paving. Walnut Alley, from 48th St. to 49th St., by grading and paving. Hamilton St., from 32nd St. to Boundary St.; Boundary St., from Hamilton St. to Washington St., and Washington St. from Boundary St. to 26th St., as one improvement, by grading, constructing necessary culverts, drains and retaining walls, and by paving. R. E. Crow is Clerk.

✣Bids will be received until noon, June 14, by County Commissioners, Steubenville, O., for the necessary labor and materials to construct the Bantam Ridge Free Turnpike Road in Cross Creek Township, Jefferson County, Ohio, in accordance with the plans and specifications now on file in the office of the County Commissioners. Total length of said Free Turnpike Road 17,787 ft.; divided into 2 sections. Section No. 1, Station No. 0 at residence of D. K. Andrews to the line, between the farms of Joseph M. Thompson and Joshua F. Rine, total length 11,300 ft. Section No. 2, Station No. 0 on line between the farms of Jos. M. Thompson and Joshua F. Rine, to the Southern terminus of the road at Fernwood Station. Total length 6,487 ft. A certified check in the sum of $300 must accompany each bid.

✣Bids will be received until noon, June 17, by Paul B. Van Winkle, Village Clerk, Richwood, O., for furnishing the necessary material and labor for improving Bomford St. from the West Line of the N. Railroad right of way to the inte Pearl St. by paving with vitrifi asphalt block to the width of 24

✣Bids will be received until noon, June 3, by Director of Public Service, Youngstown, O., for furnishing the necessary labor and material for paving Hughes St. from Market St. to Oak Hill Ave., and Olivet Co between Hughes St. and Lot No. 12077. H. M Millin is Clerk.

✣Bids will be received until noon, June 3, by Director of Public Service, Youngstown, O., for paving Garfield St., from Market St. to Glenwood Ave. Plans and specifications are on file with the City Engine W. H McMillin is Clerk.

✣Bids will be received until noon, June 3, by Director of Public Service, Youngstown O., for the necessary labor and m paving Worthington St., from Fer Jefferson St. W. H. McMillin is er

✣Bids will be received until no by Director of Public Service, Y O., for furnishing the necessary al material for paving Darrow St., be rod Ave and Shelby St W. H Clerk.

✣Bids will be received until no by Director of Public Service, Y O., for furnishing the necessary la terials for paving Homer Ave., fr St to the city limits W. H. Clerk.

✣Bids will be received until Ju vertisement) by Commissioner County, Chardon, O., for grading with bituminated concrete the Scot Road, 8,960 ft. long and 14 ft. wide to cost $11,843. H. A. Cowles Auditor.

⦿The Mapel-Mullen Constructi Lima, O., has been awarded the F. F. Harman, director of pu Lima, for grading, curbing, draini ing the central portion of Brice Metcalf St. to Washington St., w brick pavement, at $1,960. The w cement curb and gutter, brick pav crete foundation, catch basins, dr tile, etc. Bids were opened May 15.

⦿Chas Bird of Springfield, awarded the contract by the comn Coshocton county, Coshocton, O., and paving with a bituminous sur water-bound macadam, the Walh Gilford road, in New Castle and ships, said county. The contra $16,170. The length of the road and the width 12 ft. James R. lumbus, O., is state highway comr

⦿William Schwartz of Omega, awarded the contract by the comm Morgan county at McConnellsvi grading and paving with brick th Road in Windsor and Penn tow county, at $14,500. The length of 6,500 ft. and the width 12 ft Marker, Columbus, O., is state highway missioner. Bids were opened May 4.

⦿W. C. Wooley of Marion, O., has awarded the contracts by the Carroll Commissioners, Carrollton, O., for a paving with brick the Petersburg ter and Union Townships for a 5,500 ft., at $13,592, and for pavin the Steubenville-Canton road in C ship for a distance of 7,025 ft., at were opened May 17. James R. M umbus, O., is State Highway Co

⦿The Board of Control of Li awarded the contract for the pav Ave., from Washington to Metca St. Metropolitan vitrified brick to e Mullen Construction Co. of Lima

⦿Springer & Rogers of New Phila O., have been awarded the cont Tuscarawas County Commissioners, Philadelphia, for the additional paving on the Wooster road at $ liam Brode & Co., of Newcomerstown, $23,599 on the work.

Following low bids were recen

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

ty of Dayton, O., for paving [illegible]
not to be awarded for some time:
st of Wayne Ave., from Short St. to
, with cement, Yount & Jackson, $825;
ammer, brick, $1,125. Forest Ave.,
hman to Rung Sts., with straight ce-
bing on brick, David Beard, $15,247;
[illegible] curb and gutter, [illegible]
ing Co., $17,211; on asphalt [illegible]
Paving Block Co., 2-in. block, $19,-
2½-in. block, $20,072; on 3½-in. creo-
od block, W. J. Kernan & Co., $21,-
rest Ave., from Rung St. to Main
straight cement curb and brick pave-
avid Beard, $14,859; with combined
gutter and asphalt paving, American
[illegible] & [illegible] $17,7[illegible]
lt block, the Asphalt Block Paving
093; on 2½-in. asphalt block, As-
ock Paving Co., $18,918; for creo-
od block, American Construction &
o., for 3-in. block, $21,130. Clover
Fillmore to Nassau St., on brick
ght cement curb, David Beard, $11,-
ry St., from Bayard to the levee, on
ement with straight cement curb,
Jackson [illegible]
ty Council of Toledo, O., has ap-
resolution providing for the paving
it St., from Cherry to Perry Sts.,
ooth pavement. City Engineer G. W.
ll prepare plans and specifications.

Oklahoma.

[illegible] be received until 7 [illegible]
J. Kohr, city clerk, Poteau, Okla.,
ng, macadamizing, curbing, guttering
ng the following streets and avenues
ty of Poteau, Okla., to-wit: Dewey
n Frisco right of way to the Kansas
hern right of way; Clayton Ave.,
Kenna St. to Bagwell St.; Parker
rom Frisco right of way to Walter
Ave., from Walter St. to Bagwell
Ave., from Witte St. to Bagwell,
vell St., from Sage Ave. to Amos
lter St., from Dewey Ave. to Amos
per St., from Rogers Ave. to Ward
tte St., from Dewey Ave. to Elm
[illegible] St., from Dewey Ave. to
[illegible]

Oregon.

Gross of Sheridan, Ore., has been
he contract by the city of William-
R. W. Jones, McMinnville, Ore.,
for the construction of concrete
and macadam on Main St., from A
St., approximately 5,000 sq. yds. The
rice is $10,100. Bids were opened

Pennsylvania.

will be received until 7 p. m., June
I. Simeral, Secretary of Council, 69
Ave., Bellevue, Pa., for grading,
aving, laying a cement sidewalk on
of street, constructing a Ligonier
ng on east side of street and other-
ving S. Fremont St. from Division
right of way line of the P., Ft. W.
Approximate quantities: 1,500 ft.
ing, 2,900 sq. yds. Hillside brick
ng, 350 cu. yds. concrete, 100 ft.
n sewer, 8 storm sewer inlets, 1,300
r block railing, 2,000 cu. yds. exca-
00 sq. ft. cement sidewalk. Council
he right to reject any or all bids.
specifications can be seen and bid-
s obtained at the office of the bor-
neer. A certified check for $500 to
each proposal. John McBride,
ngineer, room 708 Fitzsimons Bldg.,
Pa.

ill be received until June 18 by the
way Department, Harrisburg, Pa.,
provement of 10,344 ft. of roadway
No. 142 in Salisburg Township,
County; 1,337 ft. in Wharton Town-
te County, and 45,460 ft. on Route
Bucks County. E. M. Bigelow,
Pa., is State Highway Commis-

epartment of Highways of Easton,
warded the following contracts for
[illegible] A [illegible]
[illegible] pavement [illegible]
Bushkill St., between Second and Fourth Sts., as follows: Amiesite, $1.55 per sq. yd.; concrete gutters, $0.50 a lin. ft.; resetting curb, $0.40 a ft. Frank McInerney, laying Dolarway pavement on Second St., between Northampton and Ferry Sts., as follows: $1.34 a sq. yd.; gutters, $0.48 a lin. ft.; resetting curb, $0.30 a ft.

⦿Following bids were received May 21 by the State Highway Department, Harrisburg, Pa., Edward M. Bigelow, Commissioner, for the construction of five sections of main highways in various parts of the state:

Route 26—Union County, Buffalo Township, 18,100 ft. Asphaltic Concrete—Neff & Horn, Slatington, Pa., $70,684; Chas. T. Eastburn (awarded contract), Yardley, Pa., $61,441; Blaisdell & Sheldon, Punxsutawney, Pa., $75,-539; The Emery Construction Co., Mt. Jewett, Pa., $79,825; The McNerney Construction Co., Canton, Pa., $66,753; Stucker Bros. Construction Co., Harrisburg, Pa., $66,952; G. Ralph March, Philadelphia, Pa., $76,883.

Route 246—Allegheny County, Westview Borough, 6,494 ft. Brick Block—Ridge Bros. Co., Pittsburgh, Pa., $41,464; Samuel Gamble, Carnegie, Pa., $45,437; The Duster Contracting Co., Tarentum, Pa., $44,779; M. O. Herron & Co. (awarded contract), Pittsburgh, Pa., $36,691; Ott Bros. & Co., Pittsburgh, Pa., $36,-863.

Route 47—Bedford County, East St. Clair Township, 4,217 ft. Telford Macadam—Saupp & Herr Contracting Co. (awarded contract), Altoona, Pa., $12,852; Buterbaugh & Mack, Windber, Pa., $15,287.

Route 1—Dauphin County, Susquehanna Township, 20,085 ft. Asphaltic Concrete—Central Construction & Supply Co., Harrisburg, Pa., $70,711; Stucker Bros. Construction Co., Harrisburg, Pa., $73,756; Chas. T. Eastburn (awarded contract), Yardley, Pa., $69,434.

Route 238—Mercer County Hickory Township, 8,085 ft. Brick Block—Blaisdell & Sheldon, Punxsutawney, Pa., $43,342; Wm. McIntyre & Sons (awarded contract), Sharon, Pa., $28,971; Findley, Waid & Co., Sharpsville, Pa., $28,498; Tony Morello, Butler, Pa., $29,835.

The State Highway Commission of Pennsylvania, Edward M. Bigelow, Commissioner, Harrisburg, is making arrangements for inviting bids for additional sections of main highways in various parts of the state.

South Dakota.

✣Bids will be received until May 31, by Board of County Commissioners, Mitchell, S. Dak., for the construction of 6 miles of new roadway north of the city.

Tennessee.

The Polk County Commissioners, Benton, Tenn., it is said, will let contracts about June 10 for the construction of a pike road from Postelle, through Ducktown by way of Isabella, to Copperhill. The distance is about 7 miles.

Texas.

✣Bids will be received until 11 a. m., June 1, by Commissioners Court, Dallas, Texas, for grading and graveling that part of the Mesquite and Wilmer road designated in the aforesaid order as a county cross road. A description of said road being given in the field notes on file in office of the County Engineer. A certified check for a sum equal to 5 per cent of amount of contract must accompany each bid. George L. Fearn, County Auditor.

The City Council of Temple, Tex., has adopted a resolution for paving Central Ave., from Second St. to the Missouri, Kansas & Texas Ry. passenger terminal at 14th St., a distance of 7 blocks. Concrete pavement will be used.

The citizens of Coke County, Tex., at a recent meeting voted against the issuance of bonds in the sum of $60,000 for the construction of good roads. Robert Lee is the county seat.

The Fort Bend County Commissioners' Court, Richmond, Tex., have been asked by citizens of Fresno to award them a portion of the bond issue in road district No. 1 for their locality for the purpose of building a road from Arcola to connect with the Harris County shell road at Pierces Junction, 7 miles south of Houston. This district has issued $150,000 of bonds and is now considering an additional $2,000,000 for shell roads.

Virginia.

✣Bids will be received at once by the American Boulevard Corporation, Norfolk, Va., for 20,000 yds. paving; 16,000 yd. curbing; 6,000 sq. yds. of sidewalk; 4,000 ft. of 6-in. water pipe. Arthur C. Freeman, Jr., Arcade Bldg., Norfolk, Va., is Consulting Engineer.

Surveyors from the office of the State Highway Commissioner at Richmond, Va., are at work in Stafford County staking out a route for the proposed good roads in that county, contracts for which are expected to be awarded in time to begin work in July. Bonds in the sum of $100,000 were recently voted for good roads by the county.

✣Bids will be received until noon, May 31, by clerk, Prince George, Va., for the construction of 2½ miles of gravel and sand clay road between Middle Road and Bull Hill Road. Plans and specifications are on file with the clerk and P. St. J. Wilson, state highway commissioner, Richmond, Va.

The citizens of Orange County, Va., at a recent election voted the issuance of bonds in the sum of $50,000 for permanently improving the roads in the Barbour district, and bonds in the sum of $75,000 for roads in the Taylor district. Orange is the county seat.

Washington.

✣Bids will be received until 10 a. m., June 5, by J. W. Sweazy, County Auditor, Walla Walla, Wash., for the construction of permanent highway No. 2 known as the Park St. extension. Plans and specifications are on file with County Clerk, Auditor and Engineer and State Highway Commissioner.

⦿The Stevens County Commissioners, Colville, Wash., have let the contract for the building of the Addy-Gifford state road to the Stevens County Construction Co. of Kettle Falls, Wash. The contract calls for 3½ miles of road at $8,300.

⦿Following bids were received by the King County Commissioners, Seattle, Wash., for the construction of the D. McCallum road and for making repairs to the Juanita Dock: J. A. Zinkan, $12,729; Homer Crosby, $11,467; John L. Stanley & Co., $11,489; Elliott & Zindorf, Alaska Bldg., Seattle, $8,092; McQuaid & Moore, $8,323. The contract was awarded to the lowest bidder.

⦿The Board of Public Works of Seattle, Wash., has awarded the contract for the grading and curbing of Genesee St., et al., to Geo. C. Dietrich & Co., Globe Bldg., Seattle, at $62,670.

⦿Haukeli, Hegg & Co. have been awarded the contract by the city of Aberdeen, Wash., Chas. W. Ewart city engineer, for the paving of Randall, C and E Sts. at an estimated cost of $13,753. The work includes concrete pavement at $1.45 and asphalt pavement at $1.95. Three widths of pavement, 36 ft., 25 ft. and 20 ft. The work includes curbs and gutters. Bids were opened May 1.

City Engineer Morton Macartney of Spokane, Wash., has completed plans for the regrade of Post, Monroe and Jefferson Sts. The streets will be paved with asphalt and brick at a cost of about $54,000.

The Town Council of Newport, Wash., has condemned all board sidewalks on two blocks of Washington Ave., and ordered them replaced with concrete walks.

Plans for the paving of Sprague Ave., from Lee to Havana St. at the east city limits, to connect with the Apple Way, have been filed with Commissioner of Public Works D. C. Coates by City Engineer Morton Macartney of Spokane, Wash. The distance is a mile and a half and the average cost for the various [illegible] material figured on is about $250 per 50 ft. The estimates are as follows: Asphalt and brick, $70,900; bitulithic, $92,900; bitu-mass, $65,200; concrete, $81,800; granitoid concrete, $91,200; Hassam concrete, $81,200; Spokane bituminous and brick, $70,400. The area in the district is 1,796,759 sq. ft. and the area on the petition is 958,727 sq. ft.

Following bids were received May 17 by the Board of Public Works of Seattle, Wash., for the grading and curbing of Genesee St. et al.: G. C. Dietrich & Co., Globe Bldg., Seattle, $62,670; Marks, Russell & Gallagher, $75,864; W. F. Manney & Co., $73,628; Sloane Bros., $77,580; Andrew Peterson, $68,898; P. J. McHugh, $65,593; Holt & Jeffery, $66,227; Andrew Peterson & Co., $78,542, and Zindorf & Elliott, $70,432.

The City Council of Pullman, Wash., has decided to pave 20 blocks of streets this year, as follows: State St., from Garden City addition to Olson, and Olson St., from State to Grand St.; Star Route Ave., entire length, and Montgomery from Star Route to the college campus. Professors Edwards and Snyder of the Washington State College, Pullman, have been employed as engineers on the work.

Wisconsin.

✣Bids will be received until 5 p. m., June 3, by Board of Public Works, at the office of H. C. Leonhardt, City Clerk, Sturgeon Bay, Wis., for the macadamizing of Green Bay Road, Union St., from State to McKinley; McKinley St., from Union to Prospect; Prospect, from McKinley to Green Bay Road; Green Bay road from Prospect to City Limits.

✣Bids will be received until 5 p. m., June 3, by Board of Public Works, at the office of H. C. Leonhardt, City Clerk, Sturgeon Bay, Wis., for macadamizing Cedar St., from Portage St. to Reynolds St.

✣Bids will be received until noon, June 4, by Streets and Sidewalks Committee, City Council, Monroe, Wis., for the paving of the public square, including about 18,000 sq. yds.

✣Bids will be received until 10:30 a. m., June 5, by Department of Public Works, J. P. Sherer, deputy commissioner, Milwaukee, Wis., for doing the work of removing defective wooden sidewalks and replacing them with cement concrete sidewalks in the Eighteenth, Nineteenth, Twentieth, Twenty-first, Twenty-second, Twenty-third, Twenty-fourth and Twenty-fifth wards of the city of Milwaukee, according to the respective specifications.

✣Bids will be received until 10:30 a. m., June 4, by Department of Public Works, J. P. Sherer, deputy commissioner, Milwaukee, Wis., for doing the work of removing defective wooden sidewalks and replacing them with cement concrete sidewalks in the Tenth, Eleventh, Twelfth, Thirteenth, Fourteenth, Fifteenth, Sixteenth and Seventeenth wards of the city of Milwaukee, according to the respective specifications.

✣Bids will be received until 10:30 a. m., June 3, by Department of Public Works, Milwaukee, Wis., for doing the work of removing defective wooden sidewalks and replacing them with cement concrete sidewalks in the First, Second, Third, Fourth, Figth, Sixth, Seventh, Eighth and Ninth wards of the city of Milwaukee, according to the respective specifications. J. P. Sherer is deputy commissioner.

Wyoming.

⊙Houck & Alsup of Cheyenne Wyo been awarded the contract by Ars ball, Maj. and Quartermaster, S. Fort D. A. Russell, Wyo., for the onstr of curbs and gutters, carriage blks, hitching rings, light poles, relayi sidewalk etc., at $5,392. Bids were opene May 15

Canada.

⊙The Bitulithic & Contractin Co., Winnipeg, Man., has been awar d the contract by the City Council of Assi ola (P O Winnipeg), Man., for the pavin of Portage Ave. to the municipal hall at S Charles at $2.86 per sq. yd., for the first s ion, a distance of about a mile and a hal etween the city limits and the west side f Lot St. James, and $2.90 a yd., frc the point to the municipal hall, a di nce miles.

⊙The City Council of Sherbro e, G. Griffith secretary-treasurer, ha e bids received May 17 for the cotr 5,000 sq. yds. of granolithic sidew s, decided to do the same by day bc were opened May 20.

C. G. Annable, Rathmullen, Sas Treasurer Municipality of New nt will sell debentures June 1 for e of $12,500 worth of road-buildi mac and for constructing roads.

The Board of Trade of Orill Ont approved of the proposition to p Ma at an estimated cost of $58,000. is w clude putting all wires undergrou and ing the streets with cluster lights.

IRRIGATION, DRAINAGE, LEVEES AND CANA

Arizona.

Advices from Florence, Ariz., state that the Pinal Mutual Irrigation Co. has raised $30,000 and is planning to have work started early next month in its diversion canal. Thomas F. Weedin is interested.

California.

A. W. Pioda, City Engineer of Redwood City, Cal., has been making surveys with a view to widening Redwood Creek, from Broadway to the Center St. bridge, to 24 ft. and bulkheading.

Florida.

✣The Trustees of the Internal Improvement Fund rejected all bids received until May 22, for the construction of locks and wing dams near the south shore of Lake Okeechobee and directed J. O. Wright, Chief Drainage Engineer, Tallahassee, Fla., to readvertise the work, bids to be received until July 10.

Illinois.

Bids were opened May 13 by Major C. Keller, U. S. Engineer, Rock Island, Ill., for widening and deepening South Slough at Milan, Ill. The probable successful bidder on this work is R. J. Phelps, Carbon Cliff, Ill., at $12,160. The work includes about 80,000 cu. yds. of earth and mud excavation by use of a boom (or bucket) dredge.

Bids will be received by A. W. Baldwin, or Loren McKee, Carrollton, Ill., for furnishing the Keach Drainage & Levee District with one 48-in. pump and engine. Official advertisement will be found elsewhere in this issue.

Indiana.

✣Bids will be received, it is reported, by P. J. Troyer, Superintendent of Construction and Engineer, Plymouth, Ind., for the construction of 6 branches of the Peter Sarber Ditch.

Farmers of Carr Township have filed a petition in the Circuit Court asking for the construction of a levee about 9 miles long to protect some 5,000 acres of land from overflow from the White River. Kochenour & Price, Brownstown, Ind., are attorneys for the petitioners.

Iowa.

⊙Contracts for the construction of Drainage District No. 80 of Greene County, bids for which were opened May 20 by the County Supervisors at Jefferson, Ia., have been let as follows: W. A. De Long, at $6,711 for the labor, and the Redfield Brick & Tile Co., at $8,101 for the tile.

Louisiana.

Surveys have been made for the proposed drainage district in Cameron Parish which will reclaim some 280,000 acres of land. T. H. Mandell, Lake Charles, La., is the Engineer.

Michigan.

✣E. W. Redman, Ithaca, Mich., Drain Commissioner of Gratiot County, will on June 10, at residence of Adelbert Hale, eight miles west and one mile north of Ithaca, sell at public auction the construction of Drain No. 111. The drain is 10.8 miles long, including two branches. The lower 2.3 miles, or main drain, will have a bottom width of 10 ft. The next 2.1 miles of main will have bottom width of 6 ft. and the upper 0.84 miles will have a 4 ft. bottom. Branch 1 will have 2.55 miles of 6 ft. bottom and two miles of 4 ft. bottom. Branch 2, 2.05 miles long, will have a 4 ft. bottom throughout. The larger part of the work on the main drain is cleaning out, except where changes are made for straightening. The cuts from hubs vary from 2 ft. to 10 ft. On Branch 1 the upper 3 miles will be new work with average cut of about 5 ft. Branch 2, except lower ¼ mile, will be largely cleaning out. Some timber, mostly small second growth, will be encountered on the branches. A very little on the main.

⊙Contracts were recently let by E. W. Redman, Drain Commissioner of Gratiot County, for Drain No. 279, a tile drain, as follows: Section No. 1, 292 rods, at $1.50 a rod to F. L. Fox, for the labor only. There are 27.6 rods of 15-in. tile, 92.4 rods of 12-in. 95.08 rods of 10-in. and 76.92 rods of 8-in. The cuts will average about 3.7 ft. Four catch basins and one head wall are also include amount. Section 2, containing 8 let to John Smith for $824, or $1 er r labor and furnishing material f and structing 2 catch basins. Section w 8-in. tile; average cut 4 ft. The hlin for this work was let as a sepate contra for hauling about 6 miles for $15

⊙Contracts for constructing he Meh Drain of Clinton and Ingham C nties we awarded May 22 at Mason, Mich is follow Section 1, 104 rods, to E. L. Pea ly of sing, at 50 cts. per rod; Section of rods, at 30 cts. per rod, to sam contr The third section of 480 rods of t was H. H. Horton of Williamston, rod. The American Sewer P awarded the contract to furnish ne til the sum of $1,545.

Minnesota.

✣Bids will be received until 1 18, by F. E. Ware, Stevens Co v A Morris, Minn., for constructing ch including the following approxi ite ties: 2,900 ft. of 8 in. tile, clay or eam cement; 2,100 ft. of 10 in. tile, c or cured cement; 1,600 ft. of 12 i tile burned clay or steam cured cem ; 24 of 14 in. tile, hard burned clay, r cul glazed vitrified; 33 ft. of open w . A depth of cut 5.11 ft.; deepest cut, 07 ft ging all in black dirt and clay, rock or quicksand. Location of wo one north of the City of Morris. T esti cost of the work is $2,214.

✣Bids will be received until 1 m 18, by F. E. Ware, Auditor Ste is Morris, Minn., for the construct No. 13 in that county, including approximate quantities: 2,800 ft. tile; 3,500 ft. of 8-in. clay tile; 10-in. clay tile; 4,200 ft. of 12-in. c ft. of 10-in. hard burned clay o salt vitrified tile; 3,678 ft. of 16 in. rd clay or cull salt glazed vitrified t depth of cut, 5.27 ft.; deepest Digging all in black dirt and cl, no trees or quicksand. Location of rk, wil

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

of Alberta, Minn. The [illegible] work is $4,322.

Missouri.

ils will be received, according to reports, R. Heager, County Engineer, Fulton, or the excavation of about 120,000 cu. earth.

following bids were received May Major Edward H. Schulz, U. S. Engi- Kansas City, Mo., for constructing 12,- ft. of standard revetment on the Mis- River about 31 miles below Kansas City ee miles below Missouri City, Mo.; J. Murray Contracting Co., Kansas City, 1.75 lin. ft.; McGuire & Stanton Con- n Co., Leavenworth Kan. (awarded [illegible] per lin. ft.

Nebraska.

tlett & Kling, Cedar Rapids, Ia., have arded the contract at $361,378 for con- g Dam No. 3 for the North Platte of the U. S. Reclamation Service. Bids work were opened April 22, and were our May 1 issue. The work involves dling of about 840,000 cu. yds. of ma- nd the placing of 250,000 lbs. of rein- steel.

Ohio.

were opened May 14 by [illegible] County Engineer, Lancaster, for the ment of the Hocking River, the con- eing awarded to C. H. Stansburg & t $32,950.

Oregon.

have been taken at Echo, Ore., toward l organization of the Paradise Irriga- strict. This project will cover 60,000 f semi-arid lands lying east of and y to Echo, Stanfield and Hermiston. [illegible] brought from the Umatilla starting from Thorn Hollow, above on, and following, to a great extent, inal survey of the old Sturgis ditch. ain ditch will be approximately 36 length to the top of the divide north dleton, from which point two main will branch out, each about 20 miles th. Two reservoirs, one in Despain other in Stage Gulch, will be con- in connection with the system.

emphis, Tenn., and Vicinity.

[illegible] CORRESPONDENCE.

first levee work to be offered un- recent appropriation made by the ppi River Commission is advertised J. A. Woodruff, U. S. Army of the Mississippi River District with head- at Vicksburg, to be let on June 3 607,000 cu. yds. will be awarded. The situated in three states, Mississippi, na and Arkansas and comprises the of the most severe crevasses which curred in the lower district from nt floods. At Beulah, Miss., which miles below Rosedale, 692,000 cu. offered, and for the benefit of the tors who desire to inspect the work te that the territory is between sta- 50 and 2205 and is known as sec- en of the Commission division. At efferson, Ark., station 680 to 692, one, 60,000 yards will be left. At Forrest, station 1750 to 1780, 403,- ds are advertised and this is known on four, which is also coupled with k to be offered at Salem, La., break is 452,000 cu. yds. between stations d 2533. Taking the average yardage tation, it will be seen that the Pan- rrest work is the heaviest and will ut 13,000 cu. yds., which for levee considered very heavy work. This ar section, can in the opinion of the in charge, be best handled by hovels. All of the work advertised e a section of 8 ft. crown with not n a three to one back and front [illegible] all but Lake Jefferson will be ted. Light topping will be done in 1½ ft. above gross grade of the [illegible] The town [illegible] 2 and [illegible] completed on or before Nov. 30, 1912. For the benefit of those contractors who may desire to make inspection of the work, we list below the best means of getting to the breaks. Lake Jefferson Loop can be reached by either rail or river: Watson, Ark., by rail; Rosedale, Miss., by river, from which point a launch can be secured; Panther Forrest, Ark., by boat landing at the work or by going to Arkansas City by rail and then taking team to the work, following the old levee the entire distance; Salem, La., by local boats from Vicksburg which will land at or close by the work; Lake Beulah, Miss., by boat or railroad to Rosedale. All bids and guarantees must be made on forms compiled by Major Woodruff and submitted in triplicate. It might be well to note, in view of the present wet condition of the ground, that all borrow pits are on the river side. In being the first United States officer to advertise for work under the new allotments, Major Woodruff has received many congratulations, for he will have the pick of the contractors and it is the general opinion that there will not be nearly enough teams to do all the work which will be advertised in this section within the next three months. It is presumed that the Memphis office will have to pay very dearly for the work which will be let by it later on. And if the St. Francis levee board does not hurry its bond issue, the chances are that when Chief Engineer Covington is ready, all the levee boys who possess large outfits will be hard at work on other contracts and will not be in position to take on more propositions.

A pall was cast over the local contractors last Saturday when the news of the death of Edward J. Manigan was received. Ed died Friday night in New Orleans where he had been for many months under the care of an expert doctor. For the past 15 years Ed Manigan has been the best known street contractor in this territory and at the time of his death was one of the Vice Presidents of the Roach-Manigan Paving Co. His reputation was not only confined to Memphis, but as evidenced by the telegrams received, extended throughout the South and West. As a token of respect, all construction work in Memphis was suspended for a day and it was with sorrowful hearts that the local boys bowed their heads when the news of Ed's death was announced.

Martin Jennings, the hustling Memphis levee builder who was awarded contract by Maj. Clarke S. Smith for closing about 21 breaks in the Upper River District near Birds Point, Mo., is preparing to move his forces on the work and will continue operations until the gaps are fully and finally closed. It seems at the present writing as if the June rise will interfere very materially with the progress of Martin's work, but if there is any dry ground at all, the hustling little fellow will be sure to find it— and use same to the best advantage.

Luther Y. Kerr is out on an inspection trip getting dope on the new levee work which Major Smith is preparing to advertise. Luther being the Assistant Engineer of the Memphis government district and the man who has the big say in the matter of new work.

It is rumored in local construction circles that the Southern Railway contemplates considerable new work in the vicinity of Macon, Ga., and according to some of the local boys who are on the mailing list of the latter road, the work will come up at once. All of the railroads who figure on getting a share of the Panama business are contemplating improvements of their lines and much new work is expected to be announced this summer.

Capt. Sherrill of the New Orleans office has had his hands full the past week trying to close the crevass at Hymelia, La., where the flood has washed out over 2,000 ft. of levee. The Mississippi River Commission has allotted $100,000 for this particular project, but at this writing Capt. Sherrill has about abandoned his gallant fight, for it was seen that the 5,000,000 gallons of water which rushes through the break per second is entitrely too big to combat. Already, the reports have it, $50,000 was spent in the effort to protect the valuable land which will be devastated by the roaring waters.

After the engineers of the Memphis, Dallas & Gulf R. R. complete surveys from Glenwood to Roseboro, Ark., the work of construction will be begun and project rushed through to a rapid completion. Several Memphis firms have their eyes on the contract.

Jerry Deal of Charleston, Mo., is chairman of a committee of property owners in the eastern part of Scott, Mississippi and New Madrid counties which have combined to protect the lands in that section from the overflows of the Mississippi River. This is the same territory in which Martin Jennings has just been awarded a contract and it is possible that when Martin finishes his government work, he may be able to make a private deal with the land owners for a staunch protection levee in that section of Missouri.

Shuford Brothers at Grapewin, Miss., write that they are now in the market for some good railroad or levee work. The boys feel that they must have a good price before they will move their outfit, for feed and supplies are too high to bid in work at the old figures. Then, too, with so much new work in sight, the boys are sure of getting something good.

Jack Goddard, of the firm of Goddard & Garrison, paving contractors, is going around town with the "smile that won't rub off" when he thinks of the fat juicy contracts his firm have on the string. Jack says that they expect to make a nice, fat pile this year, as they have lots of fine, good price work.

President Schly, of the Meridian and Memphis railroad, is authority for the statement that the New Orleans, Mobile & Chicago will extend from Middleton to Jackson, Tennessee, where a connection will be made with the Chicago & Eastern. Pres. Schly says that this connection will be a fine thing for that part of the country.

It is rumored that it is the intention of the Illinois Central R. R. to take over the Alabama, Tennessee & Northern R. R., known as the Cochran lines, and extend same quite a piece. It seems that this little line will be made quite profitable by judicious improvement and extensions.

It is the intention of the Interstate Levee Association to arrange for a convention to be held here some time this fall, in the interest of levee building and drainage problems. A meeting will be held here soon to arrange the details, and much interest is being taken in the movement.

The advisory board of the St. Francis Levee Board met here on the 23rd, at their Memphis offices in the Randolph Building, to decide on a plan of operation for the coming summer's work. Results have not yet been given out, but it is to be supposed that quite a lot of proposed work was taken under consideration.

Although the water has passed below the flood stage, more damage is showing up every day in this section. For instance: In the northern part of the city all the pike roads are carried through Wolf and Hatchie River bottoms along the tops of levees, which became water soaked through the long period of high water, and now that partial support of the water is removed, the levees are sloughing off in huge sections. North Second street is impassable, and residents of Woodstock, Fraser Station, Millington and adjoining villages have been compelled to come into Memphis via the

Hyndman Ferry road. This road is now showing signs of heavy damage. Immediately at the bridge over Wolf River, the road is opening up straight down the middle, and in the course of ten days will be impassable. When this sloughs off, it is more than probable that the retaining wall of the bridge will be carried along with it.

If this happens, almost half of the bridge will fall, and it will take months to repair the damage. Work is being rushed on North Second street, in order to get it in shape before Hyndeman Ferry road is too bad to travel, and the Superintendent of the road gang says that it will be perhaps ten days before this can be finished. If the caving continues, Hyndeman Ferry levee will have to be practically rebuilt, and should it give way before North Second street is again in commission, great hardship will be worked on the farmers north of the city.

That much interest is being taken in the Good Roads Movement in Arkansas and adjoining states is evidenced by the fact that on July 3 and 4 there will be held a Tri-State Road Convention, at Mone Ne, Arkansas. This will be participated in by Arkansas, Missouri and Oklahoma, and the Federal Government is also taking an interest in it. George R. Brown, of Little Rock, is Secretary, and says that this convention will do a world of good for all three states.

The information is given out by those who should be in position to know, that the Illinois Central is after the New Orleans Great Northern R. R. If the I. C. can obtain that road, and then build the Gulfport and Western from Gulfport into Covington, thus gaining entry into Gulfport, i will be of inestimable value to them, as the road at New Orleans is already so congested that some other outlet must be obtained. Of late, the I. C. has been branching out very rapidly, and should have some nice work to offer contractors.

At a meeting held here recently, which was attended by W. H. Russe and G. D. Burgess, of the firm of Russe & Burgess Co., one of the largest land owners in the Delta; T. F. Turley, King Holloway, Col. R. F. Abbay, Reid Leatherman, J. J. Williams, R. T. Lamb, Kenneth Stevenson, Mrs. W. C. Knight, and a number of other large land owners, a movement was started to organize a new Drainage District for the benefit of the Mississippi Delta. Dr. H. W. Crenshaw, of Crenshaw, Miss., was chairman of the meeting and John McGrath acted as Secretary. Plans were submitted by A. E. Morgan, Drainage Engineer for this project, which will embrace portions of DeSoto, Tunica and Quitman counties, and reclaim perhaps half a million acres of fine farm land. The petition has already been started, and is expected to be ready for presentation soon. If ten per cent of the people interested will sign this petition, the district will be then making a fair start. Another meeting will be called in the near future, at which the matter will be finally taken up.

Allie Bartee, in charge of the big Helena Contract of the Roach-Manigan Paving Company of this city, was in town recently, and states that he has finally started things there, and expects to make record time in completing this job.

Texas.

The Stowell Canal Co. of Stowell, Chambers County, Tex., has been chartered with a capital stock of $40,000, the incorporators being F. W. Schwettman, J. M. Ino A. L. Hunter.

Utah.

Bids as follows were received May 16 at the office of the U. S. Reclamation Service, Provo, for constructing terminal drop, chute and bridge abutments on work connected with the Strawberry Valley Irrigation Project, (1) standing for bid of Midwest Engineering Co., 301 McCague Bldg., Omaha, Neb., and (2) for bid of W. O. Morrison, 409 Cooper Bldg., Denver, Colo.

Excavation, Class 1, 4,000 cu. yds...$
Excavation, Class 2, 250 cu. yds...
Excavation, Class 3, 250 cu. yds...
Backfilling, [illegible] cu. yds.......
Overhaul, 500 cu. yds.......
Concrete, 876 cu. yds.......
Paving, 225 cu. yds.......

Totals..........$1

The following bids were received M at the office of the U. S. Reclamation S Provo, Utah., for concrete intakes a for work in connection with the Valley Irrigation Project, (1) standi bid of Midwest Engineering Co., O and (2) for bid of W. O. Morris Colo.:

Excavation, Class 1, 2,200 cu. yds...$
Excavation, Class 2, 225 cu. yds...
Excavation, Class 3, 225 cu. yds...
Backfilling, 555 cu. yds..........
Overhaul, 500 cu. yds..............
Concrete, 560 cu. yds..............
Paving, 260 cu. yds.............
Rockfill, 175 cu. yds...............

Totals..............$1

WATER-WORKS

Alabama.

Plans are being prepared by the J. B. McCrary Co. of Atlanta, Ga., for the installation of a water works system in Stevenson, Ala., at an estimated cost of $14,000. The work will include reservoir, fire plugs, mains, etc. The supply will be obtained by gravity. The work will be in charge of the water works committee.

Arizona.

✣Bids will be received until 10 a. m., June 12, by Capt. J. L. Jordan, Constructing Quartermaster, Fort Huachuca, Ariz., for construction complete of 8-in. steel water pipe line, approximately 8½ miles long.

F. E. Arthur and W. E. Williams of the Douglas Light & Power Co., Douglas, Ariz., have purchased a tract of land near Florence, Ariz., with a view of erecting an electric power plant and water works system.

Arkansas.

The city of Sulphur Springs, Ark., is making arrangements to install a water works system.

California.

The Board of City Trustees of Fullerton, Cal., has accepted the preliminary plans for the installation of a water works system. W. J. Renshaw is City Engineer.

A mass meeting was recently held in Redlands, Cal., to discuss the proposed municipal water system and bond issue of $600,000 for its installation. The citizens are reported to be in favor of the proposition.

Colorado.

✣Bids will be received until 10 a. m., June 15 by Capt. T. T. Frissell, Quartermaster, Fort Logan, Col., for the sinking of an 8-in. tubular deep well at that depot.

The City Council of Montrose, Colo., has instructed the city engineer to prepare plans and specifications for enlarging the water works system at an expense of $70,000.

Connecticut.

⊙The Hartford Paving & Construction Co., Hartford, Conn., has been awarded the contract by the Board of Water Commissioners, Southington, Conn., for the laying of 21,000 ft. of 12-in., and 8-in. cast iron water pipe and appurtenances, at $6,600. Samuel H. McKenzie is Engineer. Bids were opened May 11.

Idaho.

⊙Vogler Plumbing & Heating Co. has been awarded the contract by the City of Salmon, Ida., for the construction of a 120,000-gal. concrete reservoir and 4¼ miles of water mains, at $24,250. Bids were opened May 16. F. C. Miller is City Clerk.

Illinois.

✣Bids will be received by the Board of Local Improvements, Cicero, Ill., George Comerford, President, until 8 p. m., June 3, for furnishing labor, materials, etc., necessary to construct a main water supply in 60th Ave. (Austin Ave.), from 16th St. to 24th St. Cash or certified check for 10 per cent of proposal must accompany bid.

⊙Bids were opened and contracts awarded as follows by the Village of Ashton, Ill., for constructing complete a water works system: 10,130 lin. ft. 4-in. main, 57 cts.; 13,770 lin. ft. 6-in., 73 cts; 8,760 lin. ft. 8-in., 98 cts.; 1,500 cu. yds. rock excavation, $2.20; 35 hydrants, $29; 21 4-in. gate valves and boxes, $12; 26 6-in. gate valves and boxes, $16; 27 8-in gate valves and boxes, $21; 1 brick valve box with iron cover, $38.50; total bid, $29,999; awarded to Des Moines Bridge & Iron Works, Des Moines, Ia. Furnishing and erecting 1 60,000-gallon tank, including gage, painting, frost box and user pipe, $4,425; same as above with 40,000-gallon tank, $2,250; same as above according to bidder's plans, $3,280; contract for 60,000-gallon tank with elliptical bottom awarded to Chicago Bridge & Iron Works, 105th St. and Throop St., Chicago, Ill., price $3,280; 150 lin. ft. 12-in. well with 12-in. casing, per lin. ft., $4.50; 25 lin. ft. 10-i 10-in. casing, per ft., $4; 6-in. well per specifications, 1st., 100 ft., $2.75 next lin. ft., $2.50; next, 500 lin. ft., $ 1,000 lin. ft., $1.35; 6-in. Cook well place, per length of 6 ft., $30; 6-i iron casing in place, per lin. ft., $ yds. excavation for dug well, 75 yds. concrete, per cu. yd., $6; tot $3,016; awarded to M. Halloran, R The Aetna Engineering Bureau, 17 St., Chicago, are engineers in char Zeller, Jr., is President of the villa

⊙The following contracts for labor, materials, etc., necessary t water service pipes have been awar Board of Local Improvements, Clag Edward J. Glack is Secretary. B Dickens Ave., Jefferson Ave. and David Walsh, 6628 South Chicago Harding Ave., Jas. J. Renn, 367 Ave.; Jackson Ave., W. 22d Pl., W Jas. H. Roche, 222 E. 31st St.; W Loomis St., Milwaukee Ave., S. P D. Hardin, 3139 Indiana Ave.

⊙The Mutual Electric Co., Adams & ton St., Chicago, Ill., has been awarded contract by the Board of Adm Springfield, Ill., for equipping works of the Elgin State Hospital, with motors, pumps, wire, etc., at $ work includes one 50 k. v. a. gene 35 h.p. induction motor; one 90- acting triplex pump; one horizon centrifugal pump of 325 gals.; one distributing panel, and 5,500 ft. No wire. Bids were opened May 20.

⊙The Birdsall-Griffith Constructi Racine, Wis., has been awarded t by the Board of Local Improveme Charles, Ill., G. N. Lamb, Enginee for extensions of water mains, includir the ing of about 1,344 ft. of 4-in., and 6-in. pipe. The contract price is $8 Bids were opened May 15.

W. G. Stromquist, assistant engineer

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Water Survey at the University of ill submit a special report on the rks plant of Warsaw, Ill., to the city A filter plant is to be installed.

Indiana.

r Bros. of Peru, Ind., have been he contract for the construction of ipe line for the Chesapeake & Ohio , which is to furnish all the water e company at Peru for the filling of ks, boiler washings, etc. The pipe ins. in diameter and the water will into a concrete tank, to be built at d shops. The tank is to be 103 ft. 3 ft. wide and 10 ft. deep.

ill be prepared by Engineer J. F. uth Bend, Ind., for the installation icipal water plant in the town of e Haute, Ind. Specifications have red by Town Engineer R. Paige for s of mains and 90 water plugs d cost is $25,000.

rd of School Trustees of Logans- contemplates individual water fil- which include a boiler and aratus. Deep wells will probably t all the schools which will cost

Iowa.

ty Council of Indianola, Ia., has tract for the new cement reservoir ructed on South River to the Lyt- King Construction Co., of Des , at $13,040. The reservoir is to be y Sept. 1.

Council of Red Oak, Ia., has solution providing for the installa- umber of water mains.

Kentucky.

rman Water Works Co. contem- cing the water tank at Morgan- which was recently destroyed, by a new one of steel.

uncil of Mt Sterling, K. ranchise for water and light to the t & Ice Co. of Mt. Sterling.

Maryland.

ll be received until noon, June 17, . A. Ferry, Constructing Quarter- t Howard, Md., for sinking 10- ep well, additions to power shing and installing 2 boilers and power plant of that place.

Massachusetts.

is Balboni Co. has been awarded the Department of Public oston, Mass., for the relaying of in Sumner, Princeton and Tren- Boston at $1,569.

Gerrish of Boston, Mass., has d the contract by the Department orks of that city for laying water lexible joints in Boston Harbor, sland to Spectacle Island, at $16,- idders were: McCarthy & Walsh, Ellis, $18,917; Hiram W. Phil-

Michigan.

l & Co. of Lima, O. have been contract by the Village of Man- h., for the construction of a system at $23,600, from plans of Civil Engineer, The Nasby, . The improvement will include approximate quantities and extension, 50 h.p. gasoline en- 125 lb. pressure, force pump, rvoir, 345 tons cast iron pipe, t iron specials, 1 10-in. valve and valves and boxes, 6 6-in valves 4-in valves and boxes, 30 ng 10 lin. ft. 10-in. pipe, laying pipe, laying 7,920 lin. ft. 6-in. 2,810 lin. ft. 4-in. pipe. Bids were

k & Son of Grand Haven, Mich., ed the contract by the city en for the drilling of a 30-in. the water works. The esti- $2,500. Bids were opened May

[illegible] Mich., is Engineer.

⊙Keating Bros., 149 Harrison St., Detroit, Mich., have been awarded the contract by the city of Grand Haven, Mich., for the construction of 3,500 ft. of 16-in. suction main. The estimated cost of the work is $5,900. Bids were opened May 21.

The Board of Public Works of Owosso, Mich., plans to lay water mains this season at an estimated cost of $9,500. W. E. Hall is President of the Board.

The Common Council of Bay City, Mich., contemplates employing an engineer to make experiments for the purpose of learning what is to be done to better the condition of the water supply.

Minnesota.

⊙The Ramsey County Commissioners, St. Paul, Minn., have let the contract for the digging of a well at Silver Lake, town of North St. Paul, to Matt Holland, at $3.50 per ft.

The Village Council of Mountain Iron, Minn., has approved the idea of voting $50,000 in bonds for village improvements. It is proposed to build a steel water tank with 100,000 gals. capacity and to lay new mains. A brick power house for the electric plant will also be built.

Bids for the drilling of an artesian well at the U. S. postoffice at Minneapolis, Minn., were received May 22 by the Supervising Architect, Treasury Department, Washington, D. C., as follows: Item 1, being price under 700 ft.; item 2, price per ft., over 700 ft.: W. T. Peterson, Madison, Wis., item 1, $4.50; item 2, $4.50; completed by Aug. 1, 1912. S. Swenson Artesian Well Co., Minneapolis, Minn., item 1, $1,191; item 2, $1.74; completed by Aug. 1, 1912. W. H. Cater Contracting Co., Chicago, Ill., item 1, $2,300; item 2, $3; completed by July 22. J. F. McCarthy, Minneapolis, item 1, $2 per ft.: item 2, $2 per ft.; completed within 60 days. Griffith & Walker, Zion City, Ill., item 1, $1,645; item 2, $2.35; completed in 45 days.

Mississippi.

The citizens of Yazoo City, Miss., on May 17 voted against the issuance of bonds in the sum of $30,000 for the purpose of installing water meters and adding another boiler to the water plant.

Nebraska.

✣Bids will be received until 8 p. m., June 8, by Village of Hyannis, Nebr., for the construction of a water system. It will consist of furnishing and laying 1,800 feet of 6-in. mains, 4,124 ft. of 4-in. mains; furnishing and setting 12 fire hydrants; furnishing and erecting 1 15-h.p. gasoline or distillate engine, 1 vertical deep well pump, 1 80,000-gal. concrete reservoir, 1 concrete block building, 800 ft. hose, hose cart, 2 Callahan nozzles and fire bell; furnishing all material and sinking 8-ft. tubular well. Engineer's estimate, $8,000. A certified check of 5 per cent of the amount of the proposal on a regular Nebraska National or State bank and payable to the Village Treasurer of Hyannis, Neb., must accompany each proposal. Plans and specifications are on file with Village Clerk C. K. Bassett of Hyannis, Neb., and with the Alamo Engine & Supply Co., engineers, Omaha, Neb., where they can be examined. All contractors desiring copy of the plans and specifications for their own personal use can obtain a copy from the engineers for $5.

The citizens of Coleridge, Nebr., at a recent election voted the issuance of bonds to the extent of $8,500 for the purpose of extending the water works and erecting a new stand pipe.

New Jersey.

The City Council of Stanhope, N. J., has deferred action on the question of introducing a resolution calling a special election to vote on authorization of the installation of a municipal water plant and the issuing of bonds amounting ao $30,000. The Council voted to offer $9,000 for the water pipes of the Rockland Water Co., now in use.

New Mexico.

A movement is on foot to encourage the building of a water works system in the town of Aztec, N. Mex.

New York.

✣Bids will be received until 11 a. m., June 12 by Capt. F. T. Arnold, Constructing Quartermaster, Fort H. G. Wright (Fisher's Island) N. Y., for the construction of 34 reinforced concrete cisterns ranging from 5,255 to 15,549 gals. each. complete with downspout, overflow, drains, pumps and suction lines.

✣Bids will be received until 3 p. m., June 15, by W. R. Wadsworth, President of the Water Commission, Geneseo, N. Y., for building a distributing reservoir and appurtenances and laying cast iron water pipes between same and existing reservoir at Geneseo, N. Y. Plans and specifications are on file with the President of the Water Commission.

The taxpayers of Voorheesville, N. Y., at a recent election voted against the establishing of a new pumping station to pump water into the lower reservoir.

The Boston & Albany Railroad Co. plans the construction of a water and coaling station at Mellenville, Columbia County, N. Y., at an estimated cost of $7,500. F. B. Freeman, Boston, Mass., is Chief Engineer.

The citizens of Albion, N. Y., will vote May 31 on the proposition of issuing bonds in the sum of $130,000 for the installation of a municipal water works system. If the proposition carries Consulting Engineers Witmer & Brown of Buffalo, N. Y., will prepare plans and supervise the construction.

The Common Council of Rochester, N. Y., has authorized the construction of dykes at Hemlock and Canadice Lakes, together with a conduit connecting the two lakes to increase the storage capacity of the lakes. This work is to be preliminary to the construction of a third conduit from Hemlock Lake to the city.

Ohio.

⊙Henry R. Worthington Co., New York City, has been awarded the contract by J. McCarthy, Director of Public Service, Newark, O., for furnishing one direct connecting steam engine driven centrifugal pump of 5,000,000-gal. capacity. The contract price is $1,029. The pump will be set up by the city. Bids were opened May 16.

City Engineer F. M. Lillie of Youngstown, O., has forwarded plans for improvements to the filter plant, costing approximately $125,000, to the State Board of Health for approval. The plans were prepared by Assistant City Engineer N. E. Hawkins.

Oregon.

⊙John Keating of Portland, Ore., has been awarded the contract for the construction of the city water works at Monmouth, Ore.

Mayor Stieb of Milwaukie, Ore., has appointed a special committee to make a thorough investigation of the water works proposition. It is proposed to bond the town for the purpose of installing a system.

The City Council of Hillsboro, Ore., has granted a franchise to the Washington-Oregon Corporation permitting it to bring mountain water into the city, and it is expected that a pipe line will be in operation, tapping Sain Creek, 17 miles southwest of the city, inside of 90 days. The company intends putting in a storage reservoir near Dilley.

Pennsylvania.

✣Bids will be received until 4 p. m., June 7, by Borough Engineer, Tarentum, Pa., for furnishing the necessary labor and material for constructing distributing system for the borough. The work will include the following approximate quantities: 16,630 ft. of 4-in c. i. pipe, Class C, 11,870 ft., Class B, 11,270 ft. of 6-in. c. i. pipe, Class C, 14,320 ft., Class B; 420 ft. of 8-in. c. i. pipe, Class C; 1,460 ft., Class B; 1,320 ft. of 10-in. c. i. pipe, Class C; 930 ft. Class B, 2,840 ft. of 12-in. c. i. pipe, [illegible] 2650 ft., Class B. 25 [illegible] hydrants, complete; 55 4-in. valves with c. i. boxes 40 6-in. valves with c. i. boxes, 2 8-in. valves with c. i. boxes, 4 12-in. valves with c. i. [illegible] plugs, 30,530 ft. to be laid under paving. Proposals must be addressed to [illegible], Borough Clerk, and contain a certified check of 2 per cent of amount bid. Plans, specifications and blank forms for proposals may be procured at the Borough Building.

The Manheim Township Water Co., Manheim, Pa., has been incorporated with a capital stock of $7,500 for the purpose of supplying water to the people living adjacent to the Lancaster and Lititz turnpike. The directors are: Allan A. Herr, Paris R. Hostetter and Reah R. Stauffer.

The Water Board of Steelton, Pa., has asked the Borough Council for an appropriation of nearly $7,000, to be used for improvements to the pumping station.

Fred C. Dunlap, chief of the bureau of water, Philadelphia, Pa., is preparing plans for the improvement of the West Philadelphia water supply. Changes will be made in the Belmont filters which will increase the filtration capacity from 40,000,000 gals. a day to 60,000,000 gals. This will necessitate the construction of a pipe line to carry the water from Belmont to the Georges Hill reservoir. Three hundred thousand dollars will be appropriated from the new loan for the work.

The borough of Phoenixville, Pa., has employed Chester & Fleming, Hydraulic Engineers, Pittsburgh, Pa., to supervise the construction of a 3,000,000-gal. mechanical filter plant in accordance with plans prepared by the engineers.

Rhode Island.

✣Bids will be received until 11 a. m., June 22, by Bureau of Yards & Docks, Navy Department, Washington, D. C., for fresh water supply pipe (under water) at the naval torpedo station, Newport, R. I.

South Carolina.

Plans are being prepared by Consulting Engineer Gilbert C. White of Charlotte, N. C., for the installation of a water works system in Cheraw, S. C., at an estimated cost of $47,000. Contracts will be let as soon as plans are completed. The Commissioner of Public Works will be in charge of the work. D. L. Freeman is Clerk.

An election wil be held in Camden, S. C., on June 14, for the purpose of voting on the issuance of bonds in the sum of $[illegible] for the installation of a water works system and electric lights. Plans have been prepared for the work. The water supply will be secured from Little Pine Tree Creek. G. G. Alexander is City Clerk and Treasurer.

South Dakota.

A special election will probably be held in White, S. Dak., in the near future to vote on the proposition of installing a system of water works.

At a recent meeting of citizens of Ethan, S. Dak., a petition was signed authorizing the Town Board to contract for the installation of a water works system.

Texas.

⊙Shutt & Co. of Dallas, Tex., have been awarded the contract by the Atchison, Topeka & Santa Fe Railroad Co., for the sinking of an 8-in. deep well just south of the power house at the shops in Cleburne, Tex.

The citizens of Palacios, Tex., at a recent election voted the issuance of bonds in the sum of $25,000 for the purpose of purchasing, rebuilding and extending the city water works.

Capitalists of San Benito, Tex., represented by Capt. S. A. Robertson, Gen. Agent Lynch and C. E. McLellan, Chief Engineer of the San Benito & Rio Grande Ry. Co., have made a proposition to the Rio Grande City Commercial Club to erect and maintain a large plant to furnish a waterworks system throughout the city, as well as to establish an ice plant and electric light system.

Assistant City Engineer Eugene Couch of Dallas, Tex., has completed plans for the new power plant for the Oak Cliff waterworks station. The building is to be of concrete and brick construction, fireproof throughout, and the architectural design similar to the White Rock pumping station.

Virginia.

✣Bids are being received by the American Boulevard Corporation, Norfolk, Va., for the construction of 4,000 ft. of 6-in. water pipe as mentioned under Roads and Streets in this issue. Arthur C. Freeman, Jr., Norfolk, Va., is Consulting Engineer.

Washington.

✣Bids will be received until 11 a. m., June 6, by Capt. J. R. Pourie, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for laying 4-in. cast iron water [illegible] making certain service connectio at Fort Worden, Wash.

⊙The Jahn Contracting Co., Rai [illegible] Seattle, Wash., has been awarded t [illegible] by the Board of Public Works o that city for the construction of water ma [illegible] Ave., South et al., at $28,693.

Wisconsin.

⊙The W. L. Thorne Co. of la [illegible] Wis., has secured a sub-contrac from M. Roherty for the drilling of a 12-in. ell in the village of Belleville, Wis.

The City Council of West End, Wis. has decided to extend the city wer ma [illegible] about 6,000 ft.

Canada.

✣Bids will be received at once [illegible] Commissioners, Berlin, Ont., for [illegible] foll ing additions to the water works t B [illegible] Ont.: (a) 500,000-gal. elevated wa [illegible] (b) covered concrete reservoir [illegible] including 8,000 cu. yds. of excavati.

The citizens of Battleford, Sask., a [illegible] election indorsed two by-laws for e [illegible] diture of $150,000 as follows: $100, [illegible] tending electric light and power la [illegible] waterworks and sewerage, and [illegible] granolithic sidewalks.

Messrs. J. G. Sing, Chairman of [illegible] Board; Willis Chipman, Secy.: Iam [illegible] dolph, Chicago, Ill., and T. Aird M [illegible] ronto, water experts for the city (Tor [illegible] Ont., have submitted their report th [illegible] Council on the proposed improvem ts [illegible] waterworks system. A summary [illegible] port, recommending improvements [illegible] lows: Construct an additional w [illegible] system in the vicinity of Scarboro [illegible] an estimated cost of $5,320,000. [illegible] crib of the new system to be laid [illegible] from shore and seven miles rom Morley Ave. sewage disposal wks [illegible] vide a chlorination plant for [illegible] in connection with the filtrat [illegible] The capacity of the reservoir to [illegible] 000 gallons, the water to gravitate [illegible] boro' Heights to the city through a [illegible] duit. All the city below College [illegible] supplied by gravitation from Scarb [illegible] north of College to be served by [illegible] Plains pumping station. Duplicate [illegible] filtration plant, duplicate the intak pip [illegible] continue the present service, the imov [illegible] to cost $1,620,000. Prevent waste (wate [illegible] meters at a cost of about $1,140,00

SEWERAGE AND GARBAGE DISPOS

Alabama.

✣Bids will be received until 10 a. m., June 25, by Board of Commissioners, First Sewerage District, W. J. Sandoz, Secy., Birmingham, Ala., for the construction, complete, of system of sanitary sewers, comprising about 10 miles of 18 to 6-in. pipe sewers with ordinary accessories and Imhoff purification plant. Certified check for 3 per cent; the bid must be filed. Walter G. Kirkpatrik, 703 Farley Bldg., Birmingham, Ala., is Engineer.

⊙Sullivan, Long & Haggerty of Bessemer, Ala., have been awarded the contract by the City Commission of Mobile, Ala., for sanitary sewer extensions at $49,905. Other bids submitted were: P. W. Mulvahill, $85,995; Jett Bros.' Contracting Co., $92,173; J. W. Curley & Co., $53,077; F. H. Fleming & Co., $57,509.

The City Council of Alabama City, Ala., is preparing to build a water and sewerage system and wishes to make it a comprehensive one so that, ultimately, it might be used by Gadsden, Alabama City, and the steel works.

The city of Mobile, Ala., will sell bonds June 10 in the sum of $60,000 for the purpose of extending the sewer system. Bids will shortly be asked on the construction work.

California.

City Engineer Homer Hamlin of Los Angeles, Cal., in his report to the Board of Public Works, has estimated the cost of a complete storm water sewer system for the city, with the necessary outfalls or extensions of the main trunk sewers at $9,300,235. This cost is intended to cover 37 separate drainage areas, comprising 68,782.5 acres.

The Board of City Trustees of Fullerton, Cal., has accepted the preliminary plans for a sewer system. W. J. Renshaw is City Engineer.

The city of Sausalito, Cal., will let contracts in about 90 days for the construction of new sewers and extending the present sewer system, estimated to cost $50,446. The work will include laying 15,107 ft. 6-in. pipe; 8,898 ft. 8-in. pipe; 5,859 ft. 10-in. pipe; 1,684 ft. 12-in. pipe; 900 ft. 14-in. pipe; 300 ft. 16-in. pipe; 600 ft. 18-in. pipe; 460 ft. 22-in. pipe, and 600 ft. 24-in. vitrified iron stone sewer; 33 manholes, 94 lampholes; reinforcement of 1,640 ft. at outlet intide water. H. W. Cadwell is City Engineer.

The city of Hermosa Beach, Cal., has taken over the sewerage plant which was owned by the Hermosa Beach Land & Water Co.

Engineer F. H. Olmsted of Olm [illegible] lelen, Wright & Callender Bldg., L [illegible] Cal., has declared the proposition [illegible] outfall sewer from the San Gabr [illegible] the ocean for the accommodation [illegible] and 17 other cities of this district [illegible] preliminary steps should be taken [illegible] in the way of securing this improvement [illegible] D. Reavis is President of the Outl [illegible] Association.

F. A. Garland has been empl [illegible] City Council of Santa Barbara, C [illegible] as [illegible] neer in charge of the proposed se r sys [illegible] A system with two outlets, one by avit [illegible] one by pump is being agitated.

Bids as follows have been receid [illegible] Bureau of Yards and Docks, Na De [illegible] ment, Washington, D. C, for [illegible] garbage crematories at the navy y ds, [illegible] Sound, Norfolk, Va., and at the na l tr [illegible] station, San Francisco: (1) pric for [illegible] crematories, complete; (2) price [illegible] tory at the Norfolk navy yard; ([illegible] pri [illegible] crematory at the Puget Sound [illegible] (4) price for crematory at the na tr [illegible] station, San Francisco; (5) price [illegible] tories, complete, under bidder's sp ifica [illegible] Morse-Bulger Destructor Co., 39 Cortlan [illegible] St., New York City, (2) $6,875. [illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Co., 1508 Burt St., Omaha, Ne
25; (2) $8,875; (3) $5,750; (4) $1,-
arie Incinerator Co., 345 McKnight
mneapolis, Minn., (5) $10,000. (Cha-
rs, 714 Fulton Bldg., Pittsburgh, Pa.,
, Lewis & Kitchen, 900 Michig
cago, Ill., (1) $21,282; (2) $8,400
, (4) $3,780; (5) Norfolk, $2,000
und, $1,900; San Francisco, $800.
gineering Co., 63 Oliver St., Boston,
) $7,775. Dickson Engineering &
ng Co., 209 Nasby Bldg., Toledo, O.,
50, (2) $4,500; (3) $6,050; (4) $
Norfolk, $7,500; Puget Sound, $9,-
Francisco, $4,040.

Connecticut.

of Waterbury, Conn., will let
om time to time during the
the construction of tile pip
an estimated cost of $20,000. R
is City Engineer.

District of Columbia.

ill be received until 10:30 a. m.,
Maj. F. C. Boggs, General Pur
er Isthmian Canal Commission,
n, D. C., for furnishing under Can-
713, steel rope, structural steel, riv-
hammers, galvanized buckets, door
or mats, belt lacing, vitrified sewer
tar pitch and lumber.

Florida.

be received until noon June
y Board, State of Florida, at
of Maj. F. G. Yerkes, Secy., 1620
St., Jacksonville, Fla., for the
on of a sanitary sewerage system
2 miles of 6 to 12 in. pipe, man
tanks, etc. W. W. Lyon, 305
lg., Jacksonville, Fla., is Consult-
r

of Trade of Fort Lauderdale,
tes bonding the town for the in-
a sewerage system.

ive been prepared by City Engineer
rris of Apalachicola, Fla., for the
extensions to the sewer system and
g laterals. The estimated cost is
he work will be done by the city.

Idaho.

nance has been introduced in the
il of Pocatello, Ida., calling for the
lateral sewer district No. 7, cover-
mber of blocks in the northwestern
y.

ness men of Kellogg, Ida., recently
eting and decided to go ahead with
ction of a sewer through the busi-
ict. The citizens recently voted
issuance of bonds in the sum of
system of sewers.

Illinois.

will be received by the Board of
provements, Chicago, Ill., Ed. J.
cretary, until 11 a. m., June 7, for
labor, materials, etc., necessary to
sewers in the following streets:
d Ave., 300 lin. ft. 12-in. internal
verage cut 9 ft.; High St., 270 lin.
2.0 ft.; Potomac Ave., 670 lin. ft.
ft.; W. 70th St., 235 lin. ft. 12-in.,
house drains, 150 lin. ft. 6-in., 6 ft.;
k Ave., 1,670 lin. ft. 3½-ft. double
13.0 ft., 1,010 lin. ft. 3.0-ft. double
12.0 ft.; Burnside Ave., 396 lin. ft.
ole invert brick, 10.5 ft.; Calumet
n. ft. 15-in. 9.0 ft., 670 lin. ft. 12-in.,
89th Pl., 670 lin. ft. 10.5 ft., 670
n., 8.5 ft.; E. 90th St., 670 lin. ft.
ft., 670 lin. ft. 12-in., 8.0 ft.; E.
'0 lin. ft. 15-in., 9.0 ft., 670 lin. ft.
ft.; E. 9st Pl., 670 lin. ft. 15-in.,
lin. ft. 12-in., 7.5 ft.; N. 47th Ct.,
15-in. 11.0 ft., 1,340 lin. ft. 12-in.,
lin. ft. 15-in. 11.0 ft.; South Park
in. ft. 2½-ft. double invert brick,
5 lin. ft. 2.0 double invert brick,
lin. ft. 18-in. double strength, 11.5
St., 670 lin. ft. 15-in., 10.0 ft., 670
n., 8.0 ft., 450 lin. ft. 12in. 10.0 ft.;
670 lin. ft. 15-in., 10.5 ft., 670 lin.
[illegible]
10.5 ft., 670 lin. ft. 12-in., 8.0 ft., 270 lin. ft. 12-in., 7.5 ft.; E. 91st Pl., 670 lin. ft. 15-in., 10.5 ft., 670 lin. ft. 12-in., 8.5 ft., 270 lin. ft. 12-in., 9.0 ft.; Argyle St., 780 lin. ft. 4.5-ft. double ring brick, 12.5 ft., 560 lin. ft.4.0 double ring brick, 12.5 ft., 725 lin. ft. 3.0-ft. double ring, 12.0 ft.; Evanston Ave., 300 lin ft. 2.5-ft. double ring, 10.0 ft., 300 lin. ft. 12-in., 8.5 ft., 640 lin. ft. 18-in double strength, 10.0 ft., 640 lin. ft. 15-in., 10.5 ft., 1,000 lin. ft. 18-in. double strength, 10.5 ft.; Kenmore Ave., 370 lin. ft. 15-in., 9.0 ft., 370 lin. ft. 12-in., 8.0 ft., 400 lin. ft. 15-in., 9.5 ft., 270 lin. ft., 12-in., 9.5 ft.; Winthrop Ave., 1,000 lin. ft. 18-in. double strength, 10.0 ft., 370 lin. ft. 15-in., 9.0 ft., 370 lin. ft. 12-in., 8.0 ft., 410 lin. ft. 15-in., 9.5 ft., 270 lin. ft. 12-in., 9.5 ft. The work includes construction of manholes, catch basins, maintenance of pavement, etc.

⊙J. E. & B. S. Crane, Gracis and 11th Sts., Murphysboro, Ill., have been awarded the contract by the Board of Local Improvements of that city, for the construction of West Side Sewer Extension No. 2 at $2,700. The work includes approximately 3,300 ft. of 8 to 10-in. vitrified pipe sewer. Bids were opened May 18. R. A. Rollo, City Engineer.

⊙The E. R. Harding Co., of Racine, Wis., has been awarded the contract by the Board of Local Improvements of Sandwich, Ill., for the construction of a system of sanitary sewers at $38,301. The work will comprise the following quantities: 3,410 ft. of 18 in., 260 ft. of 15 in., 2,050 ft. of 12 in., 4,950 ft. of 10 in., 25,300 ft. of 8 in. and 3,900 ft. of 6 in. tile pipe sewer with 126 circular 3-foot manholes, 10 flush tanks, 552 ft. of 12-in. outlet drain and a sewage purification plant. W. S. Shields Co., Hartford Bldg., Chicago, is Engineer. Bids were opened May 21.

⊙Henry Maffioli, Rockford, has been awarded the contract by the Board of Local Improvements of Rockford, Ill., for extensions of the sewer on Harlem and Daisy Aves. The estimated cost of the Harlem Ave. job is $3,000 and that of the Daisy Ave. work $3,500.

A movement is on foot in Peotone, Ill., to establish a sewerage system for the village.

The Walter H. Zimmerman Co., Consulting Engineers, 38 S. Dearborn St., Chicago, Ill., has been making surveys for the installation of a sewerage system for the town of Earlville, Ill.

⊙Goodwin & Ryan of Springfield, Ill., have been awarded the contract by the Board of Local Improvements of Hamilton, Ill., for the complete construction of a system of sanitary sewerage at $14,000. Bids were opened April 30 by Hu[illegible] P. Kinkade, Secy. of Board.

⊙The following contracts for furnishing the labor, materials, etc., necessary to construct sewers have been awarded by the Board of Local Improvements, Chicago, Ill., Edward J. Glackin, Secretary: Byron St., Simon Ryan, 2927 W. Congress St.; Darwin Terrace, George Poutorelli, N. 48th Ct., Al Scully, N. 57th Ave., Geo. Poutorelli, S. Green St., Geo. Poutorelli, S. Green St. De Vito Passarelli and Tirtilli; W. 36th Pl., A. Notordonato; N. Kedzie Ave., Wm. F. Healy, Reaper Block; W. 41st St., Oakley Ave., and alley east of Western Ave., M. Poutorelli, 4817 W. Dakin St.; Constance Ave., Canini Roberts; Avondale Ave., N. Central Park Ave., S. Ryan, Ridgeland Ave., C. Roberts; Saginaw Ave., M. J. McNamara; Yates Ave., M. Poutorelli; Greenwood Terrace, Mont Clare Ave., A. Notordonato; E. 71st St., Yates Ave., M. Poutorelli; Houston Ave., Illinois Ave.; Jno. W. Brunt, 2447 E. 74th St.

The City Council of Jerseyville, Ill., contemplates extending the sewer from South State St., east to Maple Ave., and north to the Bluff Line road, then south through the Snedeker farm.

The street, alley and drainage committee of the City Council, Minonk, Ill., plans the construction of a drainage system in the town. Sewer pipe ranging in size from 12 to 18 ins. will be used.

City Engineer E. F. Harper of East St. Louis, Ill., has submitted plans and specifications to the Board of Local Improvements for the Winstandley sewer district, which will be an auxiliary of the $750,000 outlet sewer now being completed.

A preliminary survey was made last week in Maroa, Ill., for the purpose of estimating the cost of a sewer system.

The Board of Local Improvements of Molire, Ill., has confirmed the proposed 25th St. sewer and water system. The system will serve that territory lying between 11½ and 18½ Ave., and between 23d and 26th Sts.

Mayor Bean of Streator, Ill., in his annual address to the City Council urged the laying of a sewer in the Coal Run Creek. Fred H. Renz is City Engineer.

The citizens of Plano, Ill., have voted in favor of the proposition to install a sewer system. H. D. Hallett of Aurora, Ill., is Consulting Engineer. The work will be in charge of the Board of Local Improvements.

Bids were received as follows May 13th, by the Board of Local Improvements, Chicago, Ill., E. J. Glackin, Secretary, for furnishing the labor, materials, etc., necessary to construct sewers in the following streets: Byron St., 300 lin. ft., 12-in., $107, total $321, Geo. Pontorelli; Darwin Terrace, 930 lin. ft., 12-in., $1.14, total $1,060, S. Ryan, 2927 W. Congress St.; N. 48th Ct., 270 lin. ft., 12-in., $1.48, total $400, Al. Scully; N. 57th Ave., 610 lin. ft., 15-in., $1.55, total $945, G. Pontorelli; Green St., 700 lin. ft., 12-in., $1.27, wing sewers, 70 lin. ft. 12-in., $1.22, total $974, G. Pontorelli; Green St., 370 lin. ft., 12-in., $1.50, total $555, De Vito, Passarelli & Tirtilli; N. Kenzie Ave., 630 lin. ft., 15-in., $1.45, 680 lin. ft., 12-in., $1.35, total $1,831, Wm. F. Healy, Reaper Blk.; W. 36th Pl., 510 lin. ft., 12-in., $1.29, total $658, A. Notordonato; Wrightwood Ave., 300 lin. ft., 12-in., $1.32, total $396, G. Pontorelli; W. 41st St., 530 lin. ft., 15-in., $1.60; S. Oakley Ave., 640 lin. ft., 12-in., $1.09; aley east of Western Ave. 890 lin. ft., 12-in., $1.23, total $2,640 M. Pontorelli 4817 W. Dakin St.; Constance Ave., 610 lin. ft., 15-in., $1.90, 670 lin. ft., 12-in, $1.66, wing sewers, 140 lin. ft., 12-in., $1.40, total $2,467, C. Roberts; Avondale Ave., 710 lin. ft., 20-in., double strength, $1.85; N. Central Park Ave. 620 lin. ft., 15-in., $1.43, 500 lin. ft., 12-in., $1.22, total $2,810, S. Ryan; Ridgeland Ave., 640 lin. ft., 15-in., $1.70, 670 lin. ft., 12-in., $1.50, wing sewers, 140 lin. ft., 12-in., $1.20, total $2,261, C. Roberts; Saginaw Ave. 670 lin. ft., 20-in., double strength, $2.28, 670 lin. ft., 19 in., double strength, $1.91, 670 lin. ft., 15-in., $1.57, 630 lin. ft., 12-in., $1.39, total $4,742, M. J. McNamara; E. 70th St., 180 lin. ft., 3.0-ft. brick double ring, $6.00; Yates Ave., 670 lin. ft., 18-in. double strength, $1.98; 670 lin. ft., 15-in., $1.63; 565 lin. ft., 12-in., $1.25; 640 lin. ft., 18-in. double strength, $2.00; E. 71st St., 510 lin. ft., 15-in., $1.63; 510 lin. ft., 15-in., $1.25; total, $10,237, M. Pontorelli; Greenwood Terrace, 160 lin. ft., 15-in., $1.45; Mont Clare Ave., 670 lin. ft., 15-in., $1.45; 670 lin. ft., 12-in., $1.35; total $2,108, A. Notordonato; Houston Ave., 500 lin. ft., 15-in., $2.50; Illinois St., 1,220 lin. ft., 12-in., $2.00; Bond Ave., 1,020 lin. ft., 15-in., $2.50; total $8,340, Jno. W. Brunt, 2447 E. 74th St. The contracts have not been awarded.

Indiana.

✣Bids will be received until 4 p. m., May 31, by Board of Public Works, Terre Haute, Ind., for the construction of a sewer in 23rd St. W. A. Thornton is Secretary of the Board.

The Board of Public Works of Elkhart, Ind., has confirmed resolutions for the building of five sewers, located as follows: Arcade Ave., from Albama St. to South Blvd.; on Indiana Ave., from Eden St. to Main St.; on Fulton St., from Pleasant St. to Michigan St.; on Laurel St., from Pleasant St. to Michigan St., and on Maple Row, from Pleasant St. to Michigan St.

The City Council of Goshen, Ind., has passed a resolution providing for the construction of a sewer on the West Side, from Riverside Blvd., 700 ft., west of the West

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Baptist church, and run east to Dewey Ave., thence northeast on Dewey Ave. to Indiana Ave. and Lincoln Ave., thence north on Indiana Ave. to the Elkhart river, emptying into that stream at a point near the Chicago-Detroit Bag Co.'s bridge. The estimated cost is $10,000.

The Board of Public Works of South Bend, Ind., has adopted resolutions for the construction of three new sewers, as follows: Trunk sewer on Eddy St., from Jefferson Blvd. to Division St.; trunk sewer on Mishawaka Ave., from 16th St. to the Sample St. bridge, and a sewer on Main St., from Indiana Ave. to Ewing Ave.

The city engineer has been instructed by the City Council of Washington, Ind., to prepare plans and specifications for a sewer on Southeast 5th St.

Wendel W. Chaffin, Asst. City Engineer of Fort Wayne, Ind., is preparing plans for the construction of new sewers to cost about $15,000. The work will include brick and pipe sewers. The work will be in charge of the Board of Public Works, Henry W. Becker, Clerk.

The city engineer of Ligonier, Ind., is making plans providing for a trunk sewer to be run under the subway while under construction.

Iowa.

⊙C. B. McNamara Co. has been awarded the contract at Dubuque, Ia., for the placing of a sewer on Wood St. by the City Council at $0.61 per ft. for an 8-in. tile pipe, $28 for manholes and $40 for drop manholes.

⊙Oliver J. Kringle of Elkader, Ia., has been awarded the contract by the Town Council of Ashton, Ia., J. W. Clark, Clerk, for the construction of 1,360 ft. of 10-in. pipe, 1,640 ft. of 8-in. pipe and 1,200 ft. of 6-in. pipe; 12 ft. of outfall pipe, bulkhead concrete, 40 ft. of vitrified outfall pipe and 11 manholes. The contract price is $2,181. Bids were opened May 21.

⊙The Blackhawk Construction Co., of Waterloo, Ia., has been awarded the contract by the city of Waverly, Ia., F. A. Lee, City Clerk, for the construction of storm sewers as follows: 1,360 ft. of 24-in.; 660 ft. of 18-in.; 1,187 ft. of 15-in., and 1,430 ft. of 12-in. sewer. The contract price is $9,800. Bids were opened May 14.

Plans have been prepared by City Engineer E. F. Bridges of Oskaloosa, Ia., for the construction of about three miles of 8-in., 10-in. and 12-in. vitrified pipe sewers, to cost approximately $8,000. The contract will probably be let in June.

The City Council of Ottumwa, Ia., has rejected all bids received May 6 for the construction of certain trunk and main sewers in the city.

The City Council of Des Moines, Ia., has orered plans prepared for a sewer in University Ave., from 37th to 39th St. The system will require a pumping station.

The city of Des Moines, Ia., has purchased from India T. Phegley 35 acres of ground in the Chesterfield district to be used for a site for a sewerage disposal plant.

The City Council of Charles City, Ia., has been petitioned to call a special election to vote upon a municipal pumping station and the extension of the sewerage. The city will be bonded for $50,000 if the issue carries.

The City Council of Sibley, Ia., has decided to install a sewerage system at an estimated cost of $4,500. M. Tschirgi of Dubuque, Ia., is Engineer.

A special election will be held in Holstein, Ia., on June 6 for the purpose of voting on the proposition of installing a sewerage system.

Kansas.

Plans have been completed for the construction of a storm water sewer system for Newton, Kan., estimated to cost $25,000. The entire city has been divided into two districts, and the area to be drained will be 470 acres. There will be about three miles of sewer tile laid, ranging from 12 to 48 ins. in diameter.

The City Commission of Iola, Kan., has established Sewer District No. 14. The district includes about three blocks north of Jackson Ave., and east of First St. Work will be started at once.

Louisiana.

⊙The Sewerage and Water Board of New Orleans, La., has awarded the contract for the lining and covering of the canal in Claiborne Ave., from Elysian Fields Ave. to Lafayette Ave. to W. J. Comerford.

The Board of Commissioners of the First Sewerage District, Opelousas, La., have sold $40,000 bonds, and bids will be asked for construction of a system of sewers in about 30 days. Walter G. Kirkpatrick, 703-704 Farley Bldg., Birmingham, Ala., is Engineer.

Maryland.

Governor Goldsborough of Maryland has appointed a committee of Maryland citizens to co-operate with a committee representing the district in the preparation of plans for the draining of Maryland towns bordering on the District of Columbia line through the district sewers.

The citizens of Preston, Md., at a recent election voted to bond the town for not more than $7,000 to construct a sewerage system. The sewer will empty into Linchester River, about one mile distant. Alexander Noble is a member of the Board of Commissioners.

Massachusetts.

⊙The Department of Public Works of Boston, Mass., has awarded George J. Regan the contract for the construction of pipe sewers and drains in Hilburn St., between Clarendon Ave. and Metropolitan Ave. and in Clarendon Ave. between Hilburn St. and a point 180 ft northwesterly, West Roxbury, at $1,664.

⊙McCarthy & Walsh have been awarded the contract by the Department of Public Works of Boston, Mass., for sewerage works in Cabot st., Marble St., Newbern St., Warwick St., Westminster St., Weston St. and Weston Pl., Roxbury, at $9,725. Other bidders were: Michele De Sisto & Co., $9,735; John McCourt & Co., $9,832.

The Selectmen of Monson, Mass., have decided to call a special town meeting to accept the act by the Legislature authorizing the town to construct a system of sewerage.

The city of Lowell, Mass., will construct new and make extensions to the present system of sewers by day labor. The estimated cost is $50,000. Some plans have been prepared. Stephen Kearney is City Engineer. Geo. H. Brown, Commissioner, will have charge.

Michigan.

⊙The contract for the construction of a sewer on Butler St., between Washtenaw and Genesee Sts., city of Lansing, Mich., has been awarded to Fitzpatrick, Fisher & Noyce at $5,800.

⊙Payne & Curry have been awarded the contract by the Village Council of Otsego, Mich., W. G. Conlan, Clerk, for the construction of sewers in North and Hammond Sts., at $8,718. Bids were opened May 20.

The citizens of Sturgis, Mich., at a recent election voted the issuance of bonds in the sum of $57,000 for the construction of a sewerage system.

Minnesota.

✣Bids will be received until June 11 by Common Council, Morris, Minn., for the construction of a sewer as follows: District No. 16, on 5th St., consisting of 1,412 ft. of 8 in. sewer, 4 manholes and one line of 4 in. drain tile. District No. 21 on 10th St. and Pacific Ave., consisting of 1,597 ft. of 8-in. sewer, 3 manholes and 1 flush tank and 1 line of 4-in. drain tile. Plans and specifications are on file and blank proposals may be obtained at the office of the City Clerk of Morris, Minn., and of Loweth & Wolff, Consulting Engineers, St. Paul, Minn. C. B. Burkee is City Clerk.

✣Bids will be received until June 4 by City Council, Stillwater, Minn., for the construction of 2,578 ft. of pipe sewer on The pipe will be 6 in., 8 in. and 24 vitrif L. W. Clarke is City Engineer.

⊙The City Council of Willmar, linn., has let the contract for the construcn of the proposed new sewer system to V B. Bosworth of Ada, Minn., at $27,500. ther bidders were: F. Desourmux Consttion Co., Mankato, Minn., $33,500; Henry Welzium, Dows, Ia., $32,500; J. H. Roberts, rookings, S. Dak., $33,200; Fraser & Danfort St. Paul, Minn., $32,000; G. S. Redmond, Pipestone, Minn., $29,930; Pastoret Lawrenc Co., Duluth, Minn., $37,919; L. W. Schrt, Fargo, N. Dak., $33,604; Paulson Ditch & Construction Co., Cottonwood, Minn., wiout tank, $25,831, and Peterson & Geer, sc ing tank only, $3,500.

⊙Frank H. Gray of Fergus Fa, Minn., has been awarded the contract b the City Council of that place for the makg of extensions to the sewer system at $27 Bids were opened May 20. S. A. Levor, Clerk.

⊙E. T. Webster, 437 Beacon Ave Minn., has been awarded the contraby H Hayes, Comptroller, University of innesota, Minneapolis, Minn., for the construion of a sewer from a point near the Agricultural School, St. Anthony Park, to coect with the city sewer, corner Cleveland ar. Scudder Ave., at $4,049. Bids were opened

The council committee on sewer of Minneapolis, Minn., has recommended th a storm sewer be constructed at Upton Avenue and St. to drain the district known as [illegible] Lake. The estimated cost is $10,00

The Village Council of Hibbing, instructed the city engineer to lay u and specifications for a sewer to bu summer at an estimated cost of $7,00

Missouri.

⊙T. K. Wood has been awarded the tract by the City Council of Joplin, M the construction of a sanitary sewe trict No. 9, intended to afford sewer ties for the lowland district in the the Frisco depot.

The City Council of Joplin, Mo ported, has passed an order providi redistricting of the sewer system oth It is proposed to install a storm ter s tem. A. B. Cooke is City Engineer

The Board of Health of Kansas ty, has passed a resolution declaring that w be to the city's interest to let a co a private concern which would colle pose of the garbage at a reduction plant be built. The board plans to let the con for 10 years and will submit advertisement bids at once. W. P. Motley is Pre ent

Nebraska.

⊙The Anderson Friedman Constr of Omaha, Nebr., has been award tract by Capt. C. A. Matrin, Quar Fort Crook, Nebr., for the laying mately 800 ft. of 10-in. sewer outlet Bids were opened May 13.

New Jersey.

✣Bids will be received until 8 June 11, by City Council, South N. J., for the construction of the icsville section of the sanitary s tem of the city. A certified check must be filled with each bid. R is City Clerk.

⊙The contract for a complete r of the sewer system of Salem, N. J. awarded by the Common Council t lantic Construction & Supply Co. o City, N. J., at $61,372. The work miles of sewer system and must be by Dec. 1.

⊙The Lane Paving Co., of Atla N. J., has been awarded the contr Common Council of Ventnor City City, N. J., for the construction of $5,121. The work includes: 1,000 pipe sewer; 1,000 ft. 10-in. pipe sev ft. 8-in. pipe sewer; 21 manhole

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

nd outlet pipe. Bids were [illegible] W. I. Risley is City Engineer.

ity Council of South Amboy, N. J., [illegible] Mack, Clerk, has [illegible] all [illegible] April 30 for the [illegible] echanicsville section of the sanier system of the city on account [illegible]

ing bids were received May 14 by alley Sewerage Commission, Essex inton St., Newark, N. J., Wm. M. hief Engineer, for the construction n 15 of the Main Intercepting Sewer, [illegible] The approximate quantities of the as follows: Section 15: 3,445 lin. [illegible] about 35 ft. in depth, [illegible] crete sewer in tunnel; 2,750 lin. ft. crete sewer in tunnel; 4,500 cu. yds. [illegible] excavation in trench, (1) stands for enlon Contracting Co., Brooklyn, C. B. Clark & Co., Baltimore, Md.; F. Brackett, Ridgewood, N. J.; (4) Shanley Co., Newark, N. J., and arson & Son, Inc., New York City:

[illegible]						
[illegible]						
excavation and refill, in [illegible]						
nry in tunnel	6,200 cu. yds.	7.80	10.25	18.00	20.00	20.00
in manholes and appurtenances work	200 cu. yds.	12.00	16.00	15.00	15.00	20.00
vation in trench	1,500 cu. yds.	3.00	1.50	4.00	4.00	3.09

New York.

will be received until 11 a. m., y Board of Sewer Commissioners, [illegible] sewer on South Broad St. and e., the approximate quantities for about as follows: 600 lin. ft. of wer, average cut of 7 feet; 1,250 10 in. sewer, average cut of 7 feet; ft. of 8 in. sewer, average cut of 7 0 lin. ft. of 6 in. underdrain; 2 ks; 12 manholes; 65 lin. ft. extra g under D. L. & W. R. R. Also nstruction of a sanitary sewer on ., Taylor Ave., and a Lane from to Grove Ave., the approximate of which are about as follows: [illegible] 0 lin. ft. 6 in. underdrain, 4 manlushtanks; 400 cu. yds. extra filling Ave. and Lane. The above work mmenced within ten days after contract and completed on or ctober 1, 1912, excepting South which is to be completed on or ug. 1, 1912. A. B. Packer is secre-

Board of Contract and Supply of N. Y., has awarded the contract er in Jennings and Goodman Sts. to eder & Hicks Contracting Co. at $21,-

llage Council of Lestershire, N. Y., d an agreement to co-operate with f Binghamton, N. Y., in the pronstruction of the Downsville-Lester-er. The taxpayers will vote on the n.

ing Engineer Rudolph Hering of k City is completing plans for the on of the intercepting sewer and isposal plant for the city of Albany. allace Greenalch is Commissioner of orks. Frank R. Lanagan is City

J. Fort, Chief Engineer of Sewers in N. Y., and George T. Hammond, in charge of designing under Mr. e left for Europe to study sewerage

[illegible] system in Brooklyn. The city has recently ap- [illegible]

North Carolina.

✣[illegible] 18, by the Councilman of Water and Sewerage, W. E. Perdew, Wilmington, N. C., for furnishing the necessary labor and material for the construction of about 38 miles of vitrified concrete and cast iron sewers from [illegible] tenances and sterilizing plant. F. F. Pillet is City Engineer.

[illegible] ern States Engineering Co., of Chattanooga, Tenn., for the construction of new sewers in [illegible] is official in charge.

The citizens of Monroe, N. C., have voted bonds in the sum of $30,000 for the installation of a sewerage system.

Ohio.

✣Bids will be received until June 10 at noon, by Circleville, O., for the extension of the sanitary sewer system including the following approximate quantities: 3,548 ft. of 8-in. pipe; 766 ft. of 10-in. pipe in place; 795 ft. of 12-in. pipe in place; 2,593 ft. of 15-in. pipe in place; 398 ft. of 18-in. pipe in place; 10 manholes; 4 flush tanks. Louis Schneider is Director of Public Service and O. W. Stiles, Circleville, O., is Consulting Engineer.

Chief Engineer M. J. Bahin has submitted plans, profiles and estimates on several projects to Service Director Edward Schaefer of Springfield, O., covering the Indian Run storm drain, Wheldon ditch, etc. The laying of the Indian Run storm drain from Snyder park to the Highlands will cost approximately $161,228; storm sewer in Henry St., from Lagonda Ave. to Lowell St. and in Lowell St. to the creek, approximately $9,085; Wheldon ditch drain into Mill Run, $63,252.

The Department of Public Service of Cambridge, O., will let contracts about July 6 for the making of extensions to the sewer system at an estimated cost of $17,500. The work will include 2,805 ft. 12-in. vitrified sewer, 1,534 ft. 8-in. vitrified sewer, 429 ft. 10-in. sewer, 4,000 ft. 5-in. house drains, 530 ft. 6-in. cast iron pipe and 100 ft. 12-in. cast iron pipe; also the installation of an ejector plant and the building of the house for the same. Karl M. Cosgrove is City Engineer.

The city of Reading, O., will let contracts about September of this year for the construction of 55,000 ft. of new sewers at an estimated cost of $55,000. Vitrified pipe will be used and brick manholes. D. S. Hesbrook, Pickering Bldg., Cincinnati, O., is Engineer.

City Engineer G. A. Crayton of Lima, O., on May 14 completed plans for extending the sewer system of the city 2,000 ft. with 15-in. pipe. The contract for this work will probably be let in August.

The Sewer Committee of the City Council, Lima, O., has recommended the construction of a new trunk sewer in the west end to relieve the Timberlake sewer, joining the latter where it turns on North St., and running south on Charles St. to the east end of Lakewood Ave. The sewer would be of vitrified tile and would cost about $35,000. G. A. Crayton is City Engineer.

Oklahoma.

Steps have been taken to amend the Indian appropriation bill so as to obtain a specific appropriation of $35,000 for the construction of a sewer through Platte National Park, Sulphur, Okla.

Oregon.

⊙The City Council of Portland, Ore., on May 10 awarded the contracts for the construction of both branches of the Sullivan's gulch sewer system, as follows: Giebisch & Joplin, Portland, branch No. 1, $66,202; K. Sauset, branch No. 2, $72,771. Both tubes will be laid with stone block inverts.

City Engineer Tom Hurlburt of Portland, Ore., has prepared plans for the Tolman Ave. branch of the Eastermoreland sewer system. The cost is estimated at $36,373 for reinforced concrete and $36,185 with cement sewer pipe.

The City Council of Klamath Falls, Ore., has made arrangements for holding a special election for voting on the issuance of bonds in the sum of $125,000 for the construction of sewers.

Pennsylvania.

The Borough Council of Dunmore, Pa., has passed an ordinance providing for the building of Section T sewer at an estimated cost of $5,000.

The Borough Council of New Kensington, Pa., has purchased a site for the erection of a sewage disposal plant from the Burrell Improvement Co. of Pittsburgh. The plant will cost about $40,000.

State Commissioner of Health Samuel G. Dixon has notified the borough of Somerset, Pa., that it must construct a sewage disposal plant before July 1, 1915. Until that time the borough will be permitted to empty its sewage into Cox's Creek. Charles I. Shaver is Secretary of the Town Council.

Henry Gross, Engineer for the Board of Public Works of Harrisburg, Pa., will commence the preparation of plans for the river front sewer as soon as surveys are completed. James H. Fuertes of New York City is Consulting Engineer.

The City Council of East Mauch Chunk, Pa., has approved the plans prepared for the construction of a sewer system.

The Borough Council of West Chester, Pa., has authorized the Sewer Committee to make arrangements to lay 16,000 ft. of sewer pipe along the central streets of the town to connect with the new outfall sewer, which is about completed to Washington and New Sts., and runs to the northern disposal plant and septic beds in East Bradford Township.

Engineer M. B. Briese of Wyoming, Pa., has prepared a comprehensive sewerage map of the borough of Charleroi, Pa. Sewerage plans are being prepared by Borough Engineer Alexander Gray. A sewage disposal plant will be constructed.

The City Councils of York, Pa., has approved the plans of City Engineer Geo. A. Warner for improved trap inlets for the city's system of storm water sewers. The inlets are to have two openings at the surface of the street.

South Carolina.

All of the sewer work under way and that already planned for in the city of Columbia, S. C., will be done by day labor. F. C. Wyse is Engineer-Superintendent. A. D. Barnes, City Clerk.

Plans are being prepared by Consulting Engineer Gilbert C. White of Charlotte, N. C., for the construction of a sewer system in Cheraw, S. C., at an estimated cost of [illegible] The work will be in charge of the Public Works Commissioner. D. L. Freeman is Clerk.

Tennessee.

Messrs. Hunt & Houston of Memphis, Tenn., representatives of construction and bonding companies, respectively, it is reported, have secured a franchise from the City Council of Malvern, Ark., to install a sewerage and waterworks system.

Texas.

⊙Mayfield & Shaw of Lawton, Okla., have been awarded the contract by Capt. R. B. Reamy, Constructing Quartermaster, Fort Bliss, Tex., for furnishing labor and material for the construction of a 4-in. sewer. Bids were opened May 20.

An election was held in Calvert, Tex., on May 28 for the purpose of voting on the issuance of bonds in the sum of $25,000 for the installation of a sewer system, and an election in the precinct to vote bonds to the amount of $150,000 for good roads.

City Engineer von Zuben of Fort Worth, Tex., has urged the City Commission to construct four drainage sewers to cost from $20,000 to $50,000. They are at the vicinity of 6th Ave. and Murphy St., in the 8th ward, at Carson and Mimosa Sts., between 8th Ave. and Hemphill St. on Rosedale St., in the 7th ward, and a sewer in the business district from 13th and Houston Sts. over 13th St. to Calhoun and north over Calhoun and Jones to 9th St.

Engineer M. C. Welborn, in charge of sewer construction in Austin, Tex., has submitted a statement to the City Council embodying an estimate of the worth of the plant of the Austin Sewerage Co., and advises the purchase of the plant at $100,000. The engineer's estimate of the plant is as follows:

4,170 ft. 21-in. standard vit. clay pipe..	$ 16,114
10,297 ft. 15-in. and 10-in. standard vit. clay pipe ...	29,791
8,005 ft. 12-in. standard vit. clay pipe...	10,084
68,401 ft. 8-in. standard vit. clay pipe...	45,556
50,702 ft. 6-in. standard vit. clay pipe...	22,011
52,806 ft. 4-in. standard vit. clay pipe...	8,792
Removing and replacing [illegible] sq. yds. of paving	[illegible]
Sixty manholes	1,500
Twenty lampholes	300
Ten flush tanks	250
	$142,182
Deduct for surplus and useless lines	4,54[illegible]
	$137,642
Deduct [illegible] per cent for deterioration	$ 16,382
	$121,260
Deduct present worth of paid connection	2,36[illegible]
Total cost to replace system	$118,89[illegible]

Business men of Bartlett, Tex., are organizing a stock company for the purpose of installing a sewer system, $10,000 having already been subscribed.

An election will be held in Calvert, Tex., on May 28, for the purpose of voting on the issuance of bonds in the sum of $25,000 for sewerage.

Virginia.

⊙Guild & Co., Chattanooga, Tenn., have been awarded the contract by the Board of Control of Norfolk, Va., for the construction of sewers in the Ninth and Tenth Wards of the city at $167,769. The work includes three pump wells, manholes, flush tanks, and 20, 18, 16, 15, 12, 10 and 8-in. terra cotta pipes. Bids were opened May 22. W. T. Brooke is City Engineer.

Washington.

✣Bids will be received until 8 p. m., June 3, by E. P. Holgren, City Clerk, Stanwood, Wash., for the construction of a sewer system. Plans and specifications may be had of Rutherford & Whitford, 648 New York Block. The work will include laying 1,000 ft. of 78-in., 400 ft. of 10-in. sewer pipe and constructing 12x60x6 ft. concrete reservoir at Stanwood.

Plans have been approved by the Board of Public Works at Spokane, Wash., for the construction of a sewer system in the district south of Mainto Park. The estimated cost is $23,000.

⊙The contract for the construction of a sewer system in Kennewick, Wash., has been awarded by the City Council to the Northwestern Construction Co., of Spokane, Wash., at $40,000.

⊙The city of Walla Walla, Wash., W. R. Rehorn, City Engineer, has awarded the contract for sewer work to the Sutherland Co., at $5,531. The work will include the following: 2,355 ft. 10-in. sewer, 3,900 ft. 8-in. sewer, 35 10-in. Y's extra, 124 8-in. Y's extra, 21 manholes, 90 ft. of 8-in. cast iron soil pipe and 5 flush tank castings. Other bidders were: Heuser & Elbury, $6,839. Dion Eric, and Xura Case, $7,694.

⊙The Northwest Construction o., Realty Bldg., Spokane, Wash., has been arded the contract by the City Council of ennewick, Wash., for the construction of eig mile city sewers at $37,899. The sewer will be of concrete with brick manholes.

West Virginia.

⊙H. C. Brooks Constructi Co., of Clarksburg, W. Va., has been arded the contract by the Mayor and C of Kingwood, W. Va., for the ton of 20,708 ft. of 8-in. sani sewer with all connections. Bids we opened May 11.

Wisconsin.

⊙The Russell Construction Co. has awarded the contract by the Ci sion of the proposed main sewer Park from Susquehanna to Elm $24,533.

⊙Frank Mansfield of Lake Mill W. been awarded the contract by Board of Johnson Creek, Wis., f struction of sanitary sewers an ances. The work includes 4,500 lin sewer, 15 regular manholes of br ular manholes of concrete, 5 dro 2 lampholes and Imhoff tank opened May 16.

A committee of the City Council Lac, Wis., has been appointed to different systems of sewage dispos structions to recommend type of p city. After the system has been an estimate of cost is to be made issue or other method of financing sition voted on. J. S. McCullou Engineer.

Canada.

⊙McLaren Co., 65 Cumberland ronto, Ont., has been awarded t for the construction of a sew works for the House of Refuge Ont., for which bids were opened Neil F. Macnachtan, County Clerk T. Aird Murray, 303 Lumsden Bld is Engineer.

The City Council of Orillia, t., p the laying of an additional thr sewers this summer

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC

California.

✣Bids will be received until 11 a. m., June 10, by Constructing Quartermaster, Fort Mason, Calif., for installing electric light distributing system at the Letterman General Hospital Presidio of San Francisco, Calif.

Connecticut.

✣Bids will be received until 2 p. m., June 15, by Capt. A. E. Waldron, U. S. Engineer, New London, Conn., for turbine generators, condensers, synchronous converters (or motor generators) and voltage regulator.

District of Columbia.

✣Bids will be received until 11 a. m., June 3, by Capt. P. F. Archer, U. S. Marine Corps, Mills Bldg., Washington, D. C., for furnishing 1 mountain transit, 1 Y level, 1 level rod, 1 table place and 50 lbs. plain table paper.

✣Bids will be received until 2 p. m., June 7, by Bureau of Engraving and Printing, Washington, D. C., for furnishing oils, etc., during the fiscal year beginning July 1, 1912.

Hawaii.

✣Bids will be received until 10 a. m., June 14, by B. F. Cheatham, Quartermaster, Honolulu, H. T., for building material, including flooring, wire screening, mill work, roofing and hardware.

Idaho.

⊙The American Falls Power Co. has awarded a contract to James A. Green & Co., 111 W. Monroe St., Chicago, Ill., for the erection of a power plant at American Falls. The contract price is said to be $250,000, but additions contemplated to the original contract and which will be decided upon in the next 60 days, will run the total cost of the contract close to the half million dollar mark. The plant, which is to be constructed at once, will furnish additional power to Pocatello. The buildings, raceway and the dam to be built will be sufficient to generate a total of 35,000 hp., although but one unit of 5,000 hp. will be installed at present. The contractors for the work have sublet all of the contracts for the furnishing of the materials and machinery of the plant. The contract for the water wheel to be used in furnishing motive power to run the generators and dynamos was let to the Allis-Chalmers Co. of Milwaukee, at a cost of $35,000, and the contract for the generators, transformers and all other electrical supplies was given to the General Electrical Co. of New York, at a cost of $35,000. The contract for the installation of the hydraulic and electrical equipment was given to the Lynch-Cannon Co. of Salt Lake, which will commence the in the machinery as soon as the Jame & Co. has completed the buildin power stations, which will be about ov this year. The dam and raceway w be c pleted about Jan. 15 of next year.

Illinois.

✣Bids will be received until 3 9, by James Knox Taylor, Supervis tect, Treasury Department, Wash C., for the extension, remodeling, ing plumbing, gas piping, heating electric conduits and wiring, inter fixtures, and approaches of the Un postoffice at Evanston, Ill. The wo plated is a one-story basement and extension of approximately 3,300 s ground area, fireproof construction, ing and tin roof, and certain remo repairs of present building. Dra specifications may be obtained from todian of site at Evanston, Ill., discretion of the Supervising Arch

Bids for constructing and furnish oline launch were received May 15 McGann, Commissioner of Public W cago, Ill. The Weckler Boat C Park Blvd., Chicago, Ill., was low b a bid of $3,900.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Iowa.

Parks Co. of Omaha, Neb., have [illegible] building at Council Bluffs, Ia., [illegible] owner Positive Print Machine o., Omaha. Harry W. Mool Co. were awarded the contract for and ornamental iron, Bayley [illegible] forcing, and reinforcing bars. [illegible]

Louisiana.

[illegible] ew Orleans by J. F. Coleman, Con- [illegible] n terminal and warehouse in that eport recommends that the cotton th through and local be treated to- concentrated at one location. The ses that trackage in the way of a rd for the handling of both the the through business be pro- [illegible] ed at one end of the yard, and that ses be located about in the center l and behind the proposed wharf l that the wharf be 4,000 ft. long; [illegible] stent with the business to be hand- [illegible] will be believed to be necessary for g of such business as may be ex- ch of these facilities may be in- xtension or by adding other ware- may be desired. It is proposed that nd shed be built by the Dock Board [illegible] he warehouse account. The follow- d costs were given:

ation of 1911 business:	
[illegible]	[illegible]
[illegible]	[illegible]
[illegible] and [illegible]	
[illegible]	[illegible]
	$2,590,000
ation of 1907 business	
[illegible]	2,320,000
[illegible]	696,000
[illegible]	[illegible]
[illegible] tracks for	
[illegible]	[illegible]
and equipment	2,951,000
	30,000
	[illegible]
ness of:	
ts (bales)	3,100,000
[illegible]	[illegible]
[illegible]	[illegible]
	315,000
[illegible] for	
tton	100,000
[illegible]	[illegible]
	$5,702,000

ouis & San Francisco R. R. is pre- for the construction of the new lips at New Orleans.

Maryland.

[illegible] until June [illegible] s, Springfield State Hospital for at the office of Owens & Sisco, 1605 Continental Bldg., Baltimore, e erection of a dining hall and the women's group and for the [illegible] Sykesville, Md.

opened May 15 by Lt. Col. W. C. S. Engineer, Baltimore, Md., for out 131,500 cu. yds. of material iconico River in Maryland, the rbor Improvement Co., Philadel- 16.8 cts. per cu. yd. being the low

ll be received until 3 p. m., July Knox Taylor, Supervising Arch- ury Department, Washington, D. C., for the extension, remodeling, etc., including plumbing, gas piping, heating apparatus, [illegible] Mich. The work contemplated is the construction of a one-story basement and attic extension of approximately 1,900 sq. ft. ground area; fireproof construction, stone and brick facing and tin roof; and certain remodeling and repairing of the present building. Drawings and specifications may be obtained from the custodian of site at Traverse City, Mich., or at the discretion of the Supervising Architect. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until 3 p. m., July 10, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring system and interior lighting fixtures of the United States postoffice at Lansing, Mich. The extension is about 38 by 74 ft., two stories and basement, stone faced, slate roof, fireproof construction. Drawings and specifications may be obtained from the custodian at Lansing, Mich., or at the discretion of the Supervising Architect.

Minnesota.

✣Bids will be received until June 10 by John Flaschenriem, Village Recorder, Olivia, Minn., for furnishing one 50 to 75-h.p. oil engine to be installed at the electric light plant.

⊙Barnett & Record, Minneapolis, Minn., have been awarded the contract for constructing an extension of the Pittsburgh Coal Co.'s Dock No. 5 on Allouez Bay. The Duluth-Superior Dredging Co., has the contracts for the dredging. The extension is to be 1,200 ft. and the width 450 ft. The estimated cost of the improvement will be approximately $300,-000.

Mississippi.

✣Bids will be received until 2 p. m., June 8 (postponement of date from May 9), by E. H. Turner, Secy., Columbia, La., for the construction of school building in accordance with plans and specifications by Xavier A. Kramer, Architect, Magnolia, Miss.

Missouri.

The Secretary of the Mississippi River Commission, 1307 Liggett Bldg., St. Louis, Mo., will shortly invite bids for the fabricated structural steel framing for a shop building 70x160 ft., with truss roof. Specifications and blank form of proposal will be furnished on application.

Montana.

✣Bids will be received until 3 p. m., July 3, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, complete, including plumbing, gas piping, heating apparatus, electric conduit and wiring and lighting fixtures, of the United States postoffice at Billings, Mont. The building is three stories and basement, with a ground area of approximately 7,250 sq. ft. Fireproof construction, stone and brick facing, tin roof. Drawings and specifications may be obtained from the custodian of site at Billings, Mont., or at this office, at the discretion of the Supervising Architect.

Nebraska.

⊙Contract has been let to F. P. Gould & Son of Omaha to erect the Scottish Rite Temple at Omaha. It will be of buff Bedford brick, stone, marble and steel with concrete and wood floors. John Latenser is Architect, Omaha. C. E. Herring is member of Buidling Committee, Omaha Nat'l Bank Bldg. It will be three stories and basement, 96x124, and cost $150,000.

⊙H. L Stevens & Co. of Chicago have been awarded the contract for erection of a brick fireproof theatre for J. L. Brandeis & Sons of Omaha to be leased to Starland Palace (L. & Paul LeMarquand, owners). It will be three stories with basement and sub-basement, retiring rooms for ladies and gentlemen, and all theatre fixtures. It will be 66x132. Cost $85,000. John Latenser [illegible]

The 6-story building at Omaha of the Ames estate was burned with almost a total loss. Walter Petersen of Omaha is tearing down structure, preparatory to either remodeling old building or building new one. Fisher & Lawrie are Architects in either case. Cost about $50,000. W. Farnam Smith, 1320 Farnam St., is the representative of the estate.

The contract for Medical School for University of Nebraska at Omaha has been awarded to John H. Harte of Omaha at $74,377. Reinforcing bars "M/C" bars were awarded to Harry W. Mool Co. of Omaha. J. J. Hannighen of Omaha got the heating contract and Western Heating Co. of Omaha got the plumbing contract. Building will be of brick, stone, marble and steel; will be 4 stories, 104x99. Cost $85,000. Shepley, Rutan and Coolidge of Chicago are Architects. Chas. E. Chowins of Lincoln is Superintendent of Buildings.

New Hampshire.

⊙The Aberthaw Construction Co., Boston, Mass., has received the contract for the erection of new reinforced concrete buildings of the Milton Leather Board Co., Milton, N. H. The main building will be 185x70 ft., with two stories and basement. Adjoining will be a raw stock room 120x40 ft. and 30 ft. high. I. W. Jones, Milton, N. H., is the engineer.

New Jersey.

✣Bids will be received until 11 a. m., June 15, by Maj. R. R. Raymond, U. S. Engineer, Wilmington, Del., for removing wreck of steamer Ranald, lying sunk off Atlantic City, N. J

New York.

✣Bids will be received until noon, June 3, by Col. S. W. Roessier, U. S. Engineer, Army Bldg., New York City, for the installation of dummy armament, fire control stations and accessories in the armory of the 9th coast artillery district, New York.

⊙The Turner Construction Co., 11 Broadway, New York City, has been awarded the general contract for the construction of reinforced concrete oil building for Valentine & Co., at their plant, 364 Manhattan Ave., Brooklyn. This building is 64x33 ft. in plan, two stories in height. The Turner Construction Co. has also been awarded general contract for the construction of reinforced concrete building for the Hartford Suspension Co., on Morgan St., Jersey City, N. J. building to be 75 ft. by 127 ft. in plan, 6 stories in height. Howard Chapman, Architect. The same contractors have also been awarded general contract for the construction of a factory building for James C. Doran & Sons, in Providence, R. I., building "L" shape, having 13,-000 sq. ft. per floor, nine stories in height. Monks & Johnson, Architects. Work on all of these contracts is to be undertaken at once.

⊙Barrows-Stewart Co., 40 Central St., Boston, Mass., has been awarded the contract for the following reinforced concrete structures for the West Virginia Pulp & Paper Co., at Mechanicsville, N. Y.: Sedimentation basin, 325x110 ft., clear water reservoir, 325x85 ft., storage and mixing house, 54x28 ft., filter house, 113x83 ft., pipe line, 1,800 ft. long. F. G. Ten Broeck of 200 Fifth Ave., New York, is Consulting Engineer for the owners.

The State Canal Board has approved plans for the erection of a dam in the Mohawk River at Scotia as a part of the barge canal system at an estimated cost of $888,-553. John A. Bensell, Albany, N. Y., is State Engineer.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

North Carolina.

✣[illegible] ll be received until 3 p. m., June 28, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring system and interior lighting fixtures of the United States postoffice and court house at Reidsville, N. C. The extension will be two stories and basement with a ground area of about 1,470 sq. ft., of nonfireproof construction, brick faced, slate roof. Drawings and specifications may be obtained from the custodian at Reidsville, N. C., or at the discretion of the Supervising Architect.

Ohio.

✣Bids will be received until 3 p. m., July 8, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures of the extension, remodeling, etc., of the United States postoffice at Portsmouth, Ohio. The extension is to be of one and two stories and basement, of approximately 2,100 sq. ft. ground area, brick faced with slate roof, and of nonfireproof construction, except the first floor. Drawings and specifications may be obtained from the custodian of the site at Portsmouth, Ohio, or at the discretion of the Supervising Architect. Official advertisement will be found elsewhere in this issue.

Bids as follows were received May 21 by Lieut. Col. H. Jervey, U. S. Engineer, Cincinnati, O., for construction of five loose stone dikes and shore protection in Ohio River opposite Sisters Island, (1) standing for bid of Hollerbach & May Contract Co., Evansville, Ind., and (2) for bid of Oscar F. Barrett, Cincinnati, O.:

	(1)	(2)
Excavation, 11,[illegible] cu. yds.	[illegible]	[illegible]
Stone, 6 to [illegible] cu. ft. each, [illegible] cu. yds.	[illegible]	[illegible]
Stone, ¾ to 1½ cu. ft. each, 20,100 cu. yds.	[illegible]	[illegible]
Total	[illegible]	[illegible]

Oklahoma.

✣Bids will be received until 7:30 p. m., June 11, by Jesse Field, City Clerk, Hobart, Okla., for the construction complete, except lighting fixtures and steam boiler, of a city hall, auditorium and store building, 70x100 ft. The height of store rooms and auditorium through two-thirds of its length and of four office floors in the other third, no basement. It is non-fireproof construction; brick facing with stone trim; wood cornice, composition roof over auditorium, asbestos shingle roof over rigging loft. After June 1 drawings will be on file with the city clerk of Hobart, the Hanson Bldg. Supply Co., Oklahoma City, The Industrial Record, Dallas, Tex., and W. A. Etherton, Architect, Stillwater, Okla. A certified check for $1,000 will be required with each bid. The usual right to reject any bids.

Oregon.

The following bids were received May 16 by Col. Henry Jervey, U. S. Engineer, Cincinnati, O., for the hire of four dredges for work on the improvement of the Ohio River: The Monongahela & Western Co. to supply three dredges at $135 each per day, the Fieger-Austin Co. to supply one dredge at $135 and the Sheridan-Kirk Co. one at $145 per day.

Pennsylvania.

✣Bids will be received until 3 p. m., July 5, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for an electric push button lift in the U. S. postoffice at York, Pa., in accordance with specifications on file with the Supervising Architect.

✣Bids will be received until 10 a. m., June 3, by Department of Supplies, Philadelphia, Pa., for furnishing the following supplies for the year of 1912: Class B.—Bricks, cinders, etc. Also for the following specials: Boiler tubes for Bureau of Water and four disinfecting wagons for the Bureau of Health.

Bids as follow were received May 11 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a pile and reinforced concrete pier at the navy yard, Philadelphia, Pa.; Riverside Contracting Co., 39 Cortlandt St., New York City, $128,718; C. M. Leach, P. O. Box 2285, Boston, Mass, $152,876; Wm. L. Miller, 71 Alford St., Boston, Mass., $145,400; Edw. F. Fonder, 1116 Land Title Bldg., Philadelphia, Pa., $190,000; American Paving & Contracting Co., 211 S. 9th St., Philadelphia, Pa., $192,475.

South Dakota.

✣Bids will be received until 6 p. m., June 17, by Regents of Education, F. W. Ford, Secy., Elk Point, S. Dak., for erection of a science hall for the Springfield Normal School at Springfield, S. Dak. Jos. Schwartz, Sioux Falls, S. Dak., is Architect.

✣Bids will be received until 6 p. m., June 17, by Regents of Education, Elk Point, S. Dak., for brick boiler house and central heating plant at the State Normal School, Springfield, S. Dak. Joseph Schwartz, Sioux Falls, S. Dak., is Architect.

Texas.

✣Bids will be received until 3 p. m., June 29, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures, of the United States postoffice at Austin, Tex. The building is two stories and basement, stone and brick faced, of fireproof construction (except roof), with a ground area of approximately 15,200 square feet. Drawings and specifications may be obtained from the custodian of site at Austin, Tex., or at the office of the Supervising Architect.

⊙The City Water Power Co., which obtained a franchise from Austin, Tex., several months ago to reconstruct the dam across the Colorado River, install a hydraulic plant and to maintain and operate it for 30 years, has let the contract for the construction work to the William P. Carmichael Co., Liggett Bldg., St. Louis. The cost to the city under the terms of the franchise is to be $1,500,000, to be paid in 50 semi-annual instalments. The dam will be of reinforced concrete and will form a reservoir and pleasure lake about 30 miles long and ¼ mile wide.

Bids were opened May 15 by Maj. Earl I. Brown, U. S. Engineer, Galveston, Tex., for dredging the Houston Ship Channel, the bids received being as follows, (1) standing for bid on Division No. 1 in Galveston Bay, 10,538,000 cu. yds., (2) bid on Division No. 1 in Galveston Bay, alternate route, 12,050,000 cu. yds., (3) bid on Division No. 2 Morgan's Beacon to Vinces Bayou, 6,100,000 cu. yds., (4) bid on Division No. 3, Vincens Bayou to and including turning basin, 4,025,000 cu. yds.: Southern Dredging Co., Mobile, Ala., (4) 24 cts.; Coastwise Dredging Co., (1) 9.3 cts.; Bowers Southern Dredging Co., Galveston, Tex., (1) 8½ cts., (2) 12½ cts., (3) 13½ cts., (4) 19 cts.; L. T. Gaylord, Mobile, Ala., (1) 6.95 cts., (2) 12 cts., (3) 14.9 cts., (4) 18 cts.

C. D. Hill & Co., architects, Dallas, Tex., have been selected by the Dallas City Commission to prepare plans and specifications for the new City Hall to be erected at a cost of about $400,000 for construction only and to face on Harwood St., between Main and Commerce Sts.

Virginia.

✣Bids will be received until 1:30 p. m., June 21, by F. E. Skinner, Treasurer, Southern Branch, N. H. D. V. S., National Soldiers' Home, Va., for furnishing labor and material for remodeling steam heating system, north wing and administration section f hospit Building No. 39.

✣Bids will be received until une 12 b Constructing Quartermaster, For Myer, Va. for removal of oil boilers in post ospital and annex building and substituting w ones.

Washington.

✣Bids will be received until [illegible] Capt. H. L. Kinnison, Quartern ster, Van couver Barracks, Wash., for fu shing one 1-in. Worthington duplex-piston hot water heater, one 12-in. thermometer in brass c[illegible] and one steam plant thermometer

Bids will be received until noon July 1, by Maj. J. B. Cavanaugh, U. S. En eer, Seattle, Wash., for furnishing 200,000 barrels Portland cement. Official advert ment will be found elsewhere in this issue.

Canada.

✣Bids will be received until Ju retary Y. M. C. A., Sault Ste. for the construction of a build place.

⊙The Aberthaw Construction C[illegible] Mass., has been awarded the cont[illegible] the erection of the new group of [illegible] the American Cyanide Co., Nia[illegible] Ont. The building will have conc[illegible] tions with steel frames and con[illegible] and form an extension to the pre[illegible] They were designed by K. F. C[illegible] eral Manager.

⊙A. F. Dobson of Minnedosa, [illegible] been awarded the contract by the [illegible] Power Co., Minnedosa, H. F. Ma[illegible] for the construction of the spill[illegible] penstocks and power house foun[illegible] the company at $34,000. Bids w[illegible] May 10.

The City Council of New Wes[illegible] C., has adopted the scheme to cons[illegible] from the foot of 10th St. to the fo[illegible] vale St., practically the whole city [illegible] A by-law will be prepared to su[illegible] voters.

The
Reinforced Conc
Pocket Book

By L. J. MENSCH, M. Am Soc. C.

Containing Tables, Rules and [illegible] tions for the Convenient D[illegible] Rational Construction and Read Computation of Reinforced Concrete (der Beams, Footings, Columns, etc.

A book written by a trained [illegible] and successful contractor for these engineers and those having a knowledge of mechanics and building construction

Full leather, 216 pages; 4½x6½

Price $4.00 net

The Myron C. Clark Publishi
608 S. Dearborn Street CHICA

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

GRANITOID PAVEMENT

[illegible]

'he Superior of all 'ermanent Pavements.

he Blome Company atented Granitoid oncrete Pavement

[illegible] hic construction. Per- [illegible]

o those interested we will be glad to furnish further details

GRANITOID

TO CONTRACTORS
TO MUNICIPALITIES

Arrangements will be made with reliable contractors in such territory as may be deemed advisable.

Royalty arrangements will be made to provide for competitive bidding. Specifications and particulars cheerfully sent upon request.

GRANOCRETE PAVEMENT

[illegible]

conomical in Cost.

onstructed Upon Corct Principles.

[illegible] Granocrete Pavement is

specially Adapted r Streets of ighter Traffic and ighways

[illegible] "Granrete" construction covthe essential points of e proper kind of surfac- [illegible] insuring s lasting qualities.

[illegible] GRANOCRETE [illegible] automobile and [illegible]

If a low priced pavement is desired, [illegible] ce of a firm long enged in concrete conruction.

GRANOCRETE [illegible]

RUDOLPH S. BLOME COMPANY OWNERS AND CONTRACTORS

GENERAL OFFICES, CITY HALL SQUARE BLDG., CHICAGO, ILL.

ew York, N. Y. New Orleans, La. Birmingham, Ala. Fort Worth, Texas Vancouver, B. C.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SEALED PROPOSALS

For Construction of Cook County Hospital General Work.

Sealed proposals are invited by the Board of Commissioners of Cook County for the furnishing of all labor, materials, machinery, apparatus, implements, etc., except that portion contained in the plans and specifications for plumbing work, required in the erection and completion of the new Cook County Hospital, to be located on blocks 1 and 2 of David Cadwise's Subdivision of the East Seventy-four and Fifty-two hundredths (74.52) acres of the West one-half (½) of the Southeast one-quarter (¼) of Section eighteen (18), Township thirty-nine (39), Range fourteen (14), East of the third P. M., comprising twelve and two hundred fifty-three thousandths (12.253) acres and bounded by Harrison Street on the North, Polk Street on the South, Wood Street on the East and Lincoln Street on the West, in the City of Chicago, and State of Illinois, in accordance with drawings and specifications with addenda No. 1 to said specifications, prepared by Paul Gerhardt, County Architect, which plans and specifications with addenda No. 1 to said specifications may be obtained in my office, Room 519, Cook County Court House, Chicago, Ill.

Contractors desiring to figure on this work must deposit sum of Two Hundred and Fifty ($250.00) Dollars, which must be in the form of currency or certified check made payable to the order of P. J. Murray, Superintendent of Public Service, for each set of plans and specifications, which amount will be receipted for and returned to them upon the return in good order of all plans and specifications.

Proposals must be made on the regular printed form to be obtained in my office, Room 519, Cook County Court House, and must be enclosed in envelope furnished for the purpose, which must be sealed properly indorsed and addressed to P. J. Murray, Superintendent of Public Service, Room 519, Cook County Court House.

Each bid must be accompanied by a deposit of Fifty Thousand Dollars ($50,000), which must be in the form of currency or certified check made payable to the order of Peter Bartzen, President of Board of Commissioners of Cook County, and must be drawn upon some banking institution of good standing doing business in Cook County, which deposit will be returned to the bidder if his bid is rejected or, if his bid is accepted, upon bidder entering into contract with Cook County and giving such bond as may be required for the satisfactory performance of the same within five days from date of notification that said contract and bond are ready for signature. Should the bidder fail to enter into said contract and bond within five (5) days from date of notification that said contract and bond are ready for execution, said deposit shall be retained by Cook County, not as a forfeiture but as liquidated damages which the owner will suffer by reason of such default.

Bids will be received in my office up to 1:00 p. m., Wednesday, June 12, 1912, and must be deposited in the box provided for that purpose, said bids to be transmitted to the Board of Commissioners of Cook County at 2:00 p. m., by whom they will be publicly opened.

No bid will be considered unless the bidder gives satisfactory proofs of his ability to execute an enterprise of this magnitude.

The work called for by the plans and specifications, with addenda No. 1 to said specifications, must be delivered complete in all respects within the time stated in the Instructions to Bidders.

Consideration will be given to proposals for delivering the work complete before the time stated in the Instructions to Bidders.

Firms bidding will give the names of individuals comprising same and corporations bidding will give the names of their executive officers and names of officials authorized to execute contracts on behalf of the corporation.

The right is reserved to reject all bids.

By order of the Board of Commissioners ot Cook County.

P. J. MURRAY,
Superintendent of Public Service.

CONTRACTORS' PLANT FOR SALE.

- 2 65-ton Bucyrus steam shovels, A No. 1 condition, like new.
- 1 Lidgerwood hoist, 7"x10", D. D. D. C., with boiler.
- 1 Mundy hoist, 6¼"x10", D. D. D. C., Wright's swinging attachment.
- 9 Porter dinkies, saddle tank, 9"x14", 3-foot gauge.
- 1 Worthington duplex pump, 6x4x6.
- 2 Shannon guy derricks, mas. 60', boom 55', with guys, lines and bull wheels
- 2 Shannon stiff leg derricks, mast 25', with lines, blocks, etc.
- 4 Standard gauge track laying cars.
- 4 Ingersoll-Rand rock drills, size "D" 32, with steel hose, complete.
- 65 4-yard one-way South Baltimore dump cars.
- 1 3,500-lb. pile driver hammer.
- 1 1, 200-lb. pile driver hammer.
- Lot 56-60-lb. frogs and switches.
- 2 No. 0 Star well drills.
- 1 1½ cu. yd. McKelvey concrete mixer with boiler.
- Lot Dupont's batteries, No. 3-4, all overhauled at factory, good as new.
- 6 Kitson lights, overhauled at factory.
- 54 Contractors' dump carts and harness (Wilson & Childs make).
- 2 Stuebner's bottom dump concrete buckets, capacity 24 feet.
- 4 Stuebner's standard self-dumping buckets, capacity 20 feet.
- 2 25-ton Norton ball bearing jacks, like new, with foot lift.
- 1 Johnson & Hartwell improved sand dryer.
- 1 Yale & Towne 3,000-lb. duplex convertible screw block.

Prices and any other information desired will be given upon application.

D. F. KEENAN COMPANY,
Scenery Hill, Pa.

OFFICE OF CONSTRUCTING QUARTERMASTER.—Fort Huachuca, Arizona, May 9, 1912.—Sealed proposals will be received here until 10 a. m. June 12, 1912, and then publicly opened, for construction complete of eight inch steel water pipe line approximately eight and one-half miles long. Deposit of $10 required to insure return of plans and specifications. Information on application. J. L. JORDAN, Capt. and Quartermaster, U. S. A.

NOTICE TO CONTRACTOR.

Sealed bids will be received un 2 o'clock p. m. on the 31st day of May, 912, by the Auditor of Scott County, Iow for the construction of a new tubular eel pier, the removal of the old pier, straht-ening bent steel work and realignin the superstructure of the steel bridge oss the Wapsipinicon River at the pli- highway along the west side of Sect 6 Township 80 North, Range 2 East be-tween Clinton County and Scott C ty Iowa, all as shown on the plans an le-scribed in the specifications now o fil in the office of the County Audito o Clinton County and on file in the off o the County Auditor of Scott County, va which are hereby referred to and m part of this notice.

All bids must be in sealed env endorsed upon the outside with the ld-der's name and address, must be on proposal blanks furnished by the Au to of Clinton County or by the Audit o Scott County, and be accompanied a certified check in a separate seal velope endorsed upon the outside wit h bidder's name and address, which ti-fied check shall be drawn on some resn-sible bank in Clinton County or ott County, in the amount of one n ($100.00) dollars, payable to the ord o F. W. Leedham, County Auditor of n-ton County, or to the order of Ed. l-lins, County Auditor of Scott Count as security that the bidder whose pro al is accepted will enter into contract win seven (7) days from the date of acct-ance of his bid for the faithful exec on of the work herein specified and gi a bond hereinafter specified, which m shall become the property of C County and Scott County in case of il-ure to enter into a contract and give id bond. The contractor whose propos is accepted shall give a bond with appr ed sureties in the sum of 25 per cent o e amount of his bid.

The counties reserve the right to r ct any or all bids.

Bids will be opened at 2 o'clock p m. on the 31st day of May, 1912, by the -ditor of Scott County, in the office o e County Auditor of Scott County, Da -port, Iowa.

The work embraces approximately e following:

19,400 lbs. steel work.
350 lineal feet wood piling.
36 cu. yds. concrete.

Passed . . . . . .

. . . .
County Audit

. . . .
County Audit

TREASURY DEPARTMENT, OFF OF THE SUPERVISING ARCHITEC— Washington, D. C., May 10, 191— Sealed proposals will be received at is office until 3 o'clock p. m. on the 21st y of June, 1912, and then opened, for e installation of a heating and ventila g apparatus, etc., for the United States t office and courthouse building at Char - ton, W. Va., in accordance with the dr - ings and specification therefor, copie f which may be had at this office or at e office of the superintendent of const tion at Charleston, W. Va., at the dis tion of the Supervising Architect.

JAMES KNOX TAYLOR.
Supervising Architec

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

STREET IMPROVEMENT.

Clinton, Iowa.

posals will be received on [illegible] at 8 o'clock p. m. for paving [illegible]

[illegible]

work includes supplying material [illegible] necessary to construct the e paving and consists of the follow- approximate quantities:

osoted Wood Block Paving:
000 sq. yds. paving.
700 lin. ft. curb and gutter.
Vitrified Block Paving:
000 sq. yds. paving.
700 lin. ft. curb and gutter.
Asphalt Paving:
000 sq. yds. paving.
000 sq. yds. vitrified block paving.
700 lin. ft. curb and gutter.
Concrete Paving:
0 sq. yds. paving
700 lin. ft. curb.

posals must be in sealed envel and be accompanied by a certified k on a responsible bank in the City of on in a separate envelope and pay- to the order of E. B. Chandler, City surer, for the sum of $1,000.00.

nd required equal to 50 per cent of contract price. One of the above four kinds of paving will be selected at the bids are received. Proposals will be ed publicly, the city reserving the t to reject any and all bids.

ns and specifications may be seen at office of the City Clerk or City En-

C. J. REUSCHE,
City Clerk.
J. G. THORNE,
City Engineer.

FOR SALE.

-ton saddle tank Vulcan locomotive.
-ton saddle tank Vulcan locomotive.
yard Austin dump cars.
tons 35 and 40-lb. rails.
00 6x6x6 hardwood ties.
arsh single action pump, 1½x2 in.
[illegible] named property is at Al- bion, N. Y.

Also

-ton Bucyrus shovel, thoroughly overhauled.
ns soft iron and steel.
-ton Norton jack.
number of track jacks.

is property is at Lyell road crossing he Barge Canal in the town of Gates,

of the above named property will be on a chattel mortgage May 29, 1912, o'clock a. m. at the last mentioned

H. E. HAMIL,
Mortgagee's Agent,
Rochester, N. Y.

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aled bids will be received for im- ement of Broadway Paving Distri e city of Pekin, Ill., by Charles Duis- er, President of Board of Local Im- ement, until 2 o'clock p. m., June 5, consisting of 13,770 sq. yds. [illegible] ng on a concrete foundation and as- t filler, 4,900 cu. yds. excavation, 8,700 ft. concrete curb, 2 catch basins and ections. Plans and specifications fur- ed by the City Engineer.

JOHN R. SEIBERT,
City Engineer.

NOTICE FOR BIDS.

Notice is hereby given that sealed bids will be received by the Board of County Commissioners of Twin Falls County, Idaho, up to 10 o'clock A. M., June 17, 1912, for the furnishing of all material and labor for the construction of two steel bridges across Rock Creek Canyon, in Twin Falls County, No. 1 to be located at or near the section line between Sections 21 and 22, Town 10 South, Range 17 E. B. M., and No. 2 at or near the section line between Sections 8 and 9, Town 10 South, Range 17 E. B. M., said bid to be according to specifications furnished by the bidders. Each bid to be accompanied by a certified check in a sum equal to 10 per cent of the amount of the bid; check made payable to the Treasurer of Twin Falls County, Idaho, as a guarantee of good faith on the part of the bidder that if awarded the contract he will forthwith accept the same and will enter into a contract under bond within ten days with the Board of County Commissioners of Twin Falls County, Idaho, and if he fail to do so said guarantee of 10 per cent will be forfeited to said Twin Falls County as liquidated damages to be used for the benefit of the Road and Bridge fund of said county.

Separate bids shall be submitted for each bridge. Bids to be sealed and marked "Proposal to construct Rock Creek Bridge No. 1"; "Proposal to construct Rock Creek Bridge No. 2," addressed to O. G. Zuck, Chairman, and mailed to E. J. Finch, Clerk, Twin Falls, Idaho, so that bids will be on file with said clerk on the date first above mentioned.

Profiles will be furnished on application to the clerk of the Board of County Commissioners. The Board reserves the right to reject any and all bids.

By order of the Board of County Commissioners, Twin Falls County, Idaho.

Dated Twin Falls, Idaho, May 14, 1912.

O. G. ZUCK, Chairman.

Attest:
E. J. Finch, Clerk.

CONCRETE SUB-CONTRACTORS WANTED.

We have about twenty thousand cubic yards of concrete work distributed in small bridges, abutments, headgates, drops, etc., which we will let to responsible contractors in quantities to suit at good prices.

JANSEY BROS.-BOOMER & HUGHES.
1-2 Mackie Bldg.,
Calgary, Alberta.

PROPOSAL.

Fort Bliss, Texas, May 17, 1912.

Sealed proposals in triplicate will be received until 12 Noon, June 10, 1912, and then opened for furnishing labor and material for constructing sewer pipe line connecting outfall sewer at Fort Bliss with sewerage system of El Paso, Texas. Information furnished upon application. Envelopes containing proposals to be indorsed "Proposals for Sewer Pipe Line" and addressed to constructing quartermaster.

CAPT. ROBERT J. REANEY,
Constructing Quartermaster.

NOTICE OF LETTING DRAINAGE CONTRACT.

Sealed proposals for the construction of drainage canals in the Back Swamp and Jacob Swamp Drainage District, near Lumberton, N. C., will be received by the drainage commissioners of said district at Lumberton, N. C., up to 12 o'clock M., June 12, 1912, and at that time they will be publicly opened and read. Each proposal shall be inclosed in a sealed envelope and addressed to the chairman of the Board of Drainage Commissioners of the Back Swamp and Jacob Swamp Drainage District, Lumberton, N. C., endorsed "Proposal for Constructing Drainage Canals."

Each proposal shall be accompanied by a certified check, drawn payable to the order of the chairman of the Board of Drainage Commissioners, in the amount of $1,000; this check to be an evidence of the good faith of the bidder and to be held as liquidated damages in case the award is made and the contract and bond are not entered into promptly. Checks of unsuccessful bidders will be returned as soon as the award is made.

Specifications and blank forms of proposals will be furnished upon application, and a full set of maps, plans and profiles may be seen at the office of the Drainage Commissioners, or at the office of the Attorney for the Drainage Commissioners, at Lumberton, N. C.

The approximate length of these canals is 52 miles, and the approximate yardage to be excavated is 1,240,400 cu. yds. The work must be finished within two years from the letting of the contract and the commissioners will require three dredges to be operated at the same time.

The work will be let either as a whole or in sections, but no bid will be considered for less than one-third of the entire work. Bidders may submit bids for the whole of said work or for one-third thereof. The right is reserved to reject any and all bids.

G. B. SELLERS
Chairman for Board of Commissioners.
THOMAS L. JOHNSON,
Attorney for Drainage District.

TREASURY DEPARTMENT.—Office of the Supervising Architect, Washington, D. C., May 21, 1912. Sealed proposals will be received in this office until 3 o'clock p. m. on the 8th day of July, 1912, and then opened, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures) of the extension, remodeling, etc., of the United States post office at Portsmouth, Ohio. The extension is to be of one and two stories and basement, of approximately 2,100 square feet ground area, brick faced with slate roof, and of non-fireproof construction, except the first floor. Drawings and specifications may be obtained from the custodian of the site at Portsmouth, Ohio, or at this office, at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

Mammoth Hot Springs, Wyo., May 15, 1912. Sealed proposals in triplicate, will be received here until 2 P. M. June 10, 1912, and then publicly opened, for furnishing labor and materials for constructing Annex to Hospital, including plumbing, heating, electric wiring and fixtures, at Fort Yellowstone, Wyo. Information furnished on application. Envelopes containing proposals to be indorsed "Proposals for Annex to Hospital" and addressed to Constructing Quartermaster.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

NOTICE TO PAVING CONTRACTORS.

[illegible] of the Village of Dolton, Illinois, until 8 o'clock p. m. of June 10, 1912, and then publicly opened, for the paving of certain streets as follows: A 16-foot pavement on Lincoln Avenue and Chicago Street, being 630 rods, more or less. Specifications may be had from the Village Clerk [illegible]

Each bid must be accompanied with a certified check for the sum of $1,200.00. The Village Board reserves the right to reject any or all bids received. A real estate bond acceptable to the Village Board for 50 per cent of the contract price will be required.

WILLIAM G. DOLTON,
Village Clerk,
Dolton, Cook County, Illinois.

NOTICE OF CIVIL SERVICE EXAMINATIONS.

Chicago, May 27, 1912.

The Civil Service Commission of the city of Chicago will hold an examination for expert on System and Organization, engineering service in Room 1006 City Hall, Chicago, June 7 and 8, 1912. The salary of this position is $3,000 per annum, and persons living outside of the city will be permitted to take the examination.

Applications will be mailed on written request sent to the Commission, Room [illegible]

The Board of Drainage Commissioners of the Keach Drainage & Levee District of Carrollton, Illinois, will receive plans and proposals for a forty-eight inch pump and engine for their District. Address A. W. Baldwin or Loren McKee, Carrollton, Illinois.

TREASURY DEPARTMENT.—Office of the Supervising Architect. Washington, D. C., May 22, 1912. Sealed proposals will be received in this office until 3 o'clock p. m. on the 2nd day of July, 1912, and then opened, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches) of the United States post office and custom house at Traverse City, Mich. The work contemplated is the construction of a one-story basement and attic extension of approximately 1,900 square feet ground area; fireproof construction, stone and brick facing and tin roof; and certain remodeling and repairing of the present building. Drawings and specifications may be obtained from the custodian of site at Traverse City, Mich., or at this office, at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

Bids will be received by the undersigned up to 12 o'clock noon of Monday, June 17, 1912, for the erection of a creosoted timber or reinforced concrete bridge over Bayou Rapides, near the Red River Oil Co. Plans and specifications on file in the office of J. W. Sylvester, City Engineer, Alexandria, La. Certified check for two hundred dollars should accompany all bids.

Mammoth Hot Springs, Wyo., May 15, 1912. Sealed proposals in triplicate, will be received here until 2 P. M. June 15, 1912, and then publicly opened, for furnishing and installing pews and other furniture in Chapel at Fort Yellowstone, Wyoming. Information furnished on application. Envelopes containing proposals to be indorsed "Proposals for Furniture in Chapel" and addressed to the Constructing Quartermaster.

NOTICE TO SEWER CONTRACTORS.

Sealed proposals for the construction of sanitary sewer and storm sewers and appurtenances in the city of Watertown, Wisconsin, will be received at the office of the board of public works in said city, until Saturday, the first day of June, 1912, at two (2) o'clock P. M.

The work comprises, approximately:

SANITARY SEWERS.

2,627 feet of 8 inch vitrified pipe;
60 feet of 8 inch cast iron pipe;
2,815 feet of 10 inch vitrified pipe;
991 feet of 15 inch vitrified pipe;
16 manholes;
2 ordinary flushtanks;
2 automatic flushtanks;
63 lineal feet of 6-inch risers.

STORM SEWERS.

160 feet of 10 inch vitrified pipe;
365 feet of 12 inch vitrified pipe;
327 feet of 15 inch vitrified pipe;
6 catch basins;
2 manholes.

Plans, profiles, specifications and form of contract may be seen at the office of said board.

ARNOLD KRAEFT,
City Engineer.

Bids will be received until 1 p. m., June 12, at the Court House in Danville, by the Bridge Committee of the Board of Supervisors and the Highway Commissioners of Oakwood Township for the construction of a reinforced concrete arch bridge of sixty foot span, over Minnehaha Creek, in Oakwood Township. Plans and specifications are on file at the office of John F. Fisher, Engineer, 17 West Harrison St., Danville, Ill.

Proposals for the purchase of Steel Lighters, offered for sale by the Isthmian Canal Commission, which are no longer needed. Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., July 3, 1912, at which time they will be opened in public, for the purchase of the above-mentioned articles. Blanks and general information relating to this Circular (No. 709) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State St., New York city; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point St., San Francisco, Cal.; also from the U. S. Engineer Offices in the following cities: Seattle, Wash., Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburgh, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Commercial Club, Tacoma, Wash.—F. C. Boggs, Major, Corps of Engineers, U. S. A., General Purchasing Officer.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., May 15, 1912. SEALED PROPOSALS will be received at this office until 3 o'clock p. m. on the 25th day of June, 1912, and then opened, for the construction, complete (including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures), of the United States post office at Mansfield, Ohio. The building is two stories and basement and has a ground area of approximately 7,800 square feet; first floor only of fireproof construction; tin roof, stone facing. Drawings and specifications may be obtained from the custodian of site at Mansfield, Ohio, or at this office, at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

SEWER CONSTRUCTION

Sealed proposals will be receive by the Sewer Commissioners of Sand nt, Idaho, for the necessary material nd labor in laying about 23,000 fee of Sewers.

Bids will be received until 12 o'ck noon, June 15, 1912, and then pucly opened.

Information on application.

WM. J. COSTELLO, Clerl
Sewer Commissi

NOTICE FOR BIDS.

Plans and Specifications for a syst of Water-Works to cost about $15,000 a on file with the Village Clerk of Louis le Nebr., and the Alamo Engine & S ply Co., Engineers, Omaha, Nebr. All n-tractors desiring a copy of the plans nd specifications for their own persona se can obtain a copy from the Engineer for $5.00. Dated at Louisville, Nebr., Ma 13 1912.

C. A. RICHEY
Chairman of [illegible]

ROAD IMPROVEMENT.

Bids will be received at the office o he County Auditor of Winona County, i-nona, Minn., for the improvement by a-cadamizing of about 21 miles of ad. Plans on file in the office of the C ty Auditor. Engineer, O. B. Leland. ds opened June 18, 1912.

BRIDGES.

Bids will be received at the offi of the County Auditor of Winona Co y, Winona, Minn., up to 4 p. m., June h, for the furnishing and erection of ee highway bridges as follows: One 40-ot, one 30-foot and one 80-foot. Plan on file in the office of the County Audito

O. B. LELAND, Engine

TREASURY DEPARTMEN
Office of the Supervising Arch t,
Washington, D. C., May 16th, 19

SEALED PROPOSALS will be rec ed in this office until 3 o'clock p. m. o he 27th day of June, 1912, and then op d, for the extension, remodeling, etc. (in d-ing plumbing, gas piping, heating a p a-tus, electric conduits and wiring, an n-terior lighting fixtures), of the U ed States post office at Chester, Pa.

The work contemplated is the cons c-tion of a 2-story basement and unfini ed attic extension of approximately 00 square feet ground area. The first or only is of fireproof construction, ext or facing of stone and brick with slate of, and there will be certain repairs an l-terations in the present building.

Drawings and specifications may be b-tained from the custodian at Chester, a., or at this office, at the discretion o he Supervising Architect.

JAMES KNOX TAYLOR
Supervising Archi t.

TREASURY DEPARTMENT, Offic of the Supervising Architect.—Washin n, D. C., May 7, 1912.—Sealed proposals ill be received in this office until 3 o' ck p. m. on the 18th day of June, 1912, d then opened, for the construction, -plete (including plumbing, gas pi g, heating apparatus, electric conduits d wiring, and interior lighting fixtures of the United States post office at Kingfi r, Okla. The building is of one story, e-ment, mezzanine and unfinished attic, d has a ground area of approximately 00 square feet, non-fireproof construc n, stone and stucco facing, and tile f. Drawings and specifications may be -tained from the custodian of site at K -fisher, Okla., or at this office, at the -cretion of the Supervising Architect

JAMES KNOX TAYLOR
Supervising Archite

Engineering & Contracting

Devoted to the Economics of Civil Engineering Design
and to Methods and Cost of Construction

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[illegible] second-class matter, April 17, 1907, at the Post Office at Chicago, Illinois, under act of March 3d, 1879. Copyright, 1912, by the Myron C. Clark Publishing Co.

an Examples of Reinforced Con- te Canal Lock Construction.

[illegible] few European countries in which [illegible] is not more freely used [illegible] is in America. This is particularly [illegible] respect to navigation and in the [illegible] England, where reinforced [illegible] was, because of old restrictive laws. [illegible] it is represented by [illegible] works of a kind of which [illegible] in America are rare. British devel- of reinforced concrete has been, how- y largely the work of engineers of ed Continental European building t evidences, therefore, the character- foreign rather than of native develop- hatever the reason may be, however, is that England possesses marine reinforced concrete which are far an any in America. With Continental [illegible] far more unfavorable ca. It will be understood that we are strictly to reinforced concrete in tements. In the size and number of crete waterway and harbor structures ranks well.

example of the way in which Euro- e venturing in the use of reinforced we may note the two reinforced con- ks built by Russian engineers as de- lsewhere in this issue. One of these perhaps abnormal, but the other is ypical, except for the great length in n to its width. This lock is strictly [illegible] concrete in design and construc- he actual details of the construction in the article and we need only refer such general features as seem to be [illegible] To us there seems to be two lessons: (1) Saving in cost, and eased possibilities of construction on ible foundation beds.

ires barely a glance at the wall and ctions of the Tobel-Kama lock in on with any familiar lock structure on American waterways to show the great difference in mass and the corresponding saving in volume of concrete which the European structure presents. Of course, the saving in cost is not proportional to the difference in the volume of masonry because the reinforced concrete is far the more expensive. There was, however, according to the figures, a substantial saving got by using the structure illustrated instead of one with plain concrete gravity walls. The Russian engineers estimated the difference in cost to be 20 per cent. Strictly speaking, this saving cannot be credited alone to saving in masonry. Much of it resulted from the lesser cost of foundation work, made possible by the lighter weight of the reinforced concrete structure. In this feature we believe lies the chief merit of reinforced concrete for lock construction.

The items favoring cheaper foundation construction would seem to be mainly first, of course, the lighter weight of the structure and consequently the safer use of soils of moderate supporting power as a foundation bed; second the decreased thickness of invert required and consequently shallower excavations for foundations, third, the greater flexibility of the reinforced invert in case of uneven settlement. All of these may be important advantages in many locations where locks may have to be built. They give reinforced concrete a claim for careful consideration in competition with mass concrete in lock construction. To go farther than this in advocating the material is scarcely warranted.

Referring again to the Tobel-Kama lock, we direct attention to the very thin sections used. The wall slabs are nowhere over 8 ins. thick and the same slender proportions exist throughout all the parts of the lock walls and invert. Such sections are characteristic of the reinforced concrete work of European designers and argue a confidence in this material, which, judging from their designs in general, many American engineers seem loth to grant it.

A Supreme Court Decision on the Constitutionality of a Stream Pollution Law.

The Supreme Court of Ohio, in a recent decision, pronounced the "Bense Act" constitutional. The Bense Act is the Ohio law on stream pollution. Since this law is similar to that in force in some other states, the decision of the court on its constitutionality is of wide interest, not only among state board of health officials, but to all sanitary engineers, and others interested in state control of the design and operation of sewerage systems.

The decision is too long to be published here in full. The full text of the decision was published in the Bulletin of the Ohio State Board of Health for April, 1912. It makes very interesting reading. An abstract appears elsewhere in this issue. The objections raised by counsel for the city contesting the constitutionality of the act may be placed properly under the head of technicalities. The technicalities could not withstand the common sense interpretation of the law, in this case, by the supreme court judges.

Some comments of the court may be of interest here. Speaking of the wisdom of withholding from local authorities final discretion over matters relating to local health conditions, the court said:

> While it (a sewage disposal plant) then becomes largely a local improvement, yet it is not one that the state has delegated to the municipal authorities complete and absolute control thereof. The health of the inhabitants of the city is still a matter of concern to the state, and of such vital concern that the general assembly has not thought proper to commit it exclusively to the control and discretion of men who may not have any particular ability or experience in sanitary affairs. The loss of a single life is a direct economic loss to the state, and, therefore, it wisely refrains from com-

mitting to inexperienced people final discre- [illegible] of [illegible] the life and health of its citizens, but aside from the concern of the state for the health and comfort of the residents of any one city, its vigilance seeks to serve a larger purpose. Cities are no longer enclosed by stone walls and separate and apart from the balance of the state. The sanitary condition existing in any one city of the state is of vast importance to all the people of the state, for if one city is permitted to maintain sanitary conditions that will breed contagious and infectious diseases, its business and social relation with all other parts of the state will necessarily expose other citizens to the same diseases.

Under the Ohio law cities in Ohio that sewer into streams bordering on other states, from which unpurified sewage is discharged into the common stream, are not required to purify their sewage. This provision of the act was pronounced constitutional although it apparently makes an unjust distinction between two classes of cities, namely those located on interstate streams and those not so located. The court ruled that it would serve no good purpose whatsoever to require Ohio cities sewering into the Ohio River [illegible] their sewage, when upstream West Virginia and Kentucky cities were discharging sewage into the same stream. This [illegible] tion ultimately will lead to federal control of interstate stream pollution.

GENERAL ARTICLES

Two Examples of Reinforced Concrete Canal Lock Construction in Russia.

Concrete canal locks are extensively used in America. Without exception however these locks are of plain concrete with massive gravity section walls and solid floors differing but slightly from older stone masonry designs. The great locks at Panama, those of the New York State Barge Canal and the numerous smaller structures on American inland waterways are all of this one type. The details which we give here of reinforced concrete locks are, therefore, of novelty and interest. These two locks were built in Russia and are described by Mr. A. Nikolsky, engineer in chief of ways and communications, Schuesselberg, in a report to the International Congress of Navigation, 1912. We condense the following description from this report:

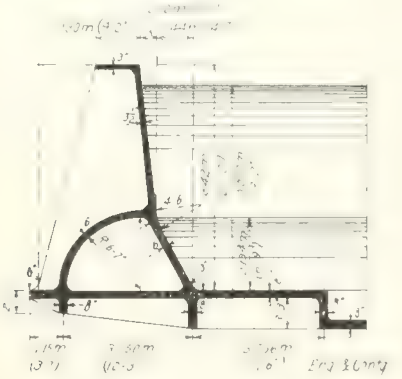


Fig. 1—Diagram of Half Cross-Section of Reinforced Concrete Lock.

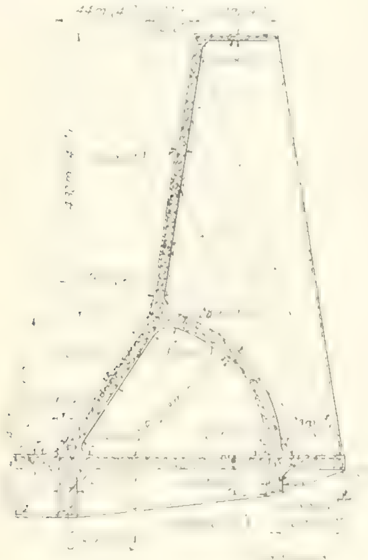


Fig. 2—Details of Reinforced Concrete Lock Wall.

The first lock described is on the waterway which will connect the Tobel and Kama rivers through the Oural mountain range. The lock chambers are 17 m. (55.76 ft.) wide and 275 m. (902 ft.) long. The great length in proportion to the width of this lock was adopted to provide for locking through a tug with its train of barges.

The depth over the sills is 2.3 m. (7.54 ft.) in accordance with the standard draft of vessels adopted on part of the Russian waterway system. The drop at the lock is 3.20 m. (10.5 ft.)

The invert of the lock, similar to the one in the lock of the Harmas-Köros river, is a concrete monolith 1 m. (3.28 ft.) thick, strengthened by reinforced concrete beams 30 cm. (12 ins.) wide, spaced 1.6 m. (5.25 ft.) apart and connected together by a reinforced concrete slab 25 cm. (9.84 ins.) thick which occurs sometimes on the top of the invert and sometimes at the bottom according to whether the bending moment is positive or negative (Fig. 1).

The reinforcement of these beams consists of fourteen 26 mm. (1.02 ins.) round rods in the part in tension and of seven rods of the same size in the part in compression. The invert beams are prolonged at each extremity under the walls of the lock, as shown on the illustration. This provides a continuous foundation common to the invert and the lock walls. The spaces between the reinforced concrete beams are filled with poor concrete in mass.

The lock walls are also built of reinforced concrete and consist of a thin outer vertical slab of varying thickness, namely, 20 cm. (7.87 ins.) from the base up to the water level of the lower reach, and 12 cm. (4.72 ins.) above that point. This vertical slab is supported by buttresses which bear on the invert beams. The outer face of the lock walls have a vertical batter of 1 in 2 in the portion between the invert and the water level of the lower reach and a batter of 1 in 10 in the part above. The top of the walls is 0.50 m. (1.64 ft.) above the water level of the upper reach. It has a coping 1.25 (4.1 ft.) wide and 10 cm. (3.94 ins.) thick and the paving around the lock is brought up close to this coping.

A filling and emptying culvert is provided through the base of the lock wa[illegible] form of a semi-circular arch (Fig. [illegible]), which commences at the water level of [illegible]e lower reach so that the culvert is 2 m. (6.56 ft.) high and 3 m. (9.84 ft.) wide, and [illegible] inforced concrete arch 18 cm. th[illegible] water from the culvert passes into the [illegible] through a series of circular sluic[illegible] 5.40 m. (17.71 ft.) apart.

The culvert is rectangular in section with walls 0.20 m. (0.66 ft.) thick in the portions near the end of the lock. This shape of culvert facilitates the construction of t[illegible] slui[illegible] in the culvert itself and enables a series of small beams to be built so that the lock chamber and the culvert can be completely emptied, if necessary.

We may remark that the whole height of the lower reach has been utilized in the construction of the culvert so that the lock can be filled in the shortest possible space of time.

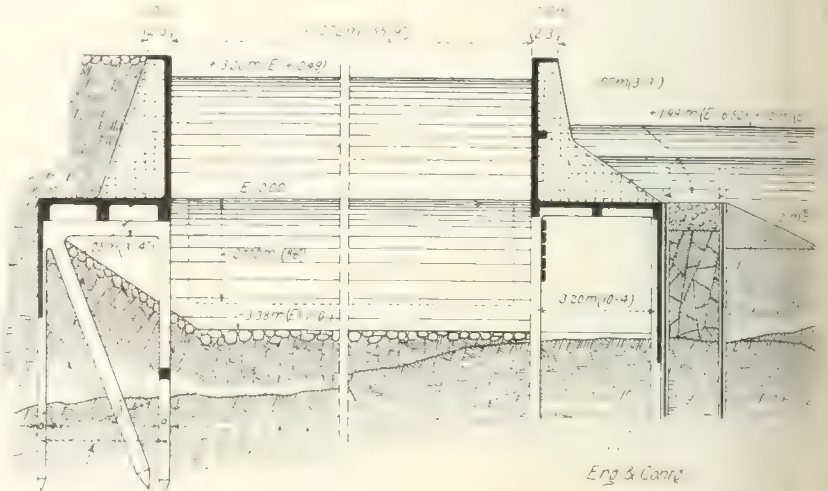
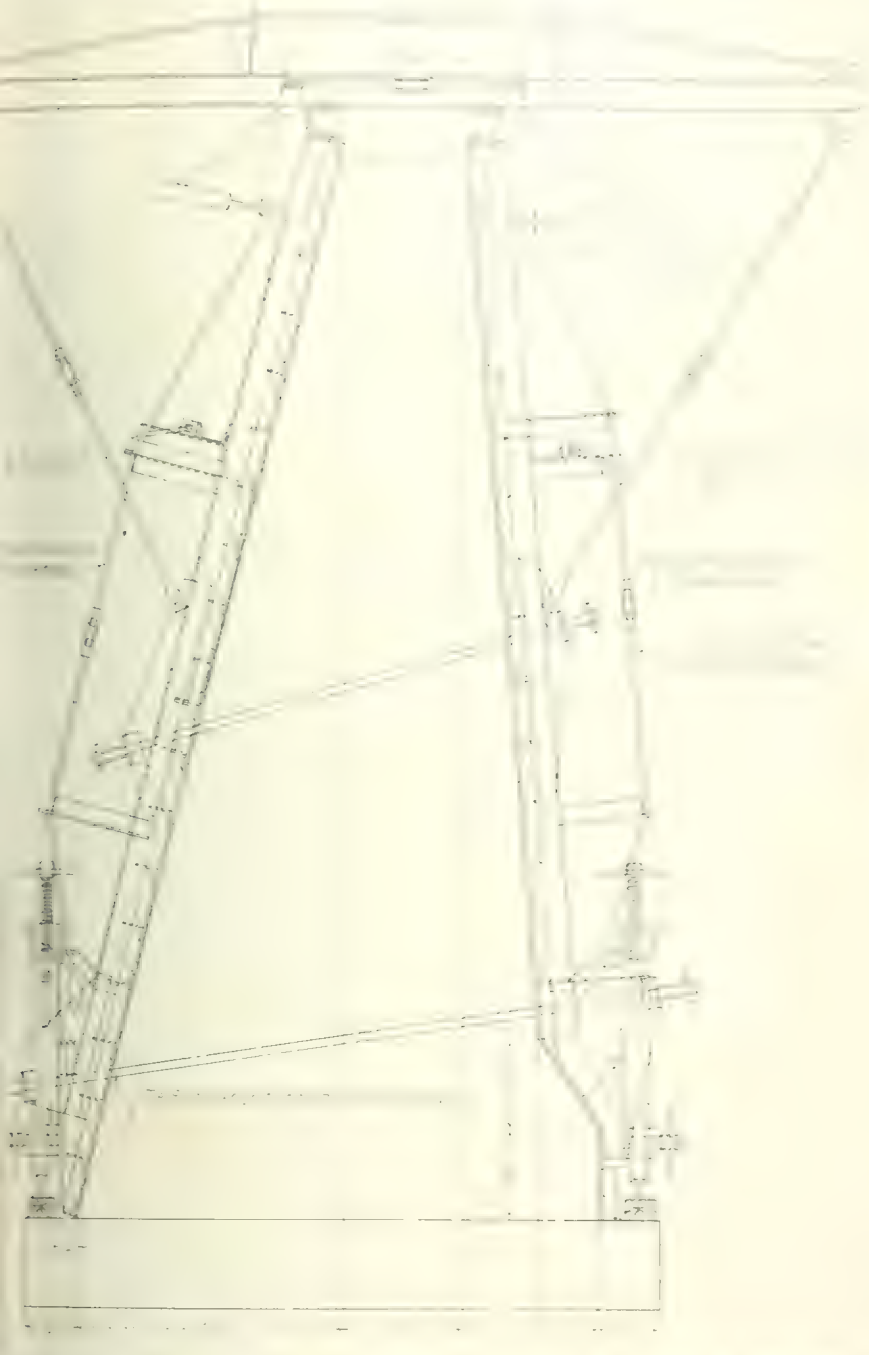


Fig. 3—Diagram Cross-Section of Reinforced Concrete Lock Carried on P[illegible]s.

The arrangement of the reinforcement in the lock walls and buttresses is the [illegible] that generally adopted in similar [illegible] taking the necessary stresses. (Fig. [illegible]

In calculating the reinforced conc[illegible] tions of the lock, it was assumed that [illegible] crete would only take compressive [illegible] whilst the steel would work both in [illegible] and compression. The coefficient of [illegible] is assumed to be constant and the [illegible] of the ordinary coefficient of elastici[illegible] steel to that of the concrete was as[illegible] be 15. The resistance of concrete [illegible] pression was assumed at 30 kg. per [illegible] (426 lbs. per sq. in.) and its resistance to shear at ½ kg. per sq. cm. The t[illegible] the steel was taken at 1,000 kg. per [illegible] (14,200 lbs. per sq. in.) and the she[illegible] kg. per sq. cm. (10,650 lbs. per sq. in[illegible] adhesion between the steel and the [illegible] was taken at 4.5 kg. per sq. m. (64 [illegible] sq. in.).

Reinforced concrete was used in [illegible] of the above scheme so as to economize in the cost of construction as compa[illegible] an ordinary lock with masonry or n[illegible] crete walls. This economy was re[illegible] the cost of construction of a reinfor[illegible]



of Traveling Steel Wall Form Used on Contract 43 New York State Barge Canal.

[illegible] estimated at [illegible] [illegible], whereas this cost would [illegible] out at 4,500,000 francs ($900,000) for inary type of construction, thus showing [illegible] 20 per cent

ner structure which deserves attention ock now being built at the fluvial port nski, on the Volga. The size of the [illegible] it to accommodate the largest craft oly along the river. For economical

masonry is only used at the ends of and the lock chamber and invert the earth merely covered by ordi-ng. The walls of the lock chamber n two different ways. On the side aining pond, the lock chamber wall two rows of piles and sheet piling .68 ft.) apart, with a top layer 71 s.) thick of mass concrete between (Fig. 3). On the opposite side of the wall merely an ordinary bank f 3.2, paved over. This method n for the wall of the lock cham-pted for the portions between the the low water level of the Volga. level, and within the limits of the

variations of the water level in the lock, the walls of the lock chamber are vertical, and of reinforced concrete, so as to economize the water in locking. These walls rest on reinforced concrete piles, which are spaced 3.20 m. (10.6 ft.) apart along the length of the lock, and 2.13 m. (6.98 ft.) apart in the direction at right angles to this.

In addition to the vertical piles on the embankment side, inclined piles are provided to resist the thrust. The piles in the front row are 30 cm. x 30 cm. (11.8 ins.) in section and those in the second row are 20 cm. x 20 cm. (17.87 ins.). The inclined piles are 35 cm. x 35 cm. (13.78 ins.) in section.

A Traveling Steel Form for Long Concrete Walls.

The traveling steel wall forms shown in the accompanying drawing was used for the construction of two walls, 20 ft. high, 10 ft. wide at the base, tapering to 2 ft. on top, and each about 4,000 ft. long. The work is a portion of Contract 63, New York State Barge Canal, for which the contractor is H. S. Kerbaugh, Inc., who sublet the wall work to Meyers & McWilliams, of Lancaster, Pa. The walls are built in 30-ft. sections and practically no expense is had for dressing up the work after the forms are removed, as the steel plate leaves a perfectly smooth face. The contractors have been compelled to carry on construction work during the winter months, and owing to the construction of the forms of steel they have been able to apply heat to the outside of the forms in many different ways which would have been impractical with wooden forms.

The cost of handling the forms as stated by the contractor, Mr. J. H. McWilliams, is 12 cts. per cu. yd. Using the figures given above for the wall dimensions, this cost will be 12 cts. per square yard of forms used, 53 cts. per lineal foot of wall, or $16 for each move made. The forms are made up of standard parts used on straight wall forms by the Blaw Steel Centering Co., consisting of 2x5 ft. plates with angle uprights. In this case seven vertical trusses as shown are used to stiffen the wall plates against outward pressure of the fresh concrete and horizontal trusses are introduced as shown to prevent the plates from bulging at the vertical joints. Across the top are two trusses placed 5 ft. from the ends of the 30-ft. unit for holding the forms apart. All trusses are supplied with turnbuckles in the tension rods so that easy and exact adjustment is possible. Tie rods are also placed as shown in the lower part of the section to prevent bulging. These are run through pipes to facilitate removal. The whole unit is supported on rails running on timbers on the concrete wall base. The drawing shows clearly the method of loosening the forms by means of a screw jack placed over the wheel. As the wall is battered it is only necessary to raise the form by these screws to free it from contact with the wall. It can then be rolled along to the next position.

Another feature of the form is the provision of tracks carrying a hopper and a chute. These will be noted in the drawing.

Concrete is brought to the forms from a plant consisting of two 1-cu.-yd. Koehring mixers. These dump into a 1-cu.-yd. bottom dump, brackets of which form are placed on an ordinary flat car hauled by a dinky engine. A traveling derrick is set between the parallel walls and this handles the buckets from the cars to the forms.

Four sets or units of the wall forms are used. The two in advance build alternate 30-ft. sections and the two following close up the gaps between. It is necessary, by this method, for the advance forms to have end plates forming bulkheads, but the units following do not need them. The men who set the forms can by this scheme be continuously employed. While the forward forms are being set the followers will be receiving concrete, and vice-versa.

Suspended Centering for Arch Construction.

Sir: In your issue of June 21, 1911, the writer contributed an article entitled, "Method of Employing a Suspended Flexible Centering for the Construction of the Chickahominy River Concrete Arch, Richmond, Va." This article described in detail a method of constructing concrete arches without the use of falsework, and involving the use of longitudinal cables, supporting flexibly connected centering of voussoirs, as devised, patented, and operated by the writer.

In May, 1910, a paper was presented before the Engineers' Club of St. Louis (illustrated by stereopticon), covering the same matter, and which was subsequently published (with editorial comment) in various technical journals, both in America and abroad. As a result of these publications, letters were received from many sources, including distinguished engineers and others, commenting upon the novelty, utility, simplicity, and economy of the methods disclosed.

In your issue of April 24, 1912, there appears an article contributed by Mr. H. G. Tyrrell, entitled "The Advantages of Suspended Centering for Arch Construction." In this article Mr. Tyrrell repeats in detail, under his sub-headings, "Suspended-Centering" and "Merits of Suspended-Centering," the methods devised, patented, and previously published by the writer (Eng.-Contg., June 21, 1911), and attributes same to "Thos. Telford and his contemporaries, from 1810 to 1825." Such a statement is inaccurate, misleading and unjust. There is nothing in the methods proposed by Telford and others that would suggest those of the writer, or even indicate their feasibility, as comparison will demonstrate.

Telford's methods cover the well known backstay or guyed-cantilever principle of erection, similar to that proposed by Brunel, Stephenson and others, and which was subsequently used in the erection of the Eads bridge at St. Louis. At no time has the writer presented a claim in any of his patents, publications, constructions, or elsewhere, which could be read upon Telford and his contemporaries or upon prior art from any source. Every reference cited by Mr. Tyrrell was known and met. There is no desire to cover such constructions which do not and can not respond to the writer's claims in structure, in operation, or in spirit.

Mr. Tyrrell says that "the method of erecting arches without timber centers underneath is not new." This is true enough, broadly speaking. He could even go further and say that "flexibly connected centerings" is not new, for that matter. No claim has ever been made for such a "centering" in itself, but only as an element in a new combination. One might just as well say that the telephone was not new (or patentable) because Morse had disclosed the use of the electric current for "transmitting intelligence."

Mr. Charles Worthington's publication, covering a method of erecting the great steel arch of 1,800 ft. over the St. Lawrence River (as mentioned by Mr. Tyrrell), did not appear until long after the writer's patents had been applied for and issued in the United States, Canada and other foreign countries.

The writer's publications covering the concrete arch construction at Portsmouth and Richmond, Va., are unquestionably (so far as the references of record) the first disclosure of a system of construction in which the concrete molds or separately molded voussoirs are supported by longitudinal cables, as described. Mr. Tyrrell states he knows of another case. Let him state, if he can, its location, builders or owners.

To use flexible cables and hangers in lieu of the prior rigid-falsework, backstays or guyed-cantilever methods of Telford and others is conceded by many distinguished engineers and others a step in advance and one which would not logically follow from a consideration of prior methods in which rigidity of falsework, backstays, etc., have always been held essential.

To perceive that the cable method which would naturally be presumed (and was) to be impracticable could be successfully applied for the purpose in hand certainly involved more than a mere extension of prior ideas. It seems that the superiority of the scheme over the old methods of Telford and others as regards simplicity, ease of manipulation, range of utility, and economy (which Mr. Tyrrell now recognizes and appreciates so highly), coupled with the fact that the teachings of the art have been opposed to the practicability of the method and with the fact that the method is an undisputed success leads fairly to the conclusion that such an advance in the art was the product of invention in a degree more than sufficient to warrant not only favorable comment and approval but also credit.

PHILIP AYLETT.

4001 Connecticut St.,
St. Louis, Mo., May 9, 1912.

(In accordance with our regular practice proof of the above letter was submitted to Mr. Tyrrell. His reply is published below.—Editors.)

Sirs: Replying to the comments of Mr. Aylett on my article in "Engineering and Contracting," entitled "Suspended Centering for Arch Construction," Mr. Aylett is entitled to great credit for his accomplishments in this direction, including the two bridges at Portsmouth and Richmond of 1909, referred to in my article. His reports and address at St. Louis are interesting, and might be supplemented by reference to many articles on the same subject appearing in European journals during the last century.

It was not my intention to detract in any way from credit due to the present generation of engineers—on the other hand my writings are often burdened to excess with names, merely that full credit may be given to those who have earned it. In the present case, the idea of suspended centering is traced from its inception in the forepart of the nineteenth century, to the present time, and a more careful reading of my article will show that the above gentlemen's patents are not attributed, as stated, to Mr. Telford.

The subject of "credits" and priority of design, is an old source of contention, and even in this very matter of arch centers, Mr. Hawkins, in 1812, wrote in one of the English journals, a scathing article entitled "A Proposed Method of Erecting Arches Without Falsework, by John Isaac Hawkins," in which he accused Mr. Telford of using his ideas without giving him credit. The writer is, of course, claiming no credit whatever for originality in the matter of arch centering, but merely called attention in a live American engineering journal, to the economy of suspended centering for concrete arches, as supplementary in some ways to the data in his treatise, entitled "Concrete Bridges and Culverts."

So many methods of erecting arches without false work, and modifications of these methods, were proposed in England during the first part of the last century, that almost every phase of the subject was considered, the method proposed by Mr. Hawkins, drawings of which are extant, being almost identical with that used 60 years later for erecting the metal arches at St. Louis. An account of Mr. Telford's method of erecting with back stays, together with a large illustration, may be seen in "The Life of Thomas Telford." In Mr. John Seaward's design of 1825, a 600-ft. cast iron arch over the Thames at London, was to be erected without falsework, by the use of guy rods from a shore tower to the successive voussoirs. It may be noted here, that this method of erection was considered by many to be new on the Niagara arches.

The difference between backstays and suspensions is not well defined, for some suspension bridges in Europe depend wholly upon back stays, while many early ones in America had both backstays and suspension cables, while recent ones have the direct suspension cables only. The method of erection by suspending consecutive voussoirs by means of flexible cable backstays was used in 1906, or three years previous to those in Virginia, when building the bridge for the Belvidere Electric Railroad near Belvidere, Ill. (See Engineering News, Aug. 30, 1906.) The dates of the two bridges in Virginia, and the method proposed for crossing the St. Lawrence at Quebec, are given in my article as 1909, and 1910, and are correct.

The critic says that he was familiar with the methods proposed and used by Mr. Telford and his contemporaries. But even when a modern inventor has no knowledge of what others have accomplishd in the same line before him, he is often entitled to full credit, and his work as far as he is concerned, is quite as original as though the same problems had never been solved before.

H. G. TYRRELL.

Evanston, Ill., May 27, 1912.

Standard Tests for Sand and Other Aggregates for Use in Mortar and Concrete.

Sirs: The National Association of Cement Users, through their Committee on Specifications and Methods of Tests for Concrete Materials, are investigating the problem of testing sand and other aggregates for use in Portland cement mortar and concrete to determine their suitability for such use. This Committee desires to get into communication with all laboratories who are now testing sand aggregates, and to secure their co-operation with the Committee in formulating standard tests for these materials. The Committee is particularly anxious to secure samples of sand which appear suitable for use in concrete, but in practice prove unsuited. The would welcome communications from ested in the subject who are willing to co-operate in this work to the extent of furnishing data obtained in their laboratory or field practice, or of recommending forms of tests which may be considered by the Committee. Communications should be addressed to Cloyd M. Chapman, Westinghouse, Church, Kerr & Co., St., New York.

(Signed)

COMMITTEE ON SPECIFICATION METHODS OF TESTS FOR MATERIALS.
Sanford E. Thompson, Chairman
William B. Fuller,
R. S. Greenman,
Arthur N. Talbot,
Cloyd M. Chapman, Secretar

New York City, May 28, 1912.

(The committee is engaged in great importance to all users of other cement products. They deserve est co-operation of engineers or ot possess information on the points —Editors.)

Cost of Concrete Caisson Dock Foundations.

Sirs:—I note that on page 513 of En & Contracting of May 8, 1912, you ha the heading of "Cost of Concrete Cais Foundations," quoted the detailed cos vation for piers, and of concrete su from page 351 of the Annual Report of mian Canal Commission for 1911. however, omitted the explanatory no bottom of the table on this page, w terially affects the cost of the con structure.

The actual cost of these tw completed dock is as follows:

EXCAVATION FOR PIERS

Excavating by hand	[illegible]
Excavating by orange-peel	15,4
Disposal of waste	22,
Pumping (to cover special pumping for keeping water out of holes)	22.6
Maintenance of equipment	22,6
Preliminary and general work	22,6
Plant arbitrary	22,6
Division expense	22,6
Total excavation	22,6

CONCRETE CONSTRUCTION, 6,341

Wood forms in place
Steel forms in place
Cement
Rock
Sand
Mixing
Placing
Reinforcement
Division expense
Large rocks in mass
Maintenance of equipment
Preliminary and general work
Plant arbitrary
Total

I will be glad if you will publish mation, as that contained in the issue to above is entirely misleading.

Respectfully,
S. B. WILLIA
Division E

Cerozal, Canal Zone, May 17, 1912.

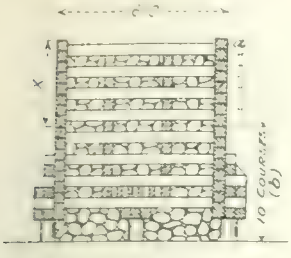
(The above costs are for the construction the concrete caisson foundations of ama R. R. Dock. The methods and of the construction were describe issue of Jan. 17, 1912.—Editors.)

On May 18 about 84 per cent of th for all the locks at Panama was in am amount being 3,666,246 cu. yds. out of 4,303,486. A total of 24,133 cu. placed during the week ending May

.od of Making Rapid Cost Esti-nates for Crib Pier and Break-water Construction.

.ng rapid cost estimates of pier and [illegible] water construction is often required [illegible] ers in the service of the Government. ich emergencies as these Mr. G. A. M. :rantz, Assistant Engineer at Chicago, veloped a method which he describes in ssional Memoirs."

s of Structures.—There are six differ- pes of structures considered. These are



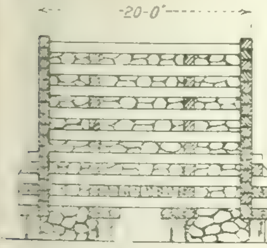
ig. 1—Type I, Crib Breakwater.

ted by Figs 1 to 6. Each consists of a nstruction 100 ft. long. The first four [illegible] s. The last two are 30 ft. wide each t on stone foundations, 4 ft. and 6 ft. espectively.

xamination of the various plans will hat in each of the above types the of materials contained in the ten low- ses (counting from the lake bottom) is ant quantity for that type; and that in [illegible] the quantities are the same for each spectively.

fact suggested the practicability of us- formula for a straight line for the tion of the total cost of a crib of any height, after the materials of the ten ourses, and in the two upper courses, vely, have been ascertained. Thus we [illegible] $Y = aX + b$, in which Y nts the cost of a crib structure 100 ft. cording to either of the types; *a* rep- the cost of all materials in one of the ourses (the constant given in the table eing the average of the two upper), X equals number of courses desired ne tenth course; and *b* equals the cost aterials used in the lower ten courses. ght of the timberwork above the lake (2 ft. in types 1 to 4, inclusive, Fig.1) ed as two courses. The stone founda- the other types shown are counted as d six courses, respectively. The bot- rse of the crib work is 1.5 ft. high, all urses being 1 ft. each.

is one discrepancy in the formula



. 2—Type II, Crib Breakwater.

ould affect the accuracy of the re- not remedies. This is accounted for

Formula.—As stated, the constants represent the cost of *all* materials in ent parts of the crib as noted. These consist of lumber, drift bolts and l (in types 1 to 4), of piles and screw he unit prices of each of these ma- ll also be factors. The formula con- these items will be as follows:

$$+ a^dD + a^sS) X + b^tT + b^dD + b^sS + pP + cC$$

TABLE [illegible] TYPES WITH TIES AND LONGITUDINALS OF 10 x 12-INCH TIMBERS.

No.	Width of		Thou. ft.	Cwts.	a^s Cords.	Thou. ft. measure.	Cwts.	Cords.	p No.	c Cwt.
1...	[illegible]	Pile	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	92.947	27	5.1
		Pile	4.996	[illegible]	[illegible]	[illegible]	37.5	100.450	40	6.7
		Pile	5.312	[illegible]	15.444	67.734	37.8	129.336	40	6.7
		Pile	5.786	[illegible]	19.823	79.518	38.3	150.641	[illegible]	8.4
		Stone	[illegible]	4.6	[illegible]	40.492	25.9	259.943	0	0
		Stone	[illegible]	4.6	19.823	[illegible]	17.3	301.547	0	0

[illegible] and *c* represent, respectively, the quantities of timber drift bolts, stone piles and screw bolts (as shown in Table I below), for each type, and T, D, S, P and C the unit prices of materials, viz., per thousand board feet of timber, per hundred weight for bolts per cord of 128 ft. for stone, and for each pile. All prices are for materials "secured in the work." It must be particularly remembered that X represents the number of courses above the tenth course.

As has already been stated, the constant a^t represents the amount of timber required in *one* of the courses above the tenth course, and the constant b^t the total amount in the ten lower courses. From this it follows clearly that the total amount of timber required in 100 lin. ft. of a crib of any of the types, respectively, will be found by means of the simple formula:

[illegible] X [illegible]

using the respective values for the constants in Table I. In the same manner the amount of drift bolts, stone, etc., may be obtained.

The discrepancies referred to above have been remedied and the constants have been corrected accordingly and are to be used *as given* in the table.

[illegible]

Chief Elements in the Structures.—It may be found desirable to verify the various amounts entering into the calculation, and for that purpose the general dimensions of timbers, etc., are here given; it being believed that, for the sake of comparison between the different types, it is desirable to maintain uniformity with regard to the dimensions of all the principal parts of the structures.

Thus, the following dimensions have been used for each of the six types: bottom side timbers, 12x18 ins.; all other side timbers, end timbers and bearing timbers, 12x12 ins.; ties and longitudinals, 10x12 ins. (2-ft. long searves having been provided for the latter); stone bottom (in types 1 to 4) in middle pockets, 6x12 ins.; the grillage bottom in types 5 and 6 are made of 12x12-in. timbers.

The lowest set of longitudinals (in types 1 to 4) are extended to the full length of the crib, 100 ft., and blocks are placed at each end of the crib, between these longitudinals and the bearing timbers, which are also 100 ft. in length. An extra bearing timber, 12x12 ins., is provided—in type 4, Fig. 1, above the stone bottom. All cross ties are dove-tailed into the side timbers and the longitudinals into the end walls. Stone has been provided for in the walls between the cribs, the calculation thus covering the filling of the crib for its entire length.

In estimating the amount of stone required, calculation has been made on the assumption that the whole volume of the crib, less the space occupied by timber, is filled with stone. While this is not strictly correct, it has been done to compensate for such stone that will usually settle down into the sand bottom and work out on the sides; also, to some extent, for irregularity in the lake bottom.

Drift bolts, 32x20 ins. in length, are provided for in regular columns in the side and end walls; also through bearing timbers and protruding ties, and in the crossings of ties and longitudinals, alternately in each crossing.

[illegible] *and Its Remedy.*—It was stated above that the quantities in each set of two courses above the tenth

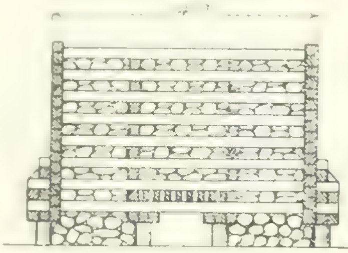


Fig. 3—Type III, Crib Breakwater.

course are constant amounts for each type. There is an exception to this rule. The top course of every structure has less timber and stone than each of the other courses, because there are no longitudinals in this course and no stone in the upper half of it. There are, however, more bolts in the top course, as a 20-in. bolt is placed in each of the top, side and end walls, in each column of 32-in. bolts, where these reach only to the upper face of the third course from the top.

To remedy this, the respective amounts are deducted—for timber and stone—and added for drift bolts, to the corresponding materials in the constants *b*, for each respective type. These amounts are given in Table II. The figures given in Table I are the corrected amounts, as already mentioned.

Suggested Simplification.—If a large number of cribs of different types and heights are to be estimated for, and prices suitable to the locality and period have been determined, the formula may be materially simplified by inserting these prices in the formula and developing the calculations for the values of *a* and *b*, respectively, thus giving the formula the initial form: $Y = ax + b$, after which the computation will be reduced to the simplest kind, according to the variations in the values of x.

Different Quality of Timber in Sub and Superstructure.—The above formulas contemplate only one kind of timber for the whole structure. Should it be required to provide for different quality of timber for

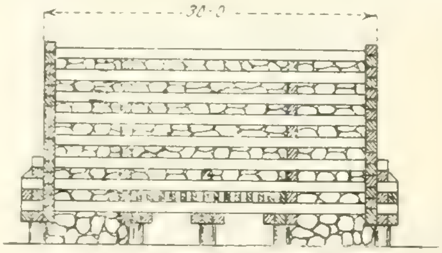


Fig. 4—Type IV, Crib Breakwater.

sub and superstructure (where the prices differ materially) then proceed as follows:

For the substructure use the general formula with constants as given in Table I; adapting the prices for timber to be used, and

TABLE II.—CONTENTS USED TO COMPENSATE FOR DISCREPANCY IN THE TOP COURSES.

	—With 10x12-in. timbers—			—With 12x12-in. timbers—		
Types	Timber, M bd ft	Bolts, cwt	Stone, cords	Timber, M bd ft.	Bolts, cwt	Stone, cords.
1	[illegible]	+2.3	4.747	1.152	+2.3	—4.625
2	[illegible]	+2.4	6.279	1.152	+2.4	—6.157
3	—0.960	+2.4	—8.591	—1.152	+2.4	—7.687
4	0.960	+2.5	10.107	1.152	+2.5	—9.984
5	—0.960	+2.5	—10.107	—1.152	+2.5	—9.984
6	0.960	+2.5	10.107	—1.152	+2.5	—9.984

with x fixed according to the number of courses in *this part* of the work.

For the superstructure use the same formula with the constant *a* as above; but for the constant *b* substitute the values for this constant (with + or — signs as indicated) as given in Table III, and make x = the number of courses desired in the superstructure, and use the price for the proposed kind of timber accordingly.

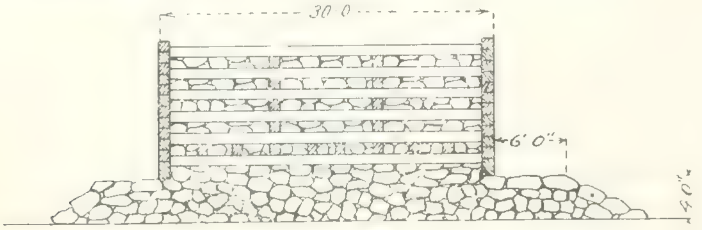


Fig. 5—Type V. Crib Breakwater.

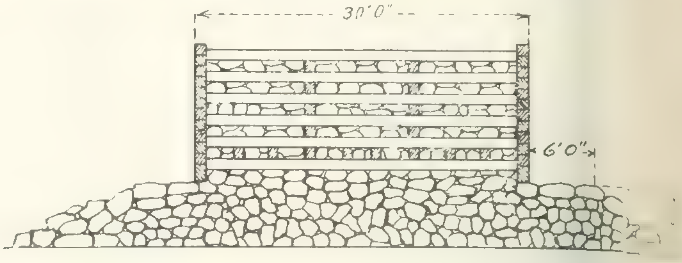


Fig. 6—Type VI, Crib Breakwater.

Rebuilding Superstructure.—Should it be required to prepare an estimate for the cost of rebuilding the superstructure over old crib work the same method should be followed, adding, however, only the cost of removing the old work.

Modification in Types.—If it is preferred to use 12x12 in. timbers for ties and longitudinals, this would increase the constants for timber and decrease the constants for stone. The constants for bolts would not be affected. Table III gives the constants calculated to fit such cases, all other elements remaining unaltered.

Decking.—The crib work is generally covered by some kind of decking to protect the stone filling, especially if the work is exposed to severe storms. The form of decking generally used in this district consists of 6x10 in. planking laid flat, 2 ins. apart, and spiked to the cross ties with ½x14 in. spikes, washers being used under the heads of the spikes, which has proved very advantageous in giving much better hold. One hundred linear feet of a deck plank contains 500 ft., b. m., and the spikes required for that length of deck plank, including washers, will weigh approximately 50 lbs.

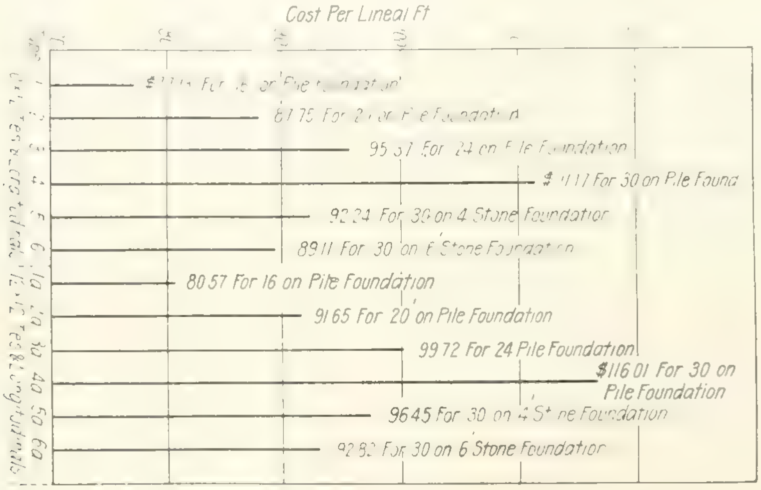


Fig. 7—Diagram Showing Relative Costs of Crib Breakwaters of Different Types.

The total cost of the decking, of the kind described, for any of the types of cribs may be obtained by the simple formula: $z = \frac{(E + K) x}{2}$ in which z represents the cost of the decking over 100 lin. ft. of the crib; E = the cost per m. ft. b. m. of the deck timbers; K = the cost per cwt. of the spikes and washers, and x = the width (*inside* of the side timbers) of the crib to be covered.

Intermediate Decking Supports.—When a pier or breakwater is greatly exposed to severe gales, it is very desirable to place intermediate supports under the decking, half-way between the cross ties. These supports may be made of 3x12 in. planks placed on edge and resting on the two top longitudinals and, at each end, on a 3x12 in.x2-ft. piece of plank spiked to the side walls, with their tops level with the tops of the longitudinals. The length of each plank will be equal to the inside width of the crib. If, however, they are estimated equal to the *outer* width of the crib + 2 ft., in length, the two pieces to be spiked to the side walls will be provided for. The decking should, as a matter of course, be spiked to this planking. As there are twelve spaces between the ties in each crib, the cost of the decking supports will be obtained by the formula: $Y = 0.036\ F\ (w - 2) + 0.3\ K\ (w - 2)$ in which Y represents the total cost of the decking supports for a crib 100 ft. long; F equals the cost per m. ft. b. m. of the planks; K equals the cost per cwt. of spikes and washers and w equals the outside width of the crib.

The approach of the completion of the Panama canal is evidenced by the recent estimate of 3½ million pounds of explosives for 1912, about half the amount used last year.

TABLE III.—CONSTANTS FOR TYPES WITH TIES AND LONGITUDINALS OF 12x12-IN TIMBERS.

Types	a^t 1,000 ft. B.M.	a^1 Cwt.	a^s Cords.	b^t 1,000 ft. B. M.	b^1 Cwt.	b^s Cords.	p Piles.	c Screw bolts.
1A	5.064	4.3	9.783	59.622	37.0	91.374	27	5.1
2A	[illegible]	4.1	12.273	68.220	37.5	98.648	40	6.7
3A	[illegible]	4.4	15.164	71.952	37.8	128.068	40	6.7
4A	6.316	4.6	19.500	83.703	38.3	148.267	53	8.4
5A	6.316	4.6	19.509	43.320	25.9	258.238	0	0
6A	6.316	4.6	[illegible]	30.672	17.3	300.493	0	0

A Storage Battery Electric Lo motive for Tunnel Haulage in the nder City Tunnel, Catskill Aque uct.

Industrial storage battery electr locomotives designed for carrying the lo on the locomotive itself have been on t market for some years; but the pioneer l motives of this type built for hauling tra ng loads in tunnel work were put into se recently in that part of the Catskill now being constructed under New and extending from 110th St. to Uni This tunnel is about 11 ft. in diar crete lined, and is being driven thr rock from 250 to 300 ft. below level. A series of six shafts has en sunk approximately a mile apart, and vated material is transported to t of the shafts on cars drawn by tl tives. Here it is hoisted to the sur to four trailers form the usual tr each locomotive has a maximum ad per trip of half a mile.

Smith, Hauser, Locher & Co., wha cuting this contract for the city placed six of these storage batte haulage locomotives, manufacture by General Electric Co., in operation, nd ordered six additional locomotives locomotives were prohibitive becaus the tunnel headings would not permit thei entrance The operation of the locomotives has proved efficient and economica and permitted laying the tracks with which hauling by mules necessit locomotives in use conform to the ollowing specifications:

Type of motor (single motor)..........GE-
Diameter wheels....................
Wheel base.........................
Total weight.........................
Length over all.......................ft. 10 ins
Height over batteries.......................4 ft
Track gage.........................
Speed at maximum T. E.......5 mil per hour

The batteries are 44-cell, 21-plat ype and have 45-ampere, 6-hour discharg The locomotives are equipped with a hour meter, headlight and gong. e consists of two steel channel sides nd plate ends carefully fitted at the nts and held rigidly together with bolts angles. A coupler suitable to the ty of cars employed is attached at the rear l. Cast steel pedestal jaws, which carry t journa boxes, are bolted to the lower w of the channel side frames.

The cast steel journal boxes are f a special design and are fitted with rolle bearings which assure efficient mechanical tr smiss of power and consequent economy consumption. The weight of the is ported from the journal boxes by coiled springs. The wheels are and securely keyed to the wheel a es. axles are made of a special grad and are case hardened at the jour s.

The motor used is of the auton designed especially to operate fron and has characteristics that effect the possible economy in the use of batte It has high efficiency, and a larg capacity. The armature shaft rota bearings, and consequently the fric are very slight and the bearing we is tically negligible. The motor is very designed, yet readily accessible for repair It is dust and moisture [illegible] ounted in a cast steel suspension, [illegible] side of which is supported on [illegible] he axle; while the other side is spring- nded from the locomotive frame, in ac- nce with standard locomotive practice e motor drives the rear axle [illegible] reduction gearing [illegible]

Storage Battery Electric Locomotive for the Under-City Tunnel, Catskill Aqueduct.

[illegible] al with the suspension cradle, carrying intermediate gearing. As slow speed [illegible] y locomotive, the use of double reduc- earing permits such speeds without rheo- losses; and, due to the large gear reduc- rom armature shaft to wheel tread, very tractive efforts are obtained at compara- small current inputs to the motor.

storage batteries are especially designed he service, are of rugged construction, have specially made plates with high e-hour efficiency. The cells are grouped r or more trays and are mounted in a iron frame with wooden base and cover [illegible] locomotive frame. The latter

Fig. 1—View of Lock at Galena for Which Gates Were Renewed with Lock Submerged.

[illegible] is governed by individual require-

Railway Subways are under construc- Buenos Aires, Argentina. A gyratory nachine made in Hamburg, Germany used for a portion of the excavation ter is said to excavate 2 cu. yds. of ma- t each cycle of operation.

Methods and Costs of Replacing Lock Gates in a Submerged Lock.

Building lock gates ashore, launching them, and putting them in place when the lock was submerged 8 to 10 ft. on the lower mitre sill, was one of the novel features in replacing the Galena River lock gates at Galena, Ill., by the U. S. Government. It was imperative that navigation should not be interrupted. Preparations were made, materials placed at site of work, and everything possible was done during fall so as to proceed with the work immediately upon close of navigation (Nov. 10).

The lock is 280x52 ft. and has masonry side walls and wooden floor. The elevation of the lower mitre sill is 2 ft. below and the upper is 3 ft. above datum. Datum is the low water of 1864 of this locality. The dimensions of the upper gates are 9 ft. x 30 ft. 2 ins. and the lower ones are 13 ft. 8 ins. x 30 ft. 2 ins. At the site of the lock (Fig. 1) a crib dam extends across the river, with its crest at an elevation of 8 ft. above datum.

The old gates, which were constructed in 1890 of pine lumber, except toe posts which were of oak, were so badly decayed that none of the lumber was fit for use in the new gates. Part of the metal work of the old gates was utilized in constructing the new gates.

Earth cofferdams, 96 ft. and 112 ft., respectively, were constructed above and below the lock. These dams were about 4 ft. thick by 10 to 18 ft. deep. The forms were com posed partly of salvage lumber obtained fro condemned boats. Earth filling was wheele from a nearby bank. Owing to the excep tionally high stage of water and sever

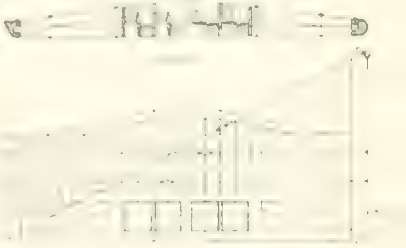


Fig. 2—Detail of Lock Gate.

weather, for the season, the cofferdams wer not completed until Dec. 7. A 6-in. centrifuga pump was put at work pumping out the loc chamber. A depth of water of 9.2 ft. c lower mitre sill was reduced to 6.5 ft., whe leaks developed so rapidly that work of pumping out the lock chamber was discontinue and an extra line of sheet piling was drive on the outside of the lower cofferdam an the intervening space was filled with eart An attempt was again made to pump out th lock chamber Dec. 29, with no better succes Canvas placed on the outside of the coffe dams did not help matters materially. Th

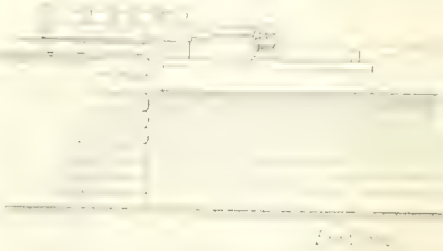


Fig. 3—Sketch Showing Method of Launchir Gate.

work was stubbornly fought through a co winter until Feb. 24, when it was discovere that large leaks existed under the lock-wa and through the floor of the lock chambe and the work of pumping out the lock chamber was abandoned.

Measurements of the old gates were the very carefully made, with a view to makin the gates on land and placing them with th lock submerged. The gate timbers were a sembled in a horizontal position on blockin ashore in accordance with the measuremen obtained. The two upper gates were hoiste

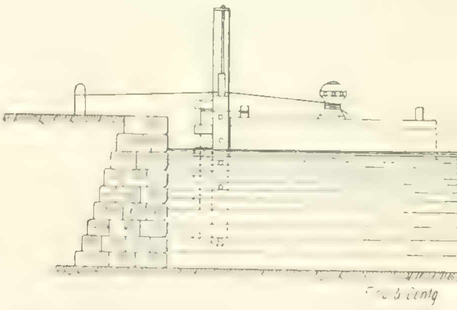


Fig. 4—Sketch Showing Gate Locked t Barge in Position for Hanging.

to an upright position in order to put on th sheeting and place the wickets. This metho seemed to be of no particular advantage, an the two lower gates were constructed in horizontal position.

For launching the gates a barge was utilize on which two hand capstans had been place temporarily. The gates were moved to th lock wall upon rollers, with the top side c he gate extending over the lock wall about ft. on the barge, and were then fastened ith ropes to the barge (Fig. 3). The barge as then slowly hauled toward opposite side f lock by winding on the capstans until the ate slipped off the wall into the water and as then lashed to barge (Fig. 4). The gates roved to be nicely balanced as to buoyancy, aking it an easy matter to control the gate any position desired. The barge was then oved to the recess and the gate guided into lace and fastened.

The four gates were launched and fastened in place in four days by six men, about half of which time was devoted to removing mud from recesses and mitre sills. The gates mitred satisfactorily.

The estimate of cost for replacing the gates, based on the method finally adopted, was $3,000. Later it was decided to use cofferdams in connection with the work. The cost of building and removing the cofferdams, etc., was $2,125.97. The cost of the gates was as follows:

Material	[illegible]
Labor building	[illegible]
Labor launching and placing	[illegible]
Wrecking and removing old gates	193.38
Total	[illegible]

Approximately 20,000 ft. B. M. of lumber were required to build the cofferdams. The gates (Fig. 3) contain 6,826 ft. B. M. of selected white oak lumber (heel and to post, and casing around wickets), and 20[illegible]8 ft. B. M. of selected fir lumber, all of which was creosoted.

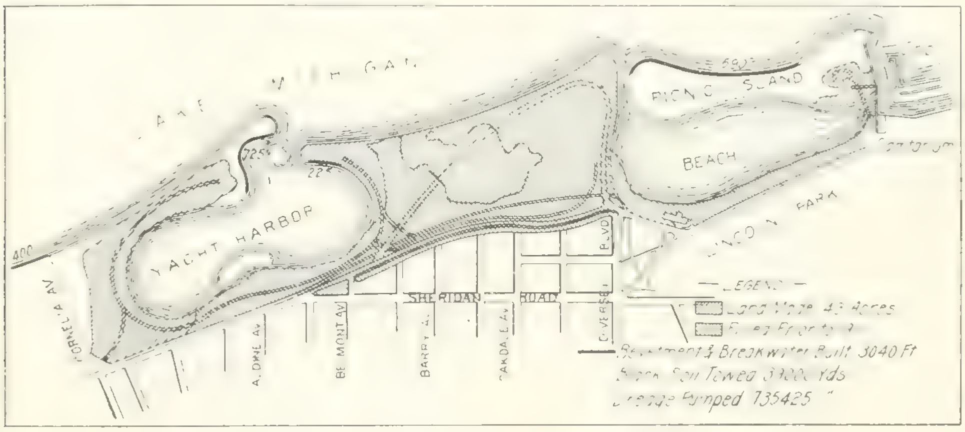
EARTH AND ROCK SECTION

Cost of 735,425 Cu. Yds. of Hydraulic Dredge Fill for the Extension of Lincoln Park, Chicago, Ill.

I.

(STAFF ARTICLE.)

Nearly 200 acres are being added to the rea of Lincoln Park, Chicago, by filling in he shallower waters of Lake Michigan which order the park. At the end of 1911 there had een completed 125 acres of the total 197.54 cres of fill, and of this 43 acres were added n 1911. The filling is being done by hydrauic dredge and besides dredging there are equired breakwater construction, riprapping, grading, etc. In a series of four articles, of which this is the first, the methods and costs for 1911, of doing each class of work will be presented. The articles will cover: Hydraulic Dredge Filling; Stone Filled Timber Crib Breakwater Construction; Tug Boat Towing Operations, and Repairs to Pile Drivers and Derricks. The methods and costs of doing corresponding work during 1910 were given in our issue of Feb. 22, 1911, where also the dredge was fully described.



Map Showing Lincoln Park Extension Work, Chicago, Ill.

HYDRAULIC DREDGE FILL.

The 30-in. dredge "Francis T. Simmons," which was purchased in 1907, has now made 3,040,181 cu. yds. of fill or an average per season of 608,036 cu. yds. for the five seasons since she was put in commission. The average cost per cubic yard for the five years' work has been $0.1248. The dredge has been excavating in clay at a depth of from 12 to 35 ft. The material is pumped through a pipe line consisting of sections 95 ft. long. The pipe is 30 ins. in diameter and is carried between two other pipes made water tight to support the central conduit in the water. The sections are joined by a rubber connection, and the whole when in the water floats with only about 6 or 8 ins. of the pipe above the surface. This pipe line construction withstands rough weather well so that the dredge has been able to put in a larger percentage of time at work than would have been possible with a dipper dredge. The time report of the dredge follows:

TIME REPORT OF DREDGES, 1911.

Available working time, hours	4,620
Pumping time, hours	3,288½
Pumping time, percentage of total time	71.2
Delays:	Hours.
Weather, 6.2% or	288
Miscellaneous, 22.6% or	1,043½
Total delays, 28.8% or	1,331½

The best month's work was during November, when 79.5 per cent of the available time was worked, and the poorest month was April, when 65 per cent of the available time was worked. The dredge was placed in commission April 15, 1911, and continued in operation until Nov. 30, 1911. The percentage of time worked this year shows an increase of 10 per cent over the pumping time of any previous year.

The dredge began the seaon's work inside the yacht harbor (See Fig. 1) and on April 26, started work outside the breakwater south of the entrance and continued working outside of the breakwaters whenever possible. The fill south of the yacht harbor, except for bringing up to grade a small area, was completed on July 27, and the dredge was moved north to fill north of the yacht harbor. On account of the rough weather during September, October and November considerable time was spent inside, so that little excavation now remains to be done in the yacht harbor. The shore line of the harbor is practically complete and the north end was made heavy enough to withstand the winter seas. During October an area of 2.9 acres was filled, as shown by Fig. 1, at the south end of Picnic Island. The total time spent by the dredge working outside the breakwater was 2,191 hours and that inside was 2,427 hours. The cost data for dredging for the season is shown in Table I.

During the season no repairs involving any extended loss of time were necessary. There was no loss of time due to the main pump and only 2¼ hours on account of repairs to the main engines. A short connecting section of cast iron in the discharge was worn through and replaced with cast steel. The cast steel pump casing and elbows show ve[illegible] wear.

TABLE I.—COST OF DREDGE OPE AND REPAIRS.

Total yardage	
Operation.	
	Sub-totals.
Labor	$18,573.85
Adpministration	1,112.56
Watching	178.66
Total	$19,865.07
Fuel	$17,726.58
Supplies, tools, sleeves, oil, etc.	6,786.66
Commissary, labor	1,500.00
Supplies	6,067.37
Total	$ 7,567.37
Repairs, labor	$ 535.75
Material	1,390.10
Derrick	951.59
Total	$ 2,877.44
Towing, "Richard B."	$ 2,377.16
"Keystone"	5,512.06
"Hausler"	11,455.41
Total	$19,344.63
Miscellaneous—	
Teams	$ 65.33
Insurance	4,101.53
Motor boat	363.37
Scow service	270.42
Pile driver	245.38
Total	$ 5,046.03
Total operation	$79,213.78
REPAIRS.	
Labor	$ 7,05[illegible]
Material	[illegible],746.[illegible]
Fuel	468.[illegible]
Supplies	171.[illegible]
Commissary	826.24
Dunham tug	76.00
"Richard B"	485.59
"Keystone"	17[illegible].07
"Hausler"	201.63
Total	$ 93[illegible].29
Misc. teams and pile driver	147.55
Derrick	357.46
Total	$ 505.01
Grand total repairs	$15,712.62
Total operation and repairs	94,926.40

The pontoon pipe was lined with an auxiliary wearing lining covering the botto third of the pipe. This ⅜-in. sheet was worn and has been replaced for the 1912 season work. The rubber sleeves joining the section of the discharge pipe gave fairly good servic The average life of a sleeve was 41 days; but eliminating those sleeves which were damaged due to the condition of the pontoons, the average life of a sleeve was 54 days. The cutter blades required to be renewed each year.

Comparison of Speed of Drilling the Laramie-Poudre Tunnel with Recent European Tunnel Records.

The method of driving the Laramie tunnel was described in some detail in sues of April 10 and May 15, 1912, a complete records of progress were Because of the speed with which this was driven it assumes importance wh pared with European tunnels of much size. This feature is enlarged upon interesting discussion by Mr. W. L. S in Proceedings American Society ers, Vol. xxxviii, p. 707. Mr. Saunders [illegible] some data to these already [illegible] for the Simpson and Loetschberg tun- d we give his discussion here [illegible]

e is one great difference between the ie-Poudre tunnel and any other. Un- speed of driving has been attained with- use of a carriage and is a [illegible] may be called a method [illegible] of tunnel driving. To begin with, it e understood that there is a distinct nce between European and American . The great tunnels of [illegible] Cenis, Saint Gothard, Arlberg, Simplon etschberg—are the greatest tunnels in rld. These tunnels, especially the Simp- Loetschberg, have been driven by a which has been perfected through perience to such a degree that, at least as speed of driving is concerned, noth- equalled it.

THE SIMPLON TUNNEL.

Simplon is the longest railway tunnel world, the distance between portals be- miles. The elevation of the Swiss is 2,250 ft. and of the Italian portal . above sea-level; the highest point in nel is midway between the portals, and elevation of 2,310 ft.; from this sum- the line descends on a 2 per cent [illegible] on a 7 per [illegible] at the Italian end.

work consists of twin single-track tun- actly parallel in plan and profile, and roughout with masonry. The centers unnels are 55.76 ft. apart; at the sum- the cross-section is increased in di- s to accommodate two tracks.

ter bottom drift was first driven by rills, and then timbered and covered closely-boarded roof. From this drift was driven upward to the roof-line 4 ft. (50 m.). The top heading was cavated by working in both directions ch of these shafts. Next in order, [illegible] heading was [illegible] n the two side cheeks of the bottom The lower drift being timbered, no tion of the traffic in it was caused by val of the rock above.

The advance drift was the only the operation performed by power- The drills used were Brandt rotary [illegible] in groups of two on a hrust-bar about 12 ins. in diameter. ust-bar was pivoted to a drill-carriage nterbalanced.

ection at the heading was nominally ft., or 61.75 sq. ft., and as the depth blast was roughly 4.5 ft., the mate- oved by each blast ranged from 265 u. ft.

verage daily advance was about 16 ft. talian end and from 20 to 21 ft. at s end. This work was in gneiss. In more friable nature, such as anhy- calcium sulphate, an advance of as 34 ft. in 24 hours was made. After st, the time required to clean the set the drills, complete the boring ove the drill-carriage, was more than

ives.—The explosives used were dy- t the Italian end, and blasting gelatine wiss end. The dynamite was put up ges weighing about 1 lb.; each hole rged with six cartridges; each blast ift, therefore, used from 60 to 66 lbs. er, or about 6.5 lbs. per cubic yard. were fired by ordinary fuses, cut so as n interval between the firing of suc- oles; about 15 mins. was required h blast to clear the fumes from the This was accomplished with a ven- pipe running close to the face and f a spray of water. The ventilating usted about 35 cu. ft. of air per sec- the spray absorbed the sulphurous

g.—The spoil was cleared from the one gang while another gang loaded cted muck into narrow-gage cars hauled by horses. No machines were used, all the material being handled by manual labor. The work of clearing the heading was rushed to enable the drills to be put to work as soon as possible. To this end the clearing gangs were composed of men who had been previously rested by performing light work, and only the most skilled and energetic laborers were employed. The majority of the workers were from Southern Italy. There were 14 or 15 men at each heading, working in three shifts daily. Each gang had two horses for each shift. Horses, which cost $1.60 per 8-hour shift, died off rapidly, and were paid for by the tunnel contractors. Other methods of transportation were tried, but proved less economical than horses in the advance headings. The horses took the cars to the compressed-air locomotives, and these in turn took them to the steam locomotives.

The time taken for each portion of the attack was as follows:

[illegible]

One whole attack required from 4.5 to 5.5 hours, resulting in an advance of 3 ft. 9 ins., or a daily advance of 18 ft. From this it appears that the time spent in clearing away the spoil equalled that consumed in drilling, and it is in this clearing that a saving of time is likely to be effected, rather than in the process of drilling.

The average temperature at the face was 73° F. during drilling operations, 76° F. after firing, and a maximum of 80° F. on the south side, with 80° F. and 85° F. before and after firing.

Rate of Progress.—The progress for three months is given in the trial report for 1900, as follows:

At Brigue [illegible] machines in one heading and two in the paral- [illegible] had a total depth of 26,600 ft., and 14,700 re-sharpenings of the drilling tool.

At Brigue [illegible] men and [illegible] horses were em- ployed at one time in the tunnel. At Iselle the [illegible] were [illegible] men, and 16 horses, working in shifts of 8 hours. Outside the tunnel, in the shops, forges, etc., the men work from 8 to 11 hours per day, the total being 541 men at Brigue and [illegible] men at Iselle.

On the Italian side, where the rock is very much harder, there were three drilling machines in each heading; the total length excavated, with a cross-sectional area of 62 sq. ft., was 960 yds., or 6,700 cu. yds., in 91 working days. This required 61,293 re-sharpened tools, 758 attacks, 7,940 holes, with a total depth of 33,000 ft., and 56,000 lbs. of dynamite. The average time spent in drilling was 2 hrs., 55 mins. and in charging and clearing, 2 hrs., 36 mins.

Thus, in the hard gneiss, to excavate 1 cu. yd. of rock required 8.5 lbs. of dynamite and each tool pierced 6.5 ins. of rock before it required re-sharpening.

THE LOETSCHBERG TUNNEL.

The Loetschberg Tunnel, driven through the Bernese Alps, in Switzerland, is the last link of a railroad system connecting the City of Berne directly with the Village of Brigue, which is at the north portal of the Simplon Tunnel. With its completion, and the lately finished 12,000-ft. Weisenstein railroad tunnel located about 30 miles north of Berne, it forms the shortest route between London, Paris, Brussels, or Hamburg, and Genoa, via Berne, Thun, Brigue and Milan.

The question of connecting the Bernese Oberland with the Rhone Valley had its origin as far back as 1866, and the present location of the tunnel was proposed in 1899. In that year two consulting engineers, at the request of the Bernese Government, began a careful study of the location of the proposed road, and reported in favor of a single-track tunnel 44,500 ft. long, basing their estimate on an average cost of $4.90 per cubic yard for tunnel excavation and $6.55 per cubic yard for masonry lining throughout the tunnel length. The total cost of the tunnel was estimated at $107 per linear foot.

Assuming an average progress of 4 ft. per day for hand-drilling, or from 5 to 8 ft. for machine-drilling, and from 15 to 18 ft. for rapid driving, the time required for completing the tunnel was estimated at 5 years. The maximum rock temperature expected was 95° F.

Later, however, the expected increase of the traffic through the Simplon Tunnel brought out the question of accommodating two tracks in the proposed tunnel, and therefore it was decided to drive a double-track tunnel.

Estimates were prepared, and the cost of the new proposed tunnel was calculated to be:

Tunnel excavation and lining...	..$ 8,660,000
Tracks, installations, etc.......	[illegible]
Total	[illegible]

or [illegible] per linear foot.

The main tunnel is 47,678 ft. long, and was first planned to be on a tangent. After the cave-in of July 24, 1908, it was found necessary to insert a curve of 3,600 ft. radius in the tunnel in order to drive through solid [illegible] The maximum grade in the tunnel is 7 per cent. The distance from the south portal to the end of the line, at Brigue, is 15.75 miles. Of this length, 28 per cent, or 23,200 ft., consists of 21 tunnels, the longest being 4,450 ft. Of this stretch, 54 per cent is on curves, and 90 per cent on grade. The difference in elevation between the south portal and Brigue is 1,110 ft., and the maximum grade is 2.7 per cent.

Summarizing, the total length of the road is 45.8 miles, of which 36 per cent, or 86,900 ft., is tunnels. Let it be added that, for construction purposes, narrow-gage railways had first to be built to reach each portal. On the south side of the tunnel the construction railway necessitated 38 tunnels, aggregating 18,000 ft. Of the 38 tunnels, 11 only will be part of the permanent road.

Rate of Progress.—Driving the headings was begun on Oct. 1, 1906, for a single-track tunnel, and continued until Oct. 1, 1907, when it was decided to drive a double-track tunnel; 86 per cent of the tunnel had been driven by Oct. 31, 1910. The headings met on March 31, 1911. On Oct. 31, 1910, the 4,000 ft. of heading which had been abandoned after the cave-in of 1908 had been regained.

The power-plant for the south heading, situated at Goppenstein, was driven by electric power. The current was brought at 15,000 volts, and stepped down to 500 volts for power purposes.

Compressed air for the drills (Ingersoll-Rand) was furnished by three 2-stage Ingersoll-Rand compressors, each having a capacity of 1,950 cu. ft. of free air per minute, and a compression of 145 lbs. per square inch. They were driven by 400-h.p. electric motors. Compressed air for the locomotives was furnished by two 4-stage Ingersoll-Rand compressors, having a capacity of 460 cu. ft. of free air per minute, and a compression of 1,760 lbs. per square inch. They were driven by 250-h.p. electric motors.

The power plant for the north heading was situated in Kandersteg. Electric power, used throughout the works, was brought from Spiez at 15,000 volts, and stepped down to 500 volts for power purposes in the tunnel as well as in the shops.

Compressed air for the drills (Meyer) was furnished by two units, each consisting of a 2-stage, Meyer, air-compressor, each having a capacity of 1,770 cu. ft. of free air per minute, and a pressure of 117 lbs. per square inch. They were belt-driven by 450-h.p. electric motors.

Compressed air for the locomotives was furnished by two units, each consisting of a 5-stage, Meyer, high-pressure compressor, with a capacity of 565 cu. ft. of free air per minute, and a pressure of 1,760 lbs. per square inch. They were belt-driven by a 250-h.p. electric motor.

A drill-carriage of simple but efficient de-

[illegible] each carriage carried four or five drills. It can be easily seen that the drills could be swung independently through an arc of a circle or moved sideways, while they could be given different positions by being swung in a vertical plane.

The time required to change the machine from a position where the drills are not in use to that required for actual drilling was usually from 6 to 8 mins. This fact alone shows the superiority of this system of carrying the drills for such work over any other method used up to the present time.

Labor and Wages.—Italian labor, mostly from the northern provinces, was used throughout the works, with the exception of some Macedonians lately imported.

A bonus system of payment was used throughout the different kinds of operations. The following wages were paid

	Daily wages	Average bonus	Total
Drill foreman	$1.50	$1.10	$2.60
Drill runners	1.00	0.70	1.70
Muckers	0.80	0.50	1.30
Nippers	0.70	0.30	1.00
Tracklayers	0.80	0.15	0.95
Masons	1.00	0.40	1.40

There were three 8-hour shifts per day.

The width of the finished tunnel section is 28 ft. at the arch springing and 25 ft. at the base of the rail. The arch is semicircular, the crown being 20.7 ft. above the base of the rail.

As to the sequence of excavation, a bottom heading, 6.5x10 ft., was first driven several hundred feet in advance of the enlargement. Upraises, from 500 to 600 ft. apart, were then driven, and a top heading was started back and forth. The top heading was then enlarged.

In the bottom heading the mining operations were as follows: The drill carriage was run forward from its siding close to the face of the heading, passing over 5 by 5-ft. by ⅜-in. steel plates laid on the floor of the heading for a length of about 30 ft. Each plate had 1-in. holes at the corners for ease in handling with a pick.

The water and air pipes, laid on one side of the heading to about 40 ft. from its face, were connected with the drill carriage, and the drilling began with the top holes. Water sprinkling was done frequently, especially in starting the holes, in order to lay the dust.

Without interfering with drilling, mucking was going on just behind the drill carriage, and the loaded muck-cars were run back to a siding, where trains of from 20 to 30 cars were formed and hauled out by air locomotives.

Drilling having been completed in the heading, the drill carriage was run back to its siding, and the steel plates laid on the floor were covered with a layer of muck about 4 ins. thick, to prevent deterioration.

The bore-holes were then loaded and carefully tamped, and the last man to leave the heading, after firing the fuses, opened the air pipe valve, the escaping air thus creating a cushion of fresh air from the face of the heading back to a certain distance, so that, after blasting, the muckers were able to go to work without delay.

In the heading, only a high-grade explosive was used, and this broke the rock into small pieces and rendered mucking with shovels easy. The bore-holes, having an average depth of about 4 ft., were started with 3-in. drills and finished with 2-in. drills. On account of giving better results, firing was done with fuses about 4 ft. long, the center holes being fired first.

Mucking operations were as follows: Two empty cars were run to the heading, the first one being immediately loaded by two or three men shoveling without interruption until the car was fully loaded. This operation was performed in 3 or 4 minutes, which means that 1 cu. yd. was loaded in from 2.5 to 3 minutes.

Owing to the manner of drilling and blasting and to the shallow holes, the muck, instead of piling up in front of the face of the heading, was thrown back, and formed a layer over the floor, which enabled the track to be cleared rapidly.

Getting rid of the muck is always a problem in tunnel-driving. At Loetschberg a cubic-meter car (35.5 cu. ft.) was filled in 5 minutes, and it took only 1 minute to get this car away and bring an empty car to the heading. In order to do this, small entries or chambers were excavated at intervals in the lateral wall of the main heading, which permitted an empty car to be thrown from the track on the side, thus clearing the track and allowing the filled car to pass, whereupon the empty car was turned up on its wheels and rolled into the heading. This is an illustration of an improvised siding in a narrow heading, by which one car may pass another.

Drilling was started not more than 5 minutes after the removal of the last carload. This result, which at first sight seems impossible, was only obtained by absolute discipline.

The man who knows that his only work at this moment is to connect the air main to the drill carriage does not do anything else; the men whose duty it is to screw the carriage tightly to the wall immediately jump to the right place.

The system of a low and wide gallery was adopted, the proportion being 1:2, as the gallery is 6 ft. high and 12 ft. wide. The rate of drilling was 15 or 16 holes in from 1.1 to 1.15 hours.

An engineer who recently visited this work says:

> When I arrived at the heading it was 9.30 a. m. The holes were being prepared for blasting. The blast took place at [illegible] minutes after the blast the men were in place removing the debris, and at a little after 11 a. m. the drill-carriage was in place again and the rock-drills were working. It usually takes from 25 to 30 minutes between the time at which the drilling is finished and the time at which the start is made to remove the debris; that is to say, 25 minutes for taking away the drill-carriage, cleaning the holes, loading with explosives and blasting. An additional 5 minutes are consumed in getting the smoke away by means of the ventilator, and then the men get to work at the debris. In order to assist the men, a spray of water is discharged near the heading after the blast. This water is brought into the tunnel in a pipe placed within a larger pipe, which insulates it and keeps its temperature from being affected by the temperature of the tunnel.

Drilling in the top heading was accomplished with two or three drills, carried on tripods or on a horizontal bar, while hammer hand-drills were used generally for the enlargement.

Mucking operations in the top heading were very simple, since all blasted material was dumped directly through the upraises into cars running on a siding in the bottom heading.

The operations of blasting, mucking, timbering and hauling were performed without interruption and without interference with each other, and a special force of engineers was required in order to obtain such a result.

The nature of the rock was different on the two ends of the tunnel. An average of one steel was required in the north end for 1 cu. m. of excavation, while on the south end an average of from 5 to 7 was required for the same work. The average consumption of steels for 2.5 years was: north end, 2.33; south end, 7.70 per cu. m., driven.

The report for 1910 shows that in the first part the rock encountered on both the north and south ends was practically the same, although the average drilling time was much less on the north than on the south end. To explain this, the air pressure on the north end during this period was 7.75, as compared with 5.7 atmospheres on the south end, which largely accounts for the difference. It must also be noted that the number of steels per cubic meter of rock removed was, on the north end, 4.65, and on the south, 8.61, which indicates either that the effect of the rock on the drill-bits was different, or that the blacksmithing work was unequal.

The things most important about these great Alpine tunnels are that in both of hem a form of tunnel carriage was used wh h very materially aided the progress. This rriage is in no sense the type of carriage in duced in the Hoosac Tunnel and attempted in arious tunnels, notably the Trans-Andine, th difference being that all the old style carries, the original burleigh, for instance, which as one of the first of its type, involved an a aratus which practically filled the entire are of the heading. This never was a success hat is, it never accomplished what its signers sought. The Alpine tunnel carriages are no larger in area than a baby carriag They consist of a simple little car, mounted n four wheels, combining nothing more than st iron and steel. This car runs on a narr -gauge sectional track serving as a means l which a heavy shaft bar may be carried to the heading and jacked in position. T drills were mounted on the shaft bar, and w ther in the case of the hydraulic drills used at implon or the percussive drills used at Loe hberg, the machines were heavy and could t have been handled without some form of rriage.

With the use of these heavy drills d tunnel carriages the following records he been made:

At the Simplon the average daily dvance per heading was about 16 ft. at th It [illegible] end and from 20 to 21 ft. at the S s end. This was in gneiss. In less difficult cks an advance as high as 34 ft. in 24 hours w made.

At Loetschberg yearly records per ca inc ran as high as 21 and 27.6 ft. per d while monthly averages per heading were s hich as 32.3 and 33.9 ft., with some daily erages beyond anything ever achieved in tun l driving.

At Laramie, Mr. D. W. Brunton in his paper presented at the San Francisco eeting of the American Institute of Mini Engineers, in October, 1911, says:

> From March 1st, to March 8, 1911, [illegible] the tunnel was driven in a single [illegible] ft., a daily average of 24 ft.; but th ighest rate of progress was made during the st fou days of January, 1911, when the tu el was driven 112 ft., or 28 ft. per day; the rec month being March, 1911, 653 ft. being drive

The Alpine tunnels referred to we driven by the European system and this aramie Tunnel was driven by the America system, but the American system as used at aramie involves a distinct departure, in tha instead of columns being used for mounting drills, a horizontal shaft bar was used s ilar to that carried by the Alpine tunnel car ge, but with the distinct difference that the aramie bar was a light, simple apparatus, o 3 ins. in diameter, mounting three hammer ills, as distinguished from percussive drills

The main purpose in a carriage i o provide a means by which heavy dri g machinery may be used so as to do ra work, and the main advantage of a carr e over the column system is that it enables e contractor to put his heavy machinery i he face and at work more rapidly than wit he use of columns. If, however, heavy chinery is not required for the heading; t t is, if the work can be done equally well the use of light drills, then the necessity for arriage is removed.

Now, it is a well-known fact that rills of light weight, which always means rills of smaller diameter of cylinder, will n accomplish as much work in heading drivin s drills of heavier weight and larger dia ter of cylinder. This is true as long as cussive drills are compared; that is, piston ills, machines where the cutting tool f an extension of the piston rod ar where this cutting tool and piston are reciprocated by the power. At Laramie, owever, a different type of drill was d, machines of the hammer type, where t cutting tool is not attached to the piston r ut is held stationary in the hole and the ist n used to hammer the end of the st . T type of drill is lighter in weight, a , owing to the absence of the percussive rinciple, there is very much less vibration to its mounting, hence it is not neces- provide heavy mountings and tunnel es, but the drills attached to a hori- bar are simply lifted over the top of ck by a gang of men, jacked in place, drilling begins at the top of the head- ile the mucking is going on below.

nnection with this system, it must be in mind that water and air, injected the steel into the hole, form a very nt part of the equipment. Without doubtful if the holes could have been with sufficient rapidity, and it has the dvantage of quieting the dust and im- the atmosphere.

th the Loetschberg and Laramie Tun- e headings were about 10 ft. wide, at is was the width of the first Loetsch- eading. At Laramie the height was 8 at Loetschberg 6 ft. 6 ins. This addi- eight at Laramie called for the drilling e holes and the removal of about 25 t more material. Although this is a p in some ways, it is partly compen- or by the greater space it gives in [illegible]

omparing these tunnels, it is striking e that at Laramie the actual drilling as more than double that at Loetsch- t Loetschberg the holes were drilled to of only 4 ft., this being repeated for our shift, while at Laramie the holes uch deeper, and it is readily under- hat deep holes cannot be drilled at age speed of shallow ones.

Loetschberg Tunnel there were drilled =26 holes × 4 ft. = 104 ft., and the rilling time was 2 hours, or 52 ft. of ere drilled per hour. In the Laramie there were 23 × 7.5 ft. = 172 ft., but ing time was 5 hours, so that the num- eet drilled per hour was 172 ÷ 5 = 34.5 ompared with 52 ft. If it were not other operations of the cycle were th remarkable celerity, the time record Laramie Tunnel would not have been is good as it was, and it is evident more time could have been saved, it ave been in the actual drilling.

. and Time Study of Drilling ast Holes with Well Drills.

se of well drills for drilling blast holes ties having working faces of greater an can be drilled with small drills me quite common within the last few A study of the conditions which have well drill prominent in quarry opera- d a study of the operations of the affecting the costs of quarrying is l in a paper by R. R. Sanderson, pre- the convention of the Natural Lime turers' Association. Mr. Sanderson manager for a company which makes ls and may therefore be expected to mpletely the advantages which ssess for quarry work. The sub- ver, is well handled, and methods of the costs and conditions, we believe, e of interest and value to our read- paper as abstracted is as follows:

railroad contractor belongs the hon- ing big hole drills, or, as they are led, blast hole machines of the ler type. The contractor was led em for three reasons; first, because he could put down holes without of cleaning the dirt from off the is necessary when tripod drills were cond, because he could drill large ich were easily loaded, and, third, be- [illegible] down the holes [illegible] ired and thus he could not only blast mount of material at one time, but [illegible] all down [illegible] the working [illegible]

beginning the contractor had no idea ould save on his drilling and explo- [illegible] using big holes. In fact, he t there would be a loss on these t he figured that these losses would by gains from other sources, such ing at one level, etc.

st quarryman to install a big drill was one operating a quarry carrying an extremely high breast and the experimental installation was made in the hopes that the supposedly high drilling and explosive costs would be absorbed by other savings.

Later on a quarryman working a breast 40 ft. in height figured that if he would space the holes far enough back and far enough apart and then load them properly, that he ought to be able not only to carry all of his operations to one level, but that he ought also be able to reduce his drilling costs enough to offset any extra explosive needed. In these experiments, the spacing of the holes was extremely wide and thus the material came out in large blocks. However, as this particular quarry was equipped with big steam shovels and a big crusher, the ultimate results were very satisfactory, and thus the big drills were said to be all right for 40 ft., breasts when the plants were equipped with big shovels and big crushers.

The most serious handicap which had to be overcome was the ignorance on the part of the manufacturers of the big drills. This ignorance was not only passive, but it was down-right active and resulted in there being placed in a considerable number of quarries many machines which were entirely unsuited for the work. I believe, however, that the quarrymen should shoulder at least a part of this blame, for they insisted on a so-called good price, and thus the drill manufacturers, at first ignorant of quarry work or quarry conditions, furnished them with little, light, well-drill outfits which, while they would drill a hole, were nevertheless a long time at it.

The showing made by these small outfits was, in a number of cases, so poor as to amount almost to a failure and as is the case in the introduction of any new machine or method, one failure in the beginning, even though the cause for it is not understood, is very apt to condemn the whole, and requires a large number of successes to counteract its evil effect.

The difference between the big drill and the small drill is a difference not only of construction, but also of application, and thus involves quite a change in blasting methods.

The blasting operations conducted with small drills are carried on with holes of small diameter and comparatively shallow depths; as a rule 20 to 25 ft. is the limit of economical depth. Owing to the small diameter of the holes, it is necessary, in order to get sufficient explosive in the ground, to drill the holes close together, thus making the number of feet of hole per ton of rock moved very high, when compared with the big holes.

The limitation of economical drilling depth with a small drill requires comparatively shallow shooting and thus it is usually the custom to carry a quarry breast back in benches.

With the big drills the idea is to drill holes of large diameter and space them far apart, thus bringing the number of feet of hole per ton of rock moved down to the lowest point. Furthermore, as there is no reasonable limit to the depth which can be drilled with the big machines, the holes are drilled the full depth of the quarry, thus bringing all operations down to one level and furnishing at each shot a large quantity of broken stone.

The advantages which have caused the introduction of the big drills and which are instrumental in making the big outfits successful as cost reducers, are as follows:

First: The per ton drilling cost is less, due to the wider spacing. While a small machine under conditons which are favorable to it will drill faster than the big machine, still this difference rarely becomes greater than 2 to 1 and seldom gets as high as 1½ to 1. Figuring the small hole as averaging 2¼ ins. and the well-drill hole as averaging 5½ ins. in diameter, we then have a capacity ratio between the two holes of 3.97 to 23.76. A pretty safe general rule to follow in preliminary testing, in blasting, is that 1 sq. in. of drill hole will displace 8½ sq. ft. of stone. Figuring on the above basis, the 2¼-in. hole will handle 33.74 sq. ft. and the 5½-in. hole will handle 201.96 sq. ft., which calculated in linear feet of hole means that it will require 5.99 times as much small hole drilling as large hole drilling.

Now to put the above in figures more simply, we will assume that in a certain quarry a big machine will drill 60 ft. of hole per day. To equal this amount of hole, as far as blasting ability is concerned, the small machine will have to drill 5.99 times as much, or 359.4 ft. of 2¼-in. hole.

Suppose now, as stated in the beginning, that a small drill will drill 1½ times as much hole as the well drill, then we can expect from each small drill an output of 90 ft. per day. Dividing the 359.4, this being the number of feet of small hole required to equal the 60 ft. of well drill hole, by the average output of each small drill, which we have figured to be 90 ft., gives us 3.99 or practically 4, this being the number of small drills required to stand even with the big machine.

Now as for the cost of operating a big drill, I have rarely found it to be ½ greater than the cost of properly operating a small drill which will show good results on 20 to 25 ft. work

Supposing, however, that the big drill does cost 1½ times as much to operate as a small drill, then the ratio in total cost is as 1½ to 1, or, in other words, the tripod drilling costs 2.7 times as much per ton as the big hole drilling.

Second: The big holes save in explosive. (This point will be discussed in a later issue.)

Third: The big holes are drilled full depth of the breast and thus they do away with bench men, who are not only expensive as labor but are also expensive risks, as they are not only in danger themselves, but they are a menace to the workmen below. Another expense connected with bench cleaning (this being an expense which is not often figured), is the loss in productive capacity of the men on the floor of the quarry on account of being on the lookout for the men above. This item ranges all the way from 10 to 20 per cent loss in efficiency up to complete non-production of a certain section of the quarry, where on account of the risk involved it is necessary to abandon loading until the bench cleaning operations are over.

Fourth: Such a large amount of stone can be shot down at one time that it makes it possible to keep a steady and uniform supply of rock ahead of the men, thus bringing the production of the plant up to the maximum. This item is one which does not, as a rule, receive proper credit. The removal of the worry of a stone shortage from the foreman's mind gives him more time and inclination to devote his energies to the rest of the plant, and if the man is of the proper kind, this will result in increased plant efficiency.

Fifth: The shooting is done less often, thus cutting out lost time.

Sixth: Big holes are easier to load, and, compared with the tonnage, are cheaper to load.

Seventh: Big holes are the same size from top to bottom and thus it is possible to load the most explosive where it will do the most good, in the bottom. This results in making a cleaner and better quarry floor.

The seven advantages just named are the primary advantages and should be taken note of when the subject of installing a big machine is being considered. To get the best results from the big machine each quarry must be studied as a separate unit, and a plan worked out, which, for that particular quarry, will produce the best ultimate costs. By best ultimate costs I do not mean that it is necessary to make every charge connected with producing the stone the minimum, but that the final or total cost will be the lowest possible. To arrive at such a result requires, as stated above, a broad survey of the entire plant and takes into consideration all operations connected with putting the product through the plant. The items to be considered are: First, an item which we will call Overhead, which, as we will figure it, is in each plant a fairly well fixed charge; second, cost of drilling per [illegible] reduced, and third cost of ex[illegible] stone produced.

The first item, Overhead, will be considered as embracing all operating expenses not directly connected with the drilling and explosive costs. In those plants, loading by tonnage, the loading costs need not, unless it is desired, be considered, as they have no effect [illegible] plants.

The second item, cost of drilling per ton of stone produced, will be subdivided into primary drilling and secondary drilling. Primary drilling will cover the big hole work, and secondary drilling will cover block-holding or any other necessary drilling.

The third item, cost of explosive per ton of rock produced, will be subdivided into primary explosive and secondary explosive. Primary explosive will embrace that explosive used in the initial or big hole shots, and secondary explosive will embrace the explosive used in block-holing or mud capping.

The following list will make it easy to note the divisions as I have given them:

Overhead Cost per ton:
  1 Fixed mill or kiln expenses.
  2 Loading stone by shovel or per day by hand, cost.
  3 Labor cost of loading holes.
  4 Auxiliary labor around quarry.
  Other expenses not directly connected with drilling and explosive costs, and not covered by the above.
Cost of Drilling per ton:
  1 Primary drilling.
  2 Secondary drilling.
Cost of Explosive per ton
  1 Primary explosive.
  2 Secondary explosive.

The three main divisions above are so correlated that one cannot be considered without considering the others, and thus all three will be discussed together, however, it is my intention to discuss the field of blasting only as it influences drilling costs.

To reduce the per ton drilling cost to the lowest point, it is very clear that if all other conditions remain the same, the cheapest stone will be that which is produced by the widest spacing. Thus a 20x20-ft. spacing will move 2.77 times as much material as a 12x12-ft. spacing. Now it is very evident that to move a block 20x20 ft. will require more explosive, and, it may be a higher grade of explosive than will be required to move a block 12x12 feet. We are thus brought to the point where we must credit the item drilling with its extra saving per ton and debit it with the extra explosive cost, and then swing backward or forward in the spacing until we reach what we might term the peak of economy.

Before settling on this point as final, however, we have our secondary drilling and explosive charges and also our overhead costs to consider.

To test our peak point by the yard stick of secondary costs, it is necessary to charge the primary drilling costs for the wide spaced holes with any extra drilling costs or extra explosive costs above the secondary drilling and explosive costs when the narrower spacing is used. Having applied the secondary test, there remains only the item of overhead to consider.

Taking a 600-ton plant as an example, the overhead remains practically the same regardless of whether 500 or 600 tons of stone per day pass through the plant. Thus a spacing of holes which will produce stone ready to load, at a cost of 4 cts. per ton, but which causes the stone to be shot out in such condition that only 300 tons per day can be handled, is more costly than the stone which costs 6 cts. per ton to drill and shoot, but which comes out in such shape that 400 tons per day can be loaded. Each quarryman who keeps a close, or even a fairly close, cost record of his work, will be able to figure about what his overhead runs and will thus be in a position to figure the amounts of per ton overhead on different outputs per day.

To illustrate this point, we will suppose that a plant which produces 400 to 500 tons per day has an overhead of $65.00. This is for a hand loading plant on the tonnage basis. When this plant produces 500 tons per day the ovearhead cost runs 13 cts. per ton; when it produces 400 tons per day the overhead runs 16¼ cts. per ton. Thus the 500 tons cost 3¼ cts. less per ton to produce than the 400 tons.

Many of those operating by the big hole method get the idea that to produce most economical results it is necessary to carry the spacing of holes to the limit. The idea of big initial tonnage seems to occupy their minds to the exclusion of ultimate low per ton cost of stone. Some of this fault can, I believe, be laid at the door of the advocates of the big machines. In an effort to make a big showing and to demonstrate the low per ton cost of the initial drilling, they recommend a spacing of holes which, while it shows up the drill in a good light as far as the amount of stone shot down is concerned, still is not fair, for the reason that the saving made in drilling is more than offset by losses at other points, due to handling badly prepared material. A good superintendent soon detects this false economy, but many will consider only the first showing and will thus continue to throw away money on account of the very thing which they consider is showing a nice profit.

I will illustrate this by an example taken from two plants, one a hand loading and the other a shovel loading plant. The hand loading plant is a crushed-rock outfit with a quarry carrying a breast 50 ft. in height. When their big drill was first installed, the spacing was 15x15 ft. and 250 lbs. of explosive was used in each hole. This method of spacing gave considerable large rock and the spacing was changed to 12x12 ft. and 150 lbs. of explosive used in each hole. The narrower spacing added 46-100 cts. per ton to the cost of the primary drilling, but it cut 23-100 cts. per ton off the primary explosive. Under secondary drilling and explosive costs the additional drilling and explosive required by the wide spacing over that required by the narrow spacing amounted to 72-100 cts. per ton, and thus the saving by reason of the narrow spacing is 49-100 cts., or practically ½ ct. per ton. Besides effecting a saving of ½ ct. per ton, the narrow spacing enabled the output of the plant to be increased 12 per cent, which increased the saving per ton to quite a bit more than 1 cent.

The reason why the secondary cost mounted up so high on the wide spacing on this work was due to doing all secondary drilling by hand and doing a large amount of mud capping.

My next illustration is drawn from the experience of one of the country's largest crushed rock producers. Here the largest shovels and largest crusher are used.

When they first installed the big drills they determined, after considerable experimenting, that a spacing of 17 ft. back and 14 ft. apart gave them best ultimate results. A short time ago an economical idea came to one of the officers and in direct opposition to their powder man's advice. The holes were ordered spaced 22 ft. back and 18 ft. apart. This new spacing was adopted and a 10-hole shot made. Under the old system their shovels were each loading from 1,200 to 2,000 tons per day. Under the new spacing the rock came out in such condition that 400 tons per day per shovel was the best they could possibly do. Besides the low tonnage output, the bottom of the quarry was left in such shape that it had to be extensively block holed to smooth it up.

In drilling with well driller tools probably 80 per cent of the hole made is due to the crushing effect of the heavy weight, while the other 20 per cent is due to the chopping action of the edge of the bit. Under such circumstances it is readily apparent that the best way to increase the amount of hole made is to increase the weight of the tools. However, as the weight of the tools is made greater, it becomes necessary to increase the size and strength of the machine in order to handle them satisfactorily, and thus a point is finally reached where the extra weight and unwieldiness of the machine offsets any gain made by having heavier tools. The determination of this point is a problem which cannot be solved by fixed rules, it being necessary to move according to experience gained by trials and tests. Experience up to the present time seems to settle upon a weight of tools of about 1,150 lbs. for 5 to 5½-in. holes, and to get this weight a drilling stem 4 in. in diameter by 20 ft. long is used.

After having settled upon the size of tools to be used the elements, which in a big drill influence the number of feet made in a unit of time, leaving out of consideration the hardness of rock and such exterior influences, are:

Number of strokes of drill per minute.
Number of feet drilled before bailing out.
Time required to pull the tools.
Time required to bail out.
Time required to let the tools back into the hole and start drilling.

The above are the primary elements.

We also have secondary elements which are:

Time required to move machine from one hole to the next and start drilling.
Time required to change bits.
Time required to splice rope.
Time required to change rope end for end.
Time required to put on new rope.
Lost time from other causes.

The secondary elements, considered separately, are not as important as the primary due to the fact that they are less frequently repeated and thus a slight loss of time does not have much effect on final results. A drilling machine either tripod or well drill has what we might term productive and nonproductive periods. The productive period covers that time in which the drill is making hole, that is, striking on the rock, and the non-productive covers all other time. It is readily apparent that, other things being equal, the machine which is able to reduce its non-productive time to the minimum will drill the most holes.

Let us first take up the number of strokes of drill per minute.

We will assume that in a day's drilling the productive period covers 7 hrs. and that we are getting 55 strokes per minute during the 7 hours. Assume further that in 7 hrs. we drill 60 ft., then the total number of blows delivered in cutting the 60 ft. is [illegible] or 23,100. Dividing 23,100 by 60, the number of feet drilled, gives us 385, the number of blows required to drill one foot. Suppose now we are able to increase the number of blows to 59 per minute, which will give us a gain of 1,680 in the 7 hours. Dividing this 1,680 by 385, the number of blows required to drill one foot, gives us 4.3, which shows that an increase of 4 blows per minute has added 4.3 feet to the day's work. A properly constructed big drill will, on holes to a depth of 35 to 40 feet, deliver 58 to 60 strokes per minute, and thus there is absolutely no excuse for a drill man allowing his tools to run along about 50 strokes per minute, like so many of them do.

Having brought the number of blows per unit of time up to the maximum, the next step is to try and increase the total number of blows per day by cutting down the non-productive time, thus throwing more time to producing time.

Taking up the number of feet drilled before bailing out: Each time the hole is bailed, three operations are involved, namely, hoisting the tools, running the bailer and the lowering the tools back into the hole and again starting drilling operations.

Suppose now that the time involved in the bailing operation is divided as follows: Hoisting the tools, 2 min.; running the bailer, 4 min.; returning the tools to the hole, 2 min.

Thus each time the hole is cleaned out we have taken 8 minutes off of the production time. Assuming as in the beginning a daily footage of 60 ft. and also assuming that on an average of 4 ft. is drilled before bailing, then we have 15 bailing periods or a total of 8x15, or 120 minutes. Now, suppose by careful attention to details, we are able to reduce the bailing time by one-half. We will then be adding one hour to our production time, which will increase the amount of hole 9.45 ft. per day.

There is another method of eliminating this loss bailing time and that is by bailing less often. This must be handled carefully s what will be gained in time may be efficiency, due to the tools not being est work in a hole full of thick sludge.

methods of analysis given above as to the primary elements should also lied to the secondary elements, and all r time stopped.

osts involved in operating a machine Drill man, helper, power, sharpening epairs and renewals, interest and de- ion, oil, superintendence.

cost of power depends upon the kind With gasoline power, and gasoline at s a gallon, the cost ranges from 7 per day. With electric power at 2 cts. owatt, the cost ranges around $1.25 per With steam power, the cost depends he cost of water and coal delivered at chines. Ten to twelve barrels of water 0 to 650 lbs. of coal will be required y. With compressed air, the cost will ut the same as a 3¼-inch tripod drill.

cost of sharpening bits will depend up- [illegible] of rock. On rock of medium ss, one bit will last at least a full day, ll require three-quarters of an hour to r to dress.

irs and renewals will range from 65 ts. per day; 50 cents of this will be lling cable, which has to be replaced [illegible] 60 days.

interest will run 20 cents per day, fig- total cost of $1,000.00 for the outfit. preciation, assuming a life of 10 years [illegible] per day. In respect to [illegible] however, quite a bit of this is by the items repairs and renewals.

st is so low as to be almost negligible, ave included it to cover all items. We [illegible] 10 cents per day.

intendence cost on a big drill is much [illegible] on a small drill for the reason [illegible] amount of work can be laid out igned to the drill man without further n on the part of the superintendent.

ng in mind the plan which I have fol- ut in treating of big hole drilling, not arate item which stands alone and has ence on other quarry operations, but rt of a complete cycle of operations, mparative data showing the differ- tween big hole costs and small hole ould be of value. Four plants are s follows:

[illegible] Material gotten out for Lime shed Rock

breast	34 ft.
Stratification	[illegible] to 8 ft.
[illegible]	Hand
[illegible]	[illegible] ins.
[illegible]	[illegible] ins.
[illegible]	[illegible] ft.
[illegible]	[illegible] ft.
[illegible]	[illegible] cts.
[illegible]	[illegible] cts.
[illegible]	[illegible] cts.
Cost shooting per ton well drill	2.21 cts.
[illegible]	[illegible] ft.
[illegible]	[illegible] ft.
Saving in drilling per ton	1.48 cts.
[illegible]	[illegible] cts.
[illegible]	[illegible] cts.
Total saving per ton	4.24 cts.

The high overhead saving in this case was due not only to better output, but also to the fact that the ledge contained three or four different kinds of stone which by previous methods of bench shooting had to be mixed by hand. By shooting everything down together, the stone was mixed in the shooting.

Second Plant: Material gotten out for Crushed Rock.

Quarry breast	50 ft.
Stratification	[illegible] to 10 ft.
Method of loading	Hand
Average size small holes	2¼ ins.
[illegible]	[illegible] ins.
[illegible]	[illegible] ft.
Spacing well drill holes	13x13 ft.
Cost drilling per ton, small drill	4.3 cts.
Cost drilling per ton, well drill	.88 cts.
Cost shooting per ton, small holes	3.2 cts.
Cost shooting per ton, well drill	2.8 cts.
Drilling per day, small drill	50 ft.
Drilling per day, well drill	50 ft.
Saving on drilling per ton	3.42 cts.
Saving on shooting per ton	0.4 cts.
Saving on overhead per ton	1.7 cts.
Total saving per ton	5.52 cts.

The item overhead was derived from an increase of 75 tons per day due to better loading conditions.

You will note that I have made no allowance for the increased profits due to the additional 75 tons, but have figured only the actual saving. If it is true, as I am being sometimes told by stone producers, that they are losing money on every ton of stone produced, it would probably be better for me not to mention this extra 75 tons, as figuring on their basis, the greater the output, the greater their loss.

The records which follow cover a rather peculiar limestone formation. The strata are not only very thin, averaging 2 to 4 inches, but they appear to be without continuity. When drilling this formation with tripod drills, a great amount of caving trouble was experienced. Some days this was so bad that a tripod drill would not complete a single hole. I make this explanation to account for the high tripod drilling costs.

Third Plant: Material gotten out for Cement.

Quarry breast	30 ft.
Stratification	Thin, shelly
Method of loading	Shovel
Average size of small holes	[illegible] ins.
Size of well drill holes	[illegible] ins.
Spacing small holes	6x6 ft.
Spacing well drill holes	11x11 ft.
Cost drilling per ton, small holes	7.0 cts.
Cost drilling per ton, well drill	0.6 cts.
Cost shooting per ton, small holes	3.5 cts.
Cost shooting per ton, well drill	2.8 cts.
Drilling per day, small drill	35 ft.
Drilling per day, well drill	90 ft.
Saving on drilling per ton	6.4 cts.
Saving on shooting per ton	0.4 cts.
Saving on overhead per ton (no data)	
Total saving per ton	6.8 cts.

The fourth and last comparative record is taken from a large capacity crushed rock plant. Previous to installing well drills they were drilling a 40-ft. ledge with large air drills. Although the operation of the drills was not very satisfactory on the deep holes, thus bringing up the drilling cost to a high figure, still the ultimate costs derived from working the high breast justified the high per ton drilling cost.

Fourth Plant: Material gotten out for Crushed Rock.

Quarry breast	40 ft.
Stratification	2 to 8 ft.
Method of loading	Biggest size shovels
Average size small holes	[illegible]-in. top, 3¼-in. bot'm
Size of well drill holes	5½ ins.
Spacing small holes	8x8 ft.
Spacing well drill holes	18x12 ft.
Cost drilling per ton, small holes	5.76 cts.
Cost shooting per ton, well drill	82 cts.
Cost shooting per ton, small holes	3.98 cts.
Cost shooting per ton, well drill	2.94 cts.
Drilling per day, small drill	34.6 ft.
Drilling per day, well drill	64.2 ft.
Saving in drilling per ton	4.94 cts.
Saving in shooting, per ton	1.04 cts.
Saving in overhead, per ton (no data)	
Total saving per ton	5.98 cts.

The four comparisons made will give a good general idea of how the amount of saving runs. Some plants are doing better than the figures given, while there are, of course, others which do not show up as well. One thing which has handicapped me a good deal in working out comparative costs is the lack of attention paid to cost records by the quarrymen, most of whom seem to carry such things in their heads.

OADS AND STREETS SECTION

Sprinkling at St. Paul, Minn.: hods of Keeping Records and Making Assessments.

tle intelligent attention is commonly street sprinkling and so few attempts e for the improvement in efficiency omy of this municipal function, that owing description of the way this handled at St. Paul, Minn., should terest to all municipal engineers. At it has been demonstrated that sys- attention to details will bring results so common an everyday operation as rinkling. This description of the St. thods has been taken from a paper by Mr. C. L. Annan, Office Engi- he Department of Public Works, for ion at the Sept. 18 meeting of the Society of Civil Engineers, and the Proceedings of the Society, Vol. I, No. 5, pp. 632-640. For years the of St. Paul put up with unsatisfac- et sprinkling. In the earlier years was done by contract, the cost be- ly assessed, at considerable expense, he property supposed to be benefited. a substitute, an annual appropriation ded, for a few years, in the general to meet the cost of sprinkling by day he result was intolerable. Finally, at the general election in May, 1908, a sprinkling amendment was submitted to the people, and in 1909 the Commissioner of Public Works took charge of street sprinkling under this amendment. The system inaugurated at that time has been fairly perfected and it has been demonstrated that systematic attention to details has brought results at least commensurate with the cost. The amendment provided for an appropriation of $60,000 for the first year and an additional $40,000 for the second year. By that time the system should be running smoothly under the revolving funds fed by the assessment of the property benefited.

The third season under the new law opened with about 230 miles of streets to be sprinkled. New routes were added from time to time and a few were discontinued, resulting in a total gain for the season of about 9 miles. There is generally strong opposition to the discontinuance of a route once started.

From two to eight trips, depending on the nature of the street surface and the amount of traffic, are made each day. There are nine sprinkling districts, each under the supervision of an inspector at $75; a chief inspector or overseer at $110 is also employed. The ten inspectors report daily. The chief inspector advises and assists local inspectors and makes special examinations. The inspectors' reports are tabulated daily; all complaints are investigated, and the written reports are filed for reference. The foreman of stand-pipe construction and repair crews receives daily instructions, and the yardmaster returns a daily statement of sprinkler distribution and repairs. Careful itineraries on each team route are taken from time to time, and, in short, the head of the department is intimately informed of all details concerning equipment and operation.

In assessing the cost of the work, the abutting frontage, number of trips per day, and length of time sprinkled, are taken into consideration. For the season of 1911, 43 assessment rates thus resulted, ranging from less than 1 ct. to 11½ cts. per front foot of abutting property. The cost of water is not included in the assessment, the city charter so providing.

Water sprinkling of macadam was superseded early in the season by oil spraying. It was estimated that about 1/5 gal. per sq. yd. of a 20 per cent liquid asphalt might be applied three times during the season at a cost not to exceed that of water sprinkling for the same period. The latter part of the season being unusually wet, comparatively few streets required the three coats of oil.

The sprinkling wagons are city property; 40 new and 31 second-hand sprinklers, vary-

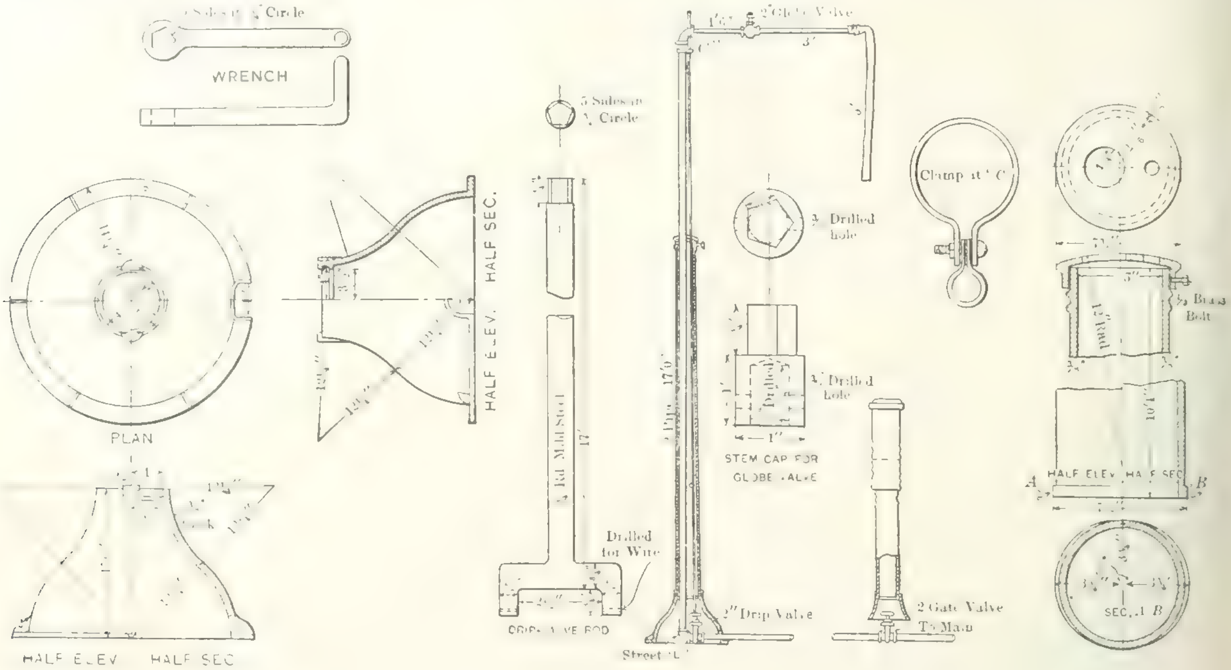


Fig. 1—Details of Stand Pipe Used by Department of Public Works of St. Paul, Minn.

[illegible] capacity from 600 to 750 gals., were urchased in 1903. Twelve 750-gal. tanks ere added in 1909, and as many more in 910. These 95 sprinklers allowed a 10 per cent reserve. All were in good repair after thorough overhauling during the winter.

Teams were used for 7 days in the week at 100 per month, rain or shine, under an agreement with the Teamsters' Union. Previous to April 1st, teamsters were allowed $4 per day or actual time.

Inspectorships, formerly political sinecures, were transformed to realities. Consistent daily reports, investigations of complaints, route tineraries, and first-hand information as to ondition of sprinklers and stand-pipes, require a certain amount of attention.

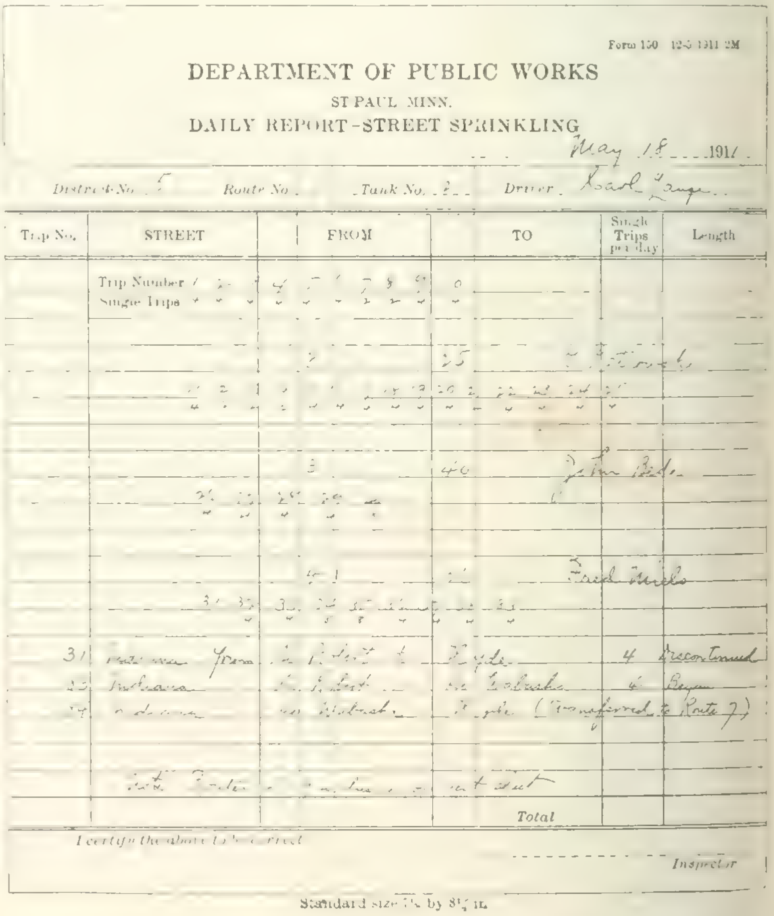
Five men at $2 and a team at $3 keep the tand-pipes in repair under the supervision f a foreman, who also attends to the maintenance of the public drinking fountains. This orce also moved 16 stand-pipes from one oint to another and erected 17 new ones in 911. A stand-pipe, installed, Fig. 1, costs bout $60. The top valves are removed in October to prevent damage by freezing, and re replaced in April, an underground valve being used in March and November. There re 463 stand-pipes now in service.

The stand-pipe is quite generally regarded s a nuisance, and much opposition is met in ocating it. It is not so much its unsightliness as the frequent presence near it of the heavy sprinkler, the standing horses, and the general sloppiness that make it objectionable. For washing ice, mixing cement, and other purposes, the stand-pipe is a great convenience o any outsider with a pipe-wrench. The Water Department and the police had long overlooked this kind of larceny, but a few arrests by special officers of the Sprinkling Department, and a few trials and convictions, now and again, somewhat abated this nuisance of mud and damaging misuse.

The method of assessing is as follows: A clerk, at $60, enters the daily reports (Form 150, Fig. 2) on Form 152 (Fig. 3), and indexes complaints and special orders to inspectors by number on the same form. Complaints are taken in duplicate on a general department form, the duplicate being held against the inspector until he turns in his report.

Form 152 (Fig. 3) is arranged in a check file divided into districts by tab cards of a distinctive color. The districts are subdivided into routes by cards of another color, one compartment in each district being reserved for "dead" trip slips. The current trip slips will not average more than ten to a route so they are readily accessible though the aggregate may be considerably more than 1,000.

Trip and route numbers may be changed on a trip slip (Form 152) but a change of limits necessitates new slips and cross-references and the consigning of the obsolete slip to the "dead" division until required for assessment purposes. All assessment forms are handled on the loose-leaf system.


Form 150 12-5 1911 2M

DEPARTMENT OF PUBLIC WORKS
ST PAUL MINN.
DAILY REPORT-STREET SPRINKLING

May 18 1911

District No. 5 Route No. [illegible] Tank No. 2 Driver Karl Lange

Trip No.	STREET	FROM	TO	Single Trips per day	Length
	Trip Number [illegible] Single Trips [illegible]				
31	[illegible]	[illegible]	Hyde	4	Discontinued
[illegible]	Indiana	[illegible]	[illegible]	4	Begun
[illegible]	Indiana	Wabash	Hyde (Transferred to Route 7)		
			Total		

I certify the above to be correct

Inspector

Standard size 7½ by 8½ in.

Fig. 2—Form for Daily Report on Street Sprinkling.

Two men, at $80, are employed from March 15th to August 1st in making a transcript from the County Auditor's records on Form 151 (Fig. 4) and preparing assessment sheets (Form 166, Fig. 5). The force is then doubled to make the assessment, post, and check it, the work to be completed early in October.

The assessment rate, A, per front foot of property abutting on any particular section of sprinkled street is derived as follows:

D = trips per day on the particular route

M = sprinkling period, in months an for the same route,

$C = D \times M$ (nearest integer),

F = total frontage on same route,

$P = C \times F$,

of products, P, for all routes, ated total cost of sprinkling all utes. (From the five months actual

DISTRICT N
ROUTE N
FROM
MAY
SEPT

Fig. 3—Form for Recording Season's Sprinkling.

cord a close estimate can be made r T.)

$C \times R$.

of the method of procedure and of n of volumes may be obtained by

The total of Column P is S. The total of Column F [illegible] is obviously the first item in Column $C \times R$. R being constant, there are as many values of A as there are of C and $F \times R$. for each group is checked by the total.

[illegible] Form 154 are [illegible] completed, and the slips are rearranged in ward groups. In the meantime, Form 166 has been prepared to correspond with each sheet of Form 154, of which it is an extension applied

whereon the seven lots in the Auditor's Sub. No. 30, noted on the first line of page 720, are entered in detail. The 1911 assessment contained 3,472 sheets of Form 151.

The cost of making the assessment of 1910 was a little more than 2 per cent, but City Railway complications raised this ratio to more than 3 per cent in 1911.

Early in May, 1911, the Supreme Court of the State decreed that the St. Paul City Railway Company must at once comply with the Ordinance of October, 1909, requiring this company to sprinkle its tracks. As an immediate alternative, the company agreed with the Commissioner of Public Works to pay the Sprinkling Department for doing the work. The cost of sprinkling streets traversed by the City Railway was to be prorated as to time and space from the totals of the general assessment for the same streets. Form 190 (Fig. 7) was provided for this record.

As soon as arrangements could be made, the City Railway Company sprinkled many miles of its track space with road oil.

The occasional itinerary which has been referred to has proved to be a practicable and an excellent feature. It was called for at irregular intervals, and the returns assisted in determining the efficiency of both teamsters and inspectors. Each teamster and inspector

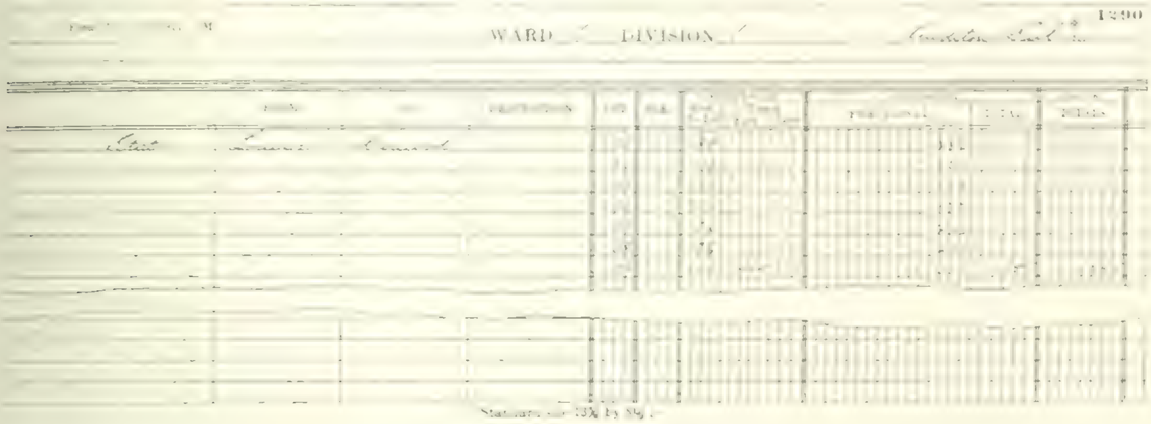

1290
WARD
DIVISION

Fig. 4—Form Used for Making Transcripts for County Auditor's Records.

eference to the assessment of 1911. record, on Form 152, was sum- Form 154 (Fig. 6), embracing s in twelve groups, one for each group arranged alphabetically by es and bound with flat-head fasten- coefficient, C, having been deter- each slip, the 1,439 slips were re- 43 groups, corresponding to the

to the property to be assessed. Form 166 is arranged alphabetically. When complete, the sheets are paged consecutively from the first sheet of Ward 1 to the last sheet of Ward 12.

The assessment is finally made on Form 151, there being as many sheets of this form as there are block numbers involved on the various plates and subdivisions named on Form 166.

is furnished with a specific route sheet, and the care taken to equalize routes is generally appreciated and tends to the good of the service. The routes as traveled are reported on Form 173 (Fig. 8). They are platted on light blueprints. A summary is made of the number of tanks of water used and of the feet of effective and idle travel in a half day. The 45 sq. miles of sprinkling area are

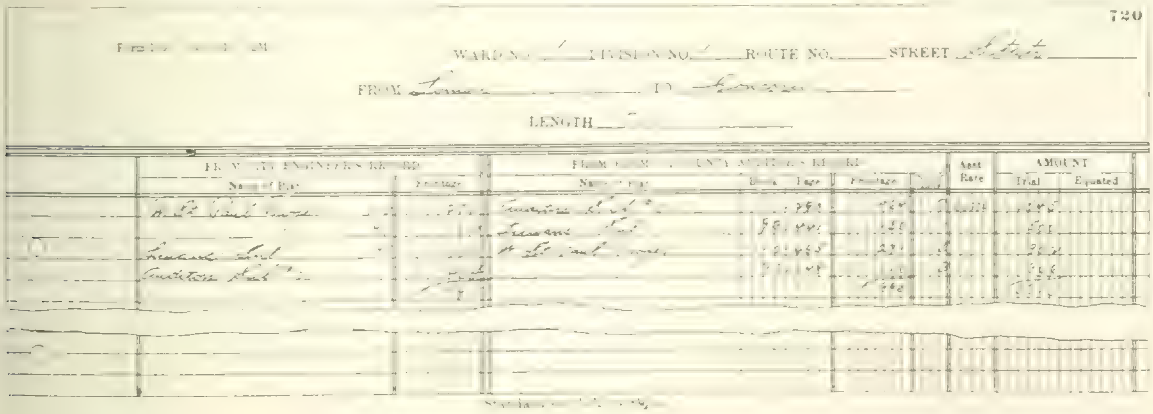

720
WARD NO.
DIVISION NO.
ROUTE NO.
STREET
FROM
TO
LENGTH
Name of Plat
Frontage
Asst Rate
AMOUNT
Trial
Equated

Fig. 5—Form Used for Assessment Sheets.

ns of C. A five-column table was ed with a line for each value of

F	P	F × R	C × R
[illegible]	34,006	62.91	0.00185
[illegible]	[illegible]	256.23	0.00370
	and so on, to		
[illegible]	[illegible]	[illegible]	0.11479
.815	50,529,857	93,480.24	

For instance, on page 720 of Form 166 there are four blocks of property containing lots to be assessed. There will consequently be four corresponding sheets of Form 151. These sheets are arranged alphabetically by plot names in ward groups, and they are also paged consecutively.

Page 1290 (Fig. 4) is a specimen sheet

covered by 34 tracings (8½ by 13½ ins.) on a scale of 600 ft. to 1 in., and from these tracings the blueprints referred to are made as required.

Among the many owners of the 50,000 lots, more or less, assessed, there are many complainants who desire to know the particulars, and, for the benefit of this class, a special form has been prepared. Occasionally a correction is necessary; there were only twenty on the first assessment made under this sys-[illegible]

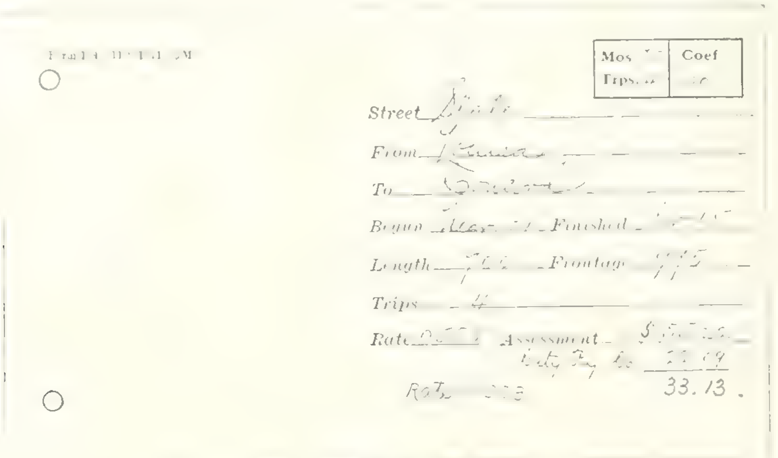

Mos Coef
Trips
Street
From
To
Begun Finished
Length Frontage
Trips 4
Rate Assessment
City Ry Co
33.13
Rate
Standard size by 4 in

Fig. 6—Form Used for Summarizing Daily Records.

The assessment for each ward is cross-checked and balanced to a cent. A concluding word may be said as to the daily reports, Form 150 (Fig. 2). Each section of street has its trip number. The small figures under the trip numbers show the number of trips actually made for the day. Under Route 4 it will be noted that Trip No. 31 lacks the subnumber. The explanation immediately follows. To write "31" is equivalent to writing "Indiana Avenue, from South Robert Street to Hyde Street." On May 18th Trip No. 31 was divided, a portion of it (No. 84) being transferred from Route 4 to Route 7.

Each inspector keeps a consecutive list of last numbers in his district and can thus assign a new number when necessary.

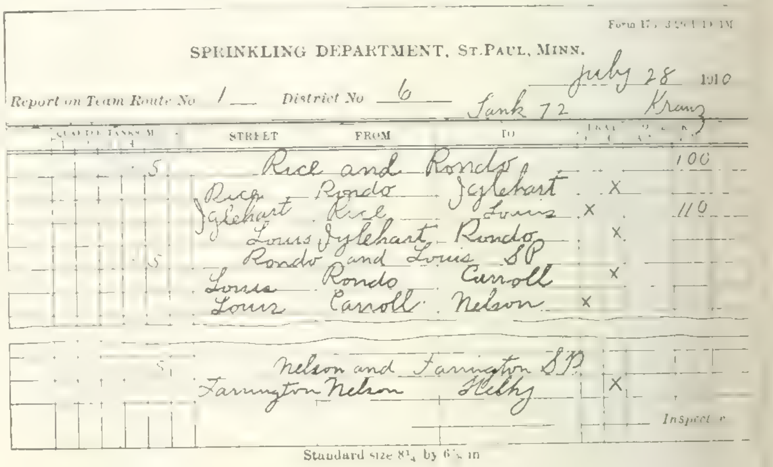

SPRINKLING DEPARTMENT, ST. PAUL, MINN.
July 28 1910
Report on Team Route No 1 District No 6 Tank 72 Kranz
STREET FROM TO
5 Rice and Rondo 100
Rice Rondo Iglehart X
Iglehart Rice Louis X 110
Louis Iglehart Rondo X
5 Rondo and Louis SP
Louis Rondo Carroll X
Louis Carroll Nelson X
5 Nelson and Farrington SP
Farrington Nelson Selby X
Inspector
Standard size 8¼ by 6⅞ in

Fig. 8—Form Used for Reporting Routes Traveled.

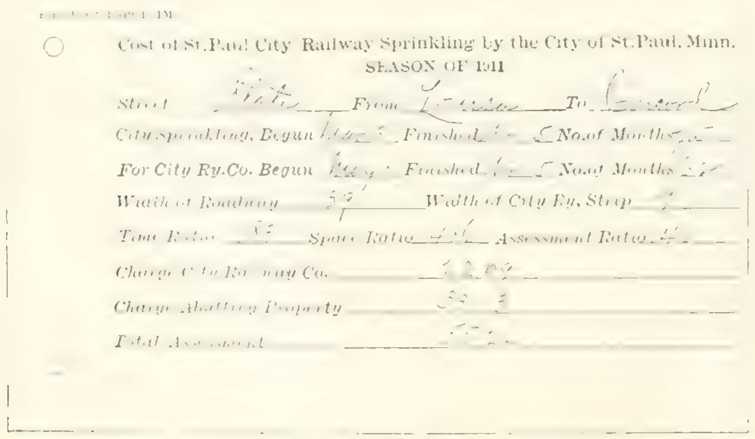

Cost of St. Paul City Railway Sprinkling by the City of St. Paul, Minn.
SEASON OF 1911
Street From To
City Sprinkling, Begun Finished No. of Months
For City Ry. Co. Begun Finished No. of Months
Width of Roadway 52' Width of City Ry. Strip
Team Ratio Space Ratio Assessment Ratio
Charge City Railway Co.
Charge Abutting Property
Total Assessment
Standard size 6½ by 4 in.

Fig. 7—Form Used for Pro-rating Assessment.

Progress Report on the White Plains Road Experimental Pavements.

These experimental pavements were constructed in the fall of 1910 in the Borough of the Bronx, New York City, the work being done under the direction of Mr. William H. Connell, at that time Assistant Commissioner of Public Works. This experimental work was described fully in our issues of April 19 and April 26, 1911. In the Proceedings of the American Society of Civil Engineers, Vol. xxxviii, No. 5, pp. 773-781, is given the following description of the conditions of the different pavements in January, 1912. The cost data for repairs to the pavement are given in Table I. The cost of repairs to each section is based on the construction cost per sq. yd. of the respective section and the cost per sq. yd. of repairs is obtained by dividing the total cost by the total number of square yards in the section. The construction cost is used for this purpose because it is deemed to be a fairer basis of comparison of the miantenance cost of the respective sections than that of the actual cost of repairs, which in a number of cases would be misleading, owing to the high cost per sq. yd. due to lack of proper facilities for making repairs.

The condition of the different sections was as follows:

TABLE I—COST OF CONSTRUCTION AND REPAIRS.

Sec. No.	Sq. yds. repaired	Construction cost per sq. yd.	Total cost of repairs.
1	6.4	$0.80	$ 5.12
2	32.3	0.832	26.87
3	0.0		0.00
4	0.0		0.00
5	3.	0.75	2.25
6	3.5	.	0.00
7	17.91	...	[illegible]
8	8.0	0.124	8.99
9	2.7	1.33	3.59
10	54.6	1.077	58.80
11	243.2	0.031	12.53
12a*	354.1	...	4.19
12b	5.8	0.654	3.79
12b*	118.0	...	1.49
13	4.3	1.209	5.19
14	0.0	..	0.00
15	413.2	0.04	16.67
16	35.	0.67	23.45
17	0.0	.	0.00

*Surfaced with sand

Section One: 0 + 00 to 3 + 25.—Bituminous pavement, mixing method, laid by the Barber Asphalt Co. Surface even. The mixture, however, is apparently too dry; 5.4 per cent of asphaltic cement of 38 penetration The penetration and percentage o cement should be increased.

Section Two: 3 + 25 to 6 + 50.— pavement, mixing method, laid in with Borough of the Bronx S Surface even and entirely satisfac pairs were due to moisture in the which worked in from the railw There was no pavement between tracks last winter.

Section Three: 6 + 50 to 8 + even. An excess of asphaltic cemen in the seal coat, which caused a slig during high temperatures. No quired.

Section Four: 8 + 00 to 11 nous pavement, mixing method, lai supervision of the Standard Oil uneven. Pavement laid during l tures; set before it received prop sion under roller; traffic increased until waves are about 2 ft. apart. cement apparently too soft at hig ture for this method of constructi pairs required.

Section Five: 11 + 25 to 14 minous pavement, mixing method, the supervision of The Texas even, but has settled under traffic that of any other section. Mixtur enough, ¾-in. stone only being use has heaved in several spots, possi moisture, as surface is not water- to some extent where seal coat Repairs due to settlement.

Section Six: 14 + 50 to 17 + laid under the supervision of the Surface satisfactory, but not as was in June, 1911, possibly due to tion of settlement of foundation a traffic during high temperatures. to frost in foundation. Very slig during high temperatures.

Section Seven: 17 + 75 to 20 + 7.—Sicilian Asphalto, laid by the Sicilian even. A very desirable surface for ives and automobile traffic.

[illegible] pavement, mixing method, laid under ervision of the Barrett Manufacturing [illegible] somewhat wavy, apparently [illegible] nbination of settlement of foundation ct of traffic during high temperatures. leeding during high temperatures.

[illegible] pavement, mixing method. Surface wavy, possibly due to foundation. As-s apparently helped tar, as this section show any tendency to break up in cold as the tar did when used without the of asphalt. (See Section Ten.) Did d to any appreciable extent during nperatures.

[illegible] pavement, mixing method. (United ar.) Surface somewhat uneven, due lation. Binder very brittle in cold [illegible] in foundation or overheated binder. imber were undoubtedly due to the aracter of the binder in cold weather. tion, however, showed less tendency during high temperatures than the tions on which tar was used for a

[illegible] —Barrett Manufacturing Co.'s "Modern Pavement." [illegible] for surface stone to separate. There was considerable moisture under the foundation when this pavement was laid; it bled to a considerable extent in places during high temperatures, due to excess of binder.

[illegible] Bituminous pavement, penetration method. (Sanford and Strain's Asphalt Binder.) Surface slightly wavy; bled to a great extent during high temperatures, which necessitated an [illegible] wearing surface is not as thick as was stated in report.

[illegible] Standard Oil Co.'s Special Binder. Surface slightly wavy; bled to some extent, but not as badly as Section Twelve A. Spread sand to take up excess binder.

[illegible] sam Concrete Pavement. Surface good, with the exception of two cracks extending the entire width of the roadway, and two places about 9 ins. in diameter where the stone has picked up.

[illegible] Water-Bound Macadam. This section is at present in an ideal condition for a suitable bituminous surface treatment. The top dressing has been scattered and washed away. It will be necessary to resurface this section next season or to apply a bituminous surface treatment.

Section Fifteen: 34 + 50 to 36 + 25.—Bituminous pavement, penetration method. (Tarvia X.) Surface even. Applied Tarvia B and sand, as surface stone seemed to be separating in places.

Section Sixteen: 36 + 25 to 37 + 75.—Bituminous pavement, penetration method. (Bermudez Asphalt.) Surface slightly wavy. No repairs made thus far, except those due to a settlement of 1 ft. or more over a sewer; shows signs of moisture in the wearing surface or foundation, is a question at present. Slight bleeding during high temperatures.

[illegible] Bituminous pavement, penetration method. Surface even and very satisfactory to date. Slight bleeding during high temperatures.

[illegible] Standard Oil Co.'s sand surface method. Bituminous surface has entirely disappeared. Surface was not in condition to receive treatment, owing to new patches where screenings had not set. The bituminous material applied to this section was not at all suitable for the [illegible]

ATER SUPPLY, SEWERAGE AND SANITATION SECTION

sign and Methods Employed in ucting the Cooke Water Power : on the Au Sable River in higan—Concrete Mixtures sed—Tests of Turbines— Camp Sanitation.

Staff Article.)

DESIGN.

oke water power development plant on the Au Sable River, in the lower of Michigan, about 16 miles from where the river discharges into on. The plant was built by force the employes of the Eastern Micher Co. This development is the first of plants which this company plans to the Au Sable River. The second own as the Five Channels Development now under construction at a point upstream from the Cooke plant. Sable River is fed by springs and n flow is unusually uniform from ar. There are only two tributaries nsiderable size in the 60 miles of stream above Cooke. One of these as an average flow of 100 cu. ft. l, and the other only 25 cu. ft. per or the first 25 miles above the nt the river is fed only by springs, springs are very uniformly distrib-, minimum flow of the river is 1,100 d the ordinary maximum is 3,300 ly once since 1899, which is as far e United Geological Survey records this stream, has the flow reached A 40-ft. head is developed at drainage area is 1,641 square pondage is 1,914 acres.

layout of the development is Fig. 1. A section through the cen-[illegible] is shown in Fig. 2, and through the center of the Tainter own in Fig. 3. Tainter gates are the spillway and are operated as [illegible] The same type of gates headgates to control the entrance the turbine chambers. This use tes to control the flow of water [illegible] believed to be the first such gates for this purpose hydro-electric practice. The gates and 20 ft. 6 ins. high and conly novel feature of design in the se. Ultimately these gates will be directly controlled by the plant operator from the switchboard.

The Tainter gates are built up of structural steel shapes riveted together. The face of the gate is curved to the arc of a circle of 20 ft. radius about the gate axis as a center. There are seven radial ribs which radiate at equal angular intervals from the axis to the face. These ribs are all made of single angles 7x3½x7/16 in. in section. The main strut of the face, which lies along the chord of the circular arc, is a single 10 in., 20-lb. channel, riveted to the ribs at points of intersection. There are four diagonal braces which intersect the ribs. The main diagonal brace is along a perpendicular dropped from the top of the gate to the lower rib. This brace is composed of a 5x3½x7/16 in. angle and a 3x2x⅜ in. angle. Parallel to this brace and midway between it and the axis, is another diagonal brace composed of two angles, one 4x4x⅜ in. and the other 3x2x⅜ in. Running from the bottom of the main diagonal to the top of the parallel diagonal is another brace made of a 4x4x⅜ in. angle, and parallel to the latter brace is another of the same section, extending across the ribs from the bottom of the second diagonal above described. All diagonals are riveted to the ribs at intersection points. At the back of the face plate and parallel to the axis one 15-in., 33-lb. channel is placed at the face end of each rib. At the back of the face and in the plane of the ribs a 5x3x3/16 angle runs the full height of the face. These angles are spaced 2 ft. 4 ins. on centers and form the portion of the framework to which the face plates are directly riveted. The upper three panels of the face plate are ¼ in. thick, the next two sections are 5/16 in. thick, and the remaining two sections are ⅜ in. thick. The gates are provided with white oak stop and sill blocks. The axial shaft about which the gate turns is 10 ins. in diameter. Each gate shaft is separately operated by means of a 5 h. p. motor. The Tainter headgate and upstream end of the "Quadruplex" turbine unit is shown in Fig. 4.

CONSTRUCTION.

The Cooke development is 16 miles from the nearest town and can be reached only by driving across the country or by means of a narrow gage logging railroad. This fact had a marked influence on the construction plant and methods.

Construction operations were begun in the fall of 1909. All materials and machinery used on the construction and in the permanent equipment, with the exception of round timber cut near the dam site, were freighted in from the town of Au Sable, a distance of 16 miles, over a narrow gage logging road. A 10,000-barrel cement shed was erected and filled at the outset of the work. A 500 h. p. steam plant was built for the express purpose of furnishing power for use in the construction operations. The steam engines in this auxiliary plant were belt connected to generators and the electrical current so generated was transmitted to various motors used in operating pumps, concrete mixers, etc. A machine shop was built and equipped with the usual machines, including one large drill press.

A construction view of the dam is shown in Fig. 5. The total width between bluffs at the dam site is about 800 ft. The width of the stream, before construction, was 100 ft. and its greatest depth, at midstream, was 10 ft.

The first construction operation was to divert the flow of the river from its channel into a natural back channel which at one time had formed the stream bed. A diversion crib was built across the main channel by driving enough piling to hold the spruce and cedar mattresses in position. Clay taken from the power house excavation was deposited against the crib-work, thus forming enough of a dam to bring the back channel into action.

The excavation was then made for the stream sections of the dam. The total depth of this excavation was 25 ft. at midchannel, and it was made by means of a Monighan drag-line excavator. The material so excavated, which was clay, was dumped into 6 cu. yd. Western side-dump cars. These cars were hauled over standard gage track by means of a hoisting engine. The engine was at first placed at the far end of the diversion crib and filling material was brought up to the desired height to close the river. Then the hoisting engine was moved so that the entire bed of the river for 300 ft. above the dam was filled. A similar clay cofferdam was built down stream from the dam. No leaks developed in these cofferdams. The diverted flow of the stream is shown at about the center of the trestle-work in Fig. 5.

At the left-hand side of the spillway section the trestle used in making the hydraulicked fill may be seen in Fig. 5. This fill is 550 ft. long and averages 45 ft. high. The

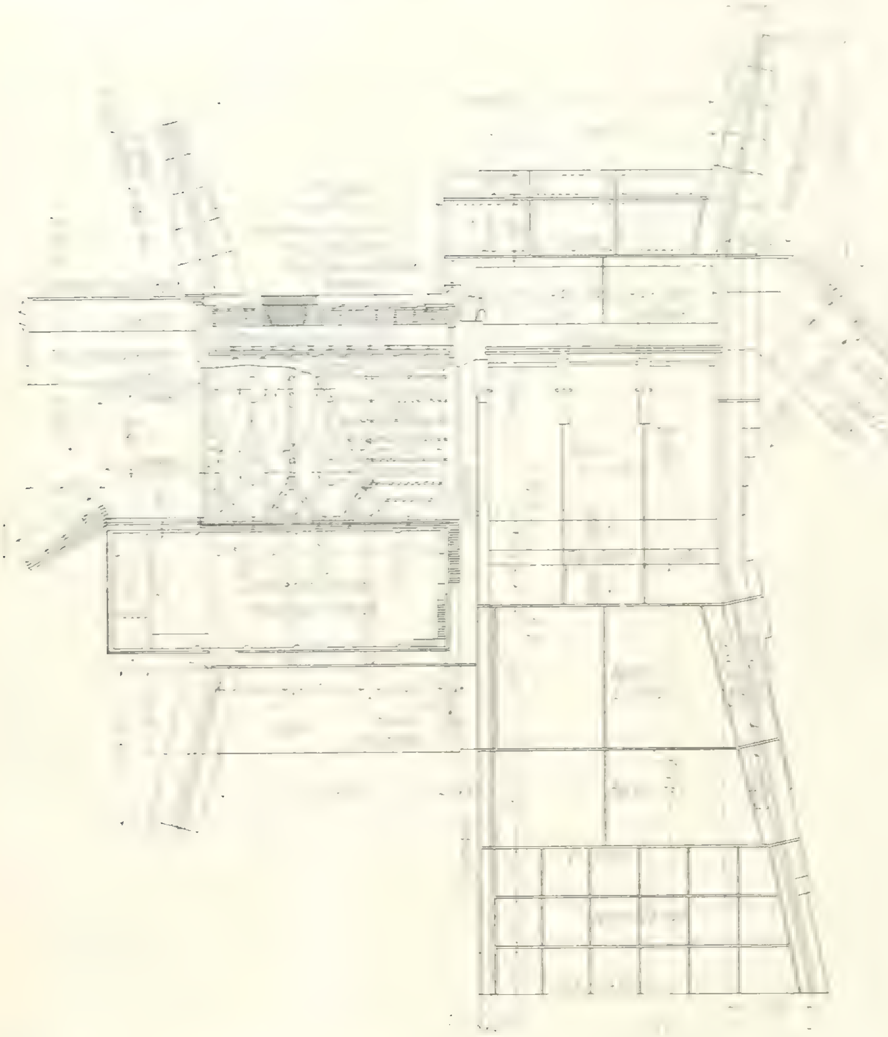


Fig. 1—General Plan of Cooke Water Power Development on Au Sable River, Michigan.

[illegible] maximum height of [illegible] entirely of round timber cut near the dam site.

The water used in the sluicing operations was pumped from the river by means of two 3-stage 8-in. De Laval centrifugal pumps, belt driven from electric motors. These pumps ran at 1,140 revolutions per minute and each pump was capable of pumping 1,350 gals. per minute against a total head of 350 ft. The discharge pipe from these pumps was 800 ft. long and was No. 14 gage American spiral riveted pipe, 12 ins. in diameter. A close view of the hydraulicking is shown in Fig. 6. The hoses used were ordinary rubber-lined fire hose, 4 ins. in diameter. The nozzles used were 1⅛ ins. in diameter.

The sluicing trough was made of No. 12 gage sheet steel, rolled to a semicircle of 30 ins. diameter. This form of trough has been used before and always with excellent results. The trough grades used were 6½ and 8 per cent, mostly the latter. The coefficient C in the formula $V = C\sqrt{rs}$ was found to be 130 when $V = 17$ ft. per second. With one pump running the mean velocity of flow in the trough on the 8 per cent grade was found to be 15 ft. per second, and the depth of water at the center of the trough was 4 ins.

About 156,000 cu. yds. of material were sluiced into place, measured in the pit. Of this amount 9,800 cu. yds. was clay, and the remaining 146,200 cu. yds. of fill was composed of a fine, round yellow sand. During the month of July, 1911, 38,000 cu. yds. of fill was made. This was equivalent in volume to 65 per cent of the water pumped. In June the percentage of solids transported was equal to 55 per cent of the transporting water pumped, and in August the corresponding percentage was 49. Only sand was moved in those three months. In October of the same year clay alone was handled and the solids transported were equal in volume to 16 per cent of the water used. On an average the amount of soil transported was equivalent to 38½ per cent of the volume of the transporting water. The quantity of water pumped was determined from the guaranteed efficiency and the efficiency curve, furnished by the pump builders, in conjunction with the pressure pumped against, which was read from a gage at 15 minute intervals. A close view of the hydraulic fill, the sluicing trestle and the water supply line is shown in Fig. 7. The horizontal longitudinal braces between trestle bents indicate the level of the track on which cars were operated in conveying concrete for the [illegible]

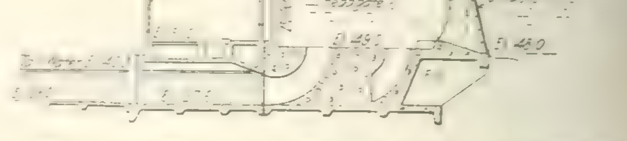


Fig. 2—Longitudinal Section Through Center of Turbines.

The construction of the sluiced fill, which was begun in the spring of 19 put the back channel out of service and diverted the stream flow back into the main channel. The position of the temporary gates which passed the stream flow through the spillway section until the plant was completed are shown in the sectional view given by Fig 3.

CONCRETE MIXTURES USED.

The aggregate in all concrete mixtures used was pit run gravel having about [illegible] per cent voids. Various mixtures were used according to the service conditions imposed on the concrete in different parts of the structure.

The gravel was taken from a pit [illegible] from the work. A Monighan [illegible] 1½ cu. yd. bucket was used both for stripping and for loading the 6 cu. yd. cars. A temporary standard gage electric railway was built out to the gravel pit.

All concrete was mixed in No. 2 Engineering and Contracting Cu The gravel was dumped into a boc dump cars and elevated by means c elevators into an elevated bin, wh fed by gravity, as desired, into The mixer dumped directly intc Koppel cars. Only a half yard was dumped into a car, however car was pushed by one man out c on the trestle, where it was dur concrete was spouted from the tre forms. A trestle, built largely of ber, was constructed over the pc penstock and spillway sections f pose.

Fig. 8 is a general outline plan c The concrete is divided into sectio venience in cost keeping. The num on this plan also serve as an in various concrete mixtures emplo the specifications which follow crete used may be divided into t classes, namely, mass concrete an crete. Mass concrete consists of slabs or masses 18 ins. and over which contain no reinforcing ste reinforcing steel, spaced more th on centers. Mass concrete is de the odd numbers and thin conc even numbers shown on the diag 8. Thin concrete consists of wa small masses less than 18 ins with or without reinforcing [illegible] forced concrete of any thickness in the above specification for ma

Mass Concrete.—No. 1 includes [illegible] wall and footings under [illegible] side of the power house extendi joint between the power house an to the downstream end of the is a 1:7 concrete. No. 3 inclu wall between the spillway [illegible] and its extension as a parti stream to the end of the spi cross walls which extend un slab are included. This is No. 5 includes all of the spillway base slab from the upstream lin way section, but not including th 12-in. apron, to the lower side The lower 5 ft. of this sl [illegible] is a 1:4½ concrete [illegible] cement to the cubic yard, and th of this slab is a 1:7 concrete. Nos. 9 are all 1:7 concrete. No. 7 is the wall between gate No. 1 and gate 9 is the 4 ft. thick wall between and gate No. 2. No. 11 includes [illegible] walls of the spillway, respectively center of the inclined slabs of the and at the downstream edge of

Fig. 3—Section Through Center of Tainter Gates.

does not include the upstream gate section, which is No. 32.

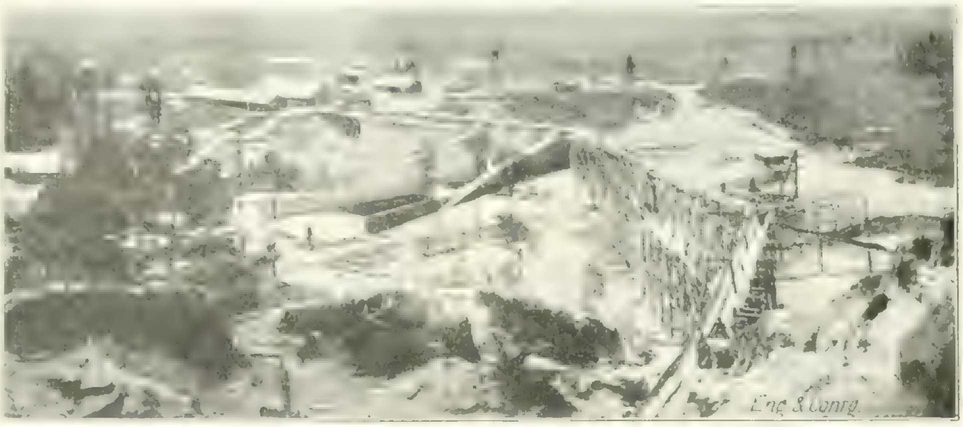
ncrete.—No. 2 is the complete upg wall at the southwesterly corner istocks as far downstream as the [illegible] This was stated as 1:7 but the voids were filled. No. 4 is ly core wall. This is a 1:5¾ con- 6 is the southerly retaining or from the southwesterly corner of [illegible] This is a 1:7 minimum filled. No. 8 is the southeasterly along the tailrace from the down- of the power house and includes lar reinforced runway or deck slab in this wall next to the power is is a 1:7 minimum with the voids 10 is the tailrace apron bounded ansion joints. This is 1:5¾. No. es all of the concrete in the power ndations and power house floor rom wall No. 1 and up to expanistruction joints at the power house boundary walls within 2 ft. above said floor. This is a 1:5¾ all thin work, but walls and more in thickness which to be run with a 1:7 concrete were ith 1:7. No. 14 comprises the con- the power house above the main at elevation 151.00 or above conoints in boundary walls within 2 or below said floor. Concrete as r No. 12. No. 16 comprises all of concrete under the penstocks upstream

nter Headgate and Upstream End of Turbine Unit.

expansion joint between penstocks house, including the southerly log upstream from the power house 16 extends upward to elevation

[illegible] at the headgate sills and to construction joints [illegible]

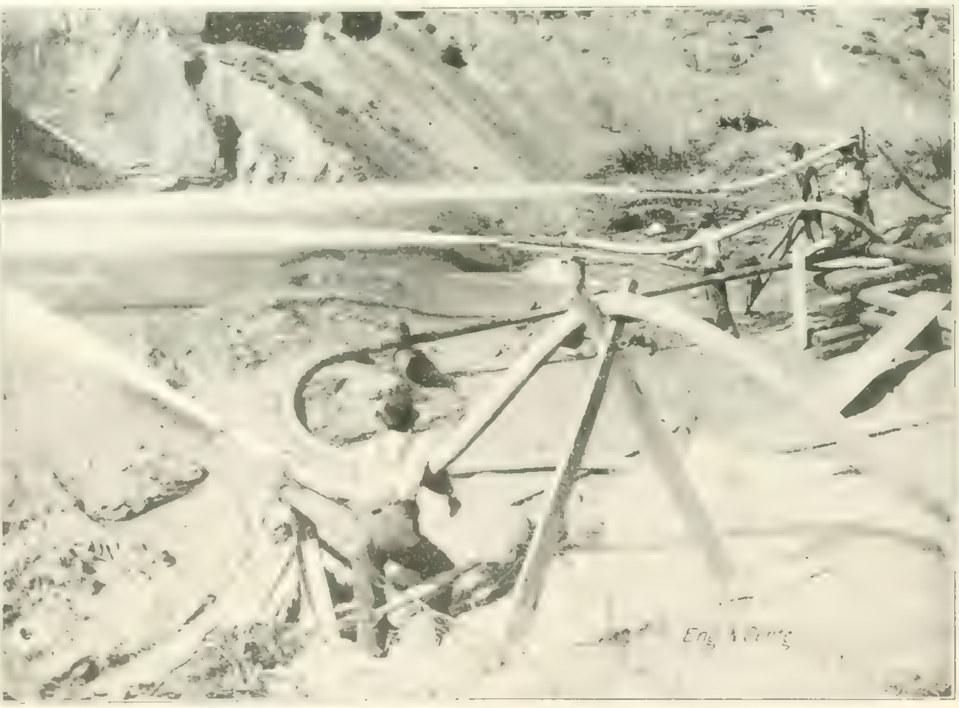
stock floor. No. 16 includes all of the concrete under the racks up to elevation 148.00 and 152.00. The toothings which are cut into the clay below the base slab are 1:7. The base slab itself and all of the thin work around the draft tubes up to elevation 145.50 is 1:5¾. Between elevation 145.50 and the penstock and rack floor level is 1:7. As far as possible all heavy walls extending up and downstream included in No. 16 are 1:7 concrete. No. 18 comprises all of the concrete penstock walls above the penstock floor or above construction joints within 2 ft. above or below the penstock floor, and includes the wall between penstocks and log chutes above said construction joists near penstock floor and the retaining wall on the south side of the penstock as far easterly downstream as the joint at the power house, but does not include the retaining wall upstream from the transformer pit and switch gallery, which is a part of No. 14. No. 18 includes all concrete deck, runway and floor over the penstocks, gates and racks. No 1 is a 1:5¾ concrete except the heavy walls 4 ft. to 6 ft. in thickness, which bound the penstocks on the north and south sides respectively. These heavy walls are of a 1:7 concrete. No. 30 includes the 12 in. apron upstream from the temporary openings under Tainter gates. This is 1:7. No. 32 comprises the inclined deck slabs of Tainter gates and the upstream transverse wall on which the inclined slabs rest. This is a 1:5¾ concrete, as is also No. 34. No. 34 is the runway or bridge over the Tainter gates, extending from the north retaining wall across the log chute. Nos. 36, 38, 40, 42, 44 and 46



Eng & Contrg.

Fig. 5—General Construction View.

are the several sections separated by construction and expansion joints of the northerly retaining wall, complete with footings, fish chute and any other attachments which are a part of said wall. These are 1:7 with voids filled, except that the outside, bottom and cover of fish chute are 1:5¾. No. 48 comprises the three rows of apron slabs, 51 ft. total width, at the downstream edge of the spillway apron. Nos. 48 and 50 are 1:5¾. No. 50 comprises the apron slabs, 34 ft. width, next adjacent to No. 48 upstream. No. 52



Eng & Contrg.

Fig. 6—Hydraulicking for Earth Dam.

Fig. 7—Hydraulicking on Earth Dam at Cooke.

[illegible] slabs, about 50 ft. in width, extending up to the line of the weir. This is a 1:7 concrete. No. 54 comprises the floor of the log chute, including any reinforced cross girders supporting this floor between the log chute walls. Also the nine concrete struts 18"x24" in size between these walls and the curtain wall between log chute walls at the upstream end above elevation 137.00. Nos. 54 and 56 are built of a 1:5¾ concrete. No 56 is the northerly core wall. The penstock walls are absolutely water tight under a 30 ft. head.

TESTS OF TURBINES

The hydroelectric equipment is as follows: Three Allis-Chalmers quadruplex, horizontal, open flume turbines, with 50 in. "E" runners, rated at 4,150 h. p. each at 38 ft. head, 180 r. p. m., regulated by Allis-Chalmers oil pressure type No. 3 governors. These turbines are direct connected to 3,333 K. V. A., 2,500 volt, 180 r. p. m., 60 cycle, 3 phase General Electric generators, with 32 k. w. direct connected exciters. The turbines receive water from the storage reservoirs through approximately 2,500 sq. ft. gross area of trash rocks built up of 3½x5/16 in bars, spaced on 2 in. centers. During the tests the individual turbine pits were closed off by means of the Tainter gates. The two separate twin turbines of each unit discharged into separate draft tubes, that of the back turbine dividing into two branches so as to clear the down stream draft tube. Permanent appurtenances, for purposes of conducting tests on the efficiency of the hydroelectric machinery, were built as parts of the plant. Fig. 9 shows the position of the testing weir in plan, and Fig. 10 is a cross-section of the weir.

Head Measurement.—The effective head was taken as the difference in elevations of the headwater between the two twin turbines and the tailwater at the down stream wall of the power house about 40 ft. from the discharge end of the draft tube. Two benchmarks [illegible] fixed at the sides of each turbine flume [illegible] based upon the elevations of the [illegible] float gage readings of the headwater [illegible] were made, the float consisting of steel [illegible] attached to a weighted tin float. Gage [illegible] stants were taken and checked from time [illegible] time during the test. Tailwater elevation [illegible] measured over benches fixed on the two sides of each tailrace. Tape readings were made directly from these bench marks to the tail water elevation. In addition to these tape readings a float gage was installed in the middle flume, No. 2 turbine, on the inside of the downstream power house wall and these readings were taken continuously throughout the test. For all practical purposes they check absolutely with the readings in the different flumes.

Fig. 8—Diagram of Dam Showing Locations of Various Concrete Mixtures Employed.

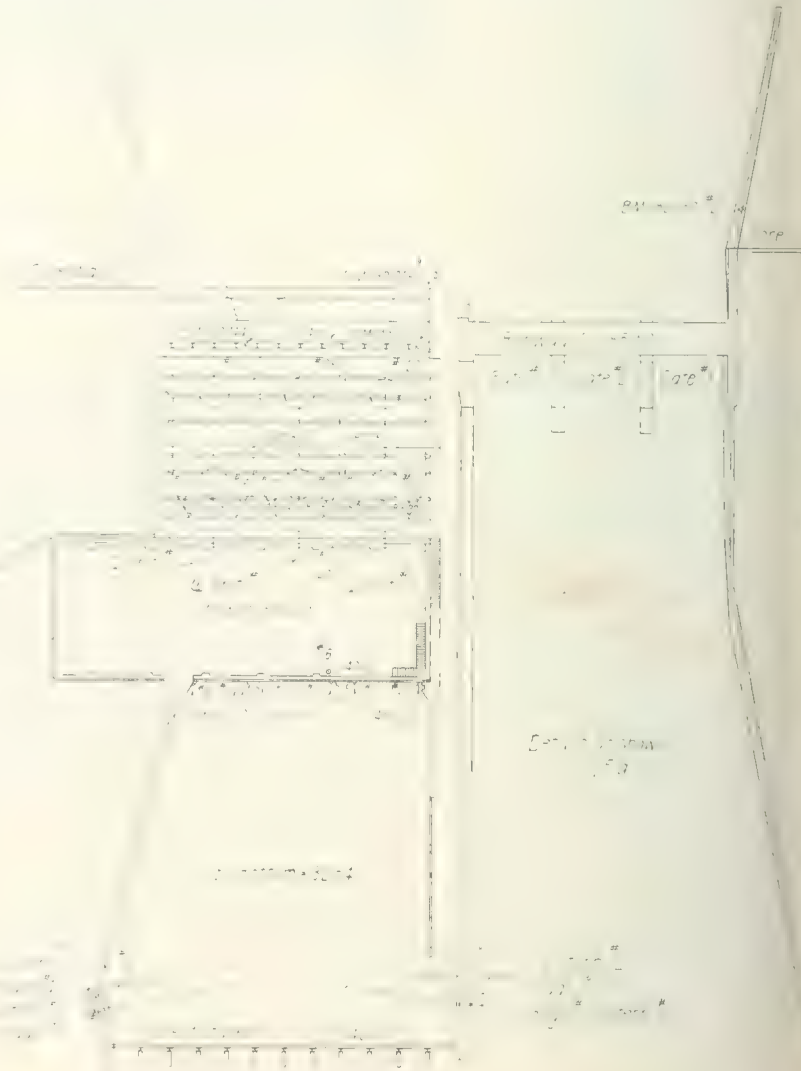


Fig. 9—Plan Showing Arrangements Made for Testing Turbine Efficien

Water Consumption.—The water [illegible] by the turbines during the various tests were measured by a sharp edge weir w[illegible] tractions suppressed. Weir crest is [illegible] ft in length, and the flow over the weir varied from 0.9 ft. to 2.4 ft. above the weir. The weir crest was placed at [illegible] of 142.05. The average elevation of the bottom of the channel below the weir crest was approximately 132 to 135, while the average elevation of the bottom of the channel 25 ft. upstream from the weir crest was 132, this figure having been used in determining the area which fixed the velocity of the approach.

Ventilation was provided for [illegible] three 6 in. planks just below the [illegible] extending horizontally downstream [illegible] complete breaks were made in the [illegible] sheet of water. This down-stream tailwater elevation varied from 139 to 141 ft.

The elevation of the water above the weir measured by means of four [illegible] ced in barrels which were connected of pipes to the tailrace. These pipe s for gages Nos. 2 and 4 extended

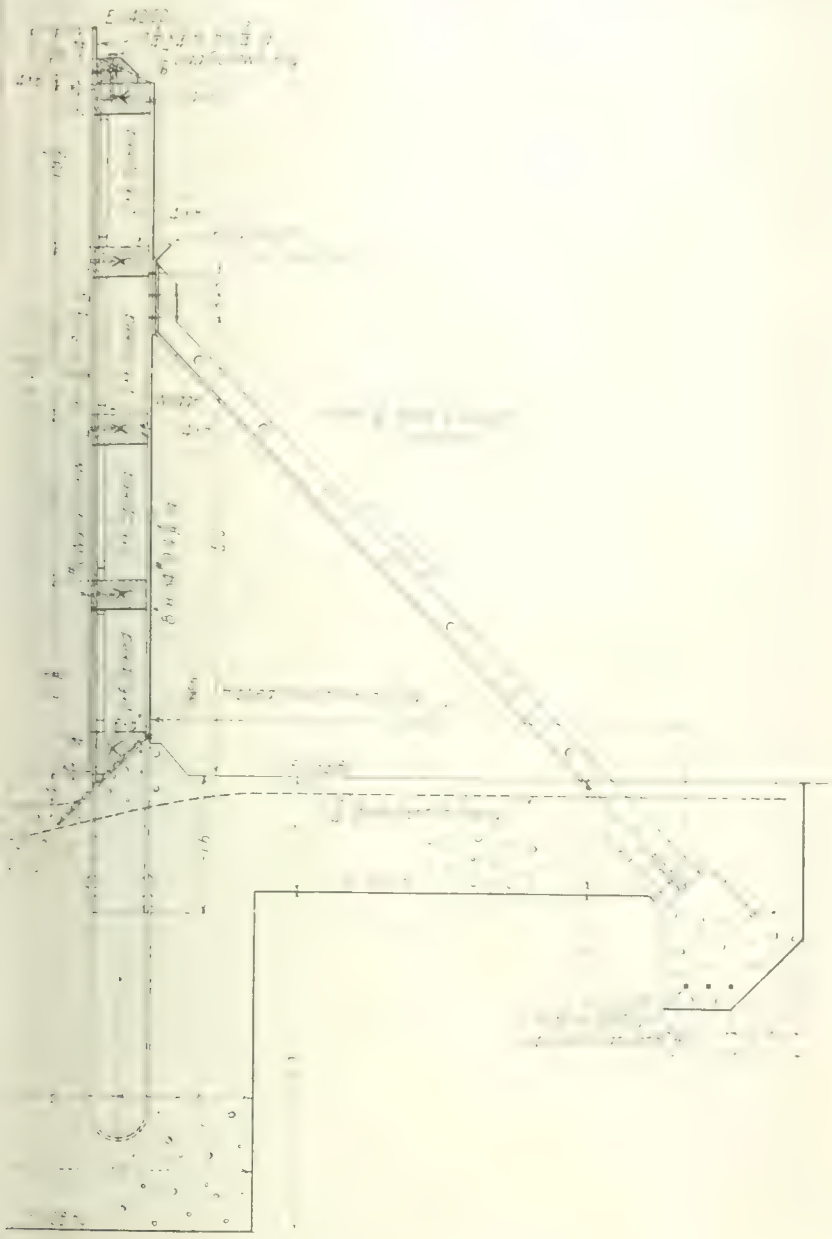


Fig. 10—Cross-Section of Testing Weir.

ings in the side walls of the chan gages Nos. 1 and 3 were piped to ings in the horizontal top of con estals, spaced so as to divide the about three equal parts. The open ich the gage barrels were piped were ft. upstream from the weir crest d approximately 8 ft. below the weir

vation of the water levels in the e taken by means of Gurley hook hich were set by means of a level. After setting gages the con determined for each gage and used ing the actual gage readings. The litions were excellent at all times. agreed to base quantity calculations regular Francis formula, correcting ty of approach. The velocity of ap s agreed upon as the mean velocity nnel figured from quantity and full on, basing this latter upon the ele the channel bottom of 132.54 ft. The d in computing quantities was as

$Q = 3.33\,LH^{\frac{3}{2}}$ where

$H^{\frac{3}{2}} = [\,D - h^{\frac{3}{2}} \quad h^{\frac{3}{2}}]$.

the measured elevation over the

[illegible] velocity of approach. It was further agreed upon to consider the weight of water in making calculations as 62.4 lbs. per cu. ft.

B. H. P. Output.—The power developed by the turbines was measured by means of electrical readings on the generators, correction being made for losses in the generators themselves. Shop tests on the generators were used in calculating the output of the units. Electrical readings during all of the tests were taken by a representative of the Electric Test Laboratories of New York.

The load was secured by means of four water rheostats, located in the tail race. Turbine gates were adjusted to desired openings by means of the mechanical hand gear, and the speed adjusted to 180 R. P. M. by means of varying the load by the rheostats. Actual gate openings were obtained, as a special calibration scale was placed on the indicator at the regulating mechanism reading directly to inches openings of the downstream guide vane. Runs were of approximately 15 to 25 minutes duration at each gate setting after the desired conditions had become constant.

The results of the official efficiency test made on unit No. 3 are shown on Fig. 11. It will be noted that a maximum efficiency of 89 per cent and a half load efficiency of 79 per cent were obtained, the corresponding guarantees being 84 per cent and 75 per cent.

The notable feature in connection with these test results is the fact that the obtained efficiency curve so closely parallels the guarantee curve. This was in evidence not only for unit No. 3 on which the official run was made but also in connection with the check tests made on units Nos. 2 and 1.

After the runners were designed and built, one of them was tested at the Holyoke testing flume, showing results exactly corresponding to those later obtained in the power plant. It is unusual that such a thorough check is available on commercial units of this size and furnishes reliable data indicating that advanced hydraulic turbine design is on an exact scientific basis, including not only the runner design, upon which so much stress has always been laid, but also the correlative factors of guide vanes, casings, draft tube, etc.

CAMP REGULATIONS.

As a part of the plan for maintaining order in the camp, insuring compliance with proper sanitary regulations, and for providing suitable living accommodations for the persons employed in the construction of the dam and power plant, various agreements were entered into between the company and individuals whereby the company granted permission to the individual to occupy certain property, subject to regulations. A tract of land was subdivided and laid off in building lots, with streets and alleys. The occupant of a lot was given permission to erect a dwelling upon it. About 70 houses were erected. The company furnished a water supply which was pumped from the Au Sable River above the dam and distributed in pipe lines laid in the streets of the construction village. A sewer system also was provided with a slop or drain inlet common to every four lots. No charge was made for this service. Permits were granted, when desired, to connect a house branch drain to the common drains and sewers.

Each occupant was given permission to board two relatives besides his immediate family. No poultry or live stock was allowed to be kept on the premises. All dwellings

Fig. 11—Curves Showing Guaranteed and Test Efficiencies of Allis-Chalmers Turbine.

were adequately screened and the occupant was required to maintain the screens in good condition.

Occupants were required to maintain the premises in a clean and sanitary condition. All slops and waste liquid which would pass through the drain grating were disposed of in that manner. All solid waste materials were either burned or buried on the premises in small pits not less than 2 ft. deep. These pits were kept tightly covered. When filled within 8 ins. of the surface the pits were filled with earth. No slops or wastes were thrown on the ground nor retained on the premises undisposed of for more than 24 hours.

OPERATION.

The Cooke plant was put in operation in February, 1912. The high tension line runs in a southwesterly direction to the sub-station located at Zilwaukee, a suburb of Saginaw. At this sub-station current is stepped down for consumption in Saginaw and Bay City. The high tension line continues on in a southeasterly direction to Flint, the present end of the high voltage line. During the coming summer the high tension line will be connected with lines now running to Owosso and Lansing, and later on to Battle Creek. The latter city is 250 miles from the Cooke plant. The voltage on the high tension line is 140,000, the highest in the world.

No part of the construction has been by contract, all work being done within the owners' organization. The executive committee is composed of Mr. W. A. Foote of Jackson, Mich., and Messrs. W. M. Eaton and B. C. Cobb of the firm of Hodenpyl, Hardy & Co., 14 Wall St., New York City, all practical and experienced men.

Mr. Wm. G. Fargo is hydraulic engineer for both the completed Cooke Development and the Five Channels Development under construction. A topographical survey of the entire basin of the Au Sable River was made by his force of engineers in 1908 and 1909, and studies are now being made for a third development. Mr. J. B. Foote, in addition to his many other official obligations to electric properties in Michigan, is general manager and electrical engineer and is responsible for the design, construction and operation of the unusual electric installation herein mentioned.

Some Principles and Conditions Affecting the Selection of a Water Wheel Unit.

Some of the principles and conditions affecting the selection of a water wheel unit were given in recent piper by O. B. Coldwell, before the Portland, Oregon, meeting of the Pacific Coast Branch of the American Institute of Electrical Engineers, as reported in the Journal of Electricity, Power and Gas of San Francisco. An abstract of the paper follows:

The conditions which must be met with in the particular plant where the installation is to be made determine the general make-up of the unit. Water wheels may have but a single runner, may have a pair of runners, or for low heads, four or even six runners to the unit. In some places a vertical design of unit is required, while in others horizontal units best suit the conditions in many instances, it is merely a matter of taste, but in most cases there are features which influence the selection of horizontal or vertical units.

When a pair of wheels is used, it must be determined whether an outward discharge or a bottom center discharge is the more desirable. Both schemes are used, one involving a single draft tube, the other two draft tubes.

When low heads are met with, open flumes are possible and a properly arranged open flume may take the place of the closed flume. In high head work it is, of course, necessary to use a closed flume.

The housing enclosing the runners may have various forms. For instance, it can be a scroll case design or a cylindrical design; it can be made out of cast iron, cast steel or steel plate or may even be formed in concrete. The scroll case has high economy on account of the water passages being designed so as to give a proper increase in velocity before the water enters the runners.

There are many other types of flumes, such as the cone shaped type. This type has ordinarily high economy, but has the disadvantage of a bearing which is not readily accessible.

Consideration must be given as to whether the inlet of the unit is to be beneath the floor line or above; the general question of accessibility of the various parts of the unit, the location of the governor, and many other points must be given attention. Racks of ample area must be provided at the intake in order that there may be low velocities through same and little loss of head. The pipe line must have careful consideration and proper velocities must be selected.

In plants with long pipe lines, the speed regulation and the consequent pressure variation is of great importance; as the latter has to do with the strength necessary and, therefore, the design of the pipe line. In some cases, pressure regulators are necessary. Again, surge tanks may be used. The draft tube must have proper attention and the tail-race be such as to give low velocities. If the tail-race is restricted, the total head is affected.

In order that the purchaser and water wheel manufacturer may have at hand when the wheel is being designed data covering all of the points which should enter into the design, it has been thought advisable to give a list of questions which should be filled out as completely as possible by the purchaser and sent to the manufacturing company for use when making his wheel.

DATA TO BE GIVEN TO WATER WHEEL MANUFACTURER.

1. Number of units.
2. Horsepower of water wheels.
3. Kw. of generator.
4. Total head.
5. Open flume or closed flume.
6. If closed flume, what is number of pipes?
7. What kind of pipe?—wooden stave, steel or concrete?
8. Diameter of pipes.
9. Effective head (unless design of all water passages to and from wheel is left to water wheel manufacturer).
10. Head water elevation.
11. Floor elevation.
12. Tail water elevation.
13. Head variable, if so, what is normal operating head?
14. If head is variable, what is the range of variation?
15. How important is power and economy at lowest head?
16. Speed of generator, if already decided.
17. If speed of generator is not decided, name speeds which seem to purchaser most desirable and ask recommendations.
18. Flywheel effect of generator.
19. What speed regulation is desired for different load changes?
20. Will units run in parallel with other plants? If so, give general characteristics of such plants.
21. If running in parallel with other plants, can these plants be used to regulate the system?
22. What is the character of load factor?
23. What is the nature of water (silty or clear)?
24. What date shipment of material is desired.
25. Advise if it is expected that manufacturer shall furnish governor.
26. Give sketches of power plant site.
27. Give information as to what is to be expected in the way of guarantees.
28. Give any other information which you think would influence the design of the wheel.

It will not be attempted here to outline the specifications which should be made out to cover the purchase of the water wheel unit, but a list of data which should be supplied by the water wheel company is offered.

DATA TO BE SUPPLIED TO PURCHASER BY WATER WHEEL MANUFACTURER.

1. A check of the calculation on effective head.
2. Horsepower guarantee at normal head.
3. Guarantee at other heads, if head variable.
4. Speed guarantee, including runaway.
5. Recommendation for best speed if same has not been determined.
6. Speed regulation guarantees.
7. Efficiency guarantees at full load, ¾ load and ½ load.
8. Point of greatest efficiency and value of same in per cent.
9. Efficiency guarantee for available head conditions.
10. If water wheel manufacturer furnish governor, give information as to the type, make, power required to operate same, and what variation in speed will not be exceeded before the governor will begin to readjust gates to meet change of load, either gradual or sudden.

In what time will governor completely open or close gates?

Within how many seconds will the speed of the unit be restored to normal?

11. Complete drawings shown proposed.
12. Complete description of ma posed.
13. Guarantee of durability.
14. Guarantee of shipment.

The Decision of the Supreme Court of Ohio on the Constitutionality of the Ohio Stream lution Law.

On April 2, 1912, the Supren Ohio handed down a decision "Bense Act" to be constitutional Act is the Ohio law which del authority to the State Board of matters relating to the pollution of the State by sewage and other municipalities, institutions, or m plants. Where such pollution is f the State Board of Health may purification of the sewage or othe may compel the purification of supplies where it is found that t water supply is impure and health. The act also gives the B ity to investigate the condition sewage purification works and to changes to be made in constructi od of operation as will bring desired, and to fix a time at wh the must be completed, which time shall subject to the approval of the g attorney general, and it is further the act, that when such order so not acceptable to any city, village or owner affected thereby, it, o have the right of appeal of the qu necessity and reasonableness of s two reputable and experienced s neers, one to be chosen by the corporation or owner, the other by the state board of health, but t chosen shall not be a regular emp board, and if these engineers are agree, then they shall choose a th of like standing. The engineers such board of reference shall ha affirm, modify or reject the order board of health submitted to them an decision shall be final.

It is further provided that no c or that is now discharging sewage in which separates the state of Ohi other state, shall be required to in purification works as long as the sewage of cities or villages of any is discharged into the river abov city or village.

The Greenville case is the on where the action of the Board has e into court. This is the case in wh stitutionality of the Bense Act upon by the Supreme Court.

Following complaint in writing tees of Greenville township that was being created by the city of G discharging its sewage into Greenle the Board investigated the cond plained of and finally on Sept. 2 dered the city to purify its sewage sfactory to the Board, on or before [illegible]

ity officials at first declined to carry order for the reasons, among others, city was heavily in debt and had no ith which to comply with the order of -d, and that the debt incurred in build- fication works would interfere with, id prevent other improvements held by ials to be more important and neces- n the erection of a disposal plant.

the city officials had not made any ef- carry the order into effect within the d time, the Board notified them on 1909, that they must proceed to con- e plant or the Board would cause to sed and enforced against them the and forfeitures provided by law. on, in self-defense and not because idered the findings and orders of the ist and reasonable or warranted by ing conditions, the city officials passed ted the necessary resolutions to pro- carry out the Board's findings and

; point the City of Greenville, by its itor, filed a petition, in the courts of pleas of the county in which the city , which alleged that the findings were it to warrant the orders and that the t was unconstitutional. The petition it a temporary injunction be issued the city council, and other city of- d their successors in office, from is- selling the bonds of the city for the of constructing the disposal works, the State Board of Health be en- om taking any steps to enforce its ind orders, and from imposing the feitures and penalties provided by e Act against the city officials for comply therewith.

petition a motion was filed by the ird to require the city to separately number its causes of action. Ac- on May 20, 1910, an amended peti- filed setting forth three causes of id asking for an injunction as be- this amended petition a demurrer by the Board which was sustained by on pleas court and the city's petition issed. From this judgment the city to the circuit court and that court the demurrer to the amended petition l been filed by the State Board of The case was then carried to the su- irt where, by the mutual consent of s to the controversy, the only ques- itted for determination was the con- ity of the Bense Act.

nstitutionality of the Act was as- the city upon four points. The points presented in order and the judicial on them are stated in substance.

Act provides for compulsory arbi- id therefore is in conflict with sec- d 16 of Article 1 of the constitution te of Ohio. Section 5 provides that t of trial by jury shall be inviolate." 5 provides that "all courts shall be every person, for any injury done s land, goods, person, or reputation, remedy by due course of law; and ministered without denial or delay." point the judges of the supreme nented, in substance, as follows:

[illegible] powers. It is a creation of statute the general assembly of Ohio has [illegible] territory embraced within the state the municipal legislature has such as the legislature of the state sees r upon it, and it may grant or with- [illegible] ency of the state, and its right to own local affairs rests wholly on the int of powers by the general assem- state. The state is still the sov- may extend, limit or revoke these will. In granting to a municipality vers to be exercised for the benefit lic health of that municipality the ot relinquished its authority and con- important particular over any of the territory comprised within the limits of the [illegible] irrespective of political divisions or territories [illegible] municipality may challenge the judgment of a state board of health and submit the question [illegible] skilled in sanitary work is a most liberal provision so far as municipalities are concerned, and far more liberal than many of the statutes relating to the powers of a state board of health. There is no theory upon which a mere agency of the state has a right to litigate the right of the state to enforce through any agency it pleases sanitary rules and regulations for the preservation of the health and comfort of all the people of the state.

The second ground urged against the constitutionality of this Act is that it coerces city officials in the compliance with the orders of the State Board of Health and controls their discretion by severity of penalty, and is, therefore, in conflict with section 1 of Article 14 of the constitution of the United States, which provides: "No State shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any State deprive any person of life, liberty or property, without due process of law; nor deny to any person within its jurisdiction the equal protection of the laws." On this point the court ruled, substantially, as follows:

The state does not seek to control the discretion of the municipal authorities in this matter, but on the contrary refuses to commit to them any discretion touching the particular matters committed to the care and control of the state board of health. In so far as they are charged with any duty in reference to the carrying out of the orders and directions of the state board of health they are ministerial officers only, and it is fully settled that a public officer may be required to perform a ministerial act and that a failure or refusal by such officer to perform a ministerial act may be made a criminal offense and punished as a misdemeanor. The question whether he is guilty of this misdemeanor is a proper question for judicial inquiry, and, if he be innocent of any dereliction, neglect, or refusal on his part, the courts will protect him. The law in this respect does not seek to deprive him of liberty or property without due process of law, nor does it deny to him equal protection of the laws. In our system of government there is nothing anomalous in the fact that an officer that is vested with official discretion in many matters and things pertaining to his office may nevertheless be required to perform certain ministerial duties. In so far as official discretion is concerned, courts will not interfere unless he is guilty of a plain abuse of discretion, but ministerial acts may always be enforced and there is no constitutional objection to imposing upon him, for failure to perform ministerial duties, a fixed penalty or a penalty within fixed limits to be imposed by the tribunal authorized to determine his guilt or innocence.

The third ground urged against the constitutionality of the Bense Act by the lawyers for Greenville was that "it delegates the taxing power of said city to the State Board of Health, and therefore is in conflict with sections 2 and 5 of Article 12 of the constitution of the State of Ohio.

Section 2 provides for taxing, by a uniform rule, of moneys, credits, investments in bonds, stocks, joint stock companies or otherwise; and also of real and personal property according to its true value in money, except as to certain bonds, burying grounds, school houses, churches and institutions of purely public charity and property used exclusively for any public purpose, and certain exemptions for each individual. The comment of the court on this point was, briefly, as follows:

Clearly this law is not in conflict with this provision of the constitution, for all property within the city is to be equally taxed and the only question that could arise is as to whether the improvement ordered is particularly required by the people of the city, and is so exclusively for their benefit that the city alone should bear the entire cost. About this question there can be but little doubt. If the city possessed the absolute right to discharge its sewage into a living stream of water, thereby polluting the same and destroying all riparian rights below and creating a menace to the health and comfort of those living on the banks of this stream below the point of discharge, then it might be said that any change in the manner of sewage disposal would not be for the benefit of the city, but for those citizens of the state residing below the outlet of the city sewers. But the city has no such absolute right, and whenever this condition of affairs exists it is right and proper for the state to interfere and to prevent it from a further continuance of this nuisance, and the city then having no other means for disposal of its sewage, it is primarily for its benefit that such disposal plant must be established.

The disposal plant is for the benefit of the residents of the city. It is the primary duty of the city to provide for sanitary disposal of its sewage, and it is not in violation of any provision of the constitution that it should bear the entire cost of erecting and maintaining a purification plant, and to require it to do so is not an arbitrary, unreasonable or unfair exercise of the police power of the state.

Section 5 of Article XII provides that no tax shall be levied except in pursuance of law and every law imposing a tax shall state distinctly the object of the same to which only it shall be applied. On this point the court commented, in part, as follows:

It is difficult to see how this legislation offends against this provision of the constitution. It is clear that this tax is to be levied in pursuance of law, and the object of the taxation is distinctly stated, and there is no intention or effort to apply the money raised thereby to any other purpose, so that every condition required by the constitution in this respect would appear to be fully complied with, but the contention that the power to levy this tax is taken from the taxing authority of the city and conferred upon the state board of health is not so easily disposed of. Section 16 of article 13 provides that the general assembly shall provide for the organization of cities and incorporated villages by general laws and restricts their power of taxation, assessment, borrowing money, contracting debts and loaning their credits so as to prevent the abuse of such power. By this provision it will be seen that municipal corporations have not plenary power to levy taxes, but are subject in that behalf entirely to the will of the general assembly of Ohio as expressed in the statutory laws of this state. This law does not pretend to clothe the state board of health with the power to levy taxes, but it does confer on that board the power to determine, subject to the right of appeal to a board of arbitrators, as therein provided, the right to require the city to install works or means satisfactory to the board for purifying, or otherwise disposing of its sewage, and leaves to the municipal authorities the duty of complying with this order and of providing by taxation the means with which to comply therewith. This legislation does not differ in any particular with many other provisions relating to the power of the state board of health. We must not overlook the fact that the general assembly is sovereign. It creates this state board of health as an agency to assist it in that important function of government looking to the preservation of public health and comfort, and authorizes it to determine what will best conduce to such ends, and then it directs other agencies of the government to carry into effect the orders and directions of that board. It could do all this without the aid of any agency. The fact that a principal employs an agent in the conduct of his business in no way curtails the power and authority of the principal.

In this case it is apparent that the tax is levied for governmental purposes clearly within the powers of the general assembly, notwithstanding it is especially for the needs and the benefits of the city of Greenville and is primarily for the corporate purposes of the city of [illegible] The state's appealing it is not at [illegible] to require that city to bear the burden and to conform to the orders and requirements of the state board of health by discontinuing the discharge of its sewage into a living stream and providing a proper disposal plant, so that the health of not only the citizens of the state residing in that city shall be preserved and protected but of all the people in the state coming in business or social relation with them. The state would be powerless to perform this important function of government if the local officers were permitted to exercise their discretion in levying or refusing to levy a tax for that purpose.

The fourth objection to the Bense Act, urged by counsel for the city, is as follows: "Said Act being of a general nature, does not have uniform operation throughout the state, and is, therefore, in conflict with section 26 of Article 2 of the constitution of the state of Ohio." That portion of the Act said to violate this provision of the constitution is as follows: "Provided that no city or village that is now discharging sewage into any river which separates the state of Ohio from another state shall be required to install sewage purification works as long as the unpurified sewage of cities or villages in any other state is discharged into said river above said Ohio city or village." The substance of the ruling of the court on this point is as follows:

> Every law is supposed to serve some purpose, and it would be absurd to impose burdens upon persons, corporations, villages and cities that could not possibly work to the public good or operate to public advantage or the protection of public rights. One of the evident purposes of this act, and so declared in its title, is to prevent the pollution of streams, and where it is apparent that the state is powerless to prevent this pollution by reason of the control and authority of states bordering the opposite bank of a river, it would not only be folly but unjust and arbitrary to compel the citizens of this state to do or refrain from doing any act, the doing of which, or the refraining from which, would operate to no good purpose, either public or private.
>
> It has been repeatedly held by this court that where a law is available in every part of the state as to all persons and things in the same condition or category, it is of uniform operation throughout the state. This law does operate uniformly in every part of the state upon all persons and things in the same condition or category. There is a substantial reason for excluding from the operation of this statute those persons, corporations, villages and cities located on the banks of a stream that separates Ohio from another state. It is not an attempt by the general assembly of Ohio to avoid the limitation of this provision of the constitution by a false, or faulty classification, but on the contrary is a fair and honest effort to legislate for all the people of the state without unjust or arbitrary discrimination in favor of one class to the advantage of another.

The judgment of the circuit court was reversed by the supreme court. The full text of the decision of the supreme court is published in the Bulletin of the Ohio State Board of Health for April, 1912.

Costs of Mining, Diamond Drilling and Shaft Sinking, British Columbia.

The costs of mining at LeRoi No. 2 Mines, Rossland, B. C., are given by Ernest Levy in the Journal of the Canadian Mining Institute. The stoping costs are as follows:

	Per ton.
Labor	$0.76
Explosives	0.22
Illuminants	[illegible]
Sundries	[illegible]
General	[illegible]
Sorting ore (labor)	0.21
Power plant labor	0.07
Supplies	[illegible]
Mine general labor	0.33
Supplies	[illegible]
Total per ton	$2.54

During the year 4,202 ft. of drifting and crosscutting was done and 160 ft. of raising and winzing, which cost $17.72 per ft. In addition the main shaft was sunk 193 ft. at $75.56 per ft. It is 800 ft. deep, has three compartments and measures 14.5x5 ft. inside the timbers. It is equipped with a 150-h. p. double conical drum hoist. The costs of mining for 5 successive years are shown in the following table:

Year ending.	Drifting and cross-cutting, feet.	Raising and winzing, feet.	Cts. per ft. Total.
1910	4,202	160	$17.72
1909	3,220	338	14.35
1908	4,302	270	14.17
1907	[illegible]	[illegible]	14.58
1906	3,392	187	12.91

In diamond drilling 11,508 ft. w a cost of $1.73 per ft. The aver hole was 371 ft.

An Analysis of the Efficiencies of the Component Parts of a Hydro-electric System.

The accompanying table gives a outline the losses and efficiencies, for 1911, of the Seattle Municipal Light and Power Plant. This matter was presented by J. Ross in a recent paper before the Pacific Coast section of the American Institute of Electrical Engineers. The figures given are believed to approximate closely the true values since great care was taken in the measurements made by frequently calibrated instruments. All results have been checked in as many ws sible.

The Seattle plant is a hydroelectri delivering water to two 1,500 kw. el and two 5,000 kw. turbine units the head through two pipes approxima miles long, one of which is 67¾ a 49 ins. inside diameter. The curr mitted at 60,000 volts through Seattle, a distance of 38.7 miles, distributed at 15,000 and 2,400 vts by approximately 20,000 custom the city street lighting.

OUTLINE OF LOSSES AND EFFICIENCIES FOR 1911, SEATTLE MUNICIPAL
POWER PLANT.

	Per cent all day efficiency.	Total 1911 input, kw. hr.	Average 1911 input kw.	Total 1911 loss, kw.-hr.	Average 1911 loss, kw.	Per cent loss.
Generating system	54.4	52,639,000	6,009	23,990,300	2,739	45.6
Penstocks	97.7	52,639,000	6,009	1,214,900	139	2.3
Generating station	55.7	51,424,100	5,870	22,775,400	2,600	44.3
Water wheels	60.7	50,758,900	5,795	19,944,400	2,277	30.3
Generators	93.5	30,814,500	3,518	1,990,800	227	6.5
Exciters		665,200	76	665,200	76	
Station lights and control	....	175,000	20	175,000	20	
Transmission system	91.6	28,648,700	3,270	2,413,500	276	8.4
Step up transformers	96.1	28,648,700	3,270	1,126,000	129	3.9
Transmission lines	98.6	27,522,700	3,141	378,000	43	1.4
Step-down transformers	96.6	27,144,700	3,098	909,500	104	3.4
Distributing system	79.2	26,235,200	2,994	5,448,700	622	20.8
City substation	98.7	26,235,200	2,994	346,400	40	1.3
S. Lights and control	....	317,400	37	317,400	37	1.2
Switchboard meters	....	....		29,000	3	..
15,000-volt system	92.5	11,587,000	1,323	868,600	90	7.5
15,000-volt lines	99.2	11,587,000	1,323	93,500	11	0.8
15,000-volt transformers	93.2	11,493,500	1,312	775,100	88	6.8
Series street lights	86.3	2,672,800	305	367,200	42	13.7
Transformers	95.0	2,672,800	305	133,700	15	5.0
Series circuits	90.8	2,539,100	290	233,500	27	9.2
Cluster street lights	79.1	1,486,000	170	310,000	35	20.9
Cluster transformers	87.8	1,486,000	170	181,000	21	12.2
Underground cables	90.1	1,305,000	149	129,000	15	9.9
2,400-volt commercial system	76.2	13,178,400	1,612	3,123,700	357	23.8
Feeder regulators	98.6	13,178,400	1,612	178,500	20	1.4
Primary feeders	96.0	12,999,900	1,592	521,600	60	4.0
Transformers	88.8	12,478,300	1,532	1,391,000	159	11.2
Secondaries	92.9	11,087,300	1,373	782,600	89	7.1
Customers' meters	97.6	10,304,700	1,284	250,000	29	2.4
Direct-current system	35.7	673,200	77	432,800	49	64.3
Motor-generator	38.0	673,200	77	417,000	48	62.0
D-C. circuits	95.0	256,200	29	12,800	1	5.0
Customers' meters	98.8	243,400	28	3,000		1.2

Summary: Total power loss .....31,852,500 kw-hr. Aver
Total power delivered to customers.....17,304,900 kw-hr. Aver
Total power delivered to street lamps.....3,481,600 kw-hr. Aver
Total delivered power.....20,786,500 kw-hr. Aver
Over-all efficiency, 39.5 per cent.
[1 kw. hr. at the customers' premises requires 1,364 gals. (5,163 liters) of wate Lake at average head of 590 ft. (179.8 m.)].

DRAINAGE AND IRRIGATION SECTI

Three Approved Designs for Weir Dams for Irrigation Canals.

In irrigation work occasion arises frequently for the employment of wire dams. Ordinarily the conditions are such that these dams must be constructed on soft bottom and their design must, therefore, take account of upward pressure. In the past such construction prevailed and as it will continue to some extent one of the designs shown is for a wood dam. Concrete, however, is replacing wood, and two of the designs shown are of concrete. The wood dam design has been worked out by Mr. W. C. Hammat, of San Francisco, Cal., for the San Joaquin & King's River Canal & Irrigation Co. . The two concrete dams are the design of Mr. John B. Leonard, San Francisco, Cal. Both designs are described briefly in a paper by Mr. Hammat in Proceedings American Society of Civil Engineers, Vol. XXXVIII, p. 655, from which we abstract the following description:

Referring to Fig. 1, the bricks *B, C. D,* should be pounded on standard piles, driven to sufficient depth to give the necessary bearing value, as well as safety ag mining. The wall *I I* is the wall, which should be of sheet-piling to sufficient depth and with sufficient joints to reduce the velocity of flow to less than that which w with it the foundation material. tongued and grooved, or some should be used, and great care taken not to split it in driving a stroy its imperviousness. Anoth sheet-piling, *A E,* not necessarily de be driven up stream from the floor, *A J*, may be laid between the s. This floor need not rest on piling be laid on mud-sills, if the bottom horoughly compact. Between the bents, ould be an apron, *J K*, of open design, r to avoid under pressure, and ex- down stream a sufficient distance to he bottom against erosive action. At

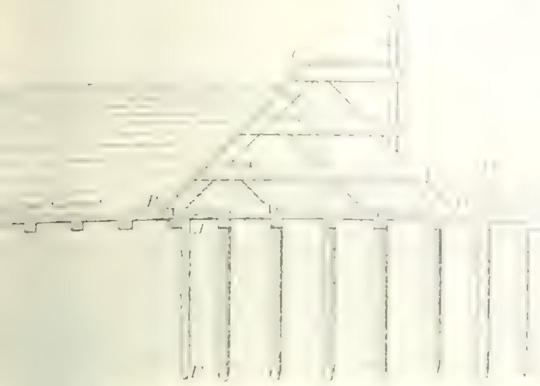
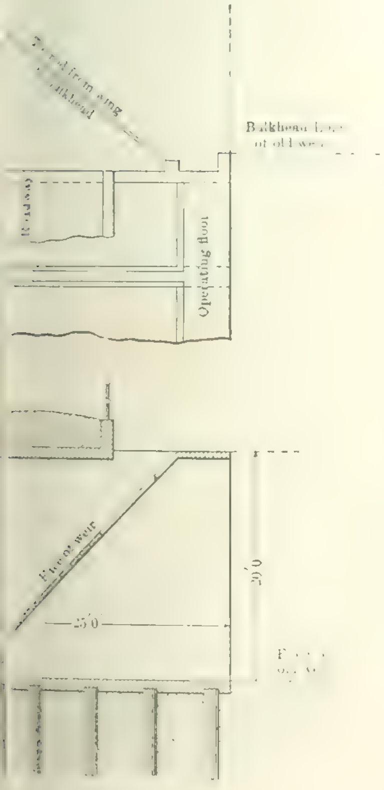


Fig. 1—Wood Wier Dam of Improved Form

the end of the apron, another line of ng, *K G*, may be driven, not neces- great length or tightness, but merely caution against undermining. If the eater than 4 ft., a small bulkhead, *H*, e built across the floor a few feet m its lower edge, in order to form o act as a water cushion. Instead the floor may be built about 2 ft. an the bed of the stream or canal. former is the simpler construction, where the lower floor level might additional inconvenience and ex construction.

oregoing design is used, and the con- is carefully superintended, special



Concrete Wier Dam, Kern County, Cal.

taken to keep *A E*, *A J*, and *J F* t, and *J K* with free passage for the ow, there will always be a pressure s instead of a pull, and consequently ood of failure.

[illegible] type is compara- tively small. One across the San Joaquin River, near Mendota, Cal., is 16 ft. high and 380 ft. long and passes 40 sec. ft. of water per foot when open, and it cost $140 per lineal foot. Smaller structures in sloughs and canals [illegible] lineal foot, according to size and difficulty of construction.

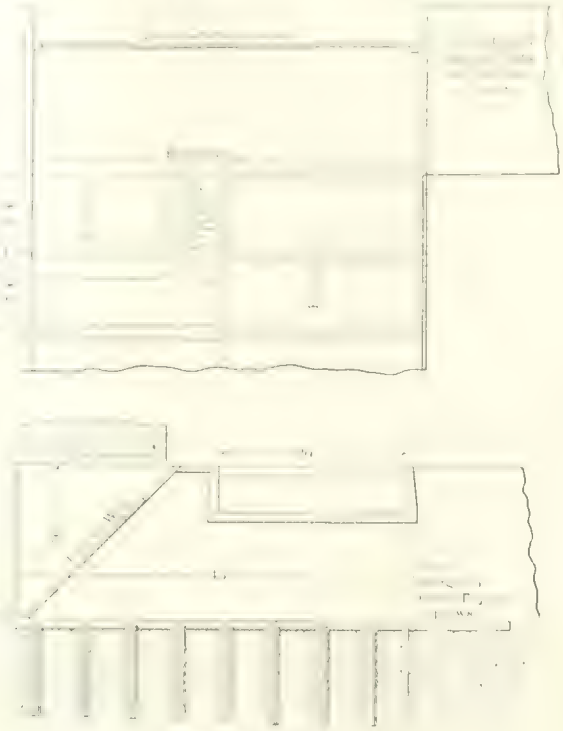


Fig. 2—Concrete Wier Dam, Merced County, Cal.

With the going out of use of timber for irrigation structures, the type of dam to which the above structure belongs is itself disappearing, being replaced in general by regulators with submerged openings. There have been a few cases, however, where the material of construction has been changed without essentially changing the design. Among the latter are two reinforced concrete weirs, one at the head of Temple Slough, Merced County, California, and the other in the Kern Valley Water Co.'s canal, in Kern County, California, both designed by John B. Leonard, for Miller and Lux, Inc. The former carries the Poso Canal across in a flume, and is of the dimensions and form approximately given in Fig. 2. The one in Kern County is shown in Fig. 3 and relies on the bulkheads and floor of the old timber structure below for bank and bottom protection, which accounts for the short length of the apron. It will be noted that the uplift in the upstream toe, in both cases, is counterbalanced by a reinforced concrete bridge carrying a roadway.

The writer sees nothing to criticize in these designs, for they are as strong and stable structures as could be built of this type. Some expense might be saved, however, by putting weep holes in the apron, to relieve the pressure, and by extending this apron up stream from the up-stream weir face to reduce the gradient of seepage flow.

Diagrams for Designing Trapezoidal Channels and Ditches.

The relation of the factors governing the flow in a channel is given by Kutter's formula:

$$V = C\sqrt{RS}$$

V is the velocity of the water in the channel; *R* is the hydraulic radius, equal to the area of the cross-section of the stream divided by the wetted perimeter of the channel, and *C* is a constant, depending upon the values of *R*, *S*, and the roughness of the channel surface. A paper by Mr. H. S. Chucks in the "Cornell Civil Engineer" for May, 1912, discusses a method of designing drainage channels by means of a set of diagrams worked out by Prof. T. P. Church of Cornell University and based upon Kutter's formula. We abstract the paper as follows:

Assume *V*, *C*, *R* and *S* determined. For a given channel, if the slope of the channel bed is fixed, *V* and *R* must have some definite and relative values. The value of *R*, the hydraulic radius, limits the dimensions of the channel in that the ratio of its area to its wetted perimeter must be a certain definite value.

If, further, the discharge is fixed, the dimensions of the channel are further limited. The discharge divided by the velocity (any assumed velocity unless in the case of earth channels when the maximum velocity is kept below 2.5 ft. per second to prevent erosion) will give a certain area. This area divided by *R* (the value of *R* corresponding to the value of *V* assumed above and given by Kutter's formula) will give a certain value for the wetted perimeter. That is, certain dimensions must be determined such that they will give the required area and wetted perimeter and will satisfy the value of the assumed velocity. In general, a great deal of cut and try work must be done to determine these dimensions before all these conditons can be satisfied. The work is made more difficult when the cross-section of the channel is trapezoidal, and when it happens that a pair of values for the area and hydraulic radius is so fixed that it is impossible to find dimensions to satisfy them. This latter fact will be brought out more clearly when the diagrams are explained.

The diagrams in this study consist of two sets of curves: The first set (in full lines) shows the variation of hydraulic radius with the depth and bottom width of the channel, and the second set (in dashes) shows the variation of the area of the cross-section of the channel with the dimension of the channel. The theory upon which these curves are drawn will now be explained. Referring to the given Fig. 1, *d* is the depth and *b* is the bottom width of the channel; *a* is the angle of the bank slope.

$$\frac{1}{2}\left[2b + \frac{2d}{\tan a}\right]d = bd + \frac{d^2}{\tan a} = A \quad (1)$$

area

$$b + \frac{2d}{\sin a} = p \text{ or wetted perimeter} \quad (2)$$

$$\frac{A}{p} \quad R. \qquad .(B)$$

$b +$

Equation A is represented in the diagrams by the curves shown in dashes, and equation

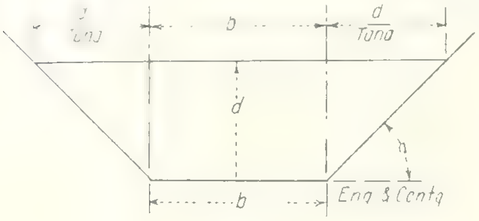


Fig. 1.

B by curves in full lines. Diagram 1 has been constructed upon the bases of a 1:1 bank slope; diagram 2, 1½:1; diagram 3, 2:1. Table I gives the values of angle a and also shows the different materials most adapted for use with different bank slopes.

Substituting the values of sin a and tan a in equations A and B above, the equations for the curves in the three diagrams are reduced and simplified to the following:

For diagram 1 (bank slope 1:1)

$$b + 2.83d = p \ldots\ldots (A_1)$$

$$\frac{bd + d^2}{b + 2.83d} = R \ldots\ldots\ldots\ldots\ldots\ldots (B_1)$$

$bd + d^2 =$ area

For diagram 2 (bank slope 1:1)

$$b + 3.6d = p \ldots\ldots (A_2)$$

$$\frac{bd + 1.5d^2}{b + 3.6d} = R \ldots\ldots\ldots\ldots\ldots\ldots (B_2)$$

$bd + 1.5d^2 =$ area

For diagram 3 (bank slope 2:1)

$$b + 4.47d = p \ldots\ldots (A_3)$$

$$\frac{bd + 2d^2}{b + 4.47d} = R \ldots\ldots (B_3)$$

$bd + 2d^2 =$ area

Application of the Diagrams.—Let it be required to design an earth channel to carry 500 cu. ft. of water with a maximum velocity of 2.5 ft. per second. The slope of the channel bed is 5 ft. in 2 miles, or 5 in 10580 or 0.000473.

The data given are sufficient to determine the value of R, the hydraulic radius. By means of Kutter's formula or with Prof. Church's hydraulic diagram, R is found to be 3.5. The required area of the channel is $500 \div 2.5 = 200$ sq. ft. For earth channel, the bank slope of 2:1 will be used. Using diagram 3, with arguments, area equal to 200 and R equal to 3.5, the dimensions are found, at the intersection of those two lines, to be 4.3 ft. deep and 38 ft. for bottom width. Checking the dimensions.

$$38 \times 4.3 + 2 \times 4.3^2 = 200.4 = A$$

$$38 + 4.47 \times 4.3 = 57.2 = p$$

$$\frac{200.4}{57.2} = 3.51 = R.$$

These results are the closest that the diagrams will give.

These dimensions seem to give somewhat too flat a channel, but they are the only values that will satisfy the given data. In order to get a channel of more proportionate dimensions, either the slope of the channel bed or the velocity of the water or both must be changed. Decreasing the slope of the channel bed (keeping the velocity constant) and consequently increasing the value of R, or increasing the velocity, will make the depth of the channel greater and the bottom width narrower. One of the ways to reduce the slope of the channel bed is to increase the length of the channel without changing the difference of elevation between the upper and lower ends of the channel.

Examples: It is required to design a concrete channel to carry 483 cu. ft. of water. The slope of the channel is fixed to be 5 ft. in 2 miles or 0.000473. In concrete channels, the velocity is not fixed. With an assumed velocity of 5 ft. per second, the value of R is found from Kutter's formula to be 3 ft. The required area is $483 \div 5 = 96.7$ sq. ft. The bank slope for concrete channel is 1:1. Using diagram 1, with arguments, area equal to 96.7 and R equal to 3, the dimensions of the channel are interpolated to be 3.82 ft. deep and 21.5 ft. for bottom width. This is a somewhat narrow channel. The design may be changed by assuming another velocity, since the velocity in concrete channels is not fixed. Now take a velocity equal to 5.5 ft. per second, the required area will then be $483 \div 5.5 = 87.8$ sq. ft. The value of R now is found to be about 3.4 ft.

TABLE I.

Bank Slope.	Slope Angle. a	Sin a.	Tan a.	Character of materi bank slope is most
1:1	45°	0.707	1.000	Hardpan, concrete.
1½:1	33° 41′	0.555	0.666	Coarse gravel, clayey
2:1	26° 34′	0.447	0.500	Coarse sand, loose ear

Using Diagram 1 again but with arguments of 87.8 for area and 3.4 for R, the dimensions of the channel are found in this latter case to be 7 ft. deep and 5.5 ft. for bottom width. Sometimes several changes are necessary to determine the reasonable dimensions of the channel required. Checking the dimensions:

Area $= bd + d^2 = 5.5 \times 7 + 7^2 = 87.5$ sq. ft.

Wetted perimeter $= b + 2.83d = 5.5 + 2.83 \times 7 = 25.3$ ft.

$$\frac{A}{p} = R = \frac{87.5}{25.3} = 3.46$$

These values are the closest that the diagram will give.

It is always best to check the dimensions after they are found to see how closely they satisfy the given conditions of the problem. For this purpose, equations A_1, B_1, A_2, B_2, etc., are to be used.

Let it be required to design a channel to be built in firm gravel to carry 210 cu. ft. of water. The slope of the channel bed is 4 ft. in 10,000 ft.

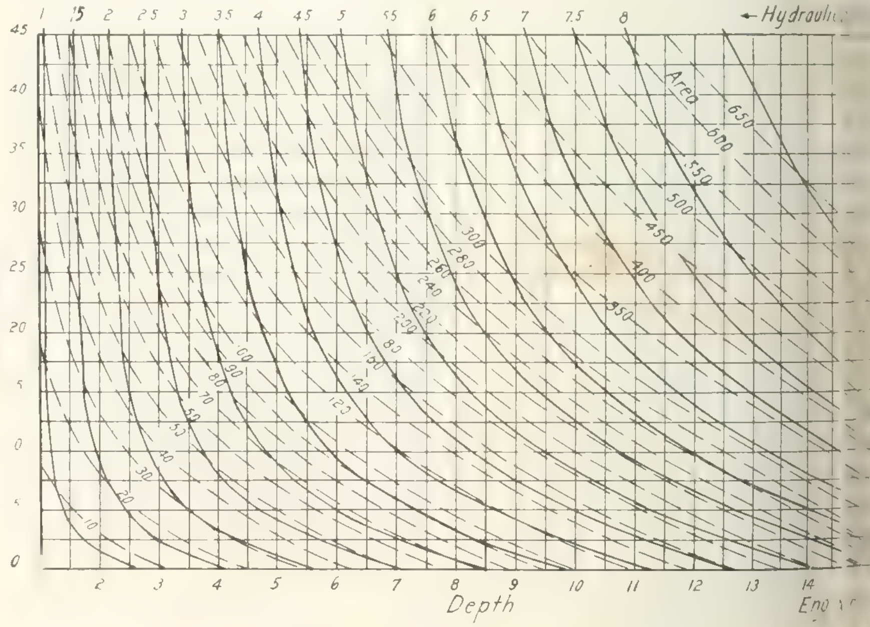


Diagram 1.

For firm gravel channel the bank slope of 1½:1 is to be used. With an assumed velocity of 3 ft. per second, the value of R is found to be 3 ft. The required area for the velocity is $210 \div 3 = 70$ sq. ft.

Referring to Diagram 2, it shows that the two lines representing area equal to 70 and R equal to 3 do not intersect. This means that no dimensions can be found to satisfy the conditions given. Some change in the data of the problem is therefor necessary. Reducing the slope of the chann bed and keeping the velocity constant will ge a larger value for R. This will make th two line to go farther apart and therefore ill be further from the solution of the pr lem. Increasing the velocity and keepin the slope constant will give a smaller re ired area and will therefore have the same fect. Decreasing the velocity and keepin the slope constant will make R smaller a the required area larger. Let us now assume a smaller velocity equal to 2.8 ft. r second The value of R now, according Kutter's formula, is 2.7 ft., and the requir area for this velocity is 75 sq. ft. The [illegible] which can now be interpolated fr Diagram 2, are 4.5 ft. deep and 10 ft. for b m width. If a narrower channel is wanted, he trials are necessary.

On the other hand, the data of problem are sometimes so fixed that two ts mensions or two channel sectic can be found and both will satisfy the c litions of the problem. Let us suppose th following are the data of a given problem Require area of a channel is 260 sq. ft. Hydraulic radius, R, is 5.5 ft. Bank slope 1½:1.

Diagram 2 shows the two lines r area equal 260 and R equal to 5.5 other twice. This means that two mensions are possible and both will given conditions of the problem. The sets of values are: 9.65 ft. de ft. for bottom width, and 12.5 ft deep an 2 ft. for bottom width.

These diagrams are constructed independent of any units used. They apply t ric system as well as the English stem the units of area and hydraulic ra is ar square feet and feet, the dimension given in feet; if in square inches and ches, the dimensions given are in inches; nd if in square meters and meters, the given are in meters.

Three barges belonging to the Canal Commission are being tow South America for use on the Paci the Isthmus. The distance is 10,479 barges, which are in tow by the tug left Colon on Feb. 11 and will arri boa about June 20.

Defective Drain Tile.

…ar articles referring to the [illegible] …e in the Chicago Stock Yards call up …, of increasing importance in [illegible] …ith the drainage of agricultural lands. …number of failures of concrete drain … occurred, and the problem of making

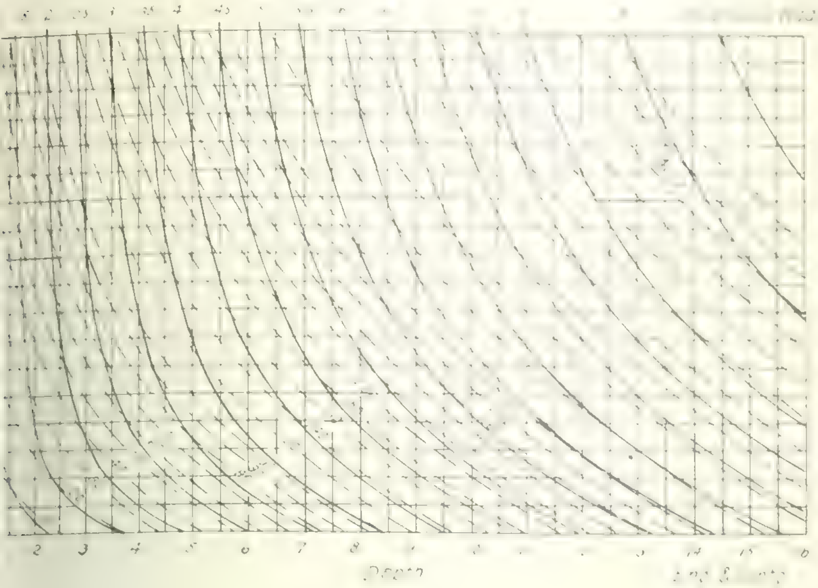


Diagram 2.

… tile seems yet unsolved. …is in spite of the vast amount of tile already done and of the fact that …uch that has stood for many years. …atly increased call for drain tile has … the use of clay from new fields and …d gravel such as are found available … places without proving the quality …e demand. The call for tile has also … the operation of tile factories by … little or no previous training or ex…ith such work.

… is that a large amount of poor …ing put into tile by incompetent and … parties. A lot of poor tile is the …sult. In many cases starting with …poor quality and a large per cent of …ile have also suffered from lean mix…ven mixing, dry mixing, poor tamp… water and of sun and wind pro…ile curing, from being handled and …e green, etc., in addition to being …hin walled in the case of most of the

…ng trait was unwittingly told by …acturer who does not know Webster's … of "scruples" once when he said, … no scruples about those tile." The …y had previously remarked that he … mixing the concrete as dry as pos…s to make the tile porous. We were … for a Sunday afternoon stroll among … by another financially interested …asked if we did not think they would … if placed in the ground. We …reeing with him by pointing out the …hey were breaking down right there …r own weight where one row of 12-… been piled upon another.

…e will indicate in a way the problem … user of tile, and records of some …ence will serve to show better how … are carried. These will refer prin…oncrete tile, but are not intended to …tion away from the fact that a lot …le are also proving unsatisfactory … strength and in lasting qualities. … among all sizes a mixture of tile … not come up to the general stand… required standard either, and it is …lt for inspectors to cull out all such …le. Many of these tile break from …k with the boot heel, especially when …et. We have inspected 12-in. tile …overed in a ditch having an inch [illegible] dark and wet looking all the way around them. [illegible] with [illegible] have given personal interior inspection after the ditches were filled. Frequent breakage is found. Not many of the tile collapse at an early date, though a lot of tile crack when the ditches are first filled. Some of the tile show no breaks until a considerable time after being loaded.

The breaks are longitudinal and four in number. The top and bottom cracks open inward and the sides open outward, the tile settling and spreading until the sides of the ditch prevent them from going farther. That is the position of many of the large tile now. The flattening of part of the tile in the lines has produced a very rough job from originally well laid tile and left openings caused by the disalignment of the tile. We believe some tile may stand or be held up by the ditch banks for so long as to be classed as a permanent thing, but under the conditions and in the soil where these large drain tile are used, and after repeated observations, we have refused to yield to the pressure brought to bear upon us by the contractors and county supervisors to [illegible] even to the extent of discharging us for our bull-headedness.

It seems evident that the common practice of making tile walls equal in thickness to one-twelfth the diameter results in far too light a wall for large tile. A pressure test on a dry tile is not an indication of the strength of the tile when in use in the wet ground. Neither will a test of a few minutes show what a tile may do under continued stress as many tile have not shown breakage until long after the ditch was filled. Testing is also rendered difficult and unsatisfactory by reason of the variation in quality and strength, while in use each tile is responsible for its part of the drain. They are not as strands in a cable but as links in a chain, and only one chain, no stronger than its weakest link.

F. O. NELSON.

[illegible], Ia., May 24, 1912.

Performance of a Steam Shovel in Rock.

The [illegible] data shows the April record [illegible] No. [illegible] at Panama which was working in a Borrow Pit at Folks River, excavating rock for filling at the Cristobal Terminal Docks:

Quantities of Excavation (64 per cent Rock, 36 per cent Earth).

	Cu. yds.
By car measurement	59,560
By cross section	53,050
By cross section, rock	33,520
By cross section, earth	19,530
Average per car	8.91

Operation Report.

Days worked	26
Hours under steam	200.00
Hours worked	138.00
Per cent of time under steam that shovel worked	69.0
Average daily output, cross section measurement	2,122

Delays.

Cause.	Hours and minutes.	Per cent of time under steam.
Mining	4.30	2.2
Cleaning track	2.30	1.3
Repairs	5.05	2.5
Waiting for cars	12.30	6.3
Switching	13.35	6.8
Derailment	1.30	0.7
Moving up shovel	18.55	9.5
Cutting out (once)	0.30	0.2
Waiting for steam	1.50	0.9
Cleaning slide from shovel	1.15	0.6
Total	62.00	31.0

During the month of April, 1912, the daily average number of steamshovels at work in the Culebra Cut at Panama, was 45.78 and the total number of shovel days was 1,144½, as compared with 46.27 at work during March, with 1,203 shovel days. The average yardage per shovel day in April was 1,414.3 cu. yds. During April of the preceding year the average yardage per shovel day was 1,370.7 cu. yds.

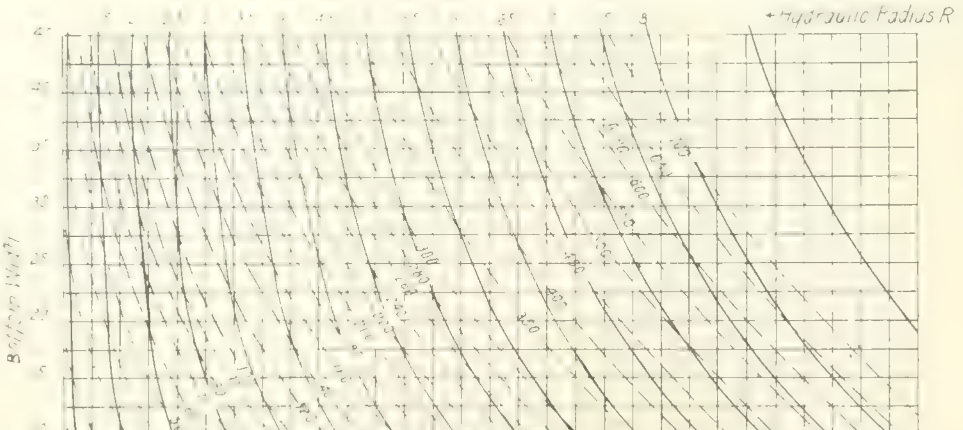


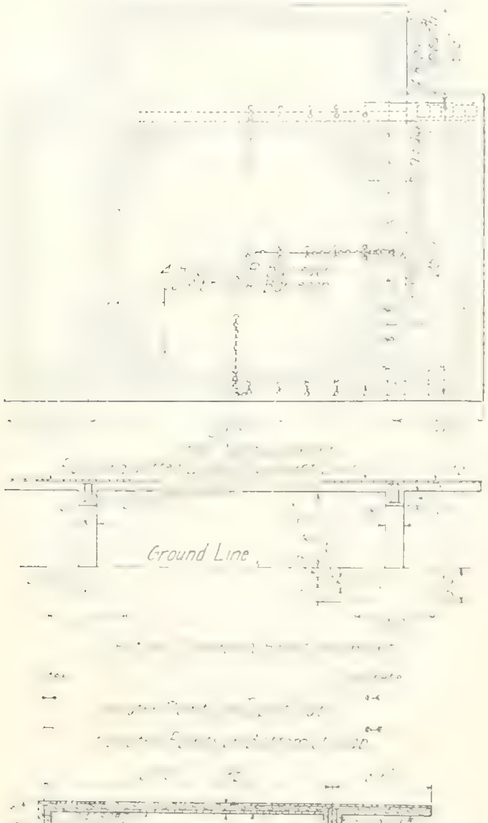
Diagram 3.

BRIDGES AND BUILDINGS SECTION

A Series of Tests to Determine Stresses in Reinforced Concrete Floors in Completed Buildings.

III.

Load deflection tests have been frequently made on reinforced concrete building floors. They are of value in judging the quality of workmanship and for the confidence which they give to the owner and tenant, but they are of slight value as indication of the stresses developed. Recently, therefore, attention has been given to testing completed buildings to secure measurements of stresses and deformations and to determine their amount and distribution and the effect of one part of the structure upon another. The first of these completed building tests was described by Mr. Arthur R. Lord in our issue of Dec. 28, 1910. During 1911 three similar tests were made and are reported by the committee of the National Association of Cement Users, Prof. A. N. Talbott, chairman. As these tests are a new feature in the investigation of reinforced concrete, we give them in abstract in three articles, of which this is the third. These articles are confined to a presentation of results only; for the method of conducting the tests the reader is referred to the paper by Mr. Lord, mentioned above.



Plan and Sections of Test Panel with Cantilever Extensions.

TEST PANEL.

The test panel represented a wall panel of a continuous floor, and to approximate existing conditions, cantilevers were built on three sides. These cantilevers were loaded during the test until the tangents to the slab over the supporting beams became approximately horizontal, as they would have been in a continuous floor under multiple panel loading. The panel proper was 25 ft. long by 26 ft. 9 ins. wide, as shown by Fig. 1, and was carried by steel I-beams, fire-proofed with concrete. These beams rest on steel bearing plates on concrete posts at each corner of the panel. Seven-inch tile was used with a cover 2½ ins. of 1:1.5:3 concrete, making the total thickness of the slab 9½ ins. The arrangement of tile was such that when alternate rows of block-tile and channel-tile were laid, the concrete was formed into two series of intersecting I-beams, spaced 15 in. centers each way and having 3-in. stems. Small furring-tile, laid at the intersection of the ribs thus formed, complete the tile ceiling surface. The panel was reinforced, as shown by Fig. 1.

The panel was poured on September 1, 1911, under unfavorable conditions, it being necessary to carry on a considerable portion of the work after dark. The weather was very hot during the next few days, and several of them were holidays, so that the slab was not even kept wet down. On the whole, conditions under which this slab was erected were probably not more favorable than would exist on an actual building.

Sand in sacks was used for the load, each sack being filled on the scales and weighing 100 lbs. The loading was started on Nov. 23, 1911, and progressed by stages, alternating with readings, until 650 lbs. per sq. ft. was reached on Dec. 6, 1911. The test was stopped at this point because of the expense involved in placing the load upon the high piles of sacks. The total load remained in place on the panel for 48 hours, after which unloading was started and was completed five days later.

The test load required by the City of St. Louis is a superimposed load, equal to twice the live load, plus the dead load, or 380 lbs. per sq. ft. for this panel. Up to this load the cantilevers were carefully loaded to horizontality, but from this stage on, no more load was applied to the cantilevers, and they rose slightly, thus increasing the deflection at the center of the panel.

The horizontality of the tanget over th beams was determined by meas tions of both slabs and cantilevers at a series of points lying along a line perpendicular to the beams. The deflections were and a smooth curve drawn which glance whether or not horizontal It was often found necessary to sl on the cantilevers several times correct amount and position were

Both steel and concrete stresses as well deflections, were measured throughout the test, exceptionally complete set readings being taken under the design load of 150 lbs. per square foot, and under the quired by the city of St. Louis; i. imposed load, equal to once the de twice the live load, or 380 lbs. foot. Deflections were read by m distance from a steel plate fasted ceiling to a steel rod held in a scaffold An inside micrometer reading to was used, both plate and rod havi sunk holes which locate the posi instrument exactly.

Stresses on the steel were read tensometer, which is a modificati Berry strain gage used to read the concrete. Both of these instrum points which are inserted into drilled in the steel or in metal pa the concrete, and read directly to or by estimation to one-quart amount. An 8-in. gage length throughout the test. The length instrument changes with changes perature of the observer's hands. for which readings were taken on standard bars, and all temperat tions necessary have been appli stresses given in the table. Mr. W read steel stresses with a modifica Berry strain gage, which was m University of Illinois.

A summary of the observe stresses is given in Table I. The those which are induced in the loads greater than 75 lbs. per squa deriving the concrete stresses t modulus used was 3,250,000. A s the observed steel stresses is give II. A summary of the stresses a tions is as follows:

150 lbs. per sq. ft. 0.167 in. or 1 1
380 lbs. per sq. ft. 0.86 in. or 1

No definite conclusion as to the c of stress among the two sets of r can reached from the data obtained in this test, although the stresses obtaine that about 65 per cent of the loa ried across the short span of the stead of the 55 per cent assumed.

TABLE I.—CONCRETE STRESSES.

Location.		Design Load—150 lbs. Live load.	Dead load.	Total.	St. Louis C Live load.
Top of slab at center	Long span	100	100	200	675
	Short span	100	100	200	800
Bottom of slab at flange of supporting beam	Long span	[illegible]	150	475	1,250
	Short span, fixed end	400	200	600	1,525
	Short span, free end.	150	75	225	427
Bottom of slab on rib just outside of beam flange	Long span	175	75	250	425
	Short span, fixed end	400	200	600	1,775
	Short span, free end.	175	100	275	[illegible]

TABLE II.—STEEL STRESSES.

Location.		Design Load—150 lbs. Live load.	Dead load.	Total.	St. Louis Co Live load.	De lo
Bottom of slab at center	Long span	3,500	2,000	5,500	19,500	2,
	Short span	7,500	3,500	11,000	26,500	[illegible]
Top of slab at support	Long span	3,500	1,500	5,000	37,500	1,
	Short span, fixed end	6,500	3,500	10,000	28,500	3,
	Short span, free end.	7,500	4,000	11,500	8,500	4,
Bottom flange of I-beams	Short span	7,000	3,500	10,500	17,500	3,
	Long span*	3,500	2,000	5,500	9,500	2,
	Long span†	7,500	4,000	11,500	22,000	4,

*Sandrel beam.
†Interior beam.

Note.—Stresses due to dead load were obtained by projecting the stress curve to the z load.

NEWS SECTION

itorial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

omment—The Doings of the Week—
er Commissioners—Good Roads in Illinois—
Another 8-Hour Law
Railways, Steam and Electric ... [illegible]
Bridges, Steel and Concrete ... [illegible]
[illegible] [illegible]
Water Works [illegible]
Sewerage and Garbage Disposal [illegible]
[illegible] Docks, Contracts, Supplies, etc. [illegible]

Doings of Week.

There has been [illegible] doings in the railroad construction field during the past week, and the contracts let during that period will stack up favorably with any previous week of Chief of the work let is the con- of the new line from Great Falls, o Lewistown for the Chicago, Mil- & Puget Sound Ry. Twohy Bros., Ore., received the east section of k, their contract including 2,500,000 of excavation, of which about 1,000,- yds. is rock; Winston Bros., Minne- Iinn., secured the west section, this ounting to about 2,000,000 cu. yds. of n, of which 500,000 cu. yds. is rock. good-sized contract is the one se- y Walter H. Denison, Wagoner, r the 90-mile extension for the Santa en Lubbock, Tex., and Texico. This involves over 1,000,000 cu. yds. of n. The Wichita Union Terminal . of Wichita, Kan., which was to let contracts for a union station nsive track elevation work on May oned the letting on account of certain way and legal complications. As soon are disposed of the contracts will be ong the other railroad contracts let are the following: O. J. Pruit, Mont- Ala., for 9 miles of grading for the of the Birmingham & Southeastern Tallahassee to Eclectic, Ala.; J. A. Pine Bluff, Ark., 5 miles on the above ; grading for 32 miles of second ck for the Chicago & Eastern Illi- R. was awarded to Sheehan Bros., Ill., for the section between Tus- Arthur, Ill., and to M. C. Connors hicago, for the section from Arthur ay, Ill.; Coughlan & Sheils Co., 45 St., Boston, Mass., at $241,475. ing Sec 2A of the Dorchester Tun- the Transit Commission of Boston. . A. Ware Construction Co., Houser t. Louis, Mo., five miles of steam ork on the Wabash R. R. between and Knights, Ill.; R. Galiardi, Con- . Pa., for grading, etc., for a 3½-mile f the Western Maryland Ry., at Station, Md.; W. H. Gahagan, 189 e St., Brooklyn, N. Y., for recon- of about 6,000 ft. by the Manhattan ivision of the Long Island R. R. in York, the work including a 4-tube ut 3,500 ft. long and an embank ng & Standifer, Spokane, Wash., construction of the new Oregon- ton Railroad & Navigation Co. cut- Portland to Spokane, extending from to Ayer, Wash., a distance of 100 ameron & McManus & Joyce, Keokuk, rading on re-alignment of main track Chicago, Burlington & Quincy R. R. Keokuk and Montrose incident to n on account of construction of power Keokuk; Culliton Bros., Spokane, or grading for the first 10 miles of extension of the Esquimalt & Nana- R. from McBride Junction, B. C., to

the largest drainage contract let r last issue appears to be the one secured by the Canal Construction Co. of Chicago, Ill. This contract calls for the construction of a system of drainage canals in the Beaver Bayou Drainage District, near Helena, Ark., the work calling for about 1,600,000 cu. yds. of excavation. Another big Government levee contract is coming up for letting on June 10. This will be located in the Reelfoot, Upper St. Francis and Lower St. Francis Levee Districts and amounts to about 1,100,000 cu. yds. Bids will be opened at Memphis, Tenn., by Maj. Clarke S. Smith, U. S. Engineer. This is but the beginning of extensive rebuilding, enlargement and new work which will come up in the near future. In the meantime two bills, aggregating $74,000,000 for levee work and improvements to the Mississippi River, are now before Congress. One will provide for an immediate appropriation of $11,000,000 with continuing appropriations for three succeeding years, beginning with July 1, 1913. Of each $11,000,000 the bill provides that $8,000,000 should be devoted to levee construction and repair, the remainder to be devoted to river improvement work.

Bids were opened May 31 by the Trustees of the Sanitary District of Chicago for another contract for work on the construction of the Calumet-Sag Channel. But two bids were received, Green & Sons Co., Chicago, Ill., at $444,990 being the low bidder.

In the way of sewer work the largest contract of the past week appears to be the one let to the Donlon Contracting Co., Brooklyn, N. Y., by the Passaic Valley Sewerage Commission of Newark, N. J. This contract amounted to $207,419 and called for the building of section 15 of the intercepting sewer. The Commission opened bids on May 28 on another section of this sewer, the McCanley-Manton Co., Brooklyn, N. Y., at $262,564 being the low bidders.

Advices from Nunn, Colo., state that according to a contract just made between the Northern Colorado Irrigation District and the promoters, on which electors of the district will vote June 18, the district reservoirs will have a total capacity of 63,200 acre feet of water. In addition there will be 6 laterals to distribute the water and 3 main ditches. Halligan reservoir is to be enlarged and Stonewall reservoir and several others will furnish storage water. For the construction of the system, designed to water 50,000 acres, a bond issue of $2,400,000 is to be voted.

Good Roads in Illinois.

The State of Illinois in 1909 had 94,141 miles of public roads. Of this total 8,914 miles, or 9.5 per cent, were so-called improved roads. A committee of the Illinois Bankers' Association, which has been making an investigation to ascertain the reason for the backwardness of this state in the construction of improved highways, has recently issued its report. The committee finds that of approximately $7,000,000 raised in the state each year for road construction and repair $2,500,000 is wasted. This waste the committee reports is due to the system by which the responsibility for the upkeep of the state's 94,000 miles of roads is divided among 4,800 highway commissioners, each of whom is at liberty to do about as he pleases. The report suggests a complete change in the system. It proposes that the county be the unit instead of the township and that there be financial aid from the state and the county. It suggests that the organization consist of a state highway commission of three members, a state highway engineer, a highway engineer in each county who may also be county surveyor, and a highway commissioner in each town who will devote his whole time to the work. Under the system proposed improvement and maintenance of the main roads would be undertaken at state and county expense, and connecting roads would be improved at local expense.

Engineer Commissioner.

The citizens of New England are so conservative that in many towns the form of local government inaugurated before the Revolution is still followed. The commission plan has made little headway in this section of the country, and various other attempts to improve on the present form of city or town government have met with little success. It is, therefore, with some surprise that we learn of the action of the town of Norwood, Mass. At a special town meeting held recently the citizens of this place voted to employ a town manager. This manager will have charge of the many business affairs of the town and will handle the expenditure of the money, subject to the directions of the Board of Selectmen. He will be Town Engineer and Superintendent of Public Works and will have charge of the roads, water supply and lighting system and will supervise all town employes. This manager will be an engineer. A similar plan has been employed successfully for several years by the city of Staunton, Va. It may be noted here that much of the success of the experiment at Staunton is ascribed to the fact that the man selected to manage the financial affairs of the city was a civil engineer. The city of Fredericksburg, Va., has also been considering placing its municipal affairs in the hands of a manager. Some time ago a special committee, composed of members of the City Council and citizens reported to the City Council an ordinance providing that a commission be selected, who shall attend to all contracts and to the buying of all supplies for the city. The ordinance provided that the commissioner should be an engineer.

Another 8-Hour Law.

The U. S. Senate on May 31 passed a bill extending the eight-hour principle to all contracts involving labor on government work. This bill, which also has been passed by the House, provides that "every contract, hereafter adopted for the government requiring the employment of laborers or mechanics shall contain a provision that no laborer or mechanic doing any part of the work contemplated by the contract shall be required or permitted to work more than eight hours in one calendar day." A penalty of $5 per day for each laborer or mechanic worked in excess of this period is imposed and made a part of the contract.

PERSONAL

Mr. Bruce, chief engineer for the Dominion Government on the final location of the [illegible] has resigned.

Mr. W. D. Uhler, second assistant engineer in charge of road maintenance of the public service commission of Baltimore, Md., has resigned to accept a position with a Philadelphia company.

Mr. Ralph Boggs, a civil engineer of Boise City, Idaho, was drowned in the Spokane river by the capsizing of a boat on May 22. He had been in Boise City about four years and was graduated from the University of Washington.

Mr. Edw. Schildhauer, electrical engineer with the Isthmian canal commission at Panama, is visiting in the states on his annual leave of absence. Mr. Schildhauer was graduated from the University of Wisconsin in 1906.

Maj. Gen. John F. O'Ryan, commanding the New York National Guard, has appointed Maj. Eugene W. Van C. Lucas, formerly of the corps of engineers, U. S. A., to the office of chief engineer. Major Lucas was graduated from West Point in 1887.

Mr. Selbert M. Connor has resigned his position as engineering draftsman in one of the large railroads terminating in Chicago and announces that he has opened an office at 414 Sherman St., where he is prepared to make mechanical or other engineering drawings, maps, etc.

Mr. Jean M. Allen, who has been superintendent for H. P. Burgard on barge canal contract No. 37 for the past year, has accepted a position as general superintendent for the Pacific coast work of the Atlantic, Gulf & Pacific Dredge Co. of San Francisco. He will have charge of all Pacific excavation work.

Mr. William McClellan, Electrical Engineer of the New York State Public Service Commission, was elected a manager for a term of three years at the annual meeting on May 21 of the American Institute of Electrical Engineers. Mr. McClellan was also recently appointed chairman of the Electrification Committee of the New York Railroad Club.

Mr. H. H. Adams, president, and Mr. John V. Hanna, chief engineer of the Kansas City Terminal Ry. Co., conducted a special train tour over the $35,000,000 project in Kansas City recently for the purpose of inspection. This was Mr. Adam's first trip over the property. He succeeds Mr. W. S. Kinnear as president, whose resignation was recently noticed in this column.

Daniel Hudson Burnham of Chicago died in Heidelberg, Germany, on June 1st. Mr. Burnham was architect of the Chicago World's Fair, and a large number of the most important buildings in this country and abroad were designed by him. His more recent work, however, and that for which he will be noted, is his work of planning cities. He was chief designer of the Chicago plan, the San Francisco plan, the Manila and Bagio plans, in the Philippines and the plan for the civic center of Cleveland. He was born Sept. 4, 1846, at Henderson, N. Y., and came to Chicago in 1856.

Mr. William L. Derr, who has been Steam Railroad Inspector for the Public Service Commission, New York, since June 8, 1909, has resigned to become superintendent of one of the divisions from Omaha to Oelwin, Iowa. Mr. Derr was educated at the Polytechnic College of Pennsylvania, Philadelphia. He served on Pennsylvania Lines as an assistant engineer and track supervisor; Erie Railroad as superintendent of various divisions and chief engineer; New York, New Haven & Hartford, and Chicago & Alton Railroads as superintendent; and the Metropolitan Street Railway of New York as general superintendent.

Civil Service Examinations.

The U. S. Civil Service Commission announces an examination on June 12 to secure eligibles to fill vacancies in the position of laboratory assistant, qualifying in engineering at salaries from $900 to $1,200 per annum.

An examination will also be held for the position of assistant to inspector of ordnance at a salary of $1,200 per annum. This examination will be held on June 26 and 27.

A third examination by the U. S. Civil Service Commission will be held on July 10 to fill a vacancy in the position of mechanician and laboratory assistant in the bureau of mines, San Francisco, at a salary ranging from $1,000 to $1,400 per annum. Information may be had by application to the civil service commission, Washington, D. C., or to the secretary of the board of examiners, federal buildings of most any large city.

INDUSTRIAL

The magazine "Building Management" has been sold to C. A. Patterson, and the Porter-Patterson Co. will hereafter be known as the Patterson Publishing Co. The magazine will be moved at once to the City Hall Square Bldg., Chicago.

The Watson-Stillman Co., 50 Church St., New York, announces the following officers as chosen at a directors' meeting May 15th: President, E. A. Stillman; Vice President and Secretary, A. F. Stillman; Treasurer, J. P. Bird; Chief Engineer, Carl Wigtel; Superintendent, Frank Lary. A new branch office is to be opened at Philadelphia shortly and shop facilities are being improved to meet increasing business.

The contract for placing Raymond concrete piles in the foundations of an acid plant to be erected at Bayway, N. J., for the Standard Oil Co. has been awarded to the Raymond Concrete Pile Co. of New York and Chicago. The Raymond Concrete Pile Co. also has been awarded the contract for placing Raymond concrete piles in the foundations of the Louisville Railways high power station at Louisville, Ky. D. X. Murphy & Bros., Architects.

The MacArthur Concrete Pile & Foundation Co., 11 Pine St., New York, has recently been awarded a contract for upward of 2,700 pedestal concrete piles, together with a large amount of concrete capping and similar work for the new Willerica shops of the Boston & Maine Railroad, North Willerica, Mass. Ten large shop buildings covering about 150 acres are to be constructed and heavy locomotive and train loads are to be carried in a number of places. A. B. Corthell is the Chief Engineer, F. W. Irwin Special Engineer for the job, and S. P. Coffin is the Assistant Engineer in charge of the work in the field. Another contract recently awarded to the MacArthur Concrete Pile & Foundation Co. is for the pedestal pile foundations of an extension to the power house of the Middletown Electric Light Company, Middletown, Conn. The piles are to be carried several feet above the ground level, carrying a reinforced concrete floor to be constructed by the foundation contractor. The work also includes a waterproofed coal pit and foundations for a large radial brick chimney.

CATALOGUES

Rumley Bulletin.—Paper, 6x9 ins., 16 pp. M. Rumley Co., Laporte, Ind.

This is a new bulletin being published by the above company devoted to the interests of machinery for farm and road building.

Dump Wagons. Paper, 6x9 [illegible] A Streich & Bro. Co., 668 W. Lake St., Chicago, Ill.

This catalog contains illustrations of dump wagons of 1½ to 4 yds. capacities, with specifications and descriptions.

Paving and Roads.—Paper, 8x5¼ [illegible] 16 pp. The Texas Co., 17 Battery Place, New York City.

This is the May issue of the [illegible] which is published in the interest of [illegible] roads, and contains records of the [illegible]neers of the company in connection [illegible] road construction and maintenance.

Turbo Alternators.—Paper, 7[illegible] pp. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Circular No. 1094 under date of April, 1912, contains illustrated descriptions of Westinghouse turbo-alternators as installed in several large plants. Line dr[illegible] details are shown.

Expansion Bolt.—Paper, 4¼x9 ins., 28 pp. Cinch Expansion Bolt & Engineering Co., 401 Broome St., New York City.

Bulletin No. 100 illustrates and describes a method of anchoring without producing extraordinary tensile and shearing stresses. Prices, sizes, etc., are given.

Weston Instruments.—Paper, 8[illegible] ins., 32 pp. Weston Electrical Instrument Co., Waverly Park, Newark, N. J.

Bulletin No. 8 illustrates and describes electrical measuring instruments, the Weston miniature precision group consisting of switchboard and portable meters of all kinds.

Webster Method.—Paper, 6x9 ins., 2[illegible] pp. Webster Manufacturing Co., Tiffin, [illegible]

This is the May bulletin of [illegible] company which describes and illustrates installations of Webster plants for sand and gravel washing and coal handl[illegible] articles show interesting mode[illegible] which should furnish serviceable d[illegible] persons using this class of equipment.

Turbo Blower.—Paper, 6x9 ins., [illegible] Turbo Blower Co., 30 Church [illegible] York City.

This is bulletin D, containing [illegible] trated description of the standar[illegible] regulator for regulating and [illegible] high and low pressure steam blowers. Directions for setting, etc., are given.

Traction Engines.—Paper, 9x1[illegible] ins., 40 pp. Buffalo Pitts Co., Buffalo, N. [illegible]

This catalog illustrates and describes contractors' special double cylinder road engines and reversible road cars for heavy freight and special reversible cars for hauling and spreading crushed stone and gravel. Special attention is paid to the details of construction of the traction engines and reversible wagons.

Air Compressor Accessories.—Paper, 6x9 ins., 40 pp. Sullivan Machine Co., Peoples Gas Bldg., Chicago, Ill.

This is bulletin 58-L, replacing bulletin 58-I. The first portion of the pamphlet contains a description of the accessories such as air receivers, reheaters and unloading devices used in connection with [illegible] compressors. Bulletin also contains a large amount of compressed air data and practical articles on the operation of compressed air machinery.

Another catalog, 5½x3½ ins., [illegible] pp., is booklet No. 108, which deals with machinery for contractors, including rock drills, stone channelers, diamond drills and hammer drills.

A third bulletin, No. 66-F, deals particularly with Sullivan light weight rock drills. Complete information is given.

Air Compressors and Pneumatic Tools.—Paper, 6x9 ins., 8 pp. Thos. H. Dallett Company, York & 23d Sts., [illegible]phia, Pa.

Six bulletins on the following [illegible] have been issued by the above company: Bulletin No. 200, General Construction Details of Air Compressors; Bulletin No. 201, Straight Line Belt Driven Air Compressors; Bulletin 202, Straight Line Steam Driven pressors, Bulletin 203, Duplex an d Belt Driven Machines; Bulletin ex and Compound Steam Drive , Bulletin 1014, Yankee P . ulletin 1024, Hand Rock Drill. lletins contain descriptive matter strations and diagrams, table and dimensions.

Hoisting Engines.—Paper, 7½x8 2 pp. Reliance Machine & T ks, St. Louis, Mo.

nailing card illustrates hoisting derricks, clam shell buckets and patent pumps, all of which are sold ve named company.

tent Decrees.—Paper, 8x11 ins., 4 National Bridge Company, Con- ng Engineers, Indianapolis, Ind.

aper contains a list of patent de- cost saving improvements in con- dges and suits in which decrees rendered in the United Stat nding the patents valid.

estos Roofing.—Paper, 4½x8 ins., H. W. Johns-Manville Company son Ave. and 4th St., New York

lder illustrates the use of J. M Roofing on factory buildings and ormation regarding the tests for inst fire

liances.—Paper, 6x9 ins., 32 pp. nal Board of Fire Underwriters.

ntains a list of manufacturers of ances published by the National Fire Underwriters at the recom- n of the Underwriters' Laborator- ving examinations and tests con- nder standards recommended by nal Fire Protection Association. edition of January, 1912 The vised semi-annually. Another list il and chemical appliances is also by the above.

Hydro Rec [illegible] 4 pp. [illegible] Block. [illegible] the following subjects. Hydro Recording [illegible] Differential Draft Recorder and Indicator, Hydro Pressure Draft Recorder and Hydro Recording and Indicating Meters. The pamphlets are illustrated with photographs and line drawings and give complete de- [illegible]

Jackohol.—Paper, 5½x3¼ ins., 8 pp. Watson-Stillman Company, 50 Church St., New York City

This folder, which is designated as Bulletin J, contains information regarding a filling liquid for hydraulic tools such as jacks, presses, punches, benders, etc., which, it is claimed, does not thicken, gum or change chemical composition, and is protective to the metal surface and packings with which [illegible]

Deep Well Pumps.—Paper, 8½x11½ ins., 72 pp. [illegible] Company, Beaver Falls, Pa.

This is the new addition of catalog No. 6 dealing with Downie Deep Well Pumps. The [illegible] giving descriptive matter and illustrations of pumps and their details, and containing lists of sizes, dimensions and prices. The pumps dealt with cover a wide range.

Reinforced Concrete Construction.—Paper, 6x9 ins., 72 pp. Southern Ferro-Concrete Company, Atlanta, Ga.

The above catalog is issued by a firm of engineers and contractors and contains information as to the advantages of ferro-concrete construction, with examples of designs for foundations and for superstructure of various types of concrete buildings. Interesting illustrations are given and copies [illegible] architects and owners.

Studebaker Wagons.—Paper, 6⅞x10½ ins., 16 pp. Studebaker Corporation, South Bend, Ind.

This catalog contains descriptions and illustrations of Studebaker wagons for earth moving, road oiling and sprinkling.

Drawing Materials.—Paper, 6x8 ins., 2 pp. E. G. Reuhle & Co., 119 Fulton St., New York City.

This circular illustrates and describes a new lettergraph and pen guider for large or small alphabet and numerals.

Foundry Products.—Paper, 6x8 ins., 64 pp. James B. Clow & Sons, Harrison St. Bridge, Chicago.

This catalog contains descriptions, illustrations and tables of dimensions, sizes and prices of cast iron pipe and fittings, manhole covers, curb guards, lamp posts, water troughs and fountains.

The Cummings System.—Paper, 6x9 ins., 16 pp. Electric Welding Co., Pittsburgh, Pa.

This bulletin illustrates and describes the Cummings system of concrete reinforcement. Complete line drawings, half-tones and descriptions of details are given.

Hammer Drills.—Paper, 6x9 ins., 16 pp. Ingersoll-Rand Co., 11 Broadway, New York City.

This is Bulletin 4111, descriptive of type "BC" butterfly hammer drills. These hammers are equipped with telescope feed and can also be furnished with dust allayers, which are strongly advocated as a safeguard to the health of the miners. The Butterfly valve consists of two wings and a central stem on which it oscillates. The catalog shows sectional views of the machine and also several cuts of machine at work underground, together with a list of duplicate parts.

AILWAYS, STEAM AND ELECTRIC

Alabama.

icts for the extension of the Bir- & Southeastern Ry., W. M. Blount, Union Springs, Ala., from Talla- Eclectic, 14 miles, have been let Pruit, Montgomery, Ala., and J. A. ine Bluff, Ark., the former receiving s and the latter five miles.

uthern Ry. is to expend about $10,- e construction of a 1-mile spur from o the fair grounds for the Black

Spradlin, promoter of the proposed from Birmingham to Chattanooga. er San Mountain, recently announced n, Ala., that surveys had been com- the Chattanooga end and would be at Birmingham. It is hoped to have condition to start work late this fall ext spring.

abama & Great Southern Railroad, it d, will shortly construct a line into Although nothing definite is obtain- generally believed that the report unded. J. W. Evens, Birmingham, uperintendent.

lders of the Mobile West Shore Co., Mobile, have authorized an is- 2,000,000 of bonds. The bond issue ce the construction of an interurban ailway from Mobile to Pascagoula, is proposed to have completed with- The project is backed by Mobile men, the leader of them being Judge l. Robert K. Warren, formerly sec- the Louisville and Nashville R. R., resident and general manager of the

Arizona.

s from Tucson, Ariz., state that Roy anager of the Copper Creek line, near Mammoth, is planning on securing English capital to construct a railroad from the mine down the San Pedro River to a connection with the Southern Pacific.

Arkansas.

The Little Rock & Augusta Ry. Co., mentioned in our last issue, has been incorporated with a capital stock of $100,000, and proposes to build seven miles of track, connecting the 178 acres of factory sites in South Argenta with the 768 acres of corresponding land lying in Factoria, a part of Little Rock. An agreement has been reached with a firm of bridge erectors to erect the private bridge across the Arkansas, which will connect the two sites. The road will extend from Ninth and Railroad Sts., ranging south, and will come into Argenta from the south, just below the Buckeye Cotton Oil Co. The construction of the roadbed will begin at once, it is said. A. C. Read, vice president of the Southern Trust Co., Little Rock, is interested.

California.

The Big Four Electric Ry. Co. has filed its articles of incorporation. This company has a capital stock of $1,000,000 and proposes to build a road that will run from Tulare to Woodville, thence to Popular, thence to Porterville, and a branch line to run from Tulare to Visalia, making the main line and the branch 34 miles long. This is the line promoted by Frank Avery and Davis Oliver of San Francisco.

The Engineering Department of the Southern Pacific Ry. is reported to have completed final surveys for the new line from Los Angeles to Spokane, Wash. The route as planned will be about as follows: From Los Angeles to Mojave, the present main line of the Southern Pacific will be used, and from Mojave to Owenyo, in Inyo County, a new line will be constructed along the route of the Los Angeles aqueduct. From Owenyo to Tonopah Junction, the old California and Colorado Railroad, a narrow gauge line owned by the Southern Pacific Company will be standardized at an expense of thousands of dollars, and a short extension will take the line to Hazen, Nev., on the main line of the Central Pacific. From Hazen to Winnemucca, Nev., the main line of the Central Pacific will be followed, and from there a new line will be constructed to Nampa, Idaho, on the main line of the Oregon Short Line. The main line of this road will be used to Huntington, Ore., and from there to Homestead, Idaho, the Northwestern tracks. From Homestead the surveyors have run a line along the Snake River to Spokane, Wash., the northern terminus of the new route.

Colorado.

Advices from Denver state that the Denver, Northwestern & Pacific R. R. (Moffat road), for which receivers recently were appointed, will be restored to the owners in 30 days, if negotiations now pending are successful. The advices state that representatives of the receivers, the owners and the holders of $3,500,000 notes, whose nonpayment caused the receivership, will meet in New York to consider a settlement. It is understood that an adjudication of the difficulties may be reached by the noteholders agreeing to an extension of those obligations.

The Denver City Tramway Co., John A. Beeler, General Manager, Denver, Colo., has begun securing property to carry out its plan for connecting up of the Denver & Interurban with the Moffat road for the purpose of facilitating the interchange of traffic between the two systems. The plan of the tramway com-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] extend the interurban line from some point on the north side, presumably Hazel court, on down through the Argo district to connect with the Moffat road in the vicinity of Fifteenth street. This will require the electrification of a portion of the Moffat tracks or the laying of additional tracks for the electric line. Construction work on the extension will not be started for some time. The extension of the interurban line is understood to be the first link in the proposed belt line about the city of Denver, which the tramway contemplates at some future time.

Delaware.

The Wilmington, New Castle & Delaware City Ry. Co. has been incorporated with a capital stock of $250,000, for the purpose of constructing, maintaining and operating railways. Robert H. Richards, Wilmington, Del., is counsel for the company.

District of Columbia.

The Virginia Terminal Co. has asked Congress for permission to construct a double track street railway line, running from Rosslyn, Va., across Aqueduct bridge and to Union Station by way of 36th St., M St., and New Jersey Ave., in Washington. The company will have a capital stock of $500,000, and is understood to have its plans well along. Harry Wardman and A. A. Thomas, of Washington, and J. G. Dudley, I. C. Taylor and E. F. Crawford of Virginia, are interested.

Florida.

The Live Oak, Perry & Gulf Ry. has surveys under way for rebuilding the first 30 miles, starting at Live Oak, Fla. The capital for construction has been secured and construction contracts will be let soon. W. L. Roach, Live Oak, Fla., is President and V. G. Watters, Live Oak is Chief Engineer.

Georgia.

Burke & Joseph, contractors, Cape Girardeau, Mo., have 35 miles of tracklaying on the Gainesville & Northwestern Ry. out of Gainesville, Ga., which they will sublet.

The Georgia Coast & Piedmont Railroad Co., operating between Collins and Darien, is to extend the line of the road from Reidsville to Vidalia. The company plans to issue bonds amounting to $3,500,000 for the purpose. It will have connection with several trunk lines. A line is also proposed from Darien to Brunswick. A. de Sola Mendes, Darien, Ga., is Vice-President and General Manager.

The Americus, Tifton & Atlantic R. R. Co., projecting a 110-mile line through Americus, Oakfield, Doles, Ashburn, Tipton, Nashville and Milltown, will have surveys made soon. In the meantime the company is selling $100,000 of common stock to pay for grading, etc., and will probably let construction contracts in 60 or 90 days. The company will organize in about two weeks when it gets its charter. The chief engineer has not been engaged as yet. J. W. Myers, Tifton, Ga., is interested.

Illinois.

The Chicago & Suburban Traction Co., a new corporation, has asked a franchise of the Cook County Board to operate on 237 sections of Cook county highways, covering 91 miles. The new traction company wants to build an electric railroad from Evanston to Elgin, thence to Oak Forest, and from there to the Illinois state line near Hammond, Ind. The ordinance provides for a 20-year franchise, and stipulates that the company shall have built and completed ten miles of track in three years and the entire proposed trackage in ten years. This company is incorporated with a capital stock of $5,000,000. W. J. C. Kenyon, Chicago, former president of the Illinois Tunnel Co., is president, and James O. Small is secretary. Its attorneys are Louis J. Behan and Herbert S. Duncombe.

⊙The Chicago & Eastern Illinois R. R. Co. has awarded contracts for grading for 32 miles of second main track as follows: Grading between Tuscola and Arthur, Ill., to Sheehan Brothers of Danville, Ill.; grading from Arthur to Findlay, Ill., to M. C. Connors & Co., of Chicago.

Indiana.

A. O. Cunningham, Chief Engineer of the Wabash Railroad, St. Louis, Mo., has informed the Board of Public Works, Fort Wayne, Ind., that the company has appropriated the necessary funds for the completion of track elevation west of Calhoun St. The board expects that arrangements will soon be completed with the Pennsylvania R. R. for its portion of the work.

The Cleveland, Cincinnati, Chicago & St. Louis Railroad (Big Four) will start work shortly, it is reported, on the reconstruction of the Fairland, Franklin & Martinsville branch in Indiana. The roadbed is to be regraded and regraveled and 60-lb. steel rails installed. W. B. McLoughlin, Indianapolis, Ind., is Engineer Maintenance of Way.

Iowa.

⊙Cameron, McManus & Joyce, Keokuk, Ia., have been awarded a contract by the Chicago, Burlington & Quincy R. R. for grading on realignment of main track between Keokuk and Montrose incident to the re-elevation on account of the construction of the power dam at Keokuk. There are also terminal improvements at Keokuk yard, including a coal chute, ice house and yard extension.

Council Committee of Dubuque, Ia., has voted to grant the Union Electric Co., 340 Main St., Dubuque, a franchise to use the streets to gain an entrance to Eagle Point Park. It is understood that work on the extension will be started at an early date.

Kansas.

The Wichita Union Terminal Ry. Co., C. J. Skinner, Resident Engineer, Wichita, Kan., on account of certain right of way and legal complications, has postponed the letting of contracts for the Union Station and other track elevation work at Wichita. These contracts were to have been let on May 22.

Surveys are underway for the projected line of the recently incorporated Newton, Kansas & Nebraska R. R. Co. of Newton, which proposes to build a line north from Newton via Goessel, Canton and Roxbury to the north line of the state. It is the intention to build a standard gage railroad and operate motor cars for passenger service and steam for the freight business. The officers are: T. H. McManus, Newton, president; Dr. Axtell, Newton, vice president; Roy T. Glass, Canton, secretary; Jas. A. Spilman, treasurer, and J. M. Simpson of Canton, M. A. Moore, C. E. Grove and F. E. Devlin, county surveyor of Harvey county, are on the board of directors. S. V. Wardell is Chief Engineer.

Kentucky.

Preliminary surveys are underway for the extension of the Blue Grass Traction Co. (Kentucky Traction & Terminal Co., Lexington, Ky.) from Frankfort to Shelbyville. Two routes are under contemplation—one by way of the state line, the other by way of Benson. Rowland Cox, Taylorsville, is in charge of the surveys.

The Chesapeake & Ohio Railroad will reconstruct 80 miles of the Big Sa y Divisic it is said. Heavier rails and add onal balla will be laid on the line which r s into El horn, Ky., toward which the Car na, Cli field & Ohio Railroad is building line fr Dante. L. B. Allen is Engineer [illegible] of Way, Covington, Ky.

It has been announced that e Callah Construction Co., Knoxville, Ten which l the contract for the construction f the Le ington & Eastern line of the puisville Nashville to the mining regions f Letch County, Ky., will complete work about o month, on the section between lazard a Whitesburg.

Louisiana.

Press reports quote J. A. Eds , Presid Kansas City Southern Ry., as tating th that road was still working on p ns to ent New Orleans on its own tracks. rior t Mississippi flood the outlook ha been gratifying and work had been surveys for the new tracks and ot r venture The flood has had a tendency to r ple any extension work the rai have had in view, but when the side and normal conditions are projects will be resumed. The a Southern has recently had its s surveying the country from Sl Alexandria and it is thought that dria link may be the first in th which will reach to New Orlear

Maryland.

⊙R. Galiardi, Connellsville, P awarded a contract by the Weste R. R. for grading, etc., for a 3½ at Charlton Station, Md., crossir mac River in West Virginia. T vania Steel Co. has been awarded for the steel work for the 1,175-

Massachusetts.

⊙Bids were opened May 23 by Transit Commission, Boston, Ma structing Sec. A 2, of the Dorche the section being 500 ft. long and Winter St. The contract was Coughlan & Sheils Co., 43 Tremo ton, Mass., at $241,475. The item this work were as follows (1) bid of Jones & Meehan, 24 Oak maica Plain, (2) for Bruno & Pe mont St., Boston, (3) for John 1012 Old South Bldg., Boston, (4 for Nawn Contracting Co., 82 Savin St. bury, (5) for P. McGovern & Co. 6 St., Boston, (6) for Coleman B Mass., (7) for Mullen, O'Riordan M Alfred St., Charlestown, and (8) r C lan & Sheils Co.:

	(1)	(2)	(3)	(4)	(5)	(6)
Excavation, [illegible] cu. yds.	$ [illegible]	$ [illegible]	$ [illegible]	$ 4.50	$ 4.60	$ 4.40
Removing masonry, 1,300 cu. yds.	15.00	10.00	12.00	7.00	7.00	8.00
Concrete masonry, 9,000 cu. yds..	15.00	13.50	12.00	10.50	9.50	9.50
Cinder concrete, 1,500 cu. yds....	6.00	8.00	10.00	5.00	7.00	6.00
Brick masonry, 300 cu. yds.......	25.00	18.00	18.00	20.00	16.00	16.00
6-12-in. clay pipe, 100 lin. ft.	[illegible]	1.00	[illegible]	0.50	1.00	0.50
Setting reinforcing rods, 250 tons	25.00	15.00	12.00	8.00	10.00	9.00
Setting steel and iron, 250 tons...	25.00	15.00	20.00	10.00	[illegible]	15.00
Portland cement mortar, 500 sq. yds.	[illegible]	[illegible]	[illegible]	0.50	0.50	0.60
Prepared textile or asphalt, 20,000 sq. yds.	0.50	0.60	0.60	0.50	0.30	0.45
Tarred felt and pitch, 20,000 sq. yds.	0.50	0.40	0.30	0.30	0.60	0.25
Other costs and risks not covered by other items, lump..........	25,000	35,000	27,000	20,000	14,500	20,000
16-in. cast iron pipe, 500 lin. ft...	6.00	2.00	1.00	1.00	1.00	1.25
8-in.-12-in. cast iron pipe, 850 lin. ft.	[illegible]	1.50	[illegible]	0.80	1.00	1.00
Totals	[illegible]	$376,475	$340,630	[illegible]	$283,750	$278,925

Michigan.

No definite action has been ta Board of Trade, Manistee, Mich., ports of the reconnaissance party posed Manistee-Muskegon R. R. ommended that $5,000 be raised a preliminary survey.

The Grand Trunk, it is reporte heavy rails on the line between Gr Mich., and Detroit, during the co mer. M. S. Blaiklock, Montreal, gineer Maintenance of Way.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

eld Northwestern Electric Ry., started [illegible] years ago and abandoned [illegible] the road bed was [illegible] ld to Chicago parties headed by L. C. s. Following the sale the road was or e with the following officers: President, avis, of Chicago; vice president and [illegible] Charley H. White, of Chicago. The [illegible] will be known as the Albion, Brook- al Charlotte Railway, and 600 H. P. ir motor cars will be operated on the ending from Albion to Charlotte via [illegible]

Minnesota.

Loweth, Chief Engineer of the Chi- lwaukee & St. Paul Ry., has filed with it council committee on grade crossing on, of Minneapolis, Minn., plans clude the following: Elevation of the e tracks 17 ft. above the present Ornamental bridging over 15 street r. Vacation of 9th ave. s. Tunneling n ave. s. from Washington ave. to 2d ing off of 25 ft. of Washington ave. w approaches to tunnel. Appreciable rade on only four streets. Head- ft. under every bridge. The cost [illegible]

luth and the Iron Country.

[illegible]

& Shepard, contractors, St. Paul. e that they have been awarded nal work in the Milwaukee Rail- Dakota. They have some excel- ork and grader work to let.

& Elzy Company, contractors, St. Iinn., advise that they have been some new work, and are in the mar- sub-contractors, graders and team

ett & Record Co., dock and elevator rs, were awarded the contract by the gh Coal Company for the extension of their coal docks at Superior, Wis. , including the filling, amounts to ree hundred thousand dollars. The & Superior Dredge Company were the contract for the filling on this

Harding, representing Brodrick & wire rope manufacturers, was a caller ffice a few days ago, and stated busi- very good.

n Rice of Wick, O'Connell & Co., ller last week and stated that he was arket for some railroad work. They mall car outfit and can be addressed, this office.

Shipman, representing the Troy Works, was a caller, and spent about in this territory calling on the trade.

Johann, western sales manager for or Iron & Steel Co., headquarters at came in to see us this week. He urned from a trip over the Iron and stated that business was very

Thompson, General Superintendent Drake & Stratton Co., has returned nding the winter in California. Mr. on has been very ill all winter, but pletely recovered, and is looking fine. is friends are very glad to see him

Hazen, Chief Engineer of the Duluth, & Pacific Ry. Co., and in charge of 0 miles of work for the Canadian spent a few days in the city last He stated that their construction work ing along very well, and that they had completely covered.

Hawkins, Vice President and Gen- nager of the Drake & Stratton Co., rs, has returned from spending the n Florida. He expects to spend the n Duluth.

abor situation at Duluth and vicinity [illegible] every day. The demand [illegible] increasing, and the supply is not one- [illegible] all the places offered [illegible]

[illegible] ditions for [illegible] to come. We are in [illegible] especially crews of foreigners. Any foreign crews wishing to come up this way, get in touch with me.

A. G. Kingston, treasurer of the Roberts, Kingston Contracting Co., was a caller, and stated that they had two steam shovels at work at the present time, and the work was [illegible] and said that he was not doing anything at the present time, but was in the market for some small car work.

J. B. Rhodes, better known as "Dusty" Rhodes, expert dump car man for the Western Wheeled Scraper Co., was with us last week. Business with the Western Wheeled Scraper Co., he states, is very good.

This office was advised by J. H. Flick of the J. H. Flick Construction Co., Chicago, Ill., that they have some small car work to sub-let on the Milwaukee in Michigan.

C. H. Rossiter, traveling representative for the Marion Steam Shovel Co., spent a day in Duluth this week. Business booming in the steam shovel line.

Richard Evans, railroad contractor, was a caller on us a few days ago, and stated that he has five steam shovels working at the present time, and that all of his work is progressing very nicely.

The Great Northern Ore Lands Co., which is the holding company for a large number of iron mines in this vicinity, has taken bids for the stripping work of one of their mines, estimated yardage 6,000,000 cu. yds., work to be completed within 2½ years. The following were among the contractors that were looking over this work: John Porter and Andrew Porter, Porter Brothers; F. C. Winston and H. C. Hanson of Winston Brothers Co.; the Drake & Stratton Co., Butler Brothers Company, and F. R. Jones. This contract was to be awarded some time before the first of June. It will take a large amount of equipment, and will furnish employment to a great many laborers.

Mississippi.

The Finkbine Lumber Co., Wiggins, Miss., in the near future expects to extend its logging road six or eight miles, and will be open for figures from contractors to do the grading, build the trestles and put in culverts, etc.

Promoters have met with success in securing the necessary right of way for the construction of the proposed line of the Memphis, Columbus & Pensacola R. R., and it is believed that matters will take definite form shortly. The new line will use a portion of the survey made by General N. B. Forrest down the Tombigbee Valley in 1868.

Missouri.

A banking syndicate composed of the Guarantee Trust Co., Rhoades & Co. and William Solomon & Co., has purchased $7,500,000 of first terminal and unifying mortgage 5 per cent bonds of the St. Louis & Southwestern Ry. Co. This is a part of the $100,000,000 authorization dated Jan. 1, 1912, which matures in 1952

St. Louis Items.

⦿The J. A. Ware Construction Co., Houser Bldg., St. Louis, Mo., secured five miles of nice steam shovel work on the Wabash R. R., between Decatur and Knights, Ill.

⦿Cameron, McManus & Joyce were awarded the contract for moving the Burlington grade back from the river between Keokuk and Montrose, Ia. They have 300,000 yards of nice team work to sublet there. Keokuk, Ia., will catch them

⦿Prichard & Craig have taken a piece of the Chicago & Eastern Illinois work near Findley, Ill., from M. C. Connors & Co.

⦿Headley & Son have subbed 25,000 yds. of team work near Kirksville, Ill. from M. C Connors & Co. on the C. & E. I. R. R

⦿M. C. Connors & Co., 14 S. Canal St., Chicago, Ill., secured the contract for double tracking the Chicago & Eastern Illinois R. R. between Findlay and Arthur, Ill. They can use several small team outfits on this work.

S. T. Neely, representing the List & Gifford Construction Co. of Kansas City, Mo., passed through St. Louis the other day on his way to Marianna, Ark., where they are going to resume work on the Memphis-Marianna cut-off of the Iron Mountain R. R., which has been under water for a couple of months.

W. E. Tench of W. E. Tench & Co., Detroit, Mich., came in and bought a couple of car loads of big mules, which they shipped on to their Wabash R. R. work in Michigan

J. B. Vogt has finished his work at Herrin, Ill., and moved his outfit, consisting of 15 teams, to Bellville, Ill. Vogt is in the market for some more work.

R. H. & G. A. McWilliams have started on their Sun Flower Drainage district work with a new 1½-yard American Steel floating dredge. F. Lacefield is in charge of this work and expects to finish it in about eight months.

Smith Bros. of Benton, Ill., have moved their outfit on to a piece of M. C. Connors & Co.'s work on the C. & E. I. R. R., near Cadwell, Ill.

M. Warkley is now with W. E. Tench & Co., at Milan, Mich.

H. M. Richey, General Superintendent of the Southern District of the St. Louis, Iron Mountain & Southern Ry., has resigned his position on account of the ill health of Mrs. Richey, and is succeeded by Mr. J. W. Dean of St. Louis.

(Father) E. L. House has been awarded the contract for loading ties for the St. L. I. M. & S. R. R.

John Beecher of Beecher Bros. is here. Nothing new.

A million dollar warehouse, ten stories high, with railroad switches on the ground floor and all modern accessories, will be erected by Thomas K. Niedringhaus of the National Stamping and Enameling Company, east of Third St., between Florida St. and Cass Ave. The warehouse will be controlled by a new corporation yet to be formed, which will engage in a general storage and warehouse business. Tom Bennett of the Mortgage Trust Company is working with Niedringhaus in promoting the new industry, but declined to make public at this time full details of the plans. The facts became known when Councilman William Protzmann introduced a bill in the Assembly to vacate Second St., between Florida St. and Cass Ave. T. K. Niedringhaus owns the abutting property on both sides of Second St. in this block and Protzmann admitted that a 10-story warehouse was planned. In the bill nothing is stipulated as to compensation to the city for the vacation, but it was stated by Protzmann that Niedringhaus is willing to pay a reasonable amount for the acquisition of the public street. The closing of the block will not interfere with traffic, as there is no continuation of Second St. at one end of the block. The recent activity in real estate in this section of the city will be accelerated by the erection of this mammoth warehouse, and the outlook for the vicinity is decidedly roseate.

Attracted by the advantages of St. Louis as a lumber market, a member of a large hardwood lumber company of Milwaukee has secured a plot of 4½ acres, fronting 400 ft. on the Oak Hill branch of the Missouri Pacific R. R., where a lumber and hardwood industry will be established shortly. The property is just west of King's Highway. It adjoins the Quick Meal Stove Factory, and is just west of the Seidel Lumber Company's yards. Other concerns in that growing industrial section are Hemp & Co., manufacturers of stoves; The Carondelet Foundry Company, the Polar Wave Ice and Fuel Company, and Blackmer & Post, fire clay works.

Rice cultivation in the South is opening a new field for Missouri mules. W. E. Evans, head of the legal department of the Frisco System, and P. H. Dean of St. Louis, re-

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] extensive rice land in Arkan[illegible] result, the information bureau of the National Stock Yards says, the sale of mules during the week was much larger than usual, Evans and Dean having purchased a large number.

General Manager L. C. Haynes of the East St. Louis & Suburban Ry. made a tour of inspection of the Alton street car lines last week. Mr. Haynes rode over the lines with other officers of the company, and stated that an appropriation of $50,000 had been made to rebuild the Alton lines this summer. Representatives of the Piasa Light & Power Co. announced enough signatures had been obtained to guarantee that the company would be able to erect its lines on every street in Alton. The average was 66 per cent of the property frontage on each street. The City Council will hold a special meeting to give first reading to the franchise ordinance for the Piasa Light & Power Company. Haynes said he believed J. J. Cummings of Chicago was financing the new company.

Montana.

⊙The Chicago, Milwaukee & Puget Sound Ry. has awarded the contracts for constructing its line from Great Falls to Lewistown, Mont. Winston Bros. Co., Globe Bldg., Minneapolis, Minn., secured the contract for the west end of the line, the work including 2,000,000 cu. yds. of excavation, of which about 500,000 cu. yds. is rock, and Twohy Bros., Portland, Ore., secured the east end, their contract involving 2,500,000 cu. yds. of excavation, of which 1,000,000 cu. yds. is rock. There are a number of tunnels in both sections.

Nebraska.

Citizens of Bethany, Neb., have organized a company with a capital stock of $25,000, and propose to build a street car line from that place to the State farm.

New York.

✣Bids are being received by Gabriel Bros. Construction Co., Holley, N. Y., for 60,000 cu. yds. of earth excavation and 18,000 cu. yds. of concrete, located 20 miles west of Rochester, N. Y., on the New York Central Railroad.

⊙W. H. Gahagan, Brooklyn, N. Y., has been awarded the contract for the reconstruction of about 6,000 ft. of the Manhattan Beach Division of the Long Island R. R. in East New York. The work will include a 4-tube tunnel about 3,500 ft. long and an embankment from Granite St. to the Brooklyn Borough line.

The Public Service Commission of the First District, New York City, has ordered drawings and plans for the proposed 2-mile tunnel to be built under New York Bay to place Staten Island on New York City's rapid transit map and provide a through line to be used by steam railroads for passenger and freight traffic.

Board of Trustees of Freeport (L. I.), N. Y., have granted a franchise to the Freeport Ry. Co., a local corporation, for a street surface railway, which will begin at Grove St. and Olive Boulevard, run south to Front St. and thence westward to the dock of the Great South Bay Ferry Co., which is operated and controlled by the directors of the traction company.

The Public Service Commission for the First District of New York City has laid out the rapid transit route for the extension of the new Seventh Avenue Subway, to be operated by the Interborough Rapid Transit Company, to Brooklyn. The new route will leave the proposed Seventh Avenue Subway in West Broadway at Murray St., will curve into Park Place and run through Park Place to and under Broadway and then under the Post Office Building to Beekman St., and through Beekman St. to William St., through William St. to Old Slip and through Old Slip to and under the East River to Clark St., Brooklyn; through Clark St. to Fulton St., and through Fulton St. to a junction with the existing subway at or near Borough Hall. This completes the laying out of routes for the Interborough's part of the proposed dual system, with the exception of a short link in Lexington Av., providing for the junction of the existing subway with the Lexington Avenue Subway. The point of junction has not yet been agreed upon, but it will be in Lexington Av. some place between 32d and 42d Sts. The only other route for the dual system remaining to be laid out is the proposed tunnel line to Staten Island, which will be connected with the Fourth Avenue Subway in Brooklyn, and operated as a part of the Brooklyn Rapid Transit System.

The Public Service Commission has sent to Senator O'Gorman at Washington the draft of a bill which he will introduce in Congress, giving the City of New York permission to build the proposed subway for the Interborough's Brooklyn tunnel under the Post Office Building at Broadway and Mail Street. This property is owned by the National Government, and while it is possible for the city now to get a revocable permit from the Secretary of the Treasury, there is no way of obtaining a permanent right. The Commission's counsel has advised that a permanent right should be obtained, and therefore the bill sent to Senator O'Gorman was prepared. This bill, if passed, will authorize the Secretary of the Treasury to grant the City of New York a permanent right of way for the proposed subway under the Federal Building.

North Dakota.

The Great Northern Ry. has plans under consideration for the construction of a line 400 miles long starting from a point on the New Rockford-Williston line in North Dakota, a little west of New Rockford, through North Dakota into Montana asd thence west to Lewiston. The new road will give the Great Northern an alternative transcontinental road and will alleviate the necessity of double-tracking the main line through Montana. A. H. Hoagland, St. Paul, Minn., is Chief Engineer.

Ohio

The Pittsburgh & Lake Erie R. R., W. A. Atwood, Chief Engineer, Pittsburgh, Pa., has taken bids for constructing two sections of its subsidiary line, the Lake Erie & Eastern. Contracts for the middle section of this work have been awarded to Culbertson Bros., Cleveland, O.; McKelvy Hine Co., Pittsburgh, Pa., and the Duquesne Contracting Co., Pittsburgh, Pa., as previously noted.

There is a report, which cannot be confirmed at this time, that an appropriation of $5,000,000 is to be spent for rejuvenating the Detroit, Toledo & Ironton R. R. G. K. Lowell, Detroit, Mich., is Receiver.

Right of way is being secured for the proposed electric railway from Mansfield to Canal Dover, through Millersburg and Holmes County. W. D. Todd and James W. Wiggins of Warren, Pa., are interested.

It is rumored that the Pennsylvania R. R. is contemplating making a number of important changes in the Cincinnati terminal of the Cincinnati, Lebanon & Northern R. R. During the past several years the Pennsylvania R. R. Co., which owns and controls the Cincinnati, Lebanon & Northern, has been quietly acquiring property adjacent to the terminal of the latter line in Cincinnati, with a view to enlarging the yards and otherwise improving the terminal facilities. It is understood that a number of buildings now on the property, which has been acquired by the Pennsylvania R. R., and which lies adjacent to the C., L. & N. terminals, are to be razed shortly. It is also said that the C., L. & N. depot and other buildings on the terminal will be torn down and modern buildings erected in their stead. It is understood the contract for this work is about to be let.

Oklahoma.

The town of Cheyenne, Okla., is to hold an election shortly to vote on issuing bonds for the construction of a railroad to connect the town with the Clinton & Oklahoma Western. A local company will be organized to build the line 5 miles due east from the tapping the Clinton & Oklahoma W[illegible] south of Strong City. H. D. Cox and J. W. Cooper of Cheyenne are intereste[illegible]

A Citizens' Booster Club is be[illegible] ized at Beaver, Okla., to give a bon[illegible] 000 to the first railroad crossing the [illegible] side of Beaver County. G. [illegible] Ogl[illegible] ident of the club.

The promoters of the Ardmore, Duncan & Lawton Ry. Co. are reported to have signed contracts with New York parties for finan[illegible] the road. It is stated that the mon[illegible] be forthcoming for the immediate [illegible] of the line from Lawton to Ardmore. [illegible] L. Harmon, Lawton, Okla., is Pre[illegible]

Oregon.

⊙Porter & Conley, Portland, Ore., and the Oregon Pile Driving Co., Portland, have sub[illegible] contracts from Twohy Bros., Portland, [illegible] work on the latter's contract for constructing a short line from Salem, Ore., to [illegible] Ore., connecting two parallel lines of the Southern Pacific. The general contract, which was noted some time ago in these columns, includes 150,000 cu. yds. earth excavation and 2,500 lin. ft. of pile and timber bridges.

The Portland, Nehalem & Sea Coast R. R. Co. has been incorporated with a capital stock of $750,000, and proposes to build [illegible] from Portland to Astoria. This is [illegible] be a Southern Pacific project. The [illegible] tors are J. A. Jackson, C. E. Wigl[illegible] W. O. McCarthy.

Officials of the Oregon-Washington R. [illegible] & Navigation Co., and City Engi[illegible] Hurlburt, Portland, Ore., are prepa[illegible] for the lowering of the tracks in [illegible] Gulch from East 28th st. to the [illegible] eliminating all grade crossings. The [illegible] include the construction of a viaduct [illegible] Road crossing estimated to cost $53,[illegible]

Pennsylvania.

⊙Swanson Bros., Rockwood, Pa., [illegible] in our last issue, have been awarde[illegible] tract for constructing double track [illegible] Rockwood and Garrett, Pa., for the [illegible] ville & State Line R. R. The contra[illegible] 250,000 cu. yds. earth excavation and 5[illegible] yds. concrete masonry. None of th[illegible] to be sub-let.

O'Connor & Madigan, who have the contract for grading the West Penn cut-off near the McClure works at Swedetown, Pa., have started work.

Business Men's Association of Chester, Pa., has taken up a project for the construction of a trolley line northward, touchin[illegible] ton, Llanwellan, Rockdale, Lenni, C[illegible] Glen Riddle, Wawa, Glen Mills [illegible] small localities. The line would tap [illegible] but eight miles from Chester, in wh[illegible] six to seven thousand people reside[illegible]

Rhode Island.

Actual construction work has been started [illegible] Woonsocket, R. I., on the line of the Southern New England Railroad from [illegible] Mass., to Providence, R. I. As mentioned [illegible] the May 15 issue of "Engineering [illegible] tracting," the O'Brien Construction Co., 5[illegible] Morris Park ave., New York [illegible] awarded the contract for grading and masonry work on the Rhode Island section of the line and John Marsch, 105 S. La Salle st., Chicago, Ill., was given the Massachusetts section.

Texas.

⊙The Houston & Texas Central R. R. [illegible] awarded the contract for the construction [illegible] the 5-mile section from Giddings eastward [illegible] P. M. Johnston & Son, 620 Binz Bldg., Houston.

⊙Karner Bros. & Co., Dallas, Te[illegible] have the contract for grading for the terminals to be built by the Katy in Waco.

Officials of the St. Louis, Brownsville & Mexico (Frisco System) recently held conference with interested citizens of [illegible]toria, Texas, concerning an extension of [illegible] line from Keyser, a station on the Port Connor branch, 5 miles below Bloomington, [illegible] Austwell, Refugio County, on San Antonio Bay, a

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

:e of 14 miles. J. H. Elliott, Houston, is Vice-President and General Man-

receivers of the Kansas City, Mexico nt Ry., W. W. Colpitts, Chief Engineer, City, Mo., are understood to have con- [illegible] 00 will be sold to continue construction n the line.

ndicate of capitalists Philadelphia, Pa., -ted to have purchased a large tract of Gaines County, Texas, which it is to colonize. A railroad is planned to tructed through Seminole to a connec- th some line in that vicinity.

Business League of Austin, Texas, is ing with the San Antonio, Rockport & Ry., with a view of securing the con- n of the line south of San Antonio into via Lockhart, Texas.

Gulf, Texas & Western Ry. has finished tion of the proposed extension of its m Jacksboro southeastward to a con- with the Weatherford, Mineral Wells [illegible] The distance is 23¼ miles. It is l to begin construction within the or 90 days, and it is hoped to com- work by the end of the present year. re no water ways of consequence, and cipal work will be that of excavation ankment, the line showing an aver- bout 17,000 cu. yds. to the mile. The has drilled the cuts in order to get ion as to the probability of rock, and very small proportion of the work ill classify either solid or loose rock. Cain, Praetorian Bldg., Dallas, Tex., President and General Manager.

er H. Denison, Wagoner, Okla., has [illegible] for the Santa Fe between Lubbock, d Texico, on the line of Texas and xico. The work is to be commenced e next 10 days or two weeks and is mpleted by the end of the year 1912. something over 1,000,000 cu. yds. miles. It is two-way pay and fine ork, and is fine material in a dry [illegible] stock. Mr. Denison expects to open ice in Lubbock, Tex., at which place be interviewed by sub-contractors [illegible]

Washington.

regon-Washington Railroad & Navi- ., F. L. Pitman, Chief Engineer of ion, Spokane, Wash., and the Chi- waukee & Puget Sound Ry. Co. will onstruct 1.32 miles of single track ith Montesano to Montesano, Wash- The construction involves a 240-ft. ck steel draw bridge over the Che- er.

mored that the Southern Pacific Ry. plating the construction of a new south line east of the Sierras from the inland country of the state of on. Nothing definite in regard to osition is, as yet, available.

⦿Flagg & Standifer, Spokane, Wash., have been awarded the contract for the construc- [illegible] been assembled at Hooper, a point half-way between Spokane and Ayer, where the rail-laying and ballasting will begin. The track will be laid both ways from that point, at the rate of about two miles a day. The estimated cost of the work is $400,000. Guy Standifer, of the contracting firm, is in Portland, superintending the shipping of the firm's outfit to Hooper, where work on the contract will begin.

West Virginia.

A plan is on foot to construct a railroad in Nicholas and Greenbrier counties. Among those interested in the project are Herbert Fitzpatric, R. M. Baker, J. W. Hagen, Jr., Herman M. Pugh and Samuel Biern, Huntington, W. Va.

The Morgantown & Wheeling Ry. Co. has been incorporated with a capital stock of $1,000,000 and proposes to build an electric railway from Morgantown to Wheeling. The incorporators are Julius Monroe and E. M. Lantz of Kingwood, and John M. Gregg and D. M. Willis of Morgantown.

The Gauley & Summersville R. R. Co., Swiss, W. Va., has been chartered with a capital stock of $10,000 and proposes to build a line from the mouth of Peters Creek on the Gauley River to Summersville, for the development of timber and mineral rights in that section. Peter Carroll, W. A. Porter, W. T. Weaver, W. H. Gilbert and W. T. Wells, all of Charleston, W. Va., are interested.

Wisconsin.

The State Railroad Commission of Wisconsin has instructed the Chicago, Milwaukee & St. Paul R. R., and the Chicago & Northwestern to complete the elevation of their tracks on the south side of Milwaukee, Wis. by December 31, 1914.

Right of way is stated to have been secured for an electric line from Wausau to Merrill. Neal Brown, Wausau, President of the Wausau Street R. R. Co., is interested.

The Wausau Street R. R. Co. has petitioned the City Council of Wausau for a franchise to extend its line from Sixth St. west on Wausau Ave. to Third St., thence south on Third St. to connect with the street railway already constructed by that company. This will give the company a loop.

Wyoming.

Advices from Shoshoni, Wyo., state that track laying on the Burlington from Big Horn canon, south of Thermopolis, has commenced, and the line will be built to Bonneville, opposite Shoshoni, by June 10. The grade is almost ready for the entire line to Powder River, east of this place, where connection will be made with the Chicago & Northwestern. Large gangs are relaying the Cheyenne & Northern tracks between Hartville Junction and Orin Junction with heavy steel, and ballasting the roadbed. By the time traffic is established the entire line from the Gulf to the northwest will be capable of handling heavy through trains. Grading between Powder River and Oris Junction is to be pushed, and in another year it is believed the Burlington will be able to operate trains over its own tracks there.

Canada.

⦿Culliton Bros., Spokane, Wash., have been awarded the contract for the grading and bridge work for the first 10 miles of the new extension of the Esquimalt & Nanaimo Ry., from McBride Junction to Courtenay.

⦿A. E. Trites & Son, Moncton, N. B., the general contractors, have awarded sub-contracts to the following for work in connection with the construction of the extension of the Fredericton & Grand Lake & Coal & Ry. Co.'s line from Globe, N. B., to Minto, N. B.: McPhail & Baird, Mavor Bros., Sutton & McLain, Cooke, Kitchen & Co., John Mavor, D. C. Burpee & Son. All sub-contracts on this work have now been let.

⦿The Canadian Pacific Ry. has awarded the contract for constructing its $1,400,000 depot at Vancouver, B. C., to the Westinghouse, Church Kerr Co., New York City. In accordance with the agreement with the city, the railway will also build a tunnel in the downtown section to relieve the congestion of traffic. Railway crossings will be abolished and overhead bridges built, the whole involving a total of several million dollars.

City Council of Saskatoon, Sask., has closed a contract with the Stone & Webster Engineering Corp., Boston, Mass., for financing the proposed municipal street railway for a year. This has been done without submitting a by-law to the people, in order that there may be no delay and so that the paving operations on the main business streets where the car lines will be constructed will not be held up. Stone & Webster will receive 12½ per cent on the estimated cost and in addition 5 per cent on the money loaned. Three carloads of material ordered by the company which secured the charter in the first place, is now in the city and orders have been placed for $60,000 more.

The City Council of Toronto, Ont., has passed a resolution authorizing Corporation Counsel Drayton to secure a railway expert as an official to be attached to his department for street railway traffic purposes. The resolution also provides that funds to the extent of $35,000 be provided for the securing of expert assistance required in connection with transportation matters, such expert or experts to be residents of Canada, if such can be found satisfactory to the Corporation Counsel.

The London Electric Ry. Co. of London, Ont., has been purchased by a syndicate headed by William Mackenzie of Toronto. The purchase is said to be part of a general consolidation of electric lines in Western Ontario.

Town Council of Berlin, Ont., will submit by-laws to the citizens providing for the purchase of two new street cars and the erection of car barns for the municipal railway.

OADS, STREETS AND PAVEMENTS

Arkansas.

will be received until 1 p. m., June ommissioners of Street Improve- trict No. 195, F. H. Schwartz, Gazette Bldg., Little Rock, Ark., rading and paving of Denison St. to 14th Sts., with water-bound or acadam and for laying sidewalks trict. E. A. Kingsley, Markham r Sts., Little Rock, Ark., is Engi-

ssioners of the West Fifth Ave. istrict, Pine Bluff, Ark., have let ct for the paving of that avenue St. west to the Cotton Belt tracks, to Levy & Levy of Muskogee, Okla., at about $20,000. Asphaltic concrete will be used. Other bidders were: Southern Bitulithic Co., Nashville, Tenn.; Standard Engineering & Construction Co., Dallas, Tex.; Municipal Construction Co., Kansas City, Mo.; W. E. McGehee, Little Rock, Ark., and Western Paving Co., Oklahoma City, Okla.

California.

⦿Clark & Henery of Stockton, Cal., have been awarded the contract by the City Council of Eugene, Ore., for the paving of West Seventh St., from Olive to Blair, at $1.60 per sq. yd. The total cost will be $21,770.

Colorado.

The U. S. Reclamation Service, 408 Commonwealth Bldg., Denver, Colo., Morris Bien, Acting Director, rejected all bids received April 25 for the furnishing of 260,000 bbls. of Portland cement, f. o. b. cars at works of shipment during the years of 1913 to 1916 inclusive. The estimated requirements for each of the above years is as follows: 1913, 70,000 bbls.; 1914, 85,000 bbls.; 1915, 85,000 bbls., and 1916, 20,000 bbls.

District of Columbia.

Following bids were received by the Commissioners of the District of Columbia, Washington, D. C., for furnishing vitirified paving blocks during the next fiscal year: C. P. Mayer Brick Co., Bridgeville, Pa., $21.35 per M.; Baltimore Clay Products Co., Baltimore, Md., $21.15; Mack Mfg. Co., Philadelphia, Pa., delivery by Pennsylvania Railroad, $24.65; by Baltimore & Ohio Railroad, $26.94; Morgantown Brick Co., Morgantown, W. Va., $21.10; American Sewer Pipe Co., Akron, O., delivery Second and Florida Ave., $24.85; Second and I Sts., $22.45; Allegheny Valley Brick Co., Torrytown, Pa., $20.85.

Florida.

✣Bids will be received until 7 P. M., June 18, by City Clerk, T. J. Sheridan, Clearwater, Fla., for the construction of about 8,220 sq. yds. of pavement of vitrified brick, asphalt, macadam or crushed rock.

Georgia.

⊙The City Council of Fitzgerald, Ga., has let the contract for the paving of 10 blocks to the Alabama Paving Co. Work has been started.

The City Council of Augusta, Ga., has authorized the Commissioner of Public Works to prepare plans and specifications for the paving of 10th St., from Broad to Ellis. Nisbet Wingfield is City Engineer.

Illinois.

✣Bids for the road work hereinafter described will be received by the Commissioners of Highways of the Town of Wysox, County of Carroll, State of Illinois, until 2 p. m., June 14, 1912, at the real estate office of M. W. Pittman, Milledgeville, Ill. The Commissioners reserve the right to reject any or all proposals. Proposals may be sent by mail addressed as follows: "Proposals for road work in the Town of Wysox, J. E. Miller, Town Clerk, Milledgeville, Ill." The roads in Section 1 and Section 2 are located as follows: Section No. 1, Road No. 1.—Beginning at the Whiteside County line and extending north 1 mile on the township line between Wysox and Elkhorn Grove townships. Road No. 2.—Beginning at the southeast village limits of Milledgeville on the Milledgeville-Sterling road and extending in a southeasterly direction to the township line. Road No. 3.—Beginning at the south village limits of Milledgeville and extending south seven-eighths (⅞) mile on the quarter section line through Section 26. Road No. 4.—Beginning at the southwest corner of Section 26 and extending north 1 mile. Road No. 5.—Beginning at the northeast corner of Section 27 and extending west 1 mile. Road No. 6.—Beginning at the southwest corner of Section 27 and extending north 1 mile. Section No. 2, Road No. 1.—Beginning at the west village limits of Milledgeville on the Milledgeville-Chadwick road and extending northwest along Milledgeville-Chadwick road two and one-half (2½) miles to the northwest corner of Section 21. Road No 2.—Beginning at the northwest corner of village limits and extending west one-fourth mile and north 1½ miles. Road No. 3.—Beginning at the northeast corner of the village limits and extending east one-fourth mile and north 1½ miles. Road No. 4.—Beginning at the common corner of Sections 16, 17, 20 and 21 and extending north 2½ miles. Work to be completed on or before Sept. 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office, or may be obtained, upon application in writing, from the Illinois Highway Commission.

✣Bids will be received until 10:30 a. m., June 14, by Board of Local Improvements, Shelbyville, Ill., for three paving contracts including 26 blocks of vitrified brick paving, concrete base and asphaltic filling. A. L Yantis is Secretary of the Board.

✣Bids will be received until 11 a. m., June 11th, by the Board of Local Improvements, Chicago, Ill., Ed. J. Glackin, Secretary, for furnishing labor, materials, etc., necessary to construct pavements on the following streets and alleys: Berteau Ave., 3,350 lin. ft. concrete curb and gutter, 5,000 sq. yds. asphalt; Cheltenham Pl., 800 lin. ft. concrete curb and gutter, 1,090 sq. yds. asphalt; S. Fifth Ave., 870 lin. ft. concrete curb and gutter, 1,170 sq. yds. asphalt; 43rd Ct., 6,700 lin. ft. concrete curb and gutter, 10,800 sq. yds. asphalt; W. 54th St., 4,770 lin. ft. concrete curb and gutter, 7,720 sq. yds. asphalt; Frink St., 10,870 lin. ft. concrete curb and gutter, 13,815 sq. yds. asphalt; Honore St., 3,790 lin. ft. concrete curb and gutter, 5,760 sq. yds. asphalt; E. 97th St., 2,870 lin. ft. sandstone curbing, 4,890 sq. yds. macadam; Olive Ave., 1,670 lin. ft. concrete curb and gutter, 2,440 sq. yds. asphalt; 16th St., 2,500 lin. ft. concrete curb and gutter, 3,850 sq. yds. asphalt; Talman Ave., 2,560 lin. ft. concrete curb and gutter, 4,100 sq. yds. asphalt; alley, Marble Pl., Des Plaines St., etc., 400 lin. ft. concrete curbing, 300 sq. yds. granite block; alley, Blackhawk St., Cleveland Ave., 1,480 lin. ft. concrete curbing, 1,100 sq. yds. brick; alleys Vincennes Ave., 43rd St., etc., 1,740 lin. ft. concrete curbing, 1,380 sq. yds. brick; alley, Vincennes Ave., 50th St., etc., 1,040 lin. ft. concrete curbing, 575 sq. yds. brick; alley, Cottage Grove Ave., 63rd St., etc., 1,430 lin. ft. concrete curbing, 1,130 sq. yds. brick; alleys, Addison St., Rokeby St., etc., 1,390 lin. ft. concrete curbing, 1,090 sq. yds. brick; alley, Madison Ave., 53rd St., etc., 920 lin. ft. concrete curbing, 920 sq. yds. brick; alley, Wellington St., Evanston Ave., etc., 970 lin. ft. concrete curbing, 870 sq. yds. brick; alleys, Taylor St., Johnson St., etc., 2,000 lin. ft. concrete curbing, 1,400 sq. yds. brick.; alleys, Taylor St., Blue Island Ave., 1,150 lin. ft. concrete curbing, 1,200 sq. yds. brick; alley, Polk St., S. Morgan St., 1,800 lin. ft. concrete curbing, 1,550 sq. yds. brick. The work includes concrete foundation, sewer adjustment, etc.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., June 12, for furnishing and delivering to the Bureau of Streets appromixately 1,000 barrels of Portland cement, according to specifications on file at his office.

⊙Keys & McNamara of La Salle, Ill., have been awarded the contract by the City Council of Spring Valley, Ill., for the proposed paving of St. Paul St., at $30,712. The street is four blocks long.

⊙The Board of Local Improvements of Jerseyville, Ill., has awarded the contract for the paving of East and West Pearl Sts. to Hanes & Son of Cairo, Ill.

⊙Following bids were received May 24 by the City of Glencoe, Ill., for the paving of Bluff St., etc., for which Windes & Marsh of Winnetka, Ill., are Engineers: (1) standing for engineer's estimate; (2) bid of Edw. M. Laing, Highland Park, Ill. (awarded contract); (3) Jas. Cape & Sons, Racine, Wis.; (4) John Hayes' Sons, Naperville, Ill.; (5) Jno. A. McGarry, 1008 Security Bldg., Chicago, and (6) Western Improvement Co., Racine, Wis.

Quantities.	(1)	(2)	(3)	(4)	
[illegible] sq. yds. [illegible] bonded with [illegible] gals. bituminous cement	$ 1.30	$*1.25	$ 1.[illegible]	$ 1.35	
26,456 lin. ft. concrete curb, 7 in. wide, 24 in. deep	.50	.50	[illegible]	[illegible]	
[illegible] cu. yds. excavation		[illegible]	.40	[illegible]	
[illegible] lin. ft. plank and curb		.30	[illegible]	.30	
310 lin. ft. 24-in. drain tile, av. cut 3.8 ft.	1.[illegible]	1.50	1.[illegible]	1.50	
1,330 lin. ft. 15-in. drain tile, av. cut 4.3 ft.	[illegible]	.70	[illegible]	[illegible]	
1,050 lin. ft. 15-in. drain tile, av. cut 3.0 ft.	[illegible]	.50	.50	.50	
334 lin. ft. 15-in. drain tile, av. cut 6.0 ft.	[illegible]	1.00	1.00	1.00	1
[illegible] lin. ft. 12-in. drain tile, av. cut 3.0 ft.	[illegible]	.45	.50	[illegible]	
520 lin. ft. 12-in. drain tile, av. cut 4.5 ft.	[illegible]	.65	.60	.60	
1,180 lin. ft. 10-in. drain tile, av. cut 4.0 ft.	[illegible]	.50	[illegible]	[illegible]	
440 lin. ft. 10-in. [illegible]	[illegible]	.60	[illegible]	[illegible]	
320 lin. ft. 8-in. drain tile, av. cut 2.6 ft.	[illegible]	.35	[illegible]	.35	
630 lin. ft. 8-in. drain tile, av. cut 3.5 ft.	[illegible]	.40	.50	.35	
8,494 lin. ft. 8-in. drain tile, av. cut 5.0 ft.	.50	[illegible]	.50	[illegible]	
610 lin. ft. 8-in. drain tile, av. cut 4.0 ft.	.45	.40	.40	.45	
200 lin. ft. 8-in. drain tile, av. cut 6.0 ft.	.60	.70	[illegible]	60	
2 cast iron inlet covers	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible] catch basins with cast iron covers	40.00	[illegible]	40.00	[illegible]	
45 comb. inlets and manholes with cast iron covers	[illegible]	33.00	[illegible]	[illegible]	
96½ cu. yds. of concrete-ret. walls, culverts	8.50	7.50	8.00	[illegible]	
15 cu. yds. reinforced concrete for culverts	10.00	10.00	[illegible]	[illegible]	1
22 present manhole covers adjusted		1.00	2.00	[illegible]	
15 present valve boxes adjusted	238.66	.50	1.00	[illegible]	
Total of bids	[illegible]	[illegible]	$70,761	$71,91[illegible]	$72[illegible]

*Awarded upon agreement to use "Tarvia" or "Pioneer."

†Includes $4,330 as cost of making and collecting assessment

‡$1.30 per sq. yd. with Tarvia or Pioneer; $1.35 for Sarco.

⊙Jas. Cape & Sons Co. and Chr Peterson of Racine, Wis., have been awarded the contract by the Board of Local Improvements of Waukegan, Ill., for the paving of Gillett Ave., Ridgeland Ave. and Hickory St., at $22,897. Brick will be laid on Gillett Ave. and asphalt macadam on Ridgeland and Hickory. Bids were opened May 20 by A. S. Rogers, Secy.

The City Council of Waukegan, Ill., has passed ordinances providing for the paving of West Madison St., Fairview Pl. and Sherman Pl., with macadam at an approximate cost of $9.144.

The Board of Local Improvements of Quincy, Ill., has adopted a resolution for the paving of Maine and Hampshire Sts., from Fifth to Eighth Sts., and Sixth St., from Vermont to Jersey St. The material specified will be concrete base with a brick surface.

The Board of Local Improvements of R[illegible]ford, Ill., has voted the sum of $[illegible] the macadamizing of Churchill [illegible] streets. It is also proposed to pa[illegible] St., at an estimated cost of $71,079

The Town Council of Oakwood, [illegible] poses to pave Scott St. its entire l[illegible]

The City Council of Monmouth, Ill. has passed an ordinance for the improv[illegible] the new paving district known as Pa[illegible] trict No. 64, designated as the We[illegible] B[illegible] Ave. district, providing for the improvement of 18 blocks in the northwest part o[illegible] by paving and grading the same [illegible]mated cost is $35,798. K. M. [illegible] City Engineer.

Indiana.

⊙The Vigo County Commissione[illegible] Haute, Ind., have awarded the contr[illegible] for road for which bids were opened [illegible] 25 as follows: A. K. Strole Road in Fayette Township, Ferguson & Lee of Shelbyville, Ind., at $5,500; Rigney Road in [illegible] Township, Ferguson & Lee at $3.1[illegible] [illegible]ker gravel road in Lost Creek, at [illegible] Nathan G. Wallace is County Audi[illegible]

The Board of Public Works of [illegible]port, Ind., proposes to pave Erie Av[illegible] as far as 12th St. H. H. Thompson is C[illegible] Engineer.

The City Council of Brazil, Ind. has instructed the City Engineer to prep[illegible] plans and specifications for the paving of [illegible] alley between West Kruzan and Blaine Sts and the alley continuation of Franklin St. to [illegible] said alley.

Citizens of Tolleston have petitioned the Board of Public Works of Gary, [illegible]d., for the paving of about 20 blocks. A[illegible]halt is specified.

Iowa.

✣Bids will be received until Ju[illegible] Greenfield, Ia., for about 15,000 sq. [illegible]d paving to be either cement, concrete [illegible] A certified check for $1,000 must be [illegible]d each bid. M. C. McCreight is Tow[illegible] Cle[illegible]

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Engineering Co., Clinton, Ia., are Engi-

ds will be received until June 20 (re- isement) by city of Albia, Ia., for the [illegible] 200 ft. of curb and gutter. Hall & . Centerville, Ia., are Engineers.

e contract for the paving of Grand Ave. oncrete, from Greenwood park to 56th s been awarded by the City Council of oines, Ia., to the Lytton & Rankin Con- n Co. at $1.46 a sq. yd., including curb- he J. W. Turner Improvement Co. se- the contract for the paving of Eighth m Market to Elm, with brick at $2.13

City Council of Des Moines, Ia., has d the following contracts for improve- vork: Concrete paving, Grand Ave., ood to 56th St., Lytton-Reinking Co., er sq. yd.; brick paving, Eighth St., to Elm St., J. W. Turner Improve- o., $2.13 per sq. yd.; curbing, Wood- e., and 32nd St., J. L. Hansman, $0.317 ; curbing, 41st St., University Ave. to Ave., Wagner Co., $0.33 per ft.

A. Camery of Harlan, Ia., has been d the contract by the city of Iowa a., J. O. Gregg, City Clerk, for the ction of 30,000 sq. yds., of Portland concrete paving and 15,000 lin. ft. ing at $1.17 and $0.27, respectively. ere opened May 29.

Commercial Club of Lake City, Ia., [illegible] long the highways leading to the Prices and descriptions of metal or igns suitable for this use may be Dr. F. E. Kauffman of Lake City. Anderson is Engineer.

City Council of Des Moines, Ia., has to pave University Ave., from 37th lendale cemetery, with bitulithic. The ill include about 40,000 sq. yds. J. W. City Engineer.

City Council of Perry, Ia., has in- the City Solicitor to prepare a resolu- viding for the paving of Otley Ave.

lting Engineers Hall & Adams of Ia., are preparing plans for sev- cks of concrete pavement for that

City Council of Albia, Ia., has rejected received for the proposed paving this The work will be re-advertised.

Council of Des Moines, Ia., has ned to order the construction of pavement on Fourth St., from Euclid on Ave., in Highland Park.

City Council of Burlington, Ia., has the paving of Harrison Ave., from t. to Madison Ave. H. G. Vollmer is gineer.

City Council of Winterset, Ia., has let tract for paving with sheet asphalt, om Bermuda or Trinidad, to R. A. Marshalltown, Ia., at $1.71 a sq. yd., 36 for curbing, and $0.55 for curbing tering. Pavement will be laid on 28 Other bidders were Horrabin Bros., ty, Ia.; Des Moines Asphalt Co., Des Ia., and the Bryant Asphalt Co.

Kansas.

City Commission of Kansas City, Kan., igating the use of cement as a paving with a view to using it on streets parsely settled districts and for pav- s. William Barclay is City Engineer.

Maryland.

Maryland Roads Commission, Balti- as awarded the contract for the con- of the stretch of road through Blad- to U. D. Rich at $10,997.

Paving Commission of Baltimore, Md., Compton, Chairman, has named the g streets for pavement work: Mul- t., between Fulton Ave. and Monroe h sheet asphalt or bituminous con- Balderson St., between Light and Sts., with granite blocks; Perry St., Belford and Charles Sts., with gran- Materials have been selected for the following streets already agreed upon for paving: Lanvale St., Madison to Eutaw, and Linden to Park Aves.; sheet asphalt or bituminous concrete; McCulloh St., Lafayette to North Aves., sheet asphalt or bituminous concrete; Park Ave., Lanvale St. to Lafayette Ave.; sheet asphalt; Lafayette Ave. to McMechen St., sheet asphalt or bituminous concrete; Fayette St., Poppleton to Pine; vitrified blocks; Lexington St., Aisquith St. to Central Ave.; vitrified blocks; Linden Ave., Dolphin St. to North Ave., sheet asphalt, with vitrified blocks between the car tracks; Bolton St., Lafayette to North Aves.; asphalt over cobbles.

The Maryland State Roads Commission, Baltimore, Md., has rejected the bid of the Juniata Paving Co. for the construction of the stretch of road on the Washington Blvd., between the Baltimore & Ohio Railroad tracks and Halethorpe. The road is 4,000 ft. long.

Michigan.

◉Carpenter & Anderson of Grand Rapids, Mich., have been awarded the contract by the City Council of Hillsdale, Mich., for the paving of Broad St., at $17,624. Sarcolithic will be used. Other bidders were: W. R. Caldwell, Traverse City, $15,683; Green Construction Co., $16,747. C. L. Herron is City Engineer.

◉John Doyle of Grand Rapids, Mich., has been awarded the contract for the construction of 9 miles of improved roadway from the City of Ionia, Mich., into Orange Township. The estimated cost is $11,000.

The Board of Public Works of Jackson, Mich., has under consideration a considerable amount of paving work for this summer. The Board has also purchased a road roller with scarifying attachment from the Huber Mfg. Co., of Marion, Ind.

Minnesota.

✣Bids will be received until 5 p. m., June 12, by F. C. Lang, Village Engineer, Chisholm, Minn., for the construction complete of about 12,950 sq. yds. of paving. Bids will be considered on sandstone, bitulithic, creosoted wood blocks, donnellite, grano-crete and brick. Official advertisement will be found elsewhere in this issue.

◉Mat. J. Ryan of Hastings, Minn., has been awarded the contract by the Dakota County Commissioners, F. A. Hoffman, Auditor, Hastings, for grading the San Cooley Road on State Road No. 2, located 3 miles south of Hastings, at $3,235; O. C. Mahn of South St. Paul, Minn., for constructing 3 culverts on the same road at $1,487. Bids were opened May 27.

◉Studebaker Bros. Co., Minneapolis, Minn., has been awarded the contract by the city of Crookston, Minn., A. M. Childs, City Clerk, for furnishing a street flusher. Bids were opened May 14.

◉Henry Wilder of Crookston, Minn., has been awarded the contract by the Board of Polk County Commissioners, Crookston, for the grading of State Road No. 1 on line between sections 13-24, town of Reis; sections 18-19, 17-20, town of Liberty; sections 20-21, 28-29, 32-33, town of Russia, at $0.15 per cu. yd. Bids were opened May 24 by H. J. Welter, County Auditor.

Missouri.

◉The Buchanan County Court, St. Joseph, Mo., has awarded contracts for road work aggregating about $70,000 as follows: Mike Costello, grading the Sparta-Faucett-Stafford road, 16 miles, at $0.13¼ per cu. yd., for excavation; estimated cost is $30,000. Young Bros. Construction Co., DeKalb road, macadamizing at $0.97½ per lin. ft.; estimated cost is $40,000.

◉Perkinson Bros. Construction Co., 3237 Carter Ave., St. Louis, Mo., has been awarded the contract by the Board of Public Improvements of that city, for the reconstruction of North Market St., between 15th St. and Glasgow Ave., at $56,444. Bids were opened May 17.

◉The Granite Bituminous Paving Co., Pierce Bldg., of St. Louis, Mo., has been awarded the contract by the Board of Local Improvements of St. Louis for the improvement of Kingshighway Blvd., from Arsenal St., etc., at $34,752. Bids were opened May 17.

Drafts of ordinances for brick alley pavements, the cost of which will amount to $97,060, were approved by the Board of Public Improvements of St. Louis, Mo.

Montana.

A petition has been filed with the City Council of Great Falls, Mont., by citizens, asking that a special improvement district be created for the paving of First Ave., north, with bitulithic paving, at a cost not to exceed $2.60 per sq. yd. M. L. Morris is City Engineer.

The City Council of Great Falls, Mont., has ordered that concrete sidewalks 5 ft. in width be constructed on both sides of 11th St., from Central Ave. to Second Ave., south.

◉The City Council of Helena, Mont., has awarded the following contracts for street paving, sidewalks, etc.: Helena Ave., with brick, Smith & Saner, $14,344; Railroad St., with bricks, Louis Johnson, $23,332; Davis St., between Eighth Ave. and 11th, with cement sidewalks, parks and curbs, Louis Johnson, [illegible]

Nebraska.

◉The Ford Paving Co., of Omaha, Neb., has been awarded the contract by that city for the construction of approximately 70,000 sq. ft. of residence walk, 4,000 sq. ft. of business walk and 150 cu. yds. of grading at the following prices: $0.10¾ on 4-in. residence walk, $0.14 on 6-in. business walk, and $0.48 a cu. yd. on grading

New Hampshire.

✣Bids will be received until 1 p. m., June 14, by S. Percy Hooker, State Superintendent of Highways, Concord, N. H., for the construction of the following: Gravel road in town of Candia, estimated to cost $2,500; trap rock road in Bow, estimated to cost $3,600; trap rock road in Bedford, estimated to cost $1,500.

New Jersey.

✣Bids will be received until 10:30 a. m., June 5, by Board of Street and Water Commissioners, John Prout, Chairman, Jersey City, N. J., for the improvement of Randolph Ave., from Bramhall Ave. to Newark & N. Y. R. R. E. B. See is Clerk.

✣Bids will be received until 8 p. m., June 10, by Township Committee, Millburn, N. J., for oiling the following public roads, or sections thereof, in said township: Hobart Ave., from Parkway to Taylor road; Hobart Ave., from Highland Ave. to Old Short Hills road; Short Hills Ave., from D., L & W. R. R. bridge to Millburn Ave.; Highland Ave., from Western drive to Forest drive; Jefferson road, from Old Short Hills road to Montview Ave.; Montview Ave., from Jefferson road to Delwick lane; Old Short Hills road, from Parsonage road to the D., L. & W. R. R. bridge; Glen Ave., from Old Short Hills road to Wyoming Ave., including Laurel St. Wyoming Ave., from Milburn Ave. to Clinton to the township line. Bidders may submit bids on a square yard basis on any or all of the following materials: Tarvia B, Texaco Liquid Asphalt No. 1, Standard McAdam Asphalt Binder A. Specifications for the application of each of the said materials can be obtained from Milton R. Silance, Township Clerk.

✣Bids will be received until 10:30 a. m., June 5, by Board of Street and Water Commissioners, Jersey City, N. J., for the improvement of portions of Germania Ave., North St. and St. Paul's Ave. John Prout is Chairman of the Board.

✣Bids will be received until 10:30 a. m., June 5, by Board of Street and Water Commissioners, Jersey City, N. J., for the improvement of Bostwick Ave., from Bergen Ave. to Jackson Ave. E. B. See is Clerk.

✣Bids will be received until 8 p. m., June 17, by City Council, Westfield, N. J., for improving certain city streets. The Engineer's approximate estimate of the amount

✣ indicates work now open for bids. ◉ indicates a contract let recently.

[illegible] follows: 7,000 cu
ds. of excavation, 10,820 sq. yds. of ma-
dam, 3,650 sq. yds. of macadam resur-
ced, 1,332 lin. ft. of concrete curb, 900 lin.
of concrete curb and gutter, 800 lin. ft.
blue stone curb reset on concrete, 2,275
n. ft. of new blue stone curb set on con-
ete, 3,075 lin. ft. of vitrified brick gutter
a concrete base, 1,600 lin. ft. of 6-in. un-
erdrain, 355 lin. ft. of concrete culverts.
ach proposal must be accompanied by a
rtified check for $500, drawn to the order
the Treasurer of the Town of Westfield,
J. Forms of proposal, specifications,
ntract and bond may be obtained from A.
Vars, Town Engineer, Town Hall,
estfield, N. J.

New York.

⊙The Buffalo Steam Roller Co., Buffalo,
Y., by the Board of Swatara Township
mmissioners, A. W. Ellenberger, Secy.,
nhaut, Pa., was awarded contract for fur-
shing one 12-ton combined steam road
ller and tractor and fuel and water
agon. Bids were opened May 4. The ma-
ine was delivered the last week in May.

Ohio.

✣Bids will be received until noon, June 28,
Board of Hamilton County Commissioners,
ncinnati, O., for furnishing under Specifica-
ns 325, crushed stone on board cars at
inslow Park or Blue Ash for repair of
ainfield Pike in Sycamore township. Albert
inhardt is Clerk. A certified check for $500
ist be filed with each bid.

✣Bids will be received until noon, June 28,
Board of County Commissioners, Albert
inhardt, Clerk, Cincinnati, O., for construct-
under Specifications No. 343, a concrete
vert on Reading Road, 1,500 ft. south of
rthage Ave., in Mill Creek township. A
tified check for $500 must be filed with
h bid.

✣Bids will be received until noon, June 10,
Hancock County Commissioners, Findlay,
for the construction of 1.29 miles of stone
e on T. L. Peterman Road, Eagle town-
p. A certified check for $200 must be filed
h each bid.

✣Bids will be received until noon, June 10,
Board of Hancock County Commissioners,
ndlay, O., for the construction of one and
raction miles of stone pike on what is com-
nly known as the Edson Line road, Eagle
vnship. A certified check for $200 must be
d with each bid.

✣Bids will be received at the office of the
nmissioners of Geauga County at Chardon,
until noon, June 12, 1912, for grading and
ing with a bituminated concrete, the Scot-
d-Station road. State Highway "D" pet.
411 in Chester township, said county.
ngth 8,960 ft., or 1.70 miles. Width of
ement, 14 ft. Estimated cost of construc-
n, $15,407. A draft or certified check for
0 shall be deposited with each bid. The
cessful bidder will be required to give bond
an amount equal to the contract price.
te set for completion, Sept. 1, 1912. Plans
specifications are on file in the office of the
inty Commissioners and the State Highway
partment. The State Highway Commis-
ner reserves the right to reject any and all
s. James R. Marker, Columbus, O., is
te Highway Commissioner.

✣Bids will be received until 10 a. m.,
e 17, by H. K. Lodge, Clerk Road Com-
sioners, St. Clairsville, O., for the con-
uction of a brick roadway, with concrete
ms, from Bannock and Flushing Pike,
r Bannock, to the Flushing & Morris-
n road about ¼ mile north of Mt. Hope
ool house, a distance of 5.6 miles, di-
ed into two sections. D. A. Elkin, Bel-
e, O., is Engineer. Official advertise-
nt will be found elsewhere in this issue.

⊙Adams & Walters of Richwood, O.,
e been awarded the contract by the
rd of Union County Commissioners,
rysville, O., for the construction of one
one-half miles of gravel roadway on
McBride Road in Dover and Leesburg
townships, at $3,854. C. A. Morelock is County Auditor.

⊙C. B. Hall & Son, of Findlay, O., are the probable contractors for the construction of 3,700 sq. yds. of vitrified block pavement on Center St., McManness Ave., etc., for which bids were opened May 28 by J. C. Edie, City Clerk of Findlay, O.

⊙Pickett & Shannafeld of Bellaire, O., have been awarded the contract by Pultney Township Clerk, W. J. Campbell, Bellaire, for the construction of a brick roadway from the corporation line of the city to Pease Township, a distance of 1.43 miles. Bids were opened May 29.

⊙O'Brien & Stringer, 663 Exchange St., Akron, O., have been awarded the contract by the Commissioners of Summit County, Akron, for the paving of Shent Road with bituminous concrete in Copley and Bath Townships, at $17,890. The road is 12,546.2 ft., and 14 ft. wide. James R. Marker is State Commissioner of Highways. Bids were opened May 27.

⊙The Village Council of Genoa, O., has let the contract for paving Main St. its entire length to Freshwater & Sons of Chester, W Va., for $38,863. Boland brick will be used. George Champe of Toledo is Engineer.

⊙The Road Commissioners of District No. 1, Mahoning County, O., according to advices from Youngstown, the county seat, have awarded contracts for road improvements as follows: Frank Hanna, Boardman road, Section No. 2, with brick at $18,614; Turner & Olson, Boardman road, Section No. 3, with brick at $14,778; G. A. Galdini, town line road, Section No. 2, with macadam at $13,796; E. J. Kane, town line road, Section No. 3, with macadam at $17,022, and Ross O'Rourke, Raccoon road, with macadam at $8,929.

⊙The Board of Control of Toledo, O., has awarded the following contracts for paving: Smead Ave., from Bancroft to Monroe Sts., with vitrified brick, John McMahon, $7,905; Goodale Ave., Auburn to Ayers Ave., with macadam, Russell & Jennison, $5,735; Blaine Ave. and Ayers Ave., from Delaware Ave. to Clifton St., by grading, Joseph Beach, at $1,537 and $1,464, respectively.

⊙Following bids were received by the Village Council of Genoa, O., for the paving of Main St.; contract reported to have been awarded to the lowest bidder: Russell & Jennison Co., Toledo, O., $40,512; W. A. Miller & Son, Genoa, $40,093; T. J. Mulligan, Lima, O., $40,520; E. A. Freshwater, Chester, W. Va., $38,863; Garrigan Bros., Toledo, O., $43,285; Asphalt Block & Pavement Co., Toledo, $43,761; Modern Construction Co., Fremont, O., $46,161.

Oregon.

The Lane County Commissioners, Stacy M. Russell, Clerk, Eugene, Ore., rejected all bids received May 16 for the construction of a macadam road in the county, about 27,577 ft. in length. The work will probably be done by day labor.

The City Council of Marshfield, Ore., has ordered 9 blocks of hard surface pavement in the business section of town, and several blocks in the residential section.

Following bids were received May 23 by the City Council of Portland, Ore., for street paving work: East 36th St., from East Harrison to Hawthorne, gravel bitulithic, Pacific Bridge Co., $6,591; Warren Construction Co., $6,625; Barber Asphalt Paving Co., $6,600; Oregon Independent Paving Co., $6,300. Asphalt pavement, Oregon Independent Paving Co., $6,783. East 27th St., from Halsey and Hancock, grading and concrete curbs and walks, Bechill Bros., $1,663; Kibbe-Welton Co., $1,523; Oregon Independent Paving Co., $1,626; Hilliard & Maginnis, $1,426; Crawford & Co., $1,685. Elmore St., from Lombard to Russett, asphalt pavement, Oregon Independent Paving Co., $2,069. Gravel bitulithic, Oregon Independent Paving Co., $1,978. Concrete pavement, Oregon Independent Paving Co., $1,798; Jeffery & Bufton, $1,852. Aschley St., from Grand Ave. to East Sixth, grading
and concrete curbs and walks, Bechill ls
$363; Oregon Independent Paving Co.
Terwilliger St., from Macadam to Co t.
concrete pavement, Montague-O'Reilley o.,
$1,687; Oregon Independent Paving o.,
$1,829; Jeffery & Bufton, $1,752. Gravel tu-
lithic, Warren Construction Co., $2,187; re-
gon Independent Paving Co., $2,052. ast
Ninth St., from Cora to Rhone, concrete ve-
ment, Montague-O'Reilley Co., $10,177; Jery
& Bufton, $10,875. Asphalt pavement, re-
gon Independent Paving Co., $12,243. Gve
bitulithic, Pacific Bridge Co., $13,583; Wen
Construction Co., $13,615; Barber Asalt
Paving Co., $13,482; Oregon Independent av-
ing Co., $12,243. East Hoyt St. dict
grading and concrete curbs and walks, Cter
Bros., $4,861; Kibbe-Welton Co., $4,732; n-
ning & Co., $5,268; Keenan Bros., $4 2;
Oregon Independent Paving Co., $5,255. ap-
man St., from Mill to 200 ft. south of ill
concrete pavement, Montague-O'Reilley o.,
$1,523; Oregon Independent Paving o.
$1,662; Hilliard & Maginnis, $1,428; Jery
& Bufton, $1,471. Gravel bitulithic, P fic
Bridge Co., $1,508; Warren Constructio
$1,828; Oregon Independent Paving o.
$1,822. Nebraska St., from Corbett to ir
ginia, concrete pavement, Kibbe-Welton o.
$26,776; Jeffery & Bufton, $26,972; Oon
Independent Paving Co., $29,387. Gravel u-
lithic, Warren Construction Co., $3 5
Barber Asphalt Paving Co., $33,076; Oon
Independent Paving Co., $31,860. Asal
pavement, Acme Paving Co., $33,526; Oon
Independent Paving Co., $33,593. Twenty rs
St. and Vista Ave., concrete pavement, rt-
land Concrete Pile & Equipment Co., $16
Kibbe-Welton Co., $15,010; Hilliard & Mn-
nis, $16,867. Gravel bitulithic, Warren n
struction Co., $18,054. Holgate St. dict
asphalt pavement, Acme Paving Co., $89 2;
Oregon Independent Paving Co., $88,424. s-
phalt macadam, Jeffery & Bufton, $8 9
Gravel bitulithic, Oregon Independent Png
Co., $82,944; Warren Construction Co., 8,-
195; Pacific Bridge Co., $88,130. Ham
pavement, Oregon Hassam Paving Co., 1-
871. Kerby St., from Ainsworth to Portld
grading and concrete curbs and sidews
Bechill Bros., $4,154; Kibbe-Welton o.
$3,535; Oregon Independent Paving o.
$3,802. East 39th St., from Schiller to Wd
stock, grading and concrete curbs and wks
Bechill Bros., $12,653; Stevens & White, 5,-
343; Joplin & Meeks, $11,590; Oregon le-
pendent Paving Co., $15,162. East 25th t.,
from Wild Rose Addition to Halsey St., d-
ing and concrete curbs and walks, Bil
Bros., $1,252; Kibbe-Welton Co., $1,129; re-
gon Independent Paving Co., $1,209; Hi rd
& Maginnis, $1,144; Crawford & Co., $62

Pennsylvania.

⊙The Common Council of McKeesport a.
has let the contracts for the repaving of th
Ave., from Coursin St. to Gas alley, to w-
man Bros. Co. The street will be repav as
far as $45,000 will take it.

⊙Following bids were received by the n-
sylvania State Highway Department, Edrd
M. Bigelow, Commissioner, Harrisburg or
the construction of the National Road, Vh
ington County, Section 17, being 24,603 ft.
with asphaltic-concrete: The Hallam n-
struction Co., Washington, Pa., $101,72 R
B. Taylor, Bellefonte, Pa., $98,337, awled
contract; Neelen & Daly, Pittsburgh, a.
$106,244. Bids were opened May 28.

South Carolina.

⊙V. I. Spurgeon of Gaffney, S. C. as
been awarded the contract by that city or
the construction of 3,000 sq. yds. of sidewks.
at $0.97 per yd.

Texas.

⊙The contract for the building of app
mately 37 miles of good roads in Gainelle
Precinct of Cooke County, Tex., has en
awarded to the Fort Worth Building C
Fort Worth, Tex., at about $100,00
work will be done under the supervisi
County Civil Engineer F. B. Truax.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Utah.

ds will be received until 10 a. m. [illegible] of Noble Warrum, City Recorder, ake City, Utah, for the improvement roximately 1½ miles of streets, by , curbing, guttering and paving with . Official advertisement will be elsewhere in this issue.

Virginia.

[illegible] Department, Washington, D. C., for . roadway and wireless ground system naval reservation, Arlington, Va.

petition of Freeholders of South District Judge H. W. Holt of the Court, Staunton, Va., ordered an elec- r July 2 on $250,000 bond issue for ads.

nsiderable amount of street paving work rtly be begun in Bristol, Va., includ- rry St., known as Sycamore, from St. to Front; Winston's alley, from Moore, and Cumberland and Oak Sts.

Washington.

s will be received, it is believed, un- 26 by Aberdeen, Wash., for paving ay and River St., including about ds. Charles W. Ewart is City Engi-

s will be received until 2 p. m., June Board of King County Commissioners. Wash., for the necessary material and Jap or Chinese labor excluded) for struction portions of Kirkland-Median The work consists of clearing right of ft. wide, grubbing and constructing a adway, etc. Plans and specifications file with the County Engineer. O. A. Clerk.

J. F. Hill Paving Co., of Chicago. been awarded the contract by the uncil of Goldendale, Wash., for the of 52 blocks of streets at an esti- ost of $74,000. A pavement with a oken rock base and 2-in. asphaltic be laid. The company bid $1.18 a

sh & Christensen of Everett, Wash., een awarded the contract by the Snohomish, Wash., for the improve- Pine St., at $11,178.

city of Aberdeen, Wash., Chas. W. City Engineer, on May 22 awarded tract for the paving of Broadway irst to Sixth Sts., Local Improve- istrict No. 401, including 7,770 sq. the Barber Asphalt Paving Co., at

n & Irwin of Hoquiam, Wash., have arded the contract by the County Commissioners, Montesano, Wash., for grading and graveling state road No. 9, permanent highway No. 3, at $6,629. Bids were opened May 20 by R. G. Trask, County Auditor of Chehalis County.

The City Commission of North Yakima, Wash., has passed a resolution of intention for the paving of North First St., with a 40-ft. roadway. The specifications call for different kinds of pavement. The estimated cost [illegible] is City Engineer

Property owners of Colfax, Wash., have formed a paving district and have petitioned the City Council to be allowed to specify Dolarway pavement.

Snohomish County Commissioner James McCulloch, Everett, Wash., has completed plans for the improvement of the road between Snohomish and Monroe. It is proposed to make the road 24 ft wide on the travel surface, with ditches each side, extending the roadway to a total of 30 ft. The road is 7 miles in length. County Engineer John R Birney will prepare the plans for the completion of the surfacing of the road.

The City Council of Aberdeen, Wash., on May 22 passed a resolution for paving of Broadway and River Sts., approximately 12,000 sq. yds. If not protested the job will be let June 26. Chas. W. Ewart is City Engineer

West Virginia.

⊙The Marshall County Court, Moundsville, W. Va., has let the contract for paving in Glen Dale to Rosser & Maloney of Bellaire, O., as follows: Concrete and paving $1.52 per yd., gravel ballast and paving $1.25, paving on concrete between tracks $0.95, paving on natural gravel bed $1.10.

Wisconsin.

✣Bids will be received until 10 a. m., June 5, by C. J. Morisset, Commissioner of Highways, Superior, Wis., for the grading of the hills on both sides of Middle River on Spaulding Ave. in N. W. ¼ of the S. W. ¼ of Sec. 36-47-12.

✣Plans have been prepared by City Engineer C. U. Boley of Sheboygan, Wis., for the construction of 23,475 sq. yds. of two-course concrete pavement and 11,000 lin. ft. of combination curb with asphalt filler. Bids on this work will be received until June 8.

✣Bids will be received until 10 a. m., June 5, by County Clerk, Superior, Wis., for the grading of the hills both sides of Bergren Creek on Totogettic Road in Section 27, 43, 12, and putting in a cement culvert. Separate bids will be received for the grading and culvert. C. J. Morisset is Commissioner of Highways.

✣Bids will be received until 10 a. m., June 5, by County Clerk, Superior, Wis., for the construction of the Lakeside road from the east line of the Northern Pacific right of way eastward to the east line of Sections 7 and 18, 48-12. Separate bids for cleaning and for grading any part of the road will be considered. C. J. Morisset is Commissioner of Highways.

⊙J. R. Ritchie has been awarded the contract for furnishing 1,500 yds. of crushed stone on Webster Ave. at $0.39 a yd., in the town of Allouez, Wis., and the McGrath Construction Co., for removing 2,100 yds. of earth from the hill on Webster Ave., at $0.31 a yd.

⊙William & Patrick McGavock of Beloit, Wis., have been awarded the contract by County Commissioner Jones, Janesville, Wis., for road improvements west of Beloit at $4,500.

⊙Frank Bartz of Appleton, Wis., has been awarded the contract by that city, E. L. Williams, City Clerk, for the construction of a retaining wall on South River St., at $4,742. Bids were opened May 17.

⊙The city of Madison, Wis., O. S. Norsman, City Clerk, has awarded the following contracts for macadam paving and cement curb and gutter, for which bids were opened May 29: John Icke, J. R. Cullinane, J. W. Mitchell and John Delaney, all of Madison.

⊙La Crosse Stone Co., La Crosse, Wis., has been awarded the contract by the Board of Public Works of that city, for the paving of Vine St. from West Ave. to 16th St., a distance of 4 blocks, including curb and gutter, at $6,454. Bids were opened May 27. Jas. T. Day is President of the Board.

Following bids were received by the Board of Public Works of Superior, Wis., May 20, for the paving of Tower Ave.: Asphalt—P. McDonnell, Duluth, $85,904; White Construction Co., $89,079; Ed. Johnson, $90,941; E. A. Dahl, $91,897; Fielding & Shepley, $91,606. Asphaltic concrete—P. McDonnell, $82,979; Fielding & Shepley, St. Paul, Minn., $81,063. Brick—E. Johnson, $92,019; P. McDonnell, $92,547; P. E. Bergman & Co., $92,572; M. Peterson, $95,341; E. A. Dahl, $93,532; Russell Construction Co., $91,473; Fielding & Shepley, $94,021; S. H. Riches, $94,095; John Diffor, $95,399. Creosoted blocks—P. E. Bergman & Co., $144,617; M. Peterson, $112,299; Fielding & Shepley, $105,550; Ed. Johnson, $100,469. Sandstone blocks—M. Peterson, $124,462; E. A. Dahl, $118,281; Fielding & Shepley, $119,846. Concrete—M. Peterson, $65,884.

Canada.

The property owners of Windsor, Ont., on May 30, voted a by-law authorizing the sale of debentures for sidewalks to the amount of $30,000.

RIDGES—STEEL AND CONCRETE

California.

Board of Ventura County Super- entura, Calif., has awarded the con- the construction of 11 concrete piers 90 ft. combination truss spans to sup- act fence and floor of present pile pproaches to the Montalvo bridge, to land Bridge Co., 660 Gibraltar Bldg., City, Mo., at $21,971. J. B. McCloskey y Clerk.

Florida.

issioners of Orange County, Orlando, e under consideration the construc- steel draw bridge over the St. Johns the foot of Celery Ave., connecting and Orange Counties.

Georgia.

will be received until June 25, by County Commissioners of Roads and Milledgeville, Ga., and Putnam [illegible] nue, Eatonton, Ga., for the construction of a bridge over Little River at Gage's Ford. The structure will be 231 ft. long.

Illinois.

✣Bids will be received until 2 p. m., June 8 (postponement of date from May 28), at the Court House, Jerseyville, Ill., for the construction of one reinforced concrete bridge to be built in Quarry Township, Jersey County. William T. Byrnes, Town Clerk, Grafton, Ill. Williams Hollow Bridge: Span, 30 ft.; roadway, 16 ft.; total height, about 13 ft. Estimated amount of total concrete, about 79.4 cu. yds.; reinforcing steel, about 10,000 pounds. Nearest railroad station, Grafton, about 8 miles. Boat landing on Illinois River, 1¼ miles. Local gravel might be obtained, but would require screening and washing. Low water flow, 6 ins. deep and 4 ft. wide; high water flow, 11 ft. deep. Stream channel to be changed. [illegible] ft. Back fill and approach grades to be included in contract. Work to be completed on or before August 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's Office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received up to 10:30 a. m., June 8, 1912, at the Court House at Jerseyville for two reinforced concrete bridges, to be built in Ruyle Township, Jersey County. S. H. Ruyle, Town Clerk, Medora, Ill. Ryan Branch: Span, 30 ft.; roadway, 16 ft.; total height, about 15 ft. Estimated amount of total concrete, 95 cubic yards; reinforcing steel, 11,400 pounds. Nearest railroad station, Kemper, on the C., B. & Q., about 2½ miles. Present bridge about 40 ft. long, wood. Low water flow, dry; high water flow, about 11 ft.

[illegible] to be carried about 3 ft. [illegible] stream, through sandy clay to lay. Green timber can be found about onealf mile from bridge site. John Barnes ridge: Span, 12 ft.; roadway, 16 ft.; total eight, about 14 ft. Estimated amount of total oncrete, 70.2 cu. yds.; reinforcing steel, 4,510 ounds. Nearest railroad station, Kemper, on e C., B. & Q., about 3 miles. Low water ow, dry; high water flow, about 5 ft. deep. xcavation to be carried about 3 ft. below tream bed, in sandy clay. Piles will probably e necessary. Present bridge about 22 ft. ong. Green timber for piles can be found bout ¼ mile from bridge site. No local conrete materials available. Work to be comleted on or before August 1, 1912. More detailed information may be had by an examiation of the plans and specifications prepared y the Illinois Highway Commission, which ay be seen at the Town Clerk's office or ay be obtained upon application in writing, rom the Illinois Highway Commission, pringfield, Illinois.

✣Bids will be received up to 12 noon, June 1, at Sheridan, for the construction of five einforced concrete bridges and culverts to be uilt in Mission Township, La Salle County. obert Knapp, Town Clerk, Sheridan, Ill.

Name	Span	Gravel at bridge site per cu. yd	Old bridge	Low water	Excavation.
eterson	2 ft. 6 in.	$1.25	20-in. tile	Dry	Clay
aterwell, Jr......	2 ft.	1.25	16-in. tile	Dry	Clay
imson	16 ft.	1.25	16 in. wood	Dry	Clay
Iason	10 ft.	1.25	6 ft. 6-in. wood	Dry	Clay
Lane	[illegible] ft.	[illegible]	wood	Dry	Clay

Prices above given for gravel are approxiate. Gravel said to contain considerable xcess of sand. Total estimated amount of oncrete in the five bridges, 165.9 cu. yds.; reinforcing steel, 12,483 pounds.

Work to be completed on or before Sept. 0,1912. More detailed information may be ad by an examination of the plans and specications prepared by the Illinois Highway ommission which may be seen at the Town lerk's office or may be obtained upon appliation in writing from the Illinois Highway ommission, Springfield, Ill.

✣Bids will be received at the Council room, the City Hall, Hillsboro, Illinois, up to 2 m., June 10, for the construction of a reinorced concrete bridge in the City of Hillsoro, Montgomery County. G. H. Longwell, ity Clerk, Hillsboro, Ill. Wood St. Bridge: pan, one 40 ft., reinforced concrete girder ridge, on reinforced concrete abutments; oadway, 24 ft.; sidewalk, 6 ft.; finished roaday to bottom of footings, 17 ft. 3 ins.; wings, 5 ft. 9 ins. Estimated amount of concrete in ructure, 217.3 cu. yds.; reinforcing steel, 4,530 pounds. All material will have to be hipped in. Bridge site ¾ of a mile from Big our station. Present structure is a 40 ft. eel leg bridge; same to be removed. Ordiary depth of stream, 8 ft. deep and 40 ft ide, still water. Excavation in soft mud, ill probably require piles. Work to be comleted on or before September 10, 1912. More etailed information may be had by an examiation of the plans and specifications prepared y the Illinois Highway Commission, which ay be seen at the Town Clerk's Office or ay be obtained upon application in writing, rom the Illinois Highway Commission, pringfield, Ill.

✣Bids will be received up to 3 p. m., June 1912, at Prophetstown, Ill., for five reforced concrete culverts and bridges to be uilt in Prophetstown Township, Whiteside ounty. Simon Keiser, Town Clerk, Prophetsown, Ill. It is reported that gravel for conrete may be obtained for each of the bridges t the Rock River for 10 cents per cubic yd., t the pit. All the present bridges are wood. xcavation for box culverts to be carried bout 9 ins. below stream bed for barrel and ½ ft. for end walls. Excavation for Lanaster bridge to be carried about 3 ft. below tream bed and piles driven. The excavation or the five bridges will be in sand. Millard ill: 8x6 ft. box; 4½ miles to Rock River ravel pit; total concrete, 48.2; total steel, ,245; low water flow, dry; depth of high water flow, 5 ft. S. Lindon Grove: 12x5 ft. box; 1 mile to Rock River gravel pit; total concrete, 45.3; total steel, 4,650; low water flow, dry; depth of high water flow, 5 ft.; Houch, 8x6 ft. box; 2 miles to Rock River gravel pit; total concrete, 36.4; total steel, 4,480; low water flow, dry; depth of high water flow, 4 ft. N. Lindon Grove: 12x4 ft; 1 mile to Rock River gravel pit; total concrete, 38.1; total steel, 4,470; low water flow, dry; depth of high water flow, 4 ft. Lancaster: 20 ft. span; 2½ miles to Rock River gravel pit; total concrete, 59.9; total steel, 4,394; low water flow, dry; depth of high water flow, 4 ft. Work to be completed on or before September 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

⦿S. A. Christlieb, Paxton, Ill., has been awarded the contract at $1,462 for furnishing all labor and materials for the construction of two 20 ft. reinforced concrete bridges, with 16 ft. roadways. Bids were opened at Paxton, Ill., May 29. N. E. Johnson is Town Clerk.

⦿The Porter-McCully Construction Co., Mackinaw, Ill., has been awarded the contract for the construction of a bridge over Funk's branch at Danvers, at their bid of $1,377. The structure will be 60 ft. long.

⦿Supervisors and Highway Commissioners of Taylorville, South Fork and Buckhart townships, Ill., awarded the contract for the reconstruction of old Ralston bridge across the South Fork to Frank Miller, Springfield, Ill., at $8,100.

A special town meeting was recently held at Rosedale, Ill., to vote on the proposition to borrow money for the construction of a new iron bridge at McKinney Bridge and Possum Creek and to repair the outlet bridge.

⦿The contract for the construction of a reinforced concrete bridge, to be known as the Texas bridge over the Iroquois River on the Middleport Concord township line in Iroquois County, has been awarded to W. H. Shons, Freeport, Ill., at $6,464. C. E. Barber, Watseka, Ill., is Town Clerk. Bids were opened May 24.

The City Council of Galesburg, Ill., has under consideration the construction of a new bridge at Broad St., over Cedar Fork, estimated to cost $2,000.

Indiana.

✣Bids will be received until 10 a. m., June 6, by Board of Huntington County Commissioners, Huntington, Ind., for the construction of a reinforced concrete bridge over Little River on Broadway at Huntington, Ind. Harold Guthrie is Huntington County Auditor.

✣Bids will be received until June 17, by Board of County Commissioners, South Bend, Ind., for the construction of 8 bridges in St. Joseph County, as follows: 1 Eighth street plate girder bridge, near Walkerton. 2 Burkholder bridge, Liberty township, flat top I beam bridge. 3 Six bridge Liberty township, flat top I beam bridge. 4 Burk bridge Liberty township, flat top I beam bridge. 5 Shupert bridge Liberty township, flat top I beam bridge. 6 Vincent bridge Lincoln township, plate girder bridge. 7 Repairing Crumstown bridge between Warren and Greene townships. 8 New flat top I beam bridge over East La Salle avenue race in South Bend. Clarence Sedgwick is County Auditor.

⦿The Board of Kosciusko County Commissioners, Warsaw, Ind., has awarded the contract for the construction of 11 new bridges to W. J. Dillingham, Warsaw, Ind., at $3,686. The new bridges to be constructed are as follows: Bortz bridge, Scott township; bridge, Wayne township; Downing Monroe township; Sudlow bridge, Creek township; Wiley bridge, Monroe ship; Graff bridge, Seward township; bridge, Clay township; Paxton bridge, ington township; Brumbaugh bridge Buren township; Hanold bridge, H township; Henwood bridge, Tippecanoe ship.

⦿The Board of Public Works, Loga Ind., has awarded the contract for th struction of reinforced concrete piers frame headgates and plank bridge fl George H. Palmer & Co., at $3,400. Bid opened April 30. H. H. Thompson Engineer.

The County Council, Logansport, In authorized a bond issue to build a across the Wabash River at Georgetowr structure, it is estimated, will cost $40,

Iowa.

✣Bids will be received until noon, J by C. H. Crooks, General Manager Dodge, Des Moines & Southern R. R., Ia., for the construction of a concret structure for a steel viaduct 2¼ miles of Boone. The work will include tw ments and 28 piers containing approx 740 cu. yds. of concrete. C. J. Steigl Assistant Engineer. Official adver will be found elsewhere in this issue.

⦿Board of Supervisors, Green Count ferson, Ia., has awarded the contract construction of the Eureka bridge Marsh Engineering Co., Des Moines, $3,300. Other bids received were Wi Weightman, $15,900; Midland Bridg $16,800; Empire Bridge Co., $17,000. T specifications call for a structure consist three 70-ft. arches.

Plans and specifications for tubular pi the contemplated bridge to be erected o the Wapsie by Scott and Clinton Countie been approved by the Board of Scott Commissioners, Scott, Ia. The structur estimated, will cost $1,583.

It is said that plans have been chang the Chicago, Milwaukee & St. Paul R for the construction of the proposed over the Des Moines River, west of M Ia., shortening the structure by 1,000 f

Kansas.

✣Bids will be received until noon, Je by Board of Washington County Commiss ers, Washington, Kan., for the constr of the following bridges and bridge r Two steel spans of 85 ft. each, upo tubular piers, across the Little Blue Ri section 21 Little Blue Township. One steel span, superstructure only, in leaf township. One 30 ft. steel I beam bents between sections 18 and 19 in ford township. One 30 ft. steel I beam structure between sections 25 and 36 in township. One 30 ft. steel I beam supe ture in section 22 in Mill Creek Tow One 32 ft. steel I beam superstructu tween sections 2 and 11 in Hanover tow One 30 ft. steel I beam superstructu tween sections 28 and 33 in Coleman tow One 20 ft. steel I beam superstructu tween sections 10 and 11 in Barnes Tow Repairing the steel tubular piers o Spencerville bridge in Section 36, F Township. Plans for the foregoing st are on file in the office of the County J. A. Maxwell, County Clerk.

✣Bids will be received up to Noon 7, at the office of the County Clerk Court House at Westmoreland, Kansa the construction and repair of a brid tween Riley County and Pottawatomie ty over the Blue River at Cleburne. posit of $50.00 must accompany each bi burne Bridge: Composed of two new steel spans each 149 ft. 2 in. center to end pins, 16 ft. roadway and wood floo two concrete piers each 44 ft. 6 ins. Work also includes removing one 100-f and two sets of 36-in. tubular piers. mated quantities: 130 cu. yds. concret 2,432 pounds steel reinforcement in eac

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] will be in said [illegible] to be carried [illegible] bout 16 ft. below low water; 16 piles t. long will be required for each pier. available in the river at the bridg. bble stone suitable to be crushed for can be delivered at bridge site for u. yd. Nearest station, Cleburne. ¹s ans and specifications are on file at n and Westmoreland in the County ffice and copies of the same may be nailing $1.00 to the State Engineer. n, Kansas.

will be received until 9 a. m., June reported, for the construction of a reinforced concrete viaduct over the acific and the Chicago, Rock Island R. R., at Kansas City, Kan. The will cost, it is estimated, over William Barclay is City Engineer.

Massachusetts.

he recommendation of J. P. Barnes, , Board of Public Works, Pittsfield. e Highway Committee voted to rec- the appropriation of $5,375 for the certain bridges.

Michigan.

[illegible] y Board of Public Works, Saginaw. the construction of a bridge across aw river on the extension of John- in accordance with the plans and ons therefore on file in the office of l of Public Works and City Engi-

ity of Kalamazoo, Mich., has award- ontract for the construction of a bridge 210 ft. long, including three ns with 30 ft. roadway, to R. Heys- 16,000. A. Lenderink is City Engi-

Grosse Ile Bridge Co., Grosse Ile, s awarded the contract for the con- of a bridge between Grosse Ile and and to the Detroit Bridge & Steel Detroit, Mich. The company has is- ,000 of bonds.

idge will be of girder construction opening for the passage of boats. ble portion of the bridge to be of rzer Rolling Lift type with fixed orted on concrete masonry piers and and the necessary filling back of the to adjacent cross streets.

pecifications and full information are the office of the Board, copies of l be furnished to any bona fide bid- tting twenty-five dollars with the City therefor, which deposit will be re- on the return of the plans and speci- Proposals for the work must be ied by a certified check on some he city of Saginaw, or a New York able to the order of the City Treas- substructure $2,000, for superstruc- 0. W. F. Jahnke is City Clerk.

plans have been completed by H. , City Engineer, Saginaw, Mich., for ruction of the new Johnson St. The design calls for a structure 520 consisting of 5 spans. Bids for the ent, which is estimated to cost ill be received shortly.

Minnesota.

will be received until 2 p. m., June Halden, County Auditor, Duluth, [illegible]) Clearing, grubbing, grading and [illegible] n Road, south from N. E. corner of ownship 51-21; (b) Clearing, grub- ling and corduroying one and one-) miles of the LaVaque Road, north St. Louis River; (c) Clearing, grub- corduroying one and one-half (1½) he Morris Thomas Road from S. ¼ Sec. 25 to S. W. corner of Sec. 50-16; and (d) Clearing, grubbing roying approximately one-half (½) he Canosia Road from D. M. & N. to S. E. corner of Sec. 21, Twp. 50- [illegible] said above described work [illegible]

[illegible] ing, grubbing and corduroying approximately three and one-half (3½) miles of the Walhalla Road from Miller Trunk Road east to [illegible] construction of necessary bridges and culverts; (f) Constructing wooden bridge across Waterhen River, on the Johnson Road, in Twp. 56-16; and (g) Clearing, grubbing, grading, ditching and corduroying two (2) miles of the Fraser Road, south from Town Line Road, on east line of Secs. 1 & 12, Twp. 56-19; all of said above described work being in the Sixth Commissioner District.

⦿Great Northern Bridge Co., Minneapolis, Minn., has been awarded the contract for the construction of 13 new steel bridges in Polk County, Minn., at $19,836. H. J. Welte, Crookston, Minn., is County Auditor. Bids for the work were opened May 24.

⦿The Board of Polk County Commissioners, Crookston, Minn., has awarded the contract for the construction of a new bridge over the Red Lake River on Washington Ave., East Grand Forks, to James McIlraith, East Grand Forks, Minn., at $11,696. The structure is 967 ft long. H. J. Welte is County Auditor. Bids for the work were opened [illegible]

Missouri.

Members of the House of Delegates, St. Louis, Mo., have reached an agreement to pass a bill authorizing an election to be held August 5 for the purpose of voting bonds $2,750,000 to complete the Free Bridge.

Montana.

A petition is to be filed with the Commissioners of Cascade County, Great Falls, Mont., shortly, asking for the construction of a modern bridge over the river at Ulm, Mont.

Nebraska.

Assistant State Engineer Roberts, Lincoln, Nebr., recently held a conference with the Holt and Boyd County Boards in regard to the construction of a bridge over the Niobrara River. Several sites have been suggested and the selection of a site has been left to a referendum vote of the people directly interested.

It is expected that the city of Omaha, Nebr., and the Missouri Pacific Ry. will shortly reach an agreement in regard to the construction of the proposed Dodge St. viaduct. G. W. Craig is City Engineer.

New York.

The Common Council of Cohoes, N. Y., has ordered the Vliet St. Erie Canal bridge closed and has communicated with the State Authorities in regard to having a new structure erected at that point.

A. H. Mallery, at $1,240, was the lowest bidder for the reconstruction of the bridge over Bear Trap Creek in Park St., Syracuse, N. Y.

The New York Central Railroad Co. is reported to have let a contract June 1 for the construction of a new bridge over the Oswego River in Oswego, N. Y., estimated to cost $240,000. The structure, it is said, will be completed early in October. J. L. Miller, New York City, is Bridge Engineer of the railroad.

North Dakota.

⦿The Board of County Commissioners, Cando, N. Dak., has awarded the contract for the construction of 6 steel and concrete bridges to the Beach Manufacturing Co., Grand Forks, N. Dak., at $5,965. F. F. Vaughan is County Auditor. Bids were opened May 20.

Ohio.

The City Engineering Department of Dayton, O., is preparing plans for the repair of the Herman Ave. Bridge. G. C. Cummins is City Engineer.

It is proposed that the City of Cincinnati, O., construct a viaduct over Duck Creek, from Langland Ave., Evanston, to Fairview Ave., Hyde Park, connecting the two suburbs.

It is reported that the River and Harbor Commission of Cleveland, O., has reached no definite decision in regard to the required clearance for the new low level rolling lift bridges proposed by the city. Corrigan, McKinney & Co. are to erect a bridge over the river at Clark Ave. in a short time, it is said.

Oklahoma.

It is expected that the City Commissioners of Guthrie, Okla., will call an election shortly to vote on the issuance of $25,000 of bonds, the city's share of the cost of building a $115,000 viaduct jointly with the Santa Fe Railway System. The viaduct as now planned is to be on Cleveland Ave., over the river from Second St., on this side to Sixth St. on the West Side. It is to be of reinforced concrete with steel girders, 32 ft. wide from outside to outside, 30 ft, in the clear, with a 24 ft. roadway and a 6 ft. pedestrian walk.

Oregon.

City Engineer Tom Hurlburt, Portland, Ore., and officials of the Oregon-Washington Railroad & Navigation Co., have prepared plans for the construction of a viaduct over Sandy Hook crossing to cost $53,573.

Pennsylvania.

✣Bids are being received by the Allentown Bridge Co., Allentown, Pa., W. W. Wysor, Chief Engineer, for the construction of a reinforced concrete bridge to be erected in this city, connecting the new 12th Ward with the main part of town. The bridge will be known as the "South Eighth Street Viaduct," and will have a length, exclusive of approaches, of 1,800 ft., and a length over all of 2,600 ft. The roadway will be 120 ft. above ground level at the highest point and this will be surmounted by a concrete balustrade 4½ ft. high, and concrete posts 22 ft. high for supporting lamps and trolley. There will be a 32-ft. roadway carrying the two tracks of the Lehigh Valley Transit Company and two 7-ft. sidewalks, making a total width of 46 ft. The viaduct was designed by Mr. B. H. Davis, Consulting Engineer, Metropolitan Bldg., New York. Bids will be opened June 24. The Allentown Bridge Company is owned and controlled by the Lehigh Valley Transit Company and the building of this bridge is in line with numerous other improvements being made by the Transit Company for improving its service and shortening the time between this city and Philadelphia.

✣Bids will be received until Noon, June 25, by G. F. Greiner, Secretary, Town Council, Ridgway, Pa., for the construction of a reinforced concrete bridge over Elk Creek, at N. Broad St. F. W. Ward is Borough Engineer.

⦿The contract for the erection of a new wooden bridge over the Schuylkill River at Leesport, Pa., has been let by D. K. Hoch, County Controller, Reading, Pa., to D. B. Wanner, Reading, Pa., No. 2 at $1,014.

⦿Commissioners of Blair County, Holidaysburg, Pa., have awarded the following contracts for the construction of bridges: For two arch bridges, one over Canoe Creek, near Bagshaw's, and one over the Clover Creek, at Klepser's Mill, to E. H. Brua, Hollidaysburg, Pa., at $1,747, and $1,992, respectively; for concrete girder bridge over Mill Run in Logan Township, to Fogel & Co., at $1,283. The following bids were received and held over, on the 2-arch concrete bridge over the Juniata River at Ironsville: Ferro Concrete Co., $9,495; Lanner Brothers, $11,700; Fogel & Co., $11,786; G. A. and F. M. Wagman, $13,885.

A committee of business men of Pittston, Pa., has filed a petition with the County Commissioners, Wilkesbarre, Pa., for the construction of a bridge at Water St., to replace the present structure.

Commissioners of Luzerne County, Wilkesbarre, Pa., and of Columbia County, O., have decided to accept the plans prepared by W. S. Miles, Luzerne County Engineer and Engineer Williams, of Columbia County for the construction of a reinforced concrete floor in the Berwick-Nescoupeck inter-county bridge

It has been announced at Pittsburgh, Pa., by the Pennsylvania R. R. Co., that the company will appropriate $40,000 for the removal of the old viaduct which crosses the Panhandle tracks near the old Sheraden borough line. N. [illegible] is City Engineer.

South Dakota.

Commissioners of Pennington County, Rapid City, S. Dak., have completed arrangements for the construction of two county bridges.

All bids received May 6, by Leroy C. Eastman, City Auditor, Hot Springs, S. Dak., for the repairing of the State Home Bridge on the southwest side of the Home Grounds, were rejected and the work postponed until a later date.

Tennessee.

✣Bids will be received until noon, June 18, by E. H. Little, Johnson City, Tenn., for the construction of a 300 ft. steel trestle, consisting of two 130-ft. spans, 12-ton capacity, concrete abutments and steel cylinder piers.

Texas.

✣Bids will be received until June 10, by city of Alice, Texas, for the construction of several bridges with concrete abutments.

Citizens of Boerne, Texas, have decided to build a steel bridge over the Cibolo on Main St., by popular subscription. The cost of the structure is estimated at $1,750. Max Beseler is a member of the committee appointed to contract for the structure.

Commissioners of Dewitt County, Cuero, Tex., have granted the petition of the citizens of Nordheim and Yorktown for the construction of a bridge over Smith Creek between the two places. The cost of the structure, it is estimated, will be about $2,500 or $3,000.

It is probable that the election to vote on the issuance of bonds by the city of Houston, Texas, will be postponed until the middie of July. It is proposed to vote $2,500,000, of which $200,000 will be used for bridge construction and repair, and $750,000 for drainage.

Washington.

✣Bids will received until 10 a. m., June 6, by Board of Athens County Commissioners, A. F. Rosenoff, Clerk, Ritzville, Wash., for the construction of the following bridges: One 30-ft. span between Sections 22 and 27, Township 19 North, of Range 35, E. W. M. One 30-ft. span on Section 17, Township 20, North, of Range 34, E. W. M. One 75-ft. span between Sections 33 and 34, of Township 19, North, of Range 33, E. W. M. One 96-ft. span in the Town of Lind. One 75-ft. span between Sections 17 and 18, of Township 17 North, of Range 34, E. W. M. One 60-ft. span between Sections 26 and 27, of Township 15 North, of Range 37, E. W. M.

The Commissioners of King County, Seattle, Wash., have decided to hold an election this fall to vote on the proposition of issuing bonds for $500,000 for the construction of concrete piers and two cantilever steel bridges across Lake Washington from Bailey Peninsula to Mercer Island to the eastern shore of the lake.

It has been suggested to R. E. Strahorn, Spokane, Wash., Vice-President of the Oregon-Washington Railroad & Navigation Co., that a concrete bridge be erected at Monroe St., Spokane, Wash., instead of the steel structure, as planned. The cost of the concrete bridge would be $600,000, just twice as much as that of the steel bridge.

The Oregon-Washington Railroad & Navigation Co., and the Chicago, Milwaukee & Puget Sound Ry. Co., will jointly construct in connection with about a mile and a half of new line a 240-ft. single track steel draw bridge over the Chehalis River, between Montesano and South Montesano, Wash. J. P. O'Brien is Vice-President and General Manager of the Oregon-Washington Railroad & Navigation Co.

Wisconsin.

A special election will be held at Ierrill, Wis., shortly, to submit to the voters t proposition of building a bridge over Prair River.

The State Railroad Commission, Wisconsin, has instructed the Chicago & Northwestern R. R. to construct a new viad t over its tracks one-fourth mile north of endota Station, Dane County, or to repair t present bridge, whose approaches are n in dangerous condition. W. C. Ar trong, Chicago, Ill., is Bridge Engineer of e railroad.

It is believed that the City Cou l will shortly take up with the State Railro Commission the matter of securing the construction of the proposed new bridge over e Fox River at Algoma St., Oshkosh, Wis. F. H Randall is City Engineer.

The City Commission, Superior, is. is reported to have completed arrangem ts for the immediate construction of the proposed extension of the Balknaw St., viaduct Terminal tracks. E. B. Banks is C neer.

Canada.

✣Bids will be received until Noon, ul by Mackenzie, Mann & Co., Ltd., M ot tan Bldg., Vancouver, B. C., for the c tion of sub and superstructures for 1 over Fraser, Thompson and North T Rivers on that section of the Canadia ern Pacific Ry., between Port Mann lowhead Pass, Province of British C. Waddell & Harrington, Winch Bld. couver, B. C., are Consulting Enginee

⊙The contract for the constructio f superstructure of the 23d St. Subway Sas toon, Sask., has been awarded to the o ion Bridge Co., Winnipeg, Man., at [illegible] G. T. Clark is City Engineer. Bids r th work were opened May 17.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

The Overcup Drainage District of Jackson and Woodruff Counties, Arkansas, has recently completed its organization. Sealed bids for about $60,000 in bonds will be received by the Commissioners of the District at Newport, Ark., on June 20th. The District covers about 22,000 acres, about 60 per cent of which is in cultivation. At the present time the average value of the land in the District is about $40 an acre, and the average cost of the improvement is about $4 an acre. The Morgan Engineering Co., Memphis, Tenn., are engineers for the improvement.

A petition for the organization of a Drainage District for the improvement of 100,000 acres of land in the Cache River Valley in Poinsett and Jackson Counties, Ark., has been filed at Newport. The Morgan Engineering Co., Memphis, Tenn., are the engineers.

Florida.

✣Bids will be received until July 2, by Commissioners of DeSota County, Arcadia, Fla., for the construction of drainage ditch in Section 10. W. J. Wingate is Chairman of the Commission.

Idaho.

The Secretary of Interior has authorized the U. S. Reclamation Service to proceed with the construction of the pumping plant, distribution system, and transmission line for the west extension of the Minidoka irrigation project, Idaho. The extension will cover an area of 2,200 acres of high land lying about 6 miles northwest of Barley. Water for irrigation will be pumped by power generated at Minidoka dam and transmitted electrically down the valley. The estimated cost of the work is $72,500. P. M. Fagg, Rupert, Idaho, is Project Engineer.

Illinois.

✣Bids will be received until noon, June 13, by I. J. Bryan, Clerk, The Sanitary District of Chicago, 1,500 76 West Monroe St., Chicago, Ill., for excavation in the north shore channel. The work consists of excavation in the Wilmette Harbor and in the entrance to same and the rip-rapping and excavation of certain portions of the North Shore Channel.

Bids as follows were received May 31 by the Trustees of the Sanitary District of Chicago for the excavation and construction of contract section 5 of the Calumet-Sag Channel, (1) standing for bid of Green & Sons Co., Chicago, Ill., and (2) for bid of Shnable & Quinn, Chicago, Ill.:

	(1)	(2)
Excavation, glacial drift, 1,070,000 cu. yds.	$0.24	$0.28
Excavation solid rock, 111,000 cu. yds.	.70	.74
Riprap slopes, 69,000 sq. yds.	1.00	.50
Roadway construction, 4,800 lin. ft.	1.00	1.00
Concrete, No. 1, 775 cu. yds.	10.00	10.00
Concrete, No. 2, 600 cu. yds.	7.00	7.00
Completed concrete cylinders, 100 cu. ft.	.60	1.00
Reinforcing metal, 30,000 lbs.	.04	.04
Erection of McLoughlin Road bridge	3,000	3,000
Erection of West 52d St. bridge	5,000	4,500
Totals	$444,990	$462,790

Indiana.

⊙Roy Perkins, South Milford, Ind., has been awarded the contract for constructing the August Reinhart Ditch in La Grange County, the work including 60,000 cu. yds. of open ditch and 4,900 ft. of tile.

Iowa.

✣Bids will be received until 1:30 p. m., June 18, by Auditor Pottawattamie County, Council Bluffs, Ia., for the construction of the Wilson ditch and lateral drains in Harrison County, Ia. The main ditch is about miles long with 6 ft. bottom and includir ab ut 98,800 cu. yds. Official advertisement ill found elsewhere in this issue.

Kansas.

The dates for receiving bids for tl excavation work in the Delaware River lainage District, mentioned in our May 22 ise, has not as yet been definitely settled. t will probably be in the neighborhood of uly 1. There is some additional work being anned, and the total excavation will probabl xceed 500,000 cu. yds. H. B. Walker, Ma iattai Kan., is the Engineer.

Louisiana.

Two bills, aggregating $74,000,000 f levee work and improvements to the Mississippi River, were introduced in th on May 29. Representative Ransdell of Louisiana introduced one provi an immediate appropriation of $ with continuing appropriations f succeeding years, beginning with 1913. Of each $11,000,000 the bill that $8,000,000 should be devoted construction and repair, the remaind devoted to river improvement work.

Michigan.

⊙Contracts as follows for the south branch of the Macon drain were awarded ay 22, by James Sloan, County Drain Commissioner, Adrian: Sec. 1, one mile of ditch, Horace Pulver, Dundee, Mich.; Sec. 2, 8½ les of dredge work, Edw. Bodette, Toledo, The Beach Mfg. Co., Charlotte, Mich., secured the contract at $3,425 for the reinforce of seven bridge abutments, and Wyn op & Gormeley, Toledo, O., secured the ntract for two new bridges, including abutm ts, at about $4,000.

Minnesota.

s will be received until 11 a. m., [illegible] L. H. Slocum, County Auditor, Inter- l Falls, Minn., for the construction of Ditch No. 1, Koochiching County. The ill be about 17 miles in length and will about 65,749 cu. yds. of earth excava- The cost is estimated at about $15,125.

s will be received until 2 p. m., June L. H. Slocum, County Auditor, Inter- l Falls, Minn., for the construction of l ditch No. 2, Koochiching County, including 75,795 cu. yds. of excavation.

s will be received until 10 a. m., June L. H. Slocum, Koochiching County r. International Falls, Minn., for the ction of Judicial ditch No. 3, including cu. yds. of excavation. The ditch will miles long.

Commissioners of Brown County, have rescinded their action regarding blishment of County Ditch No. 19, and nsequence no contracts were let on May the construction of this ditch. L. G. New Ulm, Minn., is County Auditor.

Mississippi.

s will be received until noon, July 1, . Nelms, Chairman, Washington Coun- nage Commissioners, at the office of B. dan, Chief Engineer, 430 New Wein- dg., Greenville, Miss., for the construc- about 19 miles of dredge ditch rang- m 26 to 56 ft. bottom and including ap- ately 1,960,000 cu. yds. Official adver- t will be found elsewhere in this issue.

ition is being circulated for the organi- of the Cold Water Drainage District counties in Northern Mississippi, im- ly south of Memphis. This district about 350,000 acres. The Morgan En- g Co., Memphis, Tenn., are engineers [illegible]

Tri-County Drainage District of Tu- ate and Panola Counties, Mississippi. ently been organized. The hearing for l establishment of the district will be the next term of court. Morgan En- g Co., Memphis, Tenn., are the engi-

Missouri.

owners in Portage and Desiroux ips of St. Charles County, voted on on the establishment of a levee district. vee proposed is to be about 21,000 ft. ontaining 182,000 cu. yds. of earth. Riske, St. Charles, Mo., is the Engi-

Montana.

derick Tews, Billings, Mont., has been d the contract at $2,420, for the exca- and back filling of drainage ditches in [illegible] Newton, Mont. U. S. Reclamation Service. Bids ened April 15.

were opened May 21 at Malta, Mont., U. S. Reclamation Service for the [illegible] and structures of the Dodson Canal of the Milk River Project, of Geo. O. Sanford is Project Engineer. nedule 1 Ezra Eveaux, Wagner, Mont., bidder at $876; Peter Taylor, Malta, $4,467, was low bidder on Schedule es Eugene Boucher, Malta, Mont., on only the Class 1 excavation of le 6, was low bidder on the schedule. [illegible] bidder on all of the earth work E. Hilton, Billings, Mont., his bid s follows:

e 1.

	Cu. yds.	
[illegible] –		
[illegible]	3,500	$0.35
[illegible]	100	0.35
[illegible]	10	1.00
[illegible]	2,800	0.02
[illegible] –		
[illegible]	11,000	0.35
[illegible]	100	0.35
[illegible]	[illegible]	1.00
[illegible]	100	0.02
[illegible] –		
[illegible]	8,500	0.35
[illegible]	100	0.35
[illegible]	10	1.00

Schedule 4.

[illegible]

Schedule 5.

[illegible]

Class 3	10	1.00

The Midland Engineering Co., North Yakima, [illegible] 7, which covered the structures.

Bids were received May 21 at the office of the U. S. Reclamation Service, Malta, Mont., for earth work and structures on the Dodson North canal of the Milk River Project, of which Geo. O. Sanford is Project Engineer. The following bids were received on the five earthwork schedules: (1) being bid of Wynn & O'Neill, Malta, Mont.; (2) bid of J. E. Hilton, Billings, Mont., and (3) bid of Hayden Bros., Portland, Ore.:

	(1)	(2)	(3)
Schedule 1.			
[illegible] yds.	$0.27½	$0.17	[illegible]
[illegible]	0.50	0.35	[illegible]
Class 3, 10 cu. [illegible]	1.00	1.00	1.75
Overhaul, 1,000 cu. [illegible]	0.02	0.02	0.02
Total Schedule 1....	$11,492	$ 7,120	$10,877
Schedule 2.			
Class 1, 77,000 cu. [illegible]	[illegible]	[illegible]	$0.20
[illegible]	0.50	0.35	0.50
Class 3, 10 cu. yds.	1.00	1.00	1.75
Overh'l, 31,000 cu. [illegible]	0.02	0.02	0.02
[illegible]	$18,005	$13,755	$16,087
Schedule 3.			
Class 1, 95,000 cu. [illegible]	[illegible]	[illegible]	$0.22
Class 2, 100 cu. [illegible]	[illegible]	[illegible]	0.50
Class 3, 10 cu. yds.	1.00	1.00	[illegible]
Overh'l, 27,000 cu. yds.	0.02	0.02	0.02
[illegible]	$18,650	$16,735	$21,507
Schedule 4.			
Class 1, 40,000 cu. yds	[illegible]	[illegible]	$0.23
Class 2, 100 cu. [illegible]	0.50	0.35	0.50
Class 3, 10 cu. [illegible]	1.00	1.00	1.75
Overhaul, 6,200 cu. yds.	0.02	0.02	0.02
[illegible]	$ 7,784	$ 6,969	$ 9,391
Schedule 5.			
Class 1, 17,000 cu [illegible]	$0.19	$0.17	$0.19
Class [illegible]	0.50	0.35	0.50
Class 3, 10 cu [illegible]	1.00	1.00	1.75
Overhaul, 6,200 cu. yds	0.02	0.02	0.02
Total Schedule 5...	$ 3,414	$ 3,059	[illegible]

The bids received on the structures (Schedule 6) were as follows: (1) standing for bid of Midland Engineering Co., North Yakima, Wash.; (2) bid of John S. Penson, Williston, N. Dak.; (3) bid of Hayden Bros., Portland, Ore., and (4) bid of J. S. Hilend, Pompey's Pillar, Mont.

		(1)	(2)	(3)	(4)
Excavation:					
Class 1	6,500 cu. yds.	$0.48	$0.465	$0.35	$0.5
Class [illegible]	10 cu. yds.	[illegible]	1.00	0.75	2.0
Class [illegible]	10 cu. yds.	3.00	1.75	2.00	2.1
Puddling	750 cu. yds.	0.60	0.50	0.40	2.5
Concrete	1,[illegible] cu. yds.	11.90	9.80	11.75	15.0
[illegible]	[illegible] cu. yds.	6.00	2.80	3.00	5.0
Grouted paving	255 cu. yds.	7.00	2.95	3.50	[illegible]
Riprap	250 cu. yds.	3.00	2.60	2.50	[illegible]
Hauling and laying 14-in. C. I. pipe	36 lin. ft.	0.25	1.00	0.40	1.0
Hauling and laying 24-in. C. I. pipe	24 lin. ft.	0.50	[illegible]	0.70	1.0
24-in. vitrified pipe	210 lin. ft.	0.20	0.80	0.35	0.5
30-in. vitrified pipe	220 lin. ft.	[illegible]	1.00	0.45	[illegible]
24-in. concrete pipe	210 lin. ft.	0.20	0.90	0.37	0.6
30-in. concrete pipe	220 lin. ft.	0.25	1.10	0.50	0.7
Structural steel	7,000 lbs.	[illegible]	0.02	0.01	0.0
Gates, [illegible]	[illegible] gates	25.00	35.00	[illegible]	25.0
Gates, [illegible]	4 gates	25.00	22.00	4.00	5.0
Steel flumes	160 lin. ft.	0.20	0.60	0.40	1.0
Lumber, bridges and flumes	38,200 ft. B.M.	12.00	22.00	10.00	[illegible]
Lumber turnouts, checks, drops	48,000 ft. B.M.	19.00	30.00	10.00	25.0
		[illegible]	[illegible]	[illegible]	[illegible]

Ohio.

◉Standard Contracting Co., Cleveland, O., has been awarded the contract at about $21,700 for widening Black River for the City of Lorain, O.

Oregon.

H. Hirschberg, Independence, Ore., has filed an application with the State Engineer for permission to divert water of the Little Luckiamute River to supply the towns of Independence and Monmouth with electrical power and also for irrigation purposes.

Memphis, Tenn., and Vicinity.

[illegible]

✣Contractors in this section had better sharpen up pencils and start figuring on the big government letting which will take place here on June 10th. Major Clarke S. Smith is asking for bids on the 1,100,000 cu. yds. of levee construction in the Reelfoot and Upper St. Francis Districts; also some of the Lower St. Francis District. This is only [illegible] largement and new levee work which will take place in the coming season. The opening guns were fired by Maj. Woodroff, who has asked for bids on nearly a million yards, to be let June 3d, and it is soon expected that the State Levee Boards will chip in with their work. Everything points to a banner year for the contractors, and you can bet they are all looking to their equipment and filling up on live stock.

In this connection, all the stock traders around here are looking towards a nice fat profit, owing to the unprecedented demand for stock, to take the place of stock drowned by the long flood; and also expect to sell quite a few of the long-eared hybrid variety to the local contractors, who will all be clamoring for mules soon. For those who are not lucky in landing contracts can make a nice pile by sub-letting from the lucky ones, as there will be plenty of good price work done this year.

✣Frank R. Merrin, Secretary of the Second District Road Commission, at Horn Lake, Miss., has issued a call for bids to grade the Fogg Road and the Lakeville-Goodman roads. These contracts will be let at public outcry, work to begin at once. This work contains about 55,000 cu. yds. of excavation, and covers about 14 miles of road. Time of completion, Oct. 15th, 1912. Bids will be received on June 6th at the Hernando Courthouse.

◉At the letting held here at Memphis by the Street Commissioners last Tuesday there was some sharp bidding, and several Memphis contractors secured some nice contracts. Pouncey pulled a few fat plums out, and the Roach-Manigan Paving Co. secured two or three gravel streets. Exact figures cannot be obtained by the writer at present. The Roach-Manigan Co. were low on brick for Butler Av., but this contract will not be awarded at present. It is planned to install a huge storm sewer from this street to the Bayou on the south end, and it will be some time before this contract will be re-advertised. The installation of this sewer is made necessary by the fact that this section is somewhat lower than the surrounding territory, and a drai must be provided for storm water, whic would flood the street at every heavy stor if some outlet were not provided.

◉Contract was awarded the Canal Construc tion Co. of Chicago, Ill., on May 30 for th construction of a system of drainage canal in the Beaver Bayou Drainage District, nea Helena, Ark. This work contains approxi mately 1,600,000 yards of dirt, and went a 8¼ cts. per cu. yd. The whole work will cos about $150,000, and work will commence within ten days or two weeks. The Canal Construction Co. underbid about ten or twelve contractors, and state that the work will be rushed through on record time.

T. H. Sater, at work on the Memphis, Dallas & Gulf extension from Murfreesboro to Hot Springs, says that this road certainly has some fine work. He has now finished miles one and two, and is working on mile six, which he says is as pretty a piece of work as he ever laid eyes on. W. J. Murphy, on the same contract, agrees in every particular with Mr. Sater. W. J. has finished two miles of road, and is pushing his work in good style.

Big Bill Walker went by the other day. Bill has so many contracts on his hands he hardly has time to stop and shake hands. He has only recently returned to the city from some place in Mississippi, where he bid on a big job of concrete work. Someone else beat him to it, but he says there are as good fish in the sea as ever came out. Better luck next time, Bill.

Bob Colglazier, Superintendent of the Roach-Manigan Paving Co., left recently for Fort Worth, where he hangs out. Bob came to Memphis to lay Union Av. with asphalt, and now that the contract is practically completed, has to hustle back to Fort Worth, where the company has a number of large contracts. Bob says that he hung up one or two new records while here, for the day's run, and is well satisfied with the job.

T. W. Roach, in charge of Roach & Stansell's big steam shovel plant, left the other day for Moores, Miss., to get things in shape for the season's work. Winters says that it will take until perhaps the middle of July to clear things up enough to start work, inasmuch as the Levee Board built a protection levee straight down the track, and he has five miles of track to dig out from under 6 feet of dirt, and one or two miles of new track to lay. He expects to finish this contract by the first of next year, and says he will sure hang up some records for stripping dirt.

Tommy Carrol, old-time locomotive man, was in to see us the other day. Tommy, it seems, has amassed enough of the wherewithal to abstain from work and enjoy himself. At present he is doing a little spare-time work by pulling the throttle on his friend Billy Bryan's gasoline roller, inasmuch as Billy was unable to obtain a "chauffeur" in town who could handle the gas roller. Tommy's great pleasure in life is to drop in and swap fish tales, but when it comes to work, he can shuck his coat and make the best of them rustle.

Jesse Nichols is making dirt fly on his grading contract for the Speedway Terrace Land Co. Jesse lit into that job with a whacking good outfit, and is camped right on the ground. He says he will pull the work through in two shakes of a lamb's tail, and make money on it too.

Sam Walker was around to see us the other day, and says he is entirely satisfied, thank you, with the way his work is going. Sam is a hustler, and knows which end to start on when he begins a contract.

Word comes in from "Cap'n John" Prescott, who is working near Tupelo, Miss., that he is making a good thing out of the road-building game. John is constructing several miles of the prettiest gravel road one ever laid eyes on.

President Killough, of the Interstate Levee Association, has called a meeting at Memphis for July 18th and 19th. All residents of the Mississippi Valley, from New Orleans up to Cairo, are invited to attend this meeting, when plans will be discussed for a long campaign of levee building, drainage work and such. This meeting will put up several men famous in the dirt-moving game, who will deliver a series of talks on protection devices for the farm lands.

In order to prepare for the quick rebuilding of all the small country roads which were all but washed away by the overflow in Shelby County, the County Commissioners have ordered a large quantity of split-log drags, and the county forces expect to have all the roads back in fine condition by the middle of the summer. Practically every road in the north end of the county was put out of business.

Surveyors are now working on the Pidgeon Roost Road, from the Tennessee boundary line to the line of Marshall county, by way of Olive Branch, Miss., and work will soon commence on this and other roads in the vicinity. Mississippi has begun to take an active interest in good roads, and an immense lot of work will be done in that state this summer.

Texas.

✤Bids will be received until June 10, by John M. Murch, County Auditor, Galveston, Texas, for the excavation of drainage ditch near Texas City, about 12,800 ft. in length.

Utah.

✤Bids will be received until July 1, it is reported by the Ogden River Reservoi Co., W. Glassman, President, Ogden, Utah, for the construction of a rock filled concrete re wall dam with a steel face.

⊙The Midwest Engineering Co., 1 Mc-Cague Bldg., Omaha, Neb., has been warded the contract at $16,380.30 for the co ruction of drop, chute and bridge abutmen on the Indian Creek and Trail Hollow dive ion canals, Strawberry Valley irrigation project, Utah. Bids on this work were opene May 16, and were given in our last issue.

⊙W. O. Morrison, 409 Cooper Bl, Denver, Colo., has been awarded the c ract at $13,806 for the construction of concre intakes and bridges on the Indian Creek a Trail Hollow diversion canals, Strawberr Valley irrigation project, Utah. The item d bids on this work received May 16 were iven in our last issue.

Washington.

It is believed that final survey Kittitas High Line Canal will be c pleted by late summer and that the work ll then be placed under contract. An en ieering party is now in the field making fina urveys for one portion of the canal. Anoth which has been running the final li the lake to the mouth of the canyo well out into the valley, a few mil Thorp. The new party started wor at point where the siphon will cross the River, near the station of Dudley work to the north and east, while the crew will continue down the south b the west side of the river. From the the point where the big canal empt into the river, the north branch is proximately 50 miles in length, and it is pected that the work of running the lines completed soon. The engineering head for this work are at Ellensburg.

Wisconsin.

⊙Skook & Johnson, Stanchfield, Min, h been awarded the contract for the work in the First Addition to the Ra Drainage District of Dane County. T adge amounts to about 150,900 cu. y were opened May 29 at Madison, W

⊙Chas. W. Rood Construction Co Grand Rapids, Wis., has been awarded the co act at 9.38 cts. per cu. yd. for work for t Leola Dainage District. The contract calls 18.50 miles of ditch requiring 231,192 cu. yd of excavation. Bids were opened May 30 by W B. Angelo, Plainfield, Wis.

WATER-WORKS

Alabama.

The City Commission of Birmingham, Ala., has passed a resolution instructing City Engineer Walter G. Kirkpatrick to report as soon as practical a preliminary plan looking to the location and construction by the city of its own waterworks system.

California.

⊙The city of Oakland, Cal., has awarded the contract for the construction of the extension of the high pressure auxiliary pipe line in 14th st., from Washington, west of Market st., to William Heafey, of that city, at $11,465. Other bidders were Contra Costa Construction Co., $13,294, and John Heafey, $12,848.

⊙The Knight & Hyde Construction Co., of San Diego, Cal., has been awarded the contract by the Quartermaster at Fort Rosecrans, Cal., for the construction of a 6-in. water main across the naval reservation at the fort for $3,475. Bids were opened May 17.

The citizens of Vallejo, Cal., on May 20, voted on the issuance of bonds in the sum of $100,000 for the construction of a municipal light and water plant.

The city council of Alhambra, Cal., is planning a municipal water system and has had Engineer T. B. Downer investigating the various sources of supply, among which are considered the San Gabriel Valley Co.'s plant, Owens River water and the supply of the Chapman wells. The Engineer reports that the city will require 11,250,000 gals. a day.

The citizens of the southern part of Marion County, Cal., will vote June 25 on the appointment of a board to examine schemes for a municipal water system. The Board of Supervisors, San Rafael, is in charge.

Colorado.

An election is to be held in Oak Creek, Colo., soon for the purpose of voting on the issuance of bonds in the sum of $30,000 for the installation of a municipal waterworks.

Delaware.

✤Bids will be received until 10 a. m., June 14, by Quartermaster, Fort Dupont, Del., for sinking one 10-in. tubular deep well at Fort Dupont, Del.

District of Columbia.

✤Bids will be received until 2 p. m., June 12, by Commissioners of the District of Columbia, for furnishing and delivering 10,000 ⅝-in. and 250 ¾-in. water meters fo the water department of the city.

✤Bids will be received until 11 a. 22, by H. R. Stanford, Chief of B Yards and Docks, Navy Department ington, D. C., for the furnishing and tending the installation of a 25,000-g ruple effect seawater distilling plant appurtenances in connection with the power plant at the naval station, Gua Cuba.

Georgia.

An election was held in Marshallv on May 29, for the purpose of voting issuance of bonds in the sum of $20, the building, equipping and operatin tem of waterworks, and $5,000 for an light plant.

It is reported the City Council of Ga., has passed an ordinance provi the issuance of bonds in the sum of for the improvements of the waterwo tem, and $1,000,000 for flood protecti

Idaho.

⊙The contract for the extension of waterworks of Salmon City, Ida., h let to the Vogler Plumbing & Heating at $21,250. Work will [illegible] of City Engineer [illegible]

Illinois.

will be received until [illegible] Rockford, Ill., for furn[illegible] speed motor, direct connected to a -gal. 16-in. centrifugal pump for the orks department. Wallace Treichler Engineer.

will be received by [illegible] sioner of Public Works, Chicago, Ill., a. m., June 12, for furnishing, deliv- d erecting at the Jefferson Park pump- , 4410 N. 47th Av. [illegible] cting or single-acting, each of a ca- 1,000,000 gallons per 24 hours against ng head of 40 ft. driven by single cyl- ternal combustion engines, each of 35 ing kerosene fuel. Important data is ws: Normal speed, 44 R. P. M.; nor- d, not including friction, 140 ft. brake wer, 35; number of cylinders, 1; bore der, not less than 11.5 ins.; length of ins. Cash or certified check for $500 company proposal. Official advertise- [illegible] elsewhere in this issue.

will be received until June 10 (all eived May 29 rejected) by City Clerk, Ill., for furnishing necessary labor and for the improvement of the munici- erworks system. Plans and specifica- on file with the city clerk, or Fuller- o., Chemical Bldg., St. Louis, Mo., rs.

[illegible] Island Bridge & [illegible] land, Ill., has been awarded the con- the village of Compton, Ill., J. S. Clerk, for the construction of a steel wer and tank. Edward Byrne, La Il., is Engineer. Bids were opened [illegible]

ving are the lowest bids submitted to the Board of Local Improvements, Ill., for furnishing, delivering and ting water supply pipes inplace: Yates 574 lin. ft. 8-in., $1.18; valve basins, Murphy, 5315 Wabash Ave.; Wabash 40 lin. ft. 8-in. $1.17, M. Murphy and Passarelli and Tirtilli; E. 98th St., ft. 6-in. $1.18; valve basins, $30, Simon 37 Congress St.; Spaulding Ave., 442 6-in., $1,40; valve basins, $30, Simon 8th Pl., 675 lin. ft. 6-in., $0.92, Simon Yale St., 516 lin. ft. 6-in., $0.98, M. ; California Ave., 2,620 lin. ft. 6-in., Murphy; Claremont Ave., 625 lin. ft. .39, M. Murphy; Indiana Ave., 1,040 -in., $1.06, M. Murphy, S. Ryan; Irving 300 lin. ft. 8-in., $1.09; valve basins, Ryan; 71st Ave., 1,380 lin. ft. 8-in., Ryan; Saginaw Ave., 645 lin. ft. 8-in., . Murphy; Marianna St., 720 lin. ft. 84, Ed. Connor, 2432 Cortland St.; E. , 682 lin. ft. 12-in., $1.16, M. Murphy; Ave., 1,317 lin. ft. 8-in., $1.14; valve 30, M. Murphy; Ridgeland Ave., 1,317 -in., $1.14, M. Murphy; 71st Pl., 1,187 -in., $1.06, M. Murphy; 72nd St., 1,187 -in., $1.06, M. Murphy; 73rd St., 1,187 8-in., $1.05, M. Murphy. Edward J. is Secretary of the Board.

oard of Local Improvements of Rock ll., has recommended the adoption of ance providing for the construction of ains on certain streets and avenues th St. to 41st St., and from 14th to e. City Engineer Wallace Treichler nated the cost of the work at $7,207.

ors of a municipal waterworks plant port, Ill., propose to organize a com- purchase the Freeport Waterworks l the plant in trust until the city is uy it.

Indiana.

Board of Public Works of South d., has awarded the contract for the ain St. and West Division St. water to W. H. Burke & Co., and the water connections on North Scott homas Williams.

Iowa.

Consulting Engineers Hall & Adams of Cen- [illegible] ville Water Works Co., at Centerville, Ia. Bids [illegible]

The Town Council of Kimballton, Ia., Hans Madsen, Clerk, has postponed the letting of the contract for the construction of a waterworks system for which bids were to have been opened May 22. C. D. Forsbeck, of [illegible]

The citizens of Alden, Ia., at a recent election, voted in favor of the installation of a municipal waterworks system.

Kansas.

The citizens of Williamsburg, Franklin [illegible] ance of bonds in the sum of $5,000 for a mu- [illegible]

Louisiana.

✣Bids will be received until noon, August 1, by F. S. Shields, Secretary, Sewerage & Water Board, 508 City Hall, New Orleans, La., for the construction of a reinforced concrete siphon under the New Basin Navigation Canal at Broad St., under Contract 45 D. A certified check for $1,000 must be filed with each bid.

Massachusetts.

◉The Water Board of Holyoke, Mass., has awarded the contract for the new gateway to the Whiting St. reservoir to W. W. Salter, at $1,632. The bids for the construction of the gate-house for the White reservoir were rejected and plans for the construction of a cement gate-house referred to the chairman.

Michigan.

◉The Board of Public Works of Grand Rapids, Mich., has awarded the contract for the equipment and supplies for the filtration plant laboratory to the Scientific Materials Co., at $2,168.

The Newaygo Improvement Association of Newaygo, Mich., is taking steps toward the installing of a new water system. The Village Council has been asked to call a special election to vote on the proposition.

Mississippi.

The citizens of Meridian, Miss., will probably vote on the issuance of bonds in the sum of $170,000 for the municipal waterworks. Of that amount $100,000 will be used to retire warrants and the remainder for improvements.

Missouri.

✣Bids will be received until 8 p. m., June 11, by Buell Cable, City Clerk, Doniphan, Mo., for the construction of a sanitary sewer system and for an extension of water mains. Plans and specifications of sewer system may be seen at the office of F. L. Wilcox, Chemical Bldg., St. Louis, Mo., or at the Ripley County Bank, Doniphan, Mo.

✣Bids will be received until June 7, it is reported by the Board of Public Improvements, St. Louis, Mo., for the construction of about 30,000 ft. of water pipe.

Montana.

◉The City Council of Helena, Mont., has awarded the contract for furnishing one car of water pipe to A. M. Holter Co., of Helena, [illegible]

Nebraska.

✣Bids will be received until noon, June 5, by Village Clerk, Butte, Nebr., for digging and curbing of a town well, digging trenches and laying about 800 ft. of water mains, filling trenches, etc. J. P. Wood is Chairman Board of Trustees.

A petition has been presented to the Board of Trustees of Palmer, Nebr., asking that a special election be called for the purpose of voting again on the issuance of bonds for the installation of a waterworks system. The estimated cost of the plant is $10,000.

The Village Board of Sidney, Nebr., has rejected all bids received for the purchase of the $22,000 water bonds. The bonds will probably be sold at private sale.

New Jersey.

The Woodbury, N. J., Borough Council held a meeting the last week in May for the purpose of discussing the water question and decide whether the city should have artesian water or construct a filtration plant.

New York.

✣Bids will be received until Noon, June 19, by Board of Trustees, Wolcott, N. Y., for the construction of about 6 miles of cast iron mains, standpipe, small reservoir, pump house, two electric driven power pumps and other accessories. L. W. Knapp is Village Clerk and C. C. Hopkins, 349 Cutler Bldg., Rochester, N. Y., is Consulting Engineer.

✣Bids will be received until June 17, by M. Gray Zalinski, Depot Quartermaster, Army Bldg., New York City, for furnishing under Schedule 324, 400 hand fire extinguishers and "S" water meters as follows: Forty-six at Fort Lincoln, 227 at Fort Sam Houston, 41 at Fort Lawton, 46 at Fort Williams, 282 at Fort Leavenworth, 86 at Fort Ethan Allen, 28 at Fort Flagler, 70 at Fort Benjamin Harrison, and 253 for the Depot Quartermaster, New York.

✣Bids will be received until 1:30 p. m., June 17, by M. Gray Zalinski, Depot Quartermaster, New York City, for furnishing and delivering fire extinguishers and water meters at various posts.

Comptroller Edward S. Osborne, of Rochester, N. Y., on May 29, it is reported, sold $150,000 worth of waterworks improvement notes, the proceeds to be used to put in improvements at Hemlock and Canadice lakes. Ordinances have been passed and approved for the construction of a dyke at the North end of Hemlock Lake and for the construction of a pipe to connect the two lakes.

The Mayor and Water Board of Watervliet, N. Y., have had the following oral propositions submitted to them to furnish the city with a new waterworks system: Frederick A. Bond, of Albany, at $300,000, using the Mohawk River for the supply; Schuyler R. Shafe, New York City, at $630,000, taking water from the Hudson River, with $18,000 annual maintenance; Frank R. Hermans, Troy, N. Y., at $230,000, water to be furnished at the west side of the river, with $18,000 annual maintenance; Walter E. Sexton, Mineola, N. Y., at $400,000, $475,000 and $675,000, on three propositions; Solomon, Norcross & Keis, of Watervliet, three propositions, as follows: Water to be taken from Troy, $275,795; from the Hudson River above Cohoes with filtration plant, $356,615; water from the French Mills, a settlement about 12 miles southwest from the city, by way of the Shakers Springs, either by a gravity system at $401,925, or by a pumping system at $447,850.

Ohio.

The citizens of Akron, O., at a recent election, May 21, voted the issuance of bonds in the sum of $1,225,000 for the making of extensions and improving the water works system. Plans were prepared by Consulting Engineers Barbour & Bradbury of Akron.

The Board of Control of Cambridge, O., on May 28 appointed City Engineer Karl M. Cosgrove to act as sanitary engineer for the city of Cambridge in the designing and constructing of a water purification and sewage disposal plant, which may be constructed in the near future.

Oklahoma.

The town of Quinlan, Okla., is planning to vote bonds in the sum of $20,000 for the installation of a waterworks system.

Oregon.

Following bids were received by the Executive Board of Portland, Ore., May 27, for the 8-in. standpipe for the water tower on the new fireboat David Campbell: Smith & Watson Iron Works, $2,600; Vulcan Iron Works $[illegible]

✣ indicates work now open for bids. ◉ indicates a contract let recently.

Pennsylvania.

✣Bids will be received until Noon, June 11, by M. L. Cooke, Director, Department of Public Works, Bureau of Water, Philadelphia, Pa., for Contract 192, completion of Queen Lane Filter Plant; Contract No. 193, furnishing and placing cut granite for Queen Lane Filters. Plans and specifications are on file with the Chief of the Bureau.

⊙The Waterworks Commissioners of Erie, Pa., William Hamilton, President, have awarded the contract for waterworks improvements to the Henry Shenk Co., of Erie, at approximately $412,000. The work includes filter plant but not boilers, and boiler house equipment and low service pumping machinery.

The Common Council of Franklin, Pa., has adopted a resolution instructing the Water Commission to investigate the question of obtaining a larger supply of pure water and report the result to Council.

The American Waterworks & Guarantee Co., of Pittsburgh, Pa., has increased its capital stock from $10,000,000 to $20,000,000 for further development.

The Borough Council of Coudersport, Pa., contemplates the installation of a municipal water works system.

South Dakota.

The Town Board of Ethan, S. Dak., has been authorized to install a municipal system of waterworks at an estimated cost of $7,500.

A special election will probably be called soon in Springfield, S. Dak., for the purpose of voting on the issuance of bonds in the sum of $2,500 for the extension of the municipal waterworks system and the grading of the streets.

A number of citizens of Harrisburg, S. Dak., are agitating the construction of a system of waterworks. It is probable that a special election will soon be called to vote on the proposition.

Texas.

The Commercial Club of Cuero, Tex., has asked the City Council to replace the smaller water mains with those 8 ins. in diameter throughout the fire district.

Washington.

✣Bids will be received until 11 a. m., June 15, by Constructing Quartermaster, Vancouver Barracks, Wash., for the removal of a turbine pump from bottom of 205 ft. well, installing a turbine pump capable of handling sand in water capacity 100 gals. per minute, including shafting frame, ladder, etc., and resetting of motor.

West Virginia.

The Commissioners of Parkersburg, W. Va., will sell bonds June 14 in the sum of $100,000 for the purpose of constructing a reservoir and extending the water system of the city.

Wisconsin.

✣Bids will be received until 10 a. m., June 17, by D. W. Stanford, Supt., Walworth County Asylum, Elkhorn, Wis., for the construction of a reinforced concrete reservoir [illegible] ft. in diameter by 11 ft. deep. Bids will be received to include cement and with the cement furnished by the County. W. G. Kirchoff, Madison, Wis., is Consulting Engineer.

The city of Appleton, Wis., will issue bonds in the sum of $200,000 for the improvement of the waterworks system. New mains will be laid to the extent of 15 miles.

Wyoming.

✣Bids will be received until 10 a.m., June 29 by City Council, Torrington, Wyo., for furnishing the necessary labor and material for the construction of a water works system and a sanitary sewer system. Shepperd Engineering Co., 726 Majestic Bldg., Denver, Colo., is Engineer. A certified check for $1,000 must be filed with the bid for water works proposition and a $1,000 check for the sewer system. Charles Brubaker is City Clerk. Official advertisement will be found elsewhere in this issue.

Canada.

✣Bids will be received until 5 p. 10, by D. G. Tate, City Clerk, Vern for Waterworks Contract No. 2, for ply and delivery of 125 gate valves a drants, ranging in size from 4-inch 8-inch. Specifications can be obtained from the City Engineer's office, City Hall, Vernon,

SEWERAGE AND GARBAGE DISPOSA

Alabama.

Sullivan, Long & Haggerty of Bessemer, Ala., have been awarded the contract by the Board of Revenue of Birmingham, Ala., for the construction of the new Boyles sanitary sewer at $34,123. The sewer will be 2½ miles long and will drain the Boyles district.

Arkansas.

⊙The City of Texarkana, Ark., has let the contract for the installation of sewers in District No. 17 to George Conway of Webber Place, which is in the district. The work will cost approximately $17,000.

California.

An election will be held in Fowler, Cal., in the near future for the purpose of voting on the issuance of bonds in the sum of $28,000 for the installation of a sewer system.

A petition has been circulated to annex Erickson and Hero addition to the city of Kingsburg, Cal. Immediately upon their annexation it is planned to call a bond election for the purpose of constructing a sewer system to serve the territory.

Connecticut.

Bernardino Silvestri of Hartford, Conn., submitted the lowest bid to the Board of Contract and Supply of that city for the rebuilding of about 360 ft. of the intercepting sewer at $6,293. Other bidders were: Charles H. Slocomb & Co., $6,421; J. M. Manucchio, $7,864; Pierson Engineering Co., $7,631; W. M. Byrne & Co., $8,640; O'Neil Bros., $7,460; A. D. Bernardino, $8,175; Hartford Paving Co., $6,480, and Frank Dinello, $6,358.

District of Columbia.

Following bids were received by the Commissioners of the District of Columbia, Washington, D. C., on May 28, for furnishing terra-cotta sewer pipe for the use of the district government during the next fiscal year. (1) Standing for bid of Thos. Somerville Co., Washington, D. C.; (2) Potomac River Clay Works, Alexandria, Va.; (3) American Sewer Pipe Co., Akron, O., and (4) J. Parry Lukens, Philadelphia, Pa. Item 1, 6-in. terra-cotta sewer pipe; (1) 7.5 cts.; (2) 7 cts.; (3) 10.4 cts.; (4) 10 cts. Item 2, 8-in. do.; (1) 10.5 cts.; (2) 11.5 cts.; (3) 14.3 cts.; (4) 14 cts. Item 3, 10-in. do.; (2) 15 cts.; (3) 20.4 cts. and 20.8 cts.; (4) 21 cts. Item 4, 12-in. do.; (2) 18 cts.; (3) 26 cts.; (4) 26.5 cts. Item 5, 15-in. do.; (3) 35.1 cts.; (4) 36 cts. Item 6, 18-in. do.; (3) 49.4 cts.; (4) 50 cts. Item 7, 21-in. do.; (3) 78 cts.; (4) 80 cts. Item 8, 24-in. do.; (3) 84.5 cts.; (4) 85 cts. Item 9, 6x6-in. Y's; (1) 31 cts. each; (2) 35 cts.; (3) 40 cts.; (4) 40 cts. Item 10, 8x6-in. Y's; (1) 42 cts.; (2) 45 cts.; (3) 55 cts.; (4) 55 cts. Item 11, 10x6-in. Y's; (2) 65 cts.; (3) 80 cts.; (4) 85 cts. Item 12, 12x6-in. Y's (2) 85 cts.; (3) $1; (4) $1.05. Item 13, 15x6-in. Y's; (3) $1.35; (4) $1.40. Item 14, 18x6-in. Y's; (3) $1.90; (4) $2. Item 15, 21x6-in. Y's; (3) $3; (4) $3.15. Item 16, 24x6-in. Y's; (3) $3.25; (4) $3.50. Item 17, 6-in. one-eighth bends; (1) 23 cts. each; (2) 25 cts.; (3) 30 cts.; (4) 30 cts. Item 18, 6-in. one-quarter bends; (1) 23 cts.; (2) 25 cts.; (3) 30 cts.; (4) 30 cts. Item 19, 8-in. one-eighth bends; (1) 30 cts.; (2) 35 cts.; (3) 21.25 cts.; (4) 55 cts. Item 20, 8-in. one-quarter bends; (1) 30 cts.; (2) 35 cts.; (3) 41.25 cts.; (4) 55 cts.

Following bids were received by the Commissioners of the District of Columbia, Washington, D. C., on May 28, for furnishing 400,000, more or less, repressed vitrified sewer invert brick during the next fiscal year: Morgantown Brick Co., Morgantown, W. Va., $14.93 per M.; Wallace Brick Co., Washington, D. C., $18.55 per M.; Mack Mfg. Co., Philadelphia, Pa., $14.26 per M.; American Sewer Pipe Co., Akron, O., delivery Second and Florida Ave., $17.40; delivery Second and I Sts., southeast, $15.50; Allegheny Valley Brick Co., Torrytown, Pa., $15.40.

Georgia.

✣Bids will be received until 11 a. m., June 15, by Constructing Quartermaster, Fort McPherson, Ga., for the construction of a sewage purification plant.

The City of Nashville, Ga., has employed Engineer C. H. McGahn of Valdosta, Ga., to survey the city and make an estimate of the cost of installing a system of sewers. A. W. Patterson is Mayor.

The citizens of Blackshear, Ga., will vote June 25 on the proposition of issuing bonds in the sum of $23,000 for the install sewer system.

Illinois.

⊙Thornton & Micheals have been the contract by the Board of Local ments of Mattoon, Ill., C. L. James, gineer, for paving and sewer work a including the following: 6,500 yds. o tion; 14,770 sq. yds. brick paving wit filler; 606½ lin. ft. marginal curb; 9 ft. combined curb and gutter; 380 sewer pipe relaid; 760 ft. 12-in. sewer pipe laid; 360 ft. 8-in. sewer pipe laid; catch basins; 17 inlets. Bids were opened a 2

⊙The Board of Local Impr Galesburg, Ill., has awarded the contract for the Ferris St. sewer to the O'Connor Grading & Contracting Co., at $1,936.

An election will probably be held in the village of Minooka, Ill., in the near future for the purpose of voting on the issuance bon for the installation of a sewer syste

The City Council of Rockford, voted an appropriation of $95,263 for struction of the Southeast End sewer $8,50 for the Auburn St. sewer, and $1,780 for the Kilburn Ave. sewer.

Indiana.

✣Bids will be received until 10 a. , J 10, by Board of Marion County Commissioners, Indianapolis, Ind., for the construction of a sewage disposal plant for the Asylum for Incurable Insane, located Ju etta, Ind.

The citizens of Sharpsville, Ind., at re election voted against the installation of sewer system.

City Civil Engineer High O'Neall of Washington, Ind., has submitted plans and specifications to the City Council for a 7-ft. o-ring brick sewer across the south branch of Hawkins Creek on Southeast Fifth St. The sewer will be 60 ft. long and the estimated cost construction is $3,500.

The Common Council of Goshen, Ill., adopted a resolution providing for struction of a sewer system in West

The City Council of Frankfort, I., has passed a resolution ordering the construction

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

strict sewer to drain the western [illegible] the city.

Board of Public Works [illegible] Mich., has been petitioned for a sewer [illegible] St., between Ann and Margaret Sts.

Iowa.

[illegible] Engineers Hall & [illegible] ville, Ia., have prepared plans for a disposal plant for Albia, Ia., and bids [illegible] be asked. The plans include [illegible] sand filters.

Kansas

[illegible] will be received until [illegible] of Education, H. L. McNary, Garnett, for sanitary equipment and sewerage to [illegible] alled in the Longfellow and Irving [illegible]

ids received by City Clerk G. E. Strau- [illegible] Ottawa, Kan., on April 17, for fur- [illegible] installing a garbage [illegible] of 5, 10 or 15 ton [illegible] rs, have been rejected. The project abandoned at the present time. C. S. [illegible] s City Engineer.

Louisiana.

s will be received until 10 a. m., June [illegible] Board of Commissioners, First Sewer- strict, W. J. Sandoz, Secy., Opelousas, the construction complete of sanitary ystem including about 10 miles 6 to 18- , accessories and Imhoff purification [illegible] Kirkpatrick, [illegible] gham, Ala., is Engineer.

Maryland.

wing bids were received by the Board rds of Baltimore, Md., Calvin W. Hen- Chief Engineer of the Sewerage Com- on Sanitary Contract No. 89, San- wers in District No. 40-B: The H. C. Co., Clarksburg, W. Va., $44,840, 125 ; Ryan & Reilly, Baltimore, Md., $48,677, ; Wm. McCarthy & Co., Baltimore, 0,674, 100 days; James Ferry & Sons, altimore, Md., $55,960, 90 days; B. F. & Son, Baltimore, Md., $68,443, 120

Massachusetts.

[illegible] Council of Springfield, Mass., [illegible] the contract to the Merg Engineering Milk St., Boston, Mass., for the dis- [illegible] garbage.

Selectmen of Monson, Mass., contem- stalling a sewerage system.

Michigan.

s will be received until noon, June Board of Public Works, Sturgis, Mich., nishing the materials and labor requir- ilding a system of sewers, comprising mately 40,000 ft. of 8 to 18-in., 3,000 ft. ewers, a sewage pumping station and ge disposal plant. Official advertise- ill be found elsewhere in this issue.

contract for furnishing about 50,000 rick to the City of Alpena, Mich., has arded to F. B. Stevens of Detroit, at $8.80 per M., f. o. b. Alpena.

ewer committee of Kalamazoo, Mich., n definite action toward the expendi- $25,000 for the new sewer mains and during the coming year. It is planned a trunk line sewer similar to the St. main on Patterson St. and Doug- at an estimated cost of $13,000. Lat- roughout the city will be constructed remaining $12,000.

ls received May 27 by the City Coun- osswell, Mich., for the construction of in Main District No. 1 in the city of ll, have been taken under advisement ne 10. J. W. Dexter is City Clerk.

Minnesota.

will be received until 5 p. m., June 7, mon Council, Austin, Minn., for the tion of a sewer on Kenwood Ave. d specifications are on file with Frank , City Recorder.

Engineer L. W. Clarke of Stillwater, has prepared plans for the construc- the South Second St. sewer, which [illegible] the [illegible] received during July.

City Engineer H. E. Blomquist of Mankato, [illegible] building of a sanitary sewer on North Fifth St.

Missouri.

The Council of Maplewood City, Mo., has rejected all bids received for the installation of a sewer system in Sewer District No. 2, [illegible] will be re-advertised.

The City Council of Springfield, Mo., has retained Consulting Engineer Alexander Potter, 114 Liberty St., New York City, to make the survey for the extension of the public sewers, to prepare plans and specifications for [illegible] for the superintendency of the work.

Montana.

The City Council of Lewistown, Mont., has sold bonds in the sum of $60,000 for sewer work to N. W. Halsey & Co., of Chicago, Ill.

Nebraska.

⊙The Conley Incinerator Co., 1508 Burt St., Omaha, Neb., has been awarded the contract for the erection of the garbage incinerator at the Puget Sound Navy Yard, Bremerton, Wash. The contract price is $5,750.

New Jersey.

⊙The Donlon Contracting Co., 84 Broadway, Brooklyn, N. Y., has been awarded the contract by the Passaic Valley Sewerage Commissions, Newark, N. J., for the construction of Section 15 of the intercepting sewer system at $207,419. Bids were opened May 14. The itemized bids received on the work were given in a recent issue.

Bids [illegible] May 28 by the Passaic Valley Sewer Commission, J. S. Gibson, Clerk, Newark, N. J., for the construction of Section 9 of the Main Intercepting Sewer, the work including the following approximate quantities: 1,700 lin. ft. [illegible] sewer in trench, from about 23 ft. to about 30 ft. in depth; 2,300 lin. ft. 126-in. concrete sewer in tunnel; 4,500 [illegible] Portland cement concrete in trench; 6,000 cu. yds. Portland cement concrete in tunnel; 100 cu. yds. brick masonry in manholes; 100 cu. yds. rock excavation in trench. The itemized bids received on this work were as follows: (1) Standing for bid of O'Rourke Engineering Construction Co., New York; (2) for bid of the J. F. Shanley Co., Newark, N. J.; (3) for Bell Ross Contracting Co., New York; (4) for J. Connelly Construction Co., Cleveland; (5) for J. F. Cogan Co., New York; (6) for Mullen, O'Roirden & Miller, Boston, Mass.; (7) for Cantrell Construction Co., Philadelphia, Pa.; (8) for McCanley-Manton Co., Brooklyn, N. Y.:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earth excavation and refilling in [illegible] lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$ 22.12
Earth or rock excavation and refilling [illegible] sewer, 2,300 lin. ft.	[illegible]	[illegible]	[illegible]	[illegible]	94.00	[illegible]	70.00	48.75
Concrete masonry in trench, 4,500 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Concrete masonry in tunnel, 6,000 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.00	[illegible]	11.70
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.00	15.00
Rock excavation in trench, 100 cu. [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10.00	[illegible]	3.50
Totals	$678,300	$614,200	$478,235	$431,700	$129,200	$356,800	$294,825	$262,564

New York.

✣Bids will be received until June 17, by Board of Sewer Commissioners, Frankfort, N. Y., for the construction of new septic tank, in accordance with plans and specifications on file with Perry Vrooman, Canajoharie, N. Y., Engineer.

The Metropolitan Sewerage Commission of New York City has asked the Board of Estimate for an appropriation of $47,000 to commence operation on the new sewer system.

State Health Commissioner Eugene H. Porter has notified the city officials of Hornell, N. Y., that they must have plans prepared by June 20 for the installation of a sewage disposal plant, to stop polluting the Canisteo River.

[illegible] of Corning, N. Y., have been instructed by State Health Commissioner Eugene H. Porter to have plans prepared by June 20 for the installation of a sewage disposal plant.

The Sewer Committee of Huntington, N. Y., has passed a resolution to adopt the Imhoff [illegible] The district [illegible] in length, and a mile or more in width, extending from the Long Island Railroad on the south to the Mill Pond on the north and from the high school building on the east to the top of Cold Spring Hill and the country club on the west. The plant will cost approximately [illegible].

Ohio.

✣Bids will be received until noon, June 6, by Director of Public Service, Cleveland, O., for the construction of sewers in the following named streets, avenues, courts and thoroughfares: Euclid Ave., between East 40th St. and East 55th St. [illegible] Ave. N. E., between East 100th St. and East 103rd St. West 88th St., between Brinsmade Ave. S. W. and Denison Ave. S. W. Adams Ave. N. E., between East 92nd St. and East 105th St. East 92nd St., between Adams Ave. N. E. and Pierpont Ave. N. E. East 93rd St., between St. Clair Ave. N. E. and Adams Ave. N. E. Yale Ave. N. E., between East 93rd St. and East 105th St. Empire Ave. N. E., between East 93rd St. and Herrick Rd. N. E. Each bid must be made in accordance with the plans and specifications, which may be seen at the office of the Chief Engineer, Room 305, City Hall. W. H. Kirby is Secretary.

⊙D. E. Sullivan & Son have been awarded the contract by the Board of Control of Columbus, O., for the construction of the West Side storm sewer. The sewer will drain the territory west of the Hilltop and south of Broad St., ranging in size from 24 ins. to 8 ft. in diameter. The cost is about $60,000.

⊙The Board of Control of Columbus, O., has let the contract for the construction of the relief sewer in Medill Ave. and 20th St. to H. E. Hunt at $22,000.

The City Council of Toledo, O., has approved a resolution providing for the construction of a sewer in the section of the city known as Glassboro, to drain Maher, Central, Paxton, St. John, Norton and other streets in the vicinity. It will be 11,000 ft. long, and will cost about $10,000.

Oklahoma.

The City Commissioners of Bartlesville, Okla., have approved the plans and specifications of City Engineer E. D. Kirkpatrick, for the three new sewer districts, which were recently created. District No. 5 embraces blocks 1, 2, 3 and 4, also 125 ft. of block 23 in the George B. Keeler addition. District No. 6 comprises blocks 1, 2, 3 and lot "D" in the McCaleb addition. District No. 7 consists of blocks 4, 5, 6 and the east half of 7 in McCaleb addition.

Oregon.

⊙K. L. Hall has been awarded the contract by the sewer committee of the City Council, Eugene, Ore., for the construction of an 8-in. sewer in the alley between Madison and Monroe from First to alley between Clark and Cheshire to the Jefferson St. sewer. The contract price is $1,294.

Following bids were received May 27 by the City Executive Board of Portland, Ore., for sewers, as follows: East 33rd St., extension of the Sullivan's Gulch sewer system—Concrete Construction Co., lock joint sewer, $84,827; E. L. Riner, reinforced concrete sewer, $79,983; Jeffery & Bulton, reinforced concrete sewer, $91,008; Reliance Construction Co., monolithic sewer, $95,162, lock joint sewer, $87,101, and reinforced concrete sewer, $85,231; Jahn Construction Co., reinforced concrete sewer, $85,994, and lock joint sewer, $89,949; Municipal Construction Co., lock joint sewer, $88,790; Pacific Bridge Co., monolithic sewer, $92,745, and lock joint sewer, $89,685; Pearson Construction Co., monolithic sewer, $106,814, and lock joint sewer, $95,487; K. G. Lundstrum, reinforced concrete sewer, $92,694.

Pennsylvania.

✣Bids will be received until 8 p. m., June 6, by Sewer Committee, Pittsburgh, Pa., for the construction of a 5, 4 and 3 ft. brick or concrete storm sewer in Sill and Patterson avenue, and a 12, 10 and 4 in. sanitary terra cotta sewer in Patterson and Starcamp avenue. Approximate estimates: 3,000 ft. of 5-ft. brick or concrete storm sewer. 2,300 ft. of 4-ft. brick or concrete storm sewer. 750 ft. of 3-ft. brick or concrete storm sewer. 1,960 ft. of 12-in. sanitary terra cotta sewer. 1,810 ft. of 10-in. sanitary terra cotta sewer. 120 ft. of 8-in. sanitary terra cotta sewer. 370 ft. of 4-in. sanitary terra cotta sewer. With the necessary inlets, manholes, concrete outlet, etc. Plans and specifications on file in the office of the City Engineer. C. E. Soles is City Controller.

⦿George Waller, of Wampum, Pa., has been awarded the contract at Ellwood City, Pa., for the construction of the southern part of the Fourth St. storm sewer at $6,105.

The Highway Committee of Williamsport, Pa., will re-advertise for bids for the completion of the Funston Ave. sewer work. John B. Otto is City Engineer.

Engineers in the Department of Public Works of Harrisburg, Pa., have made preparations to begin surveys for the retaining wall for the interceptor sewer.

The Borough Council of Collingdale, Pa., has passed an ordinance considering an increase in the borough's indebtedness of $40,000 for constructing a system of sewers.

Texas.

City Engineer Frank Dormant, of Houston, Tex., has workel out a complete new sewerage system for every section of the city. An election will be held June 26 for the purpose of voting on the issuance of bonds in the sum of $2,500,000 for municipal improvements, included in which will be $1,000,000 for the sewers.

Plans have been prepared by City Engineer L. C. Hinckley of Wichita Falls, Tex., for extending the sewer system a distance of 8,000 ft. at an estimated cost of $4,000. The work includes 11 manholes. The work will be done by day labor.

Virginia.

⦿George M. Guild & Co., of Chattanooga, Tenn., have been awarded the contract at Norfolk, Va., for the installation of a complete new sewer system in two wards, at $200,000.

Washington.

⦿Geo. Westgate has been awarded the contract by the city of Snohomish, Wash., for the construction of the Pine St. sewer at $4,574.

⦿The City Council of Pasco, Wash., has let the contract for the construction of sewers in the Sylvester addition to the Paine Construction Co., of Tacoma, Wash., at $6,787.

City Engineer W. H. North, of Bellingham, Wash., has submitted preliminary estimates on the sewers in an alley between Grant and Humboldt Sts. The sewer will be 8 ins. in diameter and will cost approximately $3,656.

Wisconsin.

✣Bids will be received until 10 a. m., June 15, by Board of Public Works, Racine, Wis., for furnishing the necessary labor and material for constructing public sewer Da Place from the end of the present s er to point 80 ft. south, including 80 lin t. 8-in pipe; 1 lamphole. P. H. Connolly is member of the board.

⦿E. R. Harding Co., of Racine, is., has been awarled the contract by the Boa of L cal Improvements of Sandwich, Ill. for th construction of a sewer system, incluc g puri fication plant at $38,301. Other bidd were F. T. Banner & Co., Marion, Ind., 42,085 John W. Farley, La Grange, Ill., $42,6 ; C. T Bartlett, Chicago, Ill., sewer syste $28,547, and Grav Robinson & Co., Ill., sewer system only, $30,281.

⦿The contract for the erection of tank and the building of a sewer s awarded by the town of Johnson Cre, Wi to F. P. Mansfield, f Lakemills, $3,680 and $1,700.

The City Council of Kewaunee, s accepted the plans prepared by Eng W. Reed, of Green Bay, Wis., for th tion of a sewer system.

Wyoming.

✣Bids will be received until 10 a 29, by City Council, Torrington, W furnishing the necessary labor and for the construction of sanitary sew and a water works system. Sheppe Engineering Co., 726 Majestic Bldg., Denv are Engineers. Separate checks i each must be filed with bids for the constructions. C. D. Brubaker is City Clerk advertisement will be found elsewher issue.

Canada.

✣Bids will be received until June E. Moore, Secretary-Treasurer, Tisda for the necessary labor and materia stalling a system of storm-water sewe

The Town Council of Berlin, Ont., mit by-laws to the taxpayers providin construction of a new trunk system o the erection of municipal sheds, the of two new street cars, the erectio barns and the purchase of 20 acres fo and agricultural show grounds mated cost of the sewers is $100,000.

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ET.

Alabama.

⦿The Southern Ferro Concrete Co. of Atlanta, Ga., Engineers and Contractors, has been awarded the contract for the design and erection of a 5-story reinforced concrete skeleton frame for a modern, up-to-date mercantile building at Birmingham, Ala., for R. D. Burnett. The size of the building is 140x50 ft. Harry B. Wheelock, Birmingham, is the architect.

Connecticut.

✣Bids will be received until 11 a. m., June 15, by Capt. F. T. Arnold, Constructing Quartermaster, New London, Conn., for constructing at Fort Terry (Plum Island), N. Y., a coal handling and storage plant, consisting of a frame building with concrete floor and footings, industrial railway, motors, etc.

District of Columbia.

✣Bids will be received until Noon, June 12, by Lieut. Col. W. C. Langfitt, U. S. Engineer, 920 17th St. N. W., Washington, D. C., for furnishing materials and erecting complete a brick storehouse on Potomac Park.

✣Bids will be received until 2 p. m., June 11, by Disbursing Clerk, U. S. Department of Agriculture, Washington, D. C., for the furnishing of 250 miles No. 22 B. & S. gage insulated copper wire and 250 miles of No. 20 B. & S. gage insulated copper wire.

✣Bids will be received until 10:30 a. m., June 8, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 714, malleable iron castings, wrought iron or steel pipe, steel cable, bronze wire cloth, anvils, galvanized buckets, shovels, cocks, window glass, packing and sulphate of copper.

✣Bids will be received until 2:30 p. m., June 8, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 714-A, steel reinforcing bars.

✣Bids will be received until 11 a. m., June 17, by Maj. H. L. Pettus, Depot Quartermaster, Washington, D. C., for the construction complete, including plumbing, electric work, etc., of an isolation hospital, kitchen addition to hospital proper and an addition to nurses' quarters, Walter Reed General Hospital, Takoma Park, D. C.

✣Bids will be received until June 10, by Chief Signal Officer, War Department, Washington, D. C., for furnishing under proposal 590, 23,000 ft. of cable, 10 pair paper insulated, lead sheathed, and 28,000 ft. cable paper insulated, lead sheathed and armored.

Georgia.

✣Bids will be received until 11 a. m., June 15, by Capt. Guy Cushman, Constructing Quartermaster, Fort Oglethorpe, Ga., for the construction of an electric lighting syste post.

Illinois.

✣Bids will be received until 2 p. Ju 1, by N. M. Woodward, City Clerk Cha paign, Ill., for furnishing the necessa and material for the installation of a street lighting system. J. R. Cra Old Colony Bldg., Chicago, Ill., is Co Engineer.

Hawaii.

✣Bids will be received until Noon, ne by Frank B. Edwards, Constructing arte master, Honolulu, H. T., for construc n, cluding plumbing, electric wiring and xture of an addition to hospital building Fort Shafter, Honolulu, H. T.

Louisiana.

✣Bids will be received until Noon, by William Folse, Chairman, Buildi mittee, Paterson, La., for the construct high school building to be erected at t Stevens & Nelson Co., 1109 Henne New Orleans, La., are Architects.

✣Bids will be received until 7:30 p. 12, by Board of Commissioners of the New Orleans, 200 New Orleans Cou New Orleans, La., for furnishing and steel rolling doors in the William A. han and Press St. sheds built on t front.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Massachusetts.

s will be received until 2 o. m., June 7, artment of Agriculture, Washington, D. remodeling barns, constructing railroad uperintendent's house, erecting a wire tc., at the U. S. animal quarantine sta- ttleton, Middlesex County, Mass.

Michigan.

s will be received until 3 p. m., June Col. C. McD. Townsend, U. S. Engi- ederal Bldg., Detroit, Mich., for the g of Rouge River, Mich.

Minnesota.

s will be received until 2 p. m., June 27, t House Inspector, Detroit, Mich., for struction of a double dwelling for at Duluth Range Light Station, Minn.

Missouri.

s will be received until 11 a. m., June ieut. Col. C. L. Potter, U. S. Engineer, s, Mo., for furnishing 20,000 piles.

s will be received until 11 a. m., June ieut. Col. C. L. Potter, U. S. Engineer, is, Mo., for furnishing 80,000 cu. yds. and 20,000 cu. yds. of spalls.

s will be received until 11 a. m., June ieut. Col. C. L. Potter, U. S. Engineer, s, Mo., for furnishing 50,000 cords of

New Jersey.

s will be received until 3 p. m., June oard of Chosen Freeholders, Hudson Jersey City, N. J., for the construc- a concrete bulkhead wall on the Hack- River at the Penitentiary, Secaucus, Valter O'Mara is Clerk.

s will be received until 11 a. m., June H. R. Stanford, Chief of Bureau of nd Docks, Navy Department, Wash- D. C., for a reinforced concrete floor, stairs, railings, etc., at the U. S. lagazine, Fort La Fayette, N. J.

New York.

will be received until June 27 by Zalinski, Depot Quartermaster, Army New York City, for furnishing and ting an iron fence or railing to sur- he present stone wall extending along and north sides of the Cypress Hills, Cemetery, Brooklyn, N. Y.

will be received until Noon, June 12, W. M. Black, U. S. Engineer, Army New York City, N. Y., for furnishing vering Portland cement.

will be received until 10 a. m., June onstructing Quartermaster, Fort Slo- Y., for furnishing the labor and ma- r reflooring the dining room, bread d dishwashing room in the general lding at Fort Slocum, N. Y.

Ohio.

will be received until 1 p. m., June io State Board of Agriculture, Colum- for furnishing all material and per- e of all labor to build and erect a barn, farm barn, piggery anl sanitary pits at the State Serum Farm, in Lick- nty, 13 miles from Columbus, Ohio. nd specifications prepared by Dawson , architects, 44 East Broad St., hio, and on file at the offices of [illegible] state, with all [illegible]

Pennsylvania.

will be received until noon, June 11, el B. Rambo, Superintendent of Pub- nds and Buildings, Harrisburg, Pa., nstruction of a protecting wall, terraces, etc., around the monu- ted by the Commonwealth of Penn- at Cherry tree or Canoe place, In- ounty, Pa.

Riverside Construction Co., 39 Cort- ., New York City, has been awarded tract by the Bureau of Yards and Navy Department, for pier work at phia, Pa., bids for which were opened

Texas.

[illegible] erection and completion of a school building. C. H. Page & Bro., Austin, Texas, are Architects.

✣Bids will be received until Noon, June 10, by Judge E. P. Marshall, Nacogdoches, Texas, for the construction of a 2-story reinforced concrete and brick jail building. Lang & Witchell, 623 Wilson Bldg., Dallas, Texas, are Architects.

Virginia.

✣Bids will be received until Noon, June 15, by J. R. Holland, Chairman, Holy Neck District School Board, Holland, Va., for the erection of 2-story brick school building to be erected at Boulder, Nansemond County, Va.

Washington.

✣Bids will be received until noon, July 1, by Maj. J. B. Cavanaugh, U. S. Engineer, Seattle, Wash., for furnishing 200,000 barrels of Portland cement. Official advertisement will be found elsewhere in this issue.

✣Bids will be received until Noon, June 28, by Maj. J. B. Cavanaugh, U. S. Engineer, Seattle, Wash., for the furnishing of sand and gravel.

✣Bids will be received until Noon, July 1, by Maj. J. B. Cavanaugh, U. S. Engineer, Seattle, Wash., for furnishing 200,000 barrels of Portland cement.

⦿Deitrich & Co., Globe Block, Seattle, Wash., have been awarded the contract at about $10,000 for constructing a municipal wharf for the City of Brementon, Wash. The structure will be of frame construction, and the contract includes piling and wharf floor. Bids [illegible]

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Diagrams for Designing Reinforced Concrete Structures; Including Diagrams for Reactions and Strength of Steel Beams

By G. F. Dodge, M. West. Soc. Eng.
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DITCH AND LATERAL DRAINS.

Sealed bids will be received by the Auditor of Pottawattamie County, Ia., at Council Bluffs, up to 1:30 P. M. Tuesday, June 18, 1912, for construction of the Wilson ditch and lateral drains, in Harrison County, Ia. The main ditch is about two miles long, with six feet bottom width. The estimated excavation is 98,800 cubic yards, the time limit for completion is Jan. 1, 1913. This work is suited to a small dragline or other dry land machine.

In connection with the above main ditch, six lateral drains are required; three of these are small open ditches with four feet bottom width, the total excavation being about 24,800 cubic yards. The time limit for completion on this work is December 1, 1912. This is all dry land work, suitable for a small machine.

There are three tile drains requiring the following quantities of material, viz.:

1,000 lineal feet of 10-inch tile.
1,300 lineal feet of 12-inch tile.
1,300 lineal feet of 14-inch tile.
1,800 lineal feet of 16-inch tile.
1,300 lineal feet of 20-inch tile.
1,475 lineal feet of 24-inch tile.
1 catch basin.
18 manholes.

The contractor will bid to furnish the material and do the work. The time limit for completion is December 1, 1912.

Contractors can bid for portions or all of the work, the right being reserved by the Joint Boards of Supervisors of Harrison and Pottawattamie Counties to reject any or all bids.

The work is located on the Missouri bottom four miles southwest from Missouri Valley, Ia.

Plans and profiles are on file with the County Auditor at Logan, Ia., and with the Auditor at Council Bluffs, Ia., and specifications, form of contract and blank form for bidders can be had on application to either of those officers or to Seth Dean, Construction Engineer, at Glenwood, Ia.

The bids will be opened at 1:30 P. M., June 18, 1912, at the room of the Board of Supervisors in the Court House at Council Bluffs.

A. F. GAINES,
Auditor of Harrison County, Ia.
Logan, Ia., May 28, 1912.

CONCRETE AND STEEL BRIDGES.

Sealed bids will be received by the Board of Supervisers of Audubon County until 9 o'clock a. m., June 12, 1912, for the construction of concrete and steel bridges in the county.

Plans and specifications on file with the County Auditor at Audubon, Iowa, and the Engineer, C. D. Forsbeck, 613 Black Hawk Bldg., Waterloo, Iowa. Each bid must be accompanied by a certified check for two hundred dollars.

U. S. ENGINEER OFFICE, Seattle, Wash., May 28, 1912.—Sealed proposals for furnishing 200,000 barrels of Portland cement will be received here until 12 m., July 1, 1912, and then publicly opened. Information on application. J. B. CAVANAUGH, Major, Engrs.

WATER WORKS SYSTEM AND SANITARY SEWER.

Torrington, Wyo., May 21, 1912.

Sealed bids will be received by the City Council of the City of Torrington, Wyo., until 10 o'clock a. m. of Saturday, June 29, 1912, for the furnishing of all materials and the complete construction of a water works system and a sanitary sewer system for the Town of Torrington, Wyo., according to plans and specifications on file in the office of the City Clerk of said city, and in the office of the Shepperd Engineering Company, 726 Majestic Bldg., Denver, Colo.

Bids must be submitted separately on the above propositions.

Each bid on the water works proposition must be accompanied by a certified check for $1,000.

Each bid on the sewer proposition must be accompanied by a certified check for $1,000.

All necessary information, blank forms of proposals and instructions to bidders will be furnished on application to the City Clerk of Torrington, Wyo.

Copies of plans and specifications may be obtained from the City Clerk of Torrington, Wyo., or the Shepperd Engineering Co., Denver, Colo., upon payment of $5.00 per set.

The right is reserved to reject any or all bids.

CHARLES D. BRUBAKER
RALPH PAXTON, Mayor.
City Clerk.

PROPOSALS FOR DREDGING.

May 30, 1912.

Sealed bids addressed to J. H. Nelms, Chairman, will be received at the office of the Engineer, Room 430, New Weinberg building, Greenville, Miss., by the Board of Washington County Drainage Commissioners, to 12 m., July 1, 1912, for the construction of about nineteen miles of dredge ditch ranging from twenty-six to fifty-six feet bottom; approximate quantities 1,960,000 cubic yards. Also for the clearing of two natural streams aggregating about seventeen miles. Plans, profiles and specifications are on file at the office of the Engineer, and can be furnished on application. A certified check for $5,000.00 must accompany each bid. The right is reserved to reject any or all bids, or to let the work as may appear to be for the best interest of the district.

THE WASHINGTON COUNTY DRAINAGE COMMISSIONERS.
B. B. GORDAN, Chief Engineer.
Greenville, Miss.

TREASURY DEPARTMENT.—Office of the Supervising Architect, Washington, D. C., May 27, 1912. Sealed proposals will be received at this office until 3 o'clock p. m., on the 10th day of July, 1912, and then opened for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring system and interior lighting fixtures) of the United States postoffice at Lansing, Mich. This extension is about 38 by 74 feet, two stories and basement, stone faced, slate roof, fireproof construction. Drawings and specifications may be obtained from the custodian at Lansing, Mich., or at his office, in the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

SEWERS AND SEWAGE DISPOSAL WORKS.

Sealed proposals will be received by the Board of Public Works of the City of Sturgis, Michigan, until twelve o'clock (noon) Tuesday, June 18th, 1912, for furnishing the materials and labor required in building a system of sewers, comprising approximately 40,000 feet 8 to 18-inch, 3,000 feet 30-inch, a sewage pumping station and a sewage disposal plant.

All bids must be made upon the printed forms prepared for the purpose and enclosed in a sealed envelope, directed to the Board of Public Works, and endorsed on the outside of the envelope, "Proposals for Sewers."

Each bid must be accompanied by a certified check for sewers $2,000, disposal plant $500, pumping station $500, as a guarantee of good faith.

Plans and specifications for the work can be seen at the office of the Board of Public Works and at the office of Geo. S. Pierson, Engineer, Kalamazoo, Mich.

The City of Sturgis reserves the right to reject any bid and all bids and to consider the qualifications of bidders in determining the award of the contract.

BOARD OF PUBLIC WORKS
Sturgis, Mi

STREET MPROVEMENT.

Bids for the improvement of approximately one and one-half miles of streets, by grading, curb and guttering, and paving with asphalt, will be received by the City Recorder of Salt Lake City, Utah, until 10 o'clock a. m., June 24th, 1912. The approximate yardage to be laid is 35,000 sq. yds.

Plans and specifications can be seen at the office of the City Engineer, or copies may be obtained upon receipt of a 00 deposit.

By order of the Board of Commissioners.

NOBLE WARRUM
City Record

CONCRETE SEWER.

Burlington, Iow

Bids for the construction of 1,065 feet of 16-foot reinforced concrete arch sewer will be received at the office of the City Clerk up to 9 a. m., June 17, 191

For plans and specifications addres

H. G. VOLLMER,
City Enginee

TRACK LAYING TO LET.

TO LET—35 miles of track laying on the Gainesville & Northwestern Railway out of Gainesville, Ga. Address Burk & Joseph, Cape Girardeau, Mo.

DEPARTMENT OF THE INTERIOR—United States Reclamation Service, Washington, D. C., June 1, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Elephant Butte, New Mexico, until 2 o'clock p. m., June 20, 1912, for furnishing ball mills, tube mills, a rock crusher, a rotary dryer and a mixing and weighing machine for a sand-cement plant on the Rio Grande Project, New Mexico-Texas. For particulars address the U. S. Reclamation Service, Elephant Butte, New Mexico, or Washington, D. C. F. H. NEWELL, Director.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SEALED PROPOSALS

For Construction of Cook County Hospital General Work.

Sealed proposals are [illegible] Board of Commissioners [illegible] for the furnishing of all labor, materials, machinery, apparatus, implements, etc., except that portion contained in the plans and specifications for plumbing work, required in the erection and completion of the new Cook County Hospital, to be located on blocks 1 and 2 of David Codwise's Subdivision of the East Seventy-four and Fifty-two hundredths (74.52) acres of the West one-half (½) of the Southeast one-quarter (¼) of Section eighteen (18), Township thirty-nine (39), Range fourteen (14), East of the third P. M., comprising twelve and two hundred fifty-three thousandths (12.253) acres and bounded by Harrison Street on the North, Polk Street on the South, Wood Street on the East and Lincoln Street on the West, in the City of Chicago, and State of Illinois, in accordance with drawings and specifications with addenda No. 1 to said specifications, prepared by Paul Gerhardt, County Architect, which plans and specifications with addenda No. 1 to said specifications may be obtained in my office, Room 519, Cook County Court House, Chicago, Ill.

Contractors desiring to figure on this work must deposit sum of Two Hundred and Fifty ($250.00) Dollars, which must be in the form of currency or certified check made payable to the order of P. J. Murray, Superintendent of Public Service, for each set of plans and specifications, which amount will be receipted for and returned to them upon the return in good order of all plans and specifications.

Proposals must be made on the regular printed form to be obtained in my office, Room 519, Cook County Court House, and must be enclosed in envelope furnished for the purpose, which must be sealed, properly indorsed and addressed to P. J. Murray, Superintendent of Public Service, Room 519, Cook County Court House.

Each bid must be accompanied by a deposit of Fifty Thousand Dollars ($50,000), which must be in the form of currency or certified check made payable to the order of Peter Bartzen, President of Board of Commissioners of Cook County, and must be drawn upon some banking institution of good standing doing business in Cook County, which deposit will be returned to the bidder if his bid is rejected; or, if his bid is accepted, upon bidder entering into contract with Cook County and giving such bond as may be required for the satisfactory performance of the same within five days from date of notification that said contract and bond are ready for signature. Should the bidder fail to enter into said contract and bond within five (5) days from date of notification that said contract and bond are ready for execution, said deposit shall be retained by Cook County, not as a forfeiture but as liquidated damages which the owner will suffer by reason of such default.

Bids will be received in my office up to 2:00 p. m., Wednesday, June 12, 1912, and must be deposited in the box provided for that purpose, said bids to be transmitted to the Board of Commissioners of Cook County at 2:00 p. m., by whom they will be publicly opened.

[illegible] der gives satisfactory proofs of his ability [illegible] tude [illegible] specifications, with addenda No. 1 to said [illegible] in all respects within the time stated in the Instructions to Bidders.

Consideration will be given to proposals for delivering the work complete before the time stated in the Instructions to Bidders.

Firms bidding will give the names of individuals comprising same and corporations bidding will give the names of their executive officers and names of officials authorized to execute contracts on behalf of the corporation.

The right is reserved to reject all bids.

By order of the Board of Commissioners of Cook County.

P. J. MURRAY,
Superintendent of Public Service.

CONCRETE SUB-CONTRACTORS WANTED.

We have about twenty thousand cubic yards of concrete work distributed in small bridges, abutments, headgates, drops, etc., which we will let to responsible contractors in quantities to suit at good prices.

JANSEY BROS.-BOOMER & HUGHES.
1-2 Mackie Bldg.,
Calgary, Alberta.

PROPOSAL.

Fort Bliss, Texas, May 17, 1912.

Sealed proposals in triplicate will be received until 12 Noon, June 10, 1912, and then opened for furnishing labor and material for constructing sewer pipe line connecting outfall sewer at Fort Bliss with sewerage system of El Paso, Texas. Information furnished upon application. Envelopes containing proposals to be indorsed "Proposals for Sewer Pipe Line" and addressed to constructing quartermaster.

CAPT. ROBERT J. REANEY,
Constructing Quartermaster.

NOTICE TO PAVING CONTRACTORS.

Sealed bids will be received by the President and Board of Trustees of the Village of Dolton, Illinois, until 8 o'clock p. m. of June 10, 1912, and then publicly opened, for the paving of certain streets as follows: A 16-foot pavement on Lincoln Avenue and Chicago Street, being 630 rods, more or less. Specifications may be had from the Village Clerk or W. F. Propper, 911 Ashland Block, Chicago.

Each bid must be accompanied with a certified check for the sum of $1,200.00. The Village Board reserves the right to reject any or all bids received. A real estate bond acceptable to the Village Board for 50 per cent of the contract price will be required.

WILLIAM G. DOLTON,
Village Clerk,
Dolton, Cook County, Illinois.

NOTICE OF LETTING DRAINAGE CONTRACT.

Sealed proposals for the construction of drainage canals in the Back Swamp and Jacob Swamp Drainage District, near Lumberton, N. C., will be received by the drainage commissioners of said district at Lumberton, N. C., up to 12 o'clock M., June 12, 1912, and at that time they will be publicly opened and read. Each proposal shall be inclosed in a sealed envelope and addressed to the chairman of the Board of Drainage Commissioners of the Back Swamp and Jacob Swamp Drainage District, Lumberton, N. C., endorsed "Proposal for Constructing Drainage Canals."

Each proposal shall be accompanied by a certified check, drawn payable to the order of the chairman of the Board of Drainage Commissioners, in the amount of $1,000; this check to be an evidence of the good faith of the bidder and to be held as liquidated damages in case the award is made and the contract and bond are not entered into promptly. Checks of unsuccessful bidders will be returned as soon as the award is made.

Specifications and blank forms of proposals will be furnished upon application, and a full set of maps, plans and profiles may be seen at the office of the Drainage Commissioners, or at the office of the Attorney for the Drainage Commissioners, at Lumberton, N. C.

The approximate length of these canals is 52 miles, and the approximate yardage to be excavated is 1,240,400 cu. yds. The work must be finished within two years from the letting of the contract and the commissioners will require three dredges to be operated at the same time.

The work will be let either as a whole or in sections, but no bid will be considered for less than one-third of the entire work. Bidders may submit bids for the whole of said work or for one-third thereof. The right is reserved to reject any and all bids.

G. B. SELLERS.
Chairman for Board of Commissioners.
THOMAS L. JOHNSON.
Attorney for Drainage District.

The Board of Drainage Commissioners of the Keach Drainage & Levee District of Carrollton, Illinois, will receive plans and proposals for a forty-eight inch pump and engine for their District. Address A. W. Baldwin or Loren McKee, Carrollton, Illinois.

Mammoth Hot Springs, Wyo., May 15, 1912. Sealed proposals in triplicate, will be received here until 2 P. M. June 10, 1912, and then publicly opened, for furnishing labor and materials for constructing Annex to Hospital, including plumbing, heating, electric wiring and fixtures, at Fort Yellowstone, Wyo. Information furnished on application. Envelopes containing proposals to be indorsed "Proposals for Annex to Hospital" and addressed to Constructing Quartermaster.

Mammoth Hot Springs, Wyo., May 15, 1912. Sealed proposals in triplicate, will be received here until 2 P. M. June 10, 1912, and then publicly opened, for furnishing and installing pews and other furniture in Chapel at Fort Yellowstone, Wyoming. Information furnished on application. Envelopes containing proposals to be indorsed "Proposals for Furniture in Chapel" and addressed to the Constructing Quartermaster.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SUBSTRUCTURES FOR STEEL VIADUCTS.

Bids will be received by the General Manager Ft. Dodge, Des Moines & Southern, for the construction of the concrete substructure for Steel Viaduct Bridge 2¼ North of Boone, Ia.

Bids will be received until 12 o'clock, noon June 8, 1912. Each bid must be in accordance with the form of proposal as furnished by General Manager, and accompanied by a certified check of $100 on some reliable bank of Boone, payable to the Ft. Dodge, Des Moines & Southern, to be forfeited if the successful bidder fails to enter the contract.

The proposed work consists of two abutments and twenty-eight piers containing approximately 740 yards of concrete.

Plans and specifications may be obtained from Chief Engineer, Boone, Ia.

Two bids will be received, one for concrete with broken stone and one for concrete with gravel.

The right to reject any and all bids is reserved. Proposals should be enclosed in a sealed envelope and marked "Proposal for Substructure Steel Viaduct Bridges."

C. H. CROOKS, Gen. Mgr.,
Ft. Dodge, Des Moines & So. R. R.
Boone, Iowa.

PAVING MATERIALS.

Sealed bids will be received at the office of the Village Recorder of Chisholm, Minn., up to 5 p. m. of Wednesday, June 12, for the construction complete of about 12,950 sq. yds. of paving. Bids will also be received on the material only for each pavement. The pavement on which bids will be received are sandstone, bitulithic, creosoted wood blocks, donnellite, granocrete and brick.

Plans and specifications can be seen at the offices of the Village Recorder and Engineer. All bids must be on form of proposal furnished by the village.

A certified check for five per cent (5%) of the amount of bid, made payable to the Village of Chisholm, Minn., must accompany each bid.

The right is reserved to reject any and all bids or to accept any bid considered advantageous to the village.

F. C. LANG,
Village Engineer.

OFFICE OF CONSTRUCTING QUARTERMASTER.—Fort Huachuca, Arizona, May 9, 1912.—Sealed proposals will be received here until 10 a. m. June 12, 1912, and then publicly opened, for construction complete of eight inch steel water pipe line approximately eight and one-half miles long. Deposit of $10 required to insure return of plans and specifications. Information on application. J. L. JORDAN, Capt. and Quartermaster, U. S. A.

Fort Hancock, N. J., June 1, 1912. Sealed proposals, in triplicate, will be received here until 12 m., June 15, 1912, and then opened, for installing electric lighting system and apparatus in power plant. Information furnished on application. Envelopes containing proposals should be indorsed "Proposals for Installing Electric Lighting System" and addressed to Quartermaster.

PUMPING MACHINERY, JEFFERSON PARK PUMPING STATION.

Chicago, May 28, 1912.

Sealed proposals will be received by the city of Chicago until 11 a. m., Tuesday, June 11, 1912, at room 406, City Hall, for pumping machinery, consisting of three triplex single or double acting pumps, or duplex double acting pumps, each of a capacity of one million gallons per 24 hours, against a working head of 140 ft., driven by single cylinder internal combustion engines, each of 35 horse power using kerosene fuel. The pumps, engines and auxiliaries are to be delivered and erected complete and ready to run at Jefferson Park Pumping Station at 4440 N. 47th Ave., Chicago, according to plans and specifications on file in the office of the department of public works of said city, room 406, City Hall.

Proposals must be made out upon blank furnished at said office, and be addressed to said department, indorsed "Proposal for Pumping Machinery, Jefferson Park Pumping Station," and be accompanied with $500 in money or a certified check for the same amount on some responsible bank located and doing business in the city of Chicago and made payable to the order of the commissioner of public works.

The commissioner of public works reserves the right to reject any or all bids.

No proposal will be considered unless the party offering it shall furnish evidence satisfactory to the commissioner of public works of his ability, and that he has the necessary facilities, together with sufficient pecuniary resources, to fulfill the conditions of the contract and specifications, provided such contract should be awarded to him.

Companies or firms bidding will give the individual names as well as the name of the firm, with their address.

L. E. McGANN,
Commissioner of Public Works.

CONSTRUCTION OF A BRICK ROADWAY.

Sealed bids or proposals will be received by the Road Commissioners of the Wheeling and Union Turnpike, at the office of the County Auditor, St. Clairsville, Ohio, until 10 o'clock a. m., June 17, 1912, for the construction of a brick roadway, with concrete berms, from Bannock and Flushing Pike, near Bannock, to the Flushing and Morristown Road, about one-quarter of a mile north of Mt. Hope school house, a distance of 5.6 miles, divided into two sections, as described by the specifications.

Proposals must be made out on blanks furnished gratuitously upon application and must be accompanied with a bond or certified check on some solvent bank in the sum of five hundred ($500) dollars, payable to the Road Commissioners, as a guarantee that a contract will be entered into if the proposal be accepted.

Plans and specifications may be seen at the office of the County Auditor, St. Clairsville, Ohio, at the residence of H. K. Lodge, near Bannock, Ohio, or at the office of D. A. Elkin, Engineer, Bellaire, Ohio.

The right is reserved to reject any and all bids.

All proposals must be in sealed envelopes, marked on the outside, "Paving Bids," and must be addressed to H. K. Lodge, Clerk for the Road Commissioners, St. Clairsville, Ohio.

H. K. LODGE,
Clerk of the Road Commissioners.

NOTICE FOR BIDS.

Notice is hereby given that sealed ids will be received by the Board of County Commissioners of Twin Falls Coty Idaho, up to 10 o'clock A. M., Jun 17, 1912, for the furnishing of all mat ial and labor for the construction of two eel bridges across Rock Creek Canyon in Twin Falls County, No. 1 to be locat at or near the section line between Sec ns 21 and 22, Town 10 South, Range 17 E B. M., and No. 2 at or near the section ne between Sections 8 and 9, Town 10 South, Range 17 E. B. M., said bid to be acc d-ing to specifications furnished by the d-ders. Each bid to be accompanied a certified check in a sum equal to 10 er cent of the amount of the bid; c k made payable to the Treasurer of in Falls County, Idaho, as a guarante of good faith on the part of the bidder th if awarded the contract he will forth h accept the same and will enter into a -tract under bond within ten days h the Board of County Commissioners of Twin Falls County, Idaho, and if he il to do so said guarantee of 10 per cent li be forfeited to said Twin Falls Count s liquidated damages to be used for e benefit of the Road and Bridge fun of said county.

Separate bids shall be submitted r each bridge. Bids to be sealed d marked "Proposal to construct R Creek Bridge No. 1"; "Proposal to struct Rock Creek Bridge No. 2," dressed to O. G. Zuck, Chairman, d mailed to E. J. Finch, Clerk, Twin F, Idaho, so that bids will be on file with d clerk on the date first above mentione

Profiles will be furnished on appl-tion to the clerk of the Board of Cou Commissioners. The Board reserves e right to reject any and all bids.

By order of the Board of County C-missioners, Twin Falls County, Idaho.

Dated Twin Falls, Idaho, May 14, 1

O. G. ZUCK, Chairma

Attest

E. J. Finch, Clerk.

NOTICE OF CIVIL SERVICE EXAMINATIONS.

Chicago, May 27, 191

The Civil Service Commission of city of Chicago will hold an examinat for expert on System and Organizati engineering service in Room 1006 C Hall, Chicago, June 7 and 8, 1912. T salary of this position is $3,000 per a num, and persons living outside of t city will be permitted to take the exa ination.

Applications will be mailed on writt request sent to the Commission, Ro 610 City Hall, Chicago, Ill.

SEWER CONSTRUCTION.

Sealed proposals will be received the Sewer Commissioners of Sandpoi Idaho, for the necessary material a labor in laying about 23,000 feet Sewers.

Bids will be received until 12 o'clo noon, June 15, 1912, and then publi opened.

Information on application.

WM. J. COSTELLO, Clerk,
Sewer Commission.

Engineering & Contracting

Devoted to the Economics of Civil Engineering Design
and to Methods and Cost of Construction

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IPTION RATES Payable in Advance [illegible] *Mex., Alask., Hawaii, Guam, Porto Rico, Philippine Islands, Republic of Panama, Canal Zone and* [illegible] *Canada* [illegible] *a year* [illegible]

VII. Volume No. 24. [illegible] JUNE 12, 1912.

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ainage Ditch Maintenance.

[illegible]
ant and a much neglected feature
work. This feature is ditch
There is really no literature on
[illegible]
erature is rewarded with only a
tered general articles. These condi-
e not strange. There is no drainage
aintenance in America. Ditches are
ly being redug after having silted up
years until almost useless, but this
be called maintenance. We im-
would be difficult to discover a
ge ditch system in the United
owners give it regular systematic
e similar, we say, to that which
roadbed, or even an irrigation system.
These are not diplomatic assertions
but we have been unable to discover
which indicates that they are untrue.

re any obvious reason why a system
age ditches may be exempt from the
of up-keep? There certainly is not.
soil ditch is particularly subject to
tion, because it is built more fre-
not in such a manner that de-
n is invited. To maintain its form
channel must have, above all things,
de slopes. To keep from being silted
rth channel must have a grade which
a silt-carrying current, and must be
ends and valleys which interrupt
The truth of these statements
ubted.

[illegible]
gives their channels stable side
infrequently no attempt is made
the sides at all. In both cases nature
matter in hand and secures equilib-
caving the banks. The job is seldom
e, whatever else may be in its favor.
re very good engineers who believe
that nature should be left to do the side sloping. They allow for it by digging the channel originally much larger than the volume of water to be carried demands. If this surplus channel section is not provided the channel is injuriously constructed when nature slopes the sides. In any case nature sloped ditches are bound to have sides and bottom irregularities which induce silting.

Most drainage ditches do not have sufficient fall to give a silt-carrying current. Quite frequently there is no remedy for this fault. Nature often has not provided the difference in elevation necessary for the required fall. Here, then, the ditch must be dug as it can be, and not as the theory of silt-carrying currents indicate that it should be dug. Sometimes, however, when proper ditch fall is quite possible, it is not secured. More often the ditch is laid out with unnecessary bends, or grade bumps, or both. All of these conditions induce silting.

It is clear from what has been said that free drainage ditches can be expected to preseve their efficiency as conduits for long periods without repairs. They are, indeed, no different in this respect from roads or railway track, or any other engineering structure. They gradually deteriorate and decrease in efficiency as they grow old. In the case of roads and railways deterioration is met by periodical and systematic maintenance repairs, and efficiency is thus not allowed to decrease. This logical business method is practically never adopted for drainage ditches. They are allowed to cave and silt up and to become choked with vegetation until they no longer carry off the water, and then they are reconstructed to begin another similar cycle of life. There is, as we asserted previously, no drainage ditch maintenance in America.

Recently drainage officials have begun to assert their discontent with the conditions as they exist and to urge a more businesslike up-keep of ditch property. No one, however, seems to have a very clear idea of how to systematize ditch maintenance, or of how to perform the necessary work, or of how much it will cost. The writer of the article referred to above quotes some isolated cost figures for ditch cleaning, but they are admittedly of uncertain value. Data are badly needed on this question and, indeed, on the whole problem of ditch maintenance. Drainage engineers having experience can do valuable service by publishing it. We should be glad to publish and pay for practical working articles.

Puzzuolana-Portland Cement for Marine Construction.

Notable success in obtaining a concrete which resists the attack of sea water is being claimed by Italian engineers. This concrete is made from a cement got by mixing ground puzzuolana with ordinary Portland cement. In a general discussion of the value of this mixture, which was published in our issue of May 29, 1912, Mr. L. Luiggi, a prominent Italian authority on marine construction, asserts emphatically that the ordinary problems of sea water distintegration of concrete are solved by the mixed cement. In another column of this issue we describe a breakwater structure in which all of the concrete was made of puzzuolana-Portland cement. This confidence of the Italian engineers is deserving of attention by builders of marine works of concrete.

A Correction.

Our attention is called to a typographical error in our issue of May 15th, page 543, in the article entitled "Cost of Hauling With a Motor Truck in Arizona." The error consisted in the omission of a decimal point in the figure giving the cost per ton mile. The corrected figure should be 0.75 cts., or ¾ of 1 ct. per ton mile.

GENERAL ARTICLES

Annual Convention of the American Water Works Association.

The 32d annual convention of the American Water Works Association was held in Louisville, Kentucky, on June 3 to June 7, inclusive.

The activities of members of the association were limited to such matters as registration and committee meetings on Monday. The business of the convention was formally taken up on Tuesday morning. Mr. Alexander Milne, superintendent of water works in St. Catherines, Ontario, who has been president of the association during the past year, was detained at home on account of important construction work now in progress in his department. His annual address was read by the secretary.

The committee on standard specifications for wrought iron pipe made a satisfactory progress report. This committee is endeavoring to furnish a simple test whereby wrought iron pipe may readily be distinguished from steel pipe. A field test for determining the quality of wrought pipe is another aim of this committee. The report of the committee on uniform annual reports and accounts, made a year ago and held over to this convention, was accepted by the association. The committee on the creation of a National Bureau or Department of Health made a progress report. They were further instructed to foster such legislation, and, if possible, to have engineers named for important official positions in the department when it is established.

The Committee on Depreciation made a progress report. The recommendations of the committee relative to methods of charging off depreciation will be put in shape for publication in the present volume of the proceedings of the association. In the absence of the chairman, Mr. Metcalf, Mr. Alvord spoke for the committee and presented an outline of the points under consideration. He spoke of the wide difference in the percentage charged off as depreciation in various water departments and of the corresponding understanding, or lack of understanding, of the meaning of the term. He pointed out that if two per cent per annum is charged off per annum, that two per cent should be in the form of a tangible asset of the department. He further called attention to the fact that the word should have more than a bookkeeping significance and that to write "two per cent depreciation" on a piece of paper, to be waved in the air, was of no value unless based on a tangible asset in the form of cash, property, or otherwise. This precipitated a spirited discussion, in which many members participated. Many subjects of interest to the members were discussed besides the question of depreciation. Water rates to large and small consumers and depreciation were the chief topics touched upon in this discussion. The point was made by Mr. Leslie Smith of Cleveland that the percentage charged off as depreciation should vary from city to city through fairly wide limits in conformation to varying local conditions of soil, water, service, and so on. The practice of comparing operating costs of private and municipal plants also came up for discussion. It was pointed out that municipal plants, often by faulty bookkeeping, show a surplus at the end of the year which looks well, but such items as rent, taxes, etc., are not directly paid by and charged to the water department. Uniformity on these points was considered desirable by some representatives of both types of ownership. The afternoon was spent in a trip to the river pumping station of the Louisville Water Company.

Mr. Edward Wegmann read a very interesting paper on Ancient and Modern Water Works. This paper was illustrated by means of lantern slides, showing the famous aqueducts of the Romans and Greeks and other contemporaneous peoples. These works, the greatest of ancient times, were compared and contrasted with the works for the water supply of the City of New York, unquestionably the greatest works of the present day. The New York works were taken up at their inception in a large dug well and traced down to date. This paper, while interesting to all, was of special interest, doubtless, to the many guests present on Tuesday evening.

Mr. William W. Brush presented a paper entitled Floor Area Unit as a Basis for Estimating Consumption. This method of estimating consumption was employed for Manhattan Island conditions when estimating the future requirements of that district preparatory to fixing upon the size of the under city tunnel of the Catskill Aqueduct. This method was described in Engineering & Contracting in the issue of Dec. 20, 1911.

On Wednesday morning the topics proposed for the Question Box were taken up, in part. Among the topics so discussed the following are mentioned: Street sprinkling by street car companies, purchase of coal under specifications, steam production as a by-product of garbage incineration, and the regulation and control of large fire service connections and damages to such services caused by falling walls. Points made in these discussions are too numerous to be presented in the present brief summary of the convention proceedings, but will be presented in this journal at some other time, each subject by itself.

The election of officers and the selection of the place for holding the 1913 convention were taken up as the special order of business Wednesday forenoon. Mr. Dow R. Gwinn, president and manager of the Terre Haute, Indiana, Water Company, was elected president. The first to fourth vice presidents elected were, respectively, Robt. J. Thomas of Lowell, Mass.; John A. Affleck of Harrisburg, Pa.; George G. Earl, New Orleans, La., and Theodore A. Leisen of Louisville. All of the officials mentioned were elected without contest, each being advanced one office higher than that held during the past year. Mr. Chas. B. Henderson of Davenport, Iowa, was elected fifth vice president in a vote by the members. Mr. John M. Diven of Troy, N. Y., was reelected secretary-treasurer.

Capt. H. G. H. Tarr read a paper at the Wednesday afternoon session, entitled More Than Fifty Years of Reminiscence in Water Works. Capt. Tarr spoke of the time when cast iron pipe cost $90 a ton, and pipe companies bid for the privilege of being low bidder. Other of the older members told of their observation of the development of the water works business in all its branches.

I. M. de Varona, in a paper read by a representative, described the present organization of the Bureau of Water Supply of the City of New York. Diagrams of the organization, with which readers of this journal are familiar, were shown.

Elihu C. Church read a paper on the Philosophy of Purchasing Supplies. Mr. Church has had charge of the recent reorganization of the purchasing department of the New York Board of Water Supply. His paper was based on the present practice of the Board in purchasing. In addition, he laid down the general principle to be observed in buying supplies, which is as follows: Secure good supplies, in the proper quantity, at a fair price. Many of the supplies purchased by the Board are bought on very carefully prepared specifications, even down to matches. All supplies not of a perishable nature, such as rubber boots, are required to be returned to the purchasing department when worn out. This procedure accomplishes a two-fold purpose. It affords a check on the quality of the goods furnished, and shows whether or not the goods have been honestly and fairly handled by those to whom they were supplied.

Mr. Harrington Emerson presented a paper on Efficient Management, which, while general, was so well received that Mr. Emerson was accorded a vote of thanks by the a ciation. The ethical considerations, which for an important part of efficient managem t, were taken up in turn. The equipment nd handling of the steamship Titanic wer cited as examples of inefficient management esulting from the failure of the owners and icers of that ship to comply with the ideal safety, the considerations of common sense, e attention to the advice of competent tec ical advisers, and the principles of the fai deal.

On Thursday morning Mr. Bu rs presented a paper on Steam Turb es and Centrifugal Pumps. This paper aim to present an economic comparison bet en the turbo-centrifugal pump and the c nk and fly wheel type of pumping engine. e limits of the economic application of the o types of pumps were indicated, but were ontested by Mr. Chester of Pittsburgh and . L. F Strothman of the Allis-Chalmers ompany. The conclusions of the paper were ased on uniform load conditions, and, as p ted out by Mr. Chester, such conditions do n obtain in a majority of water works installa ns. Mr Chester advised the members to opt the turbo-centrifugal type only in c unction with reservoir service. All agreed at this type of pump had its legitimate a lication that it had improved greatly in rec t and doubtless would continue to more rapidly during the next five years.

Mr. Alexander Potter presented describing the details of design of settling reservoir which he designed for th City of Muskogee, Oklahoma. This paper is blished in abstract elsewhere in this issue.

Mr. M. L. Worrell read a paper scribing how two stream crossings were m e with Ward pipe at Rome, Georgia. This per contained valuable construction data, an will be published in full in the next issue E NEERING & CONTRACTING.

Prof. Albert F. Ganz delivered very interesting lecture on the electrolyt corrosion of water mains by stray curre s from electric street railways. The lect e was illustrated by means of numerous lantern slides showing the effects of electr sis on pipe, and illustrating the various ethods which have been adopted in electrol s mitigation work. The recent court de ion in the celebrated Peoria case was c mented on, and Prof. Ganz advised the wat works men to unite in opposing the furt r electrolytic corrosion of their water m s. An abstract of the paper will be pub he in this journal at a later date.

Mr. E. H. Briedenbach presented illustrated paper describing the design, s tion and operation of the new water plant at Owensboro, Ky. The r laboratory tests of the raw and iltered water were given.

The results of chlorination at veland were described by Dr. Daniel D. Ja son of New York City in an illustrated lec e. The hypochlorite sterilization of the Ka s City supply was described in a paper pre red by S. Y. High.

Mr. Edward S. Cole read a pape ntitled The Cost of Water, or Is It Wor While to Stop Waste? This paper is a g l summing up of the economic impor ce of water waste prevention and an ab act of it will be presented later in this ournal. Another interesting paper which l later be presented to our readers in abst t was read by C. G. Wigley of the en ieering department of the State Board o Health of New Jersey, on the subject, To W a Degree Must Sewage Be Purified?

At the last session on Friday ernoon several papers were read by title. Several important resolutions were passed and a few committees appointed. One c mittee is to collect water works statistics, luding water consumption, water rates, tc. in American cities.

ssociation now has a membership ng about 925. The next annual con will be held in Minneapolis.

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ing and Repair Costs of Tug s Tending Dredge and Tow g, Lincoln Park Extension Work, Chicago, Ill.

II.

(STAFF ARTICLE.)

200 acres are being added to th Lincoln Park, Chicago, by filling in the r waters of Lake Michigan whic the park. At the end of 1911 there n completed 125 acres of the total res of fill, and of this 43 acres were 1911. The filling is being done by dredge and besides dredging there ired breakwater construction, riprap- ding, etc. In a series of four articles, this is the second, the methods and 1911, of doing each class of work presented. The articles will cover: ic Dredge Filling; Stone Filled Tim- Breakwater Construction; Tug Boat Operations, and Repairs to Pile Driv- Derricks. The methods and cost of rresponding work during 1910 were our issue of Feb. 22, 1911.

TOWING OPERATIONS.

ription of the tugs used for towing found in our issue of Feb. 22, 1911, so are given the crews employed and es paid them. The "Keystone" is a 94 tons and the "Richmond B" usler" are wooden boats of 63 and

tugs were used on the general work was assigned to a special part of k. One served the dredge, another ack soil from the stripping operations rainage canal at Lemont, Ill., and a ved the pile drivers and did miscel- vork. The tug "Keystone" served the rom April 20 to June 9, when she p one of the dredge cables in her She was towed to the drydock and n June 14. It was found on inspec- her rudder was in such a condition new one. This was built up The tug went into commission again 19 towing black soil from that date l, 1912. During the season she towed . yds. of black soil at a cost of 17½ ubic yard, and 12,000 cu. yds. of stone, yds. of which were handled before in conjunction with the black soil of 33 cts. per cubic yard, and 3,940 after Dec. 1 at a cost of 55 cts. per d. Table I gives by items the cost of and repairs for the season.

COST OF OPERATION AND RE-
IRS TO TUG "KEYSTONE."

ommission	2,377¼	
Operation.		
	Total.	**Per hour.**
	$ 6,699.70	$2.86
	89.34	
	4,230.00	1.78
	1,123.51	0.47
	127.50	0.05
as	234.81	0.10
	$12,504.86	$5.25
Repairs.		
	$ 1,891.28	$0.80
	1,316.12	0.55
	3.40	0.09
	44.96	
	55.35	
	98.39	
pairs	$ 3,409.50	$1.44
eration and repairs.	$15,914.36	$6.69

"Hausler" did not go into commis- June 15 on account of repairs to her ich required from Feb. 20 to June 2. aces were practically rebuilt. The r operation for the season is shown I.

TABLE II.—COST OF OPERATION AND RE-
PAIRS OF TUG "HAUSLER."

Hours in commission	3,602½	
Operation.		
	Total.	**Per hour.**
Labor	$ [illegible]	$2.03
Watchmen	[illegible]	
Fuel	[illegible]	[illegible]
Supplies	644.03	0.18
Insurance	[illegible]	[illegible]
Total operation	$ [illegible]	$3.00
Repairs.		
Labor	$ [illegible]	$0.2[illegible]
Material	[illegible]	[illegible]
Derrick	[illegible]	
[illegible]	[illegible]	0.08
Total repairs	$ [illegible]	$1.[illegible]
Total operation and repairs.	$14,756.67	$4.10

The "Richard B," the third tug, was in commission after March 7, and was engaged in miscellaneous work on days when needed and went into continuous service on July 11, serving the breakwater construction fleet, assisting the "Hausler" in serving the dredge and towing the black soil from the river to the work. Her cost for the season is given by Table III.

TABLE III.—COST OF OPERATION AND RE-
PAIRS OF TUG "RICHARD B."

Hours in commission	2,184½	
Operation.		
	Total.	**Per hour.**
Labor	$ [illegible]	$2.06
Watchman	[illegible]	
Fuel	1,235.75	0.57
Supplies	351.08	0.16
Insurance	[illegible]	[illegible]
Miscellaneous	3.33	.....
Total operation	$ 6,201.28	$2.8[illegible]
Repairs.		
Labor	$ [illegible]	$0.1[illegible]
Material	172.84	0.08
Pile driver	[illegible]	0.10
Derrick	[illegible]	
Total Repairs	$ 763.18	$0.3[illegible]
Total operation and repairs.	$ 6,964.46	$3.19

The cost of operation of the motor boat is given below for eight months. Its time was charged to the entire fleet.

	Total	Per day
Operation.		
Labor	$ [illegible]	$3.56
Supplies	335.73	
Total	$ 855.73	
Repairs.		
Labor	$ 291.81	$1.63
Material	13.72	
Derrick	[illegible]	
Total	$ 1,246.71	$5.19

Reinforced Concrete Lock Construction by the Hungarian State Water Survey.

A description of reinforced concrete locks constructed in Russia was given in our issue of June 5, 1912. In this issue we describe a similar use of reinforced concrete worked out by the engineers of the Hungarian State Water Survey and reported to the International Congress of Navigation by the Survey. The lock described is located on the Koros River at Bokeny, and was designed by Mr. Constantin Zielinski, professor at the Engineering Polytechnic School at Budapest. We quote from the report further as follows:

The available length of the lock is 70 m. and its width—between the ends of the lock and also between the side walls—is 10 m. The maximum lift is 3 m. The invert consists of ⊥ shaped reinforced concrete beams spaced 1.36 m. apart, connected together. The depth of the beams in the lock chamber is 0.70 m. The square gaps between the reinforced concrete beams and secondary beams are filled with poor concrete in mass.

The invert has been calculated as a girder, resting on an elastic foundation, and exposed to a uniformly distributed load throughout its length.

The loads are represented by the weights of the side walls, and the embankments, and by the lateral thrust of the earth. The data used for several locks built in Hungary on similar kind of soil have been taken as a basis in the calculations of the elasticity and compressibility of the soil. These data have been obtained by measuring the settlement from time to time, due to the increasing loads as the lock was being built. It has been assumed also that the reactions of the soil which balance the weight of the invert are in direct proportion at each point of the invert to the actual settlement at that point. Taking this as a basis of calculation, the following dimensions have been obtained from the invert beam: Depth 0.70 m., breadth 0.25 m., width of slab 0.12 m. The reinforcement consists of two round 35 m/m. rods, and one round 40 mm. rod.

The side walls of the lock are ribbed, similarly to the retaining walls. These ribs are connected to the invert beams, so that the whole of the lock forms a monolithic structure. The ribs are placed so near together that the slab between them need only be 0.10 m. thick. It was only in the lower part of the side wall which holds the filling culvert which passes through the ribs, that larger dimensions and stronger reinforcement had to be adopted.

No dressed stone has been employed in this lock, but the exposed portions, such as the hollow quoins and the sills, are protected instead by steel flats or angle irons. The side walls are not faced, and for this reason they are protected against the blows of craft by a number of vertical timber baulks. These baulks are naturally connected to the ribs, so that the blows from the vessels may be transmitted directly to the latter.

We may mention here that in both the dam and the reinforced concrete lock water-tight inverts 10 m. and 18 m. long, have been constructed one above the work, and one below it. The inverts and the revetments of the banks, which are borne by them, are made of water-tight reinforced concrete slabs, with the object of leading the flow of the water from the upper pond and protecting still further the dam and the locks against scouring. The slabs on the revetment of the banks are 1 sq. m. in area; they are molded beforehand, and are designed to interlock with one another. They were laid side by side on the bank, and anchored at their corners into the soil by a small pile of reinforced concrete; the small gaps remaining between the slabs were afterwards filled in with concrete. The revetments of the inverts above and below the work were made in situ of slabs 4 sq. m. in area which were likewise fastened down at the corners.

From the preceding we see that the lock of Bökény consists entirely of reinforced concrete, and for this very reason we are able to deduce conclusions from this experience which may be applied to the employment of reinforced concrete for other similar works. In the first place we should point out that in hydraulic works which are built on the alluvial sand of the large Hungarian plains, the most important point to consider is the type of foundation to adopt, which is also intimately connected with the question of excavation.

Construction of foundations by compressed air would certainly be the best method to employ, but it is hardly suitable for this work on account of its high cost, and we are therefore compelled to carry out this construction in open trench. One cannot readily remove the water which flows into the open trenches without disturbing the soil. In general one cannot lower the level of the subterranean waters by sinking pits near the excavation to collect the waters, because the sand on the Hungarian plains is so fine that the water will only fill these pits to a slight extent. The only way which remains is to concrete the inverts under water, or else to divert the subterranean springs into collecting sumps, and pump the water out of these. The excavation of the lowest layers is more often than not a very onerous task. Experience shows us that the simplest and cheapest method to adopt, before the removal of the final bottom layer of 3 or 4 ms. is to surround the inverts to be constructed by watertight sheet piling, and then to excavate this earth when thus protected against the inflow of water.

Generally speaking water is tapped from the springs during the execution of the work.

[illegible] which generally [illegible] the [illegible] greater frequency [illegible] the depth of the excavation is greater.

[illegible] lead us finally to the conclusion that in such circumstances the in- [illegible] reinforced concrete [illegible] follows:

(1) A reinforced concrete invert is very much thinner than a mass concrete invert. For instance, the invert of the Bokény lock, including the mass concrete foundation, is only 1 m. thick, whereas the inverts of our other locks which have been founded on the same kind of natural soil are from 2 to 3 m. thick. Consequently the adoption of reinforced concrete enables one to dispense with that portion of the work which is the most difficult and costly, namely, the excavation.

[illegible] excavation need not be carried down so deep one can either dispense with the sheet piling or a least reduce its dimensions

(3) The foundation soil is disturbed to a lesser degree because the springs are the less frequent, and the less intense the shallower the foundation.

(4) Reinforced concrete inverts are much less rigid and can take much more unequal loadings than an invert of mass concrete which is two or three times as thick. For instance, the invert in the Bökény lock settled down nearly 10 m. more near the side walls than along the center of the lock without cracking. The dangers which arise from unequal settlement are minimized when the invert is built of reinforced concrete, without counting that even if the concrete should split the reinforcement ensures a temporary protection.

It goes without saying that inverts can only be satisfactorily constructed in reinforced concrete provided the excavation or trench is quite dry. This applies particularly to the case of an invert with complicated reinforcement like the one at Bökény. In this instance the conditions were fairly favorable for this lock, as it was built in a short cut connecting a bend of the river. The excavation was consequently 200 m. away from the bed of the Korös.

The upper and lower bends of the cut were only excavated after the lock was built. Furthermore, during the construction of the invert the water level of the river happened to be favorably low, so that a layer of mass concrete 0.30 m. thick was sufficient protection against the spurting of water from springs. This dimension under less favorable conditions would have to be considerably increased.

It is a remarkable fact that the designer has kept strictly in his design for the inver. of this lock to the characteristic form of reinforced concrete structures in which beams and slabs alternate (ribbed slabs). This example is the practical expression of the designer's particular views on the subject. We do not consider, however, that this method is a good one to follow. We are of opinion, on the contrary, that the reinforcement of the invert should be as simple as possible, and thereby easier to place owing to the obstacles which are found in excavation and hamper the work of placing complicated reinforcement.

We have already said that the lock is a monolithic structure. We have pointed out the disadvantages of monolithic structures of this type; owing to the heterogeneous nature of the foundation soil, the settlement of the upper end of the lock was greater than that of the lock chamber and of the lower end of the lock, which caused a number of thin cracks on the top 3 or 4 ins. of the side walls, and also a much bigger crack in each side wall. The reason being that the upper part of the side walls at the height of 6.5 m. was not able to adjust itself to this unequal settlement. We must say, however, that we only found cracks in the upper part of the side walls, and that the lower part, as well as the invert, were free from cracks, although the invert was only slightly reinforced in the longitudinal direction. This fact confirms the opinions of those who hold that it is necessary to provide expansion joints in locks, not only in the invert, but also in the side walls.

We must also call attention to the fact that the side walls of the Bökény lock are not faced. It is true that the exposed concrete will weather fairly well, as the concrete employed has been carefully selected and the work carefully carried out, but we should consider for future work whether it would not be desirable to face the concrete with stone or some other suitable material, as concrete tends to chip away under frequent shocks.

Methods of Arranging Doubletrees and Three Horse Eveners.

In making three horse eveners little difficulty will be experienced if consideration is taken of the fact that the amount of work each horse does is in proportion to the lever arm or the portion of the doubletree given to him.

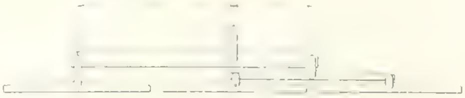

Fig. 1—Common Three-Horse Evener.

In the case of three horses the third horse, or the one which works singly, should be given a leverage to make its pull equal to that of the other two. The length of the evener, and also the lengths of the singletrees, will depend upon the size of the horses and also whether it is desired to work them close together or somewhat spread apart. For summer work the horses will stand the heat better if given plenty of room.

In Fig. 1 is shown a common three horse evener arranged for horses of about equal weight and strength. This distances shown are recommended for horses of medium size and should be increased proportionately for large teams.

Sometimes it is necessary in working young animals or light horses to give them plenty of advantage by increasing the length of the lever arm. This must be done by trial, as no rule will do for all cases. The most satisfactory way is to bore a number of holes and shift the clevis until the small horse is able to carry the load the entire day without becoming more fatigued than the other horses. It is believed by some men that the amount of lever arm or advantage given to the smaller horse should be in proportion to the weight of the animal, but this is not always satisfactory because it is also necessary to take into account the physical condition of the horses. A type of evener which permits an unusually close hitch is shown by Fig. 2. These two eveners are recommended in the "Bulletin" of the International Harvester Co.

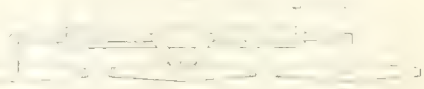

Fig. 2—Evener for Close Hitching.

Method of Constructing a Breakwater at Naples, Italy, Using Concrete Hollow Blocks Made of Puzzuolana-Portland Cement.

The new breakwater at Granili, Italy, is notable because of the use of hollow instead of solid concrete blocks for the superstructure. These blocks, too, are molded of puzzuolana Portland cement concrete. In the matter of molding and laying the blocks, American engineers will also note several novel features. An example is the use of reinforced concrete cement panels with iron frames to form the block molds. Another is the placing of lead pipe on the edges of the walls of each block laid to afford an even bearing for the superimposed block. These various features were worked out under the directi of Mr. I. Inglese, Inspector General, Corp [illegible] Engineers, Genoa, Italy, who des the [illegible] breakwater construction in a repo [illegible] International Congress of Navigatio [illegible] stract from this report as follows:

GENERAL DATA.

The breakwater at the Granili [illegible] main work of defense for the new [illegible] basins at the east of the port of Na [illegible] breakwater starts from the north e of the present curved one, runs in a straig line for a length of 1,000 m. (3,280 ft.), w h a direction of E. 29° 2′ S., or nearly pa lel with the shore, from which it is distant [illegible] m. (1,968 ft.), and lies perpendicu to the waves coming from the open sea. e depth of the water in which the work sta s varies from 18 m. (59 ft.) at its initial p t to 24 m. (78.72 ft.) at its eastern end.

The foundation of the breakwate is built of random stone or rip-rap coming f m three different quarries operated solely fo he construction of this work; two of thes quarries are in the peninsula of Sorrento and e third in the gulf of Pozzuoli. The founti n is leveled off at reference (—10.50) [illegible] at which it is 38 m. (124.64 ft.) wide. e slopes make an angle with the horizontal [illegible] the tangent is 2 on 3 on the sea s nd 1 on 1 on the land side (Fig. 1). O [illegible] rap work, which is dressed down [illegible] fully leveled by means of small sto [illegible] and broken stone, is built the su ructure composed of cellular blocks accordi [illegible] system proposed by Mr. Inglese.

The horizontal section of thes [illegible] measures 9 m. × 5 m. (29.5 × 16.4 [illegible] a height of 2.3 m. (7.54 ft.). Five f these blocks placed one on top of anothe form a pillar and two pillars coupled toget r make up the width of the substructure. T block contain each two cells of 3.5m. × 3 [illegible] m. (11½ × 11½ × 7½ ft.), so that [illegible] lar incloses two wells, each of wh measures 3.5 m. × 3.5 m. × 11.5 m. (11½ [illegible] 37¾ ft.), giving for each pilllar a al volume of 281.75 cu. m. The volum [illegible] walls of each pillar is 235.75 cu. r [illegible] quently the total volume of each pill [illegible] substructure is 517.500 cu. m.

The weight of the concrete requir t fill one of the two cells of [illegible] block is 56.435 tonnes* and the total weight of pillar when finished is 1,045.350 tonnes, th weight of the concrete used in the constr [illegible] ing 2.02 tonnes per cubic meter.

In order to protect the foot of e substructure from the scour which t under tow might cause, there has been laio n th outside risberm of the foundation row artificial blocks measuring, each one m. 2.5 m × 2 m. (16.4 × 8.2 × 6.56) weighing 50.5 tonnes.

This system of pillars forms the ase of the superstructure of ordinary maso , made of rubble stone and lime mortar a pozzuolana, which covers the entire wid of the substructure and forms a mass ab 2 m. (6.56 ft.) high.

The inner side of this mass is ar ge as a quay to which vessels can tie up, ile on the outside there is a shelter wall wh rises to reference (+6.00).† The inside q y is 11 m. (36 ft.) wide; the parapet is 5 m. (18 ft.) thick at the bottom and 5.30 m. 4 ft at the top.

WORK YARD

A work yard was laid out on the ore a the Granili for carrying on the work n general and especially for the manufactu of the cellular blocks and the concrete re red to fill their cells, as well as the blocks or the protection of the foot of the sub ucture. This yard was 500 m. (1,640 ft.) long large masonry bridge 80 m. (262.4 ft.) le was built at the middle of the yard for e purpose of shipping the blocks. The dth of the yard was 164 m. (538 ft.) at th bridge.

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*Tonne means a metric ton of 2,204 [illegible]

†The zero of these references is the [illegible] of the water.

1 ft.) in the part to the west of the [illegible]

area was divided as folows among the services and plants:

	Sq. m.
[illegible]	[illegible]

ldition to the large masonry bridge, her bridges, made of wood and built s, was used for unloading materials, ll of which came by sea.

r blocks are built on large plat- nforced cement laid on a bed of ey are placed in five parallel rows [illegible] side of the rows of blocks are laid six track with steel rails weighing 45 kgs. tre (=91 lbs. per yard), which are stringers of reinforced cement. The e laid in pairs 6.50 m. (21.3 ft.) apart centers and form a permanent track the derrick which lifts the blocks

e middle of the yard, two tracks of [illegible] nd run to the outer end of the large s circulating on these two tracks ocks to the point of embarkation yard contains 200 of these platforms place, therefore, for the same number s There are on the bridge and along- [illegible] tforms intended for the manufacture [illegible]

e east and west sides of the bridge ed the tracks intended for the trans- n of the drop-bottom boxes used to the concrete in the wells of pillars f cellular blocks.

ellular blocks are built in molds erect- the platforms mentioned above. The [illegible] f reinforced cement. The sides t the bottom by the flanges of the [illegible] rons so arranged on supports as to be work under tension or compression s to prevent any deformation of the

der to prevent the concrete, while set- om adhering to the sides of the molds he platform, these surfaces are washed [illegible] stand in the molds for 10 days, on [illegible] le to make three cellular blocks

rdinary blocks, on the contrary, are [illegible] ened by wood frames and the others f iron.

ete is all made by machinery ca- ning out 200 cu. m. a day. This e doubled, if necessary, by work- night. The concrete used for the ks has the following proportions nts: Mortar (1 part of fat lime rts of pozzuolana); 1 part by volume. stone (limestone): 2 parts by volume. [illegible] rete.

ellular blocks are raised, and carried shore end of the shipping bridge by of an electric derrick.

derrick stands on four two-wheeled f which two are used to move the along the row of blocks. This move- obtained by means of a 25 h.p. elec- [illegible] 7 ft.) per minute A 75 h.p. electric is used for raising the blocks at the 1 metre per minute. The block hav- n raised, it is carried by the movable [illegible] deposited on the block car which is to carry it to the outer end of the bridge.

The frame of the block car is made of two double girders with full sides placed at a distance from each other the same as the distance between the longitudinal faces of a cellular block, and connected together by transverse lattice girders. The frame is carried on [illegible]

The concrete with which the pillars of cellular blocks are to be filled is loaded, as it leaves the mixers, into metallic drop-bottom boxes of about 11 cu. m. capacity, mounted on special cars. These are hauled to the shipping point by a 50 h.p. continuous current electric locomotive, at a tension of 500 volts. A speed of 100 m. (328 ft.) per minute can be had.

There are on hand twelve metallic boxes and eight cars; these allow three trains of four boxes each to be formed so as to have the transportation accord with the output of mixers and the time necessary for depositing the concrete and for keeping the work going on continuously.

Other plants are reserved for supplying materials. The blocks of which the broken stone is to be made come in boxes, loaded on barges, and are carried on temporary Decauville tracks to the deposit yard by a cable system driven by electric capstans of 30 h.p. each. The stone for the continuous charging furnace, for making the quicklime, was loaded and carried in the same way.

The pozzuolana and coal, on the other hand, were brought to the yard in barges having a capacity of about 60 cu. m. and unloaded by a ladder lift. The chain of the lift was driven by a 50 h.p. semi-stationary steam engine at the end of the double bridge which carries the lift. For the preparation of the slaked lime there were disposable 22 beds having a total capacity of about 900 cu. m. of the lime paste.

The yard is provided with a machine shop for the repair and maintenance of the various machines and engines. This shop is furnished with boring and punching machines, shears, planes, forge, etc., the whole driven by a 12 h.p. electric motor.

The motive power is obtained from the electric energy supplied by the Neapolitan Society under the form of a 4,000-volt alternating current. This current is transformed in a building put up for the purpose, with an equipment suited to the machines used in the yard. The building contains four transformers, which reduce the potential of the current to 260 volts, and a motor of 100 h.p. coupled directly to a dynamo by means of which the alternating current of 260 bolts is transformed into a continuous current of 500 volts.

The station also contains two meters for the motive power and one meter for the lighting of the yard, storehouses, offices, etc. The crushers, grinders, capstans for unloading materials, machine shop and derricks for lifting the ordinary concrete blocks work by the alternating current, while the derrick for raising the cellular blocks, the automotive cars for carrying them and the locomotive for transporting the drop-bottom boxes carrying the concrete work by continuous current. The electric lines which run around the yard have a total length of 4,000 metres of wire.

It has already been said that the top surface of the stone embankment, on which the substructure of cellular blocks is to stand, was smoothed off with small materials, leveled down by means of a ballasted wood frame carrying a level with an air bubble, attention being paid to having the layer of these materials at least 15 cm. thick. In order to place the blocks, a floating sheer-legs was used having a lifting capacity of 120 tonnes, and driven by a steam engine of 120 h.p. The fall of the sheer-legs carries the self-detaching apparatus, made of steel, and weighing about 10 tonnes.

The cellular blocks are raised by means of eight locks placed at the base of four articulated parallelograms; a double system of balance beams insures the simultaneous working of each group of locks, and the simultaneous working of the two groups together is obtained by means of the hook suspended to the fall. The apparatus is placed in the inside of the block with its two parallelograms closed; as the latter open they cause the locks to penetrate into grooves made at the bottom of the longitudinal walls of the blocks. The mere movement of rotation of an axle is enough to hook on to the block when the apparatus is so placed that the locks are just at the grooves. The locks let go automatically at the instant that the upper frame of the apparatus rests upon the block. The point of suspension of the articulated parallelograms being then changed, the latter close by their own weight and cause the locks to withdraw.

The cellular blocks are set by skillful divers after having first found a number of reference points by which to place the bottom block of each pillar. One block being located, the other four are placed accurately on top of it and the pillar is thus formed. The pillars are filled by means of a second floating sheer-legs with a 70 h.p. motor. As the reach of this craft is 7.50 m. (21.6 ft.), it can lower the concrete hoppers into the two wells of a pillar. While this operation is going on, the pontoon carrying the hoisting apparatus is made fast in such a way as to allow the 120-tonner sheer-legs which is placed with its pontoon normal to the other, to set the blocks for a new pillar. In order that the two pontoons may occupy the desired position, the one which places the concrete has its forward end slightly tapered. Four hoppers at a time are taken from their cars at the end of the loading bridge and placed on another pontoon which has special arrangements to receive them. The sheer-legs then takes them up and empties them into the wells.

These hoppers, or drop-bottom boxes, should be so made as to fulfil three condi-

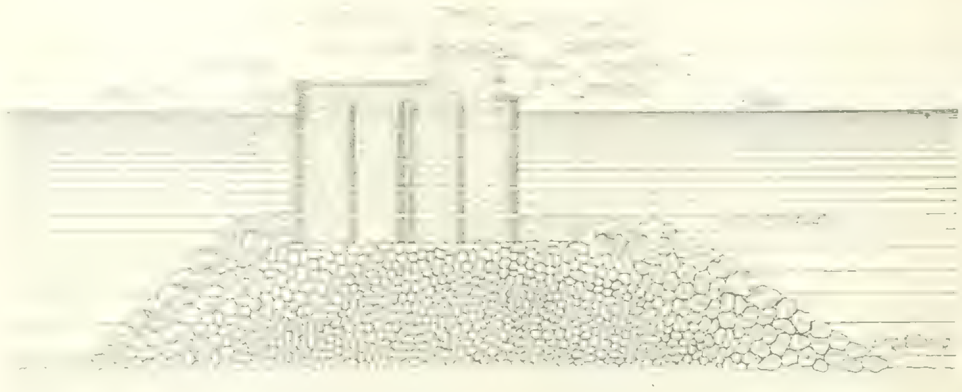

Fig. 1—Section of Concrete Block Breakwater at Naples, Italy.

(1) To prevent, when the box is immersed, the water which comes in along the op edges from washing the mortar off from he broken stone; (2) The drop-bottoms hould open easily when the box reaches the bottom of the wells; (3) The concrete should eave the box and spread out in the wells by he mere motion of raising the box, without he necessity of resorting to shocks or other pecial movements.

In order to satisfy the first condition, the box is supplied with sheet iron covers in which holes have been bored. The two other conditions are satisfied by the special shape of the hopper and the way in which it works.

This box or hopper is made in two parts, he upper being a cube with a triangular prism attached, of which the two inclined ides are hinged to two sides of the cube and form the drop bottom of the box, opening outward from the middle. The sides of he cube, to which the drop leaves of the bottom are hinged, are made each in one piece; the other two sides are made in two pieces which can be separated from each other by a slight angular motion around an axle which is parallel to the sides to which the eaves of the drop bottom are hinged. The opening movement of the two parts of the ube is limited by special stops to the amount equired to allow the lower face of each, when it opens, to let go its bearing on a holding strip placed longitudinally at the center of the hopper, and corresponding with a pivot of rotation in the lower part of the cube. The hopper is suspended to a special beam attached at its middle to the hook of the fall of the sheer-legs.

Furthermore, the hopper is suspended to his beam by means of four chains leading o its four angles, but these chains do not ome into play when the hopper, closed, is held by the central suspension.

So soon as the hopper touches the bottom, a counterpoised lever causes the shaft which carries the central suspension to turn; he latter is then lengthened out and the hopper is suspended from the four lateral chains. By a slight lifting movement, the two halves of the hopper open and at the same time let go of the drop bottoms so that the bottom of the hopper being widened out the contents re discharged and the concrete is spread in nearly regular layer at the bottom of the well, as has been many times observed by he divers. It can also be affirmed that the concrete is deposited so perfectly that no sensible disturbance of the water takes place.

Before beginning to fill the pillars, a stratum of small bags of concrete about 30 cm. thick is laid over the bottom of the well, and the openings left in the longitudinal walls of the blocks, whereby to raise them, are also filled with small bags of concrete.

SPEED WITH WHICH THE WORKS ARE CARRIED ON.

Setting the blocks began on Nov. 29, 1910, beginning where this new breakwater starts from the old curved one. By July 20, 1911, there had been set 150 cellular blocks which made 30 pillars and 60 lin. m. of breakwater. The average number of blocks set in a day was five and the maximum number was ten; this maximum was reached on July 14, 15 and 17. This number of blocks might, however, represent a normal day's work if the capacity of the plant and the size of the yard were equal to furnishing it, for it has been observed that the time used in loading, transporting and setting a cellular block varied from 1 hour to ½ hours, according as it was a question of setting blocks of the upper or the lower tiers.

The concrete filling has required, so far, two days for each pillar, but this time can be reduced hereafter, as all the necessary plants have been finished and especially as mechanical traction has been adopted for moving the boxes inside of the yard.

Comparing now the results of the work done in this way with the data relating to the construction of the curved breakwater built in the same locality and, consequently, under almost identical conditions of time suitable for work, but having a substructure of ordinary artificial blocks superposed in tiers, the following result is reached:

	Curved break-water.	New break-water
Number of blocks set per working day	5	5
Volume of the blocks set per day, cbm	110.00	235.75
Area of surface covered, square metres	11.25	45.00

Hence it follows clearly that the work done with the cellular blocks is, under equal conditions, four times that done with ordinary blocks.

TROUBLES ENCOUNTERED

In constructing some of the pillars with cellular blocks, some of the latter were damaged occasionally at points corresponding to the second suspension groove, that is 2.33 m. from the outside edge. No damage has been noticed in the end walls in the partitions. These injuries, however, were of small moment. They were caused by slight movements of settling which, bringing a false bearing under a part of the blocks, caused in the concrete tensile strains beyond the limit of resistance.

This trouble was overcome by giving the blocks a uniform support through the interposition of lead pipes secured to their top surface by means of plaster. The outside diameter of the pipes was 45 mm. and the inside diameter 20 mm. Six of them are placed on each longitudinal wall, laterally to the suspension grooves.

The main object of these pieces is to give to the blocks such points of support as will prevent their having to bear strains greater than those anticipated even if the top of the random stone foundation be a little irregular or if an ununiform settlement take place has also been sought, by the application of these tubes, to have the pressures on the bottom block spread over its entire surface, this helps to insure a greater uniformity of the movements caused by the settlement of the rip-rap foundation.

This arrangement has met fully al tations, the pillars on which the tul been used showed no signs of chippi fissures of any kind during the vario ations of setting or filling or after ter work which was always carried concrete containing 100 kgms. of cei cubic metre.

FOUNDATION OF THE BREAKWAT

The foundation of the breakwater is a very important part of the work. Although leveled off at reference (—10.50), this foundation made up of a mass of random stone rip-rap containing a million and 50,000 tons of natural blocks.

The rip-rap, as already said, came from three quarries which also supplied the broken stone for making artificial blocks a crete, and the rubble stone for the n The two quarries on the Sorrento peninsula (Equa and Villazzano) give dolomitic limestone, the third, situated on the Gulf of Pozzuoli, furnishes stone of a trachytic character. The specific gravity of these two rocks 2.7 for the limestone and 2.60 for the trachytic stone.

EARTH AND ROCK SECTIO

Volumes of Water Required for Effective Hydraulicking.

The accompanying tables show the amount f water required for effective use in operting hydraulic giants, and the amount of water which will flow through nozzles from ½ in. to 10 ins. in diameter, under given eads from 50 to 700 ft. The tables were ompiled by engineers of the Union Iron Works Co., San Francisco, Cal., published in heir catalog No. 5, on hydraulic excavating machinery.

TABLE I.—VOLUMES OF WATER REQUIRED FOR EFFECTIVE HYDRAULICKING.

Head Ft.	2-in. nozzle. Cu. ft. per min.	2½-in. nozzle. Cu. ft. per min	3-in. nozzle. Cu. ft. per min.	4-in. nozzle. Cu. ft. per min	5-in. nozzle. Cu. ft. per min
100	120	188	278	488	750
150	150	233	338	600	938
200	158	270	390	690	1,073
250	195	300	435	773	
300	210	330	480	848	
350	225	360	508	915	
400	240	383	548	975	

The fuel consumed by locomotives on the railroads of the United States during the fiscal year 1911 totaled 132,000,000 tons, which is equal to one-fifth of the entire annual output of the coal mines of the country. This item required an expenditure of about $240,000,000, or 12 per cent of the total operating expenses of the railroads.

TABLE II.—VELOCITY IN FEET PER SECOND AND FLOW OF WATER THROUGH LARGE NOZZLES UNDER HEADS OF FROM 50 TO [illegible] FT.

Head of water in ft.	Velocity in ft. per sec	1½-in nozzle. Cu. ft. per min.	2-in. nozzle. Cu. ft. per min.	2½-in. nozzle. Cu. ft. per min.	3-in. nozzle. Cu. ft. per min.	3½-in. nozzle. Cu. ft. per min.	4-in. nozzle. Cu. ft. per min.	4½-in. nozzle. Cu. ft per min.	5-in. nozzle. Cu. ft. per min.	5½-in. nozzle. Cu. ft. per min.	6-in. nozzle. Cu. ft. per min.	7-in. nozzle. Cu. ft. per min.	8-in. nozzle. Cu. ft. per min.	9-in. nozzle. Cu. ft. per min.
50	56.75	41.74	74.22	116.11	167.18	227.45	296.91	375.91	464.10	561.82	668.74	910.15	1,188.68	1,504.32
60	62.16	45.84	81.30	127.17	183.13	249.09	325.22	411.73	508.34	615.38	732.49	993.92	1,302.00	1,647.73
70	67.14	49.50	87.81	137.36	197.79	269.09	351.27	444.73	549.07	664.68	791.17	1,076.79	1,406.31	1,779.74
80	71.78	52.92	93.88	146.85	211.44	287.69	375.55	475.47	587.01	710.62	845.85	1,151.20	1,503.50	1,902.74
90	76.13	56.16	99.57	155.76	224.27	305.12	398.31	504.28	622.59	753.68	897.11	1,220.97	1,594.62	2,018.05
100	80.25	59.22	104.96	164.19	236.41	321.64	419.86	531.57	656.28	794.47	945.66	1,287.04	1,680.91	2,127.26
125	89.72	66.18	117.34	183.56	264.31	359.58	469.41	594.30	733.73	888.22	1,057.26	1,438.92	1,879.27	2,378.29
150	98.28	72.48	128.55	201.08	289.49	393.90	506.20	651.00	803.73	972.97	1,158.13	1,576.21	2,058.57	2,605.20
175	106.10	78.30	138.77	217.08	312.15	425.24	555.11	702.80	867.68	1,050.39	1,250.28	1,701.63	2,222.37	2,812.49
200	113.50	83.76	148.45	232.22	334.37	454.90	593.83	751.82	928.20	1,123.65	1,337.48	1,820.31	2,377.37	3,008.65
250	127.10	93.78	166.24	260.04	374.43	509.41	664.98	841.91	1,039.42	1,258.29	1,497.74	2,038.42	2,662.23	3,369.16
300	139.00	102.54	181.81	284.39	409.49	557.11	727.24	920.73	1,136.74	1,376.10	1,637.97	2,229.28	2,911.49	3,684.61
350	150.10	110.76	196.33	307.10	442.19	601.60	785.32	994.26	1,227.51	1,485.99	1,768.77	2,407.30	3,143.99	3,978.85
400	160.50	118.44	209.93	328.38	472.83	643.28	839.73	1,063.15	1,312.56	1,588.95	1,891.33	2,574.09	3,361.83	4,254.53
450	170.20	125.58	222.61	348.22	501.40	682.16	890.48	1,127.40	1,401.89	1,684.98	2,005.63	2,729.66	3,565.00	4,511.66
500	179.40	132.39	234.65	367.05	528.51	719.03	938.62	1,188.34	1,467.13	1,776.06	2,114.04	2,877.21	3,757.71	4,755.53
550	188.20	138.84	246.16	385.05	554.43	754.30	984.66	1,246.63	1,539.09	1,863.18	2,217.54	3,018.35	3,942.03	4,988.80
600	196.60	145.08	257.14	402.24	579.18	787.97	1,028.61	1,302.27	1,607.79	1,946.34	2,316.73	3,153.07	4,117.98	5,211.47
700	212.30	156.66	277.68	434.36	625.43	850.89	1,110.75	1,406.27	1,736.18	2,101.77	2,501.94	3,404.86	4,446.83	5,627.64

od of Sinking 233 ft. of 10x45-ft. haft in One Month, a South African Shaft Sinking Record.

x45-ft., seven compartment rock shaft ink 233 ft. during March, 1912, for the mines, Witwatersrand, South Africa. the quarter including March this shaft ink 583 ft., which also is a record for trict. The previous three months' record made at the Brakpan [illegible] The method of sinking by which these s were obtained is described by Mr. A. -Key in "Mining and Engineering " for June 1, 1912, and we take the fol- extracts from this description:

shaft in which the calendar month's sinking has been made is of seven com- nts, the excavations being 45 ft. by equal to 450 cu. ft. area, or 37.5 tons foot of shaft in the solid. The total allied for the month as hoisted for the sunk were 8,155, equal to 35 tons to the which comes very close to the estimate. king was done through quartzites and hales, 155 ft. of quartzites and 78 ft. of [illegible] passed during the month. It worthy that only one-third of the dis- was in the Kimberley shale; previous s have been almost entirely in that for- The record was made from 1,738 ft. 1 ft. Natives do all the hand drilling oveling, 82 natives with a leading sink- a white assistant forming the shift's crew. Eight-hour shifts are work- lays a week. The majority of the boys ouble hand, using 7-lb. hammers, the nches only having "single-hand boys" rk on them. No particular trouble or given to a "sink." The shaft being it with its long axis on the dip, advan- taken of the bedding planes, the great ty of the holes being inclined to the against the strata.

ing with a skip installation, one of the bjects striven for is a flat bottom, an kip sinking shaft bottom being a bench t each end. The reason of this is the facility for loading the broken rock e skips and getting each skip in its turn e bottom at approximately the same It is obvious that if the "benching" sys- ere in use in a skip shaft with the en- nning double and the skips landing at tom at different levels, innumerable dif- s would be encountered such as tipping ties, risk of kinking the rope, either g the skip away empty or taxing the dily by shoveling the rock 3 or 4 ft. into the skip; in fact, many unforeseen s would be encountered which would delay and probably accidents. Blasting was every 8 hours. From 40 to 45 completes a round for a shaft and s the shaft. These holes are drilled ft. 6 ins. to 5 ft. in depth. Four are abreast for the length of the shaft. de holes are given from a plumb line rom the bottom set. Gelatine ⅞-in. di- is used. Smith's "27 Special" fuse is nd Edgar Allen & Co.'s Green Label steel. The tonnage broken per hole ed for the month was 2.23 tons, the e consumed being 0.457 lb. The average r of natives employed was 82.

pump is installed in the shaft below the water, 30 skips a shift, being han- ith the sinking skips from "rings" at s points.

ering.—Four timber men are employed. en and six boys being "bottom set" men, an and four boys are on the hitches, and permanent guides, and one man e boy on the brattice. All timber men norning shift only from 7 a. m. to 3 and only for very urgent reasons is allowed. After the sinking shift is bottom and hoisting man has com- l, the two bottom set men go down eir lines, stage planks, blocks, wedges oys." Their first duty is to block the o the bottom set, using the bottom carry their stage planks. They are not l to interfere with the skips once they have reached their place of work, until the sinker has finished cleaning up, had his drills down, and started his "boys" drilling. Then the engines are handed over to the timber men, who take them to hang the next set. From the time the banks men shackles on the first pair of wall plates until the set is hung, filled in, tightened up and temporarily blocked, and the timber men are up to surface with their stage planks and "boys," is an hour to an hour and a half. Timber men are not allowed to deal with "tight" ground on the timber. The sinker is responsible and is compelled to take it down. Knowing this he is careful with his lines and little is ever heard of ground being "on." If a set of permanent guides is required or a set of bearers to be taken down, as soon as the timber men have hung their wall plates and had their "filling in" timber sent down they turn the engine over to the other man, who goes on with that particular work.

Fifty-seven skips, or 114 tons, of rock have been hoisted from the bottom, one set blocked, another hung and filled, four 30-ft. guides hung and bolted up, the shaft drilled over, and blasted a quarter of an hour before the end of the shift. All hitches are cut, bearers installed and timber dropped while the shift is at work in the bottom. The shafts carry six 8-in. and 4-in. penthouses, two, one above another, in each "dummy" compartment. Running four skips in a 7-compartment shaft gives each end and the center compartment clear. In these the penthouses are placed.

There are 132 cu. ft. of pitch pine in each set. The timbers are 7-ft. centers, 6 ft. 3 ins. between; wall plates and end pieces, 9x9 ins.; center studdle over the joint 10x7 ins.; corner studdles, 8x8 ins.; intermediate studdles, 10x4 ins.; dividers, 9x7 ins. The guides are 8x4-in. pitch pine carried on channel brackets bolted to the dividers. Lagging, when any is used, is 12x12-in. pitch pine. Bearer sets are put in approximately every 120 ft., each bearer being made up of three pieces. Under the end pieces three 9x9 ins., making a bearer 27x9 ins.; under the dividers three 9x7 ins., making a bearer 27x9 ins. Hitches are cut to a minimum of 4 ins. in the solid surface. Wire plumb lines are dropped once a month to check the timber and timber men's lines. All the framing guides, ladders, rings, etc., are got out for the 4 shafts by 3 men by hand. To date of writing, in this shaft, 64 sets of 7-ft. center timber has been put in position in 61 consecutive days. This in itself constitutes a record, and is one that will be difficult to excel. Six hanging bolts a side are required, three for each half plate. "Waverly" 1⅛-in. iron is used for the bolts. The wall plates are in two halves, and are simply butt-jointed on a divider, no plating or bolting being used. The length of the two wall plate halves is respectively 22 ft. 9½ ins. and 20 ft. 8½ ins., making a total length of 43 ft. 6 ins. The dividers are 6 ft. 6 ins., giving a shaft width over the timber of 8 ft.

Compartment sizes are as follows: The south, or pump, compartment is 8 ft. 6 ins. by 6 ft. 6 ins. in the clear. The other six compartments are each 6 ft. 6 ins. by 5 ft. in the clear. The pump compartment is divided up as follows: 2 ft. 8 ins. ladderway, 3 ft. 6 ins. for repairing cage, the "runners" 4 and 4½ ins. being bolted to the wall plates, and 2 ft. 4 ins. for pipe bearers and columns. The power cables are carried down in the space between the wall plates and the repairing cage ends. All lights used in the shaft are carbide.

Ventilation.—No fan installation or pipes are in use. A wooden chimney is taken up above the headgear, the entire area of the pump compartment. A ⅞-in. brattice between the pump compartment dividers and "scribed" to the ground, is carried down with the timber. This gives a natural draught of from 20,000 to 25,000 cu. ft. of air per minute passing over the shaft bottom. Ten minutes after blasting the bottom is clear of smoke and fumes.

Equipment.—The shaft is equipped with a modern steel headgear, 110 ft. from the collar to the platform and covering all com partments. Two double drum engines are i use, one a geared Robey 16½x33-in. cylinde and the other a Fraser & Chalmers 22x48-in cylinder. All drums are 8 ft. in diamete The boilers are Babcock & Wilcox Dutch ove type. The winding ropes are 1⅛ ins. in di ameter. The sinking skips are 45 cu. ft. ca pacity.

Organization.—The officials in direct touc with the shaft are mine captain, enginee and foreman boilermaker. No shift bosses o foremen timber men are employed. Th opinion is held that a shift boss hinders an acts as a stumbling block in the way of th man who is doing the work. The men are o the best type and work on the bonus sys tem. All men connected with the sinking joi in the bonus list. Six engine drivers are em ployed, being divided in 8-hr. shifts. All kno the system installed and work with grea efficiency.

Suggestions in Loading and Firin Well Drill Blast Holes.

The following notes and records of loadin and firing well drill holes in quarry work ar given in a paper by Mr. S. R. Russell, Wil mington, Del., before the National Lime Manu facturers' Association.

In all quarry blasting the object to be at tained is maximum material broken at leas cost. In quarries where the stone is used fo lime making, a predominance of one-ma stone is desired and too great a number o spawls is just so much waste. In quarrie where the stone is used for commercial pur poses, and where it must be crushed the mor broken up the stone is after a shot, the bet ter. In either case excessive mudcapping o block-holding on the quarry floor ought t be avoided.

The question of the best explosive for ob taining the desired results is of great impor tance and each superintendent should stud the conditions of his own quarry. There ar many explosives manufactured, nearly all o which differ in some way. Some are slow others quick; some bulky; others dense, et Conditions differ so much in actual practic that the choice of the proper explosive for certain class of work sometimes requires con siderable patient labor and experimenting.

Time expended in studying the action i blasting of various explosives having differen properties, is time well spent. It may be th means of making a great saving in mone Each quarryman should give this subject clos attention as a great deal of money can be, an is wasted in ignorant use of explosives.

The correct spacing and location of bor holes is of just as much importance as th kind of explosives. Many times when poo results are attributed to the explosive, th fault really lies in poorly placed holes. Thi is a subject requiring study by the quarry man of every local condition.

Authorities differ as to the most economica diameter of hole in well drill blasting. Som favor the 3-in. or 4-in. hole, others the larg ones. There is good reason to believe, how ever, that it is just as cheap to drill a 5⅝-i or 6-in. hole as one of smaller bore. Th larger hole has the advantage of permittin a greater spacing and a better concentratio of explosives in the bottom where they ar usually the most needed. It also allows th use of a heavier stem and drill bit, minimizin break-downs.

"Squibbing" or "pringing" well-drill hole is not recommended. It is a slow, tediou and expensive operation. It is necessary t have the machine nearby to clean the hol in case of clogging. If a hole of this siz should cave so badly that it could not b opened, the loss is considerable, and beside there is more or less danger in springing hole of a great depth.

There is no hard and fast rule for th proper spacing of holes. A great deal depend on local conditions. With a 5⅝-in. hole, whic is more commonly used, it is advisable firs not to exceed 20 ft. by 20.0 ft. After a fe blasts are made it may be found that the holes could be set back to 25.0 feet or more. In no case, however, should they be much more than 20.0 ft. apart for best results.

It is good practice to drill the holes at least four or five feet below the quarry floor. This insures a better breakage at the bottom, [illegible] access for a steam shovel if one is used.

In blasting deep holes in quarry operations, dynamite is generally used, although occasionally blasting powder or Judson powder is better. Blasting powder is much slower in action and more bulky than dynamite, and will naturally bring down the stone in large lumps, requiring further treatment on the floor. Judson powder R. R. P. possesses some of the features of dynamite, but is not a great deal quicker in action than blasting powder. Naturally, if these explosives are used either the holes must be spaced more closely or springing must be resorted to to concentrate the charge at the bottom, but in any case the fragmentation is not as great with these explosives as with dynamite.

No rule can be given as to the amount of dynamite to use in holes of given depth. A great deal depends on the local conditions. It requires about 15 lbs. of dynamite of the densty of Atlas, for instance, to fill one foot of a 6-in. hole, the cartridges being slit and amped well. As a general rule it can be said hat a hole of any depth should be filled at east half its length with explosive. A 40-ft. [illegible] should have 20.0 ft., a 60-ft. hole 30.0 ft. of dynamite, and so on.

In order to secure maximum breakage and proper distribution of the explosive in the bore hole, the charge should come up in the hole o at least 30.0 ft. from the top (some experienced blasters will always load up to within 20 ft. of the surface). However, in holes 00 ft. deep, this would mean 70.0 ft. of dynamite, or 70x15, which is 1,050 lbs. This is generally more than necessary if the holes re properly located.

It is absolutely essential that the force be properly distributed in order to obtain maximum results in blasting. This is done in holes of this depth by double or triple loading, that is, by breaking the load. From 700 bs. to 800 lbs. of 40-per cent and 60-per cent ynamite is a very satisfactory load for holes f 100-ft. depth. About 500 lbs. can be loaded n the bottom, then some tamping filled in nd the rest of the charge loaded above this. The object in breaking the load is to distribte the charge where the rock is hardest and ot have some of it at seams or weak spots, where a part of its value would be wasted, nd also to assist in breaking the upper strata y bringing the powder higher up in the holes. Often the fall alone is depended upon for the op breakage. In a line of holes, the charges f explosives can be arranged in this way so hat the dynamite in one hole will be on the ame level as tamping in the next, etc. This have found the most effective way to secure maximum fragmentation with the least amount f explosives.

The record of a few blasts will give a beter idea of what results may be expected in ell drill blasting. Some of these blasts I ersonally directed, and the data for others obtained from reliable sources.

A blast made in limestone used for railroad allast, consisted of eight holes—average epth, 48.0 ft.; average space between holes, 3.0 ft.; average face burden, 19.0 ft. In all 300 lbs. of 40-per cent dynamite were used, roducing 13,000 tons, or about 4 tons per ounds of explosive.

A blast in cement rock consisted of nine oles—average depth, 62.0 ft.; average space etween holes, 20.0 ft.; average face burden, 2.0 ft. In all 2,500 lbs. of 60-per cent, and 800 lbs. of 40-per cent dynamite were used, roducing 28,000 tons of stone, or 6.5 tons er pound of powder.

A blast in cement rock consisted of seven oles—average depth, 60.0 ft.; average face urden, 23.0 ft.; average space between holes, .0 ft. Altogether 500 pounds of 60-per cent, nd 2,900 pounds of 40 per cent dynamite were used, producing 15,000 tons of stone, or 4.41 tons per pound.

A blast made in a hard massive limestone used for ballast, consisted of eight holes—average depth, 95.0 ft.; average space between holes, 28.0 ft.; average face burden, 33.0 ft. In all 2,200 lbs. blasting gelatin, 3,350 lbs. 60-per cent dynamite, and 1,250 lbs. of 40-per cent dynamite were used—a total of 6,800 lbs., producing about 62,000 tons or 9 tons to a pound of explosive.

A blast in limestone used for lime manufacturing, consisted of three holes—average depth 100.0 ft.; average space between holes 17.0 ft.; average face burden, 24.0 ft. In all 1,200 lbs. of 60-per cent, and 1,600 lbs. of 40-per cent dynamite were used, producing 13,000 tons, or about 4.6 tons per pound.

A blast in limestone used for cement manufacture consisted of nine holes—average depth 52.5 ins.; average space between holes 20.0 ft.; average face burden 36.0 ft. In all 1,720 lbs. of 60-per cent, and 2,500 lbs. of 40-per cent dynamite were used, displacing 31,000 tons, or 7.3 tons per pound of explosive.

Some of these blasts were much more effective than others, as some were better balanced. An average of from four to six tons of stone to the pound of explosive is about what should be expected in blasting limestone.

I recommend a little 60-per cent dynamite in the bottom of holes, and 40-per cent, or even a lower grade, for the remainder of the charge. The use of the 60-per cent gives more assurance of "kicking" out the bottom, which of course is nearly always the hardest nut to crack.

It is well to always used strong detonators. At least No. 6 electric fuses, and better still, No. 8, and two should be used in each hole, one about one-fourth of the way up in the charge, and the other near the top. If it is found necessary to splice extra lengths to the fuse wires, the joints should be carefully twisted and well taped. The use of two primers serves the double purpose of assuring thorough detonation of the explosive charge and also afford a way out in case one detonator should be broken or otherwise damaged during tamping.

If the hole is doubled or triple-loaded it is best to have two primers below the break in the charge for the same reason as just described. Each electric fuse should be tested with a reliable galvanometer before loading, and again after the holes have been loaded and tamped. The entire circuit should be tested when loading is completed and all connections have been made, except to the blasting machine or power circuit. In this work there is nothing gained by loading dynamite loose in the holes—that is, removing the paper shells. In fact the danger is greatly increased by so doing, as loose powder may then be scattered all along the walls of the hole and at the mouth. When this occurs there is always the possibility of a stone working loose and getting wedged between the tamping block and the side of the hole, causing friction and setting off the charge.

Simply slit the cartridge longitudinally on two or three sides, dropping in from 10 to 15 lbs. at a time and tamping well with a wooden block. This may be increased to 25 lbs. at a time as the top of the charge is approached.

In loading holes of extreme depth, the question might arise whether it is safe to drop dynamite of say 60-per cent or 40-per cent strength such a distance. I can answer only by saying that the general practice is to drop it in this way. Usually there is some water at the bottom of the hole, and the cartridges are slit so that the dynamite does not receive a very hard shock when it reaches bottom. The water also serves as a cushion and when we get above the water, the powder already in the hole serves the same purpose. If, however, any hesitancy is felt about dropping dynamite in this way, the first few feet of hole can be loaded by attaching a sharp stick to the end of a string, inserting the stick in the dynamite cartridge and lowering almost to the bottom of hole; then release the dynamite with a quick jerk of the string.

A tamping block should be of wo[illegible] about 4.0 feet long, and just enough smaller [illegible] diameter than the hole to have good cleara[illegible]e. Do not use a block too small in diameter [illegible]s there is danger of lose stones falling in the [illegible] getting wedged between the block [illegible] the walls, causing trouble and anxiety. T[illegible] tamping block should be weighted by borin[illegible] a hole about 1½ ins. in diameter at the bo[illegible]m f[illegible] about half its length and filling with [illegible]oulten lead or babbitt. By weighting the bloc[illegible] in this way it is possible to tamp the powd[illegible] better at the bottom of the holes where usu[illegible]ly will be found some water. Of course [illegible] water as possible should be remov[illegible] fr[illegible] the holes before loading is started. [illegible]e rope can be fastened at the other end by [illegible]ring a hole through the block from side to [illegible]le and grooving above each end of the hol[illegible] to the top of the block so that the rope [illegible]ll not project beyond the perimeter of the [illegible]ck.

For very deep holes a light tripod [illegible]an built and the tamping block operated [illegible] men with rope over pulley at the ap[illegible] keeps the rope in the center of the [illegible]le is easier for the men than lifting di[illegible] hand.

Another good arrangement is a hea[illegible] shaped like a bootjack with a pulley [illegible] slotted end. This end is placed over [illegible]ter of the hole and the rope is allow[illegible] over the pulley. Tamping with a dr[illegible] by screwing a wooden block on the en[illegible] is extremely dangerous and should neve[illegible] lowed. The use of any metal parts i[illegible] is condemned by the best authoriti[illegible] great many accidents have been ca[illegible] this way.

I have used the drills to let down [illegible] up the blocks in tamping holes of 10[illegible] more in depth by attaching the [illegible] pump reel on the drill carriage. This [illegible] all right when the machine is run by air, [illegible] advisable if operated from a stationer[illegible] or electricity. It is slower also than [illegible] by the tripod, as considerable time is s[illegible] moving the drill from one hole to the o[illegible]r.

After each hole is loaded with the ex[illegible] charge it should be filled clear to the [illegible] with clay, sand or screenings, and [illegible] care being taken not to break the in[illegible] of the electric fuse wires. When all h[illegible] loaded and connected be sure by test t[illegible] the resistance of the circuit does not exc[illegible] the capacity of the blasting machine, and [illegible] the holes as soon as possible after loa[illegible] is completed.

Some rules which should always be [illegible] are as follows:

Allow no smoking in the vicinity [illegible] the loading operations.

See that the men assisting in loadin[illegible] have no matches, especially friction matc[illegible] in their coat pockets. There is a cha[illegible] these falling into the hole while loadi[illegible] and the result might be disastrous.

Do not allow loose powder to accu[illegible] around the mouth of the hole. The [illegible] the sole of a man's shoe may cause s[illegible] friction to explode the charge. Careful[illegible] is important; to illustrate: In a dynamite [illegible] facturing plant no one wearing a sho[illegible] nails in the sole is allowed in any [illegible] the buildings.

Do not bring out all the powder f[illegible] the blast at one time; and do not allow it t[illegible] out in the open over night.

If possible, complete the loading and [illegible] in one day. If it takes more than o[illegible] day to load the holes, do not connect the [illegible] holes until just before firing. When le[illegible] over night, cover the ends of the electric fuse [illegible] with earth. An electric storm during th[illegible] has been known to set off a blast.

Be sure dynamite is thawed before [illegible] Do not cut, or try to break a frozen dy[illegible] cartridge; and do not load frozen dy[illegible] in the bore hole.

Mail Tubes for London.—A syste[illegible] tube railways is being planned t[illegible] mail in London. Parcels will be handl[illegible] as well as mail. The road will be abo[illegible] miles long, according to the present [illegible]

for Determining Bonus Payment the Los Angeles Aqueduct.

[illegible] previously in this journal [illegible] Aqueduct, some 217 miles [illegible] nstructed nearly entirely by force account work. One of the features of the man nt has been the extensive use of a system of payment of labor. The sys s proven to be very successful in hast- construction and reducing costs. In and Minerals" for June, 1912, the rules [illegible]

[illegible]

—Ten days shall constitute a period. st period to be from the 1st to the 10th month, inclusive; the second from the the 20th, inclusive; the third from t to the end of the month. Bonus pay- shall be allowed upon the basis of meas- [illegible]

[illegible] named classes of employes shall be al- to participate in bonus payments: Tun- [illegible] us crew; shift bosses, miners, muckers.

unnel Foreman.—The tunnel foreman ot be considered as one of the "shift If he is in charge of more than one crew he shall be allowed bonus based he "mean" bonus progress per shift of us crews under his supervision.

hift Boss.—The shift boss shall be con- as one of the shift crew. He will ate in the bonus on the same basis as n of the crew under his direction. An on to this rule is made when a shift placed in charge of two or more shifts rent headings. In this case he would ed on the same basis as a foreman, to- t be considered as one of the crew, ould be allowed bonus based upon the onus progress.

[illegible] 24 hours shall be determined by the r or superintendent in charge of the after consultation with the chief engi-

rimming and Timbering.—All trimming e done by the crew sharing the bonus. timbers are placed by the miners from [illegible] at portion of the tunnel shall be con- as a timbered section; otherwise it ot be so considered.

ontinuous Work and Exceptions.—Only ho work continuously through the 10- [illegible] entitled to the bonus:

Any employe, entitled to bonus earn- ho is injured or becomes ill during a from conditions arising directly from construction, shall participate in bonus ortion to the number of shifts worked during said period.

If an employe, entitled to bonus earn- transferred during a period from a to another part of the work for rea- her than his own request, he shall par- in bonus in proportion to the number s worked by him on such heading.

terruptions of Work.—If the work is oted by the failure of power, shortage erial or supplies, floods, cave-ins, or auses beyond the control of the men, shall be entitled to bonus pay in pro- to the number of shifts worked by uring period in which such interrup- ccurred.

hen Both Timbered and Untimbered s Done by the Crew in the Same Pe- To established a uniform system of ng bonus earnings in above case the ng formula will be used:

[illegible] = average base rate per shift.

[illegible] $\frac{y}{b}$

[illegible]

y = untimbered progress = 30 feet;
a = required timbered per shift = 2 feet;
[illegible] per shift = 2.5 feet;
s = number of shifts dur- [illegible]

Then

[illegible] = shifts required at base rate;

$\frac{y}{b}$ = shifts required at base rate.

Or, substituting values,

[illegible] = 12.5 shifts required at base rate

[illegible] 12.0 shifts required at base rate

Total, 24.5 shifts required at base rate

[illegible] = 2.245 average base rate.

20 × 2.245 = 44.9 feet = progress required.
55 — 44.9 = 10.1 feet = bonus footage.

10. Computations of Bonus Footage and Earnings.—The computations of bonus footage shall be made by dividing the total number of feet run during the period by the total number of shifts worked during the period. From this average footage per shift there shall be deducted the base rate of progress required, and the remainder, if any, will be the bonus footage per shift. The bonus earned *per man* during the period, will be the number of shifts in which he worked, times the average bonus footage, times the bonus price per foot. (Provided all conditions as outlined in these rules are complied with.)

EXAMPLE 1.—Three shifts working 10 days.
Total progress for period, 150 feet.
3 shifts × 10 days = 30 shifts worked
150 feet ÷ 30 shifts = 5 feet per shift
Base rate of progress = 3.5 feet per shift

Bonus footage 1.5 feet per shift
Bonus earned for period *per man* = 1.5 feet × 10 shifts × 25 cents per foot = $3.75.

EXAMPLE 2.—One shift working 10 days.
Total progress for period 50 feet.
1 shift × 10 days = 10 shifts worked
50 [illegible] feet per shift
Base rate of progress = 3.5 feet per shift

Bonus footage 1.5 feet per shift
Bonus earned for period *per man* = 1.5 feet × 10 shifts × 25 cents per foot = $3.75.

11. Interpretation of Rules.—If any of the above rules are not clear to the engineers or superintendents in charge of work, such rule must be referred to the chief engineer for interpretation.

12. The chief engineer shall determine what tunnels shall be given certain base rates and bonus per foot as outlined in the schedules for the various divisions.

The base rate for determining the bonus depended on whether the rock was soft or hard, or whether the excavation was timbered or untimbered; on the number of men on each shift advancing the work; whether the work was done by machine drills or hand drills, and finally on the square feet of cross-section for the tunnel. Bonus schedules were prepared and approved for tunnel driving on the Little Lake division, Bowlder Peak and Grapevine sections of Division 5-A; the Jawbone division; the North Antelope division; the Elizabeth tunnel and the Saugus division. As the Los Angeles Aqueduct is 217 miles long it follows that there were different kinds of rock which varied in hardness, consequently the bonus footage varied. Two schedules, one for the Jawbone division and the other for the Saugus division of the tunnel, are here given.

[illegible] FOR TUNNEL WORK IN THE JAWBONE DIVISION

[illegible] tunnel [illegible] feet.	Class of rock.	Timbered or untimbered.	Class of work.	Base rate per shift. Feet.	No. of men per shift	Bonus per man per foot per shift. Cents.
[illegible]	Soft	[illegible]	Hand	4.0	[illegible]	[illegible]
[illegible]	Soft	Timbered	Hand		[illegible]	[illegible]
[illegible]	[illegible]	Untimbered	[illegible]		10	[illegible]
[illegible]	Hard	Timbered	Hand	2.0	[illegible]	25
[illegible]	[illegible]	Untimbered	M[illegible]		11	[illegible]
[illegible]	[illegible]	Timbered	M[illegible]	2.3	11	40

[illegible] FOR TUNNEL WORK IN THE SAUGUS DIVISION.

[illegible] tunnel [illegible] feet	[illegible] rock	Timbered or untimbered.	Class of work.	Base rate per shift. Feet.	No. of men per shift.	Bonus per man per foot per shift. Cents.
1,000	[illegible]	[illegible]	[illegible]	2.3	13	[illegible]
1,000	[illegible]	[illegible]	Hand	2.0		[illegible]
1,000	Hard	[illegible]	[illegible]	3.0	15	40
[illegible]	[illegible]	Timbered	[illegible]			40
[illegible]	Soft	Untimbered	[illegible]		13	[illegible]
1,000	Soft	Timbered	Hand		15	35
[illegible]	Soft	[illegible]	Hand	[illegible]	11	25
120	Soft	Timbered	Hand	3.5	11	25
[illegible]	Soft	[illegible]	Machine	5.0	11	25
[illegible]	Soft	[illegible]	M[illegible]		11	25

Method of Constructing Pedro Miguel Dam.

In the construction of the dam at the upper end of Pedro Miguel Lock, Panama, the principle is the inclosure of an impervious core of clay between two parallel toes of heavy rock. The dumping of clay between the rock toes has brought together the inner edges of the masses dumped from opposite sides, and this core will soon be built up to about 105 ft above sea level. The clay is supplied by four steam shovels, which are excavating in the canal channel through the proposed Miraflores [illegible] The material is dumped in the daytime and through the night it is sprayed with jets of water until it becomes mud and settles into an impermeable mass. The five jets used are supplied with a 4½ in. main through which water is forced by an air driven pump. The pump is kept in constant operation and when the jets are not in use the water flows out at the upper end of the main into the depression between the converging sides of the core and furthers the work of settlement. The toes of rock have not yet been extended from the hill called Cerro Luisa to the lock on account of the railway tracks which crossed the site of the dam in making connections with the mixing plants at the upper approach to the lock. These tracks have recently been removed, following the completion of connections along the west side and north end of the dam, and the extension of the toes to full length is under way. The portion yet to be built is about 150 yds. long. About 480,000 cu. yds. of filling has been placed.

Vacuum Street Cleaner.—The street railway tracks in the city of Strassburg will hereafter be cleaned by means of a vacuum cleaner, recently adopted. In form and appearance it resembles a box car, and is equipped with drive and vacuum cleaner motors. The dirt is first sprinkled and then sucked up into the car by the vacuum apparatus. This device enables one man to clean 25 miles of track per day, which is equivalent to the output of 17 men under old conditions.

ROADS AND STREETS SECTIO

Portland Cement Concrete Roads.

At a meeting of the American Association Portland Cement Manufacturers held at hicago on May 9 last, Mr. Logan Waller age, Director U. S. Office of Public Roads, esented the following paper in which he ves some interesting information on the esent practice in the construction of conete pavements:

For some years the best practice in city reets construction has called for Portland ment concrete foundations. Used for this irpose, concrete has proved more satisfactory an any other material, and no improvement ould reasonably be expected.

During the past ten years probably more exeriments with road materials have been made an in any other period in the world's hisry. The new traffic conditions brought about the automobile have almost completely upt our standards for rural and suburban oads. During this time much experimenting as been done with the object of making oncrete available as a road material. Up to e last four or five years, however, I think can be safely said that concrete as a road urfacing material has in most cases not roven to be altogether satisfactory.

While this is true in general, yet there are olated instances where concrete has been sed for road construction with such a degree f success, that complete success seems to be most in sight. This fact alone, it seems to e, justifies an assumption that concrete can e made generally successful as a road maerial, provided sufficient care is used in the election of materials, their mixing, laying and uring, all of which necessitates skilled superision.

Probably no form of construction requires reater homogeneity than that of a road surace, as no other structure is subjected to ore severe chemical and physical wear, and successful road must wear uniformly and noothly.

From the best information obtainable, it ppears that great variation has existed in e construction of Portland cement concrete avements up to the present time. Pavements ave been laid, in many cases, in two courses, nd, in a considerable number of places, in but ne course. A great variety of proportions ave been used for the foundation course and or the wearing surface where two courses ave been used, and almost as many variations the proportions where a single course has een laid. In the absence of definite, published formation as to the behavior of these differnt mixes, laid either in one or two courses, is yet too early to attempt to predict what ill ultimately be found to be the best and ost economical method of constructing these avements. Portland cement concrete has een used so successfully in nearly all forms f construction that it seems reasonable to xpect that we cannot go far wrong in using oncrete for a pavement if we adopt the best andard practice in use today for other types f construction.

First, we should select only Portland cement hich will conform in every respect to the andard specifications for that material adoptd by the American Society for Testing Maerials, and all cement should be tested before is used.

Second, sand should be clean, sharp, coarse nd well graded, and may contain not to exeed 5 per cent of loam or clay, provided oranic matter is not present.

Third, the coarse aggregate should be comosed of clean, hard, sound rock; of gravel f a good quality; or of hard, dense, crushed last-furnace slag. The coarse aggregate hould be broken or screened so as to be reained on a ¼-in. mesh and pass in any direcion through a 1¼-in. mesh. Clean water, free from strong acids and alkalis, of course, should be used in making concrete.

A sufficient amount of cement should be used to a little more than fill the voids in the sand, and a sufficient amount of mortar should be used to a little more than fill the voids in the coarse aggregate. The mixing, of course, can be either done by hand or by machine. If by machine—which is preferable on large jobs—I would recommend a batch mixer, in order to adhere strictly to the correct proportioning of the materials.

No definite rule can be laid down for proportioning materials, but, as a general proposition, probably a 1-2-4 or a 1-3-5 mix will, in most cases give satisfactory results.

It is evident that a great field for careful experimentation is open here, upon the results of which will largely depend the economical construction of future concrete pavements.

Assuming that our foundation is as carefully prepared, and as thoroughly drained and compacted as would be necessary for the best form of pavement, the concrete must be carefully placed, spread, and compacted by tamping to a uniform thickness of six or more inches—the thickness depending upon the character of the foundation and the character of the traffic to which the pavement is to be subjected.

I believe one reason why many concrete pavements have failed in the past is because the concrete has been improperly cured before traffic has been allowed upon it. We know that concrete cured under water attains a greater ultimate strength than that cured in air. For this reason I would recommend a fairly wet mix and for a period of from one to two weeks after the concrete has been laid that the surface be kept thoroughly moistened by sprinkling. If provision can be made for keeping the sun from coming directly on the surface, this should prove very beneficial. This protection can be accomplished by covering the surface of the concrete with loam or other soil of which the shoulders of the road are composed. True, such protection will add to the expense of the pavement, but I believe the additional cost will be more than offset by the increased strength of the concrete. In the case of city pavements, this protection might be accomplished by covering the surface with straw, sawdust, or shavings. It occurs to me that further opportunity for the concrete to gain additional strength would be provided at slight expense if, after the curing just mentioned has been completed and the loam or soil has been removed and the surface allowed to dry, a thin coat of bituminous material be immediately applied. This form of construction was used at Ithaca, N. Y., by the office of Public Roads in 1909, and, I am told, at Ann Arbor, Michigan, for the past three seasons. It seems to me that it would materially lessen the shocks from traffic, and if only one bituminous coat were applied and allowed to wear off, it would be worth the additional cost as a protection to the new concrete. Further, it holds the moisture in the concrete.

Experiments indicate that concrete upon drying exhibits shrinkage, and, at the end of six months, the shrinkage amounts in fairly dry concrete to ¾ in. to the 100 ft. This is as much contraction as would be caused by a change in temperature of over 100° F., showing that the effect of moisture in causing the cracking of concrete is certainly as great as, if not in excess of, that due to change in temperature. If means could be provided for preventing the drying out of the moisture, much of this shrinkage would be prevented. The consequence would be a more solid mass of concrete.

The bituminous top just described would prevent the rapid drying out of the concrete mass, and, therefore, prevent the formation of many of the cracks which would otherwise occur. Provided cracks did occur, the bituminous covering would be immediately driven into these cracks by traffic, and the cushiong effect of the bituminous top would preve chipping and spalling of the concrete a these cracks.

Undoubtedly provision must be me for expansion and contraction. While uble to state exactly what this allowance shd be, the best practice up to the present timseems to call for an expansion joint ⅜ in. t ½ in along each side of the pavement at thcurbing in the case of streets, and a transve expansion joint about every 25 ft. Expience may show us, however, that these tra joints can be placed further apart.

My examination of concrete pavemts so far laid has indicated that a transver joint of ½ in. filled with suitable pavin pitch makes a satisfactory joint, and preven ch ping at the edges of the concrete.

On account of the dense surface, a c ¼ in. to the foot is probably suffici concrete pavements. Such a flat crown desirable on any pavement, on accou tendency to distribute the traffic over tire width of the pavement. By the different floats, almost any kind of a finish can be obtained. For ordinary tr course, too smooth a surface is not deal on account of its tendency towards speri ness.

One feature of the best Portland ment concrete pavements that looks particul teresting is the probable low cost o tenance. I have reports from the citen neer of Portland, Maine, of 17 sects of concrete pavement built by the grouting method, the oldest of these pavements havi been laid in 1907. Several sections have be laid each year since. The reports indica there has been no maintenance expe any one of these sections. Portland is of about 55,000 inhabitants, and many concrete sections are subject to exsi traffic on streets with double car tracks Several other instances have been brought notice where substantially no main ance charge has obtained on concrete pavents from three to five years old, and whe the wear is practically slight.

Figures collected by the Office of blic Roads relative to the cost of maintena of plain macadam and bituminous macadan avements under fairly heavy traffic conditi indicate that these pavements, when perly maintained, entail an annual absolute aintenance charge of approximately $450 p mile per annum for plain macadam, and pibly from $800 to $1,000 per mile per annu for bituminous macadam, for 15-ft. surfs. These figures have led me to believe t we must seek a more permanent form of avements for country road surfaces. I ho that the concrete road will meet this requirent.

In the matter of sustaining normal ads the capacity of concrete pavements as compared with the capacity of ordinary madam or bituminous macadam surfaces, must superior. Numerical data or experiment evidence on this subject is as yet meagre. t is not difficult, however, to draw certain nite conclusions when we consider the nat of the materials involved. It is well know that macadam roads have rutted under heavy ads For ruts to develop rapidly it is quite dent that some shearing of the madacam sface occurs. Of course, rutting also takes pl because of wear and lateral displacem of stone. The capacity of concrete pavems to resist shear is relatively much greater, a we may perhaps note this is the first point superiority of concrete over macadam pavents for sustaining normal loads.

It is common practice to assume, in ig ing concrete bridge floors that normal re sures over an area are transmitted th the slab in lines of pressure whose bota surface is conical; with elements at an ig degrees or more with the h[illegible] [illegible] needs demonstration that the s[illegible] iption cannot hold for macadam slabs, i. rmal pressure cannot be transmitted by a lam slab over as large an area of the -ace, and this [illegible] econd advantage of concrete over macanstruction.

may, if we choose, compare concrete surfaces with macadam road surfaces, asg that each is an arch between curbs. It difficult to see that concrete is superior arch in the following way: Consider tire sub-grade carefully removed from a am road surface; there is some doubt whether the macadam surface would alone. On the other hand it is easy to e complete concrete slab crown not only ng after the removal of the sub-grade, also see this arch of concrete sustain erable load without a sub-grade, so that ıst admit the third superiority of conroads over any macadam construction ir action as an arch to sustain normal re.

to the present time, we have not been ned greatly over the presence of heavy upon our roads. There is now, however evidence that we cannot place an upper n the loads which may be exnected to almost any newly built road. The prac- delivering coal, for example, in large ies by motor trucks is rapidly increasn the vicinity of cities there seems reabelieve that this practice may wholly [illegible] lots. We must frankly admit that whatnethod of transportation over roads the most economical will be adopted. not seem likely that in the long run ions upon the weight of loads will inand it, therefore, is very evident that road surfaces must be constructed with le factor of safety, in view of probable e of traffic, both numerically and in nnage.

n the comparisons made above between d cement concrete and plain macadam minous macadam, it is evident that we e practicaly assured that the Portland concrete road is far better able to meet anging traffic conditions than either of ner surfaces. From our knowledge of ength of Portland cement concrete, we sign a road surface of this material to ractically any traffic requirement.

onclusion, I desire to state that I beoncrete roads can be built that will sucfly meet all modern traffic conditions, if nt care is exercised in their construct may be too early to express an opin- the maintenance costs of such roads, heless, with proper supervision, I vene prediction that they can be brought ver figure under equal traffic conditions, th macadam roads.

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lts: Sources of Supply and Methods of Preparation.

lemand for country and suburban roads very largely increased the production nsumption of asphalts and bituminous s that it becomes of much interest to as to the origin and methods of prep- of the various asphaltic materials upon et. In the May issue of the Journal Western Society of Engineers, Mr. Kirschbraun, Consulting Engineer, Chill., discusses these matters as follows:

nercially speaking, there are two classes alts—natural and artificial; the former, ated, is a variety of solid natural bituhe latter is artificially produced from mineral bitumen—i. e., petroleum. It stated that the word asphalt is not re in its scientific sense, for it has reacquired a far wider meaning than its significance. It was first applied to te the European bituminous lime rock—ıral mixture of bitumen and carbonate which was the forerunner of the preshalt pavement. The word asphaltum erly been applied to such natural bitumens as Trinidad lake asphalt. The enormous development and production of artificial products suitable for paving purposes, has resulted in a loose application of the word asphalt to a commercial significance embracing all solid bituminous products prepared from solid or liquid natural bitumen, such products being commercially useful for asphalt paving and for kindred arts.

Natural asphalt, or, properly speaking, asphaltum, has been known from earliest antiquity. Although deposits occur widely distributed over the globe, there are today but few sufficient in extent or so advantageously located as to be of commercial importance. Briefly stated, there are sources of natural asphalt in Venezuela, Trinidad, Mexico, Cuba, Egypt, Palestine, Asia Minor, Persia. In North America there are deposits of various solid bitumens in West Virginia, Oklahoma, Colorado, Utah, California, Texas, and in Athabasca. Many of these are of interest scientifically on account of their manner of occurrence or peculiarities of constitution, but it will be impossible to consider in this connection any but those sources which are commercially important to the paving ind[illegible] in this country.

[illegible] tum, and the earliest recognized in the paving industry, is the Trinidad deposit located on the island of Trinidad, British West Indies. There are a number of deposits of asphalt upon the island, the principal one being that of Pitch Lake, so called because the deposit, occupying the crater of an old volcano, resembles a lake with its shore line of vegetation. Mr. Clifford Richardson, in his "Modern Asphalt Pavement," has fully described this deposit, the salient features of which may be given here.

The surface of this lake of asphalt is sufficiently hard to support a team in motion, although any solid objects at rest are gradually engulfed in the asphalt. The pitch is in constant motion to such an extent as to interfere with making borings or the running of levels. There is a constant influx of new material from a subterranean source, which raises the center of the lake slightly above the sides. Near the center of the lake, borings have been made to a depth of 135 ft. without reaching bottom, at which point the movement of the pitch was so great as to make it imposible to continue the borings. Mr. Richardson has estimated that the deposit contains at least 9,000,000 tons of pitch and is being replenished at the rate of 18,000 to 20,000 tons per year. The level of the lake has been lowered somewhat by the withdrawal in recent years, of over a million tons of asphalt.

Crude Trinidad asphalt is a peculiar combination of water, mineral matter, and bitumen. The crude material contains about 30 per cent of water, 40 per cent of bitumen, and about 30 per cent of mineral matter. The bitumen, water and clay appear to be combined or emulsified in uniform proportions.

At certain points the lake pitch has overflown the cratre and has spread over the contiguous land, producing various deposits called land pitch, which as become more or less hardened and freed from water by exposure. The land asphalt is of course from the same source, and of the same character as the lake asphalt, differing from it very slightly so far as chemical analysis shows. Much stress was laid at one time upon the slight differences between land and lake asphalt. The most that may be said, however, of these differences is that the land asphalt requires somewhat more and a better quality of flux oil than the lake asphalt, to produce the necessary softness for use.

West of the island of Trinidad, on the main land, is located the Bermudez deposit in the state of that name, in Venezuela. This deposit is also said to be in the form of a lake, and although very shallow it covers a wide area of swampy territory, to the extent of 900 acres. The deposit is apparently the result of exudation of tar or maltha springs, which has been hardened by the effect of exposure and climatic heat. These maltha springs are apparent at many points at the surface o the lake where the material exudes in a thic liquid condition. The material is softer tha the Trinidad asphalt and is not emulsified wit water or mineral matter. It is a comparative ly pure bitumen and caries a small amoun of non-bituminous portion, which occurs ap parently through the entanglement and col lection of vegetable matters by the soft pitcl Aside from the difference in hardness and th foreign matter with which the Trinidad an Bermudez asphalts are mixed, their bitumen have quite similar ultimate composition.

Still further west in Venezuela is locate the Maracaibo deposit, about 50 miles inlan from the Gulf of Maracaibo. There are number of deposits in the vicinity and the as phalt appears to originate in maltha or ta springs as does the Bermudez deposit, the mal tha having become hardened by exposure t a semi-solid, nearly pure, asphalt. The charac ter of the material is quite different from th ermudex asphalt, and it is recognizable by it particularly rank odor and the peculiar gumm nature of the impurities with which it is con taminated. The Maracaibo deposit has bee of variable commercial importance, possibl on account of the difficulty of access, and it use has been limited in recent years to com paratively few localities.

On the island of Cuba there are a larg number of deposits of various kinds of as phalts, some of which were of commercia importance in the early days of the pavin industry. Pavements were laid at an earl date in the city of Washington, D. C., wit asphalt from Cuba known as Bejucal asphal from a district of that name. This asphal attained considerable commercial importanc at one time, but in recent years it has dis appeared from the market for the reason tha the material occurs in comparatively sma pockets, making it difficult and expensive t mine. There are a number of similarly oc curring deposits upon the island, but the onl one of large extent is located in the Pina del Rio province about 40 miles west of Ha vana and about 5 miles from Mariel bay, fror which the deposit takes its name. This ma terial has been used in the United States fo about ten years and has attained considerabl importance. So far as is known to the write no account of this deposit has been given i any engineering literature, and for that rea son this description is given in somewhat mor detail than the better known deposits pre viously described.

The asphalt of these Mariel deposits is very hard material resembling, in its crud state, bituminous coal. It contains about 5 to 60 per cent of pure bitumen and about 4 per cent of mineral matter. Like the Trinida material, there is great uniformity in th proximate composition of the asphalt fror different sections of the deposit. The aspha occurs in immense seams and veins, some o which may be followed for several mile across country by their outcroppings. Certai of the seams lie horizontally, and have bee worked by open cuts to a convenient depth following the seams in their general trenc At other point of outcropping, the materia has been obtruded in a vertical direction an the excavation of open pits has followed th crude material downward. At one of thes openings a pit had been excavated about 20 ft. in diameter to a depth of about 150 ft where the vein had narrowed. At this poin it again widened out as it extended downward At the time of observation the pit had bee sunk to a depth of approximately 250 ft., a which point the cost of timbering and pumpin of water and the widening of the vein ha apparently necessitated the further remova of material by driving horizontal galleries int the mass of the deposit. So far as could b ascertained, at no point had the depth of th deposit been gaged, but the various excava tions and cuts apparently widened as they pro ceeded downward suggesting the possibilit that at sufficient depth they would run to gether into a mother lode. Undoubtedly th deposit will yield much of scientific interes as it is more fully uncovered and studied. I has been impossible to obtain any sufficientl

[illegible]
[illegible]
he quantities are very large. Great amounts
[illegible]
[illegible]
ur in various parts of the United States, as
[illegible]
re certain deposits of large extent which
[illegible]
[illegible] well
nown brand of such material. The develop-
nent of the oil-asphalt industry in California
nade it commercially impracticable to work
hese natural asphalt deposits, and there is
ow no solid natural California asphalt upon
he market. The most important and the only
ommercial supply of natural asphalt in this
ountry is contained in the Gilsonite deposits
f Utah. These are located in the eastern part
f that state, near the Colorado line, in a
omparatively limited area, and in a very
naccessible country. The veins are small and
cattered about, and although the material
oes not occur in very large masses, there
xists in the aggregate a large quantity of the
ilsonite. The latter is a hard black bitumen
aving a brilliant lustre and a conchoidal frac-
ure. It is very brittle and is easily converted
a reddish brown powder.

The manner of occurrence of the Gilsonite
ndicates that it has been forced into fissures
n the rock while in a semi-plastic condition.
he veins are usually from a few inches to a
ew feet wide, and there are only a small
umber sufficiently large to be worked. The
nining of Gilsonite presents many uncertain-
es, for, on account of the broken condition
f the country the most promising prospects
ave a habit of pinching out suddenly. Dis-
strous explosions have occurred in the Gil
onite mines due to the fine Gilsonite powder
rom the dislodged masses. A very ingenious
nethod of mining has been recently developed
hich consists of directing a jet of steam
gainst the face of the veins. The unequal
xpansion of the material causes it to fracture
nd break off in masses.

Gilsonite appears on the market as firsts and
econds. The seconds are taken from the
uter portions of the veins and are of a harder
nd more indurated nature. The seconds are
hysically distinguished from firsts by their
nore metallic lustre and by differences of
racture. Sometimes the distinction between
rsts and seconds is merely one of size. There
re great differences in quality in various Gil-
onites which may be detected sometimes by
ppearance, but more often require chemical
nd physical tests for differentiation.

Gilsonite has some very desirable properties,
naking it of great value in other applications
esides the paving art. It is compounded into
oofing materials, varnishes, lacquers, rubber
ubstitutes, and insulation compounds. It
ame into use in the paving industry about 15
ears ago, and for a time considerable quan-
ties were used in that way, but quite recently
he demand for it in other arts and its cost
ave somewhat limited its use in that con-
ection.

The foregoing are the principal sources of
atural asphaltum now commercially availa-
le. By far the largest part of the domestic
roduction, however, is artificial asphalt pro-
uced from various petroleum oils. The petro-
eum oils of this country are generally classed
nto three groups, known as paraffine, semi-
sphaltic, and asphalt petroleums. The oils
f the Pennsylvania field are paraffine base
ils. Those of the Illinois, Kansas, Oklahoma
nd Gulf fields are semi-asphaltic to varying
egrees. The California oils are generally
onsidered asphaltic. No artificial asphalt is
nade from the Pennsylvania or paraffine oils,
ut large quantities are produced from the
ls of the semi-asphaltic and California group.

The earliest oil asphalt of this country was
roduced as a by-product from the straight
stillation of California crude petroleums.
he early asphalt so produced fell into dis-
epute on account of the careless manner of
roduction, the lack of uniformity, and the
feriority for the product through improper
ethods of distillation. The demand for a
etter quality has induced improvement in refining methods, which has resulted in recent years in superior products being prepared especially for paving purposes.

There are at present two methods used in preparing oil asphalts, which methods are more or less adaptable according to the character of the oil operated upon. The first method is that of ordinary distillation of the crude petroleum with the use of saturated steam, the distillation being carried on until the solid or asphaltic portion of the oil remains. The distillation is carried on in large stills holding from 300 to 1,000 bbls. of oil. Steam is injected into the bottom of the stills through perforated pipes to effect agitation and assist in the removal of the volatile oils. In the best practice, steam is also injected at the top of the stills to facilitate carrying off the heavy oil vapors, and to prevent their decomposition by condensation and dropping back into the hot oil. The maximum temperature employed in careful practice rarely exceeds 700° F. The material in the stills is brought to the desired consistency and run into cooling stills or through pipes cooled by oil used for succeeding charges. Sometimes the material from several stills is run into one large receiving still, where it is mixed with other batches and a greater degree of uniformity thereby attained. Aside from the kind of oil used, the value of the product of this distillation process depends upon the various means of preventing local overheating and decomposition, the amount and efficient distribution of steam injected, the time of the distillation, and the temperatures employed. There are commercial asphalts prepared in this way from California, Mexico and Texas oils, and probably within a short time there will be products on the market from asphaltic oils derived from other sources.

The method of distillation described is more applicable to asphaltic base oils and is not generally employed with the semi-asphaltic oils of the mid-continent field. Certain of these oils are not reducible to solid asphalts by this method on account of the excessive temperatures necessary, and the resultant decomposition attending the attempt to remove the paraffine and vaseline hydrocarbons which are largely present in such oils.

This brings us to a second method of preparation of asphaltic products by air blowing. That method has been developed particularly through an effort to utilize petroleum residuums of the character not reducible by the distillation process described. While directd particularly to such oils, the method is nevertheless most advantageously employed with the strictly asphaltic oils, of which the California oil is representative. Asphalts prepared by this method are commercially known as blown-oil asphalts.

In the preparation of blown-oil asphalts, petroleum residuum is the raw material. This petroleum residuum is prepared as the residue from the distillation of crude pertroleums with steam through the lubricating oil fractions, and is continued in the best practice, with the removal of as much of the vaseline (if present) as can be accomplished without decomposition. The air-blowing operation is conducted in open kettles equipped with perforated pipes along the bottom. The residuum is kept at a temperature much below that at which normally it distills, and air is injected into the mass through the perforated pipes, producing a violent agitation and intimate contact between the residuum and air. The injection of air under these conditions produces, among other reactions, oxidation and condensation of the hydrocarbons of the residuum. The oil treated gradually thickens and the process is continued until a product of the desired consistency is obtained. A significant characteristic of the process is that there is no material loss during the operation.

When residuum oils are used that are not sufficiently asphaltic to yield products of the quality desired, it is necessary to add asphaltic material such as Gilsonite—which is a hard bitumen—to the blown oil. By variations of the character of the residuum, and the amounts and character of solid base introduced, it is possible to produce a variety of products
adaptable for many purposes. The blown-
oil products possess, among other characteris-
[illegible] and a [illegible]
degree of inertness to temperature [illegible]

The quality of the product must [illegible]
sidered with reference to the purp[illegible]
which it is to be used, but it depends generally
upon the asphaltic character and ma[illegible]er of
distillation of the residuum used, and the ex-
tent of the blowing operation. These [illegible]
have in recent years been used in [illegible]
minous concrete pavements described.

It has been necessary to discuss the various
[illegible] oil asphalts in connec[illegible] with
their manner of preparation. The preparation
of natural asphalts is comparatively simple
Gilsonite is a very pure bitumen and
no refining before admixture with flu[illegible]
natural asphalts are refined by me[illegible]ng
large kettles with steam or direct hea[illegible] there
by expelling the water and light [illegible]
allowing the coarse mineral or forei[illegible] mat
ters to separate out. Sometimes flux [illegible]
other asphaltic materials are added
process of refining. After thorougl
tion of foreign matters, the refined
is drawn off into packages or moulds
ment. Where the material is to be
stationary plants, it is there tempere
further addition of petroleum resid
fluxing oils to the consistency desired
used in portable plants or under
which do not permit of this fluxing, tl
must be prepared at the refinery
necessary amount of flux for the desir[illegible] con
sistency. This flux is incorporated du[illegible]g [illegible]
refining process, as described. The
material may be petroleum residuum
or semi-solid, prepared from oil pro[illegible]
described.

It will be seen from a survey of th[illegible]
sources of asphalts the various met[illegible]ls of
preparation, and the different fluxing n
with which they may be compounded
recognition of the properties of the
cial products is no simple matter. R
velopment of new sources of supply
ficial asphalts, the changes in the
of preparation, and the recent tend
ward compounding of various material [illegible]
brand names, has complicated the [illegible]
[illegible] recognition of suitable produ[illegible]
engineer and technologist to a degree [illegible]
ing the most thorough knowled[illegible]
chemical and physical characteristics o[illegible]
materials—considered especially in con[illegible]
with their method of preparati[illegible]
market.

In considering the requirements for [illegible]
products for bituminous-macadam pav[illegible]ents,
it must be remembered that the condit[illegible]s to
be met are somewhat different than in [illegible]
asphalt pavements, consequently our [illegible]
ence with the sheet-asphalt pavement may
admit of modification in certain con[illegible]ons.
Bituminous concrete pavements are con-
structed of large aggregate, graded to [illegible]tain
minimum voids. This combination of [illegible]
particles possesses a certain stability [illegible] de-
pendent upon the binding medium, a[illegible]
thereby, under normal conditions of [illegible]
the use of a less cementitious binding [illegible]
than in the fine sand aggregate of the [illegible]
asphalt pavements. Further, the si[illegible] and
character of the stone particles ena[illegible] the
coating of same with thicker films [illegible] the
binder. These considerations may mod[illegible] the
requirements of asphalt cement for th[illegible] pur-
pose in view.

It is possible to state briefly a num[illegible]
requirements for asphalt cement fo[illegible] this
purpose.

First, it must have chemical stabil[illegible]
weathering qualities, and the ability t[illegible] per-
manently retain its physical properties.

Second, it must be well prepared, [illegible]
geneous, and free from decomposition pr[illegible]ucts
or evidences of overheating.

Third, it must be sufficiently cemen[illegible]ous
to meet particular conditions of constr[illegible]ion,
climate and traffic, especially retaining its [illegible]
ing value in summer to the extent of pr[illegible]ent-
ing displacement of the mineral aggreg[illegible]

Fourth, it should impart to the pavem[illegible] a
desirable degree of resiliency and su[illegible]

[illegible]

h, it must be waterproof.

purpose of specifications being to define, ts, a desirable degree of these various es, it remains to consider in what way ay be accomplished.

ortunately it has been impossible to de- sts to measure directly certain of these s. For example, there is no very sat- [illegible] ue of these asphaltic products, and of this characteristic must be in- from other tests. The problem is fur- omplicated by the wide differences in ter of various products described. As er of fact, it is almost impossible to by a single specification, all types of s without widening the various pro- to such an extent as to apply too [illegible] actice to draw separate specifications the various types of asphalt are con- , covering each type specifically.

[illegible] rth, the first requirement of chem- is covered by suitable evaporation [illegible] l is volatile under standard tem- e conditions. The hardening of the due to this volatilization and oxidation rmined by hardness tests with a pene- [illegible] f hardening observed is an indica- [illegible] ature at which the asphalt gives off t vapor to ignite—determined as the [illegible] terial.

second condition may be determined whereby various solvents separate or decomposition products. The nditions of preparation of oil asphalts indicated by fixed carbon tests. With ce to fluxed natural asphalts, this test light upon the suitability and homo- of flux combinations, which latter may e definitely gaged and checked by ductility.

third condition cannot at present be by a general test for binding values. ious other tests may be taken as in- , to a degree, of this feature. In with blown-oil asphalts, the extent h the residuum used is asphaltic, or en modified with asphaltic material. , directly the cementitiousness of the This is covered in the specifications [illegible] the use of a heavy oil as the raw ma- [illegible] nt with the other properties. Again, ing the maximum melting point per- , with relation to a given hardness, a sphaltic product is obtained, and one s therefore more cementitious. With e to other asphalts, the binding prop- re roughly gaged by considerations lity with relation to hardness, bearing the origin of the product examined.

ourth condition, as well as the pre- is controlled by prescribing a proper ncy of cement for the particular con- to be encountered; malleability and g values are to an extent functions stency. The consistency of the product emes of temperature governs to a xtent this resiliency of the pavement. too close limits must be avoided in ot to sacrifice the binding qualities ement. The malleability of the pave- ixture at low temperatures may be irectly. This characteristic of the t mixture is a function of the cement- ity of the asphalt, the consistency, nt present, and its ability to elongate. y it is a function of the viscosity ement.

eady indicated, the various properties asphaltic cements are so interrelated iations in one property entail corre- changes in other characteristics. For a certain inertness to temperature is desirable, but this quality, if too nphasized, causes corresponding loss

[illegible]

this time to go into further detail regarding the significance of tests or the interrelation of various properties possessed by these asphalts. It is sufficient to say that in all these matters a happy medium must be sought, adaptable in each case to requirements of traffic, construction, climate and the result which it is desired to attain. These are not matters capable of mathematic analysis and the definite setting of values, but are rather [illegible] understanding of various problems involved. [illegible] tions which have given successful results.

In conclusion, I would emphasize the necessity of scientific records of service given by products of known and predetermined characteristics. The haphazard method of construction of roads and pavements without knowledge of the character of the materials employed, is no longer followed, and engineers and technologists are rapidly acquiring closer control and more certain results through experience gained from records of successes and failures under known conditions.

The Third International Road Congress.

The Third International Road Congress will be held in London from Monday, June the 23rd, to Saturday, June the 28th, 1913. These Congresses will in future be held triennially. The first was held in Paris in 1908, and the second in Brussels in 1910. Their object is to collect, discuss and circulate all the latest practical and scientific knowledge with regard to the construction and maintenance of highways. The Congress of 1913 is held on the invitation of the British Government. Over 30 governments have intimated to the British Minister of Foreign Affairs their intention of taking part officially in the Congress.

In view of the great advance effected in the methods of road construction and maintenance in recent years by the extension of the use of bituminous binding material and the numerous experiments that have been made and data accumulated since the last Congress, there is no doubt that the discussion of the various questions to be submitted to the Congress will make the London meeting a notable event in the history of road engineering.

The two previous Congresses aroused great interest among engineers, surveyors, automobilists and manufacturers of road making materials throughout the world, and a number of very valuable papers were contributed by the world's leading authorities on various subjects connected with the construction of roads.

Having regard to the rapid development of road construction in America, these Congresses cannot fail to prove of very great benefit and interest to those responsible for the good condition of the public highways in this country, and it is to be hoped that in view of the numerous opportunities for inspection of works and sites in England the number of American delegates and members of the Congress will be large.

The Congress of next year will receive and consider a number of papers and reports by the leading authorities throughout the world on the maintenance of roads, their foundations and proper drainage, the prevention of dust and mud, the laying of light railways and tramways on roads, the choice of surfacing materials, the influence of weight and speed of vehicles on roads and bridges, the conditions that should be filled by horse or mechanically propelled vehicles in order that they may not damage or suffer damage from the roads, etc.

The chairman of the Local Organizing Committee is Sir George S. Gibb, chairman of the Imperial Road Board. Sir Charles D. Rose, Bart., M. P., is treasurer, and Mr. W. Rees Jeffreys (secretary of the Road Board), Queen Anne's Chambers, Broadway, Westminster, London, S. W., is honorary secretary.

An exhibition of road machinery, materials and appliances used in road construction is being organized in connection with the Congress, and in view of the fact that a very large attendance of foreign delegates is expected, in addition to engineers and surveyors from all parts of the United Kingdom, the exhibition will, it is expected, prove of great practical commercial value.

Notes on Road and Street Work.

Cost of Resurfacing Gravel Roads.—Three of the roads in the Metropolitan Park System in Massachusetts were resurfaced in 1911, the cost of the work, according to the last annual report of the Metropolitan Park Commission, being as follows:

	Cts. per sq. yd.	Cts. per sq. yd.	Cts. per sq. yd.
Gravel	15.0	12.1	13.0
[illegible]	[illegible]	[illegible]	[illegible]
Cost of applying binder	....	1.2	2.6
Total	26.9	22.4	26.8

Bituminous binder, [illegible]

¹Standard asphalt binder (Standard Oil Co.) [illegible] oil (Standard Oil Co.).

Road No. 1 is in the Middlesex Falls Reservation. The resurfacing covered a length of 1,400 ft. and a width of 36 ft., the yardage amounted to 5,600. Road No. 2 is also in the Middlesex Falls Reservation, the length resurfaced being 2,000 ft., and the width 19 ft.; the total yardage was 4,220. Road No. 3 is in the Mystic Valley Parkway, and was resurfaced for a length of 500 ft., a width of 34 ft., and area of 1,890 sq. yds.

Cutting Through Concrete Pavement for Underground Work.—In a paper presented [illegible] the American Portland Cement Manufacturers, Mr. J. S. McCullough, City Engineer of Fond du Lac, Wis., gave the folowing description of the methods employed in that city by the Wisconsin Telephone Co. in cutting through the concrete pavement in order to construct conduits. The company cut a trench 18 ins. to 20 ins. wide through 4,300 lin. ft. of concrete pavement and replaced it. The concrete was broken out in slabs by drilling holes 10 ins. to 12 ins. apart on the line of the trench and breaking out the slab with wedges and feathers. A small steam drill such as is used in stone quarries would drill about 400 ft. a day and two men could break out the slabs. After completing the installation of the conduit the cut out piece was replaced with all new material by a concrete paving contractor and it is stated that up to the present time there are no places showing any defect. The cost of the work was as follows:

	Per sq. yd.
[illegible]	[illegible]
Replacing pavement, original contractor's price, as provided in interest with city..	1.500
Replacing asphalt joint, old asphalt used..	.082
Total	[illegible]

Mr. McCullough also gave the following as showing the cost of removal and replacement on about 2,000 lin. ft. of brick street on this same work:

	Per sq. yd.
Removing brick and concrete foundation..	$0.286
Cost of brick to replace those broken in [illegible]	[illegible]
Relaying concrete foundations and sand cushion	[illegible]
[illegible]	[illegible]
Total	[illegible]

Bituminous Surfaces for Steel-Tire Traffic.—In a discussion last January before the American Society of Civil Engineers on Road Construction and Maintenance, Mr. W. H. Fulweiler, Assoc. M. Am. Soc. C. E., stated* that when the steel-tire traffic becomes pronounced on a road or street, the thinnest possible surface treatment seems to give the best results. Mr. Fulweiler has found that an application of about ½ gal. of fairly heavy binder, covered with screenings, would give good results where automobile traffic was predominant; but when that same treatment was used in localities where the character of the traffic was similar to that in a small town, the surface was cut up badly, and the best results were obtained by a very thin treatment which simply protected the surface or acted like a coat of varnish on a floor. This treatment is applied directly on the stones which have to carry the load. Mr. Fulweiler stated that in surface treatments it seems highly probable that if two applications are better than one, three are better than two. If it is attempted to apply a cold material with a gravity distributor it is very difficult to put on much less than ½ gal. per sq. yd. If a pressure distributor is used, a very much smaller quantity can be applied. If a total of about ⅜ gal. per sq. yd. is put on in three separate applications, the result is apparently quite as desirable as with the single application of ½ gal. with the gravity sprinkler, and it is much more uniform. In this way, if a spot is missed on the first application, the second treatment covers it, or if it is missed on the second treatment, the third treatment covers it. By applying three coats and by allowing 8 or 10 hours for each coat to set, the best results are obtained, and ⅛ gal. per sq. yd. is saved.

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*Proceedings American Society of Civil Engineers, Vol. XXXVIII, No. 5, p. 760.

Macadam Construction in Los Angeles County, Cal.—When the present Los Angeles County Highway Commission went into office in 1911 it made some changes in the methods of constructing the system of improved highways. The methods of construction followed during the last 6 months of 1911 are described as follows in the last report of Frank H. Joynes, Chief Engineer of the Commission:

> The method followed in macadam construction was based on the mechanical locking of the stone, and not on the binding of stone together by asphaltic oil. Asphaltic oil when exposed to the air and sun develops considerable strength in a comparatively short time, but sealed up in the body of a road it appears to lie dormant, developing no strength and acting more as a lubricant than as a binder. Asphaltic oil is of great value in road construction when used in such a manner that its strength will develop, but is of no value otherwise. This desired strength develops when the oil is placed on the surface and it is here that we are using it. It is believed that with a firm subgrade under a mechanically locked mass of broken stone covered with a tough, uniform coating of asphaltic oil we will get a road that will stand heavy travel by the simple maintenance of the asphaltic oil coat. The above-mentioned method is one easily understood and one that at first thought would be considered a method engineers and contractors could follow readily, yet the mechanical locking of stone is an art not to be learned from books, and one requiring great patience and a continual, close and careful watching on the part of the engineer, contractor, foreman and laborers.

Creosoted Wood Block Paving.—At the 8th annual meeting of the American Wood Preservers' Association last January one of the speakers cited the following experience in paving with wood blocks which had dried out considerably: Bergen Ave., Jersey City, was paved by a sub-contractor who had little experience with wood block. The Water Department decided to put in a new main after the blocks were delivered on the street. They were tight piled on the sidewalk, but dried out considerably in the two or three months they laid there. In the beginning the inspector insisted on having the blocks laid very close together. A 1½-in. pitch expansion joint along the curb was put in as the paving proceeded. The first two squares laid expanded as soon as the street was turned over to traffic. The expansion joint along the curb was closed up and the pavement bulged. The sub-contractor then changed his method. He paved the blocks loosely and instead of immediately putting the expansion joint in place along the curb, he put sand in. Some two or three weeks after the street was paved and had been well sprinkled, he took the sand out of the expansion joints and where the expansion of the blocks had narrowed the space, he cut off the ends of the blocks so as to make a space at least 1½ ins. wide. He then filled the space with pitch. No trouble has been experienced with this section of the street. The speaker stated that he believed that this construction was a remedy to those streets where, due to sewers, water connections, etc., the blocks have to lay on the streets for a long time and get dried out before being used.

Cost Data on Construction of Brick Block Pavements at Webb City, Mo.

Contributed by E. W. Robinson, Assistant City Engineer, Webb City, Mo.

The following data were obtained from the daily reports of the inspectors employed on the construction of two vitrified brick block pavements in this city. On one job the cost of mixing and placing the concrete base, setting the blocks and pouring the filler was obtained, while on the other job nothing but the cost of the concrete base was secured. No data were obtained upon the excavation or upon the placing of the sand cushion for the reason that an inspector was not on the job when these operations were carried on. While the costs given do not show the actual total cost of the finished pavement, they are complete for the different operations and represent a fair average for work done in this city during the last three years.

The specifications require the sub-grade to be excavated 10 ins. below, and parallel to, the finished surface of the pavement, and to be thoroughly compacted by rolling or ramming. The concrete base was 4 ins. in thickness and was composed of one part of Portland cement to eight parts of mine "tailings," or gravel. The blocks were set on a 2-in. cushion of river sand and rolled with a 5-ton horse roller until smooth and even. The sand cushion was shaped with a "lute," the cross-section of the street varying so much that a template reaching from curb to curb, or curb to center of street, could not be used. Good results can be secured by this method when the lute is in the hands of an experienced person with a good eye for such work. The asphalt filler was heated in a 500-gal. portable kettle and was poured between the blocks by means of the regular pouring cans generally used for such purposes.

CONCRETE BASE.

Job No. 1—197.2 cu. yds.—1,775 sq. yds.

	Per cu. yd	Per sq. yd
Foreman, 36 hrs. at $0.27 7/9	$0.0507	$0.0056
Feeding mixer, 1 man on cement, 2 men on gravel, 103 hrs. at $0.19 4/9	0.1016	0.0113
Placing concrete, 1 man wheeling, 2 men shoveling, 86 hrs. at $0.19 4/9	0.0848	0.0094
Spreading and luting, 35 hrs. at $0.19 4/9	0.0345	0.0038
Tamping, 35 hrs. at $0.19 4/9	0.0345	0.0038
Rent on mixer, 4 days at $8.00	0.1623	0.0180
Cement, 635 sacks at $0.40	1.2880	0.1431
Gravel, 198 cu. yds. at $0.50	0.5020	0.0558
Water, 2,204 cu. ft. at $0.50 per 100 cu. ft.	0.0559	0.0062
Total	$2.314	$0.257

A Coltrin continuous mixer No. 12 was used on this job, one man feeding on each side. The sub-grade was not prepared sufficiently far in advance to allow concrete to be placed on consecutive days, and the preparation and re-organization of the gang for each day's work probably caused the cost to be higher than it should have been. The street was 32 ft. wide between curbs.

CONCRETE BASE.

Job No. 2.—365.6 cu. yds.—3,290 sq. yds.

	Per cu. yd.	Per sq. yd
Foreman, 76 hrs. at $0.27 7/9	$0.0578	$0.0064
Feeding mixer, 1 man on cement, 2 men on gravel, 192 hrs. at $0.22 2/9	0.1167	0.0130
Placing concrete, 134½ hrs. at $0.20	0.0736	0.0082
Spreading and luting, 59 hrs. at $0.27 7/9	0.0448	0.0050
Tamping, 64½ hrs. at $0.20	0.0353	0.0039
Rent on machine, 7 days at $5.00	0.0957	0.0106
Cement, 1,253 sacks at $0.35	1.1995	0.1333
Gravel, 367 cu. yds. at $0.50	0.5019	0.0557
Water, 1,889 cu. ft. at $0.50 per 100 cu. ft.	0.0259	0.0029
Total	$2.151	$0.239

A Coltrin continuous mixer No. 9 was used on the job, two men feeding on the one side. The foreman made a hand most of the time helping wherever the work was behind. The street was 38 ft. wide between curbs with a double car track in the center. On one block concrete was placed between the ties and between the tracks, on the rest of the [illegible] confined to the space between the outer rail and the curbs except a few places where the old concrete has been removed to raise joints and straighten track. The space on one side of the tracks was finished before the other side was started.

SETTING BLOCKS (Labor only)

Job No. 1.—1,775 sq. yds

Foreman, 38 hrs. at $0.27 7/9	[illegible]
Brick setter, 36 hrs. at $0.50, 5 hrs at $0.27 7/9	[illegible]
Hackers, 98 hrs. at $0.19 4/9	[illegible]
Wheeling, 102 hrs. at $0.09 4/9	0.0112
Total	[illegible]

The above cost for setting the blocks was higher than necessary owing to the fact that the work was not done continuously and at no time was a full day put in by the setter. Two makes of blocks were used, one guaranteed to lay 42 to the square yard, the other 44. The blocks cost approximately $20 per 1,000 on the job.

POURING ASPHALT FILLER

Job No. 1—1,775 sq. yds

Foreman, 60 hrs. at $0.27 7/9	[illegible]
Pourers, 181 hrs. at $0.19 4/9	[illegible]
Feeding and firing kettle, 43 hrs at $0.27 7/9, 29 hrs. at $0.19 4/9	[illegible]
Night fireman, 24 hrs. at $0.27 7/9, 4 hrs at $0.19 4/9	[illegible]
Asphalt, 10.27 tons at $30.20 f. o. b. Webb City	[illegible]
Coal, 1½ tons at $4.00	[illegible]
Total	[illegible]

The asphalt was shipped in wooden barrels, the staves of which furnished considerable amount of the fuel. One make of blocks had ⅛-in. lugs on one side, the other having no lugs at all.

The excavation averaged about [illegible] ins. in depth, and assuming it could be taken out for $.50 per cu. yd., which would have been an easy matter, we have a cost of $0.1[illegible] per sq. yd. The rolling of the sub-grade with steam roller rented from the city cost $15, and the rolling of the blocks with a horse roller cost approximately $7. The sand for the cushion could have been placed on the job for $1.25 per cu. yd. and spread for $0.02 per sq. yd. We would then have a summary of the total cost of job No. 1 as follows:

Excavation	[illegible]
Rolling sub-grade	[illegible]
Concrete base	[illegible]
Sand cushion	[illegible]
Brick, in place	0.89
Rolling brick	[illegible]
Filler, in place	0.221
Total	$1.[illegible]

Bituminous Concrete as Laid by the Park Commissioners of Chicago, Ill.

In 1908 the South Park Commissioners of Chicago, Ill., began surfacing macadam by mixing bitumen with sand and stone before laying. In this year about 10,000 sq. yds. of this surfacing were laid. In the spring of 1909 the commissioners purchased two of the Link Belt Co.'s portable mixing plants, and in the following year similar plants were purchased by the West Chicago Park Commissioners and the Lincoln Park Commissioners, both of Chicago. These four plants have been operated each season since their purchase and about 1,000,000 sq. yds. of pavement have been laid with them. Most of it has been on the old macadam already in existence on the boulevards and park drives, thus offering a solution of the problem of preserving and utilizing macadam pavements. The results have been very satisfactory and the amount of repairs have been almost negligible. A description of the method employed by the South Park Commissioners in this work, together with some detail of the cost, was given in our issue of April 24, 1912. Additional data in this work were given by Mr. Linn White, Chief Engineer of the South Park Commission, and Mr. A. C. Schrader, Chief Engineer of the West Chicago Park [illegible] n, in a paper presented before Western y of Engineers and printed in the May of the Journal of the Society, from the matter in this article has been ab- d.

composition of the paving material, as Chicago, has been generally six parts ished stone, four parts of sand and 8 per cent to 9 per cent by weight of n.

paving mixture described above is of of uniform composition throughout, ger particles of stone being distributed h the mass, and the pavement made in yer. The size of the largest particle ne is about half the thickness of the ent, which is generally made from 1½ ns. No particular effort is made to the stone as to size, it being taken as es from the crusher, with the dust and ngs removed. The sand is graded from 10 in. down to dust because it is es- s stated above, to get a well filled, im is and waterproof mixture. The sur- f such a pavement necessarily presents rregularities in appearance. In certain nore coarse stone will appear, suggest- idea that the pavement is not entirely roof at such points. To insure the results and uniformity of surface it is ctice generally, but not always, to coat face of the pavement, after rolling, with or seal coat of neat bitumen and final- r it with a thin layer of stone chips or

A variation of the above described method of construction which as been used to some extent in the South Park district and which [illegible] follows:

The size and proportion of stone are reduced in the paving mixture intended for the wearing surface, and the pavement is made in two layers—a wearing surface and a binder course of comparatively large stone. The binder course may be coated with bituminous cement, or it may be laid without any coating. In either case it should be clean stone of practically one size (about 2 ins. is best), which is lightly rolled after being spread in place until it is firmly set into the macadam base, but with free and open voids left between the pieces of the stone. The paving composition for the wearing surface is then spread and thoroughly rolled until forced into the voids of the binder course.

The advantages of this type of construction are that the strong stone of the binder course forms an effectual key between the base and wearing surface, holding it against shifting or rutting, even under the most adverse conditions, and the wearing surface can be made thinner, thus reducing the cost. Also it is more flexible as to thickness and cost and recommends itself for this reason, particularly for roadways not carrying an excessive traffic.

The one-layer bituminous concrete describe above, depends mainly on its own composition for stability, whereas the two-layer pavement derives its lateral stability mainly from the binder course. In this respect, and in general form of construction, it resembles the usual form of sheet-asphalt pavement, and, indeed, may be considered a cross between it and the one-layer bituminous concrete.

During the year 1911, 137,500 sq. yds. of asphaltic concrete pavement were laid in the West Park system with its own plant, at a cost of 61¼ cts. per sq. yds. for a single-course pavement. The average thickness of the pavement laid was 2⅛ ins., and the cost includes all labor and materials used, preparation of base, repairs to machinery, and a depreciation charge of 25 per cent of the cost of the plant. The capacity of the plant is about 1,000 sq. yds. per day for pavement 2 ins. thick.

The following shows the average quantities of materials used in laying 100 sq. yds. of pavement as described above:

Crushed limestone, 1.07 cu. yds.	$1.6
Limestone screenings, 1.01 cu. yds.	1.6
Bank sand, 1.74 cu. yds.	1.0
Torpedo sand, 1.44 cu. yds.	1.5
Asphaltic cement, 2,000 lbs.	$18.00 to $18.22 per ton
Granite screenings, 0.04 cu. yds.	2.9
Gasoline, 3.6 gals.	0.10½
Kerosene, 0.35 gals.	0.05
Coal, 180 lbs.	$4.7 per ton
Wood, 0.7 cords.	

The cost per 100 sq. yds. for laying and mixing was $16.40, the cost of preparing base was $3.60 and a general charge of $7.44 includes depreciation, plant repairs, moving plant and idle time.

ATER SUPPLY, SEWERAGE AND SANITATION SECTION

od of Designing a Reinforced icrete Settling Basin for the Muskogee, Oklahoma, Water Works.

City of Muskogee, Oklahoma, has construction a number of improvements water supply and sewerage system. The mprovements consist of the construction intake tower in the Grand River some . above its junction with the Arkansas a 54-in. concrete-lined intake 2,500 ft. rock tunnel under the Arkansas basin; tallation of additional pumping units, gh and low lift; the construction of r purification plant; the reinforcement water distribution system, and the tion of a 6,000,000-gal. equalizing ir, consisting of a 50-sided polygon, walls are built entirely above the each side of the Ambursen dam sec-

portion of the water purification plant der construction is that providing for itation assisted by coagulation with sulphate and lime. Provision is made ultimately mechanical filters can be ced if they should be found necessary. sign of the settling basin for the por- der construction is described by the r for the improvements, Mr. Alexander of New York City, in a paper before merican Water Works Association. his paper we take those portions deal- the design of the reinforced concrete s follows:

ESCRIPTION OF SETTLING BASIN

new settling basin for the Muskogee orks is a reinforced concrete struc- 12 ft. square on the inside. When a depth of 18 ft., this basin holds 00,000 gals. of water. A curtain wall forced concrete divides the basin into npartments. The first, or smaller of mpartments, 218 ft. long and 52½ ft. as its bottom perforated and under- A distributing trough, 3 ft. 6 ins. d 5 ft. deep, extends the entire width first compartment. The water enters t compartment from the distributing supported upon the counterforts series round openings spaced two in each panel formed by the counterforts. A 4-in. concrete baffle, or stilling wall, in front of the distributing trough, extends the entire length of the basin. The water passes through the first compartment over the curtain wall into the larger compartment. Balanced valves in the bottom of the curtain wall equalize the pressure in the wall during filling. A collecting channel of the same size as the distributing channel is located at the far end of the basin, extending the entire width of the basin, the water enters the collecting channel through a series of 2-ft. weirs, located one in each panel. The basin is designed to operate continuously.

GENERAL DISCUSSION OF REINFORCED CONCRETE

The basin is being constructed of reinforced concrete. It is possible to construct a monolith of considerable proportions of plain concrete. However, it is but a question of time when the unequal settlement of the foundation, always possible except when the foundation is solid rock, and the shrinkage and temperature stresses set up in the mass, destroy the continuity of the structure. On the other hand, it is possible to construct and maintain as such, a reinforced concrete monolith of very large proportions.

There appears to be some doubt that thin sections of reinforced concrete are suitable for water-tight structures. There need be no fear whatever that there will be any trouble if the work is carried out as it should be. The water-tightness of concrete depends principally upon the amount of cement present, provided the sand and stone or gravel are properly proportioned. Six bags of cement per cubic yard of concrete is ordinarily sufficient to produce a water-tight mixture. This amount, however, should be increased when the hydrostatic head is considerable.

The author is opposed to the use of waterproofing ingredients or watrproofing applications. Both increase the cost of the concrete work considerably. It is far better to put the value of the waterproofing materials into the concrete itself by adding more cement. The use of a waterproofing ingredient or application tends to poor construction work, the contractor counting upon the waterproofing to help out careless construction.

The author, from his study and experience in the construction of tanks and reservoirs, has reached the conclusion that leakage may be due to any one of the following causes

(1) Faulty construction, (a) Lean and porous concrete work. (b) Inexperience and carelessness in carrying out the construction

(2) Faulty design. (a) Weak details at the connections. (b) Excessive secondary stresses at connections. (c) The use of too high unit stresses in steel and concrete.

Faulty construction can be rectified to some extent, but often only at a considerable cost by waterproofing the structure from the inside Leaks developing through faulty design are on the other hand, always difficult to master and in many cases very little can be done to remedy the unsatisfactory condition of the completed structure. To guard against the production of lean concrete work, the author's specifications provide that all cement used in the work should be paid for separately.

As 10 ft. of the basin is constructed below the original surface of the ground, it was decided to use counterforts instead of buttresses to save excavation. The counterforts are 15 ins. thick, spaced 13 ft. 4 ins. on centers The side walls of the basin are 12 ins. thick on the top, widening out to 18 ins. at the bottom. The floor of the basin is 6 ins. thick in the larger compartment, and in the smaller and underdrained one, 9 ins. The basin, including the floor, is constructed and reinforced as a monolith. No expansion joints whatever are provided. There will, however, be an expansion joint between the present basin and future extension.

The author would like to get the opinion of the members on their experience with extensive monolithic construction, both plain and reinforced, especially with reference to the conditions under which such construction has given more or less trouble.

DETAILS OF DESIGN OF BASIN.

The success of a reinforced concrete structure of any magnitude depends primarily upon the thoroughness with which the various structural details, especially the connections, are worked out. The connections should receive the same careful attention that is given them in structural work. The author, therefore thinks it advisable to dwell at some length upon the design of the structure.

The Muskogee basin is being constructed of gravel concrete. The gravel is washed river [illegible] the bed of the Arkansas River. Its size is limited to 1 in. in the side walls and counterforts, and to 2 ins. in the bottom. The sand is a very coarse river sand, obtained from the same river. It is clean, coarse and sharp, and makes a splendid con-[illegible] is being mixed approximately in the proportion of one part of Portland cement, two parts of sand, four parts of gravel. The mixture is changed slightly from time to time to meet slight changes in the quality of the aggregate.

In the design of the structure, the unit stresses were assumed as follows:

f_c = The maximum allowable working compression in the concrete in flexure, 650 lbs. per sq. in.

f_s = The maximum allowable tension in the steel, 14,000 lbs. per sq. in.

v = The maximum intensity of transverse shear in concrete (assuming a uniform distribution of the shear) 50 lbs. per sq. in.

u = The maximum working adhesion or bond stress between the concrete and deformed bars, 80 lbs. per sq. in.

e = The ratio of the modulus of elasticity of steel to concrete, 12.

These values are conservative. They limit the percentage of the steel to be used in the structure to 0.83 per cent of the area of the concrete above the steel.

The following equations, with numerical constants, have been developed in accordance with the now universally recognized theory:

[illegible] $\sqrt{\frac{M}{54}}$ (Equation 1)

M [illegible] q (Equation 2)

Where q is the distance from the compression side of the beam to the steel, known commonly as the effective depth of the beam; M is the bending moment in foot-pounds per inch width of beam, and A_s is the area of the steel required.

Equation 1 gives the effective depth of the beam when the bending moment is known and the reinforcement is fixed at 0.83 per cent of the area of the concrete above the steel.

Equation 2 gives the amount of the steel reinforcement when the bending moment is known and the depth of the beam (q) is fixed. It can only be used when the percentage of steel reinforcement is 0.83 per cent or less.

DESIGN OF SIDE WALLS.

The reinforcement in the side walls and their construction makes them partially continuous. The common theory of flexure as we know it is applicable to this case, but not with the numerical constants familiar to us. The allowance that is usually made in reinforced concrete construction for the increase in strength due to the partial continuity is a reduction of from 25 to 50 per cent in the bending moment computed on the basis of a simple beam. The exact amount of the increase in strength due to partial continuity can be computed in any one case when all the factors are known. The process, however, is a very tedious one, and entirely unnecessary. A fair assumption as to the allowance can nearly always be made. In this case, on account of the small amount of reinforcement in tension over the counterforts, this reduction has been taken at 25 per cent.

For the design of a tank, equations 1 and 2 can be put in a more convenient form, as follows:

Replacing M by its value $\frac{(w \times X \times L^2)}{10 \times b}$, where w is the weight of the water, 62½ lbs. per cu. ft., X the depth of the water, L the clear span between counterforts, b the width considered, namely 12 ins., we get,

$q = 0.247L \times$ square root of X (Equation 3)

$$A_s = \frac{.00051XL^2}{q} \quad \text{(Equation 4)}$$

Equation 3 gives the minimum effective depth of the beam or slab at any depth (X ft.) below the surface of the water. Equation 4 gives the amount of the steel reinforcement required per inch width of beam when the effective depth (q) is fixed. It cannot be used, however, when the percentage of steel reinforcement exceeds 0.83 per cent.

Figure 1 shows the forces that are acting on the walls. The water pressure increases from zero at the water surface to a maximum of 1,125 lbs. per square foot, at the bottom. Only a portion of this pressure, namely, that portion marked *a*, is carried by beam action to the counterforts. That portion marked *b* and shown by the dashed arrows, is carried by cantilever action directly to the footing. The diagram shows that the walls receive their maximum stress as a beam at a point approximately 15 ft. below the water level. The minimum thickness of concrete wall that it is possible to use under the conditions assumed is computed as follows from equation 3: Substituting in this equation, we have

$q = 0.247 \times 12.08 \times$ square root of $15 =$ 11.55 ins.

Allowing 2½ ins. of concrete to cover the steel, we obtained a minimum thickness of 14 ins. The plans show the thickness of the wall at this depth to be 17 ins. On account of the low cost of the concrete materials and the comparatively high cost of the steel reinforcement, it was deemed more economical to use a heavier section than the minimum that could be used. In places where concrete materials are costly, it would be possible to construct the side walls 8 ins .thick on the top and 15 ins. thick at the bottom.

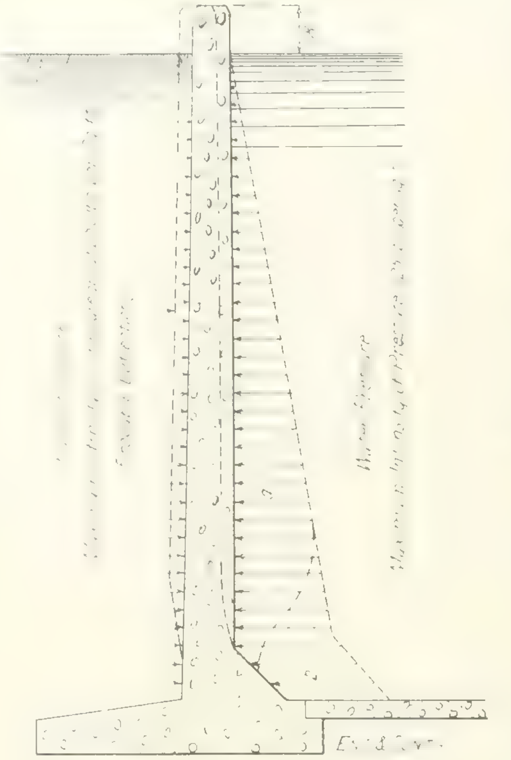

Fig. 1—Diagram of Forces Acting on the Walls.

The amount of steel reinforcement, A_s, that would be required 15 ft. below the water level, can be readily obtained by means of equation 4: $A_s = \frac{.00051XL^2}{q}$.

Substituting for X, 15 ft.; for L, 12.08 ft., and for q, 14.64 ins. we obtain, $A_s = .0763$.

The spacing of ¾-in. round rods will be. .4418 (the area of a ¾-in. round rod) divided by .0763 (the amount of steel required per lineal inch), giving 5.79 ins. as the spacing. The drawing shows the spacing to be 5.5 ins. at this point.

In Fig. 1 is shown graphically by dotted arrows the earth pressure acting against the wall from the outside. It is proposed to back up the walls of the basin on three sides as shown on the plan. As there is a possibility that this backing may be removed at any time, no allowance whatever has been made for the additional stability given to the tank by the backing.

Attention is called to the connection of the walls of the tank to the bottom. The pressure from within forces the side walls outward, the deflection reaching the maximum half way between the counterforts. The connection of the walls to the footing must be either a sliding joint to permit of this movement, which is impracticable, or sufficient reinforcement must be provided to prevent the possibility of rupture at this point. Fig. 1 shows diagrammatically, but in a somewhat exaggerated form, the deflection of the side walls at the center of the span when the reservoir is full of water. The rigid connection spoken of is a concrete fillet 18 ins. on the side, reinforced with ½-in. round bars spaced 12 ins. on centers. This rigid connection transfers by cantilever action .some of the hydrostatic pressure against the lower portion of the wall directly to the footing. The amount of this pressure transfer is shown diagrammatically by the dashed arrows in Fig. 1, marked *b*.

Figure 2 shows all of the forces except the earth pressure, acting on a section of the tank 13 ft. [illegible] ins. long, including one counterfort and half of the clear span of the wall on either side of it. The total weight of the concrete for this section is 106,150 lbs., with its center of gravity located 9 ft. from the heel (*o*) of the footing. The total horizontal water pressure against this part of the tank is 135,000 lbs. and the weight of the water resting on the footing is 150,000 lbs. Let us assume for the present that the sliding of the wall is prevented by the tension in the bottom. This tension amounts to 1,000 lbs. per lineal foot of footing and is shown acting 1.25 ft. above the bottom of the footing. All these forces are shown in their true positions in the figure.

Since the forces shown acting on this portion of the structure are in equilibrium we have

$$z = \frac{\Sigma M}{\Sigma W} \text{ or}$$

$$\begin{aligned} 106{,}150 \times 9 &= +955{,}350 \\ 150{,}000 \times 5 &= +750{,}000 \\ 135{,}000 \times 7.5 &= 1{,}012{,}500 \\ 135{,}000 \times 1.25 &= -168{,}750 \\ \Sigma M &= 2{,}549{,}100 \\ \Sigma V &= 256{,}150 \\ z &= 9.95 \end{aligned}$$

This shows that the resultant pressure on the footing, namely, 256,150 lbs., pierces the base 9.95 ft. from the heel, which is practically two-thirds of 15½ ft., the width of the base. Consequently, the distribution of the foundation pressure on the footing is in the form of a triangle, about as shown in the figure. It reaches a maximum pressure of 2,300 lbs. at the toe and nearly zero at the heel. Sufficient steel is provided for in the bottom to take care of a tension of 1,000 lbs. per lineal foot of footing where it joins the 6-in. concrete bottom. This reinforcement consists of ⅜-in. round rods spaced 3 ins. centers. The plan erroneously shows these bars to be placed 12-in. centers. This amount of steel is sufficient to resist this tension with a unit stress well within the elastic limit of these steel bars. The author does not wish to convey the idea that this tension is developed to the extent shown in Fig. 2. A very large proportion of it will be developed by friction between the footing and the opposing earth, and some by the earth backing, which, however, will not be always present.

DESIGN OF COUNTERPARTS.

Figure 3 shows the forces acting on the counterfort proper. The reaction of the tension in this case, amounts to 93, [illegible] and its distribution is about as shown in the figure. It reaches its maximum 15 ft. below the water level. This tension is taken care of by thirty-two ½-in. round bars at an average unit stress of 14,900 lbs. [illegible] not a very high value. In the discussion we have ignored the additional stability [illegible] from the earth pressure, and also the gth of the concrete in the counterforts, may be considerable.

greatest of care must be taken to anchor alls to the counterforts. In this case, [illegible] the [illegible] ½-in. tension bars and fastening them louble nuts to two 2½-in by ⅜-in. plates, [illegible]

–A I Forces Acting Except Earth Pressure.

reinforcing plan. The object of the nut is to prevent the possibility of play [illegible]

is not a cantilever at all. In a ver, the internal resisting forces acting plane yz, must balance algebraically. [illegible]

counterfort, as can be readily seen. that act on the counterfort are

nsion exerted by the walls on the 93,500 lbs.

rizontal pressure of the water act- the counterfort proper, 13,600 lbs.

the weight of the counterfort proper,

he total tension between the footing e counterfort along the plane yz, 109,250 own acting 6.07 ft. from the point y.

he shear between the counterfort and ll of the basin, 109,250 lbs. plus 16,500 [illegible]

z. 107,100 lbs.

rmination of the amount of the Q and its distribution with reference plane yz, is a very interesting one, and this reason given in detail. Taking ts about a point, y, we obtain the fol- equation:

[illegible]

is equation, there are two unknown ies, p and p^1. A safe assumption to ince there is no tension at the heel (c) $p + p^1$ cannot exceed the sum of the of the water above the footing and ght of the concrete itself. This amounts lbs. per square foot of footing, thus the additional equation

$$p + p^1 = 1350 \times 13.33$$

hese two equations we obtain

$$p = 3,850 \text{ lbs. and}$$

$$p^1 = 14,150 \text{ lbs.}$$

total resultant tension Q, and its loca- n now be readily found, and is given igure as 109.250 acting 6.07 ft. from y. tension of 109,250 lbs. is taken care of een ⅞-in. round bars at an average unit of 11,350 lbs. The maximum stress in ars probably reaches 14,000 lbs. per square inch. The bars are anchored in the concrete footing by two 2½-in. by ⅜-in. plates 8 ft. 6 ins. long, to which they are fastened [illegible]

The distribution of the pressure along the plane yz is a more or less indeterminate one. [illegible] reinforcement of the footing course. Only in a very special case will its distribution be such as to make the counterfort a cantilever. The method so often followed of designing a counterfort as a cantilever and placing all the steel reinforcement in the back of the counterfort, is an erroneous one. It places in the footing course a concentrated and rather high tension, and at a point where it cannot be properly taken care of, thus producing enormous secondary stresses in the footing, which would be a serious defect in the structure.

[illegible]

The reinforcement of the corners of the settling basin is of some interest. This reinforcement consists of a triangular concrete fillet 24 ins. on each side, reinforced with ⅜-in. round bars, each 6 ft. 3 ins. long, and spaced the same as the ¾-in. horizontal reinforcement in the walls of the basin. The adhesion between the steel and the concrete is counted upon to securely tie in the corner. No rigid connection whatever is used for the reinforcement.

[illegible]

The footing overhangs the wall for a distance of 4 ft. It is 18 ins. thick at the point where it joins the wall and narrows down to 12 ins. at the outer end. The following computations give some idea as to the methods used in designing this footing.

The upward pressure on the overhanging portion ranges from 2,300 lbs. per square foot to 1,750 lbs. per square foot. The thickness of the footing at c-d, Fig. 2, should be sufficient to keep the shearing stress down to a safe working value. The total upward pressure per lineal foot of footing course, amounts to 8,100 lbs. This gives an average value for the shear of 37.5 lbs. per square inch—a very safe value. Equation 2 can be used to compute the amount of steel required, as follows:

$$[illegible] \over 1020 \times q$$

where M represents the bending moment in foot-pounds per lineal inch of footing at the plane c-d, which amounts to 1,410 foot-pounds.

q is 18 ins. minus 3 ins.

Substituting in this equation, we obtain for A_s, 0.0922 sq. ins. This amount of steel requires a spacing of 4.80 ins. for ¾-in. round bars. A spacing of 6 ins. is shown on the plans. This spacing used is considered ample, as the computations just outlined do not take into consideration the weight of the overhanging footing nor the weight of the earth backing.

CONCLUSION.

The above general outline of the methods used in designing the settling basin conveys some idea of the thoroughness and carefulness with which a structure of this type must be designed.

Horizontal construction joints are used freely. The unfinished surface is always left in as rough a condition as possible, but never roughened up after the concrete has partially set. The author has found that this roughening often losens the stone in the concrete, but not sufficiently so that they can be removed, a condition which is apt to impair the water-tightness of the structure. To start a day's work, the surface is thoroughly cleaned with wire brushes and water, and a cement liquid mortar mixed in the same proportions as the mortar in the concrete, is poured over the old work to a depth of ½ in. This method always gives a good water-tight horizontal construction joint.

Vertical joints are permitted only in certain places, as these joints are very difficult to make water-tight. All vertical joints in the walls are made directly over the counterports.

The specifications call for two coats of neat cement wash to be applied with a whitewash brush on the inside of the basin. Both of these coats are to be applied to the concrete when damp but not wet, and the second coat must be applied before the first one has had time to get very hard. Any leakage that may develop in the basin previous to its final acceptance must be repaired by the contractor at his own expense, no additional compensation whatever being permitted for this work under the specifications. The contractor, realizing the importance of doing conscientious work all the time to prevent subsequent trouble from leakage, is producing a first-class structure. The work is being done so thoroughly that very little leakage, if any, is expected when the basin is filled for the first time this summer.

The contract for the construction of the basin was let to W. W. Fuller, of Muskogee, Oklahoma. The following is an approximate estimate of the quantities of material required, together with the contract unit prices:

[illegible]	[illegible]
1,930 cu. yds. 1:2:4 concrete at $6.25..	12,062.5
[illegible]	[illegible]
220,000 lbs. of steel at $0.035............	7,700.0
3,520 ft. 3-in. vitrified sewer pipe at $0.20	704.0
[illegible] pipe at $0.20	160.0
220 ft. 24-in. vitrified sewer pipe at [illegible]	[illegible]
1 manhole complete	50.0
160 ft. 12-in. cast iron pipe at $2.25	360.0
40 ft. 18-in. cast iron pipe at $4.00	160.0
380 ft. 36-in. cast iron pipe at $8.00	3,040.0
28,000 lbs. cast iron specials at $0.05..	1,400.0
5 12-in. gate valves at $10.00......	150.0
6 18-in. press. equalizing valves at [illegible]	[illegible]
1 24-in. tidal valve at $18.00......	18.0
485 ft. 1½-in. pipe railing at $0.60..	291.0
Superstructure for valve cham- [illegible]	[illegible]
1,000 lbs. wrought iron and steel at $0.05	50.0
300 ft. ¾-in. galv. w. i. pipe at $0.30	90.0
Total	$44,80[illegible]

First Italian Subway—The city of Naples is to have the first passenger subway to be constructed in Italy. An estimate of cost has been made, the probable expense of the undertaking being placed at $5,790,000 by the engineers. French capital is said to be behind the work. The urban portion of the subway is to be about 5 miles long, and the suburban portion 6¼ miles long. The estimated time of construction is 4 years.

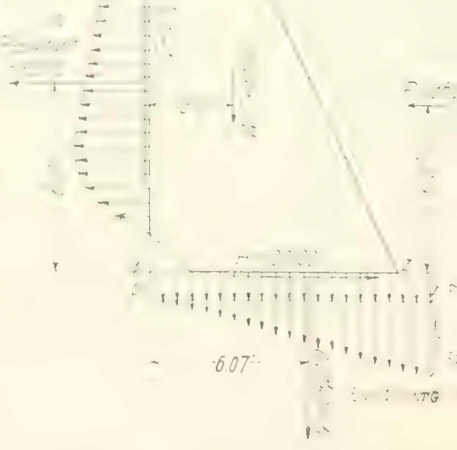

Fig. 3—Stresses Acting on the Counterfort Proper.

Construction Camp Sanitation in the State of Washington.

For several years past the Washington State Board of Health has made a special study of sanitary conditions in construction and other camps in that state. A study of the vital statistics disclosed the fact that a considerable proportion of the deaths in the state from typhoid fever occurred among workmen employed in camps. A considerable amount of time was spent in the summer of 1910 in investigating camp conditions, chiefly among the lumber camps of Western Washington. The results of this investigation proved more conclusively than ever that the ordinary logging camp, construction camp, or sawmill settlement was very much in need of sanitary supervision. Many of these camps were not only inviting outbreaks of typhoid among the men themselves, because of neglect of fundamental sanitary precautions, but in addition were seriously polluting the water supplies of many cities of the state. In the autumn of 1911 an outbreak of typhoid fever among the construction camps of a new railroad line occurred of such an extent that the State Sanitary Inspector was sent to make a careful examination into the camps. His report showed conclusively that the entire outbreak was due to two things—careless disposal of human excreta in the camps and transmission of the germs by flies from the exposed human fecal matter to the unprotected food of the other men in the camp.

As a result of the studies made the State Board of Health adopted the following regulation on April 10, 1912, as published in a recent bulletin of the Board, from which the information here given was taken:

Camp Sanitation.

That hereafter contractors and all other persons who may establish an industrial camp or camps, for the purpose of logging or any like industry, or for the purpose of constructing any road, railroad or irrigation canal, or other work requiring the maintenance of camps for men engaged in such work, or any other temporary or permanent industrial camps of whatsoever nature, shall report to the State Commissioner of Health concerning the location of such camp or camps, and shall arrange such camp or camps in a manner approved by the State Commissioner of Health so as to maintain good sanitary conditions, and shall at all times keep such camp or camps in a sanitary condition satisfactory to the State Board of Health.

The State Commissioner of Health, in accordance with the intent of this regulation on camp sanitation, has prepared and has ready for distribution an outline of camp arrangement and construction which in general covers the principal sanitary points to be considered, but since any of these directions may need modification to suit the peculiar conditions of individual camps, special attention is directed to that feature of the regulation which directs contractors to report to the State Board of Health on the proposed location and sanitary arrangements of their camps before actually installing them.

The following specific regulations, based on the outline above mentioned, were prepared by the Chief Surgeon of the hospital service for the contractors constructing the Great Northern extension from Wenatchee to Oroville:

Sanitary Camp Regulations.

All sub-contractors, when locating and operating their camps, will conform to the following "Sanitary Camp Regulations," as advised by the Washington State Board of Health.

It is requested that all sub-contractors consult with the Surgeon in charge of the Hospital Service when deciding the location and arrangement of camps, that he may assist in the carrying out of such regulations as the State Board of Health requires and thereby save any further expense of rearrangement or relocation.

1. Camps should be established upon dry, well drained ground.

2. Any natural sink-holes or collections of pools of water should be artificially drained and filled when the camp is first established.

3. The general scheme of the relation of the buildings of the camps should be as follows:

(a) Kitchen should be at the up-river and extreme end of the camp.

(b) Next should be the office and commissary.

(c) Then the bunk houses, with

(d) Urinals adjoining, and toilet and stable following in the order named. (The stable so placed is at the extreme down-river end of the camp.)

4. Relating to kitchen, garbage disposal and employes handling food:

(a) The kitchen and eating house should be effectively screened. Thorough and systematic scrubbing should be regularly insisted upon. All garbage should be immediately buried, as should also tin cans and any other non-inflammable refuse. Inflammable waste materials can be burned.

(b) All persons engaged in the care of the premises and the handling of foodstuffs—particularly cooks and helpers—should be carefully examined by the line physician, particular attention being paid to the point as to whether or not they have suffered from typhoid fever within recent years.

(c) All food supplies should be effectively screened.

5. Bunk houses should be screened, properly ventilated, regularly and thoroughly cleaned.

6. A portable urine trough, made with four boards, enclosed at ends, the top board being hinged so as to act as a lid, should be constructed and placed to the down-river side of and near the bunk house. The urine can be delivered from the trough to a hole in the ground through a square wooden pipe. This hole must be covered. The trough should be so devised that the lid will fall shut when not in use. An upright and block will not permit the lid to be raised to the perpendicular and so it will fall shut automatically. The urine trough should be limed frequently.

7. The toilet must be entirely enclosed and all openings effectively screened. The front of the structure can be leaned in so that the door cannot swing out far enough to fall open. At the back of the structure the last two or three boards can be cross-stripped and swung onto hinges to enable the frequent throwing of dirt upon fecal collections in the bottom of the pit.

Important. The use of the toilet and urine trough provided for the men should be made obligatory and instant discharge of any employe polluting the soil in the neighborhood of a camp must be rigidly enforced to make such rule effective.

8. When the stables are cleaned all manure must be hauled as far away from the kitchen as possible. In many instances arrangements can be made with neighboring orchardists to haul the manure away two or three times a week in return for its value as fertilizer for their orchards. When these arrangements cannot be made then the manure should be burned as soon as possible (daily).

9. The supply of water for the camps should be carefully decided upon and whenever possible it is well to run it in pipes from an absolutely uncontaminated source.

The Commissioner of Health recently made a tour of inspection of the contractors' camps along the Columbia from Pateros to Wenatchee. Practically every contractor was complying with the spirit of the regulations with care and evident purpose to do his best. Several of the camps were not yet begun. At these places the plans of the camps were gone over in detail with the contractor or his representative, and everywhere there appeared a spirit of co-operation with the surgeon and health authorities on the part of the contractor. An attempt was made to convince every contractor seen that these regulations were not adopted to place annoying restrictions upon their business, but because it had been definitely proven in camps where such methods were in force that not only was the contractor the gainer by having less sickness in his camps, but that the efficiency and contentment of the entire force were improved notably.

Some Successful Examples from French Practice of Facing Reservoir Banks with Concrete.

French engineers have employed concrete extensively in several forms for facing the banks of reservoirs. In a report to the International Congress of Navigation, Mr. Jacquinot, Engineer in Chief, Ponts et Chaussees, describes two different methods of bank paving, both of which are of interest and one of which is of distinct novelty to American practice. The following are extracts from this report:

During 1900-6 extensive use was made of concrete, generally without reinforcement, for the banks of the reservoir of the canal between the Marne and the Saône, very important walls and extensive facing having been executed in this manner.

The concrete was made of the coarse sand, obtained by crushing limestone on the spot in machines fitted with articulated beaters. This method gives an excellent sand from all points of view and any desired degree of fineness, all that is necessary being to alter the spacing between the bars of the grating. This material is not so well known as it deserves and is very valuable in places where limestone is cheap, and natural sand dear or of poor quality.

The sand used was a kind of gravel, composed of about 50 per cent of fragments not more than 1 to 1¼ in. in diameter and 50 per cent of fine sand. The mortar obtained with this small gravel is easily rammed and sets very compact with relatively small quantities of cement (about 4½ cwt. per cu. yd. of sand).

The mortar, which might be more accurately termed "fine concrete," was spread in layers about 4½ ins. thick and compressed with a rammer. After ramming a layer of fine concrete and before spreading the next one a creamy cement grouting was applied in the form of rough-cast, like Tyrolean plastering. This unites the two layers together and renders the whole monolithic. A small block cut from the mass might be mistaken for native rock; and it is even very difficult to distinguish the bedding planes.

This rammed material has been used in constructing the breastworks of the Villegusien and Charmes dykes. The purpose of these breastworks was to prevent infiltration between the base of the earthen bank and the impermeable subsoil. That at Villegusien is about 1,350 yds. in length, with a depth attaining 20 ft. in the bottom of the valley. The breastwork at Charmes is 520 yds. long without counting the anchorages in the hillsides which will be mentioned later; and its greatest depth is 46 ft.

The hill sides backing the Charmes dyke contain beds of very permeable rock, embedded in Lias marls; and one of these beds is about 50 ft. below the wall of the reservoir. Troublesome infiltration might collect in these permeable beds, by flowing round the ends of the dyke; and there was thus a possibility of serious accidents. The risk has been obviated by extending the breastworks into the hill side for a distance of 3[illegible] ft. on the right bank and 212 ft. on the left bank, for which purpose deep trenches were cut into the hill and filled with hollow blocks of the aforesaid rammed fine concrete up to the water level. The hollows in the concrete blocks, besides lessening the cost, enable the interior to be accessible at all times for inspection and the detection of leaks.

All these large masses of rammed fine concrete in the Villegusien and Charmes dykes have proved satisfactory, the only flaws discoverable over a total length of about 1,8[illegible] yds. being four or five capillary cracks, due to the construction in sections, and showing only insignificant traces of moisture.

If walls of this magnitude had to be built of rubble, they would have taken much longer to construct, and there would have been risk of caving in the deep trenches.

The use of ferro-concrete would have lowered the cost and dispensed with the breastworks, whilst allowing the interior to be ac-

, for inspection, and the per[illegible] assured all important advantages

e up-hill slopes of the Villegusien and [illegible] dykes have been faced with [illegible] mmed fine concrete, made on the spot. e slopes have been arranged in steps t. in vertical height, separated by off- practically horizontal and 40 ins. wide. e slabs are 8 ins. thick and 10 ft. long, ated by expansion joints, 4-5 in. wide, with clay and covered at the surface a layer of mortar 1½ ins. thick. Cor- nding joints, filled in the same manner, rovided at all the angles of the steps.

mall quantity of water may find its way the joints when the reservoir is being ; and, on draining out again, when the voir is being emptied, may wash out a of the soil, the evil increasing as time on. To prevent this, however, a small ng slab of mortar poor in lime has been l underneath each joint.

h slab on the offset levels is provided a small anchoring lug of triangular sec- which engages in the underlying bank rth and prevents slipping.

large surface has been covered in this at Villegusien and Charmes; and, out out 5,000 slabs, less than half a score a few insignificant cracks, the others intact. None of them has shown any of disintegration by frost, at the points ntact with the water, although the win- re very severe in that district.

eral slabs in the Villegusien dyke were rced, as an experiment, but are no bet- an the rest, though more expensive.

en finished, the slabs are watered twice cement grouting, which improves their rance and fills up the pores in the sur- in other words, advantageously replaces ing which is always liable to crack.

s method of facing the up-hill slopes then dykes can be executed very quickly, ay be regarded as having proved quite sful.

re appears to be no need for reinforcing abs, since the concrete is not subjected to any tension strains. On the other hand, reinforcement would not enable the thickness of the slabs to be reduced, since it is necessary for the slabs to have a certain mass, in order to withstand the impact of waves and ice.

Several highly interesting reservoir dykes have been constructed, or are building in the French Pyrenees. The oldest of these is that of Orédon. It is 79 ft. high, and was constructed of soil transported and piled up by a current of water. The facing of the upper slope has to do with the subject in which we are interested, this consisting of a bed of lime concrete, 4 ft. thick at the top of the dyke and 8¾ ft. at the base, the concrete extending horizontally at the top, so as to cover the whole crown of the work. To prevent leakage a cover of bitumen, 1 in. thick, was applied, this being protected by a dry stone facing.

A main drain, also of dry stone, is situated below the concrete layer, and the water from this drain flows into a collector at the foot of the dyke.

This covering is not watertight, presumably because the concrete was not rammed and because no sufficient junction had been established with the rock.

At present the facing is being strengthened by a layer of ferro-concrete 20 ins. thick. The Orédon dyke is situated at an altitude of 6,070 ft.

Another earthen dyke is in course of construction in the Pyrenees, namely, the Aubert dyke, which has a maximum height of 4 9ft. and a length of 328 yds. The altitude is 7,087 ft. above sea level. The method of facing is the same as at Orédon, except for the following modifications: The concrete facing is reinforced by three networks of iron (4-in. mesh) connected together by binding stirrups. Spaces have been left between the second and third networks, for collecting the percolating water, this arrangement enabling the dry-stone drain (as carried out at Orédon) to be dispensed with. The bitumen casing has been replaced by one of cement, which will be cov- ered with a thick layer of coaltar, applied hot

The arrangement of the breastwork and o the bottom of the revetment on the upper slop ing face of the Aubert dyke is specially re markable. The foot of the screen fits into th ferro-concrete collector which enables the rea face of the breastwork to be visited for th purpose of locating and stopping leaks. Th whole forms an excellent abutment at th foot of the dyke.

It is interesting to compare the earthe dykes of the Pyrenees with that of the Marne Saône canal. In the former, the revetmen is rigid, reinforced, watertight and drained whereas in the other case it is flexible, devoi of reinforcement, very permeable and un drained. Here we have two radically differen systems, each of them, however, logically de vised. Without departing from the limits o our subject we cannot discuss their relativ advantages and drawbacks; and it will be suf ficient to point out that the chief advantag of the impermeable revetment is that the mas of the banking is protected from fluctuation in the degree of moisture, thus establishin the most favorable conditions for the stabilit of the front slope. The same result, howeve may be obtained in a more reliable manne by progressively easing the angle of th slope, in the lower portion, when the heigh of the dyke exceeds certain limits of stabilit

Another dyke in course of construction i the Pyrenees is that of the Oule, the object o which is to obtain motive power for electrify ing the railways. This dyke, which is of ma sonry, is 98 ft. high, 186 yds. long, and sit uated at an altitude of 5,900 ft. The fron face has a slope of 2 in 100. The maximum breadth at the base is 90 ft., and the work protected on the up-river face by a 3-in. re vetment of ferro-concrete, faced with 1½ in of cement mortar. The concrete is made of cwt. of Portland cement to 14 cu. ft. of san 28 cu. ft. of gravel. The ironwork weigh about 1 lb. per sq. yd. The facing mortar co sists of 10 cwt. of Portland cement to 28 c ft. of sand.

DRAINAGE AND IRRIGATION SECTION

ods and Cost of Making Subdivi- n on Topographical Survey for Sunnyside Unit, Yakima Proj- ect, U. S. Reclamation Service.*

[illegible] by W. E. Whistler, Engineer in Charge.

Yakima Project, Sunnyside Unit, ex- in a southeasterly direction between [illegible] 28, T 12 N, R 19, E.W.M. in which version dam and headworks are located, [illegible] 29, T 9 N, R 25 E.W.M.; is ed on the northeast by the Main Canal n the southwest by the Yakima River the land under the two syphons across akima River which supply the territory ary to the towns of Mabton and Pros- Vash., and pumping land north of the Canal and south of the Mabton lateral. project contains about 102,000 acres. ich 50,675 acres were irrigated during 910 season. The acreage in different was as follows:

[illegible]	[illegible]
and clover	[illegible]
orchard	[illegible]
orchard	8.121
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	691
s	[illegible]
[illegible]	[illegible]
y	[illegible]
aneous	472
p	[illegible]

Before the United States Reclamation Service took charge, the project was handled by private irrigation companies whose apparent object was to give water to any applicant in the cheapest possible manner. This method of allowing a distribution system to grow with little or no consideration of future development led to poor locations for the distribution of water, with large unnecessary isolated areas.

In 1905 the Government purchased the project and immediately began the work of revision and enlargement. In the same year broad topography sheets of the project were prepared for the purpose of studies tending toward a possible betterment of the existing distribution system. These sheets were partially satisfactory, possibly as satisfactory as could be expected, but the contour interval was too great and grave doubt was felt as to their accuracy as many, when compared with adjoining sheets, showed marked differences in elevations. This topography was used, however, but with expensive results in many cases; e. g., distribution systems were projected on the sheets which did not cover the ground and caused enough additional expense to have paid for the best grade of topographic work.

The first definite work toward a revision and extension of the existing distribution system was undertaken in 1910. Approximately 13,000 acres were worked out at total cost of $4,794, giving a cost per section of $236.01.

The methods used may be discussed under four heads: namely, resubdivision, base levels, revision and location.

The survey work of this resubdivision was done according to the same engineering methods as those outlined later in this article with two important differences, viz.: the allowab error of closure per section was 8 ft. vers 4 ft. in the latter work, and corners were n replaced by permanent marks nor reference

Base levels were run out, but in this, as subdivision work, the allowable error was t great and the base benches were too sca tered, which caused much trouble in field a office. Many benches were set from the ma base level lines and no check back require Some of these were used and afterwar found to be in error. Probably, these we all discovered, but in many cases the origin notes have many confusing equations.

No great attempt was made to rearran the existing distribution, as each case was separate problem. If each delivery had bee considered and possible improvement outline the cost of this work would have been exce sive. The topographic work later describe gives all this information which may taken up at any time.

In locating proposed new deliveries t method, in brief, was to send an engineer a party into the field to locate one or mo methods of serving each 40 acres with wate The various methods were compared in t office and the supposed best method accepte In many cases all locations were thrown o and additional field work was undertake After all was said and done, it was certain a matter of doubt whether the location a cepted was the best, everything considered. two things I am sure, it is impossible to pro the locations without field inspection or anticipate future wants in every detail as th method makes no provision for future add tions and revisions without additional fie work and consequent expense.

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* work described in this article was done the direction of E. McCulloh, Project En- and E A. Moritz, Engineer, Sunnyside.

Resubdivision.

[illegible] under the direction of the writer can reasonably be considered [illegible] of the project. They [illegible] sections adjacent to Sunnyside which had traveled roads on practically all section lines and were moderately level and well settled; 5 sections near the Yakima River whose surveys were extremely difficult on account of brush, trees, water, etc., encountered; and 35 sections, mostly sagebrush, varying from the smoothest to roughest topography. For the purpose of description these areas are referred to in this paper as resubdivisions numbers 1, 2 and 3.

Resubdivision No. 1.—This resubdivision, which antedated the others about a year, was different in that the internal corners were not set and roads were available on practically all section lines.

The purpose of this work was to find and replace with galvanized iron gas pipe all old obliterated, or lost corners, which include in this case section and quarter section corners on all sections, and one-sixteenth corners on correction sections; to make a resurvey of the section with an error of closure not greater than 1 ft. in 5,000 ft.; and, finally, to set all missing external quarter and one-sixteenth corners.

The survey was completed in 36 days, by a party of four men, as follows:

	Per month.
Chief of party at	[illegible]
Transitman at	[illegible]
Head chain at	65.00
Rear chain at	65.00

and at an average cost of $21.13 per section (see Table I).

The first consideration in a resurvéy of any section is to find the corners and not be deceived into accepting stakes, rocks, etc., which upon further investigation, will prove to be wrong. It has been my experience that corners once set are rarely lost, but only obliterated, and it is therefore necessary to exhaust every possible source of information before the corner can reasonably be considered lost. It should be remembered that some future surveyor may find an original corner which you report not found, and in such a case your entire work may be discredited. A good general rule is to dig just a little further and deeper than you think necessary. Section line roads, fence lines, and the evidence of some old resident are valuable guides in the search for any corner.

The section corners found, one of three cases occurred, each of which called for a different method of procedure. These cases were as follows: First, when it was possible to see from one section corner to the other; second, when it was possible to see both section corners from some intermediate point on line; and, third, when it was impossible to see both section corners from an intermediate point on line.

In some few instances, where the quarter corner was found then the quarter corner and section corner were used instead of the two section corners to determine the case under which it would fall. However, as the search for corners was a large part of the work, it generally proved more economical not to look for quarter corners until line and distance between section corners were known.

Case I: After flagging one section corner the party moved to the other found section corner and chained back to the flagged corner, using hand level and plumb bobs, and stakes were left on line at 1,300, 2,600 and 3,900 ft. While the line was being chained Chief of Party collected information concerning location of the quarter corner and began search for it. Unless the quarter corner was easily uncovered, the transitman and chainmen came up to continue the search until it was either found or considered lost. If the quarter corner was found, one-sixteenth corners were set on line between it and the section corners and midway between them, except on correction sections when all distances were made proportional to those shown on the township plats. In all cases the corners were referenced. The operation described was continued until the section was complete. The angles were read by repetition from three to six times and the nearest ten seconds to the figured angle recorded.

Case II: The two section corners were flagged, transit was shifted into line and checked by double centering and a hub on line was set and flagged. The operations were then similar to those of Case I.

Case III: The method used in this case was to run either a random or traverse line as nearly on the section line as possible. In the case of a random the offset at the section corner was measured and intermediate corners located by offsets from the random line. If a traverse line was necessary then co-ordinates of intermediate corners were figured and corners located by transit and chain.

Special care was used in the survey in plumbing and building sights. For short sights one or two lath with a red and white flag were sufficient but for long sights it became necessary to use a sight which was easily found and would mark the line distinctly. Good success was attained by a built sight with a target of red and white signal cloth tacked to cross bars and the vertical line between the red and white cloth plumbed with transit over the corner. The sight was guyed with three lengths of wire. The poles for the sights were variously made of lath, 2x2's, and 2x4's, depending upon the amount of wind, height and permanency required.

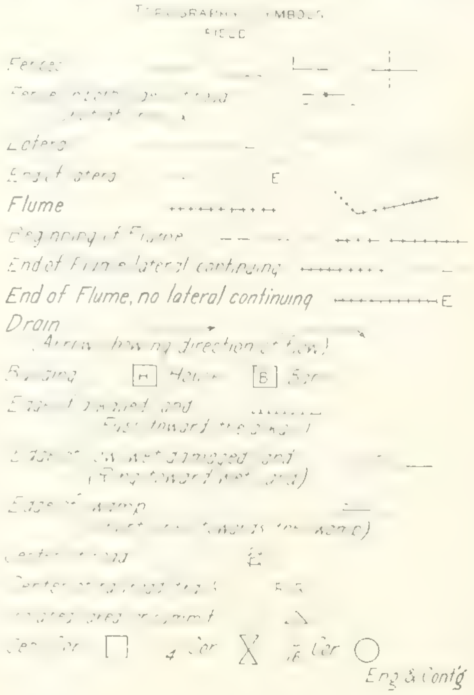
TOPOGRAPHIC SYMBOLS
FIELD
Fence
Lateral
Flume
Beginning of Flume
End of Flume lateral continuing
End of Flume, no lateral continuing
Drain
(Arrow showing direction of flow)
H
B
Eng & Cont'g

Fig. 1—Topographic Symbols Used in Keeping Notes.

Resubdivision No. 2.—This portion of the resubdivison work was undertaken early in the summer of 1911. The old public land surveys of T. 9 N., R. 22 E. W. M. were made in two parts, one north and the other south of the Yakima River. No meander points set at the river's edge could be found, due, probably, to considerable change in the river banks, so it was considered best to connect surveys across the river and to prorate as per government rules to the river in proportion to the old government township plats.

On a large portion of this survey extremely crooked traverses were unavoidable which necessitated slower and much more exact surveying in order that the allowable error might not be exceeded. Further, trees, heavy underbrush, sloughs, small lakes, and the river so retarded the work that in some cases 200 ft. per day was considered good progress. The five sections in this resubdivision were completed in 21 days and at an average [illegible] $60.40 per section.

Resubdivision No. 3 [illegible] be considered as an average for sage brush work with practically no roads and little or nothing in the line of possession. The purpose of this work was similar to that described under resubdivision No. 1, except that internal corners were set on quarter lines.

In the 35 sections resurveyed several cases of lost corners were encountered, a discussion of which in detail would be of no special value here. In general, it may be said, that no corner was considered lost without conclusive evidence that such was the case and that all were reset in strict accordance with instructions given in a pamphlet issued by the General Land Office on the "Restoration of Lost or Obliterated Corners and Subdivision of Sections." For costs of this subdivision see Table I. The equipment of the party was as follows:

- 1 transit.
- 3 range rods
- 2 100 ft. steel tapes.
- 2 sets chaining pins.
- 3 plumb bobs
- 1 pick and shovel
- 2 hand axes.
- 2 12-lb. mauls.
- 1 hand level.
- 1 pair field glasses.

In conclusion of this subject it is worth of note that many points come up which require judgment and experience to decide. A decision one way or another may mean the loss of much time. [illegible] lems must be left to the Chief's good [illegible] and no set of rules can possibly [illegible] down.

TOPOGRAPHIC SURVEYS FOR DISTRIBUTING SYSTEM.

As previously stated, the various [illegible] and sub-laterals, which distribute water [illegible] the project, were constructed with [illegible] no regard for future requirements [illegible] many sub-laterals became laterals through enlargement from year to year thereby [illegible] ing in extremely poor locations. It is not uncommon to find laterals carrying [illegible] ft. sec. with far too low velocity, having numerous curves and short tangents when the size of ditch and the topography of the country would certainly warrant a change with increased velocity. It, therefore, became evident as applications for water were received that many additions, revisions and enlargements of existing laterals must be made.

To avoid the unsatisfactory points [illegible] vious distribution and to get all the in[illegible] tion at one time, not only for present [illegible] future needs, it was decided to have [illegible] 1-ft. topography and profiles of each lat[illegible] and sublateral to unit (40 acres) [illegible]

The work, taken up in order, may [illegible] sified thus: Topography levels, later[illegible] files and topography.

Topographic levels.—Previous to [illegible] this work was undertaken the U. S. Geological Survey had set a few bench [illegible] throughout the project and later the U. S. Reclamation Service had run several [illegible] of check levels, both of which were [illegible] control for the topography levels.

These levels were run around each section and bench marks set at every section corner, quarter corner and one-sixteenth corner. Large spikes were driven into fence posts, power or telephone poles or into driven stakes (2x2x24 ins.) and guard stakes nailed to posts or driven near the stakes with the elevation to the thousandths marked thereon. In the work an error of one one-hundredth of a foot per mile was allowed, but approximately 75 per cent of the 348 mi [illegible]

TABLE I.—COST OF RESUBDIVISION SURVEYS.

	Cost.								
		Supplies							
No.	Eng'ring.	Lath.	Stakes.	Pipe.	Sundries.	Corral expense.	Depreciation.	Total.	No of sections
1	$426.00	$ 2.55	$7.00	$ 67.62	$ 3.30	$ 79.20	$ 5.90	$ 591.57	28
2	227.50	4.00	0.64	13.66	6.50	46.20	5.50	302.00	5
3	840.00	16.00	1.28	118.60	16.25	171.60	13.00	1,176.73	35

[illegible] per mile [illegible] party [illegible] n, which was equipped with wye level, precise instrument not being available, York level rod, rod rubble, ax, steel out 10 ins. in length for turning points, [illegible]

[illegible] ach closing back on its starting point ne other topography bench mark pre- [illegible]

elevations were checked and a new nade with the supposed correct eleva- The checks on control bench marks usually below 0.08 ft. but in a few in- the error was greater, in which case els were re-run between controls and rors decreased to within the allowable of error. The distances run between bench marks varied from four to miles.

field work was affected by small errors, believe these were reduced to a mini- Backsights and foresights were made equal by stadia distances and the tar- s reset three or four times and the ecorded. These small errors were due rge measure to the following causes: ate instruments, wind, excessive heat, ground and rod expansion.

ordinary wye level is inaccurate for work because it is too unstable, is ipped with a mirror wihch enables the r to read the bubble without stepping nd the bubble itself is not sufficiently e for the accuracy desired. The ad- s of a mirror cannot, in the writer's [illegible] xperiment with a wye level will prove ne. As the levelman swings his weight ne foot to the other, in alternately g the bubble for center and in reading the bubble is pulled out of position. ngy ground this fact causes much de- is, at least, a source of annoyance to erver.

[illegible] valley and it retarded the work ma- Many days were entirely or in part ause the levels had to be rechecked.

me hot weather so shortens the bub- its sensitiveness is seriously affected. found essential to shade the level the summer months, and even with this on the reliability of the work was im- Later during the hot weather the par- an work at 4 a. m., took four hours noon, and finished the day by extra the evening. The last method gave the satisfaction.

hawing of the ground during the day freeze at night caused the instrument unevenly. This was overcome by holes below the frozen surface for [illegible]

[illegible] n of the level rod due to wet weather reciable. Ten or twelve miles of lev- re-run on this account after which were frequently checked and neces- rrections made. A rod treated in anner that would make it impervious would have met a need encountered ork.

the completion of a section detail were reported by the levelman show- initial bench mark, the elevations of [illegible] -sixteenth corners, the direction in [illegible] the original bench mark.

nformation was transferred to a 3,000- map of the project which was kept [illegible] ark set and all checks made, and ul for the following reasons: First, as a concise record of work com- [illegible] further level work; second, it en- field men to distinguish the topog- nch marks from any others and to e elevation of bench marks in case es in the field were obscured; third, eeded by the computers when checking the topography level notes to make sure that the right elevations for bench marks were used; fourth, it was necessary as the first step toward the final adjustment of the elevations for the permanent bench marks.

For detail monthly costs of topography levels, see Table II

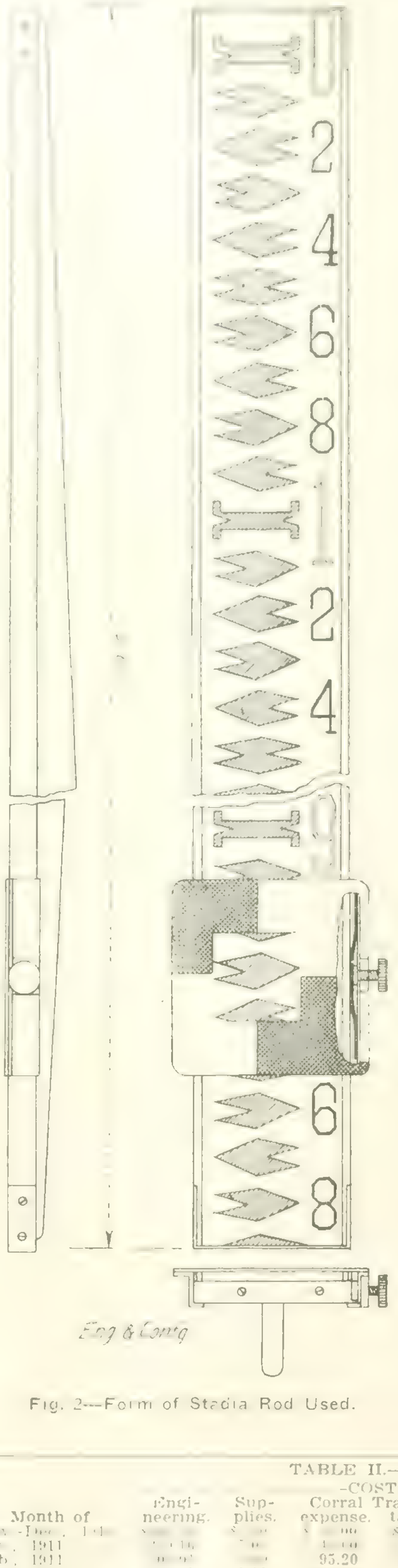

Fig. 2—Form of Stadia Rod Used.

pletion of the topography levels it was decided, inasmuch as considerable trouble had been experienced in the use of incorrect bench marks already established, to set permanent bench marks for control of all future work. They were set in the most protected place possible near the section corners and an accurate description of the location of each with reference to the adjacent section corner, cross roads, fences, etc., was recorded in the level book.

In setting these bench marks a post hole augur 3 ins. in diameter was used to dig a hole varying from 3 to 5 ft. in depth which was filled with wet concrete reinforced below frost line with steel rods, capped with an iron collar 3½ ins. in diameter and from 3 to 4 ins. in length, and the standard U. S. Reclamation Service aluminum cap for bench marks set thereon.

In setting these bench marks it seemed desirable to have the elevation correct to the nearest 0.01 ft. This necessitated re-running some check levels both between original controls and topographic bench marks and the final adjustment of the topographic levels. Hence the cost given below includes not only the actual construction of the bench marks but this additional engineering work.

Upon the completion of the field work connected with the topography levels, all the level notes were compared with the elevations shown on the 3,000-ft. scale map, previously referred to under topography levels, and the map corrected when necessary to agree with the field notes.

The control levels were next thoroughly studied and the most probable values of the elevations for the different bench marks determined, using the elevation of 747.323 for the U. S. Geological Survey bench mark at the east end of the Northern Pacific depot platform at Sunnyside as a base.

In the adjustment of the elevations for the control bench marks and the topography bench marks the point in mind was to make the summation of all the differences of elevation between successive benches equal to zero in any line of levels closing upon itself. There are several methods of doing this, none of which differ much in their final results although some are much more laborious than others. The method adopted is that recommended by J. B. Johnson in his "Theory and Practice of Surveying."

The errors of closure in any polygon of levels were made proportional to the square roots of the lengths of the sides rather than to the lengths of the sides, for since the errors in leveling are compensating it would seem that they would increase more nearly in this proportion. However, in the topography levels most of the polygons involved were sections and the square roots of the sides bore the same relation to one another as the sides themselves. The differences between corners were figured for all of the polygons and the algebraic sum obtained for each, the resulting sum being the residual error necessary to distribute among the several sides of the polygon according to the square roots of their lengths. The polygons were adjusted in the order of their errors of closure, the one with the largest error being adjusted first, the one with the next largest error second, etc., care being taken when one polygon joined another one previously adjusted to use the new value for the adjusted side, distributing the new error of closure among the remaining sides and leaving unchanged the side already adjusted.

When the permanent bench marks were set their elevations were determined from the nearest topography bench marks using for

TABLE II.—COST OF TOPOGRAPRY LEVELS

Month of	-COST- Engineering.	Supplies.	Corral expense.	Transportation.	Depreciation.	Total.	No. of miles.	Cost per mile.	Av. cost per mile.
Nov.-Dec., [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$339.50	40.0	$ 8.49	$8.49
Jan., 1911	[illegible]	[illegible]	[illegible]	0.00	[illegible]	[illegible]	[illegible]	8.22	8.34
Feb., 1911	[illegible]	[illegible]	95.20	2.50	21.30	621.51	71.0	8.75	8.52
March, 1911.....	500.00	0.00	[illegible]	[illegible]	21.30	[illegible]	71.0	10.23	9.05
April, 1911.	[illegible]	[illegible]	132.00	0.00	14.20	452.34	40.0	11.31	9.39
May, 1911.	[illegible]	[illegible]	[illegible]	[illegible]	14.20	[illegible]	43.0	11.16	9.63
June, 1911.......	57.17	0.90	[illegible]	1.00	2.40	81.27	15.0	5.42	9.44
July, 1911.......	27.17	0.00	[illegible]	0.00	1.60	44.17	8.0	[illegible]	9.34
Aug., 1911..	[illegible]	[illegible]	41.80	0.00	4.40	139.30	12.0	11.61	9.42

their elevations those marked up in the field. After the adjustment of the topography bench marks the elevations of the permanent [illegible] were changed to conform with the adjusted elevations.

The cost of setting these bench marks with the engineering work done in addition to that required for topography levels was $1,525 [illegible] benches.

Lateral Profiles.—Each lateral and sublateral was run out to unit (40 acres) delivery. The work included elevations to the nearest 0.1 ft. every 100 ft.; cross sections about every 1,000 ft. in the earth sections; elevations to the nearest 0.01 ft. and stations at all weirs, drops, checks and at the beginning and end of all flumes, pipes and chutes; also ground levels under flumes and over pipes. Pluses were taken to all fences, roads, and intersected laterals or sub-laterals. A simple distance tie to section, quarter, or one-sixteenth corner was also made at each section line and where laterals paralleled fences the distance from the same was occasionally recorded. The headchainman carried the rod, gave all pluses and elevations, and called the various structures encountered to the levelman.

The system of notation was as follows: The main lateral taking out from the Main Canal was known by the mile of its headgate, e. g., a lateral whose headgate was 39.26 miles from the headworks of the Main Canal was known as lateral 39.26. The sub-laterals taking out of this main lateral were called 39.26A, 39.26B, 39.26C, etc., according to the order in which they occurred. Subs from these sub-laterals were designated as 39.26Aa, 39.26Ab, 39.26Ac, and, likewise, subs from these were known as 39.26Aaa, 39.26Aab, etc., as far as the subdivision of the lateral took place.

The purpose of the work was to give definite information, when used in conjunction with the topographic sheets, for reconstruciton of existing distribution and for possible future extensions.

Lateral profile parties consisted of the following men:

Levelman, $80 to $85 per mo.
Head chainman, $70 per mo.
Rear chainman, $65 per mo.

Each party was equipped with a wye level, 100 ft. steel tape, set of chaining pins, axe, level rod, and team.

The levels were tied into topographic bench marks at the beginning, at as many intermediate points as possible, and at the end of each lateral or sub-lateral. A check of one-tenth of a foot per mile was required and seemed easy to meet.

There was considerable difference in the speed of the parties due partially to the length and fall of the laterals profiled, but more to the ability of the levelman. The work did not require the greatest care as frequent checks on topographic bench marks were possible. The average day's work was about two miles but three miles was nearer the average of the fastest party.

When the field books were turned in a record of the laterals covered was immediately entered upon a progress chart. The level notes were then checked to make sure that all the elevations given were correct.

Profiles were drawn up using a horizontal scale of 400 ft. to the inch and a vertical scale of 10 ft. to the inch, which showed the stations at the beginning and end of earth ditches, flumes, and pipes; at section, quarter, and one-sixteenth lines; at the headings making direct delivery, and those to sub-laterals together with the names of these sub-laterals. Cross sections of the earth ditches were also shown about every 1,000 ft. and the sizes of all flumes and pipes were given. Where the lateral crossed from one unit to another, in addition to the stationing, there was shown the unit from and into which it passed. The profiles of each lateral and its branches were shown on one sheet.

As each section of topography was platted, the profile notes were checked against the topography. Where a shot or two was missing or doubtful on the topographic sheets the information given in the profile notes often made it clear. The position of fences and the ends of flumes and pipes were also checked, as were the ground elevations under the flumes and over the pipes.

As soon as the elevations in the profile books were checked, the notes compared with the topography, the profiles penciled or inked, a record was made of it upon a progress chart. For detail monthly costs see Table III.

TABLE III.—COST OF LATERAL PROFILES.

Month of	Engineering.	Supplies.	Corral expense.	Transportation.	Depreciation	Total.	No. of miles.	Cost per mile.	[illegible]
Nov.-Dec., 1910.	$289.60	$5.00	$ 50.00	$0.00	$ 8.00	$352.60	33	$10.66	[illegible]
Jan., 1911	418.82	9.00	67.20	1.50	15.00	511.52	46	11.12	[illegible]
Feb., 1911	605.50	1.50	105.40	2.00	21.30	735.70	73	10.08	[illegible]
March, 1911	844.34	0.27	235.40	1.25	21.30	1102.56	129	8.54	[illegible]
April, 1911	813.57	1.51	220.00	1.25	21.30	1057.63	128	8.26	[illegible]
May, 1911	130.24	0.50	35.20	0.50	3.55	169.99	20	8.50	[illegible]
May, 1911*	130.25	0.49	35.20	0.50	3.55	169.99	...	....	9.16
June, 1911*	187.00	3.13	66.00	0.00	3.55	259.68		.	[illegible]
July, 1911*	48.67	0.00	0.00	0.00	0.00	48.67		...	10.16

*Clean-up work

Topography.—This work included the location of accurate 1-ft. contours, roads, fences, houses, alkalied and damaged land, swamps and all irrigation and drainage ditches, regardless of size, and whether constructed of earth, flume or pipe.

The transit, with stadia for distance and vertical angle for elevation, was decided upon as it would give both the accuracy and speed required and would not require as careful a selection of instrumentmen as the plane table. One transit, equipped with a vertical circle 10 ins. in diameter and an extra sensitive plate bubble, was found extremely well suited to topographical work because of its ease in reading and its added accuracy. It was the intention when the work was undertaken to use the plane table on part of the work but the transit met all the requirements so well that it was considered unnecessary to make further experiments.

The resubdivision surveys and topography levels, previously discussed, were used as controls for the work.

Little or no information on topography of the nature desired was avaiable so the first few sections were in a manner experimental. The first section was surveyed by a three-man party. The traverse lines were run down ridges as nearly as possible, all distances between points on traverse lines were chained, and each traverse was tied in at both ends to the most convenient section, quarter or one-sixteenth corners. The angles were read clockwise from 0 to 360° with the instrument set at 0 on the last hub occupied.

Several difficulties which retarded the progress of the work were noticeable shortly after it was begun. First, the temporary use of level rods as stadia boards resulted in a severe strain on the transitman's eyes and the practical impossibility of stadia shots longer than 600 ft.; second, the position of the traverse lines on the ridges caused some excessively long and too many short shots; third, the lack of adequate field topographic symbols necessitated a great deal of written description because of the large number of topographic features to be shown; and last, the use of chain in measuring between traverse hubs was slow. These difficulties, however, were soon overcome.

Several designs of stadia rods were considered from which the rod shown by Fig. 2 resulted. This rod was made by ourselves and met all requirements. Eight or ten transitmen were employed during the work and no important improvement was suggested by them.

To avoid the difficulties caused by running traverse lines along the ridges it was decided to run straight traverses at nearly right angles to the ridges and draws and set spur hubs* where necessary. Frequently, however, the presence of features such as rivers, lakes, deep gorges, mountains, the main canal, or some large lateral, necessitated not only changing the direction but forced the use of crooked traverse lines in order that time might not be lost in crossing these natural obstructions. In addition to covering the ground better with straight traverses, their use avoided the necessity of re-running the lines, as they [illegible] so easily checked in the field for closure. The greatest saving due to straight traverses occurred in the office in the amount [illegible] saved in platting them, for where [illegible] straight all those on a section could [illegible] ted in the time required to plat one crooked traverse.

Upon the completion of the first section, a set of topographic symbols was drawn up which was added to from time to time as the necessity arose, Fig. 1.

The use of a chain for measuring distances between traverse hubs was early discontinued and stadia distances were used instead. With the use of the stadia it was found that the error of closure was less than 10 ft. per mile which was consistent with the scale of the maps (200 ft. to 1 in.) and the ac[illegible] the work dependent upon the locati[illegible] traverse hubs.

For several months three men parties were used entirely but later these were succeeded by the more efficient five men parties. The methods and work of both will be considered in order. The three-man party consisted of a transitman and two rodmen, equipped with a transit, two stadia rods, and other accessories such as picks, shovels, stakes, lath, axes, signal cloth, team, etc. In starting a section the entire party drove around a part or the whole of it, the rodmen locating and flagging all found section, quarter, and one-sixteenth corners and the transitman making an inspection of the section to determine the most feasible way to run the traverse lines. After which the transitman set up on one section corner and established a point approximating 500 feet distant on the section [illegible] perpendicular to the direction the traverse lines were to run. This point was called T-A-1, meaning the first hub on the A traverse. The instrument was then set up on T-A-1; a sight was taken on the section corner last occupied, with the vernier of the transit reading zero; all possible stadia shots were taken; and the next traverse hub T-A[illegible] was set. In like manner T-A-3, T-A-4, etc., were set, the last point being on the section line, and, finally, a closed traverse was made by reading the angle and distance at the last traverse point to some section, quarter, or one-sixteenth corner. In locating T-2 an

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*Spur hubs are points set outside [illegible] traverse in order to reach otherwise inaccessible topography.

TABLE IV.—COST OF TRANSIT TOPOGRAPHY.

Month of	Engineering Field.	Engineering Office.	Supplies.	Corral expense.	Transportation.	Depreciation.	Total.	No of sections.	Cost per section.
Nov.-Dec., 1910	$855.80	$432.90	$10.00	$70.00	0.00	$10.00	$1378.70	8.5	$162.20
Jan., 1911	1047.28	461.34	12.00	89.00	$7.00	20.00	1736.62	9.0	192.96
Feb., 1911	1499.82	762.17	9.90	309.40	2.75	28.40	2612.44	13.5	193.51
March, 1911	1275.66	688.43	12.74	374.00	3.95	28.40	2383.18	12.5	190.65
April, 1911	1086.50	448.32	12.80	336.60	1.65	21.48	1907.35	9.9	192.66
May, 1911	1108.24	547.43	0.00	264.00	1.50	21.48	1942.65	10.5	185.01
June, 1911	1318.49	635.67	4.47	327.80	2.35	21.48	2310.26	12.5	184.82
July, 1911	1863.00	892.00	33.59	350.80	5.30	21.48	3166.17	18.1	174.92
Aug., 1911	1988.93	1017.90	29.36	345.40	3.75	21.48	3406.82	22.8	149.42
Sept., 1911	1389.67	791.98	11.73	231.00	0.00	15.00	2439.38	14.4	169.40

was turned which would make the trav- ine as nearly parallel to one side of the [illegible] iction to the line when produced. In [illegible] sible to do this and run a straight trav- in which case a slight angle was neces- One or even two small angles do not much difficulty in checking up and are imes a necessity. In sage brush sec- however, anything but a straight trav- s almost inexcusable. In an ordinarily h sage brush section five traverse lines, from five to seven stations on each line, sufficient to permit all the topograpy to ten and have no stadia shots over eight ed feet in length. In cultivated sections, ally in corn, orchards, etc., traverse hubs be set much closer together and even ufficient shots were impossible without spur hubs. All high points and pot were carefully located and a sufficient [illegible] prove the topography. Where no defi- oundary to the work of one traverse ex- e. g., fences, laterals, etc., it was flagged signal cloth that the work might not [illegible] incomplete.

ing the first few months six transit aphy parties were in the field and one party took the elevations of all traverse et. This idea was later abandoned and were run by topography parties upon mpletion of the topography of the sec- The main objection to the traverse level was that it seemed difficult for it to ll the traverse hubs, especially where hubs were set. In running these levels s also found necessary, in order to mistakes in elevation, to make a flat hat all traverse hubs should be turning and that checks be made at both ends h traverse line.

ical angles were read by the transitman [illegible] nent bench marks at both ends of each e line. The differences in elevation figured and compared with those ob- from the wye level work, which com- served as an excellent check upon re exercised by the transitman and the nent of the vertical circle.

average day's work of a three-man was about 400 complete shots, of three gs each, with approximately five shots acre. The sections were completed on erage in about nine days, not including

five-man party consisted of a transit- recorder, and three rodmen and was ed similarly to the three-man party ex- or the addition of one stadia rod and brella to cover the instrument. Before ger party was tried it was figured that ly benefits would be a saving in team e in proportion to the increased speed party and a decreased eye strain on nsitman, some of whom had been forced gn on this account. It was thought that nstant change in the focus of the eyes [illegible] recording and reading the nent was largely to blame for this The five-man party not only met the expectations but developed an increased n the work sufficient to further reduce st per section.

average day's work of a five-man par- sisted of about seven hundred and six- plete readings and it took on the av- about five days to complete a section, s not included.

salaries paid in both three and five-men were as follows:

	Per month.
man	$8[illegible] to $10[illegible]
[illegible]	7[illegible] to [illegible]
[illegible]	[illegible] to [illegible]

five five-man parties in the field the ng office force was required:

[illegible]ters at $7[illegible] per month.
ters at $70 to $80 per month
tsmen at $90 to $100 per month
ckers at $100 per month.
f draftsman at $110 to $120 per month

differences of elevation in the books first section were figured from stadia tables, after which a stadia chart was made and used. (See below.) It was good for shots up to 700 ft. in length and vertical angles up to 5° 40′. For shots longer than 700 ft., the difference of elevation was obtained for one-half the distance and this multiplied by two. For vertical angles larger than 5° 40′ the differences of elevation were obtained from stadia tables. This arrangement proved very satisfactory until the topography was taken on rough country, after which twenty-inch K. & E. stadia slide rules were used. Later these were used to the practical exclusion of the charts, although somewhat harder on the eyes. Where the country was quite flat and few of the vertical angles over 0° 24′, the computers made use of the table given below. While it may appear a little unscientific, yet it gave results never more than one-tenth of a foot in error. With a little use the table was memorized, so that a book requiring 900 reductions was often computed in two or three hours. In this table *d* stands for the number of hundreds of feet in the distance.

The differences of elevation as figured by one man were not checked except for a short time when it was done as a trial. The trial showed that the added labor was not worth the time, for few mistakes were found and these were picked up by the platters and checkers.

After the differences of elevation were obtained, the next step was to figure and check the elevations of each of the stadia shots. The elevation of the traverse station, used to the nearest tenth, was placed on a small card, and this card with the elevation directly over the differences was moved down the page from one difference to the next as the computer figured one elevation after another.

As soon as the elevations in the books on any section were checked and the section outline drawn up, that section was ready to plat. For these maps detail paper was considered and abandoned; considering the amount of money spent in field and office work it seemed reasonable to use the best of paper. Kueffel and Esser Paragon, Eugene Deitzen Double Force and their Super-Super Cold Pressed papers were all used, the latter of which gave the best service.

The first platting was done by using an Universal Drafting Machine. A fourteen-inch paper protractor was placed to one side of the map and propery oriented. Then the drafting machine scale was placed over the protractor, set at the proper angle, moved to the map and the required distance laid off. This was slow, tiresome and hard upon the eyes, in addition to requiring a costly machine. Necessity seemed to demand something simpler and easier upon the platter, and as a result of a little study and ordinary triangular engineer's scale was fitted up with a little band of metal at one end having a pin hole through it exactly at the zero of the scale which was used in conjunction with a large paper protractor having a nine-inch diameter hole cut out at its center. The method of procedure was to set up protractor and scale at the traverse station, move the scale to the required horizontal angles and mark off th proper horizontal distances, at the same tim noting the elevation of each point togethe with any topographic features shown in th field notes. The elevations were recorded up on the maps to the nearest tenth of a foot i all except the roughest country, where th nearest foot was used. Later a flat scale wa used in place of the triangular scale, it bein advantageous in that the platter could plac his hand on the scale in writing and not hav to move it out of the way. Some platting wa done with Ockerson protractors, but they wer [illegible] sary to look up but few points at a travers [illegible] through their center and into the paper at traverse station to make them ready for us

On rainy or very windy days the availabl field men came into the office and did wha kind of office work they were best fitted fo On these occasions the rodmen called th notes to the platters, enabling the platter t make very fast progress. This arrangemen worked to advantage on sage brush land bu increased the liability of errors where th topographic features were to be shown.

In contouring, the five-foot contours wer drawn in first with a soft pencil and the one next with a hard pencil. By running in th fives first it was easier to put in the ones afterwards and the use of the soft and har pencils made the fives stand out distinctl from the one-foot contours. Colored pencil were used to mark many of the topographi features. The laterals and drains were marke in blue, the boundaries of swamps in red, th boundaries of damaged land in green, an those of alkalied land in brown. Upon th completion of the penciled map it was covered by a piece of heavy, brown wrappin paper.

Each drawing was checked before bein inked. The first thing to be noticed wa whether the contours were properly spaced according to the elevations given upon the ma After this it was necessary to examine all th circular contours to see that the depressio contours were fuzzed on the inside to distinguish them from summit contours. Wher circular contours indicating either summits o depressions were found on what was otherwise an even slope, and were dependent upo only one shot which was not marked by th field man as being either a summit or depression, they were considered errors and remove from the map. The checker was expected t notice any shots or positions of contours tha were at all questionable. He sometimes foun that the shots were wrong due to a mistak in figuring the difference of elevation or th elevation. Sometimes it was plainly eviden that a plus vertical angle had been recorde instead of a minus, or vice versa. In som cases an even 100° would be added to o dropped from the correct horizontal angl e. g., 108° would be recorded instea of 208°. A mistake of this kind is not surprising when it is considered that one ma often read and recorded in a day 25 pages o notes with 20 shots to a page and three observations to a shot. Another check upon th

Vert. angle.	Difference of elevation.	Corrections.	Corrections.
[illegible]	0.1	Over 200 ft. and under 500 ft.	
	0.2	Over 500 ft.	
[illegible]	1/16 d		
[illegible]	1/11 d		
4′	[illegible] d		
[illegible]	1/7 d or [illegible] d		
6′	1/6 d		
[illegible]	1/5 d or [illegible] d		
[illegible]	1/4 d		
9′	1/4 d		
10′	.3 d		
[illegible]	1/3 d		
12′	1/3 d		+0.1 over 500 ft.
13′	.4 d	—0.1 under 500 ft.	[illegible]0.2 over 500 ft.
14′	.4 d		
15′	.4 d	+0.1 under 500 ft.	+0.[illegible] over 500 ft.
16′	.5 d	—0.1 under 500 ft.	—0.2 over 500 ft.
17′	[illegible] d		
18′	.5 d	+0.1 under 500 ft.	+0.2 over 500 ft.
19′	.6 d	—0.2 under 500 ft.	—0.3 over 500 ft.
20′	.6 d	—0.1 under 500 ft.	—0.1 over 500 ft.
21′	.6 d		
22′	.6 d	+0.2 under 500 ft.	+0.[illegible] over 500 ft.
23′	.7 d	—0.1 under 500 ft.	—0.2 over 500 ft.
24′	.7 d		

topography was obtained by checking up the laterals on the map with the profile notes which showed the stations at every turn, fence, beginning and end of flumes, etc. The profile notes also showed the elevation of the ground under all flumes and over pipes. These elevations were compared with those shown by the topography. An accurate location of the main canal and all laterals carrying 10 cu. ft. per second or over had previously been made and these were compared with the topographic location. When two adjoining sections were completed the edges were joined. The agreement of the contour lines on the two sections also furnished an additional check upon the work.

In inking the maps, the section outlines, fences, houses, railroads, lettering, etc., were shown in black ink. The 5-ft. contours were shown in Higgin's brown and the 1-ft. contours in burnt sienna color made from Higgin's inks in the proportions of 12 bottles of orange, 4 of carmine and 1 of blue. This mixture was found to be more uniform than the use of burnt sienna water color and flowed better in the pen, especially in tracing. Laterals, pipes, flumes, drains and bodies of water were inked in blue. Alkalied land was shown by covering it with dots of ink made by diluting brown with water. Swamps were indicated by broken green, parallel lines with green bunch grass here and there. Low, wet, damaged land was shown the same as swampy land with the addition of diagonal parallel lines at 30 degrees to the horizontal made with light brown ink.

The checking of the ink drawings consisted mainly in seeing that the 5-ft. contours were properly marked, the depression contours fuzzed, the circular contours all in, fence lines barbed, flumes marked, laterals properly connected, and title and legend correct.

In tracing, the same colors were used as in inking, except that black ink was used everywhere in place of blue. The checking of the tracing consisted in looking after the same points as were enumerated above under the checking of the ink drawings.

A complete record of the progress of the office work was kept on a progress chart

The work taken as a whole has proved extremely satisfactory on this project, but if it had been done prior to any construction there is no doubt the benefits would have been greater. Much useless and expensive engineering work could have been avoided and better construction put in at a reducted cost per acre. Further, the work considered in this report could have been completed at a much lower cost per section if the 90,000 acres surveyed had been taken up block by block in order and little or no descriptive work had been necessary, as would be the case on raw land. The nearest approach to these conditions occurred during the month of August, 1911, the reduced cost of which is shown on Plate III under topography for that month.

The topographic sheets, it may be remarked in passing, will be found of the greatest value in drainage studies. It seems reasonable to assume, further, that they will be of as much or perhaps more value for drainage purposes than for distribution.

In writing this paper many ideas were obtained from the field man and special assistance was given by Mr. Earle E. Cowin† in the discussion of field and preparation of office methods.

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Modern Conception of the Seven Wonders.—The ancient conception of the seven wonders of the world was as follows: The pyramids, hanging gardens of Babylon, the tomb of Mausolus, Temple of Diana, Colossus of Rhodes, the statue of Zeus and the Pharos of Egypt. The modern conception, as recently expressed at Cornell university, comprises wireless, synthetic chemistry, antitoxins, radium, aeroplanes, telephone and Panama canal.

Notes on Equipment for and Costs of Pumping for Irrigation Using Electric Power.

Pumping for irrigation is among the principal uses for which electric current is sold by the San Joaquin Light & Power Co. This company has, therefore, developed the installation and equipment of these pumping plants and has accumulated figures of costs which are of general interest. We take the following from a very elaborate review of the company's plant and power supply system which appears in the "Journal of Electricity, Power and Gas," for May 11, 1912.

In many cases two or more wells supply water for a single pump; in many cases but one well is sufficient. These plants are quite similar and comprise two types. One is the direct connected motor-pump, in which the motor and single stage centrifugal pump are mounted together on a comon cast iron base, the unit being placed at the bottom of a pit at practically the standing surface of water. The other form is, as a rule, more or less temporary in character and consists of a centrifugal pump with vertical shaft, placed in a sump at the water level, the driving motor being belted to a pulley on the pump shaft.

A typical farm equipment of the first named class consists of a concrete-lined pit, 8x12 ft., with 8-in. walls, in which are imbedded steel I-beams with L-braces for stiffness. The floor of the pit is 27 ft. below the ground surface. There are two wells 4 ft. apart opening into this pit and between them is placed the pumping unit which consists of a Westinghouse 20-h. p. 3-phase induction motor, direct connected to a No. 6 centrifugal pump. Over the pit is erected a neat wooden house which contains the controller, switch and meter. The pole structure nearby carries three 7½-kw. 6600/440-volt transformers, these are star connected on the primary side to the 10,000-volt lines. In providing service of this order, the company assembles and arranges the outfit in accordance with the ndard. adopted for the system and makes t installation for the customer. The latter ys outright for the pumping unit, the trar ormers and the section of transmission line hich it may be necessary to build from on of the distributing lines. In building a lir into a certain locality, the locations of the ells of prospective customers are determined s nearly as is possible, and the line is lc ted so that the least possible burden of cost ill fall on the customer for his line.

In the plant described above 1,025 lls. per minute are delivered against a head 42 ft the vacuum being 14 ft. This re es 15 h. p. measured at the motor, which ows a efficiency for the pump of somewhat ver 6 per cent.

The cost to the company of install g a r of this sort, including the hanging of t transformers and making all conne ons about $75. Table I is a list of mat ial a costs of a standard pumping equipm t.

The deep well pumps are of the lunger type, the pump cylinders being plac in t well below the water surface. The p operated with a vertical motion b crank or walking-beam, which in urn moved in its reciprocating motion rom crank mounted at the end of a coun -shaft. To this counter-shaft is belted the driving motor. The whole is enclosed in a uitable wooden house. One of these pumps n r Edison operates a well 175 ft. deep; the otor is a Westinghouse, type CCL, 40 h.p. T pump delivers 61 miners' inches (statute) water equivalent to a flow of 1:22 cu. ft. r second. This will irrigate 320 acres of and at the plant level. The power bill am nts to $5 per acre per year, allowing 1 mins' inch to the acre and four irrigations per ear.

At the Alpaugh colony pumps, out miles northwest of Bakersfield, the are seven wells. Each of these wells is uipped with a unit comprising a 20 h. p. luction motor driving a 7 to 8-in. centrifug

TABLE I.—LABOR AND MATERIAL FOR EQUIPMENT FOR INSTALLING ELECTRIC M TORS AND TRANSFORMERS.

	Size.	Amount.	Cost.	Size	Amount.	
Motor, 220 volt*	3 h p	1	$ 64.85	30 h.p.	1	
Transformers, 6600 volts	2 kw.	3	177.90	10 kw.	3	
Pole	35'	1	8.00	35'	1	
Crossarms	Style D	2	1.60	Style D	2	
Crossarms	Style G	2	1.60	Style G	2	1.60
Lag screws and washers	½x3½	6	.09	½x3½	6	.09
⅝"x16" bolts and washers	⅝x16	4	.30	⅝x16	4	
⅝"x14" bolts and washers	⅝x14	2	.14	⅝x14	2	
⅝"x12" bolts and washers	⅝x12	2	.14	⅝x12	2	
Sets 6600 volt line fuses complete (warning signs)	Set	3	18.00	Set	3	
1' blocks	1'	3	.30	1'	3	
Type A condulets	¾"	2	.54	2"	2	
Type B condulets	¾"	1	.40	2"	1	
Type F condulets	¾"	1	.60	2"	1	
Conduit ells	¾"	6	.66	2"	6	
Conduit straps	¾"	12	.06	2"	12	
Conduit ground clamp	¾"	2	.28	2"	2	
Conduit	¾"	80'	7.12	2"	80'	
Angle iron frame and board	2'	1	1.00	2'x6"	1	
⅛" sheet asbestos	⅛"	2'x4'	.35	⅛	3'x4'	
3 P. S. T. switch, 250 v., and screws				150 A	1	
3 P. D. T. switch, 250 v., and screws	25 A	1	1.15			
Fuse block, 3 p., 250 v., and screws	25 A	2	.80	150 A	1	
Cartridge fuses, 250 v. (running)	10 A	3	.45	95 A	3	
Cartridge fuses, 250 v. (starting)	20 A	3	.66	150 A	3	
R. C., D. B. flexible cable				No. 1-0	300'	
Primary fuse wire	½ A	12'	.05	3 A	12'	
R. C., D. B. wire	No. 10	300'	4.14			
W. P. wire	No. 8	50'	.76	No. 6	50	1.14
S. D. bare wire	No. 6	100'	1.40	No. 6	100'	
H. D. bare wire	No. 8	400'	3.50	No. 8	400	
10,000 volt insulators		12	1.56		12	
2,000 volt insulators		12	.48		12	
Standard iron pins	8"	16	3.20	8"	16	
Locust pins		8	.16		8	
Black pipe	⅜	18'	.45	⅜	18'	
Guy boxes		1	.75		1	
Pole steps		21	1.05		21	
Lbs. solder		1	.30		2	
Gal. gasoline		½	.15		1	
Loom	¾"	20'	.80	½"	20'	
Porcelain tubes	5-16x3"	18	.12	5-16x3"	18	
Porcelain tubes				¾x3	12	
Lbs. solder paste		⅛	.08		¼	
Rolls friction tape		3	.39		3	
Rolls rubber tape		2	.50		2	
Conduit box and nails (to fit conduit)		30'	2.85		30'	
Total cost of material			$310.68			1,037.11
Overload and low voltage coils					1 set	
Team			$ 20.00			
Labor						
Hotel expense						
R. R. fare and traveling time						
Total cost						

*Note.—Prices on motors include sliding base and pulley and on motors over 5 h. pensators. Low voltage and overload coils extra. Prices are approximate f. o. b. Baker are subject to change.

ump delivers 1,500 gals. per min. into a n canal. This carries the water eleven e Alpaugh colony, where it is [illegible] by a 50 h. p. motor-pump into dis- g canals and thereby does duty in irri- 8,000 acres of what is now most pro- land. The cost of this irrigation to onists is $1.25 per acre per year.

ery interesting use of water from a umping plant is illustrated in an orange near Porterville, on which the Skinner of overhead irrigation is used. In stem galvanized wrought iron pipe is through the tops of the orange trees, of pipe for every other row of trees; pported 8 ft. above ground on 4x4 in. d poles. Suitable valves are provided water may be supplied to any row of will and the joints are so arranged line of pipe may be turned to throw y in any direction desired with refer- wind and sun. Holes for the nozzles led in the pipe every four feet and ¼- s nozzle bushings are screwed into oles. These nozzles are drilled in es, depending upon the amount of irri- desired, the smallest hole being not rger than a horsehair.

ranch in question the equipment on cre sidehill tract is 180 ft. of 1½-in. ed pipe, 180 ft. 1¼ in., 170 ft. 1 in. ft. of ¾ in. The lift of the sidehill The well supplying water for this on develops 10 miners' in. of water. und that it is possible to irrigate 30 a time. The system cost $150 per acre outside of the cost of pump and well

umping plant is 40 h. p. induction rect connected to a centrifugal pump the bottom of a stave line pit 22 ft. e ground surface. The actual power to deliver 100 in. of water is 34.92 e power bill for irrigating 155 acres sent installed is $144 per month. This n probably be lessened as the equip- ncreased and the plant becomes more

aintenance of Open Drainage Ditches.

nance problems have received far less tion in the design and execution of ditches than their importance de- Some of these problems and their so- e considered in a paper before the gineering Society by A. P. Smith, engineer, of Ft. Dodge, Ia. We give ance of this paper in the following

cient velocity or volume of flow can ocured to give the water a silt car- acity, we know that the silt will in- lodge in the channel and eventually hen we have not the available fall, that the water will deposit siltage, est efforts must be to see that the o constructed and so protected as to arth from caving or being washed [illegible]

were taken in Webster County in some 60 miles of ditch that had [illegible] ad bottom width varying from 4 to ades from 1.5 to 10 ft. to the mile, all supposed to have been constructed berms and 1 to 1 side slopes. They had a minimum cut of approximately levels showed that where the area [illegible] main ditch was self-cleaning with 2 ft. to the mile. On one main out- with a tributary watershed of some es, the drain had been deepened a s by erosion. The fall was 2 ft. to We found that drains with tribu- sheds of about 2,000 acres were not ng at less than some 5 ft. to the th lesser grades and the same size ltage rapidly increased till at grades the mile we found an average of . of siltage, and with 1.5 ft. to the uch as 3 ft. of filling in the drains, ly destroying their usefulness. A 4-ft. grade required some 4,000 acres before it became self cleaning. A 3-ft. grade did not seem to be self-maintaining with a water- [illegible] to 7,000 acres.

These deductions are at best only approximate. Each engineer has a different problem. Soil and run-off conditions vary so greatly as to make rules impossible. There was little sand or loose clay on the above work. The lines were constructed almost altogether through soil which consisted of some 3 ft. of heavy black loam, and approximately 4 ft. of a tough, ordinary yellow clay, underlaid with blue clay and some hardpan.

Certainly, the correct design and location by a competent engineer has much to do with the life of open drains. The specifications, the careful planning of grade-lines, the consideration of life and efficiency without overstepping the bounds of economy, all these are of the utmost importance. Yet we cannot give the drains self-maintaining grades if the fall does not exist. We can only do our best to have the work so constructed and so maintained that the siltage will be reduced to the minimum, and the time of cleaning deferred.

The manner in which the slope of an open drain is dug is of paramount importance. Certainly, one does not expect a "sand-papered" slope, but it is possible to avoid the vertical banks and the over-hanging sods which so soon cave into the channel and perhaps do more to lessen the life of a drain than siltage from any other cause. It is very easy to destroy the slope in the careless handling of the floating dredge.

It is when the dipper is run out as far as it will reach that the slope-line is destroyed. For then the bucket is even with or actually beyond a vertical line dropped from the outer end of the boom, and as the bucket is drawn up the slope-line the pull is straight up or sometimes slightly back for the last few feet. The runner must overcome his inclination to reach and take out every bit of earth possible before moving up. Especially reaching to the limits ahead on the slope-line. Personally, I like to see the dredge so operated that the face is dug in almost a semi-circle with the cutting edge leaving the water at all points on the face at the same distance from the center of the circle or turn-table. It is true that this method leaves a somewhat corrugated slope, but a very excellent one at that.

Next in importance comes the berm. Ragged slope-lines, a berm covered with scattered earth, a berm broken on the edges by the spuds, or one on which the roll from the dipper has been left, all do much toward caving and the rapid siltage of the drain.

It is a very easy matter for a dredge to leave the berm clean from the slope-line to spoil bank practically free from roll and droppings. Each time just before the boat pulls up this cleaning should be done. Most runners accomplish it very quickly and efficiently by dropping the heel of the bucket to the berm on the edge of the drain and then with the bucket resting on the berm, by shoving the dipper out to the spoil-bank on either side, pushing the roll ahead of it. If this is done at three or four points on each side, each time before the boat pulls up, an almost perfect berm is obtained.

Some engineers are inclined to minimize the importance of a clean berm. The greatest harm, of course, is in the actual weight of the earth in the roll on the edge. This is almost sure to slide, carrying with it whole sections of the side of the drain which may almost block the channel. Then, too, the waste earth covers and destroys the sod on the berm so that none is left for a binder, as it might be called. A well-sodded berm does much toward the prevention of caving.

It is necessary that the spuds have sufficient span so as to rest well back to the spoil-bank on either side. If the edge of the berm is broken down by the spuds, caving is increased.

It is the engineer's duty to see that the "plant" is so constructed as to be capable of properly handling the job. Good work cannot be obtained if the dredge is inefficient, the boom too short, or the spuds so small or of such narrow span as to break the berm.

Locally, we have proven that we can enforce these specifications without any material decrease in the monthly yardage or increase in contract prices. I have invariably found the contractors and their foremen willing to co-operate with the engineers in improving the work. In fact, most of the knowledge that I have gained as to the possibilities of the floating dredge when properly handled, has been obtained from the contractors themselves.

In designing a drainage system, provision should be made to care for the surface water that must enter and drop into the drain. We have successfully used three methods.

One consists of a large concrete wier or spillway, built into the side of the drain. This is used where a creek with a considerable tributary shed enters and drops into it. We have constructed three such spillways in the past year and find them efficient. These contained some 25 cu. yds. of concrete each, which cost the drainage district $8.50 per yd. They were constructed under special contract.

At other points where large tile lines were designed to enter the drain and where the tributary watershed was such that we expected a heavy surface run-off, we have designed a spillway over the tile bulkhead.

The method which we have recommended most extensively in combined tile and open drainage districts, is to make provision in the last few feet of each tile line for the carrying of additional water, and to construct an open inlet into the tile line immediately outside of the waste-bank. At many points where tile lines were not contemplated when the ditch was first planned, we have recommended stub tile lines to a point outside the spoil-bank with inlets for storm water. These stubs are so designed as to be sufficient in size and depth for outlet for future and more complete tile systems.

The law should be strictly enforced as to obstruction in the drain, placing bridge-piling in same, allowing cattle to cross in the channel, and in allowing property owners to bring in improperly protected tile laterals or to cut unnecessary overflow channels through the waste-bank. All of these must be watched. The township should co-operate with the drainage district and place culverts through the waste-banks in the highway ditches. Each small chance for siltage should be guarded against. A slight bar caused by the wash-in of a 4-in. tile may cause silt deposits on a flat grade aggregating hundreds of cubic yards, and siltage once in a drain is only removed at a great expense.

In connection with our work this past year we have had occasion to make a careful investigation of the costs and methods of cleaning siltage from open drainage ditches. The amount of information to be had is very small.

In some cases where drains were short and recently silted the cleaning was accomplished by dragging some instrument, such as a threshing machine cylinder, up and down the channel during time of flood. The siltage, when loosened, being carried out by the water. This is only possible where drains have an exceptional fall. The cost is nominal.

A sand pump mounted on a light draft barge and operated by a gasoline engine has been used. This machine works down stream from the upper end, can remove siltage only and requires considerable water. I have not been able to obtain cost data for same.

An orange-peel bucket operated by a steam engine working from the top of one waste-bank has been successfully used on several drains in Calhoun and Pocahontas counties. This machine is quite efficient in removing siltage only from the channel of the drain. The cost has averaged 30 cts. per cu. yd. for removing 2 ft. of silt from 4 to 10-ft. bottom widths and slightly less for greater widths and depths.

The drag-line machine has also been used at about the same cost. This offers some advantages in the way of being able to trim up the banks. I believe that the drag-line is one of the most efficient machines for cleaning purposes. It operates from the top of one waste-bank. With both the drag-line and orange-peel the yardage cost has included the cost to the contractor of leveling down one of the waste-banks sufficient for the machine to travel over it.

When only 1 to 2 ft. of siltage are in the channel a floating dredge is almost impossible. It is usually impractical to dam the channel on account of possible damages to property owners, so that the floater must cut below grade to get through. Contracts have been let as high as 50 cts. per cu. yd. for work done in this way. When the channel is silted to the extent of 3 to 5 ft., a light draft dipper dredge is an excellent machine. It can lower the grade, trim up banks in good shape, and if yardage for one equals some 50,000 cu. yds., the work can be done for 19 to 25 cts. If the drain is almost entirely filled or if it is proposed to so enlarge the same as to give heavy yardage, we may expect much the same prices as in ordinary new work. It will be found, however, that, with correct specifications and with careful construction and protection of even our flat grade open ditches, the siltage will be so slow as to defer time of cleaning for many years.

Two Suggested Improvements in Public Drainage Work.

The piecemeal planning of drainage work has resulted in certain evils which are receiving an increasing amount of discussion by drainage engineers. There is also more attention being given now than formerly to problems of up-keep of drainage systems. These two features are discussed briefly in a paper by G. V. Skeels before the Iowa Engineering Society. An abstract of this paper follows:

It is a common and peculiar custom to begin a system of public drainage at the source or fountain head of a small stream and by the construction of new channels and dikes greatly increase the gathering capacity of the stream while the main channel is left untouched. If the same methods were used in constructing a building and we began at the roof and worked down part way and then stopped what a peculiar looking affair it would be. The various boards of supervisors are not wholly responsible for this condition of affairs but could relieve it in a large measure by joining with the boards of adjacent counties, which they often do, and make the system more complete.

It occurs to me that a better way to handle these public drainage problems would be for the state to have charge of them and appoint a supervising engineer for a district, composed of several counties, to plan the main ditches for each watershed. They should then be constructed in their proper order. The logical way to plan a drainage system would be: First, taking the entire area in the watershed to plan an adequate outlet to take care of the water after it is collected; and, second, to provide a proper system of laterals to collect the water. The actual work of construction could be carried on by the various counties under their own engineers. The present method seems to be to collect the water and dump it into some poor little creek that under normal conditions is working overtime, and cause it to overflow on some poor unfortunate farmer who happens to be farther down stream.

The proposed state supervision would require that the main outlet channels be constructed first and the cost thereof assessed to the entire watershed in proportion to the benefits. It quite frequently happens in drainage systems that the maximum benefit is reaped by the upper end of the district and the maximum cost is providing a proper outlet, and for this reason the latter is often omitted.

Another phase of drainage work that should be given considerable study is the advisability of using tile to take the place of open ditches for lateral work. There are many places where this cannot be done on account of the large amount of flood water that often comes to the ditch after a heavy rainfall. If the lateral drains a flat country of the local rainfall only, then tile is no doubt a success and worth the increased cost. In the use of tiling for drainage work, care is necessary in the selection of tile for quality, and in the proper laying, and also in the proper protection. When these fundamental things are done the lateral has the advantage of having a clear channel at all times and a permanent uniform grade. It also gives to the adjacent land a permanent outlet for its tile drainage. The efficiency of tile laterals can be increased by providing storm water inlets at the low places and thus getting the maximum flow of the tile sooner than would occur naturally. These inlets must be constructed in such manner as to protect the tile from rubbish and mud. A cheap and satisfactory inlet can be made by filling the trench over the tile with corn cobs, screened gravel or crushed stone, for a few feet in length.

The difficulty with open ditches on flat grades is that a small obstruction is sufficient to stop the flow and allow the mud to settle so that rubbish soon accumulates and the ditch is soon out of repair. The admission of the discharge from open ditches over the banks of the lateral is another cause of trouble. These little waterfalls scour out the bottom of the lateral and cause a mud bar to form immediately below, which acts as a dam to catch rubbish and mud. A cure for this evil would be to require that all surface ditches discharging into the lateral should do so through a tile entering the ditch near the bottom and discharging in the direction of the flow of the lateral. During the past year I have had charge of the cleaning out of a lateral ditch that was made five years ago and that had experienced the evils mentioned above. The cost to the district was $900 per mile. This expense was largely, but not entirely, due to obstructions that had collected.

I have examined ditches during the past year that were dug about five years ago and found them entirely filled with corn husks and weeds that had drifted in from the adjoining fields, and nobody was held responsible for this condition. It would be a long step in the right direction if the county boards would appoint a supervisor of ditches and have him inspect them regularly and keep them free from obstructions. He should control the construction of all bridges, culverts, and tiling inlets that might affect the ditches and prevent or correct any abuse of privilege by the adjacent land owners.

STEAM AND ELECTRIC RAILWAY SECTIO

Methods and Cost of Constructing Wooden Towers for a High Tension Transmission Line 25 Miles Long.

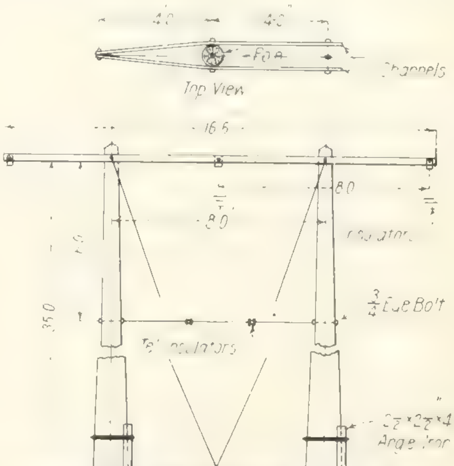
The method of constructing the 60,000 volt wooden tower line of the California-Oregon Power Co., which involved several interesting and novel features, is described by Mr. O. G. Steele in the "Journal of Electricity Power and Gas" for May 4, 1912. The details of the tower are shown by Fig. 1. Spans vary from 450 to 1,000 ft., one span being 1,465 ft. across Jennie Creek canyon.

Cast iron anchor plates were used in the foundation work while 3 in. channel iron was employed for the cross-arms. These arms are 16.6 ft. long and are painted with P. & B. paint to prevent rusting. Angle iron 2½x2½ ins. was used to bind the poles to the concrete bases shown in the illustration. Insulators of the Locke suspension type are employed. Each insulator, composed of three units, clasps the conductor by means of a straight line clamp. At the point where angles are necessary in the transmission line four units are employed in the insulator.

Every fifth tower is so constructed as to take up the strain; at these strain towers four anchors are employed with guy wires crossed, while for standard towers only two anchor plates are employed.

The raising of the towers proved an interesting problem, due to the roughness of the country. While the hillside, composing a portion of the transmission line, made only one method applicable, it was not at all times practicable to deliver the tools required. A crew of 12 to 15 men was employed.

The poles were first placed on supports about 7 ft. above the ground. The guy wires were next passed over the fork and with the aid of a block and tackle the poles were pulled into place, during which process men with pike poles guided the poles. After the poles were set on their bases the guys were pulled through the eye of the anchor rod and tightened by hand, and another crew following put the guy wires in final taut condition.



Details of Wooden Tower for High Tension Transmission Line.

Later in the progress of the work it was found that a horse could be used to raise the towers and this method proved satisfactory. As many as 25 of these towers may be thus raised in one day. Referring to the guy clamps, the ordinary three-bolt galvanized type was employed, but in the future the combination clamp will replace the three-bolt design.

An average of ten towers per mile were necessary in the construction of the transmission line, although this varied somewhat wherever rolling country prevailed. Thus in crossing canyons, spans were made of full length in most cases.

The cost of construction is estimated from the unit costs to be about as given in Table I, assuming 10 towers per mile:

TABLE I.—AVERAGE COST PER

WOOD TOWER TRANSMISSION
10 TOWERS PER MILE, 24.6 M

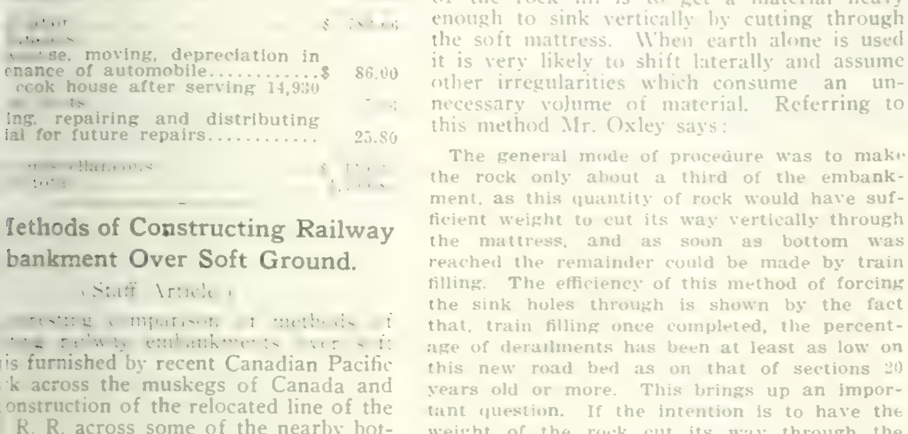
Materials:	
Wire 3 No. 2 copper, 3,242 lbs......	[illegible]
Wire 2 No. 9 iron, 1,053 lbs	[illegible]
Insulators, 100 suspension units....	[illegible]
33 suspension eyes	[illegible]
7 strain clamps	[illegible]
30 straight line clamps......	[illegible]
Channel iron arms, 10 sets of 2,132 lbs.	[illegible]
Angle iron, 338 lbs......	[illegible]
Cement, 4.35 bbls......	[illegible]

[illegible]	25	[illegible]
[illegible] insulators, 21 No. [illegible]	[illegible]	[illegible]
[illegible] hardware		
[illegible] in.	[illegible]	[illegible]
[illegible] in.	[illegible]	
bolt ⅜-in. guy clamps......	.151	7.55
-in. thimbles	.0312	1.56
[illegible]-in. strand guy cables	[illegible]	[illegible]
[illegible] rods [illegible]	[illegible]	
anchor plates	[illegible]	[illegible]
20 40-ft. red fir..............	1.629	32.58
of way, average cost of [illegible]		[illegible]
outfit and tools, proportional per mile	....	20.00
[illegible] materials		$[illegible]
r:		
[illegible] right of way		$[illegible]
[illegible] right of way		[illegible]
gging, 20 foundation holes, 2 ft. and 25 guy holes, 5 ft. deep......		79.00
		[illegible]
framing, 10 towers, at $2.29......		22.90
[illegible] cost of teams [illegible] rain; 20 poles, average 2 miles, at		[illegible]
verage cost per mile.............		20.51
l iron arms, including painting...		14.50
tion materials		25.80
20 foundations (conc.), at $5.51..		110.20
20 towers, at $5.538..............		110.76
tringing 3 copper transmission iron telephone....................		73.60
blacksmithing, coal and labor...		10.00
[illegible]		[illegible]
[illegible] and [illegible]		[illegible]
[illegible]		[illegible]
[illegible]		$[illegible]
[illegible]		
[illegible]se, moving, depreciation in enance of automobile.............$		86.00
cook house after serving 14,930 [illegible]		[illegible]
ing, repairing and distributing ial for future repairs............		25.80
[illegible]cellaneous		$[illegible]
[illegible]		[illegible]

lethods of Constructing Railway bankment Over Soft Ground.

(Staff Article.)

[illegible] comparison of methods of [illegible] railway embankments over soft [illegible] is furnished by recent Canadian Pacific [illegible]k across the muskegs of Canada and [illegible]onstruction of the relocated line of the R. R. across some of the nearby bot[illegible]ds of the Isthmus. At Panama the [illegible] adopted was to counterweight the soft on each side of the embankment to [illegible]it from swelling up and permitting the [illegible]nent to sink; in Canada a rock em[illegible]it was filled across the soft ground [illegible]wed to sink to form a solid core for [illegible] fill proper. The two methods are [illegible]ained in detail by describing specific [illegible]



[illegible]g.—Sketch Showing Method of Making Railway Embankment Over Canadian Muskegs.

[illegible]MENT ACROSS MUSKEGS, CANADA.

[illegible]pical Canadian muskeg is a pond [illegible]s grown over with vegetation until a [illegible] of dead roots and humus with plants [illegible]on its top covers the original surface [illegible]ater. In some cases the droppings [illegible] river have filled up from the bottom [illegible] original content of water is replaced [illegible] these muskegs have much the appearance of ordinary upland, but the soil will not carry load such as railway embankment.

Figure 1 shows the method of embankment construction across muskegs as described by Mr. O. E. Oxley in a paper before the Canadian Society of Civil Engineers. Briefly a rock pile is carried across the muskeg. This rock gradually cuts through the soft material and sinks to solid bottom. Meanwhile it is filled out with earth as shown. The purpose of the rock fill is to get a material heavy enough to sink vertically by cutting through the soft mattress. When earth alone is used it is very likely to shift laterally and assume other irregularities which consume an unnecessary volume of material. Referring to this method Mr. Oxley says:

Fig. 2—Sketch Showing Method of Making Railway Embankment Over the Queorada-Baja Battern at Panama.

> The general mode of procedure was to make the rock only about a third of the embankment, as this quantity of rock would have sufficient weight to cut its way vertically through the mattress, and as soon as bottom was reached the remainder could be made by train filling. The efficiency of this method of forcing the sink holes through is shown by the fact that, train filling once completed, the percentage of derailments has been at least as low on this new road bed as on that of sections 20 years old or more. This brings up an important question. If the intention is to have the weight of the rock cut its way through the mattress, and as it is only when it has done so and reached solid bottom that the earth filling becomes really effective, would it not be advisable, in some instances, before placing the rock fill, to cut right through the mattress parallel to the center line, for instance, in the case of a 30-ft. embankment, to cut two longitudinal ditches 40 ft. apart, and thus allow that whole section to sink vertically without deforming the surface at the side? Almost every case of deformation is caused by the sand or gravel floating sideways and it does not become solid for some time.

EMBANKMENT ACROSS PANAMA SWAMPS.

The relocated line of the Panama R. R. called for embankments across the valleys of the Quebrancha, Brazo, Baja and Gatun rivers. The following tabulation gives the dimensions of the four embankments:

Fill.	Length.	Height.	Cu. yds.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

Considerable trouble was encountered in [illegible] the embankments at Quebrancha and Baja, due to settlements. The soundings over these bottom lands showed varying conditions. The ground level at Quebrancha is at 20 above sea level and soundings showed it to be 150 to 180 ft. to solid rock. At Baja from the ground level at [illegible] it was found to be about 60 ft. to solid rock. The material intervening is composed of the softest clay, decomposed wood and vegetation.

The method of making these embankments is illustrated by Fig. 2, which shows a section of the Quebrancha-Baja embankment.

The first deck of the Quebrancha embankment was put into El. 50 and filled well over the entire area out to the 2:1 slope stakes for the completed embankment. A trestle was then driven at El. 70 and filling from this level was started when a small settlement occurred, on the line of the trestle, with a corresponding upheaval of the natural ground beyond the slope stakes. Work of dumping from the trestle was then suspended until the upheaved ground was weighted down by a counterweight fill. In this manner, by keeping a careful watch on the settlement and upheaval the embankment has been completed.

At Baja the weight of the filled in earth and rock has pushed away the softer material and settled practically to bed rock. A heavy counterweight has been placed on each toe.

Method of Molding Reinforced Concrete Fence Posts, Chicago, Burlington & Quincy R. R.

A reinforced concrete post plant having a capacity of 400 posts per day is being successfully operated by the Chicago, Burlington & Quincy R. R. The method of molding fence posts at this plant are outlined in a paper by Mr. L. J. Hotchkiss, Assistant Bridge Engineer, before the National Association of Cement Users. It is stated that while enough posts have not been made to determine the minimum cost possible, it seems certain that it will be low enough to compete with the price of cedar posts. The reinforced concrete post cannot, however, be so roughly handled. It is in no sense fragile and has ample strength to withstand all fence loads, but some care must be exercised not to cause cracking by throwing about.

Turning now to the manufacture and use of the posts, we abstract from Mr. Hotchkiss' paper as follows: Figure 1 is a view of the post machine. The measuring apparatus consists of two hoppers, one for gravel and one for cement. A small conveyor underneath the hoppers feeds the two materials in proper proportions into a small elevator boot. From this it is hoisted by a chain of elevator buckets and dropped into the mixer at the top of the machine.

The mixer is a large shallow bowl with a concave bottom. A number of paddles rotate in this bowl and mix the concrete, water being sprayed on it from a perforated pipe. In the bottom of the mixer is a hole which is closed by a form of gate valve, and through which [illegible] arrangement which holds four molds at a time. There is [illegible] arranged that as each mold is being filled it is alternately raised and [illegible]

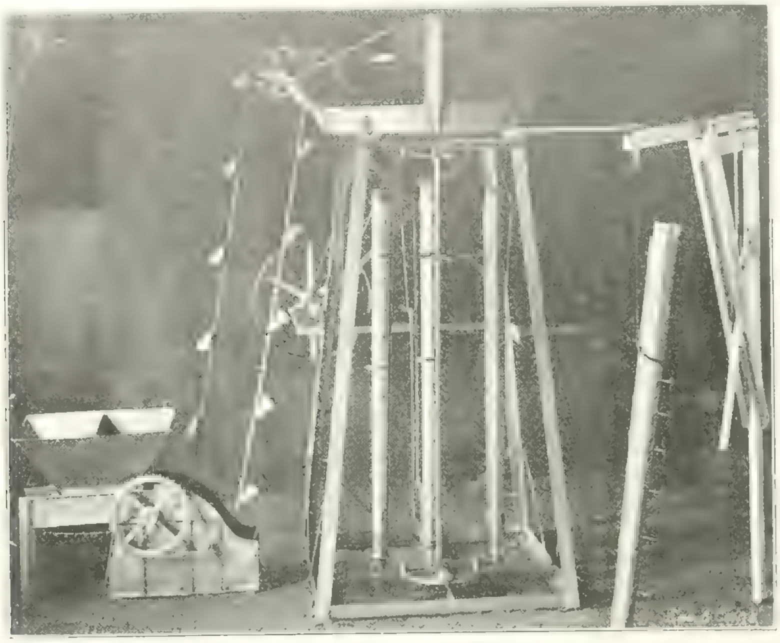


Fig. 1—View of Concrete Post Machine.

nch. This tamps the concrete effectually and nsures a smooth finish.

Two forms of reinforcement are used. The one which was used last year is made from sheets of No. 24 or No. 26 black iron. The sheets are passed through a machine which cuts out half the reinforcement for a post at each pass. At the same time long slits are cut in the iron and the edges of the slits turned up. Two strips of this material are inserted in the mold to form the reinforcement for one post.

It has not been altogether satisfactory, however. If the concrete material is a bit too coarse it does not run through the slits readily and the posts are not well filled. The reinforcement also has a tendency to get out of place during filling and is occasionally found to be near the center of the post instead of at the outside.

Figure 2 shows an improved style of reinforcement now coming into use. It is made entirely of wire, each wire being crimped to insure a bond with the concrete. The material is shipped knocked down, as shown at the left of the photograph, and is quickly made up into the cages shown at the center. The wires may be of such size as needed to give the required strength. The concrete plows around this reinforcement without obstruction.

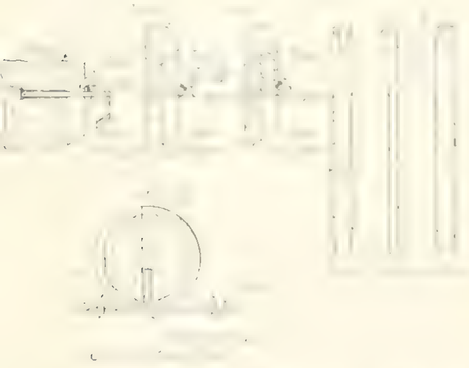


Fig. 3—Method of Fastening Wire on Grooved Posts.

As the posts are taken out of the machine they are placed on a push car. In cold weather they are stored in the house for a few days before being taken out of doors. In warm weather they are stored indoors or out, as may be most convenient. They are removed from the molds a day or two after being made and stored against the heavy timber racks until ready for shipment or until they are strong enough to be carried up in piles. For a week after being removed from the molds they are thoroughly wet down once a day and in summer they are protected from the sun by tarpaulins.

The methods of attaching the wire fencing to the concrete posts are illustrated by Figs. 3 and 4.

Figure 3 illustrates the post and also the method of fastening the wires to the posts. By reference to the cross sections it will be seen that there is a groove in one side of the post and that the holes through the posts are offset, being smaller on the grooved side of the post. These holes are of such a size that a ten-penny nail can be pushed through them until the head brings up against the offset. The fence wire is then placed on top of the projecting end of the nail and the latter bent up around the wire until its point is curled back into the groove, thus holding the wire tight against the post. This work is done with a small tool which is shown in successive positions in the upper part of the drawing. This is a very cheap and effective fastening. One difficulty has developed in connection with it, however. The pins with which the holes through the post are made are necessarily all alike. The post is tapered. As a result the small part of the hole through which the shank of the nail passes is longer nearer the bottom of the post than at the top. Consequently the nails at the top stick out too far and when bent around the fence wire the points strike the bottom of the groove and make it difficult to pull the wire up close to the post. A tapered strip is now attached to the outside of the mold under the heads of the pins. It is of such a thickness that the offset in the holes is a uniform distance from the grooved side of the post and all nails project the correct distance to insure proper fastening of the wire.

Another method of fastening the wires is shown in Fig. 4. It will be seen that the hole through the post is of uniform diameter and a piece of wire with one end doubled back is substituted for the nail. The other end of the wire projects at the back of the post, and by means of the tool shown this is twisted up into a cork-screw. The fastening has not yet been tried out in practice, but its use on an experimental post seems to indicate that it is simple and efficient. It was designed for use with a round post having no groove. As our molds are all grooved, we expect to use it with this type of post.

The post molding machine is made by the National Concrete Machinery Co., of Madison Wis. From information furnished by the company we find that the machine requires three men for its operation, one man to shovel in the material, one man to take away posts

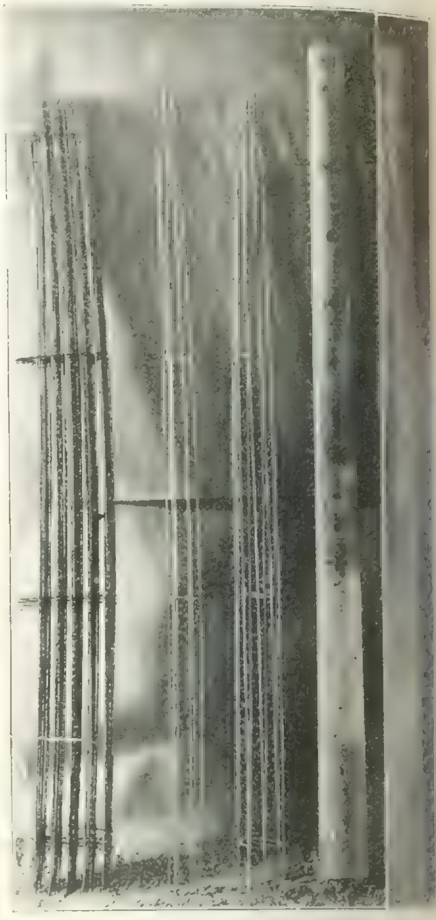


Fig. 2—View of Reinforcement for
Posts, Shown in Bundle for Sh
and Ready for Placing in Mo.

and put on empty molds, and one to o
machine. These men, it is stated, sho
40 posts per hour.

If operated in a sand pit so as to
cost of moving sand the posts shoul
duced at a cost of 15 to 20 cts. each,
the new wire reinforcements wh
fraction less than 7 cts. per post.

Cement Show Annual Meeting.

annual meeting of the Cement P
hibition Co., recently held in Chi
treasurer reported that the expense
ducting the shows in New York, Ch
Kansas City last winter amou
$77,789.28. The corresponding receipts

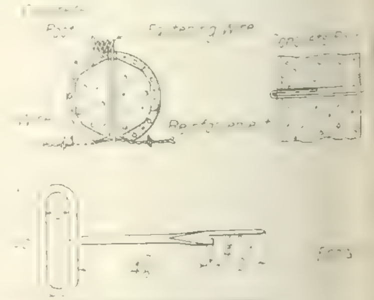


Fig. 4—Method of Fastening
Round Posts.

to $78,729.52, leaving a surplus of $94
surplus will be expended on future sh
feeling was unanimous among the
that the shows held so far have gr
tributed to the advancement of the c
dustry.

NEWS SECTION

Editorial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

[illegible]
Irrigation, Drainage, Levees and Canals..
[illegible]
Buildings, Docks, Dredging, Supplies, etc.

Doings of the Week.

[illegible]
about the poorest thus far
[illegible]
and those that were placed were most-
rment work. It is probable that this
ill continue during the month. There
leal of work being planned and it
[illegible]
July 1, when a new fiscal year will
by many of the railroads. Among
ts let in the past few days are the
James McGraw Co., Arcade Bldg.,
a. Pa., for grading and masonry
vated section between Green and
on 11th St., Philadelphia, for the
a & Reading Ry.; T. N. Sims &
elphia, Pa., for the construction of
concrete wall for the Pennsylvania
extend from the city line of Pitts-
to Bridge St. in Millvale; Porter
sas City, Mo., and Lorimer & Gal-
209 S. La Salle St., Chicago, Ill.,
g for the double track work of the
Milwaukee & St. Paul between
d Woodward, Ia.; Patricius Mc-
N. 32d St., Philadelphia, Pa., for
g and masonry for the extension of
elphia & West Chester Traction
n from Drexel Hill to Media, Pa.
re received at Vicksburg, Miss., on
about 1,600,000 cu. yds. of levee
e lowest unit bid received was 29.7
yd. and this was on only one sec-
ut 100,000 cu. yds. The other bids
tion ranged from 33.9 cts. to 36.2
her sections the bids ran from 32.5
cts. All of the bids were rejected.
n one of the largest levee projects
ted in southern Indiana has been
the Circuit Court at Princeton, Ind.
[illegible]
f the Patoka River and the con-
f a levee along the Patoka and Wa-
s from a point near Dongola, Pike
the Patoka and Wabash rivers,
stream to the Wabash, thence south
rmony.
vay of irrigation work about the
ming up in the near future is that
len River Reservoir Co., 360 24th
Utah. This company proposes to
servoir on the south fork of the
er, 18 miles east of Ogden City.
[illegible]
The company expects to be in
lvertise for bids about June 15 and
racts on or before July 15.
now being asked by the New York
rintendent of public works at Al-
, on a good sized barge canal con-
work calls for the construction of
and the substructure of Dam No.
Iohawk River at Scotia, N. Y., to-
the replacement of defective con-
he completion of protective paving,
ocks and dams at Rotterdam and

rbor Commissioners of Toronto.
plans under way which call for the
[illegible]
of the Ashbridge's Bay district.
s include the cutting of a channel 300 ft. wide and 24 ft. deep from Toronto Bay to Scarboro Beach, and the filling in of Ashbridge's Bay.

The New York State Commission of Highways was busy all last week opening bids on the $10,000,000 or $12,000,000 worth of highway improvement work. There was considerable competition for these contracts. On the bids opened on June 4 for 31 pieces of work, which aggregated 153.1 miles, 181 bids were received. The lowest bids totaled $2,179,360. This is an average of over $14,200 a mile. On the next day bids were opened on 34 pieces of work, aggregating 184.7 miles. A total of 158 bids were received on these. The lowest bid for the work totaled $2,147,387, which makes the average about $11,600 per mile.

Early Surveys in San Francisco.

[illegible] charter of San Francisco, Cal., went into effect, the [illegible] 70 years of age: but as regards early records and survey lines the city was still in its infancy. It is stated that if a profile had been made of the datum line of the city's levels before the adoption of the charter, it would have looked like a pair of stairs or steps. An interesting account of the early survey work, which was largely responsible for the conditions, is given in the last annual report of the engineer in charge of the division of surveys of the Bureau of Engineering of San Francisco. In making surveys of private property in the old portion of the city (the Fifty Vara District) where today it is valued at thousands of dollars per front foot, in the early years the city and county surveyor in many cases did not use a transit or any surveying instrument other than a steel tape: there were no street monuments or other surveyor's points or data to guide them; it was not known where the street lines were; in fact, there were no official street lines. In many case they simply measured from the nearest existing improvements and marked on the ground a piece of property the dimensions called for by the owner. This is the principal cause of the irregular lines and widths of streets in the Fifty Vara District. This loose and hazardous system was continued for many years. That part of the city known as the Homestead was never surveyed or monumented. Before the charter went into effect any one could subdivide an acreage tract of land on paper and file it with the city and county recorder, giving no consideration whatever to adjacent tracts or sub-divisions or streets, in many cases closing the streets of adjacent tracts and thus compelling the city at this time to purchase private property for the opening of these streets. In compiling the official maps of the city and county, these tracts or homesteads had to be twisted and fitted in until they had the semblance of correctness. There were no figures except block numbers on the official maps of 1870 and 1899, showing the connections of these sub-divisions. Most of the maps filed with the recorder omitted the lengths of many blocks, lots and widths of streets. Upon the original map filed of Gift Map No. 4 (which is one of the largest Homestead sub-divisions) there are no figures whatever, except the number of the lots. It does not show the width of any
[illegible]
streets are irregular, some are curved, bu
there is nothing to show their curvature, c
their beginning or ending or any tie or cor
nection with any adjoining tract or sub-div
sion. Before the charter went into effect th
city and county surveyors would not make
survey for private parties in any of the hom
steads for less than $35 per day for the fir
day and $30 per day after, making the cost c
survey from $95 to $165 for a 25-ft. lot, whic
was equal to his refusal to do the work, a
the value of the property would not justi
the expense. In 1890 City and County Su
veyor S. Harrison Smith had one of his dep
ties (Thomas Whitten) enter into contra
with a large percentage of the property ow
ers in Gift Maps 1, 2 and 3 for the survey c
their property. In that way he made a parti
survey of these homesteads, sufficient to d
termine the position of the lots under co
tract. The survey levels (bench marks) b
fore the adoption of the charter, 1900, were
a most deplorable condition, differences exis
ing in all parts of the city from .1 ft. to 2 f
or more. To run a long line of levels, it wa
necessary to change field notes by dropping c
raising the elevations in the field book to co
form to the elevation of the datum plane
the district in which work was being don
In the construction of public improvement
such as the grading of streets, curbing, ma
adamizing and construction of public sewe
in the early years, no diagrams were furnishe
contractors, showing the cuts, fills or dept
for construction of sewers. The only info
mation furnished the contractor by the ci
and county surveyor for the guidance of h
work was written with heavy blue pencil c
the adjoining fences or buildings. In the a
sence of fences or buildings a stake was dri
en and the contractor was told (verbally) i
relation to the official grade or inside botto
of the sewer. Line was never given for th
construction of sewers; the contractor dug h
trench along the center of the street. Th
city charter went into effect Jan. 2, 1900. U
to that date the city and county surveyor
office was a fee office; the surveyor received
salary from the city and county (fixed b
law) of $500 per year, merely to make h
acts official. All the fees paid into the offi
became his private funds. All salaries a
the cost of office and field operations had
be paid from his private purse, hence it w
to the interest of the county surveyors to ke
the operating expenses of the departme
down to the minimum. They did not perfo
any work they could avoid, either in office
field. There was no system of records; t
field books, maps and other data were kept
drawers or shelves, old dry goods boxes a
often piled in the corners on the floor. In o
case an old fashioned discarded washsta
with drawers was used to store considera
valuable information. All of the shelves a
improvised cases were open; none of the re
ords were kept from the accumulation of du
and dirt, except those kept in the old was
stand and a few other box drawers built u
der the draughting boards. There was no sy
tem of indexing, except memoranda writt
on legal cap or letter paper and tied with
string to the box, drawer or shelves conta
ing the records.

BOOK REVIEWS

Drillwork, Methods and Cost.—By R. R. Sanderson. Cyclone Drill Co., Orrville, Ohio. th 7x10 ins., 350 pp.

This book is not a catalog, although it is ublished by a ompany which manufactures lrilling machines and is written by the Sales Manager for the company. It is the first pracical treatise covering the methods used in lrilling wells and blast holes with cable and ollow rod tools. A feature of the book is he attention which has been given to details. n the preface it is stated that the object of he book is to present plain solid facts which ave been proven by experience in the field or the use of purchasers of well drills not experienced in their use. The book should be aluable to users of well drills of any make.

Subways and Tunnels of New York. By Gilbert H. Gilbert, Lucius L. Wightman nd W. L. Saunders. John Wiley & Sons, New York. Cloth 6½x9½ ins., 372 pp.; lustrated; $4.

This book should be of special interest o engineers and contractors for subway and unnel construction in large cities. It is a esumé of the history and the methods and osts of construction of the subways and unnels in and around Manhattan Island. The book is divided into twenty-one chapers and fourteen appendices. In the main art of the book are taken up the topogaphy, geology and history of New York n relation to its subways, the original tunels. the Manhattan-Bronx and the Brookyn-Manhattan divisions of the subways and he several systems of tunnels of the Pennylvania R. R. In the appendices the subct of mechanical plant for subway conruction — particularly air compressors, ompressed air operated machines, rock rills, etc.—is presented by means of deriptions of plans which were employed in e tunnel and subway construction.

The illustrations show the detailed methds of procedure in constructing the varius tunnels in soft ground and in rock, and large number of engineering and cost ta are given.

Geodetic Surveying.—By Edward L. Inram, C. E. McGraw-Hill Book Co., New ork. Cloth, 6½x9½ ins., 390 pp. $3.

This is a text book for the students in colges of engineering and for the practicing gineer. The book is written in two parts. hose who wish to make a study of geodetic ork without entering into involved matheatical discussions, will find a complete treatent of geodetic methods and rules for makg the necessary adjustments in the first part the book. Those who wish to become faliar with the fundamental principles of least uares, or those familiar with geodetic work, ho wish to understand the theorv on which e rules for adjusting observations are based, ay read the second part of the book alone.

The book is divided into sixteen chapters which the first ten form Part I. This part kes up the principals of triangulation; basee measurement and mathematical correcns; angle measurement; computations and justments required in triangulation work; mputing geodetic positions; geodetic levelg; astronomical determinations, and meths of map projection. Part II includes chaps IX to XVI and is devoted to the Method Least Squares and its application to the justment of observations. The chapters inde the classification of values and errors, development of the mathematical theory errors, methods of obtaining probable vals of independent quantities from their obved values, these methods extended to inde conditioned and computed quantities, d the application of the theory of least uares to conditions met with and adjustnts required in angle work, baseline work, d level work, covering all cases likely to be interest to the civil engineer. The book has en brought up to date and is as clear and ncise as it is possible to make it. The same symbols are used throughout the book for the same meaning, adopting those of most general acceptance, and each symbol is defined in a formula where the formula is developed, and the best obtainable values for all constants required in geodetic work.

The book fills a requirement felt by many institutions where geodetic surveying is taught and has been prepared to meet this need.

Sewage Disposal.—By George W. Fuller. McGraw-Hill Book Company, New York, N. Y. Cloth, 6x9 ins.; 750 pp.; illustrated; $6.

In this book the more important recent developments in the art of sewage disposal are recorded, discussed, and classified. While the author states that no attempt was made to digest all the literature of the subject, the book impresses the reviewer as a very satisfactory summing up of representative technical reports, papers, and articles of the higher grade, bearing on the problems and trend of sewage disposal. Much valuable data not heretofore published, is drawn from the author's exceptionally wide experience in this branch of sanitary engineering.

The book begins with a study of the composition of sewage. Early chapters are also devoted to a study of the decomposition of sewage by bacteria, the relation of bacteria to offensive odors, the relation of sewage bacteria to public water supplies and shellfish. The problem of sewage disposal is discussed in a short chapter which defines the problem and gives illustrations of the wide range in local conditions and types of problems encountered in this country.

The disposal of sewage by dilution is discussed in three chapters aggregating 170 pages. The chapters dealing with disposal relate to inland streams, large lakes and oceans and tidal estuaries, respectively.

There are 13 chapters dealing with the design of works for the treatment of sewage, each chapter relating usually to works for one method of purification. These chapters are on screening, plain sedimentation, septicization in connection with sedimentation, chemical precipitation in conjunction with sedimentation, electrolytic treatment, strainers, slate beds and colloidors, broad irrigation, intermittent sand filtration, contact filters, sprinkling filters, aeration, hypochlorite treatment, and ozonation. In addition to suggestions relating to the design of the various types of works, valuable general efficiency and cost data are given. In many cases construction and operation data also are given. There is also a chapter on institutional and residential plants. The book is concluded by a chapter giving a comparative summary of the various methods of disposal which are classified as well-established, or recently developed.

The book is a distinct advance in the literature on the subject of sewage disposal and will not soon be out of date in any important feature. The presentation of the subject is admirable. The book will prove useful to all engineers engaged in any way with the broad problems of sewage disposal.

Sewage Sludge.—By Alexander Elsner, Fr. Spillner, Mr. Blunk and Kenneth Allen. Translated, in part, by Kenneth and Rose S. Allen, and in part by Emil Kuichling. McGraw-Hill Book Co., New York. Cloth. 6x9 ins., 258 pp., illustrated. $2.50 net.

This book is divided into four parts, the first three of which are translated from the German. The first part relates to the treatment and utilization of sludge. This part was written by Dr. Elsner. It is based on personal observation in trips of inspection, on recent literature, and on data furnished by city officials. The composition and amount of sludge precipitated in the various purification processes is given for conditions in Germany. A valuable part of this monograph relates to methods which have been utilized in removing sludge from clarification tanks, either with or without interruption of operation. Certain mechanical contrivances for removing sludge during operation are described. Various methods of drying sludge are discussed. The util tion of sludge as a fertilizer for the produc n of gas, for its calorific value, for the traction of grease, and various other m hods of disposal are considered.

Part II relates entirely to the dry g of sludge. This is a report from the Se rage Division of the Emscher Associatio and was prepared by Dr. Spillner. It ta s up the methods used in the Emscher trict for drying different kinds of sludge, luding fresh sludge, septic tank sludg and Emscher tank sludge. The results o comparative experiments with fresh and com posed sludges are given A summ Spillner's experience with drainage ethods of drying sludge in large pl given

Part III relates to the results of t operation of some of the mechanical swa clarification plants of the Emscher ass ciation. This part was written by Dr pilner and Mr. Blunk. It contains d on the yearly costs of handling sludge The properties of various sludges are csiered.

The fourth part of the book, writ Kenneth Allen, relates to the handl sludge under American conditions. The results of various experiments are ummarized. The economic handling of d is considered, the classifications being s on method of purification and size o munity served.

This book has much to commend It summarizes the best knowledge of th two countries now most active and prog si e in sewage disposal engineering, n el Germany and the United States. The d e subject is a big one and fully warr s a full volume for its consideration.

PERSONA

Mr. Benj. Herman Davis, Consultin Engineer, announces that after June hi offices will be located in the Wh ha Bldg., 17 Battery Place, New York Ci

Mr. J. B. Martin, Forest Engineer f the Sixth District, has recently complete th construction of a suspension bridge f in length spanning the Salmon River ear Shupe, Idaho.

Mr. C. G. Young, Consulting Eng eer, formerly of 60 Wall street, New York ity, announces the removal of his offices th 28th floor of the Bankers Trust Bldg., all and Nassau Sts., New York City.

Mr. Hugh T. Hazen, formerly in th mploy of the Duluth, Winnipeg & Pacif Ry Co., as Chief Engineer, has been en ged by the Canadian Government to lay o th terminals for the new governmen oad from Prince Albert to Fort Churchill.

Messrs. Lockwood, Green & Co. ha re moved their southern offices from Genville, S. C., to the Rhodes Bldg., Atta. Ga. They hope to be able to offer ter facilities than in the past for handling gineering problems in the southern stat

Mr. Will S. Hartman has been app ted Resident Engineer in charge of the on struction on the main line of the Ch go, Milwaukee & St. Paul at Butte, Mont He was formerly City Engineer of Boz an, and more recently in the employ of th al latin Valley Ry.

Mr. Wm. L. Marcy of Annapolis, M nas been elected Secretary of the State Ed Commission, succeeding Senator E. E. os lin, who has been appointed a memb the commission. Mr. Marcy has bee gaged for contractors and for the F Government on similar work.

Mr. James Knox Taylor, Superv ng Architect for the Treasury Departme o the U. S. Government, has tendered hi es ignation, to take effect on June 15. Mr Taylor has been in the government se ce since 1895. His letter of resign tion n

s his intention of engaging in pr[illegible]
e.

J. R. Stephens has been appointed Engineer of the Missouri Pacific, sucg Mr. E. F. Mitchell, resigned. Mr. ns has been Asst. Chief Engineer for st year and has been in railway service e past 30 years, being engaged with inta Fe, Rio Grande, Grand Trunk, so on railways in South Africa.

Geo. Converse of the U. S. Governhas been selected in response to refrom the Peruvian Government for a ed officer to take charge of the saniprovement work at Iquitos, for which 00 has been appropriated. He h ranted a two years' leave of absence ill leave for South America in two

R. C. Harris has been appointed Comner of Public Works of the city of to at a salary of $8,000. He is to have thority in the reorganization of the Works Department and will conn the control of the street cleaning arbage disposal departments. It is tood that Acting City Engineer C. Powell will be made City Engi-

ATALOGUES

itific Testing.—Paper, 3¼x6⅓ ins., Electric Testing Laboratoies, New ity.

booklet contains illustrations of ent and buildings used by the Elecsting Laboratories for the purposes ducting special tests and investi-

ind Tar Spraying Machine.—Paper, 5 pp. Johnston Sprayer Co., 186 St., Worcester, Mass.

pamphlet describes the Johnston Oil r Sprayer for road work.

inery List.—Paper, 3¾x6¼ ins., 60 H. Hitchcock, 1220 Caxton Bldg., Ill.

is a monthly reference list for buysaw mill and wood working ry.

rs.—Circulars, 6x9 ins. American Valve Co., 156 No. Dearborn St., Ill.

circulars describe the motors made above company, which are applied ing press equipment.

v Duty Pile Hammers.—Paper, 6x4 p. The McKiernan-Terry Drill Co., rk City.

catalog contains illustrated descripthe McKiernan-Terry Pile Hammer les of specifications and prices.

mite.—Paper, 6x9 ins., 16 pp. Jeffervder Co., Birmingham, Ala.

booklet is issued for the purpose of the uses of Jefferson dynamite for land and for planting trees. Comtails and directions are given, with us illustrations.

Building Machinery.—Paper, 9x12 pp. J. I. Case Threshing Machine ne, Wis.

catalog illustrates and describes road machinery and general purpose en- Illustrations are shown of road rollgine tenders with street sprinkling ent, reversible road graders, drag ; crushers (both portable and sta- ; traction engines, dump wagons,

hing Machine.—Paper, 6x9 ins., 8 nicipal Engineering & Contracting 9 Railway Exchange Bldg., Chi-

catalog illustrates and describes the Sewer Excavator, showing the man operation on different jobs. The ions show a variety of work to e machine may be applied.

Brown Hoist Cranes.—Paper, 6x9 ins., 40 pp. Brown Hoisting Co., Cleveland, Ohio.

This is Catalog "A" under date of 1912. It contains illustrations and descriptions of the Brownhoist pillar crane, hand wrecking crane, mast jib crane, pillar jib crane, bracket jib crane, hand bridge crane and transfer table.

Pumps and Cylinders.—Cloth, 6½x9⅜ ins., 250 pp. The Barnes Manufacturing Co., Mansfield, Ohio.

Catalog D is a complete general catalog on pumps, including hand pumps, force pumps, centrifugal pumps, hydraulic rams, vacuum pumps, spraying pumps and all pumps and fittings for domestic service.

Turner System.—Paper, 6x9 ins., 72 pp. C. A. P. Turner, 1302 Hartford Bldg., Chicago, Ill.

This catalog deals generally with the Turner Mushroom System of Reinforced Concrete Building Construction and gives illustrations of buildings constructed by this system scattered throughout the world.

Hydraulicking Machinery.—Paper, 6¾x 10 ins., 24 pp. [illegible] Union Iron Works Co., San Francisco, Calif.

This is catalog No. 5, which illustrates and describes Evans Hydraulic Elevators and Hydraulic Mining Machinery. Information and directions are given for the use of this class of machinery, together with tables useful in this class of work.

Erie Pumps.—Paper, 6x9 ins., 8 pp. Erie Pump & Engine Works, Erie, Pa.

This is bulletin No. 28 covering Erie high duty centrifugal pumps. Illustrations and tables are given showing price lists and sepcifications.

Bulletin No. 27 contains 16 pp. and is on the subject of pumps for sand and gravel dredging. Illustrations and descriptions are given in detail with tables of useful information and specifications.

Huber Rollers.—Paper, 7x9 ins., 48 pp. Huber Manufacturing Co., Marion, Ohio.

This catalog deals with the Huber contractor line of steam rollers, scarifyers, road engines and dump wagons. Complete descriptions of the various parts of the machines are given.

Universal Cement.—Paper, 6x9 ins., 16 pp. Universal Portland Cement Co., 72 W. Adams St., Chicago, Ill.

This is the Universal bulletin for May, 1912, which contains interesting articles and illustrations of concrete construction where Universal cement was used.

Pumps.—Paper, 6x9 ins., 4 pp. The Edson Manufacturing Co., 255 Atlantic Ave., Boston, Mass.

This company has issued several circulars recently on the following subjects: Gasoline Power Diaphragm Pump Outfits, Force Pump Outfits and Trench Pumps.

Air Compressors.—Paper, 6x9 ins., 72 pp. Union Steam Pump Co., Battle Creek, Mich.

The Union Air Compressors shown in this catalog comprise a complete line of the various types and sizes in ordinary use, but the company states that it is prepared to furnish the compressors for special purposes such as extremely low pressures and large volume, or small volumes and very high pressures. Illustrations, descriptions and tables showing specifications of air compressors, auxiliary apparatus and parts of machines are given.

Spray Nozzle Sprinklers.—Paper, 6x9 ins. Spray Nozzle Co., 201 Devonshire St., Boston, Mass.

Several pamphlets issued by this company illustrate and describe the spray nozzle and its application for spray-cooling ponds for obtaining an artificial water supply required by industries located away from stream or natural ponds, for condensing steam or use in water jacketed furnaces and other apparatus. These nozzles are also used for lawn sprinking in parks, etc., and for spraying roads with bituminous compounds.

Petrolithic Construction.—Paper, 6x9 ins., 66 pp. The Petrolithic Co., Pacific Electric Bldg., Los Angeles, Cal.

This is a very complete catalog describing methods of petrolithic construction. Special attention is paid to details and a clear idea may be obtained from a perusal of the contents. The book is well illustrated with examples of work under way and of completed work.

Wizard Rock Drills.—Paper, 6x9 ins., 16 pp. McKiernan-Terry Drill Co., 115 Broadway, New York City.

Pumping Machinery.—Paper, 6x9 ins., 220 pp. Union Steam Pump Co., Battle Creek, Mich.

This is catalog No. 18, the general catalog of steam and power pumping machinery, which contains illustrations and descriptions of regular pattern high-duty and boiler-feed pumps, outside packed plunger pumps, compound piston pumps and compound plunger pumps, mine pumps, light service pumps, low and high vacuum pumps, air pumps and jet condensers, deep well pumping engines, pumps for handling hot water, automatic feed pumps, hydraulic pressure pumps and Burnham twin pumps. The catalog contains discussions on pumps and directions for installation, etc.

Graphite Products.—Paper, 6x9 ins., 40 pp. Joseph Dixon Crucible Co., Jersey City, N. J.

This book contains discussions of the use of graphite products for the railroad, with the object of bringing before the mechanical departments the various Dixon Graphite Products for the maintenance of railroad equipment. To those who are further interested in the subject and desire more detailed information, special booklets are gotten out on the following subjects:

"Philosophy of Protective Paints," paper, 3½x6 ins., 24 pp.; "Painting the Smokestack," 3⅓x6 ins., 16 pp.; "Color Specifications and Samples," 3½x6 ins., 6 pp.; "Gas Holder Painting," 5½x8½ ins., 12 pp.; "Standpipe Painting," 5½x8½ ins., 16 pp.; "Maintenance Painting for Electric Railways," 3½x6 ins., 6 pp.; "Steel Car Paint," 3½x6 ins., 12 pp.

Small Electric Light Plants.—Paper, 3¼ by 6 ins., 4 pp. Fairbanks-Morse Co., Wabash Ave. and Eldredge Place, Chicago, Ill.

This circular illustrates and describes a 50-light, 30-volt electric lighting plant. Prices are given.

INDUSTRIAL

Robert M. Smith, for several years in charge of the railway department in the eastern territory of Burton W. Mudge & Co., Chicago, with office in New York, has been made sales manager, with office in Chicago.

The Strauss design of bascule bridge has recently been adopted by the Great Northern for a 200 ft. single leaf, double track bridge over the Salmon Bay waterway at Seattle, Wash.; by the Northern Pacific for a 190 ft. single leaf, single track bridge at the same place, and by the Houston Belt and Terminal railway for a 116 ft. 6 in. single leaf bridge over Buffalo Bayou at Houston, Tex.

The board of directors of the National Association of Road Material and Machinery Manufacturers at a recent meeting at New York city passed a resolution to hold its annual exhibition at the American Road Congress. It was also resolved that during the year 1912 the members of this association be permitted to exhibit as individuals at one other road convention in addition to the annual exhibition in connection with the American Road Congress. By unanimous vote the board expressed its preference for Atlantic City, N. J., as a place for holding the American Road Congress on the understanding that the Million Dollar Pier would be available for exhibit purposes, and that the date of the congress would be the first week in October.

RAILWAYS, STEAM AND ELECTRI

Alabama.

It has been announced that the Mobile & nio Railroad has effected arrangements with e Southern Railway Co. and the Munson eamship line by which regular steamship rvice will be established between Mobile and rts upon the eastern shore of South Amer- a. The M. & O. will, it is said, make an penditure of about $500,000 for the construc- on of docks and warehouses. B. A. Wood, obile, Ala., is Chief Engineer.

Arizona.

The El Paso & Southwestern R. R., H. J. mmons, General Manager, El Paso, Tex., s location work under way for its branch e to Fort Huachuca. This branch will be out 13 miles long. J. R. Emerson, Douglas, riz., is Resident Engineer.

Arkansas.

The St. Louis & San Francisco (Frisco stem) is planning the construction of a anch line to Little Rock, Ark. The com- ny wants a direct line from Little Rock to . Louis and will use the Bonnerville branch Algoa, near Newport, then build a line to ttle Rock, east of the Iron Mountain. F. Jonah, St. Louis, Mo., is Chief Engineer construction.

California.

The Petaluma & Santa Rosa Ry. Co. (elec- c), E. M. Van Frank, President, Petaluma, l., is reported to have taken over the inter- of A. D. Bowe in the proposed electric e from Petaluma to Two Rock Valley. It stated that work on the branch line will gin on Aug. 1, and later the road will be tended to Bloomfield and Tomales.

Byron A. Bearce, President of the Tide- ter & Southern Ry. (electric), Room 4, ysicians' Bldg., Stockton, Cal., has recom- ended the construction of the road from esno to Fowler and thence to Parlier and edley, continuing south to Dinuba and salia, provided rights of way can readily secured from property owners. He also commends an additional extension of the stem, connecting at Fowler, through to lma and thence to Hanford.

Petition has been filed with the State Rail- ad Commission by the Marysville & Colusa anch of the Northern Electric Ry. Co., aska Commercial Bldg., San Francisco, for rmission to issue bonds to the amount of 100,000 for construction purposes. The ap- cation states that the building of a new line om Marysville through Colusa to Meridian Sutter county is contemplated. A new dge over the Sacramento River at Meridian included in the plans.

The San Diego & New York R. R. Engineer- Corporation has applied for articles of in- rporation in Arizona. The special objects the corporation are to make surveys and ate a line of railroad to run from San ego, Cal., in as direct a course eastward may be found most practical, through the tes of California, Arizona, New Mexico, xas, Oklahoma, Arkansas Alabama, orgia, South Carolina, North Carolina, Vir- ia, District of Columbia, Maryland, Penn- vania and New Jersey; to establish a short e steam railroad between San Diego and w York City, by constructing and acquiring ntrol by traffic agreements and otherwise th roads already constructed by which to ablish the shortest possible rail route be- een New York and San Diego for the rapid nsportation commodities, and to build and uip and operate such a system of railroads, to join with others, in acquiring and oper- ng such a line. The incorporators are: orge H. Peet, Granville, A. Richardson, y W. Thaxter of Roswell, N. Mex.; Fred ckley, John Tonge, 215 Andres Bldg., Min- apolis, Minn., and A. I. Beall, Sigourney, Ia.

The Southern Pacific Ry. has filed an application for permission to install six spur tracks in the industrial district between Atlantic and Shearer Sts., Los Angeles, Calif. The company also wants permission to install four spur tracks on Alameda St., from Marchessault St. and Macy St.

Press reports quote N. U. Hofziger, President Porterville Northeastern Railroad, Porterville, Calif., as stating that a new steam line will be constructed between Porterville and Woodville and that over two-thirds of the necessary right of way has already been secured.

It has been announced that all construction work will be completed and the road of the San Joaquin & Eastern will be opened for operation from Modoc, Calif., on the Southern Pacific, north of Clovis, to the Big Creek plant, a distance of 26 miles, by July 1.

Work will be commenced at once, according to a statement by G. W. Pursell, San Diego, Calif., on the projected line of the Los Angeles, Riverside & San Diego R. R. The first section of the road to be built will be between San Diego and Escondido.

Colorado.

The Northwestern Land & Iron Co., holding concern of the Denver, Laramie & Northwestern Ry., has plans under consideration whereby the line will be extended from Greeley to Severance, a distance of 12 miles. W. D. Hodge, Denver, Colo., is Chief Engineer of the railroad.

Delaware.

The Brandywine Ry. Co., Union Ry. Co. and Peoples Ry. Co., all of Wilmington, Del., have been consolidated under the name of Peoples' Ry. Co., with a capital stock of $1,500,000.

Consolidation papers have been filed at Dover between the Wilmington, New Castle & Southern Traction Co., New Castle, Del., and the New Castle and Delaware City Traction Co., for the purpose of operating a line between Wilmington, New Castle and Delaware City. The new company, chartered at $250,000, is backed by a New York firm. The city council of New Castle will take up the request of the company for permission to use certain streets in that city.

Georgia.

The Columbus, Chattahoochee Valley & Gulf Ry. Co., according to advices from Columbus, Ga., has been formally organized and the following officers elected: J. J. Williams, President; L. F. Humber, Vice President; S. R. Quincey, Secretary and Treasurer; Josiah Flournoy, Chief Engineer, and T. T. Miller, Attorney. It is announced that the Chief Engineer will make a trip over the proposed route for the new railroad, from Georgetown, Ga., to Atlanta, shortly, and that actual work looking to the construction of the line will commence at once. The capital stock of the new corporation is $500,000, all of which has been subscribed. The board of directors is composed of J. J. Williams, L. H. Chappell, Arthur Bussey, E. P. Owsley, L. F. Humber and W. S. Sheppard, all of Columbus, Ga. John D. Little of Atlanta is one of the large contributors.

Idaho.

The Oregon-Washington Railroad & Navigation Co., F. L. Pitman, Chief Engineer of Construction, Spokane, Wash., will probably have construction work started early this summer for a 25-mile extension from Moscow south to Genessee, Idaho.

The Utah Construction Co., Ogden, Utah, which has the contract for the construction of the Central Idaho R. R., has resumed tracklaying on the line toward Fairfield and it is hoped to have the line completed to that point by the Fourth of July.

Illinois.

The Chicago & Alton R. R., E. L. Cgar Assistant Chief Engineer, Chicago, understood to be planning a considabl amount of double track work. Plans aral under consideration for increasing yar and terminal facilities in Chicago, Kansas Ci and St. Louis.

The Village Board, Malta, Ill., has gi the Chicago, DeKalb & Western a year franchise to operate a railroad throug village, entering on Jefferson St.

Indiana.

⊙The Carter Construction Co., 42 Bad way, New York City, has about 100,0 cu. yds. of team work to sublet on its co ac for Section I, of the Chicago & Erie Diior improvements of the Erie R. R., The sio extends from Laketon, Ind., to Rocl ter Ind., and the general contract includes 00,000 cu. yds. of earth excavation, 1,500 cu. yds of embankment and 10,000 cu ds concrete masonry. The Carter Constr io Co. expects to use 4 or 5 steam shov o the work.

⊙The Fred R. Jones Co., Rochester, nd has some odd jobs of team and sma ca work to sublet on its contract for obl tracking and grade revision of the Erie R The Jones contract is located 1½ mile as of Rochester and extends to North J or It includes 350,000 cu. yds. of earth exca- tion, 350,000 cu. yds. of embankme bridges, 7 wood trestles, 3,500 cu. yds. o on crete masonry and 9,000 lin. ft. of piling. ub- contracts on this work have been let to R Connell, Janesville, Wis., and E. J. w Bros. Co., Portsmouth, Ohio.

The Montpelier Traction Co. has bee in corporated with a capital stock of $15,00 n proposes to build a line from Marion, d through Montpelier to Portland, Ind. Th in corporators are: C. L. Smith, A. H. Bean and N. W. Lacey, of Montpelier; D. E. Ins of Uhrichsville, Ohio; A. Evans Townse o Doyleston, O., and D. E. Binns, of Uhhs ville, O. The last two men are Chief Engee and Treasurer respectively, of the New rk Engineering & Construction Co.

The Chicago, South Bend & Norther In- diana Ry. Co., C. D. Emmons, General an- ager, South Bend, is reported to have dissed of a $25,000 bond issue, proceeds of whic vill be used for the immediate construction an extension at Elkhart.

Iowa.

⊙Contracts for grading for the double ck work of the Chicago, Milwaukee & St. ul between Madrid and Woodward have be let to Porter Bros., Kansas City, Mo., a to Lorimer & Gallagher Co., 209 S. LaSall St Chicago, Ill. The first mentioned secure he work between Madrid and the river, an he latter the work between the river and Wd- ward.

The city of Marshalltown, Ia., has vot to grant public utility franchises to Dows, S th Reed & Cook of Cedar Rapids. The bu ss is now controlled by Jones & Hovey o In- dependence. By the terms of the franses extensions of street car lines are to be ma.

Ordinance has been before City Coun of Dubuque to grant the Union Electric o., P. B. Sawyer, General Manager, Dubuq a franchise for an extension of the stree car line from Rhomberg Ave. on 7th Ave. to Eagle Point Park. The extension will ost about $20,000, and it is understood that on- struction work will be started as soon a he franchise is granted.

Tracklaying is under way on the Sant e- Dodge City extension and it is planne to have about 60 miles of track to Satanta m- pleted by July 1.

Construction work will be commenced ct. 1 on the Dakota, Kansas & Gulf Ry., wh

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] the first work [illegible] eloit, Kan., and Kearney, Nebr.

[illegible] has been resumed [illegible] Southwestern R. R. All necessary ions have been paid and it is hoped he road in operation to Clarinda, Ia., short time.

mored that the Chicago, Rock Island Ry. has [illegible] land adjoining Manly, Ia., and is to make the town the passenger and livision terminal. No official infor- as been obtained as yet in regard to

dar Rapids & Iowa City Ry. Co. has l surveys and has secured the capital onstruction of a 15-mile line from [illegible] Mt. Vernon [illegible] ion contracts will be let at once. G. Dows, Cedar Rapids, Ia., is presi- J. D. Wardle, Cedar Rapids, is chief

Kansas.

ansas City Western Ry. (electric) ve work started late this summer n the fall on double tracking its line sas City to Bremner Heights, a dis- about 9 miles. J. W. Richardson, rth, Kan., is General Superintendent.

nsas Central Traction Co., the in- n of which was noted in our May has applied to the State Utilities on for permission to do business in [illegible] n electric line from Parsons to Cof- Galena. The incorporators include rack, Indianapolis, Ind., and O. C. [illegible]

Kentucky.

uisville & Nashville R. R., John yton, Chief Engineer of Construc- uisville, Ky., has plans for grade work from Paris to Winchester, iles, and for a new line from Beatty- thol, Ky., about 8 miles. The L. & understood to be planning a new in the eastern part of Kentucky, point near Jenkins down Elkhorn a point near the Breaks of Sandy.

Louisiana.

Louis & San Francisco R. R., F. G. hief Engineer, St. Louis, Mo., has surveys for a line from Kindred Charles.

xas & Pacific Ry., C. H. Chamberlin, gineer, Dallas, Tex., is planning the [illegible] of about $[illegible] for its new id passenger terminals at New Or- venteen city squares, bounded by An- n, Thalia, Race Sts. and the river, e secured by purchase and by option. nger station is to front on Annuncia- e, 13 blocks up the river from Canal passenger, freight and river terminal of fireproof material, and the con- s to begin in the near future.

cCreary Lumber Co. and D. E. of Franklinton, La., have closed a Fordney-Fassett Co. for $200,000 r lying west of Franklinton, and work at once building a logging necting with the Houghton R. R.

Michigan.

esbrough Lumber Co., Thompson, s, it is said, started construction a 20-mile railroad line to Thunder transport the timber to [illegible]

Mississippi.

rs of the Queen & Crescent System g preparations for the double track- Alabama & Vicksburg division, be- kson and Vicksburg, Miss., and also ng a modern block signal system. C. , Cincinnati, O., is Chief Engineer.

t is said, has been resumed by En- f the Illinois Central on the pro- up the Pearl River Valley, from Miss., to Birmingham, Ala. Work [illegible] high water. No definite plans have been decided upon by the company for the construction. A. S. Baldwin, Chicago, Ill., is Chief Engineer

Missouri.

[illegible] Britton, General Manager, St. Louis, Mo., has entered into an arrangement with the Manufacturers Ry., E. C. Finley, Chief Engineer, St. Louis, Mo., for operation on the terminals of the latter road. The developments by the St. Louis Southwestern of an extensive system of its own in St. Louis for the receiving, forwarding and exchange of freight are understood to include a joint investment of $2,000,- [illegible]

Minnesota.

The Northern Pacific R. R. has purchased 50 acres of land in the district between Minneapolis and St. Paul for trackage purposes. The land recently acquired lies partly in Hennepin and partly in Ramsey counties, but the Northern Pacific has a large undeveloped area in northeast Minneapolis which it will strip and make into yardage at some time in the not distant future.

Duluth and the Iron Country.

W. F. Carey and Claud Siems of the Siems-Carey Co., contractors, paid us a visit last week. They have a great deal of work under course of construction in different parts of the country, in the neighborhood of twelve to fifteen million yards. Although Mr. Siems has lived in Minnesota for quite awhile, this is his first visit to Duluth, and of course was very pleased with our city. Mr. Carey told us a good story about a breakfast he had out in Montana. Well, it was good. "'Nough said."

Fred Jones of Jones Brothers, contractors, paid us a visit a few days ago. Not doing any work at the present time.

Harry Roberts, better known as Cap Roberts, of the Robert Kingston Contracting Co., who has been very ill for some time, is recovering and will be on the job in the very near future. The captain has a great many friends in this territory and they are all very pleased to hear of his recovery.

Ed. Hingston, representing the Bucyrus Steam Shovel Co., drops in to see us occasionally. Reports business in the steam shovel line very good. The writer gave him an order for a 70 ton Bucyrus on his last visit.

Frank Van Patten, with the Walsh Construction Co., reports they are doing some track laying and ballasting on the Canadian Northern near Duluth. He was in to see us a couple of times last week.

The Winston-Dear Co. was awarded a contract by the Great Northern Ore Lands Co. to strip one of its mines. The contract amounts to about 6,000,000 cu. yds. and is to be started immediately. The Winston-Dear Co., immediately on receiving the contract, placed an order with the Western Wheeled Scraper Co. for seventy-five of its 12 yd. air dump cars. There were quite a few bidders for this contract, but Winston's drew the lucky number.

E. T. Foley of Foley Brothers, contractors, was a caller at this office about a week ago. They are very busy in various sections of the country, and have a great deal of work. Mr. Foley was here looking over their work on the Duluth, Winnipeg & Pacific Railway at Duluth.

E. A. Dahl, the contractor, was a caller a few days ago. He has several sewer contracts at the present time in the city of Duluth.

R. C. McLean, a Duluth contractor, was in to see us this week, and gave us a small order for some tools. He is engaged in several sewer contracts at the present time.

The city of Hibbing, Minn., awarded to Coons & Butler last week a paving contract amounting to about $125,000, work to be started immediately. This is a new contracting firm, and this contract is the first one they have secured. There were a great many bidders for this work and the letting of the same was quite a warm session. Mr. Coons and Mr. Butler were callers at this office this week and are busy getting their plant together and their organization.

J. D. O'Connell, the contractor, came in to see us last week and left an order for some tools. He is busy on some sewer work at the present time.

J. B. ("Dusty") Rhodes, representing the Western Wheeled Scraper Co., has been spending the last two weeks with us here. He left for Aurora this week. We hope he will be back soon, because we all like Dusty.

Melvin Pattson, manager of sales for the Brown Hoisting Machinery Co., Cleveland, Ohio, spent a couple of days in the city recently. Pat looks just as good as ever and as usual has the golf bug.

H. T. Hazen, who has been chief engineer of the Duluth, Winnipeg & Pacific Railway Co. and who for the past six months has had charge of a couple of hundred miles of the construction work for the Canadian Northern, has resigned to accept a new position as chief engineer for a new railway company in Canada. It is a big project, but there is no doubt but what Mr. Hazen will handle it very nicely. We wish to extend our congratulations to Mr. Hazen.

John Butler of Butler Brothers, stripping contractors, spent a day in the city last week. They are very busy at the present time on several stripping jobs, and are working about nine steam shovels. John, like most of the good Irishmen, likes a good story and a joke. The writer bit on one of his jokes the other day and he is now very busy trying to get up one to spring on John.

The labor situation in Duluth is not improving any. Men are still scarce here and quite a demand for them. The average wages for common laborers is $2.25 per day. There is a lot of work going on and a lot more in sight. We are short a large number of men up here and any men in search of work, by coming to Duluth, will get all that they want.

Montana.

⦿Winston Bros. Co., 801 Globe Bldg., Minneapolis, Minn., which has the contract for constructing the new line of the Chicago, Milwaukee & Puget Sound Ry. from Great Falls easterly 74 miles, as noted in our last issue, has as yet let no subcontracts for the work. A portion of the work, however, will be let. The contract includes about 2,000,000 cu. yds. of classified material, including 4 tunnels, aggregating about 3,000 lin. ft.

The Butte, Anaconda & Pacific R. R. Co. has filed with the County Clerk at Anaconda, Mont., deeds for right of way purchased for the construction of the new extension. C. A. Lemon, Anaconda, Mont., is Chief Engineer of the railway.

Nebraska.

The Bethany Traction Co., of Bethany, Neb., has been incorporated with a capital stock of $25,000 and proposes to build a line from the present terminus of the Lincoln Traction Co.'s line to the university farm, extending to University Place and Bethany. A connection to Havelock may also be arranged Dr. C. W. Jester is President.

New Hampshire.

The Manchester Street Ry. Co., Manchester, N. H., has applied to the council of that city for permission to double track its lines in West Manchester, particularly that section south of the Manchester & North Weare R. R tracks to its terminal on South Main st., and also for a distance of 500 ft. north of Granite Sq.

The stockholders of the Concord & Montreal R. R. (a subsidiary company of the Boston & Maine R. R., E. H. McHenry, Vice President, Boston, Mass.), have voted to issue $1,500,000 of new stock for the construction of an electric railway over the Presidential Range to the summit of Mt. Washington and a new hotel there. Benjamin A. Kimball, Concord, N. H., is President of the Concord & Montreal R. R.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

New Jersey.

[illegible] are under way at Morristown, N. J., [illegible] a 2-mile line which will furnish a connection between the Morristown & Erie R. R., and the New Jersey & Pennsylvania R. R. A plan is also under consideration for completing the long projected tunnel route from Montclair to Verona. Surveys for this work are to be made shortly. R. W. McEwan, Whippany, N. J., President of the Morristown & Erie R. R., is interested.

The Morris County Traction Co., Morristown, N. J., has an application before the State Public Utility Commissioners for approval of a bond issue of $3,000,000.

The Stone Harbor Terminal R. R. Co. has been incorporated with a capital stock of $150,000, the incorporators including R. P. Risley, Stone Harbor, N. J.; R. H. Hendershott and C. A. Farnum, Philadelphia, Pa.

New York.

The New York, Ontario & Western Ry. has under consideration the expenditure of about $60,000 for the construction of freight yards and for laying switch tracks, at Fulton, N. Y. J. E. Childs is Vice President and General Manager, New York City.

North Dakota.

It is said that the Great Northern Railroad Co. has decided to abandon the Little Missouri River survey and crews are now completing the survey along the Cherry, Lonesome and Charbonneau Creeks through McKenzie County, N. Dak. A. H. Hoagland, St. Paul, Minn., is Chief Engineer of the railroad.

Ohio.

⦿Ferguson & Edmondson Co., Brookville, Pa., as noted in our May 29 issue, have two sections of the second track work on the Chicago & Erie Division of the Erie R. R. One section extends from Kenton, O., to Harrods, O., and the other from Elgin, O., to Wren, O. The contract includes 400,000 cu. yds. of earth excavation and 3,500 cu. yds. of concrete masonry. None of the work is to be sublet.

There is no basis for the report that the Detroit, Toledo & Erie Ry. is to expend $5,000,000 on improvements to its line.

Practically all right of way has been secured and it is expected that work will be started shortly on the proposed trolley system at Coshocton. The Edison-Beach storage battery cars are to be used. W. C. Swift, Coshocton, O., is interested.

The directors of the Toledo Railways & Light Co., Toledo, have appropriated $90,000 for double-tracking the Monroe St. line at Toledo.

Oklahoma.

The Lawton Railway & Lighting Co. has surveys underway for its proposed interurban line between Lawton and Fort Sill. It is hoped to have actual construction work started by July 15. John D. Kennard, Lawton, Okla., is the Engineer; B. R. Stephens, McAlister, Okla., is President.

The Fort Smith & Western R. R., with present terminals at Fort Smith on the east and El Reno on the west, has under consideration an extension from El Reno, crossing the Rock Island Lawton branch at Hinton and going west to Weatherford. The work, however, will not be taken up until late this year or the early part of 1913. W. M. Bushnell, Fort Smith, Ark., is Chief Engineer.

Oregon.

The Mount Hood R. R., Jos. W. West, Chief Engineer, Hood River, Ore., is reported to be considering beginning work this summer on the construction of an extension from Dee to Lost Lake.

The Multnomah Central Ry. Co., which is building from Cottrell to Sandy, is making preliminary surveys through the upper country east of Sandy, and if the proper right of way and property inducements are given by the settlers, the proposed extension from Sandy will be started immediately. The route of the railway will be up the Clear fork of the Sandy River, south of Bull Run and Lost Lake crossing at Salo Pass north of Mount Hood. Going over the Cascade Mountains, the road will tap the upper part of the Hood River Valley.

The Portland, Eugene & Eastern Ry., A. L. Welch, Portland, Ore., Vice President and General Manager, has under consideration, it is reported, the construction of a feeder line out of Eugene.

Pennsylvania.

⦿The South Fork-Portage Ry. Co. is reported to have awarded the contract for the construction of its 7½ mile line from South Fork to Portage to the Portage Construction Co., of which Sanderson & Porter, New York city, are the consulting engineers.

⦿Patricius McManus, 224 N. 32d St., Philadelphia, Pa., has been awarded the contract for the grading and masonry for the extension of the Philadelphia & West Chester Traction Co.'s system, from Drexel Hill to Media. The road will be completed on or before April 1, 1913. The new line will be built entirely upon private right of way, except within the borough limits of Media, where is passes through the main business thoroughfare. Stone stations will be built along the line. The roadway will be graded for double track, but only a single track will be laid until traffic requires a second track. A substation will be built at Burmont avenue, on the outskirts of Drexel Hill, and the new line will be equipped with the latest type of high-speed interurban cars.

⦿James McGraw Co., Arcade Bldg., Philadelphia, Pa., has been awarded a contract by the Philadelphia & Reading Ry. for grading and masonry for the construction of an elevated section on which two tracks are to be added between Green and Wood Sts., on 11th St., in Philadelphia. Work will be begun as soon as possible. Contractors are engaged in razing old buildings on the east side of the roadway in preparation for the structural work. The total estimated cost of the contract will be between $420,000 and $425,000. Part of the new track will be carried on this masonry embankment and in places steel viaducts will be built.

⦿T. N. Sims & Co., Philadelphia, Pa., have been awarded a contract by the Pennsylvania R. R. for the construction of a 3,000 ft. long concrete wall to extend from the Pittsburgh City line to Bridge St. in Millvale.

It is expected that the Stone & Webster Engineering Corp., Boston, Mass., will reach a definite decision this month regarding the construction of the projected new interurban line from Dallas to Terrell, Tex.

It is expected that the St. Louis Southwestern Ry., C. D. Purdon, Chief Engineer, Tyler, Tex., will soon begin work on its terminals at Fort Worth. The company has recently disposed of $7,500,000 of bonds, and part of this money will go for the work at Fort Worth. The company has already purchased its terminal site in Fort Worth on Ninth St., and plans partly have been formulated for the erection of extensive yards and freight offices.

The McNichol Paving & Construction Co., Philadelphia, Pa., has started work on the grading for the new trolley line that will connect the Lehigh Valley Transit Co. with the Philadelphia & Western road, which is now building a line from Strafford, on the main line of the Pennsylvania R. R. to Norristown. Work was started in the vicinity of Kneedler Station.

A bill has been introduced by Senator Oliver of Pennslyvania proposing the incorporation of the Giesboro Ry. Co. to construct and operate a trolley road from Anacostia to the steel plant at Giesboro Point. Charles V. Wheeler, Corcoran Thom, Alec G. McKenna and Harry F. Clark of the District of Columbia, and James W. Kinnear, James E. Porter and Eben V. Clarke of Pennsylvania are named as the incorporators. The bill specifies that the management of the affairs of the corporation is to be put in the hands of a board of five directors, who are to be stockholders. The main line is to run from the intersection Ave. and Portland St., thence along St. for about 1¼ miles to the mair of the plant of the Washington Ste nance Co., near Giesboro Point. is also given, if the work is done years, for the construction of a spu 4th St., from Portland St. to Firt Ave. and thence along Firth-Sterlin the southerly line of the propert Washington Steel & Ordnance Co.

Surveys are under way for a trol be built from Shaver's Creek and S ley to Cottage, Huntingdon county. is being promoted by Samuel Long Petersburg, and eleven miles of the route remain as yet to be completed

Texas.

A company has been organized b men of Fort Worth with a view t an interurban line from Fort Wort eral Wells. Dr. W. E. Brown of is reported to be interested.

Ordinance is before the City Com Texas City, Tex., to grant a franc street railway.

The Artesian Belt R. R., a 43-mil tending from MacDona to Christine purchased by the European Contract Ltd., and will become the connecti San Antonio of the projected San Rockport & Mexican R. R.

The city of Oakville, Tex., has suc raising the necessary bonus of $40, cure the construction of the San Rockport & Mexico Ry. through tha

According to an announcement re have been made by J. W. Hoffman Manager of the Missouri, Oklahom R. R., Muskogee, Okla., constructi are now being organized and wor started July 1 on the southern ext the road from Denison, Texas, thro las and possibly to Fort Worth. of the proposed line from Denison is said to be one of the lowest in Te five-tenths of 1 per cent. All of the way into Dallas has not been sec it is believed that two more weeks everything settled. The surveying been in the field for several months route is believed to be one of the sirable in North Texas. It is prob the southern extension will be buil Hoffman Construction Co.

The St. Louis, Brownsville & M R. is reported to have let a contrac construction of 15 miles of railroad gio County, which will be a portio Port O'Connor-Bloomington branch planned to have the work completed gust 15. W. Doherty, Kingsville, Assistant General Manager.

Engineers are making surveys at tonio, Texas, for the depot and sites of the proposed San Antonio, & Mexican Railroad. S. F. Turner a Hopkins, San Antonio, Texas, are in

Utah.

The United States Smelting, R Mining Co., which has acquired co some 5,000 acres of bituminous coal the Huntington field, and the Southe R. R. is understood to be planning t the railroad so as to furnish an outle entire field. The plans call for the tion of the road to parallel the mai the Denver & Rio Grande from P Thistle; thence paralleling the M branch to Hilltop, and thence runn and south to Mohrland. The maximu to Hilltop will be 1 per cent; and fr top to Mohrland the grade will not point exceed 2 per cent. The road approximately $5,000,000. The road ent is 22 miles long. F. N. Camer Lake City, is General Manager.

Virginia.

The Caroline, Clinchfield & Ohio R Crosby, Chief Engineer, Johnson City

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

en granted authority to construct a xtension from St Paul to Norton believed that the contract for this will be let shortly.

West Virginia.

Monongalia County Court has [illegible] citizens of Clay district to vote [illegible] sue of $200,000 to insure the immediate tion of the Morgantown & Dunkard Va. ., Morgantown, W. Va., to Blacksville. connects with the Waynesburg-Blacksine, now in process of construction, ally will be a part of a trolley system Grafton, W. Va., to Pittsburgh. It is le that the bond issue will carry, in case the district bonds will be exchanged trolley company's bonds.

Wyoming.

, believed that an engineering crew of hicago, Burlington & Quincy Railroad vork running a preliminary survey for ojected line from Casper, Wyo., north h the Salt Creek oil fields to Buffalo heridan.

Canada.

e Canadian Department of Railways and Canals, L. K. Jones, Secretary, Ottawa, Ont., is calling for tenders for constructing the second section of the Hudson Bay Ry. This section comprises the 68 miles between Split Lake Junction and Thicket Ports. Tenders for [illegible] asked this month

The Welland Street Ry. Co., of Welland, Ont., is arranging to extend its line to Welland Junction on the south and into Crowland Township on the east in the near future.

Rate payers of Brantford, Ont., will vote June 24 on a by-law to purchase the bonds of the Lake Erie & Northern Ry. Co. to the amount of $125,000. If the bonds are voted the city will secure a new line to Port Dover and Galt. Following the vote in Brantford, by laws will be submitted in Port Dover, Paris, Simcoe and Galt, for the purchase of $25,000 worth of bonds by each municipality. Brewster, Muirhead & Heyd, Brantford, Ont., are the solicitors for the company.

Extensive railroad improvement work is projected in Montreal, and it seems likely that $30,000,000 or $40,000,000 will be expended in this city in the next two or three years by the Canadian Northern Ry., the Grand Trunk and the Canadian Pacific Ry. About one-half this sum will be spent by the first mentioned railroad in building a 3-mile tunnel, new terminal and overhead track. The Grand Trunk Ry will spend between $9,000,000 and $10,000,00 in the elevation of the tracks and in the building of a new station. The bulk of the outlay i in connection with the elevation of the track as they cover a distance of some four mile and traverse a thickly populated section of th city. The Canadian Pacific Ry. has alread commenced the expenditure of $5,000,000 in th erection of new terminal facilities at bot Windsor Street and Place Viger, new offic buildings for the Dominion Express Co. o St. James St., and certain improvements i connection with their docking and harbo facilities.

Rate payers of Saskatoon, Sask., have vote a by-law to provide $100,000 for the construc tion of a subway under the Canadian Norther Ry. at 23d St.

Terminals for the new government roa from Prince Albert to Fort Churchill, a Fort Churchill, Que., are to be laid out unde the supervision of H. T. Hazen, formerl Chief Engineer of the Duluth, Winnipeg Pacific R. R. Co. at Port Arthur, Ont.

RIDGES—STEEL AND CONCRETE

Colorado.

e contract for the construction of the [illegible] to connect L[illegible] f the boulevard with the 14th St. viaas been awarded by the Board of Pubrks, Denver, Colo., to C. S. Lamdie & t $22,893. The other bidders were: nan-Renton Co., $23,120; Omaha Struc-Steel Co., $22,944.50; Gaffey & Keefe. .56; M. F. Levy Construction Co., $23,-Colorado Bridge & Construction Co.,

District of Columbia.

Fine Arts Commission of the District umbia has formally approved plans for oposed $250,000 concrete bridge which ross Rock Creek at Q St. Work on the uction of the bridge will begin as soon proceedings for the condemnation of proaches to the structure are com-Two years will be required to build idge. Plans for the bridge were drawn office of T. C. J. Bailey, Engineer of Glenn Brown is the Advisory Archi-

Illinois.

ds will be received up to 1:30 p. m., 17, at the County Clerk's office, Pekin, r the construction of two reinforced s to be built in Cincinnati Township, ell County. William Hays, Town R. R. No. 4, Pekin, Ill. Hawley Staridge: Span, 35 ft.; roadway, 16 ft.; height, about 16 ft. Estimated amount ncrete, 109.6 cu. yds.; reinforcing steel, lbs.; nearest railroad station, Hawley n, on the Illinois Central, about 100 ft.; t bridge, 35 ft. span, steel leg bridge; ation in gravel and clay, to be carried 4 ft. below stream bed; average depth cavation about 10 ft.; low water flow, igh water flow, about 10 ft. deep. Myridge: Span, 24 ft.; roadway, 16 ft.; height, about 11 ft.; estimated amount ncrete, 61.9 cu. yds.; reinforcing steel, lbs.; nearest railroad station, Meyers, C. & A., about 100 ft.; present bridge, span, steel leg bridge; excavation in to be carried about 3 ft. below stream clay; low water flow, dry; high water about 6 ft. deep; no local concrete maare available for either of the new s; washed gravel may be obtained at ; work to be completed on or before 20, 1912. More detailed information e had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Illinois.

✣Bids will be received until 11 a. m., June 19, by L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing material, labor, etc., necessary to repair the W. Taylor St. viaduct. The bidding sheet is made up of the following items: (A) removing and disposing of old pavement, sub-planks, sidewalks, wheel guards, etc.; (B) furnishing yellow pine sub-planking, including bolts, spikes, etc., in place; quantity assumed at 68,000 ft. B. M.; (C) furnishing white pine sidewalk planking, including fastenings in place, quantity assumed 11,000 ft. B. M.; (D) yellow pine sidewalk stringers, purring strips and bridging, including fastenings in place, quantity assumed 6,000 ft. B. M.; (E) oak wheel guards with fastenings in place, quantity assumed 6,000 ft.; (F) 7¼-in. rectangular yellow pine blocks in place, quantity assumed 730 sq. yds.; (G) 5-in. rectangular paving blocks in place, quantity assumed 290 sq. yds.; (H) 4-in. rectangular paving blocks in place, quantity assumed 150 sq. yds.; (I) approximately 16 cu. yds. of concrete, including reinforcing wire; (J) structural steel for repair work, including wheel guards, protection angles, etc.; quantity assumed 15,000 lbs.; (K) iron railings put in place, quantity assumed 500 lbs.; (L) flag stone sidewalk reset, including grading and filling, quantity assumed 80 sq. yds.; (M) removal of refuse measured in place before removed, quantity assumed 800 cu. yds.; (N) scraping and painting entire structure, including railings, etc.; cash or certified check for $500 must accompany proposal.

⦿Board of Tazewell County Commissioners, Pekin, Ill., has awarded the contract for the construction of a concrete arch bridge over LaRosh Creek, in Groveland Township, to Edward Cooney, Tremont, Ill.

Advices from Mahomet, Ill., state that plans have been prepared for the construction of a new bridge over the Sangamon River east of the town. The cost of the structure is estimated at $8,000.

Sketches of plans for the viaduct on Bridge St. to span the tracks of the Chicago, Rock Island and Pacific and the P. & P. U. Rys. have been filed with the Commissioner of Public Works, S. W. Eckley, Peoria, Ill. The principal object of this proceeding is to locate the piers on which the viaduct will rest. When the [illegible] has been completed th sketches will be returned to the maker, G. Hedrick of Kansas City and the fixed plan will be drafted.

A petition will be filed with the Highwa Commissioners asking for a special electio to submit to the voters of Erie, Ill., the proposition of rebuilding the approach to the Eri bridge, replanking and painting the structur The cost of the improvement is estimated a $8,000.

Residents of Proviso Township, at a specia election held recently, voted in favor of issuing bonds for the construction of a $20,00 reinforced concrete bridge to replace the present span over the Des Plaines River at Madison St., Maywood, Ill.

Indiana.

✣Bids will be received until noon, June 1 Newville, Ind., for the construction of double span 80-ft. bridge at Newville, in D Kalb County. A. W. Madden is County Auditor.

✣Bids will be received until 2 p. m., July (readvertisement), by Board of Spence County Commissioners, Rockport, Ind., fo the construction of 21 bridges throughout th county. J. T. Stevens is County Auditor.

⦿The contract for the construction of tw new spans on the west end of the bridge ove the White River, known as the Elliston bridg has been awarded to the Vincennes Bridg Co., Vincennes, Ind., at $14,400.

⦿Board of County Commissioners, Connersville, Ind., has awarded the contracts fo the construction of 6 concrete bridges, as follows: Paul F. Carlos, Connersville, Ind Hackleman bridge, 60-ft. span, $1,596; Ca and Roy Sherry, E. 10th St., Connersvill Ind., for Wise bridge, $373, and Hoove bridge, at $599, spans 15 ft. and 30 ft., respectively; Matney & Buzendahl, for the construction of the McCann bridge, Alexande bridge and Michener bridge, at $198, $172 an $293, respectively. Karl Hanson is Count Engineer.

⦿The Board of La Porte County Commissioners, La Porte, Ind., has awarded the contracts for the construction of bridges in No ble, Hanna, Washington and Prairie Townships, to the Rochester Bridge Co., Rocheste Ind., and W. A. Steigely, La Porte, Ind.

Iowa.

The City Clerk of Sioux City, Ia., has bee instructed to advertise for bids for the construction of three bridges over Bacon Ho low Creek.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

he contract for the removal of the old and the construction of a new steel pier nd otherwise repairing a bridge at Davenort, Ia., has not been let and new specificaons will be prepared and the work readversed.

Kansas.

Plans and specifications have been prepared y E. E. Clark, Surveyor, Jefferson County, skaloosa, Kan., for the construction of a ridge on the county line in Easton Townhip, to replace the old structure washed way.

It has been decided by the County Commisoners to erect a wooden bridge at Washingn St over Cow Creek, at Hutchinson, Kan., stead of a concrete structure, as at first condered.

Commissioners of Shawnee County, Topeka, an., rejected all bids received for the conruction of the proposed new bridge over the hicago, Rock Island & Pacific R. R. at the ick yards, Topeka. New bids will probably asked on revised plans. There is about 0,000 available for the improvement.

Kentucky.

A hearing will be held at 10 a. m., June 18. the headquarters of the Business Men's ssociation, Owensboro, Ky., on the proposed idge over the Ohio River, between Rockrt, Ind., and Owensboro, Ky. Maps and signs of the structure are on exhibition at e offices of the U. S. Engineers, in Cincinti, O., Pittsburgh, Pa., Wheeling, W. Va., d Louisville, Ky.

Massachusetts.

✣Bids will be received until noon, June 18, L. K. Rourke, Commissioner of Public orks, Boston, Mass., for building steel draw an and draw machinery of Chelsea bridge rth, over the north channel of Mystic River, arlestown to Chelsea.

At a recent town meeting, Williamsburg, ass., the Selectmen were instructed to sere estimates of the cost of building a cem- bridge to replace the old structure near the st office. A report will be prepared and omitted at the meeting, June 20.

Michigan.

The Board of Public Works, Ludington, ch., has under discussion the matter of cting a viaduct over the Pere Marquette ou in that city. It is expected that plans l soon be laid looking toward replacing the bridge with a long viaduct which will cont the two big hills. This kind of struce would be elevated sufficiently to permit Pere Marquette railroad tracks being left their present location.

Minnesota.

✣Bids will be received until 4 p. m., June by County Auditor, Winona, Minn., for nishing and erecting three highway bridges, follows: One 40-ft.; one 50-ft.; one 80- O. B. Leland is Engineer.

Mississippi.

⊙The Lincoln County Board of Supervis, Brookhaven, Miss., has awarded the cont for furnishing the necessary material two steel and concrete bridges, one being 08-ft. span and the other two spans total- 135 ft., to the Joliet Bridge & Iron Co., et, Ill., at $3,400. The structures will be cted by convict labor. Bids for supplying lvanore" culverts were rejected.

ids were received as follows by the Board County Supervisors, Vicksburg, Miss., for construction of three bridges: Bids for ding steel bridge over Clark's creek were ned and were as follows: W. T. Young lge Co., concrete floor, $1,550; W. T. ung Bridge Co., wood floor, $1,295; Vira Bridge & Iron Co., concrete, $3,000; ginia Bridge & Iron Co., wood, $2,850; ksburg Boiler & Iron Works, concrete, 00; Vicksburg Boiler & Iron Works, wood, 75; Dutton Foundry & Machine Works, crete, $1,960; Dutton Foundry & Machine rks, wood, $1,780. The bids for the Hagan bridge were: W. T. Young Bridge Co., concrete floor, $2,695; W. T. Young Bridge Co., wood floor, $1,766; Virginia Bridge & Iron Co., concrete floor, $4,004; Virginia Bridge & Iron Co., wood floor, $3,525; Vicksburg Boiler & Iron Works, concrete floor, $3,120; Vicksburg Boiler & Iron Works, wood floor, $2,660; Dutton Foundry & Machine Works, concrete, $4,096; Dutton Foundry & Machine Works, wood floor, $3,567. Bids for the Bovina bridge were: W. T Young Bridge Co., concrete floor, $2,695; W. T. Young Bridge Co., wood floor, $1,766; Virginia Bridge & Iron Works, concrete floor, $3,980; Virginia Bridge & Iron Works, wood floor, $3,480; Vicksburg Boiler & Iron Works, concrete floor, $3,031; Vicksburg Boiler & Iron Works, wood floor, $2,565; Dutton Foundry & Machine Works, concrete floor, $4,000; Dutton Foundry & Machine Works, wood floor, $3,161

Missouri.

William Kohlman, Jasper County Surveyor, has condemned the lower Spring River bridge at Carthage, Mo., and it is probable that a new structure will be erected in the near future to replace it.

⊙The contracts for the construction of steel bridges in the Carroll County Drainage District No. 3, of which Clark Jacoby is Engineer, Carrollton, Mo., have been let as follows: R. G. Culbertson, Hale, Mo., at $1,025, for 50-ft. Class A steel bridge, with two 12-ft. wooden approaches; R. E. Bates, Hale, Mo., at $1,024, for two 50-ft. Class A steel bridges, with two 12-ft. approaches; Stites Steel Bridge & Concrete Co., St. Louis, Mo., for three 75-ft. Class A steel bridges, with 15-ft. approaches, at $1,673 each, and for removing and replacing five bridges, at $1,206

Montana.

⊙The Board of County Commissioners, Yellowstone County, Billings, Mont., has awarded the contract for the construction of 11 steel bridges to the Security Bridge Co., Minneapolis, Minn. The structures will be located as follows: One 25-ft. span and one 28-ft. span bridge over Canyon Creek ditch in the vicinity of the Harmison ranch; a 24-ft. span structure over the same ditch near Great Northern Junction; one 32-ft. bridge over the main canal of the Big Dutch Company, near the Tilden beet dump; one 40-ft. span structure over Valley Creek in the vicinity of the shearing pens; one 32-ft. span over Keyser Creek, near Benbow's ranch and another of similar length over the same stream, near the Meyers' ranch; a 32-ft. span over the canal of the Billings Land and Irrigation Co. on the bench, near Young's ranch; one 40-ft. structure over Razor Creek in the vicinity of the W. W. Clarke farm; one 40-ft. span over Sand Creek, about three miles east of Pompey's Pillar, and one 50-ft. span over Two Leggin Creek, about six miles south of Hardin.

Nebraska.

⊙The Standard Bridge Co., Omaha, Nebr., has been awarded the contract for the construction of the proposed bridge over the Loup River at Loup City, Nebr., at $19,800.

⊙The following bids were received May 29, by the Scott County Clerk, Gering, Nebr., for the construction of a bridge over the North Platte River, north of Gering: (1) Standing for a reinforced concrete arch bridge, composed of 50-ft. spans about 600 ft. long, and (2) standing for a reinforced concrete girder bridge 800 ft. long, composed of 30-ft. spans: C. R. Inman, Cheyenne, Wyo., (1) $19,245, and (2) $19,245; John L. Mullen, Lincoln, Nebr., (awarded contract), (2) including fills, $21,653; Massillon Bridge & Structural Co., Kansas City, Mo., (1) $20,050, and (2) $22,000; H. T. Ward & Co., Tecumseh, Nebr., (1) $19,800, and (2) $21,900; Omaha Structural Steel Works, Omaha, Nebr., (1) $21,000, and (2) $23,000; Lincoln Construction Co., Lincoln, Nebr., (1) $18,500, and (2) $21,000; Monarch Engineering Co., Falls City, Nebr.; Midland Bridge Co., Kansas City, Mo., (1) $20,295, and (2) $22,475. D. D. Price, Lincoln, Nebr., is State Engineer.

New York.

✣Bids will be received until noon, by Duncan Peck, Superintendent State ment of Public Works, Albany, N. Contract 103, for the construction of a bridge over Oswego River and Canal at Lc St., Phoenix, N. Y. A more complete item y be found under Irrigation, Drainage, etc this issue.

⊙The Town Board of Orchard Park, Y., has awarded the contract for the construction of the new steel bridge on the Trevit Road to Jakel & Brown, at $1,493.

⊙The contract for furnishing the electrical equipment for the Ed and Willis Ave. bridges in New York City, has been awarded the Snare & Triest Co., 143 Liberty St. N York City, at $31,840. Arthur O'K Bridge Commissioner.

Bridge Commissioner Arthur J. O New York City, is planning to recommd appropriation of $2,000,000 for the struction of a new terminal station Brooklyn side of the Brooklyn Bridg the removal of the elevated tracks fror Fulton St.

The declaration of the officials of the Traction Co. that the company will no sider extensions to its Rensselaer lines compelled to pay the Greenbush Bridg for the use of structure, has revived th tation for a free bridge between Alba Y., and Rensselaer.

Ohio.

✣Bids will be received until noon, Ju by Board of Hamilton County Commi ers, Cincinnati, O., for the construction Specifications No. 343, of concrete culv Reading road, 1,500 ft. south of Carthage in Mill Creek Township. Albert Rei is Clerk. A bond for $500 must be filed each bid.

✣Bids will be received until noon, Ju 26 by Peter Frank, Jr., Wyandot County Au Upper Sandusky, O., for furnishing labo material for the construction of a steel known as the Bretz bridge, in Little dusky, Pitt Township, extreme length of 55 ft. Also for the substructure of the bridge in Sycamore Township, Haner co retaining wall in Mifflin Township, and more retaining wall in Sycamore Tow Bids for superstructure and substructure be submitted separately and in accor with the plans and specifications which be found in the Auditor's office, Wyandot Coty.

✣Bids will be received until 11 a. m., 26, by Board of Cuyahoga County Commissioners, Cleveland, O., for the constructi a culvert, per Report No. 2912, on E Heights Blvd., in Cleveland Heights T ship. F. R. Lander is County Surveyor J. F. Goldenbogen is Clerk.

⊙The contract for filling the approach bridge over Hubbard, on the Gulf roa Plymouth Township, Ashtabula County, has been let to J. P. Fitzgerald, Ashta O., at $3,127. Bids were opened June 3. V. Hillyer, Jefferson, O., is Clerk.

⊙The contract for furnishing all labor material for the construction of the Joint County bridge has been awarde Board of Darke County Commissio Greenville, O., to James Mannix, Fort covery, O. J. E. Kline is Deputy Audito

⊙The contract for the construction bridge over Nine Mile Creek, on Lake S Blvd., in the village of Bratenahl, has awarded by the Board of Cuyahoga Co Commissioners, Cleveland, O., to Colb Bros., Kamms, O., at $4,380. Bids opened May 29. J. F. Goldenbogen is Cler

A public hearing will be held by the B of Cuyahoga County Commissioners, Cleveland, O., at 11 a. m., June 22, on construction of a bridge on Highland over Euclid Creek, in Euclid Township. J. Goldenbogen is Clerk.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

rdinance has been [illegible] Council of Columbus, O., providing funds e widening of Fourth St. viaduct. Henry el is City Engineer.

Franklin County Commissioners, Cos, O., have rejected all bids received for onstruction of the new concrete bridge he Olentangy River at King Ave. The bid received was $50,000 and there is 43,000 available for the improvement. will be taken to raise more money for irpose.

Oklahoma.

Oklahoma City & Newcastle Bridge Newcastle, Okla., has been incorporated capital stock of $75,000. The [illegible] s are Charles S. Smith, New[illegible] J. E. Wright, Tuttle, Okla.; A. Haun, [illegible], Okla.

Oregon.

s will be received until June 14 by [illegible] Auditor, A. L. Barbur, Portland, Ore., [illegible] the Broadway bridge.

Pennsylvania.

ds will be received until 2 p. m., June R. J. Cunningham, County Controller, oreland County, Greenburg, Pa., for a ted wood block roadway floor and carim treated sidewalk floor and repairs steel work of the joint county bridge he Youghiogheny River at Allegheny-oreland county line at Suter Station, on). R. R.

ls will be received until noon, June 25, F. Greiner, Secretary, Town Council, y, Pa., for the construction of a reinconcrete bridge over Elk Creek on Broad St.

contract for the reconstruction and [illegible] two bridges in Montgomery [illegible] been let by the Board of Commissionorristown, Pa., to James M. Smith.

ens of Concord Township have petithe County Commissioners, West Ches[illegible] the construction of a bridge over [illegible] where the public highway leading easterly from a point on the Concordville and Chester road crosses the stream.

An ordinance will be introduced into the City Council for issuance of $210,000 of bonds for the construction of the proposed Tulpehocken St. bridge and for the construction of sewers, at Reading, Pa.

The Board of County Commissioners, West Chester, Pa., has been petitioned to construct a new bridge over Buck Run, in East Fallow[illegible]

Tennessee.

At a meeting of the Board of McCallie Ave. viaduct engineers, Chattanooga, Tenn., at which Hunter McDonald, Chief Engineer of the N. C. & St. L., and Curtis Dougherty, Chief Engineer of the C. N. O. & T. P., were present, it was decided to recommend the bid of the Chickamauga Quarry & Construction Co., Chattanooga, Tenn., $119,038.14, for the construction of the viaduct for acceptance. Other bids received for the work are as follows: Thomas Sheahan, Richmond, Va., $135,000; J. A. Omberg, Jr., Memphis, Tenn., $138,784; William P. Carmichael Co., St. Louis, Mo., $141,170; C. W. Lane & Co., Atlanta, Ga., $143,410; Noll Construction Co., Chattanooga, Tenn., $145,831; Bauml Construction Co., Chattanooga, Tenn., $150,133; Foster-Creighton-Gould Co., Nashville, Tenn., $157,480.

Texas.

✣Bids will be received until noon, June 15, by W. A. Frazier, City Clerk, Greenville, Texas, for the construction of one steel bridge, seven steel bents and concrete abutments and piers. A certified check for $1,000, payable to the Mayor of the city, must be filed with each bid.

⊙The Commissioners' Court of Milam County, Cameron, Texas, has awarded the contract for the construction of a steel bridge on Big Elm Creek, north of Cameron, at Galbreath crossing, to the El Paso Bridge Co., Dallas, Texas, at $1,100.

⊙The Commissioners' Court, Hallettsville, Texas, has awarded the contract for the construction of a bridge over Lavaca River, nea Molton, to the Massillon Bridge Co., Massillon, O., at $2,036. The structure will be o steel and will be 180 ft. long. According to the terms of the contract the work is to be completed Oct. 1.

Utah.

Land owners along the lake drive betwee the city and the lake have petitioned the City Commissioners, Provo, Utah, for the construction of a bridge over the river near the Knudson farm.

Washington.

The Board of Park Commissioners, Centra Bldg., Seattle, Wash., plans the constructio of a concrete bridge on Interlaken Blvd., ove 26th Ave., N., to cost $25,000.

The City Council of Lind, Wash., has decided to appropriate $1,000 toward the cos of constructing a bridge over the Coulee o the county road, between First and Main Sts

Wisconsin.

A hearing is being held today (June 12) at Prairie du Chien, Wis., in accordance wit the order of Maj. C. Keller, U. S. Engineer on the proposition of the Chicago, Milwauke & St. Paul R. R. to reduce in length the draw of the pontoon bridge over the Mississipp River at Prairie du Chien.

Wyoming.

✣Bids will be received until noon, July 2 by Board of Weston County Commissioners Newcastle, Wyo., for the construction of a bridge over the Big Beaver Creek 10 mile from Newcastle. The structure will be 70 ft long on piles 28 ft. in length. W. O. Carleto is Clerk.

It is rumored that a new 100-ft. steel spa railroad bridge will be constructed over the Bitter Creek, near Rock Springs, Wyo., i [illegible]

OADS, STREETS AND PAVEMENTS

Alabama.

ls will be received until 4 p. m., June Pickens County Court, Carrollton, r grading and surfacing with sand miles of road. A certified check for ust be filed with each bid. W. S. Montgomery, Ala., is State Highway er.

ls will be received until July 9 (readnent) by Elmore County Court, We-, Ala., for the construction of 5 miles te aid road. M. D. Still is Judge of . W. S. Keller, Montgomery, Ala., is ighway Engineer.

City Commission of Talladega, Ala., ered an election to be held on July [illegible] purpose of authorizing the issuance 00 5 per cent 30-year bonds for street hway purposes. It is the purpose of mission to pave the business district city and a large area of the residence

Arkansas.

s will be received until June 20, by Little Rock, Ark., it is reported, paving of West 10th St. Ford & are Engineers.

California.

s will be received until 2 p. m., June 24, fornia Highway Commission, Forum acramento, Calif., for the construction ate Highway in Yba County, including owing approximate quantities: Item 1, u. yds. of excavation without classifiItem 2, 3 cu. yds. of Class A. Portland concrete; Item 3, 70 cu. yds. of Class B Portland cement concrete; Item 4, [illegible] tons broken stone; Item 5, 1,000 cu. yds. of sand; Item 6, 450 lin. ft. 12-in. corrugated iron pipe; Item 7, 25 lin. ft. 15-in. corrugated iron pipe; Item 8, 75 lin. ft. 18-in. corrugated iron pipe; Item 9, 25 lin. ft. 24-in. corrugated iron pipe; Item 10, 2,800 barrels asphaltic oil; Item 11, 10,000 lin. ft. guard rail; Item 12, hauling and setting 89 monuments.

⊙The San Joaquin County Highway Commission, Stockton, Cal., has awarded the contract for the paving of the French Camp road with oiled macadam to J. N. Jones at $17,920. Other bidders were: Cy Moreing, $19,536; George S. Benson & Sons, $20,641.

The Trustees of Merced, Cal., have instructed the City Engineer to prepare plans and specifications for the improving of 17th, 18th, 19th and 20th Sts., from G to R. Asphalt macadam will be used for the paving and concrete for the curbing. Approximately 54 blocks will be [illegible]

Georgia.

✣Bids will be received until 10 a. m., June 17, by Board of Commissioners of Roads and Revenues, Colquit County, Moultrie, Ga., for the construction of the following roads: Autreyville Road, Section No. 1. Length 5 miles. Autreyville Road, Section No. 2. Length 4.58 miles. Ellenton Road, length 2.08 miles. According to plans and specifications on file in the office of said Board of Commissioners. A. B. Buxton is Clerk of the Board.

Idaho.

⊙The Inland Empire Hassam Paving Co. has been awarded the contract by the County Commissioners, Boise, Ida., for the building of about 2 miles of concrete roadway fro the city limits to Collister bridge, on th valley road, leading west from the north en of the city. The bid is $0.99 a sq. yd. fo a two-course concrete paving. The total cos is $25,000.

⊙The Inland Empire Hassam Paving Co., o Spokane, Wash., has been awarded the contract by the Board of County Commissioners Boise, Ida., for the construction of a hard surfaced road 20 ft. wide extending along th Valley Road from the city limits of Boise City The work includes the laying of approximatel 21,333 sq. yds. of two-course concrete pavement, concrete culverts, etc. The contrac price is $21,120. Bids were opened May 24.

The City Council of Idaho Falls, Ida., ha passed a resolution calling for the pavin of that section of the city lying betwee Eagle Rock St., on the north, and betwee Capital Ave., on the west, and the Shor Line, on the east, as well as that sectio of Broadway between Capital Ave. and th bridge across Snake River. The estimate cost is $100,000. It is probable that bitulithi will be used.

Illinois.

✣Bids will be received until 10:30 a. m. June 14, by Board of Local Improvements Shelbyville, Ill., for the construction of 2 blocks of vitrified brick pavement on concrete base and asphalt filling.

✣Bids will be received until 2 p. m., Jun 15, by Board of Local Improvements, F. F Johnson, President, Paxton, Ill., for the improvement of East State St. It is estimate

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

hat there will be about the following re- [illegible] said improvement 4,204 q. yds. of vitrified brick block paving with sand filler and surface dressed with ½ in. f sand, complete in place; 4,204 sq. yds. of oundation for paving, composed of 7 ins. f compact gravel and a sand cushion of ompact sand 1 in. thick, complete in place; 301 lin. ft. of combined concrete curb and utter set on 6 ins. of compacted gravel, omplete in place; 260 lin. ft. of protection tone set on 4 ins. of compacted gravel, omplete in place; 2,479.6 cu. yds. of excavating, grading and trimming sub-grade; 7 ast iron inlet boxes for catch basins, furnished and set in place; 8 cast iron inlet oxes for sewer pipe outlets, furnisned and et in place; 1 cast iron grate for catch asin, furnished and set in place; 8 vitrified ewer pipe elbows for curb inlet boxes, 9 ns. inside diameter, furnished and set in lace; 243 lin. ft. of No. 2 sewer pipe, 8 ins. iameter for connecting inlet boxes with atch basins, laid under pavement to depths s shown on blue print plan and trenches efilled in specified manner, complete in place.

✣Bids will be received until 2 p. m., June 5, by Board of Local Improvements, F. F. ohnson, President, Paxton, Ill., for the contruction of the improvement of East Patton t. and College St. It is estimated that here will be about the following required o complete said improvement: 6,967.9 sq. ds. of vitrified brick block paving with a and filler and surface dressed with ½ in. and, complete in place; 6,967.4 sq. yds. of oundation for paving, composed of 7 ins. f compacted gravel and a sand cushion of ompacted sand 1 in. thick, complete in lace; 5,186 lin. ft. of concrete curb and utter set on 6 ins. of compacted gravel, omplete in place, including foundation; 370 n. ft. of protection stone set on 4 ins. of ompacted gravel, complete in place, including foundation; 4,478 cu. yds. of excavating, rading and trimming sub-grade; 8 cast iron nlet boxes for catch basins, furnished and et in place; 6 cast iron inlet boxes for ewer pipe outlets, furnished and set in lace; 6 vitrified sewer pipe elbows, for onnecting inlet boxes with sewer pipe rain, furnished and set in place; 216 n. ft. of No. 2 sewer pipe, 8 ins. inside iameter for connecting inlet boxes with atch basins, laid under pavement to depths s shown on blue print plans and trench relled in specified manner, complete in place.

✣Bids will be received until noon, June 18, Board of Local Improvements, Lewiswn, Ill., for furnishing all tools, material, bor, etc., necessary for paving approxiately 16,379 sq. yds. of vitrified brick paving 4-in. concrete base, 2-in. sand cushion and tch filler; 7,830 lin. ft. combination straight oncrete curb and gutter; 1,338 lin. ft. 12 ft. adius combination concrete curb and gutter; lin. ft. 8 ft. radius combination concrete urb and gutter; 120 lin. ft. combination conrete drop curb and gutter; 1,448 lin. ft. 3-in. 12-in. oak marginal curbing; 5,796 cu. yds. xcavating and grading; 620 ft. 8-in. vitrified ewer pipe; 19 catch basins; 1 brick manhole; extra manhole covers. Fuller-Coult Co., hemical Bldg., St. Louis, Mo., are Engieers.

✣Bids will be received until 9 a. m., June , by City of Moline, Ill., for paving 23d Ave. om 15th to 27th St., including approximately .320 sq. yds. of brick pavement with 5-in. oncrete foundation, 1½-in. sand cushion and phalt filler; 8,390 ft. straight granite conete curb. Lyle Payton is City Engineer.

✣Bids will be received by L. E. McGann, ommissioner of Public Works, Chicago, Ill., ntil 11 a. m., June 15, for furnishing and devering to the 1st ward branch office, 224 W. th St., approximately 2,500 galvanized iron reet boxes according to plans and specificaons on file at office. Cash or certified check r $350 must accompany proposal.

✣Bids will be received until 2 p. m., June 18, Charles Duisdieker, President Board of ocal Improvements, Pekin, Ill., for 28,580 sq. ds. of brick paving on concrete foundation with cement grout filler; 3,425 lin. ft. of stone curb reset; 9,100 cu. yds. of excavation and filling. J. R. Seibert is City Engineer. Official advertisement will be found elsewhere in this issue.

⊙The city of Pekin, Ill., John R. Seibert, City Engineer, has awarded the contract for the improvement of Broadway Paving District to Jansen & Zoellers of Pekin, at $1.66 per sq. yd., for brick and $0.25 for curbing.

The City Council of Taylorville, Ill., has ordered 2 more miles of street paving on North Webster, Adams and Clay Sts., together with some intersections.

Indiana.

✣Bids will be received until July 1, by Board of County Commissioners, Versailles, Ind., for the construction of 1¾ miles of macadam road in Brown township, estimated to cost $11,000. J. F. Lockard is Ripley County Auditor.

⊙Harry Dobson of Osgood, Ind., has been awarded the contract by the Ripley County Commissioners, Versailles, Ind., for the construction of a macadam road in Delaware Township at $6,704. Bids were opened June 3 by J. Francis Lockard, County Auditor.

⊙The Board of Public Works of Richmond, Ind., has awarded contracts for paving West Main St., from the river west to West Fifth St., and for Ft. Wayne Ave., from the railroad to North F. St., to C. M. Kirkpatrick at $1.60 per sq. yd., for Hocking Valley brick.

⊙John T. Farrell of Ambia, Ind., has been awarded the contract by the Board of Benton County Commissioners, Fowler, Ind., for the construction of the Puetz road, a distance of one mile, at $3,780, and P. J. Kennedy of Templeton, Ind., for the improvement of the Greenwood Road, a distance of three miles, at $7,999. Bids were opened June 3. Both roads will be improved with stone.

⊙J. C. O'Connor & Son of Delphi, Ind., have been awarded the contract by the Board of Carroll County Commissioners, Delphi, Ind., for the macadamizing of roads in Jefferson and Deer Creek Townships at $48,800. Bids were opened June 4.

⊙Frank J. Wright of Portland, Ind., has ben awarded the contract by the Board of Jay County Commissioners, Portland, Ind., for the construction of a three-mile gravel road in Jackson Township at $7,848. Bids were opened June 3.

⊙Blair & Kerr of Bloomington, Ind., have been awarded the contract by the Board of Monroe County Commissioners, Bloomington, Ind., for the construction of gravel roads in Bloomington and Washington Townships at $2,290. Bids were opened June 3.

⊙O. L. Osborn of Waynetown, Ind., at $13,749, O'Connor Bros., of Crawfordsville, Ind., at $10,495, and Lawrence Jenkins of Frankfort, Ind., at $6,500, have been awarded the contracts by the Board of Montgomery County Commissioners, Crawfordsville, Ind., for the construction of highways in Coal Creek and Union Townships. Bids were opened June 4.

⊙Philip Hipskind Sons, Richmond, Ind., have been awarded the contract by the Board of Wayne County Commissioners, Richmond, Ind., for the construction of a macadamized highway in Wayne Township, 2⅛ miles long, at $42,800. Bids were opened June 5.

⊙The Board of Wabash County Commissioners, Wabash, Ind., has awarded the following contracts for the construction of four roads in Liberty Township, for which bids were opened June 4: Brane Road, Fred A. Grover, Logansport, Ind., $10,438; White Road, McGeevey & Sons, Wabash, Ind., $12,785; Harper Road, Francis Hulihan, Wabash, $11,286, and Wagoner Road, J. F. Wilson, La Fontaine, Ind., $10,673.

⊙G. M. Hopkins of Hayden, Ind., has been awarded the contract by the Board of Jennings County Commissioners, Vernon, Ind., for the construction of a pike in Spencer Township at $8,488. Bids were opened June 3.

⊙The Board of Clinton County Commissioners, Frankfort, Ind., C. F. Cromwell, County Auditor, awarded the following contracts for the construction of gravel roads for which bids were opened June 6: Corbett Road to Franfort Construction Co., Frankfort, Ind., $14,830; Shafer Road to Frankfort Construction Co., Frankfort, Ind., $12,535; Munsey Road to Adam Bros., of Lebanon, Ind., [illegible],869; Peter Road to C. C. Huffine of Frankfort, Ind., $4,088; Jacoby Road to L. W. Seaman of Frankfort, Ind., $4,600; Davis Road [illegible] The Frankfort Construction Co., Frankfort, Ind., $5,065; Sloan Road to C. C. Huffine of Frankfort, Ind., $1,424; Carter Road to C. [illegible] Maxwell of Michigantown, Ind., $1,245; W[illegible]eman Road to L. W. Seaman of Frankfort, Ind., $2,356; Stevenson Road to W. D. K[illegible]ly of Frankfort, Ind., $3,768; Friend Road to Irwin & Miller of Frankfort, Ind., $1,145; [illegible]reso Road to Irwin & Miller of Frankfort, Ind., $2,340

⊙Austin M. Shattuck of Brazil, Ind., has been awarded the contract by the Board Cl[illegible] County Commissioners, Brazil, Ind., construction of a limestone road in [illegible] Township at $4,120. Bids were opened [illegible]

⊙H. C. & Ray G. Jester of Perrysville, Ind., have been awarded the contract by the [illegible] of Vermillion County Commissioners, [illegible]port, Ind., for the construction of a [illegible] road, three-quarters of a mile long, at [illegible] and Ingram & Co., of Perrysville, for [illegible]struction of a gravel road 1¾ of a m[illegible] at $6,385. Bids were opened June 3.

⊙Tunis Snip of Thayer, Newton [illegible] Ind., has been awarded the contract [illegible] Board of Jasper County Commissioner[illegible] selaer, Ind., for the construction of [illegible] of macadamized road at $2,499. Bids were opened June 3.

⊙Ray Demass has been awarded the contract by the Board of Porter County Commissioners, Valparaiso, Ind., for the construction of [illegible] gravel road in Pine Township at $12,00[illegible] T[illegible] contract for the construction of a gravel road in Boone Township has not been awarded. Bids were opened June 4.

⊙John Overshay of Wheatland, In[illegible] been awarded the contract by the Bo[illegible] Knox County Commissioners, Vincennes, Ind., for the construction of a gravel road te[illegible]sion in Steen Township at $8,100. Bids were opened June 4.

⊙C. C. James of Lexington, Ind., have [illegible] awarded the contract by the Board of [illegible] County Commissioners, Scottsburg, Ind., for the construction of the London gravel road, 1.67 miles of stone roads and culverts, bridges, etc., at $4,799. Bids were opened June 3

⊙N. W. Jackson of Montpelier, Ind., has been awarded the contract by the Board of Blackford County Commissioners, Ha[illegible]ord, Ind., for the construction of two gravel roads in Harrison Township at $6,895. Bids were opened June 3.

⊙Roy W. Elrod of Martinsburg, Ind., [illegible] Simpson of Salem, Ind., and Leslie Dar[illegible] of Scottsburg, Ind., have been awarded the contract by the Board of Washington [illegible] Commissioners, Salem, Ind., for the construction of roads in Jackson, Jefferson and Howard Townships at $5,865, $618 and $30[illegible] Bids were opened June 3.

⊙The Board of Newton County Commissioners, Kentland, Ind., has awarded the contract to Alva Herriman for the construction of the Mac Reading road in Iroquois Township at $4,130. Bids were opened June 3.

⊙John G. Clack of Noblesville, Ind., has been awarded the contract by the Board of Hamilton County Commissioners, Noblesville, Ind., for the construction of two gravel roads in Clay Township at $3,984 and $5,984. Bids were opened June 4.

The Town Board of Bloomfield, Ind., has adopted an ordinance for paving the streets around the court house square with [illegible]ck. Remonstrances will be heard June 19.

The City Council of Connersville, Ind., it is reported, is receiving bids for the paving of a number of streets with brick, concrete, asphalt or other material.

Iowa.

✣Bids will be received until 9 a. m., June 12, by City Council, Des Moines, Ia., for paving with Warren's bitulithic paving on [illegible] 2 ins. of wearing surface upon [illegible] Portland cement concrete. Tonawanda rom the south line of Grand Ave. south line of Marsh drive, extended sterly across Tonawanda drive. About [illegible] yds. of pavement, more or less. o begin on or before the 22d day of 12, and to be completed on or before day of September, 1912. [illegible] is City Clerk.

s will be received until 9 a. m., June City Council, Des Moines, Ia., for with Warren's bitulithic paving, conof 2 ins. of wearing surfare upon 5 Portland cement concrete, Polk m the south line of [illegible] Ave. north line of Polk Pl. About 6,735 of pavement more or less. Work on or before the 20th day of July, d to be completed on or before the of September, 1912. Horace Susong Clerk.

will be received until 9 a. m., June R. Kroppach, City Clerk, Burlington, repaving with brick block and creo- [illegible] H. G. Vollmer is City Engineer. Ofvertisement will be found elsewhere in e.

will be received until 7 [illegible] by City Council at the office of C. W. City Clerk, Clarinda, Ia., for the folmprovements according to plans pre- T. S. Delay, Creston, Ia., Engineer. [illegible] and paving the following treets and portions of streets in the larinda, Iowa, to-wit: Washington St., east line of its intersection with 17th to and including its intersection with 18th St., from its intersection with ton St. north to and including its in- with State St.; State St., from its on with 18th St. west to and including ection with 22d St., and Chestnut St., intersection with 18th St. west for a of 196 ft: said paving shall be 6 ins. ess, and composed of one part Portnent, two parts sand and four parts tone; said curbing shall be laid where laid, and be 6 ins. in width and 20 pth, and composed of one part Portnent, two parts sand and four parts tone; and all to be constructed in ac- with the plans and specifications now on file in the office of the City said City. Approximately 7,450 lin. rbing and 12,300 sq. yds. of paving. shall cover the furnishing of all mad labor necessary for the making of et improvement, and the work therein on or before the 5th day of July, 12, and to be completed on or before ay of November, A. D. 1912.

City Council of Sioux City, Ia., has a contract to the National Construcof Omaha, Neb., for the paving of t., from Sixth to Seventh St., and between Pearl and Pierce Sts., olithic at $1.23 a sq. yd.

Des Moines Asphalt Co. has been the contract by the City Council Moines for the paving of Woodland 44th St. Bids on the work were as follows: Woodland Ave., 31st St., Des Moines Asphalt Co., 0, California or Mexican; $1.74, or Bermuda. Bryant Asphalt Co., $1.78. Forty-fourth street, Cham- Kingman, Des Moines Asphalt Co., lifornia or Mexican; $1.74, Bermuda lad. Bryant Asphalt Co., $1.66 and

City Council of Keokuk, Ia., has the contract for resurfacing Main meron & McManus, Keokuk, at the bid: Resurfacing brick pavement, r sq. yd.; macadam $1.68 per cu. yd.; 5 per cu. yd. in place; reconstructing ement with asphalt filler $0.53 per nacadam where necessary, $1.85 per extra sand where needed in place, cu. yd.

as Carey & Sons of Clinton, Ia., have rded the contract by that city, E. J. [illegible] Ave., from Second to Fifth Sts., at $29,074. Vitrified block will be used; also curbing and guttering. Bids were opened June 4.

⊙Thos. Carey & Sons, Weston Blk., Clinton, Ia., have been awarded the contract by that city, J. G. Thorne, City Engineer, for the construction of brick pavement at $30,024, for which bids were opened June 4. The work includes the following: 100 cu. yds. of excess grading; 12,900 sq. yds. of vitrified block; 1,250 lin. ft. of pillar curb; 2,506 lin. ft. of combined curb and gutter; 3,800 lin. ft. of resetting old stone curb; three track inlets; 194 ft. of gutter; two catchbasins; 200 lin. ft. of 10-in. vitrified pipe; 10 connections; adjusting 500 lbs. of gutter plates, and 100 lin. ft. of gutter curb.

The City Council of Perry, Ia., will shortly call for bids for the paving of Otley Ave., from Second to 12th Sts., and for the curbing of Sixth St., Warford, Third and Railroad Sts. Bids are to be considered on concrete, bitulithic and asphalt. C. E. Wilson is City Engineer.

Preliminary steps toward the laying of more street pavement have been taken by the City Council of Cedar Falls, Ia. Residents of Franklin St., from Second to 12th Sts., have petitioned for sheet asphalt. This work would include 15,000 sq. yds.

The City Council of Greenfield, Ia., passed a resolution ordering the paving of about 10 blocks. Bids will be asked for both brick and concrete.

Bids were received June 4 by the City of Clinton, Ia., J. G. Thorne, City Engineer, for paving work. The bids were taken on four classes of pavement, the unit bids received on these and on some of the other principal items of the work being as follows: (1) Standing for bid of Ford Paving Co., Cedar Rapids, Ia.; (2) McCarthy Improvement Co., Davenport, Ia.; (3) P. V. Clarke, Clinton, Ia.; (4) C. B. McNamara & Co., Dubuque, Ia.; (5) Carey & Sons, Clinton, Ia.:

	(1)	(2)	(3)	(4)	(5)
Vitrified block paving, 12,900 sq. yds.	$2.15	[illegible]	[illegible]	$2.09	$2.00
Asphalt paving, [illegible] sq. yd.	1.95	2.05			
Wood block paving, [illegible] sq. yds.	2.40				2.53
Concrete paving, [illegible]	1.20			1.44	1.30
Pillar curb, 1,250 lin. ft.	[illegible]	.85	.80	[illegible]	[illegible]
Combined curb and gutter, [illegible] lin. ft.		.70	[illegible]	.60	.70
Plain curb, 2,506 lin. ft.	.30	.40		.40	.70
Resetting old stone curb, 3,800 lin. ft.	.25	.40	[illegible]	.50	.25

[illegible] Ryan & Co., Davenport, Ia., bid $[illegible] per sq. yd.

Kentucky.

⊙The Louisville Asphalt Paving Co. has been awarded the contract by the Board of Public Works of Louisville, Ky., for the construction of asphalt pavement on Belleaire Ave., Emerald Ave., between Belleaire Ave. and Vernon St., and Bowling St., between 22nd and 25th Sts., at $1.90 a sq. yd. The work approximates $13,000. Other bidders were the American Standard Asphalt Paving Co., $1.98, and Bickel Asphalt Paving Co., $1.92.

⊙Bickel Asphalt Paving Co., of Louisville, Ky., has been awarded the contract by the Board of Public Works of that city, for the paving of Bowling Ave., for a distance of three blocks, at $1.92 per sq. yd. Bids were opened May 29.

Louisiana.

⊙The Highway Department of the Board of State Engineers, Frank M. Kerr, President and Chief Engineer, 104 New Orleans Court Bldg., New Orleans, La., has awarded the contract for the construction of 38 miles of earth roads from Colfax to Montgomery, Grant Parish, to L. B. Constant of Alexandria, La., at $79,282. Bids were opened June 4.

Maryland.

✣Bids will be received until June 19 by Board of Awards, Baltimore, Md., for the following contracts for street improvement: Contract No. 20—Resurfacing with sheet asphalt by the surface heater method. Over old asphalt, 3,000 sq. yds. Over old cobble, 17,400 sq. yds. Vitrified block paving, 250 sq. yds. Certified check $700. Contract No. 24—Vitrified block on a concrete base 3,000 sq. yds. Certified check $300. Contract No. 25—Granite block on a concrete base, 5,700 sq. yds. Certified check $600. Contract No. 26—Vitrified block on a concrete base. Vitrified block, 27,500 sq. yds. Granite block, 4,900 sq. yds. Certified check $2,500. Contract No. 27—Granite block on a concrete base 16,000 sq. yds. Certified check $2,000. In Contract No. 20 the resurfacing over old asphalt to be done for and under the supervision of the City Engineer, the remaining portion of this contract to be done under the supervision of the Paving Commission, C. A. Edel, Secretary. Specifications and proposal sheets can be obtained upon application to the office of the Paving Commission, City Hall. A deposit of $5 will be required for a specification covering each contract. This will not be refunded unless a bid is filed.

The City Council of Cumberland, Md., will on June 24 take up ordinances for passage calling for the paving with firebrick of the following streets: Allegany from Cumberland to Fayette; First, from Springvale to Virginia Ave.; Boone, from Virginia Ave. to Oak; Kearney, from Orchard to Wineow; Orchard, from Williams to Kearney; Oldtown road, from Virginia and Maryland Aves. to the Baltimore and Ohio Railroad; Goethe St., from Baltimore Ave. to the end of the street, and Frederick St., from Decatur to Linden.

The Paving Commission, R. K. Compton, Chairman, of Baltimore, Md., is to pave the following streets: Granby St., East Falls Ave. to Exeter St., vitrified brick; Exeter St., Baltimore to Lombard, granite blocks; Front St., Baltimore to Lombard, vitrified blocks; Castle St., Fayette to Madison, bituminous concrete; Richmond St., Castle to Howard, sheet asphalt or bituminous concrete; Low St., East to Aisquith, vitrified blocks; Exeter St., Fayette to Low, granite blocks.

Massachusetts.

✣Bids will be received until 1 p. m., June 15, by Town Selectmen, Southbridge, Mass., for grading and surfacing a portion of Worcester St. with broken stone. A certified check for $500 must be filed with each bid. J. A. Whittaker, Bank Bldg., is Engineer.

✣Bids will be received until noon, June 14, by L. K. Rourke, Commissioner of Public Works, Boston, Mass., for paving and regulating Park St., between Dorchester and Geneva Aves., Dorchester.

Governor Foss of Massachusetts, on June 3, signed the bill appropriating $5,000,000 for the construction of state highways. The bill provides that not more than $1,000,000 shall be spent in any year between 1912 and 1917

Governor Foss of Massachusetts has signed a measure authorizing the Metropolitan Park Commission, Boston, to expend not exceeding $200,000 a year for five consecutive years on the metropolitan parks, parkways and boulevards, as follows: For a parkway or boulevard near Horn Pond, from Pleasant St., Woburn, to Pond St., Winchester, $50,000; for a parkway or boulevard around Lake Quannapowitt, Wakefield, $50,000; for a parkway or boulevard from the junction of Mystic Valley Parkway and Main St. to Mystic Ave., Medford, $75,000; for a parkway or boulevard from Hancock St., Quincy, to Quincy Shore Reservation, $100,000; for ac-

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

quiring land around Lost Pond, Brookline, and around Hammond Pond, Newton and Brookline, $107,000; for acquiring land for a parkway from Boyden Sq., Dedham, to Stony Brook Reservation, $10,000; for acquiring land for a parkway or boulevard from Winthrop Parkway, Revere, to Winthrop Shore Reservation, Winthrop, $100,000; for a parkway or boulevard from Fresh Pond Parkway to Fresh Pond, Cambridge, $15,000; for a westerly drive in Middlesex Fells Parkway near Fellsmere Pond, Malden, $20,000; for acquiring land for a parkway or boulevard from the crossing of Columbia Road and the New Haven Railroad, to near Neponset Bridge, Boston, and from near Neponset Bridge, Quincy, to Quincy Shore Reservation, Atlantic, $475,000; for improvements on lands now held by the Metropolitan Park Commission at Dorchester Lower Mills, $8,000.

Highway Committee of the City Council of Chicopee, Mass., has reported in favor of expending $25,000 this season for macadamizing a number of streets. The committee has also suggested the expenditure of $5,000 for placing new preserved timbers and laying blocks on the Connecticut River bridge.

Michigan.

⊙The Schoolcraft County Road Commissioners, Manistique, Mich., has awarded the contract for the construction of 5 miles of state reward macadamized road, extending from Manistique to Cooks, to the Delta Contracting Co., of Escanaba, Mich., at $25,600. Other bidders were James Finn, $30,230, and Gust Fredeen, $34,550.

⊙The Globe Construction Co., of Kalamazoo, Mich., has been awarded the contract by the City of Kalamazoo, for the construction of some 50,000 ft. of asphaltic concrete with 2-in. wearing surface. The company's figures were as follows: Pioneer asphalt, 6-in. base, $1.34 per sq. yd.; 8-in. base, $1.43; Bermudez asphalt, 6-in. base, $1.40 per sq. yd.; 8-in. base, $1.49; Trinidad asphalt, 6-in. base, $1.49 per sq. yd.; 8-in. base, $1.49.

⊙The City Council of Alma, Mich., has let the contract for the paving of 11 blocks of the main thoroughfare, four blocks with brick and the remainder with concrete, to the Markle Coal & Cement Co., of Muskegon, Mich., on concrete, and G. A. Lowry, of Saginaw, Mich., on brick. The concrete pavement will have a 2-in. top with 5-in. base.

The City Council of Grand Rapids, Mich., has voted to pave Eastern Ave., from Wealthy to Franklin Sts., with asphaltic concrete. L. D. Cutcheon is General Manager of the Board of Public Works.

Minnesota.

✣Bids will be received until June 18, by County Auditor, Winona, Minn., for macadamizing about 21 miles of road. O. B. Leland is Engineer.

⊙It is reported that P. McDonnell of Duluth, Minn., has been awarded the contract by the City Council of Hibbing, Minn., for the paving of Second and Third Aves. and Pine, Center and Cedar Sts. with bitulithic at $2.40 a sq. yd. Other bids considered were: Warren Bros., bitulithic, $2.55; P. McDonnell, wood block, $2.70; Coons & Butler, 3-in. wood block, $2.57; 3½-in. wood block, $2.77; bitulithic, $2.63. Peterson & Johnson, Duluth, wood block, $2.93; bitulithic, $2.76. Fielding & Shepley, Minneapolis, Minn., 3½-in. wood block, $2.96; 3-in. wood block, $2.76. General Contracting Co., bitulithic, $2.52. E. A. Dahl, Duluth, wood block, $2.88.

The Village Council of Chisholm, Minn., has voted to pave Lake St., from Fourth Ave. to about 100 ft. east of Central Ave., and on Central Ave., from Lake St. to the south side of Chestnut St. Village Engineer F. C. Lang will prepare plans and specifications.

The City Commission of St. Cloud, Minn., has instructed the City Engineer to prepare plans and specifications for the macadamizing of East St. Germain St.

Civil Engineer Oscar Lidberg of Coleraine, Minn., has completed the survey for a new highway, 7 miles long, which it is thought will be built this year. The road begins on the west side of Coleraine and runs north through Arbo Township and into Balsam Township and connects with the Wabana Lake road.

Mississippi.

✣Bids will be received until July 1, by Commissioners of First Supervisors District, Lee County, Tupelo, Miss., for grading and macadamizing approximately 9½ miles including 40,000 cu. yds. of grading and 60,000 sq. yds. of macadamizing. L. G. Smith, Tupelo, Miss., is Engineer in charge.

⊙E. L. Garritson & Co., of Birmingham, Ala., have been awarded the contract by the Mayor and Board of Aldermen of Kosciusko, Miss., for the construction of a concrete sidewalk system at $25,000. The work includes curbs. Bids were opened June 4.

The citizens of Prentiss County, Miss., in the vicinity of Booneville, the county seat, at a recent election voted the issuance of bonds in the sum of $50,000 for good roads. Similar elections in two adjoining districts were defeated.

The Supervisors of Jackson County, Pascagoula, Miss., have appointed C. F. H. Lewis, R. L. Farnsworth and Charles E. Chidsey as commissioners of the separate road district made of District No. 3. The Commissioners are authorized to employ a civil engineer, lay out roads, to make contracts for the constructing and maintenance of roads, and to ask that the Board of Supervisors issue bonds for the separate road district to supply the money to build and maintain roads. The board is authorized to issue bonds after being advertised for 30 days, and if 20 per cent of the qualified voters of the road district do not petition against the issue, they are to be issued, and, if they do, an election is to be called to decide the will of the majority. Organization will be made at once.

Engineer Allen of Greenville, Miss., and his assistant, Victor Murphy, are beginning the work of engineering details of paving the streets of Greenwood, Miss. The pavement will be over 1 mile in length and will cost about $65,000.

The Supervisors of Grenada County, Grenada, Miss., have issued notice to the citizens and taxpayers that they propose to issue bonds at their July meeting to the amount of $60,000, $30,000 to be used in constructing and maintaining public roads and $30,000 for the erection of iron bridges in the county. This is made necessary by the bad condition of the roads and of the wooden bridges across several streams.

The following counties in Mississippi have either received petitions or voted bond issues for road purposes since October, 1911: Amite County, Liberty, county seat—Petition in District 3 for bond issue of $20,000 to build 40 miles of roads, to be heard at June meeting of Board of Supervisors. Alcorn County, Corinth, county seat—Issue of $50,000 for permanent roads. Atalla County, Kosciusko, county seat—Issue under advisement on June 1, 1912. Carroll County, Carrollton, county seat—Issued $30,000 general improvement. Chickasaw County, Houston, county seat—District 3, $50,000 for permanent roads. District 1 now has petition on file for $100,000 issue. Copiah County, Hazelhurst, county seat—District 1, $159,000 for permanent roads. Coahoma County, Clarksdale, county seat—$50,000 issue. DeSoto County, Hernando, county seat—$250,000 for permanent roads. Greene County, Leahesville, county seat—$25,000 to be issued June. Issaquenna County, Mayersville, county seat—$10,000 general improvement. Jasper County, Paulding, county seat—District 2, petition for $25,000 to be heard June meeting. Lee County, Tupelo, county seat—$50,000 for macadam roads. Lawrence County, Monticello, county seat—Petition for $125,000 to be heard June meeting. Lauderdale County, eridian, county seat—District 5, $50,000 go roads. Lafayette County, Oxford, county s —District 1, $100,000 for permanent road May 4, 1912). Madison County, county seat—$50,000 permanent road. Monroe County, Aberdeen, county seat District 4, $75,000. Prentiss County, B neville county seat—Third district voted ay 31 Qutman County, Belen, county seat $25,000 (voted Nov., 1911) general road wo Scott County, Forest, county seat—Distric , $75,000 (voted March 20, 1912), for co ruction and maintenance. Sharkey County Rolling Fork, county seat—$25,000 (vot Feb., 1912). Yalobusha County, Coffeevill county seat—District 4, $25,000 (voted M ch 30, 1912).

Missouri.

✣Jackson County Court, Indep Mo., will, it is reported, receive b June 25, for macadamizing 81st S Wornell Road to the State Line.

⊙The Columbia Paving Co. h awarded the contract by the City of Carrollton, Mo., for the paving tions of a number of streets at the bid: Earth excavation $0.29; mac cavation, $0.45; concrete curbing, $ set curbing, $0.08; paving on new $1.46; on old foundation, $1.25; S ginia St., with 4-in. sand base, $1.2

Montana.

✣Bids will be received until Ju City of Missoula, Mont., for 22,000 of pavement in two districts. Bids h called for on the following differe k of pavement: Asphalt, bitulithic, Dar hassam, hassamite, granocrete, vitirifi br creosoted wood block, gravel bituli phaltic macadam, asphaltic concrete, pa ment consisting of a 5-in. concrete le bituminous wearing surface, and cadam. F. E. Buck is City Engine

Nevada.

✣Bids will be received until 24, by Board of Washoe County sioners, Reno, Nev., for furnishing lowing: One 10-ton steam road rol; one 10-ton steam traction engine steam road roller and steam traction combined; one 1,000-gal. steel road sp wagon, with gasoline motor pump for filling same. The machinery to livered in Reno, Washoe County working order and ready for use; s chinery, if accepted by said board, to p for out of the general fund in De 1912, or June, 1913. W. A. Fogg of the Board.

New Jersey.

✣Bids will be received until 2 p. m. Ju 17, by Board of Street and Water Com sion, E. B. See, Clerk, Jersey City, for repaving Jersey Ave., from Montmery St. to the asphalt pavement at Mer St. with wood block. Specifications are at the office of the Clerk.

✣Bids will be received until 2 p 17, by Board of Street and Water Commissioners, E. B. See, Clerk, Jersey City, N. J., for the improvement of Wayne St. from the present stone pavement west of Gr St. to the stone paving at Corneliso Ave., in accordance with plans and specifications on file with the Clerk of the Board.

The Morris County Freeholders, Morristown, N. J., will make arrangements to start work on the roads in the un to be improved this year. Wm. E. Kin is County Engineer.

⊙The Orange Playground Com Orange, N. J., has awarded the contr for grading the Lincoln Ave. playground G. P. Olcott, East Orange, N. J., at abo $1 000. Contract for fencing the playgr was let to Joshua Collinson, East at $2,400.

⊙E. M. Mullin & Co., 72 Bay View Jersey City, N. J., have been awarded t tract by the Board of Street & Wate ners, Jersey City, N. J., for the im- nent of Lake St., between Hudson Blvd., ermania Ave., at 91.9 per cent. [illegible] pened June 3.

New Mexico.

General Assembly of New [illegible] Fe, on June 3 passed the [illegible] bills, which include the [illegible] popular vote in November of a proposi- to issue $500,000 in state [illegible] roads.

New York.

ids will be received until 11 a. m., [illegible] Department of Public Works, Buffalo, , for paving portions of May St., Zen- st. and Pauline St. Francis G. Ward nmissioner.

ids will be received until noon, July 2, ard of Village Trustees, Peekskill, N. the office of A. E. Cruger, Clerk, for Main St. in said village, from the east f Broad St. to the east line of property rly owned by John Cox, between the [illegible] and at street crossings [illegible] as follows: From the east line of Broad the east line of High St., with sound, urned paving brick; and from the east f High St. to the east line of property rly of John Cox, with asphalt street pav- ock, including about 10,100 sq. yds. of ent in accordance with the plans and cations on file with the village clerk. must be made to include digging, mak- undations, carting of surplus material, hing all material, labor, guards and The work will be required to be done in accordance with the plans and speci- ns, and pavements laid upon such grade wn on maps made by Reynolds & Chase, Engineers, and on file in the office of llage clerk at the Municipal Bldg.

ids will be received until 8 p. m., June T. H. O'Neill, Mayor, Auburn, N. Y., e construction of pavements in Lincoln cluding the following approximate quan- Lincoln St., 1,805 sq. yds. brick pave- 1,375 sq. yds. Medina block pavement, lin. ft. concrete combined curb and gut- ur surface water inlets. Five points, 1,- yds. brick pavement, 416 lin. ft. Medina g, 204 lin. ft. stone header, six surface inlets. Green St., 2,185 sq. yds. brick ent, 2,050 lin. ft. Medina curbing, four e water inlets. Certified check for the f $500 must accompany each proposal for f said pavements or a bond equal to 50 nt of the gross amount of the contract. specifications and blank bidding forms e obtained of Elbert C. Aldrich, City eer.

. J. Hartwell, West Broadway, Fulton. . has been awarded the contract by the of Public Works of that city, for the uction of 9,900 sq. yds. of brick pave- e $27,955. The paving will be [illegible] concrete curbs and 15-in. storm sewer rified pipe. Bids were opened June 6.

citizens of Lackawanna, N. Y., at [illegible] election voted in favor of paving lamburg Turnpike as a state highway. vitrified brick at a cost to the city and ners of property abutting on the Turn- f $40,000.

citizens of Medina, N. Y., at a recent n voted in favor of continuing Route ough the village with a full street wide pavement. The cost of the work with- village will be about $30,000.

ns are being prepared for the repaving lower Terrace in Buffalo, N. Y. Ac- g to Maj. Charles E. P. Babcock, As- t Engineer of the Bureau of Streets, expected to start work within five or eeks.

. J. Harnett, Fulton, N. Y., has been ed the contract at $27,955 by the Board ublic Works of that city for paving Broadway from the west line of West street to the D., L. & W. R. R.

North Carolina.

bt. G. Lassiter of Oxford, N. C., has warded the contract by the Town Coun- [illegible] were opened June 1. The work includes the following: 5,000 sq. yds. of mixed tarvia macadam on 4-in. concrete base; 2,500 yds. of excavating; 10,000 sq. yds. of macadam with tarvia binding. The gutters on street where mixed tarvia or macadam on concrete is to be used will be made of granite spalls. A. F. Brown & Son, Chatham, Va., are Engineers.

Ohio.

✣Bids will be received until noon, June 19, by Director of Public Service, Delaware, O., for furnishing the necessary labor and materials for the improvement of East Central Ave., from the east line of Sandusky St. to the west end of the bridge over the Olentangy River, by grading, underdraining, curbing and paving with vitrified brick or wood block, according to the plans and specifications on file in said office. J. E. Martin is Clerk.

✣Bids will be received until noon, June 15, by Board of County Commissioners, Sidney, O., for furnishing labor and material for the construction of a retaining wall along what is known as the Botkins Pike, located in Dinsmore Township, Shelby County, O. H. F. [illegible]

✣Bids will be received until noon, July 5, by Board of Hamilton County Commissioners, Cincinnati, O., for repairs, under Specifications No. 339, on Duck Creek road, between the corporation line of Cincinnati and the Deerfield road, Columbia Township. All bids must be accompanied by a bond for $500. Albert Reinhardt is Clerk.

✣Bids will be received until noon, June 28, by Board of Hamilton County Commissioners, Cincinnati, O., for the furnishing, under Specifications No 325, crushed stone on board cars at Winslow Park, or Blue Ash, for repair of the Plainfield Pike in Sycamore Township. A bond for $500 must be filed with each bid. Albert Reinhardt is Clerk.

✣Bids will be received until noon, June 12, by Director of Service, Galion, O., for the paving of Boston St., Union St., Walnut St. and alley north of East Main St. with brick, asphalt, asphalt block, wood block or treated macadam. E. C. Kochem is Clerk.

✣Bids be received until noon, June 24, by Council of the Village of Maumee, O., for furnishing the necessary labor and material for improving that part of Wayne St. extending from the easterly line of Ford St. to the easterly line of Kingsbury St., and that part of Dudley St. extending from the westerly line of Allen St. to the westerly line of Waite Ave. in said village, by grading, draining, curbing and paving the same on a concrete foundation with vitrified brick or block, asphalt block, Carbovia, Westrumite or bituminous macadam, or a concrete pavement with a surface sealed with bituminous materials, in accordance with the plans and specifications prepared by George Champs, engineer, and now on file in the office of the Village Clerk. Proposals will be received and contracts awarded for improvement of each street separately. G. V. Raab is Village Clerk.

✣Bids will be received at the office of the Commissioners of Greene County, at Xenia, Ohio, until noon June 21, 1912, for furnishing and placing as directed 850 cu. yds. loose limestone on the Columbus Road State Highway "E" pet. No. 389 in Cedarville Township, said county. Width of pavement 14 ft. Estimated cost of construction $1,402.50. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion July 21, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Perry County, at New Lexington, Ohio, until noon June 20, for gradin and paving with a waterbound macadam hav- ing a bituminous surface treatment the Ne Lexington and Corning Road State Highwa "A" pet. No. 403 in Pike Township, sa county. Length 5,972.5 ft. or 1.13 miles. Widt of pavement 14 ft. Estimated cost of constru tion $12,209. A draft or certified check f $300 shall be deposited with each bid. Th successful bidder will be required to give bon for an amount equal to the contract price. Da set for completion Sept. 1, 1912. Plans an specifications are on file in the office of th County Commissioners and the State Highwa Department. The State Highway Commi sioner reserves the right to reject any and a bids. James R. Marker, Columbus, O., State Highway Commissioner.

✣Bids will be received at the office of th Commissioners of Licking County, at Newar Ohio, until 10 a. m., June 22, 1912, for gra ing and paving the Newark Granville Exte sion Road State Highway "F" pet. No. 432, Newark and Granville Townships, said cou ty. Length 20,690 ft., or 3.92 miles. Widt of pavement 16 ft. Alternative bids will considered as follows: Bituminated concret estimated cost of construction $41,591. Tw course waterbound limestone macadam co struction, $36,509. Slag lower course, lim stone top course waterbound macadam, est mated cost of construction, $3,540. Sandsto lower course, limestone top course wate bound macadam, estimated cost of constru tion, $35,038. Two course waterbound ma adam with bituminous surface treatment, est mated cost of construction, $39,452. Slag lo er course limestone, top course water bou macadam with bituminous surface treatme estimated cost of construction, $39,084. San stone lower course, limestone top course wate bound macadam with bituminous surface trea ment, estimated cost of construction, $38,71 A draft or certified check for $300 shall deposited with each bid. The successful bi der will be required to give bond for amount equal to the contract price. Date s for completion, Sept. 15, 1912. Plans a specifications are on file in the office of t County Commissioners and the State Highwa Department. The State Highway Commi sioner reserves the right to reject any and a bids. James R. Marker, Columbus, O., is Sta Highway Commissioner.

✣Bids will be received at the office of th Commissioners of Wyandot County, at Upp Sandusky, O., until noon, June 24, for gradi and paving with a waterbound macadam Se No. 1 the Uncapher Road State Highway "A pet. No. 496, in Marseilles Township, sa county. Length 10,593 ft. or 2 miles. Width pavement 10 ft. Estimated cost of constru tion, $12,123. A draft or certified check f $300 shall be deposited with each bid. The su cessful bidder will be required to give bo for an amount equal to the contract price. Da set for completion Sept. 15, 1912. Plans a specifications are on file in the office of t County Commissioners and the State Highwa Department. The State Highway Commissio er reserves the right to reject any and a bids. James R. Marker, Columbus, O., is Sta Highway Commissioner.

◉Robt. McMelleu of Shadyside, O., h been awarded the contract by the Board Bedmont County Commissioners, St. Clair ville, O., for the construction of a concrete r taining wall along Captina Creek, near Dove York Township, 300 ft. long, 6 ft. high, 3 at base and 18-ins. on top. The contract pri is $5.45 per cu. yd. Bids were opened May by Emerson Campbell, County Auditor.

◉The Andrews Asphalt Paving Co. h ben awarded the contract by the city of T ledo, O., for grading, curbing and paving A burn Ave., with sheet asphalt at $22,202. Bi were opered May 23.

◉The Board of Control of Cincinnati, C has awarded the contract for the paving Halpin Ave., from Linwood to Griest Ave with macadam, to the Kirchner Constructi Co., at $10,404.

◉David Beard has been awarded the co tract by the Board of Control of Dayto for the paving of Clover St., from Fill- re to Nassau Sts., with Portsmouth brick $11,605. Hecker & Kirchner secured the ntract for grading and graveling Euclid e. at $1,470 and Sachs St. at $1,263.

A. Emery & Son of Zanesville, O., have en awarded the contract by the Depart- nt of Public Service of that city for the ing of four streets, as follows: Ohio , $1.43 per sq. yd.; Sunset Ave., $1.55 sq. yd.; North St., $1.55 per sq. yd., l Hall Ave., $1.65 per sq. yd.

F. G. Breslin of Louisville, Ky., has been arded the contract by the Board of Hamil- County Commissioners, Cincinnati, O., for oiling of the Loveland and Madina Road, mington to Loveland. The contract price $740. Bids were opened May 31.

F. G. Breslin of Louisville, Ky., has been arded the contract by the Board of Hamil- County Commissioners, Cincinnati, O., for oiling of the Cleves and Warsaw pike from nway Ave., to the east line of Addyston in een and Delhi Townships at $1,192. Bids re opened May 31.

Plans have been prepared and contracts will let about Sept. 1, 1912, for the construc- n of 12,000 sq. yds. of brick pavement in city of Fremont, O., at an estimated cost $28,000. The foundation will be of con- te or stone with 5-in. by 20-in. stone curb l tar, asphalt, cement or sand filler. Wm. Schepflin of Fremont is Engineer. G. eider is Director of Public Service and in rge of the work.

The City Council of Toledo, O., secured following bids recently for the repaving Main St.: Andrews Co., with sheet as- lt, $19,491; Warren Bros., sheet asphalt, ,165; Garrigan Bros., with brick, $19,903. ls received on wood block ranged from ,000 to $28,000.

The City Council of Massillon, O., has sed an ordinance providing for the pav- of South Erie St., from the end of the sent paving to the corporation line. H. Yost is City Engineer.

City Engineer Phil Weber of Canton, O., estimated the cost of paving Dueber e., from Navarre St. to the W. & L. E. ilroad at $34,099. Bids are to be received once.

The Village Council of Tippecanoe City, has passed a resolution declaring it neces- y to improve Main St., from the canal dge to Hyattsville St., by paving.

Oklahoma.

The City Commission of Oklahoma City, la., it is reported, has awarded the con- ct for the paving of Francis St., between h and 19th Sts., to the Western Paving , at $6,920. The Cleveland Trinidad Pav- Co. submitted a bid of $7,004

Oregon.

The City Engineer of Roseburg, Ore., has mated the cost of paving Winchester St. h concrete material at $13,480. The City uncil has ordered the work done. Other eets authorized to be paved with concrete : North Jackson St., Second Ave., South Second Ave. North, $15,291; Third St., 99; East Third St., First Ave. South Commercial Ave., $3,369, and Brockway, to Jackson St., $2,871

Pennsylvania.

✣Bids will be received until 10 a. m., June by Department of Supplies, Philadelphia, , for furnishing the following: Class B. cks, cinders, trap rock, screenings, etc. ss L. Lumber. Fire Extinguishers for nvention Hall. Steam road rollers for reau of Highways.

✣Bids will be received until 10 a. m., June by State Highway Department, Harris- g, Pa., E. M. Bigelow, Commissioner, the reconstruction of 45,460 ft. of as- ltic macadam road, 16 ft. wide, beginning the intersection of the Street Road and rk Road in the Village of Warminster, cks County, and extending in a northeast- direction through the villages of Harts- e, Jamison, Bridge Valley and Furlong to the Village of Buckingham, in Bucks County. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check made payable to Edward M. Bigelow, State Highway Commissioner, in the sum of $4,000.

✣Bids will be received until 10 a. m., June 18, by the State Highway Department, Harrisburg, Pa., for the reconstruction of 10,334 ft. of asphaltic macadam road, 16 ft. wide, situated as follows: From end of State Road Station 915+90 to Philadelphia Pike at Gap, Station 1019+24 in Salisbury Township, Lancaster County. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and 54 Hartman Bldg., York, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check made payable to Edward M. Bigelow, State Highway Commissioner, in the sum of $2,000.

✣Bids will be received until 10 a. m., June 18, by the State Highway Department, Harrisburg, Pa., for the reconstruction of 1,337.2 ft. of concrete road, 14 ft. wide, beginning at a point where the Fayette Springs Road intersects the National Pike at Chalk Hill, Station 0+00, and extending along said Fayette Springs Road to Station 13+37.2 in Wharton Township, Fayette County. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and Washington, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check made payable to Edward M. Bigelow, State Highway Commissioner, in the sum of $500.

⊙The Borough Council of Dale, Pa., has awarded the contract for furnishing brick during the summer to the Clymer Brick & Fireclay Co., of Clymer, Pa., at $18 per M. The Council also awarded a contract for the paving and excavating to Jones & Suppes at $24,924 for brick, tar, macadam and concrete, or $24,370 without concrete.

Bids as follows were received June 14 by Department of Public Works of Philadelphia, Pa., for about $3,000 of asphalt resurfacing: Union Paving Co., $1.12 to $1.32 a sq. yd.; Barber Asphalt Paving Co., from $1.30 to $1.50 a sq. yd.; Eastern Paving Co., work on 45th St., $1.27 a sq. yd.

South Carolina.

G. Frank League, Clerk and Treasurer of Greenville, S. C., will sell bonds June 25 to the amount of $115,000, for the purpose of paving streets and laying sidewalks. Henry Briggs is Mayor.

South Dakota.

The City Commission of Sioux Falls, S. Dak., has passed resolutions providing for the paving of Phillips Ave., from Seventh St. to 14th with concrete; from 14th to 18th with concrete, and Sixth St., from Weber to Nesmith, with concrete. S. B. Howe is City Engineer.

Texas.

⊙W. L. Pierson & Co., of Houston, Tex., have been awarded the contract by the Galveston County Commissioners, Galveston, Tex., for additional work on the causeway, that of protecting the fill on the last 1,000 ft. connecting with the island—not contemplated in the original plan. The work will cost approximately $45,000.

⊙The City Council of Temple, Tex., has awarded the contract for the paving of North Main St., with vitrified brick, to Och Br

The business men of Temple, Tex. ave raised a fund of $1,000 among then ves by subscription with which a modern reet sprinkling outfit will be purchased an pre-sented free to the city government.

⊙The Commissioners' Court, Pal ine, Tex., have awarded the contract for 2 iles of sand clay roads on the Concord oad to C. H. Black and V. H. Safford.

Following bids were received May by Maj. Earl I. Brown, Corps of Engi ers, U. S. Army, Galveston, Tex., for con uction of protection to fill behind sea all, Fort Travis, Galveston, consisting of de- walk, pavement and concrete drains: (1) Standing for bid of F. Freund & Co., Gal- veston; (2) Kelso & Vautrin, Galv on; (3) A. C. Falligant, Galveston; (4) P Funston, Little Rock, Ark., and (5) & Dugon, Newport, R. I.:

	(1)	(2)	(3)	(4)
Concrete pavement, 3,500 sq. yds.	$1.19	$1.23	$1.36	$2.25
Vitrified brick pavement, 8,700 sq. yds.	1.90	1.82	1.94	2.25
Concrete curbing, 6,800 lin. ft.	.57	.48	.44	1.00
Vitrified sewer pipe, [illegible] in., 12[illegible] lin. ft.	1.49	.25	.30	.60
Concrete drains with 10 catchbasins, 2,800 ft.	.70	.48	.70	2.25
Concrete steps, 20 cu. yds.	22.00	17.00	11.00	40.50
Concrete walks, 45 sq. yds.	1.27	1.23	1.46	2.25

Utah.

⊙The City Commissioners of Logan, have awarded the contract for the con uction of 12 miles of pavement to Jose E Wilson, Jr., of Logan, at $39,541. Othe id ders were: Wheelwright Construction o., Ogden, $45,176; N. S. Andrew, Logan, 2,- 937; L. S. Hill, Wellsville, $42,228, and Kay & Reed, Ogden, $48,439.

Virginia.

The Board of Supervisors of Prince G ge County, Va., Prince George, county sea re- jected all bids received May 31, for the ld- ing of 2½ miles of gravel and sand clay between Middle Road and Bull Hill Road has decided to do the work by day labo D. Temple is Clerk of the Board.

Washington.

✣Bids will be received until June 24, is reported, by Snohomish County Au r, Everett, Wash., for the improvement of o- homish-Monroe road.

⊙The King County Commissioners, Se e, Wash., have awarded the contract for e construction of County Permanent Hig y No. 3-A T. Ryan at $57,088 on No. 2 with 5-in. concrete base and 5-year guar- tee.

⊙The King County Commissioners, Se e, Wash., have awarded the contract for e construction of Warrenite pavement on d No. 1-A to H. A. Jordan at $36,203. e pavement will be 4-in. concrete base h 5-year guarantee.

⊙Sam Boldman of Dayton, Wash., s been awarded the contract by that city r laying the concrete walk and curbing ar d the Central school grounds at $1,582. work includes 7,000 ft. of walk and 10 lin. ft. of curb.

⊙The Board of Public Works of Bell- ham, Wash., has awarded the contract r the improvement of Bay St., from Holl o Champion St., to C. A. Roberts at $5,271

⊙C. E. Andres, Anacortes, Wash., has awarded the contract at $6,378 for the - struction of the McMurray-Snohomish r .

Bids as follows were received by the y of Spokane, Wash., for grading and pa g of Union Ave. S.: Keasal Construction asphalt, $95,694; N. A. Jones, asphalt, $1- 590; Jos. Warter, bitulithic, $92,880; Wa Const. Co., bitulithic, $101,000; W. J. Mur asphalt, $89,797; J. F. Hill, bituminous - crete, $102,072, asphalt, $106,816; A. H. R- inson, asphalt, $99,591, asphalt concrete, $- 538; Washington Paving Co., granitoid, $- 783, asphalt, $88,574; El Oso, $87,643.

⊙Bids were opened May 17 by the T of Goldendale, Wash., Samuel C. Lancas , Consulting Engineer, for paving Local

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ent District No. 5, the contract being d to the J. F. Hill Paving Co., Chi- [illegible] at $1.18 per sq. yd. [illegible] onsisting of 4 ins. of broken stone 2-in. asphaltic concrete surface. The lso includes grading, curbing, sewer c., this portion amounting to $25,581 king the total amount of the contract Bids on the paving work proper were l under two plans. Under one se plans bids were received on ots of pavement—17,000 sq. yds. 3,000 sq. yds. Under the sec- n bids were taken on 45,000 sq. yds. llowing are the unit bids received on ond plan: (1) Standing for Jeffery on; (2) for G. B. Hooley; (3) for te Paving Co.; (4) Spokane Paving truction Co.; (5) for J. F. Hill Pav- ; (6) for Kibbe-Welton Co.; (7) for Bitu-Mass Co., and (8) for Secor The following figures show the rates at which the various bidders pro- o furnish labor for force account the [illegible] paving

	Fore-man.	Laborer.	Team labor.
[illegible]	[illegible]	[illegible]	[illegible]
....	5.00	2.75	6.00
[illegible]	[illegible]	[illegible]	[illegible]
....	7.00	3.00	7.00
....	5.00	2.50	5.00

[illegible]

[illegible]	(4)	[illegible]
[illegible]	[illegible]	[illegible]
6-in. Rockalite asphaltic oil macadam, 1 [illegible]	[illegible]	[illegible]
[illegible]	(2)	[illegible]
6-in. asphaltic macadam, 2-in. surface [illegible]	(2)	1.[illegible]
[illegible]	[illegible]	[illegible]
5-in. concrete, 2-in. asp. con. surface..	(4)	1.53
[illegible]	[illegible]	[illegible]
4-in. crushed rock, 1¾-in. asp. con. surface	[illegible]	[illegible]
4-in. crushed rock, 1½-in. asp. con. surface	(5)	1.09
4-in. concrete, 1-in. binder, 1½-in. surface	(5)	1.78
4-in. concrete, paint coat, 1½-in. sheet [illegible]	[illegible]	[illegible]
5-in. concrete, asphalt cement coat....	(5)	1.36
Bitu-Mass.—		
2-in. bituminous base, 2-in. surface.....	(7)	1.12
5-in. macadam, 1 application of 75% oil, [illegible]	[illegible]	[illegible]

City Engineer Charles Ewart of Aberdeen, Wash., has reported to the City Council that an 8-ft. roadway can be laid to replace the present road on Front St., in South Aberdeen, to the county highway, for $2,700. The Engineer suggests a 16-ft. roadway at an estimated cost of $4,000.

Wisconsin.

✣Bids will be received until 2 p. m., June 15, by Board of Public Works, LaCrosse, Wis., for paving with brick Mormon Coulee Road, from 8th St. to Green Bay St. The work will include 813.4 cu. yds. of grading; 246 lin. ft. concrete headers, and 1,730 sq. yds. of brick paving. Fred Schnell is a member of the Board.

✣Bids will be received until 10:30 a. m., June 14, by Department of Public Works, Milwaukee, Wis., for the removing of defective and replacing sidewalks in 18th, 19th, 20th, 21st, 22nd, 23rd, 24th and 25th wards.

⦿Gus Olson has been awarded a contract by the Town of Woodruff, Wis., for the construction of 13,000 sq. ft. of cement walks.

⦿John Braun, North 5th St., Sheboygan, Wis., has been awarded the contract by that city, C. U. Boley, City Engineer, for the construction of concrete pavement at $35,839. The work includes 23,475 sq. yds. of pavement and 11,000 lin. ft. of combination curb and gutter. Bids were opened June 8.

Canada.

⦿The Maple Leaf Stone & Paving Co., of Simcoe, Ont., has been awarded the contract by the city of Sault Ste. Marie, Ont., W. H. Munro, Mayor, for the construction of about 169,000 sq. yds. of cement-concrete sidewalks at $0.14 per ft., and 21,000 lin. ft. of curbing at $0.30 per ft. Bids were opened May 27.

Bids received on May 31 by the City Clerk of Victoria, B. C., for the construction of some 211,000 sq. yds. of paving, have been rejected and the work has been postponed indefinitely. C. H. Rust is City Engineer.

RRIGATION, DRAINAGE, LEVEES AND CANALS

Arizona.

and specifications are understood to en completed for the diversion dam d works for the canal of the Pinal Irrigation Co., near Florence, and cely that construction contracts will the near future. Jas. D. Schuyler, Trust Bldg., Los Angeles, Cal., is con- [illegible]

California.

will be received until 2 p. m., June . S. Reclamation Service, 605 Fed- g., Los Angeles, Calif., for furnishing ivering f. o. b. cars shipping point -horsepower, 2,200-volt induction mo- e 50-horsepower, 2,200-volt induction [illegible] four 4,500 volt, 100 ampere [illegible] O. H. Ensign, Engineer.

Idaho.

are under consideration for the ir- of about 6,000 acres of land on Lit- ow, 9 miles east of Payette. The ntemplates damming Little Willow construction of the canals and later- conducting the water impounded by C. W. Helser, Boise, Idaho, is in-

Illinois.

will be received, it is reported, by J. ommissioner of Drainage, R. F. D airmont, Ill., for a drainage district in Township, Vermilion County, Ill. The ill require, it is said, the following : 1,350 ft. of 8-in., av. depth 6 ft. 3 0 ft. of 10-in., av. depth 6 ft. 3 ins.; of 12-in., av. depth 6 ft. 10 ins.; 1,- f 12-in., av. depth 3 ft. 8 ins., max- pth 11 ft. 1 in. Certified check for nt required with bids.

will be received until 1 p. m., June . E. Thomas and W. H. Nimmo, Commissioners of Sub-District No. age District No. 2, Pitman, Ill., for g the following drain tile f. o. b. ggoner, Ill.: 1,100 ft. 24-in. drain tile, 2,100 ft. 22-in. drain tile; 1,800 ft. 20-in. drain tile; 2,100 ft. 18-in. drain tile; 3,100 ft. 16-in. drain tile; 1,485 ft. 14-in. drain tile; 2,130 ft. 12-in. drain tile; 1,570 ft. 10-in. drain tile; 1,950 ft. 8-in. drain tile; 1,260 ft. 6-in. drain tile. Also for unloading from cars, hauling and distributing said tiles. Also for the work of excavating trenches, laying tiles and refilling the trenches as follows: 24-in. main, 67 rds., av. depth 5.5 ft.; 22-in. main, 127 rds., av. depth 6.0 ft.; 20-in. main, 109 rds., av. depth 6.3 ft.; 18-in. main, 127 rds., av. depth 5.6 ft.; 16-in. main, 188 rds., av. depth 6.0 ft.; 14-in. main, 90 rds., av. depth 5.7 ft.; 12-in. lines, 128 rds., av. depth 5.1 ft.; 10-in. lines, 94 rds., av. depth 5.2 ft.; 8-in. lines, 118 rds., av. depth 4.9 ft.; 6-in. lines, 76 rds., av. depth 4.7. ft. The work is to begin by or before Sept. 15, 1912, to be prosecuted vigorously, and to be fully completed by or before April 15, 1913. Bids must state prices upon seperate items. The Commissioners reserve the right to reject any or all bids, and to increase or decrease the length of drains. A certified check or cash deposit of $100 must accompany each bid, the same to be retained until contracts shall have been awarded and executed. Detailed plans and specifications for this work are on file with Ed Pearman, Town Clerk, at Waggoner, Ill., or may be examined at the office of J. W. Dappert, Engineer, at Taylorsville, Ill.

Preliminary surveys have been started for the levee and drainage district to be built along Cahokia Creek from Poag to Carpenter, west of Edwardsville. The improvement includes the removal of many curves in the creek, reducing its present length from 18 to eight miles, and the construction of levees to restrain flood waters. The improvement will cost about $500,000. Sheppard & Morgan, Edwardsville, Ill., are the engineers.

Indiana.

⦿Contracts for constructing six branches of the Peter Saber Ditch, bids for which were opened June 1 by P. J. Troyer, Superintendent of Construction, Plymouth, Ind., have been let as follows: Sec. 6, Portland Drain Tile Co., Portland, Ind., at $402; Sec. 10, John Killian, Nappanee, Ind., at $650; Sec. 16, John Killian, Nappanee, Ind., at $119; Sec. 12, Charles Brown, Tyner, Ind., at $400; Sec. 17, Ira Morris, Walkerton, Ind., at $400; Sec. 18, Wm. H. Morris, Walkerton, Ind., at $200.

The Hancock County Court, Greenfield, Ind., is to hold a hearing on the petition for dredging Brandywine Creek from the north to the south county lines, and also Swamp Creek.

Report on the proposed Wabash-Patoka River Levee has been filed by the Levee Commissioners with the Circuit Clerk at Princeton. This project includes the straightening and dredging of the Patoka River and the construction of a levee along the Patoka and Wabash Rivers from a point near Dongola, Pike county, on the Patoka and Wabash Rivers from that stream to the Wabash, thence south to New Harmony. The drainage and levees is one of the largest projects of its kind ever promoted in Southern Indiana and would affect many thousands of acres of fine land in Pike, Gibson and Posey counties. J. S. Spiker, Vincennes, Ind. is the engineer.

Petition has been filed in the Circuit Court at Brownstown, Ind., asking for the construction of a 9-mile levee to protect 5,000 acres of land in Carr Township from overflow from the White River. Kochenour & Price, Brownstown, Ind., are attorneys for the petitioners.

Iowa.

✣Bids will be received until June 20, by J. L. Hanrahan, County Auditor, Fort Dodge, Ia., for the construction of Humboldt-Webster Joint Ditch No. 102-05. The main ditch will be 21,300 ft. long and 6 and 10 ft. wide at the bottom, 3 to 15 ft. deep, slopes 1 to 1, requiring excavation of 156,000 cu. yds., estimated to cost 10 cts a yard. The following tile will be required: 1,200 ft. of 8-in., av. depth 5 ft.; 825 ft. of 10-in., av. depth 5.5

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

900 ft. of 12-in., av. depth 6 ft., 1,500 ft. of 6-in., av. depth 6 ft.; 2,000 ft. of 18-in., av. depth 10 ft.; 1,200 ft. of 22-in., av. depth 7 ft. The nearest railroad station is Vincent, Iowa, two miles from starting point of the work. Work must be begun by July 1, 1912, and completed by Jan. 1, 1913. C. H. Reynolds of Fort Dodge is the Engineer. Certified check for 10 per cent required with bids.

The sum of $80,000 is reported to have een subscribed for the construction of a canal from the Cedar River at Moscow o the Mississippi at Muscatine, the force of which will be used in developing power along he line followed in the Keokuk dam. G. M. Titus, Muscatine, Ia., is reported to be interested.

Massachusetts.

✣Bids will be received until noon, June 14, by L. K. Rourke, Commissioner of Public Works, Boston, Mass., for furnishing and driving spruce piles for sewerage works in Gove St., between Cottage and Geneva Sts., East Boston.

Mississippi.

✣Bids will be received until noon, July 1, by J. H. Nelms, Chairman, Board Washington County Drainage Commissioners at the office of B. B. Gordan, Engineer, 430 New Weinberg Bldg., Greenville, Miss., for the construction of about 19 miles of dredge ditch from 6 to 56 ft. bottom and including approximately 1,960,000 cu. yds.

Bids were opened June 3 by Maj. J. A. Woodruff, U. S. Engineer, Vicksburg, Miss., for the construction of about 1,607,000 cu. yds. of levee in the Third District; all the bids were recommended for rejection. The bids received were as follows, (1) standing for bid of Sessions & Williams, Millikin, La., (2) for bid of W. T. & E. M. Lowrance & Co., Transylvania, La., (3) for bid of Helgason, Clark & Co., Vicksburg, Miss., and (4) for bid of Roach-Stansell & Co., Memphis, Tenn.:

	(1) Cts.	(2) Cts.	(3) Cts.	(4) Cts.
ower Yazoo Levee District, Miss.				
eaulah, Miss., 2050-2205. 404 L.				
Section 1, about 100,000 cu. yds.	....	35*	33*	31.7*
Section 2, about 100,000 cu. yds.		35*	33*	31.7*
Section 3, about 100,000 cu. yds.		35*	33*	31.7*
Section 4, about 100,000 cu. yds.	....	35*	33*	31.7*
Section 5, about 100,000 cu. yds.		35*	33*	31.7*
Section 6, about 100,000 cu. yds.	32.5	35*	33*	31.7*
Section 7, about 92,000 cu. yds.	....	35*	33*	31.7*
pper Tensas Levee District, Ark. and La.				
ake Jefferson, Ark., 690-692. Ark. R.				
One section, about 60,000 cu. yds.		40	[illegible]	37.5
anther Forest, Ark., 1750-1780. 452 R.				
Section 1, about 100,000 cu. yds.		46.9*	52.5*	48.9
Section 2, about 100,000 cu. yds.		46.9*	52.5*	48.9*
Section 3, about 100,000 cu. yds.	....	46.9*	52.5*	48.9*
Section 4, about 103,000 cu. yds.		46.9*	52.5*	48.9*
alem, La., 2466-2533. 563 R.				
Section 1, about 100,000 cu. yds.	....	36.2*	33.9*	34.9*
Section 2, about 100,000 cu. yds.	29.7	36.2*	33.9*	34.9*
Section 3, about 100,000 cu. yds.	....	36.2*	33.9*	34.9*
Section 4, about 152,000 cu. yds.	....	36.2*	33.9*	34.9*

*All or none.

[1]Wish to undertake one section only.

[2]If awarded contract for Panther Forest, Ark., no other bid to be considered.

[3]Wish to undertake only about 475,000 cu. yds.

[4]Quantity bidder wishes to undertake not stated.

Montana.

Work will be started shortly, it is believed, on an 8-mile canal to irrigate land the vicinity of Townsend, Mont. The water will be diverted from the Missouri River ear Toston. Lewis Penwell, Helena, Mont., interested.

The U. S. Reclamation Service has rejected all bids received May 21 for the construction of laterals, waste water ditches and ructures on the first unit, Dodson South anal, Milk River Project, Mont. The unit ds on this work were given in our last sue. Geo. O. Sanford, Malta, Mont., is roject Engineer.

New Mexico.

✣Bids will be received until 2 p. m., June , by U. S. Reclamation Service, Elephant utte, N. Mex., for furnishing ball mills, tube ills, a rock crusher, a rotary dryer and a ixing and weighing machine for a sand cement plant on the Rio Grande project, New Mexico. F. H. Newell, Washington, D. C., is Director.

New York.

✣Bids will be received until noon, July 2, by Duncan W. Peck, Supt. of Public Works, Albany, N. Y., for the following contracts on the Barge Canal: Contract No. 8-A, Erie Canal—Section 2. For the construction of Lock No. 8, and the substructure of Dam No. 4 in the Mohawk River at Scotia, together with the replacement of defective concrete and the completion of protective paving, etc., for locks and dams at Rotterdam and Crane Village. Sheets 1 to 10 inclusive. Contract No. 103, Oswego Canal—Section 1. For constructing a bridge over the Oswego River and Canal at Lock St., Phoenix, N. Y. Sheets 1 to 6 inclusive. Plans may be seen and detailed specifications, engineer's estimate of quantities, proposal blanks, form of contract and bonds required and other information for proposers may be had at the office of the Superintendent of Public Works at Albany, N. Y., at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, N. Y.; at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, N. Y.; and at the canal office, Spaulding's Exchange, Buffalo, N. Y. Copies of detailed plans or drawings may be obtained from the State Engineer and Surveyor at Albany, N. Y., upon payment to him of the cost of producing them.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE.)

A sanguine chord was struck in the levee builders' hearts when the bids at Major J. A. Woodruff's letting in Vicksburg on the 3d were opened and it was seen that prices had returned to the old standards of 15 years ago. Although over a million yards of choice work was offered, the contractors showed a marked indifference to grabbing up the work at the prices which have held sway of late and the lowest bid turned in to the government was about 30 cents, while the highest was 54 cents. Of course, Major Woodruff rejected all bids and has readvertised the work. But according to the boys who pile up the dirt, the fact that Major Clarke S. Smith will offer over a million yards on the 10th of this month, the Vicksburg office need not expect even as good prices as were submitted on the 3d of this month, and many deem the major's action in rejecting the bids as being most unwise. The fault seems to have rested with the engineers who made up the approximate prices at which the work would go. These men based their figures on those prices which have been submitted for many years past, but failed to take into consideration the fact that the vast volume of levee work to be let by the government and levee districts will in itself raise prices beyond all former records, which fact, combined with the present high feed costs, will necessitate a large increase over former figures. In view of the fact that for e first time in fifteen years prices for lev work have assumed the normal figure, it w be of interest to the contractors at large to t here the result of the Vicksburg letting. e bids were as follows:

	Cents.
BEULAH, MISS., CREVASS.	
Helgason, Clarke & Co., Vicksburg, Mis	[illegible]
Sessions & Williamson, Greenville, Miss	[illegible]
Lowrance Brothers, Memphis, Tenn.	[illegible]
Roach & Stansell, Memphis, Tenn....	31 7
LAKE JEFFERSON, ARK.	
Helgason, Clarke & Co., Vicksburg, M.	[illegible]
Lowrance Brothers, Memphis, Tenn..	[illegible]
Roach & Stansell, Memphis, Tenn...	[illegible]
PANTHER FOREST, ARK	
Helgason, Clarke & Co., Vicksburg, Mi.	[illegible]
Lowrance Brothers, Memphis, Tenn...	[illegible]
Roach & Stansell, Memphis, Tenn.....	[illegible]
SALEM, LA.	
Helgason, Clarke & Co., Vicksburg, Mi	[illegible]
Sessions & Williamson, Greenville, Mis	[illegible]
Lowrance Brothers, Memphis, Tenn...	36
Roach & Stansell, Memphis, Tenn.....	34

To a representative of this paper Cap T. Helgason of Vicksburg, one of the in est bidders and the best all round old tin lev builder in that section, had the follow marks to make regarding the letting, point of view is valuable inasmuch as presses the feelings of the entire conc levee boys in this section and is an e hint to the state board engineers o which they will later have to offer. Tom said: "In explanation of the hig bid on this work, it must be taken into eration the cost of keeping up an team put on the ground costs us $7 counting the cost of feed, which right higher than a cat's back. Also any o does not connect with enough work t them busy at one letting will soon ha other chance, as Memphis will let yds., and New Orleans over yds. in the near future, so contractors falling over themselves to cut prices to get a look in on the work. I will to say that at the next letting, prices at least 20 per cent higher than they show this letting. Another thing that is b prices is the fact that it is absolutely sary that the majority of the work let in shape to stand the next high water, as tically all the work is in closing breaks; contractor can hardly afford to take work when he has so short a time to In fact, it was a surprise to me to lear these bids were considered high, as all levee men think we took a chance in b as low as we did. Also you must rem that the government is going to hold us ly to the eight hour law, so the workin will be cut down considerably. All take consideration, the prices submitted were all too high."

Quite a bunch of the old fellows were es ent at the Vicksburg levee letting on t 3d Mike Roach and the Lowrance boys ent down from Memphis and shucked their and sharpened their pencils and went aft the work in good shape. John Sessions of Gen ville mixed with Norris Williamson of ake Providence, La., and had a winning bid on part of the work if same had not bee rejected. Mike Lannin came up from Rouge to see the fun and was ready t some from the lucky bidders. Bob C ke, Lee Picket and Pat Harris were there Natchez and combined to make some prices. Bob Leonard of Memphis, Jim of Arkansas City and L. C. Dulaney of (Miss., were bidders on the work, as we the two Helgason boys of Vicksburg. H. F. bish of eight hour law fame and Bill M were present at the opening and joined i the general expression of surprise at the bid ing cast out.

Major Smith of the Memphis office is dering what he will have to pay for his to be offered on the 10th. In view of the that so many of the local levee boards are paring for new levees and the additional that Major Woodruff at Vicksburg will a million and a half yards to offer agai side of thirty days, the indications poi that Mayor Smith will [illegible] price for his contracts.

Burke & Son of Kansas City, Mo., are arket for a good sized piece of nice rk. They have a mighty nice little d are on the lookout for a chance to inch of work. These people can be care the Western Wheeled Scraper insas City.

ant, Tenn., will shortly let about ft. of concrete sidewalks. Practi- of this work will be put in along East eet. The appropriation by the city ides for a line of board walk, but it tood that the difference in cost will up by a private subscription. Write lerk.

Littlejohn, who was formerly in f the Roach-Manigan Paving Co.'s this point, left recently to take the f cashier on this company's big Hel- act. Cleve is on to his business and [illegible] t will not be in his department.

Shannon, plant superintendent of 1-Manigan Paving Co., left Friday Fort Worth, where he will be back stamping ground. Harry came here ne plant turning out hot stuff for enue, and now that the latter con- nished has to hustle back to Fort here they are badly in need of him. e to go a long way to find a better a more experienced man in his line

ts of the St. Francis Basin are cir- petition asking the United States it to take entire charge of the Mis- ee system. Their contention is that tate levee boards will maintain dif- ndards in levee construction, which make some sections of levee weak- thers, whereas a standard line of ld be of the same strength through- tire length, and much better able to the overflow.

The Park Commission of Memphis is casting around for some method of raising a sufficient sum to preserve Riverside Park. Recently the caving of the banks has grown to such serious proportions that it has become necessary to close the west drive. It will require perhaps $150,000 to repair damages and arrange for a method of protection against further caving. Riverside Park is one of the most beautiful recreation spots in Memphis, and something must be done, and done soon, or there will be no park left, for at the rate the banks are caving, ten or twelve years would find the river banks encroaching back several hundred feet. Even in the last year a strip over 75 ft. in width has caved into the river. The best plan yet recommended seems to be the planting of a breakwater of willows, which will break the force of the current enough to protect the bank.

The Laurel electric railway, running near Natchez, Miss., will soon start work on its line and it is probable that cars will be running by late fall. The route has not yet been decided upon, as the directors have two separate routes in mind, and whichever one is the most practical will be used. The material has already been ordered, and sufficient ties and rail will be on hand within a week or so for the construction of the entire line. It is not known who will do the grading of the roadbed, but contract has probably already been awarded for this.

The Yazoo-Mississippi Delta Levee Board has called a meeting for June 31 for the purpose of electing officers for the coming year, and also to decide upon plans for the repair of the few weak spots in the levee. All of this line withstood the flood with no breaks, but in a few places the levee is caving badly, and will require quite a little work to put same in proper shape for the next rise. The meeting will be held at Clarksdale, Miss.

Mayor Crump has called a mass meeting, which will be held soon here, to talk over some plan for the protection of the northern end of the city from overflow. According to Mayor Crump, it is necessary to raise about $1,000,000 before fall. The factions are divided between a bond issue to raise this sum and an increase of taxes. The bond issue idea seems to be the most favorable. It is very probable that the necessity of expending so much money on this project will put a decided crimp in the street improvement work for awhile, but a hustling town like Memphis will find some way to care for all improvements necessary.

On June 3 practically every property owner in the Concordia parish voted against the issuance of $500,000 in 50 year levee bonds, proposed by the fifth Louisiana district, advancing the argument that the cost should be taken care of by the government. J. T. McClellen, president of the levee board, brought up the fact that all previous appeals to the federal authorities had been without avail, and that anything done must be done by the people themselves. Representative John Clayton vigorously opposed the movement, showing that despite the fact that two bond issues of nearly a million dollars in the last ten years had been expended, all the farm lands in his section are under water.

✣Commissioners of Topashaw Swamp Land District, in Calhoun County, have asked for bids on July 3 for construction of a canal about 13 miles long. Further information may be obtained by addressing D. P. Hodge, clerk, Slate Springs, Miss.

✣Sabougla Swamp Land District will receive bids on July 3 for the construction of a canal about eight miles in length through Calhoun County. Information can be obtained from D. V. Mallory, clerk, at Redding, Miss. Section 2 of this district will also let about six miles of ditch on the same date. W. E. Genry, clerk, at Embry, Miss.

WATER-WORKS

Alabama.

will be received until about July ported, by City Council, Gadsden, urnishing 500 water meters.

catur Water Supply Co., Decatur, iven a mortgage for $300,000 on its The plant is said to be worth $500,- ill be improved.

ion will probably be held in Ala- , Ala., within the next five weeks rpose of voting on the issuance of the sum of $50.000 for waterworks, nd a new city hall.

Arkansas.

ard of Commissioners of Fort k., will construct a filtration plant umping house at a cost of $130,000.

California.

ty Council of Modesta, Cal., has let ng contracts in connection with the nunicipal waterworks system: U. n Pipe & Foundry Co., pipe, cross- ., $30,412; C. D. Vincent, Oakland, ydrants, $11,127; Crane Co., valves, on some minor supplies were re- they were considered too high.

ens of Redlands, Cal., at a recent ted the issuance of bonds for the f the waterworks system, to the $600,000.

ent mass meeting of the citizens ille, Cal., a committee of five was to gather further data relative to ly in Washington Township. J. iler, San Francisco, is Consulting

t business men of Tulare, Cal.. organizing a company for the purpose of installing an up-to-date waterworks system, at an estimated cost of $25,000. R. Linder of Tulare is interested.

The City Council of Los Angeles, Cal., has been petitioned by residents of Hollywood to install the mains for the distribution of Owens River water in the Hollywood district at the same time as the proposed sewers are laid.

The city of Fullerton, Cal., is preparing to install municipal waterworks. Plans and specifications are being prepared by Consulting Engineers Sloan & Robson, Nevada Bank Bldg., San Francisco, Cal.

Connecticut.

✣Bids will be received until 11 a. m., June 15, by Constructing Quartermaster, New London, Conn., for improving the water supply system at Fort Terry, N. Y.

Florida.

Following bids were received by the Bond Trustees of Jacksonville, Fla., recently for furnishing lots of 2,000 or more meters of ordinary sizes most commonly used: Buffalo Meter Co., $5.90 to $39; Thomson Meter Co., Brooklyn, N. Y., $7.20 to $45; National Meter Co., New York City, $8 to $50; Gamon Meter Co., Newark, N. Y., $6 to $45; Pittsburgh Meter Co., Pittsburgh, Pa., $6.50 to $50; Neptune Meter Co., New York City, $8 to $50; Hersey Mfg. Co., So. Boston, Mass., $5.25 to $37.50; Union Meter Co., Worcester, Mass., $5.50 to $35, and H. R. Worthington Co., New York City, $5.70 to $40.

Georgia.

The citizens of Valdosta, Ga., will probably vote in the near future on the question of issuing bonds in the sum of $100,000 for extension of waterworks, paving and sewers. Of the issue $60,000 would be used for waterworks and lights, $25,000 for streets and sidewalks, and $15,000 for sewers.

Plans have been prepared for the installation of a new waterworks system in Blackshear, Ga., at an estimated cost of $22,000. Water will be secured from deep wells. Bonds in the sum of the above amount will be voted upon June 25. G. P. Gregory is Mayor.

An election is to be held in Augusta, Ga., on June 24, for the purpose of voting on the issuance of bonds for the proposed improvements to the waterworks system. Nisbet Wingfield is City Engineer and Commissioner of Public Works.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., June 20, for furnishing and delivering on the city side track connected with the C. M. & St. P. Ry., at the Springfield Av. pumping station, 1747 N. Springfield Av., approximately 70,000 salt glazed brick and 1,500 facing brick to match samples on file at his office.

⊙The American Water Softener Co., of Philadelphia, Pa., has been awarded the contract by J. R. Andrews, Constructing Quartermaster, Fort Sheridan, Ill., for furnishing and installing a pressure filtration plant, at $15,150. Other contracts awarded are: Wm. A. Pape, 20 W. Lake St., Chicago, Ill., for furnishing and placing pumps at $17,454, and G E. Guadling, 1116 Wells St., Chicago, Ill., for a hot air heating system in the present pumping station. Bids on the above work were opened May 3.

The city officials of Kewanee, Ill., are considering the extension of the water mains on [illegible] Ninth to 10th St., thence east to Burr and south on Burr to Eighth St.; also N. Tremont St., from Ninth to 10th St.; West St., south from Rose to Edward St., thence east on Edward to Franklin Sts.; also West St., on Western Ave., to center of Washington St. The total length of the proposed extension is 3,734 ft., and is estimated [illegible].

A special election will be held in Highland Park, Ill., on June 15 for the purpose of deciding whether or not a bond issue of $49,500 shall be made for general water extensions.

Citizens of Barrington have voted a $13,000 bond issue for a filtration plant.

Indiana.

✣Bids will be received until 8 p. m., July 2, by City Clerk, Columbus, Ind., for furnishing labor and material for the construction of a 4,000,000-gal. water purification plant of the mechanical type. Burgess & Long, Engineers, Columbus, O.

✣Bids will be received until June 18 by Common Council, Shelbyville, Ind., for the construction of a pumping station and the installation of machinery therein. L. E. Webb is City Clerk.

Engineer Byron T. Gifford of the American District Steam Co., of Chicago, Ill., has submitted his initial plans to the Board of Public Works of Logansport, Ind., for a filtration system. It is planned to install a combination mechanical and sand filter in a 310 ft. building to cover half the width of the present 10th St. race, at an estimated cost of $50,000. The filter would be capable of filtering 12,000,000 gals. of water every 24 hours under favorable conditions.

Iowa.

⊙The Beedle Plumbing Co., of Albert Lea, Minn., has been awarded the contract by the City Council of Decorah, Ia., F. M. Hughes, City Clerk, for the making of extensions to he water main, at $0.80 per lin. ft. The work includes 1,000 ft. of 4-in. mains, two Mathews' hydrants and two gate valves. Bids were opened June 5.

⊙The Des Moines Bridge & Iron Works, Des Moines, Ia., has been awarded the contract by the City Council of Burr Oak, Ia., J. W. Green, City Clerk, for the construction of a complete waterworks system, at $28,119. Bids were opened May 23. The work must be completed by Sept. 1.

⊙M. A. Camery of Harlan, Ia., has been awarded the contract by the Town Council of Reinbeck, Ia., R. B. Ferguson, Town Clerk, or the making of extensions to the waterworks system and for constructing town sewers, outlet and tank. The contract price is 31,533. The Iowa Engineering Co., Clinton, a., are Engineers. Bids were opened June 4.

The citizens of Storm Lake, Ia., at a recent election voted to install a modern filtering plant and the extension of the water mains during the summer.

Massachusetts.

✣Bids will be received until 2 p. m., June 5, by Board of Water Commissioners, Athol, Mass., for the construction of a slow sand ltration plant. James L. Tighe, Holyoke, Mass., is Engineer.

Michigan.

The citizens of Ann Arbor, Mich., at a ecent election voted against the issuance of onds in the sum of $600,000 for the purchase f the plant of the Ann Arbor Water Co.

Minnesota.

⊙J. J. Connolly of St. Paul, Minn., has been warded the contract by the City Council of hakopee, Minn., C. T. Weiland, City Recorder, for sewer and waterworks improvements, at $8,246. The work includes the following: Installation complete of extension o water system, consisting of the following pproximate quantities: About 400 ft. of 8-in. cast iron water main to be laid on concrete addles and in the same trench with sewers; ,140 ft. of 8-in. cast iron pipe, 1,520 ft. of 6-in. cast iron pipe, together with five 5-in. hydrants and two 4-in. hydrants, with all necessary connections, specials, valves, etc., made complete with 7-ft. cover. Oscar Claussen Engineering Co., Engineers. Bids were opened May 28.

Missouri.

Goodwin & Harper of Kansas City, Mo., have been retained by the City Council of Butler, Mo., to make an appraisement of the waterworks plant, together with improvement recommendations and an estimate on the cost of a new plant with different source of water supply.

Nebraska.

✣Bids will be received until June 15, it is reported, by City of Omaha, Nebr., for the construction of a 48-in. main from Florence to Lake Sts., including appurtenances.

✣Bids will be received until 4 p. m., June 12, by Water Board, Omaha, Neb., C. R. Sherman, Acting Secretary, for furnishing f. o. b. Omaha approximately: (a) 5,400 tons 48-in. cast iron water pipe, Class C; (b) 200 tons 48-in. special castings, Class C; (c) 650 tons 36-in. cast iron water pipe, Class C; (d) 20 tons 36-in. special castings, Class C; (e) 600 tons 8-in. to 16-in. cast iron water pipe, Class B and C; (f) 50 tons 6-in. cast iron water pipe, Class B and C; (g) 33 tons 6-in. to 16-in. special castings, Class B and C; (h) 1 check valve, 48-in.; (i) 1 gate valve, 48-in.; (j) 3 check valves, 36-in.; (k) 1 gate valve, 36-in.; (l) fire hydrants in carload lots, 3 way, 6-in.; (m) gate valves in carload lots, valves varying in size from 6-in. to 24-in. Specifications for cast iron pipe and specials may be obtained at the office of the Water Board, City Hall, or 501 Karbach, Omaha, Neb.

It is reported the citizens of the village of Homer, Nebr., on May 28 voted the issuance of bonds in the sum of $10,000 for the construction of a waterworks system. James Blanchard is Village Clerk.

New Jersey.

✣Bids will be received until 8:30 p. m., June 25, by A. S. Van Arsdale, Mayor and Council of Borough of Stanhope, N. J., for a new water works plant. Plans and specifications may be examined at the Stanhope House.

✣Bids will be received until 2 p. m., June 17, by Board of Street and Water Commissioners, E. B. See, Clerk, Jersey City N. J., for the construction of a tunnel under the Hackensack River a distance of 840 ft. Plans and specifications are on file at the office of the clerk.

✣Bids will be received until 2 p. m., June 17, by Board of Street and Water Commissioners, Jersey City, N. J., for excavating trenches and refilling the same and laying cast iron water pipe in paved or unpaved streets of Jersey City, in accordance with specifications on file in the office of E. B. See, Clerk of the Board. Blank forms of bid and agreement of sureties must be obtained at the office of the Chief Engineer, City Hall, Jersey City, N. J.

✣Bids will be received until 8:30 p. m., June 25, by Mayor and Borough Council, Stanhope, N. J., for the construction of a new waterworks plant. Plans and specifications may be examined at the office, Stanhope House, Stanhope, and at Room 73, 196 Market St., Newark, N. J. A. S. Van Arsdale is Mayor.

⊙The Board of Education of Hoboken, N. J., has awarded the contract for the sinking of an artesian well at the High School to Harry E. Estes of Ridgewood, N. J., at $3.60 per ft. The well must exceed 200 ft. in depth.

New York.

✣Bids will be received until 5 p. m., June 24, by Board of Water Commissioners, 64 Martine Av., White Plains, N. Y., for A—About twelve (12) tons of four (4″) inch, fifty (50) tons of six (6″) inch, twenty-five (25) tons of eight (8″) inch and ten (10) tons of ten (10″) inch cast iron pipe; also three (3) tons of assorted bends. B—Excavating and back-filling trenches for water main.

✣Bids will be received, it is report June 13, by Municipal Board, Canajoh Y., for the construction of a pipe lin the Mohawk River.

The citizens of Oneida, N. Y., on it is reported, voted the issuance of the sum of $7,000 for the extension mains. D. J. Covell is City Clerk.

The Board of Water Commissio Lestershire, N. Y., plan to extend th mains to West Main St., and a nu intersecting streets.

The Water Commissioners of East Williston Water District, at the office of Oakley, East Williston, Nassau Co Y., rejected all bids received May 27, for 12,225 ft. of 4 to 8-in. pipes laid, 27 hydrants and necessary valves and specials set in place one meter pit and one 8-in. meter, furnished and set in place. New bids will be received on bell, spigot and universal pipes. field & Dow, Denton Bldg., Mineola, are Engineers.

Ohio.

✣Bids will be received until noon, by John Hinterschied, Clerk, Village of View Heights, O., for furnishing the sary labor and materials for constructing improvement consisting of the laying of mains or water pipes along and beneath surface of Grandview Ave., from Ave. to the north corporation line, and First Ave., from Grandview Ave. to view Ave.; and for the further improvement consisting of the laying of a sewer pipe along and beneath the surface of view Ave., from Goodale Ave. to the corporation line and in First Ave. Grandview Ave. to Broadview Ave. said Village of Grandview Heights; County, Ohio; the same to be done according to the plans and specifications on file office of said clerk. Each bid must con full name of every person or company ested in the same and be accompanied by bond in the sum of $1,000 to the sati of the Clerk.

Oregon.

The city of Hood River, Ore., has pur the privately owned waterworks syst. It is planned to sell bonds in the sum of for the purpose of piping water from Spring.

Pennsylvania.

✣Bids will be received until June, by Mayor and Department of Public Pittsburgh, Pa., for the construction of 15,000,000-gal reservoir. C. A. Finley S perintendent of Bureau of Water.

South Carolina.

It is expected that work will begin at an early date on the electric lights and waterworks plants for which a bond issue 000 was voted a short time ago by zens of Barnwell, S. C.

Consulting Engineer Gilbert C. We of Charlotte, N. C., has finished the preliminary work at Cheraw, S. C., in connection with the installation of the waterworks and sewerage, the appropriation for which was recently voted by the people of the city.

Texas.

⊙The City Council of Cleburne, Tex., has rejected all bids received on the general contract for the building of a waterwork and let a contract to the Columbia Iron of Chattanooga, Tenn., for the hydra valves. The contract for furnishing five miles of pipe went to the Americ Iron Pipe Co. of Birmingham, Ala. provement work on the plant will co 000.

⊙The following bids were submitted City Council of New Braunfels, Tex., 22 for the installation of a complete works system, for which the W. K. Co., 717-720 Dwight Bldg., Kansas Cit is Engineer. N. S. Sherman Machi Construction Co., Oklahoma City, Okl 177; Squires Electric & Constructio Kansas City, Mo., $60,818; Des Moines

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

n Co., Dallas, Tex., $61,390; Mathews' rction Co., Kansas City, [illegible]; nd Engineering & Construction Co., Ft. Ark., $58,000; B-R Electric Telephone nufacturing Co., Kansas City, Mo., $59,- O'Neil Engineering Co., Dallas, Tex., 0; Engineer's estimate, $61,069. The ct was awarded to the Midland Engig-Construction Co. of Ft. Scott, they the lowest bidder. The bid is upon the of Worthington pumps, Fairbanks- oil engines, Darling valves and hy-, Des Moines Bridge & Iron Co., 100,- l. tank and tower, and American Cast Co. pipe.

City Council of Madisonville, Tex., has d to acquire, operate and control the well of the town [illegible] estimated [illegible] $20,000 [illegible] n will be held in the near future.

Attorney General at Austin, Tex., has ved the bond issue of $20,000 made by ty of Mount Vernon, Tex., for a wa-rks system.

city officials of Cooper, Tex., are plan- to install a waterworks plant and dis-ng system.

etition is being circulated in Nordheim, to raise funds for the installation of a vorks system.

Virginia.

e Board of Control of Norfolk, Va., has d the contract for laying water mains Ninth and 10th Wards to Guild & Co., attanooga, Tenn., at $18,727 and $30,- spectively.

Washington.

City Council of Hillyard, Wash., has etitioned to use cast iron mains in place [illegible]

[illegible] Wash., has approved the plans for the Cedar River masonry dam. City Engineer A. R. Dimock estimates the cost of the work as follows: Earth excavation, dry, 15,500 yds., [illegible] $11,-400; rock excavation, dry, 43,836 yds., $43,-836; rock excavation, wet, 27,464 yds., $68,-650; concrete, 123,460 yds., $740,940; drilling, $30,000; Gatehouse connection with pipe line, $21,000; sluicing pipe and connection, $8,775; controlling tunnel, etc., $56,800; engineering and incidentals, $99,315. Bids will be called for in the near future.

The City Clerk of Tekoa, Wash., will call for bids at once for 1,110 ft. of water mains and for the extension of the 8-in. sewer pipe line.

The town of Waterville, Wash., has had surveys completed to the springs of water on Badger Mountain, a distance of five miles. The estimated amount of pipe needed is as follows: 16,000 ft. of 4-in., 470 ft. of 2½-in., 2,500 ft. of 2-in. and 2,800 ft. of 1-in., with a large quantity of gates, air valves, relief valves and reducers.

Wisconsin.

✣Bids will be received until June 20 (extension of date from June 5), by City Council, Appleton, Wis., for the equipment of pumping plant and extension of mains for the Appleton waterworks plant. Charles H. Vinal is City Engineer. E. Schueller is Commis-[illegible]

Canada.

⊙The municipality of Edmonds, B. C., has awarded the contract for the extension to the high level reservoir on Capitol Hill, which supplies the city with its entire water, to A. [illegible] $1[illegible]046. The contract for the low level reservoir, to supply River Road and South Burnaby districts, has been let to G. H. Webste of Vancouver, at $13,063.

⊙Contracts have been let by the municipalit of Melfort, Sask., J. E. Durnin, Secretary Treasurer, for furnishing water works material and for laying same, for which bid were opened on May 29: Contract "A," Canadian General Electric Co., Toronto, $6,018 Contract "B," W. M. Scott for Canadia Boving Co., Toronto, $5,130; Contract "C, Canada Foundry Co., Toronto, $5,130; Contract "D," Lindsey Bros., Spokane, Wash $1,395; Northern Electric & Mfg. Co., Winnipeg, Man., $2,685; Contract "E," Fletcher McGarvey, Saskatoon, Sask., $1,500; Contract "F," J. A. Broby & Co., Fernie, B. C $15,400; Contract "G," J. A. Broby & Co $6,600; Contract "H," Canada Foundry Co Winnipeg, $1,250; Drummond & McCal Montreal, $18,999; Contract "I," John Craig Prince Albert, $19,997; Contract "J," J. A Broby & Co., $26,149; Contract "K," Wester Dry Dock & Ship Building Co., Port Arthu Ont., $1,910. Contract "A" calls for generator, switchboard, transformers, etc.; "B, Deisel engine; "C," pumps, meters, etc.; "D, poles, wire, etc.; "E," erection of pole line "F," power house and reservoir; "G," sewerage disposal plant; "H," hydrants and valve etc.; "I," trenching and laying water pipe etc.; "J," sewer pipes, excavating and layin manholes; "K," two storage tanks.

Consulting Engineer T. Aird Murray, Toronto, Ont., has recommended that the municipality of Fort William, Ont., extend a ne 24-in. main to the reservoir, at an estimate cost of $75,000. Other improvement recommended by the Engineer will mean an exper[illegible]

EWERAGE AND GARBAGE DISPOSAL

Arkansas.

Board of Improvement of the Russell-Ark., sewer system has filed its report he City Council relative to the instal- of the same. The Board has esti- the cost of the system at $28,000. J. lock is Mayor. Bids will be received July 2.

California.

e Conley Co., of Omaha, Neb., has warded the contract for the construc- a garbage crematory at the navy yards get Sound and San Francisco at $5,570 ,500 respectively.

City Council of San Bernardino, Cal., dered the construction of a sewer in the northwest section of the city estimated cost of $30,000. Plans and ations will be prepared by City En- Karl F. Tuttle.

s are being prepared by Consulting ers Sloan & Robson, Nevada Bank San Francisco, Cal., for the installa- a sewer system in the town of on, Cal. It is proposed to install an tank.

Trustees of Hanford, Cal., contemplate an election for the purpose of voting issuance of bonds in the sum of $65,- r improvements to the sewer system. H. Coe is Mayor.

Trustees of Sanger, Cal., have en- City Engineer Chris P. Jensen of , Cal., to determine the grades for ks, streets, water and sewers.

Connecticut.

Chamber of Commerce of New Ha-onn., is agitating the creation of a olitan sewerage district, to comprise y of New Haven and all of the ad- towns. The Mayor and Board of en have been appealed to to direct partment of Engineering to make a thorough investigation of the problem for the disposition of sewage, looking toward such alteration or reconstruction of the present system as will prevent the further pollution of the rivers, harbor and the general water front.

The following low bids were received by the City of Hartford, Conn., for the construction of three sewers: Windsor St., Avon to Pleasant St., Dominick Nero, $3,104; Pleasant St., Village to Windsor St., and Windsor St., Pleasant to Main St., Hartford Paving & Construction Co., $2,907; Homestead Ave., Dominick Nero, $1,054.

Florida.

⊙J. W. Gurley & Co., of Mobile, Ala., have secured the contract for the construction of approximately 25 miles of sanitary sewers in Lakeland, Fla. The Central Construction Co., of Lakeland, was awarded the contract for the building of the disposal plant. James Nisbet Hazlehurst, Candler Bldg., Atlanta, Ga., is Engineer.

Georgia.

⊙The McCreary Excavating Co., of Atlanta, Ga., has been awarded the contract by the City Council of Macon, Ga., for the construction of new sewers. Other firms submitting bids were: The Municipal Engineering & Construction Co., Atlanta; the Bysard Construction Co., Atlanta; A. C. Brooks, of Birmingham, and A. D. Wilcox & Co., of Macon.

The citizens of Blackshear, Ga., will vote June 25 on the proposition of issuing bonds for the installation of new sewer, estimated to cost $23,000. G. P. Gregory is Mayor.

Illinois.

✣Bids will be received until 8 p. m., June 22, by City of Wheaton, Ill., for the construction of 2,890 ft. of 60-in. concrete sewer. A. L. Webster is City Engineer. Official advertisement will be found elsewhere in this issue.

✣Sealed proposals will be received by th Board of Inspectors of the House of Correc tion until 2 p. m., June 17, for furnishin and delivering sundry articles consisting o sewer pipe, explosives, lubricating oils, cement, sand, lumber, etc., for quarter period beginning July 1. Specifications may be ha upon application to the superintendent of th House of Correction, 26th St. and Californi Ave.

✣Bids will be received until 8 p. m., Jun 12, by Board of Local Improvements, Nort Chicago, Ill., for the following proposed improvements: 12,352 lin. ft. of 10, 9 and 8-i vitrified tile pipe sewer with 73 manhole complete, to be laid in portions of the street and alleys between 19th and 14th Sts. an State and South Victoria Sts. Docket No. 5 7,525 lin. ft. of 9 and 8-in. tile pipe sewe with 44 manholes complete, to be constructe and laid in portions of the streets and alley between 14th and 10th Sts. and Prescott an South Victoria St.

⊙James Craig, of Winnetka, Ill., has bee awarded the contract by the Village Boar of Winnetka for the construction of th Myrtle and Winnetka Ave. sewers at $5,90

⊙A. M. Lanyon, of Waukegan, Ill., ha been awarded the contract by the Village o Glencoe, Ill., for the construction of a sewe at $22,000.

The Board of Local Improvements o Hillsboro, Ill., has adopted a resolution pro viding for the construction of a sewer system in Hillsboro. The proposed system wil cover the principal part of the city lyin west of the lake and the branch betwee Hillsboro and East Hillsboro. The estimate cost is $40,288.

Representative citizens of Petersburg, Ill at a recent meeting decided to employe a engineer to make plans and estimate fo the installation of sewers.

The citizens of Farmington, Ill., at a recen election voted against the issuance of bond

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] installation [illegible]

Indiana.

✣[illegible] be received until 7:30 p. m. [illegible] Board of Public Works, H. W. cker, Clerk, Fort Wayne, Ind., for the nstruction of sewers and branches in a nber of streets and alleys.

✣Bids will be received until 7:30 p. m., ne 12, by City Council, Connersville, Ind., the construction of two branch sewers signated as sewers A. and B. William eder is City Clerk.

The Board of Public Works of Elkhart, l., has rejected the bids for the new Mcnald St. trunk sewer.

Iowa.

✣Bids will be received until 9 a. m., June by City Council, Des Moines, Ia., for construction of a 10-in. vitrified clay pipe ver in Tiffin Ave. from a connection with sewer in First St. east to Oxford St., nce north along Oxford St. to a point ft. south of the south line of Euclid Ave. out 1,488 lin. ft. of sewer more or less. ork to begin on or before the 25th day of ne, 1912, and to be completed on or before 1st day of August, 1912. Horance Susong City Clerk.

✣Bids will be received until 9 a. m., June by City Clerk, Burlington, Ia., for the nstruction of a 16-ft. span concrete arch ver, with the necessary catch-basins, manes, inlets and connections, along the pres- Hawkeye Creek, from the south line of ency St., northerly along said creek to oint about 50 ft. south of Mt. Pleasant St., l a 6-ft. span concrete arch branch sewer, ending from a point along said sewer, out 130 ft. south of the south side of Mt. easant St., westerly to a point 100 ft. west reof, as per plans and specifications. H. Vollmer is City Engineer.

✣Bids will be received until 9 a. m., June by City Council, Des Moines, Ia., for construction of approximately 1,488 ft. 10-in. vitrified clay pipe sewer. Horace song is City Clerk.

✣Bids will be received until 8 p. m., June by J. F. Golden, City Clerk, Creston, Ia., the following improvements in accorde with plans and specifications on file with S. DeLay, City Engineer: Construction approximately 3,000 ft. of 8-in. sewer; 6-in. Y's; 1,500 ft. of 6-in. lateral. A tified check for $500 must be filed with h bid

Assistant City Engineer Fred C. Smith of ux City, Ia., has submitted to the City uncil his estimate of the amount it will t to install a storm sewer in the new addin to be known as the Heights. The estite is $7,513. The Engineer recommends t a 24-ft. outlet west of Geneva St. and rth to Perry Creek to be built, which would ng the total cost up to $9,015.

The City Council of Cedar Falls, Ia., has opted a resolution providing for the conuction of a number of blocks of sanitary vers in Olive, 23rd, 21st, Washington, y, Tremont, Franklin and 15th Sts.

The Commercial Club of Early, Ia., has nounced its determination to secure a new ver system for the town.

The City Council of Dubuque, Ia., has lered the construction of a sanitary sewer Couler Ave., from the end of the present ver at 25th St., northerly to 32nd St. City gineer C. H. Baumgartner has estimated work will require 3,295 lin. ft. of 8-in. pipe and 13 manholes, and estimates the t at $4313. J. [illegible] Shea is City Recorder.

Kansas.

✣Bids will be received until 7:30 p. m., ne 19 by G. E. Strauchon, City Clerk, Otva, Kan., for the construction of a saniy sewer in Sewer District No. 56. This rk will include approximately 1,050 lin ft. 10-in. vitrified sewer pipe and 6 manes. Profile and specification may be obned at the office of the clerk or city engir

Plans are being prepared by City Engineer G. L. McLane of Hutchinson, Kan., for a new sewer to extend from the alley between Ninth and 10th behind Plum St., north to the alley between 11th and 12th, and then west two blocks to Maple St.

Maryland.

✣Bids will be received until noon, June 19, by J. E. Mullen, Supt. of Department of Supplies, Boston, Mass., for furnishing iron castings, such as manhole and catch-basin frames and covers, lamp-hole frames and covers, catch-basin grates, tide gates, iron inlets, traps, regular castings and such other castings as may be required between July 1, 1912, and February 1, 1913, according to plans and contract.

Following bids were received by the Board of Awards of Baltimore, Md., on Sanitary Contract, No. 90, covering the construction of a miscellaneous lot of lateral sewers; Calvin W. Hendricks, Chief Engineer of the Sewerage Commission: Ryan & Reilly, Baltimore, $44,240; M. J. Beach, Baltimore, $44,656; B. F. Sweeton & Son, Baltimore, $50,747; Jas. Ferry & Son, Baltimore, $54,270.

Massachusetts.

✣Bids will be received until 1 p. m., June 14, by Capt. R. H. C. Kelton, Constructing Quartermaster, 263 Summer St., Boston, Mass., for the construction of a garbage crematory at Fort Stong, Boston Harbor, Mass.

✣Bids will be received until noon, June 14, by Sewer Commissioners, H. R. Alexander, Chairman, Dedham, Mass., for the construction of about 1,700 ft. of 8-in. sewer.

The Board of Aldermen of Pittsfield, Mass., has adopted orders for $15,000 for improvement and extension of the sewerage system, and for $1,500 for sewer and water tion a garbage crematory at Puget Sound

Michigan.

✣Bids will be received until 8 p. m., June 13, by Board of Public Works, Grand Rapids, Mich., for the construction, reconstruction, enlarging and deepening of public sewer in Island St. S. J. Hufford is President of the Board and L. D. Cutcheon is Secretary and General Manager.

⊙Vander Weele Bros., of Grand Rapids, Mich., have been awarded the contract by the Board of Public Works of that city for the construction of the Monroe Ave. sewer at $17,174 and the North Ave. sewer at $2,092.

⊙Vander Wheele Bros., 51 Baldwin St., Grand Rapids, Mich., have been awarded the contract by the Board of Public Works of that city, for the construction of the Monroe Ave. sewer at $17,174. Bids were opened May 31. L. D. Cutcheon is Secretary and General Manager.

The City Council of Highland Park, Mich., has provided for the appointment of an Assistant to the Village Engineer for the construction of a complete drainage and sanitary sewer system. Work on the plans will be started at once. A special election will be held June 15 to decide whether a bond issue of $49,500 shall be made for general water extensions.

The City Council of Ludington, Mich., is considering a communication from the Board of Trade, recommending the calling of a special election for voting on the proposition of bonding the city for $50,000 to construct sewers and to resurface macadam streets.

City Engineer L. E. Stevens of Grand Rapids, Mich., is working on a tentative plan for extending the south end trunk sewer to drain the district between Jefferson and Eastern Aves., and Cottage Grove and Burton Aves. The sewer will range in size from 8 to 36 ins.

The Common Council of Flint, Mich., has employed Consulting Engineer Henry E. Riggs of Ann Arbor, Mich., to secure complete surveys of the city, with plans for an adequate storm and sanitary sewer system for the entire city.

Minnesota.

⊙Fraser & Danforth, Hackney Bldg., St. Paul, Minn., have been awarded the contract by the city of Stillwater, Minn., Lew. W. Clarke, City Engineer for the construction of a sewer in So. Second St., at $7,240. The work includes 1,380 ft. of 6-in. pipe; of 8-in. pipe; 185 ft. of 24-in. pipe; six manholes; three catch basins and two flush tanks. Bids were opened June 4.

Montana.

✣Bids will be received until 8 p. m. July 6, by F. D. Ovesen, Town Clerk, Chbok, Mont., for furnishing all labor and material necessary for the construction of main sewer system. Plans and specifications are with the Clerk. L. G. Smith is City neer.

✣Bids will be received until 3 p. m 15, by City of Lewistown, Mont., Marshall, Clerk, for furnishing the sary labor and material for the constr of sanitary sewers aggregating about ft. of 12 to 27-in. vitrified pipe; 31 man 1 flush tank; 21,000 cu. yds. of excav Swearingen & McCulloh are Consultin gineers.

New Jersey.

✣Bids will be received until June Common Council, Plainfield, N. J., moval and disposal of ashes, garbag rubbish from the residences and busines public places within the city. J. T. Mac ray is City Clerk.

⊙The Passaic Valley Sewerage Com sion, J. S. Gibson, Clerk, Newark, has awarded the contract for the con tion of Section No. 9 of the Main cepting Sewer, for which bids were o on May 28, to the McCauley, Manton of Brooklyn, N. Y., at $262,530. The ized bids appeared in our last issue.

New York.

✣Bids will be received until 3 p. m., 19, by Board of Contract & Supply, Schetady, N. Y., for the construction of san and surface water sewers in the S ward. The work will include the foing approximate quantities: 8,048 cu. of earth excavation, 12,071 cu. of rock excavation, 441 cu. yds. of 1-3-5 Portland cement concrete, 7,501 ft. of 8-in. vitrified tile, 4,490 lin. ft. of vitrified tile, 4,168 lin. ft. of 12-in. vitrified 5,048 lin. ft. of 15-in. vitrified tile, 1,029 li of 18-in. vitrified tile, 282 lin. ft. of vitrified tile, double strength; 1,400 lin. 30-in. vitrified tile, double strength; 36 li of 8-in. cast iron pipe, 132 lin. ft. of cast iron pipe, 168 lin. ft. of 12-in. cast pipe, 348 lin. ft. of 16-in. cast iron pipe lin. ft. of 30-in. cast iron pipe, 918 lin. manholes, vertical measurement; 40 basins, complete; 68,000 board ft. of lu sheathing, 68,000 board ft. of lumber fo tions. Plans and specifications may be tained from the office of the City Engi W. Thomas Wooley, by making a depos $10.

⊙The Board of Palatine Bridge, N. Y., has awarded the contract for the cons tion of a sewer system on Lafayette Grand Sts., in the Village, to Oliver Hu Fort Hunter, N. Y., at $10,000.

The citizens of Lestershire, N. Y., recent election voted the issuance of in the sum of $13,000 for the building Lestershire-Downsville sewer.

City Engineer E. A. Fisher of Roche N. Y., Prof. George C. Whipple of Har University and Prof. Charles Wright D of the University of Rochester, have preliminary plans for a sanitary surve the lake for a distance of several miles and west of the Genesee River harbor. survey is to be the final factor in determi just what purification steps shall be t for the treatment of Rochester's se when the effluent is carried out into the from the disposal works near the shore

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Intercepting Sewer Board of Syra-
Y., has let the contract for extending Harbor Brook improvement and in-
sewer to the city [illegible]
terminus to the Marnell Co. at $20,-

Intercepting Sewer Board of Syra-
Y., has started proceedings for the
tion of lateral sewers in the streets
Harbor Brook district.

Hicks-Johnson Contracting Co., of
ork City, has submitted the lowest
the President of the [illegible]
New York City, for the construction
le of sewer mains, 7, 8 and 9-ft. in
of reinforced concrete in Central
d 4,000 ft. of 6-in. glazed pipe for
nnections through the Glendale sec-
n Myrtle Ave. to Proctor, at $99,895.
[illegible]
ructing 1,670 ft. of 2¾-ft. and 3-ft.
sewers and 2,000 ft. of 6-in. house
n in Fresh Pond road, from Myrtle
Woodbine St., Ridgewood, at $18,544.

Ohio.

will be received until noon, June 13,
tor of Public Service, W. H. Kirby,
, Cleveland, O., for the construction
rs in the following streets, etc.:
ve., between East 30th St. and East
Gifford Ave. S. W., between Pearl
V. and Westerly City Limits; Scovill
E., between East 9th St. and East
East 79th St., between Bessemer Ave.
l Kingsbury Run; Trent Ave. S. W.,
Fulton Rd. S. W. and West 41st St.;
Ave. N. E., between East 12th St.
t 13th St.; East 113th St., between
north of Superior Ave. N. E. and
Ave. N. E.; East 40th St., between
north of Euclid Ave. and Prospect
E.; Trowbridge Ave. S. W., between
h St. and 900 ft. west of West 32nd
t 103rd St., between St. Clair Ave.
[illegible]
made in accordance with the plans
ifications, which may be seen at the
the Chief Engineer, Room 305, City

Oregon.

ity Council of Medford, Ore., it is
has created Sewer District No. 14,
n the southern part of the city.

Pennsylvania.

Borough Council of Dunmore, Pa.,
ded the contract for the construc-
the Mill and Pine Sts. section of
sewer to O'Boyle Bros., at $36,000.

Borough Councils of Williamsport,
awarded the contracts for the con-
of the Dove St. house sewer and
Ave. storm sewer to Charles Du-
at city at $2,045 and $6,538.

Kraft, So Beaver St., York, Pa., has

[illegible]
Warner, City Engineer, for the construction of a storm water sewer on Richard Ave., at $4,000. The work includes 250 ft. of 42-in. lock joint reinforced concrete pipe; 200 ft. of 36-in lock joint reinforced concrete pipe, 350 ft. of 12-in. terra cotta pipe, 12 trap inlets [illegible]

South Carolina.

City Clerk and Treasurer G. Frank League of Greenville, S. C., will sell bonds June 25 in the sum of $35,000 for the purpose of providing or extending sewerage. Henry Briggs is Mayor.

According to advices from Dillon, S. C., the Supreme Court, in a decision by Associate Justice Hydrick, dismissed the petition asking for an injunction to prevent the town of Dillon from issuing $77,000 worth of bonds for sewerage and waterworks.

Texas.

⊙The City Council of Amarilla, Tex., has awarded the contract for the making of sewer extensions to Ockander Bros. at $11,270.

⊙Contracts for the construction of the new storm sewer on Exposition Ave., from Commerce St. to Parry Ave., and for the storm sewer on Parry Ave., from Exposition Ave. to Haskel Ave., have been let by the Board of Municipal Commissioners of Dallas, Tex., to the Dallas Lime & Gravel Co. at $6,791 and $2,457 respectively.

The citizens of Paris, Tex., will vote June 25 on the proposition of issuing bonds for the installation of new sewers.

Contracts will be let within 30 days by the city of San Benito, Tex., for the installation of new sewers at an estimated cost of from $20,000 to $30,000. The work will include excavation, pipes, manholes and two disposal plants. Plans are now being prepared. B. S. Gentry is City Engineer. John M. Breen is official in charge

The Attorney General at Austin, Tex., has approved a bond issue of $17,000 by the City of La Grange, Tex., for the construction of a sewer system. Work will be started as soon as the bonds are sold.

Utah.

✣Bids will be received until 10 a. m., June 14, by Noble Warrum, City Recorder, Salt Lake City, Utah, for the construction of a pipe sewer extension, No. 301, Washington Ave., from Second East St., between Fifth and Sixth Sts.

✣Bids will be received until 10 a. m., June 14, by Noble Warrum, City Recorder, Salt Lake City, Utah, for the construction of pipe sewer extension, No. 305, Islington court north from 6th, between 2d and 3d West Sts.

Virginia.

⊙The Morse-Boulger Destructor Co., of New York City, has been awarded the contract for the construction of a garbage crematory at the Norfolk, Va., navy yard at $6,785.

Washington.

⊙The Welch & Christenson Construction Co., of Everett, Wash., has been awarded the contract by the City of Snohomish, Wash., for the proposed improvement of Pine St. and for the laying of the sub-sewer on that street at $11,172 and $3,112.

City Engineer W. H. North of Bellingham, Wash., has submitted his preliminary estimate of the cost of improving the alley between Grant and Humboldt Sts. with an 8-in. sanitary sewer, from Virginia to Illinois Sts., at $3,656.

Bids will be asked at once by the City Clerk of Tekoa, Wash., for the purpose of extending the 8-in. sewer pipe line.

Wisconsin.

✣Bids will be received until 10 a. m., June 15, by Board of Public Works, Racine, Wis., for the necessary labor and materials for the construction of a public sewer in Orange Ave., from De Koven Ave. to 20th St., including approximately 560 lin. ft. of 8-in. pipe, 1 manhole and 2 catch basins. P. H. Connolly is Chairman of the Board.

✣Bids will be received until 8 p. m., June 24, by City of Cudahy, Wis., for the construction of the following sewers: 1,970 ft. of 18-in. vitrified pipe sewer, 25 to 38 ft. deep; 2,800 ft. of 36-in. concrete sewer, from 16 to 48 ft. deep; 2,600 ft. of 48-in. concrete sewer from 10 to 20 ft. deep. J. C. Dretzka is City Clerk. Official advertisement will be found elsewhere in this issue.

⊙The Board of Public Works of Watertown, Wis., has awarded the contract for the construction of sanitary and storm water sewers to Ed. L. Bartlett at $8,167. Bids were opened June 1. Arnold Kraeft is City Engineer.

⊙The Board of Public Works of Ashland, Wis., has let the contract for the construction of the new sewerage system for the part of Ashland east of Bay City Creek to E. R. Harding & Co., of Racine, Wis., at $39,400.

⊙The Board of Public Works of Merrill, Wis., has let the contract for the construction of three blocks of 12-in. sewer in the Second Sewer District to Walter Badeau at $0.94 per ft.

Canada.

⊙McNamara, Blanchard & Shanahan, Sault Ste. Marie, have been awarded the contract by the city of Sault Ste. Marie, Ont., W. H Munro, Mayor, for the construction of Section "N" of the tile pipe sewer, and Curran & Clement, Sault Ste. Marie, for the construction of Section "NA" of the sewer. The contract prices are $20,150 and $18,740, respectively. Bids were opened May 27.

ILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

Arizona.

will be received until 11 a. m., June
ard of Control of Arizona, Phoenix,
furnishing one 20 cu. ft. portable
crete mixer fully equipped, and one
rtical gasoline engine for the state
R. Osburn is Secretary.

California.

follows were received June 4, by
vising Architect: Treasury Depart-
ashington, D. C., for the construction,
including plumbing, heating, wir-
ighting fixtures, of the U. S. public
at Santa Barbara, Cal.: King Lum-
Charlottesville, Va., $118,400; South-
Construction Co., Central Bldg., Los
Cal., $117,850; J. H. Wiese, National
dg., Omaha, Neb., $128,610; the
Construction Co., Wichita, Kans.,
Eugene Schuler, Wahpeton, N. C.,
$115,000; Geo. Hinchliff Co., Chicago, Ill., $137,900.

Plans have been presented to the City Council of Redondo, Cal., for a proposed $200,000 municipal pier.

It is expected that the plans of E. P. Goodrich, Consulting Engineer, New York City, for the permanent improvement of the Huntington concession by the city of Los Angeles, will be submitted by June 15. The improvements include a 300-ft. slip, wharves, docks, warehouses, depressed railroad tracks and a passenger station. Homer Hamlin is Harbor Engineer of Los Angeles, Cal.

Connecticut.

⊙The Aberthaw Construction Co., Boston, Mass., has been awarded the contract for the erection of a 91 by 57 ft. building for the Winchester Repeating Arms Co., New Haven, Conn. The structure will be six stories with tower, the total height being 166 ft. from ground level. L. W. Robinson of New Haven, Conn., is the architect.

District of Columbia.

✣Bids will be received until 11 a. m., June 15, by Constructing Quartermaster, Maj. H. L. Pettus, Washington, D. C., for the construction of concrete coping for the sea wall, curbing, gutters, etc., at the Army War College Reservation, Washington Barracks.

✣Bids will be received until June 17, by Lieut. R. G. Alexander, Quartermaster, Washington Barracks, D. C., for furnishing hard and soft wood for the use of the engineer troops in permanent camp at Fort Foote, Md.

✣Bids will be received until 1 p. m., July 2, by Lighthouse Inspector, Tompkinsville, N. Y., for furnishing supplies for the fiscal year ending June 30, 1913, including brushes, chimneys, dry goods, engineer stores, packings, flags, hardware, fire hose, rubber fire and steam hose, nozzles, tool steel, cold-rolled steel, lumber, lamps, mixed paints, paints and oils, varnishes, etc., ship chandlery, tin cans, brooms, etc., wicks, blocks, brass rod, sheet brass, brass tubing, copper sheets, wire and tubing, etc., brass castings, sheet metal, iron castings, ammonia, denatured alcohol, glycerin and sal soda, asbestos cement, Bon Ami, Sapolio and soap, barometers, clocks, boat compasses and time-markers, buff skins and machine-wipers, candles and lubricating oils, charcoal, American Portland cement, coal bags, cotton waste and mats, corks, excelsior and packing tow, iron, refined iron, steel billets and sheet steel, linseed oil and turpentine, mattresses and pillows, matches, rubber sheet packing and packing, crash, toilet paper, red lead, white lead and white zinc, zinc slabs, shellac and yellow metal.

✣Bids will be received until 2:30 p. m., June 27, by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 714-B, steel I beams, hose, waste baskets, etc.

✣Bids will be received until 10:30 a. m., by Maj. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing under Canal Circular 715 auxiliary electrical equipment for gatun hydro-electric station, being switchboards, switching group, transformers, battery, art compressor and crane equipment.

Georgia.

✣Bids will be received until 2 p. m., June 15, by Lieut. Wyatt O. Selkirk, Quartermaster, Fort Screven, Ga., for furnishing f. o. b. Fort Screven, Ga., door and window screens.

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., June 15, for furnishing labor, materials, etc., necessary to perform all concrete, mason cut stone, plumbing and sewerage connected with the construction of a swimming pool at the Washington Heights Pumping Station playgrounds, Vincennes Ave., 104th St., and Charles St. Cash or certified check for $500 must accompany proposal.

Indiana.

Plans have been prepared for a dam to be erected at North 17th St., Richmond, for the Richmond Lake & Park Co. John Mueller, Newcastle, Ind., is Engineer.

Kansas.

✣Bids will be received until 11 a. m., June 20, by Maj. J. T. Davidson, Constructing Quartermaster, Fort Riley, Kan., for installing steam heating plant, including necessary construction work and alterations to drill hall.

✣Bids will be received until 11 a. m., June 20, by Constructing Quartermaster, Fort Riley, Kan., for installing heating plant in cavalry drill hall at that post.

✣Bids will be received until 11 a. m., June 22, by Constructing Quartermaster, Fort Leavenworth, Kan., for the installation of heating plant in cavalry drill hall at Fort Leavenworth, Kan.

Maryland.

✣Bids will be received until noon, June 18, by Building Committee at the office of the Treasurer in Cambridge, Md., for the erection and construction of the new high school building at East New Market, Dorchester County, Md., including the heating apparatus. W. P. Beckwith, Cambridge, Md., is Treasurer of the Building Committee.

Massachusetts.

✣Bids will be received by the Municipal Building Commission, Springfield, Mass., for auditorium, tower and terraces of the new Municipal group. Further information may be obtained of the Clerk of the Works, Pynchon St., Springfield, Mass.

✣Bids will be received until noon, June 14, [illegible] Works, Boston, Mass., for building bulkhead at L St., South Boston.

Minnesota.

The Northern Coal & Dock Co., J. M. Selleck, Superintendent, Duluth, Minn., has had plans prepared for improvements at Duluth which will call for the expenditure of about $50,000. The principal work will be the enlargement of the coal shed. J. O. Back, Duluth, is the Engineer.

New Jersey.

✣Bids will be received until 8 p. m., June 17, by Raymond F. Davis, Town Clerk, National Bank Bldg., Bloomfield, N. J., for the construction of a stable and storage sheds on property in the rear of the Central Fire House on Bloomfield Ave., and for the construction and alteration of a two-story frame and stucco building, designated as Montgomery Hose House, located at the southwesterly corner of Berkeley Ave. and Jerome Pl.

✣Bids will be received until 8 p. m., June 15, by Board of Education, Orange, N. J., for the construction of a school building at Hilton. D'Oench & Yost, 105 W. 40th St., New York City, are Architects.

New York.

✣Bids will be received until 10 a. m., June 15, by Quartermaster, Fort Slocum, N. Y., for repairs and improvements in the post hospital at Fort Slocum, N. Y.

✣Bids will be received until 10 a. m., June 18, by State Fair Commission, Post-Standard Bldg., Syracuse, N. Y., for main entrance gates for New York State Fair Grounds, also his sealed bid for iron fence of approximately 4,500 ft., enclosing said State Fair Grounds, at which time said bids will be opened and read publicly. The proposal shall be accompanied by certified check in an amount equal to 5 per cent of the proposal. The contract will provide that said main entrance gates and said iron fence be completed on or before Aug. 25, 1912. Plans and specifications of proposal may be obtained from Green & Wicks, 110 Franklin St., Buffalo, N. Y.; also from the office of the State Fair Commission, Post-Standard Bldg., Syracuse, N. Y. Plans and specifications are on file and may be examined by contractors at the office of Herman W. Hoefer, State Architect, Capitol, Albany, N. Y.; at the office of the State Fair Commission, Post-Standard Bldg., Syracuse, N. Y., and at the office of Green & Wicks, 110 Franklin St., Buffalo, N. Y.

⊙The Great Lakes Dredge & Dock Co., Buffalo, N. Y., has been awarded the contract at 21.9 cts. per cu. yd., for the completion of Section 2 A of the Buffalo River and Cazenovia Creek Improvement for the city of Buffalo, N. Y. The work includes 1,500,000 cu. yds. of earth excavation. Bids were opened March 28.

Common Council of Syracuse, N. Y., will probably be asked to authorize a city bond issue of $500,000. Of this sum $300,000 will be necessary for the new Vocational High School, and $125,000 for the new Genessee School in the 8th ward.

Oklahoma.

Bids as follows were received June 5 by the Supervising Architect: Treasury Department, Washington, D. C., for the construction, complete, of the U. S. public building at Muskogee, Okla.: J. E. & A. L. Pennock, Land Title Bldg., Philadelphia, Pa., limestone, $456,000; sandstone, $467,300; Dieter & Wenzel Construction Co., Wichita, Kan., limestone, $532,638; sandstone, $541,638; King Lumber Co., Charlottesville, Va., limestone, $523,000; sandstone, $545,000; H. M. Green, Kansas City, Mo., limestone, $469,854; sandstone, $485,354; Interurban General Contracting Co., New York City, limestone, $505,600; sandstone, $541,828; Northern Construction Co., 421 Milwaukee St., Milwaukee, Wis., limestone, $515,234; sandstone, $521,200; Wm. H. Maxwell, Phoenix, Ariz., limestone, $478,317; sandstone, [illegible]

Oregon.

✣Bids will be received until 2 p. m[illegible] July 17 by Commissioner of Indian Affairs, [illegible]shington, D. C., for furnishing the necess[illegible] labor and material for the construction of [illegible] tion to brick school building at Sale[illegible] School, Oregon.

Pennsylvania.

✣Bids will be received until 7 p[illegible] June 26, by Board of Directors of the Vero[illegible] School District, addressed to J. E. Marquis, [illegible]retary, Verona, Pa., for furnishing, fabrica[illegible] and erecting structural steel work for [illegible] proposed school building in the boroug[illegible] & Frank, 519 Lewis Bldg., Pittsb[illegible] are Architects.

✣Bids will be received until 7 p[illegible] 26, by the Board of Directors of th[illegible] School District, at the office of J. E. [illegible] Secretary, Verona, Pa., for the insta[illegible] plumbing and gas fitting system; [illegible] and ventilating system and electric wi[illegible] tem in the proposed school building [illegible] & Frank, 519 Lewis Bldg., Pittsburgh [illegible] Architects.

✣Bids will be received until 11 a[illegible] 15, by Lieut. Col. C. B. Baker, Con[illegible] Quartermaster, Philadelphia, Pa., fo[illegible] ing boilers and remodeling electric [illegible] power plant at the Philadelphia dep[illegible]

Bids as follows were received Ju[illegible] Maj. Herbert Deakyne, U. S. Engin[illegible] adelphia, Pa., for dredging 53,000 cu[illegible] material near Mud Island, Pa.: Rive[illegible] bor Improvement Co., Philadelphia, [illegible] cts. per cu. yd.; Atlantic Dredging C[illegible] delphia, Pa., 32.5 cts. per cu. yd.

Tennessee.

✣Bids will be received until 10 a[illegible] 15, by Depot Quartermaster, Jeffe[illegible] Ind., for the construction and repair [illegible] buildings and stone enclosing wall at t[illegible] tanooga, Tenn., National cemetery.

Utah.

The Ogden River Reservoir Co. [illegible] be ready to call for bids about Jun[illegible] the construction of the proposed res[illegible] the South Fork of the Ogden R[illegible] miles east of Ogden. It is expected [illegible] contract will be let on or before [illegible] William Glasmann, 360 24th St., [illegible] Utah, is President.

Washington.

⊙The Brandt Construction Co., Lyo[illegible] Seattle, Wash., has been awarded a [illegible] at about $200,000 for the erection of a [illegible] ft. concrete construction building, a[illegible] and London Sts., Seattle, Wash., for [illegible] Roebuck.

Wisconsin.

✣Bids will be received until 7 [illegible] 26, by Board of Public Works, Two [illegible] Wis., for the construction of a dock [illegible] the north side of the West Twin River, e[illegible] ing from the city dock in lot 1, block 6[illegible] in a southwesterly direction along th[illegible] lished dock line to the west line of [illegible] block 78, approximately a distance of [illegible], including the tearing up of the old dock [illegible] necessary and refilling back of the ne[illegible] to the water level and extending back [illegible] shore line; all of which work shall b[illegible] according to the plans and specificati[illegible] doing the same now on file in the offic[illegible] City Clerk of said city. The contracto[illegible] furnish all work, labor and materials a[illegible] [illegible] machinery, tools [illegible] necessary for doing said work.

✣Bids will be received until 2 p. m[illegible] 17, by Martin Plehn, County Clerk, M[illegible] kee, Wis., for furnishing all material [illegible] bor for the construction of a power [illegible] poultry buildings, chicken houses and [illegible] forming part of the County School of [illegible] culture and Domestic Economy [illegible] Wauwatosa

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

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CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

CONSTRUCTION OF SEWERS.

The city of Cudahy, State of Wisconsin will receive bids until June 24, at 8 p. m., for the construction of sewers as follows:

About 1,970 ft. of 18-in. vitrified pipe sewer at a depth of from 25 to 38 ft.;

About 2,800 ft. of 36-in. concrete sewer at a depth of from 16 to 48 ft.;

About 2,600 ft. of 48-in. concrete sewer at a depth of from 10 to 20 ft.;

Together with suitable appurtenances, all in accordance with plans and specifications prepared by G. Steinhagen & Son, Consulting Engineers, and now on file in their office, 20 Mack Block, Milwaukee, Wis., and also in the office of J. C. Dretzka, City Clerk of Cudahy.

Each bid must be accompanied by a certified check in the amount of one thousand five hundred dollars ($1,500), made payable without recourse to the city of Cudahy, Wis.

Plans and specifications may be obtained by depositing five dollars ($5) to insure safe return.

Each bidder must specifically state in his proposal the time at which he proposes to complete the work.

The city reserves the right to reject any or all bids, to waive defects, and to accept any bid.

All bids must be on forms furnished by the city and must be in sealed envelopes marked on the outside, "Sewer Bid," and addressed to

J. C. DRETZKA,
City Clerk,
Cudahy, Wis.

WATER WORKS SYSTEM AND SANITARY SEWER.

Torrington, Wyo., May 21, 1912.

Sealed bids will be received by the City Council of the City of Torrington, Wyo., until 10 o'clock a. m. of Saturday, June 29, 1912, for the furnishing of all materials and the complete construction of a water works system and a sanitary sewer system for the Town of Torrington, Wyo., according to plans and specifications on file in the office of the City Clerk of said city, and in the office of the Shepperd Engineering Company, 726 Majestic Bldg., Denver, Colo.

Bids must be submitted separately on the above propositions.

Each bid on the water works proposition must be accompanied by a certified check for $1,000.

Each bid on the sewer proposition must be accompanied by a certified check for $1,000.

All necessary information, blank forms of proposals and instructions to bidders will be furnished on application to the City Clerk of Torrington, Wyo.

Copies of plans and specifications may be obtained from the City Clerk of Torrington, Wyo., or the Shepperd Engineering Co., Denver, Colo., upon payment of $5.00 per set.

The right is reserved to reject any or all bids.

CHARLES D. BRUBAKER
RALPH PAXTON, Mayor.
City Clerk.

PROPOSALS FOR DREDGING.

May 30, 1912.

Sealed bids addressed to J. H. Nelms, Chairman, will be received at the office of the Engineer, Room 430, New Weinberg building, Greenville, Miss., by the Board of Washington County Drainage Commissioners, to 12 m., July 15, 1912, for the construction of about nineteen miles of dredge ditch ranging from twenty-six to fifty-six feet bottom; approximate quantities 1,960,000 cubic yards. Also for the clearing of two natural streams aggregating about seventeen miles. Plans, profiles and specifications are on file at the office of the Engineer, and can be furnished on application. A certified check for $5,000.00 must accompany each bid. The right is reserved to reject any or all bids, or to let the work as may appear to be for the best interest of the district.

THE WASHINGTON COUNTY DRAINAGE COMMISSIONERS,
B. B. GORDAN, Chief Engineer,
Greenville, Miss.

REPAVING.

Burlington, Iowa.

Bids for the repaving with brick block and creosoted block, of 25,000 square yards on Main and Jefferson Streets, will be received at the office of the City Clerk up to 9:00 a. m., June 24th, 1912.

For specifications address,

H. G. VOLLMER,
City Engineer.

Springfield, June 8, 1912.

Sealed Bids will be received by the Board of Administration, Capital building, Springfield, Ill., up to 3 p. m., Monday, July 1, 1912, and then and there publicly opened, for furnishing and installing a steam driven, direct acting, single cylinder, piston pattern steam pump and accessories for the Kankakee State Hospital, Kankakee, Ill.

Specifications may be obtained upon application to the undersigned.

The right is reserved to reject any and all bids.

FRANK D. WHIPP,
Fiscal Supervisor,
Springfield, Ill.

CONCRETE SEWER.

Burlington, Iowa.

Bids for the construction of 1,065 feet of 16-foot reinforced concrete arch sewer will be received at the office of the City Clerk up to 9 a. m., June 17, 1912.

For plans and specifications address

H. G. VOLLMER,
City Engineer.

DEPARTMENT OF THE INTERIOR.—United States Reclamation Service. Washington, D. C., June 1, 1912. Sealed proposals will be received at the office of the United States Reclamation Service, Elephant Butte, New Mexico, until 2 o'clock p. m., June 20, 1912, for furnishing ball mills, tube mills, a rock crusher, a rotary dryer and a mixing and weighing machine for a sand-cement plant on the Rio Grande Project, New Mexico-Texas. For particulars address the U. S. Reclamation Service, Elephant Butte, New Mexico, or Washington, D. C. F. H. NEWELL, Director.

DITCH AND LATERAL DRAI

Sealed bids will be received by Auditor or Pottawattamie County, Ia., Council Bluffs, up to 1:30 P. M., Tu day, June 18, 1912, for construction the Wilson ditch and lateral drains, Harrison County, Ia. The main ditc about five miles long, with six feet tom width. The estimated excava is 98,800 cubic yards, the time limit completion is Jan. 1, 1913. This w is suited to a small dragline or other land machine.

In connection with the above m ditch, six lateral drains are requir three of these are small open ditc with four feet bottom width, the to excavation being about 24,800 cu yards. The time limit for completion this work is December 1, 1912. This all dry land work, suitable for a sm machine.

There are three tile drains requir the following quantities of material, vi

1,000 lineal feet of 10-inch tile.
1,300 lineal feet of 12-inch tile.
1,300 lineal feet of 14-inch tile.
1,800 lineal feet of 16-inch tile.
1,300 lineal feet of 20-inch tile.
3,475 lineal feet of 24-inch tile.
1 catch basin.
18 manholes.

The contractor will bid to furnish material and do the work. The ti limit for completion is December 1, 19

Contractors can bid for portions or of the work, the right being reserved the Joint Boards of Supervisors of Ha rison and Pottawattamie Counties to r ject any or all bids.

The work is located on the Missou bottom four miles southwest from Mi souri Valley, Ia.

Plans and profiles are on file with th County Auditor at Logan, Ia., and wi the Auditor at Council Bluffs, Ia., an specifications, form of contract and bla form for bidders can be had on applic tion to either of those officers or to Se Dean, Construction Engineer, at Gle wood, Ia.

The bids will be opened at 1:30 P. M June 18, 1912, at the room of the Boa of Supervisors in the Court House Council Bluffs.

A. F. GAINES,
Auditor of Harrison County, Ia.
Logan, Ia., May 28, 1912.

CONCRETE AND STEEL BRIDGES.

Sealed bids will be received by th Board of Supervisers of Audubon Cou ty until 9 o'clock a. m., June 12, 191 for the construction of concrete an steel bridges in the county.

Plans and specifications on file wit the County Auditor at Audubon, Iowa and the Engineer, C. D. Forsbeck, 61 Black Hawk Bldg., Waterloo, Iowa Each bid must be accompanied by a cer tified check for two hundred dollars.

SEWER CONSTRUCTION.

Wheaton, Ill

Bids will be received on June 22d at p. m. for the construction of 2,890 feet o 60-in. concrete sewer. For further par ticulars address

A. L. WEBSTER,
City Engineer.
Wheaton, Ill

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

PAVING MATERIALS.

Sealed bids will be received at the [illegible] e of the Village Recorder of C[illegible] [illegible] 2, for the construction complete of about 2,950 sq. yds. of paving. Bids will also [illegible] The [illegible] ill be received are sandstone, bitulithic, reosoted wood blocks, donnellite, granorete and brick.

Plans and specifications can be seen at ie offices of the Village Recorder and ngineer. All bids must be on form of roposal furnished by the village.

A certified check for five per cent (5%) [illegible] illage of Chisholm, Minn., must accomıny each bid.

The right is reserved to reject any and l bids or to accept any bid considered ivantageous to the village.

F. C. LANG,
Village Engineer.

STREET MPROVEMENT.

Bids for the improvement of approxiately one and one-half miles of streets, r grading, curb and guttering, and ıving with asphalt, will be received by e City Recorder of Salt Lake City, Utah, ıtil 10 o'clock a. m., June 24th, 1912 ıe approximate yardage to be laid is [illegible] sq. yds.

Plans and specifications can be seen at e office of the City Engineer, or copies ay be obtained upon receipt of a $5.00 posit.

By order of the Board of Commis-[illegible]

NOBLE WARRUM,
City Recorder.

ONCRETE SUB-CONTRACTORS WANTED.

We have about twenty thousand cubic rds of concrete work distributed in ıall bridges, abutments, headgates, ops, etc., which we will let to responsi- contractors in quantities to suit at od prices.

NSEY BROS.-BOOMER & HUGHES.
1-2 Mackie Bldg.,
Calgary, Alberta.

TRACK LAYING TO LET.

TO LET—35 miles of track laying on Gainesville & Northwestern Railway t of Gainesville, Ga. Address Burke & seph, Cape Girardeau, Mo.

ort Hancock, N. J., June 1, 1912. Sealed posals, in triplicate, will be received e until 12 m., June 15, 1912, and then ned, for installing electric lighting tem and apparatus in power plant. Inmation furnished on application. Enopes containing proposals should be orsed "Proposals for Installing Electric hting System" and addressed to Quarmaster.

. S. ENGINEER OFFICE, Seattle, sh., May 28, 1912.—Sealed proposals furnishing 200,000 barrels of Portland ent will be received here until 12 m., y 1, 1912, and then publicly opened. ormation on application. J. B. CAVAUGH, Major, Engrs. 22-4t

CONSTRUCTION OF A BRICK ROADWAY.

Sealed bids or proposals will be re-[illegible] Wheeling and Union Turnpike, at the office of the County Auditor, St. Clairsville, Ohio, until 10 o'clock a. m., June 17, 1912, [illegible] with concrete berms, from Bannock and Flushing Pike, near Bannock, to the Flushing and Morristown Road, about one-quarter of a mile north of Mt. Hope school house, a distance of 5.6 miles, divided into two sections, as described by the specifications.

Proposals must be made out on blanks furnished gratuitously upon application [illegible] certified check on some solvent bank in the sum of five hundred ($500) dollars, payable to the Road Commissioners, as a guarantee that a contract will be entered into if the proposal be accepted.

Plans and specifications may be seen at the office of the County Auditor, St. Clairsville, Ohio, at the residence of H. K. Lodge, near Bannock, Ohio, or at the office of D. A. Elkin, Engineer, Bellaire, Ohio.

The right is reserved to reject any and all bids.

All proposals must be in sealed envelopes, marked on the outside, "Paving Bids," and must be addressed to H. K. Lodge, Clerk for the Road Commissioners, St. Clairsville, Ohio.

H. K. LODGE,
Clerk of the Road Commissioners.

NOTICE FOR BIDS.

Notice is hereby given that sealed bids will be received by the Board of County Commissioners of Twin Falls County, Idaho, up to 10 o'clock A. M., June 17, 1912, for the furnishing of all material and labor for the construction of two steel bridges across Rock Creek Canyon, in Twin Falls County, No. 1 to be located at or near the section line between Sections 21 and 22, Town 10 South, Range 17 E. B. M., and No. 2 at or near the section line between Sections 8 and 9, Town 10 South, Range 17 E. B. M., said bid to be according to specifications furnished by the bidders. Each bid to be accompanied by a certified check in a sum equal to 10 per cent of the amount of the bid; check made payable to the Treasurer of Twin Falls County, Idaho, as a guarantee of good faith on the part of the bidder that if awarded the contract he will forthwith accept the same and will enter into a contract under bond within ten days with the Board of County Commissioners of Twin Falls County, Idaho, and if he fail to do so said guarantee of 10 per cent will be forfeited to said Twin Falls County as liquidated damages to be used for the benefit of the Road and Bridge fund of said county.

Separate bids shall be submitted for each bridge. Bids to be sealed and marked "Proposal to construct Rock Creek Bridge No. 1"; "Proposal to construct Rock Creek Bridge No. 2," addressed to O. G. Zuck, Chairman, and mailed to E. J. Finch, Clerk, Twin Falls, Idaho, so that bids will be on file with said clerk on the date first above mentioned.

Profiles will be furnished on application to the clerk of the Board of County Commissioners. The Board reserves the right to reject any and all bids.

By order of the Board of County Commissioners, Twin Falls County, Idaho.

Dated Twin Falls, Idaho, May 14, 1912.

O. G. ZUCK, Chairman.

Attest:
E. J. Finch, Clerk.

SEWERS AND SEWAGE DISPOSAL WORKS.

Sealed proposals will be received by the Board of Public Works of the City of Sturgis, Michigan, until twelve o'clock (noon) Tuesday, June 18th, 1912, for furnishing the materials and labor required in building a system of sewers, comprising approximately 40,000 feet 8 to 18-inch, 3,000 feet 30-inch, a sewage pumping station and a sewage disposal plant.

All bids must be made upon the printed forms prepared for the purpose and enclosed in a sealed envelope, directed to the Board of Public Works, and endorsed on the outside of the envelope, "Proposal for Sewers."

Each bid must be accompanied by a certified check for sewers $2,000, disposal plant $500, pumping station $50, as a guarantee of good faith.

Plans and specifications for the work can be seen at the office of the Board of Public Works and at the office of Geo. S. Pierson, Engineer, Kalamazoo, Mich.

The City of Sturgis reserves the right to reject any bid and all bids and to consider the qualifications of bidders in determining the award of the contract.

BOARD OF PUBLIC WORKS,
Sturgis, Mich.

STREET IMPROVEMENT.

Sealed bids will be received for improvement of Margaret and Ann Eliza Street paving district in the city of Pekin, Ill., by Charles Duisdicker, President of Board of Local Improvements, until [illegible] o'clock p. m., June 18, 1912, consisting of about 28,580 sq. yds. brick paving on concrete foundation, cement grout filler, 3,425 lin. ft. stone curb reset, 9,100 lin. ft. concrete curb 6x20-ins., 450 lin. ft. protection curb, 9,400 cu. yds. excavations and filling. Plans and specifications furnished by the City Engineer.

JOHN R. SEIBERT
City Engineer.

Proposals will be received by the City of Crowley, La., up to June 18, 1912, at 8 o'clock p. m., for 20,000 sq. yds. creosoted wood block pavement, 5,000 lineal feet curb, 5,500 lineal feet gutter.

B. J. BOUDREAUX, Clerk.

TREASURY DEPARTMENT.—Office of the Supervising Architect. Washington, D. C., May 27, 1912. Sealed proposals will be received at this office until 3 o'clock p. m., on the 10th day of July, 1912, and then opened for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring system and interior lighting fixtures) of the United States postoffice at Lansing, Mich. This extension is about 38 by 74 feet, two stories and basement, stone faced, slate roof, fireproof construction. Drawings and specifications may be obtained from the custodian at Lansing, Mich., or at his office, in the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

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Annual Address.
By FREDERICK W. C. WHYTE, Montana Society of Engineers.
Highway Maintenance.
By ROBERT D. KNEALE, Montana Society of Engineers.
The Hebgen Dam.
By HARRY H. COCHRANE, Montana Society of Engineers.
Journal of the Association of Engineering Societies, May, 1912.

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Devoted to the Economics of Civil Engineering Design
and to Methods and Cost of Construction

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esirability of Separating Domes- nd Commercial Uses in Re- rting Water Consumption.

al custom in this country in re- [illegible] the average monthly pumpage. [illegible] r in the city. In this manner all er, domestic, public, commercial, n, loss and waste, are lumped [illegible]

to separate the reported consump- domestic and commercial uses, at [illegible]

ying to note that a committee has ted by the American Waterworks [illegible] ther things, the amount of water used ities for domestic and commer- s. When this information is col- will throw a good deal of light on plexing problems as those which are d with meterage and the rate ques- [illegible]

not uncommon for American writers are the high per capita consumption r in this country with the relatively sumption in British cities, and to at the great difference apparently ex- the use of water in the two coun- part, in many instances a large part, great difference in water consump- ccounted for by the fact that English howing consumption usually give only [illegible] relate to the total consumption which arily spread over the entire popula- arrive at a most misleading average. been demonstrated in the residence of our larger cities, time and again, use of water for domestic purposes t exceed 10 to 15 gals. per capita in t districts. Meter readings show that domestic consumption in many first-class residence districts compare favorably with the domestic consumption in English cities. In many of our cities enough water is used for commercial purposes alone to give the city an apparent per capita consumption of 50 gals. per day, and even higher in some instances. At the recent convention of the American Waterworks Association waterworks superintendents from various cities east of the Mississippi River stated that many cases had been discovered in their cities in which a single commercial consumer stole enough water out of an unmetered fire service connection to raise the apparent average consumption of the entire city several gallons per capita per day.

The American custom of lumping all water uses together for the purposes of annual reports makes intelligent comparisons between various cities impossible. Before such figures are of any use whatever they must be supplemented with so many explanations that any convenience apparently arising from the average consumption for all purposes throughout a given city becomes of little importance.

If domestic and commercial uses of water are segregated in annual reports, all waterworks officials will be furnished a basis on which intelligent comparisons may be drawn relative to the legitimate domestic use of water. That item should not vary widely between the various cities and is the first point on which we can hope to find substantial uniformity in the quantity of water which it is considered necessary to supply.

Vacation Employment for Undergraduate Engineering Students.

Now that the long vacation season is at hand undergraduate engineering students will be looking around for something to do. Probably the majority of students will return to their homes as a matter of course, yielding either to natural impulses in that direction, or responding to the need of their services at home. A few will seek employment for the purpose of obtaining funds with which to complete their academic education. To the latter class we wish to make a few suggestions.

Even at the end of his first year in college the student should secure employment in some line closely allied to the work he expects to take up after graduation. The advantages of such employment are many and far reaching. To begin with, the young man so employed may find out, before it is too late, whether or not he is fitted for the work he plans ultimately to take up. Again, he acquires a practical knowledge of things concerning which previously he has had only vague and inaccurate impressions. After a vacation season spent in this manner he returns to college, sure that he is on the "right track." His studies will now mean much more to him than they did before. He will take an intelligent interest in his work, and will better appreciate the course of study which has been laid out for him. His observation of things in the field will enable him to ask intelligent questions in the classroom when he takes up the study of design.

The student of civil engineering, at the end of his first year, usually considers himself fortunate if he can obtain a position on a surveying party or in a drafting room. If he expects to follow what we will here call the "designing side" of civil engineering, such a position is just the place for him. However, if he has a liking for the "constructing side" of engineering, he will do well to avoid the surveying party and the drafting room. In that case he should work on some construction job, preferably as time-keeper during his first season, but as a laborer if necessary. An ever-increasing number of technical graduates are going into the contracting business, which is only the constructing side of engineering, and surely there is room for trained men in that field.

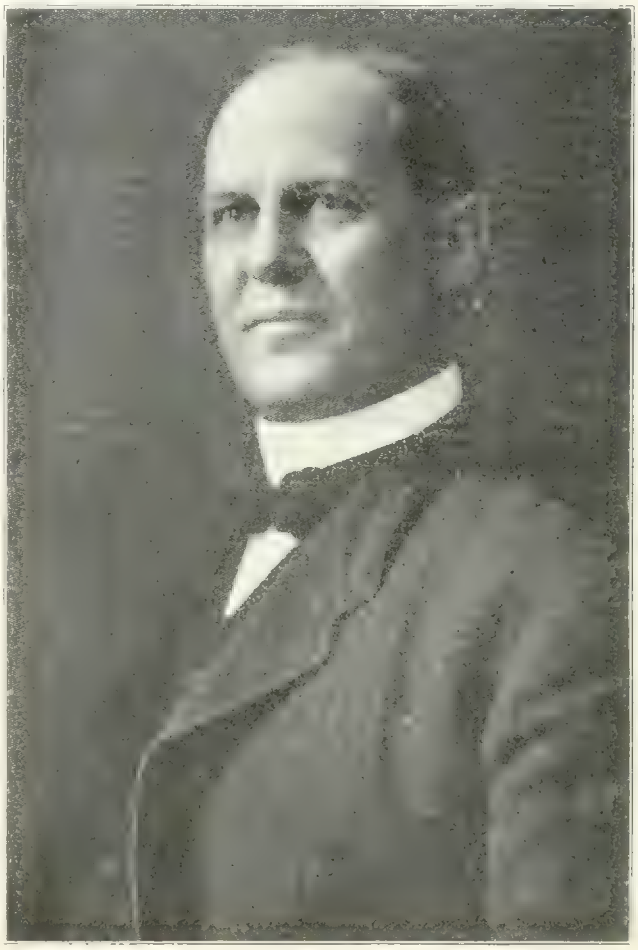
Dow R. Gwinn, President American Waterworks Association.

Dow R. Gwinn, the newly elected President of the American Waterworks Association, is President and Manager of the Terre Haute Waterworks Co., of Terre Haute, Ind. Mr. Gwinn was elected president of the Association at its thirty-second annual convention, held in Louisville, Ky., during the first week of June.

Mr. Gwinn started at the bottom in the waterworks business. His first employment in a waterworks organization was secured with the water company at Quincy, Ill., in 1882, as a timekeeper on construction work. He remained with the Quincy Company for nineteen years. During that time he occupied practically every position in the organization in turn. His experience was not limited to office work, but covered all the field operations of construction and maintenance as well. On construction work, in his early days with the company, he laid water mains. Later he had charge of the construction of a reservoir. His most important work at Quincy was an experimental study of the value of iron as a coagulant. As indicated, Mr. Gwinn worked his way up from the bottom in the Quincy company, and held the position of Superintendent of that organization at the time he was offered his present position with the Terre Haute Waterworks Co.

The subject of uniform accounting is one in which Mr. Gwinn always has taken special interest. He was a member of the Committee on Uniform Annual Reports and Accounts appointed by the American Waterworks Association. This committee at a conference, and by means of correspondence with representatives of the United States Bureau of the Census, New England Waterworks Association, American Association of Public Accountants, the Ohio Bureau of Uniform Public Accounting and others interested in the subject, drew up a form for uniform waterworks reports. This report was made at the Rochester convention of the American Waterworks Association in June, 1911, and was adopted by the Association at the recent convention held in Louisville.

The scheme of uniform accounts outlined in the report of this committee is a far more complete and comprehensive system than any previously devised. The scheme is adjustable both to large and small enterprises and possesses three main characteristics, namely: (1) The financial data are so classified and the accounts are so arranged that they provide summaries of results or conditions along such fixed lines, and upon such basis, that intelligent comparisons can be made between the summaries of different fiscal periods and between those of similar enterprises. (2) The accounts are arranged so as to show the three elements of the total cost; demand cost, customer cost, and consumption cost. (3) The accounts are so designated as to make the system readily understood and easily applied. The committee worked on this scheme of accounts for several years, and Mr. Gwinn took a keen interest in the work, but he gives Mr. Wehr, chairman of the committee, credit for the major part of the report.



Dow R Gwinn

Methods of keeping down operating expenses in the properties under his management, has been one of Mr. Gwinn's constant studies as a waterworks official. While regularly employed by the Terre Haute Waterworks Co. for the past eleven years, he has also had charge of a string of waterworks properties in various parts of the country, acting as manager for the Harris Trust and Savings Bank Co. of Chicago, and others financially interested.

At the time Mr. Gwinn took hold of the management of one of these plants it was paying 65 cts. out of every dollar of its revenue for operating expenses and taxes. In about two years' time he had the satisfaction of seeing this figure reduced to 40 cts. on each dollar of income. The gross earnings of this plant were doubled in about six years, while at the same time the increase in the amount of water consumed was hardly appreciable. Acting for the same interests, Mr. Gwinn also has made many examinations of waterworks properties in all parts of the country in connection with bond issues.

Mr. Gwinn was a pioneer in advertising to build up the waterworks business. At times the Terre Haute Waterworks Co. has carried as much as two pages of advertising. He presented a paper at the convention of the Association which was held in New Orleans in 1910 on the subject.

As an illustration of the value of advertising in building up the business of a waterworks company, Mr. Gwinn cites the use of water motor washing machine When bought in large quantities these machines usually can be bought for about 10 each. Where the consumer is supplied b meter he can, ordinarily, get enough water for one washing for 10 cts. Customers wh once use a first-class water motor washin are very likely to keep on using it. The re nues while small for each consumer er week amounts to $5.20 per annum. W re 1,000 machines are used at this rate the g ss earnings of the water company are in ased over $5,000 per annum. The pub usu does not understand the value of ese machines, and in order to bring them the attention of the people the columns o he local newspapers should be used.

Again, in some cities where sm hous are built by the mile, and cut off room sections, the man does not prov rooms or even kitcl Mr Gwinn has lear by keeping the advant kitchen sink before th public, the real estate feel the demand for sin stall them, thereby incr legitimate use of water.

Naturally, the aver knows very little about t works business. He is regard the officials of w panies as robbers and th of municipal plants as gr theory which Mr. Gwinn acted upon is that while works manager can not customer and explain al tails of the waterworks he can buy advertising sp local newspapers and s information over the enti ci

Two sayings which M Gwinn sometimes uses, illustrate s att tude toward the public some insight to his Both are familiar to all. lates to flies, molasses and and the other to the fact liteness is one of the things in the world."

Mr. Gwinn has been a m of the American Waterw sociation for many years. always taken an active pa presentation and discus technical papers before th A ciation. The paper wh ably has attracted more atten than any other presented was the one read at Wash D. C., four years ago w tained a tabulation of th rates in force in 375 A cities. This paper still i mand, and he frequently quests for copies of it.

In addition to his me on important committe Gwinn has held the five vice dencies of the Association turn In the absence of Presider Alexander Milne he acted as chairman at e cent convention.

The driving of tunnels at a great th usually interfered with to some extent high temperatures encountered. The tempe tures encountered in tunnels under high oun tains are usually considerably greate temperatures recorded in tunnels unc flat countries by about 30 to 40 per cent The influence of water on the temperature also considerable, and if an accurate record the temperature of the tunnel is kept whil ing, a sudden drop in temperature will indicated when approaching water. Such caution may prevent disaster such as occ in the Loetschberg Tunnel.

GENERAL ARTICLES

elta Dam and Storage Reservoir Supplying Water to the Rome Summit Level, New York State Barge Canal.

ted by Emile Low, M. Am. Soc. C. E.,
ident Engineer, Barge Canal.

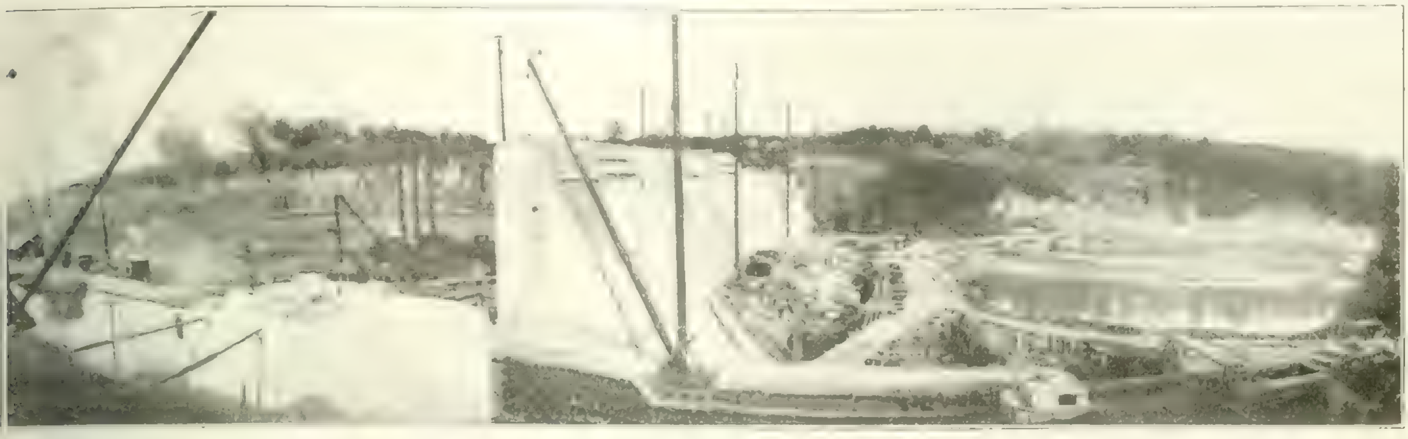


Fig. 1—General Construction View of Delta Dam, New York State Barge Canal.

State of New York at the present time ed in improving its main canal sy by widening and deepening the exist rtion of the same, and, *second*, by the of new portions, generally by the tion of streams, the Clyde, Seneca, and Mohawk rivers, of which the lat e most important. This improvement y known as the "Barge Canal" com he Erie Canal, from Buffalo to the River, at Albany, 350 miles; the in Canal, from Waterford to Whitemiles, and the Oswego Canal, from ivers to Oswego, 23 miles. The im canal will have a channel of least 75 ft. at the bottom, with a water 12 ft.; in rivers and lakes it will be d deeper. The locks are 328 ft. long, ide and 12 ft. deep, allowing the pass oats of about 2,000 tons burden, al the prism is only sufficient for boats tons burden, hence the general name mprovement, "1,000-ton Barge Canal." tire work is in charge and under the of the Hon. John A. Bensel (late t of the American Society of Civil rs), State Engineer, to whom the indebted for many of the data con this article.

SCRIPTION OF THE ERIE CANAL

ing at Buffalo, the Niagara Ship Ca be used to its junction with the Niag er at Black Rock, then the Niagara Tonawanda, thence the route is across of level country to Lockport, using f Tonawanda Creek. At Lockport the sses a break known to geologists as gara escarpment"—a cliff 60 ft. in t this point. From Lockport the ca pass to Rochester in a single level miles long; then it crosses the Gene r south of this city, continuing east llowing tributaries of the Clyde River yra. Up to this point the new canal largely the same as that of the present al, the greatest deviation being made g Rochester.

of Lyons, the old canal will not be the new location following generally r channels, that of the Clyde River nction with the Seneca River at Mon and that of the latter river to Three oint, the junction of the Seneca and Rivers, which together form the Os hen following the Oneida River cross ida Lake, traversing the valley of reek, the summit at Rome is crossed and the valley of the Mohawk River is entered. The valley of the Mohawk River is traversed to near the mouth of the river, at its junction with the Hudson River at Waterford.

The Barge Canal is really a canalization of this stream, a system of movable dams being used between Utica and Schenectady. The falls of the Mohawk River at Cohoes are passed by a diversion channel to the north. At Troy is located the last lock and from there to New York, there is the tidal navigation of the Hudson River.

WATER SUPPLY

One of the problems connected with the construction of the Barge Canal is that of an adequate water supply. Owing to the large cross-sectional area of the normal canal prism, which has a bottom width of 75 ft., depth of water of 12 ft. and a normal water surface of 123 ft., giving the water prism a sectional area of 1,188 sq. ft., a very moderate current in the canal necessitates a large volume of water for its filling and maintenance of navigation.

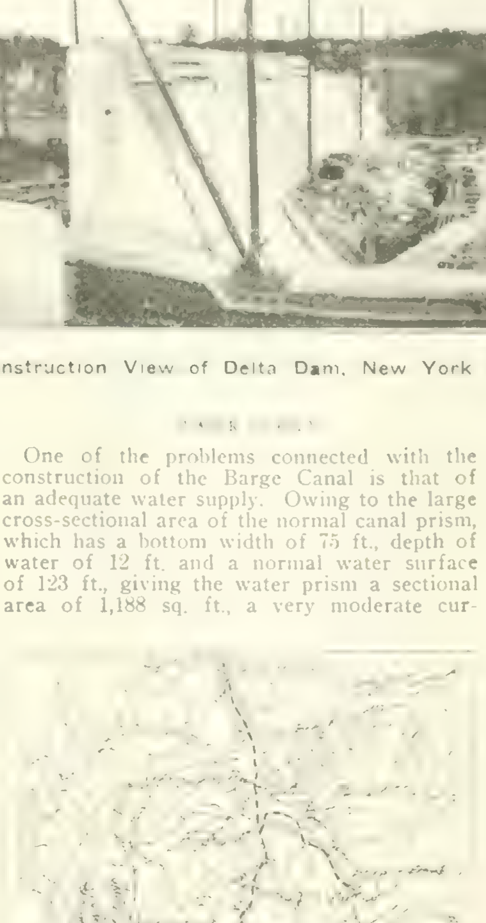


Fig. 2—Map Showing Delta Reservoir, Drainage Basin and Tributary Country.

At Buffalo the available supply from Lake Erie is practically unlimited, the Niagara River being tapped at Tonawanda, furnishes a supply for the continuously descending canal as far east as Three River Point, north of Syracuse, augmented by the flow of the Clyde and Seneca Rivers and their various tributaries. The total descent in this section is 210 ft., in a distances of 170 miles. The next section, ascending eastwards, is fairly well supplied by the Oneida River, Oneida Lake and the Fish and Wood Creek water sheds. The rise is 60 ft. between Three River Point and New London, the length of the section being 40 miles.

On account of the natural advantageous conditions, the water supply of the canal between Buffalo and New London, a distance of about 210 miles, presents no serious difficulty. Next is the Rome summit level, 15 miles long, extending from New London (7 miles west of Rome) to Oriskany (8 miles east of Rome) the water surface elevation is 420 ft. A. T. In this region there are no large streams, and hence the summit level must necessarily be supplied from a number of sources with artificial storage in order to obtain the requisite quantity of water, which is nearly twice as large as would be needed for an equal length of canal extending in only one direction, since water for leakage and lockage is drawn at each end of the summit level.

The insurance of an ample supply to this portion of the canal was therefore of special importance, and after a thorough study of the problem its most economical solution was found in the construction of two large storage reservoirs on streams within comparatively easy reach. One of the sources now being developed is the Delta reservoir in the valley of the upper Mohawk River, about 5 miles north of the city of Rome. It derives its name from the village of Delta, which has been wiped out of existence by the construction of the reservoir. A short, rocky gorge, with broad flats for a long distance above, affords here an excellent site for a dam and reservoir of great capacity. The drainage area above this point is about 140 square miles; extending along the east branch of the Mohawk River to Mohawk Hill and along the Lansing Kill to within two miles of Boonville. (See Fig. 2.)

The Delta reservoir site was thoroughly discussed in the well known Barge Canal Report of 1901, and from observations taken and computations made, it was found that the total minimum yield in cubic feet per day would be 11,062,000, while the minimum quantity available for canal purposes, would be 8,100,000 cu. ft. per day, the difference, about 3,000,000 cu. ft., being allowed to run down the river below the head of the feeder.

An estimate of cost for a dam at this place will also be found in the report just mentioned. The estimate was based on building a main dam, 60 ft. high to spillway level; the reconstruction of about 1.53 miles of the Black [illegible] t. lift, and, finally, the building of a new aqueduct across the river below the dam. [illegible] onry, with a roadway on its crest, the overflow portion 300 ft. in length being crossed [illegible]

[illegible]	[illegible]
10 per cent	119,017
[illegible]	[illegible]

[illegible] weg of the valley, being occupied by the Barge Canal, east of Utica, to near Waterford, no difficulties as to a sufficient water supply are encountered in this section, especially as the drainage gradually increases, numerous large tributaries entering the Mohawk River between the points mentioned.

BARGE CANAL IMPROVEMENT AUTHORIZED

The legislature of 1903 enacted a law (Chapter 147) which, after approval by the people of the State at the ensuing general election, authorized the enlargement of the Erie, Champlain and Oswego Canals to certain specified dimensions, an undertaking generaly known as the "Barge Canal." Within a short time after the ratification of this referendum the work of organizing an engineering force and of making surveys and plans was begun. In December, 1904, the first bids were opened, but owing to legal complications, the contracts were not entered into until April and May of the following year. The first actual work of construction was performed on April 24, 1905, at Fort Miller, in opening a temporary canal on the Champlain section. The first work on the main channel was done at Waterford, Erie canal, June 7, 1905.

Coincident with the engineering work on the canal prism itself, the subject of building suitable storage reservoirs for the Rome summit level engrossed immediate attention. Earlier surveys demonstrated the fact that there were two ideal locations for these storage reservoirs, namely, one at Delta in the Mohawk River, and the other at Hinckley on West Canada Creek. The sites having been established, the necessary engineering operations were begun on the Delta dam and reservoir May 25, 1905. The reservoir site being at some distance from the canal it was necessary before beginning the topographical surveys to run precise levels and establish bench marks for connecting the surveys with the Barge Canal datum. In general the topographic surveys were made by the stadia method and sufficient points located for interpolating and drawing 2 ft. contours on the maps. In addition all artificial features, such as highways, property lines, fences and buildings were carefully located.

The nature of the foundation of the dam site was thoroughly investigated by numerous wash and calyx drill borings, in addition to rod soundings and test pits.

DESCRIPTION OF RESERVOIR SITE

The Delta reservoir occupies a basin formed by the enlargement of the valley of the Mohawk River just above a rock-walled gorge, which is about 600 ft. wide at the valley level at the site of the dam.

The eastern wall of the basin, along the base of which the river flows, rises precipitately and attains in places an almost perpendicular height of 100 ft. This bluff, composed of the prevailing Hudson River shale and schist is known locally as the "Palisades." The basin is undoubtedly the site of an ancient glacial lake. This lake overflowed, apparently, at the site of the "Palisades" before the gorge was formed and gradually trenched and eroded the gorge, in the manner that the [illegible] Rivers gorges have been produced. Excavations for the dam disclosed a buried gorge, or depression, in the rock surface, about 25 ft. deeper than the rock in the river bottom, and excavations for the piers of the aqueduct below the end of the "Palisades" uncovered steep buried ledges and pot holes, one of these apparently about 15 ft in diameter and of great depth [illegible] these evidences of violent water action [illegible] depths simply mark the receding base [illegible] overflow from the old lake, as the [illegible] water cut its way back farther and farther into the southern slope.

The reservoir covers an area of 4⅓ [illegible] miles, when the water stands at the crest of the dam, the elevation of which is [illegible] above tide. This elevation was fixed by the desire to avoid serious incursions upon the [illegible] and attractive village of Westernville [illegible] head of the reservoir, the waters of [illegible] will even now lave the "back yards" of some of the dwellings. About 4.8 square m[illegible] land was acquired by the State, in order to provide margins around the reservoi[illegible] It has a capacity of about 2,750,000,000 [illegible] at crest level, and at maximum probable high water—elevation 554—of 3,257,000,000 [illegible] The maximum water depth at the dam [illegible]

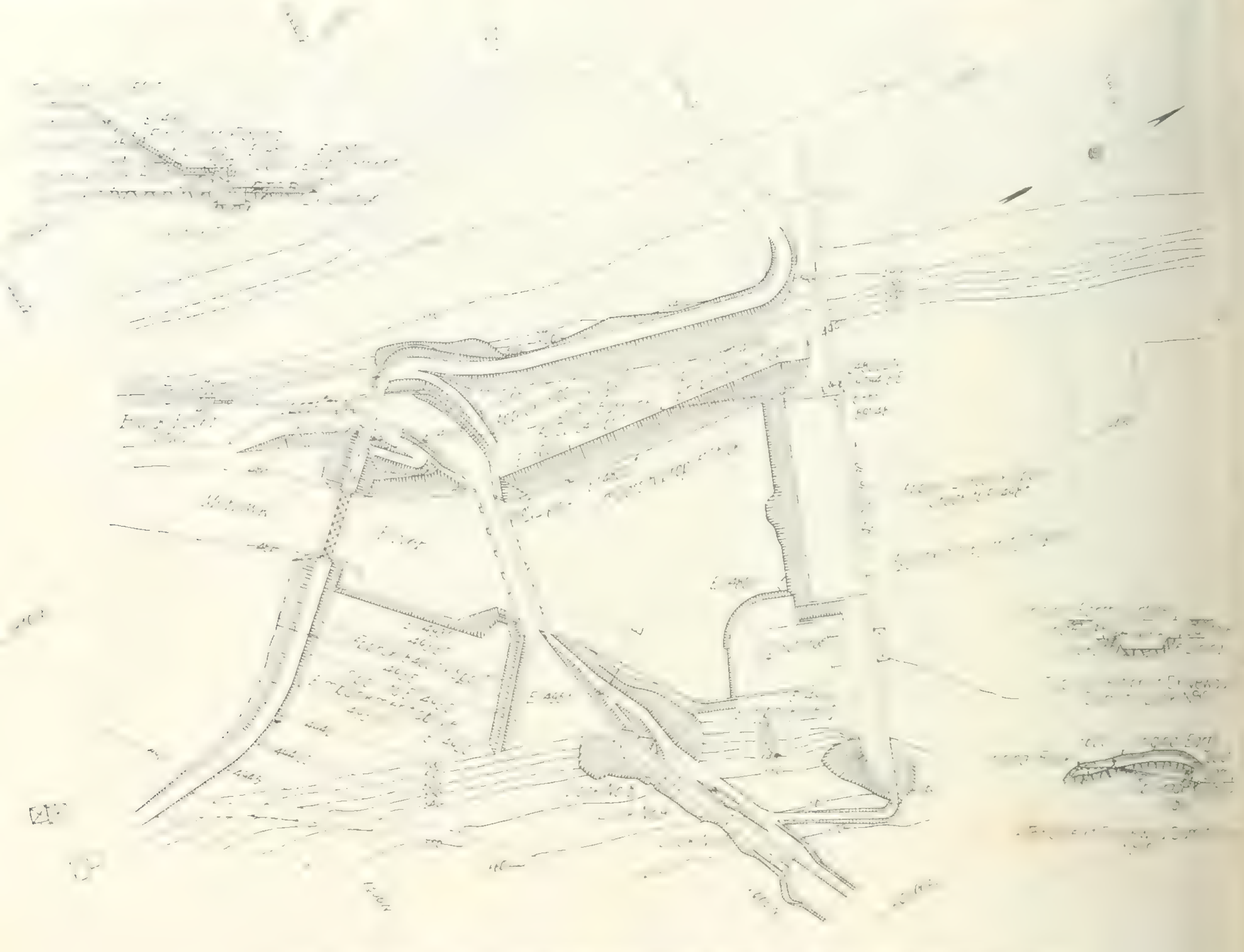


Fig. 3—General Plan Showing Structures of Delta Reservoir and Barge Canal.

[illegible] 70 ft. [illegible]
[illegible] will be [illegible]
stated the reservoir wipes out the of Delta and extends northerly to the of Westernville, submerging, however, few houses on the outskirts of the lat- all some 295 buildings, including about ellings, will be removed from the site [illegible] These will be [illegible] new [illegible] ater line. The reservoir will also sub- two cemeteries and several private bury- s, the bodies of which will be removed ried outside the limits of the reservoir reservoir will be of great value in reg the flow of the Mohawk River below n. The present low-water flow is from 150 cu. ft. per second and the maximum rge of which there is a record is cu. ft. per second. It is estimated [illegible]

[illegible] the Black River Canal, with four locks and aqueduct over the Mohawk River, highway and bridge changes is Mr. Arthur McMullen, the contract for all the above described work having been awarded him in October, 1908. The State Engineer's [illegible] twelve bids were received from contracting firms, ranging in amount from $905,347, the lowest to $1,082,750, the highest. The total amount of work done by the successful con- [illegible] neer's estimate and the contractor's bid for each and every item, unit prices and total amounts are given in Table I.

[illegible]

The plan of the dam and appertaining structures is shown by Fig. 3. The axis of the dam lies slightly northwest and southeast, the course of the Mohawk River, at the place of crossing, is southwest. The length of the dam at the elevation of the original earth surface is about 600 ft., while the total length on top, including the spillway, is 1,010 ft. This spillway is 300 ft. long, and its crest elevation is 550 ft. A. T. The portion of the dam adjoining the spillway on the west is 325 ft. long and the top elevation is 558 ft. A. T., or 8 ft. higher than the spillway, and 4 ft. above flood level. The eastern section of the dam is the same elevation, but 385 ft. long. The height of the dam, between the lowest foundation (not including the cut-off wall, which is 8 ft. deep) and the crest is 100 ft. The thickness of the top of the spillway is 13 ft., and that of the two adjoining portions 7½ ft., while at elevation 480 A. T. or 70 ft. below the crest of the spillway, the thickness is 51 ft.

The water passing over the spillway falls into a pool below, which acts as a water cushion and breaks the force of the fall. The minimum depth of the water in this pool is 10 ft. A gate-house, east of the spillway, is provided with four 60-in. cast-iron discharge pipes, having a combined capacity of 3,800 cu. ft. per second, with water in the reservoir standing at the crest of the dam. The governing requirements in designing these pipes was to provide a sufficient discharging capacity to regulate the flow, in time of summer floods, to a maximum of 2,500 cu. ft. per second, it being estimated that about 500 cu. ft. per second might pass into the river between the dam and the point where the river will enter the Barge Canal, and 3,000 cu. ft. per second being considered the maximum rate of flow which should be allowed to pass into the canal at Rome during the navigation season. Each discharge pipe will be provided with a 5x5-ft. rectangular sluice-gate at its upper end and a 48-in. gate-valve at its lower end. Above the sluice gates, in the upper gate chamber, stop planks are provided for use in cases of emergency.

As the reservoir submerged about two miles of the existing Black River Canal, it was necessary to relocate the portion between a point a few hundred feet below lock No. 7 and a point a few hundred feet above lock No. 1 These seven existing locks will be submerged or abandoned. Four new locks will be used in the relocated line, one, with a lift of 12. ft., being in the bed of the existing canal at the beginning of the new channel. At the southern end of the reservoir site the present canal runs on the west side of the river. The new waterway will extend across the river valley and by a flight of three combined locks of 20.6 ft. lift each, located southeast of the dam, it will ascend the east bank of the river and skirt the east shore of the reservoir to a junction with the old canal. The new canal will cross the river some 400 ft. south of the dam, on a reinforced concrete aqueduct about 205 ft. long, resting on two abutments and five piers.

The existing highway bridge over the river near lock No. 7 will be moved downstream some 30 ft., raised about 12 ft. in elevation and placed on new abutments. A new steel highway bridge will be place

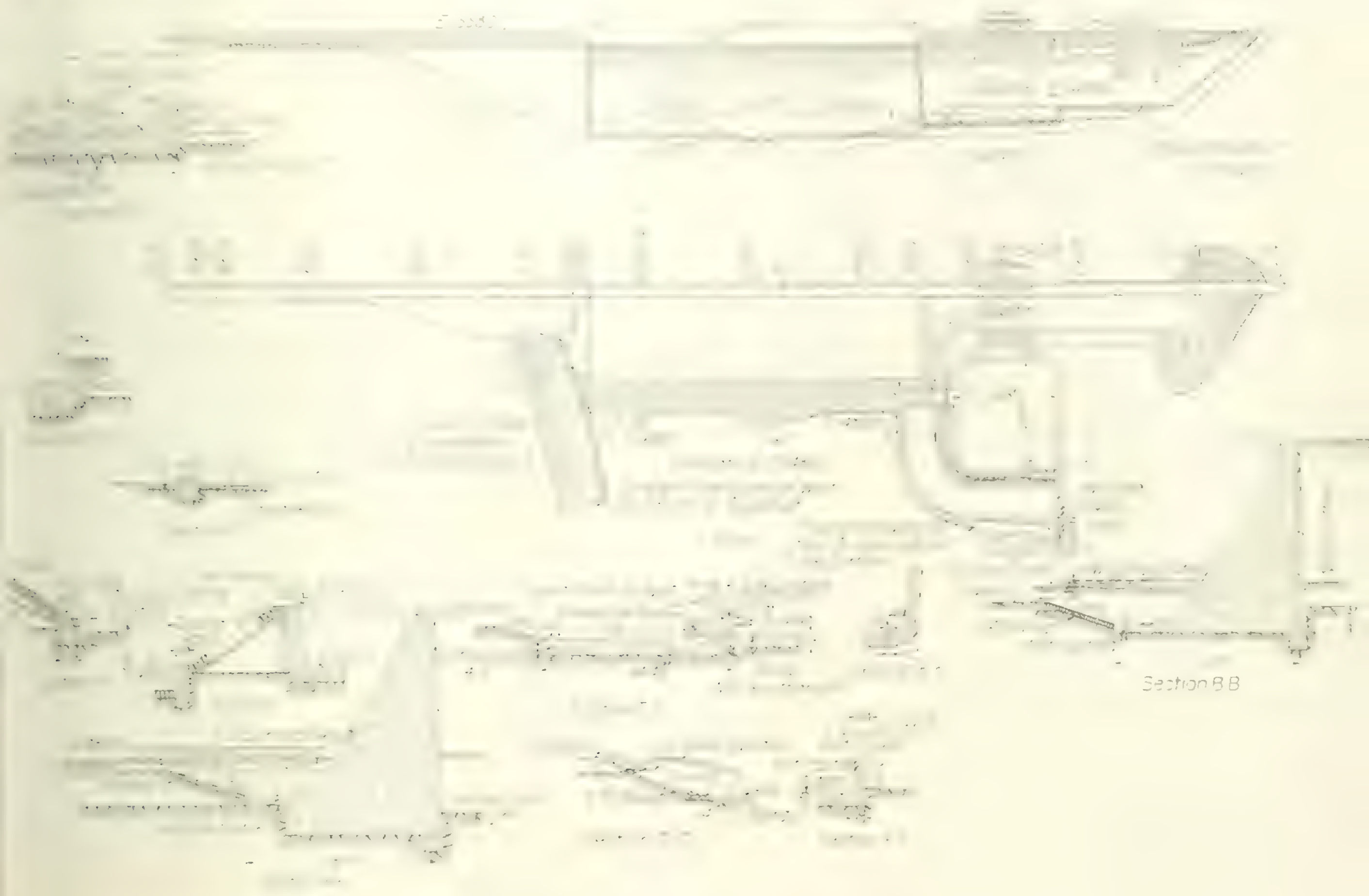


Fig. 4—Plan, Elevation and Sections of Delta Dam.

tes are properly regulated, the reser- ill limit all summer floods to about u. ft. per second, it being assumed that servoir will be kept practically empty the winter months. However, in case isregulation of the gates of the reser- e maximum flood which could pass over m would be about 5,600 cu. ft. per [illegible] compared with [illegible] e amount at present, before the res- is constructed. This regulation will tedly save considerable damage to prop- ot only by affording a more uniform n of flow, but by reducing flood heights, lding ice, and preventing ice jams and

he reservoir will submerge about two of the existing Black River Canal, it cessary to relocate this portion of the Further details concerning this change found further on.

LETTING OF CONTRACT

contractor for the construction of the reservoir, including the clearing of e, the construction of the Delta dam, [illegible] the [illegible] above the proposed new [illegible] A new highway will be constructed from the end of this bridge, joining the existing highway a few hundred feet north.

DESIGN OF DAM.

Many studies and computations were made before deciding on the profile of the Delta dam, and indeed the reinforced concrete type of structure was at one time considered. One study proposed a spillway with deep steps, to be made of concrete block facing and intended to break the force and velocity of the descending sheet of water. Another rejected study provided for carrying a highway across the top of the structure, and even a scheme for carrying the Black River Canal across in a similar manner was considered. For the alinement of the dam, a curve of 800 ft. radius was at first considered because of the improved appearance as well as on account of minor theoretical advantages, although no thought of allowing for arch action in so long a structure relative to its height was entertained. While in all cases it is possible to reach a rock foundation, the design of the dam and appertaining structures was influenced throughout by one fundamental difficulty, namely, the character of the geological formation, which is the Hudson River shale and schist. The face of the palisades and the rock lying near the surface on the higher ground is badly disintegrated and, though bed rock uncovered in the valley, most of which has been buried deeper and better protected from atmospheric agencies, appears firm and well preserved, still the best of it may be excavated with picks and wedges and surfaces or fragments exposed to the air disintegrate rapidly and completely. This geological formation is characteristic of the Hudson and Mohawk River valleys, extending from Newberg to Lake Ontario at Pulaski.

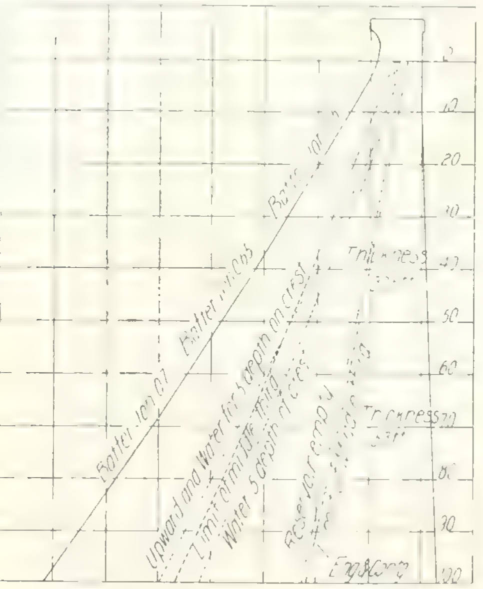


Fig. 5—Diagram Showing Lines of Pressure in Delta Dam.

Fortunately north of the dam site there is another geological formation, that of the Calciferous Trenton limestone, which furnished an excellent building material for the dam and other structures.

In the design adopted the resultant under probable conditions falls safely within the middle third of the base. With upward water pressure it falls slightly outside the middle third and deviates still further if its action (which should be obviated by proper regulation) is included. Fig. 5.

The alinement of the adopted dam is straight and the dam is designed to be carried at least 6 ft. into rock and to be built in sections generally 30 ft. long, separated by expansion joints having vertical keyways, Fig. 6, V-shaped in sections, and covering from 25 to 40 per cent of the cross-section area, while intercepting drains, formed in the masonry just beneath the downstream face, conduct any water which may percolate through the joint, to an outlet below ground. The dam is thus one of the first structures of its size to be built with expansion joints. For ae effect a frieze of arches was introduced underneath the coping on the downstrea

TABLE I.—ENGINEER'S ESTIMATES AND BUILDING PRICES FOR DELTA DAM

Item.	Measure.	Quantity.	Engineer's Estimate. Price.	Engineer's Estimate. Amount.	Arthur McMullen, 21 Pa Row, New York. Price.
Clearing	lump sum	....	$ 9,000.00	$ 9,000.00	[illegible]
Grubbing	cu. yds.	6,600	.40	2,640.00	.40
Excavation	cu. yds.	346,000	.65	224,900.00	[illegible]
Sheeting and bracing	M. ft. B. M.	20	60.00	1,200.00	60.00
Channeling	sq. ft.	25,200	.18	4,536.00	.20
Forming embankment	cu. yds.	160,600	.15	24,090.00	.18
Lining	cu. yds.	440	1.50	660.00	1.50
Puddle	cu. yds.	820	1.50	1,230.00	1.50
Sawed lumber	M. ft. B. M.	27	60.00	1,620.00	60.00
Round timber bracing	lin. ft.	1,000	.25	250.00	.20
Foundation piles	lin. ft.	820	.50	410.00	[illegible]
2nd class concrete	cu. yds.	19,100	7.50	143,250.00	7.00
Reinforced concrete	cu. yds.	927	10.00	9,270.00	10.00
Cyclopean masonry	cu. yds.	85,400	6.25	533,750.00	[illegible]
Slope wall in mortar	cu. yds.	80	5.00	400.00	5.00
Slope wall, dry	cu. yds.	80	3.50	280.00	3.50
Wash-wall	cu. yds.	340	2.00	680.00	2.00
24-in. stone paving	sq. yds.	2,520	2.50	6,300.00	2.50
1st class stone paving	sq. yds.	640	2.50	1,600.00	2.50
2nd class stone paving	sq. yds.	1,460	2.00	2,920.00	2.00
Cobblestone paving	sq. yds.	50	1.00	50.00	1.00
1st class riprap	cu. yds.	60	3.00	180.00	3.00
2nd class riprap	cu. yds.	40	2.75	110.00	2.75
3rd class riprap	cu. yds.	1,180	2.50	2,950.00	2.50
4th class riprap	cu. yds.	200	2.00	400.00	2.00
Iron pipe specials	lbs.	290,000	.02½	7,250.00	.025
Structural steel	lbs.	78,280	.05	3,914.00	.05
Metal reinforcement	lbs.	52,770	.04	2,110.80	.04
Wrought iron	lbs.	5,200	.07	364.00	.07
Steel castings	lbs.	40	.05½	2.20	.05
Iron castings, plain	lbs.	34,000	.04½	1,530.00	.045
Iron castings, machined	lbs.	81,400	.08	6,512.00	.08
Bronze castings	lbs.	920	.50	460.00	.50
Metal in lock-valves	lbs.	5,700	.10	570.00	.10
Wooden fence	lin. ft.	2,300	.22	506.00	.22
Wrought iron pipe railing	lin. ft.	1,580	1.00	1,580.00	1.00
Drilling bolt holes in rock	lin. ft.	900	.60	540.00	.60
Capstans	each	2	50.00	100.00	50.00
Superstructure, upper gate chamber	lump sum		2,550.00	2,550.00	2,550.00
Sluice gate, valves, pipes, etc.	lump sum	....	8,600.00	8,600.00	8,600.00
Cofferdams, pumping, etc.	lump sum		19,000.00	19,000.00	4,000.00
Raising highway bridge	lump sum		150.00	150.00	150.00
Maintain'g highway traffic	lump sum		650.00	650.00	650.00
Maintaining navigation	lump sum		250.00	250.00	250.00
Deduct--				$1,029,315.00	
For bridge superstructure	lump sum		65.00		65.00
For buildings	lump sum		14,725.00		14,725.00
				14,790.00	
Total				$1,014,525.00	

Summarizing we have the following:

Engineer's estimate ....
Arthur McMullen, Contractor ....

Less ....

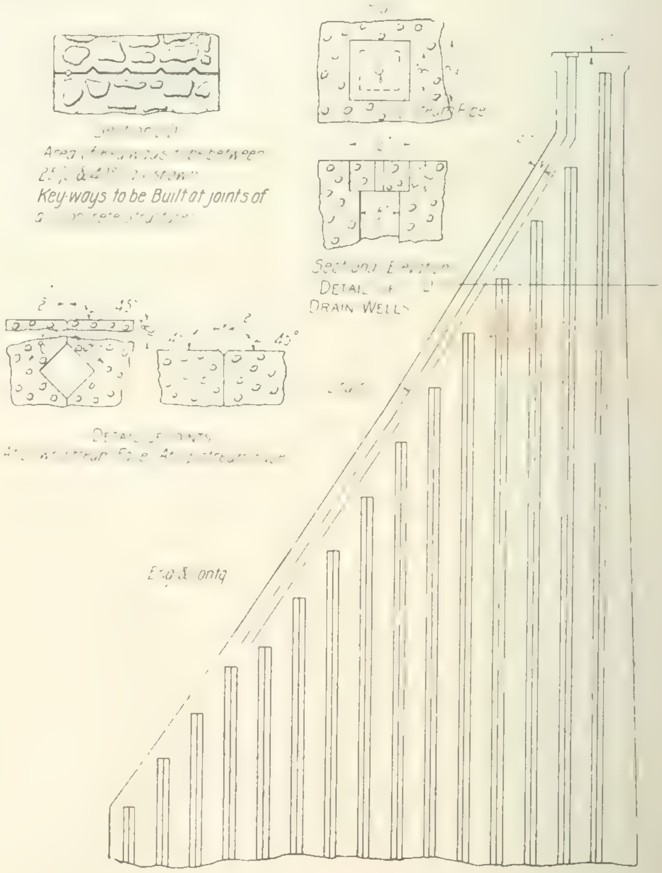


Fig. 6—Details of Construction Joints and Drains, Delta Dam.

Fig. 7—Plan of Delta Dam Work Location of Construction Plant.

the sections on either [illegible] and similarly around the superstruc- the gate house. The 60-in. cast iron e pipes mentioned above were chosen merous studies of sizes and combina- meet the requirements, and the co- of discharge was then carefully com- In providing one pipe more than the equirements and in the triple control luice gates, valves and stop planks in gate chambers, every emergency is to have been forestalled.

tecting the foundations from the out- these discharge pipes, the precaution dopted consisted of a concrete basin 0 ft. square, in passing through which r its auxiliary spillway the velocity of lowing water is greatly reduced. The from the reservoir, which in the driest estimated to be about 188 cu. ft. per will follow the natural channel of the River down to the point where the anal crosses the river at Rome. In minimum flow the greater portion of awk River supply will there be taken Barge Canal very much as it is now into the Erie Canal. However, water will always be allowed to flow e river channel below Rome to sup- ultural or other necessary uses, to a here the river is sufficiently replen- m natural sources.

[illegible] OF CONSTRUCTION.

fter the letting of the contract, active s for prosecuting vigorously the work un towards the end of the year, 1908, ontractor, Mr. Arthur McMullen, the rk being the excavation at the west he dam site, the material being used uilding of a link of construction or ailroad, 3 ft. gage, extending 660 ft. e tow path of the Black River Canal, e upper face of the dam. During the winter of 1908-1909, work on the rack system, to serve for the trans- of excavated materials and the de- f building materials was continued. buildings were also erected at the e. The contract allows the use of ing timber and wood on the reservoir he contractor free of charge and a [illegible] the same for uses of construction.

[illegible] struction plant, showing also the outlines of the various contemplated structures. A main service track, 1,550 ft long, extends along the tow path of the Black River Canal, 660 ft. above the dam, and 890 ft. below, or between the cement storage shed and the north and the site of the new lock No. 7, at the south. Leading from this main track are two double-track spur lines, resting on pile bents, and laid parallel to the dam outside of the excavation limits, one along the upper face and one along the lower face. Leading from one of the tracks of the upper spur is a track to the spoil area above the dam. A portion of the lower spur line is only single track partly within the limits of the timber crib cofferdam extending into the Mohawk River.

The lower spur line next crosses the Mohawk River (single track) on a stringer bridge, supported by three timber crib piers built in the river channel. After crossing the river this spur line divides into three tracks, two short ones leading to spoil areas along the east bank of the Mohawk River, the third, a longer one, following the hill side a distance of 640 ft., where a switch back leads to the top of the "Palisades" and close alongside of the new combined Black River locks Nos. 8, 9 and 10, and then extending along the line of the relocated Black River Canal, a distance of 1.9 miles, being the point of departure of leaving the old or present Black River Canal, immediately above lock No. 13.

Derricks on pile clusters were also erected at the same time. Eight of these are inside the service tracks flanking the upper and lower faces of the dam, and used for handling the excavations from the dam foundation and for other purposes.

The earth was removed by means of clamshells and orange peels, hoisted by the derricks, and deposited into side dump cars and transported by locomotives to the spoil areas, either to the northern one above the dam or to the lower one along the east bank of the Mohawk River.

For removing the rock, steam drills were used for drilling the blasting holes, the bottoms of which were kept from 1 to 2 ft. above the intended foundation grade, the blasted material being shoveled or placed in wooden steel-lined skips, hoisted and deposited by the derricks into side dump cars, the same as the earth excavation and similarly disposed. The rock drilling in the dam foundation began on May 13, 1909, and though the rock was so soft and seamy as to require great care in the use of explosives in order to prevent unnecessary excavation, the seams are usually tight and the small amount of water issuing from the rock inside the cofferdam was easily confined to a few box drains buried in the masonry and leading to the main sump. This was also boxed over and buried, but drained by means of a suction pipe carried up with the masonry and designed with other pipes to serve later on for filling the drain and sump with cement grout.

The plan of the construction plant, Fig. 7, shows the cofferdam mentioned above (in the bed of the Mohawk River). It is a timber crib structure, puddled with clay, and occupies about one-half of the river channel. Within its confines is the section of the dam containing the gate house, this section is 50 ft. long, extending between Stations 2 + 48.5 and 2 + 98.5, the stationing of the dam axis being from the south to the north.

The excavation for the dam foundation at the crossing of the Black River channel (old) was begun on Dec. 16, 1909, shortly after the closing of the canal for the winter and continued during the winter months and early spring of 1910, the excavated material being handled with derricks and cars. This work had to be done in the winter time so as not to interfere with the navigation of the present Black River Canal, the same being open for traffic, between the first day of June and fifteenth day of November of each year.

The cofferdam on the east side of the river (not shown on plan of construction plant) was built during July, 1910. This cofferdam includes beside the site of the main dam, also a portion of the site of the secondary dam and retaining wall along the same side of the river.

The excavation for the foundation of the main dam was completed in May, 1911, hav-

[illegible] December, 1908, [illegible] months [illegible] to the work, however not continuous, suspensions occurring during the winter months on the deeper portions.

The excavation of the relocation of the Black River Canal, 1.9 miles in length, which includes a new prism, four locks and one [illegible]

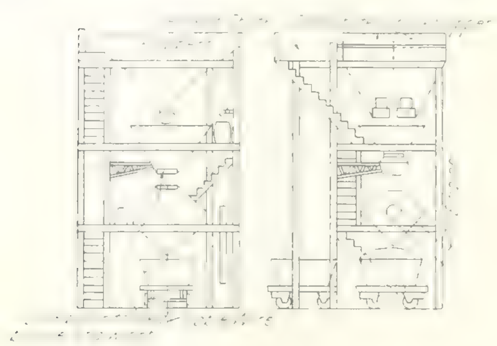


Fig. 8—Sketch Plan of Concrete Mixing Plant.

Bucyrus steam shovel, which was propelled by its own power from the New York Central R. R. at Rome to the work in February, 1909, the distance traveled was 5 miles. In addition, teams and scrapers were also used in excavating the new prism, as well as spreading and compacting the material deposited by the steam shovel. On this relocation a 25-ft. rock cutting 2,500 ft. long occurs, which was excavated without extensive use of explosives, the material being the same Hudson River shale mentioned elsewhere. This shovel made a record of 1,700 cu. yds. per day in the borrow pit, from which material for the heavy canal embankments was obtained.

As is common with all the Barge Canal work, there is no classification of materials in excavation. According to the standard specifications:

> Excavation shall consist of the loosening, loading, transporting and depositing of all materials whether wet or dry of every name and nature, necessary to be removed, for the purpose of forming the canal prism, ditches, pits for structures, for obtaining material from barrow pits, or for any other purpose necessary to complete the works under contract, except grubbing, cofferdams, pumping, bailing and draining, and the disposition of buildings, refuse and bridges, which are paid for separately.

The excavation on this contract is one of the three large items, the State Engineer's estimate being 346,000 cu. yds., which at the contract price, 65 cts. per cu. yd., amounts to $224,900.

The excavation for the new canal change was begun in March, 1909, and practically completed in February, 1910, some little work being done during April and May, 1911. The new prism was filled with water, north of the flight of locks, in June, 1911. Some difficulty was experienced with leaks at the junction with the old canal, but the trouble was soon remedied. The railroad track used by the steam shovel and for the transportation of excavated material was taken up and removed during August, 1911.

One of the striking features of the original design of the new locks Nos. 8, 9 and 10 of the relocated Black River Canal, was that the walls were nominally only 4 ft. thick at a point where they were 30 ft. in maximum height. The plan provided that these narrow walls were to be tied to the channeled rock face by 1-in. square deformed steel rods, spaced 5 ft. apart laterally and 7 ft. vertically and grouted for 3 ft. 6 ins. of their length into rock, while unbalanced water pressure would be prevented by a system of drains in the back of the wall. After the rock face had been channeled, the exposed shale rock proved so friable that gravity sections for the lock walls were substituted, the additional excavation being removed by drilling, blasting and picking. The channeling was done by a Sullivan Machinery Co. Class Y-8 steam-driven channeling machine.

[illegible]

The dam is built of cyclopean masonry, which, acording to the specifications, shall be made of stones of the quality hereinafter specified, of various shapes and sizes, embedded in second-class concrete of the quality hereinafter specified under concrete. It shall be composed of as large a proportion as possible, consistent with good work, of stones as large as can be conveniently quarried, transported and handled, not less than 50 per cent of the stone shall contain 1 cu. yd. or over.

Wet concrete in sufficient quantities shall be deposited at the location of the work, and large stones shall be immediately lowered into it. The stone shall be joggled with a bar and otherwise jarred so as to settle them well into the concrete, and the concrete shall be worked with suitable tools so as to force the escape of entrained air or surplus water and insure the filling with concrete of all spaces between and beneath the stones. Where there are places between the stones, or between the stones and the face of the masonry, or of the expansion joints, large enough to admit of a smaller stone being imbedded in the concrete, in accordance with the specifications given below, this shall be done. The object is to obtain a monolithic mass of stone and concrete with as large a proportion of stone as is compatible with the construction of water-tight masonry. The stones shall be at least 6 ins. apart at all points, but no stone shall be placed within 1 ft. of any surface of the masonry or of any imbedded metal, or of any expansion joint.

Horizontal surfaces made of account of work should have stones used as "plims" projecting above the surface of concrete, so as to break horizontal joints.

In joining new masonry to masonry that has already set, precautions shall be taken to secure a perfect binding by cleaning and washing the work already in place, and by spreading over its surface a thin wash of mortar before the new masonry is placed.

All edges shall be struck off horizontal on any temporary suspension of work.

In placing the large stones care shall be taken to secure as good bonding, both horizontal and vertical, as may be practicable with this class of masonry. Care shall be exercised to avoid in any way disturbing stones after they have been set, except for special reasons particular stones may be ordered to be removed. Wherever the bond is broken after a stone has been set the stone shall be immediately taken up and reset. Cyclopean masonry shall be protected from freezing and in warm weather from the sun.

Stone for cyclopean masonry shall be of an approved kind and quality of rock and shall be free from soil, mud or dirt. It shall be thoroughly washed and scrubbed, if necessary, to free it from all dirt. Soft stone shall not be used. The quality of the stone shall be equal to hard trap, granite, gneiss or limestone.

Structures of cyclopean masonry shall be built in alternate sections, approx[illegible] ft. long, unless otherwise shown on [illegible] Cyclopean masonry will be paid for [illegible] tract price per cubic yard for the [illegible] ity in the finished structure as [illegible] the plans or as directed by the State [illegible] Second class concrete, as specified [illegible] be made of one part of Portland cement, [illegible] and one-half parts of clean sand [illegible] crushed dust and five parts of crushed stone or gravel as shall be determined by the Engineer, all measured in loose bulk.

STONE QUARRIES.

The geological formation at the site of the dam and reservoir does not furnish suitable building material. It is the Hudson River shale, also known as the Utica shale. It is a very fine grained, dark gray to black, thin bedded shale. The black color is due to the presence of carbonaceous matter which may be readily burnt out, although, contrary to a current popular idea, nothing like a workable coal seam occurs within the formation. Occasionally some of the layers are rather sandy, especially toward the top. Toward the base of the formation some of the layers are several inches thick and are frequently [illegible] Because of the softness of the rock [illegible] character of the outcrop, this condition [illegible] favorable to the development of talus slopes. For this reason the large blocks of building stone of the cyclopean masonry [illegible] brought from the Sugar River limestone quarries, located about 24 miles north of the dam, or 3 miles north of Boonville, just over the county line between Oneida and Lewis counties, at the junction of the Black and Sugar rivers.

The Black River here, southeast of [illegible] Station, Utica Branch, New York Central R. R., flows over beds of syenite. High up on the hillside is the Pamelia limestone, an impure, whiteish-gray to bluish-gray sandy limestone, there being sandstone and conglomerite at the base. Still higher [illegible] hillside is the Lowville limestone, [illegible] blueish, dove-colored, thin to thick bedded limestone, containing calcite-filled tubes, with some of the beds uncracked. Yet higher up on the hillside is the Black River limestone. It is hard, fine grained, dark color to almost black, limestone which breaks with a smooth fracture. Interspersed through the limestone, in a very irregular manner, are small patches of black shale which causes the rock, in weathering, to break in lumpy masses. After long exposure to the [illegible] the surface color changes to a light gray. The rock is generally massive, although two or three layers can usually be fairly well made out. Another distinctive feature of the rock, particularly the upper portion, is the presence in it of many irregular shaped chertnodules.

Fig. 9—View Showing General Character of Forms for Main Dam Wor

Many large quarries have been opened up

[illegible]
[illegible]
[illegible]
abutments, and now for the Delta dam
[illegible]
ks of limestone but little black pow
[illegible]
to raise the stone off the beds, and
[illegible]
ht, the maximum weight of the lin
cks being about 16 tons. The aver-
[illegible]
or 12 cu. ft. to the ton of 2,000 lbs.

quarry plant consists of four mast and
derricks, each operated by a hoist en-
with vertical boiler. There is also an
[illegible]
which furnishes power to six Kotten
[illegible]
orted from the quarry to canal boats
[illegible]
[illegible]
ed at this quarry is about thirty men.

loaded canal boats are towed on the
[illegible]
anal, built between the years 1838 and
[illegible]
4 ft. and a water width of 42 ft. The
90x15 ft. between given posts, and
[illegible]
s. The canal extends from Rome to
ville, 25 miles, escending the entire dis-
the difference in elevation, 692 ft.,
rcome by 70 locks. From Boonville
[illegible]
[illegible]
7 is located at the site of the Delta
miles north of Rome, water eleva-
ft. A. T., so in transporting the stone
m the Sugar River quarry at Ley-
[illegible]
[illegible]
20 ft.

shed or broken stone for the con
s obtained from the Hough quarry,
ur miles south of Boonville, and 17
h of the dam, also on the line of
River canal. The rock consists of
imestone and gneiss. Five steam
employed, steam is supplied by a
boiler, and 40 per cent dynamite
[illegible]
eway transports the quarried stone
a No. 6 Kennedy Gyratory crusher.
crusher a 24-in. canvas belt con-
about 150 ft. long, carries the crushed
[illegible]
nployed at this quarry.

obtained from a pit at Frenchville,
miles north of the dam. The sand
avated and loaded by clamshells. Other
are two derricks and a locomotive; the
consists of eight men.

quarries are operated by a subsidiary
ation called the Boonville Co., Inc. A
[illegible]
[illegible]
sand, cement and supplies of all kinds.

[illegible]
[illegible]
ank or tow path side of the Black River
immediately above the lock No. 7.
el with the dock runs one of the service
d tracks, along which most of the mast
[illegible]
[illegible]
te mixer are also located here. The
[illegible]
city for 2,500 bbls. of cement. Crushed
[illegible]
[illegible]
, and subsequently hoisted to the mixer
same derrick. Cement is brought to
by rail, bags are counted and loaded
anal boats and towed via the lower end
Black River Canal to the Delta dam
The canal boats are covered over and
ed with waterproof hatches to keep out
in.

large stone for the cyclopean masonry
so unloaded by derrick, either directly
boats onto flat cars for immediate use
[illegible]

[illegible]

This is a four-stage, gravity 5-ft. cube mixer made by Thomas Carlin's Son's Co. of Pittsburg, Pa. It is revolved by a horizontal Donegan & Swift engine, of about 10 h.p. The concrete materials, sand and broken stone, are carried to the top of the mixer from the

[illegible]

same derricks which unloaded these same materials. The cement is hoisted in the same manner. At the top of the mixer, Fig. 8, is located a large supply hopper, divided into two compartments, one for sand and the other for broken stone. In addition there is a cement chute, all leading to a smaller hopper underneath the large one on top.

The broken stone and the sand are measured by leveling in the smaller hopper to the height of two straight edges, one for stone and the other for sand. The cement is not measured at all, but ten bags are poured into a small hopper and the operator of the stone and sand hopper, when he pulls the lever, which allows the stone and sand to fall, also pulls another lever which opens a trap door in the bottom of the cement chute and allows the ten bags of cement to go into the mixer. The water is measured in barrels, there being a continuous supply, the necessary amount is regulated by adjustable pipe overflows. The mixed concrete is dropped into 2-cu.-yd. bottom dump steel buckets, carried on flat cars, in trains of three cars, two carrying loaded buckets, the other car light to receive the waiting empty bucket on the work. The flat cars are operated through the concrete mixer building by means of a wire cable, worked by a small engine and drum. Mixed concrete and the large stone forming the cyclopean masonry are handled and hoisted by the derricks paralleling the dam. The same derricks are also used to work up a bed in the fresh concrete for the heaviest stone by raising and lowering them.

Stones are washed in warm weather with water through a hose (or steam in winter), also scrubbed with wire brushes. During cold weather, heated stone are used, with steam under canvas to prevent freezing. Dragon cement is used, and of which the Lawrence Portland Cement Co. of Philadelphia furnished about 100,000 bbls.

The mixture was made rather wet, so that but little tamping was required, but shovels were used to work the concrete down in narrow forms or between stones. The coarser aggregate was kept away from the face of the forms by forks. On rock foundation, the surface was cleared of all loose pieces, washed and neat cement or mortar scrubbed over it with brooms.

The proportion of large stone imbedded in the cyclopean masonry is about 40 per cent. This percentage is obtained by subtracting from the total volume of a certain content the quantity of concrete sent out from the mixer as shown by the number of batches counted by the inspector on the mixer.

The forms are allowed to remain in place for about 48 hours on mass work, before being removed. The concrete surfaces are then rubbed down immediately with mortar bricks and water and kept damp in hot weather.

The average daily output per 8-hour day of the concrete mixer is about 170 cu. yds., with a record of 254 cu. yds. of concrete, in the proportions of 1 part of cement, 2½ parts of sand and 5 parts of broken stone.

[illegible]

In the case of the smaller important structures, yellow pine lumber was used for the lagging. Nominally, 2-in. stuff is used, planed on one side, making the actual thickness 1⅞ ins. For the larger structures, such as the dam, miscellaneous lumber, mostly hemlock and maple, is used.

The studding is made of local lumber, spaced 4 ft. on centers when convenient. Where forms are in sections the two outer studs are set flush with the ends, and adjacent sections are connected by ¾-in. bolts through them, spaced 2 ft. apart. The waling pieces are of 8x10-in. timbers or larger, usually 5 ft. on
centers. On sectional forms the top ar
bottom wales are about 2 ft. "in" from th
edge. Wales are bolted at each stud by a fla
headed ¾-in. bolt through the wales, stu
and lagging, the head countersunk in th
face of the form and puttied over. The t
rods are 1 in. in diameter, connected to r
movable ends (stubs) by turnbuckles 3 in
inside the forms, the strut being heavi
greased and set in the turnbuckles only abo
1½ in. Tie rods are spaced far enough apa
in the large structures, to allow the 2 cu. y
bottom dump concrete buckets to pass b
tween them.

Compression struts or braces are frequent
placed above the tie rods for spacing pu
poses, bearing opposite the nearest stu
Form units vary in size, but are made usual
about 14 ft. high by 20 ft. long. The fac
of many forms were treated with heavy c
after planing, which resulted in very smoo
surfaces, and seemed to preserve the forn
Cracks in forms due to checking and dryi
out were filled with clay.

A saw mill installed by the contractor w
supplied with timber and logs cut off t
reservoir site, much of it hauled to the m
by teams on sleds built for the purpose—a
furnished the bulk of the lumber for form
This standing timber was also used for oth
construction purposes, for piles and strin
ers in trestles, cross ties for the various ser
ice railroad tracks, material for cofferdan
lumber for building and many other uses.

The view, Fig. 9, gives a very good id
of the larger forms as used in the main da
Their dimensions were generally 20 ft. hi
and 32 ft. long, braced with timbers and ti
by 1-in. rods, with turnbuckles much in t
same manner as described for the small
structures connected with the dam. The i
terior struts were removed as the mason
rose and bolts were left protruding to ho
in place the forms when raised for buildi
the next higher lift. The forms for the ce
[illegible] of the dam were handled [illegible]
same derricks that were used for t
handling of the excavations and the placi
of concrete and cyclopean masonry.

The second-class concrete (1:2½:5) a
the cyclopean masonry comprised the seco
and third large items of this contract, name
19,100 cu. yds. of the former at $7 per cu. y
the contract price, amounts to $133,700, a
85,400 cu. yds. of the latter item, at the co
tract price of $5.25 per cu. yds., amounts
$448,350, [illegible] added to the amount for e
cavation, totals $806,950, leaving $98,397 f
the remainder of the work.

Of course, land damages are not includ
in this estimate.

[illegible]

Other construction work connected wi
this contract is the clearing of the reservo
site, which covers an area of 4⅓ square mil
There are 295 buildings with their out-buil
ings, on the site, all of which had to be r
moved. They became the property of t
contractor, who disposed of them as he saw

Where land is used for spoil, and on t
remaining portion within the clearing limits
the reservoir, the bushes and trees were c
as close to the ground as practicable, and we
thoroughly burned or otherwise entirely r
moved from the site of the reservoir,
stumps being left more than 2½ ft. in heig
All wood and timber became the property
the contractor. The clearing limits of t
reservoir includes all of the land below co
tour elevation 555 ft. A.T. This clearing w
one of the first works done by the contract
and has extended over the years 1909-10 a
11, either large or small forces being co
stantly employed.

There is a semi-public cemetery at De
and also a few private burying grounds
the area to be flooded, the bodies in whic
numbering over 250, are to be exhumed und
authorization by special legislation and pro
erly reinterred elsewhere, notwithstanding t
fact that there has been no recent burial a
there are few interested survivors. Proposa
for this work were received Oct. 24, 1911,

ne Superintendent of Public Works and the ntract let to Joseph K. Kalk and Alfred [illegible] [illegible] County, New [illegible]

In conclusion the writer desires to acknowl- ige his obligation to the persons named be- ow (all attaches of the Department of the tate Engineer), for valuable aid given him the preparation of this article, viz.: Messrs. oble E. Whitford, Charles W. Costello, John . Greathead, Robert M. Fraser and Henry . Little.

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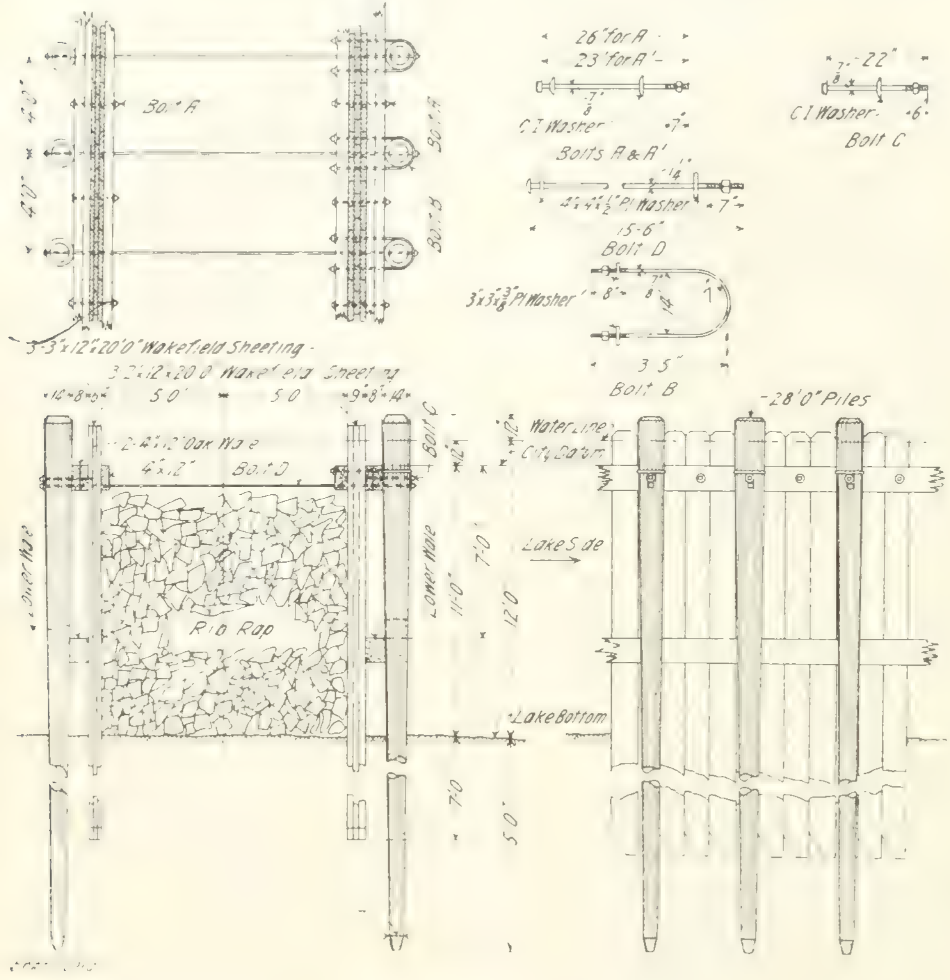
ethods and Cost of Constructing Stone-Filled Timber Breakwater, Lincoln Park Extension, Chicago, Ill.

III.

(STAFF ARTICLE.)

Nearly 200 acres are being added to the area f Lincoln Park, Chicago, by filling in the allow waters of Lake Michigan, which bor-er the park. At the end of 1911 there had een completed 125 acres of the total 197.54 cres of fill, and of this 43 acres were added 1911. The filling is being done by hydraulic redge and besides dredging there are required reakwater construction, riprapping, grading, c. In a series of four articles, of which this the *third*, the methods and costs for 1911, f doing each class of work will be presented. he articles will cover: Hydraulic Dredge Fill-g; Stone Filled Timber Crib Breakwater onstruction; Tug Boat Towing Operations, d Repairs to Pile Drivers and Derricks. The ethods and cost of doing corresponding ork during 1910 were given in our issue of eb. 22, 1911.



Details of Stone Filled Timber Breakwater, Lincoln Park Extension, Chicago.

[illegible] CONSTRUCTION

During the year 1,690 lin. ft. of breakwater ere built at Picnic Island. Work was started pril 17 by pile driver No. 1 and continued till May 27. On July 11 work was resumed, constructing sheeting. As illustrated by the accompanying drawing this breakwater consists of wood piles driven 4 ft. apart, lined on the inside with inside wales, inside of which Wakefield sheeting is driven. The whole is tied across with iron rods and filled with broken rock from the waste piles along the Chicago drainage canal. Pile driver No. 2, a new one for the park plant, was fitted out and was started on July 27, driving sheeting. The construction of breakwater up to the curve at the north end of Picnic Island was carried on at the average rate of 100 ft. per day, the maximum day's work being 125 lin. ft. Picnic Island breakwater construction was closed on Oct. 20, a pile bulkhead being built at the end, 1,690 ft. from the point of starting the season's work. Considerable difficulty was encountered near the north end of the island on account of the deep water encountered, which required filling. This was a dredge cut made in previous seasons and will be encountered again before the completion of this breakwater. A detailed statement of the cost of the work on Picnic Island breakwater is given in Table III.

TABLE I.—COST OF PICNIC ISLAND BREAKWATER, 1,690 LIN. FT.

	Total.	Per lin. ft.
Driving piles:		
Pile drivers	$1,640.91	
"Richard B."	298.62	
"Hausler"	248.43	
Superintendence	308.74	
Total	$2,4[illegible]6.70	$1.48
Straightening piles:		
Pile drivers	$ 3[illegible]	
Dock carpenters	47[illegible].17	
"Richard B."	96.82	
"Hausler"	8[illegible]	
Superintendence	58.41	
Total	$1,040.44	$0.62
Driving sheeting:		
Pile drivers	$2,794.89	
Derrick	44[illegible]	
Dock carpenters	3,484.58	
"Hausler"	661	
"Richard B."	795.1	
Scows	107.7	
Superintendence	400.	
Total	$8,686.9	$5.[illegible]
Stone filling:		
Loading at Lemont	$4,667.3	
Towing and unloading	5,756.6	
Total	$10,423.9	$6.1[illegible]
Material—Piles;		
300 30-ft. oak	$1,425.9	
518 35-ft. oak	3,00[illegible]	
80 40-ft. oak	524.[illegible]	
Total	$4,956.0	$2.[illegible]
Sheeting:		
1,480 pcs. 6"x24' Wakefield	$7,670.8	
200 pcs. 6"x28' Wakefield	1,176.0	
1,480 pcs. 6"x24' Wakefield	10,804.0	
200 pcs. 6"x28' Wakefield	1,668.8	
Total	$21,319.6	[illegible]
33,264 ft. B.M. oak sills	$1,247.4	
51,540 ft. B.M. oak wales	1,881.2	
Total	$3,128.6	
Hardware:		
420 rods 1¼"x17'x6"	$ 604.8	
840 plate washers	37.5	
2,520 bolts, 18, 22 and 24-in.	224.2	
1,680 boat spikes	24.8	
5,040 C. I. washers	183.9	
Total	$1,075.3	
Miscellaneous:		
Shipyard service	$1,114.10	
Motor boat service	181.69	
Scow service	351.[illegible]	
Supplies	198.[illegible]	
Towing	25[illegible]	
Teams	6[illegible]	
Total	$2,261.7	
Total cost 1,690 ft. of breakwater	$55,32[illegible]	

For the purpose of protecting that portion of the fill north of the north shore of the yacht harbor against the storms of winter [illegible] was claimed advisable to construct 40[illegible] ft. of breakwater north of Cornelia St., and the work was begun by pile driver No. 1 [illegible] 11. During October and November [illegible] of piles were driven and the waling [illegible] but owing to extremely bad weather, the driving of sheeting was not begun until Dec. This 400 ft. of sheeting was completed [illegible] 11. Because of the scouring of the [illegible] along this piling it was found necessary [illegible] rap nearly the whole 400 ft. The w[illegible] completed Dec. 23. A summary of the cost of this work is given in Table II. The cost items are the same as those in Table I, and for that reason only the totals are given.

TABLE II.—COST OF 400 LIN. F[illegible] BREAKWATER, CORNELIA ST. N[illegible]

Pile drivers	$ 1,476.17
Derrick	300.62
Towing	44[illegible]
Labor	1,235.56
Piles	1,208.69
Sheeting	4,9[illegible]
Lumber	764.57
Hardware	256.02
Stone	4,410.82
Miscellaneous	613.99
Total	$15,704.91

It will be noted that the cost of the breakwater is $7 per lineal foot greater than the Picnic Island breakwater. The increase cost is due almost wholly to the extra amount of riprapping to prevent scour. The towing was also higher on account of the tug "Keystone" having to tow alone from the mouth of the river and the unloading was higher because of the stone freezing in the stone boxes.

At the mouth of the yacht harbor a revetment 950 ft. in length was built to prevent scour along the inside shore line. This consisted of a single row of sheeting anchored to piles and backlogs. The revetment on the south of the entrance was begun on Aug. 9, and 225 lin. ft. were built and on the north side 725 lin. ft. were built. The greater portion of the sheetng was 18 ft. in length, longer pieces being used at the junction with the breakwater. The work was prosecuted on days when the weather did not permit of work on the outside breakwater and consequently was not always most favorable for work inside. The cost of the revetment is given in Table III.

III.—COST OF 950 LIN. FT. OF REVETMENT.

	Total.	Per lin. ft.
piles		
drivers	$1,[illegible]	
ard B." service	[illegible]	
service	[illegible]	
ntendence	[illegible]	
al	$2,274.8[illegible]	$2.[illegible]
tening piles:		
drivers	$ 128.39	
carpenters	129.32	
ard B." service	46.[illegible]	
service	[illegible]	
ntendence	[illegible]	
al	$ 372.86	$0.[illegible]
sheeting:		
drivers	$1,40[illegible]	
carpenters	1,[illegible]	
service	[illegible]	
ard B." service	[illegible]	
service	[illegible]	
ntendence	[illegible]	
	$[illegible]	$4.[illegible]
ls—Oak piles:		
	$1,8[illegible]	
	[illegible]	
al	$[illegible]18	$2.48
eld sheeting:		
6 in. x 12 ft.	$ [illegible]16	
9 in. x 14 ft.	489.[illegible]	
es. 9 in. x 18 ft.	2,442.17	
9 in. x 24 ft.	1,552.90	
al	$[illegible]	$[illegible]
s and wales		
ft. B. M.	$ 802.64	$0.85
are:		
in. bolts 18 [illegible]		
24 in.	$ 61.38	
spikes	[illegible]	
in. C. I. washers	25.55	
	$ [illegible]	$0.[illegible]
neous:		
service	$ [illegible]46	
service	181.[illegible]	
service	110.50	
les	137.84	
	1[illegible]	
	[illegible]	
al	$1,247.31	$1.31
nd total cost of revetment	$16,332.98	$17.19

detailed cost of the piles for break- construction, delivered at the shipyard, follows:

	30 ft.	[illegible] ft.	[illegible] ft.
	$4.20	$5.25	$6.00
	.233	.235	.235
	.31	.31	.31
	$4.74[illegible]	$5.795	$6.545

cost of sheeting complete and ready for is shown in Table IV.

IV.—COST OF MAKING WAKEFIELD SHEETING.

s. 6-in. sheeting, 24 ft.		Per pc.
	$1,682.31	$0.94
ware	115.96	0.07
er	7,457.12	4.18
al	$9,255.39	$5.19
6-in. sheeting, 28 ft.		
	$ 188.60	$0.94
ware	130.00	0.07
	974.00	4.87
al	$1,292.60	$5.88
9-in. sheeting, 12 ft.		
	$ 88.36	$0.94
ware	8.74	0.09
er	294.22	3.13
al	$ 391.32	$4.16
9-in. sheeting, 14 ft.		
	$ 98.70	$0.94
ware	9.45	0.09
er	383.25	3.65
al	$ 491.40	$4.68
9-in. sheeting, 18 ft.		
	$ 402.32	$0.94
ware	38.52	0.09
er	2,011.60	4.70
al	$2,452.44	$5.73
s. 9-in. sheeting, 24 ft.		
	$1,637.48	$0.94
ware	156.78	0.09
er	10,922.34	6.27
al	$12,716.60	$7.30
9-in. sheeting, 28 ft.		
	$ 188.00	$0.94
ware	18.00	0.09
er	1,462.00	7.31
al	$1,668.00	$8.34
ost of 4,553 pieces		$28,267.75
ry:		
cost of labor		$ 4,285.77
cost of hardware		477.45
cost of lumber		23,504.53
		$28,267.75

[illegible] for the break-waters, brought in boxes on scows from the spoil banks of the Chicago drainage canal at Lemont, is shown in detail in Table V.

TABLE V.—[illegible] FILLING FOR [illegible]

Received before Dec. 1, 2,891 boxes, 8,066 cu. yds.			
[illegible]		Per box.	Per cu. yd.
Labor	$3,299.52		
Supplies	1,020.52		
	$4,320.04	$1.49	$0.53
[illegible]			
"Keystone," 376 hrs.	$2,514.60		
"Richard B.," 36 hrs.	110.02		
[illegible]	[illegible]		
	$2,691.56	$0.93	$0.33
[illegible]			
Derrick, 355½ hrs.	$1,125.80		
[illegible]	[illegible]		
	$1,192.55	$0.41	$0.14
Stone boxes:			
Labor and material	$1,479.75	$0.51	$0.17
Scow service:			
[illegible]	$[illegible]	$0.[illegible]	$[illegible]
Total cost	$9,953.90	$3.43	$1.20
Received after Dec. 1, 1,412 boxes, 3,940 cu. yds.			
[illegible]		Per box.	Per cu. yd.
Labor	$1,[illegible]		
Supplies	[illegible]		
	$1,844.08	$1.31	$0.47
Towing:			
"Keystone"	[illegible]		
"Richard B"	46.07		
[illegible]	[illegible]		
	$2,184.64	$1.55	$0.55
Unloading:			
Derrick	$ [illegible]		
Superintendence	[illegible]		
	$ 497.76	$0.35	$0.12
Stone boxes:			
Labor and material	$ 535.15	$0.38	$0.13
Scow service:			
[illegible]	$ [illegible]	$[illegible]	$[illegible]
Total cost	$[illegible]	$[illegible]	$1.[illegible]

Notes on Comparative Cost of Horse and Motor Truck Transportation in Engineering and Contracting Work.

Contributed by [illegible] W. Hutchinson, Jr., M. E.

Among the problems confronting the contractor, the disposal of waste and the haulage of building material is one of the most important. The increase in the cost of maintaining a horse equipment and the necessity for speed, limits the use of horses to a comparatively narrow field, as compared with the mechanical methods of moving material.

The rapid progress of the motor truck industry and the present reliability of service provided by motor driven vehicles, places at the disposal of the contractor a means of increasing his efficiency and reducing his operating costs. That engineers and builders have given this subject their serious consideration is proven by the increasing number of motor trucks in use by contractors throughout the country. The introduction of the motor truck into the contracting field is comparable in importance to the introduction of the steam shovel and air drill.

In the following typical cases the ability of the motor truck to save money and do the work has been well proved.

The problem of removing muck and tunnel rock from the Catskill Aqueduct shafts, located in the City of New York, is a serious one. The Pittsburg Contracting Co. is building that part of the tunnel lying between 176th St. and 106th St., New York. They are using motor trucks to remove material from the lower shaft to the dumping ground at 129th St. and the Hudson River.

After making several tests with motor trucks in this line of work, the company installed two 6½-ton Saurer trucks. The distance from the farthest shaft to the dumping ground is about two miles. With horse-drawn carts it would be necessary to have a large number of teams of small capacity to do this work. Every effort is made to keep the truck in constant motion. To effect this the loading of the truck is done at the shaft mouth from chutes as shown by Fig. 1. The truck carrying a 4-cu. yd. bucket is driven under these chutes and the material loaded directly from bins into the skip. The trucks are equipped with special platform bodies designed to hold these buckets rigid.

It is proposed to attach to each truck a trailer carrying a similar skip so that the total load for each trip will be approximately 13 tons. It is expected that by having the buckets suspended over the chutes leading from the bins they may be loaded while the truck is making a trip and a great deal of time saved in this way. The skips are removed at the dumping ground by a derrick boom equipped with a dumping line, Fig. 2. This line is hung from the end of the boom and is attached to a hook riveted at the rear and at the bottom of the bucket. The load is carried out over the dump by means of a hoisting line attached to the bucket, at a point slightly in front of the center of gravity When the point at which it is desired to dump the load is reached, this hoisting line is slackened and the load is taken on the dumping line which tilts the bucket forward and discharges the load. Each truck makes an average of 12 trips per day carrying 42 cubic yards when operating without a trailer It is estimated that 300 working days in the year is the maximum that a truck may be expected to operate. This allows time for overhauling and holidays.

Figuring the cost of hauling this material according to Table I, where the motor truck is operated without trailer, the cost per cubic yard is approximately 29 cts. against 30 cts where horse equipment is used. The interest on this case is figured on the full investment and no depreciation is charged against the truck. Interest is normally figured on half the investment as an average charge during the entire life of the truck; the depreciation is figured on a mileage basis covering the estimated life of the truck. If the figures shown in the table were altered to conform to this standard, the sum of $432.00 should be added to the total yearly cost. This would bring the daily cost to $13.74, making the cost per cubic yard 33 cts. From the standpoint of earning power, these figures show that the truck without the trailer hauling 42 cu yds. per day actually earns 47 cts. per cubic yard or a net profit of $19.47 per day over the horse equipment.

Among contractors the customary amount chargeable to depreciation on all kinds of equipment is said to be 60 per cent on a three-year contract, making an annual charge of 20 per cent. If this method were used in figuring costs for operation of a motor truck in the same capacity as in the table, the amount chargeable to depreciation would be $1,260 per year, or $4.20 per day, and the total cost per cubic yard would be increased to 39 cents. This would still leave a large margin of profit to the credit of the motor truck, against horse-drawn equipment

Estimating the cost of handling this material by motor truck with trailer when the interest is figured on half the investment and the depreciation is based on the mileage life of the truck, we find the cost per cubic yard to be 33 cents. By using a trailer in connection with the truck a much greater reduction of cost can be made. The additional investment entailed and the maintenance of the trailer would be more than offset by the increased capacity and the cost per cubic yard would be reduced to approximately 17 cents Aside from this earning power of the truck the ability of these trucks to move large quantities of material rapidly, enables the other work carried on by this company to proceed much more rapidly than it could do if a horse equipment were used.

Another contractor using one 6½-ton Saurer truck, Fig. 3, hauls cement and building material over seven miles of very hilly country. Some of the grades encountered by this truck are from ½ mile to 1½ miles long and vary from 8° to 15°. Nine trips per day over these roads made an average day's work for this truck. It is loaded with 110 bags of cement on each trip, making an average load of 10,450 lbs. In this work the truck replaces 12 teams of horses costing $5 per da [illegible] team. One of these teams making approximately two trips per day over this [illegible] carry 8000 lbs. or 80 bags of cement. Twelve teams would, therefore, carry [illegible] 960 bags for $60, or $0.063 [illegible] motor truck carries 960 bags [illegible] $17, or 1.7 cts. per bag.

hicle may be equipped are of great value in general contracting work. These devices have been in use a long time with horse-drawn carts and their application to contracting work is well known, but their development as applied to motor-driven equipment is not generally realized.

same treatment accorded to horses even though it may be worked on the same job. Motor trucks should not be allowed to stand for hours in line with horse teams a[illegible] blamed for not doing more work than horses.

It is quite as important to arrange or the

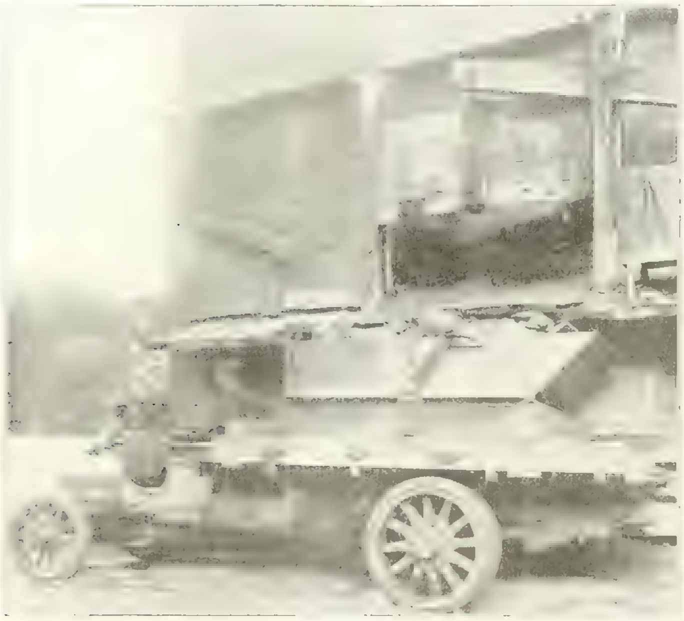


Fig. 1—A 6½-Ton Truck Loading Spoil from Bin at Shaft of Catskill Aqueduct Tunnel, New York.

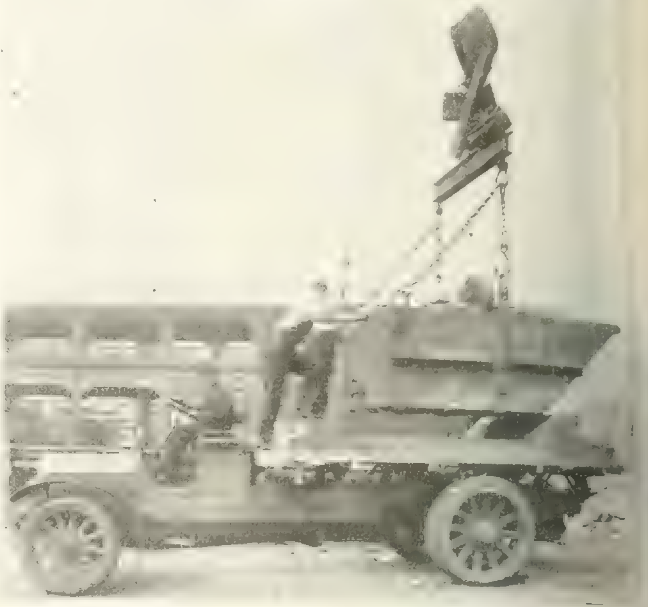


Fig. 2—Unloading the Skip Shown in Fig. 1.

The [illegible] Engineering [illegible] ontract. requiring the constant haulage of rge quantities of cement and lumber, inalled two 5-ton Mack trucks. These trucks ade two trips per day over 18 miles of good oad, replacing a horse equipment of ten ams. These trucks loaded only one way uled approximately 20 tons of building marial a day at a maximum total cost of $40 $2 a ton. If this work had been done by e ten teams the total cost would have been proximately $50 per day or $2.50 per ton.

The Keystone State Contracting Co. of onkers, N. Y., use a 6½-ton Saurer truck, ith hand dumping body, hauling cement, coal d miscellaneous supplies. This truck makes cal deliveries over good roads, but in a ery hilly section where the grades are conant and heavy. It replaces ten teams and e service rendered by this truck enables the mpany to carry on their building operations uch more efficiently and economically than hen a horse equipment was used.

The opportunities for utilizing the motor uck in contracting work are many and vard. Aside from the increased speed and pacity obtained by using motor trucks the xiliary devices with which the motor ve-

ABLE I. COST OF HAULING TUNNEL SPOIL BY MOTOR TRUCK IN NEW YORK CITY, PITTSBURG CONTRACTING CO.

(Conditions: 300 days per year, 50 miles per y; 15.000 miles per year; 3½ cu. yds. per trip [illegible] bucket, 42 cu. yds. per day of 8 hours. ₂ tons Saurer truck without trailer.)

Investment:	
[illegible]-ton Saurer chassis	$6,000
[illegible] bottom body	[illegible]
Total investment	$6,300
Fixed Charges:	
terest on $6,300 at 6	$ 378
surance Liability to persons	[illegible]
epreciation (not figured)	
river, at $21 per week	1,092
arage, at $17.50 per month	[illegible]
	$1,755
Operating Charges:	
aintenance at [illegible] cts a mile	$ [illegible]
asoline at 24 cts. (5 miles to a gallon)	[illegible]
res at [illegible] cts. (5,000 M guaranteed)	[illegible]
l and grease at 1 ct. per mile	150
Total cost per year	$3,690
Total cost per day	$12.30
Total cost per cubic yard	$ [illegible]
Total cost per mile	$ 0.256

Too much stress cannot be laid on the importance of time in connection with motor truck work. The horse during the course of the day's work requires many rest periods, especially after a long haul over a severe grade and the efficient use of horse equipment demands that fully as much of the working day be given over to stops as is devoted to keeping the team in motion. For this reason, the capacity of the horse is limited to his endurance and this in turn is dependent on conditions whch are not under the control of the contractor. A period of very hot weather or a sudden fall in temperature, covering the streets with ice or snow may render the horse almost useless; while if the weather conditions are favorable a number of heavy grades may necessitate either a reduction in the amount of work done by a single team or an increase in the number of horses required to pull a single load. It is therefore clear that the time taken in unloading such teams or the time spent by the teams in waiting to be loaded is not in reality wasted time but a necessity in the efficient handling of such work. So long as a truck is kept well oiled, well adjusted and supplied with fuel, it is always ready to work. If it is to make money, however, it must be kept in motion. For this reason a motor truck should not be given the

[illegible] equipment of a motor truck equipment after it has been bought, as it i great care in the selection of that pa make or type of truck most adaptabl work that it is to do. By far the part of time unavoidably lost is lost i ing and unloading by methods that we in connection with horse trucks; ofte tempt being made to make use of the already available for saving time. A vice that can be installed to shorten t necessary for stops will pay for itself an money right along.

Two loading and unloading [illegible] have been used for years by contracto a readily available for use in a modern or with motor trucks. The use of the po driven winch on motor trucks is be more common every day. This device erated by the engine and is connected the driving shaft and controlled by the u driver. It is used in many cases [illegible] crane or derrick for loading or [illegible] trucks. This crane or derrick may oft be

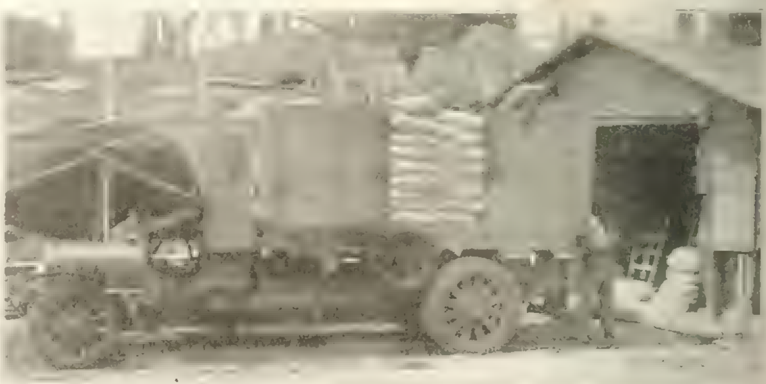
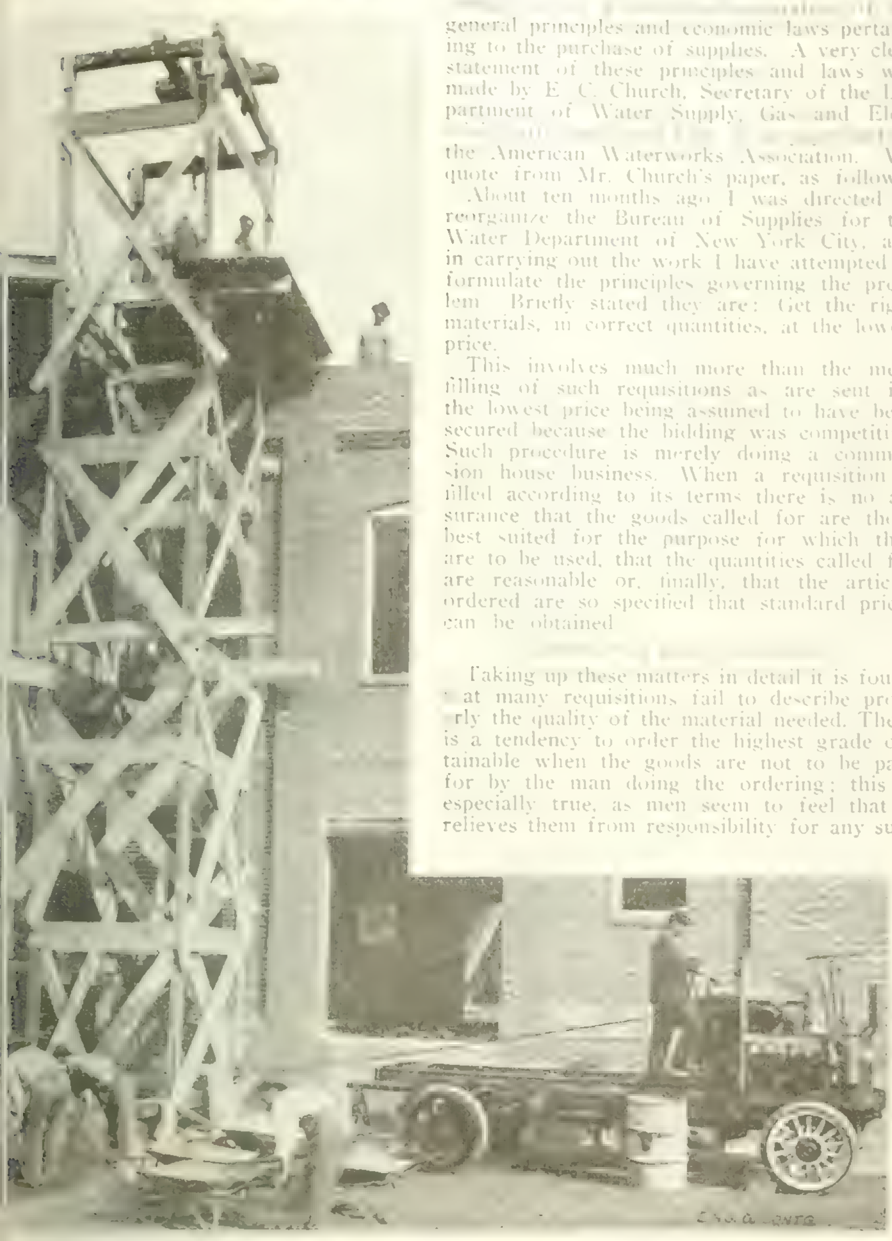


Fig. 3—Truck Hauling 110 Bags of Cement Per Trip, Costing 1.7 Cents, and Repl ng Team Haulage, Which Cost 6.3 Cents Per Bag.

attached to the truck itself and so arra that any part of the load may be rem ed without disturbing the surrounding units A truck equipped with a power winch ma be driven along the side of a building under n- struction and may hoist its load to the t er saving [illegible] and expense of [illegible] Figure 4 shows a [illegible] hoisting possible in [illegible] or racks as a means of [illegible] due to loading or unloading. These [illegible] loaded and [illegible] and may be [illegible] may seem [illegible]. If the [illegible] operated in connection with [illegible]



—View Showing Use of Winch on a Motor Truck Operating a Hoist for Building Construction.

the winch may be found to be ex- y valuable in assisting the horse trucks ough places or where foundations are dug, in pulling them up the steep in- ling out of such excavation [illegible] power dump truck on which the body truck is raised by a shaft geared to in engine drive is one of the greatest and time saving devices used in con- with motor truck work. It is operat- the driver without leaving his seat and stopped and held at any desired angle. ody, however, is available for hauling ry builders' supplies and is particularly where some of the material used is h character that it slides readily and is jured by rough handling. In dumping sand, asphalt and other road building als, the body may be elevated by the without leaving his seat and when the l elevation is attained the machine may

[illegible] over a considerable surface. The full load [illegible] truck in 35 seconds from the time of its arrival at the dumping ground, without the necessity of the driver leaving his seat.

The Philosophy of Purchasing Supplies.

[illegible] general principles and economic laws pertaining to the purchase of supplies. A very clear statement of these principles and laws was made by E. C. Church, Secretary of the Department of Water Supply, Gas and Elec- [illegible] the American Waterworks Association. We quote from Mr. Church's paper, as follows:

About ten months ago I was directed to reorganize the Bureau of Supplies for the Water Department of New York City, and in carrying out the work I have attempted to formulate the principles governing the problem. Briefly stated they are: Get the right materials, in correct quantities, at the lowest price.

This involves much more than the mere filling of such requisitions as are sent in; the lowest price being assumed to have been secured because the bidding was competitive. Such procedure is merely doing a commission house business. When a requisition is filled according to its terms there is no assurance that the goods called for are those best suited for the purpose for which they are to be used, that the quantities called for are reasonable or, finally, that the articles ordered are so specified that standard prices can be obtained.

[illegible]

Taking up these matters in detail it is found at many requisitions fail to describe properly the quality of the material needed. There is a tendency to order the highest grade obtainable when the goods are not to be paid for by the man doing the ordering; this is especially true, as men seem to feel that it relieves them from responsibility for any subsequent failure of the articles when in service. It is an expensive habit, and except in rare cases requisitions should be filled with articles of the standard commercial grades.

[illegible]

Requisitions as received must also be carefully considered to ascertain if the quantities called for are proper; for unless there is an inventory of material on hand one may easily purchase supplies, of which there are plenty in stock. I have found that new orders are often based on the orders of previous years irrespective of whether materials so ordered were used and without considering that conditions and requirements have changed in the meanwhile. To this end an inventory of the property of the department is being taken and wherever possible requisitions are filled from stock on hand.

[illegible] The storage and use of all goods should also receive th careful scrutiny of the Bureau of Supplie for it is inconsistent to keep accounts o money with great accuracy, and then whe the money is invested in stores pay no at tention to whether they are used or wastec Improper storage often results in excessiv depreciation. Supplies should be issued in ro tation: for when stores are issued in th order in which they are received no old ma terial is left on the back of the shelf to de teriorate and subsequently be thrown out. T carry these ideas into effect store houses ar being fitted up at central points, and a num ber of specially trained men have been in stalled as store-keepers.

[illegible] *Compared.*—I have also divided all supplie into two classes, consumable and non-consum able. Fuel, oil, waste, and lumber are exam ples of the first class, whereas tools, imple ments, rubber boots, etc., belong in the secon group. As soon as possible it will be arrange that none of the non-consumable supplies wi be issued till those they are to replace hav been turned in. Thus a man cannot procur a new tool until he has returned the old on and has shown that it is worn out. It is ex pected that this will safeguard much depart mental property and prevent its being use for personal purposes, sold for profit, or s carelessly looked out for that it is either los or stolen.

[illegible] the "right materials" brings the question o specifications to the front. Multiplicity o styles and types is a disadvantage, and sim plification is greatly to be desired and sough after. To this end investigations and test are now being made to determine and estab lish the standards of quality to be met b the various materials purchased. I have ha a list prepared containing the items in cur rent demand and they are being considerec one by one, with regard to their nature, com position, wearing power, keeping qualities cost and the conditions under which they ar to be used in the department. The resul desired is to get goods which will give satis faction when used.

One way of purchasing goods would be t take articles, put them in use and try ther out. If they gave satisfaction, pay for them If they did not, then reject them and retur them to the maker. Even in this case it woul be necessary to state what performance woul be regarded as meeting requirements. Thi is not practical. Men want their money upo the delivery of their wares. The purpose o a specification is therefore not alone to se up a standard regarding the kind, size, an excellence of the product desired, but it i to enable the department to say in advanc with a fair degree of certainty whether good will probably render satisfactory service.

[illegible] N thing should be left to the imagination in the writ ing of specifications. If a man knows wha he wants to let him describe it in clear-cut un mistakable language. This takes time, bu it prevents subsequent misunderstanding, ac companied by probable hard feeling and pos sible litigation.

Adjectives and adverbs have no place in specification. To say that work must be don "properly" or "suitably" or in a "workman like" manner does not really mean anything because what one man will consider "proper or "suitable" another holds to be quite th contrary. The phrase that goods must b delivered or work done "to the satisfactio of the Engineer or Inspector," has cause many a contractor to bid high in self-defense It contains the possibility of unfairness an graft and should not be allowed.

How Definite Requirements Affect Prices —It is a noticeable fact that where specifica tions are indefinite the difference between th lowest and the highest bids is very great, bu where the requirements to be met are clea and precise all the prices bid are about th same.

Specifying Procedure vs. Calling for Re sults.—Another common fault is to describ detail the particular methods to be folwed in doing a piece of work and then quire a warranty as to the result. One uld state in detail the way the work is to done and then abide by the result, or spec what is wanted and then let the contractor e his own judgment and ingenuity concern the best way to bring it about.

NO LOW PRICES LARGE COMPETITION.

In order to obtain low prices a number of ings are necessary. First it is essential to ve as much competition as possible. To ing this about lists have been prepared giv the names of the firms making the varus classes of goods, and then we notify them ıen we are in the market.

Bidding for Different Classifications Sepately.—Supply contracts are now so drawn at goods in different groups or divisions, as termined by manufacturing specialization or ade usage, may be bid on separately; for orders are drawn to contain goods of different classifications the bidders will be "mid men" and "commission merchants," not e makers of the wares nor the regular deals in the various subdivisions in which supes are customarily bought and sold.

These "middle men," besides adding their ofits to the manufacturer's price, thus ineasing the cost of the article, are as a rule esponsible parties with whom it is often satisfactory to do business.

Advantage of Buying Large Quantities at One Time.—In order to interest the manufacers and get them to bid it is necessary to purchase fairly large quantities at a time. To do this the department now buys its supplies every three months and these new quarterly contracts contain sufficient goods in each class to enable the makers to quote wholesale prices.

Emergency Supplies.—The principal exception is in the purchase of emergency supplies, and these are obtained when required. The value of placing small orders for hardware and similar supplies as needed from time to time is recognized. This obviates the necessity of keeping large sums of money invested in seldom-used materials in order to have a complete stock in the store-rooms. Unnecessary or excessive local reserves of stock will be prevented in future by careful records now being taken to show the regular demands for materials at the various storerooms.

Reducing Delivery Charges.—Another advantage of quarterly contracts is that where goods are bought in quantities all to be delivered to some central store-house the proportion of the cost chargeable to delivery becomes very small.

Purchasing Standard Materials.—As pointed out, an effort has been made to attract manufacturers by writing specifications that can be filled by standard goods, and by making the requirements so clear and definite that there is little or no chance for misundstanding.

Promptness in Awarding Contracts.—Every effort is made to reduce the time ich it takes to canvass bids, notify the low dders and award the contracts, for delay this respect might cause loss and inconvene due to possible changes in prices and mark conditions.

Systematic Methods Mean Quick yment of Bills.—The new methods have simpli fied matters that on the average the ne required after the delivery of supplies o inspect them, audit the bills and forwd the bills to the comptroller for payment h been reduced from many weeks to less tha eight days.

Necessity for Business Administra Bureau of Supplies.—In fact, it is f y realized that in order to get low price there must be fair competition between responsible manufacturers who find it to their intest to do business with the department; all o which means that the Bureau of Supplies rst b handled as a clean-cut business propos on

AIM OF THE ORGANIZATION OF THE BU

In the Bureau of Supplies itself conti and operations are being standardized th nothing will be done in a haphazard inne or left to chance. The work of the es aims to secure the economy of the fu e so systematizing and simplifying the wor that it can be done by the fewest ssible number of employees at the least cost.

EARTH AND ROCK SECTIO

ost of Lower Fielding Tunnel, Iron Mountain, California.

Costs of driving a mining tunnel in Calirnia are given in a discussion by Mr. W. C. ammott before the American Society of vil Engineers ("Proceedings," Vol. XXVIII, p 705).

The tunnel was 9 ft. 6 ins. in width and ft. 6 ins. in center height, and was mostly hard felsite, although partly in felsitic poryry, which part amounted to less than e-third and was timbered. Burleigh drills, the company's own manufacture, were used, th solid-cross steel bits, the power for opating them being obtained from a central mpressor plant receiving power from the orthern California Power Co. at a cost of ct. per kw.-hour. As there was no cause r rushing the work, only a single drill crew erated in the heading, although there was ıple space for two without interference. The acksmithing was done in the general blackith shop, which handled much other work, t only its proportion was charged against e tunnel. This was also true of powerouse expenses and superintendence. The ine had a narrow-gage railroad, which made ansportation charges light. It will be noted om the drilling diagram, Fig. 1, that a und consisted of 14 holes, and that a shot ntemplated the breaking of 5 ft. of ground The cost of the work based on complete cords was as follows:

	Per lin. ft.
rilling:	
Labor	$ 1.570
Tools and sundries	0.286
Tool sharpening	0.086
Power	0.281
Total	$ 2.223
lasting	
Labor	$ 0.504
Explosives	1.047
Tools and sundries	0.014
Total	$ 1.565
ucking:	
Labor	$ 2.360
Tools and sundries	0.220
Tool sharpening	0.040
Power	0.094
Total	$ 2.714
ramming:	
Labor	$ 0.900
Track laying	0.349
Total	$ 1.249
Timbering	
Labor	$ 0.840
Timber	0.676
Total	$ 1.516
General Expenses:	
Interest and depreciation	$ 0.851
Superintendence	0.334
Total	$ 1.185
Grand total	$10.452

The cost per cubic yard of excavation was $4.04. Other data of interest are as follows:

Cost of drilling per foot drilled	$ 0.151
Cost of timbering per foot timbered	1.516
Cost of timbering per set	27.74
Dynamite used per foot of tunnel, lbs	7.88
Feet drilled per drill sharpened	3.5
Feet drilled per foot of tunnel	.....

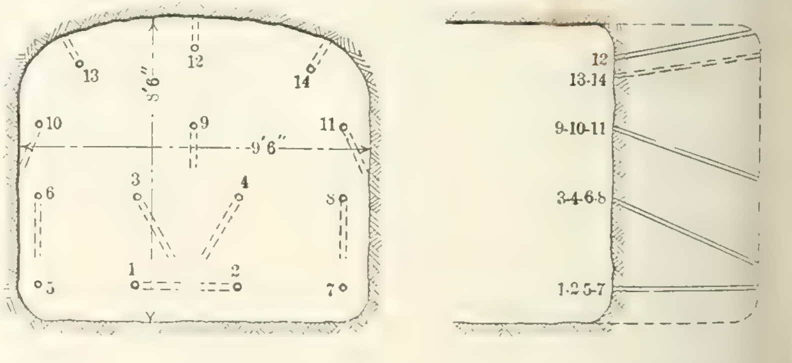


Fig. 1—Diagram Showing Arrangement of Drill Holes in Fielding Tunnel.

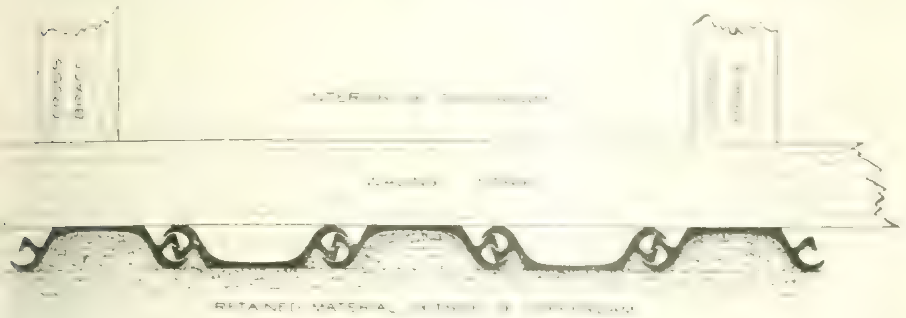
Economies of Concrete Columns.—Mr. Leonard C. Wason, President of the Aberthaw Construction Co., Boston, states that in one case the saving of concrete by reducing the size of columns on successive floors was $2.30 per column. On the other hand, the increase in form cost was $5.70 per column, entailing a loss of $3.40 per column. This is a very good example of why it is cheaper to use the same size columns on successive floors than to reduce the dimensions. To avoid frequent changes in column sizes the column reinforcement may be varied in successive stories.

A New Type of Steel Sheet Pilg.

The accompanying illustrations sho tions of the new Lackawanna Arche Sheet Piling. The characteristic feat this piling is the curving or arching web, so that the mass of metal with web lies to one side of the neutral axis the section. The outer face of the web i flattened to lie in the same horizontal plan with the extreme outer faces of the memb of the interlocked joint. In the piling wa the arches reverse with each pile with refence to the neutral axis of the wall, and th otal thickness of the wall at the center of t web is equal to, but not greater than the thiness of the wall at the interlocked joint. the same time the arched section transmi the load to the waling supports with no tency to flatten out. The haunches of the ar are thickened giving increased strength a this point against spreading and also distriting the metal in the web with reference t the neutral axis so as to increase the inerti and modulus of the section. In Fig. 1 it c be seen that on each section where pressure mes on the external part of the arch, this preure is transmitted to the waling timber thigh the interlocking members of the joint In those piles where the internal part o the arch is under pressure, the pressure is tsmitted directly through the metal to the wing

r. The bearing surface is extended con- by the thickening of the arch aunches.

interior braced cofferdam is the most form of cofferdam although structures are self-supporting. It is imes inconvenient to use interior brac- even in small cofferdams or for single It is evident that the arched steel piling



1—Typical Section of Wall of Lackawanna Arched Web Steel Sheet Piling, Showing Bearing Against Waling Timbers.

mparison to a similar pile of plain ht webbed section, all other conditions the same, has much greater transverse th. This permits the use of less bracnd a greater vertical distance between the waling timbers for piling of weight per square foot.

hould be noted however that the arched is recommended by the manufacturer transverse strength is of first imporand not where tensile strength is of first tance. In the latter case the ordinary t webbed piling will be found preferable. stance, in a large deep cofferdam, comof pockets filled with dredged material. the arched piling sections t to be mostly tensional, due to pressure the filling material within each pocket. r braced structures, where each pile acts upported vertical beam, the arched secs relatively the stronger. This piling is by the Lackawanna Steel Co. of Buf- N. Y.

ods and Costs of Rock Excavan in the Harbors of Aviles, San Esteban de Pravia, and Port de Bilbao, Spain.

use of a Lobnitz rock breaker for the up of rocks in three harbors on rth coast of Spain is described by Mr. Hernandez in a paper presented behe International Congress of Naviga- The cost of the work is compared to st of similar work by the use of explo- In conclusion an analysis made to that excavations of over 6,000 cu. ms. made more economically with a rock r than with explosives, while for jobs ing less than that amount the latter d is the more economical. An abstract paper follows:

In 1896 the work of dredging an h channel to a dock was commenced port of Aviles, Spain. The ground ed of soil which could be removed by of an ordinary dredge and partly of of rock called "Rechalda," which the whole width of the channel, and really formed part of the ridge of ighboring mountains. These rocks vary to 300 cubic meters in volume at h of 4.50 m. below the level of low of equinoxial titles. They belong to iassic period, and consist mostly of ith streaks of very hard white quartz. re these works were undertaken, some nents were made to remove the rock ans of the well known primitive sys- hand bored holes with a diver who d an explosive charge, and also with bored by compressed air, which cost $8.30 per cu. m. of excavation. After these trials we commenced dredging the channel to 4.50 m depth below equinoxial low tides, and we conveyed the rock obtained from this excavation two miles out to sea. [illegible] per cu. in., and this price was subject to a rebate of 16.50 per cent.

We investigated several systems for carrying out this removal of rock and selected a Lobnitz rock breaker which disintegrates the rock by means of a long heavy compressed steel chisel, called a "cutter," which is allowed to drop from a suitable height and breaks the stone by its impact. We shall call attention to some of the features which have been noticed during the operations and which it is well to remember, especially as any slight modification in the course of a work which largely consists of a repetition of the same operation, may considerably affect the total cost. Because, although the modification may be very slight it may represent a very large sum in the total cost of the work, owing to the great repetition of the same operation.

At the commencement of the work we received from Messrs. Lobnitz & Co. the machinery of a rock breaker with a single cutter 10 m. long and weighing 10 tons. At first, when we had no experience of this machine, we fitted it up on a couple of boats which were connected together side by side by timber joists, the necessary width for dropping the cutter being allowed between the two boats.

The rock was broken up fairly well, but considerable difficulty was experienced in moving the boats, owing to the great resistance of the current in the channel and to the fact that they were extremely exposed to the hurricanes which blow across the mouth of the port of Aviles. A new craft in timber was therefore designed and the machinery was placed upon it. This craft consisted of a single flat bottom boat 23 m. long, 11 m. beam, and 1.9 m. high, with two prows and a well in the center for dropping the cutter. The boiler, the winch, and the heating apparatus for the feed water are placed under the deck of the boat and this arrangement gives it greater stability, and tends more to preserve the heat of the boiler, engine and the steam piping, than when the plant is on deck.

The fragments of rock were extracted by a bucket dredge fitted with iron claws to assist in removing the stone which, as it mixes with the clayey marl, tends to consolidate afresh if it is not removed soon after it is broken up.

The work was carried out from April t October, when the conditions of the se enabled twenty days out of the month to b utilized. The mass of rock extracted an conveyed to the required distance average 1,630 cu. m. per month.

The cutter was dropped on points 1 m apart along alignments at right angles to th banks of the channel, these alignments bein also spaced 1 m. apart. The craft wa shifted along them by means of cables and winch. The rock was broken up into piece averaging from 15 to 20 cm. long and from to 3 decometres in volume. The work o breaking up the rock continued at each poin for a depth of 1 m. into the rocky mass an the number of blows that was necessary t achieve this varied considerably, for in som points it was necessary to have as many a 57 blows for what 1 or 2 blows woul achieve at other points. As an average 1 blows sufficed to reach the required dept The rock, however, was only extracted t a depth of 80 cm.

The number of blows averaged 60 per hou for a drop of 4 m. This estimate include the time taken in shifting the boat.

In only two or three cases during th whole of the work of removing 50,300 cu. m of rock was it necessary to break up th large blocks by blasting.

It was at first proposed to change the stee rock cutter point or movable end of the cutter, which became worn by friction, but thi operation was not practicable as the pil wore in the way shown on Fig. 1, so that th new point which was fairly flat in shap was no longer adaptable to the lower par of the cutter which had already become ver much worn. The idea of renewing the point of the two cutters employed for breaking u the rock was abandoned and these two cutters were merely shortened by 3 m. and m. respectively, which reduced their length to 7 and 9 m.

After this work had been carried out, description was published of an arrangemen which Messrs. Simons of Renfrew had applied to a suction dredge for cutting th rock. This consisted of a screw fitted wit cutters which was placed at the entrance o the suction pipe through which the broke rock cut up by this screw was drawn u This arrangement was quite sufficient fo removing the greater part of the rock whic had to be excavated at the port of Avile A suction dredge fitted with this applianc is most suitable for clayey rocks which ar more easily cut than broken, and the ver small cost of removing rock in this manne would be very much cheaper than the cos of removal by means of a rock-breaker.

Port San Esteban de Pravia.—After th work at the port of Aviles was complete the rock-breaker was used for removing another rocky mass of a relatively small cubi capacity which emerged above the low water mark on the coast of the Camtabrian Se at the entrance of the port of San Esteba de Pravia, which is also situated in the nort of Spain.

This rock, which is known as "El Lampa ron," consisted of a schistous quartz and it extremity showed above low water of equinoxial tides. At the depth of 3 m. to whic the rock was excavated, the mass was 45 m long in the direction parallel to the channe and 27 m. wide. This rock in the cente of the channel split the fairly severe currents which occur at that point, especially a

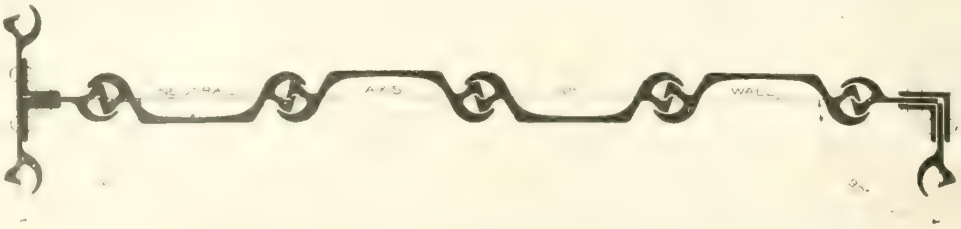


Fig. 2—Showing Assembled Sections of Arched Steel Piling, Junction and Corner Sections

[illegible] These currents have been further reinforced by the current of the river Nalon, which has its outlet at this port.

The mass of rock thus removed amounted to 3,184 cu. m., including the sand contained in the pockets of the mass. After the rock was broken up, the pieces were removed by means of the bucket dredger which had been previously used at the Port of Aviles.

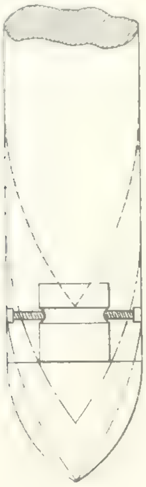


Fig. 1.—Sketch Showing Progress of Wear on Steel Cutter of Lobnitz Breaker.

This rock was very hard, but thanks to its structure, it was easy to break off. The pieces were about the size of railway ballast so that they were easily dredged. Some difficulty, however, occurred, owing to the fact that the western breakwater, which was being built for protecting the bar against the hurricanes blowing in that direction, was not yet completed. Owing to this, it was only possible to work during 58 days out of two consecutive summers, and also it was impossible to work at the outset neither during low water, nor during the semi-ebb of the spring tides, in view of the strong currents. Then again the site occupied by the rock was very restricted in length, and it was impossible to break up the rock and dredge it away at the same time.

It had also been intended to carry out the work by driving holes 1 m. apart with the cutter to a depth of 1 m. but the conformation of the rock and the motion of the sea did not permit of this being done.

The cost per cu. m. removed and transported was to be 47.70 pesetas, but it did not work out to this figure, owing to the relatively small mass to be excavated, and to the unfavorable conditions of the site which hindered the work most of the time.

We may also mention a small excavation carried out inside this very port by the same method, although its relatively small importance might have justified another method than that of a rock-breaker for leveling the rock.

The mountain side was extremely inclined at this point, and it was necessary to cut away some of the rock in order to form a horizontal foundation for the concrete blocks, which were to serve as a base for a masonry wall 13 m. high which was to carry a coal bunker.

This horizontal foundation was 14 m. by 8 m. and the mass of rock to be removed was 280 cubic meters. The small amount to be removed could have enabled one to dispense with the rock breaker, but it was used as it was available when not in use elsewhere for clearing the bar across the channel. These foundations could be carried out much more rapidly and economically (the cost worked out at $4.44 per cu. m.) than by blasting.

Port de Bilbao.—About 78,300 cu. m. of rock which obstruct the channel 13 km. away from the entrance of the harbor, are now being removed at Bilbao. The rock here is chalk and clay and goes under the name of Cayuela. The strata is horizontal and very compact in structure so that it is easily broken up, but the pieces are fairly large and more difficult to remove.

This rock lies on the right side of the channel, and occupies a site in plan which has approximately the form of the segment of a circle, of which the chord, about 860 m. long, is tangential to the center of the axis of the channel. The latter has been excavated to the level of low water of equinoxial tides, and it is now proposed to deepen this bed to 5 m. below this level, which is equivalent to the navigable depth of the other portions of the channel at this point.

The removal of the rock was commenced by the rock-breaker described above, but subsequently a new one was employed with certain alterations in the design, not only as regards the boat upon which the plant is fitted, but also as regards the machinery supplied by Messrs. Lobnitz & Co. The boat is made of steel, and the hull, prow, sides and bottom are so designed that the craft can be conveyed from one port to another and the plant worked at sites which are exposed to the swell of the sea. This design is of great importance for our country, and especially for the coast of the Cantabrian Sea, where one may not remove very heavy masses of rock, and where the work must be apportioned between several ports. The rock-breakers are also frequently called upon to do their work at exposed sites. The well for the pile is made in the poop of the boat which enables the rock to be removed even at the very toe of the quay wall. The boiler, engines, and all steam piping are placed below deck as in the case of the first rock-breaker. This boat is 23.50 m. long, 9 m. beam and 2.25 m. high; it draws 1.5 m. of water with a difference in draft of 16 cm. when the cutter is dropped.

This cutter is 10 m. long and weighs 10 tons, but the machinery is capable of working a heavier cutter. The cutter is attached to a cable which is unwound from a winch as it falls. This arrangement has several advantages:

1. It permits of a greater number of blows (twice as many from our own experience) but the blows are less hard and the effect is consequently less as the cutter does not fall freely and the effect of the blows is diminished by the friction of the cable on the winch and on the top pulley.

2. The absence of guides and release clutches enables a certain economy to be realized. The work of one man for guiding the cutter and hooking it on to the chain after each blow is saved, but the total of these savings is somewhat diminished by the extra cost of the cables and of the pulley.

3. There is no fear that when the cutter strikes an inclined portion of rock it will slide along it and fall on the sea bed, which would interrupt the work and involve expense in fishing up the cutter, as well as in repairing any damage. This consideration must not be lost sight of when one is lifting sharp rocks, or when the rock-breaker is at work on exposed sites, especially when the cutter is worked in the poop of the boat. The arrangement of the moveable point of the cutter has been modified, and instead of following the shape of the body of the cutter, the joint between the point and the cutter is covered with a steel hoop.

The steel cable has also been altered by winding the strands alternately. An ordinary cable has all its strands wound in the same direction, and this forms kinks which have to be undone after each blow of the cutter, thus entailing great waste of time.

The removal of the rock in the port of Bilbao is done with two rock-breakers which drive holes 1 m. apart in alignments which are also spaced 1 m. apart. The holes are driven to a depth of 1 m. and this enables an average thickness of 60 cu. m. of sea bed to be removed. The two rock-breakers excavate about 3,000 cu. m. per month. It was proposed to extract the fragments of rock with a Priestman grab dredge for the large masses, and a bucket dredge for the smaller pieces, but the latter had only a small efficiency and furthermore it was co dera damaged on several occasions, whi led t great waste of time. Extraction by eans this dredge was a costly and u ractica method, so that another Priestr n gra dredge had to be employed instea These two Priestman grab dredgers acco ted for 1,600 cu. m. per month on an avera which is about equivalent to the mass of r which would be removed by one of the ro -breakers. At the present moment the w is being carried out with only one of the Pries man dredges.

The jaws of the Priestman dred s hav to be renewed frequently, as they w ar con siderably through coming in con t with large rocks, which are found in the pass of disintegrated rock. The size and w ghts the pieces vary exceedingly, from eces larger than small stones, to pieces eighi about 2 tons; the average volume pieces can be taken to be from 3 t decimeters. The average size of th which are found decreases in prop the number of times the rock-break to work over the same site, and the of the layer which can be lifted in proportion.

Thanks to the site, where the being done inside the port, and to t ties which are found in Bilbao for out all kinds of repairs, there is risk of the work being stopped, possible to work from 23 to 24 month.

It costs $2.90 per cu. m. of rock li d transported to a distance of over and it was found that the breaking rock came out cheaper and the remo er than had been estimated.

One of the cutters broke across th whilst the work was being carried o

Conclusions.—If a comparison is tween the results which are ob the above system, and those which tained by the other methods we have that is, with divers, and explosives the rock surface or in holes bore rock, we arrive to the important that the easiest, and cheapest syst exposed to accidents, as well as rapid for breaking up and lifting is the one in which rock-breakers This is also the system which w nearly approximate in practice both gards price, and time taken in work, with the estimates.

It goes without saying that the im of the mass of rock to be remove determines the point beyond which is economical to employ rock-breakers. As a matter of fact, the work of a rock-bre is not remunerative in the case of small

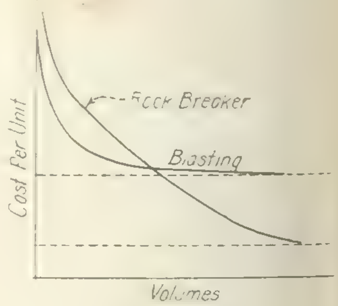


Fig. 2.—Curve Showing Relative C ts of Rock Excavation by Drilling an y Breaking.

Note.—The intersection of the curves tween 5,000 and 16,000 cu. meters.

of excavation, so that the schedule p cubic meter has to be high in order to the cost of transport of plant and st surance, and loss of time for installati and starting the work. The cost of th would therefore be more moderate method of blasting by means of dive resorted to. Instances of this kin quently occur where a solitary rock ha [illegible] y figure out the actual cost of breaking up rock and to assume the cost of lifting l transport, but we think the better method to base the estimate on the total cost ich will comprise all operations, as it is y difficult to arrive at the cost alone of aking up. As a matter of fact, the cost the latter and the cost of removal are re-rocal and when one increases the other de-ases

'he above remark is made solely with the ect of warning one, in examining tenders, inst the danger of accepting tenders ich are too low for breaking up the rock. wever, as we have already said, this oper-n is more suitably carried out by rock-akers, which are also the more economi-method for lifting the rock.

Vith a view to illustrate the results we e obtained in the rock breaking work we e carried out, we have prepared a dia-[illegible] rigidly) in which the cost of lifting the [illegible] by rock-breakers, is shown by means of ves. The volume of rock lifted is repre-ted by the absissae and the cost of the avated material per cubic meter is shown the ordinates. The absissae and the ordi-s are not shown to scale, as the diagram nerely a typical one.

f we examine the extreme limits on this [illegible] zero, the cost per unit is infinite, and as the volume increases, the cost per unit decreases, but it can never fall below a certain figure which is represented by an ordinate which we think is less in the case of a rock-breaker [illegible]

The axis of the ordinates may be considered [illegible] common to the two curves, whereas these curves have two distinct asymptotes at their other extremity, which are shown by lines parallel to the absissae.

The diagram shows that beyond the ordinate which corresponds to a certain volume to be removed, the rock-breaker is the most economical method. This point is fixed by the intersection of the two curves and its precise position depends upon various circumstances. This intersection will vary as a matter of fact according to whether the necessary plant for breaking the rock or lifting the material is available, and according to whether it is necessary to convey all the plant, necessary for lifting and transport, to the actual point where the work is being carried out, or whether it is necessary to convey the plant merely for breaking up the rock. It also depends upon the distance of the port where the rock is to be lifted and upon the position of the rock, and also whether a rock-breaker can be employed, and blasting is not feasible. It depends also upon the depth of the rock and the navigable depth to be obtained, upon the nature of the rock, and lastly upon the time in which the work has to be carried out. In order to satisfy most of these requirements it is neces-[illegible] plant which is ca transported, and which can be worked points where the sea is very heavy, and must also dispose for the bucket dredges, Priestman dredges, for the removal of rock.

We have worked on these conditions on coast of the Cantabrian Sea, and have c ried out rock cutting to 7 meters below l equinoxial tides. The cost per cubic me has varied between the limits we have in cated. The point of intersection of the t curves, relative to the cost, occurred betw two ordinates which correspond to absis [illegible]

It is certain that the tendency will be arrive at a still lower cost per cubic m [illegible] be possible to increase the volume to removed still further in the near future. stands to reason, however, that this volu will be limited in any given port, and t it will not always have the necessary [illegible] chinery which is available for carrying [illegible] necessary in this case to group the differ sites together where rock has to be remo [illegible] even to comprise all the rock lifting wh has to be carried out in several neighbor ports under one contract. This remark plies particularly to countries which do possess first class harbors which require d [illegible] ticular port in which the total amount excavation is inconsiderable.

ROADS AND STREETS SECTION

e Concrete Roads of Wayne County, Michigan.

[illegible]

he Wayne County Board of Road Com-ioners, by whom I am employed, became rested in 1909 in the use of concrete as l material, and after a thorough investi-on of the subject from all angles, decided try it on a mile of road about to be con-cted on Woodward Avenue road. Since road was built, the board has become firm converts to the use of concrete as untry road pavement, that up to Jan. 1, his year, they had built 30½ miles of this n of pavement. It can be said truthfully they are pioneers, not in the use of con-[illegible] e a scale.

1908 the board built several miles of dam road. Owing to the difficulty of se-ng a sufficient supply of crushed hard e for the second course during the road-ding season, a supply of crushed field cob-was purchased during the winter with idea of using it the following season for second course or wearing surface of the adam. Before the time to build the second on's stretch of road arrived, however, noticed the result of automobile traffic on macadam, and decided that before any money was expended on that form of truction they would at least investigate see if some more durable form of im-ement could not be found. It might be to mention in this connection, also, that nacadam roads which they built were cov-with a coating of tar and chips, with the of making them not only dustless, but firmly bound.

ter a full investigation and consultation several engineers, besides the engineers he regular force, it was thought best to e the hard stone purchased as above in ing the second course of a concrete road r than macadam. Accordingly, bids were for the construction of one mile of con-road built in two courses, the first or [illegible] and the second course, or wearing surface, of crushed cobblestone, using a 1-2-3 mix. A satisfactory bid was received and the contract awarded. Work was started in May and the road was finished and thrown open to traffic about August 1. No sooner had this road been thrown open to traffic than the board decided to build another stretch of concrete on Grand River Road, and accordingly, they used their entire appropriation available for use on Grand River in the construction of a short stretch there, built according to the same specification as the Woodward Avenue road.

By this time Woodward avenue had been subjected to considerable traffic, and on account of its standing up so well, showing, in fact, no signs of wear, and there being no apparent weaknesses developing, they decided to build still a third stretch, and built ½ mile on the Wayne road south. This road is less important than either of the other two, and was built but 10 ft. wide. It was finished late in the fall of 1909 and had to be protected from the frost by manure and other contrivances. The following year 11.304 miles of concrete road were built and in 1911, 17 miles were constructed.

METHODS OF CONSTRUCTION.

Grading.—The first work done in the construction of our concrete roads, of course, is to grade and prepare the subgrade. This is done by means of steam hauling engines and rollers and road graders and scarifiers. At some places we also find it necessary to use the rooter plow, and where grades are too steep we use scrapers for short hauls and wagons for longer hauls.

The surface of the subgrade is shaped to conform to the curvature of the finished road, and is thoroughly rolled with one of our 10-ton road rollers. Where soft or spongy places appear, they are filled with gravel or suitable substance until the foundation is made solid. If necessary, the soft or spongy material is first removed, though it is rarely necessary to do this, the fill being all that is needed to make the foundation right.

Concrete Materials.—While the law requires the board to advertise for proposals for all material and all work done which cost in cess of $500, and while other things be equal the board would undoubtedly award contract for material to the lowest bidder, fact is that no two cements are exactly al and hence it follows that other things never exactly equal. When bids are ope on cement (each proposal must be acc panied by a liberal sample) they are held for a period of 30 days, to enable us to m thorough tests, including the 28 day t before the contract is awarded. It also quently happens that the board will go into the market and purchase single sacks the same kind of cement bid upon from s eral different yards, and not only make t ourselves of those samples, but have labo tories of established reputation make t also, the idea being to see if a sample of ceptionally good cement has been furnish and also to ascertain whether the quality cement put out by the mill is uniform. If cement fails to meet the requirements est lished by the American Society of Test Materials, it is not considered further, the to which the material is put requiring be quality than even foundations or walls of h buildings. For in buildings the strain is tirely constant, except as variations are p duced by the winds, while on roads the str is sudden and severe. It would be much ter to leave the earth roads and keep th well graded than to build a concrete road poor cement, or build it any other way t exactly right.

For stone we use washed gravel, ranging size from ¼ in. to 1½ ins. This contain large percentage of trap rock, and is requi by our specification to be free from loam, c vegetable matter and other impurities; also be well graded, the larger pieces predomin ing, so that the voids are reduced to a m mum.

For sand we use only well-graded b sand, ranging in size from ¼ in. to z Lake and river sand are not approved, beca of the presence in them of too many fine p ticles, which would require too large a p portion of cement to properly coat every p ticle. Like the stone, the sand must be f om impurities, well graded, the larger par- cles predominating and the voids reduced to minimum.

The Mix.—On the first year's work, as ove stated, the mix for the first or bottom urse was 1-2½-5, and for the top or wear- g course the mix was 1-2-3. We determined at with a perfect mix, and with perfect nditions, a 1-2-4 mix with pebbles would sufficient. But our commissioners are con- rvative, and at once realized that perfect eoretic conditions would never obtain and their conservatism decided that it would be e part of wisdom to use too much cement ther than too little. Accordingly, they opted a 2-3-6 mix, which has been adhered . With well graded materials this is ample, th enough to spare, so that when the ma- rial is not perfectly graded, or when other nditions exist requiring a little additional ment, there is plenty of the more expensive aterial. Under perfect conditions, as above ated, a poorer mix could be used with safety, t a concrete road with too little cement is und to disappoint, and to be safe and con- rvative, as above stated, we use a 2-3-6, eling assured that the certainty of having e road stand up is worth the additional pense.

We have purchased mixers which are pro- ded with a boom 18 ft. long, which extends the rear, and can be easily revolved about e axis to positions varying 180°. On this om a bucket is run back and forth, by hand, d in it the mixed product is conveyed from e mixer to the road. On account of the ovability of the boom, the concrete is de- sited wherever wanted, and the expense of or eight men to haul the concrete in carts om the machine to the place required is re- ced to two.

After dumping, the concrete is well tamped; en stroked off with a "strike board," having under side curved to correspond with the sired crown of the road; after which one two "floaters" smooth off the rough surface d even up any depressions or humps that y appear. The surface is left just rough ough to afford a good foothold for horses d resistance to automobile tires.

The first day the concrete is protected from sun by canvases; after which (after final has taken place) the canvases are re- ved and the road covered with 1 or 2 ins. loose earth to prevent it drying out. It is o our practice to sprinkle the concrete, netimes more, sometimes less, depending on state of the weather. In dry weather, the ncrete should be sprinkled at least once a y for seven days. If the road is not lo- ed where trespassers are likely to come on it, the night watchman can attend to the rinkling.

Expansion.—The first year we used two cknesses of 3-ply tar paper only between sections, which are made 25 ft. in length. is affords sufficient expansion, but we soon iced that at the joint the wear could be ected, due to the impact of horses' shoes d wheels under heavy loads chipping off the ges. This wear was not great; in fact. en now, after four years' wear, the joint nnot be noticed except on a vehicle heavily ded and without springs. But the fact t chipping and wear did take place at the nts more than at any other point in the d, led us to cast about for a more durable nt, or some other form of protection.

We finally decided to use two sheets of soft el 1¼ in. in thickness and about 3 in. wide, ared to conform to the crown of the road. ear members are cut at frequent intervals the plate, and bent out, and these are firmly bedded in the concrete, which holds the el exactly in place where wanted, at the ner of the concrete in the section. These el joints are patented, and are furnished by firm in Detroit. Of course the cost is her than that of tar paper, which we orig- lly used, but the additional expense is ond a doubt an ultimate economy. Be- een the adjacent steel plates, we place a et of asphalt felt, which takes up the ex- nsion in the concrete.

Mixers.—We use only batch mixers. These are propelled by their own power when on the job, but not from one job to another, as they can move only about two miles an hour on the road, and are too heavy and too clumsy for a road vehicle. The boom on the rear is about 18 ft. long, so the mixer is moved a distance of about 15 ft. each time. This traction power and boom arrangement are both necessary in the reduction of labor behind the machine.

Moreover, by moving at short intervals, the machine is kept near the source of supply of materials; and if it should ever happen that the material is not left in quantities sufficiently liberal, a team wagonload of gravel, or of sand, or cement can easily be hauled in to make up the deficiency.

Water Supply.—The supply of water in sufficient quantities has been a vexatious problem. It was formerly necessary to team the water in 12-barrel tanks. With teams costing 50 cts. per hour, this proved a very expensive method of procuring water. This has been overcome by the purchase of several gasoline pumps and a large quantity (nearly 10 miles) of 2-in. black pipe. This pipe is laid alongside the road proposed to be improved, with connections every 150 ft., so it can be tapped at short intervals. During the day this furnishes ample water for the mixer and for the hauling engines, and also for sprinkling, when this is done in the day-time. When the sprinkling is done at night, of course, the demand on the engine is decreased. We found it necessary in some cases to pump as high as five miles, in relays, using three pumps, but even pumping this distance was found to be economical as compared with hauling in tank wagons by teams.

Drainage.—All road builders are agreed that no road will stand up that is not properly drained. We provide not only what we believe will take the water off quickly in ordinary weather, but also against flood times. When we come upon a wooden culvert 4 ft. wide, we replace it with a concrete culvert 6 or even 8 or even 10 ft. wide, having first determined by survey the area to be drained by it. We are liberal to a degree in the matter of drainage, and especially so with the dimensions of culverts and tile used.

Where electric railways run along the side of the road, as they do in many of Wayne county's roads, we lay a land tile 3 in. in diameter alongside the track, distant from the nearest rail about 4 ft. We cover the top of this course of tile with tar paper to prevent filling up by the washing of sand, etc.

For crossings, either of the road or private drives, etc., we use concrete tile which we manufacture. The diameters are 8 in., 12 in. and 24 in. We maintain a force at our storage sheds the year round, and when not otherwise engaged, we have this force making concrete tile. We use the tongue and bevel forms, and the product of this tile factory is of better quality and much cheaper in cost than can be secured in the open market. For cement tile we use a 1-3 mix of the same cement and sand that we use on our roads. If the sand is fine, of course a little richer mix should be used, but it is not only economy of money, but also of time, to insist upon the sand being coarse. Even a few pebbles up to 3-8 in. or ½ in. are not objectionable.

Interchangeable Culvert Form.—We have a standard plan and interchangeable design for all our culverts. The sketch or blue print provides for whatever width of culvert we elect to build. It also provides for a variable span —though we confine our operations to an even number of feet, ranging from 4 ft. to about 14. We also have a table showing what reinforcements are necessary for a 4 ft. span, what for a 6 ft. span, and so on, so that practically all the drawing or planning we have to do in our culvert construction is to determine what the width and span shall be, and fill in the figures on our interchangeable blue print.

This not only makes for economy of time, but also gives uniformity of appearance to the completed culverts. With the aid of the form and the table of reinforcements, the work of ordering the materials and computing volumes, etc., becomes the work of a novice.

Costs.—As widths of roads vary, it h been thought best to give the costs on a squa yard basis. Then on a 9 ft. road the cos is the number of feet to be built multiplied by the cost per square yard. For a 10 ft. rd 1/ should be added. For a 12 ft. road 1/ should be added, etc. Our costs have ranged all the way from $1.25 per sq. yd. to $1.75 per sq. yd. These figures are arrived at on the b s of roadway proper, and do not include d nage. The cost of our drainage is about 5 p cent. of the total cost of the road. Labor i about 32 per cent. to 40 per cent. of the total cost.

The variation in the above figures ll ob tain in every locality. It depends upon numerable conditions, chief among which ay be mentioned: condition of subgrade; ch acter of the country, whether hilly or level; ength of haul from nearest available side rack, condition of road over which material st be hauled; freight rate from source of su ly t side track; kind of motive power us for hauling; kind of mixer used, especiall with reference to labor-saving devices and ca city kind of weather encountered; prices p l fo labor and teams; ease or difficulty of sur adequate supply of water. It might mentioned that the ability of the forem ha a great deal to do with the cost, as to wether he is a capable, hustling, pusher, and g ou of the men all there is in them, or whet r h is a poor handler of the men and fails t nan age them to best advantage.

Maintenance.—While our macadam oads cost in the first instance about 10 per cer less than our concrete, the fact is that up this time they have cost as much, due to the ain tenance charges that have been necess keep them in good usable shape. On miles of concrete road we have not sp exceed $200 in maintenance; and most this has been spent in cleaning out the ditch and drains; painting guard rails of culvert and cutting weeds. The repairs to the core itself have been a negligible quantity.

Along with maintenance cost; in fac the same thing, may be mentioned durabilit and part of durability is resistance to the rages of the automobile. There are no loose one or particles in the concrete road, but ery particle is soldered or cemented to the mono lith which we call a section, 25 ft. lon and as wide as the road metal is built. Th uction of the automobile tires cannot buc it

The longevity of the road is not kwn The pavement laid in Bellefontaine, (21 years ago, is in good condition today, and do not believe it is presumptive to say t it will in all probability last as many more ars Our roads are built of a richer mix a of better material. With the steel joints ware now using, it does not seem as thou 50 years' wear is too much to expect fro the concrete road.

The surface of the concrete road is ust rough enough to afford good footin for horses and for automobiles, thereby affc ing good traction. The objection has been sed that it is hard on the horses feet, and t is probably true, though we fail to see h it can be any harder on them than brick. his objection, however, is one reason tha as been advanced for coating the surface ith tar and sand, and if this is done, the obj ion is overcome. And while the concrete ad may be a little harder on the horses' hoo it is also just as certain that it is easier, a in greater degree, on his muscles.

The concrete road is also dustless, ther being no detritus from the road itself. The ad is also the most sanitary of roads, as ery good rain cleans it of all foreign. tter brought on to it, with the possible exce on of where clay has accumulated in large un- tities. It is also sightly, and pleasing t he eye. If the tar coating is given, with nd enough to absorb the tar, it has the ap ar- ance of an asphalt road.

Repairing Concrete Roads.—Contrary t general opinion, the concrete road can b re- paired if it should require repairs. If ilt right in the first instance, it should not ed repairs, but when it is considered that 50 tons of gravel are used in the constructic of nle of this road 15 ft in [illegible]. p, and that each ton contains 150 shovel-, it is almost too much to expect that ry shovelful will be free from foreign sub- ice and that every cubic foot will be mixed ctly as it should be. The proper way to ke repairs is to cut out the piece found lty, beveling the edges of the cut so that wider at the top than at the bottom. Con- rable slant should be given the sides, and sides should be left rough—not so the new crete will adhere to the old, for it will in sufficient degree—but so the new con- e cannot sink and cannot slide around. It rue that there will be some adhesion be- en the new and the old, but not enough ive the same strength to the joint, as in the rete that goes to make up the old mass or new mass; and the sloping edges and the h sides will give added strength to the .

The Life of Brick Pavements.

[illegible]: the important factors [illegible] the value of a street pavement is its dur- ty or life. American data on this point meager. Byrne in his book, "Highway struction," states that the life of brick ments is 5 to ? years; Tillson in "Street ements and Paving Materials" estimates 15 years. Brick pavements have been laid his country for over 40 years and there many American cities where the age [illegible] pavements of this type [illegible] years. Seemingly most estimates hereto- made have been more a matter of opin- than the result of experience.

an attempt to obtain information as to life of pavements letters were sent to the Engineers of some 75 cities in this coun- The results of this inquiry as regards pavement are given below.

subsequent issues similar data will be n on the life of other types of pavement. ble I is a summary of the data erning the oldest brick pavements in of the cities replying to the letter of ry. Table II shows the estimated prob- life under various classes of traffic. The es in this table are the estimates of the Engineer for the respective cities noted.

e first brick pavement in Binghamton, , was laid in State St. in 1892, and car- as heavy a traffic as a city of 50,000 peo- s liable to experience. This first pave- contains 3,481 sq. yds. of Corning brick, in view of the fact that it is laid on the of the old Chenango Canal upon filled rial of tanbark and old rubbish to a of about 10 to 12 ft., is still in fair tion. The brick have worn well, but the lation has settled in spots and the street probably be serviceable for only three more. The City Engineer believes that e foundation had been upon the natural surface the life of this first pavement would have been at least 30 years.

The city of Binghamton has 267,308 sq. yds. of brick pavement, all of which, with the possible exception of the portion noted in the preceding paragraph, is in good condition. The following table shows the yardage of brick pavement laid in each year prior to [illegible]

[illegible]		[illegible]
[illegible]	2,563	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Mack.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Park.
[illegible]	[illegible]	Syracuse.
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	Clearfield.
[illegible]	[illegible]	Park.

The oldest brick pavement in Birmingham, Ala., is now in its 10th year. It is cement grout filled, has a car track in the center of the street, is about ¾-mile in length and has a 50 ft. roadway. The traffic is heavy for a city of the size of Birmingham. The pavement is now in good condition with the exception of a few cracks, and with the exception of one intersection, it has had practically no work done upon it. The City Engineer estimates that the pavement will last at least five years longer, and may possibly last ten years before it will have to be repaired. The city has a number of other brick pavements constructed since the one noted above that are not now in near so good condition, especially those that are sand filled. The trouble with these pavements, however, is ascribed as being due almost entirely to inferior brick.

Table III shows the age of some of the older brick pavements laid in Buffalo, N. Y. The table also shows the cost of repairs after expiration of 5-year guaranty, to date:

Up to 1894 10 streets in Buffalo were paved with Syracuse brick which was a small hard-burned yellow brick, thoroughly vitrified. It was quite brittle, and while it had given fair service under light traffic it was never a suitable brick. It was quite variable in quality and the city of Syracuse being near the plant was able to get the best brick made by the concern, and most of that which was shipped out was not representative of the best brick made. At the time the earlier pavements were laid the work was done under specifications filed by the contractor in which he obtained a petition of the abutting property owners. The Engineering Department of the city did not have general control of the character of the material furnished except to see that it conformed to the rather indefinite specifications filed by the contractors.

As will be seen from the table, the pavement laid in 1894 has cost 93.6 cts. per sq. yd. to maintain. This pavement was laid in Iroquois Place, a 19½-ft. alley. It never was considered a good pavement and has about outlived its usefulness. The pavem of Iroquois Place was laid with the John P ter Co. "Mack block brick." It was laid a 6-in. base of natural cement concrete, 1 sand cushion and filled, according to spec cations, with a 1 to 1 grout of English Germant Portland cement. It has a drain under the center of the pavement and ha center gutter. Although at the time this pa ment was laid the city was making ratt tests in a foundry rattler the specificatio did not call for any abrasion limit, but cal for a limit of absorption of 3 per cent a crushing strength not less than 10,000 per square inch on brick tested whole. is thought that no crushing test of this br was made. It is believed that part of giving out of this section was due to n row pavement with a center gutter and co fined heavy traffic.

The city of Burlington, Ia., has 24 miles brick pavement, the total yardage amounti to 445,000 sq. yds. The first brick pavem in this city was laid in 1887. It was co

TABLE II.—ESTIMATED LIFE IN YEA UNDER LIGHT MEDIUM AND HEAVY TRAFFIC

City.	Light traffic	Medium traffic	Hea tra
Binghamton, N. Y.	30		
[illegible]	1[illegible]	20	[illegible]
Burlington, Ia.		40	30
[illegible]			
Dallas, Tex.		[illegible]	
[illegible]		2[illegible]	
[illegible]		2[illegible]	
[illegible]	[illegible]		
[illegible]	[illegible]	20	
[illegible]	20	20	
[illegible]	[illegible]	30	
[illegible]	28-30	[illegible]	

At least [illegible]

TABLE III.—AGE OF BRICK PAVEMENTS BUFFALO, N. Y., ALSO COST OF REPAI AFTER EXPIRATION OF 5-YEAR GU ANTY TO DATE.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
1889	1*	[illegible]	[illegible]	$ [illegible].60	$0.5
1891	1[illegible]	2,067	20	201.78	[illegible]
1892	[illegible]	[illegible]	19	323.93	[illegible]
1893	1[illegible]	29,997‡	18	1,1[illegible]	[illegible]
[illegible]	1	[illegible]	17	2,657.88	[illegible]
[illegible]	3	7,347	16	916.71	[illegible]
1896	[illegible]	16,557	[illegible]	[illegible]	[illegible]
1897	[illegible]	16,888	14	898.36	[illegible]
1898	[illegible]	[illegible]	13	164.81	[illegible]
1899	7	13,920‡	12	Ten-year guara	
[illegible]	[illegible]	[illegible]	11	Ten-year guara	

*Light traffic.

†Number of square yards remaining due elimination by street car tracks, street wid ing, etc.

‡No repairs made.

TABLE I.—OLDEST BRICK PAVEMENTS IN 27 AMERICAN CITIES AND SOME DETAILS OF CONSTRUCTION.

	Population — in thousands— 1890.	1900.	1910.	Yardage.	Kind of brick.	Foundation.	Filler.	Year laid.	Present condition.	Probable further service. Years.	Traff
ton, N. Y	3[illegible]	40	48	3,481	Corning			1892	Fair	3	Heav
ngham, Ala......	26	38	133				Grout	1902	Good	5	Heav
N. Y	256	352	424	974	Syracuse			1889		..	Light
ton, Ia.	...				Local	Brick		1887	To be taken up.		......
and, O............	261	382	561		Fire clay		Sand	1888			Light
aut, O...........	...			1[illegible]		[illegible]-in. concrete	Grout	1894			Heav
l Bluffs, Ia	21	26	29		Local	Brick	Sand	1888	Being replaced.		......
ordsville, Ind....						[illegible]-in. concrete	Grout	1902	Good		Heav
Tex ..	38	43	92					1902			......
[illegible]	41	53	67		Mach	Gravel	Grout	1893	Good	[illegible]	Medi
th, N. J.	38	52	7[illegible]		Mach.	6-in. concrete	Grout	1900	[4]		Light
lle, Ind	51	59	70		Porter	6-in. concrete	Sand	1891	Good		Medi
Rapids, Mich	60	88	113	4,582	Hallwood	Concrete	Pitch	1891	"Fairly serviceable"	5	Heav
burg, Pa	39	50	64	2,[illegible]	....			1900	Fair		Heav
O.	5	16	29		Fire clay	[illegible]-in. concrete	Grout	1896	To be replaced......		Heav
ville, Ky...........	161	205	224		Vitrified			1891	[6]		Light
dford, Mass	41	62	[illegible]	9,276	Metropolitan	6-in. concrete	Grout	1902	Good		Heav
rg, Pa..	239	32[illegible]	[illegible]	2,600	Vitrified			1895	Excellent		Medi
tady, N. Y	20	32	73					1891	Good		Light
Wash ...	43	81	237		....			1893	[7]		......
, Wash...	20	37						1898	Good	.	Heav
se, N. Y.	88	108	137	12,500	Syracuse	Concrete		1891	Bad		Heav
n, N. J...	57	73	97	2,425	"State Line"	6-in. concrete	Grout	1892	Excellent	10	Light
ngton, D. C.......	230	279	331	[illegible]		[illegible] concrete		1892	Fair		Medi
ta, Kan..........	24	25	52					1896	[9]		Medi
barre, Pa.....	38	52	67		....			1892	Good		......
ster, Mass.	85	118	146	3,000				1896	Fair	..	Medi

[1] Soft brick laid flat and 2-in. sand cushion. [2] Lower course brick laid on 4 ins. sand; 1½-in. sand cushion between brick courses. [3] "Not very h left. "Some parts of it are good and some parts bad." [4] Shows bad cracks from expansion; did not have expansion joints. [5] Natural cement 5 mix. [6] Practically none of original brick left. [7] Has about reached the limit of its usefulness. [8] Natural cement concrete. [9] Portions o pavement will soon need replacing; other portions are in fair condition.

[illegible] of two courses of brick, the lower [illegible] being a very soft brick laid flat and covered by a 2-in. sand cushion. The wearing surface was a brick of local manufacture and was a good brick when proper care was used in culling. This pavement is now ready to be taken up and replaced with a brick block on a concrete foundation.

The largest proportion of the paved streets of Cleveland, O., have been surfaced with brick, the estimated yardage being 4,300,000. The first brick pavement in this city was laid on E. 65th St., between Hough Ave. and Euclid Ave., during the year 1888. This pavement was laid by the property owners, and not under the direction of the city. A small sized fire clay brick was used with a sand filler. This portion of E. 65th St. was a residence street with comparatively little other than local traffic.

During 1889 quite a number of brick pavements were laid on various residence streets in a manner similar to that of E. 65th St. above described. A few streets were also laid in 1889 with a small-sized shale brick. Several of the streets paved with brick during 1889 were paved with a tar filler. Since 1889 no brick pavements have been laid otherwise than that with either tar or grout filler.

The first pavement constructed of shale brick on a concrete foundation was laid in 1903 and 1904. This was on a portion of E. 65th St., between Francis Ave. and Union Ave. This street is one which is subjected to considerable manufacturing traffic, being a street used jointly for residence and manufacturing purposes.

During 1903 Hamilton Ave., a street subjected to heavy manufacturing traffic, was paved with a 5-in. shale brick laid upon a sand foundation. The pavement has cracked badly in places. This pavement probably forms the most pronounced case of deterioration of any of the brick streets in the city. It is thought that the trouble probably is due to faulty construction or failure to provide a proper foundation under the brick.

Very few brick pavements have been relaid in this city, so that it is difficult to estimate the probable life of a brick pavement.

Hennings Ave., a thoroughfare which is subjected to considerable traffic, and along which extends a double track street car line, was originally paved with a small fire clay brick, filled with tar in 1891, and was repaved in 1906, with a shale brick cement filled pavement upon a concrete foundation.

None of the city's brick pavements laid in accordance with modern ideas have been down long enough to draw any conclusions regarding their probable life. Such of the old brick pavements as have either been replaced by other material or are in need of relaying, are pavements laid either without proper filling of the joints, or with a quality of brick which is no longer used for paving purposes.

Table IV shows the yardage, age and some details of condition of some of the older brick pavements at Conneaut, O. In the oldest of these pavements no expansion was provided for. The expansion provision in the Harbor St. pavement was ½-in. transverse joint every 50 ft. and ½ in. along each curb. In all of the 10-year-old pavements provision for expansion was made by ½-in. transverse joint every 30 ft. and ½ in. along each curb.

The oldest brick pavement in Council Bluffs, Ia., was laid in 1888. A home-burned brick, not what would be called a good paving brick, was used. The pavement was made in two courses, the better grade of brick being laid on the top course. The bottom brick was laid on 4 ins. of sand and 1½-in. sand cushion between the courses. A sand filler was used. The city has a considerable amount of similar pavement which has been in use on residence streets from 15 to 22 years and which shows considerable deterioration. The city also has Galesburg block and brick pavement, laid 12 years ago, which shows very little wear. These later pavements have been subjected to light business traffic.

The oldest brick pavement in Crawfordsville, Ind., was laid ten years ago. It is in the business district and carries the heaviest possible traffic for a town of this size. There has been very little, if any, repairing done on the street since it was constructed. The brick are laid on 6-in. concrete base, with a cement filler. Expansion joints were made next to the curb, and also across the street, 50 ft. apart. There are probably 106,000 sq. yds. of brick pavement constructed in other parts of the city that will average about six years in age. All of them show no signs of wear whatever except where the brick were improperly laid next to car tracks. In some places next to the rails the brick has "heaved up" on account of no room for expansion. In all these cases, the streets had been torn up and the tracks laid several years after the pavement was constructed.

The city of Dallas, Tex., has about 5½ miles of brick pavement, the width ranging from 30 to 54 ft. The greater part of this is 36 ft. and 50 ft. wide. The pavement that has given the best satisfaction is the one in which the bricks have been laid close together and with a ½-in. expansion joint every 50 ft. The oldest brick pavement in the city is about ten years old. There is not, however, very much of this left. Some parts of it are good, and some parts bad. Most of the brick pavement has been laid within the last six years. This was laid under strict inspection, and brick tested according to American standard· 20 per cent ebrasion for brick and 18 per cent for blocks. The greater part of the brick stood a test of less than 15 per cent ebrasion. Most of the pavement that was laid at that time is in fair shape, though some of it had to be relaid.

Street.	Extent.	Year laid.	Brick
Louis St	Campau to Fulton	1895	Hallwood
Pearl St	Ionia to Ottawa	1895	Harris
Pearl St	Ottawa to river	1891	Hallwood
Canal St	Leonard to Coldbrook	1898	Metropolitan
Michigan Ave	Barclay to Lafayette	1897	Buckeye
Campau St	Pearl to Louis	[illegible]	Canton
Division St	Monroe to Fulton	1896	Harris
Fulton St	Division to Jefferson	[illegible]	Hallwood
Jefferson Ave	Fulton to Washington	[illegible]	Hallwood
Lake Ave	Fuller to Wealthy	1897	Harris
Lyon St	Canal to Division	1897	Harris
Market St	Monroe to Fulton	[illegible]	Hallwood

The above is a tabulation of the various brick pavements which were laid in the city of Grand Rapids, Mich., previous to 1899, and which are still in use.

As will be noted above, the oldest pavements are on Pearl and Market Sts. These streets are in the down-town district, and with the exception of the main street of the city, probably get as heavy traffic as any of the brick-paved streets. They may be said to be in fairly good condition, inasmuch as no request for their repaving has as yet been made. The Hallwood brick used in paving these streets is a small-size brick and is not now manufactured.

TABLE IV. YARDAGE, AGE AND COST OF SOME OF THE OLDER BRICK PAVEMENT AT CONNEAUT, O.

Street.	Yardage.	Age.	Foundation.	Filler.	Cost	Traffic.
Main	[illegible]	18	6-in. concrete	1-1 grout		Heavy
Harbor	8,000	12	Natural soil	1-1 grout	$1.13	Heavy
Washington	[illegible]	12	Natural soil	1-1 grout	1.13	Medium
Main St	15,000	12	Natural soil	1-1 grout	1.11	Heavy
Park Ave.	[illegible]	10	6-in. lake gravel	1-1 grout	1.20	Medium
5th St	[illegible]	10	6-in. lake gravel	1-1 grout	1.20	Medium
Broad St	2,500	10	6-in. lake gravel	1-1 grout	1.20	Medium
Depot St	3,700	10	6-in. lake gravel	1-1 grout	1.20	Medium
Sandusky	10,000	10	Natural soil	1-1 grout	.97	Medium
Buffalo	12,000	10	Natural soil	Murphy*	1.04	Light
Broad	14,000	10	Natural soil	1-1 grout	1.25	Medium
State	2,300	8	6-in. creek gravel	1-1 grout	1.42	Heavy

*On this street the Murphy grout proved unsatisfactory, and a great deal of this pavement was torn up and relaid with cement grout the next year.

The oldest brick pavement in Ir[illegible] is on Broadway, and is now 16 [illegible] The pavement as a whole is in very ba[illegible] dition at present and will be [illegible] season. The failure of the pavement is, in the opinion of the City Engineer, due chiefly to a poor foundation. Portions of the pavement where the foundation held are in good condition and would stand up for a good many years to come. This pavement [illegible] the main street and carries the heaviest traffic of any street in the city. The foundation [illegible] the Broadway pavement was a 6-i[illegible] natural cement concrete. The aggregate was crushed sandstone, and the foundation was [illegible] in quality, and not much, if any, bet[illegible] macadam foundation. The city [illegible] trouble with settlement of the pavem[illegible] sewer trenches, etc., due to the fact that the curb connections were constructed [illegible] prior to the laying of the concrete foundation [illegible] the back-fill was not properly tamped. The sand cushion is 1½ ins. in thickness. The brick are fire clay and smooth [illegible] and are about 2½ ins.x4 ins.x8 ins. in size [illegible] grout filler (probably Portland cement) was used and seems to have been of a good [illegible] ity. The expansion joints were lo[illegible] and at the curb line only. Lorain is [illegible] pavements in Reading St. that h[illegible] been down 12 years and are in almost perfect [illegible] dition.

The first vitrified brick pavement la[illegible] Louisville, Ky., was on Second St. [illegible] Broadway and Jacob, which was p[illegible] ing the summer of 1891. This pavement [illegible] been patched and repaired so much that there is practically none of the original brick left. The traffic on Second St. is comparatively light. Walnut St., from Eighth to Nth [illegible] paved in 1893 and is still in fair [illegible] This street carries a medium traf[illegible] The pavement was laid with sand fille[illegible] in joints. During the past three years [illegible] has been using Portland cement fille[illegible] rified brick pavements and in every [illegible] one the pavement has given satisfact[illegible] ice. The one defective street is du[illegible] to proper grouting and not to any fau[illegible] in design of the pavement.

The experience of the city of N[illegible] ford, Mass., in regard to brick pavem[illegible] been entirely confined to the appro[illegible] bridge and a portion of the bridge pa[illegible] in all 9,276 sq. yds. and .34 of a mile [illegible] which was laid in 1902 with Met[illegible] paving block. This pavement was l[illegible] 6 in. concrete base with Portland cem[illegible] and longitudinal and transverse [illegible] joints of asphalt. This pavement has hea[illegible] traffic and has worn extremely well. The[illegible] are two street railway tracks in the [illegible] on the bridge and, with the excepti[illegible] of few joints, the pavement shows no [illegible] ance against the track; these tracks [illegible] on steel ties and concrete beams. A [illegible] of the pavement showed a little wea[illegible] six months after it was opened t[illegible] which consisted mostly of chipping o[illegible] edges of the block. The subsequent [illegible] been very slight and the City Eng[illegible] convinced that the traffic was put on th[illegible] ment too soon after it was laid. A po[illegible] this pavement upon which the traffic [illegible] admitted for about a month shows pr[illegible] no wear at all.

The oldest brick pavement in the [illegible] Pittsburgh is Irwin Ave., from Jack[illegible] to Washington Ave., which was pa[illegible] 1895 by the former city of Allegheny. Th[illegible] were 2,600 sq. yds. of vitrified brick pa[illegible] laid on this street and to date the [illegible] maintaining same has been very sma[illegible]

[illegible] traffic [illegible] traverse this street and [illegible] street at present is excellent [illegible] on of Irwin Ave., from Washington Ave. [illegible] Ave., was paved [illegible] pressed brick and this portion of the street [illegible] excellent condition [illegible]

[illegible] the Homewood District. This alley [illegible] ght. The greater part of the brick pav- [illegible] ts in resident districts and on alleys. [illegible] racter of pavement is not used here [illegible] t is not considered suitable for the [illegible] rly heavy traffic in Pittsburgh. The [illegible] Pittsburgh, used this character of [illegible] t extensively on streets upon which [illegible] pavement was very serviceable. The [illegible] ave been paved with vitrified re- [illegible] brick.

[illegible] rst brick pavement in Providence, R. [illegible] eavy traffic. The brick surface was [illegible] in fair condition, but have had repairs [illegible] ng the interval. The roadway of this [illegible] 19 to 35 ft. between curbs.

[illegible] sq. yds. of brick pavement, none of which [illegible] ies heavy traffic. For the most part it [illegible] laced between car tracks and on streets [illegible] were not for the fact that the grade ex- [illegible]

[illegible] e first brick pavement in Schenectady was [illegible] in the fall of 1891 on Gillespie St., a resi- [illegible] ial street, approximately 700 ft. long. The [illegible] t is still in good condition, excepting, of [illegible] se, the places where it has been neces- [illegible] to tear up the pavement for repairs to [illegible] erground work. No more brick pave- [illegible] ts were laid until September, 1898. At [illegible] time Albany St., a semi-business street [illegible] ected to medium traffic, was laid. This [illegible] ment is still in use, but shows some bad [illegible] On one street in this city an inferior [illegible] of brick was used and the pavement [illegible] t to pieces in less than two years. On [illegible] r streets where it has been unnecessary [illegible] ake up the pavement for any cause, the [illegible] are still in good condition after 12 to [illegible] ears of continuous service under medium [illegible] ic.

[illegible] he city of Seattle, Wash., has 633,418 sq. [illegible] of brick pavement. The first section was [illegible] during 1893 on First Ave., South, which [illegible] ne of the heaviest traffic streets in the [illegible] This pavement has just about reached [illegible] of its usefulness. Up to the pres- [illegible] time the brick have been turned and re- [illegible] three times, those badly broken being re- [illegible] ed. Second Ave., which is another heav- [illegible] traveled street, was paved during 1896, [illegible] is in fair condition today.

[illegible] okane, Wash., has vitrified brick pave-

[illegible] very good condition. This pavement is on Howard St., one of the down-town streets leading from the City Hall to the center of the city, and carries probably as heavy a traffic as any street in the place.

One of the first brick pavements constructed west of the Allegheny Mountains was laid in Steubenville, O., in 1884. The improvement was primarily due to the effort of [illegible] New Cumberland, W. Va. The resolution adopted by the City Council on May 27, 1884, [illegible]

[illegible]

Market St. to the South Line of Adam St.

[illegible] general tax list for collections.

Resolved, That the Civil Engineer be and he is hereby directed to prepare and report to this [illegible] of each lot or parcel of land abutting or bound- [illegible] Clerk is instructed to serve legal notice on the [illegible]

The street paved has a width of 60 ft. from property line to property line; 34 ft. from curb to curb, and one curb grade is 1 ft. higher than the other, making the crown eccentric. Since the paving was put down the street has been piped for high and low pressure water, for natural gas and sewer, and a single track street car line has been constructed in the center. By reason of the numerous times the street was torn up and the brick relaid and of the surface obtained by reason of the eccentricity of the crown and the street car construction it was deemed advisable by the council to repave the street, which was done in 1909; the pavement having then been down for 25 years. In repaving the street the City Engineer found the brick to be not less than 2½ ins. in thickness and he believes that if the pavement had not been undisturbed by ditches, etc., and left on its original bed or foundation that its life would have been 10 years longer. The street is subjected to a heavy and constant traffic. It leads to the two principal industries of our city, the Labelle Iron Works and the Pope Tin Mill, and is also the outlet to the south end of the county and to the contiguous river towns.

Table V contains a list of some of the brick pavements in Syracuse, N. Y., which are [illegible] On the streets [illegible] cluded in this list, S. Salina, S. West, Water and South Ave. ought at this time [illegible] be repaved—not because the bricks composi [illegible] the pavement have become worn out [illegible] crushed, but because of settlements of fou [illegible] dations, imperfectly filled trenches where c [illegible] have been made, but particularly because [illegible] the deterioration of the railroad tracks whe [illegible] such were present.

South State St. is the only pavement h [illegible] which has failed on account of the nature [illegible] bricks were needed there was no coal w [illegible] which to burn them. It is understood th [illegible] were burned with wood. At any rate, th [illegible] worn badly. All of the brick pavements ha [illegible] carried guarantees from one to ten years, [illegible] so far as the City Engineer knows, the co [illegible] tractors have never been obliged to expe [illegible] any money on repairs during their per [illegible] of guaranty, and the city has spent so li [illegible] that, until this year, no attempt has be [illegible] made to keep a separate account.

A critical examination of all the brick pa [illegible] ments in the city was made last fall, and [illegible] liberal estimate of what would be required [illegible] put all into a fair condition. In a total len [illegible] was estimated that 19,000 sq. yds. of rep [illegible] should be made. The early pavements w [illegible] laid with natural cement concrete base; si [illegible] about 1897, only Portland cement has be [illegible] used. The streets which have shown [illegible] greatest effect of age are those which h [illegible] a bad natural foundation of soft, wet cl [illegible] quicksand, or filled ground. With the [illegible] ception of those mentioned, and possibly [illegible] few others on which there is a decad [illegible] brick pavements ha [illegible] the appearance of lasting indefinitely.

The oldest brick pavement in Trenton, [illegible] J., is just 20 years old. It was laid at a c [illegible] of $2.30 per sq. yd., which price inclu [illegible] grading, 6-in. concrete base, 1½-in. sa [illegible] cushion, a neat cement grout, and the cha [illegible] for setting all man-holes and water-box ca [illegible] ings to grade. The bricks were known [illegible] "State Line," and were made at East Pal [illegible] tine, O. Traffic is comparatively light, [illegible] though it is a residential street, located v [illegible] near the business district. The street has [illegible] area of 2,425 sq. yds., and is laid without [illegible] pansion joints. The street is in excell [illegible] condition, and in all probability will last [illegible] nearly 10 years more. The next oldest br [illegible] pavement is 19 years old. This pavem [illegible] was constructed in 1893, with Ma [illegible] Porter brick, and has an area of 14, [illegible] sq. yds. It was laid upon a 6-in. Po [illegible] land cement concrete base, and sand cushi [illegible] All joints were filled with Portland cem [illegible] grout, with no provisions made for exp [illegible] sion. It was laid at a cost of $2.10 per [illegible] yd., which included grading. Traffic is m [illegible] dium. The city has numerous other examp [illegible] of brick pavements which have worn from [illegible] to 18 years, when they were replaced. T [illegible] two oldest pavements are in comparativ [illegible] very good condition.

The oldest brick roadway pavement [illegible] Washington, D. C., was laid in 1894 on F [illegible] northwest, between Virginia Ave. and 2 [illegible] St. The pavement amounted to about 2,

TABLE V.—SOME OF THE BRICK PAVEMENTS IN SYRACUSE, N. Y., MORE THAN TEN YEARS OLD.

Street.	Sq. yds.	Kind of brick.	Laid.	Age.	St. R. R.	Trade character.	Traffic.	Remarks.
[illegible]	[illegible]	Syracuse	1891	21	Double track...	Retail business....	Heavy	Bad—should be renew
[illegible]	[illegible]	Canton Malvern..	189[illegible]	20	None	Residence	Light	Good—no signs of failu
[illegible] Ave.	1,[illegible]	Syracuse	[illegible]	[illegible]	Single track	Residence	Medium	Medium—St. R. R. bad
[illegible]	1[illegible],000	Syracuse	[illegible]	[illegible]	Double track...	Residence	Medium	Medium—St. R. R. bad
est.	12,[illegible]	Syracuse	[illegible]	[illegible]	Double track...	Retail business....	Heavy	Bad—should be renew
Water..	[illegible]	Syracuse	[illegible]	[illegible]	None	Wholesale	Heavy	Bad—should be renew
tate...	[illegible],900	Corning	1894	[illegible]	None	Retail	Heavy	Bad—should be renew
h Ave..	13,400	Syracuse	1894	1[illegible]	Double track...	Residence	Medium	Medium—St. R. R. bad
[illegible]	[illegible]	Syracuse	1894	[illegible]	None	Residence	Light	Good—no signs of failu
[illegible]	1,[illegible]	Syracuse	1894	[illegible]	None	Residence	Light	Good—no signs of failu
[illegible] Ave.	[illegible]200	Nelsonville	1895	17	None	Residence	Medium	Fair
land	10,[illegible]00	Nelsonville	1897	[illegible]	Double track	Residence	Medium	Fair—St. R. R. bad
Genesee...	[illegible]	Syracuse	1897	[illegible]	None	Residence	Medium	Good—no signs of failu
[illegible]	[illegible]	Syracuse	1900	[illegible]	Single steam...	R. R. switch......	Heavy	Good
linton, etc.	[illegible]	Syracuse	190[illegible]	1[illegible]	Double track...	Residence	Medium	Good
est et al.	[illegible]500	Syracuse	1901	11	None	Residence	Light	Good
Fayette...	[illegible]	Syracuse	1902	[illegible]	None	Heavy track	Heavy	Good
Jefferson..	[illegible]	Syracuse	1902	10	None	Heavy track	Heavy	Good.
Kennedy..	[illegible]	Syracuse	1902	10	None	Residence	Light	Good

q. yds. and was laid on 4-in. hydraulic base. his pavement is subject to medium travel nd is in fair condition. The north half f roadway of B St., northwest, between 9th nd 12th Sts., about 7,018 sq. yds., was laid 1899, on 6-in. hydraulic base. This pavement has quite heavy traffic and is in bad ondition. The south side of the roadway f Water St., southwest from P. St. westard, about 2,943 sq. yds., was paved in 1899. has medium travel and is in fair condition.

Wichita, Kan., has about 500,000 sq. yds. f brick pavement, the oldest of which was id in 1890. This first pavement consists of ve or six blocks on various streets, from Main St. to Market St. It carries a medium heavy traffic. Some of the blocks are subjected to heavier traffic than others and will soon need replacing; others are in fair condition.

The oldest brick pavement in Worcester, Mass., was laid in 1895. The section contains about 3,000 sq. yds. and carries a moderate traffic. A part of this pavement is on a grade of 7 or 8 per cent and is in a fair condition today, except where it is laid next to sewer manholes, where places are considerably worn. There is very little brick pavement in this city, about 9,000 yds. in total, some of which is subject to heavy traffic. One piece in particular containing about 100 yds has very heavy traffic. It has been laid about 8 years, but is showing signs of wear. A considerable part of the brick pavements laid here are of the Mack manufacture. In addition to the street pavements, there are a great many brick crosswalks, laid with variety of brick, and mostly of a texture harder than the Mack brick. Many of these crosswalks withstand the heavy traffic very well, even where they have been laid for 18 or 20 years, although it has been noticed that brick of extreme hardness have spalled under traffic and do not appear to have kept their surface as well as other brick of less brittleness

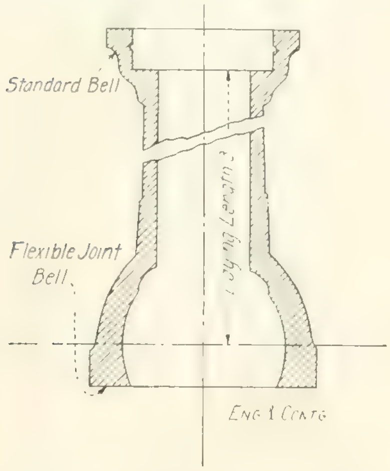
WATER SUPPLY, SEWERAGE AND SANITATION SECTION

onstruction Methods Employed in Laying Submerged Water Mains Across Three Rivers in Georgia and Mississippi.

The pipe laying job presenting the most ifficulties is encountered in laying submerged ater mains. Methods which have been sucessfully employed on this class of construcon are always of interest to water works en. A clearly presented description of the ethods adopted in crossing three rivers in eorgia and Mississippi was read in a paper M. L. Worrell, General Manager of the leridian, Miss., water works, before the rent convention of the American Water Vorks Association.

The first work of this character described Mr. Worrell, was carried out at Rome, eorgia. Three crossings were made, one rough Silver Creek and two through the towah River at different points. The creek as to be crossed near a highway or county ridge and it was deemed advisable to lay e pipe on the bottom of the creek, proprly secured, rather than to suspend it from e bridge, or to lay it on the floor thereof, account of the sudden rises and terrific oods the stream is forced to carry, at times, being the drainage outlet of a large area f mountainous country.

At the point to be crossed the creek was ft. wide between banks at street level, ft. wide at low water, and, at ordinary w water stage, 12 ft. deep. Material used as cast-iron made with John F. Ward's exible joint, size 10 ins. in diameter, weight bout 87 lbs. per ft. or 1,034 lbs. per length f 12 ft., costing 2 cts. per lb. delivered in ome.



ig. 1—Bell End of Flexible Joint on Cast Iron Water Main.

The limit of deflection of this joint is aid to be 15° though we did not find it safe use the limit, 12° being, in our experience, afer. The pipe line of five lengths, 12 ft. ach, was made up, or constructed, on a platform spanning the creek at the level of the street, then lowered by means of proper tackle into the stream, the two ends being kept clear of the water for later joining to the water mains on each side of the creek, and the submerged part being gradually lowered, thus allowing deflection, until it rested on the bottom. The pattern of the Ward Pipe bell and spigot used was of different design from the ordinary cast-iron pipe, so the two were connected by short pieces designed by the Consulting Engineer, Mr. J. N. Hazelhurst, who was in responsible charge of both engineering and construction, see Figs. 1 and 2.

After the Ward Pipe was attached to the street main a test—hereinafter described—was made for leakage, this test revealing a loss of 28,000 gals. per day of 24 hours. This being excessive a diver was sent into the water to ascertain and exactly locate the cause. The examination showed that the limit of safe deflection had been exceeded, causing three lead joints to leak very badly. We then detached the creek line from the main on each side of the creek, raised the entire line, recaulked all joints, partially filled the bottom of the creek with small boulders, using several cubic yards in securing a good foundation and in reducing the deflection to about 12°. The pipe line was again lowered into the creek and joined to the regular main, the next test showing only small leakage of about 380 gals. per day. Later this joint was again caulked and the leakage reduced to quite a small quantity—about 150 gals. per day, an amount which did not increase during the next three years.

The foundation made by the loose boulders was added to, the pipe being covered and otherwise made secure, since which time no trouble has been noted though many heavy rains have caused large floods to be thrown against it. This work was done in the month of September, 1908. The last test made was in the month of December, 1910, both for leakage and to ascertain if the pipe had moved, even slightly, down stream. No movement was noted and the leakage had not increased. The cost of this work approximated $300, everything included, or $5 per lineal foot.

The first river crossing was at Second Avenue, north of the East Rome highway bridge spanning the Etowah River, the height of the banks being about 40 ft. above low water. We prepared for this by providing the necessary wire cable, stretched from bank to bank, to which the trolleys for carrying the supply boat and pontoon raft were attached. The pontoon raft or boat, from which we were to lay the pipe in the river, was constructed, as shown in Fig. 3, and more particularly described as follows: The flotation was provided by 25 empty oil barrels, whiskey or coca cola barrels will do as well, lashed together with ½-in. manila rope, the barrels being laid in three rows, head to head, row No. 1 having ten barrels, row No. 2 five, and row No. 3 ten, the three rows being laid parallel, thus leaving a "slot" in the middle row at the stern of the raft. The barrels having been so arranged a deck was built upon them as shown, the material used being pine lumber 2x12 ins. of the necessary length to cover the barrels as laid out. The barrels were secured under the deck pieces or retaining "sleepers" enclosing the outfit. This made a strong raft, extremely buoyant and practically impossible or capsize. The carpenter work, wh pleted, left the "slot" ready for the purpose for which it was designed, that of laying the pipe through it. The wood-work was so constructed as to make it easy to transfer the "slot" from the rear to the front for purpose later described. Two trolle the necessary tackle for operating were attached to the wire cable and secured to the raft, as shown in Fig. 4.

A supply boat, utilized from a river flat or ferry boat, was provided and attached the wire cable and almost immediately beneath it this boat carrying extra lengths of pipe, pigs of lead, yarn, melting pot, etc.

The pontoon boat carried nothing but a tripod made of 2-in. wrought iron pipe, attached to flattened ends by a suitable bolt, supporting a triplex chainblock, this being for handling the pipe in process of laying in the bed of the river. The completed outfit was propelled across the river by means of a lead or hand rope. The procedure was as follows: The first joint was secured to a "dead-man" on the bank, by means of a heavy cha the outfit pushed off, the bell of the p ward, the second joint fitted therein, poured and caulked. Then the outfit moved forward again with the next and each succeeding pipe until the shore across the stream had been reached. The "slot" was then moved forward, or to the front end of the boat by removing a part of the deck, which had been constructed for the purpose. The short row

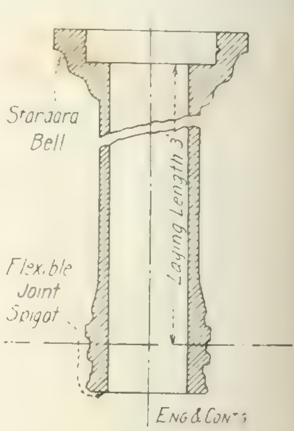


Fig. 2—Spigot End of Flexible Joint.

of five barrels was removed to the stern, which placed the movable portion of decking to the rear, thus leaving the last joint of pipe ready for attachment to the forward shore of the river and to the ordinary 0- cast-iron pipe.

The short joints or pipe for joining the Ward with the ordinary cast-iron pipe were length, or made to lay 3 [illegible] by an examination [illegible] having the standard bell on one end [illegible] flexible joint bell on [illegible] th the standard bell and [illegible]

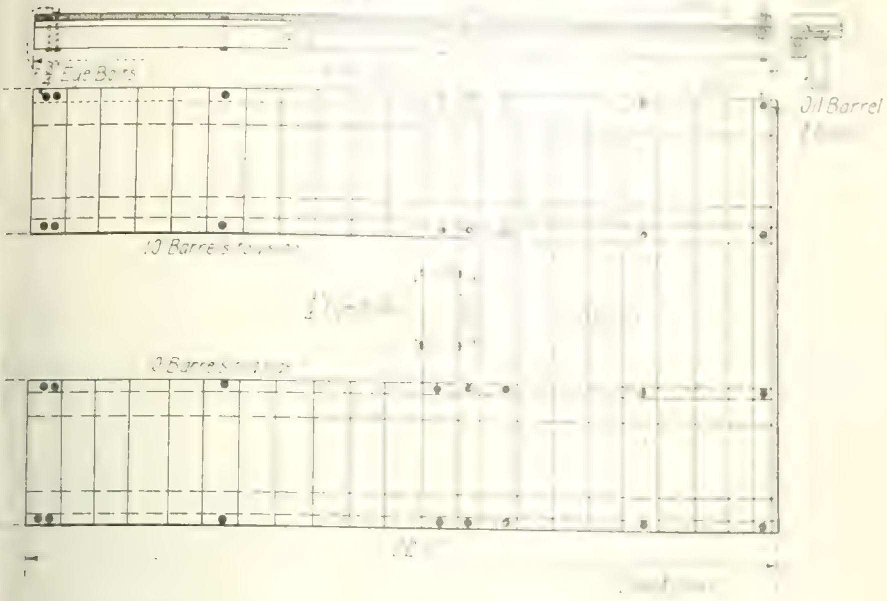


Fig. 3—Detail of Raft Used in Laying Submerged Water Main.

spigot. After the operation of laying er crossings was completed security was l by anchoring or attaching two joints h end of the river pipe to a "dead- permanently constructed in the banks, hog chains being used for the purpose. re the work of laying the pipe was be- e river bottom was sounded, and was to consist of solid rock, slaty lime- with three ledges running longitudinal- h ledge having practically the same on. The ledges were cut or notched ne pipe, while being laid, was fitted i, the notches being made by blowing portion of the ledge with dynamite. notches secured the pipe from deflec- own-stream and provided safe anchor- r the pipe without the necessity of pro- a channel in which to lay it. The of this river crossing was 216 ft. and ne required for preparation and actual was about six days. We used the serv- f a construction superintendent, who erformed the duties of foreman; a straw or gang foreman and five able-bodied laborers and one water boy, the pipe cost being about 35 cts. per ft. This ilar job cost about $700.

cross under the same river at Broad , with 12-in. pipe, the river being some- wider and deeper. Notches in the rock not cut and there was no channel to epared. The cost of this job approxi- $900. It required less time to pre- for and lay the last line on account of xperience gained in the construction of st.

work was done in the month of Sep- r, 1908, when the river was at the low- age known for years, this being some- in our favor though not necessarily so could have been too low. We had no nts and nothing of an untoward na- marred the work of construction. The was and still is entirely satisfactory and e means adopted the city was saved up- of $3,000. A water-works contractor had done similar work in Rome, though ing a different method, offering [illegible] vork, no material included, for $3,500, ost of material being approximately $1,- ncluding equipment.

each side of the stream through which ipes were laid we placed valves for cut- off the crossings in case of emergency it was by means of by-passing these

[illegible] to make the tests heretofore [illegible]. One of the valves [illegible] the

outlet tap 1 in. Lead connections, properly equipped for the purpose, were attached to the taps and the other ends connected to a very sensitive 1-in. meter, thus by-passing the valve which, along with the other valve across

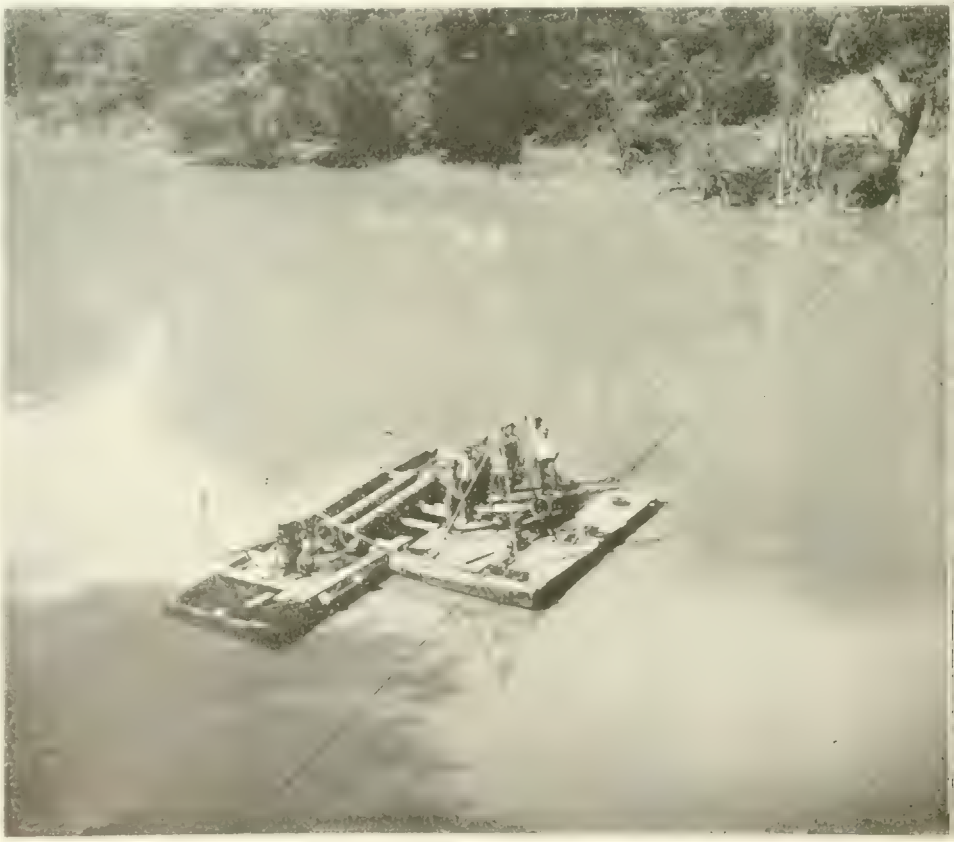


Fig. 4—View of Raft and Material Scow Used in Laying Submerged Water Main a Rome, Georgia.

the stream, was shut off. The water was turned on at the ¾-in. inlet tap, slowly and as slowly let out at the 1-in. outlet tap. As soon as the meter and outlet connection had filled, the meter ceased to operate, apparently showing that we had no leaks in first river crossing. Not entirely satisfied with this we removed the meter, blew through it to show whether it was "struck" or not, replaced it repeated the operation of by-passing and experienced the same effect. Both river crossings showed the same results at the first and all subsequent trials, which were made quarterly during term of my engagement at Rome three years.

The third stream crossing was made at Meridian, Miss., by means of an entirely differen method. This work was described by Mr W[illegible]

The reservoirs at Meridian, two in number are situated some two miles from the city and it was in laying a 20-in. cast-iron pipe for the purpose of bringing more water to the city that the stream referred to was crossed.

The elevation of the bottom of the reservoir is 5.4 ft. *only* above the bottom of the settling basin in the city, the elevation of the top of the dam, at high water mark in the reservoirs, being only 16 ft. above the top o settling basin; therefore it was absolutely necessary, if we were to secure the greates flow, to select a route as near a straight lin as possible and to construct the pipe line to an absolute grade, avoiding anything like a summit or high point in the line.

With this in view it was deemed advisabl to bridge Sowashee Creek, which had to be crossed on the way to the city. Upon opening bids for the work prices named were almost prohibitive, besides great danger wa apprehended during flood seasons when the stream carries large quantities of driftwood such as uprooted trees, logs from timber cuttings, etc. The speaker was directed by th Meridian Water Commission to devise a saf plan for crossing under the stream and t proceed with the work.

The route selected was direct, only one turn being necessary, this at an angle of 56 which was made by laying the pipe to a ra dius of 270 ft., thus reducing the friction t a minimum. At the creek there was a down ward deflection of approximately 20 ft. Th

[illegible]

washee Creek, at the point crossed, car- s quite a large amount of sand brought own from the territory above, and my in- ries and observations revealed the fact t the tendency of the creek is to fill and iden and at no time to narrow and scour or eepen. At ordinary winter height this creek, t the point on our route, is 30 ft. wide and ft. deep. Instead of pursuing the method f laying the river crossing, as at Rome, the peaker conceived the idea of using a truss eam upon which to lay the pipe in saddles, e beam to be 36 ft. in length and 3 ft. wide, onstructed on the order of the bottom of a reight car, insofar as the rods used were oncerned. The truss-beam having been built e took advantage of what seemed to be ood weather, and which fortunately proved be so, and proceeded with the work by acing across the creek two house moving uss beams, secured from a local contractor. e then rolled our own beam across on top f them, constructed the pipe line, consisting f four lengths of the ordinary 20-in. Class A" cast-iron pipe, one blow-off tee, with igot end 6-in. blow-off valve attached, then ut everything together by regulation joints f yarn and lead, secured the pipe to the truss eam by "U" bolts (bent to a 22-in. radius) d cast-iron washers and lowered the entire ridge" 4.5 ft. beneath the surface. Before oing this, however, we cut notches in the anks of the creek the required depth to al- w the lowering, thus allowing the beam, ith its load, to rest upon solid earth on each de. In order to prevent the pipe from fill- g with sand we fastened a large barrel head each end. The lowering of the load, an ppropriate weight of six tons, was success- ully accomplished by the use of two gin- les and two capstans. After clearing away e rigging and beams we dammed off the wa- r of the creek at each end of the pipe with nd-sacks and easily joined the two ends to e main pipe line approaching and leaving e creek. In order to attain full security we ave since driven six creosoted piles in three ents, capping each bent with an oaken tim- er, well seasoned, and suspending the origin- construction from these bents with "U" olts. The piles were driven in the bottom f the creek as far as they could be driven, ome 12 ft., the upper ends being sawed off ush with the top of the pipe. The creek had the meantime fallen several feet, and the pping was attached by means of 100 penny ikes generally used in bridge construction. he method used allows the water to pass oth above and beneath the pipe. It appears be strong and is absolutely rigid in every rection. We have secured the banks by riving, in present shape, two rows of Wake- ld sheet piling into the earth as far as they uld be driven, some 10 ft. or more.

he General Design and Specifications for the Elevated Structural Steel Water Tower and Tank of 100,000 Gals. Capacity, Hamilton, Ill.

The general plans and specifications to gov- n the construction of the elevated structural eel water tower and tank, of 100,000 gals. pacity, here given, were prepared by L. P. olff, Consulting Engineer of St. Paul, Minn., r Hamilton, Ill. The work on which bids ere received comprised, under a single con- act, the furnishing of all labor, tools and ma- rials necessary for the construction of the ructure, including foundations and riser pipe.

A general outline drawing of the structure shown by Fig. 1. The tower has a vertical ight of 100 ft., measured from the top of e concrete foundation piers to the lower riv- line of the bottom horizontal ring of the nk The tower is divided into three equal nels of 33 ft. 4 ins. The tank has a diam- er of 22 ft. 6 ins. on the inside of the lower rizontal ring. The vertical distance be- een lower and upper rivet lines of the tank is 26 ft. The bottom of the tank is hemispherical with a cone tip. An abstract of the specifications follows:

SPECIFICATIONS.

Foundations.—These comprise four concrete foundation piers for the tower and a concrete and brick foundation for the inlet pipe, together with all necessary excavation and backfilling. An elevation of the foundation pier is shown in Fig. 2.

The concrete for the two upper courses of the piers and for the inlet pipe foundation shall be mixed in the proportion, by volume, of one part of Portland cement, 2½ parts of clean sharp sand and 4½ parts of 2-in. broken stone, or may be of one part of Portland cement to five parts of selected pit gravel approved by the Engineer, in which the pebbles do not exceed a 2-in. cube in size, and in which the proportion of sand to pebbles when screened does not exceed 1:1½.

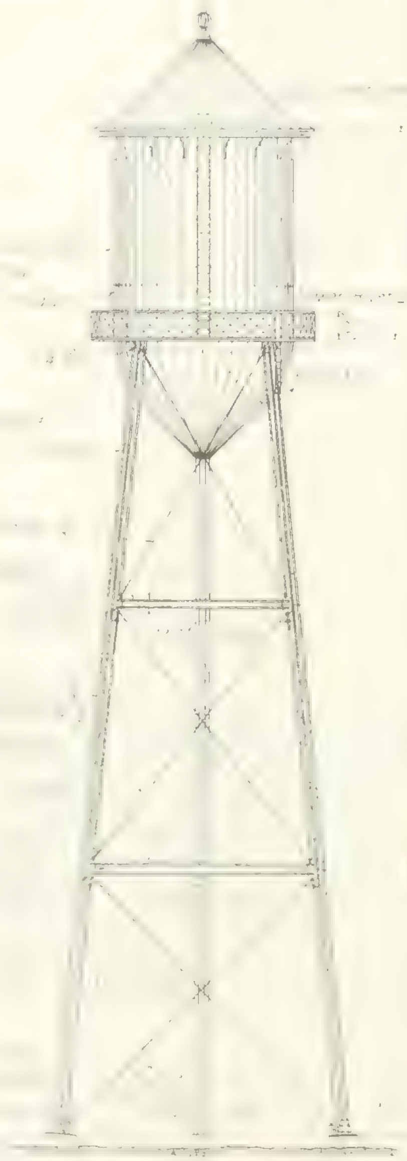


Fig 1—Outline Drawing of 100,000 Gal. Steel Tank and Tower for the Hamilton, Ill., Water Works.

The top of the first and second courses shall have a facing of cement mortar 1 in. in thickness, consisting of one part of cement and two parts of sand, this mortar finish to be put on immediately after the concrete is deposited, and the sides of these two courses shall be spaded next to the forms so as to present a smooth and even surface. The top course shall forced with three hoops of medium indicated on the plans.

The concrete in the remaining cours piers shall be mixed in the proportion ume, of one part of Portland cement, th of sand and five parts of 2-in. broken may be of one part, by volume, of cement to five parts of pit gravel of th above specified.

For the purpose of reducing the cos stone weighing from 50 lbs. to 100 lbs. e be embedded in the two lower cours stones shall be placed in horizontal lay spaces of at least 6 ins. between the st between layers.

Portland cement shall be used th and shall be of a brand approved by t neer and fully equal in all respects to products of the brand so approved. Th shall be ground fine enough so that 90 will pass through a No. 100 sieve and sh a tensile strength of not less than 500 sq. in. when mixed neat and placed on air and six days in water and shall b to such other tests as the Engineer m scribe. No cement shall be used in until it has been inspected and approve Engineer.

The concrete may be machine mix revolving batch mixer of a type app the engineer or may be mixed by hand mixing and broken stone are the cement and sand shall first be mi a mortar. The broken stone having b viously wet, shall then be added in a uniform thickness and the entire m then be turned over with shovels not l three times and more if necessary to thorough mix, enough water being make a wet mixture.

If hand mixing and pit gravel are the gravel shall first be spread upon ing platform and the cement spread gravel in a layer of uniform thickness batch shall than be turned with least twice before being wet and tw the water has been added. A sufficien of water shall be added so that the m be readily puddled. All concrete sh in place immediately after being mi

Each pier shall be completed in from two continuous operations, and lower courses to be completed in the f eration and the upper three courses to pleted in the second.

Where the sides of the excavation the concrete for the bottom course posited therein without molds, bu [illegible] shall be strong enough to permit of tho [illegible] dressed inside surfaces, so that the surface of the concrete will present a [illegible]

All concrete shall be protected from by backfilling the pits as the work is The molds for the top course shall not moved until after the completion of th tion of the structure, and the upper s shall be protected from injury. Upon tion of each pier, the top surface and th filling immediately about it shall be tho wet twice daily for six consecutive days

In case concreting is done during weather, the concrete shall be heated to perature of 70° F. before being depos place, and shall be prevented from thereafter until it has thoroughly set.

Anchor bolts for tower posts shall b into the foundations as shown on the

Metal Work.—All metal work shall b steel, except where otherwise indicated plans.

Steel and Workmanship.—All steel and manship thereon shall conform to wh known as the "Manufacturers' Standard fications" as printed in the 1903 edition Carnegie Steel Company's handbook o 219 et seq. except where otherwise s herein or on the plans.

[illegible] shall [illegible] [illegible] [illegible] Rivet Steel [illegible] Manufacture [illegible]

[illegible] the purchaser, but may be deferred unt.. [illegible] pecimen tests as may be required, not [illegible] full reports of these and certify to their [illegible]

contractor shall submit copies of all or working plans to the engineer, before ning any work thereon, and shall furnish ngineer with copies of invoices of all shipments of steel work showing the accurate it thereof.

ection.—The structure shall be completely ed, with all field connections fully riveted fore any water is pumped into the tank. racing shall be adjusted before the tank ed and readjusted afterwards as may be sary. All field connections shall be riveted. ig will be permissible only where indicated the accompanying plans. Anchor bolts [illegible] ilt into the piers.

re shall be a ½-in. layer of Portland cement between the post shoes and the top of [illegible]

For the purpose of testing the tank and inlet pipe for tightness, and locating leaks, etc., the ity will fill and empty the tank twice and if [illegible]

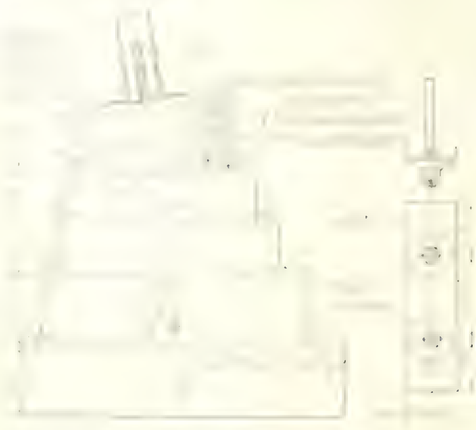


Fig. 2—Elevation of Foundation Pier

[illegible] be constructed of 2-in by 8-in. and 2-in. by [illegible] mentally and put on radially. The boards shall be covered with tarred paper and with the best

diameter and shall be of the common form coated cast iron hub and spigot water pi weighing 540 lbs. per 12-ft. length. The inl pipe shall be connected to the bottom of th tank by means of a flanged expansion joi with iron body and brass sleeve.

The inlet pipe shall have a cast iron ba elbow, set so that there will be a cover of ft. from the top of the horizontal opening the ground surface. Thirty-six feet of hori zontal pipe to connect this elbow with the ma supply pipe will be included as a part of th contract.

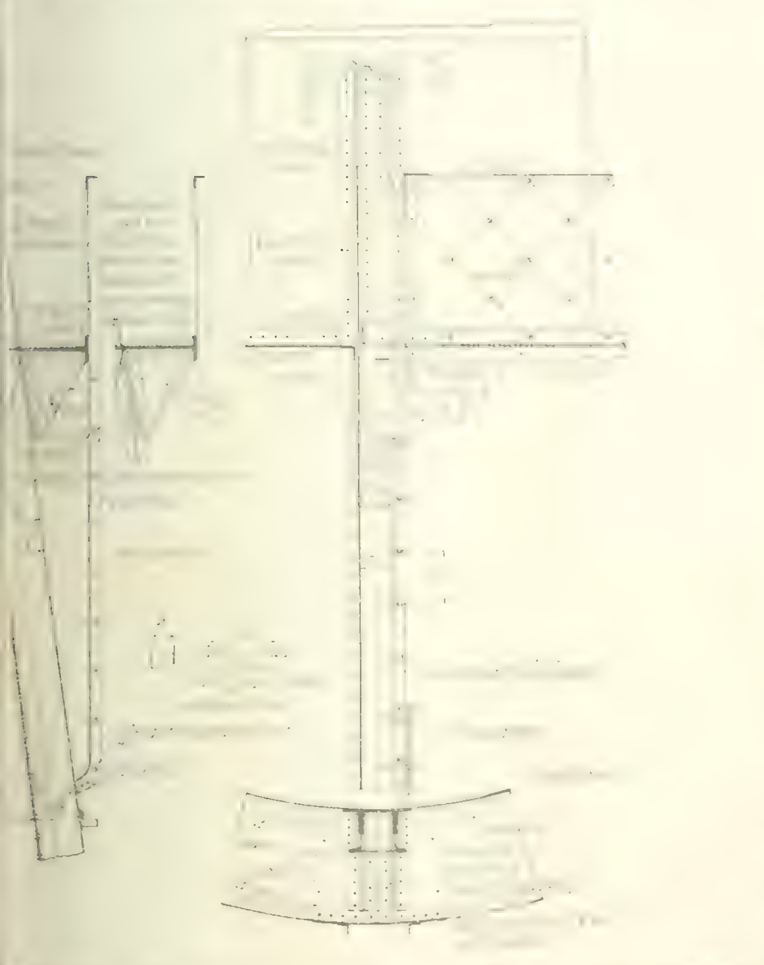
The inlet pipe shall have a frost protectio built around it, extending from the undersi of tank to the ground surface, and support upon a brick foundation extending to the co [illegible]

The frost protection shall be of woodwor square in cross-section, made by placing fo pieces of 6-in. by 6-in. halved diagonally, ver tically against the pipe, and securing to the three casings, the two inner casings to consi of one thickness of matched and dressed boar and No. 2 tarred felt and the outer casing consist of two thicknesses of matched a [illegible] air spaces made by ½-in. by 6-in. filling stri at the corners, and the vertical air spaces each side to be further divided by ½-in. by in. fillers placed 4 ft. apart vertically. All out corners shall be finished with 6-in. by ¾- strips. The outer thickness of the outer casi shall be of ⅝-in. by 4-in. cedar ceiling and t remainder of the casings shall of ⅝-in. by in. white pine or fir ceiling.

The No. 2 tarred felt shall be of the be quality and shall be put on vertically or hori zontally by enclosing all four sides with o length of felt, and in either case shall ha joints lapping 3 ins. and well tacked down.

The frost casing shall be carefully and nea built so as to be as nearly air tight as t character of the construction will permit a shall be built straight and out of wind.

The tank and its inlet pipe shall be thor oughly tight. The frost protection at the e [illegible] shall be left open until the tank has been fill



3—Details of Post Connection to Tank, and Plan of Circular Girder.

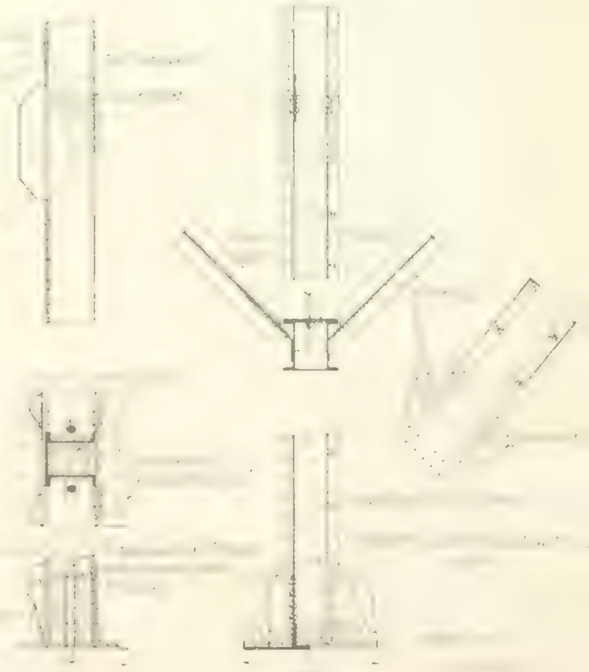


Fig. 4—Details of Tower Connections.

ial care shall be taken in riveting the so as to make water tight joints through- Where leaks exist about rivets they shall e caulked, but be cut out and replaced by rivets.

caulking edges of tank plates shall be ed to a bevel so that they may be caulked rly and made water tight

quality of cedar shingles laid with not more than 5 ins. to the weather.

Provide trap doors as shown on the plans, secured with two pairs of hinges and a strong hasp on each door.

Provide galvanized finial of neat design and construct cornices as shown on the plans.

Inlet Pipe.—The inlet pipe shall be 8 ins. in

the second time, and the pipe found to be ti and expansion joint properly adjusted.

Indicator.—The contractor shall furnish a erect a suitable indicator to indicate the hei of water in the tank. The indicator shall co sist of a target, sliding vertically between su able guides over a graduated scale on the o side of the tank, the target being connected line or chain, passing over a pulley at top f tank, to a suitable float inside the tank. The cale shall be painted either upon the tank or pon a board fastened upon the outside of he tank, the graduations being spaced not nore than 1 ft. apart with figures not more han 5 ft. apart.

Painting.—All metal work of tower shall be iven one coat of pure boiled linseed oil, preious to shipment, and after erection shall be ainted two coats of paint. The paint shall e of the best quality of graphite paint as nanufactured by the Detroit Graphite Mfg. Co., r such other as in the judgment of the engieer is equally good, and shall be of the natral graphite tint, except the balcony and its ailing and the cornices which shall be of ighter or darker tint as may be hereinafter diected, and if made lighter, the paint shall be . pure lead paint of best quality.

The tank shall be filled and tested for tightness and all leaks made tight before the first oat of paint is applied. The frost protection bout inlet pipe and also the roof shall be ainted with two coats of paint of the best uality as for steel work. The painting must e done under favorable conditions of weather.

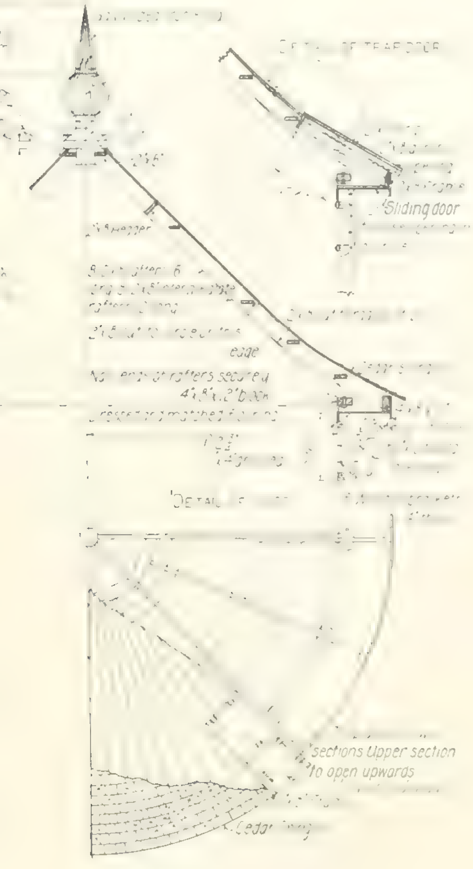


Fig. 5—Roof Details.

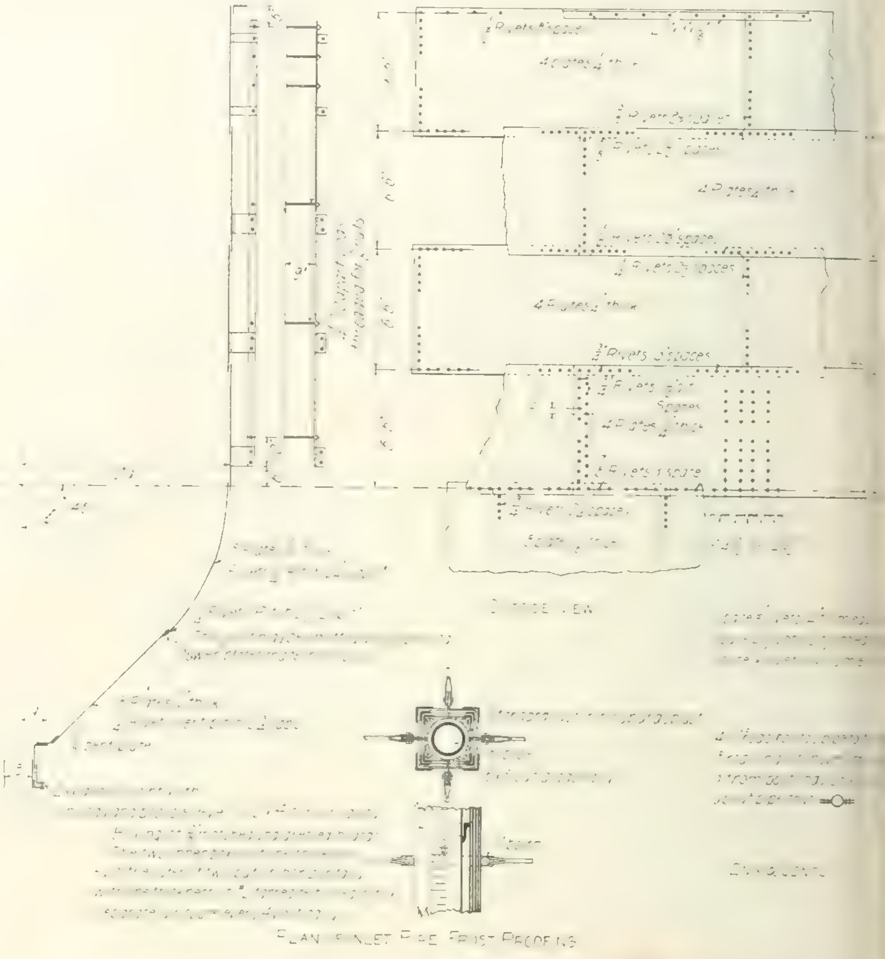


Fig. 6—Tank and Frost Casing Details.

All surfaces of foundations shall be proected so that they will not be spotted by aint.

Cleaning Up.—Upon the completion of the tructure, the site shall be cleared of all rubish and left in neat and tidy condition. All xcavations shall be backfilled and the surplus arth therefrom neatly sloped about the founations.

The contract for the work above described vas awarded to the Chicago Bridge and Iron Co. The contract price was $5,000.

The Civil Service Commission of Chicago as prepared an interesting report on the nethods, systems in use and the organization f the Department of Buildings of the City f Chicago.

Method and Cost of Making a Water Leakage Survey at Lancaster, Pa.

The methods employed in making a general house-to-house inspection for the purpose of finding leaky plumbing fixtures, in the city of Lancaster, Pa., and some of the costs of the work, were presented in a paper before the American Waterworks Association at their recent convention, by F. H. Shaw, consulting engineer and superintendent of the Lancaster Waterworks Department.

Lancaster has a population of about 50,000 people. The area of the city is four square miles, about three of which are built up. The houses are constructed of brick, with practically solid fronts between streets. This method of construction gives a population of about 25 per acre.

The city is supplied with water by a municipal plant, the first construction dating back to 1836. The water is taken from the Conestoga Creek, a tributary of the Susquehanna River, having a drainage area of 310 square miles of highly cultivated farming country containing many small towns and a population of 120 per square mile.

The water is filtered and pumped into the city against a head of 250 ft., the supply being measured by a Venturi meter located between the filter plant and the pumping station. The distribution system is connected with the pumping station by two force mains, one 30 in. and one 36 in., each being about one mile in length.

The distribution system is divided into high and low service districts. The low service district contains about 0.4 of a square mile and is supplied from the old reservoir constructed in 1836 and in 1850, which has a capacity of 6,000,000 gals. These reservoirs are filled at night by pumping through the 36-in. main.

The high service district is supplied through the 30-in. main by direct pumping. The water passes through a standpipe having a capacity of 400,000 gals., located on the reservoir grounds. The distribution system consists of 70 miles of pipe varying in size from 24 ins. to 4 ins. The system has been extended outside the city limits by various small water companies, their supply mains being metered at the city line. There are about 10,500 services in use, one-third of which are metered. All large consumers are metered and meters are being installed at the rate of about 400 per year, all new properties being metered. The schedule rate for a three story house having bath, two closets and pave wash is $17. The meter rate is [illegible] cts per 1,000 gals., with a minimum of $10.

The daily consumption averages about 7,000,000 gals., varying between 5,000,000 and 10,000,000, with a maximum pumping r[illegible] high as 12,000,000 for short periods. [illegible] ing a population of 50,000, this w[illegible] per capita consumption of 140 ga[illegible] This excessive consumption led to a i[illegible] tigation of causes and methods for co[illegible] same. A general house-to-house i[illegible] was made during the winter of 1[illegible] which time all plumbing was inspected [illegible] leakage. Results of this inspection were recorded on a card for each property in[illegible] As a result of this inspection the yearly income from water rents was increased [illegible] The city was then divided into four districts and a regular inspector appointed for each district. A yearly inspection is made [illegible] house and property owners are compelled [illegible] repair all leaky fixtures within ten days, [illegible] cases being reported and repaired during the last year.

During these investigations the necessity [illegible] a systematic search for leakage from mains became apparent and the discovery [illegible] dent of a leak which was costing [illegible] about $10,000 per year, brought the matter to a head and the necessary appropriation was made.

The survey party was organized from employes of the water department, a [illegible] ad been in the department [illegible] being placed in charge [illegible] arty worked nine hours [illegible] omposed as follows:

[illegible]
[illegible]
[illegible]
[illegible]

tal cost per day..........................$19

[illegible] meter with 2½-in. [illegible]

-in. meter.
[illegible]
i-ft. lengths 2½-in. fire hose.
2½-in. galvanized pipe.
[illegible]
shovels, wrenches, caulking tools, lead, [illegible]

first step in preparing this work was spection of all valves and repairs to placing them in working order and re- some which could not be operated. vork was done by the men in the dis- on department in advance of the sur- The survey was started on March 6th, and stopped for the winter on Decem- th. The method of procedure was as

4-in. meter was mounted on a small led truck and the connections bushed to 2½ ins., with a 2½-in. valve at in- d outlet. The large meter was by- by a ⅝-in. meter for use on small A pressure gauge was attached to the end of the large meter. The districts had an average area of 12 acres, con- about 80 houses. The district to be was shut off from the remainder of the by closing all valves on street mains. neter was then connected with a hy- outside the district by means of a 25- gth of fire hose. The 2½-in. pipe line id from the meter to a hydrant inside strict, being connected with it by an- short length of hose.

consumption of the district was then ed for one hour, readings being taken en minutes and any reductions in pres- oted. Any considerable drop in pres- ndicates either large leak or that the is too large to be supplied through a pipe. After the consumption had been ed, all connections were shut off in- e houses, an inspection of house plumb- ng made at the same time. A test was then made to determine whether any street valves were leaking water into the district by opening a fire hydrant and watching for any flow from the opening.

After everything was shut off the leakage was measured by the large or small water meter according to the amount. This flow, if any, represented the leakage from mains and also from the service. To locate the leaks, the streets inside the districts were [illegible] until the leak had been located between two valves, [illegible] which it was located by using the tele[illegible] on curb stops, hydrants and on drills driven down to the main. After the leak had been definitely located, it was dug up and repaired by the survey party and the district tested until found tight.

[illegible] a cost of about $11 per day, $2,640 for the season, for labor. The cost of lead, wool, etc., for repairing leaks was very small. One hundred and eleven districts were tested, having a total area of 1,310 acres, or 12 acres per district. There were approximately 9,000 houses in the territory covered. Following are the leaks discovered and repaired:

[illegible]	[illegible]	[illegible]
Street valves	12	[illegible]
[illegible]	[illegible]	[illegible]
Total		[illegible]

The leaks varied from 1 to 19 cu. ft. per minute. The largest leak found was a 3-in. elbow split wide open and running at the rate of 205,200 gals. per day. This line had been by-passed around the meter outside the building and was supplying four buildings. In this case the survey not only stopped the leak, but detected the illegal use of water. This leak amounted to 75,000,000 gals. per year, the actual cost of furnishing which was $2,812.50, or $172.50 more than the cost of the entire survey.

The total mileage of mains inspected was 40.8, varying in size from 4 ins. to 24 ins. The total leakage record was 118 cu. ft. per minute, or 1,271,000 gals. per day. Using $37.50 per 1,000,000 gals. as the actual cos of furnishing water exclusive of interest, th total leakage was costing the city about $17, 000 per year.

About one-quarter of the system remains t be tested, also the 20-in. supply main whic runs directly across the city. Work is no in progress on this section. One mile of 3 in. force main was laid in 1888, and teste by closing the valves at both ends, and supplying it from the other force main throug a small meter. Leakage was found amounting to $2,000 per year. The joints on th main will be dug up and re-caulked during th present season. The results of the leakag survey were not as apparent as was expecte for two reasons—one of which was the exceedingly dry summer and the failure to provide for street sprinkling by wagons, causin a great increase in the use of individual hos sprinklers. Another reason was the exceedingly cold weather during the winter whic caused an excessive use of water to preven freezing and also damaged many servic mains, all of which have probably not bee discovered.

After the present survey has been completed, some of the districts will be reteste to ascertain the damage caused during th past winter. A comparison of the consumption before and after the survey shows a decrease of 10,000,000 gals. per month durin March and April, and equal consumptio from May to September, a decrease of 8,000, 000 gals. per month during October and November, a decrease of 24,000,000 gals. durin December and an increase of 20,000,000 ga during January, February and March, whi the present consumption is about equal that before the survey began, while the consumption for 1911 is slightly less than f 1910.

Mr. Shaw considers the decrease of 24,000, 000 gals. per month shown in December fair indication of the results of the survey, abnormal conditions existed before and aft this time, which had a tendency to increa the consumption.

As an investment he believes a survey this kind, which not only locates but repai leaks, is a good one and well worth following up until he is assured that the distribution system is reasonably tight.

RAINAGE AND IRRIGATION SECTION

the Engineer May Help to Pre- ent Troubles From Defective Drain Tile.

Mr. F. O. Nelson brings out some nportant points in his letter published r issue of June 5, which ought to be red by the makers and users of drain oo many factories are turning out their t to sell even though the quality must below that necessary to insure per- construction. This is especially true cement tile industry, where but a small is necessary to buy an equipment that rn out sand and cement shells sur- g an irregular shaped opening, which e palmed off on the unsuspecting as ile. Of course these factories do not long but their career is long enough g condemnation upon cement tile in and thus injure the business of those anufacture a reliable article. This is a certain extent in the clay tile in- but the investment here is usually so that the policy adopted must be one will insure an article that will tend to an increasing demand for their prod- Many clay drain tile have failed but have not been advertised as widely as nent drain tile failures.

following are fundamental facts re- clay and cement drain tile:

lay drain tile are at their best when installed and either deteriorate or remain as good as when first made. They cannot improve in quality after being removed from the kilns as the forces acting upon them afterwards tend to destroy them.

II. Cement tile are subject to two forces when placed in the trench, the continued setting and hardening of the cement which tends to increase their strength and durability and the disintegrating action of percolating water, impurities in the aggregate, etc., which tends to weaken them. The stronger of these two sets of forces determines whether or not the tile will improve or deteriorate with age. It is seldom that they balance and keep the tile in a condition identical with that when installed.

Because of these fundamental facts, the purchaser of clay tile should insist that they are well made from durable material and this is also true of the cement article. The clay and the burning are the controlling factors for clay tile, while the cement, aggregate and the care taken in manufacturing determines the quality of the cement tile.

It is a matter of common opinion that no poor cement is placed upon the market and so the owners of cement tile plants and the engineers who have charge of the inspection of the tile do not bother to test the cement used. This is also true for the gravel used. It is doubtful if the engineer bothers himself to check up the proportions of cement and gravel being put into the tile as he takes the maker's word, who usually depends upon th automatic proportioner attached to the mixe It is doubtful if the average drainage engineer can vouch for the quality or quantities o the material entering into the tile even if th specifications require his knowledge of thes

The engineer's knowledge of the complete tile is equally deficient. A hammer or an a is his usual equipment for testing and as t the earth pressures to be borne by the til the assumption may be made that because o some unknown arch action in the filling, practically no pressure comes upon the tile. H makes no pretensions of designing the tile t withstand the superimposed loads nor specifies the methods of trenching so as to minimize the earth pressures that come upon th pipe.

However the engineer is not all at fau for his neglect in these matters. Most o the drainage work is in charge of perso elected or appointed as supervisors of drainag districts who know little and care less concerning these details as they think that th contractor will do good work and furnis good materials regardless of any plans, contracts, or inspections. The engineer is regarded as a necessary evil and worth his salary only when some responsibility can b shoved over on his shoulders. The contract blames the engineer if the tile go wrong an belittles his knowledge if they are rejecte while the officials know that the engineer method of inspection is crude and so fear th [illegible] proceedings that may be instituted for the recovery of damages because of tile destroyed by the engineer.

Heretofore there have been no reliable data [illegible] concerning the earth pressures on tile, methods for testing, or data for the design of pipe but during the past two years the Iowa Engineering Experiment Station has carried out a series of investigations to this end with the result that these kinds of data are available for any one who desires to make use of them. In several papers read before the engineering and technical societies, Professor Marston has outlined the principles and theories involved. A brief résumé of these will be given for the benefit of those who have not the original papers at hand:

[illegible]

[illegible]

[illegible] the greater the pressure, but with the same width of ditch the diameter of the pipe does not affect the load, [illegible] for large pipe in the same ditch.

[illegible] carried by the pipe descreases as the depth of fill gets greater, and after the depth of fill becomes equal to ten times the width of the ditch there is practically no further increase in the load on the pipe.

(4) The load on the pipe will depend on the weight of the ditch filling in pounds per cubic foot and upon its degree of saturation with water.

The derivation of the formula for earth pressure is quite complex, so it will be omitted. The following table which was calculated at the Engineering Experiment Station at Ames, Iowa, gives values approximately correct for a filling of saturated yellow clay in pounds per linear foot of tile in the trench:

Depth of fill in feet [illegible]	Width of ditch –in feet at the top of the tile– 3 feet.	 4 feet.
[illegible]	[illegible]	[illegible]
4	1,340	1,870
6	1,890	2,630
8	2,350	3,360
10	[illegible]	[illegible]

There are conditons under which the pressure on the tile may exceed these figures, so in the design of a pipe line the pressures should be determined by using the proper values for the weight of filling per cubic foot and the correct coefficients of friction as found from tests on the filling material itself. The pressures thus determined must be multiplied by a factor of safety, ranging from *one* to *five* or more, depending upon the depth of fill and the live loads which may come upon the tile, such as traction engines, etc., in order to secure the strength to be required in the specifications. The factor of safety should cover the weakening of the pipe due to their saturation. Samples of the pipe should be tested according to the "Ames method" and if found too weak they may be reinforced, or should plain pipe be preferred, their thickness may be calculated according to the following formula, which is based upon the formula for calculating the modulus of rupture of pipe tested according to the "Ames" method:

$$t = \sqrt{\frac{RSF}{12M}}.$$

When t = the required thickness of the pipe in inches, R = radius of the pipe in inches, S = load coming on the pipe in pounds per lineal foot, F = the factor of safety, and M = modulus of rupture of pipe in pounds per square inch, which is best determined by testing pipe of the desired size and material by the "Ames" method. The application of this formula is shown by the following problem.

Required the thickness of a 36-in. tile to be installed in a trench 4 ft. wide and 13.5 ft. deep cut in yellow clay. Tests made on pipe of the material to be used show a modulus of rupture of 1,200 lbs. per square inch. A thickness of about 3 ins. is assumed, making the outside dimension of the tile 3.5 ft., which gives a depth of fill of 10 ft. The pressure on such a pipe, as shown by the table of pressures, is 3,980 lbs. per lineal foot. The factor of safety will be assumed as 2, substituting in the formula, the above values.

$$t = \sqrt{\frac{18 \times 3980 \times 2}{12 \times 1200}} = 3.14 \text{ ins.}$$

This formula may be solved for S thus giving an approximate idea of the strength of a pipe if one is acquainted with the material from which it is made.

$$\text{(b)} \quad S = \frac{12\,[illegible]}{R},$$

the symbols having the same general meaning as given for (a). The factor of safety is omitted and S is the bearing strength of the tile in pounds per linear foot. As an illustration of its use the following is offered:

Estimate the bearing strength of a 16-in. tile having a wall thickness of 1.1 ins. and the material a modulus of rupture of 1,000 lbs. per square inch.

$$S = \frac{12 \times 1000 \times 1.1 \times 1.1}{[illegible]} = [illegible]$$

The lack of a restriction as to the width of trench cut for a tile is the cause of many failures. For instance, the above 16-in. tile would stand the pressure in a trench cut 2 ft. wide at the top of the tile and 11.5 ft. deep since the load is but 1,570 lbs. per linear foot, while if cut 3 ft. wide would give a load of 2,750 lbs. per linear foot. One of the bad tile failures in Iowa was due to this, as 16-in. tile were placed in a trench cut 3 ft. wide ranging from 8 to 12 ft. deep with the result that all of them failed while the same make and quality of tile that were placed in a trench cut 22 ins. wide and about the same depths on another section of the contract are standing in first-class shape.

Tamping the backfilling will assist the tile only by narrowing the width of the trench to that of the outside diameter of the tile. Little or no lateral support will be given since tile are of such brittle material that a deformation of two or three hundredths of an inch horizontally will cause them to rupture. For instance, if a 33-in. tile having a bearing strength of 2,500 lbs. per linear foot was placed in a trench 4 ft. wide and 13 ft. deep it would be very apt to fail if the filling material was saturated clay, since the load coming upon it is approximately 3,980 lbs. per linear foot. However, if the backfilling was compacted by tamping the net result would be as though the pipe had been installed in a trench approximately 3 ft. wide, which would reduce the weight to be carried by the pipe to 2,750 lbs. per linear foot. This would be liable to break the pipe, especially if the filling became saturated, but because of the tamping the pipe would not be as apt to collapse, after cracking, in the tamped trench as it would in the loosely filled one. However, if the tile had a strength of 3,000 lbs. per linear foot, the tamping of the filling would be apt to save it from failure. The use of trenching machines has increased the trouble from digging the trench too wide as in many cases it is more economical for the contractor to excavate an excess of earth above that required than to go to the expense to reduce the width of his cutter. The tamping of the backfilling also introduces an element of danger, since the pressures and shocks caused by it may cause the tile to break.

The above data have been compiled for the purpose of suggesting to the drainage engineer how he may do his share towards the securing of good drain tile and in the future his neglect to do so may result as seriously to him as to the contractor, for at present there is pending a case in court where the drainage district is suing its engineer to recover damages because of the failure of a line of drain tile which was installed under his supervision.

The following is a summary of the work which may be done by the drainage engineer in the design of a tile drainage system and the inspection of the tile:

(1) Determine the depths to which the various sizes of tile are to be install the width of trench necessary.

(2) Calculate the loads which mu carried by the different sizes of tile.

(3) Specify the strength of the til widths of the trenches and the quali the material to be used in the tile. It is to specify the modulus of rupture an absorption.

(4) Test the material used in th and the strength of the tile according t "Ames" method. At least 1 per cent o tile should be tested for bearing str with a minimum of five pieces of eac The remainder of the tile can be inspect the hammer test.

(5) Measure the width of trench dug and if the contractor cannot dig size specified require the use of stronger

(6) If in doubt as to the calculati the earth pressures and the quality of rial to specify, write to the Engineerin periment Station, Ames, Iowa, or to th dersigned, stating the sizes of tile, the mum, minimum, and average depths o stallation, and the character of the soil the necessary data will be furnished you

A. O. [illegible]

Ames, Iowa, June 6, 1912.

Panama Railroad Relocating Compl

The section of the Panama railr cation, known as the Gold Hill line, 9⅜ long, was formally turned over to the ma Railroad Company May 25, and the cation organization, which has been co ed as an independent department, will to exist after June 30, the close of the ent fiscal year. There remains to be permanent track through the dump north of Gamboa bridge, and this wor probably be postponed, in the interest economy, until the Central Division has ished operations in that section. At the p ent time, the new line can be utilized for running of trains for its entire length only freight trains will use the road a Gold Hill, the passenger trains continuin cross to the other side of the Canal at G boa until such time as it is found neces to take away the dike, by means of the crossover is made.

Sewer Survey, Cincinnati, O.—The of Cincinnati will issue bonds to the a of $125,000 to provide the necessary fu for making a comprehensive sewerage vestigation. The work will include making of a topographic map of the sewerage area, an underground surve all existing sewers, the planning of re sewers in the congested districts, sewers in recently annexed territory, stu for the improvement of the channel of creek and an intercepting sewer for conveyance of all of the sewage to a p of treatment and disposal. This work be handled by the Division of Sewerage vestigations, Designs and Plans, a new division of the Engineering Bureau of Department of Public Service, of which Victor T. Price is director and Mr. He M. Waite chief engineer. The offices of division are in the Odd Fellows Tem building. Other engineers engaged on work are H. S. Morse, engineer charge, Hugh C. Mitchell, engineer charge, topographic survey; E. F. Laym engineer in charge, underground surve J. E. Root, engineer in charge, office; O. Carr, cartographer and supervising dra man; E. D. Bromley, triangulator, R. Cummings, precise leveler, and Frank Farley and C. S. Earnshaw, assistant en neers.

Over 85 per cent of the concrete for all locks at Panama is in place, the am the close of work on June 1 being 3,708,71 cu. yds., out of a total of approximately 4,3 486. A total of 20,700 cu. yds. of conc was laid in the locks during the week end June 1.

NEWS SECTION

**ditorial Comment—Personals—Society Meetings—Trade Notes—Catalog Reviews—
Contract News, Embracing Bids Asked, Work Projected, Contracts Let and
Contract Prices on All Classes of Civil Engineering Construction Work.**

[illegible]

oings f the Veek.

[illegible]
the contracts let, has been
particularly dull the past
[illegible]
been awarded; the pros-
re that this condition will continue at
[illegible]
ontracts are about to be closed up and
[illegible]
to come up in the near future is the
[illegible]
ıa, Churchfield & Ohio Ry. from St.
o Norton, Va.; grade reduction work
Paris and Winchester, Ky., and be-
[illegible]
lle & Nashville R. R., and the construc-
an extension of the Chicago & Eastern
R. R. by which the Frisco will secure
ance into Peoria. Among the contracts
[illegible]
n Co., South Bend, Ind., for second
from Danville to Fairmount, Ill.,
r the Wabash R. R.; John Marsch,
St., Chicago, Ill., for second track
Worth to Orland, Ill., 5 miles, for
sh R. R.; Utah Construction Co.,
tah, for constructing cutoff from
l, Utah, east to Logan, Utah, 8 miles
Oregon Short Line R. R.; A. L. An-
& Bros., Altoona, Pa., for betterment
to the Bald Eagle Valley line of the
nia R. R.; Claude Mimms, Guthrie,
ding for the spur line of the Louis-
Nashville into the center of Clarksville.

racts on one of the biggest government
of the year were let on June 10 in
The work called for the repair and
ilding of levees in the upper and lower
ncis and Reelfoot Lake levee districts.
& Stansell, Memphis, Tenn., secured the
f the contracts. Two other large gov-
levee contracts are coming up for let-
y. One of these is a readvertise-
1,600,000 cu. yds. of levee in the
strict; the other calls for 1,000,000
f levee in the White River Levee
Bids on the first mentioned work
pened July 11 at Vicksburg, Miss.;
n White River work will be opened at
his, Tenn., on July 1.
good sized drainage contracts, on which
re now being asked, are mentioned else-
in this issue. One of these calls for the
t of 24.68 miles of drainage ditches
Inlet Swamp Drainage District of
ty, Ill., the work involving 170,000
[illegible]
earth excavation. The other work calls
e construction of a drainage system for
ge District No. 5 of Harris County,
This system will include about 100
of main ditch and laterals. Another
sized drainage job in Texas which is
to come up for letting in the near future
l in Matagorda County. The first
nd surveys for the drainage system
een made and the reports filed and ac-
. The system will include 18 ditches and
s. The average depth will be 4 ft., av-
e base, 8 ft., and estimated yardage, 1,-
cu. yds. The estimated cost is $234,-
990. The drainage district comprises s[illegible] 80,000 acres of land.

One of the largest sewerage jobs on which bids have been asked the past week calls for the construction of Sec. 15 of the main intercepting sewer in the city of Passaic, N. J., and Acquackanok for the Passaic Valley Sewerage Commissioners. Bids on this work were opened some time ago, but the work is now being readvertised. The section includes 3,445 lin. ft. 90-in. concrete sewer in trench, from about 15 ft. to about 35 ft. in depth; 1,080 lin. ft. 90-in. concrete sewer in tunnel; 2,750 lin. ft. 81-in. concrete sewer in tunnel; 4,500 cu. yds. Portland cement concrete in trench; 6,200 cu. yds. portland cement concrete in tunnel.

A further step toward the straightening of the Cuyahoga River by the City of Cleveland has been taken by the River and Harbor Commission of the city, which will report to the City Council this month recommending a plan for the work. The report will advise a definite plan of procedure and a method of financing the improvement. It is probable that the commission will advise the city to take up the work in sections and make use of the power given councils by the Cetone act to finance it. Under this law the city may require property owners deriving a benefit from the improvement to share the expense. Estimates of the cost of eliminating the bends of the river have varied from $4,400,000 to $5,500,000.

Late advices from Ottawa, Ont., indicate that the Canadian government will delay the letting of the first contracts for the construction of the Welland canal till late this fall, or perhaps next winter. It is practically decided that owing to the magnitude of the work and a desire on the part of the government to secure even fuller statistical and detailed information regarding the undertaking, nothing in the way of commencing work will be begun for the present.

Paying for Street Pavements.

There are few cities in this country which, as a whole, are as well paved as is Utica, N. Y. Practically every street in the city has a modern pavement and the work has been done so easily and steadily that no one has felt the financial burden. This condition is ascribed by Mr. George C. Warren in a communication to the Utica Press to the system employed in the city for the past 25 years for meeting the cost of construction and maintenance of street pavement. By this system the city pays one-third the cost of all original pavements and all renewals thereof and provides for this out of the annual tax budget, the paving fund thus created being an annual tax of less than an average of $1 per capita of population. The remaining two-thirds of the cost of original pavements and all renewals is assessed on the abutting frontage, each individual person assessed being given the option of paying the whole or any part of his or her assessment in cash or deferring payment for six annual installments with 6 per cent interest. To cover the deferred assessments the city issues six paving bonds, each for one-sixth of the whole amount of such deferred assessments, and payable in [illegible]e, two, three, four, five and six years with 5 per cent interest, the due dates of the bond[illegible] and assessments being coincident. The city at large pays for minor repairs required between the time of laying the original pavement and the necessity of reconstruction o[illegible] resurfacing. As an example showing th[illegible] practical working of the plan Mr. Warre[illegible] gave the following typical result on Oneid[illegible] St.: In 1892 the street was newly paved a[illegible] a cost of about $200 per lot of 50 ft. frontag[illegible] the assessment being payable in cash or a[illegible] the option of each taxpayer in six annual installments of about $33, with interest, say $3[illegible] per year for six years including interest. Th[illegible] last installment of the assessment was paid i[illegible] 1898. Then came 13 years' respite and i[illegible] 1911 the street was resurfaced at a cost o[illegible] about $90 for each lot of 50 ft. frontage, o[illegible] if any desired to pay in six annual installments at a cost including interest of less tha[illegible] $16 per annum.

"Brains and Beauty."

Beauty and brains in th
contracting business prove
[illegible]
[illegible]
[illegible] truth [illegible]
following press dispatch:
[illegible]
[illegible]
[illegible] Iowa City [illegible]
Iowa City saved between $3,000 and $4,000, ar
[illegible]
contract, because a pretty young woman ke
[illegible]
[illegible] Seven bids betwe
$19,000 and $21,000, were on file. The City Cou
[illegible]
expiration of bidding time. A leading contract
of Iowa City, was out of town, and a delay
train prevented his arrival. Appreciating the ci
cumstances, his secretary prepared a bid; rush
to the city hall, presented the document and
was duly filed. One minute later the city ha
clock struck; the time expired, and the girl ha
saved the day. Her bid was $16,180—and it ca
tured the little plum for the contractor, wh
[illegible] competing
[illegible] next lowest
of the competing men.

Women as Master Builders.

Ground has been brok
[illegible]
$50,000 building which w
be opened next fall as
institution for traini
women for the occupati
of master builder. It
stated that 36 young women already have be
enrolled for the school. Many of these a
daughters of builders, who wish to prepa
themselves to make a living in the way
ready familiar to the family. The pupils w
be taught all branches of the building indu
try, their first instruction being how actua
to do the work with their own hands. In t
school the girls will learn how to use the s
and hammer as carpenters, the trowel a
mortar as bricklayers, the bellows and wren
as plumbers and will also receive instructi
in foundation work, steam and steel constru
tion and be taught how to estimate. T
course will cover two years.

PERSONAL

Mr. R. C. Harris has been appointed Commissioner of Works of Toronto, Ontario.

Mr. C. O. Vandevanter has been appointed Assistant City Engineer of Baltimore, Md.

Mr. Robt. S. Conklin has been reappointed as Chief of the Forestry Department of Pennsylvania.

Mr. H. J. Cole has been appointed Supervisor of Improvements and Public Works at Montclair, N. J.

Mr. Frank E. Sterns, recently connected with work at Panama, has been appointed Assistant Engineer on the New Welland Canal.

Mr. John S. Mallette of Ravena, Ohio, has been engaged to make preliminary surveys and estimates for paving in the village of Mantua.

Mr. W. R. McClintock tendered his resignation as Street Commissioner for the village of Mantua, Ohio. He is succeeded by Mr. Edward Franklin.

Prof. A. H. Blanchard of Columbia University has been retained by the Board of Water Supply of New York City as Consulting Highway Engineer.

Dr. Edwin Boone Craighead, formerly President of Tulane University, has been chosen President of the University of Montana, succeeding Dr. C. D. Duniway.

Mr. E. S. McCandliss, a graduate of Purdue University of the class of 1908, has been appointed as instructor in civil engineering in the Missouri School of Mines.

Mr. F. H. Newell, Director of the U. S. Reclamation Service, has received the honorary degree of Doctor of Engineering from the Case School of Applied Science.

Mr. J. F. Goodrich has been appointed Assistant Superintendent of the Phoenix & Hayden Divisions of the Arizona Eastern R. R. Co., with office in Phoenix, Arizona.

Mr. Paul Barnard has accepted a position in the Engineering Department of the Grand Trunk Pacific Ry. at Port Arthur. He was formerly Supervisor of Track of the Chesapeake & Ohio Ry.

Mr. A. W. Haiss, Vice President of the George Haiss Mfg. Co., is to take charge of the new downtown office of the company which will be opened at 50 Church St., New York, on July 1st.

Mr. Wm. D. Woodhouse of Wethersfield, Conn., and Mr. Philip Dell of Derry, Pa., members of a Pennsylvania Railroad party of engineers, were run down and killed by a fast passenger train near New Florence, Pa., on June 7.

Mr. John A. Stahl, Jr., a graduate of Cornell in this year's class, has passed successfully the examination for engineer in state highway work and has been appointed to a position in the office of the State Highway Department of Binghamton, N. Y.

Mr. O. Blume announces that he has opened an office as consulting engineer and contractor, specializing in road and concrete work in Kenwood, Fla. He was formerly Assistant Superintendent of Construction with the New York Central & Hudson River R. R.

Col. Geo. W. Goethals, Chairman and Chief Engineer of the Isthmian Canal Commission, was given the honorary degree of Doctor of Science at Columbia University at the annual commencement. Col. Goethals also spoke at the annual commencement at West Point on June 12.

Mr. H. S. Morse has been appointed engineer in charge of the Division of Sewerage Investigations of Cincinnati. This is a new division of the Engineering Bureau of the Department of Public Service. A topographic map will be made of the entire sewerage area, an underground survey of existing sewers, a plan of relief sewers in congested districts and of new sewers in annexed territory. The topographic survey will be in charge of Mr. H. C. Mitchell, the underground surveys in charge of Mr. E. F. Layman, and Mr. J. E. Root will be Office Engineer.

Mr. J. H. Flynn, Jr., who has been on the Panama Canal since 1905, has resigned the position of Mechanical Engineer for the I. C. C. and has been elected President of the Lines-Flynn Company (inc.), 50 Church Street, New York City; Mr. Edwin M. Lines, Secretary and Treasurer. This company is engaged in jobbing-manufacturing, repairing and selling railroad and contractors' equipment. Special arrangements are being made at their Woodbridge shop to repair and "park" the released equipment from the canal, in the purchase of which the H. W. Pickett Co. of Philadelphia is interested.

Civil Service Examinations.

The U. S. Civil Service Commission announces an examination on July 10th to take place at the Federal Buildings in various cities for the position of Laboratory Aid and Engineer at a salary of $900 per annum in the Forest Products Laboratory at Madison, Wis. Full information may be had by addressing the Commission at Washington or at the Commission's offices in the Federal Building of most any large city.

An examination will likely be held in the near future by the Civil Service Commission of the City of Chicago for the position of examiner at a salary of $150 to $200 per month.

INDUSTRIAL

Macdonald shaking grates have recently been sold to the following companies: Stone-Timlow & Co., Inc., Boston, Mass.; Massasoit Mfg. Co., Fall River, Mass.; Buerkell & Co., Boston, Mass.; Bay State Insulated Wire & Cable Co., Hyde Park, Mass.; estate of John Harrington, East Cambridge, Mass.; Borough of Groton, electric dept., Groton, Conn.; Middlesex Bleachery, Dye & Print Works, Somerville, Mass.; J. C. Draper Co., Pawtucket, R. I.; A. J. Tower Co., Roxbury, Mass.

The Duff Mfg. Co. of Pittsburgh, Pa., manufacturers of Barrett Lifting Jacks, has purchased five acres of ground on Breble Ave., North Side, Pittsburgh, on the lines of the Pennsylvania and B. & O. R. R., and will start at once the erection of a new factory, which will be devoted exclusively to the manufacture of lifting jacks. The new site of the Duff Mfg. Co.'s factory and the new site of the Pittsburgh Screw and Bolt Co, occupies the Riter Conley Co.'s property and adjacent acreage, totalling about 12 acres, and is close to the plants of the Pressed Steel Car Co., the Standard Sanitary Mfg. Co. and the Edith Furnace of the Carnegie Steel Co. The construction work on the factory and office buildings will commence about July 1. The Duff Mfg. Co.'s products comprise lifting jacks, ranging in capacity from 1,000 lbs. to those capable of lifting 500 tons and over.

CATALOGUES

Contractors' Tubs.—Paper, 3½x8½ ins., 6 pp. C. W. Hunt Co., West New Brighton, Staten Island, N. Y.

This folder illustrates a number of types of tubs and dump buckets for contractors' use. The folder also shows illustrations of automatic railways, conveyors, cable railways, locomotives, hoisting engines, etc.

Tarvia.—Paper, 6x9 ins., 48 pp. Barrett Manufacturing Co., New York City.

This contains illustrations and descriptions of streets treated with Tarvia and contains letters from engineers and city officials regarding the use of the material.

Contractors' Machinery & Supplies.—Paper, 6⅞x9¾ ins., 318 pp. Harold L. Bond Co., 383 Atlantic Ave., Boston, Mass.

Catalog "D" recently issued by the above company under date of Feb. 15, 1912, supersedes all previous editions. This catalog is especially advantageous to customers for ordering all classes of contractors' machinery, tools and supplies. The catalog is well illustrated with halftones and contain of sizes, capacities, prices, etc., wi for ordering equipment and parts.

Novo Engines.—Paper, 5½x8 ins., 32 The Novo Engine Co., Lansing, Mi

This catalog illustrates and descri construction and uses of Novo gaso gines for various purposes. Specifi are given. An accompanying cata scribes the uses of Novo engines a tains letters from users.

Steam Pipe Covering.—Circular. Wyckoff & Son Co., Elmira, N. Y.

This circular illustrates a steam pipe covering manufactured from Gulf Cypress which is made so as to consist of four parts viz., 2-in. thick inner shell, asphaltum packing, dead air space; 1-in. thick outer shell and wound with galvanized wire.

Electrical Machinery.—Paper, 8x10 The General Electric Co., Schenectady

The following bulletins have been issued by the General Electric

Bulletin 4944, 16 pp. Isolated and Plant Alternating Current Switch Panels.

Bulletin 4915, 20 pp. Direct Curre Motors.

Bulletin 201, 16 pp. A Railway Mo

Bulletin 4922, 40 pp. Electricity in Mines.

Bulletin No. 4923, 72 pp. Modern tric Equipment for Economical Prod of Iron and Steel.

Electric Hoists.—Paper, 8x10½ in pp. General Electric Company, S tady, N. Y.

Bulletin No. 4939 recently issued by the above company is descriptive of el hoists for construction purposes. Con illustrations are given.

Thew Shovels.—Paper, 6x9 ins., 3 p Thew Automatic Shovel Co., Lorain,

This catalog illustrates and describes the Thew Automatic Steam and Electric Shovels with full circle swing and horizontal crowding motion. Specifications and are shown together with illustration shovels operating under various conditions.

Core Drills.—Paper, 6x9 ins., 68 pp. McKiernan-Terry Drill Co., 115 Broadway, New York City.

This catalog contains illustrated descriptions of work done with the McKiernan-Terry Drill and detailed descriptions of the drill and its parts. The catalog contains much of interest directly applicable to drilling work.

Curb Box.—Paper, 7¾x10¼ ins., 20 p The S. E. T. Valve & Hydrant Co., 50 Church St., New York City.

This catalog describes and illustrates the S. E. T. Perfect Curb Box, giving drawings and dimensions of several types and sizes. Price lists are also given.

Manufacturers' Association Bulletin.—Paper, 6x9 ins., 4 pp. American Association of Manufacturers, W. E. Plummer, Secretary, 211 Fillmore Ave., Buffalo, N.

The bulletin of the American Association of sand-lime products for April contains illustrations of buildings constructed with sand-lime brick with brief descriptions.

Little Wonder Mixer.—Paper, 6x9 16 pp. The Waterloo Cement Ma Corporation, Waterloo, Ia.

This catalog gives complete descript with illustrations, of the Little Wo Concrete Mixer.

Permanent Pavement.—Paper, 6x9 i 20 pp. Universal Portland Cement Co. W. Adams St., Chicago, Ill.

This is a monthly bulletin issued in interest of concrete pavement for ro It contains a number of interesting a cles and information on road building up-keep.

Chairs.—Paper, 8x9¾ ins., 8 pp. De Desk Co., 432 South Wabash Ave., C cago, Ill.

Booklet No. 4 is an interesting cata describing chairs "that fit you," giving grams, dimensions, descriptions, etc.

RAILWAYS, STEAM AND ELECTRIC

Alabama.

Birmingham Railway, [illegible] been granted permiss[illegible] f its line around Highland Ave., at Bir- ıam.

ıveys are under way for a line of railroad ıe Louisville & Nashville R. R. from ton, Ala., to Alabama Port, Ala. Irv- ıs on the main line betwe[illegible] Orleans, and the branch will give the ınother outlet to the gulf that is 20 miles eep water than Mobile.

Arizona.

Tucson Gas, Electric Light & Power E. Russell, Manager, Tucson, is re- [illegible] planning the expenditu[illegible] for additional track and extensions street car system at Tucson.

El Paso & Southwestern Ry., accord- advices from Phoenix, Ariz., has filed the Arizona Corporation [illegible] ed articles of incorporation providing e construction of 2,150 miles, including [illegible] separate lines [illegible] 175 miles; Hereford to Tucson, 105 Fairbank to Maricopa, 181 miles; Lewis s, 14 miles; Globe to Miami, 7 miles; to Allantown, Apache county, 200 miles; n to Phoenix, 125 miles; Winkelman to 60 miles; Kelvin to Ray, 15 Phoenix to Yuma, 180 miles; ix to Mohave City, 200 miles; Yuma to an boundary, 25 miles; Yuma to Mohave 235 miles; Tucson to Yuma, 265 miles; ı, Cochise county, to Phoenix, 220 miles. r Douglass, Bisbee, Ariz., is Vice Presi- f the railroad.

California.

Board of State Harbor Commissioners, rancisco, is to have plans prepared for ing the State Belt R. R. along the entire front of San Francisco.

Sacramento Valley Electric R. R. Co., zed recently, has applied to the State ad Commission for permission to issue shares of preferred stock and 7,500 of common stock. According to the oration articles of the company the au- d preferred stock issue is 30,000 shares, e authorized common stock issue is 20,- Of the $160,000 of stock already sub- l, $16,000 has actually been paid in. s L. Donohue is president of the com- ınd those associated with him are H. W. E. L. Sisson, L. P. Klemmer and th, Jr.

contract awarded the Utah Construc- o., Ogden, Utah, for building the Fern- Lassen R. R. of the Southern Pacific nentioned sometime ago in these col- covers 107 miles of line, extending from y, Lyon County, Nevada, to Susanville, ı County, Cal. The contract does not e bridge and trestle work, but does in- concrete masonry.

Afterthought Copper Co., operating and a smelter at Ingot, 28 miles east of ıg, is planning to build a standard gage ıd to a connection with the Southern The railroad will be known as the rnia, Shasta & Eastern. Negotiations ıder way for the purchase of the Ander- Bella Vista R. R., a 12-mile line, to be s part of the new road.

tractors are making rapid progress on ıble track work of the Santa Fe coast ınd additional men and teams are being ı the work between San Bernardino and rook and north from there to Cajon and ummit. Right of way agents are also securing the land to provide for the e of route made necessary by the im- nents.

State Railroad Commission, Sacramen- lif., has granted the application of the Stockton Terminal & Eastern R. R. Co. to issue $65,000 of bonds. The company was incorporated to run from the city of Stockton to the town of Jenny Lind in Calaveras county, a distance of approximately 30 miles. The line has been constructed and is in operation from Stockton as far as Fine, a distance of 15 miles. It is the intention of the company ultimately to operate by electricity. The proceeds to be derived from the sale of $65,000 in bonds are to be devoted to the discharge of obligations to the amount of $26,925 and for extensions and improvements. G. W. Broadhurst, Stockton, Calif., is Chief Engineer.

The Santa Fe System has under consideration the rebuilding of 8 miles of line between Temecula and Fallbrook, Calif., thereby giving the company a short line from San Bernardino to San Diego, Calif. G. W. Harris, Los Angeles, Calif., is Chief Engineer of the Coast Lines of the system.

The Southern Pacific is now planning the construction of a new line paralleling the present road through San Mateo County and down the peninsula. The new track will be used for suburban traffic. William Hood, San Francisco, Calif., is Chief Engineer.

Colorado.

Steps are being taken for the formation of a company to build a railroad from a connection with the Denver, Northwestern & Pacific R. R. at Steamboat Springs to Craig in Routt County. The line will be about 40 miles long and will follow the course of the Bear River. It is understood that the surveys have been completed and that grading work will be started this summer. It is believed that the Laramie, Hahns Peak & Pacific Ry. Co. is behind the new line, as that road has been projecting a line between the points named. J. J. Argo, Laramie, Wyo., is Locating Engineer of the Laramie, Hahns Peak & Pacific.

Connecticut.

The New London & East Lyme Street Ry. Co., 81 State St., New London, Conn., proposes to construct a 5,400 ft. extension in East Lyme.

Georgia.

Steps are being taken to organize a company at Albany, Ga., to install a street car system. C. W. Rawson, Albany, is interested.

A special meeting of the stockholders of the Central of Georgia Ry. will be held on July 18 to vote on a proposition to issue $50,000,000 5 per cent refunding bonds. At present it is proposed to sell only between $3,000,000 and $4,000,000 of the bonds. The proceeds will be used for improvements. C. K. Lawrance, Savannah, Ga., is Chief Engineer.

The Atlanta & Macon Ry. Co. of Atlanta, Ga., recently incorporated with a capital stock of $100,000, is planning the construction of an 87 mile line, and is understood to be arranging details so as to start work as soon as possible. Kennett Cowan, Corn Exchange Bank Bldg., Chicago, Ill., is interested. Others interested include W. D. Sheahan, Sellar Bullard of Chicago, C. G. Young, Bankers' Trust Bldg., New York; Hollins N. Randolph, Robert S. Parker, Hugh M. Scott of Atlanta, W. J. Massee and Howard R. Stewart of Macon, Seaton Grantland, W. J. Kincaid and J. M. Brawner of Griffin, Ga.

The Columbus, Chattahoochee Valley & Gulf Ry. Co., mentioned in our last issue, is projecting a 180-mile line from Georgetown, Ga., to Atlanta, Ga., up the Chattahoochee Valley. Surveys have not been made as yet. J. Johnson Williams, Columbus, Ga., is President, and Josiah Flournoy, Columbus, Ga., is Chief Engineer.

The Shearwood Ry. Co. of Brooklet, Ga., has applied for a charter. The capital stock is $350,000 and the company proposes a line to run from Claxton, in Tattnall county, through Brooklet and Egypt to Clyo, in Effinghai county. Among the incorporators are Joh A. Calhoun of Philadelphia, M. A. O'Byrn and John E. Foye of Savannah, George M Brinson of Springfield and J. N. Sherwood, c Brooklet, Ga. The last named is President c the Shearwood Ry., which is now operatin between Brooklet and Davis. The applicatio for a charter probably means that this road [illegible]

Illinois.

⊙The Dickey Construction Co., South Ben Ind., has been awarded a contract by the Wa bash R. R., for second track work from Dan ville to Fairmount, Ill., a distance of 11 mile John Marsch, 105 S. La Salle St., Chicago, Il has been awarded the contract for secon track work from Worth to Orland, Ill., miles.

⊙Sheahan Bros., Danville, Ill., who have th contract for second track work on the Chicag & Eastern Illinois R. R., from Tuscola to Ar thur, Ill., have let sub-contracts to Edwar Opie, Decatur, Ill., and F. J. Crowley, —— Ill. No more of the work is to be sub-let, a Sheahan Bros. will do the balance themselve This contract includes 80,000 cu. yds. of eart excavation.

The City Council of East St. Louis, Il has granted a franchise to the East St. Lou Interurban Electric Ry. Co. to operate a electric railroad over certain streets of th city and directly in the route of the wago approach to the Municipal Bridge to St. Loui Mo. The incorporators of the company are John L. Flannigen, William H. Haus, Fre W. Kraft, Albert E. Meints and Edward Cragen.

The stockholders of the Chicago & Alto R. R. will hold a meeting on Aug. 19 to con sider a proposed $20,000,000 general mortgag bond issue. The company is understood to considering a considerable amount of bette ment and terminal improvement work.

The Eastern Illinois & Peoria R. R. C has been incorporated and proposes the buil ing of a steam or electric road from Peor to St. Elmo. The incorporators are Frank Austin, Evansville, Ind., and Robert A. Den nis, Frank S. Nicholson, K. L. Richmond an Fred W. Krohn, all of Chicago. This is be lieved to be an extension of the Chicago Eastern Illinois R. R., L. C. Hartley, Chi Engineer, 7700 Wallace St., Chicago, by whic the Frisco will secure an entrance to Peori

The city of Springfield, Ill., is planning raise a bonus of $10,000 to secure the con struction of the Chicago, Peoria & St. Lou shops at that place. J. P. Ramsey, Sprin field, Ill., is Chief Executive of the company.

It is said that the Chicago, Rock Island Pacific has appropriated $25,000 for the e largement of the company's roundhouse Silvis, Ill. Eight additional stalls will built.

Engineers have completed plans and th have been formally approved for the con struction of a number of improvements to th yards of the Elgin, Joliet & Eastern R. R. East Joliet. The work, which includes add tions to the present shops, will cost abo $350,000. Arthur Montzheimer, Joliet, Ill., Chief Engineer of the railroad.

The Northern Illinois Public Utilities C according to information received from Mo rison, Ill., is negotiating with George R. Ma non, Manager of the Tampico-Hooppole R for control of the line with the intention extending it to Sterling and north to Car bridge. The system will probably be ele trified under the proposed new managemen

Indiana.

The Fort Wayne Union Traction Co. h applied for a charter in Indiana and propos to construct an electric railway through th following counties: Whitney, Noble, El

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

hart, St. Joseph, La Grange, Kosciusko, Marshall, Starke, Laporte, Porter, Lake, Fulton, Huntington, Grant, Madison, Tipton, Hamilton, Marion, Adams, DeKalb and Allen. The directors are Henry M. Williams, G. Haller, H. F. Beverforden, W. P. Walsh and George Esmond. The capital stock is $10,000.

Judge J. M. Smith of Portland, Ind., and the Commercial Club of Richmond, Ind., are behind a movement looking to the extension of the C., B. & C. through Union City to Richmond, Ind.

Iowa.

⦿The Lorimer & Gallagher Co., 947 The Rookery, Chicago, Ill., as noted in our last issue, have been awarded a contract for grade revision and double track work at Woodward, Ia., for the Chicago, Milwaukee & St. Paul Ry. The contract includes 300,000 cu. yds. of earth excavation. None of the work is to be sublet.

Capitalists of New Hampton, Ia., are working on plans and have had three surveys made for the construction of a proposed 30-mile railroad from Osage, Ia., to Mason City connecting a gap in the Great Western system.

Kansas.

The Arkansas Valley Interurban Ry. Co. of Wichita, Kan., has completed a survey for the extension of the Wichita interurban on from Halsted to Hutchinson. The line as surveyed parallels the Santa Fe railway from Burton into Hutchinson, running along the south side of the Santa Fe. The route to be followed into the city proper has not been definitely determined. The company has not as yet fully determined whether to build into Hutchinson this year or whether to expend its efforts on a southern extension from Wichita.

Commercial organizations of Kansas City, Kan., are reported to have under consideration a plan to secure the construction of the Wichita Falls & Northwestern from Wichita Falls to Wichita, Kan., and thence to Kansas City. Frank Bell, Wichita Falls, Tex., is Vice President and General Manager of the road.

Engineers of the recently incorporated Newton, Kansas & Nebraska R. R. have started surveys on the proposed line north out of Newton, Kan., through Canton, Roxbury and on to Salina or Abilene. T. H. McManus, Newton, Kan., is President of the company and Roy Glass, Canton, Kan., is Secretary.

The Continental Construction Co., of which J. H. Brewster, Independence, Kan., is President, is reported to have been awarded a contract for the construction of 140 miles of the proposed Kansas, Oklahoma & Southwestern (formerly the Cherryvale, Oklahoma & Texas Ry.). The contract includes the construction of the road between Caney, Kansas and Siloam Springs, Ark., a distance of about 100 miles, and also the line between Caney and Pawhuska, Okla., a distance of 40 miles. About 30 miles of the grade have already been constructed. The contractor will soon be ready for bridge and track material. It is also stated that as soon as the work is completed to Pawhuska the contracts will be let on the Oklahoma City division. At Oklahoma City the road will subdivide in two directions, one branch going southwest and the other a little north of west. S. M. Porter, Caney, Kan., is President of the railroad company; J. H. Brewster of Independence, Kan., General Manager, and B. J. Dalton of Lawrence, Kan., Chief Engineer.

It is reported that the St. Joseph & Grand Island Ry. has under consideration the construction of a spur extension at Hanover, Kan. E. Stenger, St. Joseph, Mo., is General Manager of the company.

Kentucky.

The Cincinnati, Licking Valley & Virginia R. R. Co., the incorporation of which was mentioned in our May 29 issue, has surveys under way for its proposed line. This company proposes to build a line of railroad from a point near the mouth of Licking River, Campbell County, to a point about Pound Gap, not far from the city of Jenkins. J. B. Walker, Birmingham, Ala.; F. D. Buskirk, Cincinnati; Thomas G. Stewart, Winchester, Ky., are interested.

Preliminary surveys have been made for the proposed trolley line from Shelbyville to Frankfort, the route running near the state pike. The company has not been organized as yet and the matter is still in the hands of the promoters. It is expected that construction contracts will be let as soon as the organization is perfected. Rowland Cox, Taylorville, Ky., is the Engineer.

The Louisville & Nashville R. R., Jno. Howe Peyton, Chief Engineer of Construction, Louisville, Ky., is contemplating grade reduction work between Paris and Winchester, Ky., and between Beattyville and Athol, Ky., as noted in our last issue. We are advised, however, that the work is not yet ready for construction.

Winston & Co., with headquarters at Winchester, Ky., who have the contract for the Louisville & Nashville extension from Winchester to Irvin, Ky., are making good progress on the work and it is planned to have steel laid to Hazard by July 1.

Louisiana.

The Baton Rouge Bridge & Terminal Co. has been incorporated with a capital stock of $1,000,000 and proposes the construction of a bridge over the Mississippi River four miles south of Baton Rouge and the building of terminals. The incorporators are Hugh Chamberlain of Baton Rouge; Joseph E. Hedges, a lawyer of New York; L. S. Stewart, a contractor of Kansas City, Mo.; Walter Bynum of Baton Rouge; W. B. Chambrlain of New Orleans and F. B. McQueety of Baton Rouge.

Maryland.

Good progress is being made with the promotion work for the Baltimore & Virginia R. R., and it is hoped to begin the actual construction of the Drum Point line late in September and have it in operating condition before the end of the year. J. Barry Mahool, Baltimore, Md., is interested.

The Washington, Westminster & Gettysburg R. R. Co. of Maryland has applied to the Public Service Commission at Annapolis, Md., for the right to issue $630,000 in bonds of $1,000 each, 144,000 in preferred stock and $100,000 in common stock, of shares of $100 each, representing the cost of the first section of the road from Washington to Sandy Spring, Md. As the construction of the road is carried on application will be made from time to time for authority to make further issues of securities. Officers of the company and others identified with the project, most of whom are residents of Washington, are William H. Saunders, president; I. H. Saunders, secretary; E. Southard Parker, S. W. Woodward, James Lansburgh, Col. M. A. Winter, A. A. Chapin, Samuel C. Redman and Thomas B. Redmond.

Massachusetts.

Governor Foss of Massachusetts has signed the bill enlarging and extending the corporate powers of the Southern New England R. R., a subsidiary company of the Grand Trunk Ry. The Southern New England R. R. is now constructing a line from Palmer, Mass., to Providence, R. I. The bill authorizes the building of another line from Palmer to Worcester; a line from the town of Blackstone north to Boston, and a line from the New Hampshire boundary to Boston. The line to the New Hampshire boundary will be built from White River Junction, Vt.

The State Senate has voted to sustain the Governor's veto of the Western Trolley Merger bill advocated by the New York, New Haven & Hartford R. R. The bill sought to combine the Worcester, Springfield and Berkshire street railways, all three of which are controlled by the New Haven R. R. The bill passed both houses by large majorities, but was vetoed by the Governor.

The Grand Trunk Ry. has had surveys started to determine the feasibility of a branch line from the New London Northern R. R. at Belchertown to Holyoke. The fiel will take all summer in all probabili perhaps into the early fall. It will p ably be nearly a year before the final ma are wholly completed. The surveys will first made through South Hadley Falls, outh Hadley and Granby, as this is the mo difficult part of the work, the way from anby to a connection with the New London orthern being level and not difficult. Th principal trouble will be in locating a sible route through South Hadley Falls and cross the river.

Michigan.

Preliminary surveys have been start for the projected line of the Muskegon & anistee Interurban Co. The W. J. Sherm Co. Toledo, O., has charge of the engineering ork. The officers of the interurban compa are as follows: President, Herman O'C nor, Holton; vice president, Carl J. Lamb, W kerville; secretary, Irwin D. Cary, He ria; treasurer, Frank Alberts, Muskegon.

Advices from Bay City, Mich., state th the Michigan Central R. R. has purchased 2 cr of land at that place for the constructio of 40-stall roundhouse and enlargement th present yards. W. H. Sellew, Detroit, ich is Principal Assistant Engineer.

The Chamber of Commerce, Alpena, ich has accepted the proposition of the City, Gaylord & Alpena R. R. to exte line from Gaylord, its present termin Alpena. The city will furnish right o through the county and city and will p terminal facilities. T. White, Boyne, ch is Vice President and Assistant General an ager of the road.

The City Council of Detroit, Mich., i sidering taking up with the Grand Ry. the proposition to separate the ra from the street grades in Dequindre St. cost of the improvement would be, it i mated, about $1,000,000.

Minnesota.

It has been announced that the Ch Milwaukee & St. Paul has completed for the improvement and enlargement o yards at Bass Lake. The work will in the filling in of a number of swamps the material excavated from the 29th St east of Colfax Ave., where the H. & D. t are being depressed in Minneapolis, M. D. Rhame, Minneapolis, Minn., is Di Engineer.

Missouri.

The construction of a new belt line at sas City is proposed by the recently chart Kansas City Industrial Belt Ry. Co. The pany proposes the building of 7½ mile track, the line starting from a point on old Belt Line at about 15th St. and Ind Ave. and going in a southeasterly directio a point 100 ft. north of the Raytown rock and about 300 ft. west of the Blue Rive which point a spur will extend three-fo of a mile due east to intercept the Rock Is tracks. The grade of this track will be as to give a clearance of 24 ft. over the tr of the Missouri Pacific, 'Frisco and Ka City Southern railroads at Leeds. The track will continue from the point descr at Raytown road south on the west side the Blue Valley to Belt Junction wher will make connection with the tracks of Missouri Pacific, Frisco & Kansas City So ern systems, thence in a westerly directio the Brush Creek Valley to Woodland H. L. Harmon of Kansas City, formerly p dent of the Kansas City Terminal Ry. Co connected with the new company.

Construction work is progressing nicely the Kansas City, Clay County & St. Jos Ry. line. According to advices from Kar City, Mo., there are now 530 men, 620 te and 23 grading machines at work on g ing on the St. Joseph division. On the celsior Springs division there are 320 430 teams and ten machines. The 320-ft. bridge over the Platte River is practic finished, as is the 1,000-ft. viaduct at De born. On the Excelsior Springs division

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

ridges over railway tracks at [illegible] third near Weedale have [illegible]

St. Louis Items.

By A. B. Koenig.

[illegible]tracts have been awarded [illegible] Bixby and Pryor [illegible] [illegible]

he Dickey Construction Co. of South Bend, d was awarded a contract for building a ecd track from Danville to Fairmount, l., distance of 11 miles. A 5 mile stretch of Worth to Orland, Ill., was awarded to Marsch of Chicago. The receivers have rded contracts this year for a total of 1, miles of second track work. In addin the contract awarded last week. double ne work has been contracted for between e llowing points: State line to Danville, Oakwood to Milan, Mich.; Decatur to nts, Ill.; Montpelier to Alvordon, O.; yrville to Litchfield, Ill.; Poag to Worn Il.; New Haven to Fort Wayne, Ind.; u to Fort Wayne.

T J. A. Ware Construction Co., Houser d St. Louis, Mo., can use several small outfits on railroad work in Illinois.

hn R. Stephens has been appointed Chief geer of the Missouri Pacific-Iron Mounn System to succeed E. F. Mitchell, rerd. At the latter's request Mr. Stephens ll ssume the duties of the office at once. is been assistant to Mr. Mitchell for the t ear. Mr. Mitchell informs us he is not a osition at present to announce his future ctions, but expected to take a rest of al months before going back into active He has been with the Missouri Pacific-n Mountain for seven years in the capacity ief Engineer. He has been engaged in id engineering work since 1882.

L. Cook of Ransom & Cook. Ottawa, came to town to look over the situa- Cook reports their work on the Santa ar Dodge City, Kans., near completion. would have had it completed long be- his if it had not been on account of the winter.

bill authorizing the removal of the d Railways tracks from 7th St. between eau Ave. and Cherokee St. and the use e Broadway tracks by 7th St. cars be- those streets has been passed by the of Delegates. The bill was the sub- f two public hearings. The United Rail- through its president and general man- Capt. Robert McCullouch, indicated the ny neither objected to the change nor ated it. If the bill passes the council, will become an artery of traffic leading wagon approach of the free bridge, it dicted. The railway company must pave p of the street 10 ft. wide.

V. Wright, Union Springs, Ala., has a wheeler, slip and rock work to let near gomery, Ala.

Wabash has received twelve of the new ing engines ordered several weeks ago, which are to be used at St. Louis, four troit and one each at Moberly and De-

rington Bros. have finished their work West Franklin, Ill., and are in the mar- or some team work. They have a rat- good 30-team outfit and have a reputa- f finishing work ahead of contract time.

C. Smith & Sons have moved their on to a job of ditching near Raddle, Ill.

eron, McManus & Joyce, Keokuk, Ia., some nice team work to let.

n Marsch, Boland Bldg., Chicago, Ill., etween 60,000 and 100,000 yards of ma- work on the Wabash R. R. double track nois to sub-let. This work is suitable for o 25-team outfit.

C. Connors & Co., 14 S. Canal St., Chi- Ill., can use a couple of 5 to 10-team near Sullivan, Ill., on the C. & E. I.

J. Smith of the L. J. Smith Construction assed through St. Louis the other day s way to Chicago, Ill. Nothing new.

Palmer & Young, the well known Minneapolis contractors, are doing nicely on their Northwestern work near Springfield, Ill.

Thos. L. Rosser, Jr., came in off his North- [illegible] phies. Returned happy.

[illegible] McManus & Joyce's work on the Burlington R. R. above Keokuk, Ia. He left here the [illegible] his outfit over there at once.

R. Costello of Costello Bros. spent a day here with his family. Rich reports all of their jobs moving along nicely.

[illegible] outfit at Kemper, Ill., on the C., B. & Q. R. R.

Mike Conroy is sticking close to his levee work near Granite City, Ill. Mike expects to finish this job shortly and will have his big team outfit idle.

A. B. Koenig returned from Corning, Ark., where he spent a week with a lot of his friends fishing. On his return to St. Louis he entertained the boys with a big fish fry and the liquid refreshments that go with a fish fry.

C. A. Samuelson has started on his Wabash work near Fort Wayne, Ind.

The largest locomotive ever operated on a railroad in this section will be delivered this week to the Iron Mountain "Hump" yards at Dupo, Ill., for switching service. The locomotive is of the Mallet type and is declared far the most powerful for yard service thus far constructed. It is similar to the Mallet type which has been in use on the Northern Pacific Ry. since 1910. The new locomotive will replace two large engines at Dupo and will be used to push trains of loaded cars over the "Hump," from where these cars are sent down an incline to various tracks to be made up into through freight trains.

W. E. Tench of W. E. Tench & Co., Detroit, Mich., was in town the other day on business. Nothing new.

Official announcement was made on June 10th by President Winchell of the Frisco lines of the appointment of J. S. Pyeatt as vice president and general manager of the New Orleans, Texas & Mexico R. R. Co. and of the Beaumont, Sour Lake & Western Ry. Co., and vice president of the St. Louis, Brownsville & Mexico Ry. Co., with headquarters at Houston, Tex., vice J. H. Elliott, resigned. Mr. Elliott has been appointed vice president and general superintendent of the Fort Worth & Rio Grande Ry. Co. and of the St. Louis, San Francisco & Texas Ry. Co., with headquarters at Fort Worth, Tex., succeeding Mr. Pyeatt. R. E. Hennessey is appointed live stock agent, with office at National Stock Yards, Ill., vice Mr. G. W. Thompson, assigned to other duties. P. G. Walton has bene appointed assistant superintendent of the Ozark division of the Frisco, with headquarters at Thayer, Mo. He will succeed the late B. F. Hunter and report to Supt. W. T. Tyler of Springfield.

The Dickey Construction Co., South Bend, Ind., has 11 miles of light team work on the Wabash R. R. east of Danville, Ill., to sub-let. There is about 50,000 yds. in the 11 miles.

A change in plans made it possible for the East St. Louis City Council, at its meetings last week, to pass the ordinance providing for the improvement of Missouri Ave. Because the estimated cost was $103,189, the ordinance was held back after its first reading to be advertised. Since the first reading, however, the East St. Louis Ry. Co. has gotten a franchise to lay its tracks on Missouri Ave. and will stand the expense of a part of the improvement, so that the estimated cost was cut from $103,189 to $96,000. The improvement is to be made from 22nd St. to the city limits.

Supt. Hadley Baldwin of the Big Four R. R. has written to Mayor Faulstich of Alton, Ill., suggesting that an addition be built to the station on the east side, and also signifying a willingness to make other improvements at the depot.

Hannon & Hickey Bros. have been busy the past week shipping labor and supplies on to their Fort Wayne, Ind., work on the Waba R. R.

The East St. Louis City Council on June [illegible] the fr chise which it gave to the East St. Louis Ra way Co. May 27 to extend its tracks on Broa way from 19th to 22nd Sts. on 22nd fr Broadway to Missouri Ave. and thence e to the city limits.

[illegible] work at Blount Springs, Ala.

Nebraska.

The Beatrice Commercial Club has appoi ed a committee to confer with the officials the Missouri Pacific in regard to the propos extension from Virginia to Beatrice, Ne a distance of 13 miles. E. F. Mitchell, Louis, Mo., is Chief Engineer.

It is reported that the project to constr the proposed line of the Yankton & Southe Ry., which was surveyed from Yankton, Dak., to the Gulf passing through Sewa Nebr., has been revived. Fremont Hill, N York City, President of the road, states t the financing of the line is practically assur Thomas Wolfe, David City, Nebr., is said be interested.

The City Council of Franklin, Nebr., h called a special election to be held July 2 submit to the voters the proposition of issui bonds amounting to $10,000 to aid the co struction of the proposed Kearney-Betl R. R.

New York.

Charters have been granted at Trent N. J., to the Stone Harbor Terminal R. R. C and a subsidiary concern, the Stone Harb R. R. Co., with capitals of $350,000 and $15 000, respectively. Work is already well und way on the project of the company to bu a 4½ mile line from the Cape May Cou House to Stone Harbor. The incorporat of the Terminal Co. are: H. Roger Hende shott, William H. Brennan, Fred M. Hill a James N. Kane of Philadelphia, David Ris and Howard S. Risley of Stone Harbor a Herbert F. Harris of Collingswood. The i corporators of the other company were: Rut erford H. Hendershott, Charles A. Farma Harris A. Norris, Stewart H. McDowell a Charles F. Bower of Philadelphia and Ree P. Risley and Dorr E. Newton of Stone Ha bor.

The officials of the Erie R. R. which co trols the Elmira, Corning & Waverly line a the Corning & Painted Post Street Ry. ha under consideration the extension of the str railway to the North Corning yards, providi the city will grant a franchise for 15 additio years, making a total of 50 years, to use t city streets.

The Public Service Commission for t First District, New York City has granted t application of the Ocean Electric Ry. Co., F Rockaway, N. Y., for the construction and o eration of an extension of its surface railro in Belle Harbor, Borough of Queens. T route of the extension is as follows: Fr the easterly side of Suffolk Ave. where it i tersects Newport Ave., along and upon Ne port Ave. westerly to the boundary line b tween the property known as Belle Harbor a the property of the Neponsit Realty Co., Adirondack Blvd. thence southerly along a upon Adirondack Blvd. to Neponsit Ave., a thence westerly along and upon Neponsit A to the easterly side of Saratoga St., being all a distance of 87/100 miles.

The Public Service Commission for t First District has adopted resolutions that t Chief Engineer and the Counsel to the Co mission be instructed to prepare and subm to the Commission at as early a date as pos ble the contract plans and form of contra for the construction of the Fourth Aven Route in Brooklyn to 86th St. for the co struction of the Astoria and Woodside Rout The Chief Engineer was also instructed make such borings and other preliminary wo as necessary on the East 14th St. tunnel, a report on possible connection of Bedford A

The Public Service Commission of the Fi District, New York, has adopted the 65th S

Brooklyn and Staten Island Route. The resolution provides the construction of a two-track subway, extending from a point in Brooklyn under Fourth Ave. at or near 65th St., where a connection can be made with the Fourth Ave. Route as already legalized, and thence extending under 67th St., Owls Head Park and under the Narrows to a point near Arrietta St. in the Borough of Richmond, where the route will diverge into two sections, one section running to a point of connection with the North Shore branch of the Staten Island Rapid Transit R. R., and the other running to a point of connection with the South Shore branch of the Staten Island Rapid Transit R. R.

New Hampshire.

The Boston & Maine R. R. is to double track its line from South Vernon, Vt., to Hinsdale, N. H. From the latter place this company is now building a new line to Brattleboro, Vt., by which it will avoid using the tracks of the Central Vermont from South Vernon. The Boston & Maine is also planning to build a new line from Windsor to White River Junction, Vt., 14 miles. This line will be build by the Sullivan County R. R., a subsidiary of the Boston & Maine. A. B. Corthell, Boston, Mass., is Chief Engineer of the Boston & Maine.

North Carolina.

The Norfolk Southern R. R. has made surveys from Troy and Mt. Gilead to Charlotte, N. C. No decision, however, has been reached as to which, if any, of these will be accepted.

Ohio.

The Wheeling & Lake Erie R. R., H. T. Douglas, Jr., Chief Engineer, Cleveland, O., is understood to be contemplating an issue of $20,000,000 bonds. Of this amount it is believed that approximately $14,000,000 will be needed to liquidate present indebtedness, leaving the balance for improvements.

Oklahoma.

Surveyors of the Winnipeg, Salina & Gulf have established their new camp at Freedom, Okla., and are making rapid progress on the Kiowa-Des Moines branch. H. Leone Miller, Salina, Kan., is promoting the project.

Oregon.

A plan is under consideration for the construction of a 26-mile electric railroad from Klamath Falls to Bonanza. George C. Clark, Everett, Wash., is interested.

Pennsyivania.

⊙A. L. Anderson & Bros., Altoona, Pa., have been awarded a contract by the Pennsylvania R. R. for betterment work to the Bald Eagle Valley road, extending from Tyrone to Lock Haven. The work includes the elimination of curves, reduction of grades, the moving of tracks 2,000 ft. nearer Bald Eagle Creek and the construction of masonry walls. About 300,000 cu. yds. of excavation are involved.

A special committee has reported to the City Council of Pittsburgh, Pa., recommending the construction of a single track street car line around Schenley Park. Surveys for the line will be made by the Department of Public Works, W. E. Gelston, Superintendent of Bureau of Surveys, and it is expected that an estimate of the cost will be ready about July 1.

The last spike in the extension of the New England R. R. from Danielsville to Tamaqua, 32 miles, was driven on June 6, and the first train was run over the line on the eighth. The line connects at Tamaqua with the Panther Creek R. R., owned by the Lehigh Coal & Navigation Co. A further extension from Tamaqua through Coaldale to Lansford is not contemplated.

The Chestnut Ridge Ry., a 13-mile line, extending from Palmerton to Kunkletown, and owned by the New Jersey Zinc Co., is to be extended to Stroudsburg in the near future. C. R. Funk, Palmerton, Pa., is Chief Engineer.

Tennessee.

⊙Claude Mimms, Guthrie, Ky., is reported to have been awarded the contract for grading for the spur line of the Louisville & Nashville R. R. from its main line into the center of Clarksville, Tenn.

Surveys are under way for what is believed to be a second belt line around the city of Memphis, Tenn. It is understood that the proposed route of the new belt line will not parallel the present one. It will start at a point on the Mississippi River opposite New South Memphis, and run direct east to the South Memphis Warehouse property. From there it will extend around the city far enough to insure its promoters that it will be beyond the city for many years to come. The interested parties are stockholders in the Frisco and Rock Island, also the South Memphis Terminal and Warehouse Co., organized and capitalized about the first of the year for $1,000,000.

C. E. James, Chattanooga, Tenn., has accepted the franchise for the interurban railroad, granted some time ago by the city commissioners of that city. This is said to insure the building of another railway through certain streets of the city, as well as interurban lines running to Dayton, Walden's Ridge and other points in Tennessee and Georgia. One line projected goes over Lookout Mountain and down into Georgia.

The Knoxville, Sevierville & Eastern Ry., W. A. Seymour, Chief Engineer, Knoxville. Tenn., is reported to be planning to begin work in the near future on the extension of the line through Sevierville to the east side of Sevier County.

Texas.

⊙The Southern Engineering & Construction Co. of Dallas, which is building the Waco-Dallas-Corsicana interurban line, has awarded a contract to the Western Tie & Timber Co., St. Louis, Mo., for about 500,000 ties. The first shipment will be made in July. Subsequent shipments will be delivered at regular intervals, and will be distributed along the line, principally at Ennis, Hillsboro and Waxahachie. Included in the lot will be switch posts and other material for actual laying of rails.

Business men of Carrizo Springs have agreed to raise a bonus of $35,000 to secure the construction of the Asherton & Gulf Ry. to that place. It is understood that the road will be built through to Eagle Pass and that the line to Carrizo Springs will be finished by Jan. 1. The Asherton & Gulf Ry. at present is 32 miles long. Asher Richardson, Asherton, Tex., is President and General Manager.

Announcement is reported to have been made by F. H. Britton, President of the St. Louis Southwestern Ry., of that road's intention to construct a line from White City to Port Arthur, Tex., giving that system a direct outlet to the Gulf of Mexico.

Sufficient right of way and bonus subscriptions have been secured to assure the construction of the San Benito & Rio Grande Ry. from San Fordyce to Rio Grande City. S. A. Robertson, San Benito, Tex., is interested.

The Gulf, Texas & Western Ry. has received bids for constructing the 23¼ m tension from Jacksboro, mentioned our June 5 issue. The work will run abou 7,000 cu. yds. to the mile. Ben B. Cain, Pr orian Bldg., Dallas, Tex., is Vice Preside and General Manager.

The Enid, Ochiltree & Western R R. is reported to have been purchased by Dr G. A Vawter and O. J. McKnight, who wi it is said, complete the construction as soon s the people along the line raise the ne ssary bonus.

The Rock Island, Farwell & Southe Ry., projecting a 190-mile line from Farwel Tex., south to Texas & Pacific R. R., has cor leted surveys and has partly secured the capi for construction purposes. Construction co racts will be let in about six months. J. Fry, Farwell, Tex., is Chief Engineer.

Utah.

⊙The Utah Construction Co., Ogden, tah has been awarded a contract by the gc Short Line R. R. for the constructio f cutoff from Ballard, Utah, east to gar Utah. The cutoff will be 8 miles long a th grading work will be very light.

Virginia.

The Virginia-Carolina Ry., Wilton E. lir gea, President, Abingdon, Va., is unde to be preparing to have construction started shortly on the extension of th from its present southeastern termin Konnarock, Washington County, Virgi Wilkesboro, N. C. Several months ag re-liminary surveys were made throug th mountains across the counties of Gr and Washington, in Virginia, and Asl North Carolina. W. P. Early of Lexi on Ky., has been appointed chief engineer the road and will be in charge of the constru on.

Washington.

⊙Flagg & Standifer Co., Marshall, Wh have finished their grading contract on the O. W. R. & N. and now have the contra lay the track and ballast same from Sp to Ayer, a distance of 103 miles. They use about 150 men with the tracklaying w, besides a large force ballasting.

Engineers of the Canadian Pacific Ry. ve about completed preliminary surveys m Trail, B. C., to Metaline, where a conne n will be made with the Idaho & Washin n Northern R. R. It is reported that a d grade, involving, however, some heavy k and tunnel work, has been found. The e strikes the Pend Oreille River at Waneta d continues along the north and east ban to Metaline. It is also reported that cross c-tion work will be started as soon as the e-liminary survey is completed.

The council of Yakima City, a place miles south of North Yakima, has been a d by the Commercial Club of that communit o submit to a vote the question of a $3,500 d issue to obtain that sum to be used as a for the encouragement of the building c electric line between that town and N h Yakima.

It is reported that the Chicago, Milwau & Puget Sound Ry. will expend approxima $800,000 in improvements in Seattle, W. The work contemplated provides for w frontage and docks, sidetracks, terminals buildings.

Wisconsin.

The Chicago, St. Paul, Minneapolis & O ha R. R., it is announced, will construc double track from Eau Claire, Wis., to head of the lakes. A. W. Trenholm, St. P Minn., is General Manager.

ROADS, STREETS AND PAVEMENTS

Alabama.

✣Bids will be received until 3 p. m., June 24, by Washington County Court, Chatom, Ala., for grading, draining and surfacing with tops oil, approximately 8 miles of state and road estimated to cost $8,000. W. S. Kell Montgomery, Ala., is State Highway En neer.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Idaho.

e City Council of Idaho Falls, Ida., has icted the city engineer to prepare esti . and plans for the [illegible] reets, and also instructed the city attor- [illegible] draw up the [illegible] ame. The streets to b [illegible] St.; Bridge, Broadway from the end acadam to bridge; Capital Ave., from dway to G; Shoup Ave., from railroad to dway, and from C to G; Cottage Ave., Bridge to G; the alley between Broad- and A; the alley between A and B; B St., en Capital and Cottage; C St., between al and Cottage, and G St., between Cap- nd Cottage.

Illinois.

[illegible] will be received [illegible] missioners of Highways of the town of n in the Village of Malden, Ill., at the [illegible] l roads; grading, draining, grading of to be 40 ft.; gravel 8 ft. in width 10 ins. [illegible] rly drained. All drain pipes and cul- urnished by the township. Gravel roads built 8 ft. from center and side road [illegible]

ids will be received until 7:30 p. m., 24, at the Village Hall, Winnetka, Ill., e paving of Spruce and Cedar Sts. The will include the following approximate [illegible] ete base, 2-in. asphalt top; 6,140 ft. of ete curb and gutter; 3,700 cu. yds. of ex- on; 2,620 ft. of 4-in. drain tile; 1,930 ft. n. drain tile; 16 catch basins. Windes & h, 598 Birch St., Winnetka, Ill., and 112 Salle St., Chicago, Ill., are Engineers.

he Board of Local Improvements of a, Ill., has awarded the contract for the facing of Ravine Ave., from Knoxville isconsin, to John W. Bushnell. The cost e stretch from Knoxville to Indiana is , while that from Indiana to Wisconsin [illegible] $1,572.

he Board of Local Improvements of istock, Ill., has awarded the contract for shing the labor and material for the con- ion of 14,837 sq. yds. of vitrified brick ent on Portland cement concrete foun- to Logan & Giertz, of Elgin, Ill. The also includes 2,660 lin. ft. of concrete ng and 1,321 ft. of storm water sewer ction. Bids were opened May 20.

ogan & Giertz, of Elgin, Ill., have been led the contract for the paving of South St., in front of the grounds of the Elgin Hospital, by the State Administration l, Springfield, at $35,000. Brick will be [illegible]

he Board of Local Improvements of M ll., has awarded the contract for the pav- f 55th St., from Fourth Ave., to the rail- to the Abrahams, Porter & Co., $3,970. reported the same company secured the act from the East Moline Board for ection of the road at $5,000.

he Vermillion County Commissioners, ille, Ill., have awarded the contract for aving of the Georgetown road from the ish Overhead Bridge at the edge of the of Danville to the corporation limits of lum, to Hoffman, Townsend & Co., of armel, Ill., at $62,300. The road is to brick and concrete, 12 ft. wide, with curb. Other bidders were: George W. man, Danville, $64,000; Roy L. Wil- , Mt. Carmel, $68,000; J. D. Lain, Bloom- n, $69,000; J. C. Poll, Danville, $69,717, H. C. Finley, Hoopeston, $72,540.

he city of Springfield, Ill., has let con- for the paving of three streets, as fol- 11th St., from North Grand to Ridgely —Nelch & Son, Springfield, $1.75 per sq. nd $.55 per ft. for curbing; College St., Allen St., to South Grand Ave.—R. F. , Springfield; Lawrence Ave., from Sev- to Eighth Sts.—R. F. Egan.

he following contracts for constructing nents have been awarded by the Board of Local Improvements, Chicago, Ill., Ed. J. Glaskin, Secretary. Catalpa Ave., 3,280 sq. yds. asphaltic macadam; total bid, $5,962, Central Paving Co., 179 W. Washington St. Costello Ave., 1,870 sq. yds. asphalt; R. F. Con- [illegible] asphalt, $12,607; Standard Paving Co., 9 S. La Salle St. Hollywood Ave., 540 sq. yds. asphalt, total, $1,742; American Asphalt Paving Co., 133 W. Washington St. Irving Park Boul., 4,619 sq. yds. brick; total, $13,530; Central Paving Co. Lake View Ave., 4,800 [illegible] Co., 133 W. Washington St. Maxwell St., 4,200 sq. yds. asphalt, $11,238 total; Parker Washington Co. 99th St., 2,300 sq. yds., granite top macadam, total $4,177, Calumet Coal & Teaming Co., 2926 E. 95th St. Richmond St., 1,800 sq. yds. asphalt, total $5,200; Standard Paving Co. Rockwell St., 3,510 sq. yds., asphalt, total $9,810; American Asphalt Paving Co. 23rd Pl., 6,940 sq. yds. asphalt, total $17,880; R. F. Conway Co. 77th St. System, 24,000 sq. yds. asphaltic macadam; A. J. McAllister, 1542 W. Garfield Blvd. 56th St., 2,550 sq. yds. creosoted wood blocks, total $9,482. Madison Ave., 6,900 sq. yds. creosoted wood blocks, total $27,436; Calumet Coal & Teaming Co. 35th St., 15,590 sq. yds. creosoted wood blocks, $65,725; Ready & Callahan, 133 W. Washington St. Washington Ave., 6,000 sq. yds. creosoted wood blocks, total $21,120; The Ryan Co., 1006 Otis Bldg. Alley, Van Buren St., etc., 300 sq. yds. brick, $885; John A. McGarry Co., Security Bldg. Alley, Belmont Ave., etc., 970 sq. yds., brick, total $2,574; Jno. A. McGarry & Co. Alley, State St., etc., 500 sq. yds. brick, total $1,369; Central Paving Co. Alley, Michigan Ave., etc., 150 sq. yds. brick, $2.45; total, $3,891; Jno. A. McGarry & Co. Alley, Garfield Blvd., etc., 2,410 sq. yds. brick, total $5,818; Jno. A. McGarry & Co. Alley, Michigan Ave., etc., 2,660 sq. yds brick, total $7,741; John A. McGarry & Co. Alley, Taylor St., etc., 1,100 sq. yds. brick, total $2,974; John A. McGarry & Co. Alley, Loomis St., etc., 900 sq. yds. brick, total $2,277; John A. McGarry & Co. The work includes concrete, combined curb and gutter, sandstone curbing, combined curb and concrete foundation, earth excavation, grading, sewer construction, adjustment, etc. Bids opened May 22.

The Board of Local Improvements of Peoria, Ill., has instructed City Engineer L. D. Jeffries to prepare estimates for the extension of the creosoted wood block paving on Adams St., down six blocks farther to Cedar St.

The Board of Local Improvement of Joliet, Ill., Wm. S. Welch, Secretary, has been petitioned by the property owners on Oneida St., between Center and Broadway, for the paving of that section of the street.

The City Council of Kankakee, Ill., has passed a resolution providing for the paving with brick of West Station St. and West Ave.

The City Council of Centralia, Ill., contemplates asking bids within a short time for the paving of approximately 14 blocks of streets. Specifications have been prepared by City Engineer Lee S. Trainor. The work will cost about $40,000.

The Board of Local Improvements of Arcola, Ill., is preparing plans for the paving of West Main and Pine Streets. The former street will extend from the west limits of the present pavement to Arcola Ave., and the latter from Adams to the end of the street.

The Board of Local Improvements of Streator, Ill., has decided to pave South Park St., from Spring St., to Center St., to a width of 24 ft., and to use concrete gutter and curb.

The Board of Local Improvements of East Moline, Ill., has adopted a resolution to pave Second Ave., from First St. to Seventh St., with asphalt. The street is to be 30 ft. wide and intersecting crossings 25 ft. The estimated cost is $36,430. The wearing surface will be a 2-in. mixture of asphaltic cement, sand and carbonate lime.

Engineer L. Claude James, of Mattoon, Ill., has started preliminary work for the pavi of the principal streets of Oakland, Ill. T following streets have been ordered pave Main St., from the extreme west end to t depot; Oak St., from Main St. to the Clov Leaf Railroad; Lincoln St., its entire lengt and Pike and Walnut Sts., from Main St. a square north.

The citizens of Beecher, Ill., have voted favor of the proposition to construct ha surface roads.

The Clerk of Douglas Township, Effingha County, Ill., has made public notice that special election will be held June 19, to vo on the proposition of borrowing $35,000 f the improvement of the roads. Effingham the county seat.

Indiana.

✣Bids will be received until 1 p. Ju 28, by Decatur and Rush Counties' Comm sioners, Greensburg, Ind., for the constru tion of a gravel road on line between sa counties. L. W. Sands, Greensburg, Ind., Auditor of Decatur County.

✣Bids will be received until Noon, Ju 22, by Board of Lake and Porter Counti Commissioners, Crown Point, Ind., for t construction of a gravel road on the line b tween the counties. C. A. Johnson is La County Auditor, Crown Point, Ind.

✣Bids will be received until 10 a. m., Ju 1, by Board of Vermillion County Comm sioners, Newport, Ind., for the grading, gra eling or macadamizing roads in Clinton, Hig land and Helt Townships. H. T. Payne County Auditor.

✣Bids will be received until 2 p. m., July by Board of Newton County Commissione Kentland, Ind., for the construction of a m cadam road in Iroquois Township. E. Bringham is County Auditor.

✣Bids will be received until July 1, Board of Jennings County Commissione Vernon, Ind., for the construction of a pi road in Vernon Township. M. W. Brogan County Auditor.

✣Bids will be received until 10 a. m., Ju 1, by Board of Clark County Commissione Jeffersonville, Ind., for the construction four roads. G. W. Stoner is County Audit

✣Bids will be received until 10 a. m., Ju 1, by Board of Tipton County Commissione Tipton, Ind., for the construction of thr gravel roads in Liberty Township. J. Tranbarger is County Auditor.

✣Bids will be received until 2 p. m., Ju 1, by Board of Dubois County Commissione Jasper, Ind., for the construction of gra roads in Patoka and Cass Townships. J. Seng is County Auditor.

✣Bids will be received until July 1, by Co missioners of Ripley County, Versailles, In for the construction of a macadam road Brown Township. J. Francis Lochard is Cou ty Auditor.

✣Bids will be received until 2 p. m., Ju 1, by Board of Blackford County, Hartfo City, Ind., for the construction of Water road, Hartford City. Road to be construct of concrete, cement combination curb a gutter and cement sidewalks. J. Cronin, J is County Auditor.

✣Bids will be received until 10 a. m., Ju 1, by Board of Martin County Commissione Shoals, Ind., for the constuction of five m cadamized roads in Perry Township. J. Morris is County Auditor.

✣Bids will be received until 10 a. m., Ju 1, by Board of Hendricks County Comm sioners, Danville, Ind., for the constructi of roads in Brown, Union and Middle Tow ships. L. W. Borders is County Auditor.

✣Bids will be received until 1 p. m., Ju 1, by Board of Martin County Commissione Shoals, Ind., for the construction of eig macadamized roads in Halbert Township a one in Center Township. J. T. Morris County Auditor.

✣Bids will be received until 10 a. m., Ju 2, by Board of Jefferson County Commissio ers, Madison, Ind., for the construction roads in Hanover Township. A. M. Taff County Auditor.

✣Bids will be received until 2 p. m., July 2, by Board of Grant County Commissioners, Marion, Ind., for the construction of six stone roads in Washington Township and one in Franklin Township. E. H. Kimball is Grant County Auditor.

✣Bids will be received until 11 a. m., July 2, by Board of Jefferson County Commissioners, Madison, Ind., for the construction of roads in Madison Township. A. M. Taff is County Auditor.

✣Bids will be received until 1 p. m., July 2, by Board of Jefferson County Commissioners, Madison, Ind., for the construction of a road in Graham Township. A. M. Taff is County Auditor.

✣Bids will be received until 1 p. m., July 2, by Board of Boone County Commissioners, Lebanon, Ind., for the construction of a gravel road. D. M. Clark is County Auditor.

✣Bids will be received until Noon, July 2, by Board of Lake County Commissioners, Crown Point, Ind., for the construction of gravel roads in Calumet and North Townships. C. A. Johnson is County Auditor.

✣Bids will be received until 2 p. m., July 2, by Board of Monroe County Commissioners, Bloomington, Ind., for the construction of a stone road in Perry Township. Horace Blakely is County Auditor.

✣Bids will be received until 10 a. m., July 2, by Board of Huntington County Commissioners, Huntington, Ind., for the construction of a highway in Huntington Township. Harold Guthrie is County Auditor.

✣Bids will be received until 10 a. m., July 2, by Board of Huntington County Commissioners, Huntington, Ind., for the construction of a stone road on line between Huntington and Lancaster and Union and Rock Creek Townships. Harold Guthrie is County Auditor.

✣Bids will be received until 2 p. m., July 2, by Board of Rush County Commissioners, Rushville, Ind., for the construction of a macadam road on line between Ripley and Posey Townships. Jesse M. Stone is County Auditor.

✣Bids will be received until 10 a. m., July 2, by Board of Porter County Commissioners, Valparaiso, Ind., for the construction of gravel roads in Morgan and Westchester Counties. C. A. Blachly is County Auditor.

✣Bids will be received until 10 a. m., July 2, by Board of Cass County Commissioners, Logansport, Ind., for the construction of a gravel road in Washington township. J. E. Wallace is County Auditor.

✣Bids will be received until 10 a. m., July 2, Board of Howard County Commissioners, Kokomo, Ind., for the construction of two gravel roads on the line between Taylor and Howard Townships. A. B. Easterling is County Auditor.

✣Bids will be received until July 3, by Board of Harrison County Commissioners, Corydon, Ind., for the construction of a gravel road in Harrison Township. William Taylor is County Auditor.

✣Bids will be received until 2 p. m., July 3, by Board of Harrison County Commissioners Corydon, Ind., for the construction of a gravel road in Heth Township. William Taylor is County Auditor.

✣Bids will be received until 11 a. m., July 3, by Board of Putnam County Commissioners, Greencastle, Ind., for the construction of macadamized roads in Greencastle, Washington and Jackson Townships. C. L. Airhart is County Auditor.

✣Bids will be received until 11 a. m., July 3, by Board of Randolph County Commissioners, Winchester, Ind., for the construction of highways in Washington, Greensfork, Nettle Creek, Stoney Creek, Wayne and Jackson Townships, eight roads in all. H. F. Wood is County Auditor.

✣Bids will be received until 10 a. m., July 8, by Board of St. Joseph County Commissioners, South Bend, Ind., for the construction of a macadamized road between Penn and Center Townships. Clarence Sedwick is County Auditor.

✣Bids will be received until 10 a. m., June 24, by Board of Public Works, Indianapolis, Ind., for the paving of alleys. The specifications include cement, asphalt, Westrumite and brick.

✣Bids will be received until 10 a. m., June 25, by Board of Public Works, South Bend, Ind., for the construction of macadam pavement on Wakewa Ave., from Michigan St. to Lafayette St. A. I. Perley is Clerk.

✣Bids will be received until 11 a. m., July 8, by Commissioners of Benton and Newton County Commissioners, at Fowler, Ind., for the construction of the Matthew Moran free stone road, 7,900 ft. long and estimated to cost $5,150. Samuel Shipman, Fowler, Ind., is Auditor of Benton County.

✣Bids will be received until noon, July 2, by Board of Dearborn County Commissioners, Lawrenceburg, Ind., for the construction of the G. W. Sawdon et al. road in Washington Township, including grading, draining and paving the roadway with crushed rock; also for the Frank Licking, et al. road in Caesar Creek Township, including grading, draining and paving with crushed stone wearing surface. William S. Fagaly is County Auditor.

✣Bids will be received until 10 a. m., July 2, by Commissioners of Montgomery County, Crawfordsville, Ind., for the construction of the following roads: J. W. LaFollette, et al. road, Franklin Township; Romulus Boyd et al. road, in Brown Township; Benjamin Easly, et al. road, in Union Township; Daniel Remley et al. road, in Union Township; O. E. Flanigan, et al. road, in Union Township; Alvah Baker road, in Clark Township; D. L. Murphy, et al. road, in Coal Creek Township. B. B. Engle is County Auditor.

⊙The County Commissioners at Columbus, Ind., have awarded the contract for the construction of the Brockman road, at the eastern terminus of Seventh St., as well as the Brockman concrete bridge over Haw Creek to J. P. Sohn, of Columbus, at $12,500. The contract for the Morrison road in Ohio Township has been awarded to Andrew Morrison, at $3,050. Fivecoats & Clark will improve the Shroyer road in Jackson Township for $4,240.

⊙The Board of Public Works of Logansport, Ind., has awarded the contract for the paving of Burlington Ave. and Fifth St., to G. H. Palmer & Co., at $34,212 and $6,696, respectively.

⊙The Grant County Commissioners, Marion, Ind., have awarded the following contracts for road work, for which bids were opened June 4: Hudson Road, Pleasant Township—Knotts & McTurnan, $10,347; Reed Road, Franklin Township—William Yates, $1,838; Dubois Road, Center Township—John W. Slater, $10,400; Emerick Road, Center Township—John W. Slater, $16,180; Whitlock Road, Richland Township—Knotts & McTurnan, $7,403, and Pancoast Road, Jefferson Township—Miles & Shaffer, $13,440.

⊙The Commissioners' Court of Fountain County, Covington, Ind., has awarded the following contracts for road work: John D. Trott Highway in Shawnee Township—E. E. McKee, $9,760; James Furr Highway, on the line between Millcreek and Cain Townships—S. S. Van Martin, $8,635; Manford Songer Highway in Van Buren Township—F. A. Gaugeby, $7,800; Carwile Road, leading south from Covington to the Wabash Township line—contract not awarded; estimated to cost $22,000 to $25,000.

Plans and specifications have been prepared by City Engineer Ben E. Wise, of Goshen, Ind., for the paving of alleys with concrete. The specifications include cement, asphalt, Westrumite and brick.

The City Council of Gary, Ind., has given the County Commissioners permission to build five new roads within the city limits.

Iowa.

✣Bids will be received until 6 p. m., June 20, by City Clerk, Albia, Ia., for the construction of 10,800 sq. yds. of brick block pavement and 8,000 yds. of curb and gutter. Hall & Adams, Centerville, Ia., are Engineers.

✣Bids will be received until about July 1, [illegible] Glenwood, Ia., for the resurfacing of about 6,000 sq. yds. of pavement with vitrified brick and the construction of approximately 3,500 lin. ft. of combined concrete curb and gutter. Plans and specifications will be on file at the office of H. H. Dean, City Engineer, or at the office of the City Clerk.

⊙The Des Moines Asphalt Paving Co. has been awarded the contract by the City Council of Des Moines, Ia., for the paving of Woodland Ave., from 31st to 33rd St., and West 44th St., from Chamberlain Ave., to Kinman Blvd., with asphalt. The company's bid for the first job was $1.628 per sq. ft., and $1.65 for 44th St. The Lytton-Reinking Construction Co. secured the contract for the [illegible] of the Country Club Blvd. and Schriver Ave., at $.32 a lin. ft.

⊙Following bids were received at Greenfield, Ia., June 11: Iowa Engineering Co., Clinton, Ia., Engineers, for constructing pavement (1) standing for bid of D. W. Wright Co., Bedford, Ia.; (2) J. S. McLaughlin & Sons, Red Oak, Ia., and (3) Beebe Bros., Omaha, Nebr:

Brick Pavement

	(2)
Excess grading, 37,000 cu. yds..	$0.[illegible]
Combined curb and gutter, 77,000 lin. ft	[illegible]
Curb, 400 lin. ft	.40
Paving, 12,860 sq. yds	2.00
Castings, 110,000 lbs	.03
False curb, 700 ft...	.15
Totals	$34,88[illegible]

Concrete Paving.

	(1)*	(2)
Excess grading, 37,000 cu. yds	$0.32	$0.3[illegible]
Curb, 77,000 lin. ft.	.25	.39
Paving, 14,860 sq. yds.	1.24	1.[illegible]
Castings, 110,000 lbs.	.02¾	.03
Gutter curb, 700 lin. ft.	.16	.15
Totals	$21,722	$26,6[illegible]

*Awarded contract

Kansas.

✣Bids will be received until June 22, [illegible] L. Miller, City Clerk, Ellinwood, Kan., [illegible] the oiling of Arndt St. between Topeka [illegible] Colorado Ave., and 100 ft. on Ellinwood east from Arndt St.

Kentucky.

The City Commissioners of Newport, [illegible] have decided to improve the following stre[illegible]: Linden Ave., from Fourth to Ohio Al[illegible]; Fourth from Monmouth to Overton; Ove[illegible] St. from Third to Sixth; Third from Col[illegible]bia to Central; Central Ave., from Third [illegible] Fifth; Fifth St., from Columbia to Cent[illegible]; Brighton from Fourth to Twelfth; Tenth [illegible], from Monmouth to Columbia. All improvements will be made with vitrified brick.

Louisiana.

Police Jury of Jefferson Parish, Gre[illegible], La., has created two road districts, and [illegible]thority was given for the calling of an e[illegible]tion July 16, at which time property hol[illegible] in the Fourth and Fifth Wards, from Har[illegible] to Waggaman, will vote 5 mills tax for 40 [illegible] to building modern roadways, covering [illegible]tance of 20 miles. It is estimated that it [illegible] require about $125,000 to do the work. [illegible] bond issue, guaranteed by the taxes, will [illegible] gotten out, and the work will commence [illegible] soon as possible.

Maine.

✣Bids will be received until 2 p. m., J[illegible] 24, by P. L. Hardison, State Commissioner [illegible] Highways, Augusta, Me., for building a s[illegible]tion of State Road, about 13,300 ft. in leng[illegible] on the designated trunk line in the town [illegible] Wells. Alternate bids will be received [illegible] the construction of concrete, bituminous m[illegible]cadam, water-bound macadam with a surf[illegible] treatment of bituminous material and grav[illegible]. Specifications and blank forms of propo[illegible] will be furnished upon application and a f[illegible] set of plans may be seen at the office of t[illegible] State Highway Commissioner, Augusta, M[illegible] and at the Mousam House, Kennebunk, Me.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Maryland.

ard of Awards at Baltimore [illegible] ied the contract for [illegible] way from Bath to Baltimore St., to the l Andrews Paving Co. at $7[illegible] e bid. The next low bidder [illegible] ngham Paving & Construction Co. [illegible] delphia, which bid $84,950. The con- alls for Belgian Block paving.

ls have been received by the Street Com- on of Easton, Md., for the construction ew permanent streets of vitrified brick, lithic, asphalt, bituminous macadam or surfacing. Between three and four miles be paved at a cost of [illegible] $90,000. Firms submitting bids on the are as follows: Elder Paving & Con- tion Co., and the Whiting, Turner Con- tion Co., of Baltimore; J. F. Shanley g & Construction Co., and Fields, Barber nderwood Paving & Construction Co., of delphia; Kelley & McFeely Construction and Eugene F. Vega Co., of Camden, N. Jassam Co., of Worcester, Mass., and the Engineering & Construction Co., of [illegible] N. J. [illegible] is Engineer.

Massachusetts.

e State Highway Commission, Arthur W. , Chief Engineer, Boston, Mass., has de- ed the allotments of new roads [illegible] ructed in Western Massachusetts this as follows: Berkshire County, Cheshire— [illegible] of State Highway and extending north- ward. Adams-Lanesboro—[illegible] e southerly end of the 1911 section of Highway and extending southerly to the ield line. Lee—From the easterly end of 909 section of State Highway southeast- Sheffield—Beginning at the Connecticut and extending northerly along the Under tain Road. Franklin County, Northfield, Beginning at the southerly end of the ng state Highway in Northfield and ex- ng southerly to River St., thence south- rly along River St., in the towns of field and Gill. Northfield—Beginning northerly part of town and extending to New Hampshire line. Hampden County, Springfield—Beginning at the end of nt State Highway and extending to West- line. Hampshire County, Granby—Be- g at end of the 1911 section of State way and extending easterly. Northamp- From the Hatfield line southerly to junc- of road to Hatfield Center (Laurel Park); also from Easthampton line northerly 7,300 ft. (Mt. Tom Road). South Had- Beginning at the end of 1909 section of Highway and extending northerly about miles. Worcester County, Ashburnham— ning at the end of the 1911 section of Highway and extending southeasterly kfield—Beginning near the easterly end e 1904 layout at East Brookfield and ex- ng northwesterly to North Brookfield Charlton—To fill gap between two sec- of State Highway, about one mile. Ster- Beginning at the end of the 1898 sec- of State Highway and extending to the Boylston line. Webster—Beginning at outheasterly end of the 1908 section of Highway and extending to Connecti- ne. Uxbridge—Beginning at the North- line and extending southerly about one- mile.

Michigan.

ne Board of Public Works of Bay City, o, has awarded the contract for the pav- f Boutell Pl., to Theodore Gafney, at

⊙ne Asphalt Paving Block Co., of Toledo, s been awarded the contract by the City il of Milan, Mich., for the laying of lt block paving with stone curb, at ap- nately $21,000.

Flowing bids were received by the Board blic Works, of Saginaw, Mich: Asphalt N. Sager, $1.49; Cleveland Trinidad g Co., $1.55; S. S. Saxton, $1.33; Car- & Anderson, $1.48. One block asphalt [illegible] 2-in. blocks and $1.99 on 2½-in. blocks. Brick [illegible] $1.33 [illegible] $1.47.

Minnesota.

✣Bids will be received until 10 a. m., June 22 by Supervisors of Bird Island Township, Bird Island, Minn., for grading road between [illegible]

⊙The Village Council of Hibbing, Minn., has awarded the contract for the paving of Second and Third Aves. and Pine, Center and Cedar Sts., with 3½ in. wood blocks, to Coons [illegible]

Mississippi.

[illegible] Miss., in session at Jackson, passed an order declaring its purpose to float a bond in the [illegible] roads construction work in the First and Fifth District.

Missouri.

The voters of the proposed Lamonte Eight-mile Road District, Pettis County, Mo., have voted in favor of the improvement and bonds will be issued to build rock roads, one of which will come west to the Johnson County line as a continuation of the Sedalia Road.

Plans for a roadway 40 ft. wide from Holmes St. to McGee, south of the Belt Line tracks have been submitted to the Board of Public Works of Kansas City, Mo., by City Engineer L. R. Ash. The estimated cost is $15,000.

New York.

The H. P. Burgard Co., of Buffalo, N. Y., at $51,526, submitted the lowest bid to the City Council of Lockport, N. Y., for the paving of Locust St., with asphalt and brick. The unit price is $2.20 per sq. yd. Other bidders were: Barber Asphalt Co., $51,932, and the Union Paving Co., $58,351.

The City Council of Dunkirk, N. Y., has rejected all bids for paving upper Deer St., and decided to do the work itself. Concrete paving will be laid.

Ohio.

✣Bids will be received until noon, June 28, by Board of Hamilton County Commissioners, Cincinnati, O., for the improvement of Cleves Road from Cooper Ave. to Stone Bridge Hollow in Miami Township. A bond for $1,000 must be filed with each bid. Albert Reinhardt is Clerk.

✣Bids will be received until noon, July 12, by Board of Hamilton County Commissioners, Albert Reinhardt, Clerk, Cincinnati, O., for the oiling, under Specifications No. 358, of Cleves and Miamitown Road from Cleves and Valley Junction Road to Harrison Pike at Miamitown, Whitewater Township. A bond for $500 must be filed with each bid.

✣Bids will be received at the office of the Commissioners of Washington County, at Marietta, Ohio, until 1 p. m., June 25, 1912, for grading and paving with a bituminated concrete, the New Matamora Road. State Highway "E" pet. No. 464 in Grandview Township, said County. Length, 5,280 ft., or 1 mile. Width of pavement, 16 ft. Estimated cost of construction, $12,209. Alternative bids will also be considered for grading and paving with brick for medium traffic the above road. Estimated cost of construction, $16,727. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, Sept. 15, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✣Bids will be received at the office of the Commissioners of Mahoning County, at Youngstown, O., until noon, June 26, for grading and paving with a waterbound macadam Section No. 2 Ellsworth Center Easterly Roa State Highway "G" pet. No. 341 in Ellswort Township, said County. Length, 6,802.5 ft or 1.29 mile. Width of pavement, 14 ft. Es timated cost of construction, $12,606. A draf or certified check for $300 shall be deposite with each bid. The successful bidder will b required to give bond for an amount equal t the contract price. Date set for completion Sept. 15, 1912. Plans and specifications are o file in the office of the County Commission ers and the State Highway Department. Th State Highway Commissioner reserves th right to reject any and all bids. James F Marker, Columbus, O., is State Highway Com missioner.

✣Bids will be received at the office of th Commissioners of Richland County, at Man field, O., until noon, June 25, 1912, for grac ing and paving with a waterbound macada Sec. No 2 Leesville Road State Highway "I pet. No. 387 in Sandusky Township, sa County. Length, 10,800 ft., or 2.04 miles. Wid of pavement, 12 ft. Estimated cost of co struction, $12,419. A draft or certified chec for $300 shall be deposited with each bi The successful bidder will be required to gi bond for an amount equal to the contract pric Date set for completion, Sept. 15, 1912. Pla and specifications are on file in the office the County Commissioners and the State Hig way Department. The State Highway Co missioner reserves the right to reject any a all bids. James R. Marker, Columbus, O., State Highway Commissioner.

✣Bids will be received at the office of t Commissioner of Cuyahoga County, at Clev land, O., until noon, June 27, 1912, for gradi and paving with brick for medium traffic t No. 2 Fisher Road State Highway "C" p No. 373 in Bedford Township, said Coun Length, 2,759 ft., or 0.52 mile. Width pavement, 14 ft. Estimated cost of constru tion, $14,300. A draft or certified check f $300 shall be deposited with each bid. T successful bidder will be required to give bo for an amount equal to the contract pri Date set for completion, Sept. 15, 1912. Pla and specifications are on file in the office the County Commissioners and the State Hig way Department. The State Highway Co missioner reserves the right to reject any a all bids. James R. Marker, Columbus, O., State Highway Commissioner.

✣Bids will be received at the office of t Commissioners of Lorain County, at Ely O., until 10 a. m., June 28, 1912, for gradi and paving with a bituminous treated wat bound macadam the Brownhelm Amherst Ro State Highway "B" pet. No. 437 in Brow helm and Amherst Townships, said Cour Length, 4,750 ft., or 0.90 mile. Width of pa ment, 12 ft. Estimated cost of constructi $6,195. A draft or certified check for $ shall be deposited with each bid. The succe ful bidder will be required to give bond an amount equal to the contract price. D set for completion, Sept. 15, 1912. Plans a specifications are on file in the office of County Commissioners and the State Highv Department. The State Highway Comm sioner reserves the right to reject any and bids. James R. Marker, Columbus, O., is St Highway Commissioner.

✣Bids will be received at the office of Commissioners of Mahoning County, Youngstown, O., until noon, June 26, 1 for grading and paving with brick for medi traffic the Youngstown-Struthers Road St Highway "H" pet. No. 493 in Coitsville Tov ship, said County. Length, 6,177.2 ft., or mile. Width of pavement, 21 and 23 ft. E mated cost of construction, $26,377. A dr or certified check for $300 shall be depos with each bid. The successful bidder will required to give bond for an amount equa the contract price. Date set for complet Sept. 15, 1912. Plans and specifications on file in the office of the County Comm sioners and the State Highway Departm The State Highway Commissioner reser the right to reject any and all bids. Ja R. Marker, Columbus, O., is State High Commissioner.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

The Trustees of Norwalk and Bronson Townships, Huron County, O., have received the following bids for road improvements: Old State road, beginning at the end of the [illegible] extending south to the center of Bronson, a distance of 7,200 ft., Modern Construction Co., Fremont, macadam, $9,099; concrete, $9,499; Horn & Miller, Bellevue, macadam, $8,484; L. P. Battefeld, Bucyrus, macadam, $9,900; C. F. Grinnell, Norwalk, macadam, $8,411. Fairfield road, from town line south to Mead bridge, Modern Construction Co., macadam, $2,700; concrete, $2,997.65. Fairfield road from brick school house to south line of Norwalk Township, a distance of 640 ft., Modern Construction Co., concrete, $608. Townsend road from east end of stone road to township line, distance of 1¼ miles, L. P. Battefeld, concrete, $5,175; Modern Construction Co., macadam, $3,645; concrete, $4,770.

The City Council of Carey, O., has passed a resolution providing for the paving of Vance St. Consulting Engineers Smith & Boulay of Toledo, O., have been retained to prepare plans.

Oregon.

⊙The City Council of Portland, Ore., has awarded the contract for the paving of East Morrison St., between East Seventh and East Ninth, to the Barber Asphalt Paving Co., at $7,043.

⊙The Warren Construction Co. has been awarded the contract by the City Council of Tillamook, Ore., for the construction of 3⅓ miles of paving in the business district to a width of 36 ft., and in the residence section to a width of 24 ft. Bitulithic will be used. The contract price is $137,857.

The City Council of Roseburg, Ore., has adopted the plans and specifications for the paving of Pine St., between Floed and Burk Sts., with asphalt, at an estimated cost of $9,279.

The citizens of Brownsville, Ore., at a recent election voted in favor of the construction of hard surface pavement. About 1 mile of street paving will be laid.

The City of Albany, Ore., is asking bids for the paving of First St., from Montgomery to Main Sts. The Council also has under consideration the paving of the following streets: Third St., from Baker to Railroad Sts.; Sixth St., from Washington to Baker Sts., and Water St., from Lafayette St. to the bridge across a gulch between Sherman and Oak Sts.

Pennsylvania.

✣Bids will be received until 8 p. m., June 21, by Borough Council, Dormont, Pa., for the grading, curbing and paving of Glenmore Ave., from Potomac Ave. to Hillsdale Ave.; La Salle Ave., from Broadway to Glenmore Ave., and Northwest Broadway, from Potomac Ave. to South Ave. Approximate quantities are 13,000 cu. yds. of grading, 6,500 lin. ft. concrete curb and gutter and 7,700 sq. yds. of paving. A certified check for $200, payable to the Borough of Dormont, must accompany each proposal. All proposals must be sealed and addressed to Emil E. Reiss, Clerk of Council, Dormont, Pa. Plans and specifications may be seen and bidding blanks and all necessary information may be had at the office of the Borough Engineers, Douglass & McKnight, 1709 Union Bank Bldg., Pittsburgh, Pa. H. M. Stilley is Chairman of Street Committee.

⊙The McGovern Construction Co. has been awarded the contract by the Borough Council of Punxsutawney, Pa., for the paving of North Penn St. with brick, stone bedding at about $4,086.

⊙James Topley & Son of McKeesport, Pa., have been awarded the contract by the Borough Council of Brackenridge, Pa., for the paving of Cherry St. and Brackenridge Ave. at $6,708.

The Borough Council of Catawissa, Pa., has decided that so far as it is concerned Main St. in that town shall be paved from curb to curb by brick, from the river bridge to Fourth St., and from that point Mill St. shall be paved by amesite at a width of 18 ft. to the Borough line at Knittle's. The roads will be improved by state aid. Civil Engineer R. A. McCachran of the State Highway Department has estimated the cost at $41,000 for brick and $33,000 for amesite.

The Central Construction & Supply Co., of Harrisburg, Pa., has submitted the lowest bid to the Highway Commission of that city for the paving and curbing of 18 streets, as follows: Boas St., 15th to 18th, asphalt, $1.89; curbing, granite, $0.85; granolithic, $0.40; steel-bound, $0.50. Seventeenth St., Berryhill to the Philadelphia & Reading R. R., asphalt, $1.83; curbing, granite, $0.85; steel-bound, $0.50. Forster, 17th to 18th, asphalt, $1.83; curbing, granite, $0.85. Forster, 15th to 16th, asphalt, $1.89; curbing, granite, $0.85. Berryhill, 18th to 19th, asphalt, $1.85; curbing, granite, $0.50. Albert alley, 15th to 16th, asphalt, $1.80. Holly, 17th to 18th, asphalt, $1.83; curbing, granite, $0.85; steel-bound, $0.50. Front, Maclay to Division, asphalt, $1.89; curbing, granite, $0.85; steel-bound, $0.50. Elm, 16th to Juniper, asphalt, $1.80; curbing, granite, $0.80; steel-bound, $0.60. Apricot, Juniper to 10-foot alley, asphalt, $1.80; curbing, granite, $0.80; steel-bound, $0.60. Liberty, 15th to 16th, asphalt, $1.94. Miller, 13th to 15th, asphalt, $1.83; curbing, granite, $0.85; steel-bound, $0.50. Miller, 17th to 18th, asphalt, $1.85; curbing, granite, $0.85; steel-bound, $0.50. Howard, Forrest to Woodbine, asphalt, $1.74; curbing, granite, $0.85; steel-bound, $0.50. Peffer, Front to Second, asphalt, $1.79; curbing, granite, $0.85; steel-bound, $0.50. Ella alley, 14th to 17th, $1.95. No curbing. Brensinger, Woodbine to Wharton, asphalt, $1.83. No curbing.

Following low bids were received by the Highwav Department of City Councils, Easton, Pa., for several street paving jobs: Muccli & Miller, a 225-ft. granolithic sidewalk on the south side of Canal St., between Davis and Fell Sts., $134; American Sewer Pipe Co., New Cumberland, W. Va., for furnishing 389,000 vitrified paving blocks and 40,700 hillside blocks, $23.45 per M and $24 per M respectively; Frank McInerney, for repaving Northampton St., between Centre Square and Front St., with vitrified paving blocks, $0.304 per sq. yd.; Frank McInerney, for repaving Third St., from Centre Square to the Lehigh bridge, with vitrified paving block, $0.304 per sq. yd.; Miles-Tighe Contracting Co., paving Bank St., from Washington to Dock Sts.; Dock St., from Fourth to Bank Sts.; Fourth St., from Washington to Dock Sts., with vitrified paving block, on a 6-in. concrete base, $1.42 per sq. yd.; Frank McInerney, paving Dock St., from Fourth St. westwardly as far as the old brick will reach, with old vitrified paving blocks, from Northampton and South Third Sts., on a 6-in. concrete base, $1.49 per sq. yd.; E. J. Kerrick, resurfacing the South Delaware River road, with a bituminous macadam, from the Lehigh bridge to the city line, $0.80 per sq. yd.

R. C. Ruthven at $1.85 per sq. yd., submitted the lowest bid to the Director of Public Service of Scranton, Pa., for the paving of Price St., from Main Ave. to Hyde Park Ave., and Hyde Park Ave., from Lafayette St. to Swetland St. Mr. Ruthven also submitted the low bid for the widening and paving of Swetland St., from Main Ave. to Rebecca Ave.

Bids will be asked shortly by the State Highway Department, E. M. Bigelow, Commissioner, Harrisburg, Pa., for Route 131, 3½ miles west of Media, and Route 74, 6 miles in length between Mercer and Sharon.

Counils Committee on Surveys of the city of Philadelphia, Pa., has passed favorably on the following main sewer projects, and there will be no further delay in authorizing the Public Works Department to proceed with the work: Adams Ave., Wyoming Ave. to Ramona St., $25,000; Cobb's Creek Park, intercepting sewer, Baltimore Ave. to Spruce St., $40,000; Cobb's Creek Park, intercepting sewer, north of Market St. to 69th St., $35,000; Cottman St., State Road to Tulip St.; Tulip St., Cottman to Bleigh; Bleigh St., Tulip St. to Torresdale Ave., $25,000; 57th St., Lebanon Ave., 180 ft. and from Susquehanna Ave. south, $10,000; Frankford intercepting sewer, Valley St., Margaret to Harrison, $12,000; Gunner's Run relief in [illegible]iana St., from Mutter St. to Fourth St., $[illegible]000; Hartwell Lane, Huron St. to St. M[illegible]tin's Lane, $20,000; Lincoln Ave., Navajo [illegible] to Hartwell Lane, $15,000; Rittenhouse St[illegible] Wissahickon Ave. to Cross St., $20,000; [illegible] Rock Run, Fisher Ave., 228 ft., $3,000; 70[illegible] St., Cobb's Creek to Kingsessing Ave.; Ki[illegible]sessing Ave., 70th St. to 69th St.; 69th St., [illegible]ingsessing Ave. to Upland, $15,000; Shu[illegible] St., Fifth St., to Broad St., $40,000; Wissa[illegible]kon high level cutoff, Stokley St., from Craw[illegible]rd to Bowman St., $25,000.

Tennessee.

⊙The City Commission of Chatta[illegible]oga, Tenn., has awarded the contract for th[illegible] paving of Fort St., a distance of two bloc[illegible] between 11th and 13th Sts., to the West[illegible] Construction Co. Specifications call for a [illegible]rick pavement.

Texas.

The Commissioners' Court, Waxa[illegible]hi[illegible] Tex., has adopted a proposition to jo[illegible] th[illegible] city in paving the public square. The [illegible] will defray about one-third of the cost [illegible] ting down the paving.

Virginia.

⊙The City Council of Richmond, V[illegible] awarded a contract to I. J. Smith & [illegible] that city, for the paving of Broad St [illegible] asphalt block at $2.54 per sq. yd. The [illegible] ment will be laid on a 6-in. concrete bas[illegible] which the city will furnish the cement [illegible] appropriation of $50,000 is available f[illegible] work.

Washington.

⊙The City Council of Tacoma, Wash.[illegible] the County Commissioners have award[illegible] contract for paving the flume line boul[illegible] through South Tacoma to the Washi[illegible] Paving Co., of Tacoma, at $88,447. A[illegible] will be used. Other bids received were: [illegible]ington Paving Co., granitoid (1) $88,78[illegible] $90,173, (3) $96,783; El Oso, $87,643; [illegible] Jones, $108,591; Keasal Construction Co., [illegible]694; Joseph Warter, Sr., $92,880, (bituli[illegible] $101,900; Warren Construction Co., $1[illegible] (bitulithic); W. J. Murphy, $88,797; J[illegible] Hill, $102,072 (bitulithic concrete) and $[illegible]816 (sheet asphalt); A. H. Robinson, $99[illegible] $93,038 (asphalt and bituminous).

⊙Commissioner Owen Woods of Tac[illegible]a, Wash., has let the contract for grading [illegible] 16th St. to Erich Mattson at $7,967, and a [illegible]tract for paving South 23rd St., from [illegible] to Jefferson St., with stone, to the Keasal [illegible]struction Co., at $11,183.

⊙C. A. Roberts has been awarded the [illegible]tract by the city of Bellingham, Wash., fo[illegible] paving of Bay St., at $5,271.

The City Council of Tacoma, Wash., is [illegible]ing bids on the paving of Delin St., G, [illegible] and M to 48th St. City Engineer W. C. [illegible]leigh has estimated the cost of the job at [illegible]000.

Wisconsin.

✣Bids will be received until 2 p. m., Jun[illegible], by Board of Public Works, Oshkosh, Wis., [illegible] furnishing the city with a number one [illegible] Perfection Steel Reversible Road Grader [illegible] road grader equally as good. R. A. Holli[illegible] is Chairman of the Board.

✣Bids will be received until 2 p. m., June [illegible], by Board of Public Works, Oshkosh, Wis., [illegible] furnishing all material and doing all the w[illegible] of grading and constructing a macadam r[illegible]way with combined cement curb and gutter [illegible] Powers Ave., between Irving St. and Ster[illegible] St., according to plans and specifications on [illegible] at the office of city clerk. R. A. Holliste[illegible] Chairman of the Board.

✣Bids will be received until 10:30 a. [illegible] June 20, by J. C. Shampnor, County High[illegible] Commissioner, at the Hotel National, Mo[illegible] Horeb, Wis., for grading and cultivating [illegible] state air roads in the town of Springdale [illegible] building one bridge. Plans and specificati[illegible] are on file at the office of the County High[illegible] Commissioner, Madison, Wis., and at the of[illegible] of H. F. Thompson, Chairman of the to[illegible] of Springdale.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

he City Council of [illegible] led the contract for the [illegible] road roller for use [illegible]

[illegible] The City Commission of Superior, Wis., has [illegible]

Becker Ave., from West First to West Fi St., and Nettleton Ave., from West Fifth [illegible]

BRIDGES—STEEL AND CONCRETE

Arkansas.

is reported that the St. Louis & San -cisco Ry. and the Kansas City Southern have under consideration the construction new steel bridge over the Arkansas River, een Fort Smith, Ark., and Van Buren. official information has been obtained as [illegible] the work.

California.

[illegible] Committee [illegible] the B[illegible] Peter Chairman, has [illegible] al election to vote on the question of [illegible] $ [illegible] bonds for the [illegible] ncrete bridges on East Main St. and Mis- Road, Alhambra, Cal.

e City Council of Stockton, Cal., has ed plans and specifications for driving in the Mormon Channel, near the Lin- St. bridge, to protect the structure from

mer Hamlin, City Engineer, Los Angeles, has recommended the underpinning of liso St. bridge some time this summer. cost of the improvements is estimated at , of which the Pacific Electric will pay [illegible]

Colorado.

ids will be received until noon June 22, by l of El Paso County Commissioners, Colo- Springs, Colo., for the construction of a 50- forced concrete bridge on the State High- No. 4, between Colorado Springs and o, near Wigwam Station. J. P. Madden [illegible] of the Board.

Illinois.

ids will be received up to 1 p. m., June 12, at the Court House, Mt. Carroll, for ng one new reinforced concrete bridge uilding one new reinforced concrete abut- for a second bridge in Freedom Town- Carroll County, A. W. Zillhart, Town , R. R. No. 5, Mt. Carroll, Ill. McLaugh- idge—Span, 20 ft.; roadway, 20 ft. Es- d amount of concrete, about 70 cu. yds.; rcing steel, about 7,644 lbs. Gravel in bed, at bridge site, free, but is deficient d, which will have to be shipped in. No t bridge. Rock foundation about 1 ft. stream bed. Low water flow, dry; high about 5½ ft. deep. Dyslin Bridge— new abutment required and old super- ure, consisting of beams and channels removed and replaced about 30 ft. Es- d amount of concrete, 54.3 cu. yds.; re- ing steel, 3,320 lbs. Excavation in gravel, carried about 4 ft. below stream bed. l may be obtained free from the creek bout 300 ft. from the bridge site, but is nt in sand, which must be shipped in. water flow, about 1 ft. deep and 10 ft. high water, about 12 ft. deep. Work completed on or before Sept. 1, 1912. detailed information may be had by an nation of the plans and specifications red by the Illinois Highway Commission, may be seen at the Town Clerk's office, y be obtained upon application in writ- rom the Illinois Highway Commission, gfield, Ill.

ids will be received up to 3 p. m., June 12, at the Court House, Mt. Carroll, for onstruction of one reinforced concrete to be built in York Township, Carroll y. N. D. Millard, Town Clerk, Thomp- Ill. Seim Bridge—Span, 40 ft.; roadway, Total estimated concrete, 126.2 cu. yds.; rcing steel, 16,350 lbs. Nearest railroad , Thompson, about 5 miles. Bank gravel e obtained about 1 mile from bridge t about 40 cts. per cu. yd.; quality not . Present bridge, 30 ft. span, wood. Low water flow, dry; high water, about 8 ft. [illegible] Work to be completed on or before Sept. 1, 1912. More [illegible] amination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office, or may be obtained upon application in writing from the Illinois Highway Commission, Springfield, Ill.

✣Bids will be received up to 1 p. m., June 22, 1912, at the Court Houes, Mt. Carroll, Ill., for the construction of one new reinforced concrete abutment and a plain concrete retaining wall, at the site of the Durham bridge, to be built in Woodland Township, Carroll County. Henry Toepfer, Town Clerk, R. R. No. 3, Mt. Carroll, Ill. The work consists of building one reinforced concrete abutment and one plain concrete retaining wall; removing north approach I beams to south end of bridge and flooring same with plank. Estimated amount of concrete in structure, 49.5 cu. yds.; reinforcing steel, about 2,155 lbs. Depth of low water flow, 1 ft.; excavation in clay. Gravel is available at creek for 50 cts. per cu. yd., about 1½ miles from the bridge site. Work to be completed on or before Sept. 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office, or may be obtained upon application in writing from the Illinois Highway Commission, Springfield, Ill.

✣Bids will be received up to 2 p. m., June 20, 1912, at Milledgeville, Ill., for the construction of four reinforced concrete bridges, to be built in Wysox Township, Carroll County. J. E. Miller, Town Clerk, Milledgeville, Ill.

Name	[illegible]	[illegible]	[illegible]		Low water	Excavation
F. Bellows	[illegible]	[illegible]	[illegible]	Steel	Dry	Clay
M. A. Hanna..	40 ft.	1¼	29 ft.	Steel	Dry	Clay
[illegible]	[illegible]	[illegible]	[illegible]	Wood	Dry	Sand
[illegible]	[illegible]	[illegible]	[illegible]	Steel	Dry	Clay

Piles will probably be required. Gravel at pit, 35 cts. per cu. yd.; no definite information as to quality. Total estimated amount of concrete in the four bridges, 427.3 cu. yds.; reinforcing steel, 61,165 lbs. Work to be completed on or before Sept. 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office, or mav be obtained upon application in writing from the Illinois Highway Commission, Springfield, Ill.

✣Bids wil be received up to 1 p. m., June 22, 1912, at the Court House, Mt. Carroll, Ill., for the construction of one reinforced concrete bridge and placing creosoted timber floors on three bridges in Salem Township, Carroll County. S. A. Keim, Town Clerk, Mt. Carroll, Ill. Beattie Bridge—Span, 12 ft.; roadway, 20 ft.; height, about 10 ft. 6 ins.; wings, about 12 ft. long. Old bridge, wood; span, 10½ ft.; roadway, 16 ft., to be removed. Estimated amount of concrete, 48.2 cu. yds.; reinforcing steel, 3,732 lbs. Low water flow, dry. Excavation in clay. Gravel is available at a bank, 3 miles from the bridge, for 50 cts. per cu. yd.; quality of gravel unknown. Dame, Sprecher and Hawk Bridges—The work consists in building about 195 sq. yds. of creosoted timber floors, including joists and risers, and placing a ¾-in. bituminous wearing surface on same. Gravel available at a bank from 1 to 2 miles from sites, for 40 cts. per cu. yd. All work to be completed on or before Aug. 15, 1912. More detailed information may be had by an examination of the plans and specificatio prepared by the Illinois Highway Commissi which may be seen at the Town Clerk's offi or may be obtained upon application in writ from the Illinois Highway Commissi Springfield, Ill.

⊙The contract for the construction of a inforced concrete arch bridge over Minneha Creek in Oakwood Township has been awa ed to the Lafayette Bridge Co., Lafayette, I at $2,743. The work will include a fill. J. Van Allen, Collison, Ill., is Chairman of Bridge Commission.

⊙J. W. Russell, Walnut, Ill., has been awa ed the contract for the construction of Black and Sandberg bridges in Walnut Tow ship, Bureau County, at $725. Bids w opened June 4.

All bids received June 8, by William Byrns, Town Clerk, Grafton, Ill., for the co struction of the Williams Hollow bridge, w rejected.

⊙The contract for the removal of the bridge and constructing a new reinforced co crete bridge at Wood St. Hillsboro, Ill., been let to Driscoll McCalman Co., Decat Ill., at $2,828. The structure will have a ft. span and 24-ft. roadway. Bids were open by G. H. Longwell, City Clerk, June 10.

Advices from Freeport, Ill., state that has been recommended that a new bridge constructed to replace the present Cedarv structure. The cost of such a bridge is es mated at $30,000 or $35,000. Charles Hefn is City Engineer.

A resolution has been introduced into City Council of Peoria, Ill., providing t the railroads be instructed to erect a viad over the track at the lower end of So Adams St. Among the railroads interested the Chicago & Northwestern, the Chica Burlington & Quincy and the M. & St. L.

⊙The contract for the construction of a inforced concrete bridge over the Spring Cre on Ohio St., Joliet, Ill., has been award to Newkirk & Powers Construction Co., Joli Ill., at $4,495. Other bids for the work w as follows: Driscoll-McCallum Co., Decat Ill., $5,390; Miller-Hey Construction C Waterloo, Ia., $5,968; Joliet Bridge & Iron C Joliet, Ill. (for iron bridge), $3,378. Wo has already been started.

Following is the lowest bid, submitted the Great Lakes Dredge and Dock Co., C cago, Ill., to L. E. McGann, Commissioner Public Works, Chicago, Ill., for removing a disposing of the center pier, protection, ab ments and approaches between the oppos dock lines, pulling and removing foundati piles, etc., 1,995, dredging, including remo of submerged timbers, riprap masonry, e 29.9 cts. per cu. yd., total $7,078.

Indiana.

✣Bids will be received until 11 a. m., Ju 29, by Board of Putnam County Commissio ers, Greencastle, Ind., for the construction two bridges in Washington Township. C. Airhart is County Auditor.

⊙The Board of County Commissione Newcastle, Ind., has awarded the contracts f the construction of bridges to the Burk Co struction Co., Newcastle, Ind., as follow Bridge south of Dunkard home near Hon Creek, $860; bridge near the M. A. Reddi farm, $875; concrete arch, east of Kenna $700; culvert near pumping station in Ha rison Township, $400; bridge near McVei farm east of Newcastle, $2,590; culvert ne Messick, $200; bridge near Crouse farm, w of Knightstown, $2,600.

⊙The Board of County Commissioners, S livan, Ind., has awarded the Sullivan Brid & Supply Co. the contract at $8,998 for t

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

n of the following bridges: Jones, Walters, Trimble, two; Puck, Crowder, Nelson, Drake, Cox, May, Goosetown, Woods, Strahley, Baldridge, Peterson, Dodds, Rusk and Carrico, amounting to $8,998. The Vincennes Bridge Co. was awarded the contract for the Cox bridge and the repair of the bridge at Merom Station at $3,002.

⊙The Board of Montgomery County Commissioners, Crawfordsville, Ind., has let the contract for the construction of a bridge to J. F. Chadwick, Mace, Ind., at $2,230. Bids were opened June 4. B. B. Engle is County Auditor.

⊙The Board of Clinton County Commissioners, Frankfort, Ind., has awarded the contract for the construction of the Armstrong St. bridge to the Frankfort Construction Co., Frankfort, Ind., at $3,485. Bids for the work were opened June 5. C. F. Cromwell is County Auditor.

⊙Advices from Jeffersonville, Ind., state that the Attica Bridge Co., Attica, Ind., has been awarded the contract for the construction of two new bridges, one at Robinson's at $1,098, and the other at Bower's ford at $1,462.

Iowa.

Board of Clinton County Supervisors, Clinton, Ia., has, it is reported, adopted revised plans for the construction of the proposed bridge over the Wapsie River, connecting Clinton and Scott Counties.

The City Council has passed an ordinance authorizing the advertising of bids for the construction of a new concrete culvert to replace the old bridge on the Sioux City and Rock River road at 33d St., Sioux City, Ia.

Advices from Omaha, Neb., state that prospects are good for the construction of the proposed new free bridge over the Missouri River between Council Bluffs, Ia., and Omaha, Neb. Elections will be held in Pottawattamie County, Ia., and Douglas County, Neb., this fall, to submit to the voters the proposition of issuing $500,000 of bonds for the project. Among those interested are J. F. Wilhelmy, H. H. Baldrige, E. A. Benson and F. D. Weed of Omaha, and F. F. Everest, H. H. Van Brunt, Joe W. Smith, A. C. Keller and W. C. Boyer of Council Bluffs, Ia.

Kansas.

⊙The contract for the construction of a reinforced concrete viaduct over the Union Pacific and the Chicago, Rock Island & Pacific Ry. at Kansas City, Kan. has been awarded to the American Bridge Co., New York City, at $70,168. Bids were opened June 11. William Barclay is City Engineer.

The City Council of Leavenworth, Kan., has passed an ordinance providing that the Leavenworth, Topeka & Southwestern R. R. Co. submit within 30 days plans and specifications for the construction of a new viaduct over Pennsylvania Ave.

⊙The Board of County Commissioners, Westmoreland, Kan., has awarded the contract for the construction of the Cleburn bridge to the Midland Bridge Co. Kansas City, Mo., at $8,747. The structure consists of two 150-ft. truss spans with concrete floor. Bids were received June 7.

⊙The Commissioners of Harvey County, Newton, Kan., on June 4, awarded the contract for the construction of the Kingery bridge and the East Emma Creek bridge No. 1 to B. H. Northcutt & Son, Hesston, Kan., at $2,157. The contract for the Little Arkansas River bridge and the Whitewater bridge was let to the Neeley Bros. Contracting Co., Larned, Kan., at $7,280. J. A. Hunter is County Clerk.

⊙The Board of Washington County Commissioners, Washington, Kan., has awarded contracts for the construction of a number of bridges to the Hanover Bridge Co., Hanover, Kan., at $5,209. The Missouri Valley Bridge Co., Leavenworth, Kan., has also been awarded several contracts for the construction of bridges at $1,500.

Minnesota.

✣Bids will be received until 11 a. m., June 25, by Board of Hassan Valley Supervisors, Biscay Hall, Hassan Valley, Minn., for the construction of a bridge over the Crow River, between Sections 16 and 21. The structure, according to plans, will have a 56-ft. span with 16-ft. roadway. E. H. Malchow is Town Clerk.

✣Bids will be received until 2 p. m., June 22, by Board of Bird Island Township Commissioners, Bird Island, Minn., for the construction of a steel bridge. M. Jungers is Chairman.

✣Bids will be received until June 20, by Board of Hennepin County Commissioners, Minneapolis, Minn., for the construction of five bridges on Ditches Nos. 21 and 22. All bids received for this work May 28 were rejected. A. P. Erickson is County Auditor.

⊙Goodhue County Commissioners, Red Wing, Minn., have awarded contracts for the construction of bridges as follows: Iblings Bridge Co., Minneapolis, Minn., two structures over Hays Creek at $959 and $835; one in Featherstone at $1,222, and one in Florence at $3,920; W. L. Bowen, Lake City, Minn., for a bridge in Central Point to cost $1,350; W. L. Bassett & Co., for a bridge in Stanton at $2,275.

Plans have been submitted by W. A. Clark, Chief Engineer of the Duluth & Iron Range R. R., Duluth, Minn., for straightening out the curve in the Seventh Ave. viaduct at Two Harbors, Minn..

⊙The Board of County Commissioners, Morris, Minn., has awarded the contract for the construction of the bridge on the new state road over the Pommede Terre, northeast of Morris, to the Security Bridge Co., Minneapolis, Minn., at $2,840.

Mississippi.

The Board of Lawrence County Supervisors, Monticello, Miss., has decided to call a special election to vote on the issuance of $50,000 of bonds for the construction of a courthouse, and $25,000 for the construction of bridges.

⊙The Joliet Bridge & Iron Works, Joliet, Ill., has been awarded the contract for the construction of a bridge over Harper's Creek in Marion County, Miss., at $1,600.

Missouri.

The Terminal Railroad Association, H. J. Pfeiter, Engineer of Maintenance of Way, St. Louis, Mo., will start work at once on the proposed Union Ave. viaduct, providing the Council permits the narrowing of the structure from 100 to 80 ft. and dispensing with the proposed concrete retaining walls.

It is reported that the St. Louis & San Francisco (Frisco) System will, during the next year, replace four large steel bridges, two of them over the Arkansas River, with heavier steel structures. R. E. Miller, Springfield, Mo., is Bridge Engineer.

The City Council of St. Louis, Mo., has passed a bill providing for the proposed "Reber" East Side approach to the Municipal Freek bridge, with the extension of 2,600 ft. to a point outside East St. Louis.

Nebraska.

The Gage County Board of Supervisors, Beatrice, Neb., has decided upon the construction of four new bridges.

⊙The Stupp Bros. Bridge & Iron Co., St. Louis, Mo., has been awarded the contract for the construction of two bridges in Saunders County, Neb. (1) North Bend State Aid Bridge, consisting of eight 180-ft. spans with concrete piers and abutments, at $58,733; (2) Fremont State Aid Bridge, consisting of seven 180-ft. and three 100-ft. spans with concrete piers and abutments, at $59,072. Other bids received for the work May 25 were as follows: Elkhorn Construction Co., Fremont, Neb. (1) $85,140; Dilding Bridge & Iron Works, Hannibal, Mo. (1) $74,750 and (2) $75 900; A. E. Shorthill Co., Marshalltown, Ia. (1) $80,000 and (2) $80,500; Midland Bridge Co., Kansas City, Mo. (1) $72,175 and (2) $72,150; Standard Bridge Co., Omaha, Neb. (1) $69,400 and (2) $68,400; Canton Bridge Co., Omaha, Neb. (1) $67,900 and (2) $69,500. J. D. Frahm, Wahoo, Neb., is County Clerk. D. D. Price, Lincoln, Neb., is State Engineer.

⊙The following bids were received Je 4 by Sherman County Clerk, Loup City, Neb., for the construction of Loup City Sta Aid bridge, consisting of four 120-ft. spa on concrete piers and 48-in. tubes: Stupp Bros. Bridge & Iron Co., St. Louis, Mo., $[illegible]; Massillon Bridge Co., Kansas City, Mo. [illegible] 600; Federal Bridge Co., Des Moine [illegible] $22,000; Interstate Bridge Co., $22,500. [illegible] ard Bridge Co., Omaha, Neb., as mentiod in our last issue, was awarded the contr at $19,800

New Jersey.

✣Bids will be received until 3 p. m. June 24, by Committee on Roads and Assessments and Speedway of the Board of Chosen Freeholders, Essex County, Newark, N. J., f the following bridges and culverts: Concre and steel beam bridge over the Rahway Riv on Oakview Ave., South Orange; 5-ft. reinforced concrete pipe on West Orchard St., Cal ell. 5,250 ft. of 24-in. stoneware pipe on Wat ung Ave., Bloomfield; 1,370 ft. of 24-in. ston are pipe on South Orange Ave., from Colle S to Ward Pl., in South Orange; renewin ai ing and painting bridge over Second on Mt. Prospect Ave., Newark; laying 1 of 18-in. vitrified pipe, and 90 ft. of cast-iron pipe on Stuyvesant Ave., Irvi James Owen is County Engineer.

New York.

✣Bids will be received until 2 p. m., J by Town Superintendents, Schroeppel Lysander, N. Y., for the construction superstructure of six spans of a rein concrete bridge over the Oswego Ri Phoenix, N. Y.

The Barge Canal Board, Albany, N. Y approved plans for the erection of a over the Erie Canal at Vliet St., Cohoes. The Legislature has appropriated $7,0 the structure.

⊙The County Superintendent of Highways Rochester, N. Y., has awarded the contract for the construction of the Rush-Wheatland steel bridge over the Genesee River to the Oswego Bridge Co., Oswego, N. Y., at $2 . The structure will be a 233-ft. pin truss bridge on concrete foundation. Other bids received were as follows: Barraly & Ingersoll, 000; Seneca Engineering Co., $28,163; he Bridge Co., $29,695; Massillon Bridge & Structural Co., $26,400. The bridge will be under the supervision of Charles F. Sto , Albany, N. Y.

North Dakota.

✣Bids will be received until July 8 at the office of T. E. Thompson, County Audr, Washburn, N. Dak., for the construction a steel I beam or truss bridge 30 ft. lg, 18 ft. wide roadway, with 10-ft. posts der to furnish plank backing. The bridg to be built across Douglas Creek on sec line between Sections 8 and 9, Township , Range 85. Bidders to furnish plans and specifications. A certified check must accompany bid in the sum of 5 per cent of the amt of bid. D. C. Wright, Chairman Co Board.

A petition has been filed with the W County Board, Grafton, N. Dak., asking the construction of a bridge over the River at Oslo and the matter of making appropration for the work will be taken

Ohio.

✣Bids will be received until 10 a. m., J 22, by Board of Shelby County Commissioners, Sidney, O., for furnishing labor and terial necessary for the construction of superstructure of one steel highway bri, 60 ft. long with 14-ft. roadway, over Tu Creek in Turtle Creek Township, near Har . Plans and specifications may be obtained H. T. Ruese, County Auditor, or the Cou Engineer.

✣Bids will be received until 10 a. m., Ju 22, by Board of Shelby County Commissione Sidney, O., for furnishing the necessary lal and material for the construction of the sup structure of one steel highway bridge, 75 long with 16-ft. roadway, over Mosquito Cr in Green Township. Plans and specificati

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

on file with the County Auditor, H. T. de, or County Engineer.

Bids will be received until 11 a. m., July Board of Cuyahoga County Commissioners, Cleveland, O., for the [illegible] bridge [illegible] Road in [illegible] Township [illegible] fications may be obtained of the County ineer, West 3d St., Cleveland, O. Frank [illegible] is County Surveyor [illegible] is Clerk.

[illegible] epartment of Public Service, Dayton, O., he construction of a 150-ft. steel truss e in connection with levee work noted r that section in this issue. Official ad- [illegible]

unty Auditor Crawford, Butler County, ilton, O., in the annual budget provides 00 for the construction of necessary es.

[illegible] ded to the C. H. Fath Co., 516 Electric, land, O., the contract for the construction of piers for the Ash-Consaul St. bridge bid of $119,234. Other bids received for work were: Great Lakes Towing Co., 46; Rabbit & Sons, $134,911.

sidents of Eastern Ave., near Duck Creek, trongly advocating the construction of a or concrete bridge over the creek to re- the present inadequate structure. A pe- will be filed with the City Council, Cin- ti, O., shortly.

Pennsylvania.

e erection of two new bridges has been mmended to the County Commissioners, a, Pa. One structure to be over Muckin- s Creek, between Darby Township and lden Borough, and the other over Ches- reek at Bone Mill Road in Thornbury

he Altoona & Logan Valley Electric St. ay Co., S. S. Crane, General Manager, ubmitted to the City Treasurer of Al- , Pa., a check for $25,000, the company's of the cost of building the proposed Seventh St. bridge. The Board of Public s recently awarded the contract for the work to the Penn Bridge Co., Beaver Pa., and work will be started shortly. ontract for the erection of the approaches e new bridge has been awarded to the [illegible]

ncil Committee on Surveys of the City hiladelphia, Pa., has recommended the uction of the following new bridges: Ave. over Indian Run, $10,000; [illegible] Ave. over P., G. & N. R. R., $16,000; St. over P., B. & W. R. R., $20,000; 72d er P., B. & W. R. R., $20,000; Mont- y St. over Connecting Ry., $45,000; 66th north over North Penna. R. R., $26,000; er Ave. over P. & B. C. R. R., $38,000; noreland St. over North Penna. R. R., ndley Ave. under North Penna. R. [illegible]

Rhode Island.

[illegible] State Board of Public Roads, P. J. n, Clerk, Providence, R. I., for the construction of two reinforced concrete bridges, Barrington, R. I., 300 ft., 6 spans; War- R. I., 200 ft., 3 spans.

Tennessee.

A conference was recently held by W. B. Hatcher, Clerk of the Knox County Road Commission, G. W. Pearsoll, County Engineer, Knoxville, Tenn., and a Committee of Blount County in regard to reconstructing the bridge over Stock Creek, through which a road roller recently fell.

Texas.

[illegible] ers, Fort Worth, Tex., by Brenneke & Fay, St. Louis, Mo. The structures, one of which will be 1,900 ft. long and the other 1,000 ft. in length, will be built with the proceeds of [illegible]

Virginia.

✣Bids will be received until noon, June 24, by Halifax County Court, Houston, Va., for the construction of the Concord Bridge, near Leda, over the Bannister River in Halifax County, Va., 15 miles from Nathalie on the Norfolk & Western Ry. The structure, which will be of steel with wooden approach and wooden bents, will be 417 ft. long, with a 12-ft. roadway. The substructure will be of concrete and cement rubble. Stone and sand may be obtained at the site. Plans and specifications may be obtained of the Clerk of the Circuit Court, Houston, Va., or at the office of Childrey-Sunday Co., Richmond, Va., at a cost of $1.35 for five bridges in the county. A certified check for $200 must be fixed with each bid. P. St. J. Wilson is State Highway Commissioner

✣Bids will be received until noon, June 24, by Halifax County Court, Houston, Va., for the construction of the Terry Bridge over Bannister River in Halifax County, 2 miles from Scottsburg, on the Southern Ry. The structure, which will be of steel with wooden approach and wooden bents, 168 ft. long, with a 12-ft. roadway. The substructure will be of concrete and cement rubble. Stone and sand may be secured within 1 mile of the site. A substructure will include tearing out Houston abutment. Plans and specifications may be obtained of the Clerk of the Circuit Court, or at Childrey-Sunday Co., Richmond, Va. A certified check for $200 must be filed with each bid. P. St. J. Wilson is State Highway Commissioner, Richmond, Va.

✣Bids will be received until noon, June 24, by Halifax County Court, Houston Va., for the construction of the Meadville Bridge over Bannister River, near Meadville, in Halifax County, 10½ miles from Houston, on the Norfolk & Western Ry. The structure will be of steel and wood, 509 ft. long, with 12-ft. roadway on a concrete and cement rubble substructure. Stone and sand may be obtained within 1 mile of the site. Plans and specifications may be obtained of the Court Clerk, or of Childrey-Sunday Co., Richmond, Va. A certified check for $200 must be filed with each bid. P. St. J. Wilson is State Highway Commissioner, Richmond, Va.

✣Bids will be received until noon, June 24, by Halifax County Court, Houston, Va., for the construction of the Henry Bridge over Sandy Creek, Halifax County, Va., about 12 miles from Paces, on the Southern Ry. The structure will be of reinforced concrete 117 ft. long, with 12-ft. roadway, on concrete and cement rubble substructure. A certified che for $200 must be filed with each bid. Pla and specifications may be obtained of the Cle of the Circuit Court, Houston, or of Childre Sunday Co., Richmond, Va. Sand and sto for the work may be obtained at the si P. St. J. Wilson is State Highway Commi sioner, Richmond, Va.

✣Bids will be received until noon, June by Halifax County Court, Houston, Va., f the construction of the Houston Bridge ov the Bannister River in Halifax County, mile from Houston, on the Norfolk & Weste Ry. The structure will be about 746 ft. lo with a 12-ft. roadway, and will have a su structure of concrete-raising blocks on masonry and cement rubble. Sand and sto may be obtained within 1 mile of the si Plans and specifications may be obtained the Clerk of the Court, or of Childrey-Sund Co., Richmond, Va. A certified check for $ must be filed with each bid. P. St. J. Wils Richmond, Va., is State Highway Commissioner.

West Virginia.

⊙The contract for the construction of superstructure of the Cheat Bridge over Cheat River has been awarded by the Cou Court, Elkins, W. Va., to the Canton Bri Co., Canton, O. Bids were opened June The structure will be a single span 100' long, with a 14-ft. roadway.

Wisconsin.

✣Bids will be received until 10:30 a. June 20, by J. C. Shampnor, County Highw Commissioner, Hotel National, Mount Hor Wis., for the construction of a bridge Springdale, as mentioned in our Roads a Streets Column in this issue. H. F. Thom son, Chairman of the Town of Springda has plans on file.

A resolution has been recommended adoption by the Railroad Committee of Common Council providing for the constru tion of a concrete bridge on Eighth A over the creek near the city limits of M [illegible]

Canada.

✣Bids will be received until noon, July by M. E. Boughton, Secretary-Treasurer Lansdowne, Arden, Man., for the erection a steel truss bridge over Grassy River, tween Sections 19, 18, 12 and 24, 18, 13, a point 3¾ miles east of Glenella. Abutme and Wing walls of cement concrete on pi (if piling proves practicable). Estimates cu. yds. Gravel for concrete at 1¼ mil The bridge is to have a clear span of 70 with a clear width of 18 ft. Preference giv tenders for the whole of the work. Pla and particulars at Arden, and at the Depa ment of Public Works, Winnipeg.

Representatives of Vancouver Island a Victoria, B. C., are to take up with the D minion Government the matter of building bridge over the Seymour narrows, connect the Island with the mainland. The cost such a structure would be, it is estimat about $20,000,000.

The contract for the construction of a st and concrete bridge over Bevans Creek Arundel Township, Argenteuil County, P. will probably be awarded to George M. Bru ton, Montreal, Que., at $4,680. Bids we opened June 1, by William Thomson, Sec tary and Treasurer, Arundel, Que.

RRIGATION, DRAINAGE, LEVEES AND CANALS

Arkansas.

liminary work is under way for the ex- e drainage system proposed for the Cen- Clay Drainage District. This system as sed will include a 25-mile main ditch and les of laterals, the whole requiring about 00 cu. yds. of excavation. James R. Corning, Ark., is the Engineer

California.

According to advices from Richmond, Cal., the Standard Oil Co. will build a tidal canal from its works through the marsh land to the bay at the north, at an estimated cost of $100,000. The canal will be 25 ft. wide. The company plans to run 1,200,000 gals. of waste oil water an hour through it.

Illinois.

✣Bids will be received until 3 p. m., Ju 22, by Commissioners of the Diveley Le and Drainage District at the office of Bro & Burnside, attorneys, Vandalia, Ill., for construction of the following work: 15, lin. ft. of earth levee, 4-ft. top, side slope to 1, approximate average fill 7 ft., appro e maximum fill 16 ft., and estimated to n 79,000 cu. yds., 19,500 lin. ft. open width, 4 to 6-ft. base width, side slopes, 1 average cut 3½ to 4 feet, and estimated to contain 20,000 cu. yds. Three concrete outlet flumes, to conclude approximately 350 lin. ft. of 18-in. salt glazed, vitrified sewer pipe; six 18-in. cast iron flap valves and approximately 25 cu. yds. of concrete work. A certified check, payable to order of commissioners, for the sum of $250 must accompany each bid. Detailed plans and specifications are on file and may be seen at the office of the engineer, J. V. Waddell, Vandalia, Ill.

✣Bids will be received until 9 a. m., June 22, by Commissioners of Drainage District No. 4, Paradise Township, Coles County, for drainage work in the district requiring the following tile: 800 ft. of 6-in., 1,300 ft. of 8-in., 160 ft. of 12-in., and 4,000 ft. of 14-in.; average depth 4 ft., except on the 12-in. tile, which is to be laid at an average depth of 6 ft. There will also be required 60 ft. of 12-in. cast iron pipe where the drain crosses the Illinois Central railroad; also one head-wall requiring 10 cu. yds. of concrete. The nearest railroad station is Magnet, Ill., 2½ miles from the work. Work is to be completed by Sept. 1, 1912. Certified check for $200 required with bids. Plans, specifications, etc., may be seen at the office of W. E. Wilson, Town Clerk, Etna, Ill., and at the law office of Emery Andrews, Mattoon, Ill. The engineer is Frank E. Bishop, Mattoon, Ill.

✣Bids will be received until 10 a. m., June 27 (readvertisement), by Commissioners of Inlet Swamp Drainage District of Lee County at the office of County Clerk, Dixon, Ill., for the following: Enlargement of 24.68 miles of open ditches, containing 172,000 cu. yds. of rock excavation and 863,000 cu. yds. of earth excavation with side slopes of ¼ to 1 in the rock excavation and ½ to 1 in the earth excavation, and base widths varying in size from 8 to 40 ft. Construction of 10.63 miles of open ditches containing 209,000 cu. yds. of earth excavation, with side slopes of ½ to 1 and 1 to 1, and base widths varying in size from 3 to 12 ft. Cleaning out of 8.49 miles of open ditches, containing 42,000 cu. yds. of earth excavation with side slopes of ½ to 1 and 1 to 1, and base widths varying in size from 4 to 12 ft. Filling in of present open ditch containing 3,400 cu. yds. to fill. Construction of 13.03 miles of tile ditches containing the following amounts and sizes of tile (separate bids on vitrified or shale tile required): 4,400 lin. ft. of 30 in. internal diameter, 4,700 lin. ft. of 27 in. internal diameter, 6,600 lin. ft. of 24 in. internal diameter, 12,150 lin. ft. of 22 in. internal diameter, 13,250 lin. ft. of 20 in. internal diameter, 9,400 lin. ft. of 18 in. internal diameter, 4,100 lin. ft. of 16 in. internal diameter, 2,600 lin. ft. of 15 in. internal diameter, 2,000 lin. ft. of 14 in. internal diameter, 8,000 lin. ft. of 12 in. internal diameter, 1,600 lin. ft. of 10 in. internal diameter and four concrete head walls and 24 brick manholes with iron covers. The tile will be laid to depths varying from 5 ft. to 13 ft. No bids will be considered unless accompanied by cash or a certified check on some national bank for a sum not less than 10 per cent of the bid. Bids will be received for the work in sections as prescribed or for the work as a whole. Plans and specifications together with the court's order for said work may be seen at the office of the County Clerk, Dixon, Ill., or at the office of J. M. Egan, Jr., Civil Engineer, Amboy, Ill., where further information may be obtained. Specifications may be had upon request of J. M. Egan, Jr., Civil Engineer, Amboy, Ill. X. F. Gehant, Secretary, Dixon, Ill.

✣Bids will be received until 1 p. m., June 25, by J. W. Shastid, Oreana, Ill., for furnishing, retrenching and laying 12,376 ft. of 14-in. to 24-in. shale drain tile. P. T. Hicks, Decatur, Ill., is County Surveyor.

Indiana.

✣Bids will be received until June 29 by Auditor of Fayette County, Connersville, Ind., for the construction of a levee three miles north of Connersville on the Waterloo road on the farms of Charles Ostheimer and Ed Thomas in Harrison township.

Michigan.

⦿Bids were opened June 10 by E. D. Redman, Drain Commissioner of Gratiot County, Ithaca, Mich., for constructing Drain No. 111, the contracts for 10 miles of main and branches being awarded to Joe Ray, Alma, Mich., at $10,555. The work includes 3,138 rods of cleaning out, widening, straightening and extending. Branch 2 was let in four sections, as team work; 376 rods, at an average price of $1.95 per rod. Branch 2 has a 4 ft. bottom and average cut of 3½ ft.

Mississippi.

✣Bids will be received until 11 a. m., July 11 (readvertisement), by Maj. J. A. Woodruff, U. S. Engineer, Vicksburg, Miss., for constructing about 1,600,000 cu. yds. of earth work in the Third District. The itemized bids for the work which were rejected were published in our last issue. Official advertisement will be found elsewhere in this issue.

Missouri.

Citizens of New Madrid, Mo., have raised a subscription of $25,000 toward cutting a canal across Madrid Bend, so as to change the course of the river.

The City Counselor of Kansas City has decided that it will be necessary, if the diversion of Turkey Creek into the Kaw River is to be made expeditiously, to provide the necessary $1,000,000 by both a bond issue and special assessment against a benefit district. Plans were made some time ago by L. R. Ash, City Engineer of Kansas City, to change the course of Turkey Creek westward through a tunnel in Greyston Heights, at an estimated cost of about $1,000,000.

New Jersey.

The following bids were received June 11, by the State Department of Inland Waterways, Trenton, for dredging a section of the inland waterway between Townsend Inlet and the bridge of the Ocean City Branch of the Philadelphia and Atlantic City Railroad across Crook Horn. The distance is approximately ten miles, and it is estimated that about 620,000 cu. yds. of dredging will be required: Atlantic Gulf & Pacific Co., New York, 12.9 cts.; E. M. Graves, 12.50 cts.; Miner Engineering Co., Washington, D. C., 11.9 cts.; Hill Dredging Co., Atlantic City, 9.85 cts.; Richards Dredging Co., Philadelphia, 8.8 cts.; Standard Engineering Co., New York, 9.35 cts.; American Dredging Co., Philadelphia, 9.3 cts.

North Carolina.

Surveys for the proposed Buffalo Drainage District No. 1 in Cleveland County have been completed by F. G. Eason, U. S. Drainage Engineer, Charleston, S. C., and a report on the project will be submitted shortly.

Ohio.

✣Bids will be received until noon, July 8, by Department of Public Service, C. J. Gross, Secretary, Dayton, O., for the construction of about 1,200,000 cu. yds. of levee, including concrete retaining walls, sewers, riprap, 150 ft. steel truss bridge, piling and other work. Official advertisement will be found elsewhere in this issue.

The River and Harbor Commission of Cleveland will report to the City Council this month recommending a plan for the straightening of the Cuyahoga River. The report will advise a definite plan of procedure and a method of financing the improvement. It is probable that the commission will advise the city to take up the work in sections and make use of the power given councils by the Cetone act to finance it. Under this law the city may require property owners deriving a benefit from the improvement to share the expense. Estimates of the cost of eliminating the bends of the river have varied from $4,400,000 to $5,500,000. Robert Hofman is City Engineer of Cleveland.

Tennessee.

✣Bids will be received until 11 a. m., by Clarke S. Smith, Maj., U. S. Eng Memphis, Tenn., for constructing about 000 cu. yds. of levee in the White River District.

Memphis, Tenn., and Vicinity

(REGULAR CORRESPONDENCE.)

⦿When bids were opened by Major S. Smith in Memphis on the 10th of J was fund that the levee builders are mined to take no more cheap work a Major, who has a world of experience i building, profited by the example of Woodruff's letting in the Vicksburg d and accepted those bids which were sub even despite the fact that they were than anything let in this district for years past. The tabulation of the bids

Bird's Point, Mo., 99,000 cu. yds.— Brothers Co., of Memphis, 24 cts. (a work); Roach & Stansell, of Memphis,

Hickman, Ky., 150,000 cu. yds.—C. T durant, Hickman, 22.7 cts. (awarded Roach & Stansell, Memphis, 26.8 cts. rance Brothers Co. & Leonard, Memph cts.; Carey Brothers Co., Memphis, 35

Wilson, Ark., 335,000 cu. yds.—Ro Stansell, Memphis, 24.8 cts (awarded Carey Brothers Co., Memphis, 26 cts. rance Brothers Co. & Leonard, Memph cts.

St. Claire, Ark., 210,000 cu. yds.—R Stansell, Memphis, 25.85 cts. (awarded Carey Bros. Co., Memphis, 25 cts.; Low Brothers & Leonard, Memphis, 24.9 cts.

Wyanoke, Ark., 385,000 cu. yds.—Roa Stansell, Memphis, 26.9 cts. (awarded Lowrance Bros. Co. & Leonard, 26.7 cts.

While it will be seen that Carey Bros were low on Wilson, Roach & Stansell a bid for all or none of three pieces whi cluded Wilson, St. Claire and Wyanoke, securing all three pieces. While it will be from the above list that the prices were close in some cases, it must be consider getting at the relative values of the bids all of the work must be finished before Ja and in the wet ground on which some levee will be built, there are but few firms to accomplish the desired results in th lotted space and the figures show a health dication inasmuch as they demonstrate th of the big firms are taking into consider the same general conditions which ten boost prices and are determined that there is money in the work, they don't wai C. T. Bondurant, a comparative newcome the levee game, made the only bid w seemed anyway out of line, but the impres seems to exist that because of his being o ground at Hickman he did not fare so after all and should make a neat sum o contract.

Now all eyes move on Vicksburg, Major J. A. Woodruff will have over a m yards to offer within the next twenty d This is the work he recently rejected bids With Roach & Stansell comparatively satis as a result of the letting on the 10th, at M phis, the Vicksburgh work should go for a higher price than before, for now Lowr Brothers & Leonard, the Helgason boys the Dulaney crowd are the only ones enough to handle the work to be offered in view of the fact that Major Smith at M phis will have another million yards to o within the next 60 days and Capt. Sherril New Orleans a like amount, to say nothing the state levee boards, the wise heads c dope out cheap prices for some time to co The same information recently published these columns about the work in the Vic burg territory on which bids were ope June 3rd and then rejected, will no doubt ply in all details to the readvertised contra

When the hustling little Assistant Engin of the United States government at Memp announced that Major Smith had a mill choice yards of levee work to dish out in very near future and that some of it mi be long time work, another happy note

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] in the levee [illegible] will perhaps be at White Hall, Ark., [illegible] yds [illegible] her 800,000 of all field work, with [illegible] will be held out to the boys with the s.

ach & Stansell, who were awarded the of the levee work recently let by Major h, have already begun to pile up dirt on new work. Last week three outfits were tched to Wyanoke, Ark., and by the 18th [illegible] e upper territory, one at Wilson and one Claire. That's some hustling all right! IcCadden, who made such a gallant high r fight at Pecan Point, Charlie Siler and ord Brothers are the ones hard at work yanoke.

he Roach-Manigan Paving Co. of this [illegible] ilt in the City of Fort Worth, Texas, on 5th inst. The above company is doing half a million dollars' worth of work in s cities and Bob Colglazier, who is in ge of the Western end of the concern, ts that he has things well in hand and oving nicely along.

oper Brothers were awarded the con- for excavation of subway to be built by ity of Memphis and the N. C. & St. L. on the Parkway and have already moved s on the work, which embraces approxi- y 14,000 cu. yds., and is expected to be ed within 30 days. Hunter McDonald is Engineer of the N. C. R. R. and J. A. rg, Jr., is looking after the interests of ark Commissioners.

s expected that within the next 90 days ity of Memphis will have in the neigh- od of 700,000 cu. yds. of levee work to The embankment to be built is for the se of protecting the low lands of the rom overflow and while City Engineer herford has not fully worked out his it is understood that the levee will ex- rom the foot of Adams St. on the south ontinue along the front of the city until ills of the suburbs near Raleigh are ed. A flood gate is expected to be built Bayou Gayoso and during high water rainage will be pumped over the gate. r Crump is desirous of having an expert h matters consult with the city forces lso if possible secure the advice of Major of the Government Engineer Corps. Mayor Crump has not given up all of having the Government contribute a n amount to the Memphis levee project, not resting on his oars until he finds out, going ahead with his plans and prepara- and will be ready to take the bit in even if Uncle Sam disappoints him.

the first time in months, points in nsas are again having regular serv- Practically all roads running into a, Ark., have now resumed operations, he track is said to be in good shape. & M. V. have also issued notice that gular schedule to points in Mississippi again go into effect, and in a short ll the roads will be running again. Some smaller towns have been cut off from ng facilities for a long time, and the will do a fine business.

three Lowrance boys, G. H., W. T. M. state that they intend to rush oper- on their contract at Atherton, La., nish in time to get a snatch at some of price work coming up. The Helga- s and Bill Stephenson and Henry Mc- are also on this work, and are doing est to finish up. It's enough to make a cuss to have a lot of cheap work that be finished before getting where one ake some money. It seems that this ct was taken simply to make expenses not with the idea of making much . It was delayed by the floods, and will have to be finished before moving. hese boys are hustlers, and will be h in plenty of time to take a crack at ork coming up.

r J. A. Woodruff has [illegible]

[illegible] ernment appropriate $2,500,000 for the protection of the Red River District, and if this measure passes, will have just oodles of work to advertise soon.

Mr Tutwiler, President of the Memphis Street Railway Co. has announced that his organization will shortly commence work on over six miles of new track, mostly in the [illegible] fic. One of these loops will run on Third St., and extensions will be made along Poplar St., and through the Speed Way Land Com- [illegible] is being opened up. Mr Tutwiler also says the company will spend many thousands of dollars for new cars and other equipment.

The Chicago, Burlington & Quincy R. R. [illegible] into Memphis, and one of their largest surveying parties are now at work on the lines [illegible] location of the entering line will be through the subdivision of the Union Land Company, paralleling the Memphis and State Line track. An officer of the railroad gives out the information that the Burlington will cross the river at Metropolis, Ill., and from there to Memphis, by way of Dyersburg, using the tracks of the Dyersburg Northern into Memphis. The entrance of this big road will help Memphis immensely, and will add largely to the value of the Union Land Company's plot, by coming in through that section.

On Saturday, June 8, the last spike was driven in the tracks of the Birmingham Northwestern, and this road is now open for service. It connects Memphis with several thriving little towns between Dyersburg and Jackson, which up to now have been lacking in shipping facilities, and all produce can now come in by way of Dyersburg over the Illinois Central. This little road is 48 miles in length, and certainly fills a longfelt want in the country it traverses.

The Southern Pacific has suspended operations in the vicinity of the Hymelia breakwater and will have to make a detour until the water subsides. The situation is growing very serious in that section, and the water loss is mounting higher every hour. Officials of the Southern Pacific state that as soon as the tracks are out of water repairs will be commenced and trains put through as soon as possible.

The Rock Island will soon commence work here on the Hopefield, Arkansas terminal, which was almost totally destroyed by the overflow, and state that they will resume traffic on their ferry in a short time. The transfer here has been out of business for some time.

Contractors in this section are becoming genuinely alarmed at the prevalence of anthrax, or charbon. It has recently broken out here, and is doing untold damage to stock owners. The experts have called a meeting for the discussion of some remedy and will do all in their power to stop the ravages. They state that the germs were carried far and wide by the flood, and that it may grow into an epidemic before stopped. However, all of the boys here played wise in ordering sufficient charbon vaccine to inoculate all their stock, and it appears that they acted in plenty of time, still they are keeping a very close watch.

Mr. H. Cassedy, one of the Commissioners of Highway District No. 1 of Lincoln County, Miss., announces that on the first Monday in July this district will receive bids on about thirty miles of gravel roads. The county has on hand approximately $100,000 to pay for this work, and desires the contract rushed to a speedy completion. This new work is a continuation of approximately twenty-eight miles of road, contract for which was let last summer, which work will be completed in a few days. Mr. Cassedy says hs thinks that the territory surrounding this district will have lots of work in the near future. Address Mr. H. Cassedy, Commissioner, Highway District No. 1, Brookhaven, Miss.

Congressman K. D. McKeller has been requested by the City Commission to arrang for the inspection of the levee system in Nort Memphis by a corps of United States Eng neers in order to arrive at the best plan fo protection.

Major T. G. Dabney, Chief Engineer of th Upper Yazoo Levee District, spent the 8t in Memphis. Major Dabney states that h has called a meeting of the levee board fo June 21, at Clarkesdale, Miss., when plan for repairs will be taken up. The Major, wh boasts of the finest levee system along the b stream (and rightly so for during the la flood his was the only embankments whic withstood the terrific strain), is greatly in fa vor of the Government contributing one-ha to the support of all levee systems and he doing all in his power to bring this about.

Texas.

✣Bids will be received until noon, July 1 by H. M. Harrison, Chairman Drainage Di trict No. 5, R. R. No. 1, La Porte, Tex., fo the construction and completion of a drain age system for drainage district No. 5, Ha ris County, Texas, consisting of about 1 miles of main ditch and laterals. Bids fo this work must be submitted on blank form which will be furnished by the secretary, Du ley Shaw, La Porte, Tex., R. R. No. 1, on ap plication. Plans, specifications and profil can be seen at the office of the engineer, N. Kolb, at South Houston, Tex. Bids may b made on the work as a whole or on any ma ditch or lateral or other section of work b itself. Where bids are made on the enti project they should be made on each class work, such as earth excavation of ditches an laterals, clearing of outlets and excavation outlets, separately, as shown more fully in th specifications. Parties bidding on this wor will be required to furnish a certified che of 5 per cent of the total amount of their bi payable to the county judge of Harris Count Texas. H. M. Harrison is Chairman an Dudley Shaw is Secretary, Drainage Distri No. 5, Harris County, Texas.

◉Bids were opened June 10 by John M Murch, County Auditor, Galveston, Tex., fo ditching along county road near Texas Cit the contract being awarded to F. Freund, 14¼ cts. per cu. yd. The work includes abo 12,800 ft. of open ditch.

The first and second surveys for a drai age system for Matagorda County Drainag District have been made and the repor filed and accepted. The system will i clude 48 ditches and laterals. The averag depth will be 4 ft., average base, 8 ft., an estimated yardage, 1,245,903 cu. yds. Th estimated cost is $234,990. The drainage di trict comprises some 80,000 acres of land. I Black, Markham, Tex., is Chief Superviso E. N. Gustafson, Bay City, Tex., is Actin Engineer.

G. Denton of the Denton Colony Co. co templates a large irrigation project on Bl Reyes Grant in Dimmitt Co. on the Nuec River Protection levees, dams, canals, pum ing plants, etc., will be constructed. Roc well-Slining Engineering Co., Gunter Bld San Antonio, Tex., are the engineers, and a now making the surveys and investigations.

Canada.

◉W. J. Birmingham, Crosshill P. O., On has been awarded the contract at $1,710, f constructing the J. H. Campbell municip drain for the city of Wellesley, Ont. This an open and tile drain proposition.

It now looks as though the Canadian go ernment would delay the letting of the fir contracts for the construction of the Wellan canal till late this fall, or perhaps next wi ter. It is practically decided that owing the magnitude of the work and a desire the part of the government to secure ev fuller statistical and detailed information r garding the undertaking, noting in the way commencing work will be begun for th present. It is practically certain that no co tracts will be let, at least not until th early winter, and in this case the work construction would not commence till th summer of 1913.

✣ indicates work now open for bids. ◉ indicates a contract let recently.

WATER-WORKS

Alabama.

[illegible] Council of [illegible] City, Ala., has [illegible] for an election in July to authorize $50,000 bonds to install a waterworks and sewerage system and build a city hall.

Commissioner James Weatherly has introduced a resolution in the Board of City Commissioners, Birmingham, Ala., requiring the city engineer to prepare plans for a waterworks system for the city of Birmingham. Walter G. Kirkpatrick is City Engineer.

California.

The Public Service Commission of Los Angeles, Cal., has instructed Chief Engineer Mulholland to begin at once the work on the Franklin canyon tunnel, and to prepare figures and plans to bring the water from the Fernando reservoir to the Franklin reservoir and through the Cahuenga pass to Inglewood and Redondo. The estimated cost of the tunnel is $70,000. The pipe line will cost over $1,000,000.

The water committee of the City Council, Los Angeles, Cal., has recommended that the Public Service Commission prepare a plan for supplying the Hollywood district with Owens River water.

District of Columbia.

✣Bids will be received until 2 p. m., June 27, by Commissioners of the Distrist of Columbia, Washington, D. C., for furnishing 2,745 tons, more or less, cast iron water pipe for use in the water department.

Bids were received June 12 by the Commissioners of the District of Columbia, Washington, D. C., for furnishing and delivering 10,000 ⅝-in., and 250 ¾-in. water meters for use in the water department, as follows: Item (1) standing for ⅝-in. and (2) for ¾-in.: Gamon Water Meter Co., Newark, N. J., (1) $6.08; (2) $9.40. Henry R. Worthington, 115 Broadway, New York City, (1) $6; (2) $9. Union Water Meter Co., Worcester, Mass., (1) $7.95; (2) $12. Buffalo Meter Co., Buffalo, N. Y., (1) $5.50 (2) $8. Hersey Mfg. Co., South Boston, Mass., (1) $5, $5.75, $5.25 and $6 for 5000 ⅝-in., $2.25; (2) $7.50 and $9. Pittsburgh Meter Co., Pittsburgh, Pa., (1) $5; 5,000 meters $520; 2,500 $5.45; (2) $7.50; 125 ¾-in. meters $7.75; 65 ¾-in. meters, $8. Thompson Meter Co., Brooklyn, N. Y., (1) $6.48 and $5.60; (2) $10.20. Neptune Meter Co., New York City, (1) $8; (2) $1[illegible].

Illinois.

✣Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., June 26, for furnishing and delivering to the water meter shops, 1330 Indiana Ave., 150 ⅝-in. disc meters, 600 ¾-in. disc meters, 300 1-in. disc meters, 200 1½-in. disc meters, 200 2-in. disc meters, all in accordance with plans and specifications on file at this office. Cash or certified check for $500 must accompany proposal.

✣Bids will be received until 8 p. m., July 2, by Village Clerk, M. J. Lochner, Morton Grove, Ill., for the construction of a 10-in. cased well, one 50,000-gal. steel tank, 120-ft. steel tower, engines, deep well pump and building. Official advertisement will be found elsewhere in this issue.

✣Bids are being asked by J. A. Lacharite, Mayor, Assumption, Ill., for the construction and completion of a brick and steel standpipe, 100 ft. high and 14 ft. in diameter, also approximately 1,000 ft. of 6-in. mains and four fire plugs.

Bids will be received by L. E. McGann, Commissioner of Public Works, Chicago, Ill., until 11 a. m., June 27, for furnishing the labor, materials, etc., necessary to fabricate and deliver at the Lake View Pumping Station, Montrose Blvd. and Clarendon Ave., such structural steel and cast iron as is required in the construction of a discharge pipe vault. Cash or certified check for $100 must accompany proposal.

The city of Assumption, Ill., plans the installation of a new waterworks system at an estimated cost of $1,000, to include a 100-ft. brick and steel standpipe, 1,500 ft. of 6-in mains and 4 fire plugs. Water will be secured from wells. R. F. Johnson is the official in charge.

The Otis Elevator Co., 80 E. Jackson Blvd., Chicago, has submitted a bid of $1,380 to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for constructing a freight elevator at the Lake View Pumping Station, Montrose avenue and Clarendon avenue. The time limit being 45 days from the date of award.

Jno. Brennan & Co. have submitted to L. E. McGann, Commissioner of Public Works, Chicago, Ill., a bid of $12.95, for furnishing, delivering and erecting to the city one 75 H. P. steam boiler of the Scotch marine type for use on a floating pile driver, complete with smoke-stack, valves, gauges, etc.

Indiana.

✣Bids will be received until July 2, it is said, by City Clerk, Columbus, Ind., for the construction of a new filter. Philip Burgess, Columbus, O., is Engineer.

⦿The City of South Bend, Ind., has awarded the contract for furnishing and placing one 10,000,000-gal. "Snow" pumping engine to Henry R. Worthington of New York City. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Engineers.

⦿The Board of Public Works of Logansport, Ind., has awarded the contract for the building of reinforced concrete head gates for the city waterworks race to G. H. Palmer & Co., of that city at $3,138.

Iowa.

✣Bids will be received until 8 p. m., June 25, by City of Cresco, Ia., A. W. Gillett, Clerk, for the construction of a water supply reservoir in accordance with plans and specifications prepared by W. L. Richards, Engineer, and on file at the office of the City Clerk.

The citizens of Lynnville, Ia., on June 17, voted on the question of whether or not a waterworks system should be installed in that city.

The City Council of Des Moines, Ia., has accepted the report of Consulting Engineer Daubney Maury, of Peoria, Ill., which advised the expenditure of about $53,000 in improvements on the waterworks system. Councilman G. B. Healy has been authorized to have the plans for the elevation of the reservoir and for the construction of the tower at Morningside made at once. Water mains will also be laid.

The citizens of Logan, Ia., at a recent election voted the issuance of bonds in the sum of $20,000 to improve the waterworks system. The erection of a standpipe, enlarging of chief water mains and extension of water mains in different parts of the city are among the proposed improvements.

Kansas.

⦿The City Council of Burr Oak, Kans., has awarded the contract for the construction and installation of the new city waterworks to the Des Moines Bridge & Iron Works, of Des Moines, Ia., at $28,119.

Massachusetts.

The Water Commissioners of Holyoke, Mass., have voted to extend the water mains from Kenilworth Castle to the Holyoke Country Club Building. This will take about 4½ miles of main. Bids will be asked at once on 6, 8 and 10-in. pipe. The Board will lay a 10-in. main as far as the Holyoke Canoe Club, and from there for a certain distance an 8-in. main and will finish to the Country Club with a 6-in. main. The estimated cost is $40,000.

Michigan.

✣Bids will be received until 3 p. m July 2, by City of Grand Haven, Mich., for u bad-ing, delivering, trenching, laying with ates hydrants and special appurtenant, and ack-filling of approximately 4,000 ft. of -in., 4,900 ft. of 8-in. and 1,900 ft. of 6-in. pi G. S. Williams, Ann Arbor, is Consulting Engineer. Official advertisement will be und elsewhere in this issue.

⦿The Mayor and City Clerk of Port H ron, Mich., have entered into a contract with, H. Baer for the construction of a concrete w ll at the waterworks at a cost of $3,136.

The Village Council of Morenci, Mic has adopted a resolution calling for a specia lection to vote on the waterworks propositi

⦿The City Council of Manchester, has awarded the contract for the insta of a waterworks system to Fitzgerald & of Lima, O., at $23,738. The work incl 70 H. P. two-cylinder St. Mary's engin ha will burn either gasoline or low-grade ils Dean underwriters 500-gal. pump, and a s nd pipe of steel of about 300,000-gal. capacit works are to be completed by Aug. 22.

At a recent meeting of the business n Sunfield, Mich., it was voted to petitio Village Council to call a special electi the purpose of voting on the propositi bonding the village for $6,000 for a w works plant.

Minnesota.

⦿The Water, Light, Power and Bui g Commission, of Chisholm, Minn., it is reported, has awarded the contract to Sha & Crowley, for the sinking of a deep art n well.

Missouri.

The Board of Public Works of Palr a, Mo., has decided that another reservo is needed to handle the rapidly growing ver demand and also to provide for such an e gency as fire. The proposition will be mitted to the citizens.

Consulting Engineers Burns & McDo ll, Scarritt Bldg., Kansas City, Mo., are pre ing plans and specifications for the insta tion of a water works and electric lig g system for Bethany, Mo., for which b ls were recently voted.

Plans and specifications have been prep d by Consulting Engineers Burns & Mc nell, Scarritt Bldg., Kansas City, Mo., r the construction of a water works system in Hermann, Mo. An election will be held 20 to vote on the issuance of bonds sum of $35,000 for the improvement and 000 for a main trunk sewer.

Montana.

⦿W. D. Lovell of Minneapolis, Minn., s been awarded the contract by the city of S-by, Mont., J. E. Nolan, City Engineer, for e construction of a municipal owned w works system, for which bids were ope June 10, at $42,000. The work will incl the following: Material for 700 ft. of w trestle from 1 ft. to 48 ft. high for 8-in. w pipe, including frostproof casing; material 500 ft. of wood trestle from 1 ft. to 26 high, for 8-in. steel pipe, including frostpr casing; material for frame pump house, 12 by 20 ft.; one 100,000-gal. wooden water t complete; one oil engine and pump compl capable of furnishing 100 gals. of water minute through 3,000 ft. of 8-in. steel pipe; 26,000 ft. of 8-in. wood pipe, against a h of 390 ft.; 20 hydrants; 12 8-in. and 14 6 gate valves for wooden water pipe; 3,000 lbs. cast iron fittings for wooden pipe; 31,000 of 6-in. wood pipe and couplings; 9,000 ft. 6-in. wood pipe and couplings; 3,000 ft. of in. wood pipe and couplings; digging 15,000 of trench; 4000 ft. of 2½ in. fire hose.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] ipe; three wrenches for above.

Nebraska.

[illegible] emple, City Clerk, North Platte, Nebr., 200 tons of 4, 6 and 8-in. cast iron pipe, drants, 7 and 6-in. valves and the neces- lead and hemp; also for digging some) ft. of trench and laying pipe. Hershey Velch is Water Commissioner. P. G. er is Engineer of the City.

he Almo Engine & Supply Co., of na, Nebr., has been awarded the contract ie Village Council of Louisville, Nebr.; Barr, Clerk, for the construction of a works system at $14,793. Bids were ed June 4 and the contract awarded 10.

e Village Board of Winnebago, Nebr., assed a resolution calling a special elec- on June 25, for the purpose of submitting e voters the proposition of bonding the e in the sum of $9,000 for waterworks ire protection.

New Hampshire.

[illegible] l action on the proposed auxiliary mu- il water supply for one year. The work stimated to cost $35,000.

New Jersey.

[illegible] to give the City Council authority to e control of the water supply. This is liminary step to the purchase of the of the two companies.

New York.

pecial election was held June 11 in Sara- ake, N. Y., for the purpose of voting on iestion of whether or not an appropria- of $50,000 should be made for the ex- n and improvement of the water system.

Department of Water has petitioned ity Council of Oswego, N. Y., to appro- the sum of $5,000 for the extending of ater mains.

lowing bids were received by Capt. F. T. d, Constructing Quartermaster, Fort H right (Fishers' Island), N. Y., on June r the construction of 34 reinforced con- cisterns, ranging from 5,255 to 15,549 each, complete with downspout, over- drains, pumps and suction lines: Con- ut Engineering & Construction Co., 8; T. A. Scott Co., $48,900; New Eng- Engineering Co., $39,863; Mitchell & Co., 9; Newport Construction & Engineering 49,177; R. L. Whipple & Co., $34,000; on Bros. Corporation, $39,840 and Harry [illegible]

North Carolina.

E. F. Lamb has sent a communication Pasquotank County Commissioners, eth City, N. C., agreeing to share one- he cost of driving some artesian wells perimental purposes with a view to pro- a pure supply of water for the city.

Ohio.

ids will be received until Noon, June 24, arles Craig, Village Clerk, Cheviot, O., e laying of 6-in. water pipe, setting fire nts, valves and special castings in St. n's Place from the main in Glenmore o the east line of Lot No. 19 of Bruns, ider and Lacher Subdivision in accord- with the plans, specifications, estimates rofiles on file in the office of the Village Each bid to be accompanied by a cer- check on some solvent bank in the sum 0, payable to the Village of Cheviot.

Oregon.

Water Commissioners and Mayor of nd, Ore., as a result of a recent visit headworks of Bull Run River, will ly order a 30-ft. dam, at a cost of $100,000, to increase the pressure. The party also investigated proposed sites for storage reservoirs.

The Water Board of Portland, Ore., has ordered the installation of a concrete reservoir on Mt. Tabor to supplant the old wooden tank. Engineer Clarke has made an estimate [illegible]

Pennsylvania.

[illegible] Bank Bldg., Pittsburgh, Pa., has been awarded the contract by the city of Pittsburgh, for the construction of baffles in the sedimentation basins at the city's filtration plant at As- [illegible] cu. yds. of concrete and the placing of 16,000 cu. yds. of filter material.

South Carolina.

[illegible] the Anderson Water, Light & Power Co., and the Portman shoals power plant on the Seneca River, have been sold to W. S. Lee, Vice-president and General Manager of the Southern Power Co.; C. Elmer Smith, President of the Morgan Smith Co., of York, Pa., and [illegible] The plant is valued at $642,000.

Texas.

⊙The Council of Pleasanton, Tex., has awarded the contract for the sinking of a 5-in. artesian well on the Franklin Addition to Pleasanton to B. F. Spradlin.

The city of Dallas, Tex., will probably advertise about July 24, for the construction of the proposed water purification plant, for which James H. Fuertes, of New York City, is Engineer.

It is reported the Salado Water Supply Co., Salado, Tex., will shortly let a contract for the sinking of a new deep well.

A movement is on foot in Oran, Tex., to build a large reservoir, which will cover 300 acres of land.

Under the instructions from the governor of Texas plans are being made for a first-class water system at the A. & M. College of Texas.

The Public Service Commission of Port Arthur, Tex., has voted to purchase the water system and 200 acres of land at Port Neches, with two artesian wells from Charles G. Gates. The citizens will be asked to vote on a bond issue for the purchase of the property.

An election will be held in Polytechnic Heights (P. O. Fort Worth), Tex., on June 20, to decide whether the city waterworks system just completed will be leased to Keller & Alvord, proprietors of the old Polytechnic Heights System.

The Commerce Trust Co., of Kansas City, Mo., has purchased a bond issue of $400,000 by the city of Waco, Tex. The proceeds will be used in installing a water filtration plant, in erecting a few reservoirs in high elevations and extending mains to unserved sections of the city.

Washington.

The City Council of Index, Wash., has rejected all bids received recently for the installation of the Municipal Waterworks System and is preparing to do the work by day labor. The cost is estimated at $10,000.

The City Council of Toppenish, Wash., has ordered five extensions of water mains of the municipal system, aggregating several miles. Iron pipe will be used.

Following bids were received by Capt. J. R. Pourie, Constructing Quartermaster, 482 Arcade Annex, Seattle, Wash., for the laying of a 4-in. cast iron water main at Fort Worden, Wash.: International Contracting Co., 70 days, $3,872; James H. Coyne, 75 days, $3,770, and Wm. B. Mullin & Co., 3615 Phinney Ave., Seattle, 75 days, $2,354.

The citzens of Oakville, Wash., at a recent election, voted in favor of the construction of a waterworks system. The supply will be secured from one of the mountai streams near town. Work will be starte within thirty days.

West Virginia.

The City Council of Elkins, W. Va., Georg Henry, City Clerk, has rejected all bids re- ceived June 15 for the repairing of the cit reservoir. The work will be done at once l day labor.

Wisconsin.

The citizens of Oshkosh, Wis., will vo at the regular election, Nov. 5, on the propo- sition of purchasing and maintaining th waterworks system.

The Common Council of Wausau, Wis., ha adopted a resolution providing for the buil ing of a number of sewers, located as follow: Washington St., Scott St., Kickbusch St., El St., Grand Ave., Stewart Ave., North Thi Ave., North Fourth Ave. The Board of Pu lic Works will receive bids on the work once.

Plans and specifications for the constructio of sewers in the Washington St. district, Ma ison, Wis., are on file with City Clerk O. Norsman.

The Common Council of Waukesha, Wi has decided to replace the old Norman pi water mains with cast iron pipe at once. Fo lowing is a list of the streets to be relaid, th length of same, the estimated cost, etc.: Map and Dunbar Aves., 4,652 ft., 6-in. pipe, est mated cost, $4,652. Wisconsin Ave., 1,767 f 6-in. pipe, $1,767. Lake and Huron Sts., 1,37 ft., 6-in. pipe, $1,375. McCall St. and Raci Ave., 1,625 ft., 6-in. pipe, $1,625. Oakla Ave., 700 ft., 6-in. pipe, $700. Randall S 1,700 ft., 6-in. pipe, $1,700. Madison St., 1,0 ft., 12-in. pipe, $2,000.

Canada.

⊙The Waterworks Commission of Berli Ont., has awarded the contract for construc ing a 1,000,000-gal. reservoir in connectio with the new $100,000 extension plant, whi is in progress this year, to John Paterson, St. Mary's, Ont., at $15,450. A new 500,00 gal. standpipe will also be erected.

The Council of the town of Canora, Sas will consider proposals about July 6 for t granting of a franchise for a supply of wat for town and railway use, for a period n exceeding 20 years. The most economical a practical source of supply is from Cryst Lake, 14 miles distant, the engineer's repo thereon indicating a cost of about $200,00 H. M. Sutherland is Secretary-Treasurer.

Ratepayers of Calgary, Alta., will shortly called upon to authorize the expenditure $1,053,600 for the improvement of a gravit tion system which is supplying the city wate City Engineer Childs has submitted figures the estimated cost of the new system. T proposed plan is to duplicate the present pi line from a point about two miles further Elbow River than the intake of the prese system, and run it into the city to join t city waterworks system at a point near t reservoir in southwest Calgary. Sediment tion tanks at the intake are provided in ord to make the water as clear as possible, and filler basin near the reservoir. The estimat cost of the new main is $738,600, the sedime tation tanks at the intake and the enlargeme and lining of the reservoir, $15,000, and t installation of 12,000,000 gallon capacity filte $200,000.

The Fire, Water and Light Committee South Vancouver, B. C., has decided to a quotations for 25 miles of 4-in. water pipi and 10 miles of 6-in. water pipes, at an es mated cost of $70,000.

Acting City Engineer George G. Powell, Toronto, Ont., has recommended the co struction of 13 additional filters at the filtr tion plant, at an estimated cost of $735,00 along with a new pipe line to the tunnel, at further cost of $140,000. The Board of Co trol has decided that plans and specificatio should be prepared at once.

✣indicates work now open for bids. ⊙indicates a contract let recently.

SEWERAGE AND GARBAGE DISPOSAL

California.

The City Council of San Barnardino, Cal., has ordered sewers constructed on Park St., between H and I Sts., and on Orange St., between B and Arrowhead Ave.

The Streets and Boulevard Committee of Los Angeles, Cal., has recommended to the City Council the building of 31 miles of storm sewers, draining the de la Brea section of the [illegible] cost of between $500,000 and $600,000.

Connecticut.

✣Bids will be received until 11 a. m., July 9, by Board of Contract & Supply, Hartford, Conn., for furnishing and erecting pumping equipment for the East Side Sewage pumping station. Joseph Buths is Secretary of the [illegible]

Illinois.

✣Bids are asked until 7 p. m., June 2[illegible], by Board of Local Improvements, Park Ridge, Ill., W. H. Malone, President, for constructing 317 water service pipes (4,755 lin. ft. of ¾-in. galvanized wrought iron pipe) and 313 house drains (4,695 lin. ft. of 6-in. pipe).

✣Bids are asked until 7 p. m., June 27, by the Board of Local Improvements, W. H. Malone, President, Park Ridge, Ill., for constructing 313 house drains, aggregating 4,695 lin. ft. of 6-in. vitrified tile pipe, and 317 water service pipes, aggregating 4,755 lin. ft. of ¾-in. galvanized wrought iron pipe. Bids are also asked for constructing 389 lin. ft. of 12-in. vitrified tile pipe sewer, and for 388 lin. ft. of 4-in. iron water main. F. R. Pfeifer is Engineer.

The town of Assumption, Ill., will let contracts about the middle of August for the construction of a new sewer system at an estimated cost of $33,000. Plans were prepared by Engineer A. B. Alexander of Decatur, Ill. The work will include about 8 miles of vitrified salt glazed pipe. R. F. Johnson, Assumption, is official in charge.

Following are the lowest bids submitted to the Board of Local Improvements, Chicago, Ill., Ed. J. Glackin, Secretary, for constructing sewers in the following streets: South Park Ave. system, total bid, $12,097; unit bids, South Park Ave., 670 lin. ft. 2½-ft. double invert brick, $3.22; 335 lin. ft. 2.0-ft. double invert brick, $3.00; 335 lin. ft. 18-in. double strength tile pipe, $1.69; E. 87th St., 670 lin. ft. 15-in., $1.37; 670 lin. ft. 12-in., $1.28; 450 lin. ft. 12-in., $1.28; E. 87th Pl., 670 lin. ft. 15-in., $1.37; 670 lin. ft. 12-in., $1.28; E. 88th St., 670 lin. ft. 15-in., $1.37; 670 lin. ft. 12-in., $1.28; E. 88th Pl., 670 lin. ft. 15-in., $1.37; 670 lin. ft. 12-in., $1.28; 270 lin. ft. 12-in., $1.28; Byrne Bros., 5502 S. Halsted St. South Park Ave. system No. 2: 1,670 lin. ft. 3½-ft. double ring brick, $4.23; 1,010 lin. ft. 3.0-ft. double ring, $3.95; Burnside Ave., 396 lin. ft. 2.0 double invert, $2.80; Calumet Ave., 720 lin. ft. 15-in., $1.35; 670 lin. ft. 12-in., $1.26; E. 89th Pl., 670 lin. ft. 15-in., $1.35; 670 lin. ft. 12-in., $1.26; E. 90th St., 670 lin. ft. 15-in., $1.35; 670 lin. ft. 12-in., $1.26; E. 91st St., 670 lin. ft. 15-in., $1.35; 670 lin. ft. 12-in., $1.26; E. 91st Pl., 670 lin. ft. 15-in., $1.35; 670 lin. ft. 12-in., $1.26; total, $20,973, Byrne Bros. Argyle St. system, 780 lin. ft. 4½-ft. double ring brick, $6.53; 560 lin. ft. 4.0-ft. double ring, $6.07; Evanston Ave., 725 lin. ft. 3.0-ft. double ring, $4.85; 300 lin. ft. 2½-ft. double ring, $4.40; 300 lin. ft. 12-in., $1.60; 640 lin. ft. 18-in. double strength, $2.75; 640 lin. ft. 15-in., $2.00; Kenmore Ave., 1,000 lin. ft. 18-in. double strength tile pipe, $2.75; 370 lin. ft. 15-in., $2.00; 370 lin. ft. 12-in., $1.60; 400 lin. ft. 15-in., $2.00; 270 lin. ft. 12-in., $1.60; Winthrop Ave., 100 lin. ft. 18-in. double strength tile pipe, $2.75; 370 lin. ft. 15-in., $2.00; 370 lin. ft. 12-in., $1.60; 410 lin. ft. 15-in., $2.00; 270 lin. ft. 12-in., $1.60; total, $27,496, H. J. McNichols, Rookery, Chicago. High St., 270 lin. ft. 15-in., $1.81; total, $488, Ch. Malone, 701 DeKoven St. Wrightwood Ave., 300 lin. ft. 12-in., $1.72, Louis Scully, 1017 W. Polk St. Potomac Ave., 670 lin. ft. 15-in., $1.40; 540 lin. ft. 12-in., $1.24, Simon Ryan, 2927 W. Congress St. W. 70th St., 235 lin. ft. 12-in., $1.09; house drains, 150 lin. ft. 6-in., 23 cts.; total, $291, Geo. Pontorelli. N. 47th Ct., 670 lin. ft. 15-in., $1.39; 1,340 lin. ft. 12-in., $1.24; 670 lin. ft. 15-in., $1.38; total, $3,517, Simon Ryan, 2927 W. Congress St. The work includes construction of catchbasins, manholes, etc. The contracts have not been awarded.

Following are the lowest bids submitted to the Board of Local Improvements, Chicago, Ill., Ed. J. Glackin, Secretary, for constructing pavements in the following streets: Berteau Ave., 3,350 lin. ft. concrete curb and gutter, 65 cts.; 5,000 sq. yds. asphalt, $2.07; total, $14,046, R. F. Conway Co., 133 W. Washington St. Cheltenham Pl., 800 lin. ft. concrete curb and gutter; 1,090 sq. yds. asphalt, $2.10; total, $3,105. Fifth Ave., 870 lin. ft. concrete curb and gutter, 68 cts.; 1,170 sq. yds. asphalt, $2.08; total, $3,384, American Asphalt Paving Co., 133 W. Washington St. 43rd Ct., 6,700 lin. ft. concrete curb and gutter, 65 cts.; 10,800 sq. yds. asphalt, $2.06; total, $30,168, H. P. Streicher Co., Memphis, Tenn. Ashland Ave., 4,770 lin. ft. concrete curb and gutter, 65 cts.; 7,720 sq. yds. asphalt, $2.03; total, $21,183, R. F. Conway Co. Frink St., 10,870 lin. ft. concrete curb and gutter, 66 cts.; 13,815 sq. yds. asphalt, $2.09; total, $40,206, American Asphalt Paving Co. Homer St., 3,790 lin. ft. concrete curb and gutter, 64 cts.; 5,760 sq. yds. asphalt, $2.12; total, $12,211, Parker Washington Co., 133 W. Washington St. 97th St., 2,870 lin. ft. sandstone curbing (7x18-in.), 75 cts.; 4,890 sq. yds. granite top macadam, $1.11; total, $9,362, Calumet Coal and Teaming Co., 9022 Commercial Ave. Olive Ave., 1,670 lin. ft. concrete curb and gutter, 65 cts.; 2,440 sq. yds. asphalt, $2.31; total, $7,491, R. F. Conway Co. 16th St., 2,500 lin. ft. concrete curb and gutter, 65 cts.; [illegible] sq. yds. asphalt, $2.06, total, $10,228, American Asphalt Paving Co. Talman Ave., 2,560 lin. ft. concrete curb and gutter, 65 cts.; 4,100 sq. yds. asphalt, $2.09; total, $11,254. Alley, Marble Pl., Adams St., etc., 400 lin. ft. concrete curb, 20 cts.; 300 sq. yds. No. 2 granite blocks, $3.57—$1,151, Jno. Dillon, 179 W. Washington St. Alley, North Ave., Cleveland Ave., etc., 1,480 lin. ft. concrete curb, 15 cts.; 1,100 sq. yds. brick, $2.44; total, $2,906, P. J. O'Brien, 9 S. La Salle St. Alley, Vincennes Ave., 50th St., etc., 1,040 lin. ft. concrete curb, 10 cts.; 575 sq. yds. brick, $2.73, total, $1,673, J. A. McGarry, 189 W. Madison St. Alley, Cottage Grove Ave., 64th St., etc., 1,430 lin. ft. concrete curb, 15 cts.; 1,130 sq. yds. brick, $2.34. Alley, Addison St., Rokeby St., etc., 1,390 lin. ft. concrete curb, 15 cts.; 1,090 sq. yds. brick, $2.19; total, $2,695, P. J. O'Brien. Alley, 53rd St., Monroe Ave., etc., 920 lin. ft. concrete curb, 20 cts.; 920 sq. yds. brick, $2.57; total, $2,548, J. A. Sackley Co., 133 W. Washington St. Alley, Wellington St., Pine Grove Ave., etc., 970 lin. ft. concrete curb, 15 cts.; 870 sq. yds. brick, $2.23; total, $2,423, Central Paving Co., 179 W. Washington St. Alley, Taylor St., Johnson St., etc., 2,000 lin. ft. concrete curb, 15 cts.; 1,400 sq. yds. brick, $2.45; total, $3,730, Central Paving Co. Alley, Taylor St., Blue Island Ave., etc., 1,150 lin. ft. of concrete curb, 15 cts.; 1,200 sq. yds. brick, $2.40, P. J. O'Brien. Alley, Polk St., Morgan St., etc., 1,800 lin. ft. concrete curb, 15 cts.; 1,550 sq. yds. brick, $2.19; total, $4,527, Central Paving Co.

The Board of Local improvements of Hillsboro, Ill., has passed a resolution providing for the construction of a $40,000 sewe in the city. Public hearing was held

The City of Assumption, Ill., wi award contracts for the constructio sewer system involving an outlay of The system will provide sewer facili every lot in the city, and will require of tile, more than 41,000 ft. of pipe. Alexander is Engineer.

The Board of Local Improveme Wheaton, Ill., A. L. Webster, memb adopted a resolution originating a lo provement in the city, consisting of a drain on Main St., and Main St. ex commencing at a point 21 ft. north south line of Illinois St. and running southerly in the center of Main St., an St. extended 2,890 ft., to the open ditch as Union Drainage Ditch No. 1. T mated cost is as follows: 2,890 ft. o cement concrete pipe set in place, in inlets for house connections, excavati back-filling at $6 per lin. ft., includi removal of the present pipe, $17,340; 3 42-in. cement concrete pipe at $4 per ft 15 ft. of 36-in. cement concrete pipe a per ft., $52.50; 5 manholes at $25 eac 1 manhole, extra large, $75; hauling exceed 1 mile, 383 tons of 30-in. pip from Main St., at $1.50 per ton, $ cleaning out ditch for 300 ft. below outlet and constructing a cement bulkh outlet of new 60-in. pipe, $200; expe making and levying special assessment ting contract, advertisements, court cost essary estimates, examinations and ot penses for making and collecting asses as provided by law, 6 per cent of the $1,109.22; total, $19,596.22.

It is reported an election was held Village of Minooka, Ill., on June 18 purpose of voting on the installation sewer system.

The Board of Public Works of Peori has instructed City Engineer L. D. J to prepare estimates for the laying of a in the Sewer District No. 1, which in that territory at the north end of th between Caroline, Perry and Grant St extending to the river. The work wil approximately $10,000.

The Garbage Commission of the City cil, Chicago, Ill., in its report just made recommends that the city should constr plant at a cost of $250,000; manage its plant; award a contract for the work that the policy of incineration shou adopted for both ashes and garbage outlying portions of the city.

Indiana.

✣Bids will be received until 10 a. m 25, by Board of Public Works, South Ind., for pipe sewer on Garst St., from lin St. to a point 100 ft. west of Lafaye A. P. Perley is Clerk.

The Board of Public Works of South Ind., has been petitioned for a sewer on awaka Ave., from 19th to First St. At ent the Board has under consideration a sewer on Mishawaka Ave.

City Engineer C. A. Williston of Gary, has presented the Board of Public Works estimates for the building of the sewer of the river and the improving of Mai in Tolleston. The estimated cost of the is $300,000.

The City of Elwood, Ind., is about t a contract for the building of a deep se on South K. St. The Council is also sidering a petition for a sewer on South H

Iowa.

⊙The City Council of Grundy Center, has awarded the contract for sewer exten work in the city to M. McIlligott at $1,

The City Council of Clinton, Ia., has

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

the construction of a [illegible] the center line of [illegible] west of Ninth St. and [illegible] enter of Fourth Ave. Chas. J. Rensche [illegible] Clerk.

citizens of the Town of Holstein, Ia., [illegible] election voted [illegible] [illegible] system [illegible] 0.

City Council of Sioux City, Ia., has [illegible] laid in West Sixth St., between Este d Helmer St., and for a sanitary sewer est 20th St., from Ross St. to West St

sulting Engineers M. Tschirgi & Sons, asonic Bldg., Cedar Rapids, Ia., are pre plans for the installation of a sewer-stem in Belmond, Ia.

[illegible] Masonic Bldg., Cedar Rapids, Ia., are [illegible]

Kansas.

Engineer Bert C. Wells of Wichita, is preparing plans for a storm water for West Wichita. Plans are being for drainage of the district bounded e Wichita and Western tracks on the Hancock Ave. on the north, Sheridan or the city limits west, and the Arkansas on the east.

nmissioner W. G. Handy of Topeka, has practically completed the preliminary in connection with the creation of a district for the construction of a sewer [illegible]

The proposed sewer will run through ndale, Melrose, Lowman Hill, Elmhurst Vashburn districts.

tracts will be let about Aug. 1 by the f Newton, Kans., for the construction orm sewers at an estimated cost of). The work will include storm sewer, 12-in. pipe, of concrete, brick or vitrile. Plans have been prepared by En- F. E. Devlin of Newton. O. W. Roft nmissioner of Public Works.

Massachusetts.

ds will be received until June 22, by Colahan, Secretary, Board of Public s, Stoneham, Mass., for construction of in Columbus Ave. and Gould St., in-g about 705 ft. D. G. Pratt, Hill Block, am, Mass., is Superintendent of Public

Minnesota.

e City Council of Stillwater, Minn., has contract for the construction of the Second St. sewer to Fraser & Danforth Paul, Minn., at $7,246. Other bidders P. J. Ryan, St. Paul, $8,244; E. T. Web-St. Paul, $8,129; Pastoret & Lawrence, , $7,344, and E. T. Sykes, Minneapolis.

Missouri.

Mayor and City Council of Maplewood, contemplate calling an election for the e of voting a special tax for the instal- of a sewer system. Engineers recently [illegible]

Hospital and Health Board of Kansas Mo., has authorized the construction of incinerator of at least 75 tons daily y. Resolutions to ask the Board of Works to advertise for bids on such to be located on the grounds of the workhouse at 20th and Vine Sts., dopted. The estimated cost is $100,000. . S. Wheeler is Health Commissioner.

citizens of Hermann, Mo., on July 20 te on the issuance of bonds in the sum [illegible] sewer.

Montana.

ulting Engineer C. W. Swearingen of Falls, Mont., has submitted plans to ty Council of Missoula, Mont., for the ction of a sewer system on the south side. The Engineer's estimates of cost are as follows: Main trunk sewer, $21,241; dis-[illegible] per lot.

The School Board of Trustees has petitioned the City Council of Great Falls, Mont., to organize a special improvement district to construct a lateral sewer through block No. 325, first alley north, from 14th to 15th St.

[illegible] for bids some time in the fall for the construc-[illegible]

Nebraska.

[illegible] Council of Fall City, Neb., for the construc-[illegible] Monarch Engineering Co., $39,327; Wm. F. Plummer & Co., $40,428, and McGuire & Stan-[illegible]

New Jersey.

✣[illegible] 25 (readvertisement), by Passaic Valley Sewerage Commissioners, Essex Bldg., Clinton St., Newark, N. J., J. S. Gibson, Clerk, for the construction of Section 15, of the Main Intercepting Sewer in the City of Passaic and Acquackanonk. Particulars that may enable contractors to judge of the character of the work are given below: Approximate quantities, Section 15, 3,445 lin. ft 90-in. concrete sewer in trench, from about 15 ft. to about 35 ft. in depth; 1,080 lin. ft 90-in. concrete sewer in tunnel; 2,750 lin. ft 81-in. concrete sewer cement concrete in tunnel; 200 cu. yds. brick masonry in manholes; 1,500 cu. yds. rock excavation in trench. Drawings, form of con-concrete in trench; 6,200 cu. yds. Portland in tunnel; 4,500 cu. yds. Portland cement tract, specifications and form of proposal may be obtained at the Commissioners' office from William M. Brown, Chief Engineer. The itemized bids received for this work May 14 were published in our May 29th issue.

⊙Collins & Gundrum, Henry St., South Amboy, N. J., have been awarded the contract by the City Council of South Amboy, Richard M. Mack City Clerk, for the construction of the Mechanicsville section of the sanitary sewer system of the city at $9,635. The work includes 100 cu. yds. of concrete in place, 2,300 ft. of 4-in. cast iron pipe in place, 20,000 ft. of 10-in. clay pipe in place, 6,000 ft of 8-in. clay pipe in place, 25 manholes, 5 flush tanks. Bids were opened June 11.

At a recent meeting of the citizens of Plainfield, N. J., and of its suburbs, it was decided that Plainfield and Dunellen and North Plainfield should build a joint sewage disposal plant on the Darling farm in Piscataway Township.

New York.

✣Bids will be received until 3 p. m., July 1, by Sewer Commissioners of the Glen Cove Sewer District, Glen Cove, N. Y., for furnishing all material and doing all work necessary to the complete construction of about twenty miles of vitrified pipe sewers, from 6 to 15 ins. in size, with the necessary branches, manholes, flush tanks and other necessary appurtenances, together with disposal works, consisting of two settling tanks, chlorinating plant and filter beds and the necessary devices for operating the same. Plans, specifications and forms of proposal are on file at the office of William H. Bowne, Engineer in Charge, Glen Cove, New York, and at the office of Johnson & Fuller, Consulting Engineers, 150 Nassau Street, New York.

✣Bids will be received until 5 p. m., June 24, by Board of Water Commissioners, East Williston Water District, at the office of F. L. Oakley, Commissioner, East Williston, Nassau County, N. Y., for furnishing the necessary labor and material for the construction of 12,-225 ft. of 4 to 8-in. pipes, 27 hydrants and necessary valves and specials; also meter pit with one 8-in. meter. All bids must be accompanied by a certified check for $250. Plans and specifications may be seen at the office of Fairfield & Dow, Engineers, Denton Bldg., Mineola, N. Y.

✣Bids will be received until 2 p. m., June 20, by J. M. Potter, Village Clerk, Granville, N. Y., for the construction of reinforced concrete reservoir, 100 ft. in diameter and 22 ft. deep, requiring approximately 550 cu. yds. of concrete and 50 tons of reinforcing steel bars. Plans and specifications are on file with Village Clerk and C. E. Collins, Drexel Bldg., Philadelphia, Pa., Consulting Engineer.

⊙Nash, Robinson & Griffin of Norwich, N. Y., have been awarded the contract by that city, C. E. Harris, City Engineer, for the construction of 8-in., 10-in. and 12-in. sanitary sewer, at $5,749. The work includes 600 lin. ft. of 12-in., 1,200 ft. of 10-in., 2,500 ft. of 8-in., 4 flush tanks, and 16 manholes. Bids were opened June 6.

Chief Engineer Glen D. Holmes of the Intercepting Sewer Board of Syracuse, N. Y., has recommended the installation of a sewage disposal plant similar to that of Worcester, Mass. It is planned to establish the plant near Onondaga Lake.

Definite plans for the protection of Jamaica Bay against sewage have been issued by the Metropolitan Sewerage Commission of New York City. The plans contemplate the construction of intercepting sewers which will lead to two central points in the Jamaica Bay district, where the sewage will be purified.

The Village of Middleport, N. Y., has sold its issue of water and sewer bonds to the amount of $104,000 to Douglas, Fenwick & Co. of New York City.

Mayor Nelson of Hornell, N. Y., has retained Consulting Engineer Clyde Potts of New York City to prepare the plans for the new sewage disposal plant, which the state has ordered the city to build at once.

The State Conservation Commission and the State Department of Health have approved the plans for additional sewers for the City of [illegible]

Ohio.

✣Bids will be received until noon, June 2- by Director of Public Service, Akron, O., fo furnishing and delivering to the city cast iro water pipe and specials, approximately as follows: Two tons 4-in pipe, 140 tons 6-in. pip 65 tons 8-in. pipe, 45 tons 10-in. pipe, 20 tor 12-in. pipe, 346 tons 16-in. pipe, 620 tons 20-i pipe, 4 tons 24-in. pipe, 715 tons 30-in. pip 6 tons of special castings from drawing 80 tons of special castings. American W W. Association Standard. A surety bon or certified check for $1,000 must b filed with each bid. R. M. Pillmore is Director of Public Service.

✣Bids will be received until noon, June 2 by Director of Public Service, Akron, O., fo furnishing and delivering to the city, iron body, bronze mounted gate valves, approx mately as follows: One 3-in. gate valve, 4-in. gate valves, 23 6-in. gate valves, 9 8-i gate valves, 1 10-in. gate valve, 7 12-in. ga valves, 10 16-in. gate valves, 3 20-in. ga valves, 5 24-in. gate valves. A surety bond certified check for $500 must be filed with eac bid. Barbour & Bradbury are engineers.

⊙T. G. Chapman has been awarded the cor tract for building Sections 2, 3, 4 and 5 of Sew er District No. 4, covering the southweste portion of the city, by the Board of Control Canton, O. Mr. Chapman's bids on the diffe ent sections were as follows: Section $4,900; Section 3, $5,980; Section 4, $6,1 and Section 5, $5,722. The bids on Section were declared to be irregular and all we rejected. The Board will advertise for ne bids.

The Village Council of Mantua, O., h engaged Civil Engineer John S. Mallette Ravenna, O., to make the preliminary surve and estimates for paving of Main St.; al plans for storm and sanitary sewers, in antic [illegible] of installation of a sewage disposal plant.

The Sewer Committee of the Village Council, Geneva, O., has arranged for the construction of a sanitary sewer on Vine St., from Chestnut to Swan St.

The Sewer Committee of the City Council, Salem, O., has recommended the building of a sewer in West 10th St., Goshen Ave. and West Eighth St. Plans are to be prepared by the City Engineer.

Oklahoma.

✣Bids will be received until June 28 by City of Coalgate, Okla., for the construction of a sanitary sewer, including the following: 1,583 ft. of 10-in. pipe; 2,570 ft. of 6-in. pipe; 6 manholes; 4 lampholes. Bids will be also taken for a storm sewer as follows: 1,420 ft. of 18-in. pipe; 272 ft. of 12-in. pipe; 8 catch basins. E. T. Brown is City Engineer.

Residents of Belleview addition have filed a petition with the City Commissioners of Tulsa, Okla., for the installment of sanitary sewers and water service in that part of the city.

Oregon.

⊙The Warren Construction Co. has been awarded the contract by the City Council of Tillamook, Ore., for the construction of a sewer system at $43,033. Other bidders were: Kennedy Construction Co., $47,366; Jeffery & Bufton, $45,272; Gibbith & Joplin, $46,192, and M. Jacobson, $47,618.

Pennsylvania.

✣Bids will be received until 8 p. m., June 20, by J. W. Davis, Secretary, 22 Runnymede Ave., Lansdowne, Pa., for the construction of a sewer on First Ave., from Marshall road to Essex Ave.; also on Plumstead Ave. All bids must be accompanied by a certified check for the amount bid.

⊙D. S. Bader of Philadelphia, Pa., has been awarded the contract by the Bureau of Water, M. L. Cooke, Director, Department of Public Works, Philadelphia, for Contract 192, completion of Queen Lane filter plant, at $35,000. The Keystone State Construction Co., Philadelphia, secured the contract for furnishing and placing cut granite for the filter plant, being Contract 193, at $10,000. Bids were opened June 11.

Bids have been received by the Sewer Committee of the City Council, McKeesport, Pa., for the construction of the Ninth and 11th Ward sewers, for which a bond issue of $70,000 has been passed. Bids were submitted by Ridge Bros. Co., Bowman Bros. Co., P. F. Rheades & Son, Henry Bohler, J. B. Sheetz & Co. and Edward H. Cannon.

The Borough Council of East Mauch Chunk, Pa., has decided not to sewer the town at an expense of $40,000.

Mayor Stratton of Reading, Pa., has signed the ordinance for the construction of a storm water sewer on Maple St., from a point 110 ft. south of Cotton St. to Culvert St.

The Board of Public Works of Harrisburg, Pa., will probably advertise for bids before July 1 for the improvement of Paxton Creek, estimated to cost $316,000. James H. Fuertes of New York City is Engineer.

The taxpayers of Glen Olden, Pa., will vote June 29 on the proposition of borrowing $30,000 for street and sewer improvements.

The Middletown Drainage Co., Middletown, Pa., which operates the sewers in that borough, has been granted a permit by State Commissioner of Health Samuel G. Dixon to extend a number of sewers in the developing part of the town. The company will eventually build a sewage disposal plant.

State Health Commissioner Samuel G. Dixon, Harrisburg, Pa., has granted permission to the owners of the Riverside development in Susquehanna Township to extend sewers. It is likely that a conference will be held between municipal and Riverside authorities relative to the terms for connecting with the Harrisburg system.

State Commissioner of Health Samuel G. Dixon has approved plans for a sewage disposal plant for the Somerset County almshouse. The state hospital for the criminal insane is also to have a sewage disposal plant, plans having been approved for one for the new institution in Wayne County.

Early in July Director of Public Service Cooke of Philadelphia, Pa., will invite bids for garbage collection next year. The contract is held this year by the Penn Reduction Co. at $278,588.

The Borough Council of Munhall, Pa., has awarded the $40,000 bond issue to J. S. & W. S. Kuhn of Pittsburgh. The proceeds will be spent in improving streets and erecting a $25,000 garbage disposal plant.

South Dakota.

⊙Bids were opened June 3 by the City of Pierre, S. Dak., Thos. Soliglad, City Engineer, for constructing sewers, the contract being awarded to Stainer & England, Pierre, S. Dak., at $17,468. The unit bids received were as follows, (1) standing for Joseph Stainer & Oluf Englund, Pierre, S. Dak.; (2) Jeffries & Roush, Fort Pierre, S. Dak.; (3) R. B. Airey, Pierre, S. Dak.; (4) Meeker & Dobson, Madison, S. Dak.; (5) R. H. Townsend, Fort Pierre, S. Dak.; (6) John H. Roberts, Brookings, S. Dak.; (7) L. W. Schruth, Fargo, N. Dak.; (8) Fraser & Danforth, St. Paul, Minn.; (9) A. L. Jones, Sioux Falls, S. Dak.; (10) Wm. F. Karbel, Pierre, S. Dak.; (11) Lewis & Leeder, Sioux City, S. Dak.; (12) R. C. Noble, Centerville, S. Dak.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Furnish and lay 8-in. sewer pipe, incl. cement joints, Ys and detachable covers, 21,106 ft.	$0.26	$0.24	$0.27½	$0.28	$0.24½	$0.25	$0.30	$0.22	$0.20	$0.30	$0.31
Furnish and lay 10-in. sewer pipe, incl. cement joints, Ys and det. covers, 2,025 ft.	.32	.50	.32	.35	.28	.33	.35	.30	.27	.45	.40
Furnish and lay 12-in. sewer pipe, incl. cement joints, Ys and det. covers, 2,435 ft.	.39	.40	.41½	.43	.31	.42	.45	.40	.32	.57	.48
Furnish and lay 15-in. sewer pipe, inc. cement joints, Ys and det. covers, 1,765 ft.	.63	.60	.62	.62	.44	.55	.60	.55	.48	.53¾	.70
Excavation and backfill under 5 ft., 2,397 ft.	.12	.10	.12	.15	.17	.08	.20	.22	.16	.13½	.12
Excavation and backfill over 5 ft. and under 7 ft., 1,25[illegible] ft.	.16	.17	.15	.18	[illegible]	.10	.25	.26	.22	.20¾	.16
Excavation and backfill over 7 ft. and under 9 ft., 14,446 ft.	.22	[illegible]	.27	.25	.30	.27	.32	.30	.32	.28¾	.25
Excavation and backfill over 9 ft. and under 11 ft., 7,375 ft.	.28	[illegible]	.30	.33	.48	.40	.40	.35	.58	.35¾	.31
Excavation and backfill over 11 ft. and under 13 ft., 1,027 ft.	.34	.40	.40	.50	.52	.60	.50	.40	.62	.42	.51
Excavation and backfill over 13 ft. and under 15 ft., 835 ft.	.42	.50	.70	.60	.60	.80	.60	.50	.68	.50	.70
Manholes complete, [illegible]	38.50	48.00	45.00	45.00	47.00	37.50	50.00	50.00	42.75	.....	50.00
Flush tanks complete, [illegible]	36.50	110.00	110.00	90.00	106.00	85.00	100.00	100.00	115.00	.....	100.00
Lampholes, 3	1.00	6.00	6.00	5.00	2.00	4.00	4.00	12.00	3.50	4.75	5.00
Rock excavation, per cu. yd., 200	2.25	3.50	4.50	5.00	3.50	10.00	2.80	9.00	6.00	2.50	5.00
Extra earth excavation, per cu. yd., 50	.70	.97	.30	.50	.60	.30	.40	.80	8.06	65	.80
Extra concrete, per cu. yd.	4.75	7.50	8.00	12.00	5.00	9.00	6.00	10.00	1.50	...	7.00

The city of Yankton, S. Dak., plans the making of extensions to the waterworks system at an estimated cost of $50,000. The work will include reservoir, water mains, pumps, etc. The water supply is secured from artesian wells. No engineer has as yet been engaged.

Texas.

✣Bids will be received until 10 a. m., July 2, by J. G. Sutton, City Secretary, Beaumont, Tex., for furnishing all material, tools and labor necessary to be used in the construction of combination storm and sanitary sewers in various parts of the City of Beaumo sisting of main sewers, extensions and of vitrified pipe and concrete rangin 8 ins. to 7½ ft. in diameter, complete catch basins, manholes and house conn Plans and specifications may be seen an forms procured at the office of C. L. S City Engineer, Beaumont, Tex., to wh quest for additional information sh addressed. Plans and profiles and spe tions may be procured direct from t Engineer. Each proposal must be accom by a certified or cashier's check on som mont bank, made payable to Emmett A cher, Mayor, in the sum of $1,000 amount to be expended approximates

Street Commissioner Maddox of Worth, Tex., has decided upon a storm from Seventh and Magnolia Aves. to M St., and Sixth Ave., as the best me relieving conditions in that section.

Consulting Engineer James H. Fue New York City has commenced prel work for the installation of a new sew tem in Dallas, Tex.

The South Side Improvement Leag Austin, Tex., has petitioned the City C to provide sewerage mains for South

The citizens of Calvert, Tex., at a election voted the issuance of bonds sum of $25,000 for the installation of the system.

The City Council of Austin, Tex., h gaged M. C. Welborn as Head Engineer sewer system. Specifications for the w to be prepared at once.

Vermont.

✣Bids will be received until 8 p. m., J by City Council, St. Albans, Vt., for the struction of an earthen dam and reserv laying about 3 miles of 12 and 15-in. pipe. D. F. McCarthy is City Engineer.

Washington.

⊙The Jahn Contract Co., Railroad Seattle, Wash., has been awarded the co by the City of South Bend, Wash., fo construction of sewers in District $25,611.

⊙C. A. Roberts has been awarded the tract by the City Council of Beilin Wash., for the construction of sewer $9,153.

⊙Capt. & Quartermaster J. R. Pourie Arcade Annex, Seattle, Wash., has aw the contract to Wm. B. Mullin & Co., Phinney Ave., Seattle, for the laying of cast iron water main and making certain s ice connections at Fort Worden, Wash

Canada.

✣Bids will be received until noon, July by G. R. Geary, Chairman Board of C trol, Toronto, Ont., for the construction Section No. 12 Highlevel Interceptor. work will include the construction of 2, lin. ft. of 4-ft. circular brick or conc sewer with connections. Plans and speci

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

are on file at the office [illegible]
engineer.

Jones Patterson of St. Mary's, Ont., has
awarded the contract by the Water Com
sioners, Berlin, Ont., for the construction

[illegible]

•The City Council of Vancouver, B. C., has

awarded the contract for the construction o
sewers in 13th Ave., Oak to Yukon St., 14t
Ave., Oak to Bridge St., except Ash t
Heather, and 15th Ave., Oak to Heather, t
[illegible]

BUILDINGS, DOCKS, DREDGING, SUPPLIES, ETC.

California.

ness men of Long Beach., Cal., have
ined the City Council asking it to se-
mpetitive plans for a municipal pier to
from the foot of Pine Ave. to Ameri-

Cuba.

ls will be received until 11 a. m., July
H. R. Stanford, Chief of Bureau of
and Docks, Navy Department, Wash-
D. C., for a steam driven ice making
frigerating plant complete, with all ac-
es and with superintendence for its in-
[illegible]

Georgia.

ls will be received until 3 p. m., Au-
by James Knox Taylor, Supervising
ect. Treasury Department, Washington,
for the construction complete, including
ng, gas piping, heating apparatus, elec-
nduits and wiring, and interior light-
tures and approaches of the United
postoffice at Carrollton, Ga. The build-
of two stories and basement and has a
area of approximately 3,800 sq. ft.,
proof construction, stone, brick, and
facing, terra cotta cornice and tin
Drawings and specifications may be ob-
from the Custodian of Site at Car-
Ga., or at the discretion of the Super-
Architect.

Hawaii.

ls will be received until 11 a. m., July
H. R. Stanford, Chief of Bureau of
and Docks, Navy Department, Wash-
D. C., for 4 electrically and 18 hand-
d traveling cranes for the naval station,
Harbor, Hawaii.

Illinois.

ls will be received until 2 p. m. June
the New Baden Electric Light & Power
ew Baden, Ill., for furnishing the neces-
bor and material for an electric light
wer plant. The installation will in-
2 80-h.p. return tubular boilers, 1 35-
and 1 50-k. v. a. single phase, 60-cycle,
olt, engine type, alternating current
ors with belted exciters, 2 steam en-
2 boiler feed pumps, 1 100-h. p. feed
heater, separators, traps, piping, 1 3-
switchboard and complete commercial
reet lighting circuits over the village.
and specifications may be seen in the
f Fred J. Koch, President of the Com-
New Baden, Ill., or in the office of the
ers, Fuller-Coult Co., Chemical Bldg.,
[illegible]

Indiana.

ls will be received until 11 a. m., June
Capt. E. S. Stayer, Quartermaster, Fort
in Harrison, Ind., for furnishing the
ry labor and material for the construc-
an isolation hospital at that post.

Iowa.

e Lytle Construction Co., Des Moines,
s been awarded the contract for erect-
Davidson Building at Sixth and Pierce
es Moines. The structure will be
ries in height and will be fireproof. It
easure 150x150 ft. The northeast cor-
the lot will be used as a heating plant
tomobile garage. The building will
out $250,000.

Louisiana.

ls will be received until 2 p. m., June
Lieut. Col. Lansing H. Beach, U. S.
er, New Orleans, La., [illegible]

[illegible] Mis-
sissippi River.

The Lake Arthur Ice, Light & Waterworks Co., Ltd., of Lake Arthur, La., has employed H. W. Wright, Supervising Engineer of Winnfield, La., to draw plans and specifications for a complete electric light and power plant, which will be operated in connection with the present ice plant.

Maryland.

✣Bids will be received until 11 a. m., June 22, by H. R. Stanford, Chief of Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of earth mounds and grading at the new target range, Naval Academy, Annapolis, Md.

Massachusetts.

✣Bids will be received until 3 p. m., July 1, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., and then opened, for sidewalks, curbs, etc., at the U. S. Post Office building, Beverly, Mass., in accordance with the drawing and specification, copies of which may be obtained from the Superintendent of Construction of the Building, whose office is Room 144, Post Office and Sub-Treasury Building, Boston, Mass., or at the discretion of the Supervising Architect.

✣Bids will be received until 8 p. m., July 2, by Committee on New School House in the Town of Lexington, Mass., at the office of the Selectmen, for erecting and completing the new Adams Grade School, 157 Massachusetts Ave., East Lexington, Mass., at the rear of the Carey branch library, and giving a bond of a surety company therefor in the sum of $20,000. Only proposals obtained at the office of the Architects, Brainerd & Leeds, 89 Franklin St., Boston, signed by the bidder, marked "Proposal for New School House," with a certified check of $3,000, payable to the town if the proposal is not carried out, will be taken under consideration by the Committee.

⊙The State Harbor and Land Commission has awarded a contract for dredging a channel 2,100 ft. long in Scituate harbor to a depth of 6 ft. at mean low water, to the Eastern Dredging Co., at 29.5 cts. per cu. yd. The amount will be 22,500 cu. yds., and the work is to be done by Oct. 1.

The members of the Fire District of Ware, Mass., have voted to appropriate $8,000 for the purchase of a motor-driven truck. George D. Storrs, Ware, is chairman of the committee.

Michigan.

✣Bids will be received until 3 p. m., July 16, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for increasing the height of the vent stacks at the U. S. Post Office and Court House, Grand Rapids, Mich., in accordance with the specification, copies of which may be had at this office, or at the office of the Custodian of the building at the discretion of the Supervising Architect.

Minnesota.

✣Bids will be received until 2 p. m., June 27, by Lieut. Col. Francis R. Shunk, U. S. Engineer, St. Paul, Minn., for steel mitering lockgate.

Missouri.

✣Bids will be received until 11 a. m., July 19, by Lieut. Col. C. L. Potter, U. S. Engineer, St. Louis, Mo., for building 6 steel pile driver hulls. Official advertisement will be found elsewhere in this issue.

New Jersey.

✣Bids will be received until 3 p. m., July [illegible] Archi-
tect, Treasury Department, Washington, D. C
for the mechanical equipment, except freigh
elevator and lift, of the United States Pos
Office at Jersey City, N. J., in accordance wit
drawings and specification, copies of whic
may be obtained at the office of the Superin-
tendent of Construction, Jersey City, N. J
or at the discretion of the Supervising Archi-
tect.

New York.

✣Bids will be received until 11 a. m., Jun
29, by Col. J. G. Warren, U. S. Engineer, Buf-
falo, N. Y., for the removal of the wreck o
the steel steamer W. C. Richardson, sunk i
Lake Erie, about one and five-eighths mile
outside of breakwater, Buffalo, N. Y.

✣Bids will be received until 11 a. m., Jul
1, by Col. J. G. Warren, U. S. Engineer
Buffalo, N. Y., for construction of concret
superstructure, outer breakwater, Oswego Har-
bor, N. Y.

⊙The Buffalo Bridge Co., Buffalo, N. Y
has closed contracts to furnish steel and d
the erecting for the following buildings: Nor-
mal Park Methodist Church, the Robb Build-
ing, Connecticut St., Buffalo; Y. M. C. A
Building at Batavia, N. Y.; Harriton Build-
ing, William St., Buffalo.

The Barge Canal Board, Albany, N. Y., ha
approved the plans for the barge canal ter-
minal at Mechanicville. The terminal is t
be constructed on the west bank of the Hud-
son River at the foot of River St., and it
estimated cost is $77,711.

Ohio.

Safety Director Cash will ask the Cit
Council of Cincinnati, O., for a bond issu
of $20,000 to cover the cost of laying th
fire alarm telegraph circuits underground i
the districts in which during the next year th
telephone company will have completed it
underground installation.

Oklahoma.

⊙Contracts were let for municipal lighting
plant at Ponca City, Okla., to the Tonkawa
Construction Co.; $30,000 of bonds wer
voted for this plant.

Oregon.

✣Bids will be received until 10 a. m., Jul
10, at the office of Whidden & Lewis, Archi-
tects, Wilcox Bldg., Portland, Ore., for th
steel office counters, with all steel, marble, iro
and metal work, etc., in connection therewith
as called for in the specifications for the Wes
Wing of the New Court House for the Count
of Multnomah, State of Oregon. Plans an
specifications may be obtained at the offic
of the architects. No proposal will be con-
sidered unless accompanied by a check payabl
to the order of the "County Court of Mult-
nomah County," certified by a responsibl
bank, for an amount equal to 10 per cent o
the aggregate proposal. T. J. Cleeton is Count
Judge.

Engineering work is under way for a hydro-
electric development on the South Fork o
the Couquille River, south of Myrtle Point
The plans are said to include the construc-
tion of a dam, an 8,000-ft. tunnel, and th
development of 10,000 h. p. as the first unit
M. J. Anderson, Grant's Pass, Ore., is th
promoter.

Pennsylvania.

✣Bids will be received until 3 p. m., Jul
26, by James Knox Taylor, Supervising Arch-
itect, Treasury Department, Washington, D
C., for the construction, including gas piping
heating apparatus, electric conduits and wiring

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

and interior lighting fixtures of the extension, remodeling, etc., of the U. S. postoffice at Oil City, Pa., the extension to be one story and basement of approximately 1,227 sq. ft. ground area; stone faced; tin roof; fireproof construction.

⦿W. H. Fissell & Co., New York City, has been awarded the contract, at $116,642, for constructing a U. S. Post Office Building at Johnstown, Pa.

Rhode Island.

✣Bids will be received until noon, July 9, by Col. F. V. Abbot, U. S. Engineer, Newport, R. I., for the removal of the wrecks of schooners Lis V. Chaples and Hannah F. Carleton in Nantucket Sound, Mass.

✣Bids will be received until 3 p. m., July 29, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring and interior lighting fixtures of the extension, remodeling, etc., to the United States postoffice and custom house at Bristol, R. I. The extension is to be one story and basement, of approximately 1,335 sq. ft. ground area, brick faced, with stone trimming and tin roof. Copies of the drawings and specification may be obtained from the office of the custodian of the site at Bristol, R. I., or at the discretion of the Supervising Architect.

Texas.

✣Bids will be received until 3 p. m., July 16, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the extension, remodeling, etc., including plumbing, gas piping, heating apparatus, and electric conduits, wiring system, and lighting fixtures, of the United States appraisers' stores, Galveston, Tex. The work comprises a 1-story extension of about 2,130 sq. ft. area, a 3-story extension of about 2,160 sq. ft. area, and a third story on the present building which has an area of about 6,850 sq. ft. The extension to be brick faced, with sheet-metal cornices, composition roof, non-fireproof construction. Drawings and specifications may be obtained from the Custodian at Galveston, Tex., or at the discretion of the Supervising Architect.

✣Bids will be received until noon, June 24, by D. C. Smith, Jr., City Controller and Secretary, Houston, Texas, for the construction of fire station No. 4. H. B. Rice is Mayor.

West Virginia.

✣Bids will be received until 3 p. m., July 15, by James Knox Taylor, Supervising Architect, Treasury Department, Washington, D. C., for the construction, including plumbing, gas piping, heating apparatus, electric conduits, and wiring and interior lighting fixtures, of the United States Post Office at Fairmont, W. Va. The building to be 1 story and basement, approximately 7,920 sq. ft. ground area, brick faced, with stone trimming and tin roof. Copies of the drawings and specification may be obtained from the office of the Custodian of the site at Fairmont, W. Va., or at the discretion of the Supervising Architect.

Canada.

✣Bids will be received until noon, July 2, by G. R. Geary, Chairman, Board of Control, Toronto, Ont., for supplying two motor driven combination hose wagons and chemical engines.

The Toronto Harbor Commissioners, A. C. Lewis, Secretary, Toronto, Ont., have plans under way which call for the expenditure of about $5,000,000 on the improvement of the Ashbridge's Bay district. These plans include the cutting of a channel 300 ft. wide and 24 ft. deep from Toronto Bay to Scarboro Beach, and the filling in of Ashbridge's Bay.

Ratepayers of Saskatoon, Sask., have voted $175,000 for electric light and power machinery, and $80,000 for extensions to electric light and power distribution system.

New and Standard Books

Send for Complete Catalog of the Following Books:

Handbook of Cost Data. SECOND EDITION.
By Halbert P. Gillette, M. Am. Soc. C. E., Managing Editor of "Engineering-Contracting." The 1910 edition of this book contains nearly 1,900 pages. Postpaid, $5.00.

Diagrams for Designing Reinforced Concrete Structures.
Including Diagrams for Reactions and Strengths of Steel Beams, by G. F. Dodge, M. West. Soc. Engrs. 13 × 15½ inches, 104 pages. Postpaid, $4.00.

Cost of Electric Transmission Lines.
(Both Conduits and Pole Lines.)
The title of this book, by Clarence Mayer, is "Telephone Construction-Methods and Cost," which is somewhat a misnomer in that it does not indicate its wide scope. It is 6 × 9 ins., 300 pages. Postpaid, $4.00.

Engineers' Pocketbook of Reinforced Concrete.
By E. Lee Heidenreich. "Mr. Heidenreich's pocketbook is nearer the ideal than any on the same subject heretofore published." —Engineerings News, Jan. 14, 1909. Leather; 4½ × 6¾ ins.; 374 pages. Postpaid, $3.00.

The Reinforced Concrete Pocketbook.
By L. J. Mensch, M. Am. Soc. C. E. A book by an experienced engineer and successful contractor. Leather; 4¼ × 6¼ ins.; 216 pages. Postpaid, $4.00.

Concrete Bridges and Culverts.
(Both Railway and Highway.)
By H. Grattan Tyrrell. Leather; 4½ × 6¾ ins.; 272 pages Postpaid, $3.00.

Tables for Structural Engineers.
By Edward Godfrey. Leather; 4 × 6½ ins.; 218 pages. Postpaid, $2.50.

Solid Bitumens.
Their Physical and Chemical Properties and Chemical Analysis, by S. F. Peckham. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $5.00.

Graphic Statics.
By Charles W. Malcolm. This book has been adopted as a textbook by a large number of engineering colleges. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $3.00.

Cost Keeping and Management Engineering.
By Halbert P. Gillette and Richard T. Dana. Cloth; 6 × 9 ins.; 360 pages. Postpaid, $3.50.

Theory and Design of Reinforced Concrete Arches.
By Arvid Reuterdahl, Chief of Bridge Dept., City of Spokane. Cloth; 6 × 9 ins.; 132 pages. Postpaid, $2.00.

Railroad Location Surveys and Estimates.
By F. Lavis, M. Am. Soc. C. E. Cloth; 6×9 ins.; 270 pages. Postpaid, $3.00.

The Trackmen's Helper.
By J. Kindelan. Cloth; 5¼ × 7½ ins.; 350 pages. Postpaid, $1.50

Practical Switchwork.
By D. H. Lovell. Cloth; 4¼ × 6¼ ins.; 174 pages. Postpaid, $1.00

Maintenance of Way Standards.
By F. A. Smith. Cloth; 5½ × 7¾ ins.; 600 pages. Postpaid, $1.50.

Railway Curves.
By F. A. Smith. Cloth; 4 × 6¼ ins.; 50 pages. Postpaid, $1.00.

Standard Turnouts.
By F. A. Smith. Leather; 4½ × 7¾ ins.; 41 pages. Postpaid, $1.00.

Engineering Work in Towns and Cities.
By Ernest McCullough. Cloth; 6 × 9 ins.; 510 pages. Postpaid, $3.00.

A Treatise on the Design and Construction of Mill Buildings and Other Industrial Plants.
By Henry Grattan Tyrrell, C. E. (Toronto University). Author of Mill Building Construction (1900), Concrete Bridges and Culverts, History of Bridge Engineering, etc. Cloth; 6 × 9 ins.; 500 pages. 650 illustrations. Price, $4.00 net, postpaid.
"Affords by far the largest and best collection of practical information on Mill Buildings yet published." — Engineering News, August 17, 1911.

Practical Cement Testing.
By W. Purves Taylor. The most complete book on the subject. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $3.00.

Concrete Construction—Methods and Cost.
By Halbert P. Gillette and Charles S. Hill, Editors of "Engineering-Contracting." Cloth; 6 × 9 ins.; 700 pages. Postpaid, $5.00.

Cements, Mortars and Concretes.
By Myron S. Falk. A summary of tests and conclusions derived therefrom. Cloth; 6 × 9 ins.; 184 pages. Postpaid, $2.50.

Surveyor's Handbook.
By T. U. Taylor, Professor of Civil Engineering, University of Texas. Leather; 4½ × 7 ins.; 328 pages. Postpaid, $2.00.

Concrete and Reinforced Concrete Construction.
By Homer A. Reid, Assoc. M. Am. Soc. C. E. The largest book on concrete. Cloth; 6 × 9 ins.; 906 pages; 715 illustrations. Postpaid, $5.00.

Bricklaying System.
By Frank B. Gilbreth, M. Am. Soc. M. E. Cloth; 6 × 9 ins.; 330 pages. Postpaid, $3.00.

Field System.
By Frank B. Gilbreth. A book of rules and instruction for the guidance of his foremen and superintendents on contract work, by the contractor who made the "Cost-plus-a-fixed-sum contract" famous. Leather; 4½ × 7 ins.; 200 pages. Postpaid, $3.00.

Rock Excavation—Methods and Cost.
By Halbert P. Gillette. Cloth; 5½ × 7 ins.; 384 pages. Postpaid, $3.00.

Backbone of Perspective.
By T. U. Taylor, Professor of Civil Engineering, University of Texas. Cloth; 4½ × 7 ins.; 56 pages. Postpaid, $1.00.

Engineering Law—The Law of Contract.
By Alexander Haring, LL.B., M. Am. Soc. C. E., Professor of Bridge and Railway Engineering, New York University. Cloth; 6 × 9 ins.; 510 pages. Postpaid, $4.00.

Concrete Inspection.
By Chas. S. Hill, C.E. Cloth; 3½ × 6 ins. 186 pages; illustrated. Postpaid $1.00.

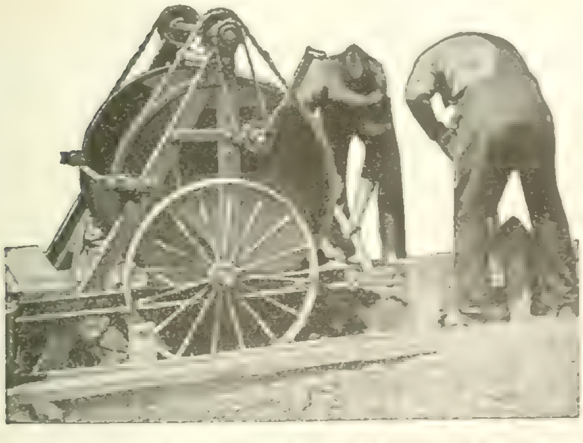
Reinforced Concrete—A Manual of Practice.
By Ernest McCullough, M. West. Soc. Engrs. Cloth; 5 × 7¾ ins.; 136 pages; illustrated. Postpaid $1.50.

THE MYRON C. CLARK PUBLISHING CO., 608 S. Dearborn Street
CHICAGO

✣ indicates work now open for bids. ⦿ indicates a contract let recently

Loading [illegible] Smith Hand Mixer.

Turning the drum of the Smith Hand Mixer. Three slow turns produce a perfect mix.



With the Smith Hand Mixer, the batch is discharged into place, under the drum. The operators then smooth up the concrete.

For the Small Concrete Job

THERE is an old way and a new way of handling small concrete jobs, such as sidewalks, culverts, light foundations etc. You can take your choice.

The Old Way Lay out a long pile of material. A couple of men, working from opposite sides of the pile, give the aggregates two turns with the shovel. *Sometimes* they only go through the motions; but, at any rate, after the material is given two real or imaginary turns, it is shoveled into barrows and wheeled to the point where wanted.

The New Way Put a **Smith Hand Mixer** on the job, place it over the forms and give the aggregates *three slow turns* in the drum. The mixed concrete is then **discharged into position, without shoveling or wheeling.** The

SMITH
HAND
MIXER

means a smaller gang, easier work, rapid and uniform mixing—REAL PROFITS. It has a batch capacity of 2½ cu. ft. of mixed concrete — will easily turn out from 30 to 35 cu. yds. of first-class concrete per day. We guarantee a mix, equal to that of any standard power mixer, and a saving of at least 30 per cent over hand mixing costs. The outfit is light and compact — can be easily moved as the work progresses — after every batch if necessary.

A Real Mixer, built for hard, continuous, reliable service — designed for the profitable production of good concrete in limited quantities, a compact handy outfit for the small concrete job. If you want to get into the profit-making class, buy a **Smith Hand Mixer.**

Write for Catalogue No. 7

The T. L. Smith Co.
1305 Majestic Bldg., MILWAUKEE, WIS.

720 Old Colony Building, CHICAGO, ILLINOIS

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

10-INCH CASED WELL, ONE 50,000 GALLON STEEL TANK ON A 120-FT. STEEL TOWER, ENGINES, DEEP WELL PUMP, AND BUILDING.

Sealed proposals are invited and will be received at the office of the Village Clerk, Morton Grove, Ill., until the hour of opening the same as hereinafter set forth; for the construction of a 10-inch cased well, one 50,000 gallon steel tank, 120-ft. steel tower, engines, deep well pump, and building. Bids must be accompanied by a certified check on a responsible bank doing business through the Chicago Clearing House, or equivalent, equal to 10 per cent of the amount of said bid, which may be obtained from the Village President, August F. Poehlmann, or the Village Clerk. Said proposals or bids shall be opened, examined and publicly declared by said board at a meeting thereof to be held in the Village Hall in the Village of Morton Grove, at the hour of 8 o'clock p. m., on the 2d day of July, A. D. 1912. For further information address M. J. Lochner, Village Clerk. The right is reserved to reject any and all bids.

AUGUST F. POEHLMANN,
Village President, Morton Grove, Ill.

WATER MAINS.

June 10, 1912

Proposals will be received by the City of Grand Haven, Michigan, until 3 o'clock p. m., Tuesday, July 2, 1912, for unloading, delivering, trenching, laying with gates, hydrants and specials appurtenant, and backfilling of approximately

4,000 feet of 10-inch
4,900 feet of 8-inch
1,900 feet of 6-inch

cast iron water mains, all in the City of Grand Haven.

The right is reserved to reject any or all bids.

Plans and specifications may be seen at the office of the City Clerk at Grand Haven, or at the office of Gardner S. Williams, Consulting Engineer, Ann Arbor, Michigan, and will be furnished on request.

STREET IMPROVEMENT.

Bids for the improvement of approximately one and one-half miles of streets, by grading, curb and guttering, and paving with asphalt, will be received by the City Recorder of Salt Lake City, Utah, until 10 o'clock a. m., July 2nd, 1912. The approximate yardage to be laid is 35,000 sq. yds.

Plans and specifications can be seen at the office of the City Engineer, or copies may be obtained upon receipt of a $5.00 deposit.

By order of the Board of Commissioners.

NOBLE WARRUM,
City Recorder.

U. S. ENGINEER OFFICE, Seattle, Wash., May 28, 1912.—Sealed proposals for furnishing 200,000 barrels of Portland cement will be received here until 12 m., July 1, 1912, and then publicly opened. Information on application. J. B. CAVANAUGH, Major, Engrs. 22-4t

GREAT MIAMI RIVER IMPROVEMENT.

Dayton, Ohio.

Sealed proposals will be received at the office of the Department of Public Service until 12 o'clock (noon), Monday, July 8, 1912, for 1,200,000 cu. yds. levee construction, including concrete retaining walls, sewers, riprap, 150 ft. steel truss bridge, piling and other work.

Detail drawings, profiles and cross-sections may be seen and General Plans and Specifications may be obtained at the office of the City Civil Engineer of the City of Dayton, Ohio.

CHAS. H. HOGLEN,
Director of Public Service.
CHAS. J. GROSS, Sec'y.

PROPOSALS FOR DREDGING.

May 30, 1912.

Sealed bids addressed to J. H. Nelms, Chairman, will be received at the office of the Engineer, Room 430, New Weinberg building, Greenville, Miss., by the Board of Washington County Drainage Commissioners, to 12 m., July 15, 1912, for the construction of about nineteen miles of dredge ditch ranging from twenty-six to fifty-six feet bottom; approximate quantities 1,960,000 cubic yards. Also for the clearing of two natural streams aggregating about seventeen miles. Plans, profiles and specifications are on file at the office of the Engineer, and can be furnished on application. A certified check for $5,000.00 must accompany each bid. The right is reserved to reject any or all bids, or to let the work as may appear to be for the best interest of the district.

THE WASHINGTON COUNTY DRAINAGE COMMISSIONERS,
B. B. GORDAN, Chief Engineer,
Greenville, Miss.

TREASURY DEPARTMENT.—Office of the Supervising Architect. Washington, D. C., May 27, 1912. Sealed proposals will be received at this office until 3 o'clock p. m., on the 10th day of July, 1912, and then opened for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring system and interior lighting fixtures) of the United States postoffice at Lansing, Mich. This extension is about 38 by 74 feet, two stories and basement, stone faced, slate roof, fireproof construction. Drawings and specifications may be obtained from the custodian at Lansing, Mich., or at his office, in the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

PROPOSALS FOR LEVEE WORK. Mississippi River Commission, Third District, U. S. Engineer Office, Vicksburg, Miss., June 10, 1912. Sealed proposals for constructing about 1,600,000 cubic yards of earthwork in this district, will be received at this office until 11 o'clock a. m., Standard Central time, July 11, 1912, and then publicly opened. Information on application. J. A. Woodruff, Major Engrs.

PROPOSAL FOR PILE DRIVER HULLS.—U. S. Engineer Office, Custom House, St. Louis, Mo., June 19, 1912. Sealed proposals for building six steel pile driver hulls will be received at this office until 11 a. m., July 19, 1912, and then publicly opened. Information on application. Chas. L. Potter, Lieut. Col., Engineers.

ROAD CONSTRUCTION.

Crossville, Tenn., June 15th, 1912.

Sealed proposals will be received by th Cumberland County Highway Commissic until 3 o'clock p. m., July 10th, 1912, a their office, Court House building, f the construction of approximately 35 mil of road in Cumberland County; same be ing a part of the Memphis to Brist Highway in said County.

The work will consist of approximatel

75,000 cu. yds. excavation.
1,200 cu. yds. rubble masonry.
100 cu. yds. concrete masonry.
1,800 lin. ft. corrugated pipe.
4,000 lin. ft. D. S. vitrified pipe.

Plans and specifications are on file a the office of the Engineer, O. W. Monro Crossville, Tenn.

Each bid must be accompanied by certified check of $250.00.

The Commission reserves the right t reject any or all bids.

O. W. MONROE, Chairman.
H. C. SABINE, Secretary.

NOTICE TO BIDDERS.

Levee Construction.

Notice is hereby given that the Gill Township Levee Committee will receive sealed bids at the office of John T. & Will H. Hays in Sullivan, Indiana, until twelve o'clock noon, on Tuesday, July 9th, 1912, for repairing the Gill Township Levee, near Riverton, in Sullivan County, Indiana. Plans and specifications can be seen at the said office of John T. & Will H. Hays. All bidders will be required to accompany their bid with a certified check of $500.00. The proposed work includes the moving of approximately 4,10 cubic yards of dirt, and the construction of a four-inch concrete wall embracing approximately 1,300 cubic yards of cement, and the construction of a wall of dirt consisting of approximately 9,100 cubic yards of dirt.

Proposals will be received by the City of Crowley, La., up to June 18, 1912, at 8 o'clock p. m., for 20,000 sq. yds. creosoted wood block pavement, 5,000 lineal feet curb, 5,500 lineal feet gutter.

B. J. BOUDREAUX, Clerk.

SEWER CONSTRUCTION.

Wheaton, Ill.

Bids will be received on June 22d at 8 p. m. for the construction of 2,890 feet of 60-in. concrete sewer. For further particulars address

A. L. WEBSTER,
City Engineer,
Wheaton, Ill.

U. S. Engineer Office, Galveston, Texas, June 19, 1912.—Sealed proposals for furnishing about 6,000 barrels American Portland Cement for Lock and Dam No. 8, Brazos River, delivered at Downs, Texas, will be received at this office unt 12 m., July 19, 1912, and then publicl opened. Information on application. Earl I. Brown, Major, Engrs.

U. S. Engineer Office, Galveston, Texas, June 19, 1912.—Sealed proposals for crushed rock or gravel, delivered at Downs, Texas, will be received at this office until 12 m., July 19, 1912, and then publicly opened. Information on application. Earl I. Brown, Major, Engrs.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SANITARY SEWERS.

Sealed bids [illegible] the City of Oskaloosa, Iowa.

[illegible]

- 132 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 2 ft. to 4 ft. cut.
- 1,441 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 4 ft. to 6 ft cut.
- ,421 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 6 ft. to 8 ft. cut.
- ,172 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 8 ft. to 10 ft. cut.
- ,338 lin. ft. 8-in. vit. pipe sewer, Portland [illegible] ft. cut.
- 940 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 12 ft. to 14 ft. cut.
- [illegible] lin. ft. 8-in. vit. pipe sewer, Portland [illegible] ft. cut.
- 125 lin. ft. 8-in. vit. pipe sewer, Portland [illegible] ft. cut.
- 192 lin. ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 6 ft. to 8 ft. cut.
- 140 lin. ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 8 ft. to 10 ft. cut.
- 350 lin. ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 10 ft. to 12 ft. cut.
- 418 lin. ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 12 ft. to 14 ft. cut.
- 345 lin ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 14 ft. to 16 ft. cut.
- 45 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 6 ft. to 8 ft. cut.
- 5 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 8 ft. to 10 ft. cut.
- 250 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 10 ft. to 12 ft. cut.
- 594 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 12 ft. to 14 ft. cut.
- [illegible] lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 14 ft to 16 ft. cut.
- 90 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 16 ft to 18 ft. cut.
- 648 vit. pipe "Y" branches, 6 in. opening with vit. stoppers cement in place.
- 65 brick and Portland cement mortar manholes with cast iron cover, complete.
- [illegible] vit. pipe and Portland cement mortar lampholes with cast iron covers, complete.

All work to be completed before December 1, 1912.

Payment for work will be made [illegible] Iowa, with the exception of ten man-[illegible]

[illegible] of the City Clerk and City Engineer.

[illegible] separate envelope, with a certified check in the sum of One Thousand ($1,000.00) Dollars, payable to the order of the City [illegible] that the bidder will enter into a contract for the doing of the work, and will give the required bond. All checks where bid is not accepted will be returned to the respective bidders, and the check of the successful bidder will be returned after the contract and the required bond have been duly executed.

Copies of plans and specifications will be furnished to prospective bidders on receipt by the City Clerk of $5.00 to cover cost of preparing same.

The City Council of the City of Oskaloosa, Iowa, reserves the right to reject any and all bids.

[illegible]

By T. H. CARLIN, City Clerk.

[illegible]

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., June 14, 1912.—Sealed proposals will be received at this office until 3 o'clock p. m. on the 26th day of July, 1912, and then opened for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, and interior lighting fixtures, of the extension, remodeling, etc., of the United States post office at Oil City, Pa., the extension to be one story and basement of approximately 1,227 square feet ground area; stone faced; tin roof; fireproof construction.

Drawings and specifications may be obtained from the custodian of site or at this office at the discretion of the Supervising Architect. James Knox Taylor, Supervising Architect.

For the Immediate Attention of Paving Contractors

[illegible]

[illegible]

Plans and specifications may be seen at the office of the City Clerk of Aledo, Ill., or at the office of N. H Tunnicliff, Civil Engineer, 712 Put- man Building, Davenport, Iowa.

For further information address

J. W. McROBERTS, Mayor

ALEDO, ILLINOIS

WATER WORKS SYSTEM AND SANITARY SEWER.

Torrington, Wyo., May 21, 1912.

Sealed bids will be received by the City Council of the City of Torrington, Wyo., until 10 o'clock a. m. of Saturday, June 29, 1912, for the furnishing of all materials and the complete construction of a water works system and a sanitary sewer system for the Town of Torrington, Wyo., according to plans and specifications on file in the office of the City Clerk of said city, and in the office of the Shepperd Engineering Company, 726 Majestic Bldg., Denver, Colo.

Bids must be submitted separately on the above propositions.

Each bid on the water works proposition must be accompanied by a certified check for $1,000.

Each bid on the sewer proposition must be accompanied by a certified check [illegible]

All necessary information, blank forms of proposals and instructions to bidders will be furnished on application to the City Clerk of Torrington, Wyo.

Copies of plans and specifications may be obtained from the City Clerk of Torrington, Wyo., or the Shepperd Engineering Co., Denver, Colo., upon payment of $5.00 per set.

The right is reserved to reject any or all bids.

CHARLES D. BRUBAKER
RALPH PAXTON, Mayor.
City Clerk.

STREET IMPROVEMENT.

Bids for the improvement of approximately one and one-half miles of streets, by grading, curb and guttering, and paving with asphalt, will be received by the City Recorder of Salt Lake City, Utah, until 10 o'clock a. m., June 24th, 1912. The approximate yardage to be laid is [illegible] sq. yds.

Plans and specifications can be seen at the office of the City Engineer, or copies may be obtained upon receipt of a $5.00 deposit.

By order of the Board of Commissioners.

NOBLE WARRUM,
City Recorder.

REPAVING.

Burlington, Iowa.

Bids for the repaving with brick block and creosoted block, of 25,000 square yards on Main and Jefferson Streets, will be received at the office of the City Clerk up to 9:00 a. m., June 24th, 1912.

For specifications address,

H. G. VOLLMER,
City Engineer.

CONCRETE SUB-CONTRACTORS WANTED.

We have about twenty thousand cubic yards of concrete work distributed in small bridges, abutments, headgates, drops, etc., which we will let to responsible contractors in quantities to suit at good prices.

JANSEY BROS.-BOOMER & HUGHES.
1-2 Mackie Bldg.,
Calgary, Alberta.

The Reinforced Concrete Pocketbook

By L. J. MENSCH, M. Am. Soc. C. E.

This book is the outcome of the experience of a man who knows his subject thoroughly, being a trained engineer and successful contractor. It is not a text book and its rational use requires a knowledge of mechanics and building construction. The tables, which occupy nearly half the pages, were very carefully figured and checked and their correctness has been thoroughly tested by many practical applications. They contain an enormous amount of information condensed in small space; not the least notable being the inclusion of the necessary data for estimating cost.

Of exceptional value to the experienced man

Contains concise information on concrete construction for the Structural Engineer consisting largely of tables, with explanations of their use, in the design and construction of girders, columns, buildings, retaining walls and bridges, with specifications for concrete work.

Also reinforced concrete chimneys, from 5′ to over 200′ diameter, 80′ to 350′ in height.

Full Leather, 4¼x6¼ inches; 216 pages
Price $4.00, net postpaid

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The Myron C. Clark Publishing Co.

608 S. Dearborn Street, Chicago

Engineering & Contracting

Devoted to the Economics of Civil Engineering Design
and to Methods and Cost of Construction

Published every Wednesday by The Myron C. Clark Publishi[illegible]ny, 608 S. Dearborn St., Chicago, Ill.
EDITORS: H. P. Gillette, C. S. Hill, C. T. Murray, H. B. Kirkland, S. C. Hadden. MANAGER: F. P. Burt.
BSCRIPTION RATES [illegible] Republic of Panama, [illegible]

:XVII. Volume No. 26. [illegible] June 26, 1912.

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other Economic Reason for Metering City Water.

[illegible] ater. The daily consumption is 210 gals. capita, which is fully double the amount ally needed. All this water is not only ped but it is filtered. Hence, if an addi- [illegible] eat expense. But the direct cost of pump- and filtering is not to be the sole cost, for State Board of Health has recently di- d all cities in Pennsylvania to cease the tion of streams with sewage. This means a sewage disposal plant capable of han- the 210 gals. per capita must be built 'hiladelphia, unless the amount of water used can be reduced. In other words, city faces a double expense for water ment; first, the present expense of filter- before use, and, second, the future ex- e of removing the sewage from the water use

l reasons that we have hitherto seen in r of metering city water fail to include last named argument—the saving in cost ewage purification. This is a new and rtant phase of the meter question.

hile the state of Pennsylvania has gone ep farther than any other state in its ping order that all sewage discharged streams must be purified, it is likely to ollowed by similar orders in other states. will make it more than ever important engineers shall study the conservation ater supply.

curious and lamentable condition exists hiladelphia. There is an ordinance actually ibiting the use of water meters, and there still many councilmen who apparently its continuance. If we were to hazard ess as to the original reason for passing a vicious ordinance, it would be this: old ring of politicians who bled the city a lancet of scandalously awarded contracts ived that, if water waste were reduced by the use of meters, the city would not require half as large a filter plant as was actually built. This would have cut in two the profits from the building of that filter plant.

Philadelphia has today filter plants capable of supplying all the water really needed by a city of twice its present population. No hydraulic engineer will deny this statement. But, in order to make the existing filter plant serve a much larger population, it is absolutely essential to curtail the extravagant use of water. This can be done only by metering both domestic and industrial users. It is now being urged that only the industrial users of water need be metered. Perhaps this will serve temporarily, but, ultimately, domestic users must be metered also.

A civil engineer is repeatedly surprised to hear intelligent men contend that they do not believe in metering city water, for "water should be as free as air." The layman seldom seems to know that, for cooking, drinking, washing and other sanitary purposes, not more than about 25 gals. of water per capita per diem are needed. Many a British city, for example, uses only 35 gals. per capita for all purposes—domestic and industrial. Where, then, does the rest go in cities like Philadelphia? A few of the other uses and wastes are as follows: (1) Lawn sprinkling, (2) leakage of plumbing fixtures, (3) leakage of water mains and service pipes, (4) faucets left open to secure cool water for drinking, (5) faucets left open to keep water from freezing in winter, (6) water kept continuously running in urinals, (7) water carelessly left running in kitchen sinks, etc.

"Water should be as free as air." So should food be free in the Utopian country that all of us would like to inhabit. But city water is never free, even where no direct charge is made for it. It is paid for in taxes, if not directly, and the rent payer pays the tax. Water must be paid for by the user. Let the payment, then, be proportionate to the use. When this is done, the user conserves the supply instead of wasting it, and ultimately finds that he has an abundance of water at less cost than before.

It is commonly objected that if water is metered many of the poorer people will not use enough for sanitary purposes. A complete answer to this objection is possible. Let it be determined what amount of water is abundantly sufficient for all domestic purposes. Suppose it to be 50 gals. per day per capita. Then let a minimum fixed monthly charge be based on the 50 gals. per capita, whether used or not. For all water in excess of the 50 gals. per capita let there be a sliding scale meter rate. This would insure no niggardliness in the use of water by anyone, while at the same time it would make it to the interest of everyone to stop all leaks and wastes.

In a recent water rate case, the Wisconsin Railroad Commission (which is a general public service commission) required water meters to be installed, in order to secure an equitable distribution of the cost of water supply among all consumers. This, we anticipate, will be the ultimate action of state public service commissions throughout America. Why should you, who are careful not to waste water, pay for the waste of your neighbor? Somebody must pay, and equity requires that the man who wastes must pay for the waste. Metering the consumers becomes the only way of securing a perfectly equitable distribution of the cost of water.

In this connection it may not be amiss again to call attention to the fact that the operating expense of pumping and filtering is only the smallest part of the cost of supplying water. The plant interest and depreciation charges constitute the major part of the cost. The greater the water consumption, the larger must be the plant, and consequently the greater the interest and depreciation.

From every point of view, therefore, it usually pays to meter a city water supply. The latest point of view, as we have indicated above, includes the added cost of purifying the sewage laden water after it has been used.

In conclusion it is interesting to read the [illegible] on page 649 of the 1906 edition of Trautwine's Civil Engineer's Pocket-book:

> In American cities, the waste (of water) often [illegible] two or three times the quantity really used. Of the 116 gals. per capita per day, delivered in New York in 1899, Mr. Freeman estimates that from 31 to 56 gals. were used, 10 unavoidably wasted and from 50 to 75 avoidably wasted.

In Philadelphia, investigations by means of the Deacon waste-water detector, on 142 modern seven-room, two-story dwellings, with bath, etc., on two intermediate streets, showed that, of 222 gals. per capita per day, furnished through 782 fixtures, 192 gals., or 86.5 per cent, were wasted, and only 30 gals., or 13.5 per cent, were used. The city is now building enormous works for the purpose of pumping, filtering, conveying, repumping, storing and distributing th wasted, as well as the small quantity u the total cost (which may reach $20,000, than half would have sufficed for the wa and unavoidably wasted.

Incidentally, do not such instances Philadelphia waste furnish an added a in favor of the commission form of c ernment, and particularly of the des of electing civil engineers to serve up commissions?

GENERAL ARTICLES

Development Cost or "Going Value" of Public Service Companies.

In the appraisal of the property of various public service companies managed by Stone and Webster, Mr. Halbert P. Gillette has determined the development cost, or development expense, of each of the properties. His report on one of the properties, the Everett Railway, Light and Water Co., forms one of the exhibits in a recent hearing before the Washington Public Service Commission. In *Engineering and Contracting* of April 17, 1912, was published that part of his report relating to the appraisal of water rights. We give herewith the part relating to development cost or "going value," together with a few paragraphs of additional matter and some slight changes furnished by Mr. Gillette. We also give one table (Table III) showing the calculation of the development cost of the Everett Railway, Light and Water Co. on an assumed 9 per cent fair return basis. The report contains similar tables based on 8 and on 10 per cent fair return. Mr. Gillette's estimated cost of reproduction of the property of this company totaled as follows:

Street railway department	$ 861,160
Light and power department	494,177
Water works department	1,103,016
Total plant (new)	$2,458,353
Development cost (30 per cent of plant value exclusive of land and working capital)	537,991
Grand total	$2,996,344

Mr. Gillette testified at the hearing that his deduction of the development cost of properties similar to the Everett Railway, Light and Water Co. had led him to believe that the development cost would normally exceed 30 per cent of the value of the physical plant exclusive of land of working capital. This 30 per cent should be added to the cost of reproducing the plant *new*. In other words, development cost not only equalled the total depreciation of the plant but was 30 per cent in addition to the depreciation, and therefore the 30 per cent should be added to the cost of reproduction new. He stated that this estimate was based upon his own appraisals of considerable number of public utility properties (not including steam railways) whose aggregate value exceeded $100,000,000.

Mr. Gillette's discussion of development cost follows:

Development Cost.—It is now well established by court decisions that a complete appraisal of the value of the property of a public service corporation must include its "non-physical property." This non-physical property is variously designated by such terms as "going concern value," "going value," "development cost or expense," etc. Whatever the term used, it is intended to cover the value of the developed business of the company.

There are two ways of estimating the value of any business: (1) By capitalizing the annual net earnings; (2) by determining the actual cost of securing the business.

The first method is the one commonly used in appraisals of business property not under the control of public rate making commissions. It may, therefore, be said to rest upon the theory of competitive price regulation of values. According to that theory, competition, acting under the law of supply and demand, determines the rates or prices charged for a product or a service. Hence the appraiser is justified in accepting the rates or prices as he finds them, and in determining the annual profits based upon those rates or prices, and finally in capitalizing those profits to determine the "going value" of the business.

When we come to properties whose rates or prices are subject to public control, we encounter a different problem entirely; for to capitalize the profits of such a corporation is virtually to determine a "going value" that may be changed at any time by the action of a public rate making commission. Without reasoning in a circle, a public rate making commission cannot assign to a property a value that is based upon the very thing that is to be determined, namely, the fair rate of charge for the service. Hence it is that public service commissions and courts have been slowly coming to a realization of the fact that "going value" cannot be logically determined by capitalizing the profits of a public service corporation. This leaves but one rational method of ascertaining the "going value," namely, the second method above given, which involves ascertaining the cost of developing the existing business of the corporation. In view of the fact that there is such confusion of terms, I have selected the expression "Development Cost" to denote the cost of developing or securing the business.

Development cost consists of several elements: (1) Cost of advertising and canvasing for new business; (2) cost of securing and training a competent business organization, and (3) deficit in fair return on the investment during the time the business is being built up from nothing to the time a fair return begins to be realized.

Item (1) often continues as an expense long after items (2) and (3) have ceased to be a source of annual expenditure; and it would be reasonable to estimate the cost of soliciting business from the very beginning of the corporation down to the time of the appraisal. However it is often very difficult to ascertain the cost of item (1), and of item (2) for that matter; and, since they are of relative insignificance compared with item (3) in the case of this company, they may be disregarded in the case now under consideration. Indeed it may be ultimately held by the courts that in no case need an appraisal include any other element of development cost than the "deficit in fair return on the investment."

It is universally conceded that every public service corporation is a public agent that is entitled to a "fair return" on a reasonable investment. Hence it follows that the entire period of its existence, from the very beginning to the time of the appraisal, must be investigated to ascertain whether or not the corporation has received a "fair return." If there have been *reasonable* deficits in fair return during the development period, then the corporation is logically entitled to recover those deficits, either by having them charged to capital account as development cost, or by amortizing them from future earnings.

The Wisconsin Railroad Commission has recently come to view the problem of "going value" in this way. I quote from th cision in the Madison Gas and Elect case:

> Comparitively few plants are therefo ing at first. Several years are often requ obtain customers enough for a paying b In the mean time the plants have to be operation and the losses (deficits in f turn) from such operation made up investor. If investors are not compensa such losses, either by being allowed rea returns thereon or through surplus e (excess above fair return), they will n tinue to invest their money in plants kind.

Due to the absence of any existing discussion of the detailed method of taining development cost by the deficit od, it has seemed to me wise to g the matter more fully than would ord be justified in a report of this characte

The Construction Period and the De ment Period.—During the construction of any public utility plant, the capit vested receives no return unless a cha made for "interest during constru Such a charge has always been held a part of the actual cost of producin property. Immediately following the struction period comes a period when th earnings are usually insufficient to yie adequate return on the capital invested. may be called the development period. the period during which the business i ing built up. During the constructio riod there are usually no earnings During the development period ther earnings, but they are usually insufficie cover both operating expenses and a fai turn on the invested capital. The dev ment period, therefore, is merely a sequ the construction period. Hence if int during construction is a legitimate char capital account, it follows that the defici low a fair return during the developme riod is equally a legitimate charge to c account.

In every well managed public utility we that interest during construction appear the ledgers as a part of the cost of the but we do not find that subsequent de below a fair return are charged to ca We have not far to look for the re The owners of public utilities have exp to recoup the early deficits of the lean by declaring larger dividends during the fat year. This they would usually do long as they were not subject to contro public utility commissions. We have now, at least in several states, to a time there is to be a limiting of rates charge public utilities. Hence we have come time when the early deficits below a return during the development period either be charged to capital account, pre ly as interest during construction is char or the deficits must be charged to a De Reserve Account which must be amort by sums annually set aside for that pur in future years.

Definition of Development Cost.—Deve ment cost is the total accumulated defici fair return up to the time when the busi begins to yield a fair return. Each an deficit in fair return should be charged capital account (or to a Deficit Reserve nt) at the end of the year in which it irs. Then the sum total of these deficits mes the development cost [illegible]

ome writers would call this the "going ie" of the business, but "going value" is expression used in several different senses different writers, so that it seems wise bandon its use entirely.

will be seen that development cost is at all analogous to "good will value," or 'going concern value" based on capitaliz- the net profits of a business. Development cost is simply a sequel to interest during construction, and [illegible] d for any given public utility, provided true construction cost, earnings and oping expenses (including taxes) are known each year from the very *beginning* of the ation of the plant. It is essential, how-, to go back to the beginning, for the ial deficits in fair return tend to become and less as time goes on, provided the inal plant is not extended greatly into fields. Of course each extension of a [illegible] line is equivalent to constructing [illegible] line, in so far as its effect upon development expense is concerned. Hence, it is that reet railway system even 20, 30 or more s old may still be incurring development cost if it is still extending its lines in- ew districts of a city.

similar manner, extensions of water [illegible] gas mains, electric lines, telephone [illegible], etc., cause development cost long after original nucleus of the plant is built.

considering the age of the plant, the hted or true average age of the com- nt constructions should be calculated. is frequently not more than one-third age of the original plant nucleus.

the great majority of American cities, particularly in those on the Pacific Coast, e has been such rapid growth during last 20 years that public service corpo- ns have been constantly enlarging their ts and extending their lines. Hence there usually certain parts of almost every t railway system that are passing through levelopment period—the period of deficits air return. If each new line or new ex- on of an old line were operated by a rate company—the aggregate development of all the lines in a city would be very [illegible] But since new lines are usually [illegible] ed merely as part of an established sys- the deficits incurred by the operation he new lines are offset in part, if not ely, by the surpluses earned by the old . Hence the larger a street railway sys- the smaller does the aggregate develop- cost appear to be. While it might be ended that in determining the develop- cost of an existing street railway sys- each new line and each new extension ld be treated as a separate utility, it s to me better to regard all lines owned single company as being a unit. Thus cially stronger lines serve to carry the ens of the weaker. This view unques- ably favors the public at the expense of public utility corporation, and there might ases where a different view would be anted.

e Effect on Development Cost Due to bining Different Services.—We are now to another element of the problem that ves the question as to whether the sur earned by one department of a company ld offset the deficit in fair return in an- r department of the same company. y companies own and operate both a t railway system and an electric light power system. The railway usually 's less profit than the light department, ite of the fact that the former is usual- monopoly while the latter is often sub- to severe competition from gas lighting s, etc. Hence, if the railway system had ed as a separate entity, its development would have been much greater than was lly the case. I have adopted the con- ative course of regarding the railway, and other departments as a unit for oses of calculating the development cost. This method also favors the public at the expense of the company.

[illegible] the question of offseting deficits by surpluses in calculating development cost, and that is whether deficits incurred in early years of operation should be offset by any surpluses secured in later years. There are two directly opposing arguments that now present themselves. According to one line of reasoning, a surplus in excess of a fair return should be used to balance an equal deficit in fair return, for otherwise a public utility might be permitted to earn more than a fair return, which is contrary to the hypothesis that a public utility is entitled to a fair return throughout its life.

On the other hand, according to another line of reasoning, it may be held that development cost can no more be wiped out by surpluses than can interest during construction or any other property value. While the public has always had the right to limit the rates charged by its agent—the public service corporation—if the public did not exercise that right, and permitted net earnings to exceed a fair return, then the public cannot now attempt to recover that surplus, either by direct levy on the existing earnings or by assigning a lower appraised value to the property. In brief, the public is guilty of "laches"—failure to exercise its legal rights at the proper time—and cannot now retrace its steps and demand an accounting.

The courts have not yet ruled definitely as to which of these two theories shall prevail. However, in the case of this company, which has not yet passed out of the development period, we are not concerned as to the propriety of offsetting early deficits by later surpluses, for there have been no surpluses.

Residual Development Cost.—If the development cost, as above defined, is to be reduced by the subsequent surpluses in fair return, then we have left what may be called the residual development cost. As just stated, it remains for the courts to settle the question as to whether "development cost" or "residual development cost" shall constitute the "non-physical value" to be assigned to a public utility.

Compounding the Interest on Deficits.—It will be noted that the method hereinafter given for calculating the accumulated deficts in fair return involves compounding the interest on the deficits. The question has been raised whether it is not equitable merely to allow simple interest instead of compound interest in cases of this sort. Although authority is overwhelmingly in favor of compounding the interest, let us consider briefly the reason why the interest should be compounded.

A "fair return," whether for interest on money or for services rendered, is normally paid periodically. Interest, for example, is normally paid semi-annually or annually. Were a special case to arise where interest was to be paid at greater intervals, say every five years, it is clear that the interest rate would have to be higher than if the interest were paid semi-annually. To illustrate, suppose a capitalist would normally loan his money at 8 per cent, interest payable annually. Suppose the same capitalist were asked to loan his money at 8 per cent, interest payable every ten years. Would he do so? Certainly not. But he might reply that he would loan it at 11.6 per cent, interest payable every ten years; for in the end he would then receive the same total income at 11.6 per cent simple interest, paid every ten years, as by the 8 per cent paid annually and thus compounded. It is a matter of no moment whether we adopt the compound interest method or the simple interest method of calculating development cost, provided we do not make the mistake of regarding the "fair return rate" on a simple interest investment as being the same as a "fair return rate" on a compound interest investment. All ordinary investments are virtually on a compound interest basis. That is, the interest or rent is paid at intervals of a year or less, which permits re-investment of the interest, and thus permits compounding it. Hence, when we speak of 8 per cent fair return on a mortgage, we invariably imply that the 8 per cent shall be paid annually. The 8 per cent would cease to be a fair return if the interest payments were to be made every ten years at simple interest. Now, the whole theory of public rgulation of rates rests on the idea of "fair return" on the investment. Hence, if we assume a "fair return" based on annual payments, we must not refuse to make payments annually, and expect to settle at the end of 10, 15 or 20 years on a simple interest basis. Yet, this is precisely what is suggested when it is proposed not to compound the "fair return rate," but to calculate development cost on a simple interest basis.

"Fair Return" During Development Period.—While the deficit method of determining development cost is simple in theory, it presents some complexity at times in practice. First, there arises the question as to the rate per cent to be used in calculating the "fair return" for the capital and for the managerial profit. This question is complicated by the fact that rates of interest and managerial profits have been higher during the early years of the existence of most public service corporations than they are today. It is further complicated by the fact that when a company is small, and in a more or less experimental era of its development, rates of fair return are higher than when it becomes large and is a demonstrated success. To be thoroughly logical, therefore, the development cost should be calculated upon the assumption of different rates of interest for different periods of years. Thus we might start with 12 per cent as the rate of fair return for the first third of the time since the plant began operation, following with 11 per cent for the second third and 10 per cent for the last third. In the present case it seems sufficiently exact to use only one rate of fair return for the entire period. Starting with the plant value at the beginning of the year, multiply that value by the rate per cent of fair return to get the fair return on the existing plant for the ensuing year. If any additions to the plant are made during the year, also estimate the fair return on them; and for this purpose it is usually sufficiently exact to assume that the money spent for the addition has been uniformly spent throughout the year, in which case multiply the cost of the additions by the rate of fair return and divide by two, since the additions during the year average a fair return on only half the full amount. The sum of these two elements of fair return gives the full fair return for the year.

Effect of Depreciation on Development Cost.—We come next to the subject of depreciation as affecting development cost. It is rare that any public service corporation has charged off on its books any considerable sum for depreciation. Therefore the book plant account usually represents the full cost of a new plant. However, public service commissions are now ascertaining the depreciated value of public utilities, so that a great injustice will be done to such utilities unless their operating expenses during past years are revised so as to show the increased costs that would have been incurred had depreciation been taken into account. In other words, if the depreciated value of the plant is to be considered, then the development cost (the deficit in fair return) must be calculated upon the assumption that opeerating expenses of past years would have been increased sufficiently to provide for the depreciation. However, the logical consequence is that the total cost of the property (physical cost plus development cost) is the same whichever method is adopted. Since this statement is not readily self-evident, let us take a simple problem for illustration.

Let us assume a plant whose first cost is $100,000 and that it begins operating January 1, 1900. Let us assume first that no depreciation fund is provided to redeem the plant at the expiration of its life. Then Ta-

TABLE I.—DEVELOPMENT COST.

	Cost Jan 1. (2.)	Fair return at 8 per cent (3.)	Net earnings (4.)	Deficit or development cost (5.)	New construction, etc. (6.)	Cost Dec. 31. (7.)
[illegible]	$100,000	$8,000	$6,000	$2,000	$1,000	$103,000
[illegible]	103,000	8,240	6,500	1,740	1,200	105,940
[illegible]	105,940	8,475	7,200	1,275	2,000	109,215
[illegible]	109,215	8,727	8,000	727	1,500	111,442
[illegible]	111,442	8,915	8,900	15	2,300	113,757
				$5,757	$8,000	$113,757

[illegible] shows the calculation of the development cost on the basis of 8 per cent as a fair return.

Note: Column (4), Net Earnings, is the difference between gross earnings from operation and operating expenses (taxes being included in operating expense, but no interest charges). Column (5) is the algebraic difference between columns (3) and (4). Column (6) gives the cost of new construction and additions to plant, including additions to stores, supplies and working capital. Column (7) is the sum of columns (1), (5) and (6).

Since deficits in fair return have practically ceased at the end of the year 1904, the development period is regarded as ended, and the development cost is $5,757. This added to the original new cost of the plant ($100,000) and to the total new construction ($8,000) gives a total value of $113,757 at the end of the development period, Dec. 31st, 1904.

Let us now assume that the plant has actually depreciated 3 per cent per annum, or a total of 15 per cent during the development period of five years. This depreciation, it should be understood, is true depreciation, that is, loss of life of plant units and not current repairs of parts of plant units; and it is also understood that operating expenses do not include true depreciation in this case.

If the average rate of annual depreciation is 3 per cent of the first cost on a sinking fund basis of 8 per cent, then the original $100,000 will have depreciated 15 per cent, or $15,000; and the "new construction" will have depreciated: 3 per cent of $1,000 for 4 years; 3 per cent of $1,200 for 3 years, etc., totaling $393; making a grand total depreciation of $15,393. It will be noted that the sinking fund method of depreciation is used, and the rate of return on the fund is 8 per cent. Error is likely to be made by assuming a lower rate, unless the appraiser bears in mind that in such a calculation as this the sinking fund must bear the same interest rate as the "fair return" rate, which in this case is assumed to be 8 per cent: for in the calculation that follows, the "fair return" is estimated at 8 per cent on the full first cost of the plant and not on its depreciated cost.

Hence if a lower rate of interest is used as the sinking fund basis the result will be to require the placing of a larger sum annually in the sinking fund than is needed to cover the actual depreciation, which in this case would result in giving the company more than the actual $15,393 depreciation. If it is desired to be perfectly exact in the calculation, increasing sums should be annually placed in the sinking fund, corresponding to the increase in the depreciable property listed under new construction; but, for the purpose of the present illustration, it will suffice to place an equal sum annually in the sinking fund. Assuming that the sinking fund deposits are made at the end of each year, and that they draw 8 per cent compound interest, it will take $2,622 to amount to the $15,393 depreciation in the five years. Table II gives the calculation, in form similar to Table I.

The development cost, therefore, is found by deducting the original cost ($100,000) plus the new construction ($8,000) from the final value ($129.150), Dec. 31, 1904. Hence we have $129,150 — $108,000 = $21,150, which is the development cost on the assumption that the plant has depreciated $15,393. But if the $108,000 plant has depreciated $15,393, its depreciated or present value is $92,607. Adding to this the $21,150 development cost we have $113,757, which is precisely the same result secured by first method shown in Table I. Comparing the two methods used in Tables I and II, we have:

	From Table I.	From Table II.
Plant cost	*$108,000	†$92,607
Development cost	5,757	21,150
Total cost	$113,757	$113,757

*New.
†Depreciated.

This example shows that the total cost (plant cost plus development cost) is the same whether the plant is regarded as new or as having suffered depreciation, for in the latter case the development cost is greater than in the first case by exactly the amount of the depreciation. However, it should be noted that this is only true when the entire depreciation of the plant is regarded as having occurred during the development period. If any considerable depreciation has occurred subsequent to the development period, then it becomes necessary to calculate the development cost and total cost according to the method used in Table II.

Care should be taken always to distinguish between development cost calculated upon the assumption that there is no depreciation (Table I) and upon the assumption that there is depreciation (Table II); for it would be an error to add the development cost deduced on the first assumption ($5,757 in the above example) to the depreciated plant value ($92,67 in this example).

The development period is usually much longer and the development cost is a much greater percentage of the plant cost than in the above example (Tables I and II), which is given merely as an illustration of the methods to be used in calculation.

Particular care should be taken that such adjustments of the operating accounts are made as will include all depreciation due to abandoned plant, the value of which is still carried in the ledger plant account. Likewise care should be taken to charge to operating expense the total net depreciation due to any fall in prices, for reasons that will next be given. These precautions are necessary because the development cost is added not to the actual cost of the plant, but to its estimated cost of reproduction.

Treatment of Depreciation Due to Fall in Prices.—Sometimes it will happen that the prices actually paid for materials, etc., were considerably higher than the prevailing prices at the time of the appraisal. Improvements in the art of manufacture, for example, often cause a decrease in price. In such cases there has occurred what may be called a price depreciation of the property. Price depreciation is quite as much entitled to consideration as any other form of depreciation in value. Hence, where price depreciation has been sufficient to warrant allowance therefor, the revised operating expenses should be made to include the price depreciation. This will act to increase the development cost by exactly the amount of the total price depreciation. Price appreciation—except in the case of land—will act in a converse manner. Land, s else where stated, takes care of its own development cost, for the courts hold th increments in land value belong to the owners.

Revision of Plant Account and Expenses in Calculating Development C—Since development cost depends upon net earnings, it becomes necessary to consider operating expenses in some detail, year by year. It may happen, for example, that construction may be charged to plant when it should have been charged to maintenance. Thus it gets into the capital account where it does not belong. The best way to determine to what extent this has happened is to contrast the plant book account with the appraised cost of reproducing the pl r doing this, allowance must be made for important changes in prices of materials pr of land, and rates of wages. Any part of the plant that is found to have been aba or destroyed, but the value of whi stands in the ledger plant account, sh charged off to operating expense wh rections are being made for the pur calculating the true development cost.

In nearly every railway system th been in existence many years, whet railway is steam or electric, more mileage of line has been abandoned. case of steam railways this has usua curred because of line changes nece in securing lower gradients and less ture, which became economic necessit the traffic grew denser.

It rarely happens, either in steam or street railway accounting records the plant account on the books is c with all the cost of the abandoned Some small credits for old rails and t usually occur, but rarely is operating e charged with enough to cover the entir inal cost of the abandoned property. ously an appraised engineer must tak to ascertain the original cost of all aba property that still stands on the ledge part of the plant account, and corre book account accordingly before calc the development cost. The original c the abandoned property should be in in the operating expenses, which, by th justment, are made to record the status of the transaction. Instead of m each of these adjustments at the time curred, the appraiser may make them a lump sum at the end of the develop period, by subtracting from the book account all the cost of abandoned pro that was carried on the books, and then ding a corresponding amount to the development cost. The result is to give the com credit for the money that it has lost in an doned property, but to give the credit in development cost column instead of the account column.

A little consideration of this matter of abandoned plant will serve, I believe, to phasize the necessity of deducing the development cost, or going value, by the de method instead of by the guessing me hitherto common in appraising public utili.

In the past, no change of grades or al ment has been made by any railway unless it could be shown that the decreased opera expense effected thereby would be suffic to pay a good return on the money requi to make the change. In the final anal this means that the net earnings must be ficient to pay a fair return not only on cost of the new line, but on the original c of the abandoned line. This is fundament sound economics not only for public but private corporations. It simply means, w expressed in another form, that the earni from the business must be sufficient to p vide not only for ordinary operating expen but for that form of extraordinary operat expense known as obsolescence. If a railw line has become obsolete—out of date as economic element—due to the growth traffic, then the operating company is entitl

TABLE II

Year (1.)	Cost Jan 1. (2.)	Fair return at 8 per cent (3.)	Net earnings. (4.)	Deficit. (5.)	New construction, etc. (6.)	Sinking fund deposit. (7.)	Cost Dec. 31. (8.)
1900	$100,000	$8,000	$6,000	$2,000	$1,000	$2,622	$105,622
1901	105,622	8,450	6,500	1,950	1,200	2,622	111,394
1902	111,394	8,912	7,200	1,712	2,000	2,622	117,728
1903	117,728	9,418	8,000	1,418	1,500	2,622	123,268
1904	123,268	9,860	8,900	961	2,300	2,622	129,150

[illegible] EVERETT, WASH.

[illegible] Statement.

	Plant Jan. 1.	Fair return on old [illegible]	Fair return on [illegible] struction [illegible] per cent.	Total return.	Gross earnings.	Operating expenses including taxes.	Net earnings.	Deficit or development cost.	New construction.	Increment in supplies and cash on hand.	Total property cost Dec. 31.
[illegible]					$ 1,712	$ 13,111	$ —11,369	$ 15,505	$ 137,868	$ 4,595	$ 157,968
		32,217	10,147		21,196	29,900	—8,704	51,068	26,090	11,305	446,431
		40,178	119	40,297	33,977	31,752	2,225	38,072	2,652	132	487,287
		43,855	149	44,004		32,988	4,467	39,537	3,443	172	530,439
			197		37,556	28,663	8,893	39,043	4,385	219	574,086
		51,667			39,690	31,226	8,464			46	618,284
		55,645				29,479	20,541		10,947	548	665,376
		59,883			55,915	34,687	21,228	39,595	20,886	[illegible]	726,901
		65,421		71,316			39,999	31,317		6,550	895,771
		80,619		97,021			48,987	48,034	364,187	18,225	1,326,517
....	1,326,517			132,751			82,909	49,842		14,850	1,688,207
				161,628		106,389	106,904	54,724	215,324	10,766	1,969,021
		177,211		178,359	251,348	113,647	137,701		25,516	1,276	2,036,471
				185,799	263,197	113,228	149,969		55,941	2,797	2,131,039
....	2,131,039	191,793	3,371	195,164	290,190	122,759	167,431	27,733	74,911	3,745	2,237,428
		201,368	10,043	211,411	342,428		178,609	32,802	223,175	11,159	2,504,564
....	2,504,564	225,110	1,426	226,836		214,116	143,411	83,425	31,688	1,585	2,621,262
		235,913	5,037	240,950		223,252	196,086	44,864	111,931	5,596	2,783,653
		250,528	8,716	259,244	481,099	256,173	224,926	34,318	193,695	9,685	3,021,351
(6 mo.)..	3,021,351	135,961	1,200	137,161	232,163	131,640	100,523	36,638	53,331	1,333	3,112,653
	$3,112,653	$2,350,014	$95,031	$2,445,045	$3,502,483	$1,879,283	$1,623,200	$821,845	$1,985,180	$105,628	$3,112,653

[illegible] New Co[illegible]

[illegible] gh obsolescence. The recovery may be either by charging the obsolete ele- to operating expense, or by allowing it nain on the books as a part of the plant nt upon which interest is to be earned. perhaps immaterial which is done, so far e public or corporation is concerned, pro- only that an appraisal of the property used as a basis of rate-making without [illegible] the development [illegible] clearly to be seen that a railway that nade extensive line changes might be gfully deprived of all the money in- d in the abandoned line were an ap- l made only of the existing line without d to development cost deduced by the t method.

[illegible] tments or Between Affiliated Companies. studying the operating expense of any ration having two or more departments render a different sort of service to the , or in studying the operating expense earnings of affiliated companies, it is sary to determine whether the charges by one department or one company to er have themselves been reasonable. it has been "all in the family" the tend- in the past has been to be more or less ss in the making of such charges; but w becomes necessary not only to adjust properly for the future, but, in calcu- development cost, to adjust them for ast.

ect on Development Cost Due to Incre- in Land Values.—There is one more tant point to consider in calculating de- ment cost, namely, the effect of steadily sing land values during the development l. It is now established by legal deci- as well as by the rulings of all rail- and public utility commissions, that a service corporation is entitled to earn r return on the increment in its land s. In other words, it shares with the of the community the gain in land s. This being so, it would be logical to bute the total gain in land values over e years during which it has occurred. if land that cost $100,000 twenty years s now worth $300,000, there has been a of $200,000 during the 20 years, or at ate of $10,000 per annum. Therefore in ating development cost, a $10,000 incre- in land value might be added each year e plant account, just as if so much new state had been purchased. By so doing ompany would get not only the benefit final gain in land value, but also receive ir return" on that gain, which is exactly individual owners of real estate get. the calculating of development cost in Madison Gas and Electric Co. case, the nsin Railroad Commission increased lant account annually by the estimated nent in land value. It seems to me [illegible] that the development cost of a public service company should be calculated by ascertaining the deficits below a fair return on the actual cost of its property, and no annual increment in land value should be allowed for in making such a calculation. Accordingly I have not given the company the benefit of any development cost based on any increment in land value.

Adjustment of Bond Discounts and Franchise Values.—As previously pointed out (in another part of the report) any bond discount in excess of a fair brokerage fee should not be regarded as plant cost for rate-making purposes. Hence the ledger accounts must be adjusted accordingly before calculating development costs. Likewise all franchise value, other than that represented in the reasonable cost of securing franchises, must be excluded from the plant cost.

Supplies and Working Cash Capital to Be Included in Property Value.—The ledgers show under "plant account" only part of the capital actually invested and in use for operating any company. In addition to the plant there is usually a considerable investment in: (1) Stores and Supplies, (2) Working Cash Capital, and (3) Bills and Accounts Receivable in excess of Bills and Accounts Payable.

A study of the financial statements showing assets and liabilities will enable one to ascertain what these items normally are, and it is well to express them as a percentage of the plant value and as a percentage of the gross receipts. Usually item (3) can be ignored, due to the balancing of receivables by payables. Usually part of item (2) can not be regarded as working capital, due to the fact that it is earning interest as a bank deposit. Often item (1) is abnormally high, or abnormally low, so that some adjustment must be made to assign a fair average to it.

Taxes Must Be Included in Operating Expenses.—Due to the requirements of the Interstate Commerce Commission, it is now quite generally customary to include Taxes in Fixed Charges, along with interest charges. This, in my opinion, is not good accounting. But without discussing the pros and cons, it is evident that taxes must be regarded as an operating expense when one is deducing the development cost, for taxes bear no analogy to interest items. In essence, taxes are almost identical with fire insurance, being, in fact, the sums paid for government protection, etc. Care must be taken, therefore, to add taxes to the operating expense if they are carried under Fixed Charges.

Interest and Rentals Must Be Excluded from Gross Earnings.—Only the earnings from operation must be considered in calculating development cost, hence earnings from any other source must be eliminated. Interest on bills receivable or on investments and rentals on property not used in operating the plant must be excluded. Likewise the operating expense must not contain any interest charges, nor must it contain any rental expenses other than those incurred in operating the plant. In brief, the net earnings must be true net earnings from operation. Up-to-date accounting records follow this rule, but the early accounts of most corporations always require investigation and frequently require adjustment.

Interest During Construction Often Improperly Omitted from Plant Account.—The plant account shown on the ledgers of many companies frequently does not contain a charge for interest during construction. This is particularly true of small public service corporations. When interest has been so omitted, the book plant account at the beginning of the operating period should be adjusted so as to include interest during construction.

Adjustment of Price Paid for Companies Acquired.—The ledger cost of plant often contains the price paid for other public utility companies. If the ledgers of those companies can be acquired, the actual cost of the plant may be ascertained and the development expense calculated. In the absence of such ledgers, the cost of the plant may be estimated if there are records of its physical character and extent.

Even in the absence of records as to a physical plant and of its actual cost, at a given time, it is often possible to estimate the probable cost at that time. This can be done by subtracting from the estimated cost of present reproduction an amount equal to the total cost of additions and improvements made since the time in question.

Summary.—From the preceding discussion it will be seen that in calculating development cost by the deficit method, the appraiser must first adjust the plant accounts for every year from the beginning of operation of the plant, eliminating all "going value" or "water," as well as any plant charges that were not reasonable. He must insert any reasonable plant charges that were improperly omitted. He must add to the plant value an amount sufficient to include a reasonable allowance for stores and working capital. Having established a fair and true property value for each year from the beginning to the date of the appraisal, he must examine and adjust the earnings and operating expenses, including taxes in the latter, and excluding interest charges from both. He must establish a fair rate of return, either as a weighted average for the entire period, or in the form of different rates for different periods. He must then calculate the difference between the "fair return" and the actual return or net earnings each year and the deficit thus calculated is the development cost, which must be added to the property value as fast as it occurs. This calculation must be carried to the end of the development period, and then the subsequent surpluses may be regarded as a minus development cost, up to the time that surpluses are sufficient to wipe out deficits. The total or accumulated deficits constitute the residual development cost.

Whether the development cost is a reasonable one is a matter to be determined only by comparing it with the development cost of other companies, making proper allowances for any variations in local conditions.

The amount allowed as a reasonable development cost may be expressed as a percentage of the cost of the plant, or of the plant exclusive of land, thus expressing the estimated development cost in the same manner that interest during construction is expressed—as a percentage of plant cost. Since development cost is, in fact, merely a sequel to interest during construction, it must be deduced from actual accounting records and must be finally appraised in precisely the same general manner as any other item of cost is appraised.

Court and Commission Decisions as to Development Cost Deduced by the Deficit Method.—While it has long been felt by students of appraisal problems that the true measure of the "going value" of a public utility should be the cost of building up its existing business, it is only within very recent years that attempts have been made to deduce "going value" or development cost in the manner above indicated. Consequently there are not yet many court decisions bearing on the subject.

In "Engineering and Contracting," Oct. 11, 1911, I published an editorial summary of the most important decisions, of which the following is an abstract:

The Supreme Court of the State of Oklahoma has recently rendered a decision in the case of the Pioneer Telephone & Telegraph Co. vs. E. H. Westenhauer, et al and the State of Oklahoma One of the most important questions at issue was whether the early deficits below a fair return should be regarded as "going value" and added to the cost of reproduction, or not. The company claimed that its early deficits below a fair return on the investment aggregated 20 per cent of the cost of the physical plant. This was not controverted by the State Corporation Commission, but it was claimed that the early deficits could not be regarded as a "going value" upon which the company could earn a return. We quote from the decision:

> The uncontroverted evidence in this case discloses that appellant's plant for the years preceding the first hearing failed to produce revenue sufficient for operating expense, current repair, and lay aside an amount for depreciation. During the time of development there is a loss of money actually expended and of dividends upon the property invested. How shall this be taken care of? Must it be borne by the owner of the plant? Or by the initial customers? Or shall it be treated as part of the investment or value of the plant constituting the basis upon which charges shall be made to all customers who receive the benefits from the increased service rendering power of the plant by reason of these expenditures? It seems that the last solution is the logical, just and correct one. If rates were to be charged from the beginning so as to cover these expenditures and earn a dividend from the time a plant is first operated, the rate of the first customers would be in many instances, if not in all, so exorbitant as to be prohibitive and would be so at the time when the plant could be of least service to them. On the other hand, the public cannot expect as a business proposition or demand as a legal right that this loss shall be borne by him who furnishes the service; for investors in public service property make such investments for the return they will yield; and, if the law required that a portion of the investments shall never yield any return, but shall be a total loss to the investor, capital would unwillingly be placed into such class of investments; but the law in our opinion does not so require. Private property can no more be taken in this method for public use without compensation than by any other method.

Then the court quotes from the decision of the Railroad Commission of Wisconsin in the case of Geo. W. Hill et al. vs. Antigo Water Co., decided Aug. 3, 1909, in which the Commission held that the going value was to be determined by ascertaining the deficits below a fair return on the investment. Speaking of the Wisconsin Commission's decision the court says:

> Although that body is not one of last resort for the determination of questions involving the reasonableness of rates, the reasoning with which it supports the doctrine above quoted commends its conclusions to us as being sound

To the cost of reproduction new (not depreciated) the court adds 20 per cent for development expense or going value, and decides that upon this total value the company is entitled to earn a fair return. The court did not find it necessary to fix what the fair return percentage should be, for the Corporation Commission had already allowed 8 per cent as being a fair return, and the evidence disclosed that the company was earning only 5.5 per cent net on the $113,556 value of the plant, including its going value or development expense.

The language of two previous decisions in Texas cases is unmistakably such as to support the theory that deficits below a fair return entitle a public service corporation to a corresponding increase in going value. We quote:

> The (Texas) Commission states that in estimating the value of these roads they included interest on the money invested during the period of construction. This is somewhat vague, but the "period of construction" mentioned is probably limited to the time when each section of the road was opened to the public for business. And even if extended to the time when the road was completed to Denison and to Austin in 1873, nearly 20 years after its construction was begun at Houston, it would not cover all of the time, and possibly not nearly all of the time, in which the railroad company and its predecessors have lost interest on the investment. (Metropolitan Trust Co. vs. Houston & T. C. R. R. Co., 90 Fed., 683.)

This decision shows that the court perceived clearly that development expense due to deficits in fair return is a sequel to interest during construction, and as such should be added to the physical property value.

The third court decision is equally explicit. We quote:

> An established railroad system may be worth more than its original cost and more than the mere cost of its physical reproduction. It has passed the initial period of little or no return to its owners which, of greater or less duration, almost always follows construction, and is not infrequently marked by default and bankruptcy. The inevitable errors in its building which finite minds and hands cannot avoid have been measurably corrected, time and effort have produced a commercial adjustment between it and the country it was intended to serve, relations have been established with patrons, and sources of traffic have been opened up and made tributary. In other words, the railroad, unlike one newly constructed, is fully equipped and is doing business as a going concern. It has attained a position after many experiences common to railroad enterprises which entail loss and cost not paid from current earnings, and which correspondingly make for value. (Mo., Kan. & Tex. Ry. Co. vs. Love, 177 Fed., 493, 496.)

Note particularly the last sentence wherein the court holds that the early losses "make for (subsequent) value."

Beside these three court decisions we have the rulings of two public service commissions to the same effect, namely, the ruling of the Wisconsin Railroad Commission in the Antigo Water Co. case (above mentioned), and in subsequent cases, and the recent ruling of the Public Service Commission for the First District of New York State. On June 23, 1911, the New York Commission rendered its decision as to rates charged by the Queens Borough Gas & Electric Co. We quote from the Commission's discussion of "going concern value":

> The converse of this proposition is that if these various expenses which go to make up "going-concern" are to be charged to operation, the company should be allowed to charge rates that will yield a sufficient income to pay them and also a fair return upon the fair value of the property. If good management and fore-sight have been used in the initiation and conduct of the undertaking, this statement is sound. But it ordinarily happens during the first few years of operation that the company does not earn a fair return. How, then, are the investors to be made whole?
>
> There are two solutions. One is to capitalize the losses or deficiencies below a fair return and all the other elements which are said to be included in "going-concern."
>
> The other solution is to charge all such expense to operation, to attempt to make no fine-spun distinctions and then to permit the company to charge in later years rates sufficient to offset its deficiencies below a fair return in the first few years.
>
> This method involves no questions as to capitalization and cannot result in the inflation of securities. Ordinarily, the company which is wisely managed follows this very course and works out an adjustment by itself. Questions arise only when the state, through some agency, is called upon to determine whether the rates are reasonable. Then the rate of return to be allowed upon the investment should be such as to offset losses in early years. This principle is adopted in this case, and no further allowance is made for "going-concern" in determining the fair value of the property."

Although the New York Commissn the deficit theory of development pense or going value, it concludes that going vae should be amortized by higher earnings in ler years, and that the Queens Borough Gas ar Electric Co. has been long enough in operatic to have earned sufficient to wipe out the ear deficits; consequently, this particular compar has no "going concern value" at present.

The Commission states that the earl financi records of the company were not obtaible, b that its gas plant had been in operatio 7 years, and its electric plant, 12 years. We que:

> If the company has not recouped elf (for "early deficiencies below a fair rate o eturn") by this time, it is doubtful whether th present consumers ought to be burdened for th reaso

This conclusion appears to us to bens for it rarely happens that any such fails to make extensions of its lines evy year. Every such extension is in essence, a rv plant and although the old original part of e plan may have passed out of the developmen the period of deficits—the new parts of are still in their development period, ans to deficits. Unless the weighted age of plant is known, it is illogical to assum development expense exists because th nucleus of the plant is old. In fact, o editors of this journal has just apprais lighting plant that is still suffering although the original nucleus of the p built more than 20 years ago.

It has been argued that failure to cha enough rates during early years and f establish an adequate depreciation fu stitute "errors" on the part of a publi corporation, and that the corporation rectify past "errors" at the expense of patrons. This sounds plausible enough, even influenced the courts in many cas facts are, however, that during the ear rates high enough to prevent deficits ca be charged without killing off even the traffic available, and that rates high en permit deposits in a depreciation fu seldom be secured.

Objections to Deficit Method of C ing Development Cost.—It has been against the deficit method of calculat velopment cost that it is susceptible o ductio ad absurdum, thus: The mo fortunate the company, the more ineffic management, and the longer the term fortune or inefficiency, the greater t cumulated deficit, hence the greater the value"—which is absurd.

The reply to this argument is that as sumes an unreasonable premise, namely tha an appraiser will not take into accou elements of misfortune or inefficiency fact, of course, an appraiser is not b take the development cost of any given pany as being the only criterion, any than he is bound to take any other partı item of original cost, such as interest construction, or engineering and supe ence, as being a reasonable cost. Th praiser should deduce, from the accoun records, the actual development cost for company, and then put it to the test of parison with other companies. Only wha *reasonable* development cost should th allowed.

It has been urged that it is illogic call any deficit an element of value, that a deficit is really the reverse, bei thing that would lead a business man to sign less value to a property rather than This reasoning is faulty, and the fa arises from a confusion of terms in the s gism. The term that is confused is the "deficit." There are two kinds of icits: (1) A permanent or irrevocable icit. (2) A temporary deficit that exists cause an investment has not yet had tim bring an adequate return.

If a man has dropped a twenty-dollar piece into the sea, he has incurred a de that certainly does not add to his assets. a man has spent $20 in advertising go and has not yet had time to secure res from the advertising, he has incurred a t porary deficit, but one that, in all probabil dd to his assets. This last is the sort icit incurred in building up almost every of business. When the business has built up to a degree that there is an as- return of the early deficits, then there t be the shadow of a doubt that the ss is worth not only the tangible assets ysical property but also the intangible of development cost.

as been claimed that to permit the addi- of development cost to the capital ac- may open the door to overcapitalization, se it is hard to say just when develop- cost has ended. This is really not an ent against development cost or "going " as an asset, but it is an assertion as *difficulty of determining* what is a rea- le development cost; for, with the s possessed by such a public service ission as that in this state, it cannot id that the commission is incapable of ting overcapitalization if it is capable ablishing the reasonableness of all the nts of cost. The Supreme Court of the d States has ruled that the going value usiness is an element of value, whether ate-making or in condemnation cases. this law is reversed, it does not lie the próvince of an appraiser or a com- n to exclude "going value" on the d that it is hard to determine how much r that it is difficult to decide when de- nent ends.

as been argued that, while a company be recouped for the cost of a reason- evelopment cost, the process of recoup- ay best be effected by allowing the com- to earn more than a fair return until the pment cost is amortized, thus making necessary to add the development cost e plant account. This, however, does elieve an appraiser or a commission determining the reasonable development for, before any calculation as to any ization can be made, it is necessary to the amount to be amortized.

vould seem that if a public utility com- were to choose not to carry its develop- cost on its books as a part of its capi- should be permitted to do so; but, as the Supreme Court has decided that going is an asset, there seems to be no dis- n on the part of a commission as to per- g a company to show the reasonable of that asset in its capital account.

ether development cost or "going value" d be gradually amortized out of earnings natter not germane to this report. It is ent merely to call attention to such a ility. But, in this connection, it should ted that the earnings of many public companies are not sufficient to permit amortization of the development cost ut raising the rates charged for the service, which would place an undue n on the public now.

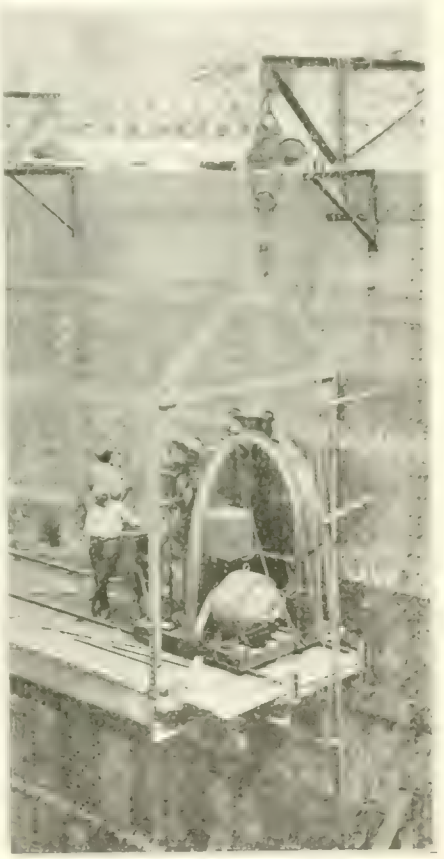
to the tendency to misunderstand the significance of the expression "deficit ir return," it might have been better ome other expression been adopted, such eferred dividends."

ther cause of confusion is the persistent h erroneous theory that an appraisal ate-making purposes is essentially a de- nation of the "market value" of the rty. It is nothing of the sort, in fact; f it were, it would suffice to ascertain arket value of the stock and bonds. The ate object of an appraisal for rate- g should be to establish the amount rea- ly invested in the physical property and ilding up the existing business. An ap- l of the physical property can be made ow one of these two items, and an sis of the annual income and expenses, the beginning to the date of appraisal sually be made to show the other item e absence of income and expense rec- the development cost must be estimated ppraisers acquainted with what the de- ment costs of similar properties have lly been.

Special Reamers for Lock Gates at Panama Drill 1 1-16-in. Holes in 1-in. Plate in 4 Seconds.

The accompanying illustration shows the method of suspending the 6-ton reaming machines for the work on the gates of the Panama locks, and the details of the reamer. Sixteen of these machines have been installed. Each machine, which weighs 6 tons, carries two spindles, mounted on a heavy cast base and driven by a 10-h. p. induction motor. That the machine may be carried over the face of the gate, it is mounted on a broad adjustable scaffold, extending the length of the gate, supported by chain-blocks from brackets affixed to the top of the gate. Some of the holes on the upstream face of a gate are enlarged to a diameter of 1 1-16 ins and others to 15-16 in., and those on the downstream face are made 15-16 in.

These machines were designed by the Foote-Burt Company of Cleveland, Ohio, especially for this work and the distinguishing features are great power, 9 speeds, from very slow for heavy drilling to very high for lighter reaming, and fixed spindles arranged to suit the uniform spacing of rivet holes in the lock gates. On test one of the machines drilled 1 1-16-in. holes through 1-in. plates in four seconds, a rate of 15 ins. per minute. It is estimated that each machine is capable of doing the work of five of the usual type of portable reamer.



Carrying Reaming Machine Used on Panama Lock Gates.

National Municipal League.—The 18th annual meeting of the National Municipal League will be held in Los Angeles on July 8 to 12, inclusive. This is the first annual meeting of the League held west of the Mississippi River. Among many other subjects the municipal health problem will be discussed. In addition to the program a study will be made of the municipal experiences of Los Angeles. Mr. Clinton Rogers Woodruff, 703 North American Bldg., Philadelphia, Pa., is Secretary.

Recent Studies of Ice Pressures and Their Consideration in Masonry Dam Design.

Allowance for ice presure is sometimes made and sometimes not made in computing masonry dam sections. The general opinion of engineers appears to be that this force should be provided for in some cases but not in others, but the limitations are not agreed upon nor is any very definite understanding had of what the pressure of ice is or what allowance for it is safe in dam design. In several recent discussions and papers considerable information is presented which is of aid in the problem and it is of interest to summarize it here.

GENERAL DISCUSSION.

In a recent discusion of masonry dam design before the American Society of Civil Engineers ice pressure is referred to by seven or eight engineers. A summary of the general opinion expressed by these engineers is made by Mr. C. L. Harrison, with comments, in the Proceedings, Vol. xxxviii, p. 665, as follows:

It is generally agreed that this force should be considered, and allowance made in some cases, but not in others. The limitations of these cases are not definitely stated by those who have discussed the subject. In order to give the matter more definite shape, it may be suggested that, under the following conditions, it is not necessary to provide for ice pressure:

(1) For the ordinary storage reservoir with sloping banks, in climates where the maximum thickness of ice is 6 ins. or less—for dams with southern exposure this limit may be placed as high as 1 ft. None of the discussions fixes this limit, but it is what the writer has in mind as a reasonable provision.

(2) For reservoirs which are filled during the flood season and from which all the stored water is drawn off each year during the low-water season. This would include even the large reservoirs on the head-waters of the Mississippi River, where the ice has a thickness of more than 4 ft., and the atmospheric temperatures reach 50° below zero.

(3) For storage reservoirs where the water will be drawn off each year during the winter to a level where the dam is strong enough to resist the ice pressure.

(4) For reservoirs where the contour of the ground at the high-water level is such that the expansive force of the ice will not reach the dam.

Mr. Gerry thinks the ice pressure, where acting, should always be allowed for, up to the crushing strength of the ice, without stating what he would use as the crushing strength of ice, while Mr. Douglas is inclined to make no allowance for it except in rare cases. The views of the others are rather indefinite, but are generally between these two.

The dams cited in Table I, where a value has been given to the ice pressure in the design, are in the vicinity of New York or Boston, where the maximum thickness of ice may be taken as about 2 ft. No allowance is made for ice pressure in the New Croton Dam, which is in the same climate.

TABLE I.

Dam.	Location.	Allowance for ice pressure in lbs. per lin. ft.
Wachusett	Boston	47,000
Olive Bridge...	New York	47,000
Kensico	New York	47,000
Croton Falls....	New York	30,000
Cross River	New York	24,000
New Croton	New York	No allowance

The stored waters in all the reservoirs in Table I are for domestic supply, and, excepting Olive Bridge and Kensico, are in service. The reasons given for the smaller allowances made for the Croton Falls and Cross River Dams are that local conditions will prevent the full ice thrust from reaching the dams, and also that they are located up stream from the New Croton. If either of these dams should fail, no valuable property would be damaged, and the waters would flow into the

TABLE I.—VALUES OF LINEAR EXPANSION AS DETERMINED BY VARIOUS EXPERIMENTS.

Authority.	Year.	Cubical expansion per degree centigrade.	Linear expansion per degree Fahrenheit.	Temperature Fahrenheit.
[illegible]	[illegible]	.0001125	.0000208	Near the freezing point. 194 distilled water.
[illegible]	[illegible]	.0001593	.0000295	
[illegible]	[illegible]	[illegible]	.0000194	
[illegible]	[illegible]	.0001535	.0000294	
[illegible]	[illegible]		.0000294	
[illegible]	[illegible]		.0000408	24
[illegible]	[illegible]		.0000280	8
[illegible]	[illegible]		.0000204	10½
[illegible]	[illegible]		.0000197	−25½
[illegible]	[illegible]	.000077	.0000143	Temperature not given.
[illegible]	[illegible]	.0001620	.0000300	
[illegible]	[illegible]	.000152	.0000281	

New Croton Reservoir. Those responsible for the design of the New Croton Dam believed that no allowance should be made at this dam for ice thrust. At first glance, this looks like a wide range in judgment, but it must be remembered that the foregoing statement gives only a part of the facts, and to this must be added the local conditions and the service the dam is to render in each case before judgment is passed on the wisdom of the design.

Reservoirs for domestic supplies are generally drawn down during the ice period, and the greatest expansion of the ice occurs at the end of this period, thus applying the pressure at a point below high-water level, where the dam is strong enough to resist it. If, however, such reservoirs are to be at high-water level during, and especially at the end of, the ice period, at any time during their service, then the proper allowance should be made for ice pressure in the design. The daily fluctuations in the water level in the forebay at power dams will usually prevent the ice from freezing to the dam, which, therefore, will not be subjected to thrust caused by the expansion of the ice in the pool above the dam. In such cases, the proper course seems to be, not to reduce the allowance, but to omit it altogether. If, however, a storage reservoir is to be filled to the high-water level during the full ice period, at any time during the life of its service, then not a partial, but the full ice pressure should be allowed for in the design of the dam. It is contemplated that the Kensico Reservoir is to be kept at or near the high-water level at all times, and therefore will be subject to full ice pressure at high-water level; also the Olive Bridge and Wachusett Dams may at intervals be subject to this pressure at high-water level. It is entirely possible that it would be proper to allow for ice pressure on a dam in a given locality and also proper to make no allowance for such pressure on another dam in the same locality, depending on the service each is to render.

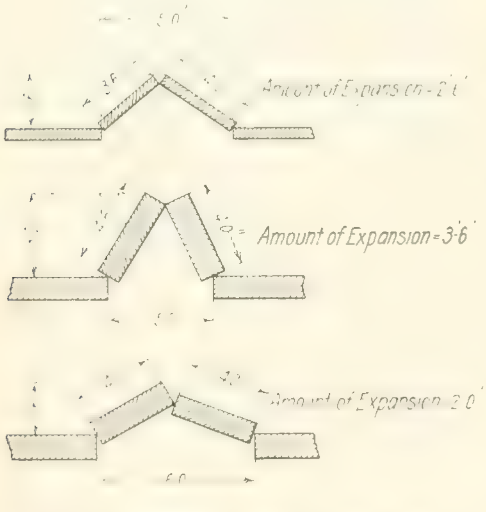


Fig. 1—Typical Forms of Ice Reefs.

The fact that so many dams have been designed and built without making a specific or separate allowance for ice thrust, and have for years stood the test of actual service without failing, is an indication that ice pressures may not be as great as sometimes thought, or that the factors of safety allowed for other purposes are sufficient to take this pressure. On the other hand, in the cases mentioned in this discussion, there seems to be good and sufficient reason for allowing for ice pressure in the designs.

OBSERVATIONS AND EXPERIMENTS ON ICE EXPANSION.

In building the Aziscohos Dam in Maine (Eng. & Contg., Jan. 4, 1911), the question of ice pressure came up for consideration and due to lack of information the engineer, Mr. Walter H. Sawyer, Portland, Me., made a number of independent studies which he records in a paper before the Maine Society of Civil Engineers. We abstract from this paper as follows:

Owing to the meagre information on this subject, the writer was led to make a study of the expansion of ice as shown by the formation of ice reefs or "wrinkles" on many of our Northern Lakes during the winter season, and also to make experiments to determine the coefficient of expansion of ice, together with its power to resist crushing and sliding. There are two days in which ice may exert a thrust.

(1) By the increase in volume that occurs when water freezes.

(2) By the expansion of the ice ie to rise in temperature.

Expansion of the first type is of importance only when ice forms in a restricted ace, as in a standpipe or tank or betwee bridge piers, and this particular property of e will be considered only briefly in this per, as the expansion of ice due to a rise in npera- ture and its effect on reservoir dams as the object of the investigation.

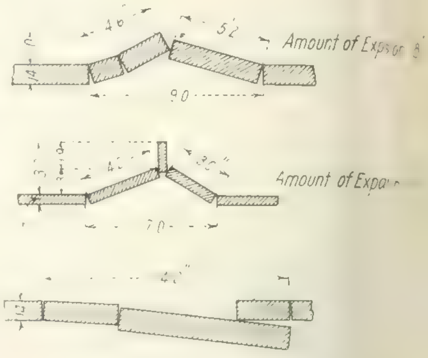


Fig. 2—Typical Forms of Ice Res

Early in the winter of 1910, the s tendent in charge of one of the R Dams was instructed to be on the wa the formation of reefs, and about th of January, 1911, information was re of the formation of reefs on Lake Mo meguntic, and a party was immediatel sent to study the formations and to gath information from residents in that sectio Se Figs. 1 and 2. Following are the concl reached after investigation, making o tions, and sifting the evidence.

The ice first cracked at the site of th during a cold period about Dec. 22, 191

TABLE III.—COEFFICIENT OF EXPANSION OF ICE AS DETERMINED BY THE AU

Date.	Hour.	—Temperature— Air.	Ice.	Scale reading	Observed ice movement	Correction for movement of pipe rod	Total exp. for 100 ft of ice	Coeff of expansion of ice
Feb. 25	11:30 a.m.	+29°F	+14°F	+0.	0.01760	0.00236	.01996	0.0000285
Feb. 25	4:30 p.m.	+38°F	+21°F	+0.15				
Feb. 26	8:30 a.m.	+25°F	+11°F	— .01	—0.0187	.00341	— .02211	0.0000317
Feb. 28	10:30 a.m.	+10°F	+ 2°F	+0				
Feb. 28	5:00 p.m.	+14°F	+ 4°F	+ .04	0.00469	0.00105	.00574	0.0000287
Mar 1	10.00 a.m.	+13°F	3°F	+0.				
Mar. 1	4:30 p.m.	+31°F	+12°F	+ .23	0.0269	0.00472	0.03162	0.0000211
Mar. 2	8:00 a.m.	+18°F	+ 8°F	— .11	—0.0105	— .00341	—0.01391	0.0000348
Mar. 2	5:00 p.m.	+35°F	+20°F	+ .35	0.0246	0.00445	0.02905	0.0000242
Mar. 3	8:00 a.m.	+15°F	+ 4°F	+ .12	0.0269	0.00544	0.03234	0.0000202
Mar. 3	5:00 p.m.	+30°F	+13°F	+ .26	0.0164	0.00393	0.02033	0.0000226
Mar. 4	8:00 a.m.	+15°F	+ 6°F	+ .12	0.0164	0.00393	0.02033	0.0000291
Mar. 4	4:15 p.m.	+23°F	+12°F	+ .22	0.0117	0.00341	0.01511	0.0000252
Mar. 5	9:00 a.m.	+ 9°F	6°F	+ .06				
Mar. 5	5:00 p.m.	+18°F	+ 1°F	+ .145	0.00996	0.00236	0.01232	0.0000176
Mar. 6	8:00 a.m.	+11°F	— 4°F	+ .07	0.00879	0.00183	0.01062	0.0000211
Mar. 6	5:00 p.m.	+19°F	+ 5°F	+ .15	0.02340	0.00445	0.0278	0.0000185
Mar. 7	8:00 a.m.	+ 2°F	10°F	— .05	0.02110	0.00681	0.02791	0.0000199
Mar. 7	2:00 p.m.	+28°F	+ 4°F	+ .13	0.02930 0.00820	0.00655 0.000262	0.03585 0.00846	0.0000199 0.0000211
Mar. 7	5:00 p.m.	+27°F	+ 8°F	+ .20	0.0304	0.00707	0.03747	0.00001705
Mar. 8	8:00 a.m	+ 1°F	—14°F	.06	0.0293	0.01034	0.03964	0.00001985
Mar. 8	2:00 p.m.	+39°F	+ 6°F	+ .19	0.0493 0.01995	0.00891 0.00105	0.05821 0.01890	0.0000201 0.0000210
Mar. 8	5:45 p.m.	+35°F	+15°F	+ .36	0.03515	0.00603	0.04118	0.0000242
Mar. 9	8:00 a.m.	+12°F	— 2°F	+ .06	0.02695	0.00786	0.03481	0.0000249
Mar. 9	1:30 p.m.	+12°F	+12°F	+ .29	0.04330 0.01640	0.00786 0.	0.05110 0.01640	0.0000256 0.0000274
Mar. 9	4:00 p.m.	+42°F	+18°F	+ .43	0.04685	0.00655	0.05340	0.0000248
Mar. 9	5:45 p.m.	+37°F	+19½°F	+ .46				
Mar. 13	8:00 a.m.	+30°F	+16 °F	+ .30	0.00820	0.00235	0.01055	0.0000302
Mar 13	4:30 p.m.	+39°F	+19½°F	+ .37				

' there was a rise in temperature [illegible] low zero to 41° above.

arge reef was formed about 10:00 A. M. n 2, 1911. When reefs form [illegible] ar the same location each year. Reefs [illegible] a warm period [illegible] one, and may form at night if the temperature is rising. Reefs generally form the ice is free from snow, or, at least, a very little upon it. Reefs do not al- occur where there is [illegible] either do they always rise, as occasional- e sheet may slide under another. Reefs or a time as expansion joints—that is, eak of the reef may rise and fall with sion and contraction of the ice sheet. seldom occur when the ice is over a thick, but instances are known where have been formed with ice twenty inches They are generally higher at the mid- the lake than at the shores. No push- p of rocks or soil is noticed in bays or

record of temperatures at Upper Dam, near the point of reefing, is given in ollowing table:

	Morning. Degrees.	Noon. Degrees.	Night. Degrees
	[illegible]		10
	1		
.....	1	[illegible]	26
.....	1	19	[illegible]
	21		
	32		25
	36		
	[illegible]	1	
		21	[illegible]
	1		
4.........	12	[illegible]	
		16	
	[illegible]	32	
		31	32

er making the observations on "reefs," ext step was to ascertain the coefficient pansion of ice per degree Fahrenheit. us experiments thave been made in the [illegible] er number of these experiments being nd the coefficient of cubical expansion. s linear expansion is that which is the of trouble, we have computed the co- [illegible] of cubical expansion divided by three s the coefficient of linear expansion," the results as given in the following ta- he data being taken from "Ice Forma- by Barnes," published by John Wiley &

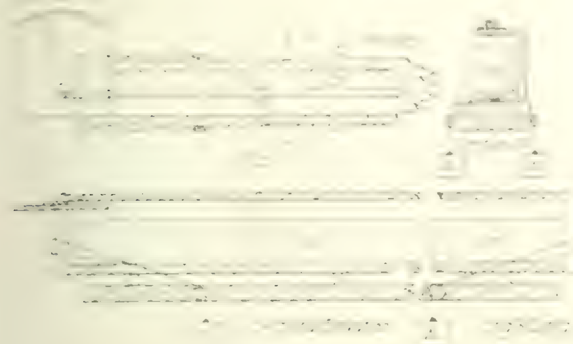
nparing the various results with those of ews, which are the most complete and nly ones that show the values of the co- nt at different temperatures, we find with the exception of the results of nant and Zabrevski, they all lie between xtremes obtained by Andrews, so that ariation in the coefficient may be due to experiments having been conducted at ent temperatures.

[illegible] Andrews the writer constructed a trough (see Fig. 3), the total length of which was 100 ft. This was made in 5-ft. sections connected together with a bellows-like construction to allow for expansion and to maintain the whole apparatus water tight. The sections were constructed with a 2x8-in. plank bottom with 1x10-in. sides. Rollers were placed under the plank bottom, so that the sections would be free to move. The trough was filled with water, and after it was frozen, the sides of the box were removed so that the air would be in contact with as much of the ice as possible. An indicator (see Fig. 3) was made by fastening one end of a swinging arm to one end of the ice box, the free end of the arm moving in the arc of a circle which was divided into one-hundredths of a foot. The arm was 16 ins. long, and at a distance of 1⅞ ins. from the pivoted end was attached one end [illegible] of the pine rod being attached to the opposite end of the ice column, as shown on Fig. 3, and this device worked perfectly, the column remaining intact during the subsequent observations.

The diagram (see Fig. 4) shows that the results obtained were uniformly less than those derived by Andrews, as shown in Table I, varying from eighty-five to ninety per cent of his results. There are two reasons which may account for this difference.

(1) The ice in our experiments probably adhered to the plank forming the bottom, and free expansion was partly prevented.

(2) The cross-section of the column was large enough to prevent it assuming the temperature of the air in a short time, the observed lag in the thermometers placed in the ice being very noticeable. Then, too, as the column was protected on the bottom by the plank, the temperature was not uniform throughout its mass, and the thermometers in [illegible]



3—Apparatus for Measuring the Coefficient of Expansion of Ice.

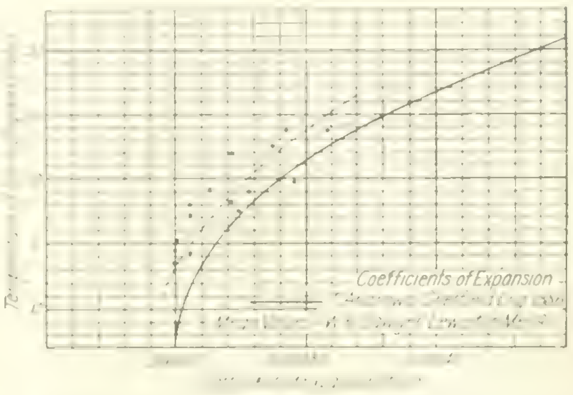


Fig. 4—Diagram Showing the Coefficient of Expansion of Ice.

[illegible] varied in length, the pine rod remained at nearly a constant length, the coefficient of expansion of pine being very small—the American Civil Engineers' Hand Book giving it at .000003 per degree Fahrenheit. A glance at Fig. 3 will indicate that the swinging arm must change its position with every change in length of the ice column. The temperature of the ice was found by reading a thermometer placed in the hole near the middle of the column. The true expansion of the ice between any two temperatures equaled the difference in scale reading at these two temperatures x 1⅞ ÷ 16, plus the linear coefficient of expansion of the pine rod x 100 x 14⅛ ÷ 16. The coefficient of expansion of the ice equals the *total expansion* divided by the expansion of the ice equals the *total expansion* divided by the variation in temperature multiplied by 100. In order to ascertain the coefficient of expansion of the ice per degree Fahrenheit, the total expansion between any two temperatures was divided by the total change in temperature, assuming that the variation of expansion was uniform, which is not strictly true, as we find that the coefficient of expansion varies at different temperatures, the variation, however, being in a constantly changing ratio as we find that the coefficient at the higher temperatures is much greater than at the lower temperatures. In computing the length of the pine rod, its temperature was taken as that of the air. The thermometers were only calibrated for even degrees, so that small variations in temperature gave but little information, six to eight degrees being the smallest change in temperature which did give consistent results.

During the first part of the experiments, we found that the ice would expand during the warm hours of the day and contract during the cooler hours of the night, and that cracks were formed in the column which did not close during expansion due to rising temperature. To counteract this tendency to form cracks, weights were attached to each

tion than actually occurred in the ice as a whole.

A study of the curves shows that the coefficient of expansion is a maximum at the freezing point, decreasing rapidly at first; the rate of decrease becoming less as the temperature approaches zero, while below zero the coefficient appears to decrease very slowly.

Having demonstrated to our own satisfaction that ice expands or contracts as the temperature rises or falls, let us consider the effect of variations of temperature of the ice covering the surface of a lake, assuming the ice to be free from snow.

If the temperature of the air is t_1° F. and that of the water t_2° F., the temperature of the top surface of the ice will be nearly the same as the air when below the freezing point, while the bottom surface of the ice being in contact with the water will be at or a little below the freezing point. As the ice in contact with the water remains at nearly the same temperature, and consequently expands and contracts but little, and as the ice in contact with the air is exposed to the greatest variations in temperature, and consequently the greatest amount of expansion and contraction, the actual expansion of the whole mass will be one-half of the maximum computed expansion for the range of temperature. The average coefficient of expansion of ice between —20° F. and 32° is .0000284, so that the total expansion of a sheet of ice a mile long for a rise in temperature of 50 degrees Fahrenheit would be

$$\frac{5,280 \times .0000284 \times 50}{2} = 3.75 \text{ ft.}$$

This corresponds closely with a statement by Mr. E. R. Beardsley in his pamphlet on the "Gravity Dam," that ice will expand nine-tenths of an inch per hundred feet for the maximum range in the temperature of the ice that we are likely to have in the Northern States. This is equivalent to an expansion of about 4 ft. per mile.

In presenting this paper, the writer feels that he has added but little to the general knowledge on the subject. He realizes that the problem of the amount of force applied to dams by reason of ice expansion is not solved. There are many experiments and observations yet to be made, and in the end we cannot lay down a "hard and fast rule" for the intensity of the ice pressure. As in all engineering problems, the engineer will have to take into consideration the local conditions.

For the purpose of aiding in the study of the problem, I give a few of the conditions which may be found at different places.

A dam may be built at the upper end of the valley, the opposite shore of the lake or pond consisting of soft mud or silt, in which case it would be expected that the ice thrust would force up the mud into ridges rather than act to overturn the dam. If, however, the opposite shore is formed of ledge or of a very hard soil, precautions must be taken to meet the thrust on the dam.

The width of the lake above the dam will have a great influence on the amount of thrust exerted. If the distance between the dam and the opposite shore is comparatively short, we may reasonably expect that the thrust will be a great deal more than it would be if the distance between the dam and the opposite shore is considerable. The ice, in the latter case, will act more like a long column; that is, it will have a greater tendency to buckle than in the first case, the movement of the ice, however, if such occurs, will be greater the longer the sheet.

If a dam is situated in a narrow valley, even a short distance below the reservoir, we would expect that the shore at the upper end of the valley would receive the greater part of the ice thrust, but if these shores should happen to be of a soft or yielding nature, some of the thrust might be passed on to the dam. If the dam is situated below a reservoir the elevation of which is being constantly changed, as in a mill pond from which water is being drawn for manufacturing purposes, the ice will be broken at the dam and on the shores and the liability of the occurrence of a dangerous thrust will be reduced.

From Mr. Bell's experiments, it may be seen that slanting up-stream faces of dams do not add an element of safety against ice thrust unless the water level is constantly varying—that is, the tendency to slip on the slanting surface is more than offset by the greater adhesion to the surface by reason of the large area of ice in contact. We will admit, however, that a vertical up-stream face will leave the dam open to receive blows from floating ice which would not be dangerous to the dam with a slanting up-stream face.

STRENGTH OF ICE

The intensity of thrust of ice against a dam is measured by the strength of ice against crushing. Tests of ice strength in tension, compression and adhesion are given in a paper by Mr. George G. Bell before the Maine Society of Civil Engineers. This paper follows:

There is very little information to be found on the crushing or tensile strength of ice. Sir Casimir Czowaski, in 1871, found that the crushing strength of hard ice below the freezing point was 208 lbs. per square inch. Colonel William Ludlow conducted experiments to find the probable effect of ice on an ice harbor at the head of Delaware Bay. The following are the conclusions that he arrived at:

There are evidences of ice yielding at from 23 to 300 lbs. per square inch. The ultimate crushing strength ranges from 100 to 1,000 lbs. per square inch, with an average of 575 lbs. Clear ice such as forms in the Delaware River will, under certain circumstances, stand 700 lbs. per square inch, while ice such as we are likely to find floating would crush at from 400 to 450 lbs.

The impact due to ice striking a dam or pier is much reduced by the elastic qualities of the ice. For the tensile strength of ice the American Civil Engineers' Pocket Book gives 142 to 223 lbs. per square inch.

To check these results and to find the adhesion of ice to a sloping concrete surface, the writer was instructed to conduct experiments, the results of which are given below.

The only apparatus available was that used for testing cement with a total capacity of 1,000 lbs. for tension and 4,500 lbs. for compression.

TENSION TESTS.

The tension samples were prepared in two different ways. The first lot by filling cement moulds with water which was allowed to freeze. In these samples, air bubbles arranged themselves perpendicular to the surface of the ice in contact with the brass, forming a core in each end, and when tested, they all failed along the line containing the points of contact and the core. Another set of samples were prepared by cutting the ice to nearly the proper size. These pieces were set in the moulds and the remaining space filled with water and moulds exposed to a freezing temperature.

The following are the results of the Tension Tests:

RESULTS OF TENSION TESTS OF ICE

No. of test.	Breaking load in lbs. per sq.in.	No. of test.	Breaking load in lbs. per sq.in.
1.	82	17	112
2	75	18	112
3	145	19.	130
4	105	20.	112
5	188	21.	135
6.	118	22	138
7	135	23.	126
8	130	24.	118
9	[illegible]	25.	120
10.	160	26.	142
11	105	27.	95
12.	135	28	90
13.	135	29.	100
14.	115	30.	80
15.	110	31.	116
16	120		
Total			13,274

Average tensile strength 120 pounds. All of the above tests broke at "Bearing Point" except Test Nos. 5 and 7, which broke at the "middle." Tests 1 to 17, inclusive, at temperature of +17°; all other tests at temperature of +15. Tests 1 to 17, inclusive, and tests 26 to 30, inclusive, on water frozen in molds. Tests 18 to 25, inclusive and test 31 on pieces cut from ice.

COMPRESSION TESTS.

In the compression tests, the 2-in. cubes were frozen in concrete molds, the remainder being cut from blocks of ice. In the adhesion tests, the pieces of ice were cut to the proper bevel and frozen to 8x8x6-in. concrete blocks. The bevels used were 1 to 1 and 12 horizontal to 8 vertical.

These tests indicate that if ice is firmly frozen to the concrete, it will develop its full crushing strength, irrespective of the inclination of the line of ice thrust to the surface of the concrete, as long as the temperature of the ice is below the freezing point.

William M. Patton, in his treatise on foundations, says that the adhesion of ice to a pier, even to the sloping surface, may be so great as to develop the full crushing strength of the ice.

The crushing strength of the adhesi sam- ples and the two compression sample No. 8 and No. 9, in which the length wa about twice the width, was 398 lbs. per squa inch, while the average for the cubes, omitt the exceptionally high one, was 626 ll p square inch.

As all the ice was taken from th sa block and the temperature was higher ir the tests of the cubes than during th sion tests, it would seem that the pape was used to insulate the ice from the cast iron blocks prevented the free of the specimens and consequently in the ultimate crushing strength.

When the natural upper surface of was perpendicular to the line of thru samples fractured horizontally and ver while when the natural upper surfa parallel to the line of thrust, the s fractured in parallel vertical planes o

In the latter case, if the ice had rea temperature of 32°, it was often imp to obtain further signs of failure, as under the pressure of 500 or 600 ll square inch, would spread or flow w further fracture.

The shortening of the ice column shown at even the small loads by th tinued dropping of the beam, while fo near failure, the ice practically flowed failure was due to compression only of these experiments were conducted temperatures. If low temperatures ha vailed, the ice would probably have more brittle and probably would not yielded as much at the higher l There was no apparatus to get the nece data to find the modulus of elasticity, a drop of the beam included the strain i the apparatus as well as the ice.

From the foregoing, it would seem at 400 lbs. per square inch would be a fair of the crushing strength of ice at the hi temperatures, and it is the amount use Colonel Ludlow and the other engineers have to deal with ice thrust.

For the tensile strength, 200 to 225 lbs square inch seems to be maximum.

The highest value obtained for the adh of ice to concrete was 225 lbs. per square As the ice in this case failed by crushing value should be increased.

Reasoning from the results of the ex ments as given in this paper, and those g in the paper by Mr. Sawyer, I offer the lowing conclusions:

If ice is floating in water, the tempera of the surface in contact with the water not fall much below 32° F. The variatio the temperature at any point in the ic nearly proportioned to the distance from surface in contact with the water and it maximum at the surface in contact with air.

The expansion of ice is a function of change in temperature, so that the tende to expand is a maximum at the upper

TABLE IV.—RESULTS OF COMPRESSION TESTS

No. of test	Size of cube.	Crushing strength.	Lbs. per sq. in.	Temperature. Ice	Temperature. Air.	Remarks.
1	[illegible]	1,926 lbs.	481.5	18	27	1[illegible] Height after crushing.
2	[illegible]	2,059 lbs.	516	18	27	1[illegible] Height after crushing.
3.	[illegible]	3,430 lbs.	1,128	13	25	
4	[illegible]	2,074 lbs.	535	32	40	Grain perpendicular to line Force.
5	[illegible]	2,224 lbs.	636	32	38	Grain parallel to line of For
6	[illegible]	1,884 lbs.	539	32	39	Grain parallel to line of For
7	[illegible]	3,400 lbs.	773	32	40	Grain perpendicular to line
8	[illegible]	2,474 lbs.	488	32	40	These samples were 4 ins. g and had grain parallel to line of orce.
9	[illegible]	1,811 lbs.	358	32	40	
10	[illegible]	3,214 lbs.	783	32	40	Grain perpendicular to line Force.
11.	[illegible]	3,449 lbs.	765	32	40	Grain parallel to line of For

TABLE V.—RESULTS OF ADHESION TESTS.

No. of test.	Size of ice.	—Bevel— Hort. a.	Vert. b.	Load at failure.	Unit compression at failure.	Unit adhesion to concrete.	Method of failure.	Temperature. Fah.	Remarks.
1.	[illegible]	12	8	4,200	370 lbs.	195	Crushing	30°	
2.	[illegible]	12	$8\frac{1}{2}$	3,800	504 lbs.	228	Crushing	30°	
3.	[illegible]	8	12	3,856	395 lbs.	158	Crushed and sheared	32°	Ice was badly crushed at before failure.
4.	[illegible]	8	12	2,960	250 lbs.	116	Adhesion	32°	Room 42°. Failure proba caused by concrete be warm, melting ice at co tact surface.
5	[illegible]	1	1	4,100	420 lbs.	185^5	Compression	30°	

[illegible] is, practically, [illegible] the ice is [illegible] [illegible] will be [illegible] ompression decreases as the distance :he upper surface and is zero at the

the maximum thrust that the ice ert will be when the upper surface is point of crushing. Taking this as unds per square inch, the thrust per [illegible] 2 × 12 × 400 = 2400t; that is, the of a sheet of ice in pounds per linear the thickness of the sheet multiplied

ough ice forms in our northern rivers kes up to three feet thick, it seems le that the greatest ice pressures ocnen the ice is from a foot to a foot half thick—that being the greatest thickt which ice reefs are formed. The for a sheet of ice 18 ins. thick is 2400 -43,200 lbs. per linear foot; for a -inch sheet, 2400 × 20 = 48,000 lbs.

e are only two references that give values of ice thrust.

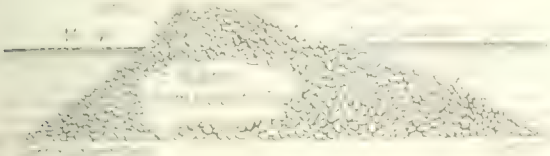


Fig. 1—Section of Delaware Breakwater.

first is in the discussion of the New Dam by Professor Cain. He states he ice between two bridge abutments apart expanded during a rise of teme and arched so that the center was bove its original level." He gives the for a 12-in. sheet of ice as 21,600 lbs. second reference is given in Volume . 11, of the Canadian Society of Civil ers, by Duncan MacPherson of a pier subjected to ice thrust on one ıly which was shoved out of line 2 d held there under passing trains unhannel was cut in the ice, when the ttled back into its original position. thrust of the ice to tip the pier only ven as 14,600 lbs. per linear foot for ins. thick. Taking the train load at bs. per linear foot would bring the up to 18,000 lbs. for ice 12 ins. thick. ably all that prevented rupture in the ıse was that there was not sufficient ion. However, the thrust of the ice likely be much greater when the arch tter.

e second case, the ice had not reached int of failure, and there is no inforgiven from which to estimate it.

e results are of interest as forces actxerted by the ice, although they do not e maximum thrust of which the ice pable, which, according to our formula, equal 28,800 lbs. per linear foot.

crushing strength of floating ice may en at about 10 tons per square foot. the amount used by W. T. Patton in ign of bridge piers at Harve de Grace. idge pier was shifted by a blow from field of ice, and the crushing strength ice was figured from the force neces- replace the pier. This was 11 tons are foot.

reful study of ice reefs and the maxiickness of the ice at which they form locality, together with experiments columns of ice floating in the water, furnish much valuable data. From the limited data, the writer believes that exposed to the full pressure of ice be designed to resist from 43,000 to bs. per linear foot, and that structures to blows from floating ice should be of resisting from 10 to 12 tons per

[illegible] exposed to the greatest thickness of floating ice.

Cost of Operating and Repairing Pile Drivers and Derrick, Lincoln Park Extension Work, Chicago.

IV.

Nearly 200 acres are being added to the area of Lincoln Park, Chicago, by filling in the shallower waters of Lake Michigan which border the park. At the end of 1911 there had been completed 125 acres of the total 197.54 acres of fill, and of this 43 acres were added in 1911. The filling is being done by hydraulic dredge and besides dredging there are required breakwater construction, riprapping, grading, etc. In a series of four articles, of which this is the fourth, the methods and costs for 1911, of doing each class of work will be presented. The articles will cover: Hydraulic Dredge Filling; Stone Filled Timber Crib Breakwater Construction; Tug Boat Towing Operations, and Repairs to Pile Drivers and Derricks. The methods and cost of doing corresponding work during 1910 were given in our issue of Feb. 22, 1911.

The pile drivers used on this work were floating drivers of the drop hammer type. The cost of operation and repairs for the season's work is given in Tables I and II. The extensive repairs, including a new deck house and a new boiler to fit driver No. 2 for work, accounts for the high repair costs for that machine.

TABLE I.—COST OF OPERATION AND REPAIRS OF PILE DRIVER NO. 1.

Hours in commission		1,135
Operation:		Per hr.
Labor	[illegible]	$4.37
Fuel	215.65	0.19
Supplies	325.80	0.29
Watching	227.04	0.20
Insurance	79.20	0.07
	$5,807.91	$5.12
Repairs:		
Labor	$ 550.28	$0.48
Material	194.04	0.17
	$ 744.32	$0.65
Total operation and repairs	$6,552.23	$5.77

TABLE II.—COST OF OPERATION AND REPAIRS FOR PILE DRIVER NO. 2.

Hours in commission		634
Operation:		Per hr.
Labor	$2,771.85	$4.37
Fuel	126.80	0.20
Supplies	184.77	0.29
Watching	132.30	0.21
Insurance	79.20	0.13
	$3,294.92	$5.20
Repairs:		
Labor	$1,237.89	$1.95
Material	676.57	1.06
Derrick	60.58	0.10
	$1,975.04	$3.11
Total operation and repairs	$5,269.96	$8.31

DERRICK WORK.

The derrick was in commission for 440 hours with a crew of two men, and for 1,254 hours with a crew of six men. The cost of operation and repairs for the 1,694 hours in service is given in Table III.

TABLE III.—COST OF DERRICK OPERATION AND REPAIRS.

Operation:		Per hr.
Labor, watching	$ [illegible]67	
Fuel	[illegible]68	
Supplies	[illegible]	
Insurance	[illegible]	
	$ [illegible]48	$0.45
Repairs:		
Labor	$ 188.70	
Material	140.[illegible]	
Teams	[illegible]	
	$ [illegible]	0.20
Total operation and repairs, excepting operating labor	$1,100.93	$0.65
April 1 to Aug. 1, 440 hrs.		
Operating labor	$ [illegible]	$1.29
Fuel, supplies and repairs	......	0.65
Cost per hr., 440 hrs.		$1.94
After Aug. 1, 1,254 hrs.		
Operating labor	$ [illegible]	$2.52
Fuel, supplies and repairs		0.65
Cost per hr., 1,254 hrs.		$3.17
Total cost for year	$[illegible]43	

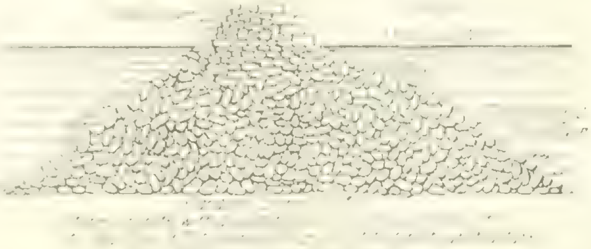


Fig. 2—Section of Breakwater at San Pedro, California.

The More Recent Types of Breakwater Construction and the Unit Cost of Several of Importance in the United States.

In a paper before the 12th International Congress of Navigation, Mr. J. F. Hasskarl, Director of the Department of Wharves, Docks and Ferries, of Philadelphia, outlines the practice in the construction of breakwaters on the sea coast and on the Great Lakes. He gives the principal dimensions and costs per lineal foot of several important breakwaters, both on the sea coast and on the Great Lakes and also the results of observations made to show the forces against which breakwaters act, which are created by wave motions during storms. An abstract of Mr. Hasskarl's paper follows.

In order to avoid misunderstanding as to class of construction to which reference is made here, I might state that, under the general and accepted meaning of the term, a breakwater is an artificial structure providing a harbor or roadstead with protection against waves, and differs from other structures in that it is essentially a wave breaker affording protection to shipping.

There are two classes of breakwaters: First, those giving shelter and protection to commercial harbors or their entrances; second, those sheltering an anchorage or roadstead—the latter, usually designated as harbors of refuge, are used by vessels in transit to escape the violence of storms or as a harbor while awaiting orders.

The various types of breakwaters which have been constructed in the different parts of this country are due to the efforts made to have them so designed as to meet the particular needs of each locality and the economic conditions encountered there.

The abundance of durable stone, conveniently located, has led to the adoption of stone almost exclusively for the construction of breakwaters along the sea coast. On the Great Lakes the earlier practice was to use large amounts of timber in the construction of those breakwaters, whereas, in later years, since lumber has become more expensive, stone and concrete have been used more extensively.

A careful study of the many different types of breakwaters completed and now under construction in the United States, proves most interesting and instructive to those interested in that class of engineering, and, considering the fact that the first breakwater (the Delaware Breakwater) constructed in this country was commenced in 1828, the American engineers have shown a great deal of originality and resourcefulness in the many effective breakwaters of different design now in existence.

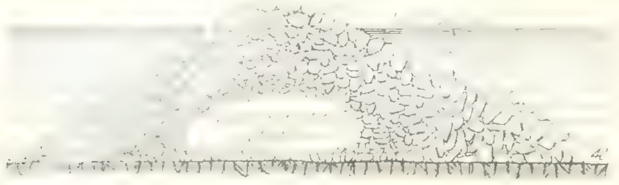


Fig. 3—Section of Colon Breakwater, Panama.

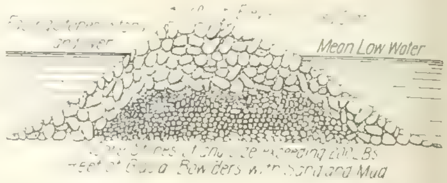


Fig. 4—Section of Point Judith Breakwater, Rhode

The writer completed the portion of the Delaware Breakwater known as the "Gap," connecting the Delaware Breakwater with the "Ice Breaker." He also had charge, from commencement to completion, of the construction of the National Harbor of Refuge, Delaware Bay. This latter work required about five years' time, and thus enabled the writer to gain much valuable practical knowledge and experience in the construction of such works.

A series of experiments conducted some years ago with the aid of dynamometers, in order to determine the force or impact of breaking waves, showed a maximum force of 6,000 lbs. per sq. ft. in the North Atlantic Ocean. Observations made in the mid-Atlantic during a severe storm showed the average height of the waves to be 26 ft., the length from 400 to 550 ft., and that they moved with a velocity of from 30 to 35 miles per hour, while the highest waves noticed were estimated as 43 ft. in height.

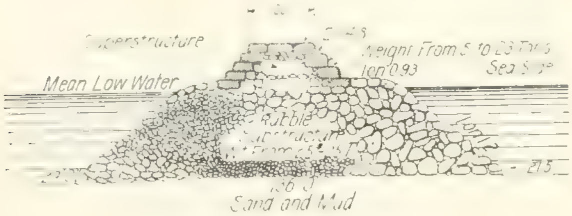


Fig. 5—Section of Breakwater, National Harbor of Refuge, Delaware Bay.

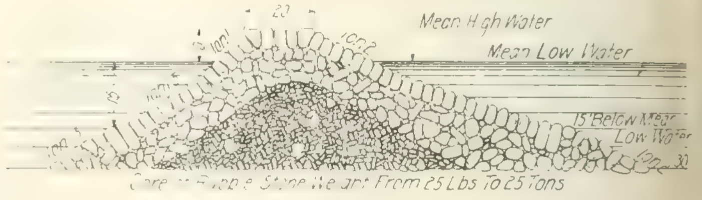


Fig. 6—Breakwater Section Recommended by Joseph F. Hasskarl.

Similar experiments conducted upon one of the Great Lakes showed a maximum force of 1,000 lbs. per sq. ft. During a severe gale it was observed that the waves were from 275 to 325 ft. in length, and attained a height of from 14 to 18 ft. above the normal surface of the lake, with a velocity of from 30 to 40 miles per hour.

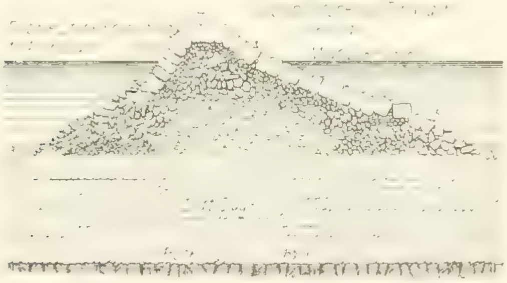


Fig. 7—Sorted Rubble Mound Breakwater at Buffalo, N. Y.

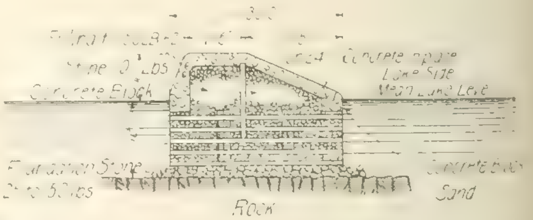


Fig. 8—Section of Detached Breakwater, Dunkirk, New York.

Experience upon the ordinary American breakwaters, built of random stone with flat slopes, has determined that the depth to which energetic wave action extends is from 12 to 15 ft. below the surface of the water, and this depth is now generally assumed as the "Plane of rest" for the materials used in such structures.

In cases where the sides of the superstructures are nearly vertical, heavy back wash or recoil results, and consequently the wave disturbance extends to a greater depth, or from 18 to 22 ft. below the surface of the water.

The American sea coast breakwaters are mostly of the composite type. These works consist of a superstructure built of stone resting on a rubble or random stone base or substructure.

The superstructures in most of these breakwaters consist of rough, strong walls upon the sea and harbor face of the work, built of large stones systematically placed, so as to secure a strong bond, the space between the walls being filled with stones varying in size so as to form a compact mass without large interstices. The advantages claimed for a breakwater of this kind are: That no material placed in it was lost; that no injury to it could do more than reduce its height somewhat; that it must always be left in good condition for repairs; and that a time must come when repairs of any kind would cease to be necessary.

The earlier types of breakwaters on the Great Lakes, during the time of cheap lumber, were constructed of timber cribs from 30 to 35 ft. square, divided into compartments by transverse and longitudinal walls, and then filled with stone and sunk side by side along the line of the proposed breakwater. The superstructures were of timber, and were continuous generally throughout the entire length of the breakwater, extending from one crib to another.

In the earlier forms the superstructure was carried up to a height of from 7 to 8 ft. above the lake level and then decked over. These structures were frequently racked and suffered serious injury from the force of the waves, and therefore required extensive and costly repairs. In order to prevent this racking, it has recently been proposed to deposit heavy riprap on the outer face of thes waters, so as to protect the same.

One of the great disadvantages of structures is the perishable nature of th rial when not entirely submerged. The life of timber structures of that sort 12 to 18 years, depending on exposure to wave and the character of the timber used construction.

A more modern type of the crib con tion breakwaters is where the cribs a off at a level of about 3 ft. below the of the water, and from this point co blocks are used and the superstructure bu up to a level of 8 to 10 ft. above the of the water. Where square blocks of crete are used they are generally about high by 5 ft. wide and 8 ft. long, and blocks of mass concrete are used the generally from 20 to 30 ft. in length, wide and 5 ft. high. The blocks are sep from one another by double layers of paper. The weight of the mass concrete ranges from 300 to 400 tons.

The tendency recently has been, in lak water construction on the Great Lakes to build them with more gentle slopes on lake faces and to give the superstructure a gentle slope also. This modified form proven itself to be very satisfactory, and extensive reflex wave action so noticeable the vertical form is hardly perceptible in newer type.

In this article reference has been made the five principal breakwaters on the sea co and six breakwaters on the Great Lakes follows:

SEA COAST BREAKWATERS.

The Delaware Breakwater has been the p totype for all our random stone sea breakwaters, and while its details have been exactly repeated, the experience gai upon that work has been utilized both in sign and construction in most of the ot localities.

While this is not exposed to such storms as some of the European breakwater it is highly probable that its slopes, throug the method by which they have been obtaine are more nearly in equilibrium with the forc which are impressed upon them than obtai [illegible] kwaters. [illegible] stones on the sea face of this breakwater.

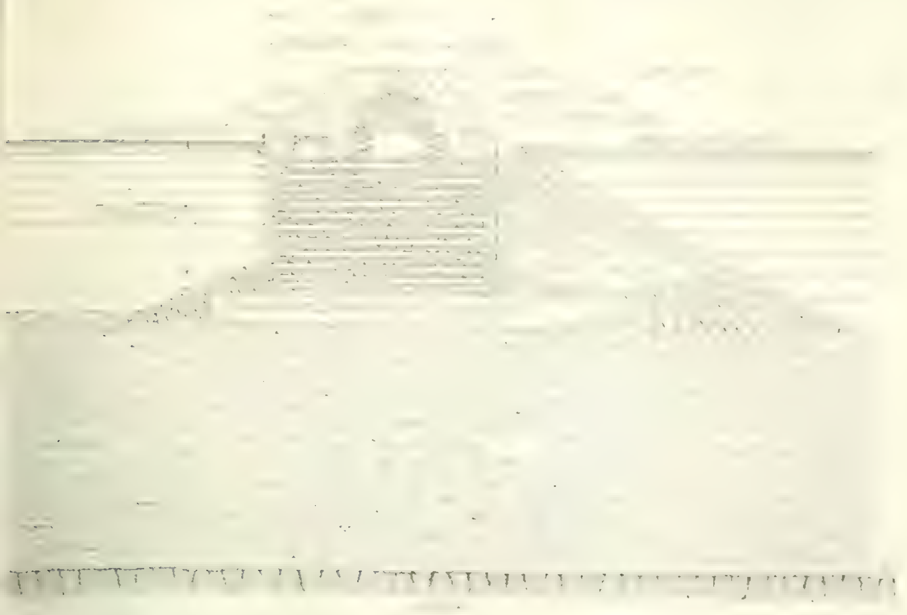
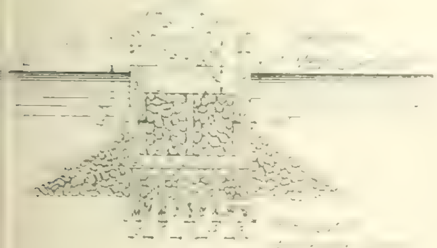


Fig. 9—South Harbor, Buffalo, New York, Timber Crib Breakwater.

hat no extensive repairs have ever been or found necessary to the same, proves r conclusively that it is built in the right rtions.

[illegible] The Delaware kwater was commenced in 1828 and com- l in 1869. Its principal dimensions and are: Length 2,558 ft.; length of Gap and Breaker, which are connected with the , 2,709 ft.—making the total length of structure 5,267 ft. Area of average cross n above sea bottom, 4,067 sq. ft. Area erage cross section above mean low water, q. ft. Area of average cross section be- mean low water, 3,520 sq. ft. Tons per ge lin. ft., 277.69. Cost per average lin. [illegible]. *Note*: The great excess of ma- placed in the structure over the enrock- at present remaining above the bottom plained as follows: The bottom is very there are no mattresses, and much of aterial has sunk into the soft mud. The t of a cubic yard of solid stone is ap- mately 2.24 tons, and a cubic yard of kment weighs about 1.68 tons.

Pedro, California.—This breakwater was enced November 12, 1898, and is still construction. Its dimensions and cost Total length when completed, about ft. Total area of average cross section sea bottom, 6,466 sq. ft. Area of aver- ross section above mean low water, 412



ig. 11—Reinforced Concrete Caisson, South Pier, Milwaukee, Wis.

Area of average cross section below low water, 6,054 sq. ft. Tons per aver- in. ft., 344.31. Cost per average lin. ft.,

on, Panama, West Breakwater.—This water was commenced in 1910 and is still

[illegible] Its dimensions and cost are: Total length when completed, 11,322.5 ft. Total area of average cross section above sea bottom, approximately 6,777 sq. ft. Area of average cross section below mean sea level, approximately 335 sq. ft. Area of average cross section below mean sea level, approximately 6,442 sq. ft. Tons per average lin. ft., 340. Estimated cost per average lin. ft., $481.

Point Judith, Rhode Island.—This breakwater was commenced February 13, 1891, and completed December 18, 1898. Its dimensions

Fig. 10—Extension of East Breakwater, Cleveland, Ohio.

and cost are: Total length of main breakwater, 6,970 ft. Total length of easterly shore arm, 2,240 ft. Total area of average cross section above sea bottom, 2,948 sq. ft. Area of average cross section above mean low water, 370 sq. ft. Area of average cross section below mean low water, 2,578 sq. ft. Tons

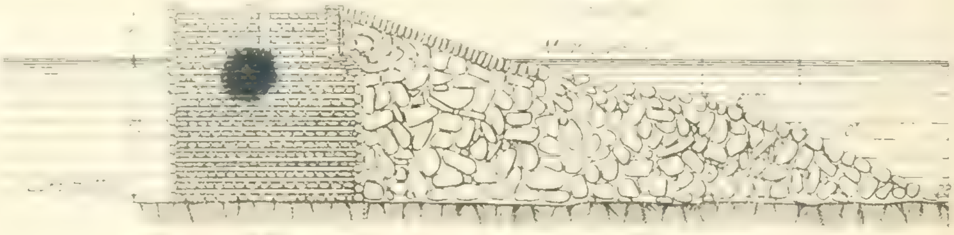


Fig. 12—West Pier, Oswego, New York, Timber Crib Breakwater.

per average lin. ft., 161.72. Cost per average lin. ft., $206.70.

National Harbor of Refuge, Delaware Bay.—This breakwater was commenced in 1897 and completed in 1901. Total length, 8,040 ft. Total area of average cross section above sea bottom, 3,474 sq. ft. Area of average cross section above mean low water, 550 sq. ft. Area of average cross section below mean low water, 2,924 sq. ft. Tons per average lin. ft., 183.82. Cost per lin. ft., $217.60.

Breakwater as Recommended by Joseph F. Hasskarl.—Total area of average cross section above sea bottom, 4,486 sq. ft. Area of average cross section above mean low water, 616 sq. ft. Area of average cross section below mean low water, 3,870 sq. ft. Approximate weight per lin. ft., 226 tons.

Buffalo, New York.—This breakwater was commenced May 19, 1897, and completed December 15, 1902. Total length, 7,250 ft. Total area of average cross section above lake bottom, 3,236.5 sq. ft. Area of average cross section above mean lake level, 312.5 sq. ft. Area of average cross section below mean lake level, 2,924 sq. ft. Tons per average lin. ft., 181.60. Cost per average lin. ft., $125.26.

Dunkirk, New York.—This breakwater was commenced August, 1897, and completed August, 1898. Total length, 310 ft. Total area of average cross section above lake bottom, 535.2 sq. ft. Area of average cross section above mean lake level, 175.2 sq. ft. Area of average cross section below mean lake level, 360 sq. ft. Tons per average lin. ft., 28.557. Cost per average lin. ft., $65.12.

Buffalo, New York.—Original breakwater built October 7, 1898—October 27, 1900. New superstructure work commenced June 18, 1901, completed May 18, 1902. Total length, 1,800 ft. Total area of average cross section above lake bottom, 2,417.68 sq. ft. Area of average cross section above mean lake level, 302.68 sq. ft. Area of average cross section below mean lake level, 2,115 sq. ft. Tons per average linear foot above lake bottom, 105.34. Cost per average linear foot above lake bottom, $242.53. Total tons per average linear foot, including gravel fill in trench, 268.84. Cost per average linear foot, including trench and gravel fill, $278.89.

Cleveland, Ohio (Eastern Extension).—This breakwater was commenced May 4, 1903, and is still under construction. Total length when completed, 15,600 ft. Total area of average cross section above lake bottom, 3,246.5 sq. ft. Area of average cross section above mean lake level, 169.6 sq. ft. Area of average cross section below mean lake level, 3,076.9 sq. ft. Tons per average linear foot, approximately 164. Cost per average linear foot, approximately $175.

Milwaukee, Wisconsin.—This breakwater was commenced June 14, 1909, and completed about September, 1910. Total length of caisson construction, 577 ft. Total area of average cross section above lake bottom, 531 sq. ft. Area of average cross section above mean lake level, 43 sq. ft. Area of average cross section below mean lake level, 488 sq. ft. No data for weight per linear foot obtainable. Cost per average linear foot, $117.94. *Note*: Stone for riprapping caissons, except about 800 tons of large stone placed on lake side, was obtained from the razing of an old pier and is not included in above estimate of cost.

Oswego, New York.—This breakwater was commenced in 1831; nearly completed, and abandoned in 1838. Work commenced on superstructure in 1832 and completed in 1833.

Total length, 1,130 ft. Total area of average cross section above lake bottom, 2,328.5 sq. ft. Area of average cross section above mean lake level, 312 sq. ft. Area of average cross section below mean lake level, 2,016.5 sq. ft. Tons per average lin. ft., 120.13. Cost per average lin. ft., $69.18.

A careful study of the Delaware Breakwater, and of the larger and more important breakwaters in this country and abroad, has lead the writer to believe that, for the American sea coast, a random stone breakwater with slopes of the several parts of the sea and harbor faces, as follows, would be the most economical and permanent in its construction, viz:

Width on top of superstructure—20 ft. Top of superstructure above high water—10 ft. Sea face, below the depth of 15 ft.—1 on 2. Sea face from 15 ft. depth to low water—1 on 3. Sea face from low water to top of superstructure—1 on 2. Harbor face, from bottom to low water—1 on 1.5. Harbor face, from low water to top of superstructure—1 on 1.

The top and the sides, down to the plane of 15 ft. below low water, should be faced with large blocks of stone, systematically laid, so as to give a comparatively smooth surface to the upper part of the breakwater, thus offering enough resistance to the waves to effectively break their force and allow them to spend their remaining energy by running up the face of the structure—and if tl exceptionally high, spill over the brea into the harbor. (See Figure 6.)

The maximum economy in random ton breakwater construction is realized wh the slopes and consequent cross section ar such as to place the work in simple stable ilibrium with the forces it is to resist, a the writer believes that if a breakwater wer constructed in accordance with the abov suggested plan, proportions, slopes, etc., it ould prove most satisfactory in every respect here would be no damaging back wash and th the severest storms could not cause any appreciable injury to such a structure.

EARTH AND ROCK SECTION

Methods of Constructing the Sand Patch Tunnel of the Baltimore and Ohio Railroad, with Records of Progress.

The Sand Patch Tunnel, which has been under construction since May, 1911, will be completed and turned over to the operating department of the Baltimore and Ohio Railroad in November of this year. This is a second bore through the summit of the Alleghany Mountains, built to relieve congestion at this point and to reduce the engine service. An article describing the construction work and giving the progress records of the work in the tunnel is printed in Mine and Quarry, from which this article is abstracted.

The old tunnel and the new one are nearly parallel. The old tunnel was built in 1871, has a single track, and is 4,777 ft. long. It required seventeen years for its construction, although there were interruptions amounting to more than nine years. It was driven by the top heading method and the maximum month's advance was 43 ft. This tunnel is on a 1 per cent grade, the summit point being 700 ft. east of its west portal. The approach grades are 1.5 per cent on the east and 1 per cent on the west. There are now three tracks leading up to the tunnel from each side, one of them being used for down traffic and the other two for fast and slow trains, up the grade.

The New Tunnel.—The new tunnel, located beside the old one and 300 ft. to the north, is 4,000 ft. long, the west portal being about 800 ft. east of that of the first tunnel. The east portals are on a line with each other and about 900 ft. apart. The grade through the new tunnel is one-half of one per cent, with a summit 15 ft. lower than that of the old one, some 2,500 ft. west of the new west portal.

At the east portal, a small approach cut, amounting to 75,000 cu. yds., was required. For the western or uphill portal, a cut 3,000 ft. long is being excavated in rock, to a maximum depth of 90 ft. from the surface. The finished road bed will be 40 ft. wide. The slope of the wall next the hill is ⅛ to 1, while that on the other side of the old cut, of which the new one is partly a widening, is 1¼ to 1.

On the high side a level bench has been left on the surface of the rock, and the earth above is sloped away from this at 1½ to 1. A concrete drain will be laid along this bench to cut off water tending to enter the cut. A plan is also being considered to intercept all drainage above the elevation of a near-by saddle in the ridge by building a contour drain high up above the cut and running it over the saddle. This work will be done this summer.

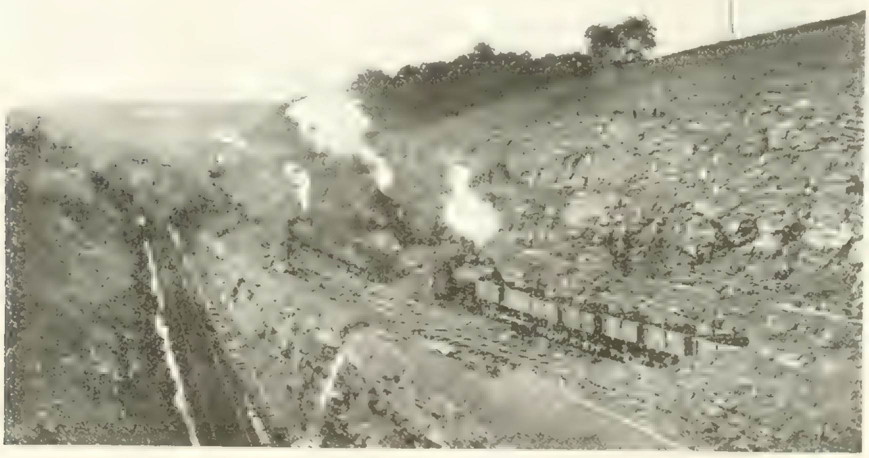


Fig. 1—View of Work in Approach Cut, Sand Patch Tunnel, Baltimore and Ohio Railroad.

Excavating Rock.—The new cut has been made independently, so as not to interrupt traffic in the old narrow single-track approach. The drilling in the cut as well as in the tunnel has been done with an equipment of about 50 Sullivan UF-1, 3¼-in. tappet valve rock drills, mounted on tripods or mining columns, as required. The rock formation is chiefly a stratified red sandstone, the beds dipping at about 90° with the line of the tunnel and cut. The rock is broken, with vertical seams, and varies in hardness. Some deep hole work has also been done with well drills.

The broken rock is loaded by four steam shovels, two 70-ton Bucyrus, one 60 and one 40-ton Marion shovels, into 4-cu. yd. dump cars, which are hauled by dinky locomotives.

The engineers were anxious to make the wall next the hill as steep as would be consistent with safety, in order to reduce to the minimum the amount of excavation required. To accomplish this purpose, it was desirable to disturb the rock wall as little as possible, particularly in view of the broken nature of the formation. To carry ou this idea, a Sullivan heavy duty direct acting an neler, operated by steam from its own ler and two Sullivan quarry bars have bee ployed. The rock is drilled and blast within 6 ft. of the engineer's wall lines the final wall cut is made with the char and quarry bars in 8-ft. lifts. The rock side the cut is then removed with light charges, so that the wall itself is not ex to the jar of blasting.

Two 3¼-in. drills were mounted on a q bar and put in about 200 ft. of 10-ft. in 10 hours. The holes were spaced 9 apart. This apparatus required four att ants, i. e., a runner and a helper for each

These methods have given good results have saved a large amount of heavy excation. A slide, totaling some 80,000 yds., curred on this approach during March, but not delay the completion of the tunnel to extent. It took place on the south side, had no effect on the channeler and quarry work. The total excavation in the cut wi about 480,000 cu. yds.

In parts of the work near the old tunnel near the sides of the old approach cut, plan of excavation has been such as to re as much as possible the shock of blastin the direction of the tunnel and the cut, to eliminate any danger from falls of r within the tunnel or the cut. To accomp the latter purpose a blasting inspector is tioned in a small building above the new nel portal, and is in communication by phone with the signal operator in the to at the Sand Patch station. Before each b the foreman asks permission of the inspec who communicates with the tower man, if no train is due, has the operating tr turned over to him by the tower man. track then remains in the inspector's cha until he again notifies the tower man that way is clear.

Tunnel Excavation.—To carry on the t excavation as rapidly as possible, two sha were sunk: No. 1, 235 ft. deep, 1,300 from the east portal, and No. 2, 135 ft. de 2,000 ft. west of No. 1, and 700 ft. east of west portal. This gave five headings to driven simultaneously, including the east tal. The heavy overburden at the west proach prevented opening the west portal un the cut was made.

The tunnel is 31 ft. wide in the clear, pr viding room for two tracks, 14 ft. betwe centers. A semicircular arch springs fro vertical side walls, at a point 11 ft. above su grade. The wall plates are 15 ft. long a 16 ft. above subgrade.

All headings were carried 9 by 16 ft. in siz Those from the east portal and from sha No. 1 were top headings, and the two fro shaft No. 2 were begun as bottom heading because the condition of the rock in the l cality seemed to give promise of faster prog ress by this method. One of these heading however, was later inclined upward and turne into a top heading.

The two shafts were completed about Augu 1, 1911, and work in all five headings bega at nearly the same time.

he bore of the tunnel was completely holed ough during December, after a progress raging 225 ft. per week of 13 10-hour ts, or 45 ft. per heading. A round of 22 es from 8 to 10 ft. deep was usually em-

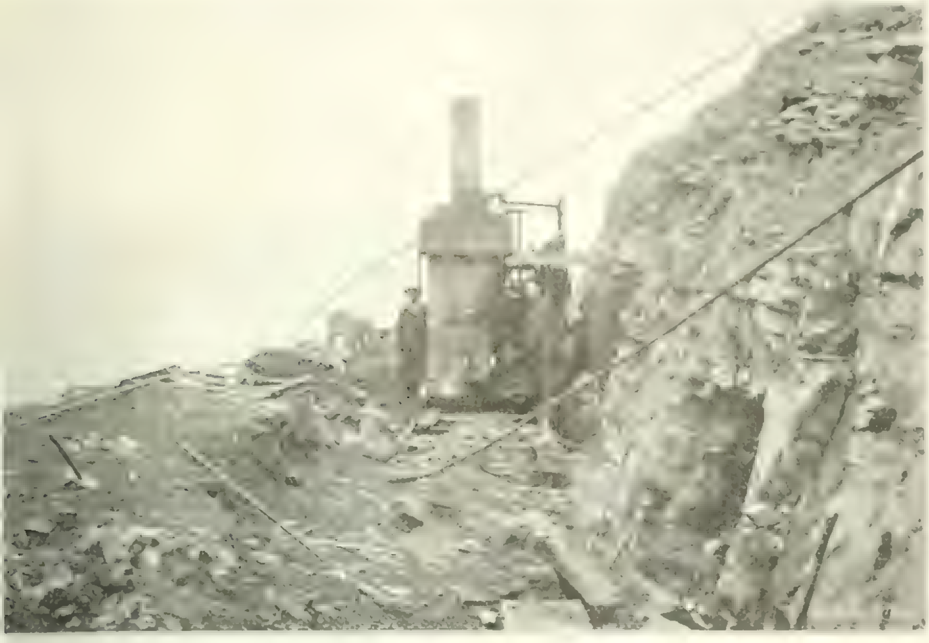


Fig. 2—View of Channels Showing Character of Rock.

ed in drilling the headings. [illegible] done with four Sullivan 3¼-in. drills, nted on two double-screw mining columns, required about 3½ hours per round. The owing table shows the monthly perform- for each of the five headings.

EW SAND PATCH TUNNEL, 1911-1912.

Table Showing Heading [illegible]
headings are numbered from east to west.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
ading No. 1						
of shifts ..		[illegible]	56	[illegible]	13	
age (total).. ..		115	[illegible]	218	99	
age per shift ..		4.8	[illegible]	[illegible]	7.6	
ading No. 2—						
of shifts.... ..		36	56	57	[illegible]	
age (total).. ..		76	224	220	[illegible]	
age per shift ..		2.1	4.0	3.9	6.1	
ading No. 3						
of shifts.... ..		36	[illegible]	57	56	[illegible]
age (total).. ..		69	[illegible]	[illegible]	296	[illegible]
age per shift ..		1.9	4.0	[illegible]	5.3	[illegible]
ading No. 4						
of shifts....	36	38	56	57	56	[illegible]
age (total)..	59	[illegible]	220	215	278	[illegible]
age per shift	1.6	2.4	3.9	3.8	5.0	[illegible]
ading No. 5—						
of shifts....	37	38	56	57	[illegible]	
age (total)..	[illegible]	[illegible]	191	220	141	
age per shift	1.7	2.1	[illegible]	3.9	5.8	

ne high record for a single month's work ny one heading was 296 ft., made in the heading from shaft No. 1 during N[illegible]ber. This gave an average of 5.3 ft. per . The headings all met, with respect to and grade, in a most satisfactory manner. removing the bench, in trimming up the and roof of the tunnel, and in [illegible] wall trimming in the approach cuts, light van drills on tripods and a number of van hand feed air hammer drills and stop- drills have accomplished a considerable ng in time and labor, as compared with l work.

mbering.—At first the rock was firm and ng, and little timbering was needed. As work advanced, however, the roof became ker and it has been necessary to timber whole tunnel, on 5-ft. centers, except for t distances at each portal, and near the shafts, where the centers are 2 or 3 ft. t. The tunnel has proved to be very dry, pite of the fact that the old tunnel is wet. This is attributed to the fact that old tunnel is above the new one and the nation of the strata is such that the old el serves to cut off the water and drain new one. The beds are inclined at from 20° with the horizontal, at right angles e tunnel line.

Bench Removal.—The 17-ft. bench is drilled with tripod drills and the spoil is removed with a 40-ton steam shovel, at a monthly rate [illegible] the east portal. A 60-ton shovel with a short boom replaced the 40-ton shovel on May 26, and even more rapid progress is being gained from this. A second 60-ton shovel will start on the bench from the west portal on July 15. The widening out and timbering of the tunnel will be completed in the latter part of this month.

Lining.—The lining was begun about June 10. This lining which is all of concrete, with the exception of a single ring of brick, starting at the 25°-point, is being placed by means of collapsible steel forms at the rate of 20 ft. per shift.

Power Plant.—Air for the drills and shovels is furnished by two straight line, two stage, steam driven compressors of about 1,600 cu. ft. capacity each, at 140 r. p. m., operated by six 100-h.p. boilers. The power house is near the west portal. Two 6-in. air lines run over the mountain to serve the two shafts, and from shaft No. 1 to the east portal there is one 6-in. main.

Electric power for lighting the tunnel is supplied by a 40-kw., 500-volt generator driven by an automatic engine. A machine shop adjoining the power house is equipped with a steam hammer, lathes and other machinery.

The construction of the Sand Patch Tunnel is under the direction of Mr. F. L. Stuart, chief engineer of the Baltimore and Ohio Railroad· Mr. Paul Didier, principal assistant engineer. Mr. A. D. P. Janney is resident engineer, in charge of construction. The work is being done under contract by the H. S. Kerbaugh Company of New York.

Test of Driving Steel Sheet Piling, Cleveland, Ohio.

One place on the short line of the L. S. & M. S. R. R. around Cleveland, Ohio, required tunneling under the grounds of a manufacturing plant. The tunnel was to have two standard grade tracks at an elevation of about 50 ft. below yard level of this plant. The wash test borings taken at this point showed:

Below grade.	
Yard level to 5 ft.	Slag and cinders.
5 ft. below to 20 ft.	Yellow clay and gravel
20 ft. below to 30 ft.	Fine gravel.
30 ft. below to 40 ft.	Coarse gravel.
40 ft. below to 50 ft.	Fine sand.
50 ft. below to 55 ft.	Coarse sand and gravel.
55 ft. down	Hard pan (blue clay).

The fine sand, 40 to 50 ft., was in the nature of quicksand, and there was a surcharged load at the sides.

The engineers of the Lake Shore R. R. decided on steel sheet piling. This work required 60 ft. penetration. Five bars of 12¾-in. x ½-in. Lackawanna steel sheet piling, weighing 40 lbs. per sq. ft. and 50 ft. long were ordered for this test. These bars were driven by a No. 1 Vulcan hammer, weighing 10,150 lbs., total striking part 5,000 lbs. with a 42-in. stroke. In general the record was as follows:

[illegible]

	Blows.
No. [illegible] Pile [illegible] actual driving time	[illegible]
No. [illegible] Pile [illegible] actual driving time	[illegible]
No. [illegible] Pile [illegible] actual driving time	2,284
No. 5 Pile 20¼ min. actual driving time	1,283

No. 5 pile was followed down to 10 ft. below the surface of the ground in 18⅝ minutes, with 1,153 blows. All five bars were driven to the surface of the ground, making a penetration of 50 ft.

Temperature of Concrete During Setting.

In a paper before the Iowa Engineering Society, Mr. W. D. Maxwell gives the following account of tests made during the Des Moines River concrete bridge work to determine the temperature of concrete during setting. A large number of readings were taken in pipes set in the piers and abutments. Readings were made from 5 to 10 ft. below the top of the concrete and 3½ to 6 ft. back from the face. The concrete was a 1:3:6 mixture, Hawkeye cement. A summary of the observations shows that the temperature increases 15° to 20° F. within the mass during setting, and that the maximum temperature is attained in 7 to 10 days, after which the temperature falls at a rate depending on the outside air. In pier No. 1, temperature increased from 45 to 64° in seven days, outside temperature ranging from 27 to 44°. In pier No. 2, temperature increased from 43 to 58° in seven days, outside temperature ranging from 6 to 33°. In west abutment, temperature increased from 66 to 86° in ten days, outside temperature ranging from 65 to 95°. In east abutment, temperature increased from 70 to 90° in ten days, outside temperature ranging from 65 to 95°.

Fig. 3—View of Drills on Quarry Bar Drilling Holes Nine Inches Apart on Line of Approach Cut.

The concrete work in the Spillway of Gatun Dam is about 89 per cent completed, 199,101 cu. yds., out of a total of 225,000, having been placed at the close of work on June 1.

ROADS AND STREETS SECTION

Highway Construction in the State of Washington by Convict Labor.

[illegible] Engineer [illegible]

[illegible] State Highway Commissioner of Washington, Mr. Henry L. [illegible] established [illegible] camp at Lyle, Wa[illegible] building the heaviest

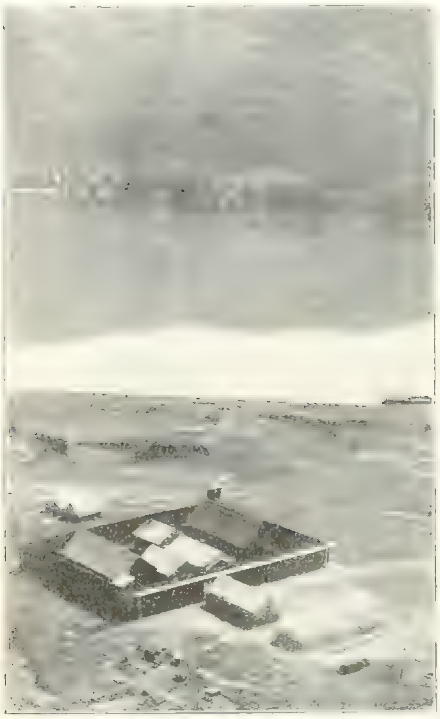


Fig. 1—Convict Camp and Stockade.

ection of State Road No. 8. This particular iece of road was selected because of its unsually favorable location, both with respect o its climatic conditions and the nature of he material to be handled.

Lying just east of the Cascade Divide and t an elevation of about 200 ft. above sea evel, we are neither subjected to the cold nd snows of Eastern Washington, nor the rinter rains of the coast, and being on the anks of the Columbia River, we receive the enefits arising from the low elevation and he temporizing winds of the Pacific Ocean hrough the Cascade gap. As proof of the nusual climate I might state that we lost ess than two days per month on account of ad weather, in spite of the fact that the rinter of 1909-10 was very severe through nost of the state. The record for the winter f 1910-11 was even better. During the first rinter the deepest snow fall was about 1 ft. nd, although we had a number of such snows, [illegible] a few days each time. The January freezes bothered some on account of the excavation being earth, but there was practically no delay after the loose and solid rock was encountered.

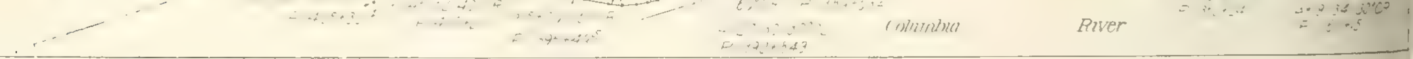


Fig. 2—Portion of State Road No. 8, Showing Series of 100-ft. Curves.

Most of the rock of this region consists of lava in columnar structure and at Lyle the cliff rises abruptly from the river's edge to an elevation of about 1,500 ft. in rude, uneven steps. The Spokane, Portland & Seatale Ry. was built, at tremendous expense, at the foot of this cliff. At an elevation of approximately 125 ft. above and a distance back of from 50 to 100 ft. from the railroad track there was a step in the cliff which could hardly be called a bench and upon this the State Road was built. On the lower side it dropped vertically to the track level, while on the upper side the lava cliffs towered pillar on pillar with only occasional flattenings of the very precipitous slope.

This bench was crossed by so many gulches and hogbacks and was itself so steep and narrow that the work was necessarily very heavy and required a great amount of labor and material to complete a short distance.

The location of the convict camp was well chosen both from the standpoint of minimum of lost time on account of winter weather and from the more important standpoint of concentration of convicts on heavy work, thus reducing the expensive guard force and enabling the state to put up a permanent stockade and camp without the constant expense of moving as work progressed.

PERSONAL RESULTS OF CONVICT LABOR

The convicts detailed on road work are in most cases those who are serving an indeterminate sentence, i. e., are sentenced for a term of from 1 to 14 years, or 2 to 20, etc., as the case may be. The most common sentences are 1 to 14 and 2 to 14 years. These men are not usually sent to the camps until after they have served their minimum. At the camp they are placed under the superintendent, who has the entire handling of the prisoners and is responsible for their safe keeping, conduct and labor.

Coming from the four corners of the earth and from all grades of society and of all occupations, these men, who have fallen into or adopted crime, are thrown together in the camp. They, as a body, offer a heterogeneous mass of brains, energy and ability hard to believe and harder to handle. It is for the superintendent to harmonize all of these different natures and bring them to act as an efficient unit in the performance of their routine work. To keep the gambler and the doctor, the hold-up man and the clerk working side by side with speed and efficiency was certainly no small job and required unlimited patience, tact and executive ability on the part of the superintendent.

The road camp is not looked upon as a place for extreme discipline, and if any should be necessary it is evidence enough that those cases should not be given their release in so short a time and are accordingly sent back to the penitentiary, where proper means can be employed. This was seldom necessary, and often men who had been a constant source of trouble and annoyance at the prison were among our very best workers. Where unusual interest and capability was shown, these men were given the more responsible jobs, such as handling the powder, or laying the masonry. Most of these men took as much pri doing their jobs in a workmanlike mann

Fig. 3—Beginning of Heavy Work, Sta. 3 (Before).

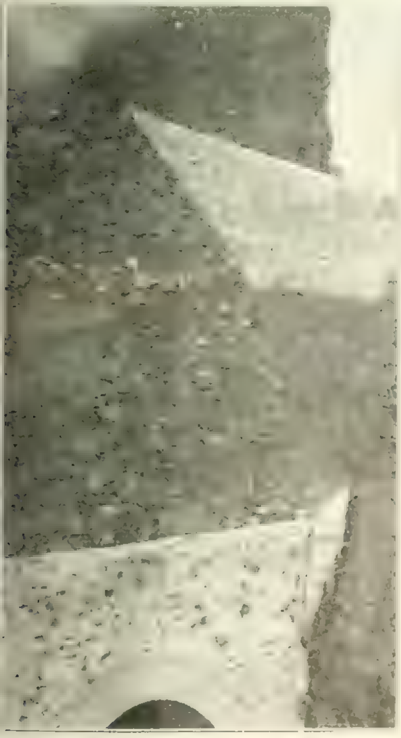
any free laborers I have noticed. Of th of men our "powder monkey" deserves u usual credit, for from the time the camp w opened until he was pardoned in May h interest never flagged, and his judgment placing the shots was of great assistance. H railroad experience had made him thorough familiar with powder; in fact, he was sent prison for taking the nitro-glycerine from dy namite to make a bomb with which to destr a personal enemy. In another case a man wh had been sent up for bank robbery prove to be one of our best and most trustworth rock men. Of course, many of the men could not change their habits nor get rid of the prison idea that the law seeks to revenge itself upon them instead of desiring only to intercept their downward course by encouragement, common-sense handling and training in an oc-on which could be used as a means of rt in after years.

se men who [illegible] and efficient work and otherwise proved elves to be capa[illegible]

—Entrance to Heavy Work, Sta. 397 (After).

[illegible] ear from the date service began on the If any proved to be agitators, mutinous y they were, after having been warned iven time to show proof of good intensent back to the penitentiary with their [illegible] taken [illegible] f years in most cases ("good time" being me taken from the total length of senon account of good conduct).

labor is as hard as ordinary pick and work, but is harder than any work they sed to in the penitentiary. Here their



. 5—View of Concrete Arch and Fill.

is out of doors, and they are given all most substantial food required. Their s not clipped and they are in every way d and managed like a gang of free rs, except that the armed guards are ing near. It has been the effort of the [illegible] to treat these men as nearly as possible like free labor and to make the road work serve as a preliminary step to and a preparation for freedom, so that the men may not be thrown, from a life of subversive inactivity, moroseness of mind and improvident nature, caused by years of servitude at indoor tasks, upon their own resources at one stroke. By this means the men are built up physically [illegible] fitted with health, training and habits for earning a living with the best of laborers.

As a rule the men appreciate the great benefits obtainable from being detailed on road work and do their best to repay in kind for the square deal accorded them and to prove that they are deserving of freedom and capable of supporting themselves by honest labor.

That they are faithful and efficient workers is proved by the record of costs and estimate as shown later

CONSTRUCTION.

[illegible] the kitchen and maintenance of camp. This force remained the same until March, when the number was increased. Fig. 1 is a view of the convict camp and stockade. Fig. 2 covers a portion of the road and shows the series of curves of 100 ft. radius, made necessary by the topography of the cliff.

After completing the light earth work in January, excavating was begun between station 380 and station 385 in the loose and solid rock. The road in this place turns through an angle of 89°, following around a cliff on a narrow ledge for a distance of about 250 ft. The cliff rises so abruptly and to such a height that it would be very expensive to go into it; and on the lower side, the ledge drops off on a ¼:1 slope for 70 ft. to the talus pile running down to the railroad track. The road was located and built along this ledge so as to require the shooting out of only 70 ft. of heavy work, but necessitated the building of 200 cu. yds. of dry wall on the edge of the cliff. After getting into the rock ledge and finding the nature of the material, we were glad that the location had been placed as much as possible upon the fill supported by wall, instead of trying to shoot out a solid road bed with ordinary dump fill, for the rock would only not break back, as we had expected, but it was almost impossible to do the necessary drilling on account of the pots containing disintegrated rock, in the shape of small cubes usually, which constantly feed down as the drill was turned in the hole. Soaking the holes did very little good. In some cases holes had to be abandoned even after loading had begun, on account of foreign material lodging midway in the holes; usually with powder both below and above.

The above section being completed and the line nearer camp having been definitely located, the crew was moved to about station 395. The work at this point, before and after, is shown by Figs. 3 and 4, respectively. The blasting of the ridge was accomplished with comparative ease because of the formation. The basaltic pillars formed a natural line of cleavage at the upper edge of the road, or rather the road was so located as to take advantage of this seam. Two 16-ft. holes were drilled toward the center, one from each side, in a V-shape and loaded with black powder and three small charges of 40 per cent dynamite placed in the crevasses near the top of the 54-ft. cut, to kick out and shatter, and all were fired with the battery. The shot was a remarkable success, as shown by the fact that the upper part of the pillars were so shattered that no masses thrown were of sufficient size to damage the track of the Spokane, Portland & Seattle Railroad, 100 ft. below, and that all the bottom of the cut was thoroughly shaken up ready for mucking into the fills, except for some bull-dozing.

Lying just east there was a loose rock slide, which extended from an elevation 90 ft. above the road down through a gulch to the railroad level. The mouth of this gulch was spanned by an 18-ft. concrete arch, 40 ft. below grade. Upon this arch 7 ft. of masonry wall was built, bringing the wall up to the top of the projecting nose of rock and the remainder of the height was built up with dry wall layed on a slope of 3 horizontal to 4 vertical. Thus we have a rock fill built away from the slide a sufficient distance to insure the road being kept free from sliding material. Moreover, by damming the mouth of the gulch and making the 40 ft. fill with the sliding material, all danger of future slides was done away with. The photograph reproduced in Fig. 5, was taken horizontally but about 20 ft. below grade. The masonry wall just beyond has a maximum height of 32 ft. and is built upon the rim of a solid rock ledge. The ¼:1 slope of the cliff extends down from the base of the wall for 40 ft. more.

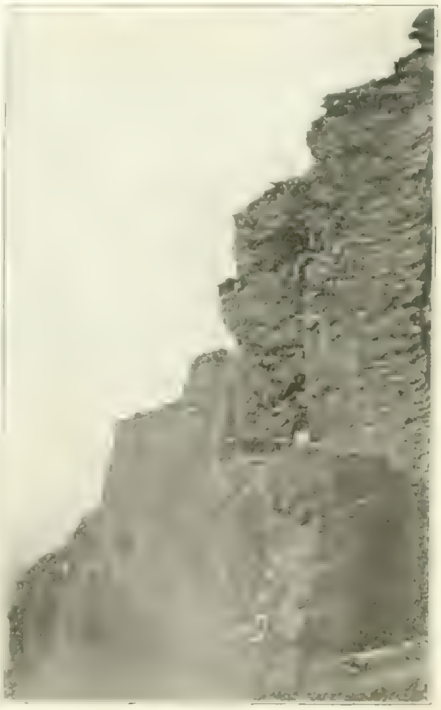


Fig. 6—Columnar Formation—Loading Crevasses.

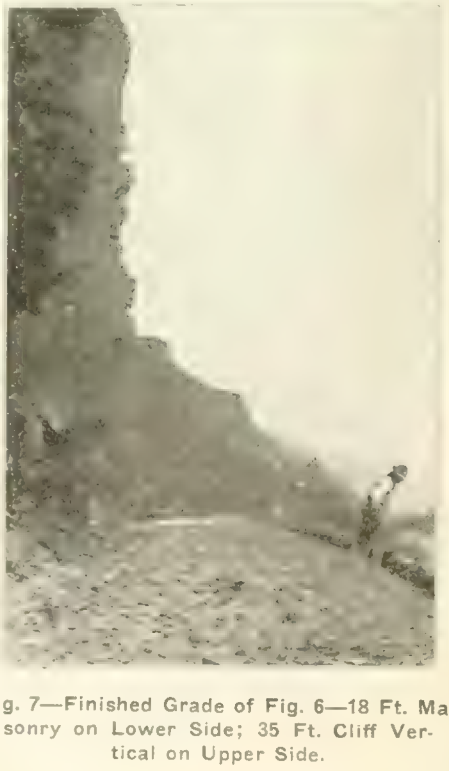


Fig. 7—Finished Grade of Fig. 6—18 Ft. Masonry on Lower Side; 35 Ft. Cliff Vertical on Upper Side.

Figures 6 and 7 show the road east before and after construction of the grade. In this material we found it impossible to drill the rock in the ordinary manner. The material was so brittle that whenever the holes were sprung they would be rendered useless by caving in. The rock was also so full of seams that it was almost impossible to get the holes down. We therefore excavated what we called snake holes, or small coyotes, about 1 ft. in diameter. This was done by drilling holes from 8 ins. to 18 ins. in depth and loading with a sufficient charge to blow out the face. Thus we used the seams to our advantage. This process proved much more economical than trying to drill in the ordinary way. When the pillars shown in photo Fig. 6 were fired we did not have enough powder distributed vertically in the crevasses, as evidenced by the fact that rock of 3 cu. yds. size were thrown down onto the track. The track was then buried by the smaller material sliding down over the cliff. The fact that the railroad was directly underneath added greatly to the difficulty and cost. The telegraph line was carried along the cliffs above our work in duplex wire. At first we attempted to handle the material so as to prevent it from going over the cliff except at those places where the track would not be damaged, but it soon developed that this was impossible. Light shooting did not bring down so much material but it usually rolled the rock over the cliff and onto the track in the shape of huge boulders, which destroyed both rails and ties. The only alternative was to load heavy and shatter the rock into such sized pieces that a minimum damage would result from striking the rails. In many places our blasting was done almost entirely by crevasse shooting.

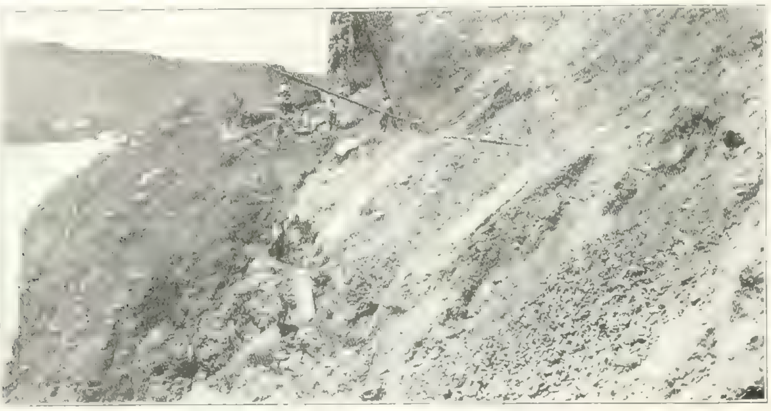


Fig. 8—Site of 140 Ft. Wall and Arch.

At the base of most of these pillars we encountered a very porous, almost spongy, substance, greyish in color and in places almost rotten. The line of separation between the porous and the brittle lava was abrupt; there being no gradation from one to the other. This substance had to be handled entirely separate from that above.

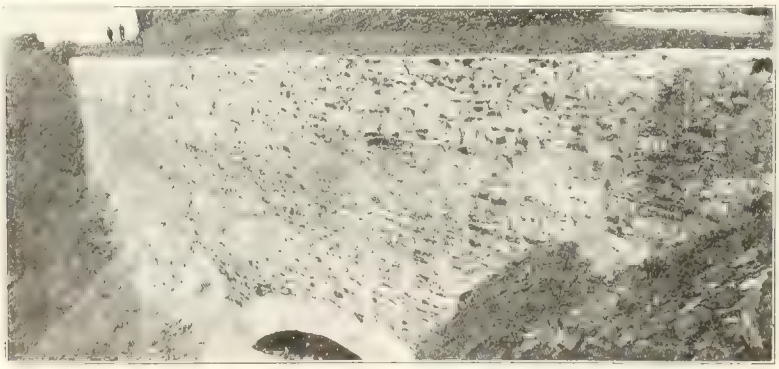


Fig. 9—Completed Wall and Arch.

Figure 8 shows our longest masonry wall and concrete arch site, and Fig. 9 shows the completed work. The wall length is 140 ft. and maximum height 38 ft., and the arch span is 50 ft. The photographs were taken from the road and from the railroad, respectively. The loose rock slide caused by the wall is similar to the one previously described, except that this one is much wider and larger, and extends continuously from the summit of talus to track without any confining gulch to make wall building simple. In this case it was necessary to excavate a footing on and between the outcroppings of the cliff. The longest space between outcroppings requiring the 50-ft. span arch, as no solid foundation could be found. The average height of wall above outcroppings was approximately 20 ft. Although the walls between the outcroppings were as much as 18 ft. high, they were narrow and firmly anchored to the rock on each side by roughening the surface. This roughening consisted of shooting pot holes in the rock face deep enough to allow the masonry to get a firm grip on the rock. The top of this anchored wall was 4 ft. thick, and all the walls have a batter of 1:12.

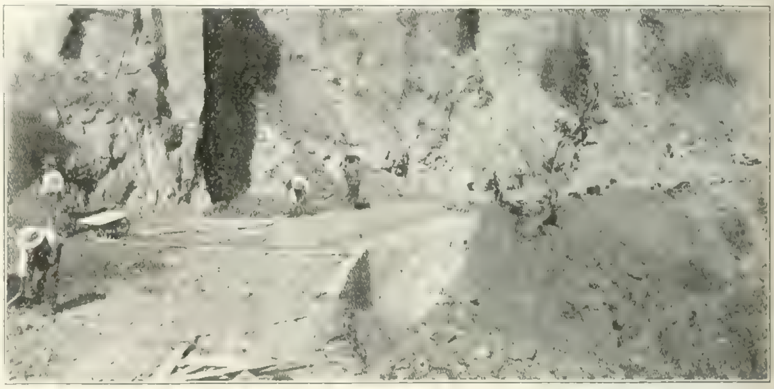


Fig. 10—Masonry Wall on 100 Ft. Radius Curve.

Skewbacks for the 50-ft. arch were excavated from the solid rock faces. The arch is composed of a 1-3-5 mixture. All sand obtainable was of a finer grain than desirable, coming from the Columbia River. T Water was obtained by pumping directly m the Columbia. Two men with a hand pu p kept two mixing boards supplied quite eas , raising the water 160 ft. Mortar used in asonry was a 1:2 mixture. The thickness arch at springing line is 4 ft. and at crow 2 ft.; the width is 10 ft., with a spandrel ng of 20 ft. The rise is 6 ft. in the 50- span. The rubble masonry was then built u n this arch and other previously described un tion with a 4-ft. base and 1 in 12 batte

In order to relieve any sliding tend the fill and unnecessary pressure aga wall, the material was benched off a vals of about 6 ft. in elevation and goi back on each bench far enough to obtain terial for filling the space below. When with 1 ft. of grade the width of the masonry was pped from a thickness of 2 ft. to 1 ft. for last foot of elevation. It is the intention surmount the masonry with a reinforc crete parapet wall. As a double pr to this wall tie rods were placed intervals and 4 ft. below the top of th and anchored to concrete dead men of the upper edge of the road bed. Th and all metal were thoroughly inca mortar.

Most of our masonry walls were bui a radius of 100 ft., and the convex side roadway, as shown in Figs. 10 and 11. photograph reproduced as Fig. 10 was from the grade, and that shown in from the railroad looking up on an an 45°. Its height above the narrow creva 28 ft. and at the top it is approximately long. The abutments are tied into the as previously described, and with the form make these walls unusually secure. 12 shows a portion of the alignment heavy work, with the wall just described the foreground and the end of the big over the 50-ft. arch in the distance.

Figure 13 shows the big dry wall 130 in height at station 385. At this point road crossed a dry gulch with a center of 85 ft. and a fill of 130 ft. out 70 ft. the lower side. The bottom width of gulch was 80 ft. and the width at grade 110 The bottom was filled to an unknown de with talus from the cliffs above. The fi intention was to put in temporary tim trestle, but on account of the favorable lo tion of the cliffs above the gulch, it was cided to make the fill. To retain the fill dry wall was built from the track level the top on a 7 horiz. to 10 vert batt The bottom width of the wall is 15 ft., b tapers down until at the 40-ft. level the faci is 3 ft. thick, which width is maintained the top. The rock is all hand placed back this facing for a distance of not less than ft. at any place and at intervals of 10 f and the hand placed fill is stepped back 30 f to prevent any tendency to slide and to bin the hand placed material to that which lie on the natural slope after sliding down int the gulch from the cliff. On either side o the gulch the cliffs rose to a height of 5 to 100 ft. above grade, and at a distance o 150 ft. up, the gulch divides, leaving a projection of rock 60 ft. in height.

e depended upon [illegible] rial and kept two drill crews at work tantly. Vertical and down sloping holes soon abandoned here for the same rea- as previously mentioned, and all work either by snake holes or short coyotes. shots were necessarily small at first, on

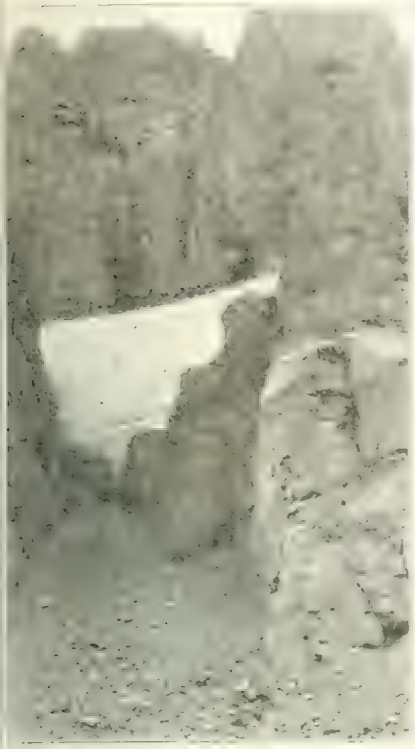


Fig. 11—View of Curved Wall.

[illegible] wall face, but as the wall was built up lasts were increased in an effort to keep oe of the blast material within easy reach e men placing the rock, but never closer 15 ft. and usually nearer 30 ft. from ace of the wall. On account of the brittle- of the rock there was often a scarcity of face material, and the men were com- d to go up the slope and bring down the The nature of the cliff material was a source of danger, for after many shots cliff face would be left jagged with rocks tantly falling. In two instances whole rs toppled over, once during the night once while the men were at work on the In the latter case about 500 cu. yds. e loose and rolled down the slope to wall. All of the men escaped except one, in the excitement, ran in the wrong tion and was buried in the slide. As by racle he was knocked down and lodged een two huge boulders, thus allowing the s to pile up over him and escaping with mber of bruises, bad cuts and a disabled

the fill approached the top the slope be- flatter and the material would not slide place. We then used material from the cliffs close at hand on either side of the , which we previously had left untouched this emergency. The last 20 ft. of the was made with talus hauled from close nd in dump cars. A massive parapet with ft. base and 2 ft. in height was extended the face. The strength of the wall was tested a number of times by large masses ock being thrown onto or near the wall In one case a small coyote in a favor- location brought down about 2100 cu. yds. landed one mass of 10 ft. diameter within t. of the wall face. It crushed its way the fill but did not shift the wall an inch. nother case a pillar 4 by 5 by 14 ft. struck he wall and broke in two, crushing the 2 ft. of the wall, but not loosening any- below. There is no earth or other mate- which can cause settlement in the fill. The quantities in the fill, the powder used and the labor employed are as follows:

[illegible]
5,666 cu. yds. riprap (hand placed fill).
20,498 cu. yds. rock fill.
[illegible]
5,200 lbs. of 40 per cent dynamite.
1,100 lbs. of black blasting powder.

The previously described work, running east from the camp, covered from Station 410 back to Station 378, and included most of the cliff work. For the next mile and a quarter eastward the road follows the talus at the foot of the cliff, gradually coming down to within 30 ft. of the track elevation. The general view of the hillside is shown in Figs. 15, 16 and 17. In a few places there were clumps of scrub oak and underbrush, which indicated easy hillside construction, and there was some solid rock, but for the most part the hillside consisted of loose rock slides lying on an angle of 32° to 38°, some of them dead and others alive, but nearly all of them ready to slide as soon as the angle of repose is disturbed.

In places where the slopes were the flattest and the road was a sufficient distance back from the railroad, the cuts and fills were made in the ordinary way, i. e., without walls. In more places we had to hand-place the lower side, and for a distance of about 1200 ft. it was necessary to build a retaining wall on the upper side of the road to hold back the slope.

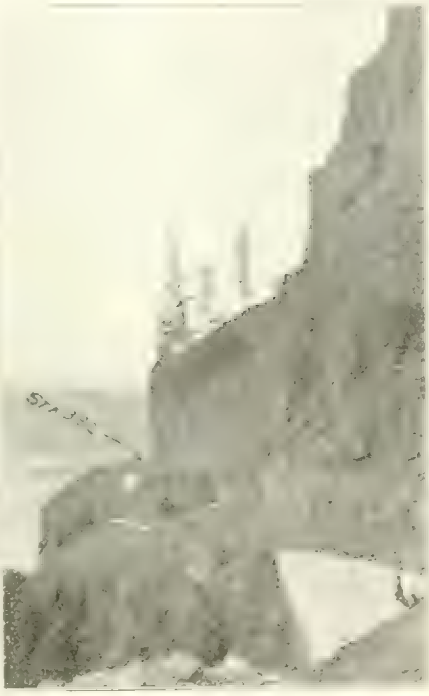


Fig. 12—View Looking West Over Grade from Sta. 387.

We at first attempted to build the lower side retaining walls on ½:1 and ¾:1 slopes in order to save going so far down the slope with the toe, but found that these walls would not be safe, using the material at hand. All lower slopes were therefore laid up either on a 1:1 slope or a 1½:1 dump. Most of the hillside was covered with boulders ranging in size from 6 ins. to 3 or 4 ft. in diameter, but underneath this top surface we might find either a mixture of earth and shale or a mass of fine rock which would flow like wheat in a bin. In one particular instance two men placed their shoveling boards side by side against one of these banks and shoveled for two weeks without once moving their boards into the hill. In fact, at the end of this time the boards were more nearly covered and the shoveling was easier than when they started, and the only thing to show for all of this work besides the fill on the lower side, was a little depression in the hillside about 125 ft. above. A few days more of shoveling, however, enabled us to retard the stream by driving drills into the bank and laying plank on edge against them and driven into the sliding material as far as possible. We were then able to excavate enough material below the planks to allow for the placing of wall boulders at the toe of slope and building up above the angle of repose of the slide. In many places the sliding material contained enough earth to make it stand on quite a steep slope for a long enough time to get a retaining wall built in front of it. These walls are not called upon to resist very great pressure, since, when the weathering face is protected, there is no tendency to disintegrate or slide.

Our worst piece of road from the standpoint of permanency is between Station 362 and Station 371. At this point the railroad had burrowed the loose rock and the sliding material back from the track for a distance of 100 ft., leaving the slide standing at such an angle that it was constantly breaking away from the top. At the west end of the slide a vertical rock cliff had been left projecting out toward the track. In order to get rid of this cliff we coyoted under it for a distance of 40 ft. and loaded with 1500 lbs. of black blasting powder and 150 lbs. of 40 per cent dynamite. When exploded no material was thrown and the entire projecting part of the cliff slid easily down into the railroad's borrow pit, and an immense quantity of slide material on the east side, which had been hanging above, was shaken loose and helped to bring the fill up to grade: 75 ft. above the track. Including the great amount of loose rock which was shaken down, there were approximately 21,000 cu. yds. moved by this shot, and all of it was needed to bring the old borrow pit fill to grade.

Beyond this point and on the big slide we attempted to bring down the talus from the top by shooting, but we were unable to drill holes and keep them clear, on account of the fine, dry material mixed with the rock, long enough to load them or even get them down. We also tried sinking and shooting wells, but we were not able to dig them deep enough in the steep side hill to gain results. Our only alternative was to put men on ropes near the top and have them pick down the face. In this way a tremendous amount of material was deposited in the 75-ft. fill, the toe of which reached nearly to the track. The fill and roadway is shown in Fig. 9. A low wall was built at the toe of the upper slope, but this slide will always require main-

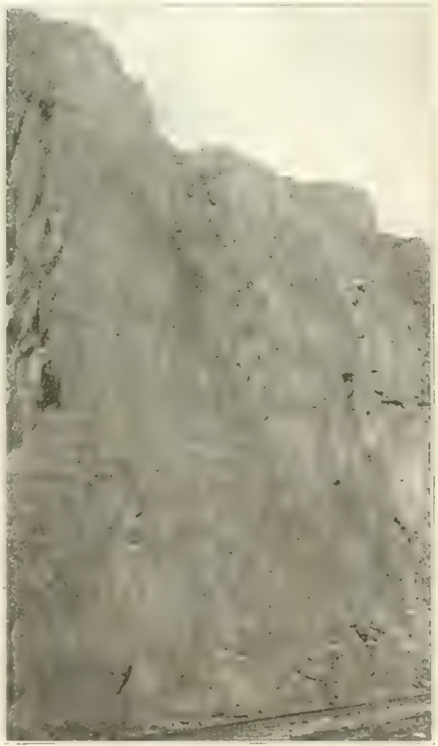


Fig. 13—Dry Masonry Wall, 130 Ft. High; Batter 7 to 10.

[illegible] these are composed of an unstable material and are constantly eroded by wind and rain.

The average roadway built through the talus is well shown by Fig. 17. Its construction presented no especial difficulty.

This work, covering a distance of 1.64 miles, was practically complete to within 500 ft. of the proposed tunnel by April 13, 1911. Beyond the proposesd tunnel the work was comparatively light for the remaining two miles, to where the road tied into the county road, leading to the Dalles ferry with a water grade and distance of eight miles, instead of climbing 1500 ft. and a distance of about 14 miles between towns. The new route would make travel between the west end of the county and Goldendale, the county seat, a much simpler matter than it is at present. The width of roadway is 20 ft. and maximum grade is 5 per cent.

The completed work is the most difficult on the entire trunk highway between Vancouver and Spokane, and is said to compare favorably with Swiss mountain roads for grandeur of scenery and the nature of construction. However, the 1911 legislature neglected to make appropriations for any state roads, and the policy of working convicts on roads was abandoned, thus leaving this expensive and much needed piece of road without an outlet.

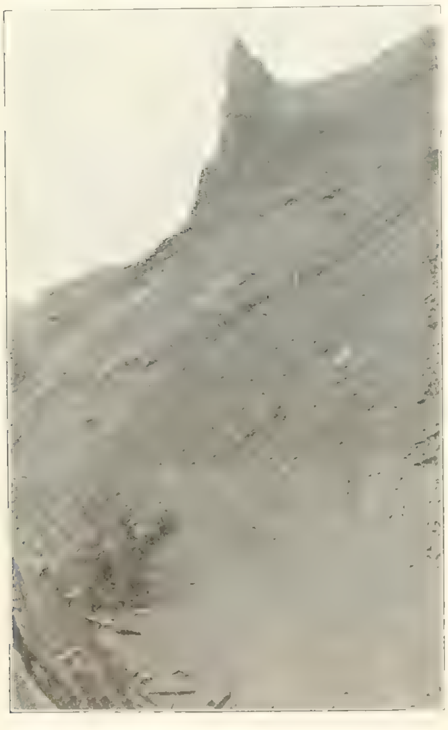


Fig. 15—Finished Road at Foot of Slide.

The illustrations and the following estimates of materials and cost will convey an idea of the largeness of the task undertaken and so nearly completed, and the economy with which it was executed, by the Highway Department.

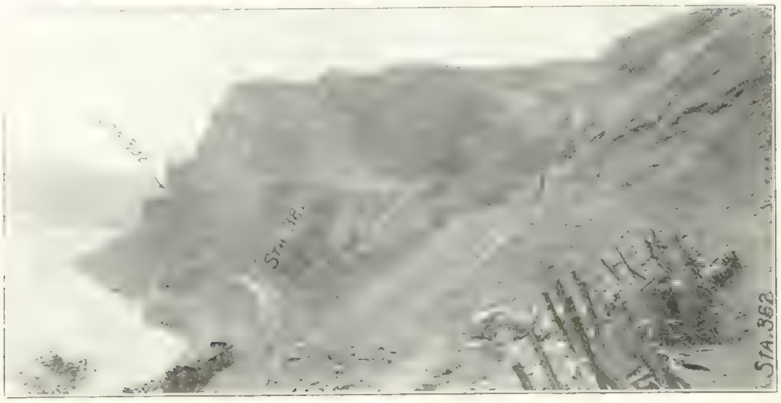


Fig. 14—View Looking West—Heavy Work in Distance.

ESTIMATE STATE ROAD NO. 8
Convict Camp — Lyle, Wash.

Engineering—	
Preliminary survey covering approx. 30 miles	$2,937.45
(or 7.1 per cent of total.)	
Location and construction engineering. 2 miles	1,696.05
(or 4.1 per cent of total.)	
Total engineering cost	4,629.69
(or 11.2 per cent of total.)	
Construction—	
Total cost of camp, its operation, salaries, equipment, materials, transportation, etc.	$39,840.11
Disposal value of camp, equipment, etc.	2,994.95
Total cost of construction	36,845.16
(or 88.8 per cent of total.)	
Total number days of convict work	21,073 days
Average expense incident to working one convict one day	$1.75
Estimate—	
Earth excavation, 2,606 cu. yds. at 30 cts.	$ 781.80
Loose rock, 113,173 cu. yds. at 50 cts.	56,586.50
Solid rock, 13,414 cu. yds. at $1.00	13,414.00
Solid rock (big wall), 20,498 cu. yds. at 65 cts.	13,323.70
Riprap, hand placed, 7,130 cu. yds. at $2.00	14,260.00
Masonry, dry, 3,790 cu. yds. at $4.00	13,960.00
Masonry, third class, 710 cu. yds. at $8.00	5,680.00
Concrete, 67 cu. yds. at $12.00	804.00
Clearing, 3 acres at $100	300.00
Total estimate of work done	$119,110.00
Cost to state of doing work	36,845.16
Saving to state through use of convict labor	$ 82,264.84
Dividing by 21,073 (total number days labor) gives average profit to state for each day one convict was employed	$3.69
Detail of construction cost—	
Superintendent, guard, etc.	$10,062.03
(or 23 per cent of total with disposal value.)	
Convict transportation	1,972.67
(or 5 per cent of total.)	
Subsistence (excepting fresh meat)	9,057.67
(or 19.5 per cent of total.)	
Subsistence, fresh meat	4,355.67
(or 9.7 per cent of total.)	
Fuel and miscellaneous	2,811.89
(or 6 per cent of total.)	
Clothing	2,464.70
(or 6 per cent of total.)	
Camp equipment, etc.	2,742.72
(or 6 per cent of total.)	
Explosives	3,332.74
(or 6.8 per cent of total.)	
Cement and sand	3,039.92
(or 6.8 per cent of total.)	
Total construction	$39,840.11

Whether we look at the above facts from the business standpoint and measure the results by dollars and cents, as shown by the $3.69 profit per day per man, or from the humanitarian point of view and count only the uplift to the convict, as evidenced by the large number of pardoned men who took up work in the surrounding neighborhood and made good, we must admit that a great success is accorded the State of Washington through her policy of justice toward the men who have fallen into crime and her wise determination to place these men where, instead of being an incumbrance and an economical loss to the public, their work will result in a profit to every citizen and the permanent development of the highways, the State of Washington is the recipient of these benefits.

A New Design of Street Mixer.

The accompanying illustration shows two new types of street mixers, which Ransome Concrete Machinery Co. of Dunellen, N. J., has recently placed on the market. The type shown is the No. 61; the other type is known as No. 60. The design of these two types has been made by the Ransome Co. after a long study of the street paving co problems, and they embody a numbe tures which are different from anyth tofore offered by mixer manufacture

The No. 60 machine is a steam-driv outfit, regularly furnished with 10-ft. dis chute capable of handling 14 cu. ft. loose material, and will mix 40 to 60 batches per hour, depending upon the speed wh material can be fed to the pivot hopp engine is 8 h.p. and the boiler 9 h. machine is arranged to drive in both directions along the work.

The various levers controlling the operations of hoisting, discharging and traction all brought to one point and the entir tion can be controlled by the enginee chute will swing through an arc of mately 180°, while the discharge point 7 ins. above the street level. The mounted on 24 and 28-in. wheels wit tires. The net weight of the machine c with power is approximately 11,000 ll

The No. 61 Ransome street mixer w dle up to 20 cu. ft. of loose material a mix from 40 to 60 batches per hour regularly equipped with a 2-cylinder gasoline engine and a 20-ft. distributing It is arranged with a clutch, by which th can be thrown out and remain idle wh machine is traveling along the road, is also equipped with a traction device a for moving in either direction. A notab ture of this outfit is the fact that the height has been kept within 11 ft. 2 ins has been done by eliminating the ch hopper and emptying direct from sk mixer.

The drilling wheels are 44 ins. in di and the front wheels 40 ins., the tires 10 ins. and 8 ins. respectively. By using th large wheels an 18-in. clearance above ground has been made possible, thus avoid any jacking up of the machine to clear m holes which are liable to project 12 ins. more above the subgrade of an unfinis

Fig. 16—Typical Hillside Work.

[illegible] r operation under the machine's own power

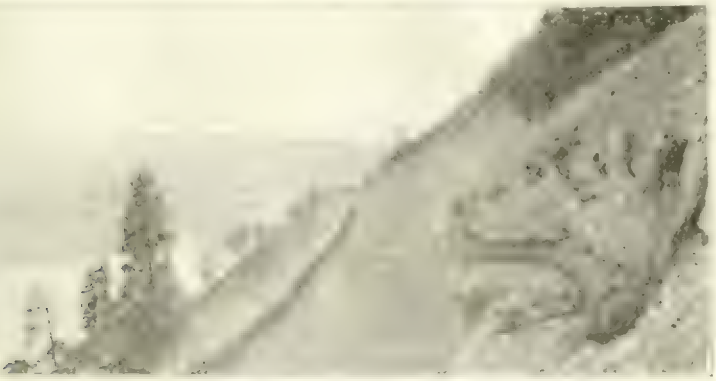


Fig. 17—Typical Construction on Dead Talus

trolley tracks, etc. If the outfit is to be drawn behind a trolley car at high speed, andard flanged wheels may be readily substituted for the ones regularly furnished, as the wheels are easily taken off, inasmuch as the driving axle is mounted in split boxes and the front axle can be swung around and [illegible]

All of the [illegible]

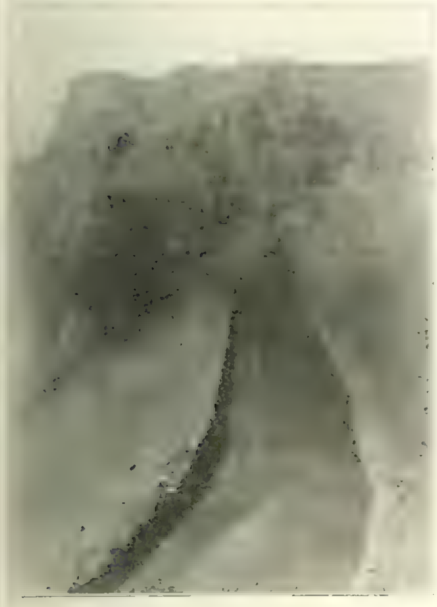
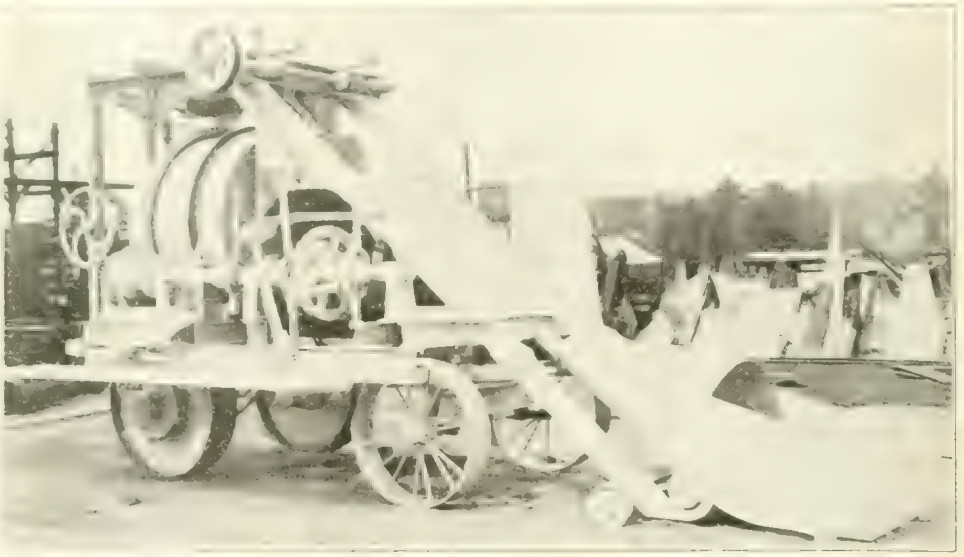


Fig. 18—Completed Roadway Along Side.

is in front. The line shaft is driven by chain and the power is transmitted through clutches to the windlass for operating the hoist, the drum and the traction wheels. Of course, when desired an electric motor can be substituted for the gasoline engine and when operated in railway service the motor could be run from overhead trolley wire. The general dimensions are as follows:

Weight	[illegible] lbs
H. P.	16
Height [illegible]	[illegible]

[illegible]	[illegible] ins.
[illegible]	[illegible] ins.
[illegible] chute	17 ft. 1 in.
[illegible]	[illegible]



View of No. 61 Street Mixer Showing Skip Ready for Batch.

American Road Congress.—The first annual meeting of the American Road Congress will be held at Atlantic City, N. J., from Sept. 30 to Oct. 5. The American Road Congress will mark the consolidation of the conventions of 40 important road organizations of the United States, including the American Association for Highway Improvement and the American Automobile Association. Atlantic City has tendered the use of the Million Dollar Pier for the gathering, and it is there that the daily sessions will be held. President Taft is the honorary president of the Congress, which has for its active president Director L. W. Page, and for its treasurer, Lee McClung, Treasurer of the United States. The National Association of Road Machinery and Material Manufacturers has voted to hold its exposition of materials and equipment in conjunction with the Congress. The first two days of the Congress will be assigned to the road users under the auspices of the American Automobile Association, the second two days to the problems of legislation, finance and economics, under the auspices of the American Association for Highway Improvement, while the last two days will be given up to the engineers, who will discuss problems of construction and maintenance, and to the various associations which will meet and map out their plans of action.

WATER SUPPLY, SEWERAGE AND SANITATION SECTION

he Water Supply of Joliet, Ill.—Methods of Overcoming Difficulties Encountered in Sinking New Deep Rock Wells.

[illegible] a paper [illegible] ssociation, published in the Proceedings for 912, Mr. H. A. Stevens, City Engineer of Joliet, Ill., describes the works built by the city an effort to keep the water supply sufficient the needs of the rapidly growing distribution system. Mr. Stevens also describes the difficulties encountered in sinking the new deep rock wells and describes the methods employed overcoming them. The paper follows:

For nearly 20 years the City of Joliet has been confronted with a problem of ever-increasing importance, to-wit, the securing of an adequate supply of pure water at a cost within the limits of its financial resources.

In 1889 the city acquired by purchase the plant, mains and equipment of a private corporation then engaged in supplying a limited section of the city with water. This company used as a source of supply, ground water furnished by springs and ponds and the water obtained from one or two small artesian wells. After obtaining possession of this plant the city started to develop an additional supply in various ways, principally by the sinking of deep artesian wells but also from a group of driven wells extending into the gravel about 40 ft., located on a five-acre piece of land adjacent to a small stream called Hickory Creek. In the next ten years six artesian wells, varying in size from 4 to 8 ins., and having a depth from 1,200 to 1,800 ft., were put in operation, all being located within a radius of a few hundred feet from the pumping station.

The aggregate production from these six artesian wells was about 1,500,000 gals. in 24 hours and the drive wells probably added as much more to the supply. However with the rapid extension of the distribution system and large increase in the number of consumers the total available supply began to be totally inadequate, especially during the summer and winter months and in case of large fires.

Various expedients were adopted to relieve the situation; a reservoir was constructed, a large air compressor was installed, with the belief that more water could be obtained from the deep wells. At the same time extensive surveys and investigations were made of eight or ten possible sources of supply.

A plan was finally adopted which would entail an expense of about $250,000 to complete. The expense was to be provided for by the sale of special water improvement bonds, the issue of which was authorized by an act of legislature. No sooner, however, were we ready to let the contract for this work than the Supreme Court held that the act of legislature authorizing the issue of these special bonds was illegal, and the whole project had to be abandoned.

It was now necessary to devise some method of obtaining additional water which would not cost more yearly than could be spared and paid for out of the annual revenues of the city. To meet this condition a system of segregated wells and pumping stations was determined upon, to be constructed as fast as our means would permit.

Up to this time the water obtained from our best well did not exceed 500,000 gals. daily and the smallest well produced but little over 100,000 gals. With the established plan of independent plans scattered at various points about the city, it was highly desirable to produce from each well as great a volume of water as possible and to this end it was decided to make the diameter of each well as large as practicable.

The first well constructed under this plan and finished in 1907 was drilled 1,621 ft. in depth and has a diameter of 16 ins. at the top and 7 ins. at the bottom, the reduction in size being due to the insertion of liners to shut off caving rock at several points. This well more than met our expectations as a water producer and furnishes about 1,200,000 gals. daily.

We were still short of water, however, and more and more frequently was it necessary to tide over periods of extreme shortage by pumping raw water direct from Hickory Creek into our mains. In 1910 after experiencing a severe water famine during the summer months, means were obtained to proceed with further well construction. It was decided to attempt to build enough new plants to put our water supply entirely on an artesian basis and cut out all water from Hickory Creek either direct or through the drive wells.

Four new wells were planned and it is to relate some of the troubles experienced in sinking the first of these that this paper is written. In the design of these wells it was determined to start the bore with a 16-in. hole and continue down with as little reduction in size as possible. In the location of the wells, the main considerations were, first, to place them at points where the surface of the ground was as low as possible in order to reduce the height of water lift; and, second, to get them widely separated and adjacent to large-sized distribution mains and located on cheap property where a pumping plant would not prove a nuisance to the local residents.

The artesian water obtained in Joliet comes principally from two sources, the St. Peter and Potsdam sandstones, which outcropping in northern Wisconsin are found at a depth of about 600 and 1,400 ft., respectively, in Joliet. In the earlier artesian wells of Joliet which penetrated these strata the water pressure was sufficient to produce flowing wells. That condition, however, has passed away and with the constantly increasing number of wells in use the static head of the water is being gradually lowered. In 1880 nearly all wells were flowing; in 1900 no wells in this vicinity were flowing and the static level of the water had receded to about 30 ft. Joliet Datum (20 ft. below the surface of the main business district). At the present time after five years of operation of our successful 1,200,000-gal. well the static head within 2,000 ft. of the well has been reduced fully 40 ft. While being pumped, the water level in the well is drawn down over 150 ft. below the surface of the ground.

Contracts were signed in September, 1910, for the construction of two out of the four new wells to be drilled, the Ohio Drilling Co. of Massillon, Ohio, having been awarded the work. This company, instead of using the customary pole rigging of all well drillers heretofore operating in Joliet, proposed to install cable rigged plants and were sanguine that they could sink each well in 90 days, instead of the usual 8 to 10-month period.

Bids were received for drilling well number one Sept. 12th, 1910. After some delay in acquiring a site, work was started Nov. 26th with a bit cutting an 18-in. hole. The specifications called for a hole of sufficient diameter to permit the insertion of 14-in. O. D. casing; but the contractor preferred to drill a hole 18 ins. instead of 16 ins., as contemplated. A McCain mounted machine with a 25-h. p. boiler and engine comprised the drilling plant. The drill stem was 5½ ins. in diameter and 30 ft. long and the string of tools were made with 3½x4½ boxes and pins.

The work started off fairly well and considering the size of the hole being drilled and the delay occurring through a number of minor mishaps we felt good progress was being made when a depth of 200 ft. was reached in about 20 days, the best day's record being 30 ft. in 24 hours. This depth was through Niagara limestone to the underlying shale formation. It was the intention to reduce the size of the bore below this point to a 12-in. hole, the 14-in. casing being planned to extend only to the 200-ft. depth, there being sealed off to prevent surface water from entering the well.

Difficulty was experienced in getting the string of casing in place. Although it was finally accomplished we found upon testing the well that there were several crooks in it and that it was out of plumb 6 ins.

As the deep well pump we had decided to use required a vertical hole at least 150 ft. down, the contractor was ordered to straighten the hole. In the meantime, while we were preparing to test the hole, the contractor had continued his drilling with a 12-in. bit. At a point about 218 ft. below the ground surface he struck oil strongly impregnated with gas and tar—a vile mixture. Suspicion naturally turned to an adjacent gas house some 200 ft. away as being responsible for this product, and although the well operators insisted the oil was shale rock oil there can be no question that the gas and tar was refuse product of the gas house. To remedy if possible this difficulty, the contractor was ordered to remove the casing already in place, straighten the hole, and extend the large bore and the 14-in. casing down through shale rock to the Trenton limestone, a total depth of about 300 ft.

The removal of the casing proved a task in itself as the string of pipe parted several times and fishing operations were necessary. Twenty-six days elapsed before it was accomplished. The straightening of the hole was then undertaken, first by starting a 20-in. reamer from the top, then using dynamite to knock off some knobs and finally starting again at the top with a 24-in. reamer and continuing down to the 200-ft. level. Thirty-five days were required to complete this task and to get the 14-in. casing down well into the shale rock. We now thought the worst of our troubles were over as there was no further sign of oil or gas and the water from the well was fine.

Drilling started again but was soon interrupted by the character of the shale rock above and outside of the casing. As fast as a few feet were drilled, the shale rock under the churning action of the drill and water would slide into the hole like liquid mud and fill up the bore 20 or 30 ft. At this inopportune time a bit came unscrewed, dropped into the soft shale and was driven crossways of the well with the upper end of the bit lodged outside of the well casing which was following down and rested on the bit. Owing to the distance the pipe had followed, together with its weight and the friction of the soft shale against it, pulling the casing could not be considered. All the arts of the well driller were then brought into play and finally with a knife hook the casing was split enough to permit the end of the bit to be hooked into the pipe, which was then driven over the bit and the bit fished out. The well casing was then grouted and sealed with Portland cement from top to bottom. Two full months were required in doing all this work. It was May the 12th, 1911, when all the iron, tools and debris were cleared away and the Trenton limestone reached at a depth of 325 ft., making a total time of nearly six months to reach a depth approximately one-fifth of the total planned depth of the well.

Progress, however, now became quite rapid and through the St. Peter sa stone sometimes 50 ft. in a day was accom ished. At a depth of 893 ft. on account of so rock, 100 ft. of 10⅝-in. liner had to be inser d but from that point no further reduction n the size was found necessary and with onl a few minor mishaps the well was co pleted through the Potsdam sandstone to a d th of 1,570 ft. on July 27th, 1911. The c tract prices for this work are as follows: $4 0 per ft. for 15-in. hole (or larger); $3.40 er ft for 12-in. hole; $3.25 per ft. for 10⅝-i hole.

Unfortunately for us our troubles w not over with the completion of the d lling. Haste was made to get in engine and ump house foundations and before the walls f the building were completed the engines w set in place and put in motion. It was a memorable day but sad, for instead of a lli gallons of the purest water wherewi slake the parched throats of our citizens issued from the pumps a mixture o blackest, oiliest, most nauseating compo was ever my misfortune to witness.

Continuous pumping for several weel but little to remedy the character o product and it was finally decided to r the pumps and put in another string of casing, about 600 ft. long, down to th Peters sandstone. Fortunately the well was amply large to permit this expedie so, with a thoroughly tested patent pack the end of the string of casing, this pip inserted in the well and the packer put i eration just above the junction of th Peters sandstone with the Trenton lime There it held so tightly that the entire of 600 ft. of casing resting upon it di budge it a particle. The pumps were ai reset and put in motion. For 15 minute th water came pure and sparkling and w thought we had the trouble beaten, but u exultation was short-lived, for soon ea globes of oil and tar again appeared an although under pumping these were mate lly reduced, enough still continued to unfit h water for use.

As a last resort it was then determine to extend the casing still deeper, to the to of the liner, making a total length of casing d linear nearly 900 ft. long. In putting is string in place, when all but three length f pipe had been inserted, a jar on the win ss caused the thread of the last pipe to p and the string of pipe dropped about 6 t to the top of the liner. After an investigation, which as far as could be determ d without taking the entire casing out, reve d no damage, the last three sections e added and the pumps started again. A y material improvement of the water was parent but it still seemed to be more or s impregnated with enough gas to render t obnoxious and we are now removing the tire 900 ft. of casing to make certain of e integrity of the pipe.

In the construction of wells number and three, the difficulties developing w more or less a repetition of the troubles well number one, except that no oil was countered. Work on number two commen May 14th, 1911, and on July 17th, 730 ft. depth had been secured. At this point, ho ever, which is in the St. Peters sandsto the character of the rock, which ordinar gives no trouble from caving, changed so m terially that it acted under the drill like qui sand. All sorts of expedients were resor to, in making progress through this strat but with a reduction in the size of the h down to 7 ins. over seven months elapsed b fore we reached the harder rock at a dep of 1,000 ft. At the present time, ten mont after starting, the depth of the well is abo 1,200 ft.

Work on well number three commenced September, 1911, and trouble immediate started with caving rock and quicksand. T only special feature which has so far deve oped with this well is the presence of a fa or fissure in the rock which causes the dr to continually work off to one side, givi great trouble in keeping the well vertical an in keeping the drill from becoming fast i the rock. Six months' work on this well ha [illegible] epth. Well number four has not yet been arted.

Our experience in Joliet in constructing this eries of wells and the welis drilled in the ist 20 years is interesting principally because f the obstacles which have had to be overome. No two wells have acted precisely the ame. While the strata are identical, the vaation in thickness of each stratum, the hanging character of the rock from hard to oft, from quicksand to flint, the possibilities f striking oil or salt water, and the variable ater productiveness of the St. Peter and otsdam deposits, have made each well a roblem of extreme uncertainty. Large bore [illegible] rill but are warranted by the largely ineased yield of water they produce.

With the probable completion and operation f all four wells during the present year the ampage of 4,000,000 or 5,000,000 gals. daily [illegible] ater level in the ground is to be expected d will probably have an important bearing [illegible] ater supply from artesian wells.

he Comparative Advantages of the Various Remedial Measures for Preventing and Reducing the Electrolysis of Water Mains—Comment on the Peoria Decision.

In an address before the American Water orks Association, Albert F. Ganz, Profesr of Electrical Engineering in Stevens Initute of Technology, discussed the comparave merits and defects of the various methls which have been adopted to reduce the ectrolysis of water mains. We present, rewith, a short synopsis of the lecture.

At points where stray electric currents ave underground metallic pipes, to flow to e surrounding soil, electrolytic corrosion is oduced, resulting in a destruction of 20 lbs. iron in one year for every ampere of curnt. It has been disputed whether the nount of destruction produced is always ual to the theoretical amount; a number laboratory experiments made recently by e author under practical conditions with rrent densities as low as those found in actice on underground piping seem to incate that the actual amount of destruction always at least equal to the theoretical nount, and is often even greater than the eoretical amount.

There is only one complete remedy for ctrolysis, and that is the use of a cometely insulated return circuit. Such railays may be provided with double overhead lley wires, as used for example in Washgton, D. C., Cincinnati and Havana; or th an insulated outgoing and return conctor in underground conduits, as used for ample on the surface lines on Manhattan land; or with separate insulated third and urth rails for the outgoing and return curnt, as is used on the Metropolitan District ailway in London. With these systems the nning tracks are not used as a part of the ctric circuit, and as both positive and gative sides of the circuit are insulated no ay currents are produced.

Where a road operates on a private rightway, the rails can often be practically inlated from ground and the escape of cur- [illegible] from the track [illegible] ds this can sometimes be practically acmplished by placing the rails on wooden s above ground and using broken stone for llast and keeping the rails out of contact th ground. In the case of railway lines erating on elevated structures the rails can fastened to wooden ties and kept out of ntact with the structure. In one large vated railway system this is done, and the nning tracks, supplemented by large bare pper cables fastened to the wooden ties, used for the return circuit. In this way the return circuit is quite thoroughly insulated from the elevated structure and from ground thus preventing stray currents from this system.

A number of remedial measures intended to reduce stray currents from electric railways using the grounded rails for a return conductor have been tried. These methods may be divided into two classes, the first class aiming to remove the current harmlessly from pipes by metallic connections or bonds between the pipes and the railway return circuit, and the second aiming to minimize stray currents through ground.

Since stray currents cause damage only where they leave pipes to flow to the surrounding soil, attempts are frequently made to prevent destruction from electrolysis by connecting or bonding the pipes or other structures by means of metallic conductors to the rails or to the negative return circuit, so as to remove the electric current by metallic conduction and thus prevent corrosion from electrolysis. This method can protect lead cable sheaths because they form continuous electrical conductors, but is not generally applicable to underground piping system, because the latter do not form continuous electrical conductors, but are more or less discontinuous networks. While lead calked joints usually have a relatively low resistance, it frequently happens that they develop such high resistance as to make them practically insulating joints, due undoubtedly to the formation of oxide coatings. Cement joints and cement pipes have such a high resistance compared with iron pipes that they are practically insulating. Bonding of pipes to the rails or to the negative return circuit can only afford local protection to the extent that the piping connected forms a continuous metallic conductor, and this latter is an unknown and uncertain quantity in a piping network. In the practical working out of a bonding or drainage system two opposing tendencies develop; first, there is a reduction in the difference of potential between pipes and rails in the positive areas, and consequent reduction of damage in those areas; and second, there is an increase of current flow on the pipes throughout the entire system, thus increasing the danger of trouble at high resistance joints or other places where two piping systems, or separate portions of the same system, are electrically discontinuous. As a rule, in the early stages of this system and especially in small networks when there are comparatively few bond connections and the resistances of the paths over the pipes are therefore relatively high, the effect is apt to be beneficial, reducing the danger in positive areas more than it increases the danger elsewhere. As the system grows and the load increases, more and heavier bonds become necessary. The current on the pipes may finally become so great that the trouble from current shunting around joints or between separate systems will increase more rapidly than the danger in the positive areas is reduced, and any further increase in the bonding becomes an actual source of danger to the system. Since bonding transfers the trouble from the region where it was most evident to a new locality where it may require several years to manifest itself, the false impression is created that the trouble has been removed. It is due largely to this obscure and slow manner in which trouble develops that has caused this method to become quite widely used. A number of cases have been reported where a main bonded to the negative return circuit at the power station was completely destroyed from electrolysis a block or two away because of a high resistance joint in the main, forcing current to shunt around the joint and leave the main a short distance away from the power station. In one of these cases one entire block of main had to be replaced. In another case, the water main on one side of the street was bonded to the negative return circuit at the power station, and a main on the opposite side of the same street, although connected through cross-piping to the bonded main, was completely destroyed because high resistance joints had developed in the connecting pipes. In addition, bonding pipes as a means of protection always render the bonded structures a part of the negative return circuit, and therefore a source of danger to other underground structures which are not bonded. It has in fact been frequently found that where gas or water service pipes cross bonded cable sheaths, currents are induced to flow from the service pipes to the cable sheaths, and produce gradual destruction of the service pipes. In the case of one city nineteen service pipes were destroyed in the course of one year directly where these pipes cross telephone ducts containing cables whose sheaths are bonded to the railway return circuit. One engineer who has studied this problem very carefully and entirely impartially has very aptly likened bonding to the drug habit, producing temporary relief at the expense of permanent and perhaps irreparable injury to the victim, which injury is, however, too rarely attributed to the true cause.

Experience shows that where there is serious trouble from electrolysis caused by large stray currents leaking from street railways, the bulk of this trouble is due to defective rail bonding, to ground connections from the negative bus-bar, and to lack of return feeders to bring current back from the rails to the power station. While stray currents can only be entirely eliminated by insulating the return circuit by the use of a double trolley, either overhead or in conduit, it is nevertheless a fact which is not generally appreciated, that when large stray currents exist, these can always be reduced to a small fraction of their present value by removing all ground connections of the negative bus-bar, and installing insulated return feeders proportioned for equal drop from radially-disposed points in the track system located at some distance from the power station. By this method the rails are drained of current and any desired part of the voltage drop can be removed from the rails and transferred to insulated conductors from which currents cannot leak. In Europe, such radial insulated return feeders for bringing current back from the rails to the power station are made necessary by regulations limiting the allowable drop in voltage in the rails, and in most cases such installations of insulated return feeders have substantially removed serious trouble from electrolysis. This system of minimizing stray currents by means of radially-disposed insulated return feeders has also been installed in a number of American cities, and the method is gradually being recognized as by far the best for minimizing stray currents. This system in fact removes the root of the trouble, by draining the rails of current and removing voltage drop from the rails and thus preventing substantial leakage of current through ground, and is therefore correct in principle. The railroad companies frequently object to this system claiming that it is prohibitively expensive. This is certainly not the case, as is evidenced by the fact that the method is in general use in Europe and in a number of American cities today. The fact is that in many electric railways there is practically no installation of negative feeders and the railway companies are often not willing to install even a moderate amount of return feeder copper. A mistake is often made in confusing the radial insulated return feeder system with paralleling the rails with copper. Of course where the negative bus-bar is connected to the rails at the power station, and these rails are paralleled with copper feeders, the drop in the rails is reduced in the proportion that the conductivity of the return circuit is increased, but no part of the drop is actually removed from the grounded rails. The amount of copper paralleling the rails that would be required to reduce stray currents to a negligible amount would in all large systems be absolutely prohibitive. This, however, is not the case with the radial insulated return feeder system. With the latter system any desired reduction in rail drop and consequently in the amount of stray current can be secured, independent of the amount of copper installed, the amount of copper being determined by the allowable drop or power loss in the return circuit. The railway company can divide the annual charge of interest on copper invested and operating expense in any ratio within wide limits without affecting the amount of stray current produced from the system. The pipe [illegible] constant expense on account of stray railway currents in the form of repairs and depreciation of their underground structures, and in the form of liability for accidents, and this can be reduced with certainty to any desired extent, short of complete elimination, by the assumption on the part of the railway company of expense in the form of interest and power charges for its return circuit. The railway companies should in all fairness assume this expense and responsibility. If the railway companies would apply as much engineering knowledge and money to their negative circuits as they do to their positive circuits there would be but little trouble from electrolysis. The pipe owning companies should co-operate with the railway companies by affording them access to their pipes for making necessary measurements, etc. After a railway company has installed a reasonable and fair return circuit, it sometimes happens that it is desirable to eliminate any remaining current on pipes by the use of properly located insulating joints. Under these circumstances the pipe owning companies should be willing to co-operate with the railway company in the installation of such joints.

DECISION IN PEORIA CASE.

In the decree recently filed in the celebrated Peoria case, the railway company is enjoined and restrained from injurying the property of the water company by electric current escaping from the rails or structures of the railway company. No particular method for preventing escape of current is prescribed in the decree, because the court in its decision has already stated that a court does not have the power to prescribe by injunction any specific system, and that this power resides only with legislative bodies. In its decision the court, however, lays great stress upon the insulated radial return feeder system, which is spoken of as a quadrilateral system. The decree also requires the water company to co-operate with the railway company to the extent of giving the railway company access to its piping system for the purpose of measuring flow of current upon its system, and of determining whether injury from electrolysis is being continued, in order that the railway company may determine whether it is complying with the terms of the decree. It is evident from this decree that the expense of providing a proper return circuit for the railway system so as to minimize escape of current falls entirely upon the railway company, as it should in all fairness. One section of the decree states that within six months after the expiration of one year after the date of the decree, the railway company may apply for a hearing on the question whether it should be permitted to make an experimental use of the drainage system, in order to ascertain whether such drainage or limited use thereof can be practically applied to the piping system.

It appears from the decision and the decree that the railway company must within one year improve its return circuit so as to prevent as much as possible the escape of stray electric currents from its system. If, after this has been done, it is found that stray currents still exist on the piping system, then the railway company may apply to the court for a hearing to determine whether the water company should be directed to permit the railway company to try a drainage system as an experiment to remove the remaining current harmlessly. A drainage system such as contemplated as a possible final measure by the Peoria decree, when properly controlled so that only small currents are drained from the pipes, does not have the objectionable and dangerous features of promiscuous bonding where large currents are made to flow on the pipes as often found in American cities, and may even be a safe final method where the soil conditions are favorable and where the underground structures are all continuous electrical conductors. It nevertheless seems to the author very unfair that any pipe owning company should be compelled by a court order to permit an electric railway company to use its pipes as a return conductor for its railway system, even to the slightest extent. If the court does not have the power to compel the railway company to adopt any specific method for eliminating the danger from electrolysis, then it certainly should not impose any specific method upon the pipe owning companies. The latter may for example prefer to remove any small remaining stray currents by means of properly located insulating joints.

It is the author's firm conviction that such remedial measures as pipe drainage or insulating pipe joints should be used if at all only as a final measure and never until the return circuit of the railway has been improved so that only small amounts of stray current remain on the underground structures. This view appears to be entirely in accord with the Peoria decision, and is certainly in accord with the best engineering practice.

The Design of the New Water Purification Plant at Fargo, North Dakota.

The water supply for the City of Fargo is drawn from the Red River of the North.

Originally water was used from the Red River for all purposes. It was hauled about the city and sold as a commodity. At a later date, about 1879, a pumping station was installed and water supplied through mains laid under a franchise by a water company. This source of supply and method of distribution was satisfactory until the water shed became settled and the river became contaminated by the run off from farms and possibly from sewage from the growing cities situated on the river above this city.

There were other objectionable features of the water for a domestic supply and in the early 90's a number of artesian wells were put down in the western part of the city. These wells produced a supply of good water but it was exceedingly hard, and considerable discussion was carried on from time to time as to the desirability of using a water carrying a large amount of mineral solids in solution.

The difficulty of obtaining a satisfactory supply of water led to many investigations as to ways and means of bettering it. At length the City Engineer, Mr. Frank L. Anders, was directed to prepare plans and specifications for a rapid sand filtration plant. A brief description of the plant adopted, based on matter contained in Mr. Anders' latest report, is here given.

The river intake is substantially constructed of cedar piling faced with fir sheet piling to prevent any movement of finely divided silt into the wet well. The outer end of the intake is constructed so that water will be taken from as near the surface as seems desirable. It is also fitted with a screen made of flat boiler plates, which will prevent any leaves or sticks from entering the intake. The intake is connected to a wet well by two 18-in. cast iron pipe lines. The well is constructed of concrete, and in two sections. Either section may be cut out of service for cleaning for one of the purposes of the well is to catch mud before it enters the suction line. The well is fitted with the necessary valves for changing the course of the water from one chamber to the other.

From the wet well to the low lift pumps the distance is about 800 ft. and connection is made between the two by an 18-in. suction line. This line is cast iron flanged pipe and at the upper end is connected to two low lift pumps. These pumps comprise that part of the plant that lifts the water from the river and delivers it to the purification plant. The pumps are the centrifugal vortex type, built by Lawrence Manufacturing Co., and are driven by Sturtevant turbines directly connected to them. The combined capacity of the two pumps is 5,000,000 gals. per 24 hours. The low lift pump pit is a concrete structure, its floor elevation being 880 and the top of the roof 906. It is 22 ft. in diameter. Ample space is obtained in the pit for the installation of another pump at some future time if necessary.

Upon leaving the low lift pumps the water is conducted through a 16-in. discharge line connected to the mixing chamber. point it is treated with a solution of li the purpose of softening it. The mixing ham ber is built of reinforced concrete, d 23 ft. wide, 53 ft. long and 18 ft. de It is fitted with vertical baffles that cau water to flow up and down through them, traversing a distance of over 1,000 f and being kept in a state of agitation in order that the chemical reactions may be completed. This process is one of the most important that takes place in the plant, and on that will have the greatest bearing on the cept ability of the purified water.

Upon leaving the mixing chamber, the ater passes into sedimentation basin No. 1 As it enters this basin a coagulant may be lded which also has a very important funct n to perform. The coagulant, which may be ther sulphate of iron or sulphate of alumin de composes and forms a hydrate, also kno floc. This is a light snow-flakelike mar which makes its appearance soon aft addition of the coagulant to the water. cross section of the basins are such a give a very low velocity to the water this is necessary in order that the floc settle and leave the water clear. The design of these basins is an important of the work, for the greater part of purification is done in them. As th forms and settles, it enmeshes and carries it most of the turbidity and a great pa the bacteria, thus relieving the filters heavy load they would otherwise have to

There are two sedimentation basins, with a capacity of about 1,000,000 gals case the chemical reactions and subs settlement is completed in basin No. 1 water may be conveyed to basin No. 2 thence to the filter. Or, if the reactions are completed in No. 1, the water can be conveyed from it directly to the filters. The x-ing chamber can be cut out entirely and the basins used with it or the two basins ed in parallel. In order to prevent after deposits from the lime action, raw water can be aed as the treated water passes from the basins. This is sometimes necessary and is the st effectual device known for this purpose.

A conduit constructed of concrete conveys the water from the sedimentation basin to the filter house and thence along the center lines of the pipe gallery in front of the filters. Connecting the conduits to the filters there are inlet chambers fitted with proper valves to conduct the flow of water into the pr chambers.

The filters are four in number, comple installed, and two more can be compl d at a small additional cost. They are constru d of reinforced concrete throughout, and e 17 ft. by 21 ft. in area. Each will hav a capacity of 1,000,000 gals. per day, exclu e of wash water.

The filters are furnished with a cast i manifold system set in concrete. O of the manifold there is laid 10 ins. carefully graded filter gravel and 30 ins a carefully prepared silica sand. Wash wa boxes, two in number, run longitudinally w the filters.

The treated water passes on to the sa from the inlet chamber, thence through sand, gravel, manifolds, drains and controll to the clear well, where the purified wa is stored until required for use. The cl well is underneath the filters, protected fr all contamination and fitted with baffle wa to keep the water in circulation.

The filters need cleaning at certain perio and this will be accomplished by reversi the flow of water through the sand and co veying the dirty water through a sewer the river below the dam. The sand is agitat during washing by air conveyed to it by suitable pipe system.

The most important parts of the plant i stallation are the filter controllers. Caref consideration was given to all the types controllers now in use and it was decid to use the Earl Filter controller. The adva tages of this piece of apparatus are man and it has no equal for the duty it is calle upon to perform. Its action is such as to kee

[illegible]
will meet the [illegible]
hout the attention of the operator.

The Head House is located directly west
the filter house, and is a two story struc-
e of brick and concrete. In the basement
re is located the wash water and air pumps.
[illegible]
perintendent's office, chemical controllers and
t of the solution tanks are on the first
or, while the second floor is devoted to
rage of chemicals and their preparation for
[illegible]

No function of a water purification plant
more important than that of properly adding the chemical solution to the raw water. The rate of consumption of water in the City of Fargo varies from about 500,000 gals. to probably about 4,000,000 gals. per 24 hours. The raw water has to be treated to meet this varying rate, and the usual method is to pass the chemical solution through an orifice having a known discharge. This orifice needs the attention of the operator in order to meet the varying rate of raw water discharge. It is at once apparent that the operator cannot do this, however faithful he may be, for he does not, at all times, know what conditions he has to meet. The whole problem is satisfactorily solved by the installation of the Earl Chemical feed controller. This device automatically meets, at every instant, the varying rate at which the raw water may be passing into the mixing chamber and the proper chemical is at all times fed to the raw water at a rate proportionate to the consumption. By the use of this device over-dosing and its ill effects are eliminated, as is also under treatment of the water. The operator can rest assured that the water is at all times being properly treated.

The plant is constructed throughout of reinforced concrete, except the buildings, which are faced with Twin City Terra Cotta tile and lined with common brick. The roofs are trussed with steel, sheathed with fir and finished with green glazed tile.

BRIDGES AND BUILDINGS SECTION

The Economical Design of Reinforced Concrete Beams.

he economical design of a reinforced con-
te beam is that design which, other things
[illegible] equal, costs least and carries the load.
[illegible] diagrams and examples for making
nomic design studies of beams are given
a bulletin recently published by the Univer-
of Utah, Salt Lake City. This bulletin
written by Prof. R. B. Ketchum. It pre-
ts, first, the assumptions adopted, outlines;
ond, the theory of stresses in reinforced
crete, and, finally, presents the tubular
l other data previously mentioned. Since
theory outlined is that common to the
t books it need not be considered at
gth; the other parts of the discussion are
que, however, and they are given in ab-
act as follows:

[illegible]

Modulus of Elasticity.—This value for
el is about 30,000,000, and for concrete it
ies and is difficult to determine accurately
experiment. For all our computations we
[illegible]
[illegible]
nt of expansion of steel is about 0.0000065,
for concrete 0.000006 per degree Fahren-
. Expansion joints should always be al-
ed in large exposed structures at inter-
s of about thirty feet.

xposed surfaces of retaining walls, bridge
s and similar structures should be rein-
ed with about 0.3 per cent of steel to
vent small cracks forming in the surface
re it is subject to wide range of tempera-
. The above per centage should be fig-
d for an area of cross section of maxi-
m thickness of about 12 ins.

Weight of Concrete.—In the following
e we have assumed the weight of con-
e to be 150 lbs. per cubic foot.

Cost Ratio.—In this discussion the cost
o is the ratio of the cost of a cubic foot
steel to the cost of a cubic foot of con-
e. For example, steel at 3 cts. a pound
s $14.70 per cubic foot and concrete at
5 per cubic yard costs 25 cts. per cubic
t, which gives a cost ratio of 58.8. Cost
os of 30 and 60 have been used in the
es, and for ordinary conditions the cost
fall within these limits.

Continuity of Beams.—Allowance for
tinuity of reinforced concrete beams and
s is usually made about as follows:

or uniform load on beam continuous at
end only, the maximum center bending
nent is assumed to be 1-10 *Wl.*

or uniform load on beam continuous at
ends, the maximum center bending mo-
t is assumed to be 1-12 *Wl.*

he negative moment over the support for
rt span beams and for slabs is usually
n equal to the maximum center bending
nent, and the same amount of steel pro-
d for the negative moment as for the pos-
moment. For long spans and beams of
ortance with special loading, the negative
nent must be carefully considered and
per provision made.

In our slab tables we have used 1-10 *Wl.* throughout

6. *Allowable Unit Stresses.*—The following conform to the recommendations made by the committees of the various engineering societies, and to recent building regulations.

(a) Steel in Tension: Mild steel is the most suitable for reinforced concrete work and in the tables we use two values of f_s, namely, 15,000 and 18,000 lbs. per square inch. Higher values than these are considered questionable by many designers, although values as high as 22,500 are used for twisted steel bars having very high elastic limit.

(b) Concrete in Compression: A mixture of about 1:2:4 attaining an ultimate strength of 2,000 lbs. per square inch in 28 days is usually assumed. The following tables are computed for two maximum values of f_c, namely, 600 and 750 lbs. per square inch. Values as high as 800 lbs. are in quite common use and some designers use even as high as 1,000 lbs., but anything higher than 750 lbs. has not yet been sanctioned by the best authorities.

(c) Concrete in Vertical Shear: In calculations on beams where concrete (not reinforced for diagonal tension) is assumed to take diagonal tension, the vertical shear unit stress, $v = V/bjd$, should not exceed 2 per cent of the ultimate compressive strength for concrete 30 days old or 40 lbs. per square inch.

(d) Bond and Spacing of Bars: For plain straight bars use 80 lbs. per square inch. For plain bars with hooked ends bent 180° with radius of three diameters, use 100 lbs. per square inch. Lateral spacing distance center to center of plain bars not less than two and a half diameters. Distance from center of bar to the side of beam not less than two diameters. Vertical spacing distance center to center of bars not less than one and a half diameters and not less than ½ in. in the clear. In slabs, bars shall not be spaced farther apart than two and one-half times the thickness of slab.

[illegible]

From the assumptions given above and the theory of stresses 26 tables were computed from which any rectangular beam may be found for a given superimposed uniform load. From these tables beams were designed and their quantities of concrete and steel were compared and prices given to them to secure Table I. To explain: Assuming a uniform cross-section of a beam throughout its length, from the tables, we have designed a series

TABLE I.—[illegible] RECTANGULAR BEAMS

[illegible] $n=15$

[illegible]	d	[illegible]	[illegible]	[illegible]	10	12	14	16	[illegible]	20	22	[illegible]	[illegible]	28	[illegible]	35	40
[illegible]		[illegible]	[illegible]	[illegible]	1.3	1.5	1.9	[illegible]									
		1.8	[illegible]	1.9		2.5	[illegible]			[illegible]							
[illegible]	[illegible]	[illegible]	1.2	1.1	[illegible]	1.3	1.6	2.0	2.5	3.0							
		1.8	[illegible]	1.8	1.9	2.1	2.3	[illegible]	3.2	3.8		[illegible]					
[illegible]	[illegible]	1.2	1.2	1.1	1.1	1.2	1.3	[illegible]	1.9	[illegible]	2.9	3.4					
		1.8	1.8		1.6	1.7	1.8	2.1	[illegible]		[illegible]	[illegible]					
[illegible]	[illegible]	1.2	1.2	1.0	1.0	1.0	1.0	1.1	1.5	1.7	2.1	2.5	2.8	3.3			[illegible]
		1.8	1.8	1.6	1.4	1.3	1.3	1.6	2.1		[illegible]	3.4	[illegible]	4.0			[illegible]
[illegible]	[illegible]	[illegible]	1.2	1.0	1.0	1.0	1.0	1.1	1.3	1.7	1.9	2.3	2.5	3.0	[illegible]		[illegible]
			1.8	1.6	1.4	1.4	1.4	1.6	2.1	2.4	2.8	3.1	3.3	3.7	4.3		
[illegible]	[illegible]	1.1	[illegible]		1.0	1.0	1.0	1.1	1.2	1.6	1.7	2.1	[illegible]	2.7	3.1	3.7	
				1.6		1.4	1.5	1.6	[illegible]	2.3	2.6	2.8	3.0	3.4	3.8	4.3	
[illegible]	[illegible]	1.1	1.1	0.9	1.0	1.0	1.0	[illegible]	1.2	1.5	[illegible]	[illegible]	2.1	2.4	2.6	3.2	4.0
		1.7	1.7	.1.6	1.4	1.5	1.5	1.6	[illegible]	2.2	2.4	2.6	[illegible]	3.1	3.4	3.9	4.7
[illegible]	[illegible]	1.0	1.0	0.9	1.0	1.0	1.0	1.1	1.1	1.4	1.6	1.8	1.9	2.1	2.2	2.7	3.5
		1.6	1.6	1.5	1.4	1.5	1.5	[illegible]	1.9	2.1	2.2	2.4	2.5	2.8	3.0	3.8	4.5
[illegible]	[illegible]	1.0	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.3	1.5	1.6	1.7	1.8	2.0	2.3	3.0
		1.6	1.5	[illegible]	1.5	1.6	1.6	1.7	1.8	1.9	2.1	[illegible]	2.3	2.5	2.7	3.7	4.3
[illegible]	[illegible]	1.0	[illegible]	0.9	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.5	1.6	1.7	2.0	2.6
		1.6	1.5	1.5	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.3	2.5	3.6	4.1
[illegible]	24	[illegible]	1.0	1.0	1.0	1.0	1.0	1.1	1.1	[illegible]	1.3	1.4	1.5	1.6	1.7	2.0	2.5
		1.6	1.5	1.5	1.5	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.3	2.5	3.4	3.9
	[illegible]	1.0		1.0	1.0	1.0	[illegible]	1.1	1.1	1.2	1.3	1.4	1.4	1.5	1.6	2.0	2.5
		1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.8	[illegible]	1.9	1.9	[illegible]	2.2	2.4	3.2	3.7
	[illegible]	1.1	[illegible]	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.4	1.5	1.6	2.0	2.4
		1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.8	1.8	1.9	2.0	2.2	2.3	3.1	3.5
32	[illegible]	[illegible]	1.1	1.1	1.0	1.0	1.0	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.5	1.9	2.4
		1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.9	2.1	2.2	2.9	3.3
[illegible]	[illegible]	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.5	1.9	2.3
		[illegible]	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.9	2.1	2.1	2.7	3.2
[illegible]	[illegible]	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.5	1.9	2.3
		1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.9	2.0	2.1	2.6	3.1
[illegible]	[illegible]	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.5	1.9	2.1
		1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7	[illegible]	1.8	1.9	2.0	2.0	2.4	2.9
10	[illegible]	[illegible]	1.0	1.0	1.0	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.8	2.0
		1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.8	1.8	1.8	1.9	2.0	2.3	2.7
[illegible]	[illegible]	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3	[illegible]	1.4	1.7	1.8
		1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.8	1.9	2.1	2.3
[illegible]	[illegible]	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.3	[illegible]	1.4	1.6	1.3
		1.6	1.6	1.6	1.6	1.6	[illegible]	1.6	1.6	1.7	1.7	1.7	1.7	1.8	1.8	2.0	2.1

NOTE: [illegible] comparing actual quantities of steel [illegible]

NOTE—[illegible]

Use lower row of figures for cost ratio of 30.

Interpolate for other values of cost ratio.

Cost of Cu. Ft. of Steel.

Cost Ratio [illegible]

[illegible]

of beams and tabulated the relative amounts of materials required, and by applying cost prices show therefrom the relative costs of [illegible] strength for a given depth. Table II shows this information for a 12-in. beam, and from this and similar tables we plot the curves, Fig. 1, showing the variation in cost of the beam with the per cent of steel. From curves in Fig. 1. and other similar curves, by plotting the points of minimum cost we are able to get at the law of variation of the economical per cent of steel with the span of the beam as shown in Fig. 2. By interpolation of diagrams in Fig. 2 we are able to tabulate, as in Table I, the economical per cent of steel for all rectangular beams of the ordinary spans and depths for cost ratios of 30 to 60.

Table I does not, however, apply to slabs, as the breadth of the beam in this case is not variable, and for any depth of slab the problem consists in finding the amount of steel that will carry the given load, and there is no economy in using more steel than is required to carry a given load.

Conclusions.—It is quite clear from a study of the above diagrams and tables, that for certain cost ratios it is economical to use high percentages of steel, even though the unit stress in the steel may be very low. The steel is not wasted by so doing as it has tne effect of lowering the neutral axis, thereby utilizing a greater portion of the concrete; for example, with 0.2 per cent of steel k equals 0.217, and for 2.0 per cent of steel, k equals 0.531, showing that in the use of a high per cent of steel we use in this case more than twice the area of concrete as compared with the low per cent of steel.

The use of high per cent of steel also has the following advantages:

(1) Decreases the weight of the beam very materially.

(2) Decreases the bond stress.

(3) As the dangerous diagonal stresses are a function of the tension and shear combined, the low stresses in tension decrease the diagonal stresses.

(4) Low working stresses in the steel provide a greater margin of safety against emergencies, as it has been shown by Professor Talbot and others that with less than 1.5 per cent of steel we cannot expect to develop the full strength of the beam.

(5) High unit stresses in the steel always call for large deformations, which in turn will cause the small cracks which a described by all the experimenters to oper vider than they would with low steel stresses. hereby increasing the possibility of corros n of the steel.

(6) Low deformations in the steel ould also necessarily give low deflections f the entire beam, which, of course, would de-sirable.

In regard to conclusion No. 1, we m say further that the dotted line shown o each of the diagrams, Fig. 1, shows the va tion of the weight of the beam with the pe cent of steel. For example, on Fig. 1 a be n 12 ins. deep span 20 ft., with 1.0 per c of steel will weigh just twice as much s a beam of the same strength, same dept and span with 4.0 per cent of steel, and the eam with 4.0 per cent of steel will be ch per The most economical per cent of ste for this particular beam being about 1.7 pe cent for a cost ratio of 60.

Shallow Beams.—As it often occurs t is desirable to make the depth of a be a minimum even at greater cost, diagrams si-lar to Fig. 1 will serve as an accurate g de as to just what effect an increase or de-crease in the depth would have in maki it necessary to use more or less steel for ny given case to carry a given load. Or per ps we should say these diagrams show just at effect a change in the amount of steel as on the total cost. If we use a depth requ ig a larger amount of steel than that show to be the economical amount for a beam of at span and depth, we can see readily how ar we are from the point of economy and n tell what the ultimate difference in st would be.

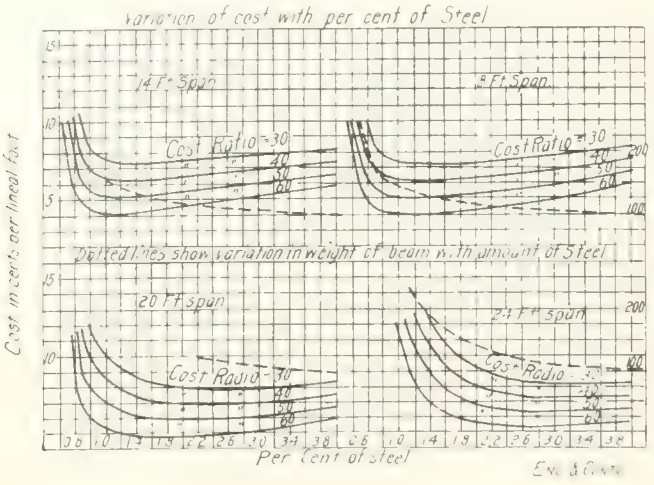


Fig. 1—Curves Showing Variation of Economical Percentage of Steel.

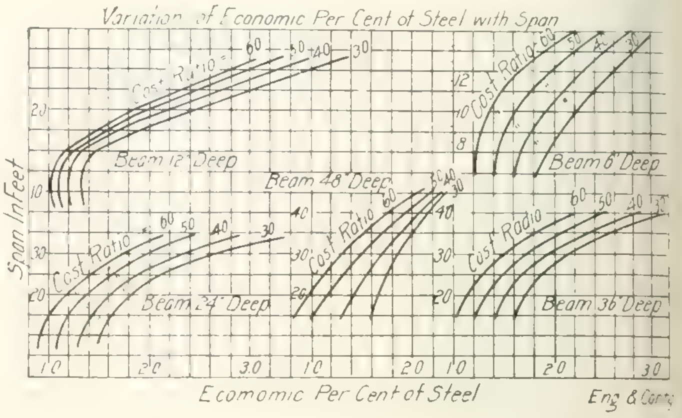


Fig. 2—Economical Percentage of Steel.

TABLE II.—RELATIVE AMOUNTS OF MATERIALS AND RELATIVE COSTS.

f_s=15000. f_c=600. h=12". n=15.

Per cent of steel.	Span in feet—8 Concr. cu ft	8 Steel lbs.	14 Concr. cu ft.	14 Steel lbs.	20 Concr. cu. ft.	20 Steel lbs.	24 Concr. cu. ft.	24 Steel lbs.	*Total cost in cents per lineal foot. Span in feet. 8	14	20	24
	[illegible]		645		×310		[illegible]					
0.2	b=	8.11							21.9 28.6 35.3			
	0.673	0.57										
0.4	b=	3.24	b	7.33					9.9 12.6 15.2	15.2 19.5 23.8		
	0.269	0.45	0.43	0.75								
0.6	b=	2.05	b–	2.48	b	5.85			6.4 7.6 8.9	7.6 9.6 11.6	18.3 23.1 28.0	
	0.170	0.43	0.20	0.52	0.486	1.23						
0.8	b=	1.57	b=	1.72	b=	2.36	b	10.4	5.2 6.5 7.8	5.6 7.0 8.4	7.9 9.8 11.8	35.7 44.3 52.9
	0.130	0.44	0.14	0.48	0.196	0.66	0.86	3.31				
1.0	b	1.46	b=	1.56	b=	1.97	b	4.11	5.1 6.3 7.5	5.2 6.4 7.6	7.0 8.6 10.2	14.5 17.9 21.3
	0.121	0.51	0.12	0.55	0.163	0.69	0.34	1.44				
1.2	b	1.37	b=	1.44	b=	1.71	b—	2.78	5.0 6.2 7.3	5.1 6.2 7.3	6.5 7.9 9.3	10.4 12.7 15.0
	0.114	0.53	0.11	0.61	0.142	0.72	0.23	1.17				
1.4	b	1.30	b=	1.36	b	1.56	b_	2.23	5.1 6.2 7.3	5.3 6.4 7.5	6.2 7.5 8.7	9.0 10.9 12.8
	0.108	0.64	0.11	0.66	0.129	0.77	0.19	1.09				
1.6	b	1.25	b=	1.30	b=	1.44	b=	1.86	5.2 6.3 7.3	5.5 6.6 7.7	6.0 7.2 8.3	7.6 9.1 10.6
	0.101	0.70	0.11	0.73	0.119	0.81	0.15	1.04				
1.8	b=	1.21	b	1.25	b=	1.36	b=	1.68	5.3 6.3 7.3	5.4 6.4 7.4	6.0 7.1 8.2	7.3 8.7 10.1
	0.100	0.76	0.10	0.79	0.113	0.86	0.14	1.06				
2.0	b	[illegible]	b	1.20	b=	1.28	b=	1.50	5.4 6.4 7.4	5.5 6.5 7.5	5.9 6.9 8.0	6.7 7.9 9.1
	0.098	0.83	0.10	0.84	0.106	0.90	0.12	1.05				
2.5	b=	1.11	b	1.13	b	1.17	b_	1.29	5.7 6.6 7.5	5.7 6.6 7.5	6.0 7.0 7.9	6.6 7.7 8.8
	0.092	0.97	0.09	0.99	0.097	1.02	0.11	1.13				
3.0	b	1.06	b=	1.07	b=	1.09	b–	1.14	5.9 6.8 7.7	6.1 7.0 7.9	6.1 7.0 7.9	6.3 7.2 8.1
	0.088	1.11	0.09	1.12	0.091	1.14	0.09	1.20				
4.0	b=	1.00	b	1.00	b=	1.00	b	1.00	6.7 7.5 8.3	6.7 7.5 8.3	6.7 7.5 8.3	6.7 7.5 8.3
	0.083	1.40	0.083	1.40	0.083	1.40	0.083	1.40				

×Assumed total uniformly distributed net load.

*The three values of cost correspond to the cost prices 30c, 40c and 50c per cu. ft. of concrete. 3c per lb. for steel used throughout.

b=width of beam in inches to carry given net load.

[illegible] of materials [illegible] for beam of width "b."

DESIGN OF SLABS.

Distribution of the Load and of the Ste—It is common to assume that continuity e ts in slabs as in beams. However, where a b is supported on all four sides and the sla s square or nearly so, it is economical to re-force in both directions. The amount f load carried by each set of reinforcing s being inversely proportional to the fo h power of the respective dimensions of e slabs. Thus we get for

Ratio 1 ÷ b	1.0	1.1	1.2	1.3	1.4
Proportion of total load carried by transverse system	0.50	0.59	0.67	0.75	0.80

If the slab is square we design the s each way to take half the load. For rectangular slabs we design a slab to take the tra-verse load as above, and design the lor-tudinal reinforcement to take the remain of the load. It is evident that the deflect will be such as to make the stress in the lor-tudinal bars small as compared to that the transverse bars, therefore it is not w to reinforce both ways when the length ceeds the breadth more than, say, 25 per c

Prof. Turneaure suggests that some m may be saved in square or rectangular sl by distributing the steel as required by moment 1-10 *Wl.* (or whatever is used the particular case in question) for the c half of the [illegible] the [illegible] of steel [illegible] the b, gradually widening the spacing of the ds to the edge, thus using three-fourths the [illegible] rm spacing, this being allowable as the esses in the center must necessarily be eater than near the edge.

[illegible] Depth and Amount of [illegible]

ble III gives the complete economic design slab for any load and span.

In explanation of how we arrive at the vals given in Table III, we first construct agrams for various spans similar to Fig. 3. om Fig. 3 we make Table III, showing the ative amounts of material and relative cost, rying the depths and the amounts of steel conform to a given load per square foot. r example, for a superimposed load of lbs. per square foot, on a span of 6 ft., may use 0.2 per cent of steel, depth of ins., or 0.4 per cent of steel, depth 5.1 ., and so on to 1.2 per cent of steel with depth of 3.8 ins.

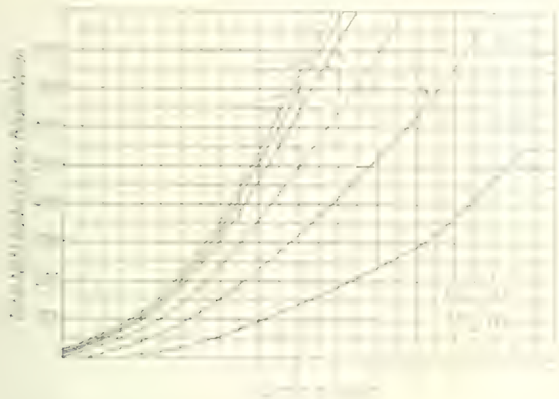


Fig. 3—Relative Amounts of Material and Cost.

Tabulating these quantities and applying t prices we are able to plot the cost curves shown on Fig. 4. These curves show very ided minimums for economical depths for various loads.

n a similar manner we have made these grams and tables for other spans, and m the curves similar to Fig. 4 we are able get at the law of variation of economical th for the various loads and cost ratios. therefore construct Fig. 5 from the minim points on the curves of diagram, Fig. We apply cost ratios of 30 to 60 to the bles II and similar, and from these rets find that the variation of economic depth [illegible] The dotted lines showing the economic depth curves for the two ratios and the full lines show the average between the two cost ratio curves. Noting that we would ordinarily want the depth only to the nearest ¼ in., the solid lines would therefore be sufficiently accurate for any cost ratio between 30 and 60.

From curves on Fig. 5, we are now able to tabulate the economic depth for any span and any load. As these depths are taken to the nearest ¼ in., it now remains for us to get the exact amount of steel required to hold the given load

When the strength of the slab depends on the steel, this problem leads to a third degree equation. When the strength depends on the concrete, we have the relation,

[illegible]

Having the value of k we can readily get p from the relation,

[illegible]

However, a more rapid solution of this problem is made by use of tables, from which we readily interpolate the exact amount of steel required. These values for the required amount of steel for the slab of proper depth are shown in Table III.

Hence we have in Table III the most economical slab completely designed for any given load and span. Similar tables could be made for unit stresses corresponding to any desired specification. In the above we have taken no account of the possible saving on the columns and girders of the structure that might be affected by using somewhat thinner slabs with more steel, thereby decreasing the dead load.

[illegible] SLABS—RELATIVE AMOUNTS OF MATERIAL AND RELATIVE COSTS. SPAN 6 FEET.

[illegible] f_s=15000 [illegible] M=1/10 WL.

[illegible] ft.=200 lbs. per sq. ft.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Total cost
.2	7.1	.592	.48	1.4	14.8	16.2
.4	5.1	.425	.64	1.9	10.6	12.5
.6	[illegible]	.375	.82	2.5	9.3	11.8
.8	4.0	.333	.94	2.8	8.3	11.1
1.0	3.9	.325	1.13	3.4	8.1	11.5
1.2	3.8	.317	1.26	3.8	7.9	11.7
Load=200 lbs. lr. ft.=400 lbs. per sq. ft.						
.2	9.3	[illegible]	.65	2.0	19.3	21.3
.4	6.6	.550	.88	2.6	13.7	16.3
.6	5.7	.475	1.11	3.3	11.8	15.1
.8	5.2	[illegible]	1.31	3.9	10.8	14.7
1.0	5.0	.417	1.56	[illegible]	10.4	15.1
1.2	4.9	.408	1.83	5.5	10.2	15.7
Load=400 lbs. lr. ft.=800 lbs. per sq. ft.						
.2	12.3	1.025	.87	2.6	25.6	28.2
.4	8.9	.742	1.23	3.7	18.5	22.2
.6	7.3	.608	1.47	4.4	15.2	19.6
.8	6.6	.550	1.75	5.3	13.7	19.0
1.0	6.4	.533	2.11	6.3	13.3	19.6
1.2	6.3	.525	2.49	7.5	13.1	20.6

*For beam one inch wide.

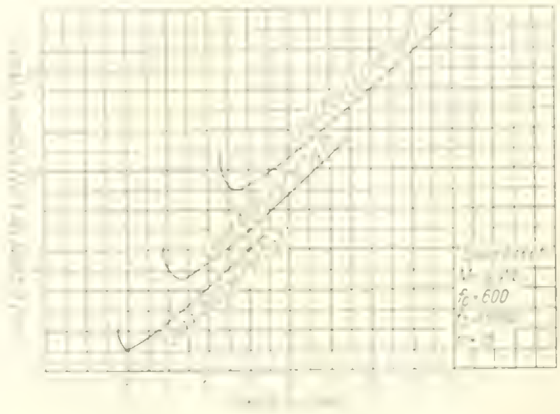


Fig. 4—Cost Curves.

BLE III.—SLABS. ECONOMIC DEPTH AND CORRESPONDING PER CENT OF STEEL.

f_s=15000 max. f_c=600 max. n=15. M=1/10 WL.

d.	Span in feet									
	5	6	7	8	9	10	11	12	13	14
	2.00	2.25	2.50	2.75	3.25	3.50	4.00	[illegible]	4.75	5.25
	0.62	0.65	0.70	0.74	0.70	0.70	0.80	0.78	0.82	0.80
	2.25	2.50	2.75	3.25	3.75	4.25	[illegible]	5.25	5.50	6.00
	0.65	0.75	0.82	0.75	0.73	0.78	0.74	0.71	0.80	0.80
	2.50	2.75	3.25	3.75	4.25	4.75	5.00	5.50	6.00	6.50
	0.65	0.78	0.68	0.74	0.78	0.75	0.90	0.91	0.87	0.85
	[illegible]	3.00	[illegible]	4.25	4.50	5.00	5.50	6.00	6.25	6.50
	0.65	0.78	0.72	0.71	0.90	0.85	0.85	0.85	0.93	0.70
	3.00	3.50	4.25	4.75	5.25	5.75	6.25	6.75	7.50	8.00
	0.70	0.70	0.73	0.74	0.76	0.78	0.80	0.85	0.77	0.82
	3.50	4.25	4.75	5.25	[illegible]	6.25	6.75	7.75	8.50	[illegible]
	0.61	0.66	0.68	0.73	0.78	0.81	0.90	0.72	0.72	0.77
	4.25	4.75	5.25	6.00	6.50	7.25	8.00	9.00	10.00	11.00
	0.72	0.70	0.80	0.75	0.84	0.80	0.79	0.75	0.73	0.67
	4.50	5.25	6.00	6.50	7.25	8.00	9.00	10.00	11.00	12.00
	0.71	0.71	0.71	0.81	0.83	0.85	[illegible]	0.78	0.74	0.72
	5.00	[illegible]	6.50	7.25	8.00	9.00	10.00	11.00	12.00	
	0.67	[illegible]	0.72	[illegible]	0.79	0.78	0.78	0.76	0.73	
	5.25	6.00	7.00	7.75	8.75	9.50	10.50	11.75		
	0.70	0.76	0.73	0.73	0.78	0.89	0.86	0.77		
	5.50	6.50	7.50	8.50	[illegible]	10.25	11.50			
	0.73	0.71	0.70	0.71	[illegible]	0.83	0.76			
	5.75	6.75	[illegible]	8.75	9.75	10.75	11.75			
	0.75	0.75	[illegible]	0.75	0.85	0.85	0.88			
	6.00	7.00	[illegible]	9.00	10.25	11.25				
	0.77	0.79	0.80	0.88	0.85	0.88				
0).	6.25	7.25	8.50	9.50	10.75	11.75				
	0.76	0.80	0.76	0.87	0.82	0.88				

pper row of figures gives depth in inches. Lower row of figures gives required per cent of steel. d given = pounds per sq. ft. superimposed load. Depths given are total depths of slab = h. en h <4", center of steel is ¾" above bottom of slab. When h = or >4" and <10" center of el is 1" above bottom of slab. When h = or >10" and <12" center of steel is 1¼" above bottom slab. The above depths are economic depths for cost ratios between 30 and 60.

Decrease of Concrete Work at Gatun Locks.

The amount of concrete placed in the walls of Gatun Locks, Panama, during the month of May amounted to 7,745½ cu. yds,. which is the least amount placed during any month since the first month of concrete placement in the locks—August, 1909. Only two of the eight 2-cu. yd. Chicago cube mixers in the construction plant were employed, and these were not in continuous use. The walls of the locks proper are finished, except for placing small quantities of concrete in tunnel construction and grouting machinery. The only heavy masonry being placed is in the cellular approach wall at the upper end of the locks. The output of concrete will be small until the inauguration of work on the lower wing and approach walls, at the sites of which excavation is being made by pipe line suction dredge. When the excavation has been completed, the pit will be pumped out, and the laying of concrete for the walls should begin about September 1, 1912.

Public Welfare Exposition.—A public welfare exposition of pure foods, sanitary, safety and building appliances for improving the conditions of home life, and assisting those engaged in public work and improvements, will be held at the University of California at Berkeley, Sept. 23 to 28. There will also be exhibits of machinery and supplies used in the administration of municipal government.

Method and Cost of Jacketing With Concrete the Underwater Portions of a Bridge Substructure.

Three masonry piers and an abutment founded on stone-filled cribs were repaired in 1911 by building jackets of concrete around the under-water portions. The old piers had been in use some 65 years. The portions above low water were of squared granite laid in mortar probably of lime or a mixture of lime and natural cement. Below low water the piers were closely framed hewn pine cribs filled with field stone and were well preserved. The strengthening work was considered necessary to fit the piers to carry a steel superstructure being built to replace the original wood spans. The conditions encountered in this work and the method and cost of doing the work are described by Mr. E. E. Greenwood, engineer in charge, in the Proceedings, Maine Society of Civil Engineers. We abstract the description as follows:

The river bed at this point consists of boulders and at some points ledge crops out. The depth of water at low tide is from two to 18 ft., averaging about 12 or 14 ft. at the piers, and the ordinary rise of the tide is about 16 ft. The old piers were protected by a heavy riprap deposited about the base, this riprap coming up above low water in a few places.

The nature of repairs decided upon was to put a jacket of reinforced concrete around each structure up to the high water line, connecting this jacket with the old work, above low water, by means of anchor rods inserted in holes drilled into the old piers about 3 ft. apart vertically and horizontally. Above high water the old work was to be thoroughly pointed up with rich cement mortar. The thickness of this concrete jacket was in general from 3 to 6 ft., finishing off at the top two and one-half feet thick.

On account of the uncertainty of what we should have to contend with as the work should progress it was thought impracticable to make specifications under which a contractor could be expected to make a reasonable bid on the work, either by unit prices or a lump sum. For instance, there was no way to estimate how much liquid concrete would be swallowed up by the unknown cavities in the old work, and it was of course desirable to fill these cavities as far as possible. It was therefore decided to do the work by the day under the supervision of a competent foreman.

Our next question was that of the best method of accomplishing the desired results, having 12 to 14 ft. of water to contend with at low water and twice a day this was increased by about 16 ft. of tide.

The first step was to remove a large part of the old riprap about the piers and prepare a foundation for the concrete jacket. As a cofferdam of sufficient depth was impracticable it was decided to do this work with divers. Therefore two divers' outfits were organized and set to work, and the old riprap and debris were removed to such a depth as to secure a suitable foundation.

It was found that the old riprap was so closely packed that it was not necessary to go down to the old river bed in most places. The depth was generally from 3 to 10 ft. below low water, with some points deeper. The writer, in a diving suit, personally examined the bottom in each case and was satisfied that a greater depth would only have been a waste of time and money.

Our next step was to devise the most practicable method of building a form for the concrete, and it was decided to build a timber crib 8 ft. wide entirely around the pier, leaving the space between the crib and pier to correspond with the required thickness of concrete, which was generally about 6 ft. below low water.

This crib was built of 8x8-in. hemlock timber and divided into checks about 8 ft. square, each alternate check being floored over to contain rocks for sinking it. The crib was built up to 2 or 3 ft. above water at low tide, thus giving something on which to work while the tide was out to build the forms in the ordinary manner above that height. After the crib was grounded all the checks were filled with field stone and a quantity of the larger sized stones was deposited outside the crib as an extra precaution against scour. The inner side of the crib was then lined with vertical matched spruce plank driven as much as possible in the bed and all holes at the bottom thoroughly chinked by divers, thus giving an almost water-tight form for the concrete. The concrete was then deposited in the water, partly by means of the bottom dump bucket and partly by means of the flexible chute method, always endeavoring to deposit the mixture with the least possible wash. After reaching the height of low water the work was mostly done by working a few hours at a time while the tide was out. The concrete in general was a 1:2:4 mixture of Portland cement, sand and crushed rock. In the abutment where the work was all above water a 1:3:6 mixture was used. This piece constituted about one-sixth of the entire job. A Smith mixer of 1 cu. yd. capacity was used on all of the work.

The cement was delivered on the work by the local dealers for $1.73 per barrel. Sand was delivered for $1.50 per load of about 1¼ cu. yds. or at about $1.20 per cubic yard. Crushed rock cost delivered on the work $2.25 per cubic yard. Labor cost $2 per day of nine hours. Hemlock lumber cost $18 per thousand and spruce lumber $22 per thousand delivered.

An accurate account was kept of the total cost but the exact division between the different classes as given below is something of an estimate but is believed to be quite near the facts. The total amount of concrete built assuming that 5 per cent of the total ntered the cavities of the old work was 2,190 u. yds

Lumber for crib work and forms cost...
Tools bought and hired...
Field stone for filling cribs
Teaming
Cement
Sand
Crushed rock
Liability insurance
Coal
Incidentals and office expenses
Labor on cribs, forms and concrete
Preparing foundations under water
Making anchor connections with old wo
Iron for reinforcing and for protectin corners
Pointing up old work above concr jacket
Riprapping outside of cribs
Engineering

Total

Less estimated salvage on tools and lun ber

Net cost

This gives a cost of $11.68 per cub for the whole job. But if we omit t six items above mentioned as not chargeable to the yard price of concr have $8.32 as the net yard price wihch i the cost of all crib work and forms.

When it is considered that the wo largely under water and also under a over which a city traffic had to be main the above prices do not appear excessi it is doubtful if a contractor would fe ranted in making such a price on a job even with a fair profit added.

The work was done between July an October 13 and was under the direct vision of Mr. Joseph Mullen of Bango has had a large experience in that l work and to whom belongs the credit cuting the work in an economical man

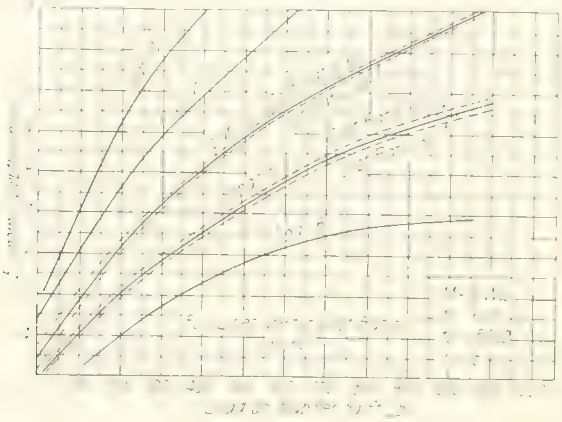


Fig. 5—Economic Depth for Any Span and Any Load.

* * *

The lower part of each leaf of th gates for the Panama locks is a tight chamber so that surrounding reduces the weight on its hinges makes it easier to move. In order t the leaf from lifting when the gat closed, the upper part of the leaf has on the side toward the upper lock le let water in and thus weigh the leaf The air chamber of the west leaf upper guard gate in the east chamb Gatun Locks was tested on June 10, by ing it with water.

The air chamber of this leaf con 13,000 cu. ft. The upper guard gat ft. 8 ins. high, are the smallest gates in the locks, except the sea For the higher gates the air chamber proportionately larger.

* * *

The total yardage excavated on Panama anal in May was 2,506,91 yds., leaving to be excavated 24,393,3 yds. to be excavated or less than eighth of the entire amount required the completed canal.

* * *

Over 86 per cent of the concrete for Panama locks is in place, the amoun the close of work on June 8 being 3.7 664½ cu. yds., out of a total of appr mately 4,302,563. A total of 21,952 cu. of concrete was laid in the locks du the week ending June 8.

* * *

The Sociedad Colombiano de Ingenieros Bogotá, Colombia, is engaged in collecting on rail sections and in making studies to termine the proper track gage for the S Railways.

* * *

Plans for the new terminal station of P. R. R. in Panama have been approved construction has been commenced. The m part of the new building, which will be of Italian Renaissance style of architecture, w a frontage of 170 ft. and a depth of 55 ft.

NEWS SECTION

Editorial Comment Personals -Society Meetings—Trade Notes Catalog Reviews—Contract News, Embracing Bids Asked, Work Projected, Contracts Let and Contract Prices on All Classes of Civil Engineering Construction Work.

he Doings of he Week.

[illegible] vious issues very little has [illegible] days in the way of awarding large railroad construction contracts. A number of smaller contracts have been ut most of the big stuff is evidently being over for the next fiscal year. Among the acts let recently are the following: W. ench & Co., 3090 West Grand Blvd., De- Mich., for grading another section of r belt line at Detroit, Mich., for the Central R. R.; D. J. Burke, Lewis- , Mont., for work on the Dry Creek line ie Milwaukee in Gallatin County, Mont.; ie Mason, Portland, Ore., for grading and ing bridges for the new line of the Clack- Southern Ry., from Oregon City, Ore., a; Karner Bros. & Co., Dallas, Tex., istructing a 17-mile branch for the Fris- rom Bloomington, Tex.; M. Ford, Cedar ds, Ia., for grading for an interurban line Cedar Rapids, Ia., to Mt. Vernon, Ia., for edar Rapids & Iowa City Ry.; J. N. Gil- ton, Ala., for grading for a 20-mile into Lauderdale County, Miss., for Iississippi Eastern R. R.; Deaks & Hinds, nto, Ont., for double tracking a portion e Canadian Pacific R. R. between Sudbury Port Arthur, Ont.

[illegible] appears to offer more opportunities tway improvements. A considerable f good sized jobs are open for bids, ted elsewhere in this issue. Among the r of these are the following: 13 con- s by the Pennsylvania State Highway De- t for the construction of roads, the length of these contracts being some- e 39 miles; improvement and exten- 29 miles of roads for Supervisors' Dis- [illegible] the construction of about 35 miles of in Cumberland County, Tenn. One of arger highway construction jobs let since last issue calls for the construction of 40 miles of permanent road for Precinct 1 of Lamar County, Texas. This contract awarded to the O'Neil Engineering Co., is, Tex., at $237,500.

ie of the planks of the platform adopted ie Republican party at its Chicago con- on provides the following:

he Mississippi River is the nation's drain- ditch. Its flood waters gathered from -one States and the Dominion of Canada, itute an overpowering force which breaks evees and pours its torrents over many on acres of the richest land in the Union, ing mails, impeding commerce, and causgreat loss of life and property.

hese floods are national in scope and the ters they produce seriously affect the gen- welfare. The State unaided cannot cope the giant problem, hence, we believe the ral Government should assume a fair pro- on of the burden of its control so as to nt the disasters from recurring floods."

expected that the Democrats will adopt nilar plank, and that the Third party will do likewise. Between the three it is pos- that something will be done.

A special message has been sent to Congress by President Taft asking for an appropriation of $1,250,000 to protect the Imperial Valley of California against emergencies of floods from the Colorado River while negotiations for the protection of that territory are pending with Mexico. An immediate appropriation was urged to be used principally in the construction of levees and revetments along the Colorado River and to be expended under his direction.

The largest dock contract let recently appears to be the one secured by Grant Smith & Co., Henry Bldg., Seattle, Wash. This contract amounts to $517,650 and calls for the construction of Pier 26 at San Francisco, Cal., for the Harbor Board of that city.

Two good-sized drainage projects in Harris County, Texas, are taking shape. The Commissioners' Court has created Drainage Districts Nos. 6 and 7, and at an early date elections will be held in the two districts to decide on the issuance of bonds with which to secure funds to put into effect the work as has been planned. The two issues, while voted on separately, will involve $300,000 in bonds, the receipts from the sale of which will be expended in the drainage works. District No. 6 will embrace about 20,000 acres of land. District [illegible]

PERSONAL

[illegible] as third assistant superintendent of sewers, Dayton, Ohio, on June 11.

Mr. George Munger gave an interesting lecture on the Construction of the Panama Canal at the Chicago Beach Hotel, Chicago, on June 19. He illustrated his lecture with motion pictures.

Mr. A. E. Foreman, formerly secretary and manager of the Concrete Engineering and Construction Co., Ltd., has been appointed chief assistant to City Engineer Rust of Victoria, B. C.

Mr. H. K. Eggleston has been appointed to the position of Steam Railroad Inspector, Public Service Commission, Second District, New York State, vice W. L. Derr, who resigned on June 1, 1912.

Mr. J. B. Stouder was appointed Steam Railroad Inspector to fill the vacancy caused by the promotion of Mr. C. R. Vanneman, Public Service Commission, Second District, New York State.

Mr. L. P. Friestedt, a prominent contractor of Chicago and inventor of Friestedt steel sheet piling, has contributed $1,000 to the new Progressive party. Mr. Friestedt is President of the Cullen-Friestedt Co., 7 S. Dearborn St., Chicago.

Mr. C. R. Vanneman, who has been Steam Railroad Inspector for the Public Service Commission of the State of New York, Second District, has been promoted to be Chief of a Division of Transportation recently created by the Commission. This division will have charge of the inspection [illegible] of steam railroads within the State. It is expected that it will also make inspection of the Interurban Electric line.

Mr. James W. Synan has been named by Governor Foss of Massachusetts to fill the vacancy on the Highway Commission caused by the retirement of Hon. Harold Parker of Lancaster, who was chairman.

Maj. W. W. Crosby, consulting engineer, of Baltimore, was given the degree of doctor of science on June 12 by the Maryland Agricultural College, in recognition of his work for the improvement of the highways of the state.

Mr. Paul Barnard has resigned as supervisor of track of the Chesapeake & Ohio Railway at Richmond, Ind., and will go to accept a position in the engineering department of the Grand Trunk & Pacific Ry. at Port Arthur, Ont.

Mr. Richard H. Dickson has been elected by the County Commissioners as road engineer for Dorchester County, Maryland. Mr. Dixon is a graduate of Maryland Agricultural College and was formerly of the State Geological Survey.

Mr. Sam A. Taylor, Pittsburgh, Pa., has been elected for the ensuing year as president of the American Mining Congress. The other officers are: D. W. Brunton, Denver, Colo., first vice president; E. A. Montgomery, Los Angeles, Calif., second vice president; Carl Scholz, Chicago, Ill., third vice president; James F. Callbreath, Denver, Colo., secretary.

Mr. C. H. Hollingsworth, formerly superintendent and engineer in charge of the construction of the water works tunnels at Buffalo, is now chief engineer and general superintendent of tunnels for the Mexican Light & Power Company at San Lorenzo de Tepeixco, Pueblo, Mexico. Several interesting articles describing tunnel construction which has been carried on under Mr. Hollingsworth's supervision, have been published in Engineering & Contracting.

Mr. Morley Donaldson has been appointed Vice President and General Manager of the Grand Trunk & Pacific lines west of Fort William, with headquarters in Winnepeg. Mr. Donaldson has been for some time superintendent of the Ottawa Division. He was an engineer on the Hoosac Tunnel, Massachusetts, and became chief draughtsman of the Canada Atlantic Ry. in 1881. He was promoted to various positions with the same road until 1905, when he became mechanical superintendent of the Ottawa division of the Grand Trunk.

Mr. E. H. Keating, formerly City Engineer of Toronto and later General Manager of the Toronto Ry. Company, died on June 17. He was a native of Halifax, Nova Scotia. He was engineer of the city of Toronto from 1892 to 1898 and from then until 1904 general manager of the Toronto railway. In 1904 he went to Mexico as managing engineer for the McKenzie-Mann interests, and for the past seven years has been in private practice in Toronto as

Senior partner of the firm of Keating & Breithaupt. He was recently honored by he Institution of Civil Engineers of Great Britain. He was a past president of the Canadian Society of Civil Engineers and a member of the Engineers' Club of Toronto, and the American Society of Civil Engineers.

INDUSTRIAL

Mr. William P. Woodburn has been appointed New England representative of the Standard Cast Iron Pipe & Foundry Co., of Brisol, Pa.

The Pittsburg Testing Laboratory, 7th and Bedford Aves., Pittsburg, Pa., has opened an office at 204 White Bldg., Seattle, Wash. Mr. C. A. Perkins is in charge.

The Gulick-Henderson Co., inspecting engineers, Pittsburg, Pa., have removed their offices, laboratories and test rooms to 525 3d Ave., Pittsburg. The San Francisco office of he company is at 444 Market St.

Mr. J. R. Flynn, Jr., has resigned his posiion as Mechanical Engineer for the Isthmian Canal Commission, and has been elected President of Lines, Flynn & Co., Inc., dealers in railway and contractors' equipment, with office at 50 Church St., New York City.

The George Haiss Mfg. Co., Inc., manufacurers of clam-shell buckets, hoisting engines, and equipments for contractors and coal dealers, will on July 1 open a downtown office in New York City at 50 Church St. The office will be in charge of Mr. A. W. Haiss, Vice-President of the company.

The first international conference and exhibition embracing every phase of fire prevenion, fire protection, and fire fighting, will be held at Madison Square Carden, New York, from Oct. 2 to Oct. 12. Fireproof building construction and all accessories, fire alarm systems, automatic sprinklers and fire extinguishers, motor fire engines, fire escapes and, in fact, every device and manufacture in the fields of fire prevention and extinguishment will be exhibited and demonstrated and in addition an important conference will hold sessions daily providing the first general consideration of the fire question by architects, builders, engineers, insurance men and fire chiefs and fire fighters on the same platform. The Mayors of the principal cities of the United States have already appointed their fire chiefs and commissioners as delegates to attend the conference and exhibition. The committee of this Fire Conference and Exposition includes Thomas J. Ahearn, New York State Fire Marshal; Joseph Johnson, New York City Fire Commissioner; W. E. Waid, representing the American Institute of Architects; Charles H. Cole, Fire Commissioner, Boston, Mass.; Chief Charles E. Swingley of St. Louis, Mo.; Richard H. Johns, President Board of Fire Commissioners, Baltimore Ma.; Charles F. Seyferlich, Chicago Fire Marshal; Chief Edward A. Waters, Philadelphia, Pa.; A. Friedlander, editor "Firemen's Herald"; W. P. Comstock, editor "Architecture and Buildings"; Guy W. Eskridge, editor "Fireproof Digest"; I. G. Hoagland, editor "Insurance Engineering"; C. W. Lansing, editor "Brick & Clay Record"; F. W. Shepperd, editor "Fire and Water Engineering"; Russell F. Whitehead, editor "Architectural Record"; E. Jay Wohlgemuth, editor "Fire Protection"; Henry R. Yates, Fire Chief, Schenectady, N. Y., and Secretary New York State Association of Fire Chief Engineers; John Stephen Sewell, late Major, Engineers, U. S. Army and U. S. Government expert on fire protection; C. A. Palmer, Michigan Fire Marshal and President Fire Marshals' Association of North America; Felicien Michotte, the French fire protection expert and President and Engineer of the Society for the Prevention of Accidents and Fire, Paris, France. The committee also includes a number of other fire chiefs, insurance officials and fire marshals, with A. D. V. Storey, 1269 Broadway, New York City secretary and general manager. Awards will be made for new inventions of value and merit, a campaign of fire prevention education will be waged in the interests of the general public, and the practical work of fire fighting will be shown with life saving exhibitions by firemen with scaling ladders, nets, the life line and similar equipment.

CATALOGUES

Texoderm.—Card, 5½x8 ins., U. S. Metal & Manufacturing Co., McCormick Bldg., Chicago, Ill.

Road Rollers.—Paper, 7½x10½ ins., 4 pp. Austin Manufacturing Co., Chicago.

This catalog illustrates a shipment of 40 motor road rollers sold to three governments.

Link Belt Locomotive Cranes.—Paper, 6x9 ins., 32 pp. Link-Belt Co., 39th St. and Stewart Ave., Chicago, Ill.

This catalog contains illustrations and describes various types of the locomotive cranes manufactured by this company. Cranes are shown operating grab buckets from flat cars and also from their own platforms mounted on standard gage trucks for single and double track. Line drawings giving dimensions and capacities are shown.

Standard Concrete Mixer.—Paper, 6x9 ins., 32 pp. Standard Scale & Supply Co., 1345-7 Wabash Ave., Chicago, Ill.

This bulletin contains illustrations and description of the Standard (formerly the Eclipse) Concrete Mixers. The catalog is well illustrated and shows various methods of installing mixers on construction work to accommodate different situations. A detailed description of the design is given, together with tables of sizes, capacities, weights, etc.

Drainage Excavator.—Paper, 6x9 ins., 16 pp. Austin Drainage Excavator Co., Railway Exchange Bldg., Chicago, Ill.

This catalog illustrates and describes a machine for digging drainage canals. Three types of machines are shown—one type which straddles the ditch and throws the earth to both sides, another type which travels on the berm and throws the dirt to one side, and a wheel machine which is for digging the smaller ditches and operates a belt conveyor which may discharge the dirt to either side.

Steel Water Towers.—Paper, 5½x8½ ins., 52 pp. Des Moines Bridge & Iron Co., Des Moines, Ia.

This catalog illustrates a number of steel tower installations in this country, as well as some foreign installations, and describes the uses to which the various types shown are put. The capacities of cylinders and tank bottoms are given in a table. Other steel products of this company, such as steel derricks, are shown.

Brownhoist Handling Equipment.—Paper, 6x9 ins., 16 pp. The Brown Hoisting Machinery Co., Cleveland, Ohio.

In this pamphlet are illustrated a few of the many types of Brownhoist machinery as applied to the rapid handling of package freight. The cuts shown are typical of the machinery built for economically handling all kinds of goods which have to be transferred from point to point in railroad and steamship terminals.

Austin Excavator.—Paper, 6x9 ins., 8 pp. F. C. Austin Drainage Excavator Co., Railway Exchange Bldg., Chicago, Ill.

This folder illustrates and describes the Austin Drainage Ditch Excavator for small and lateral canals and tile ditches. This machine is provided with convertible boom which handles the excavation to a pile, leaving several feet of berm. The machine is made in three sizes, digging a depth of 5 ft. each, and maximum bottom and top as follows: 24 and 90 ins.; 36 ins. and 36 ins. and 13 ft.

Universal Cement.—Paper, 6x9 i pp. Universal Portland Cement Co., Adams St., Chicago, Ill.

This booklet is published monthly Universal Portland Cement Compan the June issue are artitcles on rein concrete in railway construction an buildings.

Modern Boiler Tubes.—Paper, ins., 40 pp. The National Tube Co., burgh, Pa.

This illustrated catalog contains a of the evolution of the modern boile and some expert opinions on its effic The discussion is illustrated by sta mill tests.

McMyler Cranes.—Paper, 8½x11 The McMyler Co., Cleveland, Ohio.

Bulletin No. 28 on the subject of tionary Hand Power Pillar and Jib C contains illustrations and tables of si these cranes.

Bulletin No. 27 contains illustration descriptions of two line concrete bu

Bulletin No. 26 is a catalog of car d ers, locomotive cranes, ore and handling machinery, orange peel, shell and scraper buckets.

Port Huron Road Rollers.—Paper. x10 ins., 40 pp. Port Huron Engin Thresher Co., Port Huron, Mich.

This catalog illustrates and describe Port Huron rollers and traction eng and shows the parts in detail. Other machinery, such as reversible wag scarifiers, etc., are shown.

Dobbins Core Drill.—Paper, 6x9 ins pp. Manhattan Drilling Co., 25 Broad New York City.

This catalog contains illustrations descriptions of the Dobbins Core Specifications are given with lists of e ment for various types. Reprints of te cal articles describing the work of the chine are also contained in this bookle

Regrinding Valves.—Paper, 5x7¼ ins pp. The National Tube Co., Pittsbu Pa.

This catalog gives illustrations of a v that has a seat, which, after being w can be rendered as good as new by a minutes' work with the aid of a little eme Prices, sizes, etc., are given.

Eureka Mixers.—Paper, 6x9¼ ins., 24 The Eureka Machine Com., Lansing, Mi

This is general catalog No. 30, which lustrates and describes a concrete mi which automatically proportions the ma rials. The illustrations show the constr tion of the machine in detail. Tables given containing instructions for changi the proportions in the operation of mixer. Gasoline engines are also illustrat and described in detail.

Electrical Machinery.—Paper, 10½x8 i General Electric Co., Schenectady, N. Y.

Bulletin No. 4951, 24 pp., is devoted street lighting with Edison Mazda Seri lamps.

Bulletin 4952, 20 pp., is devoted to description of the Series Incandesce Street Lighting System, as furnished this company.

Bulletin No. 4925, 12 pp., is devoted the Combined Unit Mercury Arc Rectifi Outfit. This outfit consists of the co stant current transformer, direct current actance, tube tank and exciting transforme mounted on a common base.

Bulletin No. 4880 4 pp., describes company's Signal Volt-Ammeter, type S- This is used for testing direct current way signal apparatus.

Bulletin No. 4950, 24 pp., describes Washington, Baltimore & Annapolis 1200 volt, direct current railroad which has bee operating for two years.

RAILWAYS, STEAM AND ELECTRIC

Arizona.

e El Paso & Southwestern R. R., H. J. mons, General Manager, El Paso, Tex., immediately construct a branch line from s Springs, Ariz., to Fort Huachuca, Ariz. [illegible] ilt to provide railroad facilities for the post at Fort Huachuca. J. R. Emerson, las, Ariz., is Resident Engineer.

Arkansas.

[illegible] ir of Construction, St. Louis, Mo., is erstood to be contemplating the immediate le tracking of its line from Jonesboro to ge Junction.

California.

[illegible] proposition to E. D. Goode, Glen- resident of the Glendale & Eagle Rock asking him to build an electric line from orner of Broadway and Glendale Ave. easterly to connect with the Eagle Rock at Verdugo Road.

e Santa Fe System is expected to start shortly on the construction of a new ete freight shed 500 ft. long and 40 ft. at Riverside, Cal. The cost of the work timated at $150,000.

e Ocean Shore Railroad, L. H. Landis, Francisco, Cal., General Manager, has ap- to the State Railroad Commission to $700,000 of bonds to provide funds for struction of a 26-mile line from San to Santa Cruz.

icials of the Tidewater & Southern R. R. announced that the new line between kton and Modesto, Cal., will be completed in operation by July 10.

U. Nefziger, promoter of the proposed erville-Woodville R. R., has announced work will be completed about Aug. 1. The country through which this line pass is level, there are no cuts to make, lls to cross and as a result the construc- can be completed in 90 days. Practically he rights of way for the line are in.

Colorado.

e Chief Engineers of the railroads con- ed in the new union station for Denver, are understood to have agreed upon final details of a plan, and it is expected the executive committee will have the started at once. The improvements, h include a subway extending to 17th St., cost in the neighborhood of $1,000,000. bert W. Cowan, Denver, Chief Engineer he Colorado & Southern Ry., is chairman he engineers' committee.

Florida.

he Commercial Association of Pensacola, is considering a project for the estab- nent of a belt railroad. James C. Watson, sacola, is a Director of the Association.

ngineers in charge of the Key West Ex- ion R. R. at Bahia Honda are pushing the struction as rapidly as possible. Resident ineer R. L. Langford has a working party ing a side track 3,000 ft. long. This is a e of work extended across a lagoon, curv- over to West Summerland Key and con- ing with Bahia Honda bridge. At West merland Key there is a camp with one k foreman and thirty men. At Pine chan- work is being pushed along day and night, ding the trestle. At this point the dredge ado, dredge No. 1, and excavator No. 6 working day and night. Two hundred are at work here. The work at Spanish bor, under the direction of Division En- er C. S. Cole, is progressing rapidly. The luct between Spanish Harbor and Pine will be finished the last of August or first September. The force is working 24 hours y day. Up to date they have completed 22 erdams, 15 piers and have eight arches in [illegible] June 4.

Georgia.

The receivers of the Atlanta, Birmingham & Atlantic R. R., Alex Bonnyman, General Manager, Atlanta, Ga., have petitioned the U. S. Circuit Court for permission to issue $5,000,000 of receivers' certificates to be used in improvements along the line of railway.

A meeting of the charter members of the [illegible] at Tipton, Ga., early next month to complete the organization of the company. It is stated that $65,000 of the capital stock of the company has already been subscribed by towns along the projected route.

The Elberton & Eastern Ry. is reported to be planning to make preliminary surveys shortly for a line from Tignall to Lincolnton, Ga., 20 miles. A. W. Wilson, Elberton, Ga., is Chief Engineer.

The Americus, Tifton & Atlantic R. R., chartered last week with a capital stock of $100,000 and principal office at Americus, proposes the construction of a 200-mile line extending from Americus through Oakfield, Doles, Ashburn, Tifton, Nashville and Milltown. The incorporators are: G. R. Ellis and W. M. Crook, Americus; D. J. DuPree, Oakfield; C. J. Champion, Doles; J. S. Shingler and J. L. Evans, Ashburn; H. H. Tift, J. W. Greer and J. W. Myers, Tifton; J. D. Lovett, Nashville, and J. V. Talley, Milltown.

The cities of Thomson, Washington, Lexington and Athens, Ga., are taking action toward securing the construction of the projected line of the Brinson Ry. The line is already completed and in operation as far as Waynesboro. G. M. Brinson, Springfield, Ga., is President and General Superintendent.

Engineers are still at work on the survey for the proposed Atlantic Coast Line R. R. extension from Thomasville to Perry on the proposed Tampa extension. E. B. Pleasants, Wilmington, N. C., is Chief Engineer of the company.

The Central of Georgia Railroad is contemplating the construction of an extension of its line from Andalusia, Ga., to Pensacola, Fla., and it is reported that surveys of the route are well under way. C. K. Lawrence, Savannah, Ga., is Chief Engineer.

Idaho.

Engineers have completed the survey of the proposed line of the Cambridge, Indian Valley & Eastern R. R. from Cambridge, Idaho, to Indian Valley, a distance of about 14.9 miles. The cost of the construction is estimated at about $200,000, including a $9,000 bridge over the Weiser River.

Illinois.

⦿Dickey Construction Co., South Bend, Ind., as noted in our last issue, has the contract for constructing embankment for second main track for the Wabash R. R. from State Line to Newall Station, Ill., 4 miles, and from Tilton to Fairmount, Ill., 11 miles. The contract includes 105,000 cu. yds. earth excavation and a like amount of embankment.

The Chicago, Rock Island & Pacific is reported to have provided $20,000,000 for capital requirements for two years. It will complete this year, it is said, the remaining 70 miles of the Kansas City Short Line, a 53-mile lumber line of Arkansas and Louisiana, construct the proposed bridge at Memphis, Tenn., and build and equip large terminals at Omaha.

Engineers of the St. Louis, Peoria & Milwaukee have surveys well under way for the proposed line. The route has been staked out and all rights of way secured between Peoria and Lacon, Ill. North of Lacon towards Hennepin and the Three-Eye bridge at Depew, where the new line will cross the Illinois River, almost all the right of way has been [illegible] exactly located. This road will enter Peoria on the opposite side of Peoria Lake and its terminals will be near the Tazewell end of the new wagon bridge. J. W. Cherry is the promoter.

It is rumored that the Chicago, Milwaukee & St. Paul Ry. is now contemplating the construction of a third track from Chicago to Savanna, Ill. No definite information has as yet been obtained in regard to the report.

The Relay Passenger Depot Association, East St. Louis, Ill., has announced that a subway will be constructed to eliminate the present grade crossing at the Relay Depot in East St. Louis.

The Chicago, Springfield & Cairo R. R. Co., with principal offices at Chicago, and a capital stock of $10,000, has been incorporated and proposes to construct a line between Chicago, Springfield, and Cairo, through the counties of Cook, Du Page, Will, Kendall, Grundy, Livingston, Woodford, McLean, Tazewell, Logan, Sangamon, Christian, Montgomery, Bond, Clinton, Washington, Perry, Jackson, Union, Pulaski, and Alexander. The incorporators and first Board of Directors are: Delos P. Phelps, M. C. Myers, Jasper T. Darli, Charles G. Fox and W. C. Gregory, all of Chicago, Ill.

The American Public Utilities Co., of Chicago, Ill., has been chartered under the laws of the state of Delaware. The capital stock of the company is $40,000,000, and its announced purpose is to manufacture, sell and distribute natural and artificial gas and by-products; to lay pipe lines, to manufacture chandeliers and globes, to furnish light, heat and power by means of electricity and gas; to construct, maintain and operate railways; to purchase and subscribe for stocks and bonds, and to form companies for doing all kinds of business. The incorporators include Paul A. Neuffer, Harry H. Phillips, Charles J. Horn, Burrell J. Cramer, all of Chicago, and William J. Maloney, of Wilmington, Del.

A special meeting of the stockholders of the Southern Traction Co., 19 North Main St., East St. Louis, Ill., is to be held June 27 to vote on increasing the capital stock of the company by $6,000,000. It is stated that the company intends to extend its lines through Washington, Randolph and Perry Counties and into the City of Duquoin, Ill., and will need the increased capital to build tracks, terminals and switching facilities, as well as rolling stock.

Indiana.

Promotion work is under way for a traction line from Marion to Portland by way of Montpelier and Fiatt. D. E. Bims and A. E. Townsend of Cleveland, O., and C. L. Smith of Montpelier, Ind., are interested.

The Chicago, Gary & Fort Wayne R. R. Co. of Fort Wayne, incorporated last week, proposes to construct and operate an interurban road from Chicago to Fort Wayne, through Columbia City, Warsaw, Plymouth, Laporte, Gary and intervening towns. The directors are A. C. Miller, Aurora, Ill.; F. H. Wood, L. E. Underwood and C. W. Chase, Chicago, and A. A. Miller, Laporte.

The Public Utilities Co., capitalized at $6,000,000, has filed articles of incorporation. This company was organized to take over the merged electric light, gas, heat, street railway and interurban interests in Evansville. It is believed that as a result of the merger the traction lines will be extended. Henry W. Marshall of LaFayette, Ind., representing the Murdock interests, was the chief promoter of the merger. The directors of the newly organized company are the following: J. G. McKee, William Winter, W. J. McGraw, J. D. Cash, J. C. Silverthorn, C. H. Stlittorff, Charles Oswald, Levi Paxson and K. D. Leavitt.

The Vermillion Traction Co. has been incorporated with a capital stock of $25,000 and [illegible] operate an electric interurban from Terre Haute through Clinton, Hillsdale, Dana, Newport, Cayuga and Perrysville to Ridge Farm, Ill. The directors, who are also the incorporators, are J. A. Johnson, J. W. O'Hara, J. A. Davidson, J. L. Bienz and W. O. Dunlavy, all of Indianapolis.

The Crawfordsville-Danville Interurban Association, organized to promote the construction of a traction line from Crawfordsville to Danville, Ill., has been incorporated with a capital stock of $5,000 and headquarters at Kingman. The Association favors a line through territory lying several miles to the south of the Peoria division of the Big Four, which connects the two cities, and proposes to offer a bonus of $2,000 a mile for a line to run through the territory they wish to open, to provide free passage across the Wabash River and to offer other inducements, such as free right of way, franchises, etc. The directors are as follows: Dr. W. T. Gott, Crawfordsville; Charles McCabe, Crawfordsville; Jesse Clore, Alamo; N. R. Myers, Wallace; J. W. Black, Kingman; E. S. Booe, Kingman; G. B. Pavey, Cates; Dr. C. M. Coggins, Coal Creek; H. C. Randolph, Silverwood; G. S. Grondyke, Cayuga; A. M. Boyles, Perrysville; Dennis Clingan, Gessie; Fred Wolters, Rileysburg; A. R. Lynch, Danville, and Frank Knox, Danville.

Iowa.

⦿The Cedar Rapids & Iowa City Ry., J. D. Wardle, Chief Engineer, Cedar Rapids, Ia., has awarded the contract for grading for its interurban line between Cedar Rapids and Mt. Vernon to M. Ford, Cedar Rapids, Ia.

The Colfax Northern Ry. Co., of Colfax, Ia., has been incorporated with a capital stock of $100,000. The incorporators are Thomas W. Griggs, J. C. Dewesese and W. Blakeley.

Articles of incorporation have been filed with the County Recorder, Dubuque, Ia., by the Iowa Northern Ry. Co., with a capital stock of $25,000. The directors of the corporation are S. G. Durant, Dyersville, Ia., president; J. D. Denison, vice president, and George T. Lyon, secretary and treasurer. It is understood to be the plans of the company to construct a line of railroad through Jackson, Dubuque and Clayton counties, the southern terminus being Bellevue. The immediate plans of the corporation are said to be the construction of a line of railroad from Dyersville to New Vienna. The corporation starts out with a capital stock of $25,000, and is to be in existence for 50 years.

Kansas.

The Kansas Central Traction Co., the incorporation of which was mentioned in our May 29 issue, proposes the construction of a 70-mile line from Parsons to Coffeyville, Kan., and Altamont to Columbus, Kan. Surveys have not been made as yet. Philip Strack, Indianapolis, Ind., is President, and W. H. Kutz, Parsons, Kan., is Chief Engineer.

The Atchison, Topeka & Santa Fe Ry., C. F. W. Felt, Chief Engineer, Topeka, Kan., is understood to be preparing plans for the immediate lowering of the Wichita & Western tracks in Wichita.

Petitions are being circulated requesting the City Commission, Hutchinson, Kan., to call a special election to submit to the voters the proposition of granting the Hutchinson & Northern Ry. right of way through the city. The directors of the company are W. S. Thompson, C. O. Hitchcock, L. F. Davis, L. A. Bunker and F. E. Fearl.

The Newton, Kansas & Nebraska R. R. Co., recently incorporated, has completed surveys for its projected line. The capital for construction has been secured and contracts will probably be let in August or September. This company is projecting a 75-mile line, the route taking in Newton, Canton, Roxbury and Abilene. T. H. McManus, Newton, Kan., is President; S. V. Wardell, Newton, Kan., is Chief Engineer, and Roy T. Glass, Canton, Kan., is Secretary.

Louisiana.

A syndicate headed by Charles D. Warren, [illegible] over the franchise for a railway between Gretna and Waggamann, held by Leo Marriro and Robley S. Stearns. The New Orleans & Western Ry. has been chartered to build the line. The Warren syndicate now owns the New Orleans, Fort Jackson & Grand Isle R. R. and the Algiers R. R. It is thought that the Algiers and Waggamann Roads will be joined at Gretna and a long line operated.

It is planned to organize a new company to take up the construction of the proposed new terminals of the Texas & Pacific R. R. at New Orleans, La., mentioned in a previous issue. The total cost of the work will be about $5,000,000. The company has purchased a site including approximately 17 city blocks, having a water frontage, at a cost of $2,000,000.

Michigan.

⦿The Michigan Central R. R. Co. has let the contract to W. E. Tench & Co., 3090 West Grand Blvd., Detroit, Mich., for grading another section of the outer belt line in Detroit, the result of which will be to open up another large western district for manufacturing sites and clear the main line through the Eighteenth ward of freight handling. The latest belt section will extend from the River Rouge station below Oakwood around to a point on the Michigan Central main line, a mile west of the Pere Marquette bridge crossing of the Central and 4 miles east of Dearborn. This will be done by double tracking the Dearborn branch for ¾ mile from the River Rouge, and then building the belt section to the main line. The new belt section will be brought around by the western yards and freight into and out of the yards can be handled without going on the main tracks in or near the city.

Surveyors are working on a route for a new railroad to run from Rudyard to Pickford, Mich. It is believed that it is a Minneapolis, St. Paul & Sault Ste. Marie project.

Mississippi.

⦿J. N. Gillis & Son, Brewton, Ala., are reported to have been awarded a contract by the Mississippi Eastern R. R., R. K. Smith, General Manager, Hattiesburg, Miss., for grading a 20-mile extension into Lauderdale County, Miss.

The Vicksburg Light & Traction Co., of Vicksburg, Miss., has been chartered with a capital stock of $1,000,000, the incorporators being R. L. Dent, J. H. Short and I. D. Landau.

Missouri.

The Stanton & Cave Bluff R. R. Co., incorporated two weeks ago with a capital stock of $100,000, proposes to build a narrow-gage railroad from Stanton, Mo., on the St. Louis & San Francisco R. R., to Cave, Mo., on the Meramec River, and to operate an amusement and summer resort with the cave at Cave, Mo., as the principal attraction. The line will be 4½ miles long. Clearing of the right of way has been started. William H. Bauman of St. Louis is the principal stockholder. The other shareholders are as follows: John P. Boland, St. Louis; George P. Burleigh, St. Louis; Joseph Schmuke, Stanton, Mo.; Theodore Jenny, Stanton, Mo.; L. J. Mattock, St. James; C. A. Rueppele, Stanton; D. N. Gideon, Stanton; Patrick Dunn, Stanton.

Minnesota.

It is rumored that officials of the Minneapolis & St. Louis Railroad recently looked over the property at Minneapolis, Minn., with a view of improving it with large and adequate terminals. It is also believed that work will soon be taken up on an extension of the system from Leola, or some other point in South Dakota, into Canada. R. G. Kenly, Minneapolis, Minn., is Chief Engineer.

Montana.

⦿D. J. Burke, Lewistown, Mont., has been awarded a contract for work on the Dry Creek line of the Milwaukee in Galatin County. The contract calls for the handling of about 150,000 cu. yds. of dirt, and is chiefly steam shovel work.

New Hampshire.

It is rumored that the Boston & M
road has under consideration the dou
ing of the Portsmouth & Dover branc
ing the erection of a new steel br
the river at Dover Point. No official
tion has as yet been obtained in
the report. A. V. Corthell, Bosto
is Chief Engineer.

Directors of the Boston & Maine
are reported to have made the follo
propriations for improvements: $2,2
the new line between Hinsdale, N.
Brattleboro, Vt.; $41,500 for new fre
at Ipswich; $77,000 for extension of
signal system. The contract for t
dale line was let some time ago, as
these columns.

New Jersey.

City officials of Atlantic City, N.
approved an ordinance permitting th
Park Electric Ry., G. F. Toly, Jr.,
Atlantic City, running from West
Drive, Venice Park, to the Shore F
on Marmora Ave., to extend its line
the west side by way of Ohio and
Aves. to a junction with the Central P
Ry. on South Carolina Ave.

New York.

The Utica & Mohawk Valley Ry. Co
N. Y., proposes to lay double tracks
Ilion, through Main St. from the J
Bridge and Mohawk.

The Public Service Commission of t
District of New York City has compl
hearings on the approval of the plans
Jamaica yard improvement of the Long
R. R. These improvements will inv
expense of $3,440,000 and will provide
nection with other main line impro
under the same contract with the city
elimination of 30 grade crossings. J.
age, Jamaica, N. Y., is Chief Engineer
Long Island R. R.

The Jucaro & Moron Ry. Co. has b
corporated with a capital stock of $1
the incorporators being: H. H. Miller,
Wood, H. O. Coughlin, I. F. Curtin
York City; C. A. Clarke, Flatbush, N.
L. Conklin, Long Island, N. Y.

North Carolina.

W. N. Coler & Co., New York Cit
new owners of the Thomasville-Denton
are reported to be planning to put the
first-class condition and to extend it t
south to a point on the Southern R. R

The North Carolina Public Service
Greensboro, N. C., is reported to be pla
the expenditure of $75,000 for rebuildi
street railway at Salisbury, N. C.

Ohio.

The Toledo & Eastern Traction Co. of
ledo, incorporated two weeks ago with a
ital stock of $40,000, proposes to build a
from Curtice to Bono, and is understo
have made the surveys and secured the
of way. The incorporators are R. S. Holb
Wm. S. Holbrook, H. H. Whitney, Jo
Steiner and Arthur J. Barton.

Oklahoma.

The Bartlesville Interurban Ry. Co.,
Curl, President, Bartlesville, Okla., is repo
to have disposed of a $600,000 bond issue,
proceeds of which will be used for buil
the extension from Dewey, the present
minus, to Caney, Kan. It is stated that w
on the extension will be started at an e
date.

It has been announced by Jake L. Ham
Lawton, Okla., President of the Ardm
Duncan & Lawton Railroad, that financial
rangements have been completed and
work will probably be started on the propo
line from Lawton to Ardmore by July
The length of the road will be 100 miles,
a line to Sherman, Tex., is also under con
eration. The company has bonuses amou
ing to $500,000 pledged along the route
these hold good until June 1, 1913.

For the purpose of securing the const

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

[illegible] & Omaha Railroad, the towns of Texa- da, Guymon, Hooker and Carthage, in ern Oklahoma, are arranging to raise a is and provide right-of-way. The road, hartered is to build from Amarillo, Tex., h and east, to Hastings, Neb., and through [illegible] ihoma. At Texhoma the land has been red on the Texas side of the town for inals, right-of-way and depots.

Oregon.

[illegible] the bridges for the line between Oregon [illegible] completed by Sept. 1.

s are now under way for the con- [illegible] W. H. Eccles, Hood River, Ore., is it of the company, and J. W. West, River, Ore., is Chief Engineer.

is reported that surveys are already under for the construction of the proposed [illegible] Ore., through Sandy and Cherryville [illegible]

n is under consideration for the [illegible] Wasco County, to a connection with [illegible] les. It it stated that the surveys have le and the necessary construction cap- ded. Power for the operation of elec- s will be supplied by the Badger Lake Co., a private corporation in interior County, which was formed originally iming about 20,000 acres of agricul- l lands. Volney C. Driver, Wamic, Ore., [illegible]

s have been started for a new railroad etrolius to Prineville. Stanger & Co., St. Louis, Mo., are reported to have to build the line if $100,000 is sub- [illegible]

Pennsylvania.

A. L. Anderson & Bros., Inc., Altoona, will start work at once on their contract the Pennsylvania R. R., mentioned in our issue. This work is located at Howard, and involves about 300,000 cu. yds. of h excavation, including 7 miles of track, about 2,000 cu. yds. of concrete masonry.

nces are before the Councils of Jeffer- nship, Wilson Borough and Clairton ng for a franchise for a proposed street vay to run between Dravosburg and Clair- J. E. White, McKeesport, Pa., is inter- d.

he Philadelphia Rapid Transit Co., 8th Dauphin Sts., Philadelphia, Pa., is under- d to be considering a plan by which it make connections from Darby to 69th St. on. The company at present maintains a t line, running from Darby to Lansdowne, g Wycombe Ave. It would be an easy osition, it is said, to extend this line ugh undeveloped property which would onsiderably enhanced in value and would hrown open for building purposes.

he Delaware, Lackawanna & Western R. is reported to have revised its original s for the cut-off from Clarks Summit to Milford, and has extended the cut from latter place to 1 mile west of Hallstead, ing 6 miles additional. Contracts for the k under the original plan were let some ths ago as noted at the time in these col- s.

he Montgomery County Rapid Transit Co., ristown, Pa., is understood to be about ly to award a contract for the construc- of a car house and repair shop.

he Folsom & Moore Street Ry. Co., char- d last week with a capital of $4,000, is perate a 2/8-mile line in Ridley Township Prospect Park, Delaware County. The tal is $4,000. The project is understood e backed by the Philadelphia Rapid Tran- Co. The line will open up a new territory Delaware County, running from Essington to the powerhouse at Folsom, where it will connect with the transit company's Swarthmore, Media and Darby line and the Darby-Chester cars.

The Pennsylvania R. R. is going ahead with its plans for building a proposed line along the Beaver River through New Brighton. Recent real estate purchases in the later place indicate that the railroad is planning to take up the construction work in the near future.

South Carolina.

The officers of the Greenville, Spartanburg & Anderson Ry. Co., W. S. Lee, Chief Engineer, Charlotte, N. C., are reported to have decided finally on the route to be taken from Greenville to Spartanburg for the new electric line.

The Charleston-Summerville Development Co., of Charleston, S. C., has applied to the Council of that city for a franchise and rights of way through a number of streets for the construction, operation and maintenance of an electric railway. This company was given rights of way through the streets of Summerville by the Town Council of that place and is now acquiring rights of way through the suburban section. The rights of way which are asked are similar to those which the formerly projected Charleston-Summerville Electric Ry. asked for several years ago.

South Dakota.

Engineers of the Illinois Central Railroad have completed surveys for the construction of sidetracks to be built at Sioux Falls, S. Dak.

The Yankton & Southern R. R. Co., projecting a line from Yankton, S. Dak., to Galveston, Tex., has secured the right of way, and has obtained part of the construction capital. Fremont Hill, Astor House, New York City, is President.

Tennessee.

Plans for the reorganization of the Lakeview Traction Co., 177 Union Ave., Memphis, Tenn., have been formulated, and it is believed that the company will be placed on a sound financial basis by Aug. 1. This company is understood to have spent about $400,000 on its line and power plant, and it is believed that about $500,000 more is required to complete one of the branches of the system through the city, which will give an interurban line from Lakeview on the south to Overton Park on the north.

The Clarksville & Dunbar Cave R. R. Co. has been incorporated with a capital stock of $50,000 and proposes to construct and operate an electric railroad from Clarksville to Dunbar's Cave, in the Sixth civil district of Montgomery county. The incorporators are A. C. Murray, Leopold Black, A. R. Gholston, J. T. Cunningham, Jr., and Austin Peay.

Grading work is reported to have been started near Oliver Springs for the Harriman-Morgan R. R., chartered several months ago. Mayor C. E. Hendrick, Harriman, Tenn., is President.

Tennessee.

The Illinois Central R. R., A. S. Baldwin, Chief Engineer, Chicago, Ill., is understood to be planning to call for bids early next month for the construction of new elevated tracks at Memphis, extending from Linden Ave. south to Iowa Ave. The work will require about 500,000 cu. yds. of excavation, and the cost will be $250,000 to $300,000. This work is preliminary to the construction of the new union depot at Main St. and Calhoun Ave. This depot and terminals will represent an expenditure of $2,000,000 to $3,000,000.

Texas.

⦿Karner Bros. & Co., Dallas, Tex., has been awarded the contract for constructing a 17-mile branch for the Frisco from Bloomington. The line will branch off from the Port O'Connor branch of the St. Louis, Brownsville & Mexico.

⦿McSwinney Bros., Lometa, Tex., have been awarded the contract for grading of the 24-mile logging railroad of the Schote Bros. Cedar Co., from Lometan to Bend.

The State Railroad Commission has approved bonds of the Sugarland Ry., W. T. Eldridge, President, Sugarland, Tex., aggregating $193,837 on the value of the completed line between the Ramsey and Harlem State farms. The commission also approved for this road $296,654 in construction bonds for the proposed extension from Cabell Station to Rogers, a distance of 24 miles. At Rogers, the Sugarland road is to connect with the Missouri, Kansas & Texas.

The City Commission of Texas City has passed an ordinance granting to H. B. Moore, W. T. Armstrong, R. M. Orth and Harvey A. Thomas a right-of-way and franchise on all the streets and avenues of Texas City for the operation of a street railway system. The grantees in the franchise, it is understood, represent a Texas City company, and will hold the grant in their own names only until a corporation, which is now in process of organization, is ready to take it over.

The Kansas City, Mexico & Orient Ry., W. W. Colpitts, Chief Engineer, Kansas City, Mo., is understood to be planning to have work started on the extension from Granada, Tex., to Fort Stockton, as soon as the Texas courts approve the issuance of $1,000,000 of receivers' certificates.

The entire right of way for the proposed Bremond & Wootan Wells Interurban is reported to have been secured; a considerable amount of stock is also reported to have been subscribed. M. D. Watson, Wootan Wells, Tex., is interested.

The State Railroad Commission has authorized the Harriman system to issue $1,518,000 first mortgage bonds on the Galveston Victoria division of the Galveston, Harrisburg & San Antonio R. R. This division operates from Galveston to Houston, Rosenberg to Bellville and Port Lavaca to San Antonio. All the money realized from this issue will be put into improvements, relaying with heavier steel, rock ballasting and the purchase of new equipment, such as steel cars, heavier locomotives, etc.

The Stone & Webster Engineering Corp., Boston, Mass., has placed engineers in the field to make preliminary surveys for the proposed interurban line between Beaumont and Port Arthur.

The Indianapolis Construction Co., S. F. Wheaton, General Manager, Indianapolis, Ind., has been awarded a contract by capitalists of Houston, Tex., for organizing, financing and constructing 242 miles of standard gage electric freight and passenger railway connecting Houston and Texarkana. It is stated that H. U. Wallace & Co., 140 S. Dearborn St., Chicago, Ill., will have charge of the engineering work.

Final location work is reported under way for the interurban to be built between El Paso and Yvleta by the Stone & Webster Engineering Corp., of Boston, Mass. The southwestern offices of this company are at Houston.

Officials of the Bartlett & Western Ry. have requested the City of Cameron, Tex., to furnish terminal site and subscribe a bonus of $100,000 for the construction of the line into that place. E. J. Fitzgerald, Bartlett, Tex., is General Manager.

J. M. Allhands, Oklahoma City, Okla., and F. G. Burns, Houston, Texas, contractors on the proposed Frisco extension from Heyser, Tex., to Tivoli have commenced work. It is planned to have work completed by August 10.

Col. Asher Richardson, President and General Manager of the Asherton & Gulf Ry., Asherton, Tex., which is planning the construction of an extension from Asherton to Eagle Pass, has submitted a proposition to the citizens of Carrizo Springs, Tex., offering to build through that town for a bonus of $35,000.

Capitalists who have undertaken the financing of the Enid, Ochiltree & Western Railroad, projecting the construction of a line from Dalhart, Tex., to Ochiltree, have announced that construction work will be started shortly and the road completed to Dumas in time to handle the fall crops. W. T. Taylor, Dalhart, Tex., is Chief Engineer.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

Utah.

Commissioners of Box Elder County, Brigham, have granted a franchise to W. P. Funk of Logan for an electric interurban railroad from Logan to Brigham City.

Virginia.

The Virginia-Carolina Ry. has not as yet completed surveys for its projected 50-mile extension through Washington and Grayson counties, Virginia, and Ashe County, North Carolina. The construction capital has been secured and contracts will probably be let in July. W. E. Mingea, Abingdon, Va., is President, and P. W. Early, Abingdon, Va., is Chief Engineer.

West Virginia.

City Council of Clarksburg, W. Va., and the Baltimore & Ohio R. R. have reached an agreement regarding changes in certain Glen Elk streets in the vicinity of the railroad freight station. The railroad company will expend about $100,000 for these improvements, which will include grading, paving and constructing a retaining wall. F. L. Stuart, Baltimore, Md., is chief engineer.

Wisconsin.

The Eastern Wisconsin Railway & Light Co., Fond du Lac, Wis., is reported to have offered to extend the street car tracks through the west side district of Fond du Lac, provided the city will secure the necessary releases from property owners. It is stated that the company is contemplating the building of an interurban line to Ripon and Green Lake.

Wyoming.

Control of the Cheyenne Electric Ry. Co., of Cheyenne, is understood to have been acquired by the Northern Colorado Power Co., of Denver, Colo., holding company for the Cheyenne Fuel, Power & Light Co. The line probably will be extended to Lake Minnehaha, a summer resort, 2 miles east of the city, including one of the most thickly settled residence portions of Cheyenne.

Canada.

⊙Culliton Bros., 01703 Atlantic St., Spokane, Wash., who have the contract for constructing the Esquimalt & Nanaimo Ry. extension from McBride Junction to Comox, have sublet 3 miles of the work to Chas. McAllister, and 3½ miles to Hanson & Co. The general contract includes 200,000 cu. yds. earth excavation, 50,000 cu. yds. rock excavation, 2,000 cu. yds. concrete masonry, and four timber trestles, involving 1,500,000 ft. of timber. Culliton Bros. expect to sublet all earth, rock and concrete work, and to do the bridging themselves.

⊙Deaks & Hinds, Toronto, Ont., have been awarded a contract for the double tracking of a portion of the Canadian Pacific R. R. between Sudbury and Port Arthur, Ont. The cost of this double tracking will be about $10,000,000.

⊙In addition to the contract mentioned elsewhere in this issue, Culliton Bros., Spokane, Wash., are reported to have been awarded a $2,040,000 contract for the construction of two extensions of the Esquimalt & Nanaimo R. R. The first contract includes a 12-mile line from Clarksville west, estimated to cost $300,000, and the second contract is for the gra
building of a 60-mile extension of th
malt & Nanaimo from McBride Jun
C., to Kootenai, at a cost of $1,740,
line between these points has been
for some time. The firm consists of
T. and J. G. Culliton, all of Spokan
Culliton maintains a branch office
Washington.

The Burrard Inlet Terminal & Br
will call for tenders for the Second
bridge as soon as the sanction of the
Commission is secured. The bridge
the first work undertaken, but the
work by the company and also by t
couver-Westminster & Yukon Ry C
commenced soon after. It is underst
it will take 2½ years to build the
Cleveland & Cameron, Vancouver, B.
the engineers.

The North Shore Railway & Naviga
has been incorporated in New Brunsw
proposes to build a line from a poi
Adamsville, N. B., on the Intercoloni
point near Snowshoe Lake, and from
ville to Richibucto Head, with a bran
Harcourt southwest to the Salmon Ri
other branch lines. The company has
ity to take over the North Shore Ry.,
ing from Adamsville northeast to B
with a branch from Beersville to Mt.
The provisional directors include G. W
ler, Sussex, N. B.; M. F. Keith, Gener
ager North Shore Ry., Moncton, N. B
Carson, Rexton; R. J. Von Hagen,
Smith, New York; J. H. Wood and W
Davis, Philadelphia, Pa.

ROADS, STREETS AND PAVEMENT

Alabama.

✣Bids will be received until noon, July 19, by Board of Coffee County Commissioners, Elba, Ala., for grading, draining and surfacing with sand-clay 5 miles of Enterprise and Damascus road and 5 miles of road from Elba to Dannelly's cross-roads. At same time bids will be received for grading, draining and sand-claying 30 miles of county road. A certified check on state aid work $400. W. S. Keller, State Highway Engineer, Montgomery, Ala.

Arkansas.

⊙The Commissioners of Street Improvement, District No. 195, F. H. Schwartz, Secy., 317 Gazette Bldg., Little Rock, Ark., have awarded the contract to Woodsmall & McCarthy of that city, for the grading and paving of Denison St., from 7th to 14th Sts., with tarvia macadam; also guttering, curbing and the laying of sidewalks at $10,948. Bids were opened June 10.

⊙Rackliffe, Gibson & Dillingham have been awarded the contract by Board of Street Improvement, District No. 186, Little Rock, Ark., Sam. W. Reyburn, Chairman, for grading, draining and paving with wood blocks West 23d St., at $2.13 per sq. yd. The work also includes a 5-in. concrete base. A total of 14 blocks will be paved. W. F. Reichardt is Engineer. Bids were opened March 20. The contract has just been awarded.

⊙Burk Bros., Fort Smith, Ark., have been awarded the contract by the city of Poteau, Okla., for grading, macadamizing, curbing, guttering and draining the following streets and avenues, at $40,998: Dewey Ave., from Frisco right of way to the Kansas City Southern right of way; Clayton Ave., from McKenna St. to Bagwell St.; Parker Ave., from Frisco right of way to Walter St.; Sage Ave., from Walter St. to Bagwell St.; Ward Ave., from Witte St. to Bagwell St.; Bagwell St., from Sage Ave. to Amos Ave.; Walter St., from Dewey Ave. to Amos Ave.: Harper St., from Rogers Ave. to Ward Ave.; Witte St., from Dewey Ave. to Elm Ave.; McKenna St., from Dewey Ave. to Parker Ave. Bids were opened June 10. F. J. Kohr is City Clerk.

Florida.

⊙The Buffalo Steam Roller Co., Buffalo, N. Y., has been awarded the contract by the Board of Duval County Commissioners, Jacksonville, Fla., for furnishing one 7-ton tandem road roller. Gail L. Barnard is County Engineer. Bids were opened May 8. The contract has just been awarded.

Georgia.

⊙The contract for the paving of Marietta St. with wood blocks, from the Tabernacle to North Ave., has been awarded by the City Council of Atlanta, Ga., to T. D. Meador, Jr., of that city, at $2.74 per sq. yd

Plans are being completed by J. B. McCrary & Co., of Atlanta, Ga., for the construction of 50,000 sq. yds. of macadam pavement in Newnan, Ga., at an estimated cost of $75,000. The work will include clay foundation and concrete curb. The work will be done on a percentage basis. E. G. Cole is official in charge.

Colorado.

Property owners have petitioned the City Council of Boulder, Colo., to pave 40 blocks in the heart of the city.

Idaho.

⊙The City Council of Pocatello, Ida., has awarded the contract for the paving of 20 blocks in the business section with bitulithic, to Strange & Maguire Co., of Salt Lake City, Utah, at $86,636 on guaranteed paving. Other bidders on the work were: Wiles Construction Co., $89,890 and $88,257; James Kennedy Construction Co., $90,117 and $87,504; Warren Construction Co., $91,712 and $88,773, and R. M. Bardsen & Co., $96,591 and $93,325.

The citizens of Weiser, Ida., at a recent election voted the issuance of bonds for a considerable amount of improvements, included in which will be the paving of 17 blocks of the business section at an estimated cost of $75,000, and 15 miles of concrete sidewalks and curbing at an estimated cost of $150,000. R. J. Wood of the Weiser Engineering Co., is City Engineer. J. B. C
of Boise and J. W. Bailey of Baker ar
culting Engineers.

Illinois.

✣Bids will be received until 7 p. m
27, by the Board of Local Improve
Mayor W. H. Malone, President, Park
Ill., on three contracts for constructing
minous macadam. The contracts call
832 cu. yds. earth excavation and gr
456 cu. yds. earth filling and grading an
963 sq. yds. of macadam having a founda
ins. thick at the center and 5 ins. thick
sides of coarse broken limestone, bonded
stone screenings and covered with a cour
macadam broken limestone 3 ins. at the
ter and 2 ins. at the sides, the interti
which are filled with ½-in. granite chip
which is bonded with asphaltic cement.
top dressing is ½ in. thick of ½-in. gr
chips, bonded by asphaltic cement. Spec
tions are with W. H. Malone, Room
N. La Salle St., Chicago, Ill., or with W
Dewey, Park Ridge, Ill. F. R. Pfeifer is
gineer.

✣Bids will be received by the Boar
Local Improvements, Chicago, Ill., F
Glackin, Secretary, until 11 a. m., July
constructing pavements as follows: C
Av., 1,513 sq. yds. asphalt; Cornelia Av.,
sq. yds. asphalt; Fuller St., 4,900 sq. yds.
phalt; 43d St., 9,570 sq. yds. granite bl
Jefferson Av., 2,030 sq. yds. asphalt; Mar
field Av., 3,750 sq. yds. asphalt; Milwau
Av., 19,000 sq. yds. creosoted wood
Pearson St., 5,000 sq. yds. asphalt; Sangam
St., 5,100 sq. yds. creosoted wood block; T
man Av., 3,720 sq. yds. asphalt; Talman
8,600 sq. yds. asphalt; Walton Pl., 4,400
yds. asphalt; Houston Av., 6,280 sq. yds. bric
alley Pine Grove Av., Evanston Av., etc.,
sq. yds. brick; alley Belmont Av., Clifton
950 sq. yds. brick; alley Francis St., Sac
mento Av., etc.; alley Harrison St., Clark
etc., 1,100 sq. yds. granite block; Tooker
650 sq. yds. brick; alley Belmont Av., Raci
Ave., etc., 950 sq. yds. brick; alley Roscoe
Seminary Av., etc., 1,080 sq. yds. brick; all
Wellington St., Barry Av., etc., 1,040 sq. yd

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

k; alley Wellington St., Seminary Av., 1,120 sq. yds. brick; alley Wellington St., ood St., etc., 1,130 sq. yds. brick; 91st St., 60 sq. yds. brick. The work includes con- ction of manholes, catchbasins, adjust- it, etc., combined curb and gutter, 6-in. tland cement concrete foundation, etc. h or certified check for 10 per cent of bid t accompany proposal.

Bids will be received by the village of ll, Ill., until July 1, for furnishing labor, erials, etc., necessary to construct sewers pavements in the following streets: Ver- ion Av., Hamilton St., Wolf St., Waupon- St., Front St., etc. Quantities as enumer- on proposal sheet are as follows: 3,250 yds. earth excavatiuon, 1,365 lin. ft. 15-in. pipe, joints filled with Portland cement [illegible] including iron covers, 21 catchbasins cover, 6,600 lin. ft. Portland cement ncrete curb, 550 lin. ft. 4-in. by 24-in. r curb for headers, 12,800 sq. yds [illegible] ins. Portland cement con- [illegible] 17 N La Salle St., Chicago, or village k Official advertisement will be found where in this issue.

will be received until 1 p. m., July ard of Highway Commissioners, Mon- ownship, Piatt County, Ill., for the tion of 5,592 sq. yds. of vitrified brick t with necessary curb and gutter and culverts. Plans and specifications are with William Britton, Clerk, Monti- , or W. J. Day, Engineer, Bement. al advertisement will be found else- this issue.

s will be received until 11 a. m., June y of Moline, Ill., for the construction sq. yds. of brick pavement, 8,390 lin. ncrete curb. Lyle Payton is City

acts for paving alleys were awarded s on June 19 by the Board of Local nents, Chicago, Ill., Ed. J. Glackin, , Marble Pl., Adams St., etc., granite tal bid $1,151, Jno Dillon, 179 W. ton St. North Av., Cleveland Av., k, $2,906, P. J. O'Brien, 9 S. La Salle Vincennes Av., 50th St., brick, $1,673, McGarry, 189 W. Madison St. Cottage e Av., 64th St., etc., brick, The Ryan Co., Bldg. Addison St., Rokeby St., etc., $2,695, P. J. O'Brien. 53d St., Monroe k, $2,548, J. A. Sackley Co., 133 W. gton St. Wellington St., Pine Grove etc., brick, $2,423, Central Paving Co., W. Washington St. Taylor St., Johnson etc., brick, $3,730, Central Paving Co. or St., Blue Island Av., brick, P. J. ien. Polk St., Morgan St., etc., brick, 7, Central Paving Co.

[illegible] awarded the contract by the Board of Improvements, Shelbyville, Ill., for the truction of 25 blocks of brick pavement on n. concrete base, with asphaltic filler, con- [illegible] curb reset. The contract price is $55,- Bids were opened June 14 by A. L. is, Secretary. Contract will be closed 28.

ansen & Zoeller of Pekin, Ill., have been ded the contract by the Board of Local ovements of that city, J. R. Seibert, City neer, for the construction of a brick ment on a concrete base with cement at $1.65 per sq. yd. The work includes t 28,580 sq. yds. of brick paving, 3,425 lin. f stone curb reset, 9,100 cu. yds. of ex- tion and filling. The entire contract will int to about $60,000. Bids were opened 18.

e citizens of Douglas Township, Effing- County, Ill., on June 19 voted the is- ce of bonds in the sum of $35,000, for purpose of constructing 9 miles of macadam roads on the principal highways of the township. The roads will be built by contract as soon as bids can be secured. Effingham is the county seat of Effingham County.

The Board of Local Improvements of Moline, Ill., Lyle Payton, City Engineer, has rejected all bids received June 14 for the paving of 23d Ave., from 15th to 27th St., as being above the Engineer's estimate.

Indiana.

⦿The County Commissioners at Terre Haute, Ind., have awarded the contract for building the Ed B. Ferguson gravel road in Honey Creek Township, to Harry B. Carpenter of Cloverland, at $8,700. The road is two miles and 4,635 ft. long.

⦿J. D. Hoss of Indianapolis, Ind., has been awarded the contract by the Board of Park Commissioners, Indianapolis, for the construction of cement sidewalks and concrete curb and gutter along property of the city at following points: Along Fall Creek parkway, north drive, at intersection with Capital Ave.; along Fall Creek parkway, north drive, at intersection with Illinois St., and along Fall Creek parkway, south drive, at intersection with Meridian St. The curb and gutter will cost $0.80 per lin. ft., sidewalks, $0.16 per sq. ft. Bids were opened June 7.

⦿Kuthley & Standish of Bedford, Ind., have been awarded the contract by the Board of Lawrence County Commissioners, Bedford, for the construction of gravel or macadamize! roads in Marion, Shawswick, Guthrie and Perry Townships, six roads in all. Bids were opened June 4 by Ezra W. Edwards, County Auditor.

⦿Henry Harmon of Osgood, Ind., has been awarded the contract by the Board of Town Trustees, Osgood, for the construction of cement sidewalks on Maple, Craven and Franklin Sts., at $0.12¾ per sq. ft. Bids were opened June 7 by J. E. Ebel, Town Clerk.

⦿Greenwood, Connor, Boots & Grant of Connersville, Ind., have been awarded the contract by the City Council of that city, William Reeder, City Clerk, for the paving of Central, Eastern and Grant Avs., with concrete at $1.02 per sq. yd., including curb and gutter at $0.34 per lin. ft., sidewalks at $0.09½ per sq. yd., and sewers. Bids were opened June 12.

The Board of Jay County Commissioners, Portland, Ind., John Bonifas, Auditor, has not as yet let the contract for the construction of a highway in Pike Township, for which bids were opened on June 15.

Iowa.

✣Bids will be received, it is reported, until July 8, by L. Derby, City Clerk, Marshalltown, Ia., for the construction of 7 blocks of concrete pavement. The work is to be started Aug. 1 and completed by Nov. 1.

✣Bids will be received until July 8 (readvertisement), by city of Waverly, Ia., for the construction of 34,000 sq. yds. of pavement and 16,000 lin. ft. of curb. The paving will be bitulithic, sarcolithic mineral rubber, Portland cement concrete, asphaltic concrete, brick block and dolarway, the particular kind to be chosen at the time of letting the contract. Plans and specifications for all this work may be procured from F. A. Lee, City Clerk of Waverly, Ia., and Ralph B. Slippy, Civil Engineer of Waterloo, Ia.

⦿D. W. Wright & Co., of Bedford, Ia., have been awarded the contract by the city of Greenfield, Ia., M. C. McCreight, Town Clerk, for the construction of 10 blocks of paving, at $1.24 per sq. yd. for concrete and $0.25 per ft. for curb. The work will include about 10,000 sq. yds. Bids were opened June 11.

⦿James Horrabin of Iowa City, Ia., has been awarded the contract by the City Council of Des Moines, Ia., Horace Susong, City Clerk, for the construction of 37,000 sq. yds. of bitulithic on Ingersoll Ave., 28th to 38th Sts., 17,000 yds.; Tonawanda drive, Marsh drive to Grand Ave., 9,000 yds.; Polk Blvd., Ingersoll Ave. to Pleasant St., 7,000 yds., and 43d St., University Ave. to Forest Ave., 3,900 yds. The work was let at $1.95 per sq. yd. Bids were opened June 12.

The City Council of Ottumwa, Ia., has passed an ordinance providing for the paving of E. Main St., between Ash St. and Iowa Ave., and Iowa Ave. between Main and Hayne Sts. Bids will be received at once.

The City Council of Glenwood, Ia., has concluded that the new paving that is to be laid in that city this year will be brick. Approximately $10,000 will be expended on the work.

The Town Council of Clear Lake, Ia., has ordered the paving of 18 blocks of city streets this summer with concrete. All intersecting alleys will be paved.

Kansas.

✣Bids will be received until July 8, by City of Marion, Kan., for the construction of about seven blocks of brick, asphalt, asphaltic concrete or concrete pavement, including curbs and gutters. H. A. Rowland, McPherson, Kan., is Engineer and Mildred Williams is City Clerk.

✣Bids will be received until 8 p. m., July 10, by O. T. Jones, City Clerk, Pittsburg, Kan., for furnishing the necessary labor and material for the construction of brick and concrete pavement. Plans and specifications are on file with the City Clerk. L. E. Curfman is City Engineer. Official advertisement will be found elsewhere in this issue.

⦿Carper & Carr, 125 E. Main St., Anthony, Kans., have been awarded the contract by that city, E. R. Kirkpatric, City Clerk, for the construction of curb and gutter on certain parts of N. and S. Jennings and N. Anthony Ave., at $7,500. Bids were opened June 8.

⦿City Commissioners of Leavenworth, Kan., have awarded the contract on paving Kickapoo St. to McGuire & Stanton, Leavenworth, at $9,253.

Thomas F. Jones of Leavenworth, Kans., is the probable contractor for the construction of sidewalks, curbs, gutters, etc., at Fort Leavenworth, for which bids were opened by Maj. G. G. Bailey, Constructing Quartermaster, on June 12. The bid is $5,774.

Plans and specifications have been submitted to the City Commissioners of Leavenworth, Kan., by the City Engineer, for paving Cherokee St., from Grand Ave. to 11th St. The estimated cost is $2,658.05.

Kentucky.

✣Bids will be received, it is said, from July 15 until July 25, by city of Pikeville, Ky., for the construction of 15,000 sq. yds. of vitrified brick paving on concrete base. Aurick & Haynes, Pikeville, are Engineers.

Louisiana.

⦿City of Jeanerette, La., has awarded the contract for building six miles of concrete sidewalks to De Geizey & Barnard, at $16,500.

The city of Lake Charles, La., upon the recommendation of City Engineer T. H. Mandell, rejected all bids received June 4 for street paving. Bids received were as follows: Creosoted Wood Block Paving Co., [illegible] the Southern Asphalt & Construction Co., $2.29 and $2.38 on asphalt, and $2.49 on bitulithic. The work will be re-advertised shortly. Plans and specifications are on file with the city engineer.

Maryland.

✣Bids will be received until 8 p. m., June 29, by Mayor Martin M. Higgins and Council, Easton, Md., for furnishing the necessary labor and material for the complete construction of about 9,500 ft. of concrete curb and gutter.

✣Bids will be received until June 26, by Board of Awards, Baltimore, Md., for the following contracts: Contract No. 29—Fayette St., from Poppleton to Pine Sts.; Lexington St., from Aisquith St. to Central Ave., vitrified block, 5,300 sq. yds.; certified check, $600. Contract No. 30—Balderson St., from Light to Charles Sts.; Perry St., from Bedford to Charles Sts., granite block, 1,170 sq. yds.; certified check, $300. Contract No. 31—Linden Ave., from Dolphin St. to North Ave.; Bolton St., from Lafayette Ave. to North Ave.; Park Ave., from Lanvale St. to Lafayette Ave.; sheet asphalt on a concrete base, 13,650 sq. yds.; sheet asphalt over cobble, 9,100 sq. yds.; vitrified block, 5,150 sq. yds.; wood block liners, 1,115 sq. yds.; certified check, $2,000. The figures above represent the approximate quantities of the principal items appearing in the contracts. Charles A. Edel is Secretary of the Paving Commission.

⊙The Board of Awards of Baltimore, Md., on June 19 awarded the following contract upon the recommendation of the Paving Commission, Charles A. Edel, Secretary: Vitrified Block Contract No. 21—Martin J. Beach, 801 American Bldg., Baltimore, approximate bid, $8,069; Vitrified Block Contract No. 22—Martin J. Beach, approximate bid, $7,436; Vitrified Block Contract No. 23—Martin J. Beach, approximate bid, $5,353.

⊙The David M. Andrews Paving Co., Baltimore, Md., has been awarded the contract by the Board of Awards of that city, for the paving with Belgian block that portion of the new thoroughfare between Bath and Hillen Sts., at $74,000.

Massachusetts.

✣Bids will be received until noon, June 27, by Commissioner of Public Works H. E. Blaks, North Adams, Mass., for about 9,600 sq. yds. of brick paving and about 1,800 sq. yds. of concrete paving. Each bid must be accompanied by a certified check for 50 per cent amount of bid. Plans and specifications are on file with the Commissioner.

⊙The Board of Supervisors of Springfield, Mass., has awarded the contract for supplying the city with 12,800 cu. yds. of wood block paving to the United Wood Preserving Co. The block is to be laid on Willow, Sanford, Court, Chestnut and a number of other streets.

⊙The Department of Public Works of Boston, Mass., has awarded the contract for paving and regulating Park St., between Dorchester and Geneva Avs., for which bids were opened June 14, to Hugh J. McGuire, at $1,834.

⊙John A. Gaffey of Medford, Mass., has been awarded the contract by the Highway Department of New Hampshire, S. Percy Hooker, Supt., for the construction of a 2½ mile macadam road in Rochester, at $16,274, and for building one mile of trap rock road in Bow, at $3,985. The department also let a contract to Will Gordon of Franklin, N. H., for the building of 1 2-3 miles of macadam road in Tilton, at $7,559. Bids were opened June 14. S. Percy Hooker, Concord, N. H., is State Supt. of Highways.

Following bids were received by the Constructing Quartermaster, Fort Andrews, Mass., for the construction of roads, walks, etc., at that fort; bids opened June 10: T. Whalen & Co., Wollaston, Mass., $4,900; E. M. Doyle & Co., Boston, $5,975, and Tony Ross, Woburn, Mass., $9,991.

Minnesota.

The Winona County Commissioners, Winona, Minn., rejected all bids received June 18 for the macadamizing of about 21 miles of road. New bids for concrete roads will be called for later. O. B. Leland is Engineer. Jos. Winczewski is County Auditor.

Following bids were received by the village of Chisholm, Minn., F. C. Lang, Engineer, on June 12, for the construction of about 12,950 sq. yds. of paving: R. S. Blome Co., Chicago, Ill., granitoid, $2.27 per sq. yd.; Butler & Coons, Hibbing and Virginia, Minn., sandstone, $3.05, 3-in. creosoted blocks, $2.52, and 3½-in. blocks, $2.72; General Construction Co., Minneapolis, bitulithic, $2.47, sandstone, $3.12, 3-in. blocks, $2.50, and 3½-in. blocks, $2.69; P. J. McDonald, Duluth, Minn., donnelite, $2.30, 3-in. blocks, $2.50, 3½-in. blocks, $2.50, and brick, $2.40. The letting of contract was postponed until June 26.

Mississippi.

✣Bids will be received until July 5, at the Court House, Hernando County, F. R. Merrin, Secy., for grading the Jermiah Lodge road and the Church road a distance of 14 miles. A certified check for $500 must be filed with each bid. The work will consist principally of cutting down hills and widening the roadway, and some levee work.

✣Bids will be received until 2 p. m., July 2, by the First District Good Roads Commission, at the office of the Chancery Clerk, Aberdeen, Miss., for the grading and graveling of about 12 miles of roads, consisting of approximately 36,000 cu. yds. earth, 24,000 cu. yds. gravel, 800 ft. of bridge work, 300 cu. yds. concrete, 364 ft. 18-in. pipe, 370 ft. 24-in. pipe, 80 ft. 30-in. pipe and 68 ft. 36-in. pipe. Profiles and specifications can be seen in the office of the Good Roads Commission, Amery, Miss., or at the Chancery Clerk's office, Aberdeen, Miss., or at the office of Solomon-Norcross Co., Engineers, Atlanta, Ga. A certified check of 3 per cent of the amount of bid, made payable to the First District Good Roads Commission of Monroe County, Mississippi, will be required with each bid. Said proposals to be addressed to A. B. Cowden, Secretary of the First District Good Roads Commission, Armory, Miss.

✣Bids will be received until noon, July 1, by Highway Commissioners, Supervisors' District No. 1, H. Cassedy, Chairman, Lincoln County, Brookhaven, Miss., for the improvement and extension of 29 miles of roads and streets.

✣Bids will be received until noon, July 2, by Mayor and Board of Aldermen, Greenwood, Miss., for furnishing the necessary labor and material for the construction of 25,000 sq. yds. of vitrified brick, bitulithic or creosoted wood block pavement; 10,500 lin. ft. of concrete curb and gutter; 2,000 lin. ft. of granite header; 2,000 cu. yds. of excavation.. J. S. Allen is City Engineer.

⊙R. W. Gill has been awarded the contract by the Second District Road Commission, Frank R. Merrin, Secretary, Horn Lake, Miss., for the grading of the Fogg road, at $0.20 per cu. yd. The Commission also awarded the contract for the grading of the Lakeville-Goodman road to R. W. Gill and R. E. Scott at $0.22 per cu. yd. Both contracts include about 55,000 cu. yds. of excavation and covers about 14 miles of road. Bids were opened June 6.

The citizens of Meridian, Miss., on June 11 voted against the issuance of bonds in the sum of $100,000 for street improvement to connect the city paving with the county good roads; also a bond issue of $30,000 for the purpose of building approaches and paying damages for a viaduct to the South Side.

Missouri.

✣Bids will be received until noon, June 28, by Board of Public Improvements, St. Louis, Mo., for the improvement of the following streets: Reconstructing 23d St., from Washington Ave. to O'Fallon St., under Letting No. 10589; for improving Osceola St., between Broadway and Virginia Ave., under Letting No. 10590; for reconstructing 13th St., from Biddle St. to Cass Ave., under Letting No. 10591. W. T. Findly is Secretary.

The Board of Public Works of St. Louis, Mo., has rejected all bids received for asphalt paving on June 12 and orders issued for re-advertising for bids. The job called for the paving of Osceola St., between Broadway and Virginia Ave., and N. Market St., between Goodfellow and Hamilton Aves.

Montana.

No bids were received by J. E. Farnum, City Clerk, Miles City, Mont., on June 10, for furnishing f. o. b., Miles City, 7,000 vitrified paving brick.

Nebraska.

✣Bids will be received until 5 p. m., July 1, by John Wiltse City Clerk, Falls City, Nebr., for furnishing the material and d labor and material for grading, curb paving District No. 2 and 3. The w include the following approximate qu Approximate number of sq. yds. to b in District No. 2, 7,500; approximate of sq. yds. to be paved in District N 500; approximate number of ft. of in District No. 2, 1,000; approximate of ft. of curbing in District No. 3, 2 timated cost of grading and paving either district, $2.15 per sq. yd; estimated curbing, 35c per lin. ft.

✣Bids will be received until 6 p .m. by Village of Barada, Nebr., B. C. D Chairman, Village Board, for furnis necessary labor and material for t struction of cement sidewalks and c for the year of 1912.

⊙J. C. Ries & Co., of Havelock, Ne been awarded the contract by that Charles A. Currie, City Clerk, for t struction of 10,000 sq. ft. of cement si and on 30, more or less, concrete stree ings, at $0.10 and $0.17, respectivel were opened June 7.

⊙The Midwest Engineering Co., 3 Cague Bldg., Omaha, Nebr., on June cured a contract from the city of H Nebr., for the construction of Pu brick pavement on Burlington Ave., per sq. yd.

New Hampshire.

✣Bids will be received until June State Highway Department, Concord, for the improvement of a gravel road ada, estimated to cost about $2,500; a a trap rock road in Bedford, estim cost $1,500. S. P. Hooker is State intendent of Highways.

New Jersey.

⊙The Board of Street & Water C sioners, Jersey City, N. J., has awar following contracts for the improven Bostwick Ave., from Bergen Ave. to son Ave., bids opened June 5: Van & Son, 90 per cent; E. M. Mullin & per cent; Henry Byrne, 99 per cent; E O'Neill, 95 per cent, and Daniel Dono per cent.

⊙O'Reilly Bros., 90 Neptune Ave., City, N. J., have been awarded the c by the Board of Street & Water C sioners, Jersey City, for the improvem Randolph Ave., from Bramhall Ave. to ark & N. Y. R. R., at 96 per cent. Bids opened June 5.

⊙The Union County Board of Free Elizabeth, N. J., has awarded the f contracts for road work, aggregating 903; C. A. Winans & Co., Rahway, N paving Rahway Ave. to the Linden ship line, $23,286; also for paving W Ave., $38,582; William J. McCloud Elizabeth, for paving Newark Ave city line, $63,915; E. C. Humphrey, sack, N. J., for paving South Ave. field, $18,120.

⊙The Barrett Mfg. Co., New York C been awarded the contract by the T Committee, Millburn, N. J., Milton R. S Clerk, for the oiling of a number of r the township. Bids were opened June 14

⊙James C. Park of Cranford, N. J., has awarded the contract by the City Cou Westfield, N. J., for the grading, mac izing, curbing and guttering of certain st at $17,249. The engineer's estimate of amount of work to be done is as 7,000 cu. yds. of excavation, 10,820 of macadam, 3,650 sq. yds. of macadam faced, 1,332 lin. ft. of concrete curb, 900 ft. of concrete curb and gutter, 800 lin. f blue stone curb reset on concrete, 2,275 ft. of new blue stone curb set on con 3,075 lin. ft. of vitrified brick gutter on crete base, 1,600 lin. ft. of 6-in. underdr 355 lin. ft. of concrete culverts. Bids opened June 17.

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

New York.

✣[illegible] Park Commissioners, Room 13, City Hall, ffalo, N. Y., for constructing concrete [illegible] tions on file at the office of the board. G. Selkirk is Secretary.

✣Bids will be received until 11 a. m., July [illegible] erk, Chappaqua, N. Y., for the permanent [illegible] Douglas Road, Cross Road and Hard- [illegible] iles. Work to consist in grading, widen- g, building culverts, drains and guard rails, [illegible] rnishing all materials, labor and appliances refor. All such work to be done in strict ance with the plans, drawings, profiles, sections and specifications therefor, to ue intent and meaning thereof, as pre- by the Wulff Engineering Co., National [illegible]

✣Bids will be received until 2 p. m., July by Commissioners of Palisades Interstate [illegible] m St., New York City, for the construc- f the Englewood Approach in the Pal- Interstate Park at Englewood Cliffs, n County, N. Y. A certified check for must be filed with each bid. Plans are with W. G. Clark, Engineer, 30 Church ew York City.

Henry P. Burgard Co., of Buffalo, N. bmitted the lowest bids to the Depart- ent of Public Works of that city, Francis [illegible] Zenner and Pauline Sts., with asphalt, as s: May St., Specifications "B" on con- ase, $11,700; Pauline St., Specifications n concrete base, $7,800; Zenner St., Spe- ions "B" on concrete base, $10,100.

Common Council of Syracuse, N. Y., lopted an ordinance authorizing a bond f $100,000, the proceeds to be used by racuse Park Commission for park bet- [illegible]

Common Council of Jamestown, N. Y., oted to pave Prendergast Ave. with [illegible]

citzens of Watkins, N. Y., at a recent n voted the issuance of bonds for pav- urposes.

ial village election was held at Mechan- e, N. Y., on June 19, to vote on propo- s for raising $46,241 by bonding the vil- for making street improvements.

North Carolina.

✣[illegible] by Murphy Township Highway Commis- ion, Murphy, N. C., for the construction of pproximately 22,000 sq. yds. of bituminous treet paving on the various streets of the wn of Murphy. G. W. Scott, Court House ldg., is Engineer.

Ohio.

✣Bids will be received until noon, July 8, y Samuel Franks, Jr., Clerk, Millersburg, O., or paving E. Jackson St., S. Washington St. nd S. Monroe St., about 16,300 sq. yds.

✣Bids will be received until noon, June 7, by Director of Public Service, Cleveland,)., for paving the portion of the following treets affected by the separation of grades f said streets and the tracks of the Penn- ylvania R. R.: St. Clair Ave., N. E.; Su- erior Ave., N. E.; Payne Ave., N. E.; East 0th St., and Hough Ave., N. E. Plans and pecifications are on file at the office of the ity Engineer. W. H. Kirby is Secretary.

✣Bids will be received until noon, July 1, y J. W. Chrisford, Director of Public Serv- ce, Lakewood, O., for furnishing the neces- ary labor and material for grading, draining, urbing and paving with brick Quail St., Vayne Ave., Roycroft Ave. and Edanola Ave. Plans and specifications are on file with C. V. Root, 1033 Society for Savings Bldg., Cleveland, O. A certified check for $200 must e filed with each bid.

[illegible]

⊙At an Executive Session of the State Commission of Highways, Albany, N. Y., held June [illegible] the [illegible] of Highways, for which proposals were received on June 3rd, 4th, 5th, 6th, 7th, were awarded as follows:

[illegible]	[illegible] age.	[illegible]	Awarded to.	[illegible]
[illegible]	6.10	Allegany, Friendship-Bolivar, Part 1	[illegible]	$ 64,147
[illegible]	6.02	[illegible]	Lane Cons. Co., Meriden, Conn.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5.97	[illegible]	Lake Shore Cons. Co., Dunkirk	[illegible]
[illegible]	0.77	[illegible]	Thos Fitzgerald Co., Fredonia	27,476
[illegible]	[illegible]	[illegible]	Erie Cont. Co., Buffalo, N. Y.	[illegible]
[illegible]	1.21	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	McNerny Cons. Co., Canton, Pa.	17,96
[illegible]		[illegible]	[illegible]	38,38
[illegible]	3.77	[illegible]	[illegible]	[illegible]
[illegible]	1.11	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	Spellman-Oliver Co., Chateaugay.	[illegible]
		Greene, Cairo-Windham, Part 1	Catskill Cons. Co., Catskill	
5268	[illegible]	[illegible]	Herlihy Contg. Co., Glens Falls	100,72
[illegible]	[illegible]	[illegible]	Jos. Walker, Albany.	53,83
5301	[illegible]	[illegible]	[illegible]	[illegible]
844		[illegible]	[illegible]	13,25
[illegible]	[illegible]	[illegible]	Erie Contg. Co., Buffalo	83,656
[illegible]	15	[illegible]		
		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	62,033
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
961	[illegible]	[illegible]	Kennedy Cons. Co., Albany, N. Y.	2,645
[illegible]		Oswego, Sterling-Oswego, Part	[illegible]	30,187
[illegible]	3.09	Oswego, Fulton City-West First Street	Joseph H. Connors, Fulton, N. Y.	[illegible]
5196	0.67	Rensselaer, DeFreestville-South	Arnold & Shearer, Albany, N. Y.	[illegible]
	14.92	St. Lawrence, Potsdam-Nicholville	Spellman-Oliver Co., Chateaugay	158,947
1029	[illegible]	Schenectady, Central Bridge-Quaker St.	Ruddy & Saunders Cons. Co., Troy.	38,316
[illegible]	3.10	[illegible]	[illegible]	33,07
5291	1.75	Yates, Penn Yan Village	John Johnson Cons. Co., Buffalo	77,89
[illegible]	0.43	[illegible]	[illegible]	[illegible]
965	9.90	Allegany, Obi-Cuba	Ed. T. Beck & Co., Warren, Pa.	104,67
[illegible]	3.11	Broome, Binghamton-Windsor, Part 4	W. E. Bennett, Lanesboro, Pa.	27,40
827	6.71	Columbia, Chatham Center-Rider Mills	L. L. Melius, New York City	73,16
5263	5.51	Chautauqua, DeWittville-Mayville	Mahoney & Swanson Jamestown	[illegible]
[illegible]	6.74	Cattaraugus, Little Val.-Randolph Pt. 3	Dunkirk Cons. Co., Dunkirk, N. Y.	[illegible]
[illegible]	2.61	Erie, Lackawanna City-South	Thos. Fitzgerald, Fredonia	[illegible]
2-R-2	1.86	[illegible]	[illegible]	[illegible]
5198	4.62	[illegible]	[illegible]	[illegible]
997	6.13	Greene, Hunter-Jewett Center	Thos. H. Gill Co., Binghamton	[illegible]
1025	7.82	[illegible]	[illegible]	[illegible]
759	2.15	Niagara, Olcott-Lockport, Part 2	[illegible]	[illegible]
5306	6.82	[illegible]	Service & Mackey, Youngstown	149,99
671	4.31	Onondaga, Baldwinsville-Cold Spring.	[illegible]	[illegible]
5297	[illegible]	Orange, Oxford-Chester	Schunnemunk Cons. Co., Highland Mills	[illegible]
5275	8.15	[illegible]	P. H. Murray, Rochester	[illegible]
5276	6.17	Oswego, Fulton-3 Rivers, Part 2	Conroy & Nixdorf, Oneida	83,301
5230	7.52	Saratoga, Stillwater-Schuylerville, Pt.	[illegible]	[illegible]
326	4.03	[illegible]	A. G. Slatcher, Troy, N. Y.	[illegible]
986	10.95	Sullivan, Fosterdale-Mongaup Valley.	Merritt Cons. Co., Tuckahoe	131,88
5251	4.25	Oswego, Fulton-Three Rivers, Part 1.	[illegible]	[illegible]
973	5.22	[illegible]	Falk & Menzies, Buffalo	[illegible]
[illegible]	5.86	[illegible] Warwick-Greenwood Lake.	Schunnemunk Con. Co., Highland Mills	[illegible]
974	6.42	Putnam, Putnam Valley-Tompkins Cors.	H. B. Sproul Cons. Co., Peekskill.	[illegible]
[illegible]	3.66	Renss., W. Sand Lake-Averill Park	Martin Murray Co., Troy	38,470
[illegible]	18.91	St. Lawrence, Gouverneur-DeKalb	Jos. Walker Cons. Cor., Albany	184,57
1028	1.37	Schenectady, Esperance-Esperance Sta.	J. J. Maloy, Schenectady	14,107
1021	3.52	Warren, Warrensburg-Thurman Sta.	Jos. Walker Cons. Co.	[illegible],776
[illegible]	0.87	Cortland, Truxton-DeRuyter	S. P. Hull, Cortland	12,146
5261	[illegible]	[illegible]	[illegible]	58,18
704	4.71	Chenango, W. Berlin-Columbia	Schunnemunk Con. Co., Highland Mills	37,70
5207	5.47	Chemung, Elmira-Lowman	Jno. F. Dolan Contr. Co., N. Y City	71,73
5218	4.27	Chemung, Lowman-Waverly, Part 2	Peter D Connolly Co., Boston, Mass.	59,72
[illegible]	3.69	Essex, Jay-Upper Jay	Boynton & McNally, Keeseville, N. Y.	50,71
[illegible]	2.12	Livingston, Geneseo-Pittsford	Hagaman & White, Rochester, N. Y.	21,11
5272	4.20	Livingston, Portage-Mt. Morris, Pt. 1	Northwester Cons. Co., Franklin, Pa.	[illegible]
5270	6.92	Livingston, Portage-Mt. Morris, Pt. 3	Harradine Bros., Spencerport, N. Y.	[illegible]
1022	3.18	Madison, Lakeport-Oneida Lake	Monroe Rds. Co., Pittsford, N. Y.	30,53
955	0.43	Madison, Chittenango Vill.-Seneca Tpke.	No Bids Received.	
	4.24	Onondaga, Skaneateles-Camilius, Pt. 1	W. J. Burns Co., Syracuse, N. Y.	39,85
1041	6.07	On'daga, Skaneateles-Borodino-Marietta.	W. J Burns Co., Syracuse, N. Y.	69,79
5274	10.49	Onondaga, Phoenix-Syracuse	Frank L. Cohen, Buffalo, N. Y.	121,09
[illegible]	6.38	Otsego, Kelsey Cors.-W. Exeter	Harry W. Roberts Co., Utica, N. Y	[illegible]
5277	1.03	Saratoga, Schuylerville Village	Lang & Horton, Schuylerville	28,91
1032	5.38	St. Lawrence, Potsdam-Norwood	Burr C. Miller, Wilkesbarre, Pa	[illegible]
1033	1	St. Lawrence, Ogdensburg City	W. H. Ring Cont. Co., Paterson, N.	18,17
[illegible]	3.87	Suffolk, Smithtown-Ft. Salonga	Trombley & Eldert, Jamaica, N. Y	34,70
[illegible]	6.69	Tompkins, Aetna-Freeville-Dryden	Patrick D. Connolly, Ithaca, N. Y.	75,16
1015	7.24	Westchester, Crystal Spgs.-Chapaqua-Millwood	White & Calligan, Purchase, N. Y.	[illegible]
5298	7.03	Westchester, Bedford-Goldens Bridge	H. B. Sproul Cons. Co., Peekskill, N. Y	91,70
5240	5.69	Otsego, Colliers-Maryland	L. L. Melius, New York City	49,84
5281	1.77	Saratoga, Ballston Lake-High Mills	H. L. Baker, Cambridge, Mass.	15,28
5215	10.72	Broome and Tioga, Owego-Binghamton	Semper Bros., Watertown, N. Y.	121,39
5260	3.01	Chenango, Long Pond-Smithville Flats	Robt. W. Smith, New York City	32,89
705	3.81	Chenango, Sherburne-Furmans Mills	Paddleford & King, Sherburne	47,11
667	2.33	Chenango, Rockdale-Mt. Upton	Newport Cons. Co., Herkimer, N. Y	5,97
[illegible]	13.37	Delaware, Delhi-Andes	Ruddy & Saunders Cons. Co., Troy	117,96
5238	6.21	Essex, Elizabethtown-Keene, Part 2	Beebe Bros., Keene Valley, N. Y.	91,80
[illegible]	6.06	Essex, Upper Jay-Keene	Flood & Van Wirt Co., Hudson Falls.	91,34
[illegible]	7.19	Livingston, Kudders Cors.-Springwater [illegible]	[illegible]	[illegible]
5305	7.95	Niagara, Niagara Falls-Sanborn	John W. Landel, Tonawanda, N. Y.	83,78
5282	6.88	[illegible]	[illegible]	[illegible]
5254		Steuben, Hornell-Arkport	Greenfield Cons. Co., Hornell, N. Y.	28,36
5253	17.09	Steuben, Jasper-Addison	P. H. Murray, Rochester, N. Y.	148,93
[illegible]	11.66	Franklin and St. Lawrence, Nicholville-Moira	Spellman-Oliver Co., Chateaugay	115,47
[illegible]	8.51	Sullivan, Liberty Co. Line, Part 2	Ruddy & Saunders, Troy, N. Y.	104,65
5296	1.37	Sullivan, Liberty Village	Hallock & Angle, Newburgh, N. Y.	35,64
			Lane Cons. Corpn., Meriden, Conn.	143,87
5257	9.71	Tioga, Waverly-Owego, Part 3	Hendrickson-McCabe Cons. Co., Spenc-	
5290	7.01	Wayne, Wolcott-Red Creek	erport, N. Y.	71,01
[illegible]	0.95	Rensselaer, Troy City-Brunswick Tpke.	Corliss Cons. Co., Troy, N. Y.	15,90
[illegible]	1.58	Rensselaer, Troy City-Oil Mill Hill	County Cons. Co., Troy, N. Y.	19,16
5293	6.01	Washington, Cambridge-Salem, Part 2	St. Lawrence Cons. Co., Albany	58,97
5289	9.71	Tioga and Chemung, Lowman-Waverly, Part 3	John T. Dolan & Co., New York City	51,36
5237	4.23	Albany, Slingerlands-Albany	J. & T. Murphy, Cobleskill	52,51
970	10.26	St. Lawrence, Morrist'n-Hammond, Pt. 2.	A. J. Rockwood, Rochester	100,25
579	4.63	Orleans, Barry St.-West Barry	Mosier & Summers, Buffalo	42,70
1039	11.11	Onondaga, Baldwinsville-Cicero	A. J. Rockwood, Rochester	106,46
[illegible]	0.49	Onondaga, Camillus Village	W. J. Burns Co., Syracuse	7,22
[illegible]	1.02	Onondaga, East Sq. Vill.-Hartwell Ave.	Kennedy Cons. Co., Albany, N. Y.	17,52
634	3.43	Monroe, Buffalo-Part 5	Whitmore, Rauber & Vicinus, Rochester	63,83
5250	12.80	Oswego, Central Square-Union Square	McLaughlin & Birchel, Syracuse	159,50
[illegible]	0.46	Albany, Watervliet City-19th Street	Thos. H. Karr, Troy	12,78

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

No.		County and Name of Road.	Awarded to.	Amt.
	2.75	[illegible]-Wyckoff	Braver Bros., Auburn	[illegible]
	1.17	Tompkins, Mitchell St.-East Town Line.	Pat'k D. Conley, Ithaca, N. Y.	13,714
	4.01	St. Lawrence, Potsdam-Parishville, Pt. 2	Winiston Co., Browns Sta.	43,731
		[illegible] Village W[illegible]	Aikenhead, Bailey & Donaldson, Rochester	41,945
	12.99	[illegible] Schuyler, Horseheads-[illegible] Falls	Thos. H. Gill Co., Binghamton	153,940
	6.18	Essex, Elizabethtown-Keene, Part 1	Boynton & McNally, Keeseville	84,301
		[illegible] Essex, Plattsburg-Ausable [illegible], Part 2	J. B. Sullivan, Keeseville	63,626
	1.11	Fulton, Mayfield Village	Jas. E. Walsh, Mechanicville	11,526
	5.51	Livingston, Portage-Mt. Morris, Part 2.	Thos. F. Murray, LeRoy, N. Y.	[illegible]
	6.40	[illegible] Avon Line	Hendrickson, McCabe Cons. Co., Spencerport	80,371
		Madison, Bridgeport-Lakeport	Monroe Roads Co., Pittsford	58,575
	6.20	Montgomery, Ft. Plain-Hessville	Union Pav. Co., Schenectady	92,802
	12.20	Otsego, Schenecus-Schoharie Co. Line	L. L. Melius, New York City	110,886
		St. Law., Ogdensburg-Morristown, Pt. 2.	Brown & Lowe, Schenectady	51,075
	6.53	St. Lawrence, Morrist'n-Hammond, Pt. 1	Brown & Lowe, Schenectady	60,220
		Suffolk, Amityville Village	Clancy & Van Alst, Astoria	16,765
	5.99	St. Lawrence, Co. Line-Gouverneur	Burr C. Miller, Wilkesbarre, Pa	58,998
	2.51	St. Lawrence, Potsdam Village	Burr C. Miller, Wilkesbarre, Pa	31,516
	1.32	Suffolk, Babylon Village	Henry Newman, Brooklyn	38,477
		[illegible], Syracuse-Bridgeport	W. J. Burns Co., Syracuse	73,697
	1.17	Ulster, Highland Ldg.-Highland	Bridgeport Cons. Co., Poughkeepsie	79,264
	7.31	Jefferson, Watertown-Clayton, Part 3	Coleman Bros., Boston, Mass	[illegible]
	4.58	Tompkins, Cooks Cors.-Brookton, Slaterville Springs-Caroline	P. D. Conley, Ithaca	42,461
	6.36	Warren, Chestertown-Hageu, Part 1	H. B. Cooper, Albany	67,422
	3.22	Broome, Port Crane-Sanataria Springs.	H. B. Sproul Const. Co., Peekskill	27,100
	1	Chautauqua, Fredonia-Silver Creek, Pt. 1	Hurley & Lyne, Fredonia	54,237
265	4.31	Cattaraugus, Salamanca-Little Valley	Dunkirk Const. Co., Dunkirk, N. Y.	72,941
	13.42	Delaware, Hancock-East Branch	Joseph Walker Const. Co., Albany.	[illegible]
	2.89	Erie, Watervalley-Clarksburg, Part 1	John Johnson Const. Co., Buffalo	[illegible]
	3.14	Erie, Holland-Glenwood	Erie Contg. Co., Buffalo	57,851
	4.20	Erie, Chaffee-Cardinia	Frank Foote, Nunda	51,264
	[illegible]	Jefferson, Watertown-Clayton, Part 2	Colman Bros., Boston, Mass	79,399
269	13.38	Jefferson, County Line-Adams	A. J. Rockwood, Rochester	132,230
	1.25	Livingston, Avon Village	Hagaman & White, Rochester	19,154
	6.30	Livingston, Caledonia-Avon	Falk & Menzies, Buffalo	60,931
	6.36	Monroe, Stottsville-North Chili	Miller & Knickenberg, Buffalo	136,049
832	2.51	Niagara, Mountain Ridge Road	Dollard & Heeran, Albany	[illegible]
	[illegible]	Niagara, Cambria-Lockport	McMahon & Fell, Niagara Falls	[illegible]
	7.79	Oneida, Alber Creek-Lewis Co. Line	Joseph Walker Const. Co., Albany.	78,686

Ohio.

✢Bids will be received until noon, July 8, by Board of Pike County Commissioners Steubenville, O., for the necessary labor and materials to construct the Bantam Ridge Free Turnpike road in Cross Creek Township, Jefferson County, Ohio, in accordance with the plans and specifications now on file in the office of the County Commissioners. Total length of said Free Turnpike road, 17,787 ft., divided into two sections: Section No. 1, Station No. 0, at residence of D. K. Andrews to the line, between the farms of Joseph M. Thompson and Joshua F. Rine, total length 11,300 ft. Section No. 2, Station No. 0 on line between the farms of Jos. M. Thompson and Joshua F. Rine, to the Southern terminus of the road at Fennwood Station. Total length 5,487 ft. A certified check in the sum of $300 must accompany each bid as an evidence of good faith.

✢Bids will be received at the office of the Commissioners of Holmes County, at Millersburg, Ohio, until 1 p. m., July 2, 1912, for grading and paving with a bituminated concrete pavement, Sec. No. 3, Millersburg and Berlin road. State Highway "B" pet. No. 481 in Hardy Township, said county; length, 1,795.5 ft. or 0.34 mile; width of pavement, 16 ft.; estimated cost of construction, $5,225. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, Sept. 15, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., State Highway Commissioner.

✢Bids will be received at the office of the Commissioners of Columbiana County, at Lisbon, Ohio, until 10 a. m., July 3, for grading and paving with brick for heavy traffic the Salem Ellsworth road, State highway, "G" pet. No. 379, in Perry Township, said county. Length, 5,280 ft. or 1.00 mile; width of pavement, 10 and 14 ft.; estimated cost of construction, $13,539.98. A draft or certified check for $300 shall be deposited with each bid. The successful bidder will be required to give bond for an amount equal to the contract price. Date set for completion, Sept. 15, 1912. Plans and specifications are on file in the office of the County Commissioners and the State Highway Department. The State Highway Commissioner reserves the right to reject any and all bids. James R. Marker, Columbus, O., is State Highway Commissioner.

✢Bids will be received until 10 a. m., June 28, by board of Stark County Commissioners, Canton, O., for the furnishing of all materials and labor necessary to construct what is known as the Canton-Massillon Road Improvement in Canton Township, Stark County, Ohio. Following are the estimated quantities of material and labor, viz.: 32,379 cu. yds. of excavation, 60 lin. ft. of stone circular curb; 3,952 lin. ft. of stone raised curb, 5x18; 3,952 lin. ft. of stone flush curb, 4x15; 19 lin. ft. of concrete marginal curb, 8x14; 7,904 sq. yds. paving; 7,904 sq. yds. concrete base; 30 lin. ft. 12-in. pipe relaid; 2 catch basins; 20 trees removed. Said work to be done in accordance with plans, profile and specifications now on file in the Office of the Auditor of Stark County, O. Each bid must be accompanied by a certified check in the sum of $500.00 (said check to be on a bank of Stark County, Ohio), payable to the County Commissioners of Stark County, Ohio. J. H. McConnell is County Auditor.

⊙W. H. Ringwald & Sons of Chillicothe, O., have been awarded the contract by the Village Council of Richwood, O., Paul B. Van Winkle, Clerk, for the paving of Bomford St., from the west line of the N. Y. P. & O. Railroad right of way to the intersection of Pearl St., with vitrified brick. Bids were opened June 17.

⊙Wesley Wieal of Botkins, O., has been awarded the contract by the Board of County Commissioners, Sidney, O., for the construction of a retaining wall along the Botkins Pike in Dinsmore Township, Shelby County, at $1,074. Bids were opened June 15 by H. T. Ruese, Auditor.

⊙W. A. Bibler & Son Co., Arlington, O., has been awarded the contract by the Hancock County Commissioners, Findlay, O., for the construction of 1.29 miles of stone pike on the T. L. Peterman road, Eagle Township, at $4,107. Water bond macadam will be used. Bids were opened June 10.

⊙The W. A. Bibler & Son Co., Arlington, O., has been awarded the contract by the Board of Hancock County Commissioners, Findlay, O., for the construction of the Edson line road, Eagle Township, of waterbound macadam, at $3,860. The road is one and a fraction miles long. Bids were opened June 10.

⊙Munn & Henderson, Chagrin F have been awarded the contract by th missioners of Geauga County, Chard for grading and paving with bituminat crete, the Scotland-Station road, Township, at $14,480. The road is long and will be 14 ft. wide. Bi opened June 12. James R. Marker, bus, is Commissioner of State Highw

⊙The Modern Construction Co., mont, O., has been awarded the cont the Board of Bronson Township Trus the office of the Huron County Comn ers, Norwalk, O., for the grading and of concrete on 1¾ miles of road, kn Fairfield road, in Bronson Township contract price is $12,496. Bids were June 5 by A. E. Ward, Township Cle

The contract for grading, furnishi terial and macadamizing 2 4/10 miles o in York Township, Belmont County, which bids were opened on June 4 by Bonar, Township Clerk, Powhattan Poi has not been awarded. The work will advertised.

The Board of Control of Dayton, rejected all bids received recently f paving of Forest Ave., from Lehman to Sts., and from Rung to Main Sts.

City Engineer Phil Weber of Canto has estimated the cost of the propose ing of Allen St. to Kimball St., at $ The Council passed an ordinance to p with the paving of E. Lake St., from St. to St. Elmo St.

Contracts will be let about July 2 Department of Public Service of Elyri Geo. Lewis, Director, for the constructi pavement on Harrison St., Seventh St., River and E. Broad St. The work wi clude brick, and asphalt. C. M. Theob Engineer.

Oklahoma.

✢Bids will be received until June 2 City of Coalgate, Okla., for the follo work in Paving District No. 1: 25,281 yds. pavement; 9,210 cu. yds. of excava 2,350 ft. curbing; also sewer works, as elsewhere in this issue. E. T. Brown is Engineer.

Oregon.

⊙The contract for paving the Holgate district has been awarded by the City Cou of Portland, Ore., to the Oregon Independent Paving Co., with gravel bitulithic, at $ 372. The contract for paving 20th St., Carter to Spring with gravel bitulithic, awarded to the Pacific Bridge Co., at $-516. Other contracts awarded are: Twe first St., from Carter to Vista—Concrete pa ment, Kibbe-Welton Co., $15,010. Chapman from Mill to 200 ft. west of Mill—Conc pavement, Hilliard & Maginnis, $1,428. more St., from Lombard to Russell—Con pavement, Oregon Independent Paving $1,798. Terwilliger St., from Macadam Corbett Concrete pavement, Mont O'Reilley Co., $1,687. East Ninth St., fr Cora to Rhone—Gravel bitulithic, Oregon dependent Paving Co., $12,243. East 36th from Harrison to Hawthorne: Gravel bit lithic, Oregon Independent Paving Co., $6,3

⊙The City Council of Portland, Ore., h awarded the contract for the laying of W trumite on nine streets in the Kenton distr to Giebisch & Joplin of Portland, at $91,9 The streets to be paved and the amounts the contracts are: Schofield St., from Del ware to Patton, $19,804; Terry St., from Pa ton to Aubrey, $8,023; Watts St., from Del ware to Patton, $16,360; McClellan St., fro Brandon to Fenwick, $7,819; Russett St., fro Derby to Patton, $7,773; Chatam St., from Lombard to Farragut, $3,774; Willis Blvd from Brandon to Fenwick, $7,930, and Argyl St., from Brandon to Fenwick, $8,093.

The City Council of St. Johns, Ore., has declared its intention of improving Burlington St., from Bradford to Hayes St., with standard concrete surface and 6-ft. cement sidewalks, at an estimated cost of $14,112. The Council also has under consideration the paving of a number of other streets.

✢ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible]
dy Council of Portland, Ore., June 15, for
e construction of pavement, as follows: E.
h St. district: Hassam pavement—Oregon
[illegible]
fferv & Bufton, $19,751. Gravel bitulithic—
[illegible]
Oregon Independent Paving Co., $21.-
10th St. district: Hassam pavement—
Hassam Paving Co., $30,955; Mon-
'Reilley Co., $35,000. Gravel bitulithic
[illegible]
t Paving Co., $34,191. Asphalt—Bar-
sphalt Paving Co., $38,404. Asphalt con-
ete—Oregon Independent Paving Co., $34.-
3. E. 37th St., from Hancock St. to Ross-
ere Addition: Hassam—Oregon Hassam
$9,711. Gravel bitulithic—Warren
Co., $8,902; Barber Asphalt Pav-
[illegible]
t Paving Co., $5,728. E. 34th St.,
[illegible]
endent Paving Co., $5.-
:—Warren Construction
[illegible]
21st St., from Powell to Bismark:
[illegible]
ruction Co., $11,448.
Independent Paving Co.,
concrete—Oregon Independ-
[illegible]
Co., $11,220. Asphalt concrete
[illegible]
Hassam Paving Co., $9,552;
lley Co., $9,779. Wasco St.,
[illegible]
—Warren Construction Co., $4,444. As-
Oregon Independent Paving Co., $5,021.
t concrete—Oregon Independent Pav-
, $4,611. E. 15th St., from Clinton St.
hern Pacific tracks: Gravel bitulithic—
n Construction Co., $4,907; Pacific
Co., $4,767. Asphalt concrete—Oregon
ndent Paving Co., $5,227. Concrete—
Independent Paving Co., $4,425; Jef-
k Bufton, $4,244; Pacific Bridge Co., $4.-
4. Alley in Ladd's Addition, between E.
h and E. Harrison Sts.: Gravel bitulithic
Pacific Co., $4,487; Warren Construction
, $4,588. Concrete—Pacific Bridge Co., $4.-
[illegible]
t Paving Co., $4,132. Fremont St., from
ercial to Albina: Gravel bitulithic—Pa-
c Bridge Co., $8,696; Warren Construction
, $8,116. Concrete—Pacific Bridge Co., $7.-
5; Kibbe-Welton Co., $8,116; Oregon Inde-
ndent Paving Co., $6,812; Hilliard & Magin-
$6,389; Jeffery & Bufton, $6,503. Morri-
[illegible]
egon Independent Paving Co., $2,638; Har-
Howard, $2,272; Montague-O'Reilley Co.,
593. Princeton St., from McKenna to
rey: Grading and concrete curbs and walks
Oregon Independent Paving Co., $4,430;
hran, Nutting & Co., $4,485; V. W. Mason,
Bechill Bros., $4,430. E. 19th St., from
ton to Alberta: Oregon Independent
g Co., $2,282; Cochran, Nutting & Co.,
; Kibbe-Wilton Co., $2,424; Bechill
os., $2,183. E. Hoyt St., from Grand to
ion: Grading and concrete curbs and walks
Oregon Independent Paving Co., $541; Ste-
s & White, $574; Harry Howard, $596; Be-
ill Bros., $610. E. 37th St., from Westanna
Klickitat: Grading and concrete curbs and
lks—Cochran, Nutting & Co., $8,257; Gieb-
h & Joplin, $6,894; Hilliard & Maginnis,
255; Elwood Wiles, $6,531. E. 66th St. dis-
ct: Grading and concrete curbs and walks
Oregon Independent Paving Co., $5,828; O.
Patton, $6,362; Cochran, Nutting & Co.,
132; Stevens & White, $6,064; Kibbe-Wel-
n Co., $5,097; Jeffery & Bufton, $6,070;
chill Bros., $5,729; Carter Bros., $5,992

Pennsylvania.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 49,394 lin. ft. of telford-macadam road (repair work) extending from the Blair Township line at the bridge over Brush Run to the Catharine Township line at Point View. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and Hollidaysburg, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $1,000. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 16,300 lin. ft. of asphaltic concrete road, 16 ft. wide, situated as follows: From South Whitehall Township line to end of Route No. 226 in Schnecksville. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and National Bank Bldg., Allentown, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $2,000. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 8,354 lin. ft. of asphaltic bituminous macadam road (penetration method), 16 ft. wide, situated as follows: Extending from toll gate on Clayton and Hereford road to the Montgomery County line in Berks County, Hereford Township. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and Allentown, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $1,500. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 40,143 lin. ft. of asphaltic macadam road, 16 ft. wide, situated as follows: Beginning at the Shamokin Borough line on Mt. Carmel St. and passing through Johnson City, Mayesville, Kulpmont and Green Ridge to the Mt. Carmel Borough line. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and Bloomsburg, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $5,000. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for furnishing the State Highway Department with 1,000 sign plates and sign posts. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh, and 1001 Chestnut St., Philadelphia. Each bid must be made upon a blank furnished by the State Highway Department and accompanied by a certified check in the sum of $1,000. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 10,115 lin. ft. of asphaltic macadam road, 16 ft. wide, situated as follows: Extending from the Bristol-Falls Township line to bridge over Pennsylvania Railroad, in Bucks County, Falls Township. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh, and 1001 Chestnut St., Philadelphia, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in

[illegible] M. B[illegible] State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 8,048 lin. ft. of asphaltic macadam road, 16 ft. wide, situated as follows: Commencing at the crossroads at Emilie and extending to the Bristol Falls Township line in Bucks County, Bristol Township. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh, and 1001 Chestnut St., Philadelphia, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $1,500. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 18,843 lin. ft. of asphaltic bituminous macadam road (penetration method), 16 ft. wide, situated as follows: On Route No. 131, from Media to Wawa, in Delaware County. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh, and 1001 Chestnut St., Philadelphia, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $2,000. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 9,632 lin. ft. of asphaltic bituminous macadam road (penetration method), 16 ft. wide, situated as follows: From the west borough line of Mercer, Station 25+92.1 and extending in a westwardly direction to a point near the property of H. W. White, Station 122+24.5. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and Franklin, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $1,500. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 14,807 lin. ft. of asphaltic bituminous macadam road (penetration method), 16 ft. wide, situated as follows: From Station, 122+24.5, near the property of H. W. White, and extending in a westwardly direction to the east line of Lackawannock Township, Station 232×56. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and Franklin, Pa Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $2,000. T. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 3,760 lin. ft. of brick block paving, 16 ft. wide, situated as follows: From the Fallowfield Township line to Station 29+20 and from Station 51+00 to Speer's Borough line at the bridge over Maple Creek in Washington County. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and Washington, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $1,000. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 13,735 lin. ft. of asphaltic bituminous macadam road (penetration method), 16 ft. wide, situated as follows: Extending from the Indiana County line to Punxsutawney, on Route No. 63. Plans and specifications can be seen at the office of the

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittshurgh; 1001 Chestnut St., Philadelphia, and Franklin, Pa. Each [illegible] upon a blank furnished by the State Highway Department, accompanied [illegible] in the sum of $2,000. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 10 a. m., July 9, by State Highway Department, Harrisburg, Pa., for the reconstruction of 10,756 lin. ft. of asphaltic bituminous macadam road (penetration method), 16 ft. wide, situated as follows: From end of present contract, Station 1+00, near the property of Mr. Stiman, to the south borough line of Chester Hill on Route 37, between Osceola and Philipsburg. Plans and specifications can be seen at the office of the State Highway Department, Harrisburg; 2117 Farmers' Bank Bldg., Pittsburgh; 1001 Chestnut St., Philadelphia, and Clearfield Trust Bldg., Clearfield, Pa. Each bid must be made upon a blank furnished by the State Highway Department, accompanied by a certified check in the sum of $1,500. E. M. Bigelow is State Highway Commissioner.

✣Bids will be received until 4 p. m., June 29, by W. H. Isaac, Monongahela, Pa., for grading, paving and otherwise improving Carson St. The work will include approximately 280 cu. yds. of grading excavation and 980 sq. yds. of Tarvia or Warrenite pavement. Plans and specifications are on file with City Engineer, Landefeld Bldg., Monongahela, Pa.

✣Bids will be received until 8 p. m., July 1, by Borough Council, Greensburg, Pa., J. F. Beatty, Secretary, for the improvement of Hamilton St., from West Otterman St. to the Pennsylvania Railroad, and Brown Ave., from Brushton Ave. to the property of the Westmoreland Realty Co.; the first of which streets contains 1,277 cu. yds. grading, 1,780 lin. ft. curbing and 2,243 sq. yds. paving, and Brown Ave., containing 275 cu. yds. grading, 1,034 lin. ft. curbing and 1,384 sq. yds. paving. Details can be learned and blanks procured at the office of D. R. Walkinshaw, Engineer, Greensburg, Pa. Proposals must be accompanied by a certified check for $500.

✣Bids will be received until 7:30 p. m., July 8, by Borough Council, Steelton, Pa., for sub-grading, paving and curbing of Harrisburg St., between Lincoln St. and Northern Borough line. Each bid must be accompanied by a certified check for $250, payable to L. H. Sutton, Borough Treasurer. C. P. Feidt is Secretary.

✣Bids will be received until 7:30 p. m., July 8, by Council, Steelton, Pa., for sub-grading, paving and curbing Pine St., from Front to Reading St. Each bid must be accompanied by a certified check for $500 payable to L. H. Sutton, Borough Treasurer. C. P. Feidt is Secretary.

⊙The Allegheny County Commissioners, Pittsburgh, Pa., have awarded the contract to James Topley & Son, of McKeesport, Pa., for the improvement of 924 ft. of the Versailles road, near the entrance to Olympia Park, at $9,559. The road will be paved with brick.

⊙Contracts for street improvement work have been awarded as follows by the Department of Public Works of Pittsburgh, Pa.: Grading, paving and curbing Goe Ave., to Neelen & Daly, at $13,014; grading, paving and curbing St. Patrick St., to Ott Bros. Co.,, at $4,128; repaving 23d St. with block stone, to Booth & Flinn, at $3,468; repaving Merriman St. with block stone, to Booth & Flinn, at $2,963; repaving Ellsworth Ave. with asphalt, to the Barber Asphalt Paving Co., at $23,698; repaving Fox alley with brick, to J. B. Sheets Co., at $1,795; regrading and repaving Tabor St., with blockstone, Booth & Flinn, at $2,172.

Highway Commissioner E. M. Bigelow, Harrisburg, Pa., on June 18, received the following bids for the construction of three sections of main highway: Bucks County, Route No. 155, Philadelphia to New Jersey State line, 45,460 ft., in Bucks County—Union Paving Co., Philadelphia, $169,787; William C. Evans, Ambler, Pa., $194,228; The Monroe Paving Co., Philadelphia, $195,908; H. G. Hinkle, Inc., Altoona, Pa., $202,039 and $240,831. Lancaster County, Route No. 142, Lancaster to Philadelphia, 10,334 ft., in Salisbury Township—George C. Souder, Lancaster, $31,280; Bennet & Sons, Indiana, Pa., $32,570; Thomas E. McManus, Lancaster, $39,927; Fogle & Co., Hollidaysburg, $40,300; The Juniata Co., Philadelphia, $42,457. Fayette County, 1,337 ft., in Wharton Township—Wyoming Valley Construction Co., West Nanticoke, Pa., $5,197; Charles T. Eastburn, Yardley, Pa., $5,707.

The City Councils of Harrisburg, Pa., will award the contracts for paving and curbing the 18 streets, for which bids were opened recently, on July 15.

South Dakota.

✣Bids will be received until 1 p. m., July 9, by Board of Union Township Supervisors, at the office of V. Fousek, Town Clerk, Vega, S. Dak., for grading and filling roads.

Tennessee.

✣Bids will be received until 3 p. m., July 10, by Highway Commissioner, Cumberland County, Crossville, Tenn., for the construction of about 35 miles of road in Cumberland County, forming a part of the Memphis-to-Bristol Highway. The work will include the following approximate quantities: 75,000 cu. yds. excavation; 1,200 cu. yds. rubble masonry; 100 cu. yds. concrete masonry; 1,800 lin. ft. corrugated pipe; 4,000 lin. ft. D. S. vitrified pipe. Plans and specifications are on file at office of Engineer, O. W. Monroe, Crossville. Certified check, $250, must be filed with each bid.

✣Bids will be received until 10 a. m., July 4, by Board of Shelby County Commissioners, Memphis, Tenn.; for drainage pipe of concrete, terra cotta and metal for sizes ranging from 12 to 48-in. in diameter to be delivered in carload lots f. o. b. Union Railway and old Raleigh Road switch. A certified check for $500 must be filed with each bid. H. M. M'Kay is Chairman of the Board.

⊙McClary Bros. & Russel, Benton, Tenn., have been awarded the contract by the County Court, Benton, for the construction of a pike road from Bradley County line to Benton, via Benton Station, and from Duckton Station to Copperhill via Isabella, at $12,000. The contract calls for grading and macadamizing 4½ miles. Bids were opened June 8.

Texas.

⊙The Magnolia Park Land Co., of Houston, has awarded a contract to George R. Kelly, of Houston, for grading four miles of streets in the eastern suburban district of the city.

⊙The O'Neill Engineering Co., Dallas, Tex., has been awarded the contract by the Board of Permanent Road Commissioners for Justice Precinct No. 1, Lamar County, Paris, Tex., for the construction of from 40 to 48 miles of permanent broken stone roads in the precinct at $237,502. The work includes all clearing, grubbing, grading cuts and fills, rock work, base and wearing course, and the construction of concrete bridges where necessary. Bids were opened June 18 by W. F. Gill, Secretary. M. Hannah is Engineer.

The Commissioners' Court, Cameron, Tex., has ordered an election held July 23, to determine by vote whether road bonds to the amount of $200,000 shall be issued for the construction of good roads in Precinct No. 4.

The Commissioners' Court of Matagorda County, Bay City, Tex., has ordered an election held July 20, for the purpose of voting on the issuance of bonds in the sum of $100,000 for the construction of good roads in Precinct No. 1.

The Commissioners' Court, Franklin, Tex., has ordered an election for the issuance of road improvement bonds in the sum of $150,000 for Commissioners' Precinct No. 2 of Robertson County. This precinct covers the voting precincts of Hearne, Mumford, Benchley and Elliott.

The Commissioners' Court, Richmond, Tex., has been petitoned for the creation of Road District No. 2, which includes the Richmond voting precinct and Precinct No. 7. T improvement will call for a $150,000 bon issue for construction and maintenance.

Tarrant County Road Engineer Haye Fr Worth, Tex., has surveyed from 75 to 8 mi of the country roads preliminary to imp ving the same with the proceeds of the $1,0,0 bond issue. Some of the most im roads are the Fort Worth-Mansfield ro , the Fort Worth to Grapevine road, and th Fort Worth and Keller road.

An election will be held in Terrell Commissioners' district, Terrell, Tex., on June 29, for the purpose of voting on the is ance of bonds in the sum of $200,000 f work

The citizens of Robertson County, T , at a recent election voted the issuance of on in the sum of $100,000 for permanent a Franklin is the county seat.

City Council of Houston, Tex., has a ho ized Mayor Rice to advertise immediate f bids for the paving with vitrified brick th following streets: Houston Ave., ro Washington Ave. to new White Oak bridge; German St., from Internatio Great Northern R. R. track to Buffal S Dallas Ave., from Milam St. to San lip St., and San Felipe St., from Dallas A Wilson St.; Webster Ave., from Ma Crawford St.

The Commissioners of Tarrant Co ty Fort Worth, Tex., are considering the ur chase of 70 acres of quarry site or rock in Stephens County and necessary mach for crushing the rock which is located a h site. The machinery is said to be o value of about $50,000 and the total pri land and machinery will be $75,000.

Utah.

✣Bids will be received until 10 a. m., ly 2, instead of June 24, by Noble Warrum, ty Recorder, Salt Lake City, Utah, for the struction of approximately 60,000 sq. yd asphalt pavement, including the neces grading, curbing and guttering. Official vertisement will be found elsewhere in issue.

⊙P. J. Moran of Salt Lake City, Utah, s been awarded the contract by the city of den, Utah, H. J. Craven, City Engineer, the construction of two blocks of paving three intersections, at $23,521. The work includes repairs to old pavement, at $1.72 sq. yd., being asphalt. Bids were ope June 4.

Virginia.

✣Bids will be received until noon, Jul by G. B. Wallace, Attorney of Com wealth, Stafford County, Fredericksburg, for the construction of several gravel ro

✣Bids will be received until July 1, by H. Esley, Mayor, Clarksville, Va., for construction of 1,000 to 1,500 yds. of gra lithic sidewalks.

⊙F. J. McGuire has been awarded the c tract for improvements at Lochhaven, a burb of Norfolk, Va., by the American Bou vard Corporation, Norfolk, Va. The wo includes 19,000 yds. of paving, 16,000 ft. concrete curb and gutter, 5,500 sq. yds. granolithic walk. Arthur C. Freeman, A cade Bldg., Norfolk, is Consulting Engine

The Richmond-Washington Highway Co poration has been organized with a capit stock of $150,000, to build a memorial hig way in memory of the Confederate general between Washington and Richmond, by wa of Fredericksburg. The road will be 1 miles long.

Washington.

✣Bids will be received until 5 p. m., Jul 8 (change of date), by J. L. Mitchell, Tow Clerk, Sumas, Wash., for the improvemen of Cherry St., as follows: By macadamizin the said street for the full width thereof, between the international boundary line and th south line of Third St., and by constructing a cement sidewalk, 10 ft. wide, and also constructing cement curbs and gutters, upon each side of said street, in such places where there are not now cement sidewalks, curbs and

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

ders of a like nature, between the south of Boundary St. and the north line of rd St.; by macadamizing said street for a ance of 8 ft. on each side of the center said street, between the south line of the ge over Sumas Creek, and the north line Front St., all in accordance with the plans specifications filed by the Town Engineer h the Town Clerk for District No. 20, duly cpted by the Town Council. The bids for macadamizing above mentioned will be eived upon one or all of the following ds of macadam: Water bound macadam, nically bound macadam, commonly known "Rocmac," and bituminous.

•Bids will be received about Aug. 1, by Commissioners, Walla Walla, Wash., for ing E. Adler St. and N. Rose-Sumach Sts. h a hard surface pavement. The work will ude the following approximate quantities: sq. yds. of 34-ft. pavement; 3,500 sq. 28-ft. pavement. Grading, curbing and g, etc., will be included in the contract. Rehorn is City Engineer.

• s will be received until July 1, by City sioners, Walla Walla, Wash., for the tion of about 19,000 sq. ft. of 5-ft. walk. W. R. Rehorn is City En-

The Washington Paving Co., Savage-Sco- l Bldg., Seattle, Wash., has been awarded contract by the city of Tacoma, Wash., for the paving of Delin, G, S, 38th and M Sts., at $69,147.

⊙The Lincoln County Commissioners, Davenport, Wash., have awarded the contract for the construction of 3¼ miles of road, extending from Reardan east to the county line, between Lincoln and Spokane Counties, to John F. Costello of Spokane, Wash., at $16,750. Waterbound macadam is specified.

⊙The Washington Paving Co., of Tacoma, Wash., has been awarded the contract by the city of Puyallup, Wash., for the paving of Railroad Ave., at $15,643, and for the paving of Meridian Ave., at $22,532.

⊙B. S. Davis of Tacoma, Wash., has been awarded the contract by the Lewis County Commissioners, Chehalis, Wash., for the hard surfacing of over a mile of road out of the city of Chehalis. The contract price is $17,346

⊙The Hardy Construction Co., of North Yakima, Wash., has been awarded the contract by the city of Ellensburg, Wash., for the construction of 16,750 sq. yds. of Dolarway pavement, at $20,000.

⊙Chas. G. Burnett has been awarded the contract for the paving of Elm St., by the city of Bellingham, Wash., at $4,891.

Commissioners of Whatcom County, Bellingham, Wash., are planning the construction of 12 miles of new trunk road.

The City Council of Bremerton, Wash., has voted to pave the business section of the city, at an estimated cost of $75,000.

Wisconsin.

⊙John Shea of Superior, Wis., has been awarded the contract by Commissioner of Highways C. J. Morisset, Superior, for the grading of the hills on both sides of Middle River, on Spaulding Ave., at $824. Bids were opened June 5.

⊙The County Commissioners at Superior, Wis., have awarded the contract for the grading of the hills both sides of Bergren Creek on Totogettic road, in Sections 27, 43, 12, and putting in a cement culvert, to Joseph Terry of Gordon, Wis., at $999, and J. B. Palmer of Superior, at $564, respectively. Bids were opened June 5.

The City Council of Superior, Wis., has passed resolutions establishing the grade of Winter St., from Oakes Ave. west for a distance of 4,000 ft., and providing for the paving of the street. Bids will be asked on concrete, creosoted blocks, brick, sandstone and asphaltic concrete.

The Milwaukee Vanderbilt cup committee, according to advices from Milwaukee, Wis., has decided to spend $20,000 to improve the Greenfield course. Concrete banks will be put in all of the dangerous turns and the Hawley and Mill roads will be widened 8 ft. Work is to be begun at once.

BRIDGES—STEEL AND CONCRETE

California.

n election has been called by the Board Supervisors of Orange County, Santa Ana, be held on July 20 to consider the of $100,000 bonds for the construction

[illegible]

ile, Cal., accepted the report of Martin County Surveyor, declaring the Lindo bridge unsafe. New plans will be mediately and a steel structure to cost $10,000 will be erected at that place.

he Supervisors of Yuba County, Marys- e, Cal., have under consideration the re- struction of the Parks Barr bridge over the a River, 6 miles above Smartsville. The cture contains a span 360 ft. in length.

dvices from Long Beach, Cal., state that will soon be advertised for the construc- of a bridge over the Cerritos Slough at enth St.

Florida.

•Bids will be received until July 1, by rd of Osceola County, Kissimmee, Fla., the construction of a steel bridge over oe Creek. R. G. Johnston is Clerk.

Idaho.

•Bids will be received until 10 a. m., July 1, Board of Ada County Commissioners, se, Idaho, for the construction of a new 4- fir floor on the bridge over the Boise er on West Main St. Stephen Utter is rk.

•Bids will be received until July 9, it is rted, by Board of County Commissioners, ngeville, Idaho, for the construction of ridge over Cottonwood Cheek near Stites. tractors are to furnish the plans.

Illinois.

•Bids will be received until 2 p. m., July (readvertisement), at the Bridge Site, 6 s north of Balis, Ill., for the construction reinforced concrete bridge to be built be- en the towns of Fairmont and Beverly in e and Adams Counties.

•Bids will be received until 11 a. m., July t the Court House in Metropolis, Ill., for pleting the construction of 2 reinforced crete bridges in R. D. No. 2, Massac nty. Geo. C. Schneeman, County Clerk, ropolis, Ill. Green Farm Bridge—Span, ft.; roadway, 16 ft.; height, about 23 ft. Wings about 20 ft. long. Estimated amount of uncompleted masonry in structure, 101.3 cu. yds. Low water flow, 1 ft. deep. Excavation in gravel; gravel free at bridge site. Township Line Bridge—Span, 40 ft.; roadway, 16 ft.; height, about 13 ft. 6 ins. Length of wings about 12 ft. Estimated amount of uncompleted masonry, 98.8 cu. yds. Low water flow, 1 ft. deep. Excavation in gravel; gravel free at bridge site. All work to be completed on or before October 1, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office, or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Ill.

✣Bids will be received up to 2 p. m., July 20, at the bridge site, abolt 6 miles north of Baylis, Ill., for the construction of one reinforced concrete bridge, to be built between Fairmont and Beverly Townships, Pike and Adams Counties. Wm. M. Huffman, Town Clerk, Baylis, Ill. Seybold Bridge—Span, 60 ft.; roadway, 16 ft.; height about 20 ft. Estimated amount of concrete in structure, 201.1 cu. yds.; reinforcing steel, 36,213 lbs. Gravel is reported to be available at 8 cts. per ton in a creek bed about 4 miles from the bridge site. Quality not known. Low water flow about 3 ft. deep and 40 ft. wide; high water about 14 ft. deep. Piles will probably be needed for foundations and falsework. No present bridge. Nearest railroad station, Baylis, on the Wabash Railroad. A previous letting was held for this work on May 11, 1912, but on account of County aid not having been applied for, all bids were rejected. Work to be completed on or before October 15, 1912. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office, or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Ill.

✣Bids will be received up to 2 p. m., June 29, at the Town Clerk's office, Edwardsville, Ill., for two reinforced concrete bridges to be built in Edwardsville Township, Madison County. Peter Dresch, Town Clerk, Edwardsville, Ill. Klingeman Culvert—Span, 12 ft.; height, 18 ft.; length of barrel, 60 ft. Total estimated concrete, 176 cu. yds. reinforcing steel, 20,780 lbs. Nearest railroad station, Peters, about 2½ miles. Sedlaech Bridge—Span, 13 ft.; height about 16½ ft.; roadway, 16 ft. Total estimated concrete, 78 cu. yds.; reinforcing steel, 7,790 lbs. Nearest railroad station, Edwardsville, 2½ miles. No local concrete materials available. Contractors are advised to visit the site of these bridges before submitting proposals. More detailed information may be had by an examination of the plans and specifications prepared by the Illinois Highway Commission, which may be seen at the Town Clerk's office, or may be obtained upon application in writing, from the Illinois Highway Commission, Springfield, Ill.

✣The Commissioners of Cook County, Chicago, Ill., are readvertising for bids for the construction of the $2,500,000 Cook County Hospital. The new bids will be received until July 1. P. J. Murray, Room 519 Cook County Court House, Chicago, Ill., is Superintendent of Public Service.

⊙The contract for constructing a reinforced concrete bridge in the Township of Maine and in the Township of Hanover, Cook County, Ill., has been awarded to the Joliet Steel Construction Co., Joliet, Ill., the former for $6,095, the latter for $6,395. Wm. P. Feeney, 17 N. La Salle St., Chicago, is engineer in charge. Bids were opened on June 14.

⊙The contract for the construction of the two bridges, one at Hawley Station and the other at Meyers in Cincinnati Township, Tazewell County, Ill., has been awarded to George A. Quinlan, Chicago, Ill., at $2,115. Other bids received were: Judy & Cook, Mackinaw, Ill., $2,454; E. Cooney, Tremont, Ill., $2,600

⊙The contract for the construction of five reinforced concrete culverts and bridge in Prophetstown Township, Whiteside County, Ill., has been let by Simon Kreiser, Town Clerk, Prophetstown, Ill., to L. S. Wallingford at $2,650.

It has been recommended by the Mayor of Decatur, Ill., that a new bridge be constructed at Monroe St.

The Highway Commissioners of Liverpool Township, Fulton County, have petitioned the Commissioners at Lewistown, Ill., to pay one-half the estimated cost, $1,200, of a bridge in Liverpool Township.

The Commissioners of Whiteside County, Morrison, Ill., have decided to aid the High-

Commissioners of Erie Township in ing a bridge at Erie.

e Board of Supervisors of McLean ty, Bloomington, Ill., has referred to the mittee on Roads and Bridges, the petitions [illegible] between Lexington and sville, estimated to cost $4,500, and the over the Mackinaw on the Padua Road, nated to cost $3,300.

e contract for the construction of two orced concrete bridges in Ruyle Township, ey County, for which bids were received June 7, by S. H. Ruyle, Town Clerk, ora, Ill., has not been let, and the work be readvertised later.

e Board of Tazewell County Supervisors, n, Ill., has under consideration the matter uilding a new bridge to replace the present structure, known as the McMullen bridge, the Mackinaw River in Hopedale Town-

Indiana.

The Board of County Commissioners, Au-, Ind., has awarded the contract for the truction of the proposed bridge at New- Ind., to George Jaap, Fort Wayne, Ind., [illegible]

Iowa.

Bids will be received until July 3, by nty Auditor, Davenport, Ia., for the im- ement of the Wapsie River bridge, con- ng Scott and Clinton Counties. The cost e work will be about $1,800.

Bids will be received until 3 p. m., June by F. W. Leedham, County Auditor, Clin- Ia., for the construction of 16 reinforced rete bridges located on Clinton County ways. A check for $600 must be filed with bid. The cost of the structures is esti- d at $25,000. Plans and specifications pre- d by Reuben C. Hart, Clinton, Ia., are le at the Court House.

The Commissioners of Polk County, Des nes, Ia., have awarded the contract for construction of a steel bridge over the k River, near Bondurant, to N. M. Stark ge Co., Des Moines, Ia.

The Lana Construction Co., Council fs, Ia., has been awarded the contracts the construction of three new steel bridges. are located near Adel, one being 120 ft. and the other about 80 ft. span. The l structure will be constructed near Perry, and will be 220 ft.

The Board of Supervisors of Audubon nty, Ia., has awarded the contract for the truction of bridges, for which bids were ned June 12, to S. G. Hunter Iron Works Omaha, Neb., at $9,180. The contract udes seven reinforced concrete boxes, one forced concrete arch and two low steel s bridges with concrete floors and abut- ts. C. D. Forsbeck, Blackhawk Bldg., erloo, Ia., is Engineer.

Albert W. Merrick, 409 Boone National g., Boone, Ia., has been awarded the con- t for the foundations for the steel viaduct, miles north of Boone, for the Fort Dodge, Moines & Southern Ry. The work will ide 28 piers containing approximately 740 yds. of concrete. Bids were opened for work June 8.

he Board of Supervisors of Sioux County, nge City, Ia., has ordered the construction new bridge to replace the old one over Creek at Wisconsin St., Hawarden, Ia. s proposed to build a modern reinforced crete arch bridge.

Kansas.

The Commissioners of Shawnee County, eka, Kan., have, it is reported, let the tract for the construction of the proposed k plant bridge over the Kaw River, 3 miles t of Topeka, to the Leavenworth Bridge Leavenworth, Kan., at $29,500. The com- y will commence work within a few weeks expect to have it completed by January 1. ere will be eight spans in the bridge and vill have a total length of over 1,000 ft. el and reinforced concrete will be used in structure. A part of the remains of the old bridge which was washed out in the 1903 flood will be used.

It has been announced by William Daniels, Drainage Commissioner, Kansas City, Kan., and Timothy Lyons, Wayndotte County Commissioner, that plans have been prepared for the construction of a new bridge over the Kaw River, connecting with the proposed viaduct at 19th St. and Kansas Ave., Kansas City, Mo.

The Wyandotte County Commissioners, Kansas City, Kan., have decided to build a high-line bridge across the Kaw River at Kansas Ave. to meet the higher level of the proposed Twenty-third St. trafficway from Missouri, provided the Kansas City, Mo., officials see fit to begin action on their part of the structure. The Commissioners on Thursday instructed the County Engineer to prepare plans and specifications for a bridge on the lower level. These plans will be used, the Commissioners say, unless aggressive steps are taken by the Missouri officials.

Louisiana.

◉The Rapides Parish Police Jury Bridge Committee, Alexandria, La., has let the contract for the construction of a reinforced concrete bridge over the Bayou Rapides on the public road at the limits of the city, to the Hudson Construction Co., at $3,000. The structure, according to the plans prepared by I. W. Sylvester, Alexandria, City Engineer, will be 200 ft. long and will have a 14-ft. roadway.

Articles of incorporation have been filed at Baton Rouge, La., by the Baton Rouge Bridge & Terminal Co., capitalized at $1,000,000 and proposing the construction of a bridge over the Mississippi River at that point. The corporation is allowed to begin business when $10,000 of the capital stock has been subscribed. The incorporators are Hugh Chamberlain, of Baton Rouge; Joseph E. Hedges, of New York; L. S. Stewart, of Kansas City, Mo.; Walter Bynum, of Baton Rouge; W. B. Chamberlain, of New Orleans, and F. B. McQueety, of Baton Rouge.

The citizens of Lake Charles, La., have voted a ⅝ of a mill tax for 10 years to provide funds for the construction of a bridge over the Calcasieu River, between Lake Charles and Westlake.

Maryland.

A public hearing was held June 21, by Lieut.-Col. W. C. Langfitt at the City Council Chamber, Annapolis, Md., on the question of improving or rebuilding the following bridges, pronounced to be a hindrance to free navigation: Over College (Dorsey) Creek, Annapolis, Md., owned respectively by the Maryland Electric Railways Co., the County of Anne Arundel and the United States Naval Academy.

Massachusetts.

◉The Boston Bridge Works, Inc., Boston, Mass., has been awarded the contract for the reconstruction of the Chelsea Bridge North, Contract No. 2, at a bid of $117,997. Other bids received for the work June 16 were as follows: New England Structural Co., $120,182; Pennsylvania Steel Co., $138,700.

Michigan.

City Engineer H. N. Beck, Muskegon, Mich., estimates that the cost of building a bridge over Ryerson Creek on Clay Ave. will be about $3,145.

Plans are to be prepared shortly by City Engineer H. N. Beck, Muskegon, Mich., for the construction of a new concrete bridge over Ryerson Creek at Clay Ave., to cost between $2,000 and $3,000. The structure will be 66 ft. wide and will consist of a single arch resting on piles.

Minneapolis.

✣Bids will be received until 2 p. m., June 27 by Board of Norman County Commissioners, Ada, Minn., for the construction of the following concrete and steel bridges: One between Sections 14 and 15, Town of Mary, about 60 ft. long, 16-ft. roadway and 16-ft. abutments; one between Sections 23 and 26, Town of Lee, about 50 ft. long, 16-ft. roa and 16-ft. abutments; one between Sec 32 and 33, Town of Spring Creek, abo ft. long, 16-ft. roadway and 12-ft. abutm Certified check in the sum of 10 per ce the amount of the bid must be deposited the County Board. D. E. Fulton is Co Auditor.

It is reported that the Chicago, Milwa & St. Paul and the Minneapolis & St. Railroads are working on plans for the struction of a new reinforced concrete bridge over the tracks at Lake St. As posed, two 140-ft. concrete spans will c the five tracks of the two railroads. The mainder of the bridge will be filled in. west end is to be 581 ft. long and the end 820 ft. This will enable a lowering the grade from 5 per cent to 3 per cent. roadway will be 40 ft. wide, with broad s walks outside the curb. The extreme w will be 80 ft. It is estimated that it will t four or five months to construct the proaches and finish the spans. M. D. Rha Minneapolis, Minn., is District Engineer the Milwaukee R. R.

All bids received by the Board of Henne County Commissioners, Minneapolis, Mi for furnishing 50 tons of steel or corruga culverts have been rejected. New specifi tions will be presented to the Board July 1.

Minnesota.

✣Bids will be received until 4 p. m., 8, by J. L. George, Beltrami County Audit Bemidji, Minn., for the construction of a 5 ft. steel and concrete bridge over the Clea water River in Buzzle, Minn. Bids will considered for both concrete and floor plank J. L. George is County Auditor.

Mississippi.

✣Bids will be received until July 1, b Board of Supervisors, Sardis, Miss., it is said, for the construction of a steel bridge

✣Bids will be received until July 1, by Board of Monroe County Supervisors, Aberdeen Miss., for the construction of a 60-ft. span steel bridge over Cedar Creek on Egypt Road, and two 30-ft. span combination steel L-beam and concrete bridges over James Creek and James Creek Canal on Prairie Station Road. Plans and specifications are on file with the Clerk.

Missouri.

A petition has been filed with the Green County Court, Springfield, Mo., asking for the construction of a new bridge south of the James River club house. The structure as proposed will be 24 ft. long, with 16-ft. roadway.

Nebraska.

✣Bids will be received until 10 a. m., July 16, at the County Clerk's Office at Fullerton, Nebraska, for the construction of one steel bridge across the Loup River, located about one mile south of the town of Genoa, Nebraska. Bids will be received for the above bridge as follows: Genoa Bridge: One steel bridge, composed of five 136-ft. 6-in. spans, hig truss, with concrete piers and abutments, with alternate designs of piers and floors and extra materials, including earthwork, all as per plans and specifications. All bids must be sealed and accompanied by cash deposit or certified check for $1,000, made payable to Mr. F. M. Jones, County Clerk of Nance County, Nebraska. Bids will be publicly opened at the County Clerk's office in Fullerton, Nebraska, at 10:10 a. m., July 16, 1912. Copies of plans and specifications may be had upon application and payment of $5 at the office of the State Engineer. The County reserves the right to reject any and all bids or any part of any bid. D. D. Price, Lincoln, Nebr., is State Engineer.

◉The contract for the construction of all bridges in Lancaster County has been awarded to the Lincoln Construction Co., of Lincoln, Neb. Bids were opened June 3.

A bill has been introduced in Congress to grant permission to the Union Pacific to build the proposed bridge just north of the present

✣ indicates work now open for bids. ◉ indicates a contract let recently.

hi way at Omaha, Neb.

[illegible] have under consideration [illegible] a bridge over the [illegible] [illegible] ndation for the proposed structure.

New Hampshire.

t is rumored that the Boston & Maine R. R. under consideration the construction of ew steel bridge over the river at Dover nt, Dover, N. H., to replace the old pile icture on the Portsmouth & Dover branch hat place. F. E. Sampson, Nashua, N. H., Division Engineer.

New Mexico.

✣Bids will be received, it is reported, until . m., July 1, by Commissioners of Santa County, Santa Fe, N. Mex., for the con- [illegible]

New York.

The City Engineer of Utica, N. Y., G. H. ckett, has been instructed to prepare an imate for the construction of a bridge over Erie Canal at Cornelia St.

Common Council, Fulton, N. Y., has [illegible] the abutments to the lower bridge under ty labor system, as the bids submitted ntractors for the work were considered [illegible]

The New York, Ontario & Western Ry. has ns under consideration, it is reported, for [illegible] losia, N. Y., to replace the present single ck structure on the Scranton branch. R. W ntfield, Middleton, N. Y., is Assistant Engier.

Ohio.

✣Bids will be received until noon, June 27, Director of Public Service, Cleveland, O., r the construction of a reinforced concrete idge over Doan Brook. Plans and specificans are on file at the office of the Engineer. H. Kirby is Secretary of the Department.

✣Bids will be received until noon, July 5, Board of Franklin County Commissioners, lumbus, O., for furnishing the necessary or and material for the following work: [illegible] ncrete arch bridge over the Olentangy River King Ave., Columbus, O. Estimate No. 398 Constructing limestone rip-rap on the north pe of the approaches to the King Ave. idge over the Olentangy River, Columbus, Estimate No. 399—Constructing the west utment of the Olentangy River bridge on e Worthington and Elmwood Pike, Sharon ownship. The plans, specifications and estiates of quantities for doing this work, as r county plans, are on file in the offices of e County Auditor and County Surveyor. F. I. Sayre is County Auditor.

Pennsylvania.

✣Bids will be received until 1 p. m., July 2, Board of Warren County Commissioners, illiamsport, Pa., for the necessary labor and aterial for the construction and repair of e following bridges: Bridge No. 141—Reair of a 26-ft. bridge on Goodwin Gravel ad, 2 miles south of West Lebanan, Ind., d the cutting of approaches and adjacent ills to same. Said hills being commonly nown as the "Bonebrake Hill." Bridge No. 43—Construction of a 10-ft. span reinforced ncrete bridge in Section 11, Township 20 N., ange 9, W., on River road in Kent Township. idge No. 144—Construction of a 16-ft. span reinforced concrete bridge on north and south highway in Section 24, Township 22, N., Range 7, W., Warren Township. Bridge No. 145—Repair of corrugated culvert and the headwalls of the present culvert located on north and south highway at the center of Section 9, Township 22, N., Range 7, W., Warren Township. Bridge No. 146—Construction of a 12-ft. span reinforced concrete bridge on east and west highway ½ mile east of the "Little Mill" in Section 23, Township 23, N., Range 8, W., Pine Township. D. H. Moffit is County Auditor.

⦿The following contracts for which bids were received June 11, by Department of Public Works, Pittsburgh, Pa., have been let: Hoeveler St. bridge to C. M. Neeld Construction Co. at $[illegible]06.27; Tenth St. bridge to the Capital Construction Co. at $27,184; Millvale bridge to Pittsburgh Sanitary Flooring Co. at $1,029.62; W[illegible]not St. bridge to the Pittsburgh Sanitary Flooring Co. at $293.51.

The Council Committee on Surveys has recommended that $200,000 be made available for the construction in Philadelphia, Pa., as [illegible] Glenwood Ave. over P., G. and N. R. R., $16,000; 65th St. over P., B. and W. R. R., $20,000; 72d St. over P., B. and W. R. R., $20,000; Montgomery St. over Connecting Ry., $45,000; 66th Ave. north over North Penna. R. R., $26,000; Chester Ave. over P. and B. C. R. R., $38,000; Westmoreland St. over North Penna. R. R., $4,000; Lindley Ave. under North Penna. R. R., $35,000.

The City Council of Philadelphia, Pa., has passed an ordinance granting the Pennsylvania Railroad permission to widen Girard Ave. R. R. bridge, accommodating three additional tracks.

The McClintic-Marshall Co., Pottstown, Pa., has been awarded the contract for the reconstruction of the Lehigh Valley Transit Co. bridge over Trout Creek Meadow in the 12th Ward, Allentown, Pa. The new part of the structure will be 550 ft. long and 42 ft. high.

South Carolina.

⦿The Dillon County Supervisors, Dillon, S. C., have awarded the contract for the construction of a steel or reinforced concrete bridge over the Little Pee Dee River near Dillon to Edwin M. Wayland, County Engineer, as his estimate was lower than the lowest bid received. The structure will have a 28-ft. clear span and a 12-ft. roadway.

Texas.

⦿The Commissioners' Court of Uvalde County, Uvalde, Texas, has awarded the contract for the construction of the proposed bridge over the Leona River just south of the city to the El Paso Bridge & Iron Co., El Paso, Texas, at $2,638.

Virginia.

✣Bids will be received until noon, July 2, by Circuit Court, Russeli County, Lebanon, Va., for the construction of a steel bridge over Clinch River in Russell County two miles from Siding below Finney on the Norfolk & Western Ry. The superstructure will consist of two standard 119-ft. spans and two standard 50-ft. spans. The substructure will be cement rubble. Stone and sand may be obtained within 2 miles of the site. Plans and specifications may be obtained of the Clerk of the Court or of Childrey-Sunday County, Richmond, Va. P. St. J. Wilson is State Highway Commissioner.

Washington.

⦿The Board of Adams County Commissioners, Ritzville, Wash., has awarded the contracts for the construction of six steel bridges to the Central States Bridge Co., Indianapolis, Ind., at $20,000. The largest of the bridges will be erected at Lind and will have a 90-ft. span. Work will be completed by Decem-[illegible]

The Oregon-Washington Railroad & Navigation Co. according to reports will shortly let contracts for the construction of two bridges. One structure is to be erected over the Snake River to cost $60,000 and the other over Hangman Creek and the Spokane River to cost $160,000. The material for the work will be furnished by the railroad. F. L. Pitman, Spokane, Wash., is Chief Engineer.

The City Council of Spokane, Wash., has approved plans filed by the Spokane, Portland & Seattle R. R. for the erection of a reinforced concrete viaduct over 13th Ave. in Woodland addition. The proposed new bridge will have a 60-ft. opening for the street—two for 5-ft. sidewalks and a 40-ft. roadway. The road is permitted to use a supporting line of concrete columns in the middle of the street. R. Budd, Portland, Ore., is Chief Engineer.

West Virginia.

✣Bids will be received until July 11, by County Clerk, Elkins, W. Va., for the construction of a bridge and abutments to span the Tygards Valley River at Mill Creek. The structure will have a span of 105 ft. and a 14-ft. roadway. Bids will be received for steel or concrete bridge with stone or concrete abutments.

Wisconsin.

The Common Council, Milwaukee, Wis., at a recent meeting appropriated $8,000 for the construction of the proposed reinforced concrete bridge on Eighth Ave.

The City Council of Green Bay, Wis., has under consideration several plans for the construction of the proposed bridge over the East River at Main St. and also the Main St. structure.

Wyoming.

✣Bids will be received until noon, July 2, by Board of Weston County Commissioners, Newcastle, Wyo., for the construction of a bridge over Big Beaver Creek 10 miles from Newcastle. The structure will have a 70-ft. span and will be supported on piles. W. O. Carleton is Clerk.

Canada.

⦿The City Council of Vancouver, B. C. has awarded the constract for the construction of wood block pavement on Cambie St., Robson to Smythe to MacAdam & Co., $7,400; wood block pavement on Homer St., Robson to Drake, MacAdam & Co., $43,000, and stone block pavement, lane east of Granville, Davie to Pacific, to B. C. Granitoid Construction Co., at $9,949.

⦿The Court of Revision of the city streets Vancouver, B. C., has awarded the contracts for asphaltic pavements as follows: Canadian Mineral Rubber Co., 100,000 sq. yds., on 10th Ave., Alexander to Union St.; M. P. Cotton & Co., Ltd., 100,000 sq. yds., on Sixth Ave. Granville St. to Bridge St.

The Burrard Inlet Tunnel & Bridge Co. will call for bids for the construction of the Second Narrows Bridge as soon as the sanction of the Railway Commission is obtained. It is estimated that the work will take two and a half years for completion. Cleveland & Cameron, Vancouver, B. C., are Engineers.

City Council of New Westminster, B. C. has passed a by-law appropriating $250,000 for street improvements, and a by-law for $25,000 for park improvements.

IRRIGATION, DRAINAGE, LEVEES AND CANALS

Arizona.

We are advised that plans and specifications or the diversion dam and headworks for the anal of the Pinal Mutual Irrigation Co., on the Gila River, near Florence, mentioned in our June 12 issue, have not at yet been completed. James D. Schuyler, 1115 Hibernian Bldg., Los Angeles, Cal., is the Consulting Engineer.

Arkansas.

✣Bids will be received until 10 a. m., July 2 at Lewisville, Ark., for the enlargement of about 10 miles of levee in the Red River evee District No. 1, LaFayette County, Ark. he work will be north of the Cotton Belt ailroad. Further information may be ob- ained of Henry Moore, Jr., President of the istrict, Texarkana, Ark., or N. D. Harrel, ecretary, Lewisville, Ark.

Petition has been presented to the Jackson ounty Commissioners, Newport, Ark., for ne formation of drainage districts in Bird nd Jefferson Townships. Each district em- races about 3,000 acres. Lund & Hill, Little ock, Ark., have been appointed to make the rveys.

California.

President Taft has sent a special message o Congress asking it to appropriate $1,250,- 00 to protect the Imperial Valley of Califor- ia against emergencies of floods from the olorado River while negotiations for the rotection of that territory are pending with lexico. An immediate appropriation was rged to be used principally in the construc- on of levees and revetments along the Colo- ado River and to be expended under his di- ection.

Illinois.

✣Bids will be received until 2 p. m., July 1, y Warren R. Leach, Secretary, Big Lake rainage and Levee District, at the office f Glass & Bottenberg, Attorneys, Rushville, l., for levee and ditch construction, includ- ng the following approximate quantities: ection A Levee, 127,088.5 cu. yds.; Section Levee, 552,281.6 cu. yds.: Section C Levee, ,235.2 cu. yds.; Ditches 1 to 7 inclusive, 7,397.3 cu. yds. Plans and specifications may e seen at the offices of Glass & Bottenberg, ushville, Ill., or at the office of R. R. Carter. uccessor to the late C. W. Brown of Jackson- ille, Ill., or at the office of Warren R. Leach, ecretary of the Commissioners. Each pro- osal must be accompanied bv cash or certified heck on some responsible bank, payable to he order of R. C. Amrine, Treasurer, for he amount of 10 per cent of the total bid. ach bidder in connection with his proposal hall state the type of machines he expects o use, giving dimensions thereof and where he same may be seen, and the Commissioners hall determine whether or not such machinery nd equipments is sufficient for the construc- on on which the same is proposed to be sed. Any section or part of the work shall e commenced within 60 days after the notifi- ation by the Engineer or Commissioners that he same shall be commenced; that the whole nd every part of the levee and ditch work hall be completed on or before the first ay of September, 1913.

⊙Green & Sons Co., 181 N. La Salle St., Chi- ago, Ill., have been awarded the contract at 44,990 for constructing Sec. 5 of the Calu- et-Sag Channel. Bids for this work were pened May 3 by the Trustees Sanitary Dis- rict of Chicago. The itemized bids were given n our June 5 issue.

⊙Bids were opened June 21 at Pitman, Ill., or furnishing tile for Sub-District No. 3, the ontract being awarded to the Raymond Ce- ent Tile Co., for furnishing 18,595 ft. of 6-in. 24-in. tile. J. W. Dappert, Taylorsville, Ill., the Engineer.

Bids will be received, it is reported, until p. m., June 28, by John McGivney, County rainage Commissioner, at the residence of ohn Duris, Sec. 3, Osceola Township, Living- ton County, for the construction of the Os- eola and Genoa drain. This will be an open itch 8,800 ft. long, 3 and 4 ft. wide at bot- om, 2 to 6 ft. deep, 13 to 21 ft. wide at he top. Two bridges will be required; also 0 rods of 12-in. drain tile, 8 metal culverts, nd one cement arch bridge or culvert. A de- osit of $50 required with bids.

Plans will be submitted to the City Council f Peoria, Ill., by Leonard Jeffries, City Engi- eer, for the construction of a levee on the ater front between Fulton and Fayette Sts. he sum of $50,000 is available for the con- truction work.

Plans have been prepared for the construction of a main ditch, 6 ft. wide and 16,800 ft. long, for the Coloma and Montmorency No. 5 and Montmorency 3 Drainage District of Whiteside County. The main ditch contains about 30,000 cu. yds. and there will also be one lateral containing 10,000 cu. yds. F. W. Sears, Prophetstown, Ill., is the engineer.

The Chief Engineer of the Sanitary District of Chicago, Room 1500, 76 W. Monroe St., Chicago, Ill., has been directed to prepare plans and specifications for a sewage channel extending from Glencoe to Wilmette and emptying into the north shore diversion channel. The improvement for the benefit of the residents of the north shore suburbs will cost about $700,000. Its construction is dependent upon a favorable decision by the Supreme Court in an appealed case regarding the jurisdiction of the district.

Indiana.

✣Bids will be received, it is reported, until 10 a. m., July 6, by Supt. of Construction, at the office of LaFollette & McGriff, First National Bank Bldg., Portland, Ind., for the construction of the Henry Bubb ditch.

✣Bids will be received, it is reported, until June 29, by R. E. Keller, Construction Commissioner and Engineer, at the office of the County Surveyor, South Bend, Ind., for the construction of the George Steele ditch.

✣Bids will be received, it is reported, until June 29, by C. C. Ernst, Supt. of Construction, at the office of the County Surveyor, Decatur, Ind., for the construction of the A. Smith ditch and branch.

Iowa.

County Supervisors at Sioux City, Ia., have received bids for the sale of $30,000 worth of bonds for the Woodbury-Monona Drainage Ditch No. 2. The ditch runs through Willow township and extends 12 miles into Monona County. Its entire length is 18 miles. The sale of the bonds is for the carrying out of work in this county.

Kansas.

✣Bids will be received up to 1 p. m., July 16, 1912, at the office of the President of the Board of Directors, Delaware River Drainage District, near Ozawkie, Kan., for the construction of certain river cut-offs and an overflow channel. Plans and specifications are on file at the office of the Secretary of the District, near Ozawkie, Kan., and copies of the same may be obtained by mailing $5 to the State Engineer, Manhattan, Kan. The work consists in the excavation of 15 river cut-offs and one overflow channel. Lengths of cut-offs range from 250 to 1,270 ft.; average depths from 16.5 to 25.5 ft.; base widths from 28 to 45 ft.; side slopes 1 to 1. Distance between inside toe of slope of waste banks is to be 200 ft. The overflow channel is 5,300 ft. long; average depth 12 ft.; base widths 12 and 21 ft.; side slopes 1 to 1. A majority of the waste materials is to be placed on one side and 60 ft. beyond the center line of channel. Bids are solicited for the work in sections and for the construction of all the work. Total estimated amount of excavation 493,000 cu. yds. Excavation will be in earth ranging from a loam to a stiff clay. Some clearing will be required. The work is suitable for drag line excavators, or other similar types of dry land machines. There will be one railroad crossing. Maximum coal haul about 7 miles. A certified check of 5 per cent must accompany each bid. Work is to be begun within 30 days after the awarding of the contract and completed by September 1, 1913. Thos. Haney, Ozawkie, Kan., and Chas. Hoffman, Perry, Kan., will go over the work with contractors by appointment. H. B. Walker, Drainage Engineer, State Agricultural College, Manhattan, Kan., is Consulting Engineer for the District.

Minnesota.

⊙Contracts for the construction of Judicial Ditches in Koochiching County, Minn., have been let as follows: Mageau & Griffi River Falls, Minn., Ditch No. 1, 17 m 440, Ditch No. 3, 23 miles, $35,279; Hewitt, Minnesota, Minn., Ditch N miles, $18,380.

⊙S. J. Gaberick, Sheldon, Ia., h awarded the contract at $2,090 for c ing Ditch No. 12 of Stevens County, which were opened June 18 by F. E County Auditor. The work includes lowing: 2,900 ft. of 8-in. tile, clay c cured cement, 2,100 ft. of 10-in. tile, steam cured cement, 1,600 ft. of 12- hard burned clay or steam cured cem 400 ft. of 14-in. tile, hard burned clay salt glazed vitrified, 33 ft. of open wor erage depth of cut 5.11 ft., deepest c ft.

⊙Bids were opened June 18 by F. E. County Auditor, Morris, Minn., for co ing Ditch No. 13 of Stevens County, t tract being awarded to S. J. Gaberick o don, Ia., at $4,404. This ditch include ft. of 6-in. clay tile, 3,500 ft. of 8-in. cl 3,000 ft. of 10-in. clay tile, 4,200 ft. of clay tile, 1,000 ft. of 10-in. hard burne or salt glazed vitrified tile, 3,678 ft. of hard burned clay or cull salt glazed vi tile.

Mississippi.

✣Bids will be received until 4 p. m., Ju by W. E. Still, Secretary, Board of Con sioners, Tate County, Senatobia, Miss., the construction of ditch near Senatobia according to plat, profile and specificati all of which may be found at the Auditor's office. Work to begin on or be August 15th, 1912, and be completed on before December 31, 1912. Open ditch to divided into two sections: 1 and 2. Sec 1, approximately 50,000 cu. yds. Sectio 45,000 cu. yds. Depth, 2 to 6 ft.; botto ft. wide, with slope to bottom with 8 ft. berm each side. All bids must be by sect and must be accompanied by cash or cert check equal to 5 per cent of bid.

✣Bids will be received until July 3, it is s by Commissioners of Topashaw Swamp L District, Calhoun County, for the constr- tion of a 13-mile canal. D. P. Hodge, Sl Springs, Miss., is Clerk.

New Mexico.

Charles D. Miller, State Engineer, Sa Fe, N. M., has approved the plans and spe fications of the Urton Lake Carey project cover 100,000 acres near Fort Sumner, on t Pecos River, in Guadalupe County. T project will involve expenditure of $2,000,00 Four years are given for the entire constru tion, and two years for construction of on fifth of the project.

Tennessee.

✣Bids will be received until 11 a. m., Jul 1, by Maj. Clarke S. Smith, U. S. Engineer Memphis, Tenn., for the construction of abou 70,000 cu. yds. of levee work closing break in Cairo Drainage District levee.

Memphis, Tenn., and Vicinity.

(REGULAR CORRESPONDENCE.)

✣Sooner than was expected, Major Clarke S. Smith has come out with the announcement that he has 1,000,000 more yards of levee work to let, which he will offer on July 1, at Memphis. All the work is located in the White River district and for the benefit of those contractors who wish to bid on the work, below is listed information pertaining to it:

Miles.	Yards.	Kind of Work	Height.
22 to 23	[illegible]	New Loop	22.5 ft.
47 to 48	205,000	New Loop	17.6 ft.
48 to 49	205,000	New Loop	[illegible]
49 to 50	205,000	New Loop	[illegible]
61	[illegible]	Filling crevasse	18.0 ft.
65	15,000	Filling crevasse	22.0 ft.
72 to 73	59,000	New Loop	12.7 ft.

✣On July 20, Major J. A. Woodruff, in charge of the Vicksburg district, will re-let 1,000,000 cu. yds. of levee work as announced previously in this paper. The work is expected

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] Major Smith will have held two lettings prior to the Vicksburg feast and the larger contractors who could afford to take aboard a great deal of work, will have had their appetites somewhat appeased. Indeed, Major Smith may look for exceptionally high prices when he lets his work on the first, and as his is the best sort, the lower district may, in the long run, fare somewhat badly.

The first piece of work is to loop the Modoc, Ark., crevasse beginning about 2½ miles below the little town of Old Town, Ark. This place can be reached by taking steamer from Memphis and Helena. The next three pieces compose a long back line, beginning just above the Fergeson break, with which all the contractors in this section are more or less familiar, and coming out to the old levee about 2,000 ft. below the Adams store near Adams Ldg., Ark. The last three pieces are in Laconia Circle Levee. The first and second are below Henrico and the third is just back of Laconia. All of the above work is riverside borrow. Work will be put up to grade with an 8-ft. crown and 3 to 1 slopes. One foot topping will be added on the 8-ft. crown. Grubbing will be paid for at yardage contract price, stump hole measurements holding good. Work must be begun on 10 days' notice of acceptance of bid and is required to be finished by Dec. 31, 1912. It will be well for all bidders to examine map and profile which can be seen at the Engineer's office in the Federal building, Memphis. The eight-hour law will be strictly adhered to by the government officials.

Sam Bush, for the first time in many months, dropped in last week to bid his old Memphis friends good cheer. Sam is rather disgusted with his railroad work on the Rock Island near Kent and longs to once again plod old Ned on the levees. The high prices are a great inducement so Sam thinks, to bring many of the old boys back to the river, and while the longing in his heart is strong. Sam has not fully made up his mind what he will do.

Jesse Nichols is just about to finish up his work on the Memphis Compress contract and is now ready to consider some proposition from a good firm. Jesse prefers levee work, now that prices are so good, and is casting about for a connection with one of the big bugs who mop up on this sort of contracts.

Big Bill Stephenson is chafing at the bit trying to wind up his cheap contract at Atherton and get in one on the good work offered up and down the river. Bill has had a pretty hard time of it, first with high water and now with fever breaking out among his mules; but he is a game old bird and states that he will yet pull out to the good on his work.

"Old Poke" Roper says he is good and disgusted with the way his street contracts have been getting on lately, and is going to quit that work and go into the levee game. Poke says he has a great curiosity to see how his city mules will take to real hard work. He is confident that if their working ability is in accordance with their appetite, he will make more money than any one on the river. Poke is in the market for a nice little sub-contract, and would like to get next to a chance.

A committee has been appointed to journey up the river from Baton Rouge, and make an inspection of each and every crevasse in the line of levee, with a view of finding what defects were existant in the weak spots, in order to avoid these defects in future work. This committee was appointed by the General Assembly of the State of Louisiana.

The City Engineer expects the next few months to see the completion of the subways at Carolina Ave., Main St. and Third St. The Union Railway Co. is also ready to award contract for the construction of a subway under their tracks at Lamar Ave. The city officials have their eyes on several other dangerous crossings, and it is expected that they will soon introduce motions for several new subways. One point in particular that should be cared for is the Illinois Central crossing over the Parkway, where there have been several dangerous accidents. Recently a party of automobilists were struck at this intersection, and as a result one young woman lost her life. The Frisco crossing should also be provided for.

At their annual meeting, held at Memphis, on the 20th inst., the St. Francis Levee Board raised the levee tax 4 cts. per acre. The new rate will be 20 cents, against 16, the former rate, and will apply on about 1,750,000 acres. All the members agreed that this increase was necessary, in view of the immense amount of money that will be necessary to repair damages and strengthen the standing levee. The Levee Board will move their office back to Marion, Ark., at once, and take up active operations. This Board is also working on a contemplated bond issue of about one million dollars, but nothing definite has been done as yet.

Contractors on government work will have to hustle now to make money, for President Taft has signed the eight-hour bill, and now it is up to them to crowd ten hours work into eight hours. In view of the short time of completion on the majority of contracts let recently, it will take some tall hustling to pull through on time.

Dr. H. D. Cogdell, Assistant Live Stock Inspector, announces that the anthrax situation in this immediate vicinity is well under control, and no new cases have appeared for some days. This speaks well for the work of those in charge. No reports have come in from the low lands of Arkansas as yet, but rumors have it that several cases of charbon have appeared.

The County Commission is taking steps to raise about $200,000 at once, to do much needed work on roads and bridges. Chairman McKay says that there is not enough money on hand to do all the work necessary, and he will have to have more very soon.

Much interest was taken in the decision of the National Court of Claims, regarding the riparian land suits, which have been pending for seventeen or eighteen years. This decision was mainly in favor of property owners, and several millions of dollars will be collected by them for damages to lands by reason of levees constructed by the Government placing them between the river and the levee: There were over one hundred separate suits entered by owners, and each one was battled out to the end.

Engineers of the Frisco have been surveying a line from Lexington, Tenn., to Jackson for the New Orleans, Mobile & Chicago, and it is said that work will start in the immediate future. This road is planned to give entrance into Chicago from this section, according to current rumor.

Over a quarter of a million dollars in front foot assessment bonds will be issued by the City of Memphis in the near future, which looks like there will be lots of new street work coming up. As soon as this issue is disposed of, contractors here are looking for new work to be advertised by the bushel, and all are eager to get a look in.

Shortly after July 1, it is said that the Illinois Central road will call for bids on the construction of their $3,000,000 terminal at Memphis. This terminal has been planned for some time, but has only recently been settled by the officials, and they now say that work will begin shortly after the 1st of July, and that some new records will be made in the construction of this depot, which will be one of the finest in the South. In connection with this work, it is rumored that the I. C. will also raise all their tracks along the river front. The terminal plans call for the entering of all tracks into the second story of the building, and in order to do away with too sharp a grade, it will be necessary to raise the tracks for some distance. Plans were drawn by the late D. H. Burnham, of Chicago, and contract will be let by Chief Engineer A. S. Baldwin. There will be approximately half a million cubic yards of excavation. Official announcement of this work is expected any day from the Vice-President's office.

Texas.

✣Bids will be received until noon, June 2
by Commissioners of Drainage District No.
Chambers County, John Stewardson, Chai
man, Winnie, Tex., for the construction
the following canals: Spindle Top Che
ditch No. 1, 12,500 cu. yds. excavation; Spind
Top Creek ditch No. 2, 17,400 cu. yds. excav
tion; Oyster Bayou ditch, 3,500 cu. yds. exc
vation; machine ditch No. 1, 7 miles lon
machine ditch No. 4, 13 miles long; machi
ditch No. 5, 3 miles long; machine ditch No.
1 mile long; machine ditch No. 3, 2 miles lo
Plans and specifications may be seen at offi
of Drainage Commissioners at Winnie, or
County Judge at Anahuac, Tex. Bids r
ceived for work complete or for any part
same. Each bidl to be accompanied by cer
fied check for 5 per cent of the amount bi

An election will be held on July 1 in t
Katy-Clodine drainage district of Fort Be
County, Richmond, county seat, to vote on t
issuance of $100,00 drainage bonds.

The Commissioners' Court of Harris Cou
ty, Houston, has created Drainage Distr
Nos. 6 and 7, and at an early date electio
will be held in the two districts to decide
the issuance of bonds with which to secu
funds to put into effect the work as has be
planned. The two issues, while voted on se
arately, will involve $300,000 in bonds, the r
ceipts from the sale of which will be expen
ed in the drainage work. District No. 6 w
embrace about 20,000 acres of land, beginni
at Green's Bayou, thence along the right-
way of the Texas & New Orleans R. R.
the west line of the Reel survey, and taki
in East Houston and Drysdale and the su
rounding country. District No. 7 includ
about 35,000 acres of land situated betwe
the tracks of the Houston Belt and Termi
Ry. and the International & Great Northe
R. R., and including the Henson survey a
other acreage.

The Rockwell-Slining Engineering C
San Antonio, Tex., is making surveys and i
vestigations for the irrigation of the B
Reyes Grant in Dimmitt County, for G. De
ton of the Denton Colony Co.

Washington.

The Commissioners of Drainage Distr
No. 3, Herbert S. Upper, Secretary,
Leary Bldg., Seattle, Wash., have receiv
bids for the purchase of $60,000 of bonds. T
money will be used in dredging and oth
wise improving a section of the Duwam
waterway.

Necessary capital is reported to have be
assured for the construction of the Moni
branch of the Siecle Canal near Wenatch
Wash. The canal will be about 16 miles lo
and will cost about $60,000. G. G. Black,
First Ave. S., Seattle, Wash., is interested

Wisconsin.

✣Bids will be received until 10 a. m., J
30, by Commissioners of Center Drainage D
trict, G. T. Thorn, Attorney, 143 Main
Oshkosh, Wis., for the construction
ditches in the Center Drainage District
the towns of Grand Chute and Center,
Outagamie County, Wisconsin, according
the plans and specifications of the engine
now on file in the office of the Clerk of
Circuit Court of Outagamie County, W
consin. Said ditches as surveyed by the
gineer, are about 6 miles long, and the e
mated number of yards of dirt to be ex
vated is about 72,000 yds., and from 500
1000 yds. of limestone, also about 23 ac
of land to be cleared of underbrush and tr
the same being the right of way thro
which said ditch passes. Total estimated c
of construction of said ditch being $8,000,
cluding clearing and excavation of stone. B
will be received for the work as one j
Each bid must be accompanied by a certi
check on a National Bank or Trust Comp
for not less than 10% of the bid.

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

WATER-WORKS

Arkansas.

he Water and Light Commission of vette, Ark., has sold bonds to W. A. Burks Bentonville, Ark. The proceeds will be d in the construnction of a waterworks light plant.

California.

he mayor and city engineer of Riverside, ., recently visited the city of Pasadena for purpose of investigating the water plant that city, with a view to installing a simi- one in Riverside.

Colorado.

Grant Lee, 1238 Quitman St., Denver, o., has been awarded the contract by Capt. T. Frissell, Constructing Quartermaster, t Logan, Colo., for the sinking of one 8- deep tubular well at the fort. The ap- ximate cost is $5,000. Bids were opened 17.

he taxpayers of Oak Creek, Colo., on June authorized a bond issue of $30,000 for the struction of a municipal gravity system waterworks, the work to be commenced nediately and completed before fall. The ns provide for a supply of pure mountain er ample for a town of 5,000 people, with icient hydrants for fire protection.

he citizens of Johnstown, Colo., at a re- t election voted the issuance of bonds in sum of $20,000 for the construction of a waterworks system.

he city of Boulder, Colo., is advertising bids at present for the completion of the ion dam in connection with the construc- of the waterworks system. The state en- eer will supervise the work.

Connecticut.

ollowing bids were received June 15 by Constructing Quartermaster, New Lon- , Conn., for the making of improvements he water supply at Fort Terry: New Eng- d Eng. Co., New London, Conn., Item 3, 00; Whitall Electric Co., Westerley, R. I., n 3, $2,880; Sweeney & Gray Co., Long nd City, N. Y., Item 2, $2,025; Augustus venuti, New London, Item 1, $2,750, Item $2,697; J. E. Edgecomb, Groton, Conn., n 1, $2,600.

Georgia.

n election will be held in Cordele, Ga., rtly for the purpose of voting on the issu- e of bonds to the amount of $95,000 for lic improvements to the waterworks sys- , and for paving the principal business ets.

n election will be held in Valdosta, Ga., July 16 for the purpose of voting on the ance of bonds in the sum of $55,000 for rging the water plant.

Idaho.

he citizens of Weiser, Ida., at a recent tion voted the issuance of bonds for a siderable amount of improvements, in- led in which will be the laying of 10 miles water mains at an estimated cost of $90,- . R. J. Wood of the Weiser Engineering is City Engineer. J. B. Congdon of se, Ida., and J. W. Bailey of Baker, Ida., Consulting Engineers.

Illinois.

Bids will be received by L. E. McGann, mmissioner of Public Works, Chicago, Ill., il 11 a. m., July 3, for making the neces- repairs on engines Nos. 1, 2, 3 at the Chi- o Ave. pumping station, Chicago Ave. and coln Park Blvd. The repairs consist of nishing 3 suction and 3 discharge valves plete; all valve seat bodies are to be made closed grained iron, the valve seats to be bronze, accurately fitted, the casings to be from various imperfections as noted in cifications.

The Seager Engine Works, Lansing, Mich., submitted a bid of $9,395 to L. E. McGann, Commissioner of Public Works, Chicago, Ill., for furnishing, delivering and erecting at the Jefferson Park pumping station, 4440 N. 47th Ave., three triplex double-acting or single-acting pumps, each of a capacity of 100,000 gals. per 24 hrs. against a working head of 40 ft. Bids opened June 12.

The Cleveland, Cincinnati, Chicago & St. Louis Railway Co. is having surveys made at Bloomington, Ill., for several improvements which are to be made along the right of way. Among these is a new pump station which is to be erected on the south side of the tracks, just east of Center St., to replace the old frame structure. Robert Ferriday, Superintendent of Maintenance of Way, Indianapolis, Ind., is in charge of the survey.

Indiana.

✣Bids will be received until 5 p. m., July 16, by Common Council (readvertisement), Shelvybille, Ind., of the construction of a pumping station and the installation of machinery therein. L. E. Webb is Clerk.

Iowa.

The City Council of Sioux City, Ia., will take steps to carry out the plans for the improvement of the waterworks system as soon as the specifications have been prepared by Consulting Engineer Dabney Maury of Peoria, Ill. The proposed improvements will cost approximately $53,000.

The citizens of Nashua, Ia., at a recent special election voted to sink a deep well and erect a water tower to furnish a supply of pure water for the town.

Kansas.

✣Bids will be received until 2 p. m., June 27, by G. H. Krienhagen, City Clerk, Independence, Kan., for furnishing Ludlow, Corey, Ia., or Darling hydrants, f. o. b. Independence, Kan.

✣Bids will be received until 2 p. m., July 5, by G. H. Krienhage, City Clerk, Independence, Kan., for constructing and guaranteeing settling basin No. 1, Water Works extension, Independence, Kan., A. D. Stivers is City Engineer.

✣Bids will be received until 2 p. m., June 27, by G. H. Krienhagen, City Clerk, Independence, Kan., for furnishing valves, f. o. b. Independence, Kan.

✣Bids will be received until 2 p. m., June 27, by G. H. Krienhagen, City Clerk, Independence, Kan., for furnishing galvanized iron pipe and gate valves, f. o. b. Independence.

✣Bids will be received until 2 p. m., June 27, by G. H. Krienhagen, City Clerk, Independence, Kan., for furnishing cast iron pipe and special fittings, f. o. b. Independence.

✣Bids will be received until 2 p. m., July 18, by Board of Commissioners, Independence, Kan., for construction, delivery and erection of a horizontal, cross compound, crank and fly wheel, condensing pumping engine upon foundations for the city water works department. G. H. Krienhagen is City Clerk.

Kentucky.

No steps as yet have been taken in regard to the installation of a waterworks system in Harlan, Ky., and probably will not be this year. George B. Turner is Mayor.

Maryland.

✣Bids will be received, it is reported, until noon, July 2, by Water Committee at the office of the City Clerk, Westernport, Md., for the construction of a water works system. Plans and specifications are on file with the city engineer.

The Water Board of Baltimore, Md., recently made a trip to Harrisburg, Pa., for the purpose of inspecting the filtration pla that city. It is probable that the Boar recommend a loan of $2,000,000, for the struction of a similar plant in Baltimore. B. Whitman is Chief Engineer.

Massachusetts.

⊙J. M. Dineen & Son of Eastham Mass., have been awarded the contract b the Board of Water Commissioners, Athol, M for the construction of a slow sand filtr plant at $12,220. The work includes two beds 87x132 ft. each in size with earth bankments, and paved slopes, including pipes, gravel and filter sand in beds 4 in thickness. James L. Tighe, Holyoke, M is Engineer. Bids were opened June 15.

Michigan.

The citizens of Highland Park, Mich. a recent election voted the issuance of b in the sum of $49,500 for waterworks ex sions. The most important improvement cluded in the new specifications will be laying of a 16-in. water main on Hamil Blvd., from Detroit city limits to La B Ave., a distance of one mile.

Minnesota.

✣Bids will be received until 10 a. m., J 27, by City of Dawson, Minn., for the c struction of a concrete gravity dam compl containing about 330 cu. yds. of concre waste gate timber apron, sheet piling, reta ing walls, bulkheads, etc. H. O. Halvors is City Clerk.

Mississippi.

✣Bids will be received, according to ports, until 8 p. m., July 2, by Board of dermen, Biloxi, Miss., for extending the wat system.

The citizens of Poplarville, Miss., ha voted to lease the light and water plant the town to J. G. Rouse for a term of fi years.

Montana.

It is expected that the City Council of Bil ings, Mont., will endeavor to make arrange ments to purchase the privately owned wate plant, following the report on the plant o June 25, of engineers employed to investigat and determine the physical valuation of th system.

Nebraska.

An election was held in Osmond, Nebr., on June 20 for the purpose of voting on the issuance of bonds in the sum of $5,000 for the making of extensions to the waterworks.

The citizens of Homer, Nebr., at a recent election voted the issuance of bonds in the sum of $10,000 for the installation of a waterworks system.

New Hampshire.

✣Bids will be received until 2 p. m., July 1, by Selectmen, Wolfeboro, N. H., for furnishing materials and labor for the construction of about 11,000 ft. of 6-in. cast iron water main according to specifications or for the construction only.

New Jersey.

✣Bids will be received until 8 p. m., July 8, by Village Board of Trustees, South Orange, N. J., for furnishing the following materials for water works improvement: 4,650 ft. 12-in. cast iron coated bell and spigot water pipe; 48 ft. 10-in. cast iron coated bell and spigot water pipe; 90 ft. 8-in. cast iron coated bell and spigot water pipe; 7,000 lbs. of pipe specials; 4 12-in. gate valves; 2 10-in. gate valves; 2 8-in. gate valves; 8 valve boxes; 4 valve standards. All the above to be delivered, freight prepaid, to South Orange, New Jersey. Specifications covering the above can be obtained upon application to John J. Boyd, Consulting Engineer, No. 11 Broadway, New York City. Each bid must be accompanied by

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

[illegible] is Village Clerk.

✣[illegible] 8, by Village Board of Trustees, South Orange, N. J., for the construction of a con- [illegible] specifications can be obtained at the Village Hall, or at the office of John J. Boyd, Consulting Engineer, No. 11 Broadway, New [illegible] to be refunded if the plans and specifications are returned within 20 days, in good condi- [illegible] certified check to an amount of $1,000. M. A. Fitzsimmons is Village Clerk.

⦿The Board of Street and Water Commissioners, Jersey City, N. J., has awarded the contract for excavating trenches and refilling the same and laying cast iron water pipe in paved or unpaved streets of the city to Jno Nolan of that city at the following figures: Laying 8-in. pipe, $0.34½ per lin. ft.; laying 10-in. pipe, $0.35 9/10; laying 12-in. pipe, $0.37 44/00, and rock excavation, $3.90 per cu. yd. The work includes about 40,000 lin. ft. of pipe. Bids were opened June 17. E. B. See is City Clerk

The citizens of Cape May, N. J., at a re- [illegible] bonds in the sum of $50,000 for the installation of municipal water, light and sewer plant.

New York.

⦿Following bids were received by the city of Wolcott, N. Y., on June 19 for the installation of a waterworks system: Fachelte Bros., Clyde, without standpipe, $34,000, awarded contract; Conway & Co., standpipe only, $2,950; George P. Shepherd Co., Philadelphia, Pa., $42,573 for complete system; P. R. Anthony Co., Altoona, Pa., without stand- [illegible] 711, without standpipe; Paddock, George & Co., Rome, $38,250, without standpipe; James Taige Co., New York, $36,087, without standpipe; E. A. Evans, New York, $40,758, without standpipe. The following were received for standpipe only: Chicago Bridge & Iron Co., Chicago, Ill., $2,330; Dooer Boiler Works, New York, $2,585; Kennett & Co., New York, $2,890; Demoins Bridge & Iron Co., Pittsburgh, Pa., $2,420; Tippett & Wood, Pittsburgh, N. J., $2,698; Sharon Boiler Works, Sharon, Pa., $2,820, and Teeds Brothers & Co., Alliance, O., $2,900. The estimated complete cost for the system was about $42,000.

Consulting Engineers George C. Whipple and C. W. Dodge for the city of Rochester, N. Y., have made sanitary surveys of the lake and river to determine the extent of pollution caused by the sewer effluent. It is expected that the experiments made will result in information bearing on the arrangements to be provided for the new sewage disposal plant.

North Carolina.

✣Bids will be received until 2 p. m., July 16, by Board of Commissioners, Carthage, N. C., for the construction of a system of waterworks and sewerage. A certified check for 10 per cent the amount bid must be filed with each bid. W. G. Jennings is Secretary.

An election will probably be held in Weaverville, N. C., shortly for the purpose of voting on the issuance of bonds for the installation of a waterworks.

North Dakota.

✣Bids will be received until 8 p. m., July 1, by C. M. Olson, City Auditor, Wahpeton, N. Dak., for the construction of a reinforced concrete reservoir at the water works plant.

Ohio.

✣Bids will be received until noon, July 10, by City of Sandusky, O., for furnishing and installing four new filters and two sedimentation basins; also for extending the filter house and drilling a 1,500,000 well. The cost of the work is estimated at nearly $100,000.

✣Bids will be received until noon, July 18, by J. M. Williams, Director of Service, Portsmouth, O., for furnishing the necessary labor and material for the improvement of the waterworks system. Plans and specifications are on file with the Director of Service or with Witmer & Brown, Chapin Block, Buffalo, N. Y., Engineers. Official advertisement will be found elsewhere in this issue.

⦿Link & Henry have been awarded the contract by the County Commissioners, Youngstown, O., for building the concrete dam at the county infirmary lake, Canfield, at the following bid: Excavation, $1 per cu. yd.; concrete mixture 1-3-5, $6.69 per cu. yd.; concrete mixture 1-2-4, $6.98 per cu. yd.; removing old masonry, $7 per cu. yd., and dam spillway, $75.

Pennsylvania.

⦿According to advices from Canonsburg, Pa., the North Strabane Water Co. has let a contract to the Hallam Construction Co., of Washington, for the building of the water company's new impounding dam on the South or Little[illegible] branch of Chartiers Creek.

South Carolina.

On July 25 the citizens of Rock Hill, S. C., will vote on the issuance of bonds in the sum of $50,000 for the purpose of constructing a pipe line to secure additional water from the Catawba River. This pipe line will cost about [illegible]

Texas.

The city of Waco, Tex., will shortly commence work on additions and extensions to the local water plant for which bonds were recently sold. Land is to be condemned for a filtration plant in North Waco, and a reservoir is also to be constructed. Extensive additions to the mains are planned. The improvements will cost approximately $400,000.

The Wooten Wells Water Co., Wooten Wells, Robertson County, Tex., has been incorporated with a capital stock of $50,000. The incorporators are: M. D. Watson, M. W. Shuler and C. P. Link.

The City Council of Madisonville, Tex., has called an election for July 15 for the purpose of voting bonds to the amount of $16,000 for the installation of a system of waterworks. Water would be secured from deep wells.

The City Council of Kosse, Tex., it is reported, has retained the Fountain-Shaw Engineering Co., of Dallas, Tex., to prepare plans and estimates for the installation of a system of waterworks. It is proposed to issue bonds for the improvement.

The City Council of Lockhart, Tex., has granted a franchise to Joe E. McDowell to lay water pipes, mains and other appliances on the streets and alleys of the city.

Virginia.

The council committee on water of the City Council, Richmond, Va., has recommended a special appropriation of $65,000 to lay a 30-in. water main from the new reservoir along Mulberry St. to Broad and down Broad St. to Bowe, the work to be done before the street west of Harrison is paved.

Bonds to the amount of $25,000 were recently voted by the citizens of Bridgewater, Va., for the installation of a waterworks system.

Washington.

The city of Bellingham, Wash., is planning a new intake at Lake Whatcom to cost $150,000.

The City Council of Grandview, Wash., has ordered the issuance of a call for bids for the sinking of the new city well, included in part of the $18,000 water system voted by the city last spring.

Wisconsin.

✣Bids will be received until 7 p. m., July 1, by Robert Luchsinger, Village Clerk, Belleville, Wis., for the construction of a brick power house 16 ft. by 24 ft. by 12 ft. high for one 240 gal. triplex pump and one 18 to 20 h. p. gasoline engine. A certified check for $50 must be filed with each bid. W. G. Ki offer, Madison, Wis., is Engineer.

⦿Morrissey Bros., of Elkhorn, Wis., h been awarded the contract by D. W. Stanf Supt. Walworth County Asylum, Elkh Wis., for the construction of a reinfor concrete reservoir 20 ft. in diameter by 11 deep, at $1,470. W. G. Kirchoffer, Madi Wis., is Engineer. Bids were opened June

A petition has been circulated in Madi Wis., for the extension of water mains Erin and Emerald Sts.

An ordinance has been introduced in City Council of Milwaukee, Wis., provi for the construction of a permanent chlor tion plant at the North Point pumping stat The ordinance provides for an $8,000 plan

Wyoming.

The Town Council of Cody, Wyo., voted to submit to the voters of the town proposition to bond the town in the sum $30,000 for the purpose of rebuilding the terworks system. Plans and specificat were prepared some time ago by Consul Engineers Burns & McDonnell, Scarritt B Kansas City, Mo.

Canada.

✣Bids will be received until 11 a. m., 15, by Chairman, Board of Control, Winni Man., for supply of quality of 12 in. cast water pipe and specials, hydrants and valves for extension of the fire service wa works. Specifications and forms of ten together with conditions governing ten as prescribed by by-law, may be obtained the office of the City Engineer, 223 James M. Peterson is Secretary.

✣Bids will be received until 8 p. m., 9, by L. A. Duncan, Secretary-Treasurer, tevan, Sask., for the construction of the lowing works: Contract "A"—Water w force main; Contract "B"—Water works p house; Contract "D"—Water pipes; Cont "G"—Pumping machinery; Contract " Pump well; Contract "O"—Outfall sev Contract "X"—Sewage disposal works. P and specifications may be seen at Estevar at the Engineer's offices. Chipman & Po Engineers, Toronto and Winnipeg.

✣Bids will be received until 8 p. m., Ju by H. W. Dixon, Secretary-Treasurer, N Battleford, Sask., for the necessary labor material for the construction and sinking (a) steel pump well, (b) concrete pump Plans and specifications may be seen at offices of Chipman & Power, Engineers, nipeg, Man., and Toronto, Ont.

✣Bids will be received until noon, Jul by G. R. Geary, Chairman Board of Con Toronto, Ont., for the laying and jointing a 36-in. water main on Front St. from to Simcoe St. with connections. Speci tions may be obtained of the Commissione Works.

✣Bids will be received until 8 p. m., Ju by H. W. Dixon, Secretary, Treasurer, N Battleford, Sask., for the construction pump well. Plans and specifications ma seen at North Battleford or at the offic Chipman & Power, Engineers, Toronto, and Winnipeg, Man.

✣Bids will be received until 8 p. m., 15, by Joseph Cave, Secretary-Treasurer, rous, Man., for the following contracts, in cordance with plans prepared by Chipma Power, Winnipeg, Man., and Toronto, C Contract A, all labor and certain mate necessary for laying water pipes and sew contract C, this contract will be sub-div as follows: 1, furnishing materials and l for and erecting steel water tower; 2, furn ing materials and labor for and construc concrete foundation for water tower; 3, nishing material and labor for and constr ing frame housing for water tower. Cont D, furnishing cast iron water and special ings; contract E, furnishing gate valves, hydrants, etc.; contract S, furnishing se pipes and junctions; contract T, furnis

✣ indicates work now open for bids. ⦿ indicates a contract let recently.

material for concrete walks. Plans, ons, etc., may be seen at the Town trous, or at the engineer's offices, and Toronto, on or after July 1,

will be received until 8 p. m., July eph Cave, Secretary-Treasurer, Watk., for the following work, in ac- with plans prepared by Chipman & Power, Engineers, Winnipeg, Man., and Toronto, Ont.: Contract B, all labor and materials necessary for the construction of pump house; contract G, furnishing and erecting pumping machinery; contract I, furnishing material for constructing, collecting galleries and suction well.

The City Council of Winnipeg, Man., has reaffirmed its former action to proceed at once with the construction of a pipe line to Poplar Springs.

The city of Regina, Sask., plans to expend approximately $500,000 this year in enlarging and improving the system of waterworks. A large reservoir will be constructed.

The City Council of New Westminster, B. C., has passed a by-law providing $75,000 for waterworks extensions.

EWERAGE AND GARBAGE DISPOSAL

Arkansas.

will be received until July 2, by District Commissioners, Russellville, the construction of a sewer system to cost $30,000. E. A. Kingsley, ck, Ark., is Engineer.

California.

Board of Public Works of San Fran-l., has awarded the contract for the n of the section of the North Point er at Sansome, Market and Second he Daniel Construction Co., of San , at $81,303.

ty Council of Santa Ana, Cal., has l a right-of-way from the Willow . for an outfall sewer to run 1¼ the ocean.

ty Engineer of Oak Park, Cal., has plan for the installation of a sewer roughout the annexed district. The ion has been subdivided into seven ch draining in a different direction.

oard of Trade of Hollywood, Ind. s Angeles, Cal., has filed a petition City Council and Board of Public asking that plans be prepared for a nsive system of lateral sewers to con- entire district with the main sewer nstructed to connect with the outfall

Idaho.

tizens of Weiser, Ida., at a recent voted the issuance of bonds for a ble amount of improvement work, in which will be 8 miles of sewers. l to cost $70,000. R. J. Wood of er Engineering Co. is City Engineer. ngdon of Boise and J. W. Bailey of e Consulting Engineers.

Illinois.

will be received by the Board of nprovements, Chicago, Ill., until 11 a. 1st, for furnishing and delivering• laterials, etc., necessary to construct n portions of several streets.

will be received by the Board of nprovements, Chicago, Ill., Edward J. Secretary, until 11 a. m., July 1st, ishing materials, labor, etc., necessary truct housedrains in a number of

. Bartlett of Evanston, Ill., has been the contract by the Board of Local ments of North Chicago, Ill., for the tion of lateral sewer systems, as fol- n portions of Sheridan Road, Broadte St., South Park Ave., South Lin- South Victoria St., 18th St., 17th St. ortions of the alleys in block 50, South an subdivision, at $8,734; also in por- South Victoria St., South Lincoln St., St., 11th St., 12th St., 13th St. and of the alleys in blocks 1 and 2 subdivision and 5 and 6 re-subdivision of Waukegan Highlands, at $5,326.

Engineer L. D. Jeffries of Peoria, Ill., pleted plans for the disposition of the wer outlets which at the present time e proposed new city levee. According lans, the three sewers will be joined o outlets, one to empty at the south end of the new levee and the other at the north end.

The City Council of Wilmington, Ill., has retained Civil Engineer William Kramer, 30 N. La Salle St., Chicago, Ill., to prepare plans for the installation of a sewer system.

The Morse-Warren Co. has completed plans and estimates for the installation of a sewer system in the business section of the town of Gillespie, Ill.

Indiana.

✣Bids will be received until 2 p. m., July 8, by City of Thorntown, Ind., for the construction of a sanitary sewer, including the following approximate quantities: 3,267 ft. of 10-in. straight sewer pipe; 2,907 ft. of 8-in. straight sewer pipe; 381 ft. of 10-in. Y junctions; 207 ft. of 8-in. Y junctions; 22 manholes; 3 flush tanks. The cost of the work, according to the estimate of Oliver Clark, Engineer, Lebanon, Ind., is $5,548.

⊙The Board of Public Works of Hammond, Ind., has awarded the contract for the Columbia Ave. and Hoffman St. sewer, Sections A, B and C, to Lavene Bros.

⊙The City Council of Goshen, Ind., has let the contract for the West Goshen sewer system to Chas. Kutz at $6,450, for the main line on Berkey, Dewey and Indiana Aves.; also to William Byrne at $1,398, for the lateral on West St.

⊙The Board of Public Works of Fort Wayne, Ind., has awarded the contracts for $10,000 worth of sewerage in the new Pontiac Place addition in the southwest part of the city to Derheimer & France.

Iowa.

✣Bids will be received until 9 a. m., June 27, by City Clerk, Burlington, Ia., for the construction of a 15-in. vitrified pipe sewer, with the necessary catch-basins, manholes, inlets and connections, in Vine St., from the center of Sixth and Vine Sts., to the center of Alley No. 5 and Vine St., and in Alley No. 5, from the center of Alley No. 5 and Vine St. to the Angular Run sewer. H. G. Vollmer is City Engineer.

✣Bids will be received until 8 p. m., June 28, by D. S. Struble, City Clerk, LeMars, Ia., for the construction of 3,659 ft. of 8-in. sewer and 175 ft. of 10-in. sewer.

⊙O. P. Herrick has been awarded the contract by the City Council of Des Moines, Ia., Horace Susong, City Clerk, for the construction of a 10-in. vitrified clay pipe sewer in Tiffin Ave., from a connection with the sewer in First St., east to Oxford St., thence north along Oxford St., to a point 85 ft. south of the south line of Euclid Ave., at $1.03. The work includes about 1,488 lin. ft. of sewer. Bids were opened June 12.

⊙The Burlington Construction Co., Tama Bldg., Burlington, Ia., has been awarded the contract by that city, H. C. Vollmer, City Engineer, for the construction of 1,065 ft. of 16-ft. span reinforced arch sewer at $23.30 per ft., and 100 ft. of 6-ft. span arch sewer at $12 per ft. Bids were opened June 17.

⊙Frank L. Griffey & Co., of Keokuk, Ia., have been awarded the contract by that city for putting in four blocks of sanitary sewer, the sewer to have a diameter of 8 ins., at the following prices: Excavation and backfilling, $0.80 per cu. yd.; inspection heads and half heads, $18.80 each; inlets, $0.33 per each 24 ins., and pipe sewer, $0.18 per lin. ft.

⊙The Burlington Construction Co. has been awarded the contract by the City of Burlington, Ia., for putting in the gap in Hawkeye sewer. The gap is one of 900 ft. in length, extending from Agency to Mt. Pleasant Sts., while there is to be a branch sewer of 6-ft. arch running west about 100 ft. The main sewer will be a 16-ft. arch.

⊙The C. B. McNamara Contracting Co., Dubuque, Ia., has been awarded the contract by the City Council of Charles City, Ia., for the construction of a sewer 2½ miles long.

⊙Following bids were received by the City of Creston, Ia., Theodore S. De Lay, City Engineer, on June 13, for the construction of the Sycamore St. sewer: (1) Standing for bid of Geo. Auracher, Creston; (2) Geo. M. King, Des Moines, Ia.; (3) O. P. Herrick. Des Moines; (4) L. V. Hites, Des Mo'ines; (5) Western Improvement Co.. Racine, Wis.; (6) W. L. Thomas, Corning, Ia.; (7) D. W. Wright & Co., Bedford, Ia.:

	(1)	(2)	(3)	(4)	(5)	(6)*	(7)
8-in. sewer, 3,000 ft.	$0.68	$0.48	$0.45	$0.58	$0.85	$0.42½	$0.66
6-in. sewer, 1,500 ft.	.65	.42	.35	.51	.55	.37½	.54
"Y" specials, 100	.55	.25	.60	.40	.40	.51	.60
Cast iron pipe, 46 ft.	3.06	1.00	1.50	1.20	1.30	1.05	3.06
Manholes, 33 ft.	2.65	4.00	4.50	4.00	3.00	1.13	2.87
Manhole tops, 6	6.75	6.50	8.00	6.50	7.00	5.75	6.00

*Contract awarded W. L. Thomas at $2,009.

Kansas.

⊙Maj. G. G. Bailey, Constructing Quartermaster, Fort Leavenworth, Kans., has awarded the contract for the construction of a garbage crematory at the fort to the Dixon Engineering & Construction Co., of Toledo, O., at $8,600. Bids were opened May 27.

The city of Ottawa, Kans., G. E. Strauchon, City Clerk, rejected all bids received June 19 for the construction of lateral sewer No. 56. The work includes approximately 1,050 lin. ft. of 10-in. vitrified pipe and 6 manholes. New bids will be received sometime in July.

The City Commission of Hutchinson, Kan., has adopted an ordinance providing for a sewerage system in the Orchard addition to the city. The ordinance provides for a 6-in. standard vitrified pipe sewer.

The City Commission of Topeka, Kan., has been asked to advertise for bids on the construction of a sewer to be built along the extreme west side of the city. The proposed sewer will be 9 or 10 miles in length and will be known as District No. 35. A. R. Young is City Engineer.

Louisiana.

✣Bids will be received until noon, Aug. 16, by Sewerage and Water Board, New Orleans, La., for furnishing and erecting one traveling

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

crane of 40 tons capacity, electrically operated, and one of 10 tons capacity hand operated. F. S. Shields is Secretary.

Maryland.

Following bids were received by the Board of Awards of Baltimore, Md., Calvin W. Hendricks, Chief Engineer of the Sewerage Commission, on Sanitary Contract No. 92, house connections across footways in District No. 15: Gallagher, Boyle & Muller, Baltimore, Md., $30,698; James Ferry & Son, Baltimore, Md., $41,409; Ryan & Reilly, Baltimore, Md., $46,862; B. F. Sweeten & Son, Baltimore, Md., $47,386.

Massachusetts.

✣Bids will be received until 7:30 p. m., June 28, by Sewer Commissioners, Dedham, Mass., for the construction of about 1,145 ft. of 8-in. sewer in Reed St. also for about 470 ft. of 8-in. sewer in Eleanor St., Dedham, Mass., in accordance with the specifications for the same. All propo als must be made on blanks provided for the purpose and be accompanied by a check for $200. Plans and specifications can be seen at the office of the Sewer Commissioners, or the Engineer, Dedham, Mass.

⊙The Conley Incinerator Co., Anadarko, Okla., has been awarded the contract by Capt. R. H. C. Kelton, Constructing Quartermaster, 263 Summer St., Boston, Mass., for the construction of a garbage crematory at Fort Strong, Mass., at $3,750. Bids were opened June 14.

The Sewer Committee of the City Council, Beverly, Mass., has rejected all bids received recently for the construction of the Byam-Montserrat sewer at Pleasant View, estimated to cost $168,000. New bids will be asked at once on the work, as well as for 25 car loads of sewer pipe. U. G. Haskell is City Solicitor.

Michigan.

⊙The Board of Public Works of Bay City, Mich., has let the contract for the Sixth and 16th St. sewers to Nicholas Meagher at $1,962.

⊙The Board of Public Works of Sturgis, Mich., Geo. S. Pierson, Kalamazoo, Mich., Engineer, has awarded the contract for the construction of a system of sewers, comprising approximately 40,000 ft. of 8 to 18-in., and 3,000 ft. of 30-in. sewers, to F. M. Bonner of Marion, Ind., at $38,793, and a contract for constructing a pumping station at $945. At the same time the Board awarded the contract for the construction of a disposal plant to Andrew Geeck of Owasso, Mich., at $8,647. Bids were opened June 18.

Plans are being prepared by the W. J. Sherman Co., Toledo, O., for the installation of a storm sewer system at Marshall, Mich.

The Village Council of Jonesville, Mich., has passed a resolution to construct a sewer running from the south end of Maumee St. and East St., thence north to the trunk sewer on Chicago St., at an estimated cost of $3,876. Harry Godfrey is Clerk.

L. C. Hillding has submitted the lowest bid to the Board of Public Works of Grand Rapids, Mich., S. J. Hufford, President, for the construction, reconstruction, enlarging and deepening of public sewer in Island St. Bids were opened June 13. L. D. Cutcheon is Secretary and General Manager.

Minnesota.

✣Bids will be received until 8 p. m., July 16, by W. H. Quist, City Clerk, Thief River Falls, Minn., for the construction of sewers. The bids are to be compared on the basis of the engineer's approximate estimate of quantities of work to be done, which are as follows: 6.100 cu. yds. of earth excavation. Price to be made for use in case of extra work per cu. yd. of mass concrete. 2,560 lin. ft. of 12-inch sewer pipe in sand, 60 lin. ft. of 4-inch sewer pipe in sand, 4,290 lin. ft. of 8-inch sewer pipe in sand, 20 4-inch slants, 4-inch bends and plugs, 16 manholes, 1 septic tank, 5 lamp holes.

Mississippi.

The citizens of Meridian, Miss., on June 11 voted against the issuance of bonds in the sum of $20,000 for the construction of sanitary sewers.

Missouri.

✣Bids will be received until noon, June 28, by Board of Public Improvements, St. Louis, Mo., for the construction of North Harlem Joint Sewer, First Section, in the North Harlem Joint Sewer District.

The Hospital and Health Board of Kansas City, Mo., on June 18 voted to advertise for bids on the collection and destruction of all the city's garbage on a 10-year contract at a cost to the city of approximately $55,000 a year. The Board recently authorized an early call for bids on the construction of an incinerator to cost nearly $100,000. Dr. W. S. Wheeler is City Health Commissioner.

Consulting Engineers Worley & Black, Reliance Bldg., Kansas City, Mo., have been awarded the contract for the engineering work in connection with the $35,000 sewer system for Stanberry, Mo. Contracts will probably be let about Aug. 1.

City Council of Carterville, Mo., has taken up the matter of constructing sewers.

Montana.

✣All bids received June 15 by the City Council of Lewistown, Mont., F. P. Marshall, Clerk, for the construction of sanitary sewers aggregating about 10,500 ft. of 12-in. to 27-in. vitrified pipe, 31 manholes, one flush tank, and 21,000 cu. yds. of excavation, were rejected. New bids will be received until July 2. Swearingen & McCulloch are Engineers.

Mayor Duncan of Butte, Mont., is advocating a $200,000 bond issue for improving the sewer system.

Nebraska.

A special election will be held in West Point, Neb., on July 2 for the purpose of voting bonds for the extension of the present system of city sewerage. The estimated cost is $15,000.

New Jersey.

The City Council of Hightstown, N. J., is planning to call a special election to decide the proposition of bonding the town to install a sewer and disposal plant.

All bids received June 17 by the Common Council of Plainfield, N. J., J. T. MacMurray, City Clerk, for the removal and disposal of garbage, ashes and rubbish from the residence and business and public places within the city, have been referred to a committee.

New York.

✣Bids will be received until 3 p. m., July 1, by Sewer Commissioners, Glen Cove, N. Y., for furnishing all material and doing all work necessary to complete the construction of about twenty miles of vitrified pipe sewers, from 6 to 15 ins. in size with the necessary branches, manholes, flush tanks, and other necessary appurtenances, together with disposal works, consisting of two settling tanks, chlorinating plant and filter beds, and the necessary devices for operating the same. Plans, specifications and forms of proposal are on file at the office of William H. Bowne, Engineer in Charge, Glen Cove, New York; and at the office of Johnson & Fuller, Consulting Engineers, 150 Nassau Street, New York.

The City of Watertown, N. Y., Earl W. Sayles, City Engineer, plans to commence work shortly on the construction of the various improvements voted by the taxpayers. Bids are to be asked at once for the north side sewer job.

The Local Board of Jamaica, N. Y., has adopted a petition for the construction of a sewer in Jamaica Ave., from Shaw Ave. to Ferry St., Forest Parkway, from Jam Ave. to Ashland Ave.; Ferry St., from Jam Ave. to Ashland Ave., from Shaw Ave Ferry St. This sewer, which is to be in Woodhaven section, will cost, it is estima $10,400.

The Common Council of Auburn, N. has ordered a sanitary sewer in parts Lake Ave. and Swift St. constructed.

Ohio.

✣Bids will be received until noon, Jul by Director of Public Service, Lakewood, for furnishing the necessary labor and mate for the construction of a sewer in Hill Ave., between Warren Road and Mad Ave., in accordance with plans and speci tions on file at the office of C. W. Root, Society for Savings Bldg., Cleveland, O. certified check for $500 must be filed each bid. J. W. Chrisford is Director.

Oklahoma.

The City Council of McAlester, Okla., passed an ordinance repealing Sewer Dis No. 29, in the Third Ward, and creating a sewer district, embracing all of blocks 523, and 481 B. This district is composed of separate lines of sewer, one extending stra through blocks 523 and 524 and the o through block 481 B.

Pennsylvania.

✣Bids will be received until 8:30 p. m., 11, by Borough Council, Hastings, Pa., C Hoyt, Clerk, for the laying of 14,000 of sewer in accordance with specifications file with C. E. Fletcher, Sewer Engin Spangler, Pa., or at the office of the Cl A certified check for $500 must be filed each bid.

✣Bids will be received until 7:30 p. m., 1, by Town Council, West Brownsville, Pa. grading, curbing, paving and sewering Mi St. Plans and specifications are on file E. V. Kaufmann, Secretary of the Counci

David Peoples of Philadelphia, Pa., at 015, submitted the lowest bid to the Bu of Surveys of that city, for the reconstruc of the Mill Creek sewer in West Philadel Other bidders were: Joseph Lombardi, 830; Robert Higgins, $21.591, and Joesph na, $24,237.

The following main sewers are author in ordinance reported favorably by Coun Survey Committee, Philadelphia, Pa.: Ad Ave., Wyoming Ave. to Ramona St., $25, Cobb's Creek Park, intercepting sewer, B more Ave. to Spruce St., $40,000; Co Creek Park, intercepting sewer, north of ket St. to Sixty-ninth St., $35,000; Cott St., State Road to Tulip St.; Tulip St., C man to Bleigh; Bleigh St., Tulip St. to Tor dale Ave., $25,000; Fifty-seventh St., Leba Ave., 180 ft., and from Susquehanna A south, $10,000; Frankford, intercepting se Valley St., Margaret to Harrison, $12, Gunners Run relief in Indiana St., from ter St. to Fourth St., $40,000; Hartwell L Huron St. to St. Martin's Lane, $20,000; coln Ave., Navajo St. to Hartwell Lane, 000; Rittenhouse St., Wissahickon Ave Oros St., $20,000; Rock Run, Fisher Ave., ft., $3,000; Seventieth St., Cobb's Creek Kingsessing Ave.: Kingsessing Ave., Se tieth St. to Sixty-ninth St., Sixty-ninth Kingsessing Ave. to Upland, $15,000; Sh St., Fifth St. to Broad St., $40,000; Wi hickon high level cut-off, Stokley St., f Crawford to Bowman St., $25,000, t $325,000.

The Borough Council of Coatesville, has awarded the contract for preparing p for a sewage disposal plant to Alexander ter, 114 Liberty St., New York City.

The Borough Councils of Collingdale, have passed an ordinance authorizing a of $40,000 for the purpose of building an quate sewer system. The citizens will on the loan at a special election July 16. State Department of Health has appr the plans for the sewers and disposal p

✣ indicates work now open for bids. ⊙ indicates a contract let recently.

Tennessee.

Engineer Robert Hooke and assist- f Chattanooga, Tenn., are working on [illegible] the sewer system to be undertaken [illegible] authorized.

Texas.

iulting Engineers Howe & Wise, Hous- ex., are completing plans for the pro- improvements in Houston Heights. An iiture of $10,000 will be made for storm ge and drainage and $180,000 for street ements.

election will be held in Houston, Tex., y 9 to vote on the issuance of bonds sum of $2,650,000 for drainage, storm nitary sewers, paving, school buildings, s, parks and city hall annex.

missioner of Public Works Maddox of Vorth, Tex., is about to advertise for the construction of three storm sewers gnolia Ave., to relieve conditions in the Ward, at Jarvis St, to relieve condi- that section, and the extension of the nb St. storm sewer.

neers J. W. Benjamin and W. E. Dick- ave begun their field work preliminary design of the sewer system for Cuero.

Utah.

lowing contracts were awarded by the s of Salt Lake City, Utah, Noble War- City Recorder, for the construction of extensions Nos. 299, 301, 302, 303 and r which bids were opened June 14: Everill Co., No. 299, $1.16 per ft.; J. F. Johnson Co., No. 301, $1.19; A. A. Clark Co., No. 302, $1.35; L. R. Weber, No. 303, $1.45, and T. J. Everill Co., No. 305, $1.22.

The City Commission of Ogden, Utah, has created a sewer district on Childs Ave., between 28th and 29th Sts., and on Porter Ave., between 30th and 31st Sts.

Citizens of Tremonton, Utah, have subscribed $2,000 toward the installation of the proposed sanitary sewerage system.

Washington.

The City Commissioners of Spokane, Wash., have again petitioned the City Council to adopt the plans for the construction of the North Manito sewer, estimated to cost $33,000.

West Virginia.

The G. B. Hartley Engineering Co., of Morgantown, W. Va. is preparing plans and estimates for the installation of a sanitary sewerage system in Weston, W. Va.

The Town Council of Warwood, W. Va., has authorized the Mayor to call a special election that the people may vote on the issuance of bonds in the sum of $15,000 for the installation of a sewerage system.

Wisconsin.

✣Bids will be received until 8 p. m., July 1, by Common Council, Hudson, Wis., for the construction of a public sewer in Orange St., from 7th to 8th St. Plans and specifications are on file with A. Karras, City Clerk.

✣Bids will be received until 8 p. m., July 1, by C. J. Thompson, City Clerk, New London, Wis., for the construction of a sewer along McKinley and Division Sts.

The Board of Public Works of Sheboygan, Wis., has received low bid for the laying of sewers around North Second St. and Park Ave. from Huebner & Co. of that city, as follows: 10-in. sewer, $1.24 per lin. ft.; 15-in. sewer, $3.85 per ft.; 20-in. sewer, $3.80 per ft., and manholes, $48 each.

The City Council of Reedsburg, Wis., has instructed the City Engineer and City Attorney to prepare plans and specifications and ordinance to establish a sewer district in the east part of the city, with a main sewer along Willow St., and then south to the river through Center St. in South Park addition.

The Mayor and City Council of Milwaukee, Wis., have decided to ask the next Legislature to create a permanent sewerage commission of experts for carrying forward plans initiated by the original sewerage commission. This project involves the expenditure of about $13,255,000, under estimates of the commissioners.

Canada.

✣Bids will be received until 8 p. m., July 15, by Joseph Cave, Secretary-Treasurer, Watrous, Man., for the construction of sewers, as mentioned in this issue under "Waterworks."

An election will be held in North Toronto, Ont., July 6, for the purpose of voting on the construction of storm sewers at an estimated cost of $25,000; curbing both sides at an estimated cost of $14,520; paving, $155,200; special foundations under street railway rails, $72,000; total, $266,720. E. A. James is Town Engineer.

UILDINGS, DOCKS, DREDGING, SUPPLIES; ETC.

California.

nt Smith & Co., Henry Bldg., Seattle, have been awarded the contract by rbor Board of San Francisco for con- g Pier 26 at that city. The pier will concrete construction and the contract vas $517,650. It will be constructed uth of Harrison St.

Raymond Concrete Pile Co. of New nd Chicago has been commissioned by rd of trustees of Huntington Beach to plans for a municipal pier to be built city. Bonds in the sum of $70,000 een voted for the construction of the

Florida.

ls will be received until 2 p. m., July 1, rd of Gadsden County Commissioners, Cantey, Clerk, Quincy, Fla., for the ction complete (including heating, g, wiring, lighting fixtures, finishing re, clock and bell for dome, furniture, a courthouse at Quincy, Fla. Concrete ck construction. Drawings and specifi- may be obtained from the architects, & Reid, at their Atlanta office, 933 Bldg. A deposit of $15, guaranteeing e return of drawings, must be sent plication for drawings.

New York.

ls will be received until noon, June 29, L. Williams, Treasurer Cornell Uni- Ithaca, N. Y., for central heating plant New York State College of Agricul- ornell University, Ithaca, N. Y.

ls will be received until 11 a. m., July Col. J. G. Warren, U. S. Engineer, , N. Y., for furnishing and placing rip- ne and concrete deck on breakwater, Harbor, N. Y.

Canal Board, Albany, has approved the f John A. O'Connor, Albany, engineer rge of Barge Canal Terminal work, canal terminal at Albany. Bids on the ill be asked at once. The dock of the d terminal will be of reinforced con- vith piles having concrete tops, and be [illegible] to the new bulkhead line, which is about 12 or 14 ft. outside the present timber dock line. The contract calls for the grading of the site and the excavation which is to be done in the river. There is to be about 60,000 cu. yds. of excavation, most of it in the river. The estimated cost of the terminal is $133,000. The canal board has also approved of the terminal at Fort Edward, at an estimated cost of $150,000, and generally of the location of Herkimer terminal.

Bids as follows were received June 15 by the Constructing Quartermaster, New London, Conn., for coal handling and storage plant at Fort Terry: W. H. Fissell & Co., New York, $31,116; R. H. Beaumont & Co., Philadelphia, Pa., $16,707; T. A. Scott Co., New London, Conn., $18,965; C. H. Hunt Co., New York, $18,764; Harry McNally, New York, $21,000; The Guarantee Construction Co., New York, $19,760; Daniel P. Mahoney, Boston, $22,375.

Oregon.

✣Bids will be received until 10 a. m., July 10, by Patterson, Doyle & Beach, Architects, Worcester Bldg., Portland, Ore., for the construction of the Multnomah County Library at Portland.

Pennsylvania.

✣Bids will be received until noon, July 1, by George D. Porter, Director of Public Safety, Philadelphia, Pa., for combination electric and gas fixtures for new police station, new fire house, etc., southwest corner 55th and Pine streets; for electrical wiring materials for new police station, new fire house, etc., southwest corner 55th and Pine streets; specifications to be had at the office of the Electric Bureau, Room 618, City Hall. One automobile for Chief Surgeon, Bureau of Police (properly equipped for emergencies); specifications to be had at Room 215, City Hall. Alterations and additions to fire station, Snyder avenue west of 15th street; alterations and additions to offices of the Recorder of Deeds, City Hall, including steel cases, furniture, stairways, galleries, etc.; for the erection and completion of new skylights on City Hall roof; alterations and additions to morgue property and property adjoining on the east, Wood street, west of 13th street; specifications to be had at the office of the City Architect, Room 825, City Hall.

Texas.

✣Bids will be received until noon, June 19, by Maj. E. I. Brown, U. S. Engineer, Galveston, Texas, for furnishing about 6,000 barrels of American Portland Cement for Lock and Dam No. 8, Brazos River. The cement to be delivered at Downs, Texas.

✣Bids will be received until noon, July 20, by Maj. T. H. Jackson, U. S. Engineer, Dallas, Texas, for dredging in Section "B" Sabine-Neches Canal, Texas.

✣Bids will be received until noon, July 19, by Maj. E. I. Brown, U. S. Engineer, Galveston, Texas, for crushed rock or gravel delivered at Downs, Texas.

The Magnolia Petroleum Co., E. E. Plumly, General Manager, Beaumont, Tex., is to expend about $500,000 for improvements to its refining plant at Beaumont.

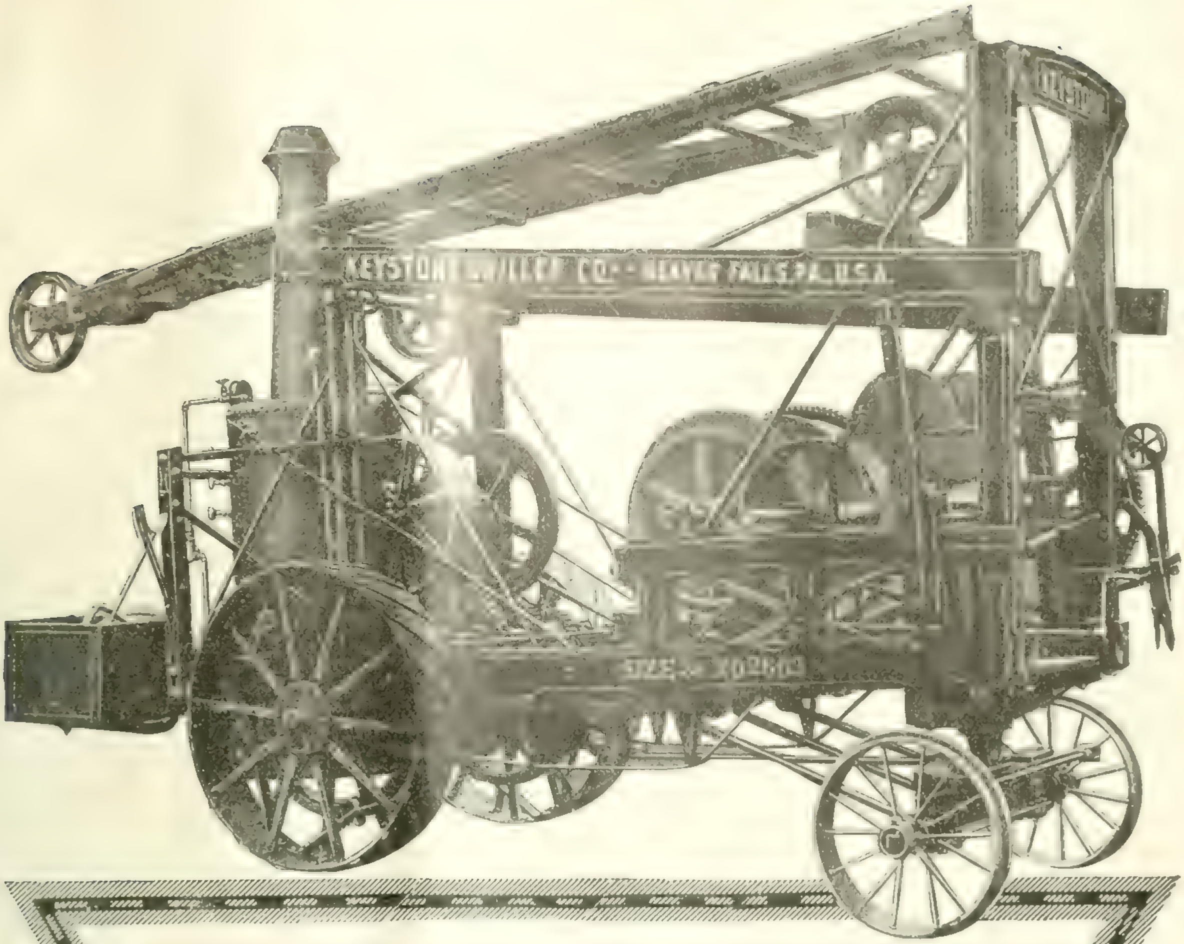
Washington.

Plans are being prepared by Wm. Kingsley, Architect, Empire Bldg., Seattle, Wash., for a 7-story stone and steel museum and office building to be erected on 5th Ave. between University and Seneca St., Seattle, for the Washington State Art Association. The building will cost about $750,000 and excavation work for it will be started in July.

Canada.

⊙R. Weddell & Co., Toronto, Ont., have been awarded the contract for dredging in Toronto Harbor at Harlan's Point for the Canadian government.

⊙The Provincial Government of Manitoba has awarded the contract for the construction of the new law courts, to be situated on the northwest corner of Kennedy and Broadway at Winnipeg to the National Construction Co. The amount of the tender was $760,000. Work on the new building will be started at once.



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It is designed especialy for **deep blast=hole work.** It is **heavier** than other drills, and every pound of material used in its construction is placed where it is needed.

It will carry a **1500 lb. drilling tool,** has a **34 to 40 inch stroke** and delivers **55 to 60 strokes per minute.**

It weighs 14,000 lbs.—has the strength to stand the "racket."

It has the straight, center-draught pull, parallel with derrick; no whipping of cable.

It has two deep-grooved spudding sheaves, in which the cable lies motionless; no chafing or burning of expensive cordage at this point.

Equipped with Electric Motor, when desired, and can be operated thus to better advantage than any other type of machine.

A catalog, quotation or salesman will be sent on request.

Keystone Quarry Drill Co.

BEAVER FALLS, PA.

170 Broadway, NEW YORK   Modnadnock Block, CHICAGO

CARTHAGE, MO.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

SANITARY SEWERS.

[illegible] ll be received by the City [illegible] Iowa, at the City Clerk's ffice, until 8:00 o'clock p. m., July 10, 912, and then publicly opened and read, or the construction of sanitary sewers in he City of Oskaloosa, Iowa.

The Engineer's approximate estimate of he work to be done is as follows:

132 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 2 ft. to 4 ft. cut.

,441 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 4 ft. to 6 ft. cut.

,421 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 6 ft. to 8 ft. cut.

172 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 8 ft. to 10 ft. cut.

,338 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 10 ft. to 12 ft. cut.

940 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 12 ft. to 14 ft. cut.

79 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 14 ft. to 16 ft. cut.

125 lin. ft. 8-in. vit. pipe sewer, Portland cement mortar joints, 16 ft. to 18 ft. cut.

192 lin. ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 6 ft. to 8 ft. cut.

140 lin. ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 8 ft. to 10 ft. cut.

350 lin. ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 10 ft. to 12 ft. cut.

418 lin. ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 12 ft. to 14 ft. cut.

345 lin ft. 10-in. vit. pipe sewer, Portland cement mortar joints, 14 ft. to 16 ft. cut.

45 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 6 ft. to 8 ft. cut.

5 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints. 8 ft. to 10 ft. cut.

250 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 10 ft. to 12 ft. cut.

594 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 12 ft. to 14 ft. cut.

360 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 14 ft to 16 ft. cut.

90 lin. ft. 12-in. vit. pipe sewer, Portland cement mortar joints, 16 ft to 18 ft. cut.

548 vit. pipe "Y" branches, 6 in. opening with vit. stoppers cement in place.

65 brick and Portland cement mortar manholes with cast iron cover, complete.

20 vit. pipe and Portland cement mortar lampholes with cast iron covers, complete.

All work to be completed before December 1, 1912.

Payment for work will be made after same is completed with special assessment sewer certificates, bearing 6 per cent interest, as provided by laws of Iowa, with the exception of ten manholes at intersections of new and old work, which will be paid for by the City when completed.

Plans and specifications will be on file on and after June 22, 1912, in the offices of the City Clerk and City Engineer.

All bids must be accompanied, in a separate envelope, with a certified check in the sum of One Thousand ($1,000.00) Dollars, payable to the order of the City Treasurer of Oskaloosa, Iowa, as security that the bidder will enter into a contract for the doing of the work, and will give the required bond. All checks where bid is not accepted will be returned to the respective bidders, and the check of the successful bidder will be returned after the contract and the required bond have been duly executed.

Copies of plans and specifications will be furnished to prospective bidders on receipt by the City Clerk of $5.00 to cover cost of preparing same.

The City Council of the City of Oskaloosa, Iowa, reserves the right to reject any and all bids.

(Signed) CITY OF OSKALOOSA, IA.
By T. H. CARLIN, City Clerk.
S. V. REYNOLDS, Mayor.

WATERWORKS IMPROVEMENT.

Portsmouth, Ohio.

Sealed bids will be received by the Director of Service up to 12 o'clock noon, July 18, 1912, for furnishing the material and labor in connection with the following improvements to the waterworks system:

Division 1—Brick pumping station, chimney, pump well and intake.

Division 2—Force main from pumping station to distributing reservoir.

Division 3—Concrete distributing reservoir.

Division 4—Filtration plant complete, including sedimentation basin.

Division 5—Pumping machinery.

Bids for each division must include bids for the appurtenances pertaining thereto

Each bid shall be accompanied by a bond subject to approval of the Service Director in the sum of 5 per cent of the amount of the bid or a certified check for the same amount on some solvent bank, made payable to David E. Edwards, City Treasurer, as a guarantee that if the bid is accepted a contract for which a 50 per cent bond must be given for its faithful performance, will be entered into within ten (10) days from the acceptance of the bid.

Plans may be seen and specifications and blank forms of proposal, which must be used, may be procured at the office of the Director of Service, Portsmouth, Ohio, or at the office of Witmer & Brown, Engineers, Chapin Block, Buffalo, N. Y.

The Engineers will furnish plans and specifications upon the payment of $25.00, which will be refunded upon the return of the plans on good condition.

Further information will be given upon application to John M. Williams, Director of Service, Portsmouth, Ohio, or Witmer & Brown, Engineers, Buffalo, N. Y.

JOHN M. WILLIAMS,
Director of Service,
Portsmouth, Ohio.

CONSTRUCTION OF A TURNPIKE.

June 21, 1912.

Sealed bids or proposals will be received by the Road Commissioners of the Mt. Hope, Lafferty and Bannock Free Turnpike, at the office of the County Auditor of Belmont County, St. Clairsville, Ohio, until 10 o'clock a. m., July 20, 1912, for the construction of a free turnpike from the Uniontown and Flushing Pike near Bannock to the Flushing and Morristown road, about ¼ mile north of Mt. Hope School House, a distance of about 5.6 miles, divided into two sections, as is described in the specifications.

Bids will be received on brick, concrete and macadam roads as specified in the specifications, and must be made out on blanks furnished gratuitously on application. Bids must be accompanied by a certified check on some solvent bank in the sum of $500, made payable to the Road Commissioners, as a guarantee that a contract will be entered into if the proposal be accepted.

Plans and specifications may be seen at the office of the County Auditor, St. Clairsville, Ohio; at the residence of H. K. Lodge, near Bannock, Ohio, or at the office of D. A. Elkin, Engineer, Bellaire, Ohio.

The right is reserved to reject any and all bids.

All proposals must be in sealed envelopes, marked on the outside, "Paving Bids" or "Macadam Bids," and must be addressed to H. K. Lodge, Secretary of the Road Commissioners, St. Clairsville, Ohio.

H. K. LODGE, Secretary.
Road Commissioners.

PAVING MATERIAL.

Sealed proposals will be received until 2 p. m., Monday, July 1, 1912, and then publicly opened in the Council Chamber of the Village of Odell, Ill., for approximately 13,000 square yards vitrified brick paving, 7,000 lineal feet gravel concrete curb, 3,000 lineal feet 9-inch to 15-inch tile pipe sewer. Bids must be made on a form which will be furnished for the purpose, sealed and addressed to the President of the Board of Local Improvements, and no bid will be considered unless accompanied by cash (or check payable to the President of said Board and certified by some responsible bank) to an amount which shall not be less than 10 per centum of the aggregate amount of such bid. Bidding blanks and specifications may be had and plans may be seen at the office of the Village Clerk, Odell, Ill., or at the office of the Aetna Engineering Bureau, 17 North La Salle St., Chicago, Ill.

THEODORE TRECKER, Clerk,
Village of Odell, Ill.

12,000 SQUARE YARDS BRICK PAVEMENT.

Sealed bids will be received until 12 o'clock noon by the Clerk of the Village of Oberlin for about 12,000 sq. yds. of brick pavement on concrete base.

Bids must be submitted on blanks furnished by the Engineer.

W. F. SCHICKLER,
Village Engineer.

CALLS FOR BIDS

Rate, $2.40 an inch, single column. **Copy received until Monday noon.**

0-INCH CASED WELL, ONE 50,000 GALLON STEEL TANK ON A 120-FT. STEEL TOWER, ENGINES, DEEP WELL PUMP, AND BUILDING.

Sealed proposals are invited and will be received at the office of the Village Clerk, Morton Grove, Ill., until the hour of opening the same as hereinafter set forth, for the construction of a 10-inch cased well, one 50,000 gallon steel tank, 120-ft. steel tower, engines, deep well pump, and building. Bids must be accompanied by a certified check on a responsible bank doing business through the Chicago Clearing House, or equivalent, equal to 10 per cent of the amount of said bid, which may be obtained from the Village President, August F. Poehlmann, or the Village Clerk. Said proposals or bids shall be opened, examined and publicly declared by said board at a meeting thereof to be held in the Village Hall in the Village of Morton Grove, at the hour of 8 o'clock p. m., on the 2d day of July, A. D. 1912. For further information address M. J. Lochner, Village Clerk. The right is reserved to reject any and all bids.

AUGUST F. POEHLMANN,
Village President, Morton Grove, Ill.

WATER MAINS.

June 10 1912

Proposals will be received by the City of Grand Haven, Michigan, until 8 o'clock p. m., Tuesday, July 2, 1912, for unloading, delivering, trenching, laying with gates, hydrants and specials appurtenant, and backfilling of approximately

4,000 feet of 10-inch
4,900 feet of 8-inch
1,900 feet of 6-inch

cast iron water mains, all in the City of Grand Haven.

The right is reserved to reject any or all bids.

Plans and specifications may be seen at the office of the City Clerk at Grand Haven, or at the office of Gardner S. Williams, Consulting Engineer, Ann Arbor, Michigan, and will be furnished on request.

PROPOSALS FOR LEVEE WORK. Mississippi River Commission, Third District, U. S. Engineer Office, Vicksburg, Miss., June 10, 1912. Sealed proposals for constructing about 1,600,000 cubic yards of earthwork in this district, will be received at this office until 11 o'clock a. m., Standard Central time, July 11, 1912, and then publicly opened. Information on application. J. A. Woodruff, Major Engrs.

PROPOSAL FOR PILE DRIVER HULLS.—U. S. Engineer Office, Custom House, St. Louis, Mo., June 19, 1912. Sealed proposals for building six steel pile driver hulls will be received at this office until 11 a. m., July 19, 1912, and then publicly opened. Information on application. Chas. L. Potter, Lieut. Col., Engineers.

U. S. ENGINEER OFFICE, Seattle, Wash., May 28, 1912.—Sealed proposals for furnishing 200,000 barrels of Portland cement will be received here until 12 m., July 1, 1912, and then publicly opened. Information on application. J. B. CAVANAUGH, Major, Engrs. 22-4t

GREAT MIAMI RIVER IMPROVEMENT.

Dayton, Ohio.

Sealed proposals will be received at the office of the Department of Public Service until 12 o'clock (noon), Monday, July 8, 1912, for 1,200,000 cu. yds. levee construction, including concrete retaining walls, sewers, riprap, 150 ft. steel truss bridge, piling and other work.

Detail drawings, profiles and cross-sec- [illegible]

Specifications may be obtained at the office of the City Civil Engineer of the City of Dayton, Ohio.

CHAS. H. HOGLEN,
Director of Public Service.
CHAS. J. GROSS, Sec'y.

U. S. Engineer Office, Galveston, Texas. June 19, 1912.—Sealed proposals for crushed rock or gravel, delivered at Downs, Texas, will be received at this office until 12 m., July 19, 1912, and then publicly opened. Information on application. Earl I. Brown, Major, Engrs.

REMODELING WATER SOFTENING PLANT.

Sealed proposals for remodeling the Oberlin Water Softening Plant, comprising the construction of concrete tanks, channels, filters and appurtenances, housed by a brick or sandstone superstructure, will be received by the Clerk of the Board of Trustees of Public Affairs of the Village of Oberlin, Ohio, until 12 o'clock noon, standard time, on the 8th day of July, 1912.

W. F. SCHICKLER,
Clerk of the Board of Trustees.
A. ELLIOTT KIMBERLY,
Consulting Engineer,
803 Columbus Savings & Trust Bldg., Columbus, Ohio

U. S. Engineer Office, Galveston, Texas. June 19, 1912.—Sealed proposals for furnishing about 6,000 barrels American Portland Cement for Lock and Dam No. 8, Brazos River, delivered at Downs, Texas, will be received at this office until 12 m., July 19, 1912, and then publicly opened. Information on application. Earl I. Brown, Major, Engrs.

ANNOUNCEMENT

The Board of Public Works of the City of Los Angeles, realizing that active construction on the Los Angeles Aqueduct is nearing completion, has authorized the organization of a Sales Department for the purpose of disposing of all excess material and equipment. While large quantities will not be available until the work is over, varying amounts will be released from time to time and either sold at nearest railroad siding or at Receiving Yard, corner Slauson and Compton avenues.

Material to be sold includes steam and electric power shovels, mules, horses, wagons of all kinds and sizes, electrical equipment, drills, drill steel and sharpeners, compressors, air receivers, pumps, boilers, locomotives, both steam and electric, rail of all sizes, riveted pipe, casing, black pipe, forges, blowers, gas engines, hoists, tunnel and dirt cars, concrete mixers and buggies, lathes, drill presses, steam hammers, machine shop equipment, etc., besides quantities of small tools of every size and description.

Correspondence or personal visits invited regarding any or all items in quantity or otherwise. If articles wanted are not yet available, record will be kept and notification made as soon as same are released.

All communications should be addressed to E. W. Bannister, Sales Engineer, 1108 Central Building.

Advertisement for Proposals for Improving Lincoln Ave. and Chicago St., Village of Dolton, Illinois.

[illegible] be received by the Board of Local Improvements of the Village of Dolton, Illinois, until 8 p. m., Friday, July 5, 1912, at the Village Hall, and then publicly opened, for constructing complete a pavement 16 ft. wide in Lincoln Ave. and Chicago St. in said Village, said work to comprise approximately the following items:

19,100 sq. yds. limestone macadam
or 19,100 " " asphalt filled macadam
or 19,100 " " tarvia filled macadam
or 19,100 " " Dolarway pavement
or 19,100 " " 1½" [illegible] surface on 6" concrete base
or 19,100 " " 1½" asphalt bound surface on 6" concrete base

Note:—Cost of excavation for pavement to be included in price per square yard.

Excavation for limestone macadam ....7,000 cu. yds.
Excavation for asphalt or tarvia filled macadam.....6,000 "
Excavation for pavement with concrete base ....5,500 "
1,100 cu. yds. excavation (additional).
43 manholes adjusted.

All proposals shall be based on constructing the work in accordance with the plans, profiles, detail drawings and specifications prepared for said work and now on file with the Village Clerk. Plans and specifications can be examined and blank proposals obtained at the office of the Village Clerk or at the office of the Engineer for the Board.

All proposals shall be submitted on blanks furnished and be accompanied by cash or certified check payable to the order of the President of the Board for the sum of Twelve Hundred ($1,200) Dollars.

For such labor and materials the contractor is to be paid in cash or warrants bearing interest at five (5) per cent.

Contractors may submit bids on one or more types of pavements specified.

The right to reject any or all bids is reserved.

AS[illegible]US CLAUSSEN,
President, Board of Local Improvements.
WM. G. DOLTON, Village Clerk.
CENTRAL ENGINEERING BUREAU,
1742 Monadnock Block, Chicago, Ill.,
Engineers.

PROPOSALS FOR DREDGING.

May 30, 1912.

Sealed bids addressed to J. H. Nelms, Chairman, will be received at the office of the Engineer, Room 430, New Weinberg building, Greenville, Miss., by the Board of Washington County Drainage Commissioners, to 12 m., July 15, 1912, for the construction of about nineteen miles of dredge ditch ranging from twenty-six to fifty-six feet bottom; approximate quantities 1,960,000 cubic yards. Also for the clearing of two natural streams aggregating about seventeen miles. Plans, profiles and specifications are on file at the office of the Engineer, and can be furnished on application. A certified check for $5,000.00 must accompany each bid. The right is reserved to reject any or all bids, or to let the work as may appear to be for the best interest of the district.

THE WASHINGTON COUNTY DRAINAGE COMMISSIONERS,
B. B. GORDAN, Chief Engineer,
Greenville, Miss.

NOTICE TO BIDDERS.

Levee Construction.

Notice is hereby given that the Gill Township Levee Committee will receive sealed bids at the office of John T. & Will H. Hays in Sullivan, Indiana, until twelve o'clock noon, on Tuesday, July 9th, 1912, for repairing the Gill Township Levee, near Riverton, in Sullivan County, Indiana. Plans and specifications can be seen at the said office of John T. & Will H. Hays. All bidders will be required to accompany their bid with a certified check of $500.00. The proposed work includes the moving of approximately 4,10 cubic yards of dirt, and the construction of a four inch concrete wall embracing approximately 1,300 cubic yards of cement, and the construction of a wall of dirt consisting of approximately 510 cubic yards of dirt.

PAVEMENT.

CONCRETE AND BRICK.

Pittsburg, Kans.

Sealed bids will be received until 8 o'clock p. m., Wednesday, July 10, 1912, at the office of the City Clerk for furnishing all labor and material for constructing approximately:

12,100 sq. yds. brick pavement on a concrete base.

4,700 sq. yds. concrete pavement.

9,100 sq. yds. double course brick pavement.

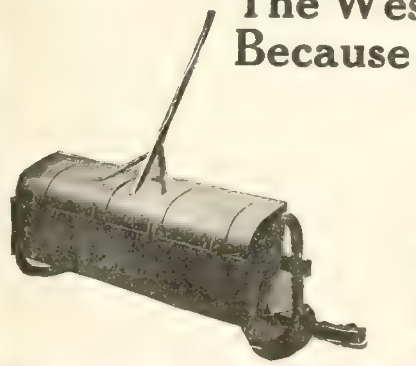
8,000 lin. ft. concrete combined curb and gutter.

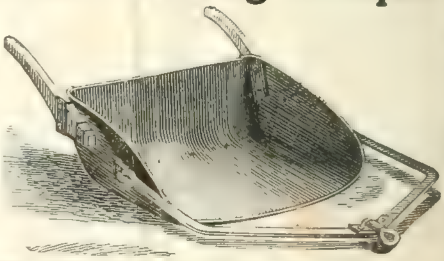
All bids must be accompanied by a certified check for $100, payable to O. T. Jones, City Clerk. The right is reserved to reject any or all bids. Plans, specifications, etc., can be had by depositing $1.00 with the City Clerk.

L. E. CURFMAN,
City Engineer.

BRICK PAVEMENT.

Bids will be received until 1 o'clock p. m., July 13, 1912, by the Highway Commissioners of Monticello Township, Piatt County, Ill., for the construction of 5,592 sq. yds. of vitrified brick pavement with necessary curb and gutter, and concrete culverts. Plans and specifications on file with Wm. Britton, Clerk, Monticello, Ill., or W. J. Day, Engineer, Bement, Ill.





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It is easier to fill.
It can be dumped sidewise, is of lighter draft; less dangerous to the team; dirt does not clog on the bottom.
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For constructing ditches, leveling land for irrigating and other purposes, we make the **FRESNO** or **BUCK** in all sizes

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